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Hydro Geomorphological Mapping Of Dosalavanka Watershed Using Remote Sensing And GIS Techniques Chittoor District, Andhra Pradesh, India

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Abstract: *Chittoor District is a hot and arid District, falls in rain shadow zone with a very low annual rainfall of 520mm. The recurrence of drought increased considerably and unless collective measures are initiated on a permanent basis the situation will become grim in future. Dosalavanka watershed in Chittoor District is selected to demonstrate the capability of high resolution satellite data in groundwater mapping at village level. This watershed is located in Survey of India toposheet No. 57 O/6. This watershed with an area of about 63 sq.km is underlined by hornblendebiotite gneiss and metabasalt traversed by dolerite dykes. Hydrogeomorphological mapping was carried out on 1:50,000 scale using IRS-P6 LISS-III satellite data. The satellite data facilitates to update the extent of built-up area, road and drainage network. Further, the revenue villages enclosed in the watershed are digitized, mosaiced and superimposed on hydrogeomorphology map. This helps to give site specific recommendation on groundwater prospects. In addition, the impact analysis of check dams constructed in the watershed is also discussed. Studies showed that after construction of check dams the water levels in wells increased, abandoned wells got rejuvenated, new bore wells came up resulting increased irrigated area.*

Key Words: *SOI Toposheet, Satellite Data LISS III, GIS, Hydrogeomorphology*

I. Introduction

The synoptic view provided by satellite remote sensing offers technologically the appropriate method for studying land and water resources, characterizing the coherent agricultural zones, and identifying the constraints/ecological problems at micro level. Effective use of space based remote sensing data suitably merged with collateral, socio-economic and meteorological data in GIS helps arriving at locale specific prescriptions to achieve sustainable development of natural resources of any drought affected region. Remote sensing data in conjunction with sufficient ground truth data provides information on geology, geomorphology, structural pattern and recharge conditions which ultimately define groundwater regime. Chittoor is a hot and arid District, falls in rain shadow zone with a very low annual rainfall of 520 mm which is second lowest in the country after Jaisalmer in Rajasthan (APSRAC 1997). Monsoon evades Chittoor District due to its location in the rain shadow region. South-West monsoon is prevented by the high altitudes of Western Ghats, making Chittoor District a rain shadow area and hence, agricultural conditions are more often precarious. Being far away from the East Coast, it does not also enjoy the rainfall benefit of the North-East monsoon. The recurrence of droughts increased considerably and unless collective measures are initiated on a permanent basis the situation will become grim in future. In order to demonstrate the capability of high resolution satellite data in groundwater mapping at village level part of Dosalavanka watershed in Chittoor District is selected. The objective of the study is to demonstrate the capability of high resolution Indian Remote Sensing satellite data in groundwater mapping with specific reference to find scientific and lasting solutions to mitigate recurring droughts at micro level. Further, the impact analysis of check dams were discussed to study augmented recharge of groundwater which ultimately resulted in sustainable development of watershed.

II. Study Area

Chittoor district is one of the chronically drought affected Rayalaseema districts of Andhra Pradesh., is situated between North Latitudes 13°30’26.097”to 13°36’26.109” and East Longitudes 79°15’11.215” to 79°21’11.663” and is covered in the Survey of India Topographical map numbers 57 O/6 on a scale of 1:50,000. It is bounded on the North by Kadapa District, and Nellore on the East Tamil Nadu state by on the South by Kurnool District. The Dosalavanka Watershed area is 63 sq.km . This District is located in a 3H zone of Andhra Pradesh.

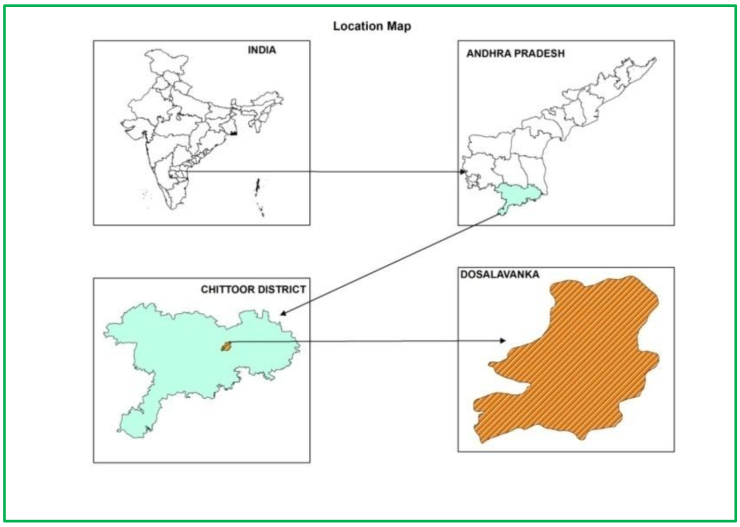

Figure 1 Location map of Dosalavanka watershed, Chittoor District, A.P, India.

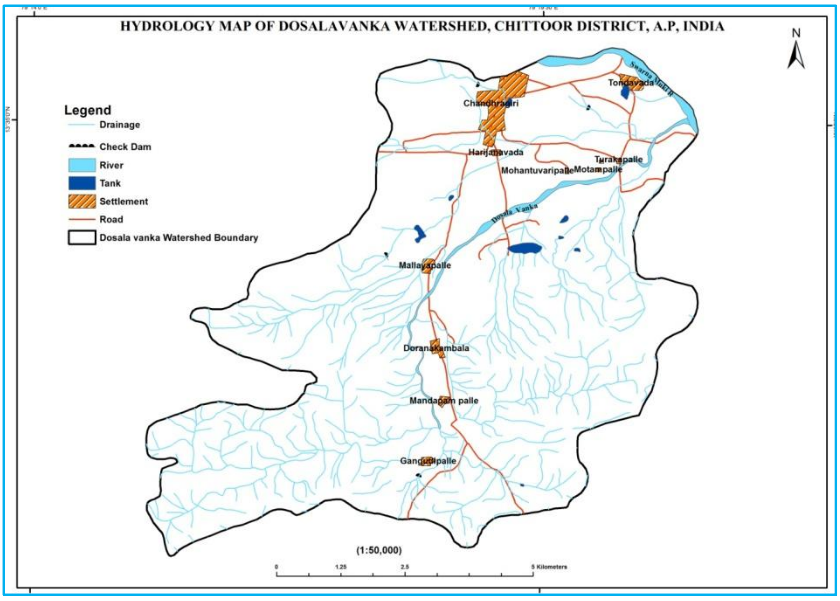

Figure 2 Drainage map of Dosalavanka watershed, Chittoor District, A.P, India

III. Methodology

The term 'Hydrogeomorphology' deals mainly with the groundwater prospects of various geomorphic units. Structure and lithology are the two parameters that control the evolution of land forms. In other words, lithology and structure control the groundwater prospects of any region. The Hydrogeomorphological map is given as figure number

The procedure adopted to prepare the hydro geomorphology map of the project area is given in the flow chart (Fig 3). It consists of basically four distinct parts. They are

1) Acquisition of satellite and collateral data
2) Preparation of pre field interpretation maps
3) Limited field checks in the doubtful areas and
4) Preparation of hydro geomorphological map

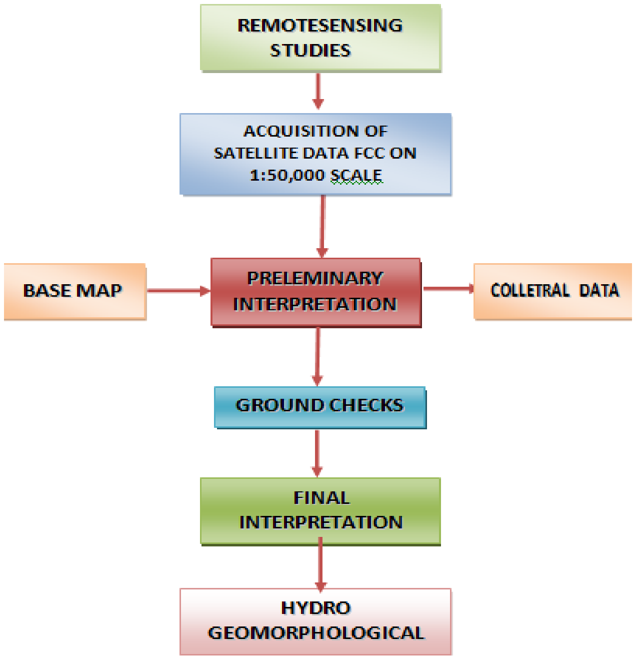

Figure 3 Flow Chart Showing the Methodology used in preparing the Geomorhological map

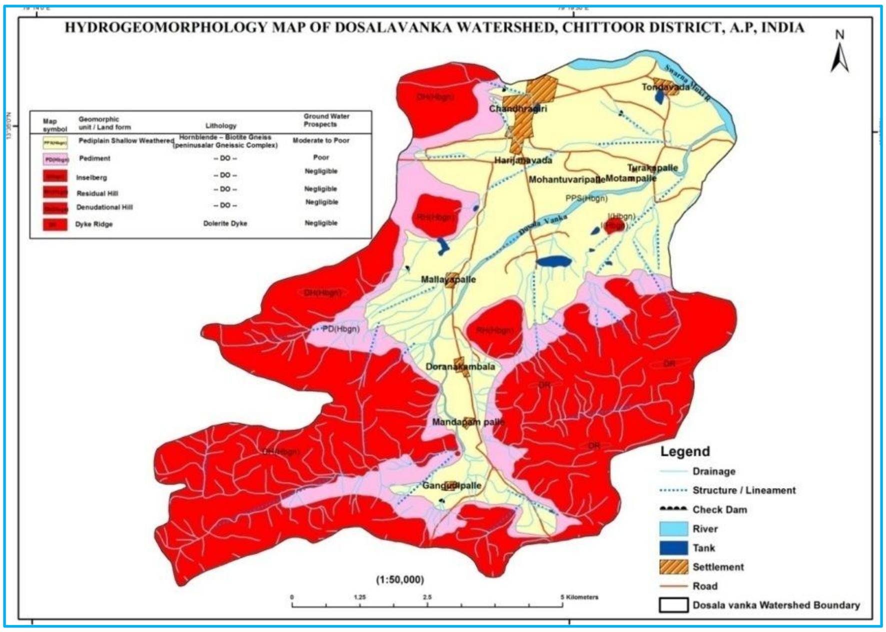

Figure 4 Hydrogeomorphology Map of Dosalavanka watershed, Chittoor District, A.P, India

1) **Shallow Weathered Pediplain (PPS –Hbgn):** It is a gently sloping smooth surface of granite gneiss with less than 5m depth of weathered material, generally covered with red soil. The groundwater prospects are poor to moderate. Moderate yields are expected along fractures/lineaments with yields ranging from 1 to 31ps. These land forms developed in the middle and northwestern part of the catchment area.
2) **Pediment (PD-Hbgn):** It is a gently sloping rock-cut surface of granites and gneisses with thin veneer of detritus. In general, the groundwater prospects in a pediment area poor.
3) **Isenberg(I-Hbgn):** This means small light hilly. These landforms are located in the Northeast corner part of the catchment area. Gently sloping rock-cut surface of granites and gneisses with thin veneer of detritus. In general, the groundwater prospects in a pediment area poor.
4) **Residual Hill (RH-Hbgn):** It is an isolated low relief relict hill occupying considerably small area. The groundwater prospects are poor. These landforms are seen in the granite terrain of the area. These landforms are located in the North part of catchment area.

5) **Denudational Hill(DH-Hbgn):** Acts as a run-off zone. Limited prospects along fractures at the lower levels. It is a granitic hill formed due to differential erosion and weathering so that a more resistant formation stands and occupies a large area. The groundwater prospects are negligible in this area as it acts as a runoff zone contributing very limited recharge to the narrow valleys within the hills and surrounding plains. Poor yields are expected along fracture/lineaments.

6) **Dyke Ridge (DR):** It is a narrow linear ridge with heap of boulders of dolerite composition or steep massive ridge standing above the ground level or sometimes highly jointed. Negligible to poor yields are expected in this landform. Moderate yields are expected in the upstream direction. Acts as a run-off zone. Barrier for groundwater movement**.**

IV. Conclusions

Integrated studies i.e. geology, geomorphology, hydrogeology, hydro geomorphology, structure and drainage in preparing the groundwater prospects map of Dosalavanka watershed revealed that the remote sensing and GIS are the best tools to assess the groundwater conditions. The categorization of groundwater potential zones in the study area is satisfactory level with the field checks also. The interpretation of this kind of information is much useful in improving the groundwater conditions of the area i.e. like in demarcating the drainage watersheds and planning for the construction of the structures like check dams, percolation tanks etc.

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