



## Geog 410: Geography (Elective)



BA 3<sup>rd</sup> Year

Tribhuvan University

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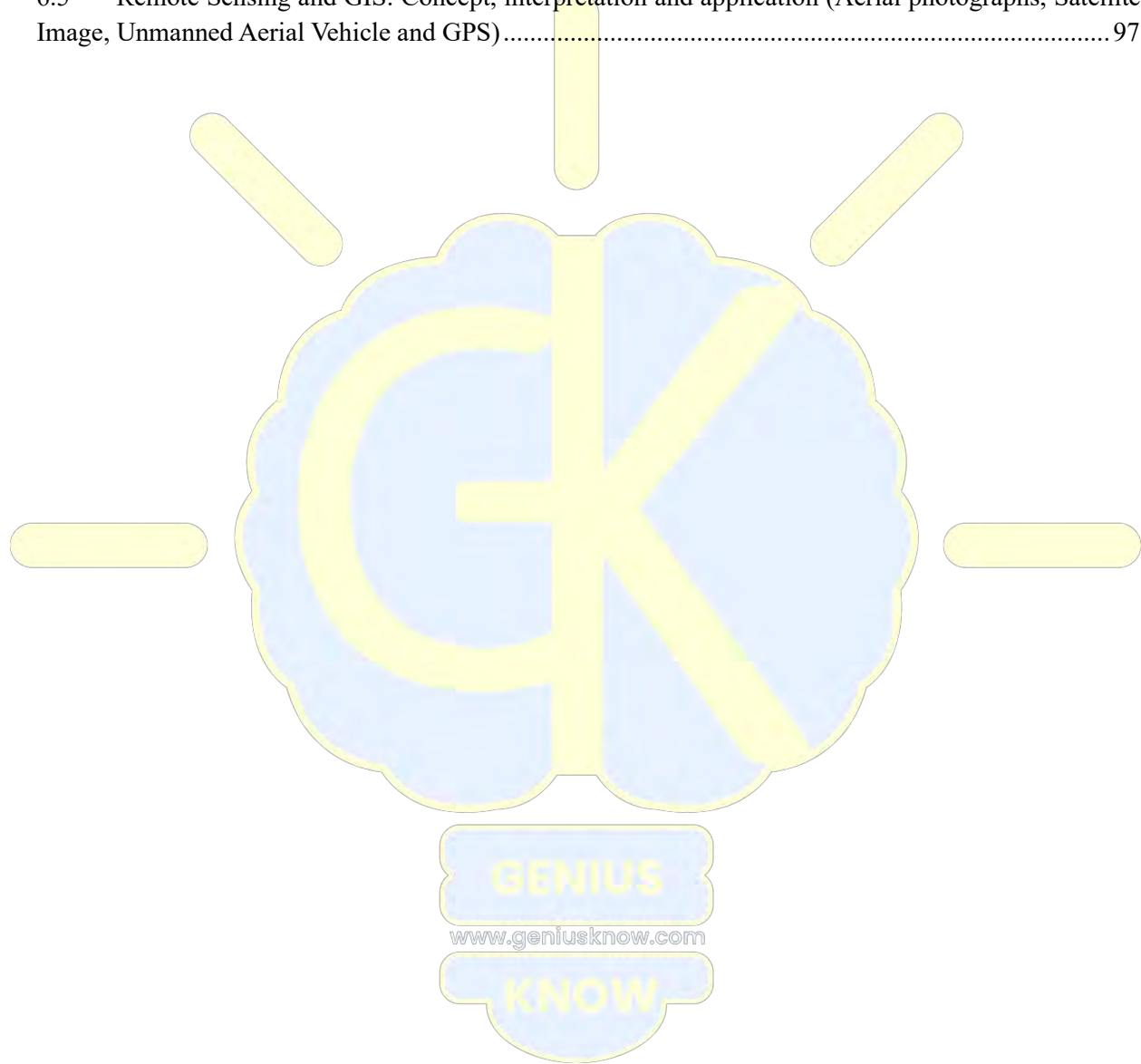
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# 1. Unit 1 Nature of geography

## 1.1 Definition, scope, and branches (Types) of geography

### A. Geography

Geography is a natural science that studies the physical features of the Earth and the distribution of life on it. It encompasses a wide range of topics, including the study of landforms, climates, oceans, coastal zones, natural resources, and human-environment interactions. Geography also explores how humans have shaped and been shaped by the natural world, including how people have impacted the environment through activities such as deforestation, urbanization, and climate change. The goal of geography is to understand the complex relationships between the physical environment and human societies, and to use this knowledge to make informed decisions about how to use and manage the Earth's resources in a sustainable manner.

Geography is the study of places and the relationships between people and their environments. Geographers explore both the physical properties of Earth's surface and the human societies spread across it. They also examine how human culture interacts with the natural environment and the way that locations and places can have an impact on people. Geography seeks to understand where things are found, why they are there, and how they develop and change over time. Geography, the study of the diverse environments, places, and spaces of Earth's surface and their interactions. It seeks to answer the questions of why things are as they are, where they are. The modern academic discipline of geography is rooted in ancient practice, concerned with the characteristics of places, in particular their natural environments and peoples, as well as the relations between the two.

Let us take the word "geography" apart. The word geography can be broken into the two basic elements of "GEO" and "GRAPHY." Geo comes from the Greek word for Earth (the word Gaea, also meaning earth, derives from the Greek as well). The "ography" part comes from the Greek word graphein, which is literally to write about something. The word "graph" derives from the same basis. Thus, GEO + GRAPHY literally means "to write about the Earth." We have commonly come to understand that the translation might also be taken as to describe and map the earth. The American Heritage dictionary defines geography as "the study of the earth and its features, inhabitants, and phenomena." I agree with the dictionary, but I like to tell my students that geography really is the study of how the world works in terms of the physical and human processes that occur every day.

## B. Scope of Geography

The scope of geography is broad and includes a wide range of topics and perspectives. Some of the key areas where geography plays an important role include:

1. **Sustainable development:** Geography provides insights into how human societies can use and manage the Earth's resources in a sustainable manner, including issues such as renewable energy, water management, and food security.
2. **Environmental management:** Geography helps us understand the impact of human activities on the natural environment and provides guidance for how to protect and conserve the Earth's ecosystems and biodiversity.
3. **Climate change:** Geography provides a comprehensive understanding of the Earth's climate system, including the causes and effects of climate change, and how it will impact human societies and the natural world.
4. **Disaster risk reduction:** Geography provides important information on the distribution of natural hazards, such as earthquakes, hurricanes, and tsunamis, and how they can impact human populations.
5. **Urbanization:** Geography explores the growth and development of cities and the challenges associated with urbanization, such as traffic congestion, air and water pollution, and housing.
6. **Tourism:** Geography provides insights into the relationships between the physical and cultural environments and the growth of the tourism industry, including issues such as sustainable tourism and cultural heritage management.
7. **International trade and globalization:** Geography examines the relationships between different regions of the world and how they are linked by trade, investment, and cultural exchange.

Overall, the scope of geography is wide-ranging, and its applications are diverse and important for addressing many of the challenges facing human societies and the natural world.

## C. Branches of geography

**There are two major branches of geography**

1. **Physical geography:** Studies the physical features of the Earth, such as landforms, climates, oceans, and natural processes such as earthquakes, hurricanes, and volcanic eruptions. Physical geography looks at the natural processes that make the surface of the earth the way it is. Physical geography includes the three major subdisciplines of Geomorphology, Meteorology, and Climatology.

I. **Geomorphology** is the study of landforms and landform processes. Geomorphologists want to know:

What are the different landforms?

Where are the different landforms?

Why are they where they are?

How do they form?

What will happen to them over time?

II. **Meteorology** is the study of atmospheric weather processes. Meteorologists want to understand:

What are the different atmospheric processes that create our weather?

Where do these weather phenomena occur?

How and why does the planetary weather system work the way it does?

What will happen with the weather in the future so they can forecast the weather?

III. **Climatology** is the study of climate, which is basically the long term pattern of temperature and precipitation. Climatology, like meteorology, is a branch of the inter-disciplinary field of Atmospheric Science. Climatologists seek to understand:

the different climate types found on earth,

the processes that cause these different climate types to occur in specific places (i.e. why are there different climate types),

the places where these climates occur,

how and why climates change over time,

and so that they can forecast the effects of climate change, what will happen to the earth's climate in the future.

2. **Human geography: Human geography** looks at the human activities that make the surface of the earth the way it is. Examines how human populations are distributed and how they interact with the environment. This includes topics such as urbanization, migration, and globalization. Human geography includes numerous subdisciplines, some of which are:

- I. cultural geography Cultural geography: Examines the ways in which culture, including language, religion, and customs, is expressed and shaped by physical and human geography.
- II. economic geography Economic geography: Explores the distribution of economic activities, such as agriculture, manufacturing, and trade, and their relationship with the physical and human geography of a region.
- III. political geography Political geography: Studies the relationships between political entities, such as nations and states, and the physical geography of a region.
- IV. Environmental geography: Studies the interactions between humans and the environment and the impact of human activities on the natural world.
- V. Population geography: Population geography is a subfield of human geography that focuses on studying the distribution, composition, and change in population patterns across different regions and their relationships with various social, economic, and environmental factors. It examines how population dynamics and characteristics vary across space and time.
- VI. Agricultural geography: Agricultural geography UC Davis, as one of the nation's leading research universities focused on agriculture, offers great potential for Nature and Society Geography students interested in the intersection of agriculture, environment, and society. The areas of sustainable agriculture, agricultural development, and agricultural policy and models are particularly strong in UC Davis geography. The new Agricultural Sustainability Institute offers Nature and Society Geography students engagement with cutting-edge work on organic, transitional, and local food and farming systems.

and many others

## Nature of Geography

“Nature and Society Geography” is a field of geography concerned with the relationships between people and the environment. The field is broad and includes geography’s two centuries of emphasis on humankind’s interaction with and modifications of natural systems, as well as newer interests in conflicts over natural resources and environmental change, assessments of the sustainability and equity of primary production systems, and critical analyses of the meanings of taken-for-granted concepts like “nature,” “natural resources,” and “degradation.”

The Nature and Society Geography subfield in geography and the UC Davis geography program occupies a middle ground between human and physical geography. Nature and society geographers rely on both qualitative and quantitative methods, including GIS and cartographic

design. In this way, overlap among the subfields is intentional, and our faculty work across fields (e.g., teach courses in human geography and nature and society geography). The subfields of Nature and Society Geography at UC Davis that are particularly strong include: agricultural geography; cultural and political ecology; environmental hazards; environmental justice and conflict; and historical nature and society geography.

## 1.2 Fundamental concepts in geography: Latitude, longitude, time zone, rotation, revolution, distance, location, area, interdependence and uniqueness of place

### A. Longitude and Latitude

The latitude symbolises phi, showing the angle between the straight line in the certain point and the equatorial plane. The latitude is specified by degrees, starting from  $0^\circ$  and ending up with  $90^\circ$  to both sides of the equator, making latitude Northern and Southern. The equator is the line with  $0^\circ$  latitude. The longitude has the symbol of lambda and is another angular coordinate defining the position of a point on a surface of earth. The longitude is defined as an angle pointing west or east from the Greenwich Meridian, which is taken as the Prime Meridian. The longitude can be defined maximum as  $180^\circ$  east from the Prime Meridian and  $180^\circ$  west from the Prime Meridian.

Both latitude and longitude are measured in degrees, which are in turn divided into minutes and seconds. For example, the tropical zone which is located to the south and to the north from the Equator is determined by the limits of  $23^\circ 26' 13.7''$  S and  $23^\circ 26' 13.7''$  N. Or. For example, the geographical coordinates of the mount Ngauruhoe in New Zealand, famous with its being the filming area for the Lord of the Rings movie, has the geographic coordinates of  $39^\circ 09' 24.6''$  S  $175^\circ 37' 55.8''$  E.

### B. Time zone

We have 24 different time zones in the world. Because the Earth rotates  $360^\circ$  every 24 hours, each time zone is  $15^\circ$  longitude apart from the other. ( $360 \div 24 = 15$ ). The Prime Meridian (Greenwich Meridian) defines the center of the first time zone in the world. This means the Prime Meridian time zone spans from  $7.5^\circ$ W to  $7.5^\circ$ E. Then, the next time to the east spans  $7.5^\circ$ E to  $22.5^\circ$ E. When you move to the right, you gain time (fast time). In other words, for every time zone that you move towards the right, you add one hour. But when you head toward the left, you lose an hour (slow time). You can find any time by counting how many degrees longitude it is away from Greenwich. For example, it would be 4 pm at  $60^\circ$ E longitude when it's noon at the Prime Meridian. Whereas it would be 8 am at  $60^\circ$ W longitude

### C. Location

Location is defined as "the position in space" of something. Latitude and longitude is a convenient way to locate something's position. The Sonoran Desert is located at a latitude and longitude of  $33^\circ 40'$ N,  $114^\circ 15'$ W. This defines the Sonoran Desert's absolute location. It actually covers an area of 311,000 square kilometers (120,000 sq mi) between  $25^\circ$  to  $33^\circ$  North and longitude  $105^\circ$  to  $118^\circ$  West. We can also define the Sonoran Desert in relation to a known location, called its relative location. "The Sonoran Desert wraps around the northern end of the



Gulf of California, from northeastern Baja California through southeastern California and southwestern Arizona to western Sonora." (Wikipedia)

#### **D. Place**

Geographers describe place as "... the human and natural phenomena that give a location its unique character ..." (Gershmel,2009). A geographer may want to know how the Sonoran Desert compares to the Sahara desert. To answer this question, a physical geographer will collect data to compare their temperatures and precipitation, and contrast the vegetation, soils and fauna found there.

#### **E. Rotation**

Rotation refers to the spinning motion of the Earth on its axis. It takes approximately 24 hours for the Earth to complete one full rotation. This rotation causes the alternation of day and night.

#### **F. Revolution**

Revolution refers to the orbital motion of the Earth around the Sun. It takes approximately 365.25 days for the Earth to complete one revolution, resulting in the change of seasons.

#### **G. Distance**

Distance refers to the measurement of space between two points. In geography, distance can be measured in various units, such as kilometers, miles, or nautical miles. It helps determine the spatial relationship between different locations.

#### **H. Location**

Location refers to the position of a particular point or place on the Earth's surface. It can be described using coordinates, such as latitude and longitude, or by using relative terms, such as near or far from other landmarks.

#### **I. Area**

Area refers to the extent or size of a geographic region or surface. It is typically measured in square units, such as square kilometers or square miles. Areas can vary in size, from small localities to large continents.

#### **J. Interdependence**

Interdependence is the concept that highlights the interconnectedness and mutual reliance between different places and regions. It recognizes that changes or events in one location can have effects on other locations, emphasizing the global nature of geography.

#### **K. Uniqueness of Place**

Uniqueness of place refers to the distinctive characteristics and qualities that make a particular location different from others. These can include physical features, cultural aspects, historical significance, and human activities specific to that place.

## 1.3 Geography as an integrated discipline, and as a spatial science

### A. geography as an integrated discipline, and as a spatial science

Geography is an integrated discipline because it draws on a wide range of natural and social sciences to study the relationships between the physical environment and human societies. It encompasses physical sciences such as geology, climatology, and oceanography, as well as social sciences such as economics, sociology, and political science. This integration allows geography to provide a comprehensive and interdisciplinary perspective on the world and its complex systems and relationships.

Geography is also considered a spatial science, meaning that it focuses on the study of space and the distribution of physical and human features across the Earth's surface. The spatial perspective of geography is central to its understanding of the world and provides a unique lens for analyzing and explaining patterns, processes, and relationships in the physical and human environment. The use of geographic information systems (GIS) and other mapping technologies is an important tool for geographers to visualize and analyze spatial data, and to support informed decision-making about environmental and social issues.

### B. Geography spatial science

The key question facing most sciences is "how" and thus focus on the process whereby something comes about regardless of time or place. Geography is described as a spatial science because it focuses is on "where" things are and why they occur there. Geographers seek to answer all or more than one of four basic questions when studying our environment. These relate to location, place, spatial pattern, and spatial interaction. Let's look at how a physical geographer answers these questions about a desert.

**Spatial Pattern:** Geographers are especially interested in the arrangement or patterns of earth phenomena. We might want to know- "What is the distribution of deserts on the Earth?". By examining a map of world.

**Spatial Interaction:** Finally, geographers are interested in how elements of the earth system interact with one another to create geographic patterns. A geographer might ask - "How do mountains interact with weather systems to affect the distribution of deserts?" By looking at maps of mountain systems, wind and precipitation patterns and, maps of climate we find that mountains oriented perpendicular to the flow of wind create moist conditions on the windward side and dry conditions on the leeward side. The dry leeward side is described as being in the "rain shadow". In many parts of the world deserts, like the Sonoran Desert of the United States is found in the rain shadow. mates, we find deserts in the dry interiors of the subtropics and midlatitudes.

## 2. Unit 2 Earth system dynamics

### 2.1 Origin and interior structure of the earth

#### A. Earth

- Earth, our home planet, is a world unlike any other. The third planet from the sun, Earth is the only place in the known universe confirmed to host life.
- Earth is the fifth largest planet in our solar system, and it's the only one known for sure to have liquid water on its surface.
- Earth orbits the sun once every 365.25 days. Earth rotates on its axis every 23.9 hours.
- At the planet's heart lies the inner core, a solid sphere of iron and nickel that's 759 miles wide and as hot as 9,800 degrees Fahrenheit. The inner core is surrounded by the outer core, a 1,400-mile-thick band of iron and nickel fluids. Beyond the outer core lies the mantle, a 1,800-mile-thick layer of viscous molten rock on which Earth's outermost layer, the crust, rests. On land, the continental crust is an average of 19 miles thick, but the oceanic crust that forms the seafloor is thinner—about three miles thick—and denser.
- Earth is estimated to be 4.54 billion years old, plus or minus about 50 million years. Scientists have scoured the Earth searching for the oldest rocks to radiometrically date. In northwestern Canada, they discovered rocks about 4.03 billion years old. Australia, they discovered minerals about 4.3 billion years old.

#### B. Origin of the earth

The origin of the Earth is a complex topic that scientists have been studying for many years. The prevailing scientific theory is known as the Big Bang theory, which suggests that the universe, including our planet, originated from a single, extremely hot and dense point about 13.8 billion years ago.

According to this theory, the Big Bang marked the beginning of the expansion of the universe. As the universe expanded and cooled down, matter and energy began to form. Around 4.6 billion years ago, a cloud of gas and dust in the Milky Way galaxy started to collapse due to gravitational forces. This collapse resulted in the formation of a spinning disk of material called the solar nebula.

Within the solar nebula, the majority of the mass accumulated at the center to form the Sun, while the remaining material began to coalesce into smaller bodies called planetesimals. Over time, these planetesimals collided and merged, forming larger objects called protoplanets. One of these protoplanets eventually became the Earth.

During its formation, the Earth went through a process called differentiation, where heavier materials sank toward the center, forming the core, while lighter materials rose to the surface,

forming the crust. This process also released a significant amount of heat, which caused the Earth's interior to become molten.

Over millions of years, the Earth's surface cooled down, allowing the formation of a solid crust. The early Earth underwent intense volcanic activity, releasing gases that formed the early atmosphere. As the Earth continued to evolve, water vapor condensed and fell as rain, leading to the formation of the oceans.

The Earth's surface went through significant changes due to geological processes such as plate tectonics, which involves the movement and interaction of large sections of the Earth's crust. These processes shaped the continents and created various landforms, including mountains, valleys, and oceans.

The study of the Earth's origin and its evolution is a constantly evolving field of scientific research. Scientists continue to investigate and refine their understanding of our planet's formation through a combination of theoretical models, observations, and studies of other celestial bodies in the universe.

- The Big Bang Theory is the leading explanation for how the universe began.
- In the 1920s in California, astronomer **Edwin Hubble** observed distant galaxies using an extremely powerful telescope. He made two mind-boggling discoveries.
- First, Hubble figured out that the Milky Way isn't the only galaxy. He realized that faint, cloud-like objects in the night sky are actually other galaxies far, far away. The Milky Way is just one of billions of galaxies.
- Second, Hubble discovered that the galaxies are constantly moving away from each other. In other words, the universe is expanding. The biggest thing that we know about is getting bigger all the time.
- Belgian priest named **Georges Lemaître** first suggested the big bang theory in the 1920s, when he theorized that the universe began from a single primordial atom. The idea received major boosts from Edwin Hubble's observations that galaxies are speeding away from us in all directions,
- The big bang theory is the consensus cosmological framework for explaining the origin, properties, and evolution of the universe.
- According to this theory, the universe began almost 14 billion years ago in an extremely hot and dense state, from which it has cooled and expanded since.
- The fundamental forces and particles of nature emerged in the first fractions of a second after the big bang.
- Key observations supporting the big bang theory include: (1) expansion of the universe, (2) cosmic microwave background radiation, (3) abundances of the lightest chemical elements, and (4) age of the oldest-known stars.

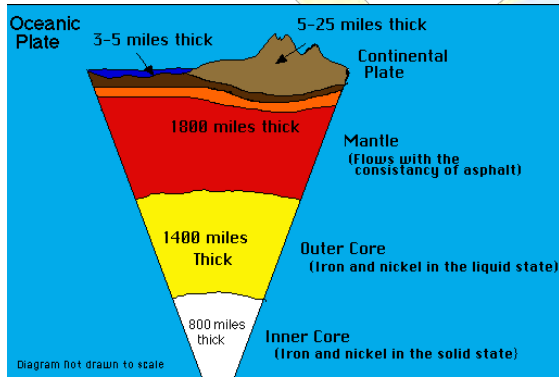
- The uniformity of the temperature of the cosmic microwave background and the universe's geometrical flatness suggest the cosmos underwent an exponential increase in size, known as inflation, soon after the big bang.
- The standard model of big bang cosmology, known as lambda cold dark matter, proposes two hypothetical entities—dark matter and dark energy—to explain the structure and history of the universe.

## C. Interior structure of the earth

### The Earth's Layers

#### • The Crust

The Earth's Crust is like the skin of an apple. It is very thin in comparison to the other three layers. The crust is only about 3-5 miles (8 kilometers) thick under the oceans (oceanic crust) and about 25 miles (32 kilometers) thick under the continents (continental crust). The temperatures of the crust vary from air temperature on top to about 1600 degrees Fahrenheit (870 degrees Celsius) in the deepest parts of the crust. You can bake a loaf of bread in your oven at 350 degrees Fahrenheit, at 1600 degrees F. rocks begin to melt.

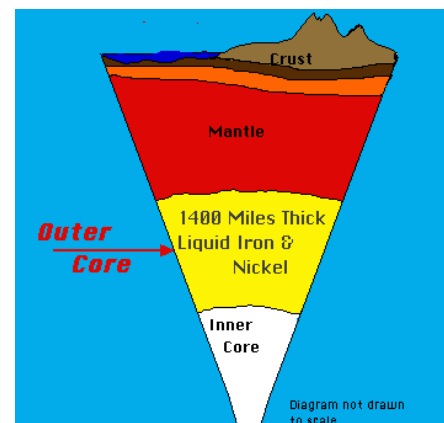


#### • The Mantle

It is the largest layer of the Earth, 1800 miles thick. The mantle is composed of very hot, dense rock. This layer of rock even flows like asphalt under a heavy weight. This flow is due to great temperature differences from the bottom to the top of the mantle. The movement of the mantle is the reason that the plates of the Earth move. The temperature of the mantle varies from 1600 degrees Fahrenheit at the top to about 4000 degrees Fahrenheit near the bottom. Many geologists believe that the mantle "flows" because of convection currents. **Convection currents** are caused by the very hot material at the deepest part of the mantle rising, then cooling, sinking again and then heating, rising and repeating the cycle over and over.

#### • Outer Core

The core of the Earth is like a ball of very hot metals. (4000 degrees F. to 9000 degrees F.) The *outer core* is so hot that the metals in it are all in the liquid state. The outer core is located about 1800 miles beneath the crust and is about 1400 miles thick. The outer core is composed of the melted metals nickel and iron.



- **Inner Core**

The inner core of the Earth has temperatures and pressures so great that the metals are squeezed together and are not able to move about like a liquid, but are forced to vibrate in place as a solid. The inner core begins about 4000 miles beneath the crust and is about 800 miles thick. The temperatures may reach 9000 degrees F. and the pressures are 45,000,000 pounds per square inch. This is 3,000,000 times the air pressure on you at sea level.

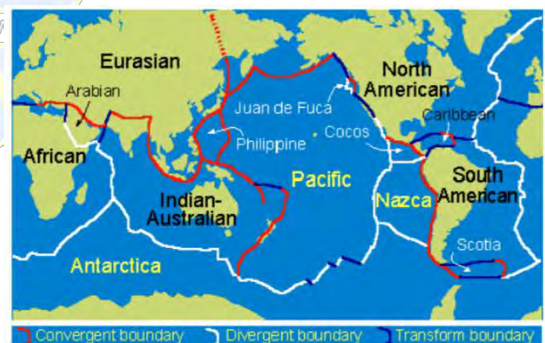
## 2.2 Origin of the continents and oceans (Plate tectonics theory)

- The Earth is made up of three main layers:
- **The Core** is at the center of the Earth. It is divided into an inner and outer core.
- **The Mantle** is the layer surrounding the core. The upper mantle is partially molten and called the asthenosphere.
- **3. The Crust, or lithosphere**, is the rigid outer-most layer. Thick continental crust underlies continents, and thin, very dense oceanic crust underlies oceans.

### D. Plate tectonics theory

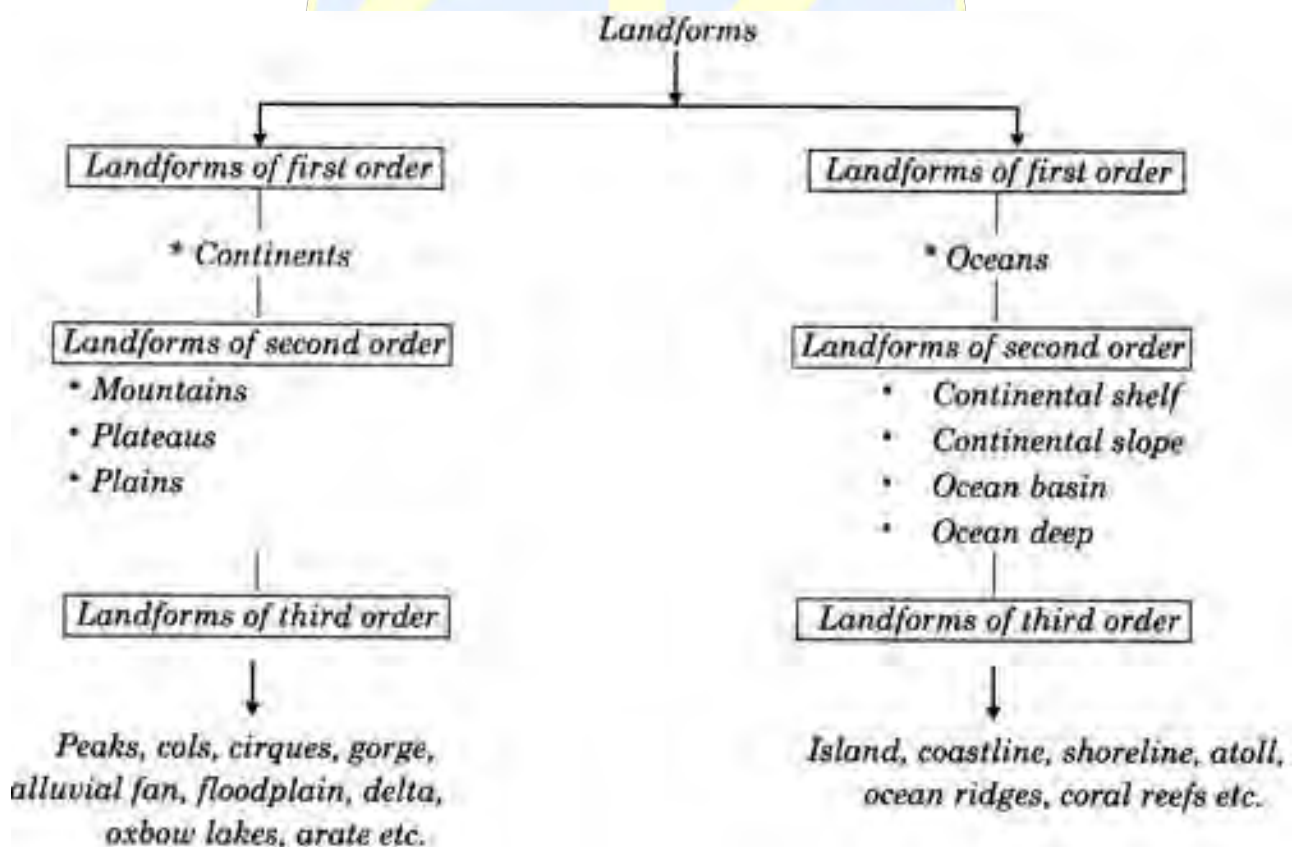
- Tectonic plates, or lithospheric plates, are constantly moving, being created, and consumed simultaneously. The motion sometimes results in earthquakes, volcanoes, and mountain ranges at the plate boundaries.
- Plate motion is driven by heat escaping from the mantle. The constant movement of heat in the mantle leads to circular convection currents. These hot convective cells are similar to the rolling boil that occurs when water is heated on a stovetop. The flowing mantle has also been compared to a —conveyor belt, moving the rigid plates in different directions.
- Fundamentally, convection occurs due to uneven heating and different densities within the liquid.
- There are three basic ways that plates interact with one another. Each of these plate boundaries has the potential to create different geological features. [www.geniusknow.com](http://www.geniusknow.com)

1. When plates collide with each other = **Convergent boundary**
2. When plates separate from each other = **Divergent boundary**
3. When plates slide along side each other = **Transform boundary**



- Plate tectonics is the theory that explains the global distribution of geological phenomena.
- Tectonic plates, large slabs of rock that divide Earth's crust, move constantly to reshape the Earth's landscape.
- Plate tectonics has become the unifying theory of geology. It explains the earth's surface movement, current and past, which has created the tallest mountain ranges and the deepest oceans.
- Some scientists think that the shifting plates, which have the ability to help adjust our planet's temperature over billions of years, are a vital element for life.
- There are many other complex fault zones and micro-plate boundaries that are active and as a result produce geological events.
- The word TECTONICS is of Greek origin and it means to build. The word tectonism refers to the deformation of the lithosphere. This deformation most notably includes mountain building.

### 2.3 Major landforms: 1<sup>st</sup> order, 2<sup>nd</sup> order and 3<sup>rd</sup> order



#### A. First-order landforms

- The . category of land forms includes huge continental platforms and ocean basins.

- First order relief features are tectonic plates and are the largest in special extent. There are two types of plates; continental plates and Oceanic plates.
- The ocean basins are entirely below the sea level. Approximately 71 percent of the earth is covered by water, with only about 29 percent of its surface appearing as continents and islands.
- The distribution of land and water in evidence today demonstrates a distinct water hemisphere and continental hemisphere.
- These are differentiated by their rock and mineral composition. Continental plates are lighter in density and are composed of granitic rock materials rich in silica and aluminum. The oceanic plates are made up of dense, basaltic rock composed of silica and magnesium.
- The formation of First order reliefs can be explained by the following theories:

1. Continental Drift Theory
2. Sea Floor Spreading
3. Plate Tectonics Theory

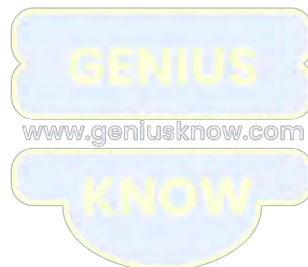
## B. Second-order landforms

- Continental features that are classified in the second order of relief include continental masses, mountain masses, plateaus, plains and lowlands.
- In the ocean basins, the second order of relief includes continental rises, slopes, abyssal plains, mid-ocean ridges, submarine canyons, and subduction trenches.
- A few examples are the Himalayas, Alps, Rocky Mountains, Andes, Tibetan plateau, plateau of Anatolia (Turkey), Indo-Gangetic plains, Siberian lowlands and the plains of Mississippi.
- Intermediate level of landforms, including mountain masses, plains, and lowlands.
- **Broadly, these landforms are grouped into:**

- (i) Hills and mountains
- (ii) Plateaus
- (iii) Plains.

## C. Third-order landforms

- These Features are for the most part created by erosion and deposition of the surface as opposed to the movement of tectonic plates.
- Individual landforms are considered in third order and also no upper limit or lower limit.



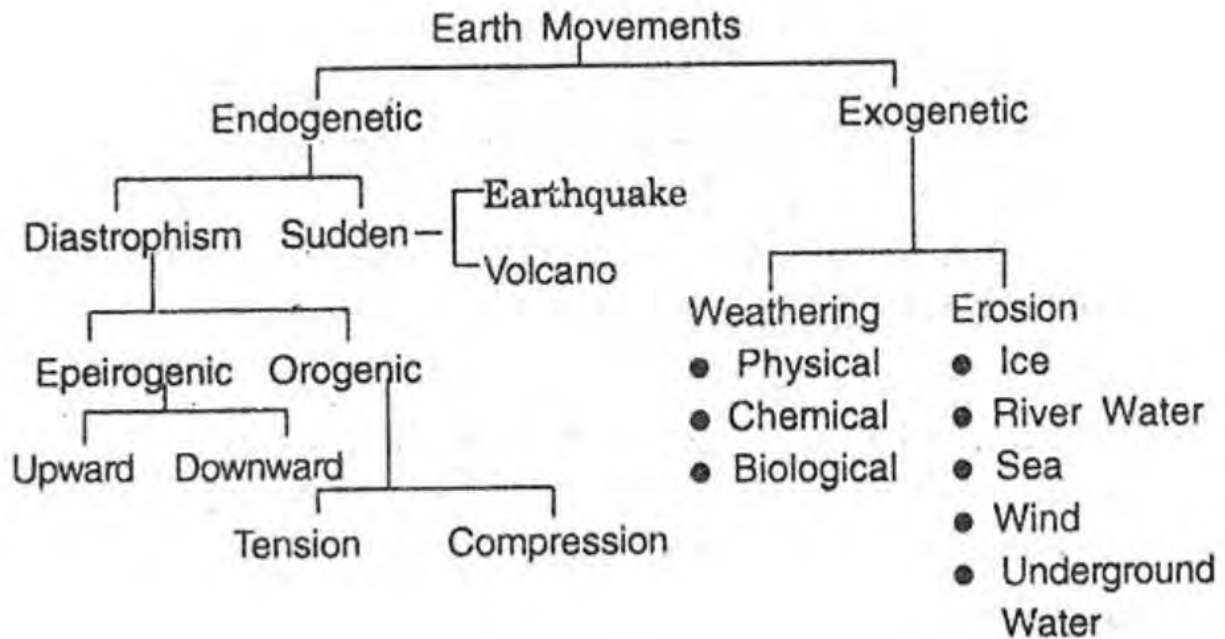


- A geomorphic agent/agency in any natural medium which is capable of securing and transporting earth materials.
- Mainly, in these order the geomorphic processes are effect a modification of the earth's surface forms.
- The third order of relief includes individual peaks, cliffs, valleys, hills, spurs, gorges, sand dunes, caves, moraines, cirques, ripples, beaches, etc. These features are identified as local landscapes.
- This type of relief basically consists of exogenic forces. Exogenic forces are those forces which originates on the surface of the earth.
- The levelling process includes erosion, transportation and deposition and as a result valleys (due to erosion) and deltas (due to deposition) are formed.
- Following are the agents which carry out the whole levelling process:

(Running water, Wind, Underground water, Glacier, Sea waves.)

## 2.4 Geomorphic processes and landforms

Geomorphic processes are the natural processes that shape the Earth's surface, creating various landforms. These processes can be classified into two main categories: endogenic processes and exogenic processes.



## A. Endogenic Processes:

I. **Plate Tectonics:** The Earth's lithosphere is divided into several large plates that float and move on the semi-fluid asthenosphere beneath them. The interactions between these plates give rise to various landforms. For instance:

- **Mountain Formation:** When two continental plates converge, their leading edges crumple, leading to the formation of mountain ranges. The Himalayas, formed by the collision of the Indian and Eurasian plates, are an excellent example.
- **Rift Valleys:** When tensional forces pull apart the Earth's crust, rift valleys are formed. The East African Rift System, including the famous Great Rift Valley, is a prime example of a rift valley formed by the separation of the African Plate.

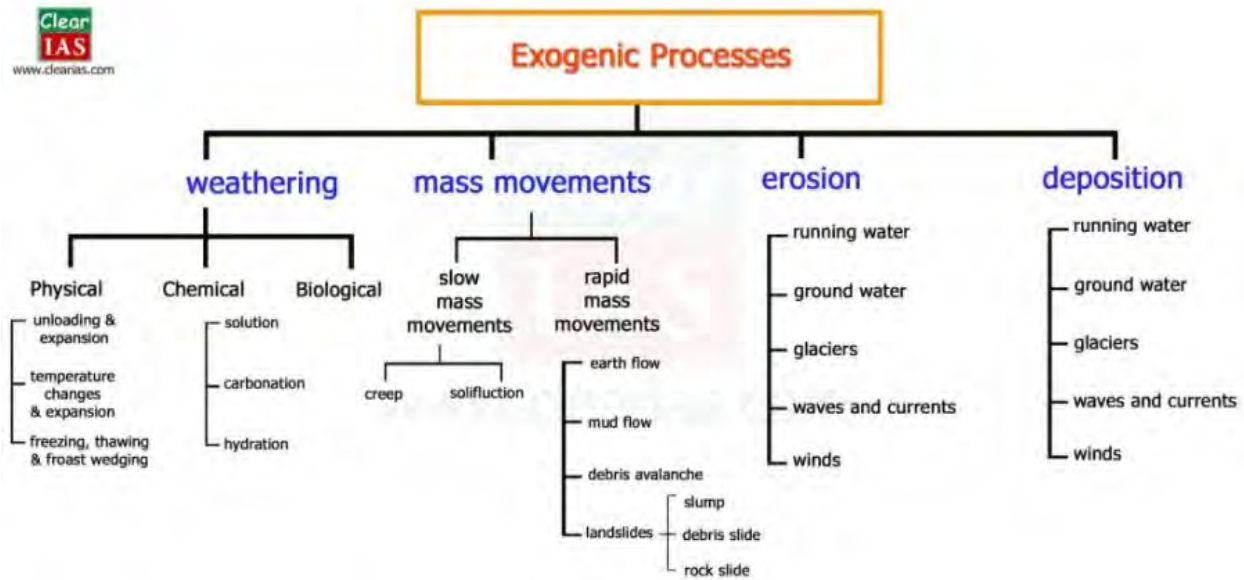
II. **Volcanism:** Volcanic activity involves the eruption of molten rock, ash, and gases from the Earth's interior onto the surface. The materials ejected during volcanic eruptions create various landforms, such as:

- **Shield Volcanoes:** These are broad, gently sloping volcanoes formed by the accumulation of basaltic lava flows. The Hawaiian Islands, particularly Mauna Loa and Mauna Kea, are examples of shield volcanoes.
- **Composite Volcanoes:** These volcanoes have steep slopes and are composed of alternating layers of lava flows and volcanic ash. The famous Mount Fuji in Japan is a composite volcano.

III. **Folding and Faulting:** Compression and tension forces within the Earth's crust lead to folding and faulting, resulting in the formation of distinct landforms:

- **Folded Mountains:** When rock layers are subjected to compressional forces, they buckle and fold, forming mountain ranges with folded structures. The Appalachian Mountains in the United States and the Alps in Europe are examples of folded mountains.
- **Fault Scarps:** Faulting occurs when rocks along a fault line break and move relative to each other. The San Andreas Fault in California, USA, is a prominent example of a fault system with visible scarps.

## B. Exogenic Processes:



I. **Weathering:** Weathering refers to the breakdown and alteration of rocks and minerals at or near the Earth's surface. There are three types of weathering:

- **Physical Weathering:** This involves the mechanical disintegration of rocks into smaller fragments without changing their chemical composition. Freeze-thaw cycles, where water expands upon freezing, can cause rocks to fracture. An example is the formation of talus slopes in mountainous areas.
- **Chemical Weathering:** Chemical processes, such as dissolution, oxidation, and hydrolysis, alter the chemical composition of rocks. Acid rain causing the dissolution of limestone and the formation of karst landscapes, like the limestone caves in the Carlsbad Caverns National Park, is an example.
- **Biological Weathering:** The action of organisms, such as plant roots growing into cracks, burrowing animals, and lichens releasing acids, contributes to the breakdown of rocks. The growth of tree roots that crack and break apart rocks is an example of biological weathering.

II. **Erosion:** Erosion involves the removal and transportation of weathered material by natural agents. Here are some examples:

- **River Erosion:** Rivers erode their channels over time, creating landforms such as valleys, canyons, and river meanders. The Grand Canyon in Arizona, USA, formed by the erosive power of the Colorado River, is a remarkable example.

- **Coastal Erosion:** The action of waves, currents, and tides erodes coastlines, leading to the formation of cliffs, sea caves, and arches. The White Cliffs of Dover in England are iconic chalk cliffs formed by coastal erosion.
- **Glacial Erosion:** Glaciers carve out valleys, cirques, and fjords as they move and erode the underlying bedrock. The fjords of Norway, such as the Geirangerfjord, are classic examples of glacial erosion.

III. **Deposition:** Deposition occurs when eroded material settles in a different location. Here are a few examples:

- **Alluvial Plains:** When rivers carry sediment downstream and deposit it on flat, low-lying areas, they form alluvial plains. The Nile River's floodplain in Egypt, known for its rich agricultural soils, is an example.
- **Deltas:** Deltas are landforms formed at the mouths of rivers where sediment is deposited in fan-shaped or triangular formations. The Mississippi River Delta in Louisiana, USA, is a prominent example.
- **Sand Dunes:** Wind carries and deposits sand in certain regions, forming sand dunes. The Sahara Desert, known for its extensive sand dunes, provides a notable example.

These are just a few examples of geomorphic processes and the landforms they create. The Earth's surface is a result of the complex interplay of these processes, acting over millions of years, and the specific landforms observed vary across different regions and environments.

## 2.5 The works of rivers and glaciers: Process and topography

### Landforms Created by River

Water is regarded as the most important geomorphic factor in causing the degradation of the ground surface in humid locations with heavy rainfall. The majority of running water erosional landforms are connected with energetic and young rivers flowing over steep grades.



## Potholes

These are the deep natural underground cave formed by the erosion of rock, especially by the action of water. These currents erode the river's bed and create small depressions in it.

- These are drilled into the **bed of a river** and are cylindrical in nature.
- The diameter and depth vary from a few centimeters to meters.
- These are formed due to the **whirling impact** of the water current in the **upper course** of the river.
- In India, the potholes can be observed in the river bed of the Kukadi, Krishna, and Godavari rivers in Maharashtra.

## V-Shaped Valley

In mountain ranges, you will find these types of valleys. V-Shaped valleys are deep river valleys with steep sides that look like the letter V, a diagram shown below will give you a better understanding.

- V-shaped valleys have steep valley walls with narrow valley floors.
- These are generally formed by the **result of erosion** and withering by fast-flowing rivers and are generally formed in the **upper course** of the river.
- A deep and narrow valley with steep sides is called a **Gorge**.
- Many gorges are found in river Ulhas in Thane district in Maharashtra and the gorge of the river Narmada at Bhedaghat near Jabalpur in Madhya Pradesh is well known.

## Canyon

A canyon has steep step-like side slopes and can be as deep as a gorge. A canyon is wider at the top than it is at the bottom. In actuality, a canyon is a type of gorge. Canyons are frequently formed in horizontally bedded material.

## Waterfalls (Geological)

Waterfalls are formed due to the erosion of both hard rock and soft rock. As the river flows over the resistant rock, it falls onto the less resistant rock, eroding it and creating a greater height difference between the two rock types, producing the **waterfall**.

- Over thousands of years, the repeated collapse of the caprock and retreat of the waterfall produces a gorge of recession.
- Waterfalls exist because of the difference in rock types. When a river flows, it passes through many different rock types and when a river passes from a resistant rock bed to a softer one, it erodes the softer one very quickly and at the junction between the rock types, it steepens its gradient.
- The highest waterfall in the world is Angel Falls in Venezuela (~800 m).
- The largest waterfall is the Chutes de Khone (Khone Falls) on the Mekong River in Laos.
- The Niagara Falls on the river Niagara and Jog Falls in Karnataka on the **Sharavathi River** are famous waterfalls.

## Meanders and Ox-bow Lakes

Meanders are bent in a river that forms as a river's sinuosity increases. A **meander** forms when moving water in a stream erodes the outer banks and widens its valley, and the inner part of the river has less energy and deposits silt.

- **Meanders** form a snake-like pattern as the river flows across a fairly flat valley floor.
- The **sinuosity** of a river is a measurement of how much a river varies from a straight line.
- Meanders are formed due to **lateral erosion** and as the erosion increases over a period of time, the meanders in the river again start flowing in a straight line.
- Meander formation is a self-intensifying process where a greater curvature results in more erosion of the bank which in turn results in greater curvature.
- **Oxbow** lakes are an evolution of meanders that undergo extensive deposition and erosion
- When the meanders cut from the main course and water accumulates in this pool then it resembles the shape of the oxbow.

## Fan-shaped Plains

These are found in the region where the **Tributaries Rivers** join the main river. Fan-shaped plains are landforms that are formed due to the deposition of material carried by the Tributaries Rivers. These flows come from a single point source at the apex of the fan, and over time move to occupy many positions on the fan surface. This deposition resembles the shape of a Fan like plains

## Flood Plains

These are formed due to the **overflows** of the river and **floods** in the nearby areas. It is an area of low-lying ground adjacent to a river, formed mainly of river sediments and subject to flooding.

- Floodplains are made by downstream traveling meanders.
- **Silt** carried by the water gets deposited in flooded areas and forms flat plains on both sides of the river.
- The **Gangetic Plain** is a floodplain.

### Levees

It is an embankment built to prevent the overflow of a river by a ridge of sediment deposited naturally alongside a river by overflowing water. When a river floods, it deposits its load over the flood plain due to a dramatic drop in the river's velocity as friction increases greatly. Repeated floods cause the **mounds** to build up and form levees.

### Delta

Delta is a term coined by **Herodotus** (The Father of History) after the Greek letter Delta because of the deltoid shaped at the mouth of the Nile River. A **River delta** is a landform that forms from the deposition of sediment carried by a **river** as the flow leaves its mouth and enters slower-moving or standing water.

- This occurs when a **river** enters an ocean, sea, estuary, lake, reservoir, or (more rarely) another **river** that cannot transport away the supplied sediment.
- Over a period of time, this deposition builds the characteristic geographic pattern of a river delta.
- **The Sunderbans** delta of the Ganga River is the largest in the world.

### What is Glacier?

"A **glacier** is a persistent body of dense ice that is constantly moving under its own weight; it forms where the accumulation of snow exceeds its ablation over many years." On an average day, a glacier moves **1 to 15** meters a day and there are two types of glaciers, **Continental** Glaciers and **Alpine or Mountain** Glacier.

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## Glacial Landforms

Glacial landforms are those created by glaciers. The majority of modern glacial landforms are the product of massive ice sheets migrating throughout the Quaternary glaciations. Glacial landforms can still be found in areas without active glaciers or glaciation processes. A straight row of stakes laid across a glacier would gradually bend as they descend the valley, implying that the glacier moves quicker in the center than at the outside.

### Types of Glacial Landforms

Glaciers form where there is more snowfall than melts each year. When snow falls, it instantly starts to compress or thicken and become more firmly packed. Firnification is the process by which snow condenses into glacial firn (thick, granular ice). When the ice thickens to around 50 meters (160 feet), the firn grains join together to produce a massive mass of solid ice. The glacier begins to calve as a result of its weight.

A glacier's many components move at varying rates. The flowing ice of the glacier advances faster than the glacier's base. There are majorly two types of Glacial Landforms **Depositional and Erosional**.

### Glacial Deposition

Glaciers have substantially impacted landscapes in mid and high-latitude alpine regions. The primary glacial depositional landforms are as follows:

- **The Drumlins:** These flat, oval-shaped topographies mimic ridges and are composed primarily of glacial till with minor amounts of gravel and sand. It forms as a result of glacier fissures that enable rock debris to slide beneath heavily weighted ice. Drumlins' long axes run parallel to the direction of ice movement. Drumlins depict the movement of glaciers. The Stoss end, the steeper of the two ends, is used to face the ice flow.



- **Esker:** The esker is one of the most stunning landforms formed by fluvioglacial deposits. They are frequently built of gravel and washed sand. The eskers vary in size and shape. When glaciers melt, water seeps down their edges or flows on top of the ice. These waters pool beneath the glacier and flow through a passage beneath the ice-like streams. These streams are produced by ice and flow above the ground. When the ice melts, very coarse objects like stones and blocks, along with a few small particles of rock debris, settle down in the valley of ice beneath the glacier and become visible as the curving ridge known as Esker.
- **Glacial Till:** Glacial till is the unsorted coarse and fine debris released by meltwater glaciers. There is some rock debris swept down and deposited that is small enough to be carried by melt-water streams. Outwash deposits are glacial fluvial deposits. The outwash sediments are varied and layered.

### Glacial Erosion

Glacial Erosion is caused by two major reasons which include Plucking and Abrasion. It is a process that is known to move the ice which is on the bed of the glacier. The pressure on the ice can make the glacier flow across the water body near which it is situated. Glacial Erosion also causes the glaciers to melt which is extremely harmful to our environment. It has an adverse impact on the climate and is also one of the reasons for the rise of sea levels.

### Erosional Landforms by Glaciers

There are three major types of erosional landforms created by glaciers. These landforms are created when the ice on the glaciers moves from their bed. It can cause major geographical changes in the area as new landforms are created. Major Glacial Erosion Landforms are provided below.

### Cirque

It is a half-open steep-sided hollow at the head of a valley or on a mountainside, formed by glacial erosion. Cirques are created by glaciers, grinding an existing valley into a rounded shape with steep sides.

- The back wall of the cirque is like a **high cliff** and the floor is concave and huge in size. The total shape resembles an **armchair**.
- When a glacier melts completely, water accumulates in the cirque and forms a lake which is known as a **tarn**.

### Hanging Valley

It is a valley that is cut across by a deeper valley or a cliff. Hanging Valley Landforms Have 2 Main Characteristics - a valley that leads to another valley below and A cliff or steep wall below the meeting point

- Hanging valleys are often associated with valley glaciers, joining the main valley along its sides.
- They are the product of different rates of erosion between the main valley and the valleys that enter it along its sides.
- The tributaries are left high above the main valley, hanging on the edges, their rivers and streams entering the main valley by either a series of small waterfalls or a single impressive fall

### Aretes and Horns

Aretes, which are glacial landforms, are usually seen between two perpendicular cirques. These U-shaped valleys were scoured by glaciers, leaving knife-edged slopes behind.

- The glaciers erode the bedrock beneath these valleys even more, resulting in aretes at the upper reaches of the parallel valleys. Between aretes between two cirques, there is typically a low area called a col.
- A number of cirques are typically clustered radially on the sides of larger mountain ranges, such as the Alps.
- When glaciers wear down the higher regions of these mountain ranges, they form sharp peaks.
- These pointed peaks, nicknamed horns, are surrounded by vertical headwall cliffs divided by aretes.

### U-shaped Valley

**U-shaped valleys**, or glacial troughs, are formed by the process of glaciation. They are characteristic of mountain glaciation in particular. They have a characteristic **U shape**, with steep, straight sides and a flat bottom.

- As the erosion of the sides is greater than that of the floor, a valley is formed with vertical sides and a wide floor. This valley is called a U-Shaped valley.
- These valleys can be several thousand feet deep and tens of miles long.
- As a glacier moves downhill through a valley, usually with a stream running through it, the shape of the valley is transformed. As the ice melts and retreats, the valley is left with very steep sides and a wide, flat floor. This parabolic shape is caused by glacial erosion striving to decrease friction as much as possible.

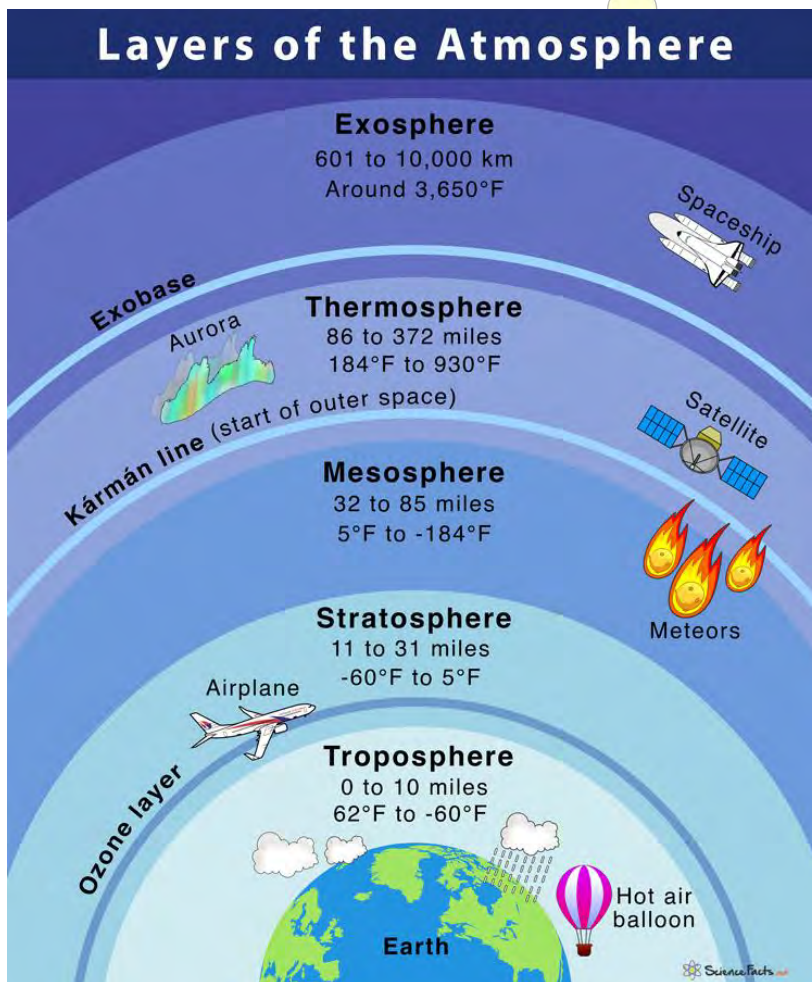
## 3. Unit 3 The atmosphere as our existence

### 3.1 Extent and composition of the atmosphere

The atmosphere is a mixture of gases that surrounds the Earth. It helps make life possible by providing us with air to breathe, shielding us from harmful ultraviolet (UV) radiation coming from the Sun, trapping heat to warm the planet, and preventing extreme temperature differences between day and night. Each of the planets in our solar system have an atmosphere, but none of them have the same ratio of gases or layered structure as Earth's atmosphere.

Nitrogen and oxygen are by far the most common gases in Earth's atmosphere. Dry air is composed of about 78% nitrogen (N<sub>2</sub>) and about 21% oxygen (O<sub>2</sub>). The remaining less than 1% of the atmosphere is a mixture of gases, including Argon (Ar) and carbon dioxide (CO<sub>2</sub>). The atmosphere also contains varying amounts of water vapor, on average about 1%. There are also many, tiny, solid or liquid particles, called aerosols, in the atmosphere. Aerosols can be made of dust, spores and pollen, salt from sea spray, volcanic ash, smoke, and pollutants introduced through human activity.

## Earth's Atmosphere



The atmosphere becomes thinner (less dense and lower in air pressure) the further it extends from the Earth's surface. It gradually gives way to the vacuum of space. There is no precise top of the atmosphere, but the area between 100-120 km (62-75 miles) above the Earth's surface is often considered the boundary between the atmosphere and space because the air is so thin here. However, there are measurable traces of atmospheric gases beyond this boundary, detectable for hundreds of kilometers/miles from Earth's surface.

There are several unique layers in Earth's atmosphere. Each has characteristic temperatures, pressures, and phenomena. We live in the troposphere, the layer closest to Earth's surface, where most clouds are found and almost

all weather occurs. Some jet aircraft fly in the next layer, the stratosphere, which contains the jet streams and a region called the ozone layer. The next layer, the mesosphere, is the coldest because there are almost no air molecules there to absorb heat energy. There are so few molecules for light to refract off of that the sky also changes from blue to black in this layer. And farthest from the surface we have the thermosphere, which absorbs much of the harmful radiation that reaches Earth from the Sun, causing this layer to reach extremely high temperatures. Beyond the thermosphere is the exosphere, which represents the transition from Earth's atmosphere to space.

**Troposphere.** Earth's troposphere extends from Earth's surface to, on average, about 12 kilometers (7.5 miles) in height, with its height lower at Earth's poles and higher at the equator. Yet this very shallow layer is tasked with holding all the air plants need for photosynthesis and animals need to breathe, and also contains about 99 percent of all water vapor and aerosols (minute solid or liquid particles suspended

in the atmosphere). In the troposphere, temperatures typically go down the higher you go, since most of the heat found in the troposphere is generated by the transfer of energy from Earth's surface. The troposphere is the densest atmospheric layer, compressed by the weight of the rest of the atmosphere above it. Most of Earth's weather happens here, and almost all clouds that are generated by weather are found here, with the exception of cumulonimbus thunder clouds, whose tops can rise into the lowest parts of the neighboring stratosphere. Most aviation takes place here, including in the transition region between the troposphere and the stratosphere.

**Stratosphere.** Located between approximately 12 and 50 kilometers (7.5 and 31 miles) above Earth's surface, the stratosphere is perhaps best known as home to Earth's ozone layer, which protects us from the Sun's harmful ultraviolet radiation. Because of that UV radiation, the higher up you go into the stratosphere, the warmer temperatures become. The stratosphere is nearly cloud- and weather-free, but polar stratospheric clouds are sometimes present in its lowest, coldest altitudes. It's also the highest part of the atmosphere that jet planes can reach.

**Mesosphere.** Located between about 50 and 80 kilometers (31 and 50 miles) above Earth's surface, the mesosphere gets progressively colder with altitude. In fact, the top of this layer is the coldest place found within the Earth system, with an average temperature of about minus 85 degrees Celsius (minus 120 degrees Fahrenheit). The very scarce water vapor present at the top of the mesosphere forms noctilucent clouds, the highest clouds in Earth's atmosphere, which can be seen by the naked eye under certain conditions and at certain times of day. Most meteors burn up in this atmospheric layer. Sounding rockets and rocket-powered aircraft can reach the mesosphere.

**Thermosphere.** Located between about 80 and 700 kilometers (50 and 440 miles) above Earth's surface is the thermosphere, whose lowest part contains the ionosphere. In this layer, temperatures increase with altitude due to the very low density of molecules found here. It is both cloud- and water vapor-free. The aurora borealis and aurora australis are sometimes seen here. The International Space Station orbits in the thermosphere.

**Exosphere.** Located between about 700 and 10,000 kilometers (440 and 6,200 miles) above Earth's surface, the exosphere is the highest layer of Earth's atmosphere and, at its top, merges with the solar wind. Molecules found here are of extremely low density, so this layer doesn't behave like a gas, and particles here escape into space. While there's no weather at all in the exosphere, the aurora borealis and aurora australis are sometimes seen in its lowest part. Most Earth satellites orbit in the exosphere.

**The Edge of Outer Space.** While there's really no clear boundary between where Earth's atmosphere ends and outer space begins, most scientists use a delineation known as the Karman line, located 100 kilometers (62 miles) above Earth's surface, to denote the transition point, since 99.99997 percent of Earth's atmosphere lies beneath this point. A February 2019 study using data from the NASA/European Space Agency Solar and Heliospheric Observatory (SOHO) spacecraft suggests, however, that the farthest reaches of Earth's atmosphere — a cloud of hydrogen atoms called the geocorona — may actually extend nearly 391,000 miles (629,300 kilometers) into space, far beyond the orbit of the Moon.

### **Solar radiation and insolation**

The sun is the primary source of energy on the Earth. This energy is radiated in all directions into space through short waves. This is known as solar radiation. Incoming solar radiation through short waves is termed insolation. The amount of insolation received on the earth's surface is far less than that is radiated from the sun because of the small size of the earth and its distance from the sun.

## 3.2 Atmospheric temperatures: Distributions and inversion of temperature

### Atmosphere temperature

The temperature of the Earth's atmosphere can range from 2,700 degrees Fahrenheit (1,500 degrees Celsius) in the increased level or at high temperatures to 59 degrees Fahrenheit (15 degrees Celsius) near the surface or below sea level. Atmospheric temperature measures the temperature at various levels in the Earth's atmosphere. This depends on factors such as incoming solar radiation, humidity, and altitude. When discussing surface temperature, the annual atmospheric temperature range at a geographic location highly depends on the type of biome measured by the Köppen climate classification.

### Factors Affecting the Temperature Distribution

The following factors influence the temperature of the air at any place:

- The latitude of the place;
- The altitude of the place;
- Distance from the sea, the air-mass circulation;
- The presence of warm and cold ocean currents;
- Local aspects.

### Global Temperature Distribution

The temperature distribution globally can be explained in two ways:

Horizontal Temperature Distribution

Vertical Temperature Distribution

#### Horizontal Temperature Distribution

Temperature distribution across the latitudes over the earth's surface is called its horizontal distribution.

On maps, the horizontal distribution of temperature is commonly shown by "Isotherms", lines connecting points that have equal temperatures.

The equatorial region is generally hot, and its temperature is high throughout the year.

Generally, from the equator to the polewards, the temperature keeps on declining.

The lowest temperature is at and near the poles.

The horizontal distribution of temperature over the globe can be studied easily from the maps of the January and July months since the seasonal extremes of high and low temperatures are most obvious in both the northern and southern hemispheres during these months.

#### Vertical Temperature Distribution

Normally, temperature decreases with an increase in elevation. It is called the normal lapse rate.

The average rate of temperature decrease upward in the troposphere is about 6 °C per km, extending to the tropopause.

This is also termed a vertical temperature gradient.

The normal lapse rate is not always the same, but it differs depending on height, season, latitude, or other local factors.

### **Inversion of Temperature**

Sometimes, the situations are reversed, and the normal lapse rate is inverted. It is called the Inversion of temperature. In other words, temperature increases with increasing height, temporarily or locally.

## **3.3 Moisture in the atmosphere: Humidity and condensations**

### **Moisture**

The troposphere is also known as the weather sphere. This is due to the water vapor in the air. After the tropopause, water vapor doesn't exist in the atmosphere. The amount of water in the air can be measured in different ways. The specific humidity of air measures how much water is in the air. Warmer air can hold more water than colder air. When the air reaches its capacity, it is saturated. This capacity doubles for about every 11°C rise in temperature. The term more often used is relative humidity. This measures how much water is in the air divided by how much it can hold. The relative humidity reading is given as a percent. The relative humidity for saturated air is 100 percent.

#### **Sources of Moisture in the Atmosphere**

- i) Evaporation from oceans, lakes, rivers & soil
- ii) Transpiration from plants and other vegetation
- iii) Perspiration from people and animals.
- iv) Sublimation: change from ice to water vapor

### **Humidity:**

Humidity refers to the amount of water vapor present in the air. It is an essential parameter in understanding the comfort levels, precipitation potential, and overall atmospheric conditions. Humidity is often expressed in terms of relative humidity (RH), which is the ratio of the actual amount of water vapor present in the air to the maximum amount of water vapor that can be held at a given temperature. Relative humidity is expressed as a percentage.

Warmer air can hold more water vapor than colder air. When warm air cools, its capacity to hold moisture decreases, and if the amount of water vapor in the air remains constant, the relative humidity increases. Conversely, if the air is cooled to the point where it reaches 100% relative humidity, it becomes saturated, and any further cooling leads to condensation.

### **Condensation**

Condensation occurs when warm air collides with cold surfaces or your home's too much humidity. When this moisture-packed warm air comes into contact with a chilly surface, it cools down quickly and releases the water, which turns into liquid droplets on the cold surface.

When excess moisture in the air surpasses the dew point, you get condensation. This can happen through several ways;

The level of moisture in the air.

The temperature of the air in your home.

The surface temperature of the windows.

The more moisture in the air, the more likely you will get condensation. The first place you will notice water condensation is on the windows; as warm air collides with a cold surface like a window, it will form water droplets. Adequate ventilation is the only way to prevent condensation. To reduce condensation, you must reduce the excess moisture in the property.

### **Forms of Condensation:**

Dew: Tiny drops of water formed when water vapor condensed at or near the earth's surface.

Frost: It is a frozen condensation that occurs when air at the ground level is supercooled below the freezing points.

Fog: A mass of tiny drops of water that form when water vapor condenses on nuclei near the earth's surface.

Clouds: A cloud is a mass of tiny drops of water resulting from condensation, which occurs high up in the atmosphere.

## **3.4 Atmospheric pressure and wind system with special focus to Monsoons**

### **Atmospheric Pressure and Winds**

Atmospheric pressure is defined as the force per unit area exerted against a surface by the weight of the air molecules above the earth's surface. In the Figure below (Figure 6.10), the pressure at point 'X' increases as the weight of the air increases. The atmospheric pressure is not distributed uniformly over the earth. The pressure increases or decreases according to the amount of molecules that exert the force on the surface.

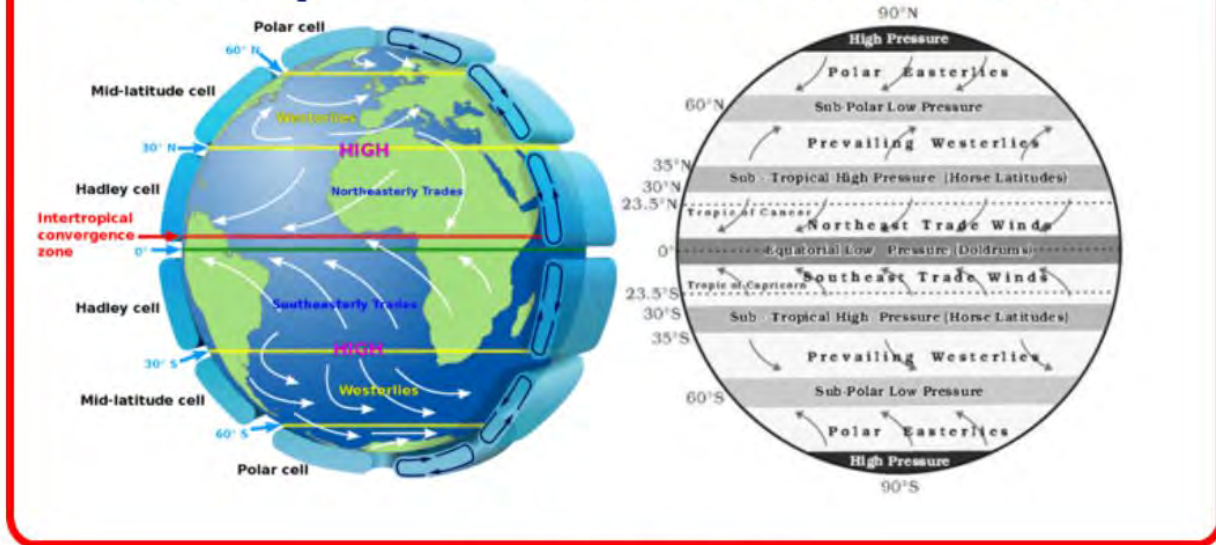
When the temperature of the air increases, the air expands and reduces the number of molecules over the unit area. It leads to a reduction in pressure. Similarly, when the temperature falls, the air contracts, and the pressure increase. Therefore, the temperature and atmospheric pressure are inversely related.

Atmospheric pressure is measured by an instrument called a barometer.'

### **Wind Systems**

The wind is the horizontal movement of air molecules from areas of high pressure to areas of low pressure to maintain atmospheric equilibrium. The wind always moves perpendicular to isobars. If the earth did not rotate, the winds would blow in a straight path. Then the earth's rotation results in Coriolis effect, and it deflects the direction of the wind. Wind direction is identified by an instrument called Wind Vane, and Anemometer measures wind speed.

# Atmospheric Pressure and Winds



Pressure Belts And Cells

## 3.5 Climatic classifications, climate change and human as an actor

### Climate classification

climate classification, the formalization of systems that recognize, clarify, and simplify climatic similarities and differences between geographic areas in order to enhance the scientific understanding of climates. Such classification schemes rely on efforts that sort and group vast amounts of environmental data to uncover patterns between interacting climatic processes. All such classifications are limited since no two areas are subject to the same physical or biological forces in exactly the same way. The creation of an individual climate scheme follows either a genetic or an empirical approach.

The earliest known classification of climate, devised by the Greeks, simply divided each hemisphere into a mathematical climate of three zones, the "summerless," "intermediate," and "winterless," thus accounting only for the latitudinal differences in solar effect (the Greek word klima means "inclination"). More recently, these zones have been labeled the Torrid, Temperate, and Frigid Zones. Apparently, the first major improvement over this classification was introduced by Alexander Supan in the nineteenth century. He based his zones on actual rather than theoretical temperatures, and named one hot belt, two temperate belts, and two cold caps. Supan also divided the world into 34 climatic provinces, with no attempt to relate similar climates of different locations. Another basic and much used approach recognizes other climatic controls as well as the sun.

The resulting climates are called (with variations) polar, temperate, tropical, continental, marine, mountain, and probably others. Of the major climatic classifications in use today, those of W. Köppen (1918) and C. W. Thornthwaite (1931) are referred to most often. Köppen's elaborate "geographical system of climates" is based upon annual and seasonal temperature and precipitation values; his climatic regions are given a letter code designation. The major categories are tropical rainy climate, dry climate, temperate rainy climate, snow forest climate, tundra climate, and perpetual frost climate. Gorczyński (1948) devised a decimal number system similar to the Köppen classification.



Thornthwaite's (1931) bioclimatological system utilizes indices of precipitation effectiveness to outline humidity provinces, and thermal efficiency for temperature provinces; and again, a letter code designates regions. Thornthwaite (1948) introduced an approach to a "rational" classification, wherein potential evapotranspiration is used as a measure of thermal efficiency, and is compared to precipitation to form a moisture index and to show amounts and periods of water surplus and deficiency. Definite break points are revealed that are adaptable as climatic boundaries. Many authors have devised modified classifications to instruct a particular audience. An excellent example is that of C. E. P. Brooks (1951) in which climatic regions are defined with respect to human activity.

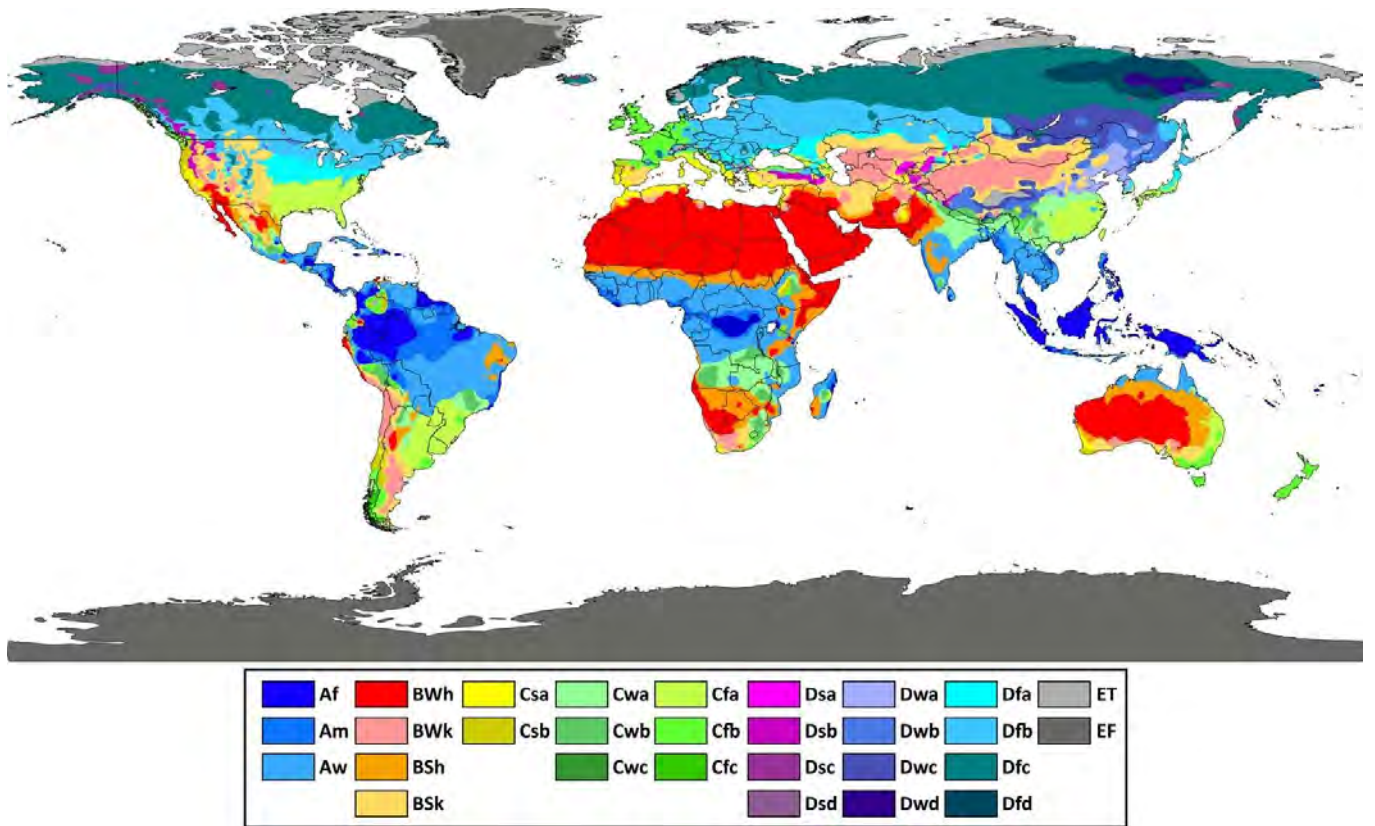
Wladimir Köppen, a German botanist-climatologist, developed the most popular (but not the first) of these vegetation-based classifications. His aim was to devise formulas that would define climatic boundaries in such a way as to correspond to those of the vegetation zones that were being mapped for the first time during his lifetime. Köppen published his first scheme in 1900 and a revised version in 1918. He continued to revise his system of classification until his death in 1940. Other climatologists modified portions of Köppen's procedure on the basis of their experience in various parts of the world.

Köppen's classification is based on a subdivision of terrestrial climates into five major types, which are represented by the capital letters A, B, C, D, and E. Each of these climate types except for B is defined by temperature criteria. Type B designates climates in which the controlling factor on vegetation is dryness (rather than coldness). Aridity is not a matter of precipitation alone but is defined by the relationship between the precipitation input to the soil in which the plants grow and the evaporative losses. Since evaporation is difficult to evaluate and is not a conventional measurement at meteorological stations, Köppen was forced to substitute a formula that identifies aridity in terms of a temperature-precipitation index (that is, evaporation is assumed to be controlled by temperature). Dry climates are divided into arid (BW) and semiarid (BS) subtypes, and each may be differentiated further by adding a third code, for warm (h) or cold (k).

The Köppen classification has been criticized on many grounds. It has been argued that extreme events, such as a periodic drought or an unusual cold spell, are just as significant in controlling vegetation distributions as the mean conditions upon which Köppen's scheme is based. It also has been pointed out that factors other than those used in the classification, such as sunshine and wind, are important to vegetation. Moreover, it has been contended that natural vegetation can respond only slowly to environmental change, so that the vegetation zones observable today are in part adjusted to past climates. Many critics have drawn attention to the rather poor correspondence between the Köppen zones and the observed vegetation distribution in many areas of the world. In spite of these and other limitations, the Köppen system remains the most popular climatic classification in use today.

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## 4. Unit 4 Human nature interaction

### 4.1 Evolution of Human and the races

The evolution of humans and the concept of races are distinct topics that require separate explanations.

1. Evolution of Humans: Humans, as a species, have evolved over millions of years through a process known as biological evolution. The scientific consensus is that modern humans, Homo sapiens, share a common ancestry with other hominin species, such as Homo erectus and Homo neanderthalensis. Key aspects of human evolution include:
  - Bipedalism: The ability to walk on two legs is considered a defining characteristic of humans and likely evolved around 4-6 million years ago.
  - Encephalization: The gradual increase in brain size and cognitive abilities, which has allowed humans to develop complex language, culture, and technology.
  - Tool Use: The use of tools has been integral to human evolution, enabling us to adapt to various environments and improve survival and resource acquisition.

- Cultural Development: Humans possess the ability to create and transmit cultural knowledge across generations, leading to the development of diverse societies, traditions, and technological advancements.
2. Human Races: The concept of race is primarily a social construct rather than a biological or genetic categorization. It is based on external physical features, such as skin color, hair texture, and facial characteristics, which vary among populations. However, genetic studies have revealed that there is more genetic diversity within racial groups than between them. The concept of race has been used historically to classify and categorize people based on perceived differences, leading to social, economic, and political implications.

From a genetic perspective, human populations exhibit a continuous gradient of genetic variation, and there are no clear-cut genetic boundaries that correspond to traditional racial categories. Genetic differences among human populations are relatively small, and most genetic variations are shared across different populations. Human genetic diversity is highest within Africa, where our species originated, and decreases gradually as we move away from Africa.

It is important to note that there is ongoing scientific debate and research regarding the nature and interpretation of human genetic variation. However, the consensus among geneticists and anthropologists is that race is not a scientifically valid concept when it comes to understanding human genetic diversity.

In summary, the evolution of humans is a biological process that has led to the emergence of Homo sapiens, while the concept of races is a social construct that does not accurately reflect the complex genetic diversity of human populations.

#### 4.2 Human nature relationship: Environment determinism, possibilism, neo-determinism and human-environmental system

The earth is comprised of two major components: nature (physical environment) and life forms including human beings. Physical geography studies natural environment and human geography studies “the relationship between the physical/natural and the human worlds, the spatial distributions of human phenomena and how they come about, the social and economic differences between different parts of the world” (Livingstone, David and Rogers 1996, p. 1-2). Geography as a discipline is comprised of multiple dualisms with varying schools of thought. There have been wide-ranging debates about the nature, subject matter, methodology and approaches of study: whether the subject matter should be human or physical; whether geography should be a theorizing/law making (nomothetic) or descriptive (idiographic); whether the approach of the study should be regional or systematic? However, it can be argued that the dichotomy between physical and human is not a valid one as nature and humans are inseparable and interdependent and should be studied holistically. As discussed earlier, the relationship between humans and natural environment is the main focus of human geography. The man nature

relationships have been interpreted in several ways. Since the post-Darwinian era, geographers have differed greatly over the approaches and methodology required for examining and interpreting human-environment relationships. In this unit, we would learn about the various schools of human geography that have attempted to explain the varying forms of human environment interactions on earth. In the following sections, we would learn about the main schools of human-environment interactions- 1) Determinism, 2) Possibilism, 3) Neo-Determinism and 4) Probabilism.

### **A. Determinism**

Broadly speaking, environmental determinism was at the center of one of the longest debates in the history of the social science of geography (Beck, 1985). This idea stirred considerable debate in the emerging field of human geography. The simple definition of environmental determinism is that “the natural environment is responsible for all human actions and the environment controls the course of human action”. In other words, it is the belief that the variations in human activities can be explained by differences in the natural environment. “The essence of deterministic school of thought is that the history, culture, lifestyle and stage of development of any social group, society or nation are exclusively or largely governed by the physical factors (terrain, climate, drainage, fauna and flora) of the environment” (Husain 2002, p.38). Determinists generally consider man as a passive agent on whom the environmental factors are acting and determining his attitude, decision-making processes and lifestyle.

Scholarly interest in the influence of the environment on people can be traced back to classical antiquity. The first attempt to explain the physical features and character traits of various people and their culture with reference to the influence of natural conditions were made by the Greek and Roman scholars. Greek historian Thucydides pointed out the natural conditions and geographical position as the underlining factors of Athens’ greatness. Aristotle believed that climatic causes result in the differences between northern Europeans and Asians. He argued that the inhabitants of cold countries are courageous, brave but unintelligent, lacking in political organization and capacity to rule their neighbors. Whereas, he thought that the people living in warm climates of Asia were intelligent, but lacking in courage which makes slavery their destiny and natural state. On the other hand, people of Greece occupying the middle positions geographically, he saw them as endowed with the finest qualities and thus destined by nature itself to rule all others. The Greek scholars correlated the easy-going ways of life in Asia to the favorable environmental conditions, whereas Europeans had to work hard for living due to poor and/or harsh environment. Greek scholars also tried to correlate varying physical features of people with their location and environment.

Similarly, Strabo (Roman geographer) postulated that the physical conditions such as slope, climate, relief etc. all are works of God and absolutely govern the lifestyles of people. The environmental determinism dominated the writings of Arab geographers as well. They divided

the habitable world into seven terrestrial zones and highlighted the physical and cultural characteristics of races and nations living in these zones. Al-Battani, Al-Masudi, Ibn-Hauqal, Al-Idrisi and Ibn-Khaldun attempted to correlate the environment with human activities and their modes of life. Al-Masudi, for example, asserted that lands with abundant water have humorous and gay people; while dry and arid regions have short-tempered people; and the nomads who live in open air are marked by strength, resolution, wisdom and physical fitness. The German philosopher, Immanuel Kant, also a determinist, strongly argued for a scientific base to the study of geographical or environmental phenomena which he considered to be just as essential as the exact sciences. The environmental causation continued throughout the 19th century when geographers regarded geography as primarily a natural science. Kant's philosophy about man and environment relationships was adopted by Alexander von Humboldt and Carl Ritter who developed an inductive approach to explain natural phenomena. Ritter attempted to establish the cause variations in the physical constitution of body, physique and health in different environmental conditions. Similarly, Humboldt also asserted that physical environment greatly affects the mode of life of the inhabitants as the mode of life in mountainous areas greatly differs from that of the plain areas.

As a scientific theory, environmental determinism was founded in the latter 19th Century by the German geographer, Friedrich Ratzel. He was in turn greatly influenced by Herbert Spencer's perspective on Darwin's theory of natural selection. Soon, other geographers picked up the idea that seemed to promise a positivistic approach to the study of human geography in relationship to habitable space. Among those who led the American determinist movement were Ellsworth Huntington, William Morris Davis, Griffith Taylor, and most notably, Ellen Churchill Semple. The scientific milieu in the late half of the 19th century and early decades of the 20<sup>th</sup> century was dominated by Darwin's ideas, deductive approaches and an acceptance of the Newtonian cause and effect relationships. The origin of scientific determinism lie in the work of Charles Darwin whose seminal book *Origin of Species* (1859) influenced many geographers.

The founder of the 'new' determinism was Friedrich Ratzel. He supplemented 'classical' geographical determinism with elements of 'social Darwinism' and developed the theory of 'lebensraum' which explains that state as an organism which owed its life to the earth and which was ever striving to seize more and more territory. In Ratzel's opinion, "similar locations lead to similar modes of life". He cited the examples of British Isles and Japan and asserted that both these countries have insular locations, which provide natural defense against the invaders. Consequently, the people of these countries were making rapid progress. Ratzel believe in the survival of the fittest and saw 'man' as the end product of evolution- an evolution in which the mainspring was the natural selection of types according to their capacity to adjust themselves to physical environment. He was convinced that the course of history, the mode of life of people and the stages of its development are closely influenced by the physical features and location of a

place. In his deterministic approach, he gave more weight to location in relation to topographic features.

At the beginning of 20th century, 'environmentalism' became particularly widespread in the United States, where leading proponents were W.M. Davis, Ellen Churchill Semple and Ellsworth Huntington. The cycle of erosion model of landform development developed by Davis was based on Darwin's ideas. Semple was a staunch proponent of determinism. Her books *American History and its Geographic Conditions* (1905) and *Influences of Geographic Environment* (1911) established environmentalism in America in the early decades of the 20<sup>th</sup> century. Semple, in her book, distinguishes the attitudinal characteristics of the people living in different physical settings. She points out that the dwellers of mountains are essentially conservative as there is little in their environment that would stimulate them to change and very little reaches from outside world. According to her, diffusion of new ideas and innovations in the hilly tracts of isolation is relatively slower as compared to the well-connected plain areas of the world. On the other hand, people living in plain areas of Europe are energetic, thoughtful and cautious. Similarly, people of the Mediterranean region, where the climate is temperate and mild, are humorous, sporting and imaginative.

## **B. POSSIBILISM**

Possibilism in geography developed as a reaction to extreme generalizations of environmental determinists that led to a counter thesis which presented the man as an active rather than a passive agent. In this view, people can do anything, anywhere they choose. Human beings carry out activities despite the constraints and restraints of the physical environment. People conquer the environment and change wilderness into productive landscape. In this scenario, the level of technology is the main consideration, not the environment itself. The concept of Possibilism is most commonly associated with the work of the French geographer Vidal de la Blache (Johnston, Gregory, Pratt and Watts, 2000). Blache developed this geographical approach as a reaction to the more traditional geographical concept of environmental determinism. Deterministic school of thought "regarded all the facets of human activity (from farming practices to political systems) as ultimately determined in character by the natural-environmental context" (Cloke, Philo and Sadler, 1991, p.64). On the other hand, the possibilist school of thought is shaped by the idea that "the natural environment offers possible avenues for human development, the precise one chosen being very much a human decision" (Cloke et al., 1991, p.65). This does not mean that people are totally free to choose their own directions, but there is an "ongoing 'dialogue' between natural environments and the human communities they support". This dialogue, as described by Blache, results in a "human world full of different *genres de vie* (lifestyles), distinctive to particular people living in particular places" (Cloke et al., 1991, p.64). Thus, possibilism explains that the environment does not dictate what people would become, but rather offers the opportunities for people what they choose to be. People adapt to the different environmental

conditions at different places and which produces different living conditions and habits (Tatham, 1951, p.167).

French historian Lucien Febvre elaborated further on the concept of possibilism and pointed out that, when it comes to human behavior in relation to the environment, “there are no necessities, but everywhere possibilities; and man, as a master of the possibilities, is the judge of their use”. According to Febvre, men have the most influence as a geographical agent on the earth. Thus, “we should put man in the first place, and no longer the earth, nor the influence of climate, nor the determinant conditions of localities” (Febvre, in Johnston et al., 2000). Both Vidal de la Blache and Lucien Febvre believed that nature is not mandatory but permissive. Other authors who contributed in developing possibilism are Isaiah Bowman and Carl Sauer who were both from the United States of America. It has been argued that the ideas of possibilism with the common emphasis on human actions and human ability to choose their destinies laid down the foundations of Humanistic geography.

The philosophy of environmentalism was increasingly attacked after the Second World War. Many geographers started criticizing the one-sided approach adopted by the determinist in interpreting geographical and historical reality, their exaggerated notions of nature’s active role and their view of man as a passive agent with limited ways of adaptation. It became clear that human actions cannot be explained only in terms of environmental factors. Spate criticized the fanatic approach of environmental determinists stating that “environment taken by it is a meaningless phrase; without man environment does not exist”. He also emphasized the need to “consider the psycho-physiological influence of the geographical environment via the social structure”. Spate concluded that geographical environment is only one of the factors of spatial differentiation and “it acts through society; cultural tradition has a certain autonomous influence”. Hartshorne rejected environmentalism on the grounds that it contradicts the concept of geography as an integrated science by separating nature from man and thus is “disruptive of fundamental unity of the field”.

Possibilism attempts to explain man and environment relationship in a different way, taking man as an active agent in environment.

Possibilism asserts that natural environment provides options, the number of which increases as the knowledge and technology of a cultural group develops. Possibilists presented a model of people perceiving the range of alternative uses to an environment and selecting the best fitted to their cultural dispositions. This point of view was named ‘possibilism’ by Lucien Febvre, who writes: “The true and only geographical problem is that of utilization of possibilities. There are no necessities, but everywhere possibilities. The natural data (factors) are much more the material than the cause of human development. The ‘essential cause’ is less nature, with its resources and its obstacles, than man himself and his own nature.” Vidal de la Blache refuted the concept of physical determinism and wrote “nature sets limits and offers possibilities for human

settlement, but the way man reacts or adjusts to these conditions depends on his own traditional way of life.” In his opinion, lifestyles (*genres de vie*) are the products and reflections of a civilization, representing the integrated result of physical, historical and social influences surrounding man’s relation to milieu in a particular place. He believed that whereas society and nature were usually represented as “two adversaries in a duel”, the human being was in fact “part of living creation” and “its most active collaborator”. He provided examples of different socio-cultural groups in the same or similar environment, and pointed out that these differences are not due to the dictates of physical environment but are the outcome of variations in attitudes, values and habits. It is this concept which became the basic philosophy of the school of possibilism.

The possibilists also argued that it is impossible to explain the difference in human society and the history of that society with reference to the influence of physical environment. They hold that human beings bring their influence to that environment and change it. For the possibilists, the works of man, not the earth and its influence, are the starting points, the most important is the freedom of man to choose. But, the possibilists also recognize the limitations imposed by physical environment. Fabvre holds the same view that “men can never entirely rid themselves whatever they do of the hold their environment has on them.” In the similar manner, Brunhes remarks that “the power and means which man has at his disposal are limited and he meets in nature bounds which he cannot cross”. Human activities can vary within certain limits of its environment, but it cannot completely overlook the environment. In other words, human beings can only modify the natural environment but it can never surpass it. Similarly, Blache pointed out that “there is no question of geographical determinism; nevertheless, geography is a key that cannot be dispensed with.”

Possibilism is intrinsically associated with the French School of Geography founded by Vidal de La Blache. The French geographers saw in the physical environment a series of possibilities for human development and argued that the actual ways in which development took place were related to the culture of the people concerned, except perhaps in regions of extremes like deserts and tundra. The historian Lucien Febvre criticized the environmental determinism by asserting the mobility of man as against the passivity of the environment, and regarded other humans as part of environment, of any group because they contributed to the formation of that group’s cultural surroundings or milieu. Influenced by the ideas of Lucien Febvre, H.J. Fleure tried to formulate world regions based on human characteristic rather than the traditional climatic-biotic regions. Possibilism has also been influential in the rise of the school of cultural geography associated with the name of Carl Ortwin Sauer and the University of California at Berkeley, and with the development of the idea of human ecology founded by H.H. Barrows of the University of Chicago. Barrows gave greater importance to humans than to environment. Sauer asserted that geographer’s role is to investigate and understand the nature of the transition from the natural to the cultural landscape. Doing so, the geographer would identify the major changes occurring as a result of human occupation of landscapes. According to the possibilists, nature is never more



than an adviser. This involves man in the first place and not the earth, nor the influence of climate or the physical surroundings of locations.

The range of possibilities in every region is limited more by human choices and desires than the dictates of the environment. For example, human beings with their technical skills can grow banana, rice and rubber in Antarctica but they have to consider the input cost. Humans can never entirely rid themselves of the hold of the physical environment. Taking this into consideration they utilize their geographical circumstances and take advantage of their natural possibilities. The possibilistic approach has been criticized by many geographers. Griffith Taylor, while criticizing possibilism, opined that society as a whole should make a choice, and since only an advisory role is assigned to geographer, his function “is not that of interpreting nature’s plan”. Taylor was largely right when he wrote that the task of geography is to study the natural environment and its effect on man, not all problems connected with man or the ‘cultural landscape’. Moreover, possibilism does not encourage study of physical environment and it promotes over anthropocentrism in geography. Geographical determinism at least obliges the geographer to turn his attention to nature. Possibilism tended to exaggerate the role of culture and to neglect the importance of natural environment. The approach of possibilism may be as ludicrous as determinism, but possibilistic generally recognized the limits to action which environment set and avoid the great generalizations made by determinists.

### **C. NEO-DETERMINISM**

The concept of ‘neo-determinism’ was put forward by Griffith Taylor- a leading Australian geographer. He argued that possibilists had developed their ideas in temperate environments such as north-western Europe, which offer several viable alternative forms of human occupancy. But such environments are rare: in most of the world as in Australia the environment is much more extreme and its control over human activity is enormous. He coined the term ‘stop- and-go determinism’ to describe his views. In the short term, people might attempt whatever they wished with regard to their environment, but in the long term, nature’s plan would ensure that the environment won the battle and forced a compromise out of its human occupants. He, in the 1920s, argued that the limits of agricultural settlement in Australia had been set by factors in the physical environment such as the distribution of rainfall.

Taylor’s view was initially most unpopular in Australia, but it has been generally accepted since then. In his book on Australia published in 1948, Taylor reaffirmed his basic position that the best economic programme for a country to follow has in large part been determined by nature (environment), and it is the geographer’s duty to interpret this programme. Man is able to accelerate, slow or stop the progress of a country’s (region’s) development. But he should not depart from directions as indicated by the natural environment. Man is like the traffic controller in a large city who alters the rate but not the direction of progress. Neo-determinism is also known as ‘stop-and-go determinism’ and Griffith Taylor’s philosophy can be explained by the

role of a traffic controller. Man follows nature's programme only if he is wise. But he admits the possible contention that within broad limits set by environment man can choose. Taylor concedes him the choice between what is wise and what is foolish. But wisdom and folly are human concepts.

The natural environment knows nothing of them. In nature there is only the 'possible' and 'impossible'. The possibilists admit that the opportunities offered by any environment are not all equal. Some environments demand little adjustments while other environments make humans struggle continuously. The ratio between human effort and return can be taken as the price nature demands from human beings for their particular choices. In no environment are the possibilities limitless and for every choice price must be paid, proponents of possibilism admit this, but within these limits freedom to choose exists. Man makes his choice, and man himself judges its relative wisdom or folly by reference to goals he himself has established. Limits to man's freedom beyond those generally recognized by possibilists are, according to Taylor's definition, those imposed by man's conception of wisdom. There is nothing indeed that contradicts the assertion of Febvre that there are no necessities but everywhere possibilities and man as a master of these possibilities is the judge of their use. Thus, man chooses, but only from the range which nature presents him. In brief, people might attempt whatever they wished with regard to their environment, but in the long term, nature's plan would ensure that the environment won the battle and forced a compromise out of its human occupants.

### 4.3 Rural and urban settlements: concept, types and classification

#### **What is a Settlement?**

Settlement: is a place where people live. A settlement may be as small as a single house in a remote area or as large as a mega city (a city with over 10 million residents) Settlements are considered population centers of humans who have developed a long-term community in a specific area. Settlements can be as complex as population centers like metropolises or settlements can be as simple as a small fishing village on a river in a remote area. Settlements have various names like towns, villages, cities, hamlets, bases, or camps. Settlements can include any organized pattern of human habitation. Settlements can have historical value, such as when the area was first settled or who first settled in the area to begin the settlement. Settlements can consist of advanced infrastructure like highways, towers, and parks or settlements can have basic features like irrigation systems and earthen enclosures.

In geography, statistics, and archaeology, a settlement, locality, or populated place is a community in which people live. A settlement can range in size from a small number of dwellings grouped together to the largest of cities with surrounding urbanized areas. Settlements may include hamlets, villages, towns, and cities. Settlement refers to the cluster of houses over space which manifests the socioeconomic conditions and the environmental constraints. Thus, a

settlement has both physical and social structures. It is not only about concrete houses but also about who resides there. The settlement is an expansion of the socio-historic, cultural, and religious perception of a man in a given geographic environment. From the nomadic herdsmen, the concept of the area grew, and with the growth of the family, the sedentary housing system grew and from it villages grew. The villages which had non-agricultural surplus developed into 'Mandis' and the transportation routes connected the Mandis and hence developed the urban settlements.

### **Rural settlement vs Urban settlement**

There are five criteria to differentiate between rural settlement and urban settlement

**Morphology (the physical structure):** The urban structures are marked by tall buildings, wide roads, administrative and recreation centres in contrast to rural settlements which are usually agrarian landscapes.

**Function (Primary, Secondary, Tertiary):** Rural areas basically have the majority of its population involved in primary functions whereas in urban areas people have secondary (manufacturing) and tertiary functions (services) as their major occupations.

**Demography (high or low population density):** Urban areas are marked by high population density and compact settlements in comparison to rural areas where population density is relatively low and settlements are scattered.

**Cultural traits:** The urban areas are marked by class stratification in contrast to the rural areas where the cast and religious stratification is more prominent.

#### **•Infrastructure:**

- **Economic infrastructure:** Economic infrastructure includes transportation, communication, etc. which is more developed in urban areas than rural areas.
- **Social infrastructure:** It includes health, education recreation, etc. where urban areas score over rural areas.

### **Rural settlement**

- Any settlements in which most of the people are engaged in primary activities such as agriculture, forestry, mining, or fishing is known as a rural settlement.
- Rural settlements are the clusters of unorganized, amorphous, closely knitted houses with poor ventilation and sewage/drainage pattern and lanes meandering (meandering roads/not properly planned) and abruptly ending into houses.
- It includes not only the village but also agricultural fields and areas of forestry and livestock raising which are functionally integrated with the village.
- They have strong currents of social bonding. Rural settlement signifies great centripetal force due to strong bonding between the people.

- Rural settlement constitutes both physical morphology and social morphology.
- Rural settlement comprises of the aggregate of the village, agricultural land, forestry, and livestock area.
- Rural settlement manifests socio-economic aspiration, their adaptability, the historical progression of a living civilization, and economic functionality.

### Hamlet

- A hamlet is a small human settlement.
- In British geography, a hamlet is considered smaller than a village and distinctly without a church.
- Officially, a hamlet differs from a village in having no commercial premises, but has residences and may have community buildings such as churches and public halls.

### Village

- A village is a clustered human settlement or community, larger than a hamlet but smaller than a town, with a population ranging from a few hundred to a few thousand.
- In the past, villages were a usual form of community for societies that practice subsistence agriculture, and also for some non-agricultural societies.
- According to the 2011 census of India, 68.84% of Indians (around 833.1 million people) live in 640,867 different villages.

### Rurban

#### Rural + Urban

- Transitional Phase in between Rural and Urban settlements
- Run by Gram Panchayets
- Population is more than 5000 but less than 10,000.

### Town

- A town is a medium-sized human settlement. Towns are generally larger than villages but smaller than cities, though the criteria which constitute them vary considerably in different parts of the world.
- Large town – 20,000 to 1 lakh people
- Town – 5,000 to 20,000 people.
- Census towns are defined as places that satisfy the following criteria:
- Minimum population of 5,000
- At least 75% of male working population engaged in non-agricultural pursuits
- Density of population at least 400/km<sup>2</sup>. (1,000 per sq. mile).

## City

- A city is a large human settlement. Cities generally have extensive systems for housing, transportation, sanitation, utilities, land use, and communication. Their density facilitates interaction between people, government organizations, and businesses, sometimes benefiting different parties in the process.
- City – 1 lakh to 3 lakh Population
- Large City – 3 lakh to 1 million population.

## Metropolis

- A metropolis is a large city or conurbation which is a significant economic, political, and cultural center for a country or region, and an important hub for regional or international connections, commerce, and communications. The term is Ancient Greek and means the “mother city” of a colony (in the ancient sense), that is, the city that sent out settlers.
- Minimum Population – 1 to 3 million.
- Conurbation – 3 to 10 million people.

## Megalopolis

- The term was used by Patrick Geddes in his 1915 book *Cities in Evolution*. Jean Gottmann popularised this term in 1961.
- A megalopolis (sometimes called a megapolis; also megaregion, or supercity) is typically defined as a chain of roughly adjacent metropolitan areas, which may be somewhat separated or may merge into a continuous urban region.
- Megalopolis is derived from Greek:(mégas) meaning ‘great’ and (pólis) meaning ‘city’, therefore literally a ‘great city’. This term is closer in meaning to megacity.
- A megalopolis, also known as a mega-region, is a clustered network of cities.
- Gottmann defined its population as 25 million.
- Doxiadis defined a small megalopolis a similar cluster with a population of about 10 million.

## Primate City

- A primate city (Latin: “prime, first rank”) is the largest city in its country or region, disproportionately larger than any others in the urban hierarchy.
- First proposed by the geographer Mark Jefferson in 1939.
- He defines a primate city as being “at least twice as large as the next largest city and more than twice as significant.”
- Among the best known examples of primate cities are London and Paris.
- Other major primate cities include Athens, Baghdad, Bangkok, Budapest, Buenos Aires, Cairo, Dublin, Jakarta, Kuala Lumpur, Lima, Mexico City, Seoul, Tehran, and Vienna.

## 4.4 Population: Change and distribution

### Population

A group of individuals of the same species occupying a particular geographic area. Populations may be relatively small and closed, as on an island or in a valley, or they may be more diffuse and without a clear boundary between them and a neighboring population of the same species. For species that reproduce sexually, the members of a population interbreed either exclusively with members of their own population or, where populations intergrade, to a greater degree than with members of other populations.

Population is generally defined as the number of people who inhabit a particular area, such as a city, town, region, country, continent, or even the entire world. Populations are measured in tens, hundreds, thousands, millions, and billions. However, raw figures like these can only give a small part of the story. Population composition refers to the statistical makeup of a population. The field of demography is the study of statistics and seeks to determine population composition, with regard to elements such as age, sex, ethnicity, wealth, and other factors.

- all the persons inhabiting a country, city, or other specified place
- the number of such inhabitants
- (sometimes functioning as plural) all the people of a particular race or class in a specific area the Chinese population of San Francisco
- the act or process of providing a place with inhabitants; colonization
- ecology a group of individuals of the same species inhabiting a given area
- astronomy either of two main groups of stars classified according to age and location. Population I consists of younger metal-rich hot white stars, many occurring in galactic clusters and forming the arms of spiral galaxies. Stars of population II are older, the brightest being red giants, and are found in the centre of spiral and elliptical galaxies in globular clusters.

### Elements of Population Composition

There are many elements of population composition that demographers look at, each of which has different implications.

**Age-** The average age of the population, or the portion of the population over or under a certain age, can tell demographers a lot. If a population has a lower median age, then the population is growing, meaning that in time, a large number of people will need jobs, housing, and social services. If the population has a higher median age, on the other hand, then the aging population will be relying on the government much more, while contributing much less to the workforce. In a quickly growing population, we would expect the median age to be lower than 50 years old.

**Sex-** The composition of a population with regard to sex is usually expected to be roughly 50/50. However, it is not exact, due to a number of factors. Males slightly outnumber females worldwide, but in many populations, females outnumber males. Males tend to outnumber females by birth ratio, but females tend to have a higher life expectancy than males. Most populations, however, have a proportion of males and females that is nearly 50/50.

**Ethnicity** - After age and sex, ethnicity is often the third most commonly studied element of population composition. The definition of ethnicity is a little more complicated, but an ethnic group is generally considered to be a group of people with a shared cultural tradition and history that distinguish them from other groups. The ethnicity of a population can have implications for political representation and social inclusion, especially in ethnically diverse nations.

**Distribution and density-** This factor refers to where and how close together the people of a certain population live. For example, the proportion of people living in rural areas versus urban areas is an important factor in demography.

**Wealth-** The wealth of a population, and more specifically, the gap between the wealthiest and poorest people in that population, is an important factor as well. Also, the distribution of wealth by group in a population, such as by sex or ethnicity, is significant too.

**Population size** - This simply refers to the number of people living in a certain area, regardless of any other factors.

**Fecundity-** This describes the fertility of a population or the rate at which a population is able to reproduce in a certain amount of time. Obviously, this factor is related to sex distribution and is one of the two main factors in population growth.

**Mortality-** This is the other factor in population growth, as it counterbalances fecundity. The mortality rate measures the average number of deaths in the population in a certain time. Not accounting for disasters, the fecundity rate minus the mortality rate is used to describe the growth in population. This is also affected by the average age of a population, as a higher median age would mean a higher mortality rate.

**Population of Nepal 2078 male and female Details:**

S.N.	Details	Number
1.	Total Population of Nepal 2078	2,91,92,480
2.	Total male population of Nepal 2078	1,42,91,311 (48.96%)

S.N.	Details	Number
3.	Total female population of Nepal 2078	1,49,01,169 (51.04%)
4.	Population growth rate of Nepal 2078	0.93%
5.	Sex Ratio	95.91
6.	Population density of Nepal 2078	198 per square kilometer
7.	Number of Nepalis living Abroad	21,69,478
8.	Total Family Number	67,61,059

### Population and Sex Ratio by Province

According to the Population of Nepal 2078, Madhesh Province is the highest populated province and Karnali province is the lowest populated province in Nepal. Total Population of Madhesh Province is 54,04,145 and Total population of Karnali Province is 15,70,418.

Analyzing the sex ratio, the highest sex ratio is 100.99 in Madhesh Pradesh and the lowest sex ratio is 90.49 in Sudurpaschim Pradesh.

Analyzing the Population Density, the highest population density is 636 in Madhesh Pradesh and the lowest sex population density is 61 in Karnali Pradesh.

Province	Total Population	Percentage	Sex Ratio	Population Density
Pradesh 1	49,72,021	17.03%	95.23	192
Madhesh Pradesh	61,26,288	20.99%	100.99	636
Bagmati Pradesh	60,84,042	20.84%	99.45	300



Province	Total Population	Percentage	Sex Ratio	Population Density
Gandaki Pradesh	24,79,745	8.49%	90.85	116
Lumbini Pradesh	51,24,225	17.55%	92.15	230
Karnali Pradesh	16,94,889	5.81%	95.58	61
Sudurpaschim Pradesh	27,11,270	9.29%	90.49	135

### Census of Nepal according to various censuses

The census was started in Nepal in 1911. Since then, the census has been conducted almost every 10/10 years. The census conducted till 1941 was limited to the head count only.

Since 1952/54 the census was done by adopting modern scientific approach. Since the establishment of the Central Bureau of Statistics in 2015 BS, all the censuses have been conducted by this department.

Census Year (B.S.)	Total Population	Sex Ratio	Yearly Population Growth Rate	Population Density (Per Square KM)
1968	56,38,749	—	—	38
1977	55,73,788	—	-0.12%	38
1987	55,32,574	—	-0.07%	38
1998	62,83,649	—	1.27%	43
2009/11	82,56,625	96.8	2.73%	56
2018	94,12,996	97.0	1.31%	64

Census (B.S.)	Year	Total Population	Sex Ratio	Yearly Population Growth Rate	Population Density (Per Square KM)
2028		1,15,55,983	101.4	2.05%	79
2038		1,50,22,839	105.0	2.62%	102
2048		1,84,91,097	99.5	2.08%	126
2058		2,31,51,423	99.8	2.25%	157
2068		2,64,94,504	94.2	1.35%	180
2078		2,91,92,480	95.9	0.93%	198

#### The 5 highest populated districts

According to the Population of Nepal 2078, Kathmandu is the highest populated district and Morang is the second highest populated district.

Total Population of Kathmandu district is 20,17,532 and Total Population of Morang District is 11,47,186.

S.N.	Name of District	Total Population
1.	Kathmandu	20,17,532
2.	Morang	11,47,186
3.	Rupandehi	11,18,975
4.	Jhapa	9,94,090

S.N.	Name of District	Total Population
5.	Sunsari	9,34,461

### The 5 Lowest populated districts

According to the Nepal population 2078, The lowest populated district is Manang and the second lowest populated district is Mustang.

S.N.	Name of District	Total Population
1.	Manag	5,645
2.	Mustang	14,596
3.	Dolpa	42,959
4.	Rasuwa	45,554
5.	Humla	55,496

Total population of Manang district is 5645 and Total population of Mustang district is 14,596.

### जनसंख्या र लैंगिक अनुपात

राष्ट्रिय जनगणना २०७८ को प्रारम्भिक नतिजा अनुसार नेपालको जनसंख्या २,९९,९२,४८० पुगेको छ, जुन दश वर्षअघि ( २०६८ साल) को जनसंख्या २,६४,९४,५०४ को तुलनामा २६,९७,९७६ ले बढी हो। दश वर्षमा नेपालको जनसंख्या १०.१८ % ले बढेको देखिन्छ। विगत दश वर्षको सरदर वार्षिक वृद्धिदर ९९ भन्दा बढी न्वयधतज० ०.९३% देखिन्छ। जुन अघिल्लो जनगणनामा १.३५% रहेको थियो। कुल जनसंख्यामा १,४२,९९,३९९ जना पुरुष ( ४८.९६%) र १,४९,०९,१६९ जना महिला (५१.०४%) रहेको छ। दश वर्ष अघि २०६८ सालको जनगणनामा कुल जनसंख्या २,६४,९४,५०४ जनामा पुरुष र महिलाको हिस्सा क्रमशः ४८.५% र ५१.५% थियो। हालको प्रारम्भिक नतिजा अनुसार लैंगिक अनुपात (प्रति १०० महिलामा पुरुषको संख्या) ९५.९९ रहेको छ जुन गत जनगणनामा ९४.९६ रहेको थियो।

### जनगणना घर र परिवार संख्या

राष्ट्रिय जनगणना २०७८ को प्रारम्भिक नतिजा अनुसार नेपालमा अक्सर बसोबास गर्ने परिवारको संख्या ६७,६९,०५९ रहेको छ र ती परिवारहरू जम्मा ५६,४३,९४५ वटा घरमा बसेका देखिएको छ अर्थात अर्थात १० वटा घरमा औसतमा

१२ वटा परिवार बसोवास गरेको देखिन्छ । हालको परिवार संख्या दश वर्ष अघिको भन्दा करिब २४.५७% ले वृद्धि भएको हो । यस अवधिमा जम्मा १३,३३,७५७ वटा परिवार थप भएको देखिन्छ ।

### परिवारको आकार

राष्ट्रिय जनगणना २०७८ को प्रारम्भिक नतिजा अनुसार प्रति परिवार ४.३२ जना सदस्य रहेको देखिन्छ जुन २०६८ मा ४.८८

जना थियो । शहरी क्षेत्रको परिवारमा सालाखाला ४.२५ जना रहेका छन् भने ग्रामीण क्षेत्रमा ४.५५ जना रहेको देखिन्छ जुन

दश वर्षअघि क्रमशः ४.३२ जना र ५.०२ जना थियो । भौगोलिक क्षेत्र अनुसार हिमाली क्षेत्रमा सालाखाला ४.२७ जना,

पहाडमा ३.९५ जना र तराई क्षेत्रमा ४.६५ जना प्रतिपरिवार रहेको देखिन्छ । प्रदेशगत आधारमा हेर्दा परिवारमा औसत सदस्य सङ्ख्या गण्डकी प्रदेशमा सबैभन्दा कम (३.६६ जना) र मधेश प्रदेशमा सबैभन्दा बढी (५.६६ जना) रहेको छ जुन २०६८ सालमा क्रमशः ४.१६ जना र ५.८० जना रहेको थियो । जिल्ला अनुसार परिवारको आकार सबैभन्दा सानो दोलखामा (३.४१ जना) देखिएको छ भने परिवारको आकार सबैभन्दा ठूलो रौतहट जिल्लामा ५.९२ जना देखिएको छ ।

### भौगोलिक क्षेत्र अनुसार जनसंख्या, लैंगिक अनुपात र वृद्धिदर

भौगोलिक क्षेत्र अनुसार कुल जनसंख्याको वितरणमा तराई क्षेत्रको अंश २०६८ सालको तुलनामा २०७८ मा वृद्धि भएको

देखिएको छ । २०६८ सालको जनगणनामा तराईमा कुल जनसंख्याको ५०.२७% हिस्सा रहेकोमा २०७८ मा वृद्धि भई ५३.६६%

पुगेको छ । हिमाली क्षेत्रमा कुल जनसंख्याको ६.७३% अंश रहेकोमा २०७८ मा केही कम भई ६.०९% रहेको देखिन्छ । त्यसैगरी

पहाडी क्षेत्रमा २०६८ मा ४३.०१% अंश रहेकोमा हाल ४०.२५%मा झरेको छ । दश वर्षको अवधिमा लैङ्गिक अनुपात तराईमा १ % विन्दुले घटेको देखिन्छ भने हिमाल तथा पहाडमा क्रमशः ३ % र ४ % विन्दुले बढेको देखिन्छ । यो गत २०६८ को जनगणनामा हिमाल, पहाड र तराईमा क्रमशः ९४, ९१ र ९७ रहेकोमा २०७८ सालको जनगणनाको प्रारम्भिक नतिजा सम्म आइपुग्दा क्रमशः ९७, ९५ र ९६ कायम हुन आएको छ । वार्षिक जनसंख्या वृद्धिदर हिमाली क्षेत्रमा ऋणात्मक (-०.०२%), पहाडी क्षेत्रमा न्यून मात्रामा धनात्मक (०.२९% ) र तराई क्षेत्रमा अन्य क्षेत्रको तुलनामा उच्च धनात्मक (१.५६%) वृद्धि देखिन्छ ।

### प्रदेश अनुसारको जनसंख्या, वृद्धिदर र परिवर्तन

प्रदेशगत रूपमा जनसंख्याको वितरण सबैभन्दा धेरै जनसंख्या मधेश प्रदेशमा ६१,२६,२८८ र सबैभन्दा कम कर्णाली प्रदेशमा

१६,९४,८८९ जना रहेको छ जुन कुल जनसंख्याको क्रमशः २०.९९% र ५.८१% छ । लैङ्गिक रूपले विश्लेषण गर्दा लैङ्गिक

अनुपात सबैभन्दा धेरै मधेश प्रदेशमा र सबैभन्दा कम सुदूरपश्चिम प्रदेशमा क्रमशः १०१ र ९० रहेको छ ।

## **Ravenstein's Laws of Migration**

In 1876, 1885 and 1889, Ernst Ravenstein, an Anglo-German geographer, published papers on internal and international migration in Britain, Europe and North America. He generalized his findings as “laws of migration”, which have informed subsequent migration research. This paper aims to compare Ravenstein’s approach to investigating migration with how researchers have studied the phenomenon more recently. Ravenstein used lifetime migrant tables for counties from the 1871 and 1881 censuses of the British Isles. Data on lifetime migrants are still routinely collected but, because of the indeterminate time interval, they are rarely used to study internal migration. Today, internal migration measures from alternative sources are used to measure internal migration: fixed interval migrant data from censuses and surveys, continuous records of migrations from registers, and “big data” from telecommunications and internet companies.

Ravenstein described and mapped county-level lifetime migration patterns, using the concepts of “absorption” and “dispersion”, using migration rates and net balances. Recently, researchers have used lifetime migrant stocks from consecutive censuses to estimate country to country flows for the world. In the last decade, an Australian-led team has built an international database of internal migration flow data and summary measures. Methods were developed to investigate the modifiable areal unit problem (MAUP), in order to design summary internal migration measures comparable across countries. Indicators of internal migration were produced for countries covering 80 percent of the world’s population.

Ravenstein observed that most migrants moved only short distances, anticipating the development of “gravity” models of migration. Recent studies calibrated the relationship between migration and distance, using gravity models. For mid-19th century Britain, Ravenstein found the dominant direction of internal migration to be towards the “centres of commerce and industry”. Urbanization is still the dominant flow direction in most countries, though, late in the process, suburbanization, counter-urbanization and re-urbanization can occur. Ravenstein focussed on place-specific migration, whereas today researchers describe migration flows using area typologies, seeking spatial generality. Ravenstein said little about migrant attributes except that women migrated more than men. In recent decades, the behaviour of migrants by age, sex, education, ethnicity, social class and partnership status have been studied intensively, using microdata from censuses and surveys.

Knowledge about processes influencing internal and international migration has rarely been built into demographic projections. Scenarios that link migration with sub-national or national inequalities and with climate or environmental change are influencing the design of policies to reduce inequalities or slow global warming.

- There is an inverse relation between distance and volume of migration. Majority of migrants moves to short distance only. Migrants going long distance generally go by preference to the large centres of commerce and industry.
- Migration proceeds step by step. The inhabitants of countryside flock into the nearby rapidly growing town. The inhabitants of the town then move to the nearby urban centre up in the hierarchy.
- Every migration current produces a counter-current.
- The native of the rural areas are more mobile than their counterpart in the urban areas, and the major direction of migration is from agricultural areas to the centres of industry and commerce.
- Migration is highly age selective where adults in the working age groups display a greater propensity to migrate.
- Volume of migration increases with the process of diversification of the economy, and improvement in transport facilities.
- Migration occurs mainly due to economic reasons.

## 4.5 Agriculture and industries as major human activities

### A. Agriculture

#### Definitions of farming systems

There is a large diversity in definitions for farming systems. The most frequently used are these:

- A farming system is a decision-making unit comprising the farm household, cropping and livestock system that transform land and labor into useful products, which can be consumed or sold (Fresco and Westphal, 1988).
- A farming system is a resource management strategy to achieve economic and sustained production to meet diverse requirement to farm household while presenting resources base and maintaining a high-level environmental quality (Lal and Miller, 1990).
- A farming system is a set of agro-economic activities that are interrelated and interact with themselves in a particular agrarian setting. It is a mix of farm enterprises to which farm families allocate its resources in order to efficiently utilize the existing enterprises for increasing the productivity and profitability of the farm. These farm enterprises are crop, livestock, aquaculture, agroforestry and agri-horticulture (Sharma et al., 1991).

- A farming system is a mix of farm enterprises such as crop, livestock, aquaculture, agroforestry and fruit crops to which farm family allocates its resources in order to efficiently manage the existing environment for the attainment of the family goal (Lal and Miller, 1990).
- A farming system is a unique and reasonable stable arrangement of farming enterprises that a household manages according to well defined practices in response to the physical, biological and socio-economic environment and accordance with the household goals preferences and resources (Shaner et.al., 1981).
- A farming system is defined as a complex interrelated matrix of soil, plants ,animals, implements, power, labor, capital and other inputs controlled in part by farming families and influenced to varying degrees by political, economic, institutional and social forces that operate at many levels (Dixon et al., 2001).
- A farming system is defined as a population of individual farm systems that have broadly similar resource basis, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate (FAO, [univ.fao.org/farming systems](http://univ.fao.org/farming_systems)).

There are significant differences among farming systems depending largely on agro-ecological conditions and pedo-climatic zones. This agro-ecological diversity, plus the heterogeneity of economic, political and social conditions has resulted in the development of a wide variety of farming systems.

### **Agriculture system in Nepal**

Nepal is an agricultural country having 66 percent people directly engaged in farming. Farming is subsistent in nature and crop is mostly integrated with livestock. Nepal is richly endowed with agro-biodiversity. Rice, maize, millet, wheat, barley and buckwheat are the major staple food crops. Similarly, oilseeds, potato, tobacco, sugarcane, jute and cotton are the important cash crops whereas lentil, gram, pigeon pea, blackgram, horsegram and soyben are the important pulse crops. Nepal is also famous for orthodox tea, large cardamom, turmeric and zinger too. Most Nepalese farmers grow diversified crops in order to hedge against erratic and uncertain weather and other unfavourable agronomic conditions.

Livestock is one of the important sources of cash income of the farm households. Livestock products which are sold for cash. The cash needs of the farm families are mainly met through the sale of milk, yoghurt, cheese, ghee, Chhurpi, meat, egg and live animals and poultry. Generally, farm families in mountains raise Yak or Chauri (Himalayan breed of cow) and sheep, in hills cow, sheep, goat and rural poultry and in Terai buffalo, cow, goat and poultry. Poultry husbandry is emerging enterprise in Terai and hills. Human and animal labours are major sources of farm power.

In addition, Nepal grows a number of fruit and vegetable crops. Some important ones are Apple, peach, pear, plum, walnut, orange, lime, lemon, mango, lichi, banana, pineapple, papaya, cucumber, lady's finger, brinjal, pumpkin and several leafy vegetables. Fresh water fish culture is another emerging enterprise in Terai whereas rainbow trout in the hills and in the lower mountains. On April 25th 2015, a 7.8 magnitude earthquake struck Nepal, with a series of strong aftershocks including one of 6.7 magnitude, and triggering avalanches in the mountains. It was the worst earthquake to hit Nepal in 80 years. Estimates indicated more than 8000 people died and many more were injured. On May 12th 2015, a second, 7.3 magnitude earthquake struck Nepal, again with strong aftershocks. The United Nations estimated that approximately eight million people had been affected by the earthquakes. Destruction of buildings, roads and other infrastructure will make re-building a long-term challenge.

### **Farming types: -**

There are three types of farming/types of agriculture and they are as follow: -

#### **Subsistence farming**

1. Subsistence farming is described as family [farming](#) because it meets the needs of the farmer's family. It required a low level of technology and household labour.
2. These types of farming produce small output. They do not use high yielding varieties of old seeds and fertilizer.
3. Facilities like electricity and irrigation are not available for them. Most subsistence farming is done manually.
4. Subsistence farming can be classified in two types:-

#### **Intensive subsistence farming:-**

- It includes a small plot of land and for growing crops, simple and low-cost tools, and more labour. The word intensive means hard work, so it means it requires more labour.
- The climate of this farming with a large number of days with sunshine and fertile soils permit growing more than one crop annually in the same land.
- Rice is the main crop of this farming. Other crops include wheat, maize, pulses, and oilseeds.
- This farming is spread in the thickly populated area of the monsoon regions. These regions are south, South East, East Asia.



### **Primitive subsistence farming:-**

It includes shifting cultivation and nomadic herding.

### **Shifting cultivation:-**

- This cultivation spread in thickly forested areas like amazon basin, tropical Africa, Southeast Asia, and northeast India. These are the areas of heavy rainfall.
- It is a quick regeneration of vegetation.
- The process of shifting cultivation is that first of all the land is cleared by falling trees and burning them. Then the ash of the trees is mixed with the land soil.
- This cultivation farming is grown on crops like maize, yam, potatoes, and cassava. Crops are grown in this land for 2 or 3 years. Then the land left out because fertilizer of the soil decreases.
- The farmers move to the other land to repeat this process. This is also called 'slash and burn agriculture'.

- Shifting cultivation is known by different names in different parts of the world

### **2. Commercial Farming**

- In this farming, crops are growing for sale in the market. The main purpose of this farming is to do business.
- It required large areas and a high level of technology.
- It's done with the high cost of tools.
- Commercial farming is 3 types.

### **Commercial grain farming:-**

- This farming is done for grains.

- This farming is done in the winter season.
- In this farming, only a single crop can be grown at one time.
- This farming spread in North America, Europe, and Asia.
- These areas are populated with large farmers.

### **Commercial mixed farming:-**

- This type of farming is done for growing foods, fodders crops.
- In this farming, one or more crops are grown together.
- It has good rainfall and irrigation.
- The crops are cared for carefully.
- The crops are done almost at the same duration.
- This farming is most used in Europe, eastern USA Argentina, southeast Australia, New Zealand and South Africa.

### **Commercial plantation farming:-**

- This farming required a large amount of labour and large areas.
- It used simple crops like tea, coffee, cotton, rubber, banana, and sugarcane.
- The products are processed in the farm itself or nearby factories.
- These products do not directly go to the sale. After growing these products, the leaves are roasted in the factories or farms. These are all tree crops.
- This farming required large transportation because the products of this farming are transported to one area to another area.
- Areas of plantation farming in tropical regions of the world –

1. Like rubber in Malaysia.
2. Tea in India.
3. Coffee in Brazil.

- This farming is mostly done in hilly areas like sub-Himalayan, Nilgiri and west Bengal.
- This farming takes a long period to mature the products but these are produced for long periods.

### 3. Home Farming: -

- Home farming includes terrace farming, gardening.
- It required small space and small tools like a garden rake, pruning shear, etc.
- This farming has the ability to grow any vegetable, fruits, flowers, and small trees in the same land.
- This farming is also used as a decorated thing for the home.
- It required small labour.
- This farming used as both commercial and subsistence.

### There are two types of farming: -

Do you know how many types of farming are done in India? If not, then we are classified below types of farming in India. Have a look for detailed information about types of farms.

#### 1. CONTAINER FARMING: -

This farming is used when you have limited space in gardens, be it a small yard, courtyard or balcony. This farming has the ability to grow almost any vegetable, fruit, and flowers.

#### 2. Vertical Farming: -

It is described as a window garden. Most vertical farming is used for small plant crops and vine crops. It includes gheeya, Loki, tomato, chili, coriander. The production of vine crops is less in the traditional way, vertical farming is very useful for vine crops.

## Cropping pattern

Cropping pattern refers to the proportion of land under cultivation of different crops at different points of time. This indicates the time and arrangement of crops in a particular land area. Any change in the cropping pattern would cause:

- change in the proportion of land under different crops
- change in space sequence and time of crops

In India, the cropping pattern is determined by rainfall, temperature, climate, technology and soil type.

In order to obtain maximum yields, different patterns of cropping are practised. The major cropping patterns include the following:

### Monocropping

Monocropping reduces soil fertility and destroys the structure of the soil. Chemical fertilizers are required to upgrade production. This practice allows the spread of pests and diseases.

### Mixed Cropping

When two or more crops are grown on the same land simultaneously, it is known as mixed cropping. For eg., growing wheat and gram on the same land at the same time is mixed cropping. This practice minimizes the risk of failure of one of the crops and insures against crop failure due to abnormal weather conditions.

The crops to be grown together should have a different maturation time and different water requirements. One tall and one dwarf crop should be grown together. The [nutrients](#) required by one crop should be less than those required by the other. One crop should have deep roots, other's should be shallow. All these criteria lead to a successful mixed cropping pattern.

#### Advantages of Mixed Cropping

- The crop yield increases.
- The pest infestation is minimized.
- Reduction in the risk of crop failure.

- The soil is utilized properly.
- More than one variety of crops can be harvested at the same time.

## **Intercropping**

Intercropping is the practice of growing more than one crop on the same field at the same time in a definite row pattern. After one row of the main crop, three rows of intercrops can be grown. This increases productivity per unit area.

Intercropping can be of different types:

### Row Intercropping

When the component crops are arranged in alternate rows it is known as row intercropping. It helps in optimum utilization of land space and suppression of weeds during the early stages of the main crop.


### Strip Intercropping

When two or more crops are grown in wide strips so that the two crops can be managed separately, it is known as strip cropping. However, the crops are close enough to interact.

### Relay Intercropping

In this type of intercropping, a second crop is planted when the existed crop has flowered but not harvested. For eg., Rice-Cauliflower-Onion-Summer gourds.

### Advantages of Intercropping

- 
- The fertility of the soil is maintained.
  - The spread of diseases and pests is controlled.
  - Optimum utilization of resources.
  - The space and time of growing more than one crop are saved.
  - Maximum utilization of nutrients present in the soil.

Maize and soybean, bajra and lobeas are some of the crops grown as intercrops.

## Crop Rotation

In this pattern, different crops are grown on the same land in preplanned succession. The crops are classified as one-year rotation, two-year rotation, and three-year rotation, depending upon their duration.

Legumes are included in the crop rotation programme to increase soil fertility. The crops which require high fertility level (wheat) can be grown after the legumes. The crops which require low inputs can be grown after the crops that require high inputs.

How are the crops selected for Rotation?

While selecting the crops for rotation, the following criteria should be adopted:

- Enough moisture should be available.
- Availability of fertilizers, man-power, and machine-power.
- Marketing and processing facilities.
- Availability of nutrients in the soil.
- The crop duration- short or long.

### *Advantages of Crop Rotation*

- The soil fertility is maintained for a prolonged period.
- The growth of weeds and pests is prevented.
- A lot of chemical fertilizers are not required.
- The physical and chemical nature of the soil remains unaltered.

### **Factors Affecting Cropping Patterns**

The cropping patterns determine the level of agricultural production. This reflects the agricultural economy of any region. The cropping patterns are affected by changes in agrarian policy, availability of agricultural inputs, improvement in technology. Thus, the cropping patterns are beneficial in improving the fertility of the soil, thereby, increasing the yield of the crops. It ensures crop protection and availability of nutrients to the crops.

## B. Industry

- **industry**, group of productive enterprises or organizations that produce or supply goods, services, or sources of income.
- In economics, industries are generally classified as primary, secondary, tertiary, and quaternary.
- An industry is a group of companies that are related based on their primary business activities. In modern economies, there are dozens of industry classifications. Industry classifications are typically grouped into larger categories called sectors.
- Similar businesses are grouped into industries based on the primary product produced or sold.
- This effectively creates industry groups, which can then be used to isolate businesses from those who participate in different activities.
- Investors and economists often study industries to better understand the factors and limitations of corporate profit growth.
- Companies operating in the same industry can also be compared to each other to evaluate the relative attractiveness of a company within that industry.

### Primary industry

- This sector of a nation's economy includes agriculture, forestry, fishing, mining, quarrying, and the extraction of minerals.
- It may be divided into two categories: genetic industry, including the production of raw materials that may be increased by human intervention in the production process;
- Extractive industry, including the production of exhaustible raw materials that cannot be augmented through cultivation.
- The genetic industries include agriculture, forestry, and livestock management and fishing—all of which are subject to scientific and technological improvement of renewable resources.
- The extractive industries include the mining of mineral ores, the quarrying of stone, and the extraction of mineral fuels.

### Secondary industry

- This sector, also called manufacturing industry, (1) takes the raw materials supplied by primary industries and processes them into consumer goods, or (2) further processes goods that other secondary industries have transformed into products, or (3) builds capital goods used to manufacture consumer and nonconsumer goods.
- Secondary industry may be divided into heavy, or large-scale, and light, or small-scale, industry.

- Large-scale industry generally requires heavy capital investment in plants and machinery, serves a large and diverse market including other manufacturing industries, has a complex industrial organization and frequently a skilled specialized labour force, and generates a large volume of output. Examples would include petroleum refining, steel and iron manufacturing.
- Light, or small-scale, industry may be characterized by the nondurability of manufactured products and a smaller capital investment in plants and equipment, and it may involve nonstandard products, such as customized or craft work.
- The labour force may be either low skilled, as in textile work and clothing manufacture, food processing, and plastics manufacture, or highly skilled, as in electronics and computer hardware manufacture

### **Tertiary industry**

- This broad sector, also called the service industry, includes industries that, while producing no tangible goods, provide services or intangible gains or generate wealth.
- This sector generally includes both private and government enterprises.
- The industries of this sector include, among others, banking, finance, insurance, investment, and real estate services; wholesale, retail, and resale trade; transportation; professional, consulting, legal, and personal services; tourism, hotels, restaurants, and entertainment; repair and maintenance services; and health, social welfare, administrative, police, security, and defense services.

### **Quaternary industry**

- An extension of tertiary industry that is often recognized as its own sector, quaternary industry, is concerned with information-based or knowledge-oriented products and services.
- Like the tertiary sector, it comprises a mixture of private and government endeavours.
- Industries and activities in this sector include information systems and information technology (IT); research and development, including technological development and scientific research; financial and strategic analysis and consulting; media and communications technologies and services; and education, including teaching and educational technologies and services.

### **History of Industrial Development in Nepal**

- In Nepal, industrial development started rather late due to the closed socio-political and economic status of the country during the Rana Regime. So, the history of industrial in 1936.
- Thereafter, in 1940, (i.e. information dissemination about cottage level skill- based enterprises) was established.



- The early and gradually developed industries were cigarette and match factories. Raghupati Jute Mills established in 1946 is regarded as the first modern industry of Nepal.
- The development of industrial sector is a crucial to attain prosperity, generate employment, alleviate poverty, promote trade and stimulate growth of national income.
- Industrial development of Nepal over past decades remains not much satisfactory. The manufacturing sector employed just 6.6 percent of the total workforce.
- Most industries are located around various urban areas of the nation like Kathmandu Valley, Biratnagar, Simara, Birgunj, Hetauda, Pokhara, Butwal, Nepalgunj and other places of the Terai region (CBS, 2014).
- England was the first country in the world to bring about industrial revolution in the beginning of the 18th century. The notable point here is that at that time there were no policies in Nepal related to industrial development.
- The process of planned industrialization started with the launching of the First Five-year Plan in 1956.
- Gradually, a number of small, medium and large-scale industries were established in the public along with private sectors.
- The foundation for the industrial estates (IEs) was laid with the establishment of Balaju Industrial Estate (BIE) in 1963 with the technical and financial assistance from the United States of America (USA).
- The main reason behind establishing the industrial estates was to facilitate the development of industries and manufacturing enterprises in the country by providing basic infrastructures like land, roads, energy, water supply, sewerage, communication etc. at a specifically designated place.
- Industrial Development Management Limited (IDML) was constituted by the Government of Nepal (GoN) in July 1988 in order to boost the balanced regional development by making optimum utilization of local capital, natural resources (agriculture and forest based etc.) and human resources for industrial promotion).
- There are 11 industrial estates and 10 are in operation except Dhankuta, six are being developed and five are proposed for consideration

**Table 1: Basic Information of Industrial Estates by 2018**

S. N.	Industrial Estates	Estd. Year	Financial Assistance	Location	Employment	Land Area (in ha.)	No. of Industries		
							Total	Running	Closed
1	Balaju	1960	USA	Kathmandu	4200	34.09	141	125	5
2	Patan	1963	India	Lalitpur	2000	14.91	118	113	2
3	Hetauda	1963	USA	Makwanpur	4100	158.73	134	102	4
4	Dharan	1972	India	Sunsari	797	10	35	29	3
5	Nepalgunj	1973	India	Banke	991	11.65	35	33	2
6	Pokhara	1974	Nepal	Kaski	3000	25.5	89	81	3
7	Butwal	1976	Nepal	Rupandehi	1859	22.09	72	65	3
8	Bhaktapur	1979	Germany	Bhaktapur	800	3.63	37	36	1
9	Dhankuta	1980	Nepal	Dhankuta	NA	3.26	NA	NA	NA
10	Birendranagar	1981	Netherlands	Surkhet	300	4.58	28	22	2
11	Gajendranarayan	1986	India	Saptari	40	14.96	11	5	4
	Total				18087	303.40	700	611	29

Source: IDML, 2018.

**Table 5: Registration of Different Nature of Industries up to 2018**

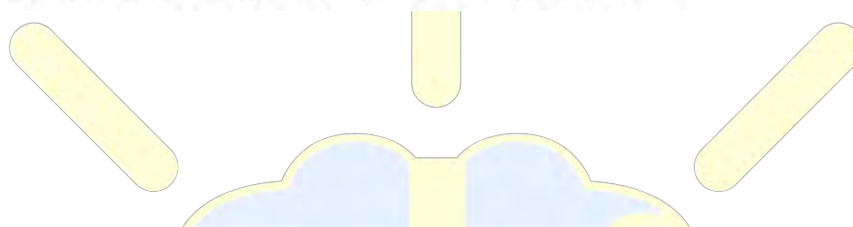
Categories	No. of Industries	Total Capital (Rs. in millions)	Fixed Capital	Working Capital	Employment Generation
Agriculture and forest based	442	23267.22	20117.54	3267.69	34898
Construction	55	48898.03	47473.36	1424.68	3648
Energy based	329	929637.6	910526.67	19110.92	31291
Information Technology	38	1651.5	1377.45	274.05	1852
Manufacturing	2897	396695.2	307014.32	90151.38	312591
Mineral	68	6870.81	5756.39	1116.52	7119
Service	2085	144828.95	95992.45	48882.5	119992
Tourism	1615	129070.55	117056.96	12005.39	64105
Total	<b>7529</b>	<b>1680919.86</b>	<b>1505315.14</b>	<b>176233.13</b>	<b>575496</b>

Source: Based on Industrial Statistics, 2017/18.

**Table 6: Registered of Scale-wise Industries up to 2018**

Scales of Industries	No. of Industries	Percent	Total Capital (Rs. in millions)	Percent	No. of Employment	Percent
Large	1030	13.68	1452564.3	86.42	149263	25.94
Medium	1,640	21.78	149426.37	8.89	152504	26.50
Small	4,859	64.54	78,929.22	4.69	273729	47.56
<b>Total</b>	<b>7,529</b>	<b>100</b>	<b>1680919.9</b>	<b>100</b>	<b>575496</b>	<b>100</b>

Source: Department of Industry, Ministry of Industry, GoN, 2018.



**Table 8: Country-wise Investment on Nepalese Industries (Rs. in 10 millions)**

Countries	No. of Industries*	Total Investment	Foreign Investment	Share in Total Investment	Employment Generation
India	713	13652.8	8680.3	35	68655
China	1226	9191.3	6346.7	25.6	56505
China Hong Kong	36	3707.2	2728.2	11	4782
South Korea	324	1624.5	1149	4.6	11070
USA	375	2083.7	838	3.4	17654
British Virgin Island	16	1630.3	806.4	3.3	2180
UK	169	897.2	538.6	2.2	10702
Mauritius	10	391.8	335.5	1.4	974
Singapore	44	820.7	296.2	1.2	3207
UAE	17	540.6	290.4	1.1	1827
Other 82 Countries	1343	6853.7	2776.5	11.2	59578
<b>Total 92 Countries</b>	<b>4273</b>	<b>41393.8</b>	<b>24785.8</b>	<b>100</b>	<b>237134</b>

Note: An asterisk \* denotes first eight months of the FY 2017/18.

Source: Economic Survey, 2018.

Distribution of Industries by Provinces

**Table 9: Province-wise Registration of Industries by 2018**

Names of Provinces	No. of Industries	Percent	Total Capital (Rs. in 10 millions)	Employment Generation	Percent
Province-1	673	9.18	34263.7	73610	12.98
Province-2	491	6.69	8374.9	50246	8.86
Bagmati	4961	67.64	58602.4	345947	61.01
Gandaki	556	7.58	25930.2	32441	5.72
Province-5	508	6.93	15521.3	52965	9.34
Karnali	38	0.52	10981.7	2562	0.46
S u d u r Paschim	107	1.46	2643.3	9263	1.63
<b>Total</b>	<b>7334</b>	<b>100</b>	<b>156317.5</b>	<b>567034</b>	<b>100</b>

Source: Economic Survey, 2018.

### Distribution of Cottage and Small Industries By Provinces

The governments of all provinces have been trying hard to raise the development of cottage and small scale industries. For the purpose it has been devising various policies and making or revising acts and changes in rules from the beginning in order to attract investments in the manufacturing sector as well as stressing on the expansion of the availability of resources.

**Table 10: Distribution of Cottage and Small Industries by Provinces**

Provinces / FY	2013/14	2014/15	2015/16	2016/17	2017/18*	Total
Province - 1	2455	4095	3387	4333	1904	16174
Province - 2	2583	2819	2318	4820	3187	15727
Bagmati	7530	8419	8275	10057	5532	39813
Gandaki	2234	3039	2598	3180	2371	13422
Province - 5	5330	4809	4494	5637	3774	24044
Karnali	742	1225	1202	1579	506	5254
Sudur Paschim	1280	1864	2043	2433	1288	8908
<b>Total</b>	<b>22154</b>	<b>26270</b>	<b>24317</b>	<b>32039</b>	<b>18562</b>	<b>123342</b>

Note: An asterisk \* denotes the first eight months of the FY 2017/18.

Source: Economic Survey, 2018.

## Special Economic Zone (SEZ)

- The Special Economic Zone (SEZ) Act - 2017 has formulated for the establishment of export promotion of Nepal.
- The government of Nepal agreed to the concept of SEZ by attracting foreign and national investors to establish industrial and business activities.
- After this, the government has so far declared two SEZs which are one in Bhairahawa of Rupandehi District and another in Simara of Bara District.
- Similarly, in total the government has planned to create a minimum of seven SEZs throughout the country; making one SEZ in each of the seven provinces.
- The Ministry of Industry, Commerce and Supplies has completed feasibility study of establishing SEZ in Biratnagar of Province-1, Panchkhal of Bagmati Province, Gorkha of Gandaki Province, Jumla of Karnali Province and Dhangadhi of Sudur Paschim Province as well as eleven are proposed for consideration.
- Cottage industries cover almost 98.17 percent out of total industries in low investment i.e. 21.44 percent and provide mass employment 81.75 percent in comparison to others.
- Cottage, small and medium scale industries cover almost 99.76 percent out of total industries in low investment i.e. 34.07 percent and provide mass employment i.e. 95.56 percent in comparison to large scale industries.

## Problems to Industrial Development in Nepal

- **Inadequate Physical and Social Infrastructures:-** Physical infrastructures such as road, energy, communication, irrigation and social infrastructures such as education, health and sanitation are insufficient. That is why private sectors are also centralized in urban areas only.
- **Lack of Corporate Culture and Institutions:-** Lack of corporate culture and intuitional development energetic people of Nepal are unable to develop managerial and entrepreneurial skills for maximum utilization of available resources. Business community is not taking risk by establishing new industries. However, they are actively participating in trading.
- **Lack of Political Stability and Will-Power:-** Nepal has been unable to mobilize resources even if it has sufficient water resources, human resources, natural beauties, cultural heritages and bio-diversities because of long standing instability and lack of strong willpower of political leaders.

- **Vicious Circle of Poverty:-** About 21 percent people are living below absolute poverty line (MoF, 2018). So, energetic youths are facing problems of capital deficiency. On the basis of the principle of vicious circle in level of income remains low, this leads to low level of saving and investment. Consequently, low investment leads to low productivity which again leads to low income. In economics, the cycle of poverty is the of factors or events by which poverty, once started, is likely to continue unless there is outside intervention.”
- **Socio Cultural Constraints:-** Socio-cultural values are one of many interacting factors that can impact economic as well as industrial development and influence on how we approach the process of economic development due to a set of values, beliefs, traditions and habits.
- **Market Imperfection:-** Imperfect market becomes a barrier to achieve economic efficiency and fair business activities. On the contrary, under perfect competition, a firm or industry can operate at the point where there is no surplus of capacity that means resources are fully utilized.
- **Human Resource Development:-** In this age of global competition, it is not just enough for the Nepalese firms to be competitive at the domestic level. For that industrial sector should have to improve economies of scale through technological advancement, marketing strengths, efficient production and distribution systems as well as affordable labor. Building up skill and competitive human resources is the key for catching opportunities for market opening and widening. East Asian countries have good examples of success stories.
- **Difficult Geographical Location:-** Nepal is surrounded by India on three sides and China on one side. So, it is a land-locked country whose transit facilities are determined by the willingness of India. Nepal has a bitter past experience in case of export and import.

### Prospects of Industrial Development in Nepal

**Hydro-electricity:-** There is a significant prospect of hydroelectricity due to high water current and 6000 rivers whose length are about 45000 km as well as estimated that about 44000 MW of economically feasible electricity can be generated from the available water resources. So, it has potential to promote industrial as well as agriculture production.

**Tourism:-** Nepal is full of natural beauty, great Himalayas, adventure places, unique cultural heritages, wide range of biodiversity and historical religious places. So, there are ample opportunities in the tourism industry.

**Forest / Herbs:-** The total area covered by forests in Nepal remains about 40.4 percent and thousands community forest user groups. In the context of sustainable conservation of biodiversity, about 23.4 percent of the total land is covered by conservation areas (MoF, 2018). In Himalayan and Hilly regions, there are different species of herbs such as Peepla, Timmur, Yarchagumba, Neem, Harro, Barro, Panchaale, large cardamom, ginger, turmeric etc. are available.

**Agro-processing:-** Majority of the people are dependent for their income and employment in agriculture and contribute 27.59 percent in GDP (MoF, 2018). So, possibility of agrobased industries such as sugar, tea, mango juice, apple juice, bel juice, tobacco, honey, milk, fish, meat and floriculture etc.

**Information Technology:-** Information technology has emerged as a strong means for developing business sectors such as tele-medicine, tele-education, e-commerce, e-trade, egovernance and so forth.

**Human Resource Development:-** Nepal has also potentiality to improve and capitalize her human resources through applied education and different vocational training which would be appropriate to mobilize her available resources as its potential capacity like in East Asia. Above mentioned prospects are positive indications of bringing the pace of the industrial development of country and catch the track of prosperity.

### **Meaning of Tourism Industry:**

Tourism is defined as an act of travel of people by any purpose from one place to another place of a country or from one country to another country. The provision made to facilitate tourists such as hotel, lodge, trekking and travel agency, rafting, guide, etc is called Tourism Industry.

Nepal is a tourism centre where people from different countries come to visit. It is providing employment opportunities to many people directly and indirectly. It contributes about 2.2% to the GDP of Nepal in 2017/18. According to the WTTC, the share of the travel and tourism sector in India's GDP is about 10 per cent. It is about 5 per cent in Nepal. Spain maintains first place globally in the global travel and tourism competitiveness index. The 2017 report covers 136 economies, of which China ranks 15th, India 40th and Nepal 103rd in global rankings. In order to promote the country's tourism industry, the government has announced the 'Visit Nepal 2020' campaign with the aim of bringing in two million tourists by 2020. In recent years, the country's tourism industry has witnessed positive signals along with the increase in the inflow of foreign tourists after being badly hit by the devastating earthquake of 2015. According to the Economic Survey of 2018/19, the number of tourist arrivals in 2018, not counting Indian tourists who arrived by land, was 1,173,072, which is 25 per cent more than in 2017. While analysing the total number of tourist arrivals by country, the top five tourist generating countries are India, China, USA, UK and Sri Lanka respectively,

making up nearly half of all tourist arrivals. The tourism industry raked in foreign currency equivalent to Rs 76.09 billion in 2017/18. Of the total number of tourists visiting Nepal in 2018 by purpose, more than a two-thirds of them arrived for vacation, entertainment or travel. Of which, entertainment made up 60 per cent, mountaineering/trekking 16 per cent, religious tours 14.4 per cent and others 9.6 per cent. In addition to foreign tourists, there is an increasing trend of internal tourists visiting different parts of Nepal. Given the growing commotion of people, lured by the natural, cultural, historical, and ethnic diversity, Nepal is capable of transforming the overall socio-economic status of the country. Some of the major tourism activities in Nepal are mountain climbing, trekking, paragliding, rafting, bungee jumping, mountain flight, rock climbing, mountain biking, jungle safari, rock climbing, bird watching and sightseeing. Hence, use of local products and skills play a pivotal role in promoting tourism that can lead to economic prosperity of the country. Nepal holds great potential for tourism development, which can stimulate economic growth and development. For Nepal, tourism is the main instrument for regional development with positive economic impact on the income, employment and production. In recent years, there has been exponential growth in the number of travel agencies, tour guides, tour operators, rafting agencies and trekking agencies. In 2018, the number of registered travel agencies reached up to 3,508 and trekking agencies 2,649. However, tourism may also have a negative impact on the environment. For sustainable tourism development, there should be optimum utilisation of natural resources and minimisation of ecological, cultural and social impacts. Additionally, there is a need for conducive policies and strategies by the government that will help improve the livelihood of the local communities through balanced and sectoral tourism development.

People do not like to stay in one place forever. They want to travel or Visit different places from time to time with different objectives. A person who visits a place, away from where s/he usually resides, for pleasure, business, or social reasons is called a tourist. By most accepted definitions, to be classed as a tourist, a person needs to stay at that place or location for longer, than a day (24 hrs), but no longer than one year. The purpose of the visit or travel can be for pilgrimage, holiday pleasure, trekking and mountaineering, business, official convention and conference, or personal reasons, other than to be employed by a resident entity in the country or place visited.

The movement of people to the place outside their usual residence, for the specific period (longer than a day and less than a year) with an objective, is known as tourism. The term 'tourism' also refers to a business providing services for tourists. The World Tourism Organization (WTO) defines tourism as, "Traveling to and staying in places outside their usual environment for not more than one consecutive year for leisure, business and other purposes."



## **Types of Tourism:**

There are different forms of tourism. With the country of reference, there are three forms of tourism which are given below:

1. **Domestic tourism:** Domestic tourism means visits within a country by visitors who are residents of that country. For example a resident of Kathmandu visiting other parts of Nepal for different purposes such as holidays, business, or personal.
2. **Inbound tourism:** Inbound refers to 'inward' or 'being received'. Inbound tourism means visits to a country by foreigners or non-resident visitors of that country. For example, a Canadian visiting Nepal is considered inbound tourism from the Nepalese perspective.
3. **Outbound tourism:** Outbound refers to “outward” or “going out”. Outbound tourism means visits by residents of a country outside that country. For example, when a resident of Nepal visits Canada then it is outbound tourism from Nepalese perspectives.

**The basic forms of tourism mentioned above can be further combined into the other three forms of tourism as given below.**

1. **Internal tourism:** Internal tourism, which includes domestic tourism as well as inbound tourism, that is, the activities of resident and nonresident visitors within the country of reference as part of domestic or international tourism trips.
2. **National tourism:** National tourism, which includes domestic tourism and outbound tourism, that is, the activities of resident visitors within and outside the country of reference, either as part of domestic or outbound tourism trips.
3. **International tourism:** International tourism, which comprises inbound tourism and outbound tourism, that is, the activities of resident visitors outside the country of reference, either as part of domestic or outbound tourism trips and the activities of non-resident visitors within the country of reference on inbound tourism trips.

The tourism Industry refers to all activities related to tourism. In other words, the tourism industry is the collective form of businesses providing services for tourists. The Industrial Enterprise Act, 2020 of Nepal, defined the tourism industry as the industry related to tourism services.

The tourism industry in the context of Nepal includes the services related to tourists' residence; motel, hotel, resort, bar and restaurants; travel agency, tour operator, healing centres, casino, massage, spa; adventure tourism; golf course, polo, pony trekking, trekking, cycling; homestay and eco-tourism, agri-tourism; cultural, religious, conference and sports tourism; fun park, water park, etc.

### **Importance of Tourism Industry in Nepal:**

1. **Source of Foreign Exchange Earnings:** Tourism Industry is the major source of foreign exchange earnings for Nepal. In the fiscal year, 2017/18 total foreign exchange earnings from tourism were Rs. 67.09 billion.
2. **Employment Generation:** The development of the tourism industry creates employment opportunities for people in tourism-related activities.
3. **Development of Cottage/Handicraft Industry:** The development of handicraft industries depends on the tourism industry. The foreign tourists like and buy handicrafts goods representing Nepalese art and culture. Attracting tourists towards this helps to develop handicraft industries in Nepal.
4. **Sources of Public and Private Income:** Government receives income from tourists in the form of taxes, fees, and royalties. The tourism industry provides employment opportunities to many people directly or indirectly. Therefore, the level of income of people increases.
5. **Cultural Exchange:** Tourism Industry helps to exchange the art and culture of Nepal with the rest of the world. The cultural exchange helps to bring change in the lifestyle and traditional thinking.
6. **Development of Human Resources:** As the tourism industry develops there is a need to produce a large number of trained and skilled manpower for the promotion of the tourism industry.
7. **Basis of Economic Development:** Tourism development helps to reduce the existing problem of unemployment by promoting employment opportunities. Likewise, it helps to protect and promote national heritage and traditional art and architecture. Hence, the government can properly utilize the tourism industry for economic development.

### **Prospects of the Tourism industry in Nepal:**

1. **Natural Beauty:** Nepal is a country full of natural beauties. Since Nepal is rich in both natural and man-made heritage, it provides an unforgettable experience to every visitor.
2. **Historical and Religious Places:** Many places in Nepal have historical and religious importance. It attracts tourists from different places of the world.
3. **Cultural Diversity:** Nepal is a multi-ethnic nation. Each ethnic group has its own language, culture and tradition. This attracts tourists for learning their culture.
4. **Climatic Diversity:** Nepal has varying topographic altitudes. So, diverse climatic conditions can be found in different parts of the country. Therefore, the tourists coming from any part of the world can have the best climatic suited to them.
5. **Trekking in the Mountainous Region:** Many people from different parts of the world come for trekking in the mountainous region from where they can enjoy the scenic beauty of the Himalayan region.

6. **Less Expenditure:** The cost of living in Nepal is cheaper than in other countries. So, the tourists from different countries and status can visit. They can also enjoy and stay for a long duration at a very low cost.
7. **Wild Life:** In Nepal, there are varieties of wildlife and bird species. Many rare birds and animals are preserved in different national parks. So, the tourists come and enjoy visiting the wildlife resorts and national parks.

#### **Problems of the Tourism industry in Nepal:**

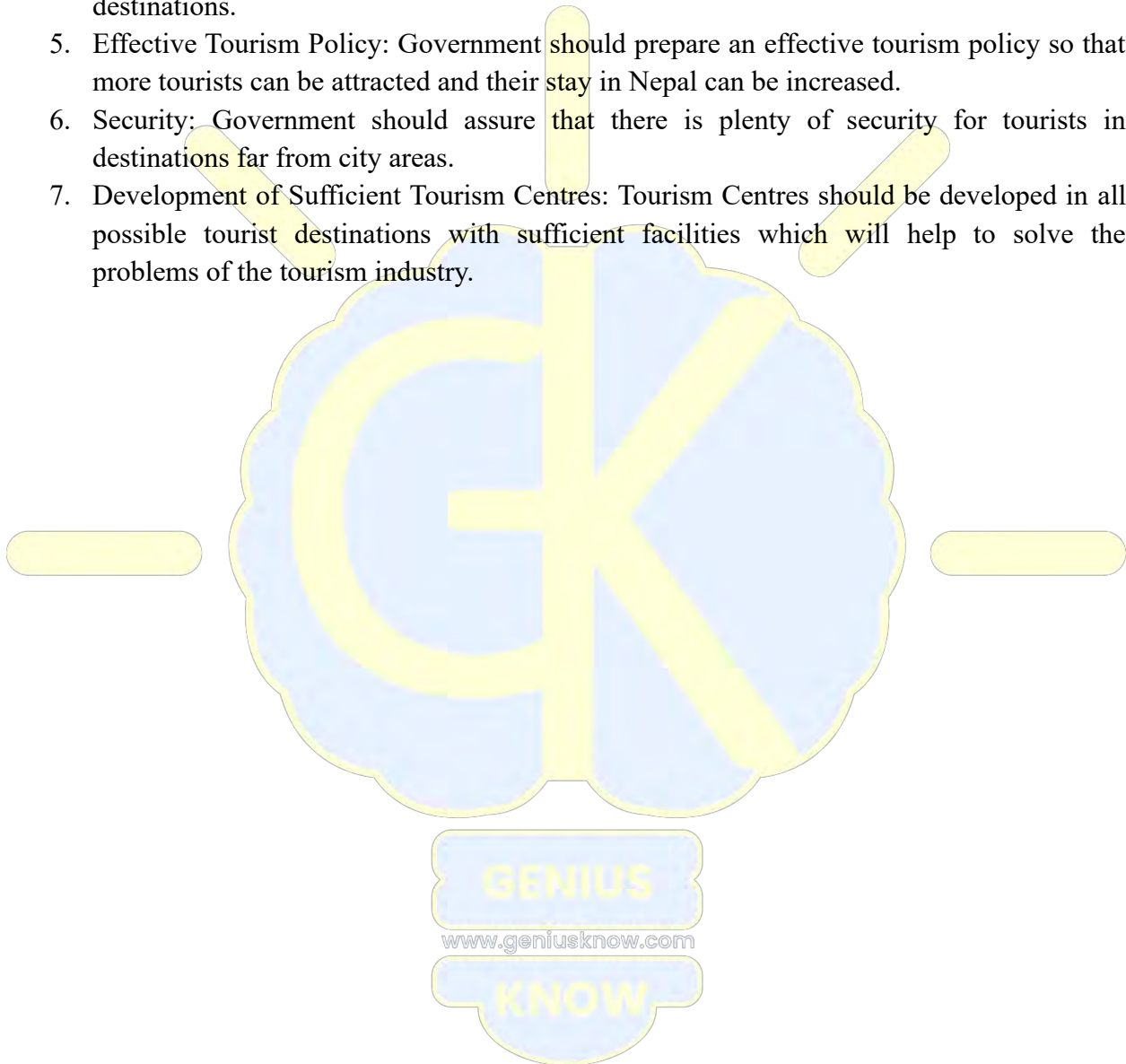
1. **Lack of Recreation Facilities:** Tourists who visit Nepal come for pleasure and enjoyment. But the recreational facilities for the tourists are very limited.
2. **Lack of Transportation and Communication Facilities:** Most of the tourists come from developed countries to spend their holiday in Nepal. But they cannot spend their time where there are no communication facilities and transportation facility. Therefore, tourists are mostly concentrated in the city and most of the beautiful places have not been explored to them.
3. **Lack of Publicity:** Though Nepal is an attractive tourist destination, it has not been well-publicized in a foreign country. The institutional arrangement for tourism promotion is very weak.
4. **Lack of Good Quality Hotels:** There are very few good quality hotels with modern facilities at the tourist spots from the accommodation. So, tourists cannot spend more days in the tourist spots which are far from such facilities.
5. **Problem of Pollution:** This is the other problem of the tourism sector. Lack of solid waste management, air pollution in major urban centres has become a great challenge to the development of the tourism industry.
6. **Lack of Tourism Centres:** There are very few tourism centres in Nepal. Due to the lack of tourism centres, the tourists have to face problems. Tourism centres provide the information required for them.
7. **Lack of Security:** This is one of the major problems in the tourism industry due to existing political disturbances. Crimes are a great restriction to the development of tourism.

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#### **Tourism industry problems in Nepal:**

1. **1. Development of Transport and Communication:** Transport and communication facilities are the basic requirements for developing the tourism industry in Nepal. There should be adequate development of transportation and communication facilities so that these are easily accessible to all the tourist destinations of the country.
2. **2. Publicity:** It is very important for the development of tourism. Special attention should be given to the advertisement through various means of media. Both government and private sector should emphasize the publicity.

3. **Control Pollution:** Government should take proper initiative for pollution control in the urban area. After taking certain measures in controlling pollution, it should be advertised as far as possible.
4. **Recreational Arrangement:** The provision of adequate recreational arrangement is very important for tourism development. The people related to the tourism sector should initiate to make arrangement of recreational arrangement in different tourism destinations.
5. **Effective Tourism Policy:** Government should prepare an effective tourism policy so that more tourists can be attracted and their stay in Nepal can be increased.
6. **Security:** Government should assure that there is plenty of security for tourists in destinations far from city areas.
7. **Development of Sufficient Tourism Centres:** Tourism Centres should be developed in all possible tourist destinations with sufficient facilities which will help to solve the problems of the tourism industry.



## 5. Unit 5 Nepal: Geography and socio-economic and political dimensions

### 5.1 Location and geopolitical situation

The geopolitical situation of a location refers to its position and relationships with other countries or regions, as well as the political, economic, and social factors that influence its standing in the world. Geopolitical situations can vary greatly depending on the specific location you are interested in.

Factors that can affect a location's geopolitical situation include its proximity to other countries, natural resources, political stability, military power, alliances, trade relationships, and historical conflicts. These factors can shape a location's relations with other nations, its role in regional or global affairs, and its overall security and stability.

It's important to note that geopolitical situations are dynamic and can change over time due to various factors such as shifts in power, changes in leadership, conflicts, economic developments, and international events. To obtain accurate and up-to-date information about the geopolitical situation of a specific location, it is best to refer to reliable news sources, government reports, or consult with geopolitical experts who specialize in that region.

#### A. Location and geopolitical situation of Nepal

Nepal is a landlocked country located in South Asia. It is bordered by China to the north and India to the south, east, and west. The country covers an area of approximately 147,516 square kilometers (56,956 square miles) and has a diverse geography, including the Himalayas in the north and the fertile Terai plains in the south.

Geopolitically, Nepal holds strategic importance due to its location between two regional powers, China and India. Historically, Nepal has maintained a policy of balancing its relations with these neighboring countries while preserving its sovereignty and independence.

Nepal has a long-standing and complex relationship with India, with cultural, economic, and political ties dating back centuries. The two countries share close people-to-people connections, and India has been Nepal's largest trading partner. However, the relationship has experienced occasional strains, particularly related to border issues and political dynamics.

Nepal's relationship with China has also gained significance in recent years. China has been increasing its economic presence in Nepal through infrastructure development projects, including roads, railways, and hydropower. Additionally, Nepal and China have been collaborating on various trade and transit agreements.

In terms of its geopolitical position, Nepal's landlocked status poses both opportunities and challenges. Its geographical location between two rapidly growing economies offers potential for

trade and transit opportunities. However, limited access to seaports and dependence on its neighbors for trade routes can also pose challenges to Nepal's economic development.

It's important to note that geopolitical situations are subject to change, influenced by various factors such as regional dynamics, global events, and domestic policies. For the most accurate and up-to-date information about Nepal's current geopolitical situation, it is advisable to refer to reliable news sources and consult with experts specializing in the region.

## 5.2 Physiography and drainage system; climates and their changes

### A. Physiography and Drainage System of Nepal

Physiography: Nepal's physiography is characterized by diverse landscapes due to its location in the Himalayas. The country can be broadly divided into three main geographic regions:

1. **Himalayan Region:** This northern region encompasses the highest mountain ranges, including Mount Everest, the world's highest peak. It consists of snow-capped mountains, glaciers, high-altitude valleys, and alpine meadows.
2. **Hill Region:** The central part of Nepal is covered by the Mahabharat Range and the Churia Hills. This region is characterized by rolling hills, terraced slopes, deep valleys, and scattered forests.
3. **Terai Region:** Located in the southernmost part of Nepal, the Terai is a fertile plain that extends along the border with India. It is characterized by flatlands, alluvial plains, and marshy grasslands.

Drainage System: Nepal's drainage system is primarily formed by numerous rivers that originate from the Himalayas. Some of the major rivers include:

1. **Koshi River:** Known as the "Sorrow of Bihar," the Koshi River is one of the largest rivers in Nepal. It originates in Tibet and flows through eastern Nepal, eventually joining the Ganges River in India.
2. **Gandaki River:** The Gandaki is one of Nepal's longest rivers, originating from the Tibetan plateau and flowing through the central part of the country. It is notable for its deep gorges and is an important water resource for hydroelectricity generation.
3. **Karnali River:** The Karnali River is Nepal's longest and westernmost river, originating in Tibet and flowing through the western part of the country. It eventually joins the Ganges River in India.
4. **Rapti River:** The Rapti River is a major river that flows through the central and western parts of Nepal before entering India. It is an important water source for irrigation and supports diverse ecosystems, including the Chitwan National Park.

Climates and Their Changes: Nepal experiences a wide range of climates due to variations in elevation. The country can be broadly classified into five climatic zones:

1. Tropical and Subtropical Zone (Terai): The Terai region has a hot and humid climate with distinct summer and winter seasons. Summers are characterized by high temperatures, while winters are milder with foggy conditions.
2. Lower Himalayan Zone: This region has a temperate climate, with mild summers and cool winters. Temperatures decrease with increasing altitude.
3. Upper Himalayan Zone: The upper Himalayan region experiences an alpine climate characterized by cold temperatures throughout the year, with freezing winters and cool summers.
4. Trans-Himalayan Zone (Rain Shadow Area): Located in the rain shadow of the Himalayas, this region experiences a dry climate with limited rainfall and low humidity. It is arid and has desert-like conditions in some areas.
5. High Mountain Zone: The high mountain zone, including the Everest region, has a severe alpine climate with extremely cold temperatures, high winds, and heavy snowfall.

Regarding climate change, Nepal, like other parts of the world, has been experiencing its effects. The country has observed changes in weather patterns, including increased temperatures, changes in precipitation patterns, and glacial retreat. These changes have implications for water resources, agriculture, biodiversity, and the livelihoods of communities dependent on natural resources. The Nepalese government and various organizations are working on climate change adaptation and mitigation measures to address these challenges.

### 5.3 Natural resources: Soil and mineral, forest, water, biodiversity resources

Natural resources: Soil and mineral, forest, water, biodiversity resources

Natural Resources in Nepal:

1. Soil and Mineral Resources: Nepal is rich in various types of soils, including fertile alluvial soils in the Terai region, as well as sandy and loamy soils in the hills. The country also possesses significant mineral resources, including limestone, coal, iron ore, copper, zinc, and various types of gemstones. However, the exploitation and utilization of these mineral resources are still in the early stages of development.
2. Forest Resources: Nepal is known for its diverse forest resources, which cover a significant portion of its land area. The country's forests include tropical, subtropical, and temperate vegetation types. These forests provide valuable timber, non-timber forest products, medicinal plants, and habitat for a wide range of flora and fauna. The government of Nepal has implemented conservation measures to protect its forests and promote sustainable forest management.
3. Water Resources: Nepal is often referred to as the "Water Tower of South Asia" due to its abundance of water resources. The country is home to numerous rivers, lakes, and glacial meltwater sources. These water resources have significant potential for hydropower generation, irrigation, and drinking water supply. Nepal has been exploring the development of its hydropower potential to meet domestic energy needs and for potential export to neighboring countries.

4. **Biodiversity Resources:** Nepal is known for its rich biodiversity and is recognized as one of the biodiversity hotspots in the world. The country's varied climatic zones and diverse ecosystems support a wide array of flora and fauna, including many endangered and endemic species. Nepal is particularly famous for its conservation areas, national parks, and wildlife reserves, such as Chitwan National Park and Sagarmatha National Park, which is home to Mount Everest. Conservation efforts are in place to protect and sustainably manage the country's biodiversity resources.

Preserving and sustainably managing these natural resources are crucial for Nepal's socio-economic development, as they provide livelihoods for communities, support tourism, contribute to the economy, and play a vital role in maintaining ecological balance and environmental well-being. The Nepalese government, along with various non-governmental organizations and international partners, is actively engaged in conservation and sustainable resource management initiatives.

## 5.4 Population change, composition, distribution and migration

### Population Change, Composition, Distribution, and Migration in Nepal

**Population Change:** Nepal has experienced significant population changes over the years. The country has seen both population growth and changing demographic trends. However, please note that the following information is based on data up to my last knowledge cutoff in September 2021, and more recent data may vary.

**Population Growth:** Nepal has had a growing population, although the growth rate has been declining in recent years. The population growth rate was estimated to be around 1.12% per year, according to the World Bank data from 2020.

**Fertility Rate:** Nepal's total fertility rate (TFR), which represents the average number of children born to a woman during her reproductive years, has been gradually declining. As of 2020, the TFR was estimated to be around 2.06 children per woman, indicating a decrease in fertility levels.

**Composition and Distribution: Age Structure:** Nepal has a relatively young population, with a significant portion of the population below the age of 25. However, the proportion of elderly individuals is increasing due to improvements in healthcare and a declining birth rate.

**Urbanization:** Nepal has been experiencing rapid urbanization, with a growing proportion of the population residing in urban areas. Major cities like Kathmandu, Pokhara, and Biratnagar have witnessed significant population growth and development.

**Ethnic Diversity:** Nepal is known for its ethnic diversity. The country has a multiethnic population with various ethnic groups and indigenous communities, each with its own distinct



culture, language, and traditions. The largest ethnic groups include Chhetri, Brahmin, Magar, Tharu, Tamang, Newar, and Gurung, among others.

**Migration: Internal Migration:** Nepal has a history of internal migration, with people moving from rural areas to urban centers in search of better opportunities, education, and healthcare. The Terai region, in particular, has seen a significant influx of people from other parts of the country.

**International Migration:** Nepal also experiences international migration, with a large number of Nepalese individuals working abroad, mainly in countries like India, Malaysia, Qatar, Saudi Arabia, and the United Arab Emirates. These individuals contribute to the country's economy through remittances.

**Factors Driving Migration:** Factors such as economic opportunities, lack of employment in rural areas, political instability, natural disasters, and conflicts have contributed to both internal and international migration in Nepal.

It's important to note that population dynamics and migration patterns can change over time due to various social, economic, and environmental factors. For the most up-to-date and detailed information on population change, composition, distribution, and migration in Nepal, it is recommended to refer to recent demographic studies, government reports, and statistical sources.

## 5.5 Economy: Agriculture, industry, trade and transportation

### **Economy: Agriculture, Industry, Trade, and Transportation in Nepal:**

**Agriculture:** Agriculture plays a significant role in Nepal's economy, employing a large portion of the population and contributing to the country's GDP. The agricultural sector is diverse and encompasses both subsistence farming and commercial agriculture. Major agricultural products include rice, maize, wheat, pulses, fruits, vegetables, tea, coffee, and spices. Livestock rearing, including dairy farming and poultry, is also an important component of the agricultural sector.

**Industry:** Nepal's industrial sector is relatively small but has been growing steadily. The country has industries involved in manufacturing, construction, energy production, and mining. Key industries include textiles, garments, cement, steel, food processing, pharmaceuticals, hydropower, and tourism-related industries. The government has been encouraging industrial development through policy initiatives and infrastructure development.

**Trade:** Nepal's trade is heavily reliant on its neighboring countries, particularly India and China. The country imports a wide range of goods, including petroleum products, machinery, consumer goods, and raw materials. Major export commodities include carpets, garments, handicrafts, textiles, tea, coffee, and medicinal herbs. Trade agreements, such as the South Asian Free Trade Area (SAFTA) and bilateral trade agreements, have aimed to facilitate trade and enhance regional economic integration.

**Transportation:** Transportation infrastructure in Nepal has been improving over the years, although challenges remain due to the country's rugged terrain. Key modes of transportation include road, air, and to a lesser extent, railways.

**Road Transportation:** Road networks connect major cities, towns, and rural areas, serving as the primary mode of transportation. However, road conditions in certain regions can be challenging, particularly in remote areas and during the monsoon season.

**Air Transportation:** Nepal has international and domestic airports, with Tribhuvan International Airport in Kathmandu being the main gateway. Domestic air travel is essential for connecting remote areas, hilly regions, and tourist destinations.

**Rail Transportation:** Nepal has limited railway infrastructure, with a short broad-gauge railway line connecting the southern town of Jaynagar in India to Janakpur in Nepal. Plans for expanding the railway network are under consideration.

**Water Transportation:** Nepal has limited inland water transport due to its landlocked nature. However, rivers are used for small-scale transportation, mainly for goods and people in certain regions.

The Nepalese government has been focusing on infrastructure development, including the expansion of road networks, upgrading airports, and exploring options for railway connectivity. These efforts aim to enhance connectivity, promote trade and tourism, and support overall economic growth in the country.

## 5.6 Tourism and heritage: Concept, problems and prospects

### 5.6 Tourism and Heritage: Concept, Problems, and Prospects in Nepal:

**Concept of Tourism and Heritage:** Tourism in Nepal revolves around the country's rich natural and cultural heritage. The concept of tourism in Nepal encompasses the exploration and appreciation of its diverse landscapes, mountains, wildlife, historical sites, cultural traditions, and religious sites. The country is famous for its trekking routes, mountaineering expeditions, wildlife reserves, ancient cities, temples, monasteries, and vibrant festivals.

**Problems in Tourism:** Despite its immense potential, the tourism sector in Nepal faces several challenges:

1. **Infrastructure:** Limited infrastructure, including roads, airports, and accommodations, particularly in remote areas, can hinder the growth of tourism.
2. **Seasonal Variation:** Tourism in Nepal is highly seasonal, with peak tourist seasons during spring and autumn. This can lead to overcrowding in popular tourist destinations during those times, while other seasons experience lower tourist flows.
3. **Natural Disasters:** Nepal is prone to natural disasters such as earthquakes, landslides, and floods, which can disrupt tourism activities and infrastructure.

4. **Political Instability:** Political instability in the past has impacted tourism growth, as it affects the perception of Nepal as a safe and stable destination.
5. **Environmental Impact:** Unregulated tourism activities, such as improper waste management and unsustainable practices, can have negative impacts on the environment, including pollution and ecological degradation.

**Prospects for Tourism and Heritage:** Nepal's tourism sector holds significant prospects for growth and development:

1. **Adventure Tourism:** Nepal's mountainous landscape provides opportunities for adventure tourism, including trekking, mountaineering, rock climbing, paragliding, and rafting. These activities attract adventure enthusiasts from around the world.
2. **Cultural Tourism:** Nepal's rich cultural heritage, ancient cities, and religious sites offer immense potential for cultural tourism. Heritage tourism includes visits to UNESCO World Heritage Sites like Kathmandu Durbar Square, Bhaktapur Durbar Square, and Lumbini, the birthplace of Lord Buddha.
3. **Ecotourism and Wildlife Tourism:** Nepal's diverse ecosystems and wildlife reserves, such as Chitwan National Park and Sagarmatha National Park, offer opportunities for ecotourism and wildlife tourism. Visitors can explore the country's unique flora, fauna, and natural habitats.
4. **Spiritual and Wellness Tourism:** Nepal's association with Buddhism and Hinduism makes it a significant destination for spiritual and wellness tourism. Visitors can engage in meditation retreats, yoga practices, and spiritual journeys to monasteries and religious sites.

To capitalize on these prospects, Nepal has been focusing on infrastructure development, sustainable tourism practices, marketing initiatives, and policy reforms to attract tourists and enhance visitor experiences. The government, tourism organizations, and stakeholders are actively involved in promoting Nepal as a premier tourism destination while addressing the challenges faced by the sector.

## 5.7 Development planning and administration: Characteristics of federal, provincial, local units

### 5.7 Development planning and administration: Characteristics of federal, provincial, local units

#### Development Planning and Administration in Nepal: Characteristics of Federal, Provincial, and Local Units

Nepal transitioned from a unitary system of government to a federal democratic system in 2015. The federal structure consists of three tiers of government: the federal government, provincial governments, and local units. Here are the characteristics of each level:

#### **Federal Government:**

1. **Legislative Power:** The federal government has the authority to make laws on subjects specified in the constitution's federal list, including defense, foreign affairs, monetary policy, and national infrastructure.

2. **Executive Power:** The federal government is responsible for the overall governance of the country, including formulating and implementing national policies and plans. It is headed by the President as the head of state and the Prime Minister as the head of government.
3. **Financial Authority:** The federal government has the power to levy and collect taxes, allocate resources, and distribute grants to provincial and local governments.

### **Provincial Governments:**

1. **Legislative Power:** Provincial governments have the authority to make laws on subjects listed in the constitution's concurrent list, which includes agriculture, education, health, tourism, and local infrastructure.
2. **Executive Power:** Provincial governments are responsible for implementing laws, policies, and programs at the provincial level. Each province has a Chief Minister as the head of the provincial government.
3. **Financial Authority:** Provincial governments have the power to collect certain taxes, manage their own finances, and receive grants from the federal government. They are responsible for budgeting and allocating resources for development projects and services within their jurisdiction.

### **Local Units:**

1. **Legislative Power:** Local units, which include municipalities and rural municipalities, have the authority to make laws on local matters listed in the constitution's local list, such as local infrastructure, local economic development, and public health and sanitation.
2. **Executive Power:** Local units are responsible for implementing local laws, policies, and programs, and providing basic services to the local population. They are led by elected representatives, such as mayors or chairpersons.
3. **Financial Authority:** Local units have the power to collect certain local taxes, manage their own finances, and receive grants from both the provincial and federal governments. They are responsible for budgeting and allocating resources for local development projects and services.

The federal system aims to decentralize power, promote local governance, and ensure effective service delivery at the grassroots level. The three tiers of government work in coordination to formulate development plans, allocate resources, and implement programs to address the specific needs and priorities of their respective jurisdictions. This decentralized approach facilitates greater citizen participation, local decision-making, and accountability in the development process.

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### **Planning Process in Nepal**

National Planning Commission sets the national development goals based on the broader policy guidance of Constitution, commitment made by the Government to the public and their declaration; feedback received for previous periodic plans; international commitments (e.g. SDGs); analysis of public needs; and evaluation of the development indicators and resource availability. The periodic Plans are formulated to achieve the national goals, with the identification of roles and responsibilities of sectoral ministries and authorities. The overall planning process also considers sustainability of development financing in Nepal ([Figure 1](#)).

Multiple institutions are involving in the planning under the institutional framework according to the role and responsibilities defined. The NPC leads the entire planning preparation but institutions such as Cabinet, Resource Committee, Steering Committee, Ministry of Finance, Ministries of Taskforce, Sectoral Committee and Line Ministries and their division and other entities are also involved.

Normally, NPC formulates five-year development Plans. However, since last few years three-year Plans are being formulated. The idea behind formulating three-year Plans was to lay the foundation for long term planning in Nepal in the expectation that the political transition would be over and stable government takes charge of development process. Because of lingered political transition, NPC ended up formulating four consecutive three-year plans. The above section details out the planning process in the country.

The following institutions and entities are broadly involved in the planning process of Nepal:

- 1) National Development Council (NDC)—to provide broad direction for the planning.
- 2) National Planning Commission—to formulate the Plans on the basis of direction provided by NDC.
- 3) Line Ministries—to set the sectoral targets, sectoral priorities, strategies, objectives and working policies.
- 4) Ministry of Finance—to project the resources and facilitate the overall planning process.
- 5) Ministers’ Council (Cabinet)—to approve and execute the plan.



**Figure 1.** Flow of national policy framework by the responsible agencies.

### Federal Planning Mechanism

The three layers of planning mechanism will be in existence with their well-defined role and responsibilities, scope of works and procedures. The National Planning Commissions’ roles will be policy formulation, suggestion and regulation for overseeing the provincial and Local Level particularly in monitoring, supervision and evaluation in plan implementation.

A provincial government planning commission will have shared responsibilities linking with federal government and the Local Level. The Provincial Planning Commission (PPC) will be more focused on preparation of province plan policies and will also endorse the national development goals of the NPC.

The Local Level will have distinctive role on service delivery to the local people. The Local Planning Unit will be responsible to collect baseline information for service delivery, infrastructure development in line with the guidelines of the NPC and the PPC. The below chart explains the planning mechanism of the federal Nepal.

### **National Planning Commission**

The National Planning Commission (NPC) is formed as a specialized entity, in order to formulate development policy and plan focusing on long-term vision and balanced and sustainable development for the rapid economic progress in Nepal. The National Planning Commission (NPC) is the apex advisory body of the Government of Nepal for formulating a national vision, periodic plans and policies for development.

The NPC is headed by the Prime Minister. At present, the NPC has one full-time Vice-Chairman, six members, and one Member-Secretary who also heads a fully staffed secretariat. The Chief-Secretary and the Finance Secretary are ex-officio members of the Commission. The national statistical organization of Nepal, the Central Bureau of Statistics (CBS), functions as a specialized entity of the NPC Secretariat, headed by a Director-General.

### **Structure of National Planning Commission**

Chairman: Prime Minister

Vice-Chairman: Government Appointee

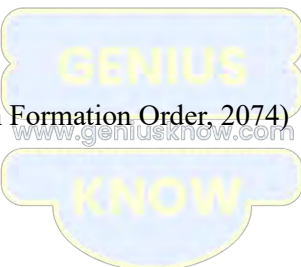
Member: Six Government Appointees including at least one female

Ex-Officio Member: Chief Secretary

Ex-Officio Member: Secretary, MoF

Member Secretary: Secretary, NPC

Source: (National Planning Commission Formation Order, 2074)



### **Provincial Planning Commission**

As the NPC sets national goals; prepares national policies and guidelines; prepares national plan; coordinates among all tiers of government and develops guidelines for monitoring and evaluation, the responsibility of preparing overall development plan within the jurisdiction of the Provincial Government lies on the Provincial Planning Commission (PPC). The NPC sets the national targets for different sectors and the PPC should prepare province level plan with strategies to achieve those targets. Similarly, the national development goals and the related policies need to be translated in the plan/programs/projects formulated by the newly established Provincial and Local Level. Furthermore, the coordination between

policy formation and implication at functional level is also equally important under the present status of the institutional capacity of the Local Levels.

Thus, a province level planning commission has been appeared imperative and have also been consistently suggested for its' formation by the respondents of the seven different Local Levels. Therefore, the Provincial Government should form/establish a province level planning commission to formulate province level plan, to coordinate for the implementation of the plan and program as well as for monitoring & evaluation of such plan and programs within the jurisdictions and territories of the PG. The PPC positions in the middle of other two tiers of planning entities involved in plan and policy formation and implementation respectively. The PPC should be more careful on distinctive and shared functions, roles and responsibilities of each tier of governments while preparing province level policy and plan.

The structure of the Provincial Planning Commission has been suggested as below:

### **Structure of the Provincial Planning Commission**

Chairman: Chief Minister

Vice Chairman: Province Government Appointee

Member: Chief Secretary, Provincial Government

Member: Deputy Chief, PG

Members: Five PG Appointees including at least two female members

Member: Secretary, Ministry of Economic Affairs and Planning, PG

Member Secretary: Secretary, Provincial Planning Commission Secretariat

### **Local Planning Unit**

The Local Government Operation Act 2017, Part 3, Article 11 has explained the functions roles and responsibilities of the Local Level in line with the distinctive functions roles and responsibilities specified in Schedule 8 of the Constitution of Nepal. The LL has to make a mid/short-term, periodic plan and local development strategies in order to implement such function, role and responsibility systematically. The Local Level plays a significant role in functionalization of the whole planning and development process by preparing local level development plan, including unit level cost estimation, based on policy and guidelines provided by the upper tiers of the governments; preparing the functional level project/programs for upper tiers; allocating the resources by developing certain priority sectors; as well as facilitating/coordinating in project implementation, monitoring and evaluation.

Therefore, the Local Level should establish a Local Planning Unit to undertake the constitutionally delegated functions, roles and responsibility formulating local level periodic plan and short/mid-term development strategies. The Unit will be further guided by the Revenue Projection and Budget Ceiling Determination Committee and the Budget and Program Formulation Committee which are provisioned respectively on Articles 66 and 67 of the Local Government Operation Act, 2017.

## The Proposed Structure of the Local Planning Unit

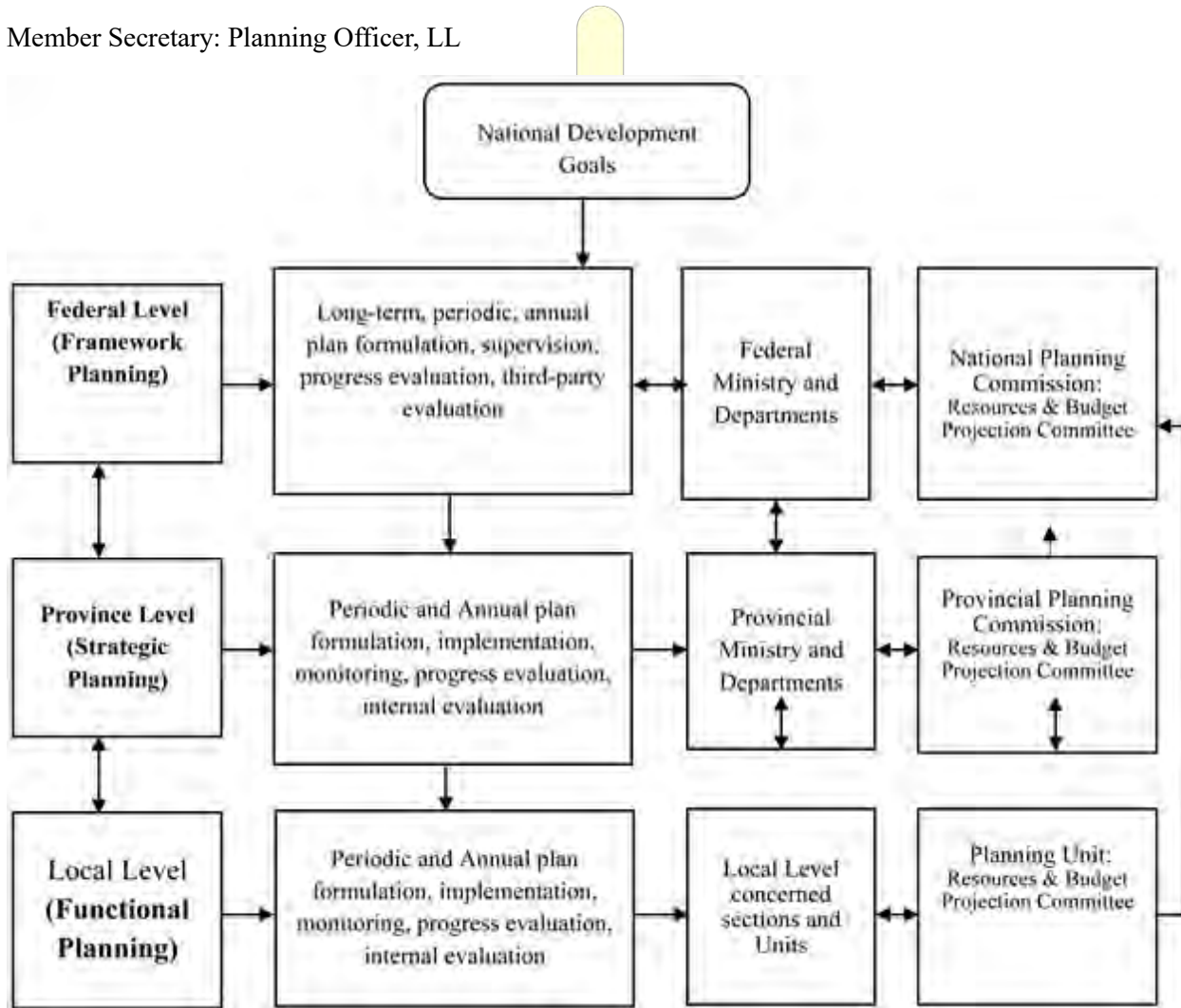
Chairman: Chief of Local Level

Member: Deputy Chief, Local Level

Member: Planning Expert, LL Appointee

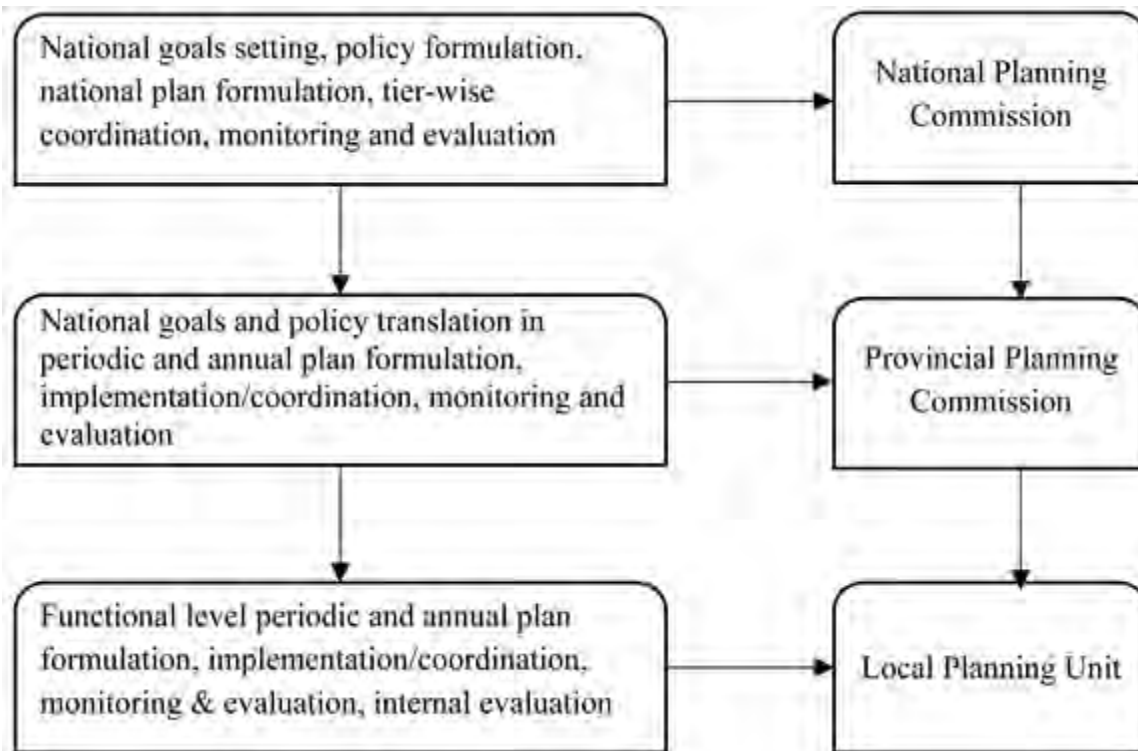
Member: Two Representatives from Ward Committees

Member Secretary: Planning Officer, LL



**Figure 2.** Relationship between three tiers of the government. Source: Taskforce study report formulated by the NPC on 2073/09/25.





**Figure 3.** Policy translation.

## 5.8 Disasters and Disaster Risk Management (DRM) in Nepal

### Disaster

Disasters are serious disruptions to the functioning of a community that exceeds its capacity to cope using its resources. Disasters can be caused by natural, man-made, and technological hazards, as well as various factors that influence the exposure and vulnerability of a community. A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability, and capacity, leading to one or more of the following: human, material, economic, and environmental losses and impacts.

Annotations: The effect of the disaster can be immediate and localized but is often widespread and could last for a long period. The effect may test or exceed the capacity of a community or society to cope using its resources and, therefore, may require assistance from external sources, which could include neighboring jurisdictions or those at the national or international levels.

The emergency is sometimes used interchangeably with the term disaster, as, for example, in the context of biological and technological hazards or health emergencies, which, however, can also relate to hazardous events that do not result in the serious disruption of the functioning of a community or society.

Disaster damage occurs during and immediately after the disaster. This is usually measured in physical units (e.g., square meters of housing, kilometers of roads, etc.), and describes the total or partial destruction of physical assets, the disruption of basic services, and damages to sources of livelihood in the affected area.

Disaster impact is the total effect, including negative effects (e.g., economic losses) and positive effects (e.g., economic gains), of a hazardous event or disaster. The term includes economic, human, and environmental impacts and may include death, injuries, disease, and other negative effects on human physical, mental, and social well-being.

For the scope of the Sendai Framework for Disaster Risk Reduction 2015-2030, the following terms are also considered:

**Small-scale disaster:** a type of disaster only affecting local communities which require assistance beyond the affected community.

**Large-scale disaster:** a type of disaster affecting a society that requires national or international assistance.

**Frequent and infrequent disasters:** depend on the probability of occurrence and the return period of a given hazard and its impacts. The impact of frequent disasters could be cumulative or chronic for a community or a society.

**A slow-onset disaster** is defined as one that emerges gradually over time. Slow-onset disasters could be associated with, e.g., drought, desertification, sea-level rise, and epidemic disease.

**A sudden-onset disaster** is triggered by a hazardous event that emerges quickly or unexpectedly. Sudden-onset disasters could be associated with, e.g., earthquakes, volcanic eruptions, flash floods, chemical explosions, critical infrastructure failure, and transport accidents.

## Types of Disasters

Natural and human-caused disasters affect thousands of people each year. Major adverse events such as these can cause catastrophic loss of life and physical destruction. They are often unexpected and can leave whole communities in shock.

People who live through a disaster can experience emotional distress. Feelings of anxiety, constant worrying, trouble sleeping, and other depression-like symptoms are common responses to disasters before, during, and after the event. Many people can “bounce back” from disasters with help from family and the community. Still, others may need additional support to cope and move forward on the path of recovery. Anyone can be at risk, including survivors living in the impacted areas and first responders and recovery workers.

## Natural Disasters

Natural disasters are large-scale geological or meteorological events that can potentially cause loss of life or property. These types of disasters include:

Tornadoes and Severe Storms

Hurricanes and Tropical Storms

Floods

Wildfires

Earthquakes

Drought

Severe storms and floods are the most common types of natural disasters reported in the United States. These meteorological events are occasionally preceded by presidential “emergency declarations” requiring state and local planning before the event, such as evacuations and protection of public assets. Disaster Distress Helpline staff can speak to those who call or text before, during, and after a natural disaster.

### **Human-Caused Disasters**

Examples include industrial accidents, shootings, terrorism, and incidents of mass violence. As with natural disasters, these traumatic events may also cause loss of life and property. They may also prompt evacuations from certain areas and overwhelm behavioral health resources in the affected communities.

In the aftermath of the tragic loss of life that occurred on September 11, 2001, the feelings of loss of security and well-being—arguably the most crucial ingredients for leading a happy, healthy life—dramatically affected the citizens of the United States. Disaster Distress Helpline staff are also trained to respond to calls or texts related to these disasters.

Incidents of Mass Violence

Other Incidents of Mass Trauma

Infectious disease outbreaks, incidents of community unrest, and other traumatic events can also bring out strong emotions in people.

The outbreak of Ebola affecting several countries in West Africa, with limited reported cases in the United States and other countries, may lead to anxiety and confusion, even to the point where it can interfere with one’s routine. Community upheaval, such as that seen in Ferguson, Mo., can also impact emotional health. News reports and the 24-hour news cycle can make people even more anxious when these events occur.

The Disaster Distress Helpline provides immediate crisis counseling to people affected by traumatic events. SAMHSA also has several resources for people affected by the Ebola outbreak and incidents of community unrest, including:

Coping with Grief After Community Violence – 2014

Coping with Stress During Infectious Disease Outbreaks – 2014

Disaster Behavioral Health Information Series Collection: Ebola Outbreak

## **Disaster and DRM in Nepal**

Nepal is exposed to multiple recurrent hazards. The country falls in the top 20th list of the most multi-hazard-prone countries in the world. The country is ranked 4th, 11<sup>th</sup>, and 30th regarding climate change, earthquake, and flood risk. Other major disasters in Nepal are landslides, fires, droughts, epidemics, storms, hailstorms, avalanches, and GLOF. Nepal loses more than 300 lives every year due to water-induced disasters. It faces high magnitudes and intensities of a multitude of natural hazards such as floods, landslides, earthquakes, fires, hailstones, windstorms, thunderbolts, cloudbursts, droughts, Glacier lake outburst floods (GLOF), avalanches, and epidemics. These are the contributing factors to disaster vulnerability in Nepal.

- Geological, ecological, and hydrometeorological phenomena
- Demographic, such as rapid population growth and increasing population density
- High degree of environmental degradation, particularly deforestation
- Fragility of landmass
- Wider spread poverty
- Topography which poses a huge infrastructural challenge

### **Landslide and Debris flow**

The movement of earth, rock or debris down slope under the influence of gravity by certain processes is called landslide. Landslide usually occurs as secondary effects of heavy rainfall and earthquakes. A debris flow is slurry of soils, rocks and organic matter combined with air and water.

The causes of landslide in Nepal are natural as well as manmade. In general the middle hills are prone to landslides. The natural phenomena like heavy rainfall, active geotectonic movements, deforestation and disturbance of hill slopes are also the major causes for occurring landslides.

### **Floods**

The topographical feature of Nepal is mainly responsible for flood. Flood is caused by heavy precipitation which may occur at any place except high Himalayan region during the monsoon season. Inundation along the river banks and erosion of land along the riverbanks causes loss by damaging irrigation and communications facilities and fertile lands across or adjacent to the riverbanks. Such phenomenon's have caused loss of lives and property in mountainous areas of

Nepal and have posed severe hazards to physical infrastructure like roads and bridges.

Inundations have disrupted social and economic development of many parts of terrain region in the country. The floods of August 2008 in Koshi river, September 2008 in Western Nepal and July

and August 1993 in the Bagmati and other rivers were the most devastating floods in Nepal.

Nepal has observed Monsoon flood as well as Flash flood. Rainfall variability (unequal rainfall in

time and space), topography (steep Mountain and flat Tarai), Deforestation (decreasing vegetative cover) are the major factors contributing to the floods in Nepal.

### **Earthquake**

The Nepalese people are living in a country of highest seismic hazard, have faced the consequences of many earthquakes including those of great earthquakes. 45 million years ago, the Indian continent collided into Southern Tibet. The Indian continent is driven under Tibet, pushing lightweight sediments upwards and thus the formation of the Himalayas. Nepal sits across the boundary between India and southern Tibet which are still moving towards each other by 2 meters per century. This movement creates pressure within the Earth, which builds up and can only be released through earthquakes. This is the only way earthquakes can happen in Nepal. Earthquakes happen very often in Nepal. Based on the seismic record of the number of earthquakes that occurred since 1255, earthquakes of magnitude greater than 8 occurred on average once every 80 years. The last great earthquake of magnitude 8.3 occurred in 1934. The seismic record of Nepal is available since 1255 AD in which 7.7 reactor scale in Kathmandu valley king Avaya Malla and one third of population lost their lives in this event. After that, a series

of earthquake occurred in Nepal. Major are in 1260, 1408, 1681, 1767, 1810, 1823, 1833, 1834, 1866, 1934, 1980 and 1988 AD. According to the seismological center of Nepal medium and small size earthquake event occur in a different part of Nepal frequently. According to Global earthquake Initiatives, Kathmandu is exposed to the greatest earthquake risk per capita among 21 megacities around the world.

### **Fire**

Fire is a recurring disaster in Nepal. During the dry season from February to May, large numbers of incident of fire are reported, mostly in the Terai where about three quarter of houses are built with thatched roofs.

Forest fires occur throughout Nepal and result deforestation of around 1.7 per cent of the total forest area annually. These fires cause economic losses and environmental degradation throwing dedicates ecosystems out of balance. It is also threatening valuable and endangered flora and fauna, degrading the soil and inducing flood and landslide.

Most of the fire incidents are caused by negligence of the people. Hunting practices, negligence by cigarette smoker, intentional fire to accelerate growth of grasses to feed livestock, intentional fire setting by herb and charcoal collectors and children playing with fires are some of the reasons

for forest fires. Certain type of trees especially Sal (shores Robusta) is particularly susceptible to fire. About 86 per cent of the population of the country inhabit in the rural areas mainly in thatched

houses closely clustered where fire hazards are likely to be common.

### **Glacial Lake Outburst Flood (GLOF)**

Glacial lakes are like natural water reservoirs dammed by ice or moraines. Lake outburst can be triggered by several factors: ice or rock avalanches, the collapse of the moraine dam due to the melting of ice buried within, the washing out of fine material by springs flowing through the (piping)

earthquakes or sudden inputs of water into the lake e.g. through heavy rains or drainage from

lakes further up glacier. ICIMODs 2001 inventory of glaciers, glacial lakes and GLOFs counted

3252 glaciers and 2323 glaciers lakes in Nepal 20 of which are very vulnerable to flooding (MoHA,

2009).

Legislatively, disaster management initiatives have been governed under the Natural Calamity (Relief) Act of 1982. This Act authorizes the government to form a Central Natural Disaster Relief Committee chaired by the Minister of Home Affairs at the central level.

Regional Natural Disaster Relief Committee at the regional level and District Natural Disaster Relief Committee at the district level. The Ministry of Home Affairs is Nepal's nodal disaster risk management agency. Importantly, the government has adopted National Strategy for Disaster

Risk Management (NSDRM), 2009, based on Hyogo Framework for Action, and this new strategy encompasses the prevention, mitigation, preparedness, response, and recovery. Disaster Risk Reduction (DRR) and Climate Change Adaptation have become national priorities and are being institutionalized to support sustainable development in Nepal.

The 10th Five-Year Plan (2002-2007) and the Three-Year Interim Plan (2007-2010) emphasized DRM as an integral component of sustainable development and prioritized pre-disaster preparedness. Ministry of Home Affairs has established a National Emergency Operation Centre (NEOC) at the national level and plans to expand it in all development regions within five years. The Ministry of Home Affairs, with support from the World Bank, has prepared a country-level MultiHazard Risk Assessment. The hazards, including the assessment, are earthquakes, floods, drought, landslides, and epidemics. The Early Warning Strategy has been prepared and will be instrumental in developing a framework for installing, operating, and maintaining an early warning system for major hazards, floods, landslides, GLOFS, and drought throughout the country.

### **Major Legal Arrangement in Nepal associated with DRM**

- Natural Calamity (Relief) Act, 1982
- Local Self Governance Act, 1999
- National Strategy for Disaster Risk Management (NSDRM) 2009
- Soil and water conservation act, 1982
- Nepal building act, 2007 and Building Code, 1994
- Environmental protection act, 1996
- National agriculture policy, 2004
- National shelter policy, 1996
- National urban policy, 2006
- National water plan, 2005 and Water resource policy, 1993
- National water resource strategy, 2002
- Water induced disaster management policy, 2006
- Strategies related to health sector

### **Institutional Mechanism**

#### **Ministry of Home Affairs Ministry of Home Affairs (MoHA)**

Ministry of Home Affairs (MoHA) acts as National Focal Agency on Disaster Management and lead agency responsible for implementation of the Disaster Risk Reduction and Management Act, 2017. The MoHA is also responsible for rescue and relief work, data collection and dissemination, as well as collection and distribution of funds and resources. It is also the leading agency for logistics management in case of the disaster beyond the capacity of the provincial and local governments. The assigned task was being implemented through Disaster Preparedness and Response Section, National Emergency Operation Centre-NEOC, in the ministry. Now, after the establishment of NDRRMA, this center comes within the new Authority under the ministry. The

ministry has also a separate division for Disaster and Conflict Management with Disaster Study, Risk Reduction and Recovery Section within. The ministry is working for new organization and management at the new context. Ministry of Federal Affairs and General Administration (MoFAGA) is the nodal ministry for the local governments to the federal government. It deals and coordinates all the aspects of disaster management issues at the local level for their functions as per the local governance act 2017. It is responsible for early recovery activities after huge disaster.

**National Disaster Risk Reduction and Management Authority (NDRRMA)** After longtime advocacy and discussion, a separate and dedicated entity to address disaster issues in Nepal was first time legislated in DRRM Act in 2017 and it is now established as the National Disaster Risk Reduction and Management Authority after the endorsement of National Disaster Risk Reduction and Management Regulation, 2019. The newly borne authority is working for its further structure, scope and functions. The primary role of this authority is to operationalize the disaster risk and management functions, making necessary arrangements for regular coordination with stakeholders, carry out response operations, search and rescue, relief, early recovery, recovery plan and implement disaster related programs. This authority is also responsible to regulate risk reduction related activities and will have an incident commander in emergency.

**Province Disaster Executive Committee/ District Disaster Management Committee/ Local Disaster Management Committee**

Provincial governments in coordination with District Disaster Management Committees (DDMC) are coordinating, facilitating and guiding the local levels in risk reduction initiatives, and the mainstreaming the development efforts by applying mitigating and preventive measures.

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## 6. Unit 6 Maps and map readings

### 6.1 Concept and types of maps (Topographic and thematic maps)

Maps are essential tools for representing and understanding spatial information. They provide a visual representation of the Earth's surface or specific areas, enabling us to navigate, analyze, and communicate geographic information. There are various types of maps, but two common categories are topographic maps and thematic maps.

1. **Topographic Maps:** Topographic maps depict the physical features of a particular area, focusing on the three-dimensional representation of the Earth's surface. These maps provide detailed information about the natural and human-made features, such as:
  - **Elevation and Relief:** Topographic maps use contour lines to indicate the elevation and shape of the land. Contour lines connect points of equal elevation, allowing users to visualize mountains, valleys, and other terrain features.
  - **Landforms:** Topographic maps show landforms like rivers, lakes, mountains, valleys, and hills. These features are represented by specific symbols, colors, or labels.
  - **Infrastructure:** Human-made features like roads, railways, buildings, bridges, and settlements are often included on topographic maps to aid navigation and understanding of the area.
  - **Vegetation:** Vegetation types, such as forests, grasslands, and wetlands, are represented using different symbols or colors, providing insights into the landscape's ecological characteristics.

Topographic maps are commonly used in outdoor activities like hiking, mountaineering, and land surveying. They help users understand the terrain and plan routes based on elevation changes and natural features.

2. **Thematic Maps:** Thematic maps focus on specific themes or subjects related to a particular area. These maps provide information about a specific topic rather than portraying the overall physical features. Some common types of thematic maps include:
  - **Population Density Map:** This map displays the distribution and density of population in a given region. Different colors or shading may represent areas with higher or lower population concentrations.
  - **Climate Map:** Climate maps show the spatial distribution of climate characteristics, such as temperature, precipitation, or climatic zones. They help identify climate patterns and understand regional variations.
  - **Land Use Map:** Land use maps depict the different ways land is utilized, including residential, commercial, agricultural, industrial, or recreational areas. These maps provide insights into human activities and spatial planning.
  - **Geological Map:** Geological maps illustrate the rock types, geological structures, and formations present in an area. They are crucial for geologists, engineers, and researchers studying the Earth's subsurface.

Thematic maps can cover a wide range of subjects, depending on the purpose and intended audience. They use various symbols, colors, and patterns to represent the specific theme or data being portrayed.

It's important to note that these two types of maps are not mutually exclusive, and they often complement each other. Many maps incorporate both topographic and thematic elements to provide a comprehensive representation of a particular area.

Overall, maps are powerful tools for visualizing and understanding spatial information, whether it's the physical features of the land (topographic maps) or specific themes and subjects (thematic maps). They play a crucial role in navigation, planning, research, and communication within the field of geography and beyond.

## 6.2 Map reading, interpretation, and navigation on Web map

With the advent of technology, web maps have become increasingly popular and accessible for map reading, interpretation, and navigation. Here are some key aspects to consider when using web maps:

1. **Familiarize Yourself with the Interface:** When using a web map, take a moment to familiarize yourself with the interface. Understand the different components, such as the zoom controls, search bar, layers panel, and map legend. Explore the available tools and functionalities to make the most of your map experience.
2. **Zooming and Pan:** Web maps provide the ability to zoom in and out and pan across the map. Use the zoom controls (typically plus and minus buttons or a scroll wheel) to adjust the level of detail and scale. Click and drag the map to navigate and explore different areas.
3. **Layers and Legend:** Web maps often include multiple layers of information that can be toggled on or off. Layers may include boundaries, roads, landmarks, satellite imagery, or thematic data. Consult the map legend or layer panel to understand the meaning and representation of different elements on the map.
4. **Search Functionality:** Web maps usually have a search bar or geocoding feature that allows you to search for specific locations, addresses, landmarks, or points of interest. Utilize this functionality to quickly navigate to a specific area of interest.
5. **Interpretation of Symbols and Colors:** Pay attention to the symbols, colors, and patterns used on the web map. They convey important information about features, such as roads, buildings, water bodies, and land use. Refer to the map legend or tooltips to understand the meaning behind these visual representations.
6. **Overlaying Additional Data:** Web maps often allow users to overlay additional data layers or thematic information onto the base map. This can include overlays for weather, transportation, population density, or any other relevant data. Explore the available options and consider overlaying data that enhances your understanding of the area.
7. **Route Planning and Directions:** Web maps typically offer route planning and directions functionality. You can input a starting point and destination to obtain a suggested route,

along with turn-by-turn directions. Take advantage of this feature for navigation purposes or to plan your travel itinerary.

8. Interactive Features: Web maps may include interactive features such as clickable points of interest, pop-up windows with additional information, and the ability to measure distances or areas. Explore these interactive elements to gather more information or perform specific tasks.

Remember to critically evaluate the accuracy and reliability of the data presented on web maps, as they can vary depending on the source and updates. Also, be mindful of the terms of use and any licensing restrictions associated with the web map platform you are using.

By effectively utilizing web maps and their functionalities, you can navigate, interpret, and extract valuable information for various purposes, including planning trips, analyzing locations, and making informed decisions based on geographic data.

### 6.3 Elements of map, map projection and symbolization

Component of map

Title: what the map is about

Compass: direction

Symbol: pictures used instead of words

Legend: explains meaning of symbols and color

Color: highlights important or different information to help interpret the results

Scale: show the proportion of map to real world

Grid reference: locate specific places on the map

Readable, suitable text/ level, suitable scale, north direction, legend on map

### 6.4 Scale: Fraction and graphical scale, large scale, medium scale and small scale maps

Scale is an important concept in map reading as it indicates the relationship between distances on a map and the corresponding distances on the Earth's surface. It allows users to understand the relative size, distance, and proportion of features represented on the map. There are different types of scales used in mapping, including fraction scales, graphical scales, and the classification of maps into large scale, medium scale, and small scale. Let's explore each of these:

1. **Fraction Scale:** Fraction scale, also known as a representative fraction or RF scale, represents the ratio between distances on the map and the actual distances on the Earth's surface. It is expressed as a fraction, where the numerator represents the map distance and the denominator represents the corresponding ground distance. For example, a scale of 1:50,000 means that one unit of measurement on the map represents 50,000 units of measurement on the ground. Smaller numbers in the denominator indicate a larger scale, while larger numbers indicate a smaller scale.
2. **Graphical Scale:** A graphical scale, also called a bar scale or linear scale, is a visual representation of the map's scale. It consists of a line or a bar divided into segments, with each segment indicating a specific distance on the ground. The length of the segments varies depending on the map scale. Users can measure distances on the map by comparing them to the segments of the graphical scale.
3. **Large Scale, Medium Scale, and Small Scale Maps:** **Large Scale Maps:** A large scale map represents a smaller area with a higher level of detail. The scale ratio is relatively large, such as 1:10,000 or 1:25,000. These maps provide a close-up view of a specific region, city, or neighborhood. They are often used for urban planning, detailed surveys, or engineering purposes.

**Medium Scale Maps:** Medium scale maps cover a larger area with less detail compared to large scale maps. The scale ratio falls in between large scale and small scale, such as 1:100,000 or 1:250,000. They are commonly used for regional planning, land use analysis, and general reference purposes.

**Small Scale Maps:** Small scale maps represent a larger area with less detail. The scale ratio is relatively small, such as 1:1,000,000 or 1:10,000,000. These maps provide a broad view of a country, continent, or the entire world. They are often used for general reference, global analysis, or educational purposes.

It's important to note that the terms "large scale" and "small scale" can be a bit counterintuitive. In cartography, "large scale" refers to maps with a larger representative fraction and more detail, while "small scale" refers to maps with a smaller representative fraction and less detail.

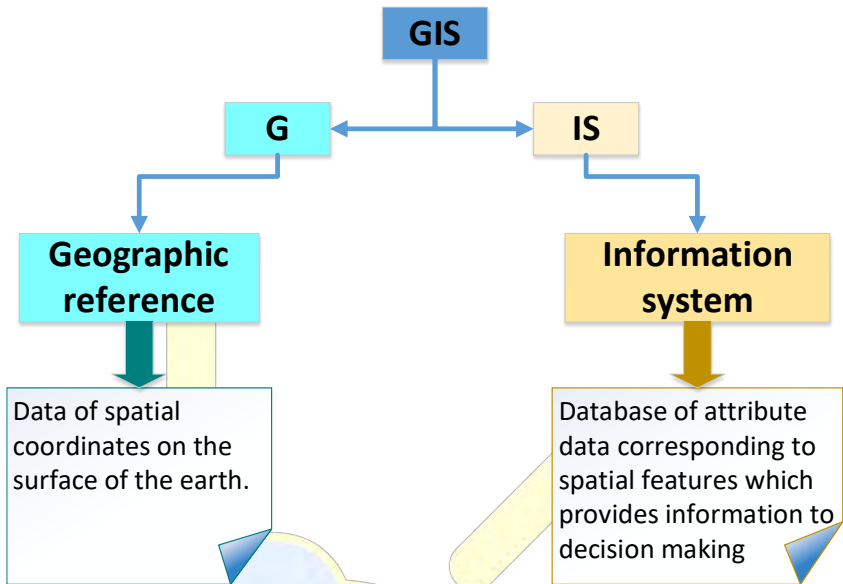
Understanding the scale of a map is crucial for interpreting distances, sizes, and relationships between features accurately. Whether you're using a fraction scale or a graphical scale, it helps you navigate the map, estimate distances, and comprehend the spatial relationships of the mapped features.

## 6.5 Remote Sensing and GIS: Concept, interpretation, and application (Aerial photographs, Satellite Image, Unmanned Aerial Vehicle and GPS)

### What is GIS?

A geographic information system (GIS) is a computer system for capturing, storing, checking, and displaying data related to positions on Earth's surface. GIS can show many different kinds of

data on a map, such as streets, buildings, vegetation and many more. This enables people to more easily see, analyze, and understand the patterns and relationships within the geographic features. Thus, GIS helps the users to understand patterns, relationships, and geographic context. The benefits include improved communication and efficiency as well as better management and decision making.



## How does GIS work?

### Maps

Maps are the geographic container for the data layers. GIS maps are easily shared and embedded in apps, and accessible by virtually everyone, everywhere.

### Data

GIS integrates many different kinds of data layers using spatial location. Most data has a geographic component. GIS data includes imagery, features, and basemaps.

### Analysis

Spatial analysis evaluates suitability and capability, estimate and predict, interpret and understand, and much more, lending new perspectives for decision-making.

## GIS components and functions

### Components of GIS:

1. **Hardware**
2. **Software**
3. **Data**

4. **Method**
  5. **People/ user**
2. **GIS functions/process**
    - **Capture**
    - **Store**
    - **Query**
    - **Analyze**
    - **Display output**

Remote Sensing and Geographic Information Systems (GIS) are two important tools in the field of geography and spatial analysis. Let's explore the concepts, interpretation, and applications of remote sensing and GIS, including aerial photographs, satellite images, unmanned aerial vehicles (UAVs), and GPS.

**Remote Sensing:** Remote sensing involves the acquisition of information about the Earth's surface from a distance, typically through the use of sensors mounted on satellites, aircraft, or UAVs. It enables the collection of data without direct physical contact with the object or area being observed.

**Interpretation:** Remote sensing data can be in the form of aerial photographs or digital images captured by sensors. These images provide valuable visual information about the Earth's surface, such as land cover, vegetation density, urban development, and natural features. Interpretation involves analyzing and extracting meaningful information from these images to understand patterns, changes, and characteristics of the Earth's surface.

**Application:** Remote sensing has various applications in geography, environmental monitoring, and resource management. It is used for mapping land cover and land use, monitoring deforestation, assessing vegetation health, identifying changes in coastal areas, analyzing urban growth, and monitoring natural disasters like floods and wildfires.

**Geographic Information Systems (GIS):** GIS is a computer-based system designed to capture, store, analyze, manipulate, and visualize geospatial data. It combines spatial data (location information) with attribute data (non-spatial information) to create layers of information that can be analyzed and displayed in map form.

**Interpretation:** GIS allows for the interpretation and analysis of spatial data by overlaying different layers of information. It enables the identification of spatial patterns, relationships, and

trends within the data. GIS can perform operations like buffering, spatial querying, proximity analysis, and spatial modeling.

**Application:** GIS has a wide range of applications across various disciplines. It is used in urban planning to analyze land use patterns and infrastructure development, in environmental management for habitat mapping and conservation planning, in transportation planning to optimize routes and analyze traffic patterns, and in emergency management for disaster preparedness and response.

**Aerial Photographs:** Aerial photographs are images captured from an elevated position using aircraft. They provide a bird's-eye view of the Earth's surface and can capture fine details of the landscape.

**Interpretation:** Aerial photographs can be interpreted to identify landforms, land cover types, vegetation density, and human-made features. By analyzing the shapes, sizes, and patterns visible in the photographs, geographers can extract valuable information about the landscape.

**Application:** Aerial photographs are used in cartography, urban planning, forestry, archaeology, and environmental studies. They help create accurate maps, assess land use changes over time, monitor urban growth, and identify archaeological sites.

**Satellite Images:** Satellite images are captured by sensors aboard satellites orbiting the Earth. They provide a wide coverage of the Earth's surface and are available in various resolutions.

**Interpretation:** Satellite images can be interpreted to identify land cover types, vegetation health, oceanic features, and atmospheric conditions. By analyzing the spectral characteristics and patterns in satellite images, geographers can extract information about the Earth's surface and its dynamics.

**Application:** Satellite images are widely used in environmental monitoring, agriculture, disaster management, and climate studies. They help monitor deforestation, track crop health, assess changes in glaciers and coastal areas, and provide early warnings for severe weather events.

**Unmanned Aerial Vehicles (UAVs):** UAVs, also known as drones, are small aircraft controlled remotely or autonomously. They are equipped with sensors to capture aerial images and data.

**Interpretation:** UAVs can capture high-resolution images and collect data in areas that are difficult to access. These images can be interpreted to analyze vegetation health, monitor