A GEOTECHNICAL STUDY OF SALT AFFECTED AREAS IN YOGI VEMANA UNIVERSITY WATERSHED AREA

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ABSTRACT: *Watershed is an area, which catches the water from precipitation and then is drained by a river and its tributaries. It is a "resource region" where the ecosystem is closely interconnected around a basic resource - water. The watershed is therefore an ideal management unit. The watershed provides a powerful study and management unit, which integrates ecological, geographical, geological, and cultural aspects of the land. The watershed is also a useful concept for integrating science with historical, cultural, economic, and political issues.*

According to the U.S. Geological Survey, most of that three percent is inaccessible. Over 68 percent of the fresh water on Earth is found in icecaps and glaciers, and just over 30 percent is found in ground water. Only about 0.3 percent of our fresh water is found in the surface water of lakes, rivers, and swamps. Here in the current study area even 0.2 percent of recharge of aquifer is not possible because of highly weathered soil in such area normal water harvesting structures like check dams wont yield any results, taking this into consideration stream passing by my college is taken its various stream orders are plotted out using toposheets and the whole together thus make the required watershed for the study purpose. Using QGIS software along with SOI toposheets, district geological map and from the Thematic data obtained from NRSC website BHUVAN the entire vector data related to the study area boundary, water body, streams, erosion, lineaments, land use landcover, salt affected and water logging, wasteland, geology, geomorphology is created. The different vector layer data is categorized in accordance to the suitability order considered for recharge as well as storage. Intersection of all the layers is made for obtaining the ideal sites required for storage or recharge of water thus by eliminating all the unnecessary area. The volume of the storage structures is given by estimation of runoff as well as the total volume of rain obtained in the study area. The entire study area data is created in coordinate Reference System WGS 84 having authority ID EPSG:4326 and then Projected into coordinate Reference System WGS 84 / UTM ZONE 44N having authority ID EPSG:32644.

Key Words: *Watershed, recharge, geomorphology, lineaments, Intersection, eliminating*

INTRODUCTION

Watershed was defined as a topographically delineated area draining into a single channel. It was a geo-hydrological unit draining at a common point by a system of streams. Conceptually, watershed development was nothing but a risk management strategy which was meant for protecting the inhabitants of the fragile and deplorable ecosystems of rural India from acute distress caused by recurring droughts and intensity of floods. Salt-affected soils of India include an area of about 8.0 million hectares, out of which 2.52 million hectares comprise of coastal saline soils holding human habitations and cultivated lands and 0.57 million hectares are under mangrove.

A watershed is the area covering all the land that contributes runoff water to a common point. It is a natural physiographic or ecological unit composed of interrelated parts and functions.

Watershed essentially is a land surface area draining into a common outlet. The size of the watershed may vary from a few hectares to thousands of hectares depending upon the size of the river or stream passing through it and the location of the outlet. For providing conditions for optimum utilization of land, water, plant and animal resources for protecting the environment, it is necessary to treat the land from top to bottom or ridge to valley. The watershed approach benefits the farmer through improved soil health, better drainage and more efficient use of rain water with the possibility of excess water being stored in suitable structures for use during scarcity periods. With voluntary farmer participation, sustainable improvement in crop and animal production is possible. Government of India accepted watershed approach as a unit of area development on the recommendations of the Task Force on Integrated Agricultural Development in Drought Prone Areas, which submitted its report in 1973. It was from the Fifth Five Year Plan that the Government of

India strongly recommended the planning and implementation of DPAP through watershed approach instead of taking the whole district as a unit. By the end of eighth plan through various initiatives under watershed development mentioned above, 9.6 m.ha. of arable land and 6.9 m.ha, of non aridable land could be treated leaving an area of 60 m.ha. of arable land and 15 m.ha. of non-arable land to be covered by the beginning of ninth plan period. In this context, the experience of the past two decades in implementation of' this programmee needs to be critically cx~minod keeping in view, the objective of maximizing the desired benefits under the programmee and renlising the best value for money and human effort.

REVIEW OF LITERATURE

A brief review of previous work done on various aspects of' watershed management is presented.

Reddy and **Walker** (1987).from their study on "impact of watershed programmers on adoption and economics of technology and on economic conditions of rural people" reported 16 per cent of arm under sole crops in Mitteniari watershed area as against 12 per cent in non-watershed villages. It is also observed that the area covered under improved varieties in watershed villages was 92 per cent as against 69 per cent in non-watershed area villages during the Kharif 1986.

of groundwater of 200 km3 , out of which 100 km3 most likely occurs in Western India.

Ratna Reddy, Y.R. (2000) observed that watershed development programme had brought fortunes for the rural development in India by improving the socio-economic status of the rural people.

Narashiman, T.N. (2008) suggested that ground water would be best managed cooperatively through local user groups and panchayathraj institutions with technical inputs from the groundwater boards at central and state level. Artificial recharge and rainwater harvesting should be actively encouraged through the use of modern methods.

Soil salinity is an issue of global importance causing many socio-economic problems. It is a serious threat to world food security by lowering crop yields. It also results in losses of hundreds of millions of dollars (US$ 12.6 billion) per year to agriculture (**Ghassemi** et al. 1995). According to the estimates of **Martinez-Beltran** and **Manzur** (2005), every year 0.25–0.50 million hectares of irrigated lands are gone out of production in the world due to salts build up in the soil.

OBJECTIVES

The main objective of this paper is to study the salt affected areas in the Yogi Vemana University campus.

METHODOLOGY

In the present study Survey of India topographic maps at scale1:50,000 published by Survey of India (SOI) have been utilized and Remote Sensing data collected in digital form from NRSC (National Remote Sensing Center, Hyderabad) the image pass on IRS-1D LISS IV data. Geomorphologicalunits, mapping with image interpretation techniques, digital image processing, exiting geology and geomorphology map using Erdas Imagine 2015 and ArcGis 10.1 and verified in field work with GCPs collection to understand the distribution of the landforms, Stream Order and the lineaments. The basic method adopted was visual interpretation of FCC and B&W data. From the image interpretation characters as tone, texture, colour, form and shape various landforms and land units were distinguished. The response of materials in the different wave length bands are also used to identify surface materials as water bodies, Dyke Ridge, Pediment, Flood Plain Shallow, Pedi plain Shallow Weathered, Pediment Inselberg Complex, Residual Hill, Denudation Hill, Inselberg, Buried Pedi plain Moderate, Buried Pedi plain Shallow, Plateau Moderately Dissected, Plateau Slightly Dissected, Valley Fill Shallow, Plateau Weathered –Shallow etc

STUDY AREA

The study area falls in the Cuddapah Basin region of Andhra Pradesh. It is located 15 km away from Kadapa town near Kadapa pulivendula road. The study area represented by the global coordinates of 14°28'30 "North Latitude and 078°42'31"East Longitude (Survey of India, Toposheet No. 57J11&57J15).

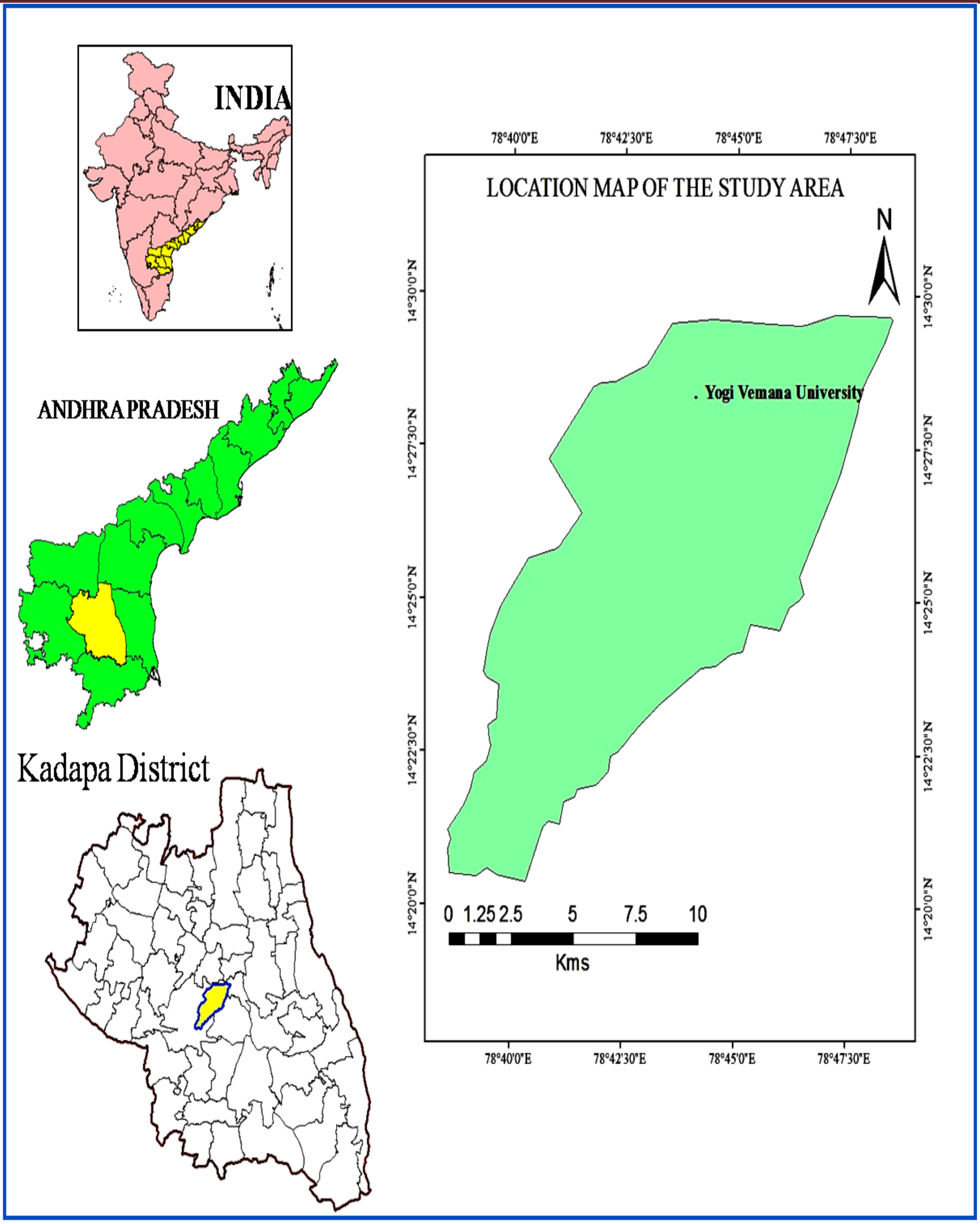

Fig 1. Location Map

SALT AFFECTED AREAS

Salt affected areas are one of the most important degraded areas where soil productivity is reduced due to either salinization (EC > 4 dS/m) or sodicity (ESP > 15) or both. The soils with EC more than 2 dS/m in black soils and >4 dS/m in non-black soils was considered as saline in the present project. Soils with soil pH more than 8.5 results in increase of exchangeable sodium percentage (ESP) in soils (> 15) and are termed as sodic. Based on the type of problem, it has been divided into saline, sodic and saline-sodic. Under NR Census project three types of salt affected soils viz., saline, sodic and saline-sodic are mapped using three seasons satellite data, field work and analysis of soil samples under three severity classes namely slight, moderate and strong. The sodic soils in the study area are plotted out by the WMS data obtained from Bhuvan which was used for creation of vector data in QGIS.

➢ **Sodic soils**

Usually it occurs in the older alluvial plains. Because of high sodium content, soils will be moist during post-monsoon season which can be seen easily in the post-monsoon image. It appears on satellite data as grayish white / dull white discrete patchy. It occurs as continuous patches with smooth texture on the image. Multi temporal data set will help in delineation of affected areas and to some extent severity classes. The soil pH values will be more than > 8.5, and EC will be < 4 dS/m and ESP is greater than 15.

Limits for Salinisation / Alkalization: Criteria for assessing salinity / sodicity in Vertisols / Non-Vertisols

Table no: 1

S.No	**Severity Class**	**Salinity (ds / m)**		**Sodicity (ESP)**	
		Vertisols	NonVertisols	Vertisols	Non- Vertisols
1.	Slight	2 – 4	4 - 8	5 – 10	15 - 40
2.	Moderate	4 – 8	8 - 16	10 – 20	40 - 60
3.	Severe	> 8	> 16	> 20	> 60

Note: S = Saline, N = Sodic, SN = Saline-sodic.

Table: 2

S. No	Type	Classes included		
		Slight	Moderate	Severe
1	Saline	S1	S2	S3
2	Sodic	N1	N2	N3
3	Saline-sodic	S1N1	S1N2, S2N1, S2N2	S1N3, S2N3, S3N1, S3N2, S3N3

Note: The sub-categorization of salt-affected soils is based on most limiting factor concept.

Figure 2: salt affected Map

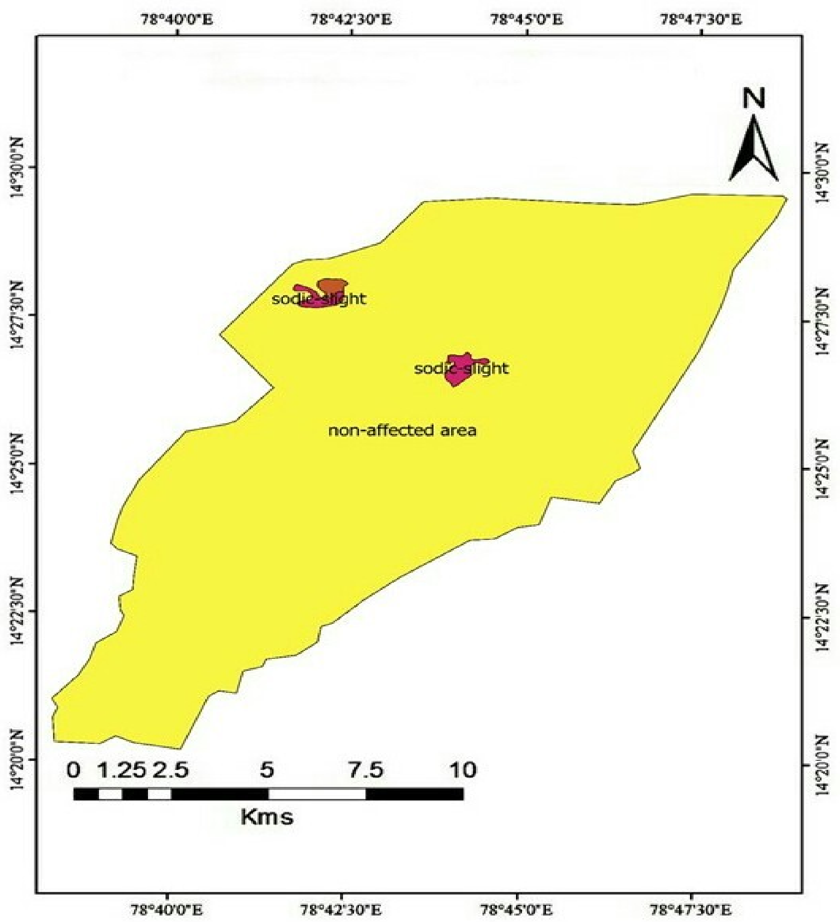

Table No 3: Salt Affected

TYPE	AREA in Sq. kms
non-affected area	141
sodic-slight	0.5
sodic-slight	0.3
sodic-moderate	0.2

Salt affected areas are one of the most important degraded areas where soil productivity is reduced due to either salinization (EC > 4 dS/m) or sodicity (ESP > 15) or both. The soils with EC more than 2 dS/m in black soils and >4 dS/m in non-black soils was considered as saline in the present project. Soils with soil pH more than 8.5 results in increase of exchangeable sodium percentage (ESP) in soils (> 15) and are termed as sodic. Based on the type of problem, it has been divided into saline, sodic and saline-sodic. Under NR Census project three types of salt affected soils viz., saline, sodic and saline-sodic are mapped using three seasons satellite data, field work and analysis of soil samples under three severity classes namely slight, moderate and strong.

CONCLUSION & RECOMMENDATIONS

In the current study area even 0.2 percent of ground water recharge is not possible because of highly weathered soil in such an area normal water harvesting structures like check dams won't yield any results, an improved scientific study is highly required for the construction of any water harvesting structures, for the selection of ideal sites in the watershed for the ground water recharge or for the storage of rain water through the construction of suitable storage tanks in the required area. By the application of Geospatial technologies as done in the current project one can accurately and quickly deliver the required analysis with the most varied complex data analysis. The runoff values obtained in the watershed are high which increase the chance of capturing the runoff water through construction of suitable water harvesting structures which is quite essential in region like Kadapa which receives low precipitation. Lineaments are taken into account according to the geology thus increasing the rate of accuracy for the Recharge or the Storage of water. The method of survey is quite different in the study as it encompasses all the data of the watershed by the application of GIS. Hence the analysis derived from water harvesting survey on Yogi Vemana University Watershed Serves as a major criterion for further proceedings. It is highly recommended that construction of suitable water harvesting structures should be made only after the careful analysis of the selected area using Science & Technology.

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