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THE STAGES OF THE DESERTIFICATION IN DIFFERENT TYPES OF SOIL IN THE SEMIARID PARAÍBA

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ABSTRACT

The intersection of the outline information of the classes of soils and levels of degradation of land in SPRING V.4.2 allowed an assessment of conservation status of these, providing a first impression of what would probably be found in the field. The field work, and confirmed, helped in the interpretation and final conclusions on the levels of land desertification. The studies showed that the soils are quite eroded at different stages. Considering that the levels of degradation of land moderate, severe and very severe define the more advanced stages of desertification, showed that 82% of Cambisolos, Luvisolos of 85%, 78% of Neosolos Regoliticos and 89% of Neosolos Litólicos are severely compromised the process of desertification. The commitment of Neosolos Flúvicos is around 69%. This impairment is associated with the use of these soils in construction, in the manufacture of ceramics, but also by the launch of the presence of sewage and garbage and dead animals. These data, quite negative for the entire area of the city reflect the impacts caused by inadequate management of land, the pressure exerted by extensive livestock, which resulted and result in accelerated erosion processes, due to lack of technical assistance to farmers by the competent bodies to the adoption of practices related to soil conservation, and non-compliance with environmental legislation.

Palavras-chave: Degradation of land, crossing, ground

Introduction

The strategy used in any scientific research is based on a network of anthologies and assumptions of human nature that define the view that the researcher has the world around you. The understanding of this statement is of great importance in the study of environmental degradation and disaster risk, and may contribute to the generation of free information standards .

A study of the adaptability of land , according to a sustainability that does not lead to degradation, mainly by accelerated soil erosion, is an important tool to increase productivity. Considering the degree of current land erosion as a yardstick to measure its degradation, it can be observed that after the fotointerpretativas and field data analysis , it was possible to fabricate in SPRING v.4.2 map of intersection of the quantitative data of soil with the level of degradation in the municipality of Taperoá - bp .

The agricultural 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 .

Regarding the advantages of their use , are presently witnessing in our country , land use driven by population and economic pressures , in total disregard to the agricultural capacity of the land . 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 deteriorated .

The survey and soil classification are in a key area of natural sciences , such as support for the rational use of agricultural vocation from its lands , reflecting directly and indirectly for the sake of power and well- being of mankind, and conservation of soil and water and other elements of the environment (Santana , 2000) .

The soil has been studied and interpreted in different ways , according to the use made of it . The interpretations and definitions are many and discordant , for the sciences related to soil involve varied knowledge , extending from the soil genesis to the mechanism of plant nutrition. There are many branches of science that are connected to ground, it may be mentioned Geology, Mining Engineering, Civil Engineering , Soil Mechanics , the Soil, the Agricultural Engineering , Biology , among others .

Miscellaneous papers relating to Geomorphology Pedology studies show that the spatial variability of soil , soil surveys and pedogenesis and produce better results when applying the field work are intensified and geomorphological methods are included . The lack of detailed knowledge about soils in semi-

arid Northeast undoubtedly opens a range of possibilities for research aiming to seek alternatives to replace or mitigate this deficiency, mainly because the vegetation is rapidly being replaced by agricultural systems, without proper foundation scientific (Cunha, 1995).

Basically, the reason for a soil survey is to delineate units containing conditions less variable than the population as a whole soils. Its major challenge is the representation of a region such that each class is sufficiently homogeneous according to the representative profile described. In practice, the goal can be achieved with the organization of soil types, where the combination of profile and its spatial arrangement are considered (McBratney & Webster, 1981).

The economy of the Brazilian semiarid region is characterized by low productivity and extensive livestock farming. The production is limited to cotton and livestock, besides the self-consumption crops (beans, maize, cassava, palm, etc.) (SA, 1994). Soils are installed where the farms are mostly wealthy in nutritional elements for plants, but many of them have serious limitations for agriculture , as uncertain and scanty rainfall. Areas with low and flat relief can also present problems linked to excess salts salinization). These limitations, however can be corrected with proper irrigation practices and drainage (Lepsch, 1976; CAVEDON, 1986).

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 brought concerns regarding environmental impacts and preserving natural short, medium and long-term resources.

To reverse this situation it is important to be raised to the characteristics and properties of natural resources 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 use 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 the most 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 Paraiba Cariri today is characterized by quite vulnerable social and environmental conditions. The intervention of human activities in this scenario has led to the sharp deterioration of natural resources, leading in some areas called " centers of desertification " , where the degradation is much more intense.

Recognized as well the importance of these factors, the limitation of these resources and

the sudden realization that you can not 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.

The evaluation of the productive potential of land will be an indispensable tool for the discussion of a rational planning of renewable natural resources instrument, particularly soils, maximizing agricultural production without however comprise a harmonious balance between human activities and the environment. Thus, this study main objective to elaborate the different levels of soil desertification in the Taperoá municipality, aiming to present forecasts for the study area and provide input to the planning of alternative exploitation of natural resources that inhibit the processes of wear and land allow the livelihood of families settling in the field.

Material and Methods

The Taperoá municipality located in the central region of the Paraiba state, Meso - and Micro - Borborema Region Western Region Cariri. According to IBGE (2007) the total population of the municipality of Taperoá is 14,720 inhabitants, and 7,770 in urban areas and 6,950 rural. Formed by massive and high hills with elevation ranging from 650-1000 meters. It occupies an area of arc extending from southern Alagoas to Rio Grande do Norte. The physical basis of the municipality has an area of approximately 639,870 km2 (SPRING v. 4.2) with 14,715 inhabitants (IBGE , 2007). Its main river is the Taperoá, intermittent regime, which rises in the Serra do Teixeira and flows into the Paraiba River in President Epitacio Pessoa. The municipal seat lies at an altitude of 532 meters at 36 ° 49'34 " west longitude and 7 ° 12'26 " south latitude coordinates.

According to the Köppen classification for the Taperoá city, the predominant type climate Bsh: hot semiarid, covering the driest area of the state. The average annual rainfall is 505.6 mm with a range of variation between 500 mm and 750 mm, and a dry season that may reach 11 months, with temperatures never below 24 0C (EFSA, 2007). Second the methodology developed by Thornthwaite (1941), the index of aridity for the city of Taperoá equals 0.28. Being in the Borborema plateau, dissected with deep narrow valleys, has two morphological units: the first represented by gentle rolling to hilly relief and, second, regarding the watershed represented by the wavy hilly relief.

The vegetation of the study area is concentrated in northeastern Paraiba is practically uniform, regional type of steppe savanna (IBGE, 1991). Its main tributaries are streams, with major bodies of accumulation are the dams: Taperoá II with a maximum capacity of 15,148,900 m3; Lagoa do Meio (Municipal) with capacity of 6,647,875 m3 (both managed by the State). The temporary crops, according to IBGE (2003) are fourteen in number, but only six are noted for their economic and social importance (beans, tomatoes, corn, cassava, sweet potato and upland cotton), occupying one for its cultivation area of 35,028 hectares, corresponding to 4.1% of the total area of the Rio Taperoá subbasin. Permanent crops are ten in number, but only six (sisal, arboreal cotton, coconuts, banana and mango) excel in economic and social importance in the county.

How to support the work we used the GPS Trimble Navigation, SPRING 4.2 software (Camara et al., 1998) multispectral images of ETM/Landsat- 5:07 referring to row 216. 16/07/2005 Date of passage . The methodology for the visual interpretation of digital images was based on the method developed by Systematic VENEZIANI & ANJOS (1982). It was based on a general recognition of the area, made through a pre-established script, which were described environmental factors (topography, natural vegetation, erosion, slope, current land use, social and economic aspects). The fieldwork allowed to know the reality of the social, economic and environmental factors, this paper studied more precisely, there is a correlation between the points raised and researched.

NDVI adjusted multispectral composition - digital image processing techniques for contrast enhancement, arithmetic were used. We also used the segmentation of bands 4 and 5 and subsequent classification levels on issues of land degradation through the classifier Bhattacharya SPRING 4.2. This used in green with bands 3 (red) and 1 (blue) allows to obtain the adjusted multispectral composition. For the study, five levels of land degradation very low, low, moderate, severe and very severe were adopted.

As they relate to soil preliminary office work were performed with the lifting of existing material on the study area, such as checking the availability of cartographic databases and studies in the area, among them: Lifting level exploratory recognition soils of the Paraíba state (BRAZIL, 1972), Agricultural Zoning of the Paraíba state (PARAÍBA, 1978). Were identified for the Taperoá -PB municipality, the following soil types: LUVISSOLO CRÔMICO Órtico vértico, VERTISSOLO, NEOSSOLO LITÓLICO Eutrófico, CAMBISSOLO HÁPLICO Eutrófico latossólico, NEOSSOLO REGOLÍTCO Eutrófico fragipânico e PLANOSSOLO NÁTRICO Sálico típico. LUVISSOLO CRÔMICO Órtico vértico - CRÔMICO Órtico vértico comprises intermediate to Vertisol soils, which have not hydromorphic textural B horizon . Originate from rocks referred to the Precambrian (CD), which are found mainly gneiss with biotite and hornblende and biotite - plagioclase gneiss .

CAMBISSOLO HÁPLICO Eutrófico - are derived from material from the breakdown of granite with hornblende - monzonítico. It is situated in undulating and hilly strong relief with flat tops and wavy. Rock outcrops are common, the soil is deep, with horizon weak, medium texture heavily drained, severely eroded in general, acid to moderately acid. The areas where the terrain is much more pronounced and rockiness are indicated to conserve natural vegetation and conserve soils.

Vertisol - comprises mineral soils with high clay content 2:1 (clay montmorillonite group) . Have high base saturation (V % value), high for the sum of exchangeable bases (S-value) with the focus on calcium and magnesium cations values. Are imperfectly drained with slow permeability, erosion ranging from laminar (the plains) severe or repeated grooves occasionally in parts where the terrain is smooth and wavy wavy .

PLANOSSOLO NÁTRICO Sálico típico - San halomórficos soils with B horizons solonétzico or nátrico, ie, a special type of textural B horizon, with exchangeable sodium saturation above 15 % and usually columnar or prismatic structure, with

rarely block. The relief consists of planed surface with gentle undulations , long slopes and tops usually plans.

NEOSSOLO LITÓLICO Eutrófico - comprises land undeveloped, shallow or very shallow. Originate from the breakdown of gneisses, referred to the Precambrian (CD), and granites, the nature and composition vary. Occur in relief from the strong wavy undulating and hilly smooth.

NEOSSOLO REGOLÍTCO Eutrófico fragipânico - comprises undeveloped soils, very sandy, moderately deep or deep, fairly easy weathering of primary materials - feature fragipan - Cx - having features like massive structure, consistency extremely hard or very hard to dry soil and firm to moist soil . Besides other important topics such as geology, geomorphology, climate, vegetation, as well as the collection of socioeconomic information, researched with the Taperoá municipality, thus constituting an extensive cartographic and bibliographic review on the topics of interest to being developed in the area .

The fieldwork for the purpose of recognizing the soils of the study area, were developed in an encompassing way, where did a tour of the entire area of the city, making up strategic caminhamentos so as to use of municipal roads and state, with all points identified and recorded using GPS. For separation of soil classes and units most representative mapping of the study area were conducted from observations of the land surface and through tests of soils in road blocks and areas of occurrence of Luvissolos Crômicos Órticos vérticos, the description was taken where we observed the presence of gullies. The collection of soil samples for physical and chemical analyzes were forwarded to the laboratory for Irrigation and Salinity of the Federal University of Campina Grande- PB, according to EMBRAPA (1997), along with the description of the profile field .

For Neossolos Flúvicos Eutróficos profile reached a greater depth than 240 cm, while the Luvissolos Crômico Órtico vértico around 44 cm and soil Neossolos Regolíticos reached depth of around 86 cm, were described and collected a total of 3 profiles totaling 12 soil samples for physical and chemical analysis, besides the use of 2 profiles already mentioned earlier. The description of the profiles was performed according to the standards of the SBCS (Lemos & Santos , 1996) .

Descriptions in the environmental conditions of occurrence of soil (location, location and slope, relief, lithology and geological formation, parent material, drainage, erosion, stoniness, rockiness, primary vegetation, local vegetation and current use) and their morphological properties are noted (thickness and nomenclature of horizons and layers, color, texture, structure, serous; consistency (dry, damp and wet); transition; roots and observations). From the field notes, the information was transferred to the base map and on this occasion, the soil types occurring in the study area and established the boundaries of the classes and soil mapping units were defined. At the end, in possession of the results of laboratory analyzes, have been made to confrontations with the field information and made the final definitions of soil characteristics and findings on the limits of mapping units, enabling the establishment of the final caption, and then prepared definitively the

soil map, scale 1:100,000 semidetailed level of recognition for the Taperoá - PB city.

Results and Discussion

The soil survey conducted in the study area had their identification and morphological characterization and analytical, as well as the intersection of information on soils and areas that are in the process of desertification. Based on visual interpretation of LANDSAT-5 and fieldwork, 05 mapping units were identified and divided into soils classes, Table. 1 presents data on the extent and corresponding percentage mapping units and soil types, respectively. Among the classes defined in the study area, there was a predominance of LUVISSOLOS CRÔMICOS Órticos vérticos and NEOSSOLOS LITÓLICOS Eutróficos – Rle.

Table. 1- Soil classes, area and pertentage of soil.

Soil classes	area (km^2)	%
CXve	36.42	5.69
RUve	36.17	5.65
RRe	52.46	8.19
RLe	251.67	39.33
TCo	255.74	39.97
Açude	7.41	1.16
TOTAL	**639.87**	**100**

the

LUVISSOLOS CRÔMICOS Órticos vérticos have restrictions with respect to physical properties, in terms of depth (shallow to shallow), around 50 cm; imperfect and high risk erosion in furrows and gullies, which covers very significant drainage areas. However, have good chemical and mineralogical conditions, with a high natural fertility. Pedogenetic and taxonomically will be characterized by soils with textural B eutrophic and high activity clay. Have a bit thick horizon (around 0-13 cm) in abrupt transition or not, for textural B of small thickness (13-20 cm), usually reddish and structure in angular or sub - angular blocks, texture on the A1 horizon is sandy clay type franc, which is slightly hard, friable, non-sticky and non- plastic. In the other, checks horizons to clay texture in angular blocks and subangular, very hard, firm to extremely firm, plastic, very plastic, sticky and very sticky. Have moderate surface stoniness abundant, represented by quartz rolled, (Figure 1).

A **B**

Figure 1 - Ambiente de ocorrência de LUVISSOLO CRÔMICO Órtico vértico - **TCo**.

NEOSSOLOS LITÓLICOS

Eutróficos - RLe - poorly developed soils are typically shallow and very shallow, with a surface horizon less than 40 cm thick followed by hard substratum, ie the present horizon seated directly on rock or on a C or Cr horizon, or on Material 90 % (by volume) or more of its mass consists of rock fragments larger than 2 mm (gravel and pebbles) and which have a lithic contact within 50 cm of the soil surface diameter. It is admits a B horizon at the beginning of training, provided that its thickness does not meet the requirements for defining any type of diagnostic B horizon (EMBRAPA, 1999). In the study area, there is occurrence of stony phase and many rock outcrops (Figure 2).

The vegetation is represented to a greater extent by hiperxerófila savanna, and also in the areas of occurrence of Cambisols soil vegetation is constituted by hypoxerophytic savanna, where you will find frequently in the tree layer angico and mastic, and the shrub layer catingueira, mufumbo, marmeleiro, jurema preta. The terrain varies from gentle to strong wavy undulating and hilly. The soil is eutrophic soils with medium to high fertility. Depending on the shallow, this soil generally is unsuitable for agricultural use, and must be submitted for use with palm pasture or natural vegetation in areas of little relief pattern. In areas of steep slope to hilly, the soil must be designed to conserve natural vegetation and wildlife protection. The Neossolos Litólicos predominate in approximate area of 251.67 km2 (39.33 %). It is found in different environments: saws and saws, pediplans, valleys and floodplains of rivers and streams. Occur mainly associated with Cambissolos, Neossolos Regolíticos, Luvissolos and outcroppings of rock.

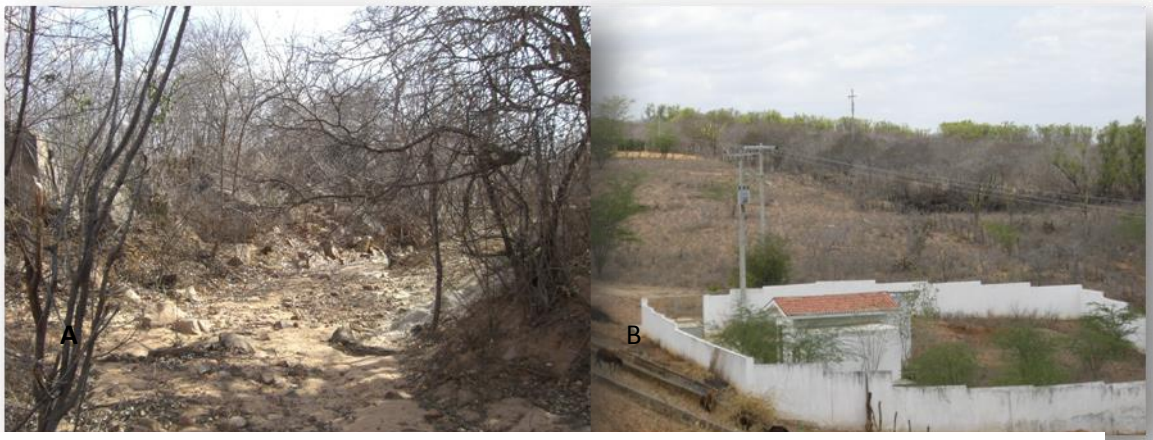

Figure 2 - NEOSSOLOS LITÓLICOS Eutróficos - RLe, (A) e (B).

Environmental degradation of the Taperoá municipality represented by five levels of degradation defined for the study area: very low, low, moderate, severe, and very severe. Beyond these levels were mapped four other them: bodies of water, clouds, shade and urban area, because they occupy a significant area in the images.

These soils are well eroded by solar erosion, due to the lack of coverage of the surface and where it is exposed, presents extensive erosion, and repeated in shallow furrows and gullies occur frequently. Levels of moderate and severe degradation of land grew by 145.64 km2 and area of 61.68 km2 respectively (Figure 3). This increase is explained by human intervention, especially the irrational use of natural resources, highlighting the extensive cattle rising, extraction of native vegetation, where fertility is highly committed, not allowing the development of grasses and low vegetation present in these areas is characterized by dwarfism.

The intersection of information layers of soil types and levels of land degradation in SPRING v.4.2 (Figure 4), considering that the degradation levels of moderate, severe and very severe land define the later stages of desertification showed that 82% Cambissolos, 85% Luvissolos, 78% Neossolos Regolíticos and 89% Neossolos Litólicos are seriously compromised by the process of desertification. The commitment of Neossolos Flúvicos is around 69 %. This impairment is associated with the use of these soils in construction, in the manufacture of ceramics, as well as the release of sewage and the presence of trash and dead animals.

These data were extremely negative for the entire area of the city reflect the impacts caused by inappropriate land management, the pressure exerted by extensive cattle that resulted and result in accelerated erosion due to lack of technical assistance to farmers by the competent bodies to related to the adoption of soil conservation practices, and non-compliance with environmental legislation. This information should serve as a warning to local and regional authorities for the high risk of desertification, and the need to create public policies for environmentally sustainable development.

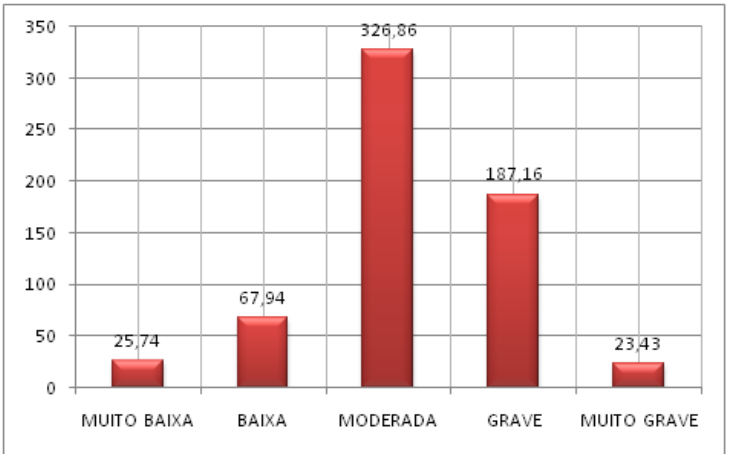

Figure 3 – Evolution of the level of the land degradation.

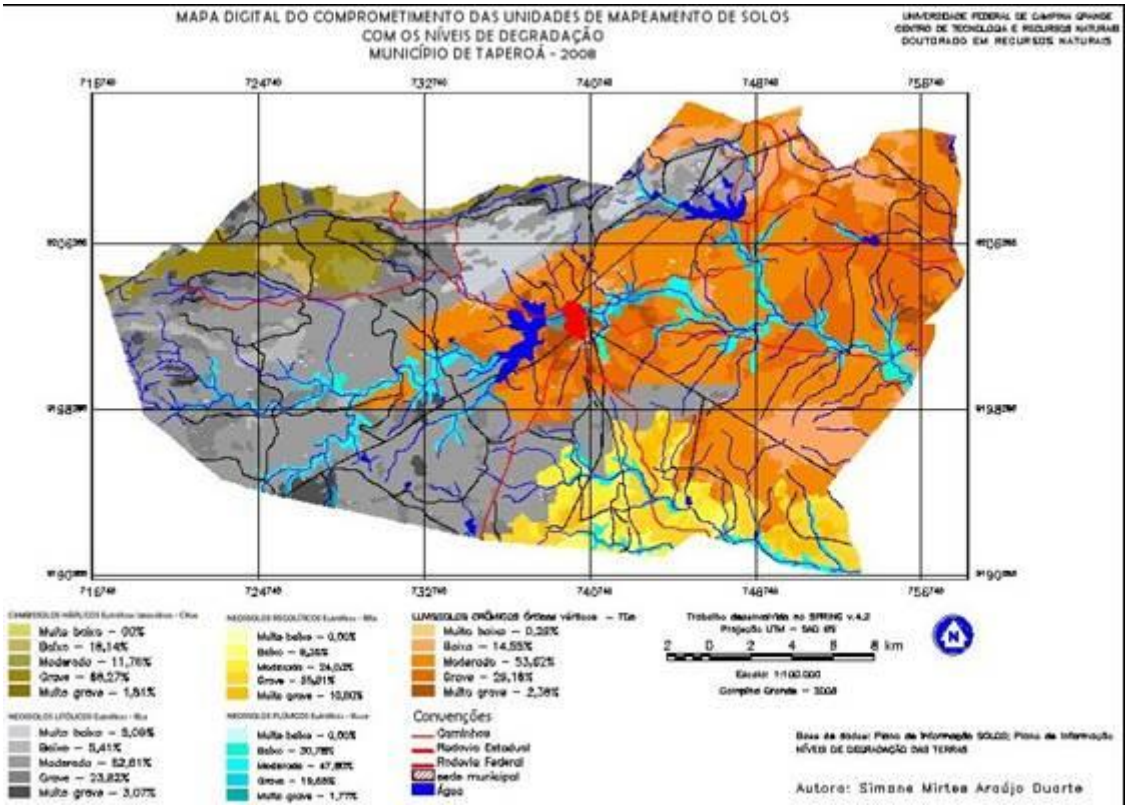

Figure 4 – Soil and level land degradation.

Studies have shown that soils are much eroded in different stages, and that the degradation effects are impacting that manifest themselves in different degrees according to the kind of soil and relief conditions, and the survey was a pedological basic document, allowing obtaining necessary information for the interpretation of studies on the topics presented here.

Conclusion

√ The municipality had a high risk of desertification by human pressure that triggers this

process, as consequential to bring social and economic problems;

√ SPRING v 4.2 enabled satisfactory manner the development of a system for geographic analysis related georeferenced objects had advantages over traditional methods, among which: the largest operation in the realization of overlapping maps (cross-checking); in the calculation of area and the generation of various thematic maps;

√ The study with crossing information of soils and areas of degradation processes showed that the units of soil classes are very fragile, and that the degradation effects are straining the social and economic impacts;

√ Studies have shown that soils is much eroded in different stages, and that the degradation effects are impacting that manifest themselves in different degrees according to the kind of soil and relief conditions;

√ The city studied at high risk to degradation by anthropogenic pressure that triggers the process of land desertification levels of moderate and severe degradation of land had an additional area of 145.64 km2 and 61.68 km2 respectively as they bring consequences social and economic problems.

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