**Chapter No :1**

**An Introduction to Geomorphology**

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| Subunits :- **An introduction to Geomorphology** : Definition, Nature, Scope, Importance.  **Impact of Geomorphological Environment on Settlement, Surface Transport & Agricultural Land use** : Geomorphology and Settlements, Geomorphology and Surface transportation, Geomorphology and Agricultural Land use |

**Introduction to Geomorphology :**

 Geography is defined, simply, as the description of the Earth.

“Geography is the description of the earth which deals with the interrelationship of phenomena that exist together in an area.”

 “Geography is concerned to provide accurate, orderly and rational description and interpretation of variable characters of the earth’s surface.”

There are two branches of geography i.e. i) Physical geography and ii) Human geography

 

**Physical Geography**

 Physical geography may be defined as the branch of geography which deals the distribution and origin of natural phenomena on the earth surface.

 Physical geography can be divide into different sub-divisions as given below.

1. Geomorphology.
2. Meteorology.
3. Climatology.
4. Oceanography.
5. Hydrology.
6. Bio-geography.

**Geomorphology:-**

It is the scientific study of landforms and processes that shape the surface features of the earth and the role of geomorphic cycle. The dynamic aspects of various natural processes acting on earth are also studied under geomorphology. Geomorphologists seek to understand the history of landforms and predict the future changes based on varieties of field investigations and analyze their quantitative characteristics. Here, emphasis is placed on exogenus and endogenus processes shaping the surface features of the earth and the role of geomorphic cycle studied in the subject.

 Geomorphology is not only concerned with simply description of land features but it deals with their spatial variation too. Geomorphology is concerned with the nature and origins of [Earth’s surface features](http://www.jotscroll.com/forums/3/posts/240/planet-earth-facts-about-the-earth-moons-rotation-orbit-atmosphere.html). Literary, a study of Earth form. Geomorphology is generally understood to embrace the study of [landforms](http://www.jotscroll.com/forums/3/posts/246/landforms-major-types-of-landforms-examples-pictures.html) and landscapes.

 “Geomorphology”- Geomorphology is an important branch of physical and systematic geography. It is derived from three Greek terms, i.e. Geo, Morphe, and Logos which means a ‘discourse on land forms’ Thus ***Geomorphology may be defined as the science which deals the distribution of different kinds of landforms on the earth surface.***

**Definition of Geomorphology**

Different geomorphologist put the definition of geomorphology as below

1. Von Engelini, 1942 : - Geomorphology is the study of earths configuration as a whole onto different dynamic processes that shapes its shape.
2. Strahler and Strahler (1983) define geomorphology as the scientific study of landforms, including their history and processes of origin.
3. Geomorphology is the study of Earth’s landforms created by mostly physical processes, including physical or chemical changes and those changes influenced by biological processes, including land use.
4. Chorley et al 1984 defines geomorphology as the scientific study of the geometric features of the earth surface.
5. According to P.G. Worcester as,“ Geomorphology as the subject of interpretative description of relief features of the earth surface.”
6. A. L. Bloom defines as, “Geomorphology is the discipline which describes systematic analysis of landscapes and the process involved for their evolution.”
7. Geomorphology studies about spatial distribution of various landforms on land surface and the cause of origin and process of evolution of these features.

Geomorphology is not restricted to those landforms that have developed at or above sea level, geomorphology includes all aspects of the interface between the solid earth, the hydrosphere and the atmosphere. Therefore, the term is not only about the landforms of the continents and their origin of concern, but also the morphology of the sea floor.

**HISTORICAL EVOLUTION OF GEOMORPHIC IDEAS IN GEOGRAPHY**

 The subject geomorphology and the geomorphic ideas grew up through the span of long history. The idea has been rooted in ancient thinking of Greek and Roman scholars. After a long gap of Dark age the geomorphic thoughts were contributed to subject by Arabs, Europeans and American scholars from time to time. The begining of the geomorphology could not take place as discipline before Hutton, though the word Geomorphology was first used by Albrecht Penck.

During ancient period, both Greek and Roman scholars like Hirodotus, Aristotile, Strabo and Small have given many simple geomorphic observations especially in terms fluvial action. ***Hirodotus*** explained the formation of delta region of Nile river by the deposition of sediments brought by Nile river from Ethiopia. ***Aristotle*** explained the work of coastal emergence by filling up of the sediments, and formation of delta at the mouth of river. ***Seneca*** explained the concept of abrasion work by river in its valley.

***Ibn sina*** , Arab geographer, gave the idea of differential rate of erosion by rivers due to variation in hardness of the rocks in which they flow. Al-Masudi gave the idea of comparative study in geomorphology. He made comparative study of landforms and made an analytical study of processes concerned in their formation. In his views, landforms are visualized to pass through a cycle of development from youth stage to mature stage and a finally old stage of peneplain. The contribution of Arabs in geomorphology were not known in Europe. Many European scholars, showed great interest in the analysis of landforms and process of their formation. They saw rivers as the main agents to sculpture the surface of the earth into various forms. Origin, velocity, work of erosion, transportation and deposition etc of the rivers were highlighted by different scholars in Europe.

***Leonardo-da-vinci*** expressed his views that the rivers cut their valleys and transport the eroded material, from one place to another place.

***Buffon*** presented the complete picture of river. He recognised the powerful erosive ability of river to destory the high lands with view recluce it at sea level.

***Desmarest*** was first apprantely to give idea of development of landforms through the successive stages of evolution.

***James Hutton*** (1726-1797) established some laws and principles regarding the development of landforms on the face of the earth surface. He evolved a concept that “present is key to the past” . and he founded the doctorine of “Uniforimtarianism” in opposite to catastrophism. This doctrine reveals that the same physical processes and laws that operate today, operated throughout geological time but not necessarily always with the same intensity as now. ***Hutton*** is known as the father of modem geomorphology. ***John playfair & Charls Lyell*** were the great followers of Huttons uniformatarianism.

Concept of marine erosion was given by ***Ramsay and Richotofen*** in 19th century.

The era of 20th century began with the systematic and scientific explaination in geomorphology in Americas, J. W. Powell, G. K. Gilbert and G.R. Dulton were poineer thinkers in geomorphology.

***Powell*** is known as the father of America Geomorphology. His contribution of river on the basis of rock structure and their origin.

***G.K.Gilbert*** introduced quantitative approach to study the relationship between stream loads, velocity lateral erosion made by river in any area.

***W.M. Davis*** explained the ‘cycle of erosion’ theory this theory is known as Davison theory in American schools.

**Landforms :**

Landforms are surface configuration of the land surface taking distinctive forms and shapes and are produce by natural forces and processes, while an assemblage of landforms make up a landscape. By form is meant the physical dimensions of a landform or area of relief (its size and shape). Two broad categories of landforms are recognized namely:

Initial landforms- landforms produced directly by external earth processes of volcanism and diastrophism.

Sequential Landforms- Those land form produced by external earth processes of erosion, deposition, weathering and mass wasting, these are collectively known as sequential landforms.

There are three types of landforms found on the earth surface as below.

1. ***First order landforms*** : - These landforms are very large, extensive that are not seen one sight from earth surface. It is formed at the initial stage onto the earth whenever earth begins to cool and solidified.
2. ***Second order landforms***- These landforms are comparatively smaller than oceans and continental sizes. These are formed due to endogenetic / endogenic /internal forces from interior earth. Mountain, plateau and plains are found on continental surfaces while subterranean ridges, ocean plains, abyssal plateau are found onto oceanic floor.
3. ***Third order landforms*** – These are comparatively smaller landforms found on the earth surface formed due to external forces/ exogenetic / exogenic forces. These are some change of agents which brings the earth surface at sea level by up denudation or down denudation process. Flowing river, Sliding glacier, striking oceanic waves, percolating underground water and blowing winds are the main change of agents which are always busy in leveling of earth surface at MSL. These are numerous types of landforms formed by different change of agents.

**Nature of Geomorphology :-**

There have always been controversy and confusion about the nature of Geomorphology, these reflects the fact that historically, Geomorphologists have at one time or another attempted to answer three basic sorts of questions about the Earths landforms and landscapes (Higgins 1989), the questions are:

1. How can these features and processes be described?
2. How can they form and changed through time?
3. What processes are responsible for them and how do these processes work?

The nature of geomorphology has been changed from time to time with scientific investigation method and study. At micro level, the evolution of various types of landforms and its development stage can be studied in geomorphology by scientific method with its causes and effects. Distribution of oceans and continents on earth surface is core part of study of geomorphology in which different geomorphic processes , their intensity and adverse effects on earth surface is studied also. Plate tectonic movement, earth movement , folding, faulting geomorphic processes are explained in the study of geomorphology. The weathering and erosional processes by different change of agents is studied in modern geomorphology. Denudational geomorphic processes focused on the former water drainage system of that region which became helpful in regional planning development .Lithological structure of region comprising of different types of rocks , its stratification also studied in geomorphology.

 Study of geomorphology is done by the following approaches as i) Historical Approach ii) Climatic-geomorphic Approach iii) Modern Functional Approach.

***The Historical Approach :-***

The historical geomorphological approach is focused on the existing landforms assemblage as a combination of effects resulting from changes through which it has passed. It states that a chronological sequence of changes in landforms. Historical approach comprise of two related approaches namely the cyclic approach and the denudation chronology approach.

1. Cyclic Approach :- These approach was initiated and established by W.M. Davis who focused on “Cycle of Erosion” in which he states that landforms are a function of structure, process and stages.
2. The Denudation Chronology Approach :- This approach was developed in Britain. This denudation chronology gives an idea about the past geomorphic processes. The main roles of denudation chronology ( has its main roles) are the identification, dating and interpretation of Plantation surfaces. In addition, it has the subsidiary aim of studying the way in which the drainage system of an area has evolved. It involves the absolute or relative dating of erosional and depositional events occurring under the influence of tectonic, climatic, or other variations.

***Climatic Geomorphology Approach***

The *criticism* on Davison & denudation chronology approach resulted into establishing new alternative theoretical approach which is known as climatic geomorphology approach put forwarded by Richthjofen . It was developed in Europe except Britain and France country. The main theme of the approach is that distinctive climates possess distinctive assemblages of processes which result in different assemblages of landforms. According to this approach, every phenomenon or process whose global extension is more or less comfortable to latitude is termed zonal.

***Modern Functional Approach***

Modern functional approach explains the existence of landforms formed by erosional and depositional process by surroundings phenomena. The modern-functional approach to geomorphology comprise of two related methods, namely:

1. Direct field observation and measurement and
2. Simulation modeling. Both involve the observation, measurement and mathematical/statistics analyses of both process and form in order to objectively explain landform evolution.

**Scope of Geomorphology:-**

The word Geomorphology was first used by the Geomophologist A. Penck.

The subject ‘geomorphology’ is the main branch of physical Geography. Geomorphology is inter-related to geological structure in geological geomorphology. Hence the subject matter or scope of geomorphology is very vast. The nature of geomorphology can be explained by distinct characteristics of various types of landforms on the earth surface. All geomorphic processes which have had been taken place on the earth surface studied in geomorphology and what are the geomorphic forces responsible for formation of various landforms on the earth surface. The interaction in between exogenesis/ external and endogenetic /internal forces are explained in geomorphology. Herodotus and Strabo explained that landforms are evolved by physical geomorphic process on the earth surface in which they emphasis on fluvial topography.

The geomorphic knowledge and investigation seem to be an essential element for understanding the problems of man in a given eco-system. Nature of topography, drainage pattern, soil characters, hydrological behavior etc are very important natural factors to determine the social economic development of the area. Man-environment relation has been gradually very complex due to increasing man’s interface with the nature’s soil erosion, deforestation, underground water depletion, filling of river channels for building construction in urban areas, embankment of river channels for controlling the floods etc are crucial intervention of man. Due to lack of geomorphic information about the distribution of various geomorphic features and the process of their evolution, sometimes would results in very serious natural and socio-economic hazards like floods, landslides earthquakes. subsidence of land etc.

The important of geomorphological studies and information would appear very useful for evaluation of natural resources and for the mitigation of diverse problems of human societies in a particular geomorphological environment . The scope of this discipline is very bright in future. Management of natural hazards, planning of rural and urban settlements cannot be made without appropriate scientific knowledge of geomorphology of the given area. It is also greatly needed in construction industries. Slope of terrain, direction of river flow, nature of Karst topography, structure of rocks and availability of water etc are very essential knowledge needed for civil engineer and Architectures before planning the construction of houses, roads, or railway lines, bridges, flying bridges in region.

Planning of regional development is also preferred on the basis of geomorphic region like river basins of watersheds.

* 1. Landuse plan in agriculture can be optimally made with the help of geomorphic information. Type of landforms, degree of slopes, areas of floods, nature of shifting of sand-dune and coastal geomorphology may determine the type of agriculture practices in an area. so the geomorphology is probably looked in applied forms.
	2. Environment geomorphology, urban- geomorphology, agricultural-geomorphology, anthropo-geomorphology etc are the excellent example of the well prospect of the discipline in future.
	3. Quantitative revolution has also enriched the subject in order to make very rational and scientific study of relationship between man & different geomorphological features.

**Importance of Geomorphology:-**

Geomorphology is the scientific study of landforms and processes that shape the surface features of the earth and the role of geomorphic cycle. The dynamic aspects of various natural processes acting on earth are also studied under geomorphology. Geomorphologists seek to understand the history of landforms and predict the future changes based on varieties of field investigations and analyze their quantitative characteristics. Here, emphasis is placed on exogenetic and endogenetic processes shaping the surface features of the earth and the role of geomorphic cycle studied in the subject.

Geomorphology studies about spatial distribution of various landforms on land surface and the cause of origin and process of evolution of these features. Geomorphology is the study of Earth’s landforms created by mostly physical processes, including physical or chemical changes and those changes influenced by biological processes, including landuse. Physical geographers apply geomorphological principals to study how landforms have changed in the past, but increasingly such principals are important for modern applications. Due to the plate tectonic movement, a distinct characteristics continents and oceans came into being since very long geological periods. Earthquakes and volcanic activity is a sudden and fast earth movement which is related to plate tectonic movements. Fluvial topography changes the surface of earth at very smaller scale.

The importance of geomorphology for physical geographers is not only important in understanding Earth’s physical changes but also in preparing for hazards. For instance, understanding issues of deforestation, soil properties, and seasonal precipitation can better assess frequencies of [flooding events](https://www.geolounge.com/the-flooding-of-chennai-urban-india-and-climate-change/) and their potential danger.

In urban settlement, construction of cemented houses, buildings, roads , fly bridges, pavement in open spaces restricts the percolation of rainfall water into ground that runoff increases due to lack of vegetation cover in rainy season and devasted much of wealth beings. Urban environments are often particularly vulnerable to natural disasters as they rapidly change a landscape through removal of native vegetation and construction that paves over land. Urban planning needs to account for natural geomorphic events so that as new urban areas are developed geomorphic factors that would affect urban places could be replicated through proper drainage or use of construction materials that are best adapted to the local environment, including factors such as humidity, rainfall, and temperature.

Natural hazards are considered within a geological and hydro meteorological conception. These hazards are strongly related to geomorphology since they are important ingredients of the earth’s surface dynamic. Hazards are results of sudden changes in long term behaviour caused by minute changes in initial conditions. Geomorphology has contributed enormously to the understanding and assessment of different natural hazards. Geomorphological work includes not only the understanding but the mapping and modelling of Earth's surface processes. Geomorphologists are becoming increasingly involved in the prevention of hazards, through  vulnerability analysis, hazard and risk assessment and management. The work of geomorphologists is therefore of prime importance for disaster prevention. Human activities have had a huge impact on the environment and landscape, through industrialization and land-use change, leading to climate change, deforestation, desertification, land degradation, air and  water pollution. These impacts are strongly linked to the occurrence of geomorphological hazards, such as floods, landslides, floods, soil erosion, and others which are strongly related to geomorphology since they are important ingredients of the Earth's surface dynamics.

IMPACT OF GEOMORPHOLOGICAL ENVIRONMENT ON SETTLEMENT, SURFACE TRANSPORT & AGRICULTURAL LANDUSE.

 As being a subject of dealing with the distribution of geomorphological features and their relation with the man, the geomorphological have very intrinsic relations with different aspects of human civilisations or cultural environment. Geomorphological Environment is one which is formed due to the present surrounding situation of various land forms on the earth surface or area. In geomorphological environment, distinct types of landforms i.e. first order, second order & third order landforms are considered. It includes first order & third order landforms are considered. The earth surface is not even/regular erevywhere. It includes first order landforms, second order landforms &third order landforms of the earth.

 A) ***First order landforms***- The Continents & Oceans which are very big in size and shape, are the first order landforms.

 B) ***Second order landforms***-Mountains, plateaus & plains which are present on the continents and ocean floor.

 C) ***Third order landformes***-The small landscape or land features seeing in one sight formed due to the earth movement is known as third order landforms. It includes waterfall, U-shaped valley, River meandering, Pot holes, Sink holes, Uvulas, Barkan, Loess plain, Coves, Delta region etc. All landform features which are produced by the agents of running water, glacier blowing wind& underground water and ocean waves are included in the category of third order landforms.

 Natural environment and the cultural environment are very much affected by distribution of landforms, mountain building movements, various kinds of erosional and denudational process and consequent features on the different parts of land surface.

 In natural environments, only natural aspects of the earth are included e.g. rainfall, distribution, drainage pattern, vegetation cover, soil formation, availability of minerals etc. climate & weather of the region etc.

 Cultural environment is known as man made environment. It includes only man made aspects like of crop cultivation, Agricultural activities, growth of urbanization, population, industrialization, socialism etc.

**Geomorphological Features and Environment**-

 Natural environment and the cultural environment are very much affected by distribution of landforms, mountain building movements, various kinds of erosional and denudational process and consequent features on the different parts of the land surface.

 Mountainous topography of young origin presents very rugged, inaccessible topography with variable fauna and flora from foothill to top. Climatic variations, immature and thin soils and slopy terrain are also distinct characters of mountain topography. Soil erosion, landslides, occurance of the earthquakes etc may be also effect of mountain building process in the weak zones. Hence mountain topography does not provides human occupancy environment. and agro climatic environment.

 Most of the rivers are originates in the mountainous region through springs, and precipitations. These rivers flows down towards the plateau or plain areas of the earth surface and endly meets to the sea/ocean/lake. This water of the river are very useful for agricultural practices, and need of human beings.

 The plain regions provides human occupance environment. Accessibility, availability of water, good soil and monotonous surface present the good agro climatic environment. About 70 percent world population reside in either river basin or coastal region.eg. Ganga is the biggest & longest river of India. and about 49 percent population of India is concentrated in the Gangatic basin.

 Plateau region is usually store house of minerals. These minerals are very useful for development of the industrialization and economic strength of nation. so many industries are establishes on or near the mineral deposits. Eg. In India, Chota Nagpur plateau is the biggest storehouse of distinct minerals like iron ore manganese, bauxite, coal etc. so the most of the heavy & metallic Industries are concentrated in the states of Bihar, Orissa, West bengal and Jharkhand. Population of these states have more dense as compared to the others.

 Besides, different varied geomorphological process like flooding of rivers, erosion of watersheds by river, shifting of sand dunes in desert region and the distribution of different type ot karst or limestone topographic features present different environment in which a particular tupe of human life can be survived surface and underground water, lithology and the vegetation cover may also be related to the human life on the earth surface.

 Distribution and orientation of landforms like mountains also reflect an influence on the amount of temperature and precipitation. Usually windward slope of mountains has higher amount of precipitation rather than the area of leeward slope of mountain. Altitudinal variation of temperature is very common. Difference in temperature of India and central Asia during winter is only due to the presence of Himalayas.

1. **Geomorphology and Settlements**.

 Geomorphological features have very unforgettable impact on the nature, type and pattern of both urban and rural settlements. All the ancient civilization was developed in the river basin Indo-Gangatic plain, Ho-yong-Ho plains etc. are so settlement in river basin is very compacted.

 Settlements in the mountain regions is very scattered in the valleys. along the gentler slope of hills, some houses are also being constructed with a great risk. Dense forests, presence of wild animals, unfavourable climatic conditions, breathing problems at higher altitudes due to the rareness of air, and inaccessibility to transportation facilities and potable water have discouraged the concentration of human inhabitation .eg. Himalayan range in India is the best example of it. Due to the unfavourable condition for settlement in Jammu-Kashmir, Uttaranchal, N-E Indian states having a spares density of settlement.

 Again Karst /limestone topography, flooded regions, weak zone of occurrence of earthquakes, volcanisms, subsidence, coastal region at the time of rising of sea level, area of migratory sand dunes are usually avoided for inhabitation due to the fear of damage of life & properties at the time of natural hazards.

 River valley, coastal low land, alluvial plains, loess plains, and delta region attracted population and consequently dense settlement flourished since ancient periods good fertile matured soil for agricultural activities and monotonous surface useful for good network of rail, road transport ways. Eg .Nile basin of Egypt, Euphrates-Taigirs basin of Europe, Indo Gangatic plain of India, Ho-yang-Ho-basin of china are important areas/regions of compact settlement. Fluvial or Riverine topography is very useful and favourable for developing settlements with running water from high mountain /hilly regions where it originates. These sediments are deposited along the river course and at the mouth of river. Due to this reason, the new fertile, matured &mineral content soil is available in the alluvial plain, flooded plain and delta region of river basin and it is very useful for agricultural activities. So much population are attracted in river basin/plain areas and thus and very dense settlements are found like of Kanpur, Varanashi Kolkatla, Allahabad and Patna. At the confluence of rivers a compact settlement is found eg. Allahabad city has situated at the confluence of Ganga & Yamuna river in uttar pradesh.

 Aeolian topography is always unfavourable to establish any type of settlement due to the presence of high temperature, low rainfall, very low humidity, less vegetation cover, scarcity of water, immature &unfertile soil, migrating of sand dunes, fastly blowing dry winds, and seasonal & dry rivers etc. A very sparse settlements are found in the desert or semi-desert regions. Only few settlements are found at or near the oasis of desert which provides a potable water to human beings, animals and some agricultural activities.

 Coastal topography provides a very good favourable condition for human settlement. The moist air, constant average temperature throughout the year, more & more rainfall, work of the ocean waves along the coast line, number of harbours /ports located along the coastline, are the favourable conditions for agriculture &trading activities of human beings. so much of the population are attracted towards the coastline and thus compact settlements are found along the low-land coast line.

 Eg Mumbai, Chennai, Kolkata are the more & more compact settlements in India. Mexico city, Tokyo New Foundland are the good examples of compact settlement along the coastline.

 Moreover, types of houses, used materials for construction and the pattern of the settlements are the effects of geomorphological features. Small, light, wooden and temporary houses are construction especially in earthquake zones. Bamboo and woods are used in hilly. or forest area for construction of small hut or hutments. Stones are used for construction of houses in plateaus and mountainous region because of abundance availability of distinct types of stones in that region. Artificial bricks are used for construction of permanent houses in plain areas and plateaus regions.

1. **Geomorphology and Surface Transport.**

 Network of roads, railways and airstrips are determined by distribution of various kinds of geomorphological features on the land surface. Construction of roads and railway tracks requires very suitable plain and hard rock region. The coastal low land areas as compared to mountain and plateau regions. In the mountain and plateau regions. the construction of roads and railways tracks are very difficult due to the rugged topography, hard rocks and presence of large number of impassable transverse hillocks. Construction of roads is very difficult and expansive as a large number of tunnels have to be made to connect the accessible places in rough topography region. There are many places in Himalayan region which are still not connected either by roads or railways. Very few roads are constructed in North Eastern Hill areas of India. The density of the roads and railways are very region is more preferred for construction of road in hilly /mountainous areas to avoid unnecessary breaking of rocks which present obstacles in the way eg. Mumbai-Pune, central Railway line is passed through Bor-Ghat of Sahyadri Range of Maharashtra. That Ghat-joins Nasik-Mumbai.

 In the plain and coastal low railways are easy due to the nearly regular topography, soft rocks lithology and absent of large number of hillocks in the enroute of transport line. The accessible places can be connected by shortage way between them in the plain regions and coastal lowland regions. eg. The North India states like U.P, Bihar, Madhya Pradesh. West Bengal have a Gangatic plain region and shows high concentration of roads and railways. Mumbai, Kolkata, Chennai, ports are situated at the coastal low lands and these are well connected to the capital, sub capitals main cities, District places of India by rail and road network.

 Moreover Karst topography, glacial topography, glacial topography Aeolian topography and fluvial geomorphic region also affect the nature of transportation system.

 Aeolian topography or desert area shows low density of roads and railways due to loose soils and high temperature which expands the rallway tracks and melts the charcoal of metalled roads. Migration of sandunes /barkhans due to the blowing wind from one place to another, is the biggest problem of desert areas surface transport. Because, sometimes the metalled roads &railway lines are completely buried under the loose sand particles and these transportational line is disturbed. The loess plains of the the deserts are very useful & favourable for the construction of road and rail transport system.

 Karst region of limestone has dangerous for road construction. Roofs of cves and blind valleys may collapse down and the built up structure would be damaged. so such regions, are usually devoid of construction.

 In the Fluvial topography, the alluvial plains are formed due to the deposition of fine particle sediments along the river valley and these are very useful and favourable for road & railway track construction. Flooded region is not suitable & favourable for road and rail transport system because the flooding on huge scale and it damages to the constructed road, rail tracks. Repeated floods, weaken and break up the structure. A huge amount of capital is also requires for construction of bridges across the rivers which are in abundance in lower basins. River meanders, braided stream & marshy delta region of fluvial topography are not suitable and favourable for the road and railway track construction. Only the middle course of the river is suitable for the construction of road and rail tracks.

The presence of permafrost in pereglaciated region especially in Arctic and Taiga climate are very serious dangerous for road construction. A knowledge about nature, process and distribution of permafrost is very essential for engineers before construction of high ways and railways. deforestation and the construction may cause melting of permafrost, consequently, collapsing of round and constructed structure may take place. In the initial stage Trans-Siberian railway suffered from damage due to thawing (melting) of permafrost . Hence the density of surface transport network system is very less in the pere-glaciated region.

1. **Geomorphology and Agricultural Landuse.**

Agricultural landuse means the proper utilization of the maximum available cultivable land surface under the various agricultural activities by different cropping system throughout the year. Geomorphological features have also very paramount effects on the agriculture practiced in different geomorphological regions. Every geomorphological regions of the earth is not usable & favourable for agriculture activities. Because agriculture activities requires good fertile, matured thick soil, extensive plain fertile, matured thick soil, extensive plain surface, good supply of water, for agriculture purpose.

Mountainous or hilly tract areas are not practiced for agriculture activities. Because steep slope, rugged & irregular relief surface, thin & immature soil and in accessibility have discouraged agricultural practices in the mountain/hill regions. It is not possible to cultivate the every segment/area of mountain regions for agriculture due to the present unfavorable geomorphic features. Longitudinal valleys, intermountain valleys and gentler slope with terracing are only areas where cultivation of some crops are grown. Horticulture, animal rearing. sericulture, plantation & terraced agriculture are mainly practiced in mountain regions. Hence agricultural landuse is minimum in the mountain and hilly areas. eg. Apple gardening in J&K and Himachal Pradesh, rubber& oil palm cultivation in Malaysia, Tea in china-Sri India are some examples of agriculture in rugged topographic region.

Plateau region is usually storehouse of distinct materials and the distribution of denuded hills & peneplains are common. The mineral region on plateaus are famous for mining activities. No any agricultural activities are practiced on that region. eg. Iron are mines, gold mines, coal pits.etc. The isolated denuded hills of plateau region are not favourable &usable for agricultural activities. The river basins & peneplain areas on plateau regions are intensively used for cultivation. sometimes a plateau regions provides a good fertile soil due to the geomorphic weathering action on that basaltic rock structural lithology. These black cotton regur soil is very useful for various crop productions like of sugarcane, cotton, wheat, Jowar etc. Deccan plateau is the best example it. Hence the agricultural land use is moderate on plateau region than the mountainous/hilly areas.

 Plain regions, river basins, coastal low land, alluvial plains and the peneplain areas are generally following very intensive agriculture system. Every bit of areable lands are brought under cultivation. Availability of both surface and subsurface water for irrigation and good alluvium fertile soil, black sols etc are encouraging for cultivation of cereals, pulses, oil seeds and various other commercial crops. Hence the agricultural landuse is high/very high in the plains of earth.

 Coastal geomorphological region are generally cultivated under the paddy farming & coconut plantation. Aquaculture and fishing are the main type of diversification of agriculture here. Hence the agricultural landuse is high in the coastal regions and rice is the major crops which persists in that region.

 Karst topographic region associated with sink holes, uvalas, polje, dolines, collapsed caverns, are not usable for agricultural activities. Many blind valleys are present in the Karsts limestone region. Hence the agricultural landuse is very less in the limestone karst region.

 Aeolian topographic regions are always unfavourable for any agricultural activities due to the scarcity of rainfall and high rate of evaporation of water. In desert area where soil is very loose and consists of hard pane of calcium carbonate in subsoil zone discourage. the deep plouging and intensive agriculture. Animal rearing and nomadic herding are important economic activites in the tropical deserts of the world. only very small agricultural farms are found at/near the oasis until the available of potable water in the useful for agricultural activities are always useful for agricultural activities due to the presence of already underground water in it. Hence the agricultural land use is very less in the desert/semi desert region due to the rugged topography and scarcity of rainfall.

 Glaciated geomorphic area have shows a very less temperature below the freezing point and distribution of ice & snow fields everywhere on the land surface. These two geomorphic factors are always unfavourable for growing of plants or agricultural crops. These regions are usually shows a low concentration of agriculture. Hence the agricultural landuse is very less in the glaciated or permafrost region.

 Fluvial topography shows a very well ideal geomorphic condition which is suitable & favourable for various agricultural activities. Generally the alluvial plains, delta regions occupies an extensive vast area of topography and shows more & more concentration of agricultural activities on it. Flooding areas of rivers in the middle & lower course of stream and area of meandering are usually associated with low concentration of agricultural activities. Hence the agricultural landuse is very high in the riverine or fluvial topography.

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| Question Bank : 1. Define Geomorphology and state its nature and its importance .
2. Define Geomorphology and state its Scope and branches with examples.
3. Explain the impact of geomorphological environments on surface transportation.
4. Explain the impact of geomorphological environments on agricultural landuse.
5. Explain the impact of geomorphological environments on settlement
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