CHAPTER - 1
INTRODUCTION

1.1 Introduction

“Geomorphology is dominantly an empirical discipline where ground truth is paramount and field relations are the fine court of appeal” (Bretz, 1962).

The simple purpose of the geomorphological study is structurally understood in the regional area and their factors of natural resources and to evaluate the local geomorphological relationships with land use /land cover analysis.

Although geomorphology traditionally focuses on the processes involved in landform formation yet this detailed scientific study of forms, materials and processes of the physical landscape provides the valuable information for the planner in developing area like Pichhore. Geomorphology provides “fundamental template on which landscape processes and human interactions with those processes take place” (Conacher, 2002).

The aim of landform analysis for this study area is basically the classification, evaluation of landform, understanding the regional features and their participation of development of land use/land cover and their changing patterns for their proper sustainable utilization and management. The study can facilitate different development strategies, important data for solving different land associated problems such as, assessment of geomorphic hazards etc. Because “all these and many other problems arise in part from mismanagement or misunderstanding of geomorphological conditions” (Cook, et al, 1982).

In order to avoid these problems, we can divide the local area in geomorphic units and make this study easy to understand, because the regional geomorphic area is composed of single ecosystem formed from the delicate relationship of a variety of environmental factors such as topography, geology, soil, climate and flora and fauna. These factors are directly concerned with development process of area and responsible for overall socio-economic growth of this underdeveloped area so that this
type of study will play a vital role in the geomorphic management of village or town planning programs. It is not only concerned with geomorphic processes, assessment or their effective analysis but its proper knowledge is also significantly important for applying geomorphic areal management scheme in several disciplines in this area. “There are many more areas where geomorphological knowledge may be applied e.g. land use management, environment management, natural disaster reduction, soil erosion and sedimentation, watershed management, river management, coastal zone management etc.” (Singh, 1998).

1.2 Location and Approach

It is a tahsil headquarter of the identical name (Fig. 1.1) situated towards south-east of Shivpuri at a distance of 77 kms, in between the Cartesian coordinates 25° 05’00” N – 25° 15’00” N and 78° 05’00” E -78° 15’00” E and falls in Survey of India toposheet no. 54 K/4. The total area is 311 sq. km. and the maximum elevation of the area is about 420 m. above average mean sea level.

The study area has bounded on the north by Karera tehsil of Madhya Pradesh and the upper part of north east border by Datia district of the same state. The north south side of this study area is surrounded by Jhansi district of Uttar Pradesh and south by Khaniyadhana tehsil of Shivpuri district of Madhya Pradesh (Fig 1.2).

Pichhore remained with the Bundelas of Orchha and then with the Marathas. It was captured by British in 1838 and returned to king of Jhansi in 1841. In 1860; it was given to Scindia in exchange of some territories [Plate-1 (a)]. This small block has great historic past, whose old emblem still survives. Besides the Chota tal of Pichhore, there are many temples such as Jaleshwar Mahadev, Narmadeshvar, Mahadev, Mouriya Mahadev, Bhairav ji and Hanumanji temple, Famous Tekari Sarkar Temple and Laxminarayan Temple, which is dedicated to Lord Vishnu and Laxmi riding on Garuda, situated over dam site. At southern bank of the small town area tank, there is an ancient ruined fort built by the late Veer Singh Judev, king of famous Orchha state.
Fig. 1.1 Location Map of the Study Area (Not to scale)
Fig. 1.2 Base Map of the Study Area
Plate-1

(a) Pichhore Fort
1.3 Communications

The study area is much better in its road communication. It lies 116 km South of Gwalior on Agra-Bombay National Highway No.3, which is an excellent all weather road. This road connects the district to Gwalior, Agra and Delhi in the North and Guna, Bhopal, Ujjain and Bombay in the south. The south east area of the Pichhore is also very closely well-connected with Jhansi and Kota by National Highway No.25. This goes up to Kanpur, Lucknow and beyond.

Broad-gauge train facility is also available in the district headquarter (Shivpuri) situated at a distance of 77km. from Pichhore town. This has been mainly connected to Shivpuri, Gwalior and Guna. These are on the Delhi-Bombay/Chennai main line.

1.4 Problems in Research Area

Land degradation is the main issue of the region which is becoming a serious threat to the study area causing many other related problems which are follows:

1) soil erosion:- created by excessive pressure on agricultural fields, accelerated by steep slopes and high runoff, exposed soil surface and inappropriate farm practice).

2) depletion of natural resources:- forest and water bodies

3) deforestation:- due to soil fertility loss, increasing waste land, fallow lands etc.

These different environmental issues are losses the food insecurity, food productivity, livelihood and economic growth of the study area and provide us the clear understanding of the natural extent of land degradation in this area (Shetty, et al, 1995). Increased population over past two decades is also creating other problems in this area.
1.5 Scope of the Work

In the study area, evaluation of environmental degradation processes required a wide range of geomorphic analysis, because the present limited knowledge of available resource is not sufficient for proper resource planning and management projection for this area. Therefore, present study has focused many inter-related geomorphic units with different aims of exclusive interpretation of geomorphic characterization and evaluation of land capability, assessing the resource potentiality and calculating limitation of different resource units for their rational land use planning with the help of remote sensing techniques. Through investigation, the characteristic importance and relation between geomorphological Process has been emphasized the land use/ land cover pattern of the area.

1.6 Previous Work

Jha, et al, (1985) have made a significant contribution in the geomorphologic lineament study of north Shivpuri, and classified the area in three geomorphic provinces based on remote sensing techniques.

Javed (2000) has presented a synoptic view of the geology and geomorphology of Bulandshahar district.

Tang (2000) analyses the slope profiles on the limestone residual hills which has been referred as a tower karst. The former are individual isolated residual hills rising from flood plain.

Sak (2002) worked for the educational value of the history of geomorphology. It includes contemporary research in the perspective of the past as well as the future that reviews and analyses primary source and past events in the discipline in order to generalize and explain geomorphic trends.

Finlayson, et al, (2003) studied the suitable erosion model with their problems and selection, description of landscape that is not easily resolved. Based on it, detailed examinations of the stream power analysis at the scale of the continental mountain ranges have been emphasized.
Rao (2002) carried out work on Siwalik foothills area with remote sensing tools in geomorphology; he illustrated the efficacy of remote sensing in environmental and geomorphological interpretations including landform ecological correlation.

Vishwambhar, et al, (2001) carried out resource analysis and area development of Shivpuri. These geomorphic appraisals provide the way for development program in the region.

Balaselvakumar (2003) has made an attempt to map the land use/land cover categories of Arjuna River basin using remote sensing techniques. This basin subjected to different kind of environment degradation by both man and nature.

Srivastava, et al, (2004) carried out work on orbicular structure in granitoid complex near Pichhore, identifying this as single shell and multi shell structure formation formed in different environment viz. magmatic, metamorphic and migmatitic in granites, gneisses etc.

Kamal and Midorikawa (2004) have investigated GIS-based study which enhances the possibility to use this map effectively for multipurpose functionality from detail oriented geomorphological hazard mapping to urban land use planning.

Gran, et al, (2006) have studied the channel bed evaluation and sedimentary transport system under declining sand input for the period from 1996 to 2003 of pasig-potrero River.

Montgomery (2006) presented a detailed description on restoration of ecology with the contribution of geomorphology. In this area, he investigated, how specific changes in fluvial and watershed process influence human habitat.

Kristine, et al, (2007) studied the headwater stream management of the forested landscape under basaltic and sandstone lithology in Washington State, USA.

Singh, et al, (2008) have carried out a significant study on the genesis of collapse granite breccia of Precambrian terrain. He has reported that this genesis breccia developed by different modes of geological processes usually occur as circular or dyke form.
Jayant, et al, (2008) have investigated detail geology of Dhala area near Pichhore. He observed that, these curvy linear features having very large quartz veins and sandy siltstone, sand stone with small exposure of bedded ash, are partly covered by quaternary alluvium.

Henck, et al, (2010) studied the spatial control of erosion in three river region, southern Tibet and southwestern China, correlated it with mean annual rainfall of the area.

Sherwood, et al, (2010) evaluated the landscape and land use of the Virginia piedmont and Blue Ridge with their complex geological and geomorphological bad rock study ranging in age from mesoproterozoic to Triassic period.

Chamapira and Goudarzi (2011) have observed the identification of geomorphology facies types which are necessary to prevent the wastage of water and soil resources and their damages in different parts of the country having special place in natural resources studies.

Rodriguez, et al, (2012) investigated weathering landforms and identified some correlation between variables like taffonis magnitude, regolith-outcrop ratio and taffoni organization in levels. These levels of taffoni allow him to identify several phases of regolith erosion in most regolith unit, in different settings and altitudes.

1.7 Methodology

In order to fulfill the aims of this prepared characteristic, various maps are formed to establish an integrated picture of this study area, like base map, lithology, geomorphology, drainage; land use /land cover etc. using different geotechnical tools like color, texture and tone.

For this research purpose, topographical map 54K/4 has been used on the scale of 1:50,000 including satellite image Liss - III, sensor digital data with resolution 23.5metres and software Erdas imagine 9.1 and ARC GIS 9.2. It has visually been interpreted by using standard geotechnical interpretation keys such as color, tone, texture, pattern of drainage, shape and topography etc. (Rao, et al, 1997).
The detailed geomorphic aspects of the area have been investigated in addition to this field work, for ground verification, and thematic detail has been done in the area, with the help of computer analysis of two years, 2005-2008. Comparative studies have been carried out under following objectives:

(1) Collection of data and consultation of available literature, related to the area under study.
(2) Analysis of meteorological data for map interpretation and map construction.
(3) Investigation of various landforms, characteristics for knowing their position.
(4) Preparation of drainage map of the area, with detailed morphometric study.
(5) Analysis of various thematic maps like geomorphological map, geological map, land use/land cover, slope, soil, lineament etc.
(6) Synthesis of available data based on laboratory and field work.
(7) Area calculation for various categories of land use/land cover.
(8) Finally field and laboratory data have been integrated to focus on the geomorphological status of the area.

To achieve the above objectives, the following methodology and procedure have been adopted in the present study area.

1.7.1 Pre Field Work

The basic objectives during this stage were literature collection of secondary data viz. geological, meteorological, geomorphological and land use/land cover related data have synthesized for identification and classification of different geomorphological landform units in the area, and study of their operative geomorphic processes, with the help of topographical sheets.

Preparation of base map and marking of detailed plans for field sampling and making necessary morphometric analysis which are based on topographical sheet.

This stage of research includes the identification, collection and recording of geographical data and marking correct observation of this.

Consultations with the officials of block level and other experienced personnel about the social and physical attributes.
Preparation of various thematic maps like, geomorphological map, base map, lithological map, land use /land cover map, drainage map, slop map soil map which are visually as well as digitally analyzed.

1.7.2 Field Investigation

Field checks and confirmation of topographical map features and land characteristics and their land use classes were carried out.

On the basis of preliminary database and planned field, work carried out for critical sectors of the area with geomorphic interpretation and also making correlation of the field data with morphometric features identified from the topographical sheet.

1.7.3 Post Field Work

All data were classified, correlated, processed for interpretation, with pre-field map modification, base map rescanning and preparation of all digitalized maps using satellite data and digital image interpretation. This post field work finally provides us the recent geomorphological and land use/ land cover knowledge of this area.

1.7.4 Sources

(1) Survey of India toposheet no. 54 K/4 on 1:50,000 scale.
(2) Satellite image LISS III, sensor, software ARC GIS (9.2)
(3) Meteorological data like rainfall, temperature, humidity etc. collected from district meteorological department.
(4) Madhya Pradesh District Gazetteers and block office reports
(5) Existing Maps and Literature.
(6) District Resources Map of the area
1.7.5 Functional Components

- The base map of the area prepared by the Survey of India degree toposheet no. 54 K/4.
- The geological map was prepared using already existing geological data collected from the Geological Survey of India, District Resource Map.
- Lineament maps have been prepared by identifying the lineaments from the satellite image by which the basic geologic structures and their form type of the particular area can be understand.
- The contour and slope map were prepared from the topographical map and aspect and DEM map prepared with the help of satellite image and contour map.
- The major part of the study area is composition of geomorphological map, prepared through satellite image which identify the occurrence multiple land forms such as pediplain, pediment ridges plain inselberge, structural hills etc. with verification of different types of field checks.
- Drainage map of the area has been prepared and interpreted with the help of Survey of India toposheet.
- Land use /land cover map of the area has been prepared and visually interpreted through the satellite image. Finally ground truth data collection, verification of doubtful areas and correction, modification and transfer of post field details of geomorphology in to original maps have been done.
Flow chart 1.1: Detailed Methodology

1. Calection of available data
2. Functional component
3. Source availability
4. Interpretation all collected data
5. All data were classified, co-related, processes
6. All the map were prepared through satellight data