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GEOSPATIAL TECHNOLOGY IN THE EVALUATION OF HYDROGEOMORPHIC LANDFORMS FOR THE GROUND WATER PROSPECT

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Abstract: *Hydro-geomorphology intricately and inextricably linked with the region's resources potential and their utilization. This is well reflected in the various characteristics hydrogeomorphologic features. One of the important natural resource i.e., ground water resources are targeted based on analysis of these features. Geospatial technologies have boosted up data capturing and information generation. Remote sensing and Geographic Information System (GIS) together have provided a powerful base for detailed mapping, database generation and analysis more effectively for the planning and management of natural resources.*
Keywords: *Remote Sensing, GIS, Ground water, hydrogeomorphology*

Introduction: The hydrogeomorphological study basically deals with the action of water with the landforms, including surface and sub surface water. The study provides a broad spectrum to comprehend various dimensions regarding natural resources, their distribution, occurrences, management etc. It largely influences the nature, spatial distribution and utilization of natural resources. Thus hydrogeomorphological maps so generated depict important landforms, prospective zones for ground water occurrences and scope for resource management. Such map helps to depict prospective zones for ground water resources. For the evaluation of ground water resources, a geomorphological terrain classification leading to the delineation of hydromorphological units is useful taking both morphological and lithological factors into consideration [1,2,3].

Hydrogeomorphological mapping is one of the most recent aspects of applied geomorphology. It is although a complex phenomenon but modern techniques of remote sensing and geographic information system (GIS) have facilitated to identify and delineate these features which can be assessed as more suitable for ground water prospects. As ground water is a sub surface phenomenon, it could not be directly observed on aerial photographs or satellite imagery. Its identification is often made indirectly through the analysis of directly observable terrain conditions having distinctive geological structure or geomorphic features with indication of hydrologic condition,

Study Area: The present study is carried out sub watershed wise in the Chakia Tahsil (24º 4' N to 25º 3' N and 83º 3' E to 83º 24' E) of Chandauli district (U.P.) (Fig. 1). Fig. 2 shows the satellite image of Chakia Tahsil. The region constitutes the alluvial plain in the north and Vindhyan upland in the south. Alluvial plain shows the sediments of Quaternary age, whereas namely *Kaimur* Upland exposed in the southern portion of the *tahsil*. This region is characterized by 'monsoon' with seasonal variations in the weather. It comprises of a stratified unmetamorphosed group of rocks of sandstone, shale, sandoquartizite and limestone. Karmanasa, Chandraprabha and Garai are the three main rivers draining the region [4]. The population of Chakia *tahsil* is mainly rural in nature. According to 2011-12 census, Chakia, Shahabganj and Naugarh blocks have a total population of 148734, 123655 and 67736 persons, which share 9.05%, 7.53% and 4.12% of total Chandauli district respectively.

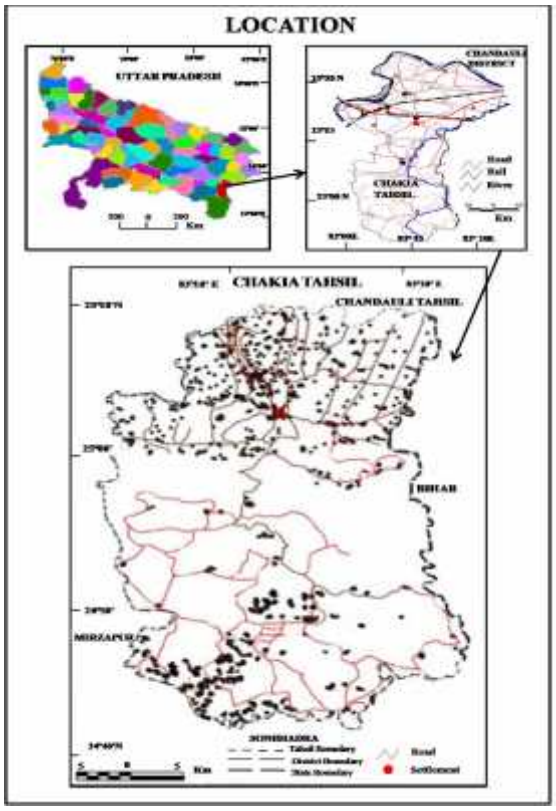


Fig. 1

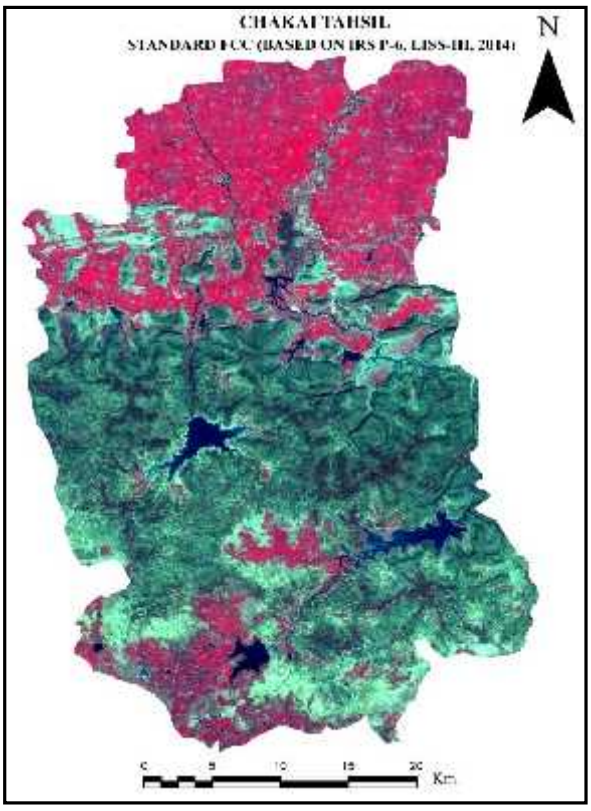


Fig. 2

Database and Methodology: In the present investigation, remote sensing and GIS techniques using IRS P6, LISS-III (2014) data have been applied to demarcate various hydrogeomorphic features. The two groups of features namely flood plain and Vindhyan plateau of Chakia tahsil, which has been divided into three watersheds, i.e., Karmanasa (K), Chandraprabha (C) and Garai (G) and 15 sub watersheds based on morphometry parametres (Fig. 3). The fourth order of streams has been considered as viable unit for micro level analysis of facts. These are identified and delineated using SOI toposheets 63O/4, 63O/8, 63P/1, 63P/2, 63P/5, 63P/6 taking into account of water divides, contour arrangement and regional terrain variations. As such Karmanas Watersheds consists of seven sub watersheds (KN1, KN2, KN3, KN4, KN5, KN6 and KN7) followed by Chandraprabha with six sub watersheds (CN1, CN2, CN3, CN4, CN5 and CN6) and Garai with two sub watersheds (GN1 and GN2) [5].

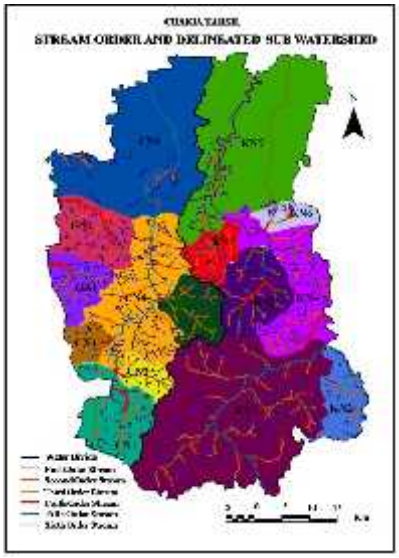


Fig.3

The features are carefully marked and delineated through visual image interpretation techniques and digitized under GIS environment (Table 1). The features are designated as AP1, AP2, P1,P2, BP1, BP2, BP3, IV, V, VF, Gorge, DP, SH, DH, RH, Rd, and Rw which indicates Alluvial plain (Type I), Alluvial plain (Type II), Pediment (Type I), Pediment (Type II), Buried Pediment (Type I), Buried Pediment (Type II), Buried Pediment (Type III), Intermontane Valley, Valley, Valley Fill, Gorge, Dissected Plateau, Structural Hill, Denudational Hill, Residual Hill, Residual Hill, Dry beds of Reservoir, and Reservoir with water respectively.

Table 4.1: General Characteristic of Hydrogeomorphic Features and Ground Water Prospect

S.N.	Hydrogeomorphic Unit	Image Description	Lithology	Ground Water Prospect
1	Alluvial Plain	Light to dark red tone with coarse to smooth texture,	Sand, silt, clay	Excellent
2	Intermontanne Valley	Medium red tone with patches of dark red tone, Coarse texture, Identified as depression between escarpment and residual hills	Colluvial deposit of varying lithology	Good to Moderate
3	Pediment	Light to moderate greenish tone, Characterized by scrub	Thin soil cover	Poor to very poor
4	Buried Pediment	Weathered material, good cultivation	Weathered rock, alluvial/colluvial materials	Good to Moderate
5	Valley fill	Medium to smooth texture	Gravel, sand, silt and alluvium	Good to excellent
6	Dissected Plateau	Marked various lineaments, covered with dense and open forest, associated with various landform features like gorge, valleys, hills	Various litho units	Good to moderate
7	Structural hills	Dense and open forest, structurally controlled unit.	Thin soil cover, rocky surface	Very Poor
8	Denudational hill	Dense forest, dark red/ brownish tone with moderate to smooth texture.	Thin soil cover	Very poor
9	Residual hills	Covered with scrub forest, bright tone with coarse to smooth texture	Sandstone and calcareous material	Very Poor

Source: *IRS P-6, LISS-III Image Interpretation done by the Researcher*

Results and Discussions

After detailed image analysis of satellite image, toposheets and field check, the various hydrogeomorphic features are carefully marked. The result shows that the Vindhyan Plateau (76.5% of total area) are dominatingly covered in the region. Rest of the Northern portion is covered under alluvial plain (Nearly 23.5%). The sub watershed wise hydrogeomorphological features and their respective area covers are shown in the Fig. 4, 5, 6, 7, 8 and 9. Alluvial plain and Vindhyan plateau comes out as a major dominant features in this region. Alluvial plain (Type I) is characterized by high fertile zone which appears in dark red tone with medium coarse to smooth texture. Ground water prospect in this region is high. Alluvial plain (Type II) with light to dark medium tone with very coarse to coarse texture shows low fertility comparatively to type I. Watershed KN7 reflects 25.48 % and 52.16 % share of alluvial plain of type I and type II respectively. Pediments in the plateau region provides scope for cultivation. These are generally described as gentle sloping, rock floored erosion surfaces or plain of low relief. Sub watershed CN1 has high % share of both the type *i.e.*, type I and II pediment, which is 15.29 % and 6.83% share respectively. Buried pediments importance lies in the potential of ground water prospects. Type I shows good prospect for agricultural activities as ground water prospect is high in this regions. Type II is characterized by open scrub forest. Type III category includes regions of very poor cultivated zones. Sub watershed KN6 shows maximum 29.39% share of type I buried pediment. KN1 sub watershed has 49.72% of maximum share of type II whereas CN1 reflects maximum of 6.51% share of type III of buried pediment. Intermontane valleys are associated with sand, silt, builders etc and offers a good permeability for ground water recharge. Sub watershed CN6 shows 31.29%, which is the maximum share. Next GN2 sub watershed shows second highest share of 23.95%. Valley is the characteristic feature of rivers carved during in their youthful

stage. The sub watershed KN3 has share of 5.53 % valley covered area. Valley fills are the characteristics features formed in youthful stage, where rivers settle downs the eroded materials brought from upper slopes. These are excellent in terms of ground water storage. Only sub watershed GN2 has reflected 7.02 % share of valley filled covered area. Most of the southern portion is covered under plateau region. The sub watersheds which reflects more than 80% area coverage are CN4 and GN1. Structural hills are marked in forms of isolated hillocks with average elevation of 200-250m. These hills are covered by forest and open scrub. With 89.59% area coverage, sub watershed CN2 has maximum reflection of this unit. Denudational hills in the dissected plateau region are covered with dense forest. Sub watershed KN6 exhibits maximum 27.46% share of area. With 6.73% share sub watershed CN6 shows existence of residual hills. Some patches has also found in sub watershed GN2, KN4, KN6 and KN7.

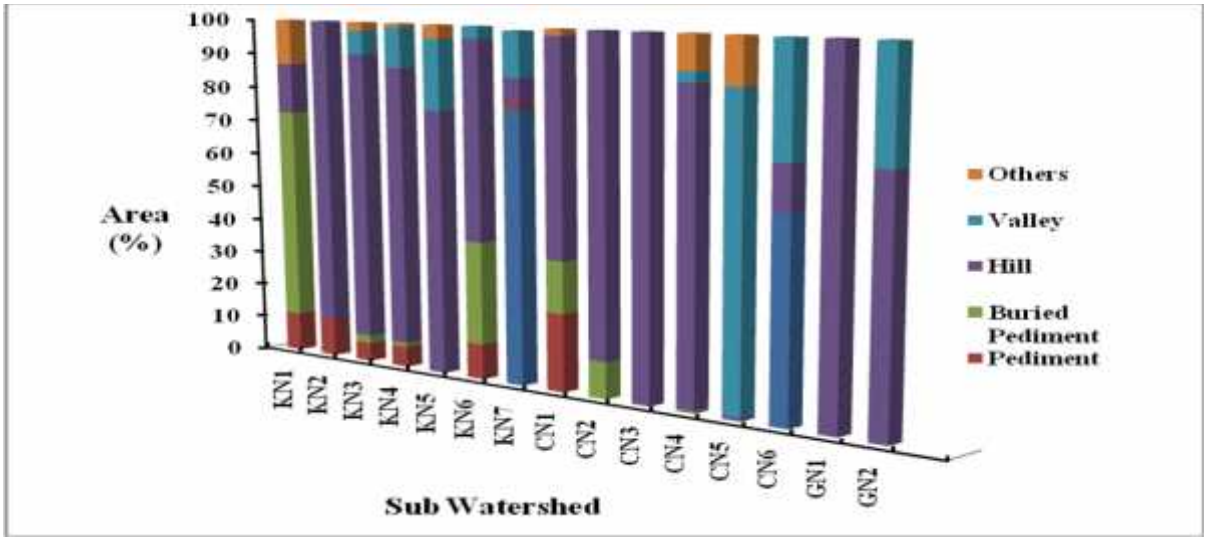


Fig. 4

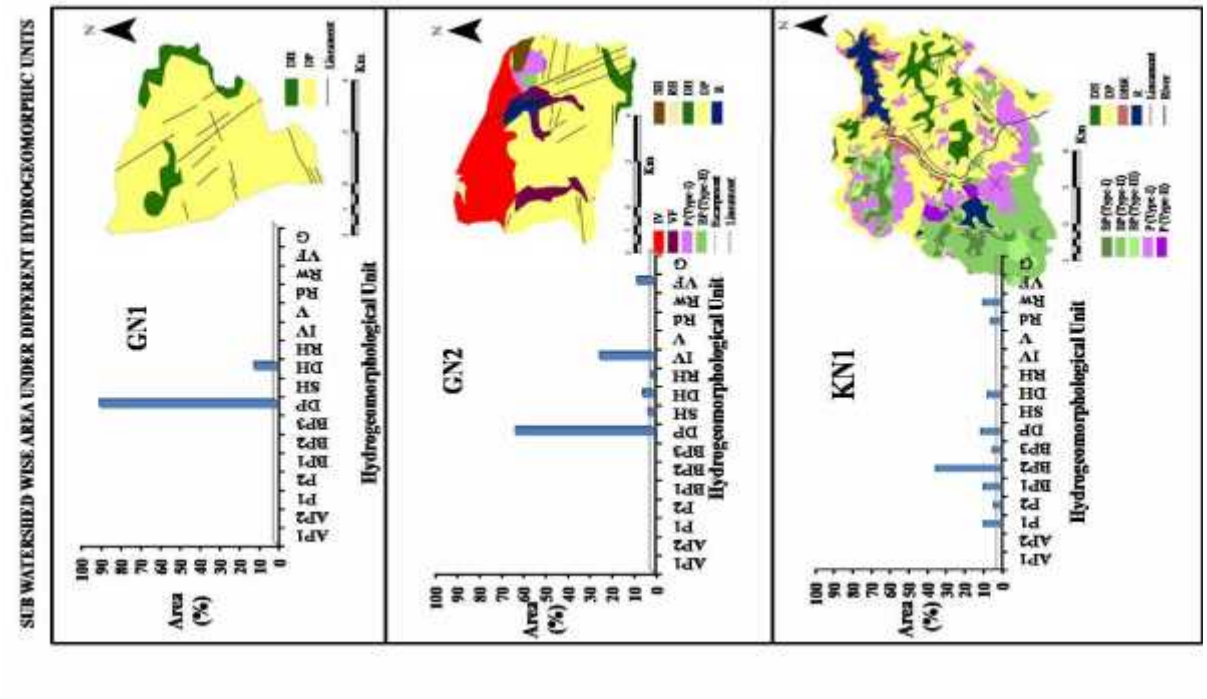


Fig. 5

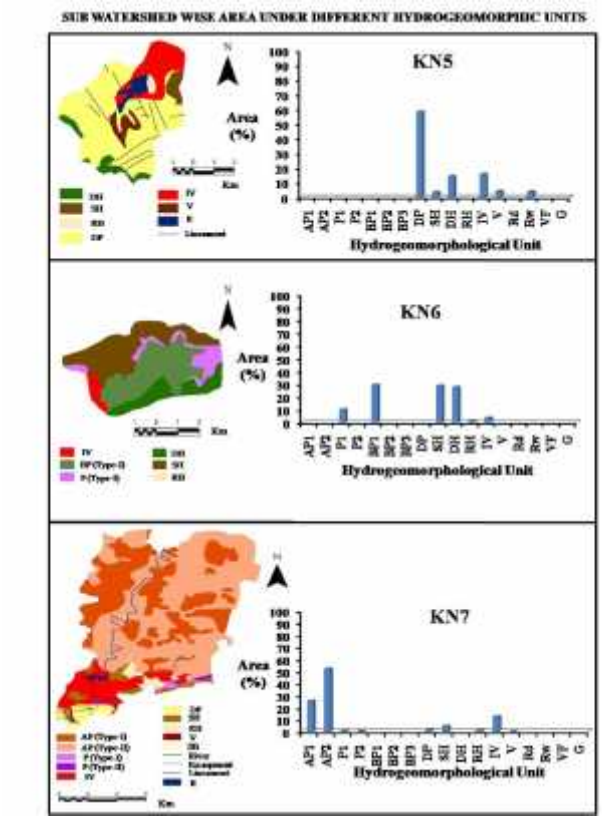
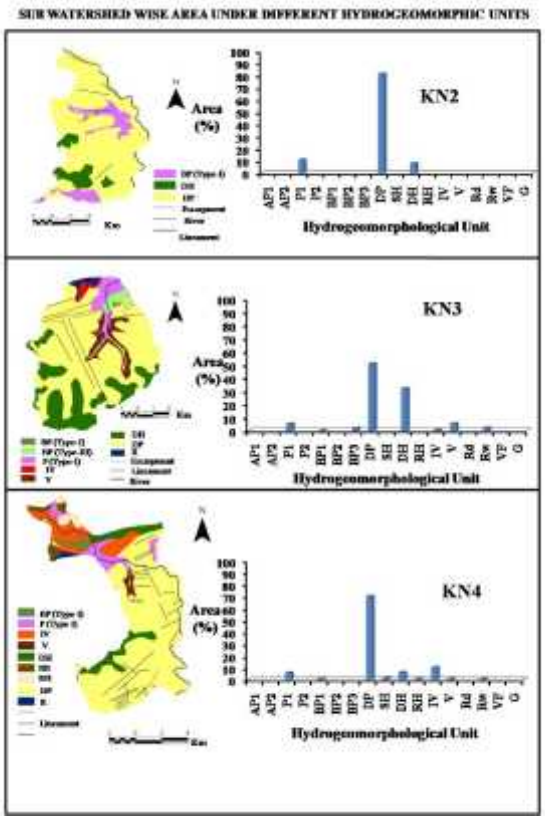


Fig. 6



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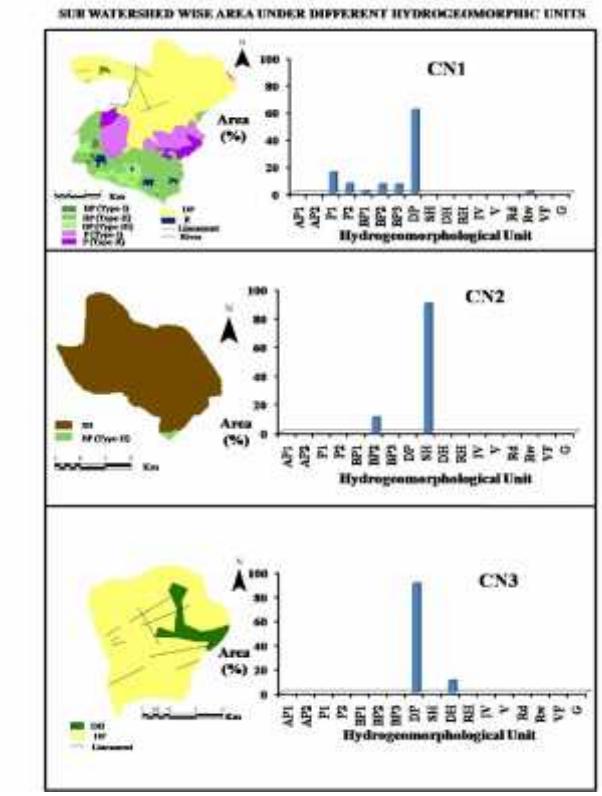

Fig. 8

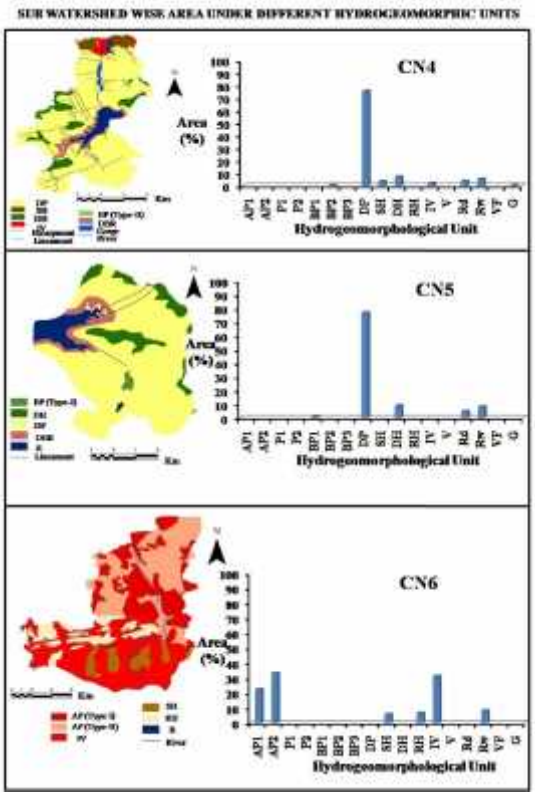

Fig. 9

Conclusion: The sub watersheds in the northern region lying in the alluvial plain zones offers good to excellent prospect for ground water resources. The sub watersheds coming in the southern regions are mostly lying under plateau regions. Ground water prospects varies from moderate to very poor. Only availability of buried pediment zones, valley fills and lineaments are prospective zones. For integrated natural resource management, it becomes too important to know every dimension of the existing resources and their associated features. The interaction of populations with their resources indicates the development of that region. Hydrogeomorphological aspects of the region have a direct association with the region's natural resources, availability and nature of utilization. Hence, the result of the present investigation related to hydrogeomorphological facts and natural resources at micro-level, i.e., watersheds/sub watersheds can give a permissible help in understanding and alleviating the problems associated with them. The ground water, recharge and discharge zones and related issues, forest, water and land resources and their management issues, etc have a greater implications with the hydrogeomorphology in the development of the area under study.

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