

GEOPROCESSING AS A TOOL FOR ENVIRONMENTAL PLANNING FOR THE CITY OF BETHANYA, SERTÃO IN THE MOXOTÓ – PE

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ABSTRACT: Economic growth and the exploitation of the rural have been harmed by the applicant lack of planning, no real knowledge of natural resources in specific regions, unfortunately, the man to perform the adaptation of land for farms, modifies soil characteristics and not absorb the limiting factors, leading to various forms of aggression, increasing degradation. The hinterland of the micro Moxotó today is characterized by social and environmental conditions quite vulnerable to the action of human activities, this scenario has provided a marked degradation of natural resources, as well as the use and management of land improperly. In order to produce scientific information for environmental monitoring system having as input geoprocessing, ensuring progress in controlling the use of natural resources and thus develop an integrated planning, providing quality of life for the population in the study area and local integration in the process of making, using techniques of geographic information systems (GIS), which allow for combinations of information from different technological processes for the production of new information for decision making in different contexts. It was concluded that the studied cities at risk to degradation by human action that triggers the process of misuse of land, bringing social and economic problems. The town of Bethany has degraded large areas, mainly by farming and grazing.

Keywords: geoprocessing, environmental planning, soil degradation.

Introduction

The planning guided by principles of environmental policy is a key tool in the management of the land and of farming process.

This, when done well rationalizes the actions, becoming an instrument of systematization of information, reflection on the problems and speculation of potential scenarios for the exploitation of natural resources.

Economic growth and exploitation of rural areas have been constantly hampered by the lack of a real plan, which is based on the knowledge of natural resources. Presently witnessing in our country, land use driven by population and economic pressures, in total disregard agricultural land suitability and its conservation. Failure to adopt technical criteria in planning has exacerbated environmental problems. Unfortunately, the man to perform the adaptation of land for farms, modifies the characteristics of the soil and do not absorb the limiting factors favoring aggression in many different ways, making them degraded.

The most impressive is noted that the farmer, who basically depends on agricultural soil to survive contributes to facilitate their destruction (Silva et al. 1999). In recent decades, increasing agricultural production and productivity and the consequent intensification of land use has brought concerns about the environmental impacts and the conservation of natural resources in the short, medium and long term. To reverse this situation it is important to be raised to the characteristics and properties of soil resources, water and vegetation, as well as their arrangement on general landscape, which will enable an assessment of their potential and their limitations. Your misuse of the land, the use of inadequate technology and lack of planning are factors that contribute to the impoverishment, not only natural resources, plus also the population that survives these resources (Ferreira and Oliveira, 1998).

To follow the dynamics of occupation and land uses is necessary to have technique to facilitate ordering of this occupation and are subject to automated processing. Among the techniques are the geographic information

systems (GIS), which allow for combinations of information from different technological processes for the production of new information for decision making in diverse contexts. Where depending on the purpose of work, plans are selected and stored in the GIS and through intersections, generate new information, which will serve as a basis for planning and recommending use and management of the environment.

The Sertão of Moxotó is characterized by quite vulnerable social and environmental conditions the action of human activities, this scenario has led to the sharp deterioration of natural resources, as well as the use and management of land improperly. Recognized, so their vulnerabilities, the limitation of these resources and the sudden realization that you cannot exhaust than the product itself productive capacity of the natural heritage, it has encouraged the development of new technologies and the potential use of natural resources available looking for a stability between ecological balance and human development.

The present work aims to produce scientific information for environmental monitoring system having as input geoprocessing, ensuring progress in controlling the use of natural resources and thus develop an integrated planning, providing quality of life for the population in the study area and local integration in the making.

Conservation and Environmental Planning in Brazil

Documents the environmental character and naturalist in Brazil can be found even in the time of the Empire, in the early decades of the 1800s, when they were discussed problems related

to impacts from human activities on natural resources. The documents alert the D. João VI and Pedro II on the environmental issue, which guided the first environmental protection regulations are written by naturalists brought to Brazil by the empire and then by disciples of the French school, who cared, in the first instance, with the quality and quantity of water resources, protection of forests to conserve water sources and sanitation of cities (SANTOS, 2004).

Proposals under environmental planning became more concrete, at the turn of the century, in the 1930s, when the planning of water resources and watershed management were modeled. The line of the current environmental policy in Brazil is seen from the 1930s, with the establishment of the Water Code, the Forest Code and the Law of Wildlife Protection. The spirit of the development of the 1950s was rooted in Brazil and the 1960 and 1970 showed a country with priority on industrialization in this period Brazilian government had very little concern for the environment.

The major concern with the environment gave up early as the 1960s in the United States, spreading to other countries and making them discussion topics such as environmental impact assessment, environmental planning and management. Brazil has entered the official form from 1981, with the National Environment Policy, a "letter of intent" with regard to environmental conservation. With the newly installed Secretary (Department of Environment) discussions were going on and whose first measures aimed at the protection of water resources.

The main reasons that led to the change of government behavior were the result of pressure from international banks, which now require

environmental impact studies for project financing, the environmentalists foreign companies, such as the IUCN / WWF (World Wildlife Foundation), with the Worldwide for strategic conservation and NGOs (nongovernmental organizations), who organized in Brazil and have demanded participation in decision making on the environment (SANTOS, 2004).

In 1981, was promulgated one of the main documents relating to the environment: the Law on National Environment Policy (NEP), Law No. 6.938/81. Before her legal guidelines were sectorized, linked to an aspect of the environment and preservation of forests, fauna protection, conservation of water resources or pollutants.

From there they were created SISNAMA (National Environment System) and CONAMA (National Environmental Council) who formulated guidelines for impact assessment, planning and management, environmental zoning, using as units of planning watersheds.

In 1986 a legal document of extreme importance was approved: Resolution 001 , CONAMA , which created the requirement for environmental impact studies in Brazil for a wide range of human activities . The departments of environment then received a great amount of environmental data.

Some environmental secretariats developed another type of diagnosis, to create APAs (Environmental Protection Areas). As these works were written for goals, different concepts and methods, has become extremely difficult to use the information and conclusions of the studies varied planning to compose a particular region.

In 1990, environmental planning has been incorporated into municipal master plans and from

these studies that elicited the most damning information about the quality of life, sustainable development, society and environment, promoted by concern for human beings.

Today, environmental planning also incorporates sustainable development perspective, concerned with maintaining stocks of natural resources, quality of life and appropriate land use, beyond the aspect of conservation and preservation of natural systems (SANTOS, 2004).

Planning: Concepts

Several concepts were created to define planning. (SANTOS, 2004) defines planning as an ongoing process that involves the collection, organization and analysis of systematized information through procedures and methods to reach decisions or choices about the best alternatives for the use of available resources. The purpose of planning is to achieve specific goals in the future, leading to the improvement of a particular situation and the development of societies.

The United Nations, 1992, also presented their own definition for planning under environmental perspective, as a process that interprets the natural resources as the "substrate" of man's activities in it and sit on it develop, seeking better quality of life.

Environmental planning has emerged in the last three decades, due to the dramatic increase in competition for land, water, energy and biological resources, which prompted the need for organizing the use of land, such use compatible with the protection of threatened environments and improve the quality of life of populations. Thus, the principles of environmental planning are referring directly to the concepts of sustainability

and multidisciplinary approach, which, in turn, require a holistic analysis approach for application (SANTOS, 2004).

Characterization of the City of Bethany

The town of Betania is located in the middle region Pernambucano Sertao and microregion Moxotó, northern portion of the Pernambuco state, limited geographically to the north with the municipalities of Flores and Calumbi south, with Floresta, east to Custodia and west, with Serra Talhada and Floresta.

The municipality is distant from the capital Recife 394 km, has a population of 12,003, where 3,712 (30.9 %) of it is urban and 8,291 (69.1 %) is the rural population of Betania, the population density of the territorial unit is 9.65 inhabitants per km² (IBGE, 2010). The municipal area covers 1,244.1 km² (IBGE, 2010) the municipality is inserted into the drive geoenvironmental Depressao Sertaneja, which is the typical landscape of northeastern semiarid, characterized by a surface pediplanation rather monotonous, predominantly mild relief wavy cut by narrow valleys, with dissected slope. (CPRM / PRODEEM, 2005). Isolates reliefs witness the intense erosion cycles that hit much of the northeastern hinterland. The vegetation is primarily composed of Caatinga Hiperxerófila with excerpts from Deciduous Forest (CPRM / PRODEEM, 2005).

The climate type is tropical semiarid, with summer rains. The rainy period starts in November ending in April, with an average annual rainfall of 774.6 mm. The highlight of economy is Betania with production of corn and beans, as goats livestock (52,000 head) and sheep

(13,200 heads) are the most representative (IBGE , 2012).

Materials and Methods

Digital Image Processing CBERS- 2B for preliminary interpretation

The methodology for the visual interpretation of digital images was based on the method developed by Systematic (VENEZIANI & ANJOS 1982). This methodology consists of a sequence of logical and systematic steps that are independent of prior knowledge of the area and the use of fotointerpretativas keys.

The visual image analysis result of a comparative study between the spectral and textural properties that each spatial phenomenon takes in several scenes recorded by associating different levels of reflectance to various phenomena, time of image acquisition related spectral targets.

Thus, the identification of units and / or thematic classes was based on the isolated study of the various elements of interpretation , then , the joint observation of these elements (drainage, relief, shade, land use and structure), being generated maps preliminary interpretation, which will be complemented by fieldwork.

Analysis and Interpretation of Orbital Images (Mapping of Lands)

The choice of the image of CBERS- 2B for the execution of the work, was the fact that this product has satisfactory spectral resolution for the execution of work and be available for free, which makes it possible for the entire user community of remote sensing products increased in applying their data in environmental studies across the country.

The image was acquired in the collection of satellite images from the National Institute for Space Research (INPE, 201) and is dated 12-05-2008 passage. Brazil and China are developing a joint space program focused on the development of specific orbital sensors for generating and environmental data. Early versions of this program satellites, so called CBERS - 1 and CBERS - 2, were placed aboard three different sensors, two Chinese production and a Brazilian production (PONZONI & SHIMABUKURO, 2007).

The CCD camera, Chinese production, provides images from a range of 113 km wide, with a spatial resolution of 20m and temporal resolution of 26 days. Has ability to guide your field of view within ± 32 degrees, making possible to obtain stereoscopic images, or to increase the temporal resolution of specific regions of the earth's surface (PONZONI & SHIMABUKURO, 2007). Through the GIS was possible to observe the real situation of land cover and land use.

Digital Image Processing

The execution of the work involved the following distinct steps: image preprocessing (reading, recording and contrast); processing (segmentation and classification); field visit to verify the mapping; analysis of the collected data and preparation of the final digital map and their respective analyzes. Through objective is computational techniques to extract information about the land surface targets in the towns of Betania and Custodia localized microrregion Sertao of Moxotó.

Arithmetic Operations - ratio between bands – NDVI

To increase the contrast between soil and vegetation, can use the bands related to the ratio between red and near infrared, thus constituting the so-called vegetation index (NDVI).

A option C = $G * ((A-B)/(A + B)) + O$,
 SPRING 5.1.7 , when applied for:

- A = near infrared – band 4
- B = red - band 3
- G = gain (Used value 256)
- O = offset (used value 64)

Vegetation index is the normalized difference (NDVI), which besides increasing the spectral contrast between vegetation and soil, has lighting effects, surface slope and "offeree " geometry, partially offset by index (CAMARA , 1996).

Adjusted multispectral composition (b1 + b3 + NDVI): Corresponds to an RGB transformation whose source of red light (R) will be positioned band 3 , in green font (G) NDVI image and in blue font (B) the band 1. This combination, the areas of high NDVI appear in green (occurrence of vegetation) and areas of low occurrence of NDVI appear in magenta, indicating the occurrence of exposed soil.

Segmentation

The process of segmentation is to divide an image into homogeneous regions considering some of its attributes, such as the gray level of the pixels and texture, to characterize the representation of objects in the scene. Segmentation involves the generation of internally homogeneous objects on which the classification is then processed.

Classifications of patterns

The classification is the establishment of a decision process in which a group of pixels is defined as belonging to a particular class. The pattern classification is divided by the phases of segmentation (extraction region), classification and mapping (Moreira, 2001).

To perform classification Bhattacharrya the classifier, which uses the training samples to estimate the probability density function for these classes indicated was used. At the end, all regions will be associated with a class defined by the algorithm; the user must associate these classes or themes, for him to classes defined in the database.

The classified images are vectorized by " Mapping " function, which allowed the quantification of vegetation cover classes and the dynamics of the use of the land , using the option 's menu theme " Measures of Classes" .

Publication of thematic maps

The final thematic maps were created in SCARTA SPRING 5.1.7 module.

Results and Discussion

Based on observations, this work is directed initially to the preparation of the base map (Figure 1). With plans in information scanned v. SPRING program. 5.2, there was a plot of the data, yielding the thematic map of the city Betania, with the following parameters: drainage, dams, rivers , roads and highways where possible the same georeferencing of CBERS - 2B network.

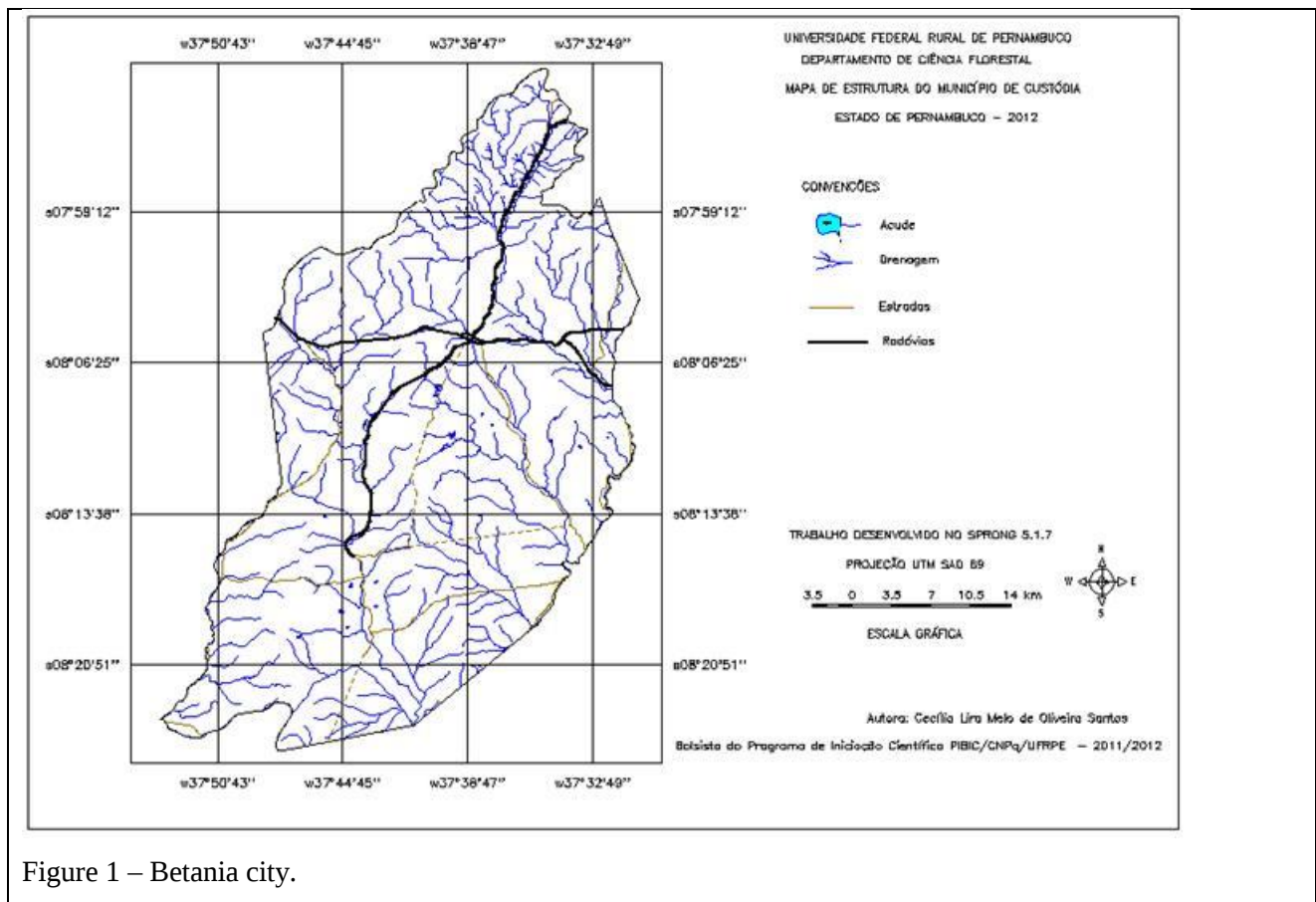


Figure 1 – Betania city.

Figure 2 shows two types of colored compositions with linear contrast. Then a comparative analysis was made of Compositions Multispectral Adjusted (CMA) for the date of 12/05/2008, which allowed us to observe the behavior of the targets, vegetation, soil and water that accurately reflects a landscape devastated by the withdrawal of its vegetation. In the image we see in green areas with vegetation cover, while magenta colors represent areas of exposed soil thus showing intermittent action man in the middle when they are inserted.

The composition with the bands 5, 4 and 3, combined with the RGB channels, respectively. With this combination, in addition to viewing the targets defined soil and water, the spectral behavior of vegetation is covered, depending on the parameters: concentration of leaf pigments, biomass content and leaf wetness, respectively. This form of colorful makeup was used during the activities. There is also the possibility of application of contrast enhancement in color compositions which allowed better visualization of the parameters used in the image.

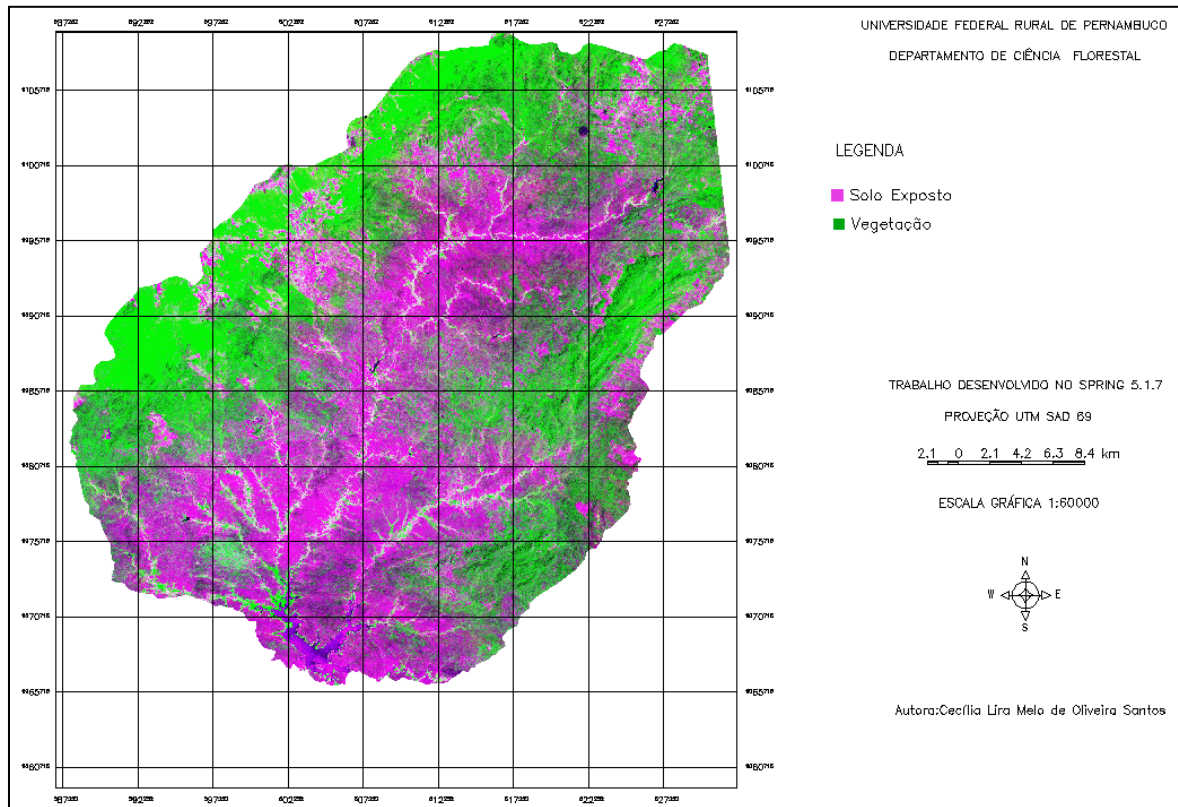


Figure 2 –RGB composition of the Betânia municipality.

Figure 3 shows a significant level of environmental degradation where the vegetation was strongly removed, which causes soil losses by erosion, soil heating by the lack of vegetation cover which undermines the whole soil biota.

The image is clear panoramic view that reproduces the look of a landscape in the exploitation of natural resources quite pronounced where shows devastation imposed as a result of

human action thus altering other standards organizations process, thus affecting the process of integration and development causing thousands of people to migrate in search of better living conditions. The area is replaced by pasture and wood serves as a source of energy, since the wood is one of the most used resources for energy, to be the cheapest source and the municipality does not have adequate technologies.



Figure 3 – Vegetation densa retired (A) and area of grassland with burnt (B).

The practical actions such as burning (Figure 3A) of vegetation have demonstrated the fragility of the region under study, in addition to accelerating the process of degradation. In some situations the bush thin cover almost non-exposed high stony ground, ridges and craters forming in areas of slope, are very disturbing, because the classes are serious degradation levels and very severe that

originate cores of desertification. In contrast to the scene of natural resource degradation evident in the NDVI map region was observed in field work that Figure 4), there are conscious actions with regard to the preservation of native vegetation, leaving intact the edges of reservoirs encountered during the field visit.



Figure 4 – Dam and dense native vegetation of the Betania municipality.

Fieldwork was conducted on December 24, 2011, to the towns of Betania and Custodia, some georeferenced points with their characterizations were collected to measure image processing subsequently produce a digital map of the use and occupation of land for Betania municipality. Figure 5 accurately portrays the continuity of man in the field, thus showing the uncontrolled exploitation of the use and occupation of land, the map was generated at a scale of 1:60,000 and the distribution of the classes were defined and quantified as: semidense vegetation, dense vegetation, riparian vegetation, water, agricultural and grazing land, indicating the

possibility of using this information as input for the choice of areas for conservation or preservation, as well as aid in monitoring vegetation over large areas , in addition to mapping of bodies of water .

The area occupied by pastures reach a value of 150.16 km² , accounting for 11.8% , since the occupation of agricultural land is 356.99 km² , equivalent to 28.1 % as the predominant slope is characterized mild relief wavy shows thus not be a limiting factor, may have a more diversified agriculture and farm in their current occupation by simple conservation practices, soil management and the rational use of land.

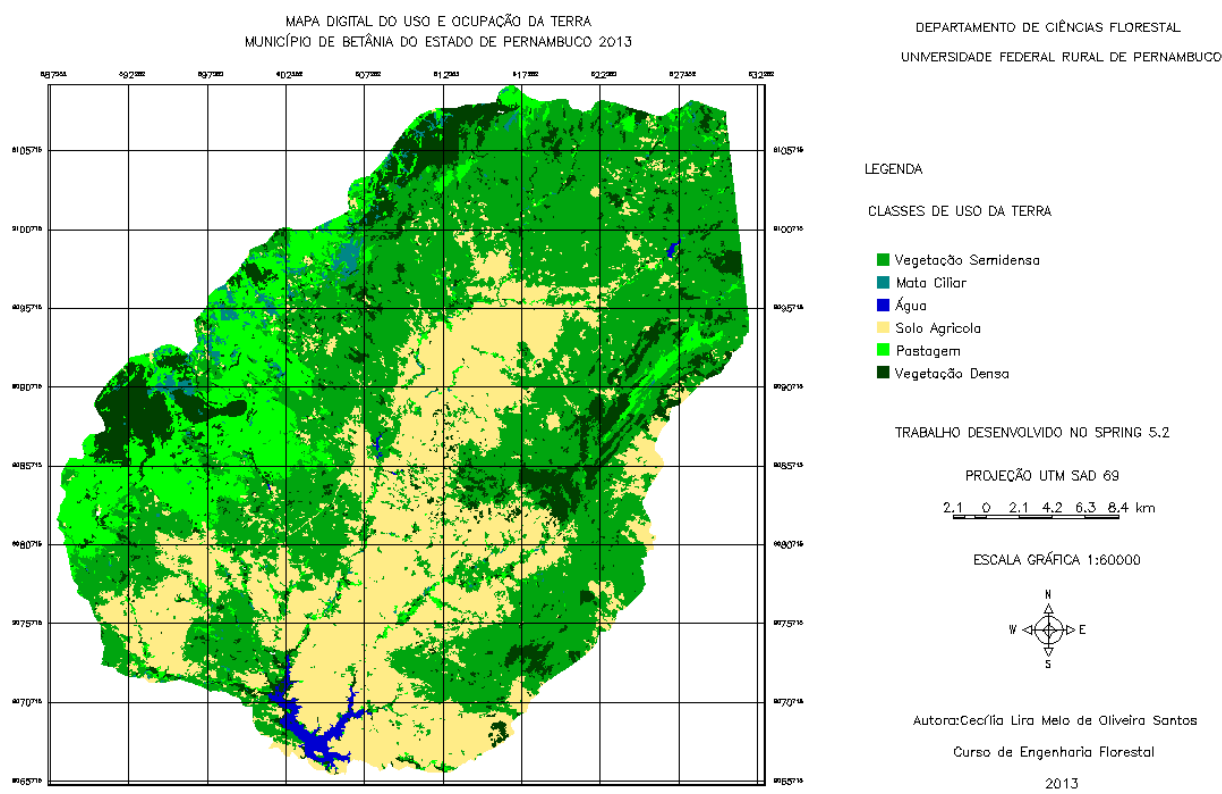


Figure 5 –Digital map of the use land of the Betânia municipality.

The class of dense vegetation represented 10.3% corresponding to 131.47 km², semidense class corresponding to 47.1 % 598.16 km², the results indicates a reduction in the class with the greatest potential of soil cover which in this case is dense relative to semi dense. Although it has significant values for vegetation semi dense these figures show is very disturbing, because this class is that the levels of degradation may increase the initiating centers of desertification.

Thus, it is emerging the development of public policies that have as a priority to reduce environmental degradation and increasing knowledge of the population. So that, thereafter, the development in this area may occur sustainably, thus ceasing to represent an obstacle to the social state.

Conclusion

The municipalities of Pernambuco Moxotó studied region at risk to degradation by the human action, which has promoted environmental issues, social and economic order in the studied mainly by misuse of the land and inadequate agricultural practices the region, worsening desertification processes in the region.

This causes problems of social and economic order in the Pernambuco semi-arid. Thus, the example of the City of Betânia has most of its population living in rural areas, and has its livelihood primarily from field activity, even so, for lack of technical guidance and assistance of public officials, contributes to worsening land degradation. However, the geoprocessing tools can be used as an essential tool in the planning

and management of natural resources in the region, and thus make the best use of soil semiarid region, as in the middle region of Pernambuco Moxotó.

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