SUMMARY

The land-use pattern of any particular geographical tract is primarily based on its geomorphic setup, climatic characteristic and soil type. The study of landform and land use management is basically an applied aspect that provides useful information to human being in their common practices.

Land use is the human use of land. Land use involves the management and modification of natural environment of wilderness into built environment such as fields, pastures, settlements, military, leisure and transportation. Land use practices vary considerably across the world. The United Nations Food and Agriculture Organization’s Water Development Division explains “land use concerns the products and for benefits obtained from use of the land as well as the land management actions (activities) carried out by humans to produce those products and benefits.”

In present time the change of land use patterns to urban areas has become a major problem resulting from economic and population growth, especially in developing states. The urbanization process which has resulted from both direct and indirect influences is multi-directional and differentiated in time and space. People transform natural habitats into man-made landscape of residential, commercial, institutional and industrial areas as well as supporting infrastructure. Fast growing populations need a large number of living units. Poor land use planning is another factor contributing to uncontrolled explosion of the urban area. As a consequence of urbanization, most natural lands have been fragmented into small pieces of land likely to create adverse environmental impacts.

This topic offers an ample scope for studying the nature complexities both structural and fluvial under the variegated climatic conditions and pedological aspects. The systematic description and analysis of landforms and terrain characteristics provide a base for any innovative research work. The study of impact and land use pattern is relevant aspect for
developmental possibilities. The proposed work is an attempt to correlate the impact of land forms or land use pattern.

Landforms are naturally occurring formations or areas of land. Land formations can be as varied as mountains, canyons or plains. Areas of land broaden the definition to include landforms as big as islands, coasts, and even continents.

A landform is a natural feature of the solid surface of the earth or other planetary body. Landforms together make up a given terrain, and their arrangement in the landscape is known as topography. Typical landforms include hills, mountains, plateaus, canyons, and valleys, as well as shoreline features such as bays, peninsulas, and seas including submerged features such as mid-ocean ridges, volcanoes, and the great ocean basins. Landforms are categorized by characteristic physical attributes such as elevation, slope, orientation, stratification, rock exposure, and soil type. Elements including various kinds of inlands, oceanic waterbodies and sub-surface features.

The scientific study of landforms is known as geomorphology. The ability to analyze and quantify morphology of the surface of the earth is essential for understanding the physical, chemical, and biological processes that occur within the landscape. It is also an expression of geologic and weathering processes that have contributed to its formation. Knowledge of terrain morphology also is essential for any engineering or land-management endeavors that affect or disturb the surface of the land. The primary science that deals with understanding, description, and mapping of the shape of terrain is geomorphology, defined in the Random House Webster's Dictionary as the study of the characteristics, origin, and development of the form or surface features of the Earth, i.e., landforms.

Landforms are defined as specific geomorphic features on the surface of the Earth, ranging from large-scale features such as plains and mountain ranges to minor features such as individual hills and valleys. Geomorphology encompasses a spectrum of approaches to the study of landforms within two major interrelated conceptual frameworks: functional and historical. The functional approach tries to explain the
existence of a landform in terms of the circumstances which surround it and allow it to be produced, sustained, or transformed such that the landform functions in a manner which reflects these circumstances, while the historical approach tries to explain the existing landform assemblage as a mixture of effects resulting from the vicissitudes through which it has passed.

Landforms evolve in response to a combination of natural and anthropogenic processes. The landscape is built up through tectonic uplift and volcanism. Denudation occurs by erosion and mass wasting, which produces sediment that is transported and deposited elsewhere within the landscape or off the coast.

Each landform has its own physical shape, size, materials and is a result of the action of certain geomorphic processes and agent(s). Actions of most of the geomorphic processes and agents are slow, and hence the results take a long time to take shape. Every landform has a beginning. Landforms once formed may change in their shape, size and nature slowly or fast due to continued action of geomorphic processes and agents. Due to changes in climatic conditions and vertical or horizontal movements of landmasses, either the intensity of processes or the processes themselves might change leading to new modifications in the landforms.

Geomorphology deals with the reconstruction of the history of the surface of the earth through a study of its forms, the materials of which it is made up of and the processes that shape it. Changes on the surface of the earth owe mostly to erosion by various geomorphic agents. These geomorphic agents acting over long periods of time produce systematic changes leading to sequential development of landforms. Each geomorphic agent produces its own assemblage of landforms.

The term, definition, meaning and concept are not same, these have difference meaning. Definition gives the meaning, give examples or use of analogy to explain the terms. While, the meaning is an explanation as to what the term is. In other words, meaning is a general explanation of a term. But, the definition can vary as per the person explaining the term. A concept is an abstract idea representing the fundamental characteristics of
what is represent. Concepts arise as abstractions or generalisations from experiences or the result of a transformation of existing ideas.

Land is the one of the most valuable resource of an area. It fulfils various basic needs of the population like cultivation, orchards, forest, grazing, dwellings and communication lines, etc. The interdepartmental working group on land use planning (IDWG-LUP) at FAO proposed in 1994 the following definitions of land, “A delineable area of the earth’s terrestrial surface, embracing all attributes of the biosphere immediately, above or below this surface, including those of the near surface climate, the soils and terrain forms, the surface hydrology including shallow lakes, rivers, marshes and swamps, the near surface sedimentary layer and associated groundwater and geo-hydrological reserves, the plant and animals populations, the human settlement pattern and physical results of past and present human activity.

The study of land use pattern is of prime concern to geographers to know the relationship between man and natural environment. Land use is an important study particularly relevant to agricultural geography. Land utilization is the product which the farm population derives from the type of agriculture; develop the provision for future production and contribution to national needs.

Land use is also related to conservation of land form. Land use is a geographical concept since it involves specific areas. The study of land use forms a significant part of geography and has assumed a place of pride in the field of applied geography. The land use study advances geography into the applied sciences as maps of land use have been recognized as essential tools of regional planning and development. The term land use relates to the human activities associated with specific piece of land, and fractures present on the earth surface. Land use is the surface utilization of all developed and vacant land on a specific point, at a given time and space. Land use is the use made of the land by man, as surveyed and mapped in series of recognized categories. Land use study assumed greater academic and practical significance especially after the brilliant contribution by Baker (1923); in United States of America, Stamp L.D.to know the details of the scheme of the land use survey in Great Britain readers are advised to
consult the account of the history and evolution of land use survey in Britain as introduced by L. Dudley Stamp in his work entitled, “The land use of Britain – Its use and Misuse.” has been able to generate a good deal of regional and systematic survey of land use of whole of Britain.

Chowdaian (2001) explained the land use and land utilisation is not one and the same. Land use is the use of actually made of any parcel of land, house, industrial location etc, are land use categories, whereas term residential, industrial, agricultural, refers to land utilization and it mainly deals with the problems related to society and the region as a whole, land utilization is therefore dynamic concepts since it undergoes certain changes due to change in socio-economic conditions, needs and with the adoption of innovation. Therefore, study of land use is a subject of continuous interest. In India, several geographers have paid attention on different aspects of land use studies at regional, district and micro level. Some of the eminent researchers who have carried out research work on different aspects of land use studies are Chatterji (1952), Shafi (1961, 1966, 1968), Prakash Rao (1959) and Jasbir Singh (1974). The study of land utilization is of immense value in tracing out the past use of land its future trends. Only through the study of past land utilization one can be able to predict its future use and evolve land use planning of a particular region.

**Objectives of the Study**

- The primary objective of the present study is to assess the impact of land forms on land use pattern in the study area.
- To evaluate the Geomorphological Characteristics of the study area.
- To examine the land forms and land use characteristics and their relationship with human activities pattern.
- To measure the pattern of Agriculture Development in the study area.

**Hypotheses**

- There is strong relationship among the impact of land forms, land use pattern and human activities.
Landforms units largely reflect the land forms pattern and level of Agricultural development.

There is a distinct relationship between size of operational land holding and landforms units.

There is a need of proper management of land use dynamics and land use changes in their spatial perspectives.

**Database**

The sources of data include both primary sources and secondary sources. In this study, primary data related to soil types, vegetation cover etc have been collected through field study. Secondary data related to climate, demographics, livestock, land use classes etc have been collected from the websites of various government agencies like Indian Meteorological Department, Indian Council for Agricultural Research, Indian Institute of Soil Sciences, Central Soil Salinity Research Institute, Uttar Pradesh Statistical Handbook, Indiastat.com, etc.

To assess the spatio-temporal variations of land use classification, remote sensing and GIS Data have been used extensively. The satellite images of the study area for different time periods have been collected from the website of National Remote Sensing Centre (Bhuvan), Global Land Cover Facilities (GLCF) and United States Geological Survey (USGS). GIS and Remote Sensing applications like ERDAS Imagine 9.2, ARC VIEW 3.2/ ARC GIS 10 have been used in the study.

**Methodology**

To analyse the data collected for the study, various statistical and spatial techniques have been used. A Cognitive and Morphometric analysis of the data has been done to find out the different proportions of land use classes in different time periods. The obtained results have been shown in the thesis with the help of tables and charts that include pie diagram, bar graphs and line graphs. Statistical products like SPSS and Microsoft Excel have been used to obtain the result as well as graphs.
Spatial data have been shown through various techniques of Remote Sensing and GIS. Population, livestock, and land classes have been shown with the help of choropleth map. Population distribution is shown with the help of Dot method. The relief and drainage map of the study area has been prepared with the help of Digital Elevation Model on ArcGIS 10.3.

To show temporal variations in land use and land cover in the study area, Supervised Classification with the help of Erdas Imagine software has been done.
Figure 1.3: Methodology for Impact of Landforms on Landuse
Conclusion and Suggestions

The present study reveals that Jhansi district extends over the Archean and new depositional range. The Northern part of the Jhansi district is mainly covered by fluvial deposition. The whole region is affected by Betwa and Dhasan River. Fluvial deposition is composed of sand, silt and chika soil. The general slope of the study area of Jhansi district is south –west to north-east. The north- eastern part of the study area is fertile and composed of thick alluvium deposit by the river and rivulets of the area. The Southern and South Western part of Jhansi District is elevated as compared to other area of district. This is highland area and Bijovara and Vindhyan Range are found in this region. Agriculture scenario is quite better in mostly plain area. Mostly plain area is also under the catchment of Betwa and Dhasan Rivers. The undulating topography can be seem in the eastern margin of the study area. Mau Ranipur block is situated on the highland. It’s maximum area comes under undulating topography.

Jhansi District's highland comprised of Jhansi, Badagaon and Babina. It is observed that in the higher slope class settlement is sparsely distributed and small in size and the number due to unequal and an uneven topography, settlement is sparsely distributed in the study area. The size of settlement is large in lower areas particularly along the catchment area of the river. The south-western part reported very high concentration of human as well livestock population. It has been observed through geomorphic indicators. The relative relief distribution determined the pattern of human economic activities. Jhansi district reflects irregulation and unequal topographic setup. It varies from south western part to north eastern part of the district. It has been noted that there is a linear relationship between relative relief, slope characteristics and the drainage frequency among the different blocks of Jhansi district. These blocks are Babina, Chirgaon, Gursarai, Mau Ranipur and Moth. It is noted that the drainage density is more in the lower part of the district towards the central and north eastern part of the study area. There is an inverse relationship between relative relief and drainage density. A clear picture of these variation and relationship can be observed in Babina, Badagaon, Bangra and Mau Ranipur where the relief is higher but drainage density is reported low similarly in Bamaur, Chirgaon, Gursarai and Moth blocks where relative relief is low and drainage
density is high. Linear relationship can be noted between slope characteristics and drainage frequency in different blocks of Jhansi district. These blocks are Babina, Badagaon, Bamaur, Bangra, Gursarai, Mau Ranipur and Moth.

Geomorphic basis provides the condition and opportunities to explore the possibilities of human sustainability on the available arable land and geomorphic conditions. Population characteristics of any area reflect a clear picture of the personality of the study area. Impact of landforms also determines the characteristics of population. Distribution of population, density of population, settlement pattern distribution of settlement, growth and variation of population, occupation and structure of work participation, sex ratio, literacy are largely governed by topographic geomorphic indicators. There is direct relationship between geomorphic characteristics and population characteristics. Bangra, Mau Ranipur, Moth and Babina blocks of Jhansi districts reported high to very high distribution of population as compared to other blocks of the study area. The pattern of distribution of population can also be correlated with the pattern of activities.

Babina is situated in the south western region of the study area. Average elevation of Babina Block is higher. Geomorphic features also vary from south western part to north and north eastern blocks of the district. Bamaur Block lies in the category of moderate distribution of population and Badagaon reported low distribution of population.

It is observed that five blocks of the study area exhibit high presence of human population. There is scarcity of arable land. A lot of geographical area is under the threat of soil erosion, gully erosion and silt erosion. Badagaon, Chirgaun and Mau Ranipur reported very high density of population. Badagaon reported low density of population. It has been observed that it is very important to study the man and land ratio particularly in the areas of bad land topography. Babina and Badagaon blocks of the study area reported high variation in the population in the last three decades. Most of the settlement in Babina and Badagaon are distributed and scattered due to topographical limitations and scarcity of arable land.

Land provides basis for human sustainability and life support system. An assessment and evaluation of land plays an important role in land resource management. Land use/land
cover is an important indicator to assume the geographical personality of any region. Land use is an outcome of interaction of man’s activities. There is an urgent need to map the landform unit at micro level. There is correlation between landforms and land use unit. Pattern of human activity is largely governed by landforms unit. A group of land use and land cover indicators also depict the real scenario of the impact of land form on land use system. It is noted and observed that there are five blocks of the study area that reported very high percent of net sown area these blocks are Moth, Mau Ranipur, Gursarai, Chirgaon, Bangra and Bamaur. There is an inverse relationship between relief pattern and net sown area at different blocks of the study area. Lower area shows the more percentage area under the net sown area but in the some areas due to unequal topography and irregular land agricultural practices are absent. Moth and Bamaur block of the study area also reported for having very high drainage density whereas Babina, Badagaon, Gursarai and Mau Ranipur reported comparatively low drainage density. It is noted that higher the elevation low the drainage density and vice versa.

It is noted that there is a great variation in the relative relief of the study area. Southwestern part is higher as compared to the other areas of the study area. Digital Elevation Model of the study area shows that southwestern part of the study area is higher as compared to the northern and eastern part. Babina block of the Jhansi also reported irregular feature in some area and having more elevation towards south as compared to north. Chirgaon block of the study area reported elevated area towards southern and eastern part. Most of the middle and eastern parts have lower relief due to presence of catchment area of Betwa river. Gursarai block is having higher elevation towards the western part as compared to eastern margin of the block. Mau Ranipur is having higher elevation towards the south western parts of the block as compared to the northern and eastern parts. Moth block having higher elevation towards south western margin of the block as compare to other parts of the block. There is an inverse relationship between elevation, distribution and size of the human settlement except in the south western parts of Jhansi district. Babina block is situated in the south western parts of the block. In some areas due to irregular and unequal topography settlement is scattered in the area of low relief also.
Babina and Badagaon block noted low production of food grain because most of the area of the block has topographical and physical barriers. Moth, Mau Ranipur, Gursarai and Bamaur reported very high to high area under the cultivation and recorded high production of food grains. Mau Ranipur and Gursarai blocks are noted for high production of pulses as compared to other areas. Livestock occupies secondary occupation in several areas. There is an acute shortage of grazing grounds. In such a situation presence of livestock population is more on limited grazing and pasture land in the different blocks of the study area. Babina reported very low presence of land under the pasture and grazing land as compared to other blocks of the study area as such as Mau Ranipur, Gursarai, Bangra and Chirgaon. Chirgoan block has reported maximum percent of area under the category of gross sown area. There is deposition of thick alluvium soil and most of the areas are under the catchment of Betwa river, therefore Moth, Mau Ranipur and Badagaon lie is moderate category under the gross sown area and Babina, Bangra, and Bamaur block lie in the category of area under gross sown.

The percent of net irrigated area is higher in Moth, Chirgaon and Badagaon block of the Jhansi district. Whereas Mau Ranipur, and Babina block lie in the moderate category. Bamaur, Gursarai and Bangra have very low percent area under the irrigation. Most of the area under these blocks are under the risk of erosion, gully erosion and silt erosion and also affected by different erosional processes. Most of the areas are under the catchment of Dhasan River. The maximum percent of cultivable wasteland is noted in Babina block. Higher topographical features have an adverse impact on agriculture. Bangra lies in the moderate category of area under wasteland as compared to other blocks of the district. Badagaon, Moth, Gursarai and Mau Ranipur reported low to very low percent of land under the category of cultivable wasteland. Bamaur and Babina reported maximum percentage under forest cover as compared to Gursarai, Moth, Badagaon and Mau Ranipur.

There is direct relationship between distribution and pattern of settlement with slope characteristics. In the area of unequal and irregular topography the size and distribution of settlement is low but in southern and south-west part of Jhansi district there is concentration of settlement due to other economic activity and presence of urban
settlement. A geographic study of impact of landforms on land use pattern in Jhansi district has been assessed on the basis of geomorphic, anthropogenic, land use and land cover and agricultural indicators. These indicators comprise of 26 variables. All variable have been processed and ranking have been assigned from 1 to 5 whereas 1 denotes the best condition and 5 indicators worst scenario condition. A group of geomorphic indicators linked relative relief characteristics, slope characteristics, drainage density and drainage frequency have been evaluated through the satellite derived data which is obtained from Bhuvan geoportal of NRSC. Each and every topographical variables have been categorized on the basis of spatial characteristics and have been assigned weight from 1 to 5. Anthropological indicators include distribution of population, density of population, growth in human population, percent of total workers, percent of marginal workers of the total workers, percent of non workers to the total workers and literacy ratio, pressure of livestock on the available grazing land has been also analyzed. Block wise fodder requirement has been analyzed. Land use and land cover indicators comprised percent of net sown area to the total area, percent of gross sown area to the total area, percent of net irrigated area, percent of cultivable waste land, percent of pasture and grazing land, percent of barren and uncultivable waste land and percent of forest cover in different blocks of the study area in their spatial context.

Agricultural indicators include area under pulses, food grain, oilseeds, agricultural productivity and fodder requirement for animal population have been also analyzed in order to assess the pressure of livestock population on limited grazing grounds. Cumulative view of impact of landform on land use pattern in Jhansi district has been processed on the basis of superimposition of characteristics of all variables, finally it has been categorized into five categories in order to find out the final picture of the impact of landforms on land use pattern. It has been observed that Moth and Bamaur blocks reported an area of 144970 hectare ie 30.43 percent of the total area of Jhansi district comprising 2984040 persons ie 25.61 percent of the total population of the Jhansi district are having favorable condition as compared to other blocks. These blocks are low lying areas and agricultural scenario is quite better. There is positive impact of landforms with
respect to land use. Lower relief reflects better agricultural condition, only Chirgaon block reported low impact of landforms of land use pattern. Chirgaon covers an area of 507.42 sq km. which is 10.65 percent of the total and Chirgaon comprises 145150 persons ie 12.46 percent of the total population.

Gursara and Mau Ranipur block lie in the moderate category having moderate impact of landforms on land use pattern and human activity. These blocks cover an area of 1308.17 sq. km. i.e 27.46 percent of the total area. These blocks comprise of 308239 persons i.e 26.43 percent of total population of the study area. Bangra and Badagaon block of the study area are having high impact of landforms on land use pattern. These blocks reported an area of 946.79 Sq. km i.e 19.88 present of the total area of the district. Bangra and Badagaon comprise 263260 persons i.e 22.60 percent of the total population. Babina block of Jhansi district reported most very high impact of landforms on land use pattern. This block reflects worst and most unfavorable condition for agricultural prosperity due to topographical barriers. Babina reported an area of 551.47 Sq. km. i.e 11.58 percent of total area. Babina comprises of 149966 persons i.e 12.87 percent of the total population.

It is noted that there is high variability in the topographical characteristics of the study area. It has direct impact on pattern of human activities. There is an urgent requirement to make an intensive planning for land resource management of the study area. There are some constructive suggestion that have been crafted for land resource management at micro level in the study area in order to maintain man and land ratio in proper manner.
Figure: Cumulative Map of Impact of Landforms in Jhansi District
To access the impact of landforms on land use pattern 26 variables has been selected and categories as follows:

**Geomorphic Variables**

- Relative Relief
- Slope Characteristics
- Drainage Frequency
- Drainage Density

**Anthropogenic Variables**

- Distribution of Population
- Population Density
- Population Growth
- Total Workers
- Marginal Workers
- Non Workers
- Literacy Ratio
- Live Stock Population
- Live Stock Density

**Agricultural Variables**

- Area of Cereal Crops
- Area of Pulses
- Area of Food Grains
- Area of Oilseeds
- Area of Agricultural Productivity
- Area of Fodder Requirement

**Land Use/Land Cover Variables**

- Net Sown Area
- Gross Sown Area
- Net Irrigated Area
- Cultivable Waste Land
- Pasture & Grazing Land
- Barren & Uncultivable Waste Land
- Forest Cover
The study area of Jhansi District exhibits a wide range of topographical variability. This variability dictates the land use pattern in the district to a large extent. The annual rainfall here is not well distributed and the drainage exists in the form of three main river system i.e. Betwa, Dhasan and Pahuj. Due to uneven topography the occurrence of drought is a common phenomenon. This drought in turn affects the groundwater recharge, lack of water for livestock population and decrease pasture and grazing land. Therefore in order to achieve a uniform and enhanced productivity in the study area, drought mitigation is an important step. It includes the drought prediction, monitoring, impact assessment, early warning system, action plan to deal with severity and the participation of government & community in the relief and responses.

Livestock population health & vitality is another important element of improving agricultural productivity. The rugged terrain & uneven topography leaves very less land available as pasture or grazing land. Therefore, the development of pasture can be achieved through cultivating grass which has high resistance to drought & rugged relief and also increases the soil productivity and moisture. Practicing rotational grazing can be another tool to let the over stressed land rest for a while. Other important measures include, soil sampling fertilizing, targeted feeding & farm maintenance.

The groundwaters scenario can be improved by planting native plants which improve permeability and prosperity of soil. Reducing wastage of water, maintenance and repair of existing pipes, judicious use of water resources, recycling, reuse and promoting rainwater harvesting, construction of check-dams and selection of less water dependent crop. Species can go a long way in solving the groundwater situation.

Selection of livestock species which give maximum yield with minimum inputs must be encouraged. More capital investment towards maintenance of livestock population along with cheap skilled labour and community land holding must be provided for better livestock management.

Diversification and intensification of existing farming systems, improvement of productivity and income from different enterprises and commodities in exiting farming
systems, sustainability of natural resources and enabling the farming community (male and female) to command the extension system is to be built into these components, sustainability of the production system, capacity building of extensionists, researchers, farmers, market players and other partners like NGOs, etc., dovetailing and re-designing of various on-going schemes of agriculture and other line departments and research institutions in the public, private and NGO sector, market led extension for enhancement of profits with focus on post harvest technologies and value addition, promotion and use of ICT in extension, promotion of Public Private Partnership, mainstreaming gender concern (Empowerment), any other programme component considered necessary for the study area.