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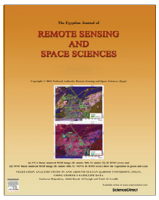

Research Paper

Assessment of soil fertility status in Paderu Mandal, Visakhapatnam district of Andhra Pradesh through Geospatial techniques

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ABSTRACT

82 soil samples were collected randomly at different land use/cover locations, which includes agriculture, forest, built up area, scrubland and plantation at a depth of 0–30 cm, analyzed for soil pH, electrical conductivity (EC) and presence of nitrogen (N), phosphorous (P) and potassium (K). Inverse Distance Weightage method (IDW) was employed for analyzing the spatial distribution of soil fertility through geospatial techniques for sustainable agriculture. It is observed that soil pH varies between 4.8 and 7.5; showing nearly 83% of the study area is acidic in nature. The EC varies from 0.04 to 0.87 ds/m with a mean of 0.21 ds/m and non saline in condition. Out of 435 km^2 of total study area, 99% of area is less in nitrogen followed by potassium (70%) and phosphorus (42%) respectively.

1. Introduction

In any agricultural operations, soil is the utmost importance as it is the cradle for all crops and plants. There are non re-renewable resources, formed at the rate of 1 in. every 250–1200 years (John Madeley, 2002). To make agriculturally productive, it may takes another 3000–12,000 years (Venkata Ramana et al., 2015). This natural resource is finite in nature and also impossible for within time span of a human life (Mandal et al., 2009). The top soil having an average depth of about 15–30 cm on which plants grow and the farming activities flourishes. Now-a-days, it is facing serious problems due to human pressure and utilization incompatible with its capacity. Hence, it is important to keep healthy and productive soil to continue our soil to function optimally to increase agriculture production with appropriate soil amendment and crop management practices (MacCarthy et al., 2013). In rural areas, the living standards of people mainly depend on agriculture, which is often determined by the fertility and productivity of soil. Soil fertility is one of the primary constraints to agricultural production in developing countries like India (Gruhn et al., 2000). It comprises not only in supply of nutrient, but also indicates their nutrient supplying capability; moreover fertility of soil is subject to man's control (Deshmukh, 2012). It may be maintained by scientific crop rotations, and the application of manure of fertilizers.

The traditional even fertilizing method is not scientifically suitable and efficient to apply fertilizer in places with different soil nutrients, because soil fertility various between region. Overuse of fertilizers can certainly lead to a waste of fertilizer resources and a serious environmental pollution (Clay, 2002; Yang and Zhang, 2008). Hence, a comprehensive knowledge of soil fertility provides a better understanding in the current situation and for identifying soil nutrient distribution and trends (Dafonte et al., 2010). Earlier studies (Isaaks and Srivastava, 1989; Goovaerts, 1997; Wollenhaypt et al., 1997; Burrough and McDonnell, 1998; Li et al., 2003; Tan et al., 2005; Xu et al., 2013; Liu et al., 2014; Behera and Shukla, 2015) proved that geo-statistical analysis methods are most useful for obtain the knowledge of characteristics, distribution and variability of soil fertility in a timely and accurate manner for precision farming .It is a management practice for increasing productivity of agriculture for the site-specific management (Cahn et al., 1994). These farming operations are vital decision-making process for land use suitability in improving crop productivity (AbdelRahman et al., 2016), where there is a need to ensure efficiency in the management of soil (Mc Cauley et al., 1997). For the purpose of improving soil management and quality as well as cost control/benefit results of agricultural producers by adapting to new technologies like Geospatial Technology (Iftikar et al., 2010; ; Markoski et al., 2015). Using these advance

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technologies, so many emeritus scholars and scientists (Weber and Englund, 1992; Gotway et al., 1996; Kravchenko and Bullock, 1999; Robinson and Metternicht, 2006; Sen and Majumdar, 2006; AbdelRahman et al., 2016; Tunçay et al., 2015) estimated and mapped the soil fertility distribution of un-sampled locations, using Inverse Distance Weightage method (IDW). It is the one of the best interpolation method, because of its simplicity, robustness and used to derive estimates of the soil fertility properties from irregularly spaced samples (Goovaerts, 1997).

Therefore, the objective of this study was to conduct geo-statistical analysis for spatial distribution and variability (allocation) of observed values and predicted values through IDW interpolation techniques, for estimating soil pH, electrical conductivity (EC) and macro nutrients (N, P, K) as well as its status for a site specific management approach in the agriculture fields of Paderu Mandal, Visakhapatnam district, Andhrapradesh state, India.

2. Study area

The study area is lies between 18° 18′–17° 56′ N of latitudes and 82° 32′–82° 53′ E of longitudes covering an area of 435 km^2 (Fig. 1). Nearly, 73% of area is under forest land fallowed by agricultural land (20.2%), plantations (2.5%) and built up land covers only 2.1%.Where soils are mainly red sandy loams and light to medium in texture. They are continuously affected due to severe weathering aberration of natural disturbances. The soil erosion is severe due to its varied and high topography of the land and heavy rainfall received during the monsoon period and less vegetative cover on its upper parts of the hills. The normal annual rainfall is 1252 mm and mean annual temperature varies from 24 °C to 35 °C. May is the hottest month and January is the coolest month. Agriculture is the main source of livelihood of the people living in this area and the people practice shifting cultivation on hill slopes. Shifting cultivation is locally known as the podu cultivation.

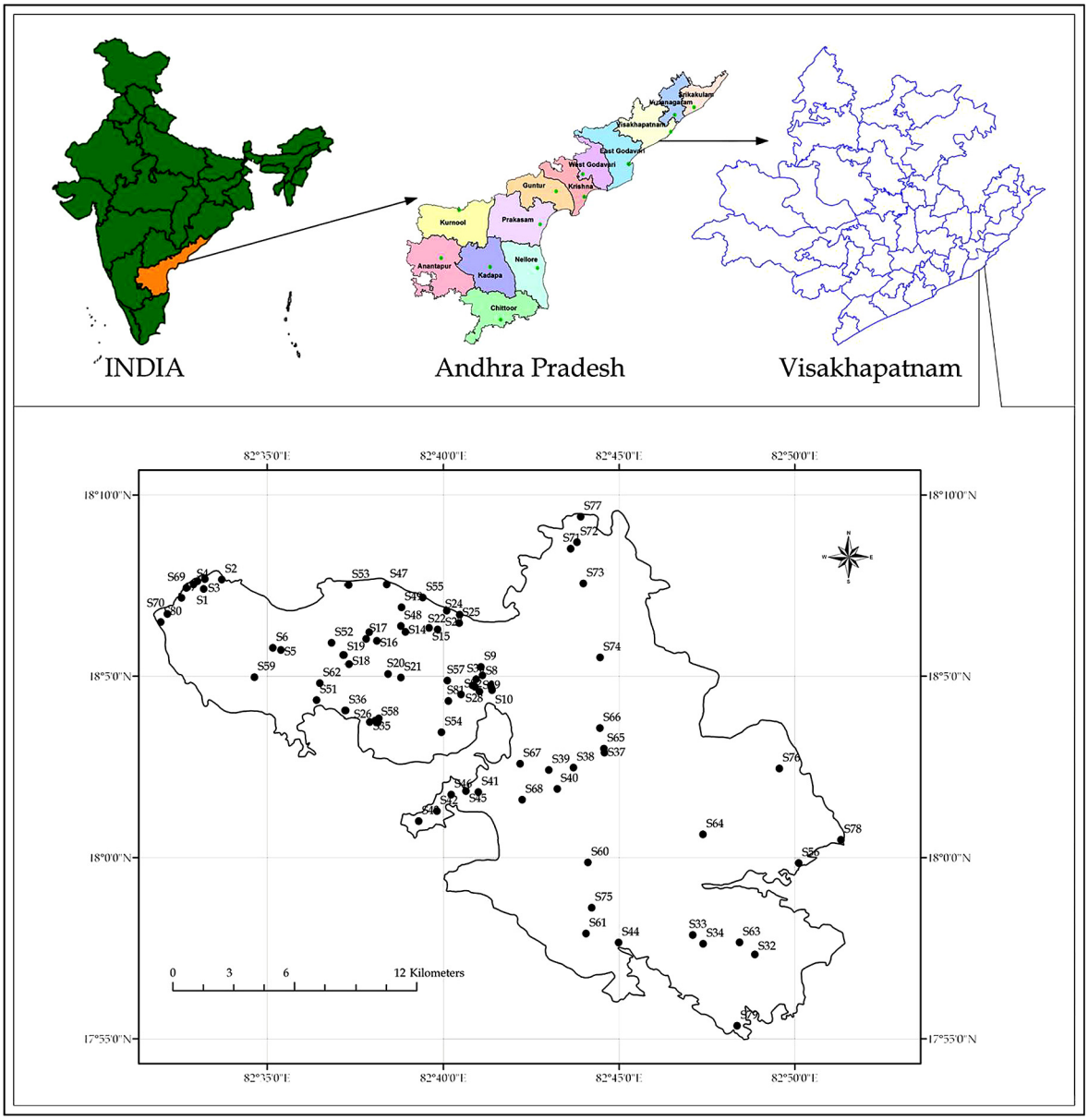

Fig. 1. Location map showing soil sample in the study area.