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Short Communication

Suitability of Areas for Implementation of Central Pivot Irrigation in the Municipality of Santarém - PA

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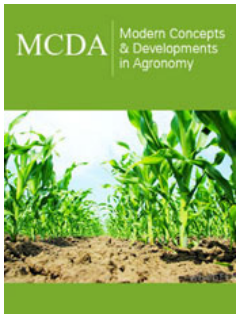

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Abstract

With the need to increase food production and a consequent increase in agricultural productivity, the use of central pivot irrigation becomes an interesting alternative to guarantee this demand. The main objective of this work was to generate data on slope to identify areas suitable for installing a central pivot in the municipality of Santarém-PA. GIS software was used to classify the areas, using a Digital Elevation Model (DEM), and digital images from Google® to identify arable areas. The municipality has potential to increase its irrigated areas with predominantly Dystrophic Yellow Oxisol soil. Excluding restricted areas such as conservation units, approximately 96% of areas were obtained suitable for installing a central pivot irrigation system, with slopes of up to 15%, and 4% with slopes greater than 15%. The municipality presents data that demonstrate a favorable relevance for the use of this technology.

Keywords: Agriculture; GIS; Productivity

Introduction

The absence or even excess of rain is considered one of the determining factors for failure in agricultural production, drought is very worrying in the sector, as in many regions it occurs during the period when plants need to absorb more water, for example, in soybean cultivation, the most critical phases of water demand are during germination/emergence and flowering/filling of grains [1].

In the Santarém region, during the rainy season, soybeans and corn are grown, the process of occupation and exploration of new crops is increasing in the region. For some authors Sano et al. [2] and Pereira et al. [3] during periods of strong drought or periods of El Niño, these plantations can be irrigated additionally with a central pivot. However, to implement this tool, the terrain must have few topographic irregularities. In this sense, this work has the specific objective of evaluating, through satellite images, whether areas in the municipality of Santarém are suitable for installing this irrigation system.

Material and Methods

The study was carried out in rural areas of the municipality of Santarém (Figure 1), state of Pará, characterized by dystrophic Yellow Oxisol soil, clayey texture [4]. To process the images, free GIS software was used, Quantum® GIS 3.4 Madeira and the Digital Elevation Model (DEM) from the TOPODATA project, with a spatial resolution of 90m and satellite images from Bing Satélite, as shown in Figure 2.

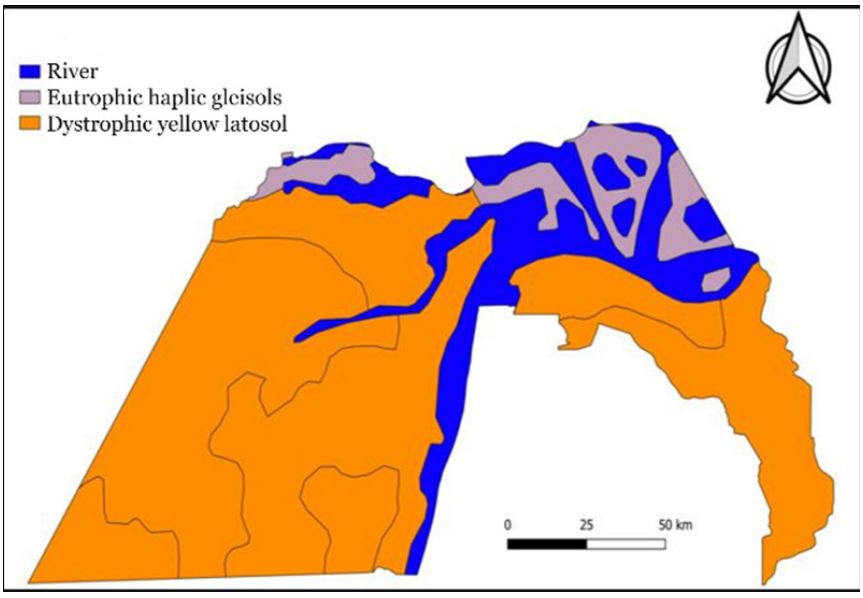

Figure 1: Map of the municipality of Santarém, characterized by soil classes. Source: Adapted from Embrapa Solos (2011).

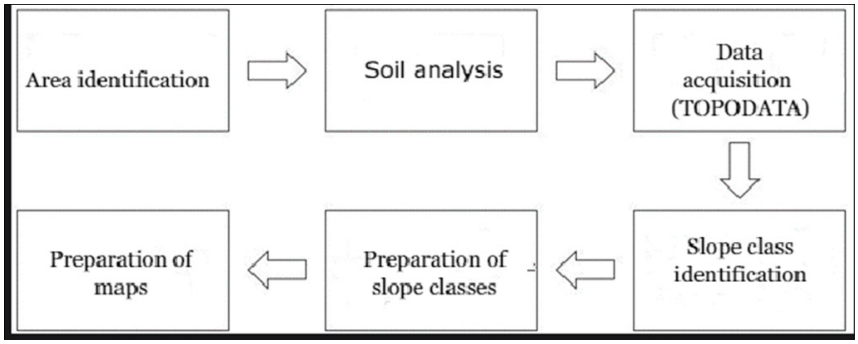

Figure 2: Methodological flowchart for classifying areas suitable for implementing Central Pivô in the municipality of Santarém - PA. Source: own authorship.

Slope Classes

Using the MDE (Digital Elevation Model) from the TOPODATA project - scene 02S555 of the SRTM (Shuttle Radar Topography Mission) mission [5], the MDE was classified (Figure 3a) according to the slopes of interest, or that is, in three classes 0-15%; 15-30% and >30% [6]. Slopes greater than 30% can cause greater water depth, favoring the erosion process.

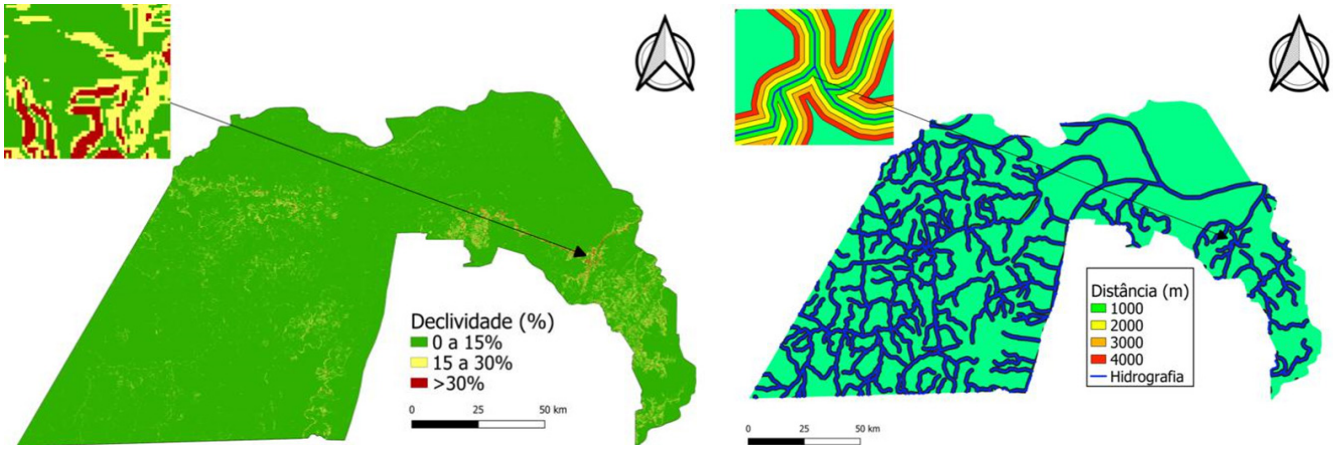

Figure 3: Soil slope classes (3a) and distance classes from the water body (3b), for the municipality of Santarém-PA.

Distance Layer Classes

This class refers to regions that were classified (Figure 3b) based on the distance from water bodies, using hydrographic data provided by the National Water Agency [7].

Result and Discussion

Santarém presents a favorable scenario, since the Amazon region contains the largest river basin on the planet, whose occupation encompasses several states in the country, including Pará [8]. Table 1 presents data on areas destined for central pivot in the municipality of Santarém - PA. Approximately 95% of the oxisol areas are suitable for installing a central pivot. These areas are included in class 1, where they have a slope of up to 15%.

Class 1 with a slope of up to 15%, the municipality has approximately 96% of the areas suitable for installing the irrigation system, as they are areas with topography that varies from gently undulating to undulating [9]. According to Lima et al. [6], slopes greater than 15% can increase the erosion process, due to the greater water depth applied, causing the loss of nutrients and soil degradation.

Table 1: Classes of areas suitable for installing a central pivot in the municipality of Santarém – PA

Class (%)	Latosol area (%)	Area (%) No restriction	Area (%) Restricted
class1 (0 to 15)	95,78	96,60	96,08
class 2 (15 to 30)	3,79	3,07	3,49
class3 (>30)	0,43	0,33	0,43
Grand total	100,00	100,00	100,00

Conclusion

The use of the GIS tool demonstrated feasibility for the suitability study, showing good results for the municipality in terms of implementing central pivot irrigation systems. In addition to topography, the quality and quantity of available water must be taken into account, as well as the availability of electrical energy.

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