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RELATIONSHIP BETWEEN VEGETATION INDICES AND ALTIMETRY IN TRIUNFO-PE, BRAZIL

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Abstract

To make an analysis of the natural conditions of a particular area it is necessary to take into consideration the various variables that it has influence. The most used in these studies are the temperature and precipitation, however, this paper proposes a more comprehensive analysis and inserts the altitude as being one of those important variables. Today it is possible to study various aspects of a natural area through the techniques of Remote Sensing and Geoprocessing. This technique, combined with a good data base allows us to accurately plot the physiognomy of the field of study. Events such as deforestation, expansion of urbanization, land use, and also their composition, are features that can, for example, be the object of study through the geotechnologies. With this in mind, the present work aims to make an analysis of the natural aspects of the municipality of Triunfo, located in the Vale do Pajeú, microregion of Pernambuco. On which note that the altitude is a relevant factor in the physical characteristics of the region, due to the clear increase in the density of vegetation in virtue of the largest dimensions altimetric data.

Keywords: Altimetric, vegetation, geotechnologies and soil use.

Introduction

Understanding the relationship between the various elements that make up the physical environment has always been of great importance to humanity. In the study of these interactions, the Remote Sensing techniques are being widely used due to its reliability. Remote Sensing is the science and art of obtaining information about an object, area or phenomenon through the analysis of data acquired by an instrument that is not in contact as object, area or phenomenon under investigation (Quartaroli, 2005).

Among the many techniques that enable the environmental analysis of a location, in

this work we used a DEM (Digital Elevation Model), which is one of the most important data for geospatial analysis, a DEM is used to denote the quantitative representation of a quantity which varies continuously in space. Data relief, geological information, surveys depths of the sea or a river, weather and geophysical data, geochemical and are typical examples of phenomena represented by a DEM (Ferreira, 2001).

Doyle (1978) defined them as ordered arrays of numbers that reproduce the spatial distribution of terrain features.

The NDVI (Normalization Difference Vegetation Index) which is widely used in environmental studies, it allows us to do analysis of the vegetation of an area. With the application of this technique has increased contrast between soil and vegetation, providing a better analysis of the composition vegetable. The vegetation indices such as NDVI, are important tools generated by remote sensing techniques that have been widely used in many studies that seek to relate the information captured by sensors with vegetation present in the study area (Galvíncio, 2008).

The NDVI, this has been widely used in global studies as a discriminator of vegetation, because it can be easily correlated to certain parameters of vegetation, such as biomass, leaf area, yield, photosynthetic activity, percentage of green cover, among others. (Elvidge and Chen, 1995 apud Laurentino et al 2011).

These techniques were applied in Triunfo municipality of the interior of Pernambuco, located in the semiarid morphoclimatic area. That due to higher altimetric elevations, (the largest in the state of Pernambuco), and peculiar characteristics, presents a colder climate, being considered a marsh elevation. Therefore, presents a different land use in relation to neighboring municipalities.

This study aims to analyze the vegetable cover of the municipality related to climate and altitude. Considered that the interaction between these factors have great influence in shaping the landscape of the municipality.

2. Materials and Methods

2.1 Study Area

The municipality of Triufo (Figure 1) is located in the micro Valley Pajeú, at a latitude of 7 ° 50'16" South and longitude 38 ° 6'7" west. Presents an average elevation of 1004 meters, making it the highest of Pernambuco. It has a total area of 191.517 km ² and a population of 15,006 inhabitants, according to the IBGE, Census 2010. Located in the Borborema Plateau contains a strong relief-wavy with the rock types and soil podzolic. The municipality is inserted into River Basin Pajeú, predominant vegetation type decidous. It has a milder climate than other neighboring municipalities, being second Köppen Aw, (Figure 1).

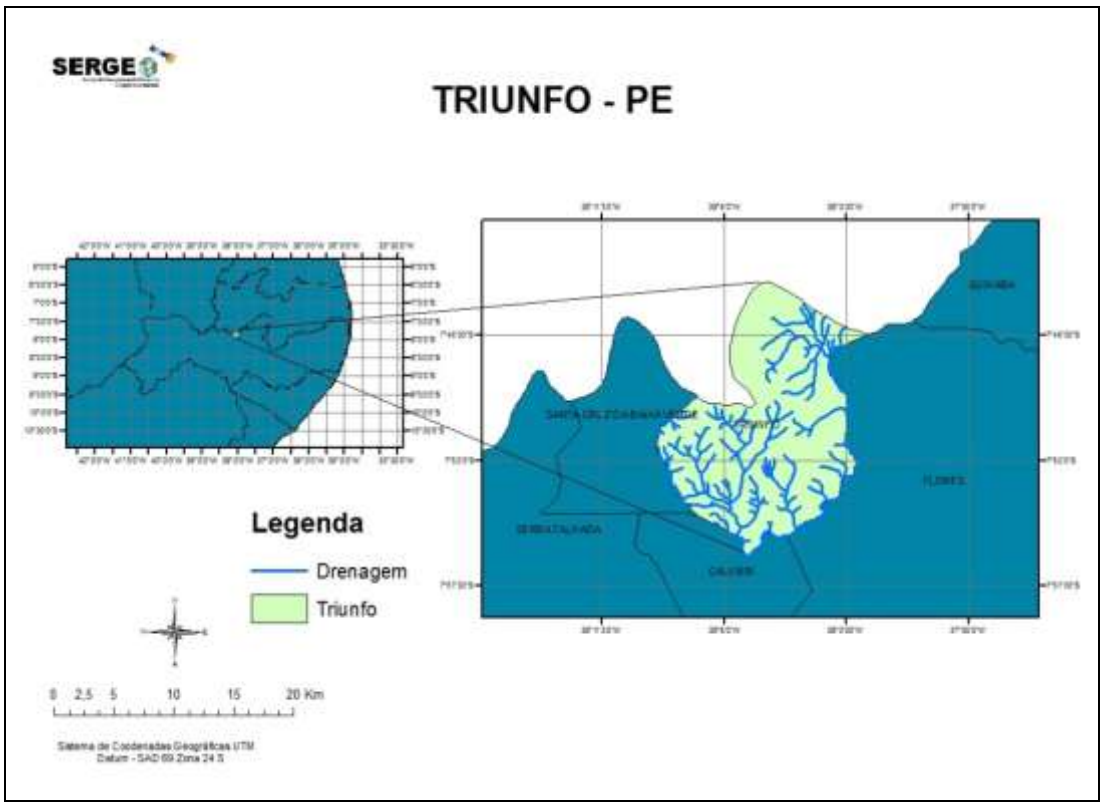

Figure 1 - Location of the Triunfo municipality of Pernambuco, Brazil.

This study used satellite images processed using software such as ERDAS 9.1 and ARCGIS 9.3 (both worked under license from the Laboratory of Remote Sensing and GIS – SERGEO/DCG/UFPE). These images comes from the Landsat 5 TM satellite in orbit 216 and point 65, passing on 03/10/2009, obtained for free through the site INPE (National Institute for Space Research) for generating and comparing rates vegetation index (NDVI) and altimetry data of the municipality. To get to the NDVI, was first conducted the process of stacking the seven spectral bands and the record of Landsat TM 5. After this is accomplished the process which generates the radiance, which constitutes radiant intensity per unit area projected onto a source-specific direction (Oliveira et al., 2010 and Galvíncio et al, 2006).

After the development of technical procedures, we performed the data analysis that brought relevant information: the area in the municipality on the exposed soil, sparse vegetation, sparse and dense vegetation and transition vegetation. Each of these classes is highlighted in NDVI for each subtype has a specific amount of water, which results in a different spectral response. It is thus possible to distinguish them from among all the others.

Regarding the DEM was used in a scene SRTM - Shuttle Radar Topography Mission, entitled SC-25-VA, acquired free of page from EMBRAPA - Empresa Brasileira de Pesquisa Agropecuária. This data is very important to understand how the relief has

influence on human activities and climatic factors, given that it allows us to draw a topographic profile of a region and mapping of altimetric data. A digital elevation model is a mathematical representation of the spatial distribution of a particular trait linked to a real surface. The surface is generally continuous and represents a phenomenon which can be varied. Even though it is most commonly associated with altimetry from the construction of a DEM is also possible to directly calculate volumes, areas, drawing profiles and cross sections, generate images or shaded in gray levels, generate maps of slope and aspect, generate slicing the intervals desired prospects and three-dimensional (ANDRADE, 2008). The MDE can be very useful in Study Science Geomorphological and all those using altimeter data with a component, since it facilitates spatial perception and allows three-dimensional view of the area being studied, (Fonseca, 2007). With these two data, the NDVI and DEM, we can make a comparison between the vegetation indices and associate them with the altimetric elevations arranged in the digital elevation model.

3 Results and discussion

As result of this study, we get two figures, an altimeter and other vegetation index for the area studied (Figure 2). As shown in NDVI, the stain on the seat of the municipal area of Triunfo is quite small relative to the size of the municipality, because in only 0.06% of the municipal territory yielded values for bare soil, assuming the pavement has a quite different spectral response of vegetation. The sparse vegetation corresponds to 1.86% of the municipality and this is basically around the urban area. These two classes are at altitudes that revolve around the 1000 meters. The open vegetation is that more present in region, in this image it corresponds to 47.40% of the territory. Analyzing their spatial arrangement can be noted that this subtype is predominant in regions that have quotas lower altitude, its largest presence is in places where the altitude does not exceed 700 meters. The transition vegetation corresponding to 42.80%, is found in higher areas, is predominantly between 700 and 1000 meters. By presenting peculiar characteristics in relation to temperature and precipitation in this region are cultivated sugar cane, banana and other tropical fruits, which would be impossible in the semiarid northeast, except in the case of irrigated crops. Finally appears dense vegetation with 7.82% of the municipal area, Figure 3, this class meets remaining areas where vegetation is preserved, and is available on the steeper slopes and other hard to reach places. Small patches of dense vegetation are scattered various points where the altitude exceeds 800 meters.

We can clearly notice that the more relief wins in altitude becomes dense vegetation Caatinga, which is characterized by xerophytic, especially being composed of shrubs and small trees usually with thorns. So the place is an exception to this rule. One

factor that stands out is that on the side that receives the southeast winds, loaded with moisture, vegetation is most luxuriant, because in this case, relief acts as a barrier, which holds some of the moisture present in the air mass Tropical Atlantic that makes this area if increase the amount of clouds and therefore increase the amount of rainfall, favoring the development of vegetation to the fact that aggregate soil type is Cambisol, which is characterized by the presence of many primary minerals in the coarse fraction and rock fragments with semi-weathered clayey (SOUZA, 2009). Thus, making it possible to develop an environment for a exuberant vegetation.

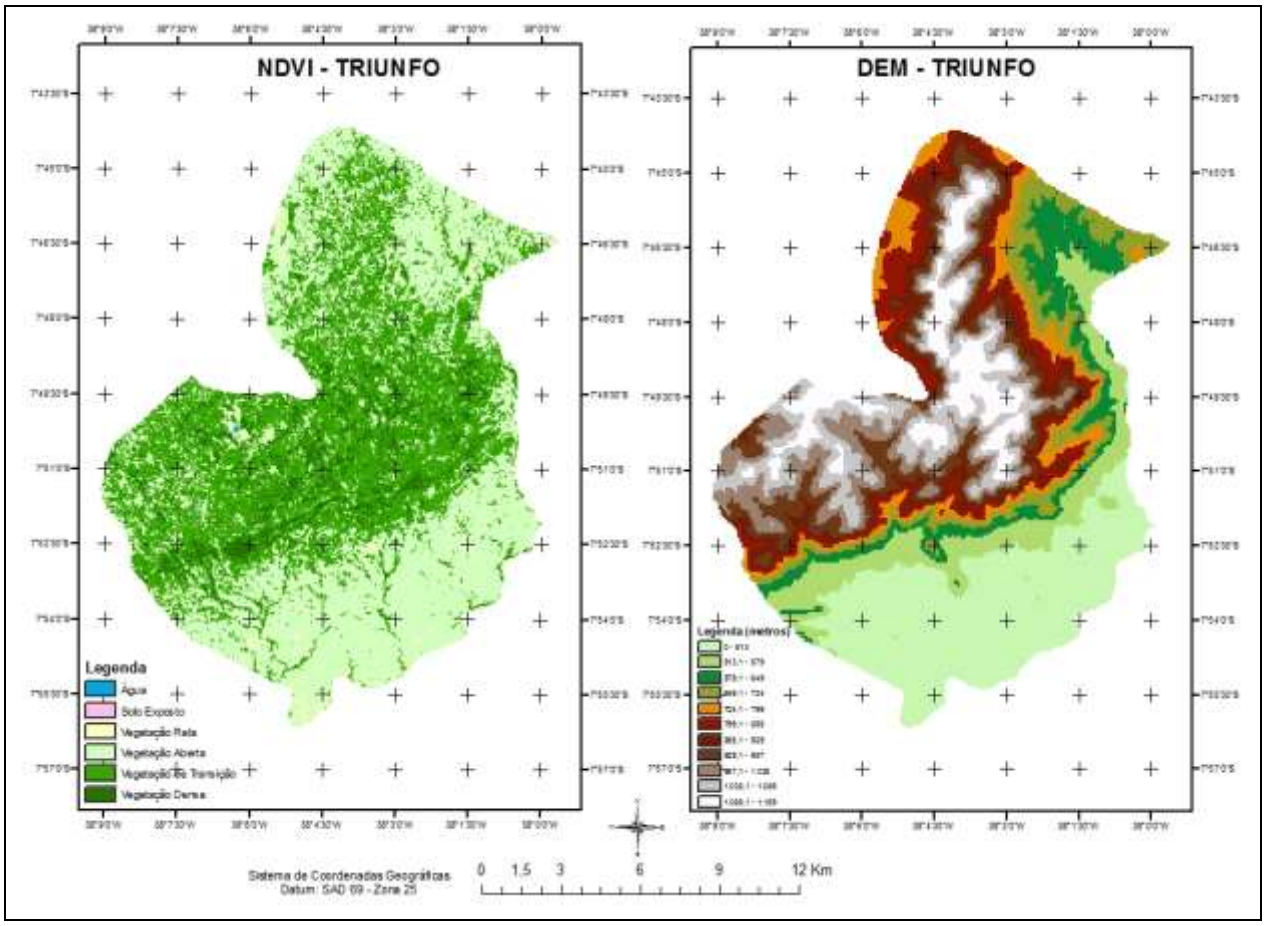

Figure 2 - NDVI and DEM of the Triunfo municipality.

Figure 3 – Percent of land cover in Triunfo-PE.

4. Conclusions

From this study it can be concluded that the methods of remote sensing and GIS are very useful when it comes to analyzing the physical space. In this case, these methods helped make a relationship between vegetation density and altitude in the municipality of Triunfo, which stands out as an exception in the space where it is located, as it is in the middle of semi-arid Pernambuco and yet have features of wettest regions in its vegetation.

The concerns that led to this study is confirmed, it became clear the increased density of vegetation while raising the altitude of the location. This increase is due to several factors, but certainly the altimetric elevations higher influence on the amount of precipitation and temperatures soften, this influence on soil formation and consequently reflected in aspects of its forest cover. These aspects were detected by NDVI which proved an excellent method for studies related to natural conditions and their impacts caused by the presence of man as a modifier of space.

5. Acknowledgements

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