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SYMPOSIUM ABSTRACTS

DEPARTMENT OF GEOGRAPHY
UNIVERSITY OF RAJASTHAN
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PREFACE

During the International Symposium on Geomorphology and Environmental Management held from 17th to 20th January, 1987 at the University of Allahabad, the Indian Institute of Geomorphologists (IGI) was formed at the Department of Geography. About 50 members joined as life members to start with. This number has now increased to 100.

The first conference of the Indian Institute of Geomorphologists was held from 28th to 30th October, 1988 at the Geography Department of Andhra University, Visakapatnam under the Dynamic Convenership of Prof. R. Vaidyanadhan, a noted Geomorphologist of this country.

This is the Second Conference of the Institute being held at the Department of Geography of Rajasthan University, Jaipur. A Symposium is also being held where about 37 papers in the field Environmental Geomorphology will be presented by Geoscientists from Universities, Institutes and Govt. Organizations from different part of the country. The present volume contains the *abstracts* of these papers.

The Organising Committee of the Conference and the Symposium at the Department of Geography, Rajasthan University, Jaipur and the Executive Council of the Indian Institute of Geomorphologists are particularly grateful to the authorities of the University of Rajasthan for releasing funds for the conduct of the Conference and Symposium from the Unassigned Grant of the University Grants Commission. The Conference and the Symposium will be held from 2 - 4 November, 1989.

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CONTENTS

DRAINAGE, LITHOLOGY AND STRUCTURE IN THE NORTH WESTERN PART OF RAJMAHAL HILLS, BIHAR, INDIA.

Srinivas Madabhushi
Geological Survey of India
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The north-western part of Rajmahal hills is characterized by Rajmahal traps and Inter-trappeans in the eastern two-thirds of the area, outcrops of Pre Cambrian metamorphic rocks in the south-west and thick Gangetic alluvial cover in the western one-third of the area.

The drainage pattern as inferred from 1" to 1 mile base aerial photographs is of low drainage density (less than 2.85 km per sq. km) and coarse texture over the entire area. However, the area comprising Rajmahal Traps is characterized by a relatively finer texture (density more than 1 km per sq. km) whereas the rest of the area has relatively coarser texture (with density of less than 1 km per sq. km). The 'coarser coarse textured drainage can be further classified into a coarse textured dendritic drainage characterizing the metamorphic terrain and the Trellised drainage characterizing the soft alluvial plain. The streams of the latter are characterized by box-shaped valleys near the trap country, gentle longitudinal valley floor gradient and smaller-sized streams within broard non-functional valleys.

The finer coarse textured drainage is divided into south-easterly and north-westerly components by a NNE-SSW drainage divide. The south-easterly component has a semi centripetal drainage pattern with the 6th order major stream flowing southwards. The bifurcation ratios of the 3rd and 4th order streams are abnormally high. This suggest a possible structural disturbance (Horton, 1945 and Stranhler, 1975).

The trellised drainage characterized by a low (2) function ratio. It is controlled by topography and nature of sediment, i.e., flat, soft alluvial plain. It is not of the rectangular type controlled by faulting nor is structurally controlled as per photo-structural studies.

On the other hand, the streams on the treppean country are structure-controlled. The lineament analysis suggests a set of fractures with the dominant trend being NW-SE. The lower-order drainage parallel these trends. The neo-tectonic activity in the Bengal Basin during post Pleistocene was such that the area south-east of Rajmahal hills (Bengal Basin) with the major deltaic sedimentary Mass is subsiding and the area north-east of Rajmahal hills is relatively uplifted (Morgan, 1959). This resulted in the structural tilting of the Rajmahal hills towards south-east., with the development of the NNE-SSW drainage divide, and the semi-centripetal drainage. The box-shaped valleys at the western scarps of Rajmahal hills, the under-fit Koa river in the alluvial plains with gentle longitudinal valley gradient, smaller meander amplitudes (smaller than flood plain width) and insignificant stream within broad, often non-functional valleys all point to a relative upliftment of the Trap country in the north-eastern part of the area.

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LAND CAPABILITY CLASSIFICATION - A PEDOGEOMORPHOLOGICAL APPROACH

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Land capability is the capability and/or ability of land to produce crops. Classification of land on the basis of use capability is very much necessary in planning and economic development of a region. Land capability classification has been developed to express the influence of the physical characteristics of land/soil (Lithology, site, drainage, erosion, character of the soil profile, soil properties like texture, structure, depth color, water holding capacity, soil P^H, organic matter, nitrogen, phosphorous, potash etc.) and climate on farming.

Pedogeomoprphology is the integration of Geomorphology and Pedology as a synthesis. Soil and landform are inseparable and they have a very close and intimate relationship between each other. As such, the Geomorphology and Pedology are to be studied together to have a better understanding of the physical environment on which the social and cultural activities (e.g. landuse practices) depends. Thus the Pedogeomorphological approach in the assessment of land capability is a scientific one in understanding the man-environment relation for planning and development purposes.

The Pedogeomorphological information needed for the system is supplied by the field examination which can be expressed in land capability classification. Land capability assessments are thus based on the knowledge of the behavior of the physical characteristics of the environment (Land/Soil together with the influence of gradient, drainage, climate etc.) landuse, management and crop performance acquired from experience and research.

Keeping these aspects in mind a case study has been made in Mayurakshi-Brahmani interfluve region, Birbhum, West Bengal for future planning and development purposes.

The Pedogeomorphological aspects which are taken into consideration in the present study include landform, slope, drainage, erosion, character of soil profile, soil P^H, organic matter, nitrogen, phosphorous and potash. Each of these attributes are assessed on the different potentiality classes.

The land capability classes that are thus identified in the region are :

I. Good Quality land - Suitable for Double/Multiple cropping depending on the availability of irrigation water.

II. Moderate Quality land-Suitable for Double cropping only with irrigation and other management practices.

III. Poor Quality land - Suitable for cultivation with difficulty. Partly suitable for mono-crop and partly for forests.

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GEOMORPHOLOGY AND WATER RESOURCES OF AN ARID ENVIRONMENT OF RAJASTHAN – A CASE STUDY

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In Barmer district, located in the arid environment of Rajasthan, there is an acute scarcity of water resources due to low and erratic rainfall, unfavourable surface and subsurface morphohydrological formations and disorganized drainage system. Geomorphology, however, by using remote sensing techniques has a direct bearing on the occurrence, circulation and quality of water resources. Accordingly, systematic study on the classification and mapping of the landforms and their geomorphological characteristics by employing aerial and space remote sensing techniques was done in the Barmer district for the location, distribution, development and management of surface and ground water resources.

Based on the morphological and Landsat spectral characteristics, ten landforms units viz. hills, rocky/ gravely pediments, buried pediments, flat older alluvial plains, sandy undulating older alluvial plains, sand dunes, interdune plains, younger alluvial plains and graded river beds and saline depressions have been identified and mapped. Geomorphological features of these landforms have a direct bearing on the location distribution and construction of surface/ water structures like village tanks (nadis), underground tanks (tanks) and the reservoirs. Among these structures, village tanks (nadis) are the source of drinking water which are distributed all over the district under different landforms. The largest density of nadis more than 5 nadis/ 100 km^2 is in flat older alluvial plains, hills and rocky/ gravelly pediments and flat buried pediments followed by 2-5 nadis/100 km^2 in flat interdune and older alluvial plains, hills and rocky/ gravelly pediments and flat buried pediments and 1-2 nadis/100 km^2 in sand dunes sandy undulating interdune and older alluvial plains.

Quantitative analysis of the geomorphological characteristics like number of streams, total stream length, drainage density, relief ratio and circularity ratio etc. of the watersheds of various shape and size located under different landforms has enabled to identify the potential watersheds. Suitable water structures like check dams, diversion channels and anicuts have been suggested for harvesting surface run-off from the potential watersheds at suitable geomorphic sites after detailed contour survey.

The study has also indicated that development, extent distribution and discharge potentials of various types of aquifers in the district have been controlled by the geomorphological and lithological factors like drainage patterns, nature and thickness of sediments, slope, altitude, rock fabrics and lineaments. Based on these factors, 8 aquifers viz. blown sand, younger alluvium, older alluvium, filled valleys, Tertiary sand stone, Lathi sandstone, granite and rhyolite have been identified and mapped under different landforms. First four types of aquifers are largely concentrated in the eastern, northeastern and southern parts of the district. The depth of water and yield of these aquifers range from 3 to 70 m and 0.5 to 5.0 lakes litters per day (llpd); respectively. Next two types of aquifers i.e. Tertiary sandstone and Lathi sand stone occur in the northern and northwestern parts of the district. The depth to water and discharge potentials of these aquifers vary from 20 to 120 m and 0.5 to 3.611 pd, respectively. Granite and rhyolite form poor aquifers restricting ground water availability in weathered and fractured zones only. The depth to water in these formations ranges from 10 to 40 m. The water yield is meager to low ranging from 0.06 to 1.0 11 pd.

Based on the concept of recharge (donor) and recharged (receptor) zones, the suitable measures for the management of ground water have been suggested.

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GEOMORPHOLOGY OF RAJASTHAN THROUGH REMOTE SENSING FOR ENVIRONMENTAL MANAGEMENT

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Geomorphology plays a significant role in the characterization of the land resources and in evaluating their physical potentials and limitations for rational development planning. However, for proper understanding of the genetic and form characteristics of the land and for mapping their spatial distribution, use of modern remote sensing techniques, especially the aerial photographs and satellite imagery, in conjunction with adequate ground truth survey, is a reliable and faster method. Using these techniques, the state of Rajasthan has been divided into the following four major geomorphic regions: The Rajasthan desert, the Aravalli mountainous region, the east Rajasthan Plains and the southeastern plateau region. Each of these regions have then been divided into several major landforms units and their physical potentials and limitations have been discussed.

The Rajasthan desert has been classified into nine major landform units, out of which the younger alluvial plains, the flat buried pediments and the flat older alluvial plains have potentials for agricultural development. The sand dunes, covering the larger area, is suitable for silvipastoral system. The Aravalli mountainous region has four major landform units and has better resource potentials. Yet under the semi-arid climate, the steeper slope and accalerated fluvial erosion due to over exploitation are creating problems. Nevertheless, the intermointane colluvial and alluvial plains are the best agricultural units within it. In the east Rajasthan Plains six major landforms units have been identified. The alluvial plains in the north-east and along the major streams elsewhere are the best for agriculture. The ravine-infested dissected alluvial plains and the dissected sand dunes need erosion control

measures. The south-eastern plateau region has two major landforms units, out of which the dissected colluvial plain is the best unit for agriculture. However, the higher drainage density is the limiting factor to the agricultural activities of these plains.

It is concluded that all the geomorphic regions have their own problems and potentials, based on their typical landforms assemblages which could be correctly identified and mapped through remote sensing, supplemented by ground verification survey. Any programme for improvement and development of these regions should be based on the genetic inherent geomorphological properties which govern their physical potential and limitations.

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ECOSYSTEM AND ENVIRONMENTAL HAZARDS OF AN ARID ENVIRONMENT - A CASE STUDY

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In Barmer district of arid Rajasthan wind erosion/deposition, water erosion, salinity/alkalinity, industrial effluent and mining are the major environmental hazards which affect the biophysical potentials of the fragile ecosystems of different types, shape and size. In order to check the further degradation of these ecosystems and to improve their agricultural productivity, systematic and reliable information on the type, genesis and distribution of fragile ecosystems and associated environmental hazards is of paramount importance. Accordingly, systematic study on the identification, genetic classification and mapping of the various ecosystems and their associated hazards was conducted in laboratory and field by using aerial and space remote sensing techniques.

In the district, ten major ecosystems viz; hills rocky/gravelly pediments, buried pediments, flat older alluvial plains, sandy undulating older alluvial plains, sand dunes, interdune plains, younger alluvial plains, graded river beds and saline depressions have been identified and mapped. These ecosystem were created by the fluvial and eolian processes under two major wet and dry phases. The ecosystems created by aeolian processes are largely located in the west of 300 mm isohyet, where as the ecosystems resulted due to fluvial action occur in the east of this isohyet.

In the recent years, the man has become a significant, geomorphic agent and due to the interaction among man, land water and wind, the impact of accelerated and natural environmental hazards on the fragile ecosystems has increased manifold. The wind erosion/deposition hazards created mainly by

wind deflation and saltation processes have affected the largest area, 68.22% of the total district area. Water erosion in the form of sheet, rill and gully hazard is only confined to the ecosystems like hills, rocky/ gravelly pediments and flat buried pediments located in the eastern and western parts of the district. The large acreage of the ecosystems such as flat older alluvial plains, younger alluvial plains and flat buried pediments has been affected by man-induced salinity/alkalinity hazard and the natural salinity/ alkalinity hazard occurs in the saline depression and younger alluvial plains and river beds. The industrial effluent agricultural lands of the younger alluvial plains located either side of the Luni river near Balotra town. The Mining of fuller's earth, bentonite and gypsum have disturbed the ecological balance of the fragile ecosystems resulting into the wind erosion/deposition and water erosion hazards.

Based on the findings of this study, it is inferred that wind erosion/deposition, water erosion and salinity/ alkalinity are the major environmental hazards identified in the district. The suitable measures such as wind breaks, shelter belts, strip cropping, contour bunding, contour furrows, contour trenching, salt leaching and use of gypsum have been suggested to control the effect of these hazards on different fragile ecosystems and to upgrade their agricultural productivity.

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SAND DUNES AND THEIR MOBILITY IN JAISALMER DISTRICT

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Situated in the extremely arid part of the Indian desert, Jaisalmer district has its 52.74% area under sand dunes and interdune plains, especially in the north, west and southeast. Seven major types of sand dunes have been recognized in the district. Out of these the longitudinal, transverse, parabolic and star dunes are relatively stable and were mostly formed during an earlier dry climatic phase. The barchanoids and the isolated barchans (and other minor features) are forming during the present dry phase. The complex dune in the west are the modifications of earlier simple longitudinal and transverse dunes, while those elsewhere in reticulate pattern, are mostly the new formations.

The longitudinal dunes are further classified into the simple unidirectional, complex unidirectional, simple bidirectional and complex bidirectional, their axis varying from N 77° E in the west to N48°E in the east, suggesting a gradual eastward change in the wind direction. The transverse dunes are classified into the simple, without longitudinal element, and the complex, with longitudinal element. The parabolic dunes are mostly compound, the length of arms decreasing from west to east. The star dunes, in a fernleaf pattern, cover a small area. Although the above dunes are mostly stable there is evidence of new longitudinal dune formation from streams of barchans. Many simple transverse dunes could also be a recent phenomenon, but need further investigation. The barchanoids have been classified into the low, simple barchanoids and the high, compound megabarchanoids. The internal arrangement of bedforms within the simple and the compound barchanoid field indicate a graduel importance of the longitudinal element within the transversals. This, alongwith the sequential

patterns in growth of longitudinal dunes and the changes in central tendency values of grain size in the above bedforms, suggest a sequential bedform development in the region, from the barchans and barchanoids to the longitudinals.

The mean grain size of the mobile dunes is 2.32 Ø, while the median value is 2.350. The values for the stable dunes are 2.47 Ø and 2.51 Ø respectively. The parabolic and the reticulate dunes have well sorted grains, while the others have moderately sorted grains. All the samples indicated coarse skewed and leptokurtic distribution.

Comparison of topographical sheets, aerial photographs, sequential satellite imagery and ground information indicate very little, if any movement of the stable dunes, except in areas of anthropogenic activities, like around settlements, and Indira Gandhi Canal network. The barchans, on the other hand, move by 30m to 45m per annum. Some megabarchanoid fields have widened marginally, but with no appreciable forward movement. The mean sand transport rate has been calculated as 35.13/ tones/m. width /year, while the theoretical rate for the average lowering of the sandy surface is 3.38 m/ year. Based on the observations some measures have been suggested for controlling the aeolian hazard.

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PROBLEMS AND POTENTIALS OF PEDOGEOMORPHIC SURFACES IN THE BASIN OF PURNA

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OBJECTIVES

The land, soil and water are the important basic resources of an area. An inventory of these resources is a pre-requisite for understanding the nature and extent of distribution. The available resources management emphasizes on optimum utilization as per their capabilities without disturbing the ecological balance. For developing rational land use plan of a basin, it is necessary to understand the pedogeomorphic surfaces and their environmental characteristics to assess the problems and potentials of each geomorphic surface towards developing a better land use plan.

METHODOLOGY

Geomorphic analysis of the Purna basin was undertaken using Landsat MSS false color composite on scale 1:250,000 supplemented topographical maps of the area. Subsequently, field traverses were undertaken to study pedological characteristics of each geomorphic surface to establish soil to landscape relationship. Problems and potentials based on pedogeomorphic characteristics and physical environment of the basin were assessed, eventually to suggest better land utilization pattern under judicious management practices.

RESULTS AND DISCUSSION

The Purna basin, one of the important cotton growing regions of india, is located between 76°0' to 77°55'E longitude and 20°10' to 21°41' N latitude and covers an area of about 18300 km^2.

A tributary of the Tapti river, the Purna, flows through the fault basin, the major portion of which falls in Maharashtra. The basin is bounded by Satpura scarp in the north and the Ajanta scarp in the south. It is composed of basaltic rocks and the alluvium derived from the basalt. On the basis of landscape analysis based on landsat imagery and supplemented with field observations, the basin may be divided into three distinct geomorphic surfaces which differ from one another in respect of morphology, morphometry, pedogenesis and land use pattern (Table 1).

1. NORTHERN HILLY TERRAIN WITH SHALLOW CLAYEY SOILS

It is located on the northern fringe of the basin having elevation ranging from 450 to 900 meters and composed of vesicular and non-vesicular flows of basalt. The terrain falls under high rainfall zone (1200-1500 mm) where summers are comparatively mild and winters are cold. It is covered with tropical dry deciduous forest.

The climate and topography have actively influenced the soil formation. The soil in general are shallow, clayey, skeletal and excessively drained. The gradient is steep and soils are prone to run off and erosion. They are less productive and unsuitable for agriculture. The northern hilly terrain is potential for development of forestry, grasslands, and wildlife sanctuary. There are numerous picturesque sites which may be worth developing as picnic spots. The narrow valley bottoms may need to be dammed for storing surface water. The relatively cool climate in the summer season merits greater attention to further developing the hill station of Chikhaldara to attract tourism and improve economy.

2. ALLUVIAL PLAIN WITH DEEP BLACK (COTTON) AND ALLUVIAL SOILS

The gently sloping to flat plain (250-400 meters above MSL) enclosed within the two fault scarps of the northern hills and the southern plateau is a geomorphic surface of deposition. The plain is a transitional zone falling between the subhumid region of the north and the semi-arid region of the south

(rainfall 1000 mm to 800 m). The region experiences scorching summer and mild winter. It is sub-divided into (a) upper alluvial plain (b) lower alluvial plain and (c) flood plain.

2. a) The upper alluvial plain situated parallel to the north-south scarp faces, is 10-15 km in width. The soils are deep to very deep, dark brown to very dark grayish brown at surface grading to dark brown in the sub-surface horizon. The region is very fertile and potential for intensive agriculture.

2. b) The lower alluvial plain, a tract of gently sloping to flat alluvial surface, is covered by deep to very deep, fine textured, moderately well to imperfectly drained Black (Cotton) soils. It is one of the major cotton growing belts of the Purna basin. The soils are suitable for various crops, including Cotton.

2. c) The flood plain zone is located along the banks of the Purna river and its major tributaries. It is composed of flood deposits which are fairly thick and highly calcareous. This unit is highly dissected by numerous gullies giving rise to bad-land topography.

The alluvial plain, in general, is one of the most fertile regions of the basin and rich in soil and resources. The stored water in the hilly and Plateau sections may be utilized for boosting agriculture in the plains. In the foot-hill zones, the ground water is abundant and thus there is a potential for developing double or even multiple cropping system. The use of improved technology may help to boost the yield potential of the area. In the deep Black soil zone, the management of soil and water resources is important as the ground water is brackish. Judiceous Canal irrigation and provision of drainage are important for intensive agriculture and profitable returns. The soils are suitable for development of vegetable and garden crops under proper management practices. Gully plugging, sedimentation and training of stream courses are imperative in this unit to save the fertile land-forms from further degradation.

3. PLATEAU SURFACE WITH SHALLOW CLAYEY SOILS

The southern boundary of the basin is marked by the plateau of Ajanta with an elevation of 450 to 600 meters above the MSL. The terrain is undulating to rolling and the escarpment slopes are highly dissected by the torrential streams during the rain seasons. The surface is formed of basaltic flows. It is located in sub-tropical semiarid climate, where rainfall is about 800 mm, and the summers are moderate and winters mild. The soils on the scarps are skeletal while those on the plateau surface are shallow to moderately deep and fine in texture.

The scarp of the plateau surfaces should be protected by restoring vegetative cover and the narrow valleys bottoms may be used for harvesting run-off water. Afforestation, contour bounding, development of grassland and gully plugging are some of the important measures to be adopted to save the plateau surface from devasting erosion hazard. Soil and moisture conservation measures are important due to low and erratic rainfall characteristics.

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TABLE 1.

PHYSICO CHEMICAL PROPERTIES OF SOILS OF PURNA BASIN

LOCATION	PHYSIO GRAPHY	PEDON NO.	HORIZON	DEPTH (cm)	PARTICLE SIZE CLASS AND ITS RANGE OF DIAMETER (MM)			ORGANIC CARBON	$CaCO_3$	pH (1:2.5)
					SAND (2.0-0.5)	SILT (0.05-0.002)	CLAY (0.002)	(%)	(%)	H_2O
1	2	3	4	5	6	7	8	9	10	11
GHATANG	1 Hilly Terrain	1	A1	0- 16	14.3	34.5	51.2	1.44	----	5.8
			B2	16- 30	9.8	35.5	54.7	1.29	----	5.8
			BC	30- 60	18.5	29.3	52.2	0.81	----	6.0
			C	60- 90	36.4	22.8	40.8	0.54	----	6.2
AKOT	2a Upper alluvial plain	2	AP	0- 10	17.0	24.3	58.7	0.48	6.5	8.2
			A12	10- 35	12.5	28.0	59.5	0.48	6.3	7.9
			A13	35- 60	12.7	27.4	59.9	0.47	7.0	7.8
			A14	60- 83	11.9	27.9	60.2	0.43	7.0	7.8
			AC	83-122	16.3	28.0	55.7	0.35	12.1	8.0
			C	122-135	35.4	20.1	44.5	0.16	15.8	8.0
Akola	2b Lower	3	Ap	0- 17	12.5	33.0	54.5	0.61	5.7	8.0
			A12	17- 46	12.6	31.2	56.2	0.40	5.8	8.1
			A13	46- 73	10.1	30.7	59.2	0.37	6.0	8.0
			A14	73-113	14.9	25.4	59.7	0.35	6.0	8.0
			AC	113-142	14.2	25.9	59.9	0.29	7.9	8.1
Purna	2c Flood plain	4	Ap	0- 20	19.25	35.44	37.84	0.63	6.16	7.7
			C1	20- 44	36.80	31.36	25.60	0.42	6.07	7.9
			IIC2	44- 66	62.10	20.40	13.20	0.08	6.95	8.2
			IIIC3	66-104	47.70	28.80	18.80	0.19	14.08	8.7
			IVC4	104-151	65.11	18.20	12.80	0.05	11.17	8.7
Botha R.F.	3 Plateau Scarp	5	A11	0- 10	14.2	19.3	66.5	1.24	-----	6.6
			A12	10- 24	18.0	19.5	62.5	0.99	-----	6.7
			C	24- 38	Weathered basalt.					
Buldana	Plateau	6	Ap	0 -10	15.6	18.5	65.9	0.51	3.3	7.2
			B21	10- 33	13.4	27.1	59.5	0.48	3.6	7.4
			B22	33- 54	11.5	37.0	51.5	0.48	3.6	7.5
			B3	54- 60	25.5	29.5	45.0	0.43	10.9	7.8
			Cca	60- 72	Weathered basalt mixed with powdary lime.					

GRAIN-SIZE PARAMETERS AND THE DISCRIMINATION OF BEACHES

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Sedimentological methods have bearing on landform analysis. Textural analysis belongs to one of the such methods. In recent years, it is suggested to avoid the utility of grain-size parameters for discriminating the different environments, as they were dependent of several factors, such as rock type, climate and agent of transportation. Present study is intended to know the possibilities to discriminate the different types of beaches by using the grain-size parameters.

For this, sand samples from 3 types of Indian beaches namely, cliffed, deltaic and normal, were collected. These samples are subjected to conventional textural analysis and the results were plotted in the bivariate scatter plots.

The conclusions drawn from this study are :

1. It is not possible to discriminate the cliffed and deltaic beaches, as the grain-size parameters of these two beaches are similar and

2. The discrimination is possible between cliffed and normal, and deltaic and normal beaches.

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WATER RESOURCES MANAGEMENT IN GONDWANA TERRAIN, GUNTUR DISTRICT, ANDHRA PRADESH

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Highly compacted upper Gondwana sandstones were exposed in a narrow zone of 50 sq. km. Numerous joints and fractures were developed in these sandstones, which form aquifer zones and recharge pathways. These fractured sandstones are underlined by the sandstones, without fractures and joints. Quarrying has been going in an area of 200 acres, which already carriedout to 6m depth. Bukingham canal is present 2.5 km away from this place. In general good yields are producing only around 75 to 90 m depth. 11 villages are present on this sandstone terrain. More than half of the village are suffering from the scarcity of drinking and irrigational water.

Data are collected about decennial population variation, animals and existing drinking and irrigation water sources. Electrical resistivity survey was carried out with a view to delineate fresh and saltwater zones. A feasible plan of approach to mitigate water problem in the area is suggested.

From this study it is concluded that the 3 villages have no water problem. Other villages are mainly suffering from the saline water and lack of fresh watersource. This problem can be mitigated by constructing a tank. For this, the existing 200 acre quarry pits may be developed into a big tank at lower costs. It will serve most of the villages on the sandstone terrain and some other adjacent villages as well. Water may be pumped from the Buckingham canal. Further the development of a fish farm will give good returns.

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A GEOMORPHOLOGICAL INVESTIGATION OF ROCK WEATHERING AND SOIL IN THE MAWSYNRAM AREA OF EAST KHASI HILLS DISTRICT, MEGHALAYA

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The study of the general nature of weathering and soil on different rock types in the Mawsynram area of East Khasi Hills District, Meghalaya reveals that most granitic rocks tend to weather uniformly to gruss. In this rock slaking is a dominating weathering processes. On the other hand the Sedimentary rocks of basal conglomerate disintegrate into different size in the study area. The slumped blocks of coarse brown Therria Sandstones are also seen scattered over the soft arkosic and calcareous sandstones. The Kopili ferruginous sandstones have also shown a peculiar honeycomb pattern of weathering. The study of limestone formations of the region show a complete dissolution of these rocks in water (Hydration). There are some unique development of stalactites and stalagmites deposit noticed in some limestone caves. Weathering on basaltic rocks shows that the crest of these rocks have been weathered at pleaces exposing the traps as inliers. The hard dolerite dykes are also seen weathered into spheroidal boulders in some places.

Further, the measurement of soil depth at number of sites in the study area permits few general observations. In the first place, marked irregularity of the soil depth on different rock surfaces at different toposequences is a characteristic feature of most of the areas. This irregularity may also be seen to

consists of different vegetation cover. In all cases, a correspondence exists between the susceptibility of rocks to weathering processes and depth of the soil. On the other hand, each individual site with their uniform rock formations also shows a progressive thinning of regolith depth from valley bottom locations towards hill top.

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GENESIS OF CATENARY SOILS IN THE MAWSYNRAM AREA OF EAST KHASI HILLS DISTRICT, MEGHALAYA

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The study of soil profiles at different topographical levels in the Mawsynram area of East Khasi Hills District. Meghalaya, reveals that various types of soil are round within a relatively small area and the soils as a natural body reflects major variations in the topo-sequences and landforms. As a result, very pale brown to grey loamy soils are to be encountered on the plateau surface, lighter brownish grey to brown loamy soils in the steep slopes and dark grayish brown to dark brown sandy clay loams on the pediment slopes and light brownish grey to yellowish brown sandy clay loams on the flood plains. Thus, it can be concluded that the soils of the study area are closely related to the releif and landforms. Moreover, the morphological features, the mechanical and chemical composition of the soils, reflects a distinct gradation as that of topo-sequences. Therefore, a thorough investigation of the relief and slope characteristics becomes imperative to highlight the catena concept which may be suitably bridge to fill the gap between Pedogenesis and Pedo classification in the present area under study.

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SEDIMENTOLOGICAL INVESTIGATIONS OF BED AND BANK MATERIALS OF THE JIA BHARALI RIVER IN ASSAM

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Sediments as basic ingredients of landforms provide valuable clues to a comprehensive understanding of the surficial geomorphic processes. In order to gain further insights into the various fluvio-sedimentary activities, sediments collected in the field are subjected to different granulomentric analyses. Although, grain-size analysis has extensively been employed in sedimentary petrology. The use in geomorphology so far is rather limited. The present study is an attempt to examine the fluvio-sedimentary environment of the Jia Bharali river of Assam based on sedimentological investigations of the bed and bank materials as well as the transported load.

The study is confined to the Assam-section of the river extending form Assam-Arunachal Pradesh boundary to its confluence with the river Brahmaputra. Quaternary sediments comprising pebbles, sand, silt and clay found along the 62 km long Assam-section of the river are described.

The sedimentological investigation is based on field work and subsequent laboratory analysis. Sediment samples from the bed and banks of the river are collected at 75 sampling sites on six different cross-sections selected for the purpose. The collected samples are analyzed by Sieving and Plummet Balance methods in the laboratory for obtaining textural parameters. Laboratory results are presented using both graphical as well as statistical techniques. The measures obtained from the analysis are then used in describing the sedimentological character of the bed, bank and suspended materials, and the associated fluvio-geomorphic processes.

BASIN AND SUBBASIN CHARACTERISTICS OF THE JIA BHARALI RIVER, NORTH-EAST INDIA : A GEOMORPHOLOGICAL APPRAISAL

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The Jia Bharali river is one of the principal Himalayan tributaries of the Brahmaputra system in north-east India draining a basin area of 11716 km^2. The basin lies partly in the State of Arunachal Pradesh and partly in Assam. Based on the interpretation of Landsat imageries, a set of twelve subbasins is selected for this study. These include four third-order basins, three fourth-order basins and five fifth order basins. Some of the important morphological and network characteristics of the basins are measured and quantitatively analyzed. These parameters are then examined against background of geology and physiography of the region.

The study further correlates the geometrical aspects of basin with their associated geological and geomorphic characteristics. The quantitative measures of basin morphology and drainage network derived from the analysis are explained so as to bring out the underlying geomorphic significance.

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FLOOD HAZARD IN THE KOPILI RIVER BASIN, ASSAM

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The kopili river, with a basin area of 14,384 km^2 is a major south bank tributary of the Brahamputra river in Assam. The geomorphology of its basin is made up of high hill ranges, plateaus and alluvial and dialluvial plains. The topography is largely uneven with about 61 per cent of the total area covered by highlands of the Shillong Plateau, Karbi Anglong hills and the hill ranges of North Cachar. The Nagaon or the Kopili plain is a gently sloping alluvial plain which covers about 39 percent of the basin. The basin has a total population of 13,71,508 (1971). Most of the population of the basin area concentrated in the Kopili plain. It is also intensively used for cultivation. With the construction of dam across the Kopili and the Umrong rivers in North Cachar hills, there has been a rapid increase of population and human activity in the upper reaches of the basin. It is also observed that as a result of creation of the infrastructure for harnessing water, forest, and mineral resources of the Kopili basin, environmental crisis such as accelerated soil erosion and higher magnitude and frequency of flood have resulted. Although flood in the Kopili plain has been a recurring feature from very early days, the situation is getting aggravated now basically due to deforestation, encroachment on naturally water-logged and swampy areas and due to intensive landuse and developments.

In the present paper an attempt is made to examine the intensity of flood hazard in the basin, its environmental as well as socio-economic determinants and the impact on the local environment.

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GEO-ECOLOGICAL STUDY OF BEELS AND SWAMPS IN NAGAON DISTRICT, ASSAM

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In the flood plains of the two major river systems of Assam, the Brahmaputra and the Barak, there are a large number of water-logged areas locally known as beels. These beels as well as the swamps of this region are geomorphologically and ecologically very important and interesting features. Most of the beels are used as public fisheries. These beels are formed mainly by fluvial action of the rivers, while a few of them are formed due to tectonic disturbances. The former type occurs mostly as Ox-bow lakes from channel cut-off or on abandoned channels.

The present study focuses on the beels and swamps of Nagaon district which are in their present condition no more than wastelands. Besides being potentially very rich in fisheries resources, these water-logged areas act as natural detention basin for overland as well as river run-off. The beels differ in their morphological characteristics, hydrological behavior and biotic resources due to the differences in their physical, economic and cultural settings. The existing flood control structures have adversely affected the development and productivity of many beels.

In this study as many as 254 beels are identified in the Nagaon district of Assam with the help of topographical maps. Landsat imageries and aerial photomosaic. The present status of these waterbodies are described based on available data and information and personal field observations.

STUDY OF SOME ASPECTS OF APPLIED GEOMORPHOLOGICAL FEATURES OF LADAKH AND TRANS HIMALAYAN REGION

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The vast expanse of cold regions of western Himalayan have inbuilt, inherent and incessant resources and unceasing potential for geomorphological research work. Due to high altitude, rugged and hostile nature of terrain the interiorness of the cold regions of Himalayas have been studied very scantly rather by Indian geomorphologists. Keeping this in view, a field study of Western Himalayas between longitudes 73 degree W to 80 degree E and the latitudes 32 degree N has been carried out especially to arrive at unique geomorphological expressions and its applied aspects.

Most of the Himalayan ranges in this viz. Ladakh, Zaskar, Solotoro and Karakoram belong to relatively recent Alpine orogeny; older mountain systems, such as Scandinavian and the Canadian Arctic Islands, tend to be of lower relief more deunded and less active tectonically. The Himalayas abound in thrusts and faults which have profound effect on fragility and slope stability. The structure of the Himalaya is of the 'folded' type. Thus, the relief of the ground is closely related to the axis of the uplift and the strike to the trend of the mountain system.

In general, the geological regionalisation of the Ladakh and Trans Himalayan regions, explain the Indus and Shyok-Nubra Valleys as occupying the discontinuous steeply thrusted suture (or palaeosubduction) zones with ophiolitic melangas. The geomorphological typology and evaluation of the terrain describes the region as an ectropic zone with retarded valley cutting. The region presents the zones with perched, barren, moonland like land pattern which is devoid of vegetation due to cloud and air-mass barrier ranges of Greater Himalayas. Xerophytic shruby bushes and stunted vegetal cover are observed along the

valleys of Indus and Shyok-Nubra. Ladakh complex is a high altitude winter cold desert, a morphoclimatic ectropic zone where surface transformation by geomorphological processes are extremely retarded. The study area geomorphologically can be suitably delineated into four unit landform pattern :

a) Shyok Nubra Valley.

b) Ladakh Massif.

c) Indus Valley.

d) Zaskar.

Apart from studying environmental effects, some of the following geomorphological expressions have been studied during the field visits :

a) Retreating phenomenon of glacier -

b) Close up of glacier snout showing the high vertical blue ice walls alongwith constantly tumbling ice blocks and stratigraphic dirt bands of glacier till.

c) A unique feature of thermoerosional cutting of ice creating an overhang niche all along glacier side longitudinally.

d) Some glacier-fluvial crater-like pits configuration on the bed of the glacier fed partly dry stream.

e) Some curious structures like earth pillars around Leh area, sculptured into an intricate mosaic of gullies and small ravines separated by sharp spurs and buttresses.

The periglcial and glacial features studied here-in primarily are the product of the cold region environments obtaining around these areas. The observations made during the field study is very encouraging, which reveals and unfolds the various aspects of geomorphological research hitherto not given due weightage and holds good promis for the futuristic research work.

SOME ASPECTS OF ENVIRONMENTAL GEOMORPHOLOGY OF LOKTAK LAKE AREA, MANIPUR.

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The present paper concerns the important aspects of environmental geomorphology of Loktak Lake and surrounding area covering a significant sector of the intermontane Manipur basin of Manipur State, India. Apart from the physical environmental factors like the general geology especially the structure, faults and tectonics; groundwater, landforms (Quaternary landforms) drainage etc., the essential components of Loktak hydel project have also been considered by this author. The lithological units encountered in the tunnel area in particular are lake sediments, terrace material and rock units of Disang (Ecoene) group from east to west. Silt, sand and pebbles of variables proportions constitute the lake sediments. The terrace material contains broken rock fragments and large size boulders in addition to silty and sandy fractions. The area shows three generations of folding, and there are three major faults particularly cutting across the tunnel alignment. The ground water in the hilly area has fractures in the rocks and emerges out as springs at two elevations of (i) 875 to 885 m, and (ii) 1100 to 1145 m mainly along the contact plane of sandstone and shale. The Loktak Hydel Project in Manipur has been constructed to transfer of water from Loktak Lake to Leimatak valley for generation of 105 MW power at 60 per cent load factor. Power draft of 42 cumees and drops of 310 m are being utilized for this purpose. Finally an attempt has also been made to discuss the related points on the changing climatic conditions and environmental hazards of the area based on modern methodology and field work.

SLOPE INSTABILITY PROBLEMS IN KARMI AREA OF CENTRAL HIMALAYA, INDIA

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Deteriorating Himalayan environment, depicted in natural hazards, has become a matter of great concern. Undoubtedly the structure and still active tectonic processes seem to be the prominent causes of slope instability, which, along with the anthropogenic stress, regulate the instability processes.

To identify old, active and susceptible areas of landslides or slope instability and to findout litho-tectonics and geomorphic elements causing the slope instability, are the two major objectives of the present study.

Karmi area, located within the coordinates of 30°4' N and 79°54'E (SOI Toposheet No. 53 N/16), in Almora District of Central Himalaya, has been selected for the study and further divided into unit areas, after preparing landuse and geomorphic maps. Intensity, magnitude and nature of instability influencing environmental parameters have been investigated for each unit area. After evaluating litho-tectonic, landuse, landforms and rainfall control on the slope movement, slope instability map, showing types and corresponding degrees of confirmed/inferred instability, has been prepared.

Seven major types of instability processes are registered in the study area, viz., surfacial erosion (15.41%), rock fall (21.64%), collapsed terraces (25.26%), slide (32.25%),flow (2.21%), slump (2.13%) and complex (1.10%). Out of the five geological formations in the study area Deoben Formation registers maximum intensity of slope instability (42.8%). It is also noted that thrust zones seems to be more prone to instability in comparison to fault and fold structures. Cultivated area has been severely affected by instability (72.56%) as composed to forest. Remedial measures to restore the land in equilibrium state have also been suggested.

SALIENT SLOPE ASPECTS OF A GRANITE HILL

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INTRODUCTION

The Bariatu hill (Ranchi) Composed mainly of Chotanagpur granite and gneiss intrusives injected into the Dharwarian Strata and exposed due to the removal of sedimentary layer by prolonged interaction of the processes of weathering, denudation and mass movement is an Ideal unit for slope study. The intrusive granites are massive with well developed spheroidal joints which generally Cause the formation of domelike hummocks or tors. On the hill slope mostly the bare granite rock is at surface while somewhere thin mantle of broken rock fragments and weathered boulders cover the solid rock.

OBJECTIVE

The present paper is an attempt to analyze the development model of slope profile of this granite hill under the condition of instability with the help of a few surveyed slope profiles. It will enable to assess and estimate the degree of interrelationship between the slope form, slope angle, slope element and the nature of surface sediment of the Bariatu hill in particular and other granite hills of the Ranchi plateau in general.

METHODOLOGY

Four slope profiles running from the crest of the hill to its base have been surveyed with the pentameter, 1.5m. in length, using the method out lined by pitty (1966). The angle of slope and the nature of surface sediment for each unit were recorded and plotted against each other without vertical exaggeration.

The materials which obscured the solid rock (else where) were classified as clitters, regoliths, mixed debris of coarse sand and stones, rock boulders of varying sizes and fine sands left behind by slope wash.

Conversely, the debris type, is in part, dependent on the slope angle. Similarly, form analysis of the profiles confirmed that convexity is the norm over the crystal section, while concavity is common on the basal section due to accumulation of debris. The tendency of slope profiles towards a perfect convexo-concave form, minimized rectilinear segments, negative curve ratio etc. indicate the control of rock resistance on the curvature of profiles, resultant micro-relief forms and the nature of weathered waste. The complex and irregular slope profile form, type and angle, thus reflect the interaction of process, structure and time.

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RECONSTRUCTION OF PALAEOCHANNEL IN PRATAPGARH DISTRICT U.P. INDIA

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Geomorphologists studying the composition, form and process of major and minor landunits, are also concerned with the landform dynamics. The study of the trend of the change caused by certain natural and anthropogenic forces is helpful, firstly, in monitoring the dynamic nature and rate of change of a landforms, secondly in working out a regional plan in perspective to changing environmental set-up. River valleys carved out by fluvial process over alluvium structure also witness considerable spatial change. The Gangetic plain of India has been a podium where evidences of such types of palaeohydrological drama played by rivers are available.

The present paper focuses on the river palaeoecology of the Pratapgarh district. Resting over the alluvial formation and characterised with the monsoon climatic conditions, the region allows the streams to erode their banks easily especially during monsoon. In the present case a palaeochannel has been reconstructed in the Kunda subdivision of the district, which runs along the 81^0 35'E. longitude starting from Kaithaula to Aidha Via Rampur and Kindhamli. There are several methods (Devid kinghton, 1984, Fluvial forms and process, p.164) to study the river channel changes but in the present case "Sedimentary Evidence Method" has been adopted where in 'surface forms' and 'internal structure' have been studied. Morphological features explicitly reveal that there exists a chain of arch shaped and longitudinal tals viz., Raipur tal (6-10 feet), Bara tal(8 feet), Gujwar tal (15 feet) and Aidha tal (5 feet) which if connected, give a shape of channel. These tals have been up and shallowed by newer and softer alluvium.

This palaeo-channel evidenced by morphological features, is supposed to be the remnant of river Duar (at present a tributary of the Ganga) which used to flow from North to

South through a meandering course and fell into the Ganga. River Daur vanished with the march of time because it was captured by the Sai which marched westward by headward erosion. Today its abodoned valley is under agricultural landuse except a few tals which are natural and supply evidences for palaeochannel reconstruction.

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PALAEOGEOGRAPHIC MODELLING OF LIDDAR VALLEY GLACIAL LANDSCAPE

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The Liddar valley is located between the pir panjal range and North kashmir range. The valley begins from the base of two snow fields in the north, from where two main upstreams, the East and the West Liddar originate and join near pahalgam. During pleistocene glaciation large valley glaciers originating at altitude of 5400 meters occupied the major part of north Liddar/ drainage basin and terminated as low as 2000 meters near Gnashibal. The huge morainic masses, roche moutonnes and linear in area and volume of ice during pleistocene. The main objective of the present paper is to evaluate the glacial fluctuation record and to reconstruct, the Palaeogeographic glacial landscape from geomorphological, palaeobotanical and lichenometric evidences.

The glacial geomorphological evidances reflect the clustering of cirques at three altitudinal zones of the valley, documenting the three glacial advances. They closely correspond with three altitudinal zones of roche's moutonnes and two sets of medium, high lateral moraines. The analysis of pollen stratigraphy of the region and the carbon dating of the adjoining region indicate the deglaciation started in the region around 17,000 B.P. in main valley, 15,000 B.P. in side valleys and 8000 B.P. around valley heads. Discrimination and subdivisions of three phases is based on various relative age criteria including moraine morphology, lichenometric analysis and weathering characteristics of surface stones. The three main phases are designated after local places :- Zaijpal-Satlanjan, Chandanwari-Kalwan and Gnashibal stages. The Ganshibal and Chandanwari-Kalwan moraines are more extensive and are well preserved. Their extensive height indicate thick ice cover of 250-150 meters was responsible for their formation during these successive stages. Moraines of Zaijpal-Satlanjan age are bouldery and sharp-crested and are youngest.

GEOMORPHOLOGICAL OBSERVATIONS IN THE MARKHA REGION OF THE ZANSKAR RANGE, KASHMIR HIMALAYA.

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A mountaineering expedition was conducted in the Markha region of the Zanskar Range of Ladakh (Kashmir Himalaya) under the auspices of the 'Clean Himalaya Expedition' organized by the Giri-Doot Mountaineering Club of Chandernagore, West Bengal during July-August 1989. Subsequent to the adventure an observational study was carried out on the geomorphological environment of this area in the Upper Indus basin (falling within the Tethys Himalaya). This paper is the revelation of the major findings of this expedition. The objectives of this study were to identify and locate major glacial and periglacial landforms in the Markha region. The methodology maintained was based on observations and correlations between the geological and geomorphological attributes. The result showed that i) successive retreat stages were followed by the glaciers (particularly the Stock glacier) nourished stages from the Zanskar Range during the Quaternary; ii) large-scale discharge and slush flow from the Stock glacier during the Quaternary developed the extensive fluvio-glacial fan at mouth of the Stock river and iii) both relict and contemporary periglacial landforms are abundant on the surrounding hillslopes.

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LAND EVALUATION AND ASSOCIATED LANDUSE SYSTEMS IN SEMI ARID MOREL RIVER BASIN (RAJASTHAN)

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The present paper makes an attempt to decipher the inherent processes and resultant pattern of Land systems found in a fluvially organized landscape in semi-arid region. It reiterates to generate an awareness that the character of river systems represents the end products and integration of all processes operating within the watershed ecosystem today, arid in the past, including the processes, which directly or indirectly have been accelerated or retarded as a result of human interference. Thus, the Land system approach furnishes a scientific method of land evaluation and its mapping. In fact, land is the stage where the play of man-environmental relationship is witnessed both in time and space. Further, the landuse systems are investigated within the Land system's frame, to examine the association between the two.

The Morel river basis is located in the east of Aravalli range between latitudes 26°6' 27" - 27° 9' 28" North and longitudes 75°44' 19"-76° 58' 49" East encompassing an area about 5800 square kilometers. The basin exhibits the superimposition of aeolian landforms over the fluvial landscape to a considerable extent.

The study region has been divided into four major Land systems and further units. The investigation is based upon conventional and remotely sensed data supported by extensive field checks. It could be well established that visual interpretation of RS. data helps greatly in land system mapping of such semi-arid ecosystems. The landuse systems could be evolved after analyzing the three year average landuse data for 316 patwer circles in the study region. A very close association has been found between the land and landuse systems.

STUDIES ON THE GEOMORPHOLOGY OF A POLYGENETIC TERRAIN, A CASE STUDY OF KANCHI BASIN

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The present author has endeavored to study the polygenetic landforms and the complex drainage peculiarities as evolved in the hills and plateau terrain of the kanchi Basin, Ranchi district, Bihar. The area under consideration is comprised of the gneissic rock mainly homogeneous in character, though accompanied by distinct joints or fractures. Situated within the humid sub-tropical monsoon climatic zone, the area enjoys hot and wet summer and cool dry winter. The landforms of this seasonally wet-dry tropics make a transition between the more distinct types of humid tropics. The major distinction between this tropical wet-dry zone and those adjacent to it results mainly from its processes i.e. active surface run-off (fluvial erosion) by rainsplash and overland flow and deep chemical weathering especially in the closely jointed granitic rock. These two processes, accompanied by recent tectonic upliftment produce a typical geomorphic character which is unique in nature. The author has tried to interpret the peculiar suites of landforms and soils of Ranchi basin which have passed through several cycles of erosions, thus registering the typical climatic criteria of the past. This type of geomorphic features are most uncommon and draw attention to further studies.

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A GEOMORPHOLOGICAL PERSPECTIVE OF MANGROVE ENVIRONMENT OF THE JAMBU ISLAND, A PART OF THE SUNDARBAN

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Jambu Island of the South Western Sundarban is characterized by deposition of autochthonus and alochthonus sediments, colonization of different types of mangroves and very recent reclamation of vegetated flats. Land form types, distribution of mangrove species, patterns of distribution of mangroves and the time scale change of mangrove species are studied in the island. The physical environmental characteristics are significant to the growth of mangrove plants in the island. Landform complexes of the island are subjected to continual change of different processes like tides, waves, river discharge, sea level movements etc. over time. Minor changes are also observed on the vegetated flats where the present fishing village of the island is situated.

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FLUVIAL PROCESSES, RIVERINE ENVIRONMENT AND GEOMORPHIC MANAGEMENT OF THE TRANS-YAMUNA REGION, ALLAHABAD DISTRICT

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The study of fluvial processes of the Trans-Yamuna region of the Allahabad district reveals the involvement of those mechanisms of morpho-dynamics, which solve the complex mysteries of sinuous and uncertain periodical swinging of river channels in the riverine environment of their own valleys. The various morphologically interesting features like sand-islands, braided streams, slumping, solifluction and ravination along the banks of the streams of the study region, are significant morphological features of the riverine environment. The shifting of channels, responding to altogether new riverine environment and formation of mis-fit valley, due to river capturing, present a geomorphologically very interesting landscape. In the present paper, the study and interpretation of fluvial processes, associated morphological features and management of geomorphic environment, have been attempted through discussions like --- fluvial processes and mechanism of silt-transportation, erosion and deposition, geometric properties and profile analysis of river channels, riverine environment and associated morphological features, channel shifting and river piracy, ravination and associated processes and management of geomorphic environment.

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OCCURANCE OF SANDSTONE IN TAPI FLOOD PLAIN

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The tapi river extends between 74° E to 78° E Longitude and 20° N to 21° N latitude. Near Bhusawal a compact hard layer of sandstone is observed on the river bank. The same type of sandstone is also observed in well sections of alluvial deposits. The thickness of the sandstone is variable. Compactuers, structure, texture and composition of sandstone also vary from one place to the another. Sandstones of maximum thickness are located on the river banks near Bhusawal.

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DIVERGENCE OF TRIBUTARY STREAMS DUE TO HEAVY SILTATION IN FLOOD PLAIN AREAS- A CASE STUDY OF SARANGKHEDA AREA IN TAPI BASIN.

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Tapi is one of the major river in Maharashtra. There is a huge sediment deposition in Tapi basin. It is a striking feature in the lower Tapi basin that the tributary streams joining from both the banks have changed their directions very near to the main river. It is a particular zone where the streams have diverted and they use to flow parallel to the main river for a long distance. In the present paper an attempt has been made to find out the probable impact of heavy siltation on the divergence of such small tributary streams.

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GROUNDWATER POTENTIALITY OF CALCRETES IN PANZARA BASIN

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It is unwise to search the groundwater in the impervious basaltic rocks over the Deccan plateau, inspite of that seepage calcrete gives some clues towards the groundwater potentiality in trap rock. In this paper an attempt has been made to know the ground water potentiality of calcrete in Panzara Basin (20-15 N -- 21 - 45 N and 73 - 75 E-76-15 E L.) in north western part of the deccan plateau. Occurrence of calcrete is very striking feature in Panzara Basin. There are three predominant type of calcrete found in Panzara Basin.-viz.-Subaceal calcrete, seepage calcrete, and lacustrinc calcrete. As far as concerned to the groundwater potentiality seepage calcrete becomes more important than remaining two types. The study is based on observation of wells in calcrete terrain, their aquifer pattern, relationship between calcrete type and groundwater etc.

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STUDY OF LANDFORMS DEVELOPMENT IN HIMALAYAS
A CASE STUDY OF DEOBAN NEAR CHAKRATA (DISTT. DEHRADOON)

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The aim of this paper is to study landform formation processes, and to investigate role of human activity as a geomorphic agent in the study areas. Which are under snow-cover in WINTER and are below snow line. The paper is based on field study of area around DEOBAN (30°44'30" N Lat. and 77°52'15" E Long) near Chakrata. Slopes and heights are measured with help of Abeny level, and Box-sextant. Rock and regolith samples are analyzed to study processes.

In the area landform formation is mainly controlled by its peculiar climatic character. Running water, only in rainy season, acts as transporter under gravity. Snow activities such as snow-slips, thawling, frost formation are important processes at work. Weathering (Oxidation and hydration) is main cause of rock disintegration and shear-reduction.

Vegetation cover shows clear impact on landform development. Northern slope of ridge covered by dense pine trees has regolith slopes, ranging from 28°-44°. On southern slope rock features are in abundance, due to deforestation and lack of vegetation. Here slope angles are higher and culminate in chaff or rock fall. Rock-Piller inform of tors, rock plates, and conical peaks are surrounded by scree material. Alignmant of peaks indicate their origin from ridges differential slope retreat.

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ENVIRONMENTAL GEOMORPHOLOGY OF MODERN AEOLIAN DEPOSITS IN RAJASTHAN DESERT, INDIA

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Characteristic modern aeolian deposits produced under natural dry environment arid- semiarid region in Rajasthan are investigated for their genetic and environmental significance. These recent aeolian deposits are hereby classified into major morphogenetic types such as : 1)Vegetation induced aelian sand sheets, 2) Shrub coppice complex, 3) Vegetation dependent sandy mounds, 4) Clustered barachans or active dune fields, 5) Linear arrays of low brachans, and perched or climbing sand heaps over older dunes-interdunes complex, 6) Obstacle lee linear accretions, 7) Emphemeral river bed and river bank dunes, and 8) Anthropogenic aeoan sand accumulations. It is inferred that the genesis and growth of these aeolian deposits are primarily dependent on the availability of sand and the prevalent wind regime. Destinctive morphologies are developed over the hard rocky desert pavement or serir and the Quaternary column of sediments respectively.

These modern aeolian accumulations are essentially reworked from older deposits of aeolian and fluvial source sediments and that their forms and dispositions are influenced by the interactions of the prevalent aerodynamic forces with respect to 1)the older stabilized and degraded dunes ; 2) nature and distribution of hard rock outcrops and configuration of the linear Quaternary sedimentation basins; 3) type and density of desert vegetation and 4) biotic and anthropogenic parameters depending upon the socio-economic and other strategic conditions of the terrain.

Small aeolian ruffles over shallow prograding sand sheets are observed to be characteristic precursors and nucleared growth centres for the development of barchanoid dune fields.

Sedimentologically, these recent aeolian deposits are characterised by fine to very fine grained (0.2mm to 0.11mm), well sorted, positively skewed and strongly leptokurtic sands with negligible clay and slit. These granulometric properties suggest that their mode of transportation has primarily been by saltation and that the contributation of surface creep and suspension mode of aeolian transportation are insignificant. These findings can be utlilised effectively in suggesting ways for checking wind erosion and dune stabilisation.

The resultant hazardous environmental impacts of these aeolian deposits include : 1)blockivg or disorganization of drainage; 2) canal fill-up or siltation; 3) shifting sand accumulations across roads and railway tracts; 4)active dune field formation around clustered human settlements and playas/sag ponds or inland basins; 5) bridge-pier obstructions and channel aggradation; 6) loose sand accumulations along agricultural field fences and other demarcated boundaries, and 7) burial of fertile lands. some parameters of scientific landuse and remedial measures are also discussed.

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APPLICATION OF REMOTE SENSING DATA FOR GEOMORPHOLOGICAL AND ENVIRONMENTAL CONSERVATION STUDIES

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The study area lies between latitudes 23° 35' - 25° 22' N and longitudes 72° 35' - 74° 22' E and covers about 34000 Sq. kms. area. It covers part of Udaipur, Sirohi, Chittaugarh, Banswara districts of Rajasthan and Mehsana district of Gujarat.

METHODOLOGY

The landsat satellite scence of MSS and TM Row 148 and path 043 at 1:1 M scale was enlarged at 1:2, 50,000 scale using Procom-2 and density slicing was done using Image Analyser on band number 7 of TM. The enlarged scene was interpreted visually for geomorphology, surface water and environmental conservation study. The images were analysed and pre field maps were prepared for the above themes. Images were scaned using illuminated magnifier (Dianascane). The features were identified and delineated on an overlay. Subsequently based on limited ground check and back ground knowledge of area, re-interpretation was done, which included few revision of boundaries. The various resource data integrated include geology, geomorphology, hydrogeology, soil and land use for generating environmental conservation maps.

RESULTS AND DISCUSSIONS

Geomorphologically, the study area represents a fairly rugged relief with structural hill ranges, linear and curvilinear ridges of quartzites and plateau with intermountaine valleys in the eastern sector. These are bordered by piedmont and pedimented areas, as well as pediplains to the east and west of the hill relief. A number of water bodies occupy local depressions. In the western part of the area depicts a vast pediplain, the monotony of which is broken by the hill relief around Sirohi, Mount Abu and a few dotted hills north of Erinpura. The structural hill ranges trend more or less NNE-SSW. The main drainage system in the area flows southerly or North-Westerly and comprises of the Jawai and Sabarmati river system and its tributries. Elevation ranges from around 308 meters to 1097 meters above mean sea level.

Six predominent geomorphic units have been mapped in the area. Which are :

1. Denudational hill,
2. Structural hill,
3. Residual hill,
4. Buried pediment,
5. Pediplain and
6. Flood plain.

CONCLUSION

Satellite data employed in this study provided better tonal and textural variations and sharpness. This facilitated delineation of geomorphic features, with greater ease. These Satellite data offers opportunities to arrive at accurate land evaluation and assessment of environment reliably. The use of satellite data for preparing such maps is quicker than conventional methods.

REMOTE SENSING AS A TOOL FOR ASSESSING ENVIRONMENTAL EFFECTS, PRESENT STATE, CHANGES AND ECOLOGICAL SIGNIFICANCE OF RESERVOIR SYSTEM IN SEMI ARID REGION.

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The present study attempts to apply aquatic remote sensing to preparation of parametric map - like presentation, quantitative evaluations and time-related investigation of Ramgarh lake Jaipur. It is the largest water source for Jaipur city which has a estimated population of more than 20 lakhs. The regulation of this lake is a continuous task of undiminishing importance.

OBJECTIVES

The aim of the study was to know the present state and the late changes of ecozones and land cover of the watershed and the water areas of Ramgarh lake which has a large catchment of 760 sq.kms, situated 20 miles Northeast of Jaipur along the hills in the groge through which the Banganga River passes before emerging on the plains. There are several schemes both to bring out and protect this natural media where the changes were important during the last fifteen years owing to supply of drinking water, fresh water fishing, cultivation and development of water sports and recreation. The remote sensing seems a good tool to give cartographical, quantititative and qualitative data as an aid to the decision.

METHODOLOGY

The satellite data includes information of aquatic areas down to the Secchi disc depth. The green and yellow wavelengths of channel 1 indicate variations with a few uppermost meters in water features, even down to tens of meters within certain open ocean areas. The red radiation of channel 2 usually comes from within the uppermost one meter layer, and the near infrared channels 3 & 4 include information from within the uppermost centimeters or millimeters respectively. In addition the uppermost part of the water column is best represented within all recorded channels.

Three landusat MSS & TM FCCS and four Black & White IRS-LISS II imagery were used for this study. The images were interpreted to study the land cover of the watershed with support of topographical, geological, geomorphological and vegetation potential maps. It was possible to obtain a classified map with all category. Landsat TM & IRS - LISS II data appeared interesting to detect easily, vegetation, water surfaces and wetlands with the level of the soil moisture in the classes. Some difficult points needed a control on the ground, during the mapping process classification of wet vegetation on humid areas near water surfaces.

The changes since 1972-89 were distinguished by comparision of interpreted TM & IRS - LISS II data with corresponding MSS data between the two data a decreasing of precepitation and reduce of surface water resulted the decrease in agricultural activity and water sports.

CONCLUSION

The study on the Ramgarh wetland has shown the high interest of the Bands of Landsat & IRS data to know at 1,50,000 scale, the state of the large wetlands land cover with details about the vegetation of humid media. It gives the possibility also to discriminate the characteristics of depth, aquatic vegetation and turbidity of water areas.

The observation of the land cover changes during the 1972-89 period in Ramgarh lake and its vicinity by satellite Remote sensing was possible and did not present too many difficluties.

DRAINAGE DENSITY IN RELATION TO PRECIPITATION INTENSITY IN THREE RIVER BASINS OF NORTH INDIA,

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INTRODUCTION

The drainage density is good representative of climatic and physiographic condition of the drainage basin. It highlights the surface expression of denudational activity within the basin which is influenced by various input and output energies. The importance of drainage density in drainage basin analysis is due to two reasons. Firstly, it reflects the potential rate at which water can be transmitted through basin. Secondly, drainage density reflects climatic condition of particular area and also basin characteristics including rock type's.

OBJECTIVE

In the present analysis an attempt has been made to analyze the relationship between climatic factors and geomorphic processes. The drainage density is considered as a representative of morphometric parameters of landform and mean annual rainfall as climate.

In order to understand the climatic influence on morphometric parameters three river basins Luni, Mahi and Brahmani of north india have been chosen. Three river basins represents the arid semi arid and humid climate respectively.

DATA BASE AND METHODOLOGY

Drainage density is a stream length per unit area calculated from third order sample basins on a scale of 1:50,000 topo sheets. These sample basins are randomly chosen through out the three river basins. The total stream length is calculated with the help of map measurer in kms. and basin area by planimeter in sq. kms. The drainage density is calculated by dividing the total streem length of the basin by total area of the basin. The amount of rainfall of various stations is collected from "Monthly and Annual Normals of rainfall and Rainy days" of Meteorological Department. The regression and correlation analysis are carried out between mean annual rainfall, rainfall intensity and drainage density to understand the relation ship between them.

CONCLUSION

Analysis of mean annual rainfall and rainfall intensity with drainage density in three river basins of north India show varying nature of drainage density. The mean annual rainfall shows a positive relation with drainage density in Mahi river basin (Semi- arid) at a high level of significance and remaining two basins show a negative trend. This confirms peculiar nature of semi-arid climate, which upholds the hypothesis that the denudation rate is high and intensive in semi-arid climate but reduces to either side of arid and humid climate due to reduction in annual rainfall and other due to increase in vegetation density. The correlation analysis of drainage density with rainfall intensity shows negative relation in arid and simi-arid climate but positive in humid climate.

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WATER LOGGING-AN ENVIRONMENTAL HAZARD IN ARID LAND IRRIGATION : A CASE STUDY OF PART OF GANGANAGAR DISTRICT (RAJASTHAN).

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The study area is located in the southern part of Ganganagar district covering an area of about 2028 square kilometers. It covers the southern part of Tibi (230 square kilometers), Hanumangarh (845 square kilometers), central part of Suratgarh (913 square kilometers) and western part of Nohar Tahsils (40 square kilometers). The region is bounded in the north by northern bank of the Ghaggar River bed between Tilwara in the east and Sardargarh in the west while in the east and south by Indira Gandhi Canal. The area is underlain by fluvial sediments superimposed by aeolian deposits. Climatically, it falls in arid zone with large variation of temperature, extreme dryness and scanty rainfall.

Geomorphologically, the region has been divided into aeolian landsystem with northern and southern sandy plains as sub-systems; and fluvial landsystem with the Ghaggar river bed, Drisadwati river bed and inundated river bed sub systems.

METHODOLOGY

A multi stage remote sensing approach is made with multidate satellite imageries, a aerial photographs (1968) and correlative ground truth data are interpreted visually for the impact of surface water irrigation on the landforms, surface run-off, ground water regime along with the environmental changes for the period between 1968 and 1986.

Introduction of large scale canal irrigation in this part of Rajasthan Desert has brought in the positive environmental changes such as improvements of micro climate, changes in floral elements, micro relief, revolution in agrarian economy and urbanization. On the contrary, negative effects such as soil salinity, water logging and marshy lands are perceptible within this short span of time. Due to excessive seepages and mismanagement of land water resources, water level is being rising continuously at an alarming rate resulting in rejuvenation of the palaeo fluvial setup. With these adverse effects intensive agricultural lands are again transformed into poor agricultural areas and ultimately to saline deserts. In the present paper systematic mapping of water logged areas has been done and some measures to combat further degradation of the ecosystem have been suggested.

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CLUSTER ANALYSIS IN THE IDENTIFICATION OF MORPHOUNITS: PERVIKHALA DRAINAGE BASIN - A CASE STUDY

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The analysis of landforms, although, has developed considerably, with regards to various parameters and methods of analysis. However, the aspect of synthesis in the identification of morphological units has remained purely subjective and based on superimposition of distributional maps of some selected parameters. Such a method involves convenient compromise by individuals, which may not correspond to the inherent character of landforms and associated morphounits.

An attempt has been made in the paper to introduce certain degree of objectivity in the demarcation of morphounits. One drainage basin in the Himachal region was selected for the said exercise, which is a tributary to Giri river. The river has witnessed successive phases of activity leading to many transformations. The drainage basin of Pervikhala, was therefore, a right choice as it too registered many imprints of landscape adjustments to changing structural physiographic changes.

About five parameters are selected to analyze the landforms i.e. relative relief, dissection index,drainage texture and absolute relief. The distributional data of these parameters were fed in a computer with instructions to select five cluster. These clusters are then compared with the conventional method of morphounit demarcation. Broadly, the two sets of morphounits appeared to have same pattern with some fluctuations. The advantage of the cluster analysis, however, is the objectivity of the procedure.

FLOOD HAZARDS AND RIVER-BANK EROSION IN THE LOWER DAMODAR BASIN.

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Lower Damodar basin in West Bengal constituting 36.40% area of about 10.000 sq. km of the entire Damodar catchment, has been a notoriously chronic flood-affected zone from time immemorial associated with extensive valley-side erosion and oscillations of the river courses causing huge damage to all facets of the life and economy of the area. The present study is an attempt to project the situation of the recurrence of floods and bank-side erosion and their consequence in the historical perspective both before and after the construction of dams by D.V.C. for flood protection and other multibenificial purpose. While the pre-dam flood conditions were quite hazardous with conspicuous valley-side erosion especially in areas adjacent to Burdwan and trans-Damodar basin, the situation in the post dam period has not been completely immuned of the flood problems because of the inadequate flood protection capacity of 1.041 million acre feet in place of 2.90 million ft. as originally recommended by Mr. M.L. Vorduin. Undesirable huge release of water from the dams necessary at the time of excessive increase of water level in the reservoirs beyond the storage capacity on account of high rainfall in the upper catchment aggravated by the increasing run-off in the lower catchment below the dams due to deforestation, mining and urbanization etc. have been responsible for very high magnitude floods in 1959,1978 and some other years causing irreparable losses to the lower basin.

The age-long bank side erosion of the trapezoidal cross-section has been responsible for lateral shifting of the lower distributary channels along with accretion of silt on the other side. Such quantitative measure of valley-side erosion have been studied from long period cross-sectional changes. In the

post-dam period the formation of cavities and scouring action below the dams are conspicuous with lesser bank-side erosion. Because of the controlled river flow, it is apprehended that most of the lower distributary channels being deprived of the natural flow will degenerate into ineffective drainage channels.

In conclusion the extent of damage of the floods with special reference to the 1978 flood has been discussed. The author has, therefore, stressed the need of re-evaluation of the post-dam conditions in the lower Damodar basin and amelioration of the problems.

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