

Course Code: GE (N)-220



GEOGRAPHY OF HIMALAYA WITH SPECIAL REFERENCE TO UTTARAKHAND



**DEPARTMENT OF GEOGRAPHY AND NATURAL
RESOURCE MANAGEMENT**

**SCHOOL OF EARTH AND ENVIRONMENTAL SCIENCE
UTTARAKHAND OPEN UNIVERSITY**

(Teenpani Bypass Road, Behind Transport Nagar Haldwani (Nainital), Uttarakhand, India)

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BLOCK 1: HIMALAYA - A MOUNTAIN SYSTEM

UNIT 1: PHYSICAL FEATURES: GEOLOGIC STRUCTURE, DRAINAGE SYSTEM, CLIMATE, NATURAL VEGETATION, SOILS, PHYSIOGRAPHIC DIVISION

1.1 OBJECTIVES

1.2 INTRODUCTION

1.3 GEOLOGIC STRUCTURE

1.4 DRAINAGE SYSTEM

1.5 CLIMATE

1.6 NATURAL VEGETATION

1.7 SOILS

1.8 PHYSIOGRAPHIC DIVISION OF UTTARAKHAND HIMALAYA

1.9 SUMMARU

1.10 GLOSSARY

1.11 ANSWER TO CHECK YOUR PROGRESS

1.12 REFERENCES

1.13 TERMINAL QUESTIONS

1.1 OBJECTIVES

After reading this unit, you will be able to:

- Understanding the Geologic structure of Uttarakhand Himalaya.
- Learn about the Drainage system of Uttarakhand Himalaya.
- Gain knowledge about the Climatic conditions of Uttarakhand Himalaya.
- Understanding the Natural Vegetation of Uttarakhand Himalaya.

1.2 INTRODUCTION

The Uttarakhand Himalaya represents a significant segment of the extensive Himalayan range, exhibiting intricate geological formations. The geologic architecture of this region is predominantly influenced by the convergence of the Indian Plate with the Eurasian Plate, a process that commenced approximately 50 million years ago. This tectonic phenomenon has resulted in the emergence of various mountain ranges, including the Great Himalayas, Lesser Himalayas, and the Shivalik Hills. Characteristic features of these ranges include steep inclines, profound valleys, and elevated plateaus. The Great Himalayas, constituting the northernmost section, are comprised of ancient crystalline rocks and encompass some of the loftiest peaks, such as Nanda Devi and Trisul. The Lesser Himalayas are characterized by metamorphic rocks and are renowned for their picturesque hill stations, including Mussoorie and Nainital, whereas the Shivalik Range to the south is distinguished by more contemporary sedimentary deposits. The complex drainage system of Uttarakhand is predominantly governed by two of India's most revered rivers, the Ganga and the Yamuna, along with their numerous tributaries. These rivers emanate from the glaciers located in the elevated Himalayas, such as the Gangotri and Yamunotri glaciers, and traverse southward, sculpting deep gorges and fertile valleys. The rivers within the state are indispensable for irrigation, potable water supply, and the generation of hydroelectric power. The Ganga river system, which includes the Bhagirathi and Alaknanda rivers, converges at Devprayag to constitute the Ganga. The Yamuna, another principal river, is augmented by tributaries such as the Tons and Asan rivers. These rivers are instrumental in molding the region's topography, giving rise to floodplains, terraces, and alluvial fans that are critical for agriculture and human habitation.

The climatic conditions of Uttarakhand exhibit considerable variability in relation to altitude, transitioning from a subtropical climate in the foothills to an alpine climate at elevated altitudes. The lower elevations, notably the Shivalik Hills, undergo hot summers and temperate winters, whereas the elevated regions of the Great Himalayas are marked by frigid winters and moderate summers. The monsoonal period, extending from June to September, is characterized by significant precipitation, which plays a vital role in the annual rainfall totals of the state. This temporal climate variability exerts a substantial influence on agricultural practices, water resource management, and the ecological systems present in Uttarakhand. During winter, the elevated areas receive considerable snowfall, which facilitates the formation of glaciers and sustains the perennial flow of river systems.

Uttarakhand is distinguished by a remarkable array of natural vegetation, shaped by its diverse climatic conditions and topographical features. At the lower altitudes, the flora predominantly comprises tropical and subtropical forests, featuring species such as sal, teak, and bamboo. Ascending to higher elevations, these forests transition to temperate woodlands that are primarily composed of oak, pine, and rhododendron. The alpine and sub-alpine zones situated above 3,000 meters are typified by meadows and grasslands, referred to locally as "bugyals," which provide a habitat for various medicinal plants and endemic flora. This rich biodiversity not only sustains a multitude of wildlife, including leopards, deer, and an extensive variety of avian species, but also serves a critical function in the economic activities of local communities, who depend on these forested areas for fuel, fodder, and non-timber forest resources.

The soils of Uttarakhand are diverse, ranging from fertile alluvial soils in the river valleys to rocky and less fertile soils in the higher altitudes. In the foothills and valleys, the alluvial soils are well-suited for agriculture, supporting crops such as rice, wheat, and sugarcane. The terraced fields seen in the hilly areas are designed to prevent soil erosion and retain moisture, allowing for the cultivation of crops like millets, barley, and various fruits. The state can be divided into three main physiographic divisions: the Shivalik Hills, the Lesser Himalayas, and the Great Himalayas. Each division has distinct characteristics in terms of elevation, climate, and vegetation, contributing to the region's overall ecological and cultural diversity. The Shivalik Hills, with their dense forests and wildlife, act as a transitional zone between the plains and the mountains, while the Great Himalayas form a formidable natural barrier, providing vital ecosystem services and influencing weather patterns.

1.3 GEOLOGIC STRUCTURE

Uttarakhand, a state located in the northern part of India, is characterized by its diverse and complex geology, which is largely shaped by its position within the Himalayan mountain range. The geology of Uttarakhand is not only significant from an academic perspective but also plays a crucial role in understanding the region's natural hazards, resources, and ecological systems. The state is divided into several geological zones, each with distinct characteristics and histories that together tell the story of the region's formation and ongoing geological processes.

1. Tectonic Setting and Formation

Uttarakhand lies in the central part of the Himalayan orogeny, which is a result of the ongoing collision between the Indian Plate and the Eurasian Plate. This collision, which began around 50 million years ago, has led to the uplift of the Himalayas, making them one of the youngest and most tectonically active mountain ranges in the world. The geological structure of Uttarakhand is dominated by the Main Central Thrust (MCT) and the Main Boundary Thrust (MBT), which are major fault lines that mark the boundaries between different tectonic zones.

The MCT separates the Higher Himalayas from the Lesser Himalayas and is associated with high-grade metamorphic rocks such as gneisses and schists. The MBT, on the other hand, separates the Lesser Himalayas from the Siwalik Range (Outer Himalayas) and is characterized by a mix of sedimentary rocks, including conglomerates, sandstones, and shales.

2. Geological Zones

The geology of Uttarakhand can be divided into three major zones based on their geological characteristics and age:

The Tethyan Himalaya (Higher Himalaya):

This zone, also known as the Inner Himalaya, consists primarily of high-grade metamorphic rocks such as gneisses, schists, and migmatites, along with granites and other igneous intrusions. These rocks were originally sediments deposited in the Tethys Ocean, which existed before the collision of the Indian and Eurasian plates. Over time, these sediments were subjected to intense pressure and heat, resulting in metamorphism and uplift. This zone includes some of the highest peaks in Uttarakhand, such as Nanda Devi and Kamet.

The Lesser Himalaya:

Located south of the Higher Himalaya, the Lesser Himalaya is composed of a variety of rocks, including low- to medium-grade metamorphic rocks like slates, phyllites, and quartzites, as well as sedimentary rocks such as limestones and dolomites. This zone is known for its steep valleys and rugged terrain. The Lesser Himalaya is also home to the Almora Crystalline Zone, a prominent geological feature consisting of metamorphic rocks that have been uplifted and exposed due to tectonic activity.

The Siwalik Range (Outer Himalaya):

The Siwalik Range, also known as the Sub-Himalaya, forms the southernmost zone of Uttarakhand and is characterized by a sequence of sedimentary rocks, including conglomerates, sandstones, and mudstones. These rocks were deposited in a foreland basin formed by the erosion of the rising Himalayas. The Siwalik rocks are relatively younger, dating from the Miocene to Pleistocene epochs (approximately 23 million to 2.6 million years ago). This zone is prone to landslides and erosion due to its relatively loose and unconsolidated sediments.

3. Major Geological Features**Nanda Devi and Nanda Devi Biosphere Reserve:**

The Nanda Devi region, part of the Tethyan Himalaya, is geologically significant due to its rugged terrain, high peaks, and glacial systems. The area is also known for its biodiversity and has been designated as a UNESCO World Heritage Site.

Dun Valleys:

The Dun valleys, such as the Dehradun and Haridwar valleys, are formed by the Siwalik hills and are characterized by alluvial deposits and fertile soils. These valleys are important agricultural regions and are also known for their seismic activity due to their proximity to major fault lines.

Almora Crystalline Zone:

This zone is a part of the Lesser Himalaya and is known for its complex geology, including the presence of highly metamorphosed rocks and granitic intrusions. The Almora Crystalline Zone is an important area for studying the tectonic evolution of the Himalayas.

1.4 DRAINAGE SYSTEM

Uttarakhand, a state in northern India, is known for its complex and diverse drainage system, shaped by its mountainous terrain and significant river networks. The state's drainage system is dominated by several major rivers that originate in the high Himalayas, traverse through deep valleys, and sustain the agriculture, hydropower, and ecology of the region. The major rivers of Uttarakhand contribute significantly to the Ganges River system, one of the most important river systems in India.

Uttarakhand Himalaya can be mainly divided into three flow systems.

- 1) Yamuna-Tons Drainage System**
- 2) Bhagirathi-Alaknanda Drainage System**
- 3) Kali Drainage System**

Major River Systems

Uttarakhand is home to two major river systems: the Ganga (Ganges) and the Yamuna, both of which originate in the state and are part of the larger Indo-Gangetic Plain drainage system. These rivers are fed by numerous tributaries that drain the entire state, forming a complex network of watercourses.

Ganga River System:

The Ganga River system is the most significant in Uttarakhand. The Ganga itself originates at the confluence of the Bhagirathi and Alaknanda rivers at Devprayag. The Bhagirathi, originating from the Gangotri Glacier, is considered the primary headstream of the Ganga. The Alaknanda, which originates from the Satopanth Glacier near the Nanda Devi peak, is another major tributary.

The Ganga River system in Uttarakhand is a fundamental part of both the natural environment and the cultural heritage of the region. This river system, originating from the towering heights of the Himalayas, plays a crucial role in shaping the geography, ecology, and socio-economic fabric of Uttarakhand. The state's mountainous terrain gives rise to the headwaters of the Ganga and its significant tributaries, making it one of the most revered and vital river systems in India.

The Ganga River, known as the Bhagirathi in its upper reaches, originates from the Gangotri Glacier in Uttarakhand at an altitude of about 3,892 meters (12,769 feet). The glacier is located in the Uttarkashi district, and the river's source is considered sacred, drawing thousands of pilgrims to the Gangotri temple each year. The Bhagirathi River is the main headstream of the Ganga and flows through steep gorges and valleys as it descends from the Himalayas.

Another significant tributary of the Ganga in Uttarakhand is the Alaknanda River, which originates from the Satopanth Glacier near the Nanda Devi peak, one of the highest mountains in India. The Alaknanda flows through the Chamoli district, joining several other tributaries before it meets the Bhagirathi at Devprayag. This confluence marks the point where the river is officially named the Ganga.

In addition to the Bhagirathi and Alaknanda, several other important rivers contribute to the Ganga River system in Uttarakhand:

Mandakini River: Originating from the Chorabari Glacier near Kedarnath, the Mandakini flows through the Rudraprayag district before joining the Alaknanda at Rudraprayag.

Pindar River: Rising from the Pindari Glacier in the Kumaon region, the Pindar River flows through the Bageshwar district and meets the Alaknanda at Karnaprayag.

Nandakini River: This river originates from the Nanda Ghunti and Trishul mountains and joins the Alaknanda at Nandaprayag.

Dhauliganga River: Originating near the India-China border, the Dhauliganga joins the Alaknanda at Vishnuprayag.

Yamuna River System: The Yamuna River, another major river originating in Uttarakhand, begins at the Yamunotri Glacier. The Yamuna flows through the western part of the state and is fed by significant tributaries like the Tons and the Asan.

The Yamuna River, one of the most significant rivers in northern India, holds substantial importance both geographically and culturally. Originating from the Himalayan region of Uttarakhand, the Yamuna plays a crucial role in shaping the physical landscape and supporting the livelihoods of millions. The river system is not only a vital water source but also deeply intertwined with the cultural and religious traditions of the region.

The Yamuna River originates from the Yamunotri Glacier, located in the Garhwal region of Uttarkashi district, Uttarakhand. The glacier lies at an altitude of about 6,387 meters (20,955 feet) on the southwestern slopes of the Bandarpunch Peak, one of the high mountain peaks in the

lower Himalayas. Yamunotri is the source of the river and is considered one of the four sacred pilgrimage sites known as the Char Dhams in Uttarakhand.

From its origin, the Yamuna flows through the rugged terrain of the Himalayas, descending rapidly as it cuts through deep gorges and valleys. The river traverses a distance of about 1,376 kilometres (855 miles) before it finally merges with the Ganga at the Triveni Sangam in Prayagraj (Allahabad), Uttar Pradesh. However, the portion of the Yamuna River that lies within Uttarakhand is particularly significant due to its pristine environment and spiritual importance.

Kali Drainage System: The Kali River, also known as the Sharda River in its lower reaches, is a significant river in the Kumaon region of Uttarakhand. It forms an important part of the region's drainage system and holds substantial geographical, ecological, and cultural importance. The Kali River primarily defines the boundary between India and Nepal in this region and is an integral part of the local hydrology.

The Kali River originates from the Greater Himalayas, specifically from the Kalapani region near the Lipulekh Pass, which is situated at an elevation of around 3,600 meters (11,811 feet). This pass is located in the Pithoragarh district of Uttarakhand and is close to the tri-junction of India, Nepal, and Tibet (China). The source of the river lies in a highly contested region, with both India and Nepal claiming ownership over the area, but the river itself flows predominantly along the border between India and Nepal.

From its origin, the Kali River flows southward, carving out deep valleys and gorges as it makes its way through the rugged terrain of the Kumaon Himalayas. The river runs parallel to the Indo-Nepal border for much of its course, with India on its west bank and Nepal on its east. The river passes through the districts of Pithoragarh, Champawat, and Udham Singh Nagar in Uttarakhand before it enters the Terai region, where it is known as the Sharda River.

The Kali/Sharda River eventually joins the Ghaghra River (a major tributary of the Ganga) in the plains of Uttar Pradesh, which further underscores its importance as a key waterway in northern India.

Major Tributaries

The Kali River drainage system is fed by numerous tributaries, which originate in the surrounding hills and contribute significantly to the river's flow. Some of the important tributaries of the Kali River in Uttarakhand include:

Goriganga River: Originating from the Milam Glacier near the India-China border, the Goriganga River is one of the primary tributaries of the Kali River. It flows through the Munsiyari region, known for its picturesque landscapes, and meets the Kali River near Jauljibi, a significant confluence point.

Dhauliganga River: Another major tributary, the Dhauliganga River, rises from the slopes of the Nanda Devi range and flows southward through the Dharchula region before joining the Kali River. This river is not to be confused with the other Dhauliganga that is a tributary of the Alaknanda River.

Saryu River: The Saryu River, also known as the Sarju or Sarayu, originates from the Kumaon Himalayas and merges with the Kali River near Pancheshwar. The confluence of the Saryu and Kali rivers is another significant point in the region, both hydrologically and culturally.

Ramganga (East) River: The Ramganga River, originating from the Namik Glacier in the Pithoragarh district, is an essential tributary of the Kali River. It flows through the picturesque valleys of the Kumaon region before joining the Kali River near the town of Rameshwar.

3. River Confluences (Prayags)

Uttarakhand is renowned for its river confluences, locally known as Prayags, where tributaries meet and merge to form the main rivers. These confluences hold significant cultural and religious importance.

- 1) **Devprayag: The confluence of Bhagirathi and Alaknanda rivers, where the Ganga is formally recognized.**
- 2) **Rudraprayag: The confluence of the Alaknanda and Mandakini rivers.**
- 3) **Karnaprayag: The confluence of the Alaknanda and Pindar rivers.**
- 4) **Nandaprayag: The confluence of the Alaknanda and Nandakini rivers.**
- 5) **Vishnuprayag: The confluence of the Alaknanda and Dhauliganga rivers.**

1.5 CLIMATE

The climatic conditions experienced in Uttarakhand vary from hot and moist subtropical in the southern part to cold alpine in the upper reaches of the Himalayan mountain in the northern parts. A warm and cool temperate climate persists over the areas between the southern and northern parts of the state. The climate at a particular place in the state is influenced by (a) Altitude/ elevation (b) Latitude or location (c) Slope and topography. The climate of Uttarakhand

is sharply demarcated in the case of two distinct divisions the predominant hilly terrain and the smaller plain region. The areas of high hills even become inaccessible in winter due to the extreme cold climate causing prolonged snowfall. The mountain range itself exerts an appreciable extent of influence on monsoon and rainfall patterns. The cold alpine climate is experienced at higher reaches where summers are cool and winters are harsh. At altitudes over 4800 m, the climate is bitterly cold with temperatures consistently below the freezing point of water and the area is perennially shrouded in snow and ice.

In general, the year may be divided into four seasons. The winter season from December to February is followed by the pre-monsoon or hot weather season from March to May. June to September constitutes the southwest monsoon season and the period of October and November is post-monsoon season.

The state is divided into two regions viz. the western part is known as the Garhwal region and the eastern part is Kumaun region. Garhwal region consists of Chamoli, Dehradun, Hardwar, Pauri Garhwal, Rudraprayag, Tehri Garhwal and Uttarkashi districts. Kumaun region consists of Almora, Bageshwar, Champawat, Nainital, Pithoragarh and Udham Singh Nagar districts.

Hardware and Udham Singh Nagar districts and some parts of Nainital, Bageshwar, Champawat, Almora, Dehradun, Pithoragarh, Tehri Garhwal, Pauri Garhwal, Rudraprayag 5 and Uttarkashi districts come under the climate type-subtropical monsoon, mild and dry winter, hot summer (Cwa). Some parts of Chamoli, Almora, Dehradun, Nainital, Uttarkashi, Pithoragarh, Rudraprayag, Bageshwar, Champawat, Pauri Garhwal and Tehri Garhwal districts come under the climate type- Tropical upland, mild winter, dry winter, short warm summer (Cwb)). High altitudinal areas of Almora, Bageshwar, Chamoli, Dehradun, Pauri Garhwal, Pithoragarh, Rudraprayag, Tehri Garhwal and Uttarkashi districts come under the climate type –Humid continental, severe winter, moist all season, short warm summer (Dfb).

High altitudinal areas (peaks) of Bageshwar, Chamoli, Pithoragarh, Rudraprayag, Tehri Garhwal and Uttarkashi districts come under the climate type –Tundra and very short summer (ET).

Temperature

The state lies in the mountainous region except for some plain areas in the districts along the southern boundary of the state. The temperatures in the state, therefore, vary considerably

from place to place in the state according to elevation, location, slope and topography. The temperature starts to rise from March and steadily rises till it reaches its peak in May to the middle of June when the mean maximum temperature in southern parts and valleys of the state is at about 34°C to 38°C and the mean minimum temperature is at about 20°C to 24°C. At places at about 2 km altitude mean maximum and mean minimum temperatures are around 23 - 24°C and 15°C respectively. On individual days maximum temperature rises to 42°C in the valleys and southern part of the state and 30°C at stations at about 2 km elevation. The highest maximum temperature on record at any individual station was 47.40°C at Roorkee Observatory on 22nd May 1978.

With the onset of the southwest monsoon, the maximum temperatures fall by about 30°C to 40°C, while the minimum temperatures remain slightly more or the same as at the end of summer. With the withdrawal of monsoon by about the end of September, both day and night temperatures start to fall reaching their lowest in January and early February. January is the coldest month with the mean maximum temperature in the southern part and river valleys about 20°C and the mean minimum temperature about 6°C. At places of 2 km elevation mean maximum and mean minimum temperatures are around 10°C to 12°C and 10°C to 30°C respectively. A much lower temperature is experienced in the wake of western disturbances during winter. On such occasions, the minimum temperature falls below the freezing point of water in the southern part and less than -10°C at high elevated areas in the northern part of the state. The lowest minimum temperature on record at any individual station was -15.10°C at Joshimath observatory on 15th January 1974.

Humidity

Summer is generally the driest part of the year when relative humidity in the afternoons generally ranges between 30% and 45% and morning relative humidity ranges between 50% and 70% in the southern part (Dehradun, Haridwar and Udham Singh Nagar districts). In these districts during southwest monsoon and winter seasons relative humidity ranges between 80% and 90% in the mornings and it is between 50% and 70% in the afternoons. Generally, mornings are more humid than the afternoons for most of the observatories except Mukteshwar, Mussoorie, Nainital and Munsiri Milan where relative humidity is higher in afternoons than in the mornings.

Rainfall

Uttarakhand, a northern state of India located in the Himalayan region, experiences a diverse range of rainfall patterns due to its varied topography and elevation. The state is divided into two main divisions: Garhwal in the west and Kumaon in the east, each of which experiences different climatic conditions. Rainfall in Uttarakhand is primarily influenced by the Southwest Monsoon, local topography, and western disturbances, resulting in significant variations across the region.

1. Monsoon Season (June to September)

The monsoon season is the primary period for rainfall in Uttarakhand, accounting for about 60-80% of the total annual precipitation. The Southwest Monsoon winds bring moisture-laden air from the Arabian Sea, which rises over the Himalayan ranges, causing heavy rainfall. The intensity and amount of rainfall vary considerably from the foothills to the higher altitudes:

Foothill Regions: Areas like Dehradun, Haridwar, and Nainital, situated in the lower altitudes (around 600-1200 meters), receive substantial monsoon rains. These regions record an average annual rainfall ranging from 1,500 to 2,500 mm. For example, Dehradun receives around 2,000-2,500 mm annually.

Mid-Himalayan Regions: Hill stations such as Mussoorie and Almora receive slightly lower rainfall compared to the foothills but still experience significant monsoon rains, averaging around 1,200 to 1,800 mm annually.

High Altitude Regions: Areas in the higher Himalayas, such as Chamoli, Uttarkashi, and Pithoragarh, receive less rainfall compared to the lower regions. The average annual precipitation in these areas is typically around 800-1,200 mm. However, these regions can experience heavy localized showers due to orographic lift and the interaction of moist air with the high mountains.

2. Winter Rainfall (December to February)

Apart from the monsoon, winter rainfall also contributes to the total annual precipitation in Uttarakhand, mainly due to western disturbances originating from the Mediterranean region. These disturbances bring moisture, resulting in snowfall in the higher altitudes (above 2,000 meters) and light to moderate rain in the lower and mid-hill areas.

Snowfall in Higher Himalayas: Districts like Uttarkashi, Chamoli, and Pithoragarh experience significant snowfall during this period, which is crucial for the region's water resources as the snowmelt feeds major rivers such as the Ganga and Yamuna.

Rainfall in Lower Regions: Dehradun and other lower hill regions experience mild to moderate rainfall, usually ranging from 50 to 100 mm during the winter months.

3. Pre-monsoon and Post-monsoon Showers

Pre-monsoon (April to May) and post-monsoon (October to November) showers also contribute to the annual rainfall but are less predictable and generally lighter compared to monsoon and winter rains. These showers are often caused by localized convection and the occasional influence of western disturbances.

Pre-monsoon Showers: These are characterized by thunderstorms and squalls, particularly in the foothills and mid-hill regions, and can sometimes cause intense but short-duration rainfall.

Post-monsoon Rainfall: This is generally less frequent but can include occasional light showers, particularly in the lower and mid-elevation areas, helping to maintain soil moisture levels before the onset of winter.

4. Regional Variations in Rainfall

Kumaon Division: Nainital district in the Kumaon division, which lies at a higher altitude, tends to receive higher rainfall compared to other areas, with places like Mukteshwar recording about 1,500 mm annually.

Garhwal Division: The Garhwal division, including areas like Tehri and Uttarkashi, shows significant variation in rainfall due to its complex terrain. While the lower regions receive around 1,200-1,800 mm annually, higher regions receive less but still substantial rainfall, often supplemented by snowfall.

5. Impact of Climate Change

Recent studies suggest that climate change is impacting the rainfall patterns in Uttarakhand, with increasing variability and unpredictability. There has been a noted rise in the frequency of extreme weather events, such as cloudbursts and flash floods, particularly in the monsoon season. These changes have significant implications for agriculture, water resources, and disaster management in the region.

1.6 NATURAL VEGETATION

Uttarakhand, a state located in the northern part of India within the lap of the Himalayas, exhibits a diverse range of natural vegetation due to its varied topography, climate, and

altitudinal gradients. The state's unique geographical and climatic conditions result in a rich biodiversity that includes tropical forests in the lower regions, temperate forests at mid-elevations, and alpine vegetation in higher altitudes. The vegetation types in Uttarakhand can be broadly classified based on altitude, climate, and ecological zones.

Uttarakhand's natural vegetation is a reflection of its diverse climatic conditions and altitudinal gradients. From tropical forests in the foothills to alpine meadows at high elevations, the state's vegetation is vital for maintaining biodiversity, regulating climate, and supporting the livelihoods of local communities. Conservation and sustainable management of these natural resources are essential to ensure ecological stability and resilience against environmental changes.

1. Tropical Moist Deciduous Forests

Found in the foothills of the Himalayas, particularly in areas like Dehradun, Haridwar, and parts of Nainital and Almora districts. These forests thrive at altitudes up to 1,200 meters.

These forests are characterized by broad-leaved trees that shed their leaves during the dry season. They receive a substantial amount of rainfall (1,000-2,000 mm annually) and are rich in biodiversity.

Dominant tree species include Sal (*Shorea robusta*), Teak (*Tectona grandis*), and various species of Acacia and Terminalia. The undergrowth consists of shrubs, climbers, and a variety of grasses. These forests are also home to several medicinal plants and herbs.

2. Tropical Dry Deciduous Forests

Occur in the drier parts of the foothills and lower slopes, particularly in the western parts of Uttarakhand where rainfall is less compared to the eastern regions.

These forests have trees that shed leaves completely during the dry season to conserve water. They are less dense than moist deciduous forests and have a more open canopy.

Common species include Sal (*Shorea robusta*), Khair (*Acacia catechu*), and Shisham (*Dalbergia sissoo*). The forest floor is often covered with grasses and thorny bushes.

3. Subtropical Pine Forests

Found between 1,000 to 2,000 meters elevation, particularly on the southern slopes of the Himalayas, including areas like Almora, Nainital, and Pauri Garhwal.

These forests are characterized by the dominance of Chir Pine (*Pinus roxburghii*), which thrives in well-drained, sandy soils. They are adapted to dry conditions and are resistant to fire, which is common in these forests.

Apart from Chir Pine, other species include Rhododendron (*Rhododendron arboreum*), Oak (*Quercus* species), and various types of ferns and shrubs in the understory. These forests are economically important for resin extraction.

4. Temperate Broad-Leaved Forests

Found at elevations ranging from 1,500 to 3,000 meters. These forests cover large parts of the middle Himalayas, including regions like Mussoorie, Chopta, and parts of Kumaon.

These are dense forests with a rich variety of flora and fauna. The climate is cooler with higher humidity compared to the lower regions.

Dominant species include Oak (*Quercus leucotrichophora*, *Quercus semecarpifolia*), Maple (*Acer* species), and Horse Chestnut (*Aesculus indica*). The understory is rich in ferns, mosses, and shrubs like Rhododendron.

5. Temperate Coniferous Forests

Found in higher elevations between 2,200 to 3,500 meters, in areas such as Kedarnath, Badrinath, and Gangotri regions.

These forests consist primarily of coniferous trees, which are adapted to cold temperatures and snow-covered conditions.

Major species include Blue Pine (*Pinus wallichiana*), Deodar (*Cedrus deodara*), Spruce (*Picea smithiana*), and Silver Fir (*Abies pindrow*). These forests provide valuable timber and are important for the ecological balance of the region.

6. Sub-Alpine Forests

Occur between 3,000 to 3,500 meters, transitioning between temperate forests and alpine meadows. They are found in places like the Valley of Flowers and the upper regions of Chamoli and Uttarkashi.

These are transitional forests with stunted tree growth due to the harsh climatic conditions, including low temperatures and heavy snowfall.

Dominant species include Birch (*Betula utilis*), Rhododendron (*Rhododendron campanulatum*), and Juniper (*Juniperus* species). These forests have a rich ground cover of mosses, lichens, and alpine shrubs.

7. Alpine Vegetation

Found above 3,500 meters, extending up to the snowline. Alpine vegetation is characteristic of the high Himalayan ranges, including Nanda Devi, Trishul, and other peaks.

The region experiences extreme conditions with very low temperatures and a short growing season. Vegetation is sparse and adapted to cold and windy environments.

Dominated by herbaceous plants, grasses, and alpine flowers like Primula, Aster, and Edelweiss. Dwarf shrubs and low-growing perennials are common. This zone is known for its stunning display of wildflowers during the short summer season.

8. Grasslands and Pastures

Found in the high-altitude regions and alpine meadows known locally as "Bugyals" (e.g., Bedni Bugyal, DayaraBugyal).

These areas are open and grassy, providing important grazing grounds for livestock and wildlife.

Grass species include Bluegrass (*Poa pratensis*), Fescue (*Festuca*), and various sedges. These grasslands are also home to many medicinal plants and herbs.

9. Wetlands and Riparian Vegetation

Found along the riverbanks of major rivers like the Ganga, Yamuna, Bhagirathi, and Alaknanda, as well as in high-altitude lakes.

These areas support hydrophytic vegetation due to the availability of water. They play a crucial role in maintaining the ecological balance and supporting birdlife and aquatic species.

Common species include willow (*Salix* species), Poplar (*Populus ciliata*), and various types of sedges and reeds. Wetlands also support species like lotus and water lilies.

Impact of Climate Change and Human Activities

Deforestation and Habitat Loss: Increasing human activities such as agriculture, logging, and urbanization are causing significant deforestation, leading to habitat loss and biodiversity reduction.

Climate Change: Rising temperatures and altered precipitation patterns are impacting the growth and distribution of vegetation zones. Alpine and sub-alpine zones are particularly vulnerable to climate change, with shifts in vegetation belts and the upward movement of species.

Conservation Efforts: The establishment of protected areas like the Nanda Devi Biosphere Reserve and Valley of Flowers National Park aims to conserve the unique flora and fauna of Uttarakhand. These efforts are crucial to preserve the natural heritage and ecological balance of the region.

1.7 SOIL

Uttarakhand, located in the northern part of India, is known for its diverse topography and climatic conditions, which significantly influence its soil types. The state's landscape includes the Himalayan mountains, Shivalik hills, river valleys, and Terai plains, leading to a variety of soil formations. These soils vary in their physical and chemical properties, fertility, and suitability for different types of vegetation and crops. This detailed overview covers the major soil types found in Uttarakhand, their distribution, characteristics, and the factors influencing their formation.

The diverse soil types of Uttarakhand, ranging from fertile alluvial soils in the plains to nutrient-poor mountain soils in high altitudes, are a reflection of the state's varied topography and climatic conditions. Understanding the distribution and characteristics of these soils is essential for effective land management, sustainable agriculture, and conservation of natural resources. Efforts to prevent soil erosion and improve soil health are crucial to maintaining the ecological balance and supporting the livelihoods of local communities in Uttarakhand.

1. Alluvial Soil

Found mainly in the Terai region and river valleys of Uttarakhand, particularly in the districts of Haridwar, Udham Singh Nagar, and parts of Nainital. Alluvial soils are also present along the banks of major rivers like the Ganga, Yamuna, Bhagirathi, and Alaknanda.

These soils are typically fertile, deep, and well-drained. They have a high proportion of sand, silt, and clay, making them loamy in texture. Alluvial soils are rich in minerals such as potash and phosphoric acid but may be deficient in nitrogen and organic matter.

Due to their fertility and good moisture-retaining capacity, alluvial soils are suitable for growing a variety of crops, including wheat, rice, sugarcane, pulses, and oilseeds. The Terai region, known for its intensive agriculture, relies heavily on these soils.

These soils are formed from the deposition of sediments by rivers and streams flowing down from the Himalayas. The continuous replenishment of soil by river sediments maintains their fertility.

2. Brown Forest Soil

Predominantly found in the middle and lower Himalayan ranges, including areas like Almora, Nainital, Pauri Garhwal, and parts of Tehri Garhwal. These soils are common at altitudes ranging from 1,000 to 3,000 meters.

Brown forest soils have a loamy texture with a good balance of sand, silt, and clay. They are rich in organic matter due to the decomposition of leaf litter from dense forest cover. These soils are generally acidic to neutral in pH.

They are moderately fertile and support the growth of temperate and subtropical forests. These soils are ideal for horticulture and agriculture, especially for growing fruits like apples, plums, and peaches, as well as crops such as potatoes, barley, and wheat.

These soils develop under forest cover and are enriched by the continuous addition of organic matter from decomposing leaves and vegetation. The cool and moist climate of the middle Himalayas facilitates the formation of these soils.

3. Mountain Soil

Found at higher altitudes, typically above 3,000 meters, in the alpine and sub-alpine regions of Uttarakhand, including Chamoli, Uttarkashi, and Pithoragarh districts.

Mountain soils are shallow, stony, and coarse-textured due to the steep slopes and high rates of erosion. They often contain a high proportion of gravel and rocks, making them less fertile. These soils are usually acidic and have low organic matter content.

Due to their shallow depth and rocky nature, mountain soils are not very fertile. However, in some areas, where organic matter accumulation is higher, they can support alpine vegetation, shrubs, and grasses. They are used for limited agriculture, mainly growing barley and some hardy vegetables.

These soils are formed through the weathering of the underlying rock and are constantly influenced by erosion, landslides, and glacial movements. The harsh climatic conditions at high altitudes limit the development of these soils.

4. Sub-Montane Soil

It occurs in the lower Himalayan region, particularly in the Shivalik hills and lower slopes of the outer Himalayas. Districts like Dehradun and Haridwar have significant areas covered with sub-montane soils.

These soils are generally light-textured, with a mixture of sand, silt, and clay. They tend to be shallow and are prone to erosion due to the steep slopes and heavy monsoon rains. Sub-montane soils have moderate fertility and are slightly acidic.

They support mixed forests and grasslands and are suitable for cultivating crops such as maize, millets, and pulses. The soils can be improved with organic matter additions and proper soil conservation practices.

Formed by the weathering of sedimentary rocks and deposition by streams and rivers. Erosion and leaching are common due to heavy rainfall and steep terrain.

5. Red and Yellow Soil

Found in the lower parts of the Kumaon and Garhwal regions, especially in areas with lower rainfall and where iron-rich parent rocks are present.

These soils are characterized by their reddish-yellow colour, which is due to the presence of iron oxides. They are generally acidic, poor in nitrogen, phosphorus, and organic matter, but can be rich in potash.

Red and yellow soils have moderate fertility and are suitable for growing millets, pulses, and oilseeds. Their productivity can be enhanced through the application of fertilizers and organic manure.

These soils are formed under conditions of high temperature and low rainfall, which promotes the oxidation of iron. The parent material of these soils is often derived from crystalline and metamorphic rocks.

6. Laterite Soil

Found in patches in the lower Himalayan regions and areas with high rainfall and warm temperatures, such as parts of Pauri Garhwal and Nainital districts.

Laterite soils are rich in iron and aluminium oxides, giving them a distinct red colour. They are porous and well-drained but have low fertility due to leaching of essential nutrients.

These soils are not very fertile and are generally used for grazing or growing crops like tea and coffee in areas where they have been enriched with organic matter. They are also suitable for cultivating cashew nuts and certain types of horticultural crops.

Laterite soils form in areas with heavy rainfall and high temperatures, where intense leaching removes silica and bases, leaving behind iron and aluminium-rich soils.

Impact of Human Activities and Conservation Efforts

Soil Erosion: Deforestation, overgrazing, and unplanned agricultural practices have led to increased soil erosion, especially in the hilly regions of Uttarakhand. Landslides and soil degradation are common issues that affect agricultural productivity and ecosystem health.

Soil Conservation: Measures such as afforestation, contour ploughing, terracing, and the construction of check dams are being implemented to prevent soil erosion and conserve soil fertility. The state government and various NGOs are actively involved in promoting sustainable land-use practices.

Climate Change Impact: Changes in precipitation patterns, temperature rise, and extreme weather events due to climate change can alter soil properties, affecting their fertility and structure. The increasing frequency of flash floods and cloudbursts in Uttarakhand poses a threat to soil stability and agricultural lands.

1.8 PHYSIOGRAPHIC DIVISION OF UTTARAKHAND HIMALAYA

The Uttarakhand Himalaya, part of the larger Himalayan mountain range, displays a diverse array of landscapes and natural features. These can be classified into distinct physiographic divisions based on their geology, topography, climate, and vegetation. The primary physiographic divisions of the Uttarakhand Himalayas include the Shivalik Hills, the Lesser Himalayas, and the Great Himalayas. Each of these divisions has unique characteristics that define the region's natural environment and influence human activities.

Uttarakhand Himalaya can be mainly divided into four parts.

- 1. Shivalik Hills (Outer Himalayas)**
- 2. Lesser Himalayas (Middle Himalayas)**

3. **Great Himalayas (Inner Himalayas)**
4. **Trans-Himalayas**

1. Shivalik Hills (Outer Himalayas)

The Shivalik Hills, also known as the Outer Himalayas, form the southernmost part of the Uttarakhand Himalayas. This range extends in a northwest-southeast direction and varies in elevation from 300 to 1,500 meters above sea level. The Shivalik Hills are relatively younger in geological age compared to the other Himalayan ranges, having formed during the Pleistocene epoch. They are primarily composed of loose, unconsolidated sediments such as gravel, sandstone, and conglomerates.

The topography of the Shivalik Hills is characterized by steep slopes and narrow valleys, often prone to erosion and landslides due to their fragile geological composition. These hills act as a transitional zone between the Indo-Gangetic Plain and the Lesser Himalayas. The Shivalik region is known for its dense forests, which include species such as sal (*Shorea robusta*), teak (*Tectona grandis*), and various types of bamboo. The forests support diverse wildlife, including tigers, leopards, elephants, and several species of deer, making the Shivalik Hills an important ecological corridor.

2. Lesser Himalayas (Middle Himalayas)

Located to the north of the Shivalik Hills, the Lesser Himalayas, also known as the Middle Himalayas or the Himachal, rise to elevations ranging from 1,500 to 4,500 meters above sea level. These mountains are characterized by their rugged terrain, deep valleys, and steep ridges. The Lesser Himalayas are geologically older than the Shivaliks and consist predominantly of metamorphic rocks such as schist and gneiss, along with sedimentary rocks like limestone and shale.

The climate in this region is cooler compared to the Shivaliks, with significant rainfall during the monsoon season. Snowfall occurs in the higher elevations during winter. The Lesser Himalayas support a diverse range of vegetation types, from subtropical forests at lower altitudes to temperate and coniferous forests at higher elevations. Common tree species include oak (*Quercus* spp.), pine (*Pinus* spp.), and rhododendron (*Rhododendron* spp.). This division is home to several popular hill stations and towns, such as Mussoorie, Nainital, and Almora, which are significant for both tourism and cultural heritage.

3. Great Himalayas (Inner Himalayas)

The Great Himalayas, or Inner Himalayas, form the northernmost and highest range in the Uttarakhand Himalayas. This division includes some of the most prominent peaks in the region, such as Nanda Devi (7,816 meters), Trisul (7,120 meters), and Kedarnath (6,940 meters). The Great Himalayas are characterized by their towering snow-covered peaks, glaciers, and deep glacial valleys. These mountains are composed mainly of highly metamorphosed rocks, including granite and quartzite, which have been uplifted and folded over millions of years due to tectonic activity.

The climatic conditions in the Great Himalayas are extreme, with very low temperatures throughout the year and heavy snowfall during winter. This region houses extensive glaciers, such as the Gangotri and Pindari glaciers, which are vital sources of freshwater and feed major rivers like the Ganga and Yamuna. The alpine and sub-alpine vegetation in this division is adapted to harsh conditions, consisting mainly of hardy grasses, shrubs, and medicinal herbs. The Great Himalayas are also home to unique wildlife, including the snow leopard, Himalayan musk deer, and various species of birds.

4 Trans-Himalayas

Although not strictly within the traditional boundaries of Uttarakhand, the Trans-Himalayan region influences the climatic and hydrological patterns of the area. This zone lies beyond the Great Himalayas and is characterized by its cold desert conditions, sparse vegetation, and isolated mountain ranges. The Trans-Himalayan region extends into parts of northern Uttarakhand, especially in the high-altitude areas that border Tibet. These regions experience minimal rainfall, making them arid and barren compared to the more verdant slopes of the Lesser and Great Himalayas.

1.9 SUMMARY

The Uttarakhand Himalaya, part of the larger Himalayan mountain range, exhibits a complex geologic structure formed through tectonic activities, primarily due to the collision of the Indian Plate with the Eurasian Plate. This region is characterized by a series of parallel mountain ranges that include the Great Himalayas (Himadri), Lesser Himalayas (Himachal), and the Shivalik ranges. The Great Himalayas, being the highest and the youngest, contain some of

the tallest peaks such as Nanda Devi and Trishul. The rock types in Uttarakhand vary significantly, including sedimentary rocks in the foothills, metamorphic rocks like schist and gneiss in the middle regions, and igneous rocks in the higher altitudes. The region is also seismically active, prone to earthquakes and landslides due to the ongoing tectonic movements. These geological features not only shape the landscape but also influence the mineral resources, groundwater flow, and overall environmental dynamics of the region.

Uttarakhand's drainage system is dominated by two major river basins: the Ganga and the Yamuna, both of which have their origins in the glaciers of the Himalayas. The Ganga river system is fed by major tributaries such as the Bhagirathi, Alaknanda, Mandakini, and Pindar, all originating from the glaciers of the Great Himalayas. The Yamuna River system includes tributaries like the Tons and the Asan. These rivers play a crucial role in the hydrology of Uttarakhand, supporting agriculture, providing drinking water, and sustaining the rich biodiversity of the region. The fast-flowing nature of these rivers, due to steep gradients, leads to deep gorges and valleys. The river systems are not only vital for the ecological balance but also hold immense religious significance, attracting pilgrims from all over the country to holy sites like Haridwar, Rishikesh, and the sources of the rivers themselves, such as Gangotri and Yamunotri.

The climate of Uttarakhand varies dramatically across different elevations, ranging from subtropical in the lower valleys to temperate and alpine in the higher altitudes. In the foothills and lower regions, summers are hot and humid, while winters are mild. As one ascends to higher elevations, the climate becomes cooler, with significant snowfall during the winter months. The region experiences a monsoon season from June to September, which brings heavy rainfall, particularly to the southern slopes of the Himalayas. This rainfall is crucial for replenishing rivers and supporting agriculture but also makes the area prone to landslides and flooding. The climate of Uttarakhand plays a critical role in determining the agricultural patterns, biodiversity, and even the socio-economic activities of the local population, such as tourism.

Uttarakhand's diverse climate and altitudinal variation have resulted in a rich variety of natural vegetation. The region can be broadly classified into tropical, subtropical, temperate, and alpine vegetation zones. In the lower foothills and valleys, one finds tropical and subtropical forests dominated by species such as sal, teak, and bamboo. Moving higher, temperate forests of oak, pine, and rhododendron become prevalent. The alpine zone, which lies above 3,000 meters,

is characterized by sparse vegetation, including grasses, shrubs, and alpine flowers, which bloom during the short summer season. These forests are not only home to a wide array of wildlife, including endangered species like the snow leopard and Himalayan tahr but also provide essential ecosystem services such as carbon sequestration, soil stabilization, and water regulation. The natural vegetation is integral to the cultural and economic life of the indigenous communities who rely on these forests for timber, fodder, and medicinal plants.

1.10 GLOSSARY

- **Geologic Structure:** Refers to the arrangement, composition, and historical formation of rock layers and tectonic features that shape the landscape. In Uttarakhand, this includes the Great Himalayas, Lesser Himalayas, and Shivalik ranges formed due to the collision between the Indian Plate and the Eurasian Plate.
- **Tectonic Plates:** Large slabs of Earth's lithosphere that move and interact, causing geological activity such as earthquakes, mountain building, and volcanic activity. The Himalayas were formed by the collision of the Indian Plate with the Eurasian Plate.
- **Drainage System:** A network of rivers, streams, and water bodies that channel precipitation and meltwater across the landscape. In Uttarakhand, major river systems include the Ganga and Yamuna, fed by glaciers and monsoon rains.
- **Glacier:** A large, slow-moving mass of ice found in mountainous regions that shape the landscape through erosion and deposition. Uttarakhand is home to several significant glaciers, such as the Gangotri and Pindari glaciers, which feed the region's major rivers.
- **River Basin:** An area of land drained by a river and its tributaries. The Ganga and Yamuna basins are crucial for Uttarakhand's hydrology, supporting agriculture, drinking water supplies, and ecosystems.
- **Climate:** The long-term pattern of weather conditions in a region, including temperature, precipitation, and wind. Uttarakhand experiences a range of climates from subtropical in the foothills to temperate and alpine in higher elevations, with a significant monsoon season.
- **Monsoon:** A seasonal wind pattern that brings heavy rainfall, particularly in South Asia. In Uttarakhand, the monsoon season from June to September provides essential water for agriculture but also poses risks of landslides and flooding.

- **Natural Vegetation:** Plant communities that grow naturally without human intervention. In Uttarakhand, vegetation varies from tropical forests in the foothills to temperate forests of oak and pine, and alpine meadows at higher altitudes.
- **Biodiversity:** The variety of plant and animal species in a particular region. Uttarakhand's diverse climate and topography support rich biodiversity, including several endemic and endangered species.
- **Soil:** The uppermost layer of the Earth's surface, consisting of mineral particles, organic matter, water, and air. Uttarakhand's soils range from fertile alluvial soils in river valleys to less fertile, rocky soils in higher altitudes.
- **Alluvial Soil:** Fertile soil deposited by rivers, rich in nutrients and suitable for agriculture. Found in the plains and valleys of Uttarakhand, supporting crops like rice, wheat, and sugarcane.
- **Terrace Farming:** An agricultural practice of cutting flat areas out of a hilly or mountainous landscape to grow crops. Common in the hilly regions of Uttarakhand to prevent soil erosion and manage water flow.
- **Physiographic Division:** A categorization of a region based on its physical characteristics, such as landforms and topography. Uttarakhand is divided into three main physiographic regions: the Shivalik foothills, the Lesser Himalayas, and the Great Himalayas.
- **Shivalik Range:** The southernmost mountain range of the Himalayas, characterized by low hills and dense forests. It forms the foothills of Uttarakhand and is known for its biodiversity and wildlife sanctuaries.
- **Alpine Zone:** A high-altitude region characterized by cold temperatures, sparse vegetation, and snow-covered peaks. In Uttarakhand, the alpine zone includes meadows, and glaciers, and is home to unique flora and fauna adapted to harsh climatic conditions.

1.11 ANSWER TO CHECK YOUR PROGRESS

1. Which major geological process led to the formation of the Uttarakhand Himalayas?

- a) Volcanic eruption
- b) Erosion by rivers
- c) Collision of tectonic plates
- d) Glacial melting

Answer: c

2. The Ganga and Yamuna rivers in Uttarakhand originate from which type of geographical feature?

- a) Deserts
- b) Lakes
- c) Glaciers
- d) Ocean

Answer: c

3. What type of climate is found in the higher altitudes of Uttarakhand?

- a) Tropical
- b) Desert
- c) Temperate
- d) Alpine

Answer: d

4. Which type of natural vegetation is most commonly found in the foothills of Uttarakhand?

- a) Alpine meadows
- b) Tropical rainforests
- c) Temperate forests
- d) Desert shrubs

Answer: b

5. The fertile soils found in the river valleys of Uttarakhand are primarily:

- a) Black soil
- b) Alluvial soil
- c) Laterite soil
- d) Sandy soil

Answer: b

6. Which physiographic division of Uttarakhand is characterized by dense forests and low hills?

- a) Shivalik Range
- b) Great Himalayas
- c) Lesser Himalayas
- d) Karakoram Range

Answer: a

7. The monsoon season in Uttarakhand typically occurs during which months?

- a) December to February
- b) March to May
- c) June to September
- d) October to November

Answer: c

8. What type of farming practice is commonly used in the hilly regions of Uttarakhand to prevent soil erosion?

- a) Slash-and-burn farming
- b) Hydroponics
- c) Terrace farming
- d) Subsistence farming

Answer: c

9. Which of the following rivers is NOT a tributary of the Ganga river system in Uttarakhand?

- a) Bhagirathi
- b) Alaknanda
- c) Mandakini
- d) Sutlej

Answer: d

10. The alpine vegetation zone in Uttarakhand is typically found at elevations above:

- a) 500 meters
- b) 1,000 meters
- c) 2,500 meters
- d) 3,000 meters

Answer: d

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1.13 TERMINAL QUESTIONS

1. Explain the geologic structure of the Uttarakhand Himalaya and discuss how tectonic activity has shaped its landscape.
2. Describe the major river systems of Uttarakhand, focusing on the origins and importance of the Ganga and Yamuna rivers. How do these rivers impact the region's agriculture and daily life?
3. Discuss the different climatic zones found in Uttarakhand. How does the climate vary with elevation, and what are the main factors influencing these climatic patterns?
4. Analyze the types of natural vegetation found in Uttarakhand. How does the vegetation change across different altitudinal zones, from tropical to alpine regions?
5. What are the characteristics of the soils in Uttarakhand? Compare and contrast the soil types found in the river valleys, foothills, and high-altitude regions.
6. Describe the physiographic divisions of Uttarakhand. How are the Shivalik Range, Lesser Himalayas, and Great Himalayas different in terms of topography, vegetation, and human settlement?
7. How does the monsoon season affect Uttarakhand? Discuss the role of monsoons in agriculture, water resources, and natural hazards such as landslides and floods.
8. Explain the significance of terrace farming in Uttarakhand's hilly regions. What are the benefits and challenges associated with this agricultural practice?
9. Discuss the role of glaciers in shaping the hydrology of Uttarakhand. How do glacial meltwater and glacial rivers contribute to the water resources of the region?
10. Evaluate the ecological and environmental challenges facing the Uttarakhand Himalaya due to its geologic structure, climate variability, and human activities. What conservation measures are necessary to protect the natural resources and biodiversity of this region?

UNIT 2: AGRICULTURE, CROP (FOOD, PLANTATION AND COMMERCIAL), AGRICULTURE PRODUCTION, IRRIGATION, LIVESTOCK RISING AND FISHERY

2.1 OBJECTIVE

2.2 INTRODUCTION

2.3 AGRICULTURE

2.4 CROP (FOOD, PLANTATION AND COMMERCIAL)

2.5 AGRICULTURE PRODUCTION

2.6 IRRIGATION

2.7 LIVESTOCK AND FISHERY

2.8 SUMMARY

2.9 GLOSSARY

2.10 ANSWER TO CHECK YOUR PROGRESS

2.11 REFERENCES

2.12 TERMINAL QUESTIONS

2.1 OBJECTIVE

After reading this unit, you will be able to:

- Understanding the Agriculture of Uttarakhand Himalaya.
- Learn about Crops especially food, plantation and commercial of Uttarakhand Himalaya.
- Gain knowledge about the Irrigation techniques of Uttarakhand Himalaya.
- Understanding the Livestock rising and fishery development of Uttarakhand Himalaya.

2.2 INTRODUCTION

Agriculture occupies a critical position in the economic framework and sustenance of the Uttarakhand Himalaya, where a substantial proportion of the populace depends on agricultural activities as their principal means of livelihood. The region's heterogeneous topography, encompassing the fertile plains at the foothills and the terraced cultivation in the elevated altitudes, facilitates a wide array of agricultural methodologies. Owing to the distinctive geographical and climatic attributes of the region, agricultural practices in Uttarakhand are typified by small, fragmented landholdings and a predominant reliance on traditional farming techniques. Nevertheless, there exists an escalating trend towards the modernization and diversification of agricultural practices aimed at augmenting productivity and accommodating shifting environmental conditions.

Agriculture in Uttarakhand is systematically classified into three principal categories of crops: food crops, plantation crops, and commercial crops. Food crops, including rice, wheat, barley, and millets, constitute the fundamental dietary components of the local populace and are predominantly cultivated in the fertile river valleys and terraced fields located on the hillsides. These crops are indispensable for ensuring food security and are predominantly raised through traditional rain-fed agricultural practices. In contrast, plantation crops such as tea, coffee, and various fruits including apples, plums, and apricots are cultivated at elevated altitudes, where the cooler climatic conditions provide optimal growth environments. The hilly regions, particularly in the Kumaon and Garhwal areas, have experienced a rise in the cultivation of horticultural crops, driven by heightened market demand and the potential for income generation.

Commercial crops, comprising sugarcane, oilseeds, and spices, are primarily cultivated in the lower elevations of the Shivalik range and within the adjacent valleys. These crops are produced for trade purposes and play a significant role in bolstering the regional economy. The

government of Uttarakhand has been actively promoting a transition among farmers toward cash crops and horticulture to enhance their economic returns and mitigate reliance on traditional subsistence farming.

The agricultural output in Uttarakhand is significantly influenced by the region's diverse climatic conditions and topographical features. The lower valleys, characterized by their fertile alluvial soils and comparatively warmer climates, demonstrate higher productivity levels compared to the more rugged and colder high-altitude regions. The implementation of terracing practices is prevalent in hilly areas to avert soil erosion and to effectively manage water resources. Despite the obstacles presented by the mountainous landscape, farmers in Uttarakhand have embraced innovative approaches such as mixed cropping and organic farming to optimize agricultural productivity.

Irrigation constitutes an essential element of agrarian practices in Uttarakhand, predominantly attributable to the irregular and seasonal characteristics of precipitation. Conventional irrigation techniques encompass the utilization of natural springs, streams, and rivers, in conjunction with minor irrigation conduits referred to as "guys," which redirect water from mountainous streams to agricultural plots. With the emergence of contemporary technological advancements, there has been a progressive transition towards more efficient irrigation methodologies such as drip and sprinkler systems, particularly in regions dedicated to the cultivation of high-value crops, including vegetables and fruits.

Cattle husbandry represents a fundamental aspect of agriculture in Uttarakhand, serving as an auxiliary source of revenue and nourishment for rural households. The pastoral communities of the region rear various livestock, including cows, buffaloes, goats, and sheep, which are well-suited to the hilly and forested landscape. Livestock plays a significant role in the agricultural economy by supplying milk, meat, wool, and manure, all of which are crucial for sustaining soil fertility. At elevated altitudes, the rearing of yak and pashmina goats is prevalent, with wool and dairy products emerging as substantial economic outputs. The amalgamation of livestock husbandry with crop production is a time-honored practice that fosters sustainable agricultural development within the region.

Aquaculture, albeit a less prominent sector in comparison to agriculture and livestock, is progressively acquiring significance within Uttarakhand's economic framework. The state is replete with an array of rivers, lakes, and reservoirs that furnish a favorable milieu for fish

cultivation. Freshwater species such as trout, mahseer, and catfish are frequently encountered in the region's rivers and streams. The government of Uttarakhand has been advocating for aquaculture and fish farming as alternative avenues for livelihood, particularly in locales endowed with appropriate aquatic habitats. Initiatives are underway to enhance cold-water fisheries and augment fish production to satisfy local demand and bolster food security.

2.3 AGRICULTURE

Agriculture is a fundamental component of Uttarakhand's economy and livelihood. With a significant portion of the population relying on agriculture, it plays a crucial role in the state's socio-economic development. The state is known for its diverse agro-climatic conditions, ranging from subtropical in the plains to temperate and alpine in the high altitudes of the Himalayas. These varying conditions allow for the cultivation of a wide range of crops, from staple cereals to fruits and spices. However, due to its hilly terrain and fragile ecology, agriculture in Uttarakhand faces unique challenges, including limited arable land, soil erosion, and dependence on monsoon rains.

Major Agricultural Zones

Uttarakhand's agricultural landscape can be broadly categorized into two zones:

- 1) **The Terai and Bhabar Regions:** These are the plains and foothills located in the southern part of the state. The Terai region, known for its rich and fertile alluvial soils, is suitable for intensive farming. It is the agricultural heartland of Uttarakhand, producing significant quantities of rice, wheat, sugarcane, and other commercial crops. The Bhabar region, with its coarser soils, supports crops like sugarcane, wheat, and various fruits.
- 2) **The Hilly and Mountainous Regions:** This area comprises the mid-altitude and high-altitude zones of the Himalayas. Here, terraced farming is a common practice to prevent soil erosion and manage water resources. Crops such as millets, barley, and pulses are predominantly grown in these regions due to their adaptability to cooler and less fertile conditions. The high-altitude areas are also known for horticulture, including the cultivation of apples, apricots, and plums.

Types of Crops Cultivated

Agriculture in Uttarakhand is characterized by a mix of food crops, cash crops, and horticultural produce.

Food Crops: Staples such as rice, wheat, and maize are widely cultivated, especially in the Terai and valley regions. In the hilly areas, millets like finger millet (ragi) and barnyard millet (jhangora) are popular due to their resilience to drought and suitability for terraced farming. Pulses like lentils and chickpeas are also common, contributing to the nutritional needs of the local population.

Cash Crops: Uttarakhand has increasingly diversified into cash crops, including sugarcane, which is grown extensively in the Terai region. The cultivation of oilseeds, soybeans, and ginger has also gained momentum as farmers look to enhance their income. The state's climate is suitable for the cultivation of aromatic and medicinal plants, which have high market value.

Horticulture: The hilly terrain and varied climate make Uttarakhand ideal for fruit cultivation. The state is a significant producer of apples, pears, peaches, and plums. The cultivation of off-season vegetables like tomatoes, capsicum, and cabbage has also been promoted, catering to both local and external markets. Floriculture, particularly the cultivation of marigolds, gladiolus, and roses, is becoming popular, contributing to the state's economy.

2.4 CROP (FOOD, PLANTATION AND COMMERCIAL)

Uttarakhand's diverse agro-climatic conditions, ranging from subtropical in the plains to temperate and alpine in the hills, support the cultivation of a variety of crops. Agriculture in Uttarakhand includes food crops for subsistence, plantation crops for commercial purposes, and other high-value cash crops that contribute significantly to the state's economy. This detailed overview examines these three major categories of crops grown in Uttarakhand.

Food Crops

Food crops are essential for the sustenance of Uttarakhand's population. The state cultivates various cereals, pulses, and vegetables to meet local food requirements.

Cereals:

Rice: Primarily grown in the Terai and Bhabar regions, rice is a staple food crop. The fertile alluvial soil, coupled with adequate irrigation facilities, makes these areas suitable for rice cultivation. Commonly grown varieties include Basmati, which is known for its aroma and export value.

Wheat: After rice, wheat is the second most important cereal crop in Uttarakhand. It is primarily cultivated during the Rabi season in the plains and valley areas. Wheat varieties such as UP-1109 and PBW-343 are popular among local farmers.

Maize: Grown in both the Kharif (monsoon) and Rabi (winter) seasons, maize is an important food and fodder crop. It is cultivated in the mid-altitude regions, where it thrives under moderate climatic conditions.

Millets:

Finger Millet (Ragi): This drought-resistant crop is commonly grown in the hilly regions of Uttarakhand. Ragi is valued for its nutritional content, including high levels of calcium and fibre.

Barnyard Millet (Jhangora): Another important millet grown in the hills, barnyard millet is known for its short growing season and adaptability to poor soils. It is often used in traditional dishes and is considered a staple in rural diets.

Pluses:

Pulses like lentils (Masoor), chickpeas (Chana), and kidney beans (Rajma) are widely cultivated in Uttarakhand. These crops play a vital role in the protein diet of the local population and are well-suited to the region's hilly terrain. Rajma, especially, is a popular pulse in the higher altitude regions due to its taste and nutritional benefits.

Vegetables:

Uttarakhand produces a variety of vegetables such as potatoes, tomatoes, peas, and beans. The state's unique climate allows for the production of off-season vegetables, which fetch higher market prices and are supplied to major markets across the country. Vegetables are grown both in kitchen gardens for local consumption and on larger scales for commercial purposes.

Plantation Crops

Plantation crops are primarily grown for commercial purposes and contribute significantly to Uttarakhand's agricultural economy.

Tea: The cultivation of tea has been gaining popularity in Uttarakhand, particularly in areas like Kausani, Almora, and Nainital. The state's cool and temperate climate in the mid-hill regions

provides ideal conditions for tea plantations. Uttarakhand tea is known for its distinct flavour and is gradually carving a niche in both national and international markets. The government has been promoting tea cultivation as a means of generating employment and income in the hilly areas.

Horticultural Crops: Fruits such as apples, apricots, plums, peaches, and pears are widely grown in Uttarakhand's hilly regions. The state's cool climate and fertile soil make it suitable for the cultivation of these temperate fruits. Apple cultivation, in particular, is a major source of income for farmers in regions like Uttarkashi and Nainital. Efforts have been made to introduce improved fruit varieties and enhance storage facilities to boost productivity and reduce post-harvest losses.

Spices and Aromatic Plants: Uttarakhand's diverse climate supports the cultivation of a variety of spices, including ginger, turmeric, and garlic. The state is also known for growing aromatic and medicinal plants such as tulsi (basil), ashwagandha, and lemongrass, which are used in traditional medicine and have a high market value.

3. Commercial Crops

Commercial crops in Uttarakhand include those that are cultivated primarily for sale and economic gain rather than for direct consumption by the farmers.

Sugarcane: Grown mainly in the Terai region, sugarcane is an important commercial crop in Uttarakhand. The crop benefits from the region's fertile soils and adequate water supply. Sugarcane farming supports the local sugar industry, which provides employment to a large number of people and contributes to the state's economy.

Oilseeds: The cultivation of oilseeds such as mustard and soybean has gained prominence in Uttarakhand, especially in the plains and foothills. These crops are grown for their oil content and are used both for domestic purposes and as raw materials in oil extraction industries. The state has been promoting the cultivation of oilseeds to reduce dependency on imported oils and improve farmer income.

Soybean: Grown as a Kharif crop, soybean is increasingly being cultivated in Uttarakhand for its high protein content and as a source of edible oil. It is also used in the preparation of various food products and animal feed. The crop's adaptability to different climatic conditions and its relatively short growing season make it a popular choice among farmers.

Floriculture: Uttarakhand has suitable conditions for the cultivation of flowers like marigolds, roses, and gladiolus. The floriculture industry has been expanding, catering to the domestic demand for ornamental flowers and also targeting export markets. Floriculture provides a high return on investment and is being promoted as an alternative source of income for farmers.

Medicinal and Aromatic Plants: The state is rich in biodiversity and supports the cultivation of medicinal and aromatic plants (MAPs) like ashwagandha, turmeric, and mentha (mint). These plants are used in the pharmaceutical, cosmetic, and food industries. Uttarakhand has established research centres to promote the cultivation of MAPs, which offer high market value and opportunities for value addition.

2.5 AGRICULTURE PRODUCTION

Agriculture in the Uttarakhand Himalaya is integral to the region's economy, culture, and livelihood. The unique topography and climatic conditions of the Himalayan terrain have shaped distinct agricultural practices that blend traditional methods with modern innovations. Uttarakhand's agriculture is diverse, ranging from subsistence farming to commercial horticulture, making it a vital contributor to the state's economy. This detailed overview explores the agricultural production systems, key crops, and the factors influencing agriculture in the Uttarakhand Himalaya.

Overview of Agricultural Practices

Agriculture in Uttarakhand is primarily rain-fed and highly dependent on the monsoon, although efforts have been made to expand irrigation facilities. The farming practices in the Himalayan region are influenced by factors such as altitude, terrain, and climatic variations. The state's agriculture can be categorized into three main zones:

- 1) **Subtropical Zone (up to 1,000 meters):** This zone includes the plains and lower foothills, where fertile alluvial soils are found. It is suitable for the cultivation of cereals, sugarcane, and vegetables.
- 2) **Temperate Zone (1,000 to 2,500 meters):** This zone covers the mid-altitude regions, characterized by cooler temperatures and a diverse range of crops such as fruits, millets, and temperate vegetables.

- 3) **Alpine Zone (above 2,500 meters):** The high-altitude regions are less suitable for traditional farming due to harsh climatic conditions, but they support pastoralism and the cultivation of cold-resistant crops like barley and certain medicinal plants.

Key Crops and Agricultural Production

Cereal Crops:

Rice: Rice is the staple food crop in the Terai and Bhabar regions of Uttarakhand, benefiting from the abundant monsoon rains and the availability of irrigation. It is cultivated primarily during the Kharif season (June to October). According to the Agriculture Census of Uttarakhand, over 200,000 hectares are devoted to rice cultivation annually, producing around 600,000 metric tonnes of rice.

Wheat: Cultivated in the Rabi season (November to April), wheat is another crucial cereal crop in Uttarakhand, especially in the plains and lower hills. The state produces approximately 1.1 million metric tonnes of wheat annually, making it one of the key food grains.

Millets: Millets such as finger millet (Ragi), barnyard millet (Jhangora), and foxtail millet are grown in the hilly regions. These crops are drought-resistant and are well-suited to the terraced farming systems of the Himalayas. Millets are important for food security and nutritional diversity due to their high nutritional content, including iron, calcium, and dietary fibre.

Horticultural Crops:

Fruits: Uttarakhand is renowned for its horticulture, especially temperate fruits such as apples, apricots, plums, peaches, and pears. The cool climate and fertile soil in regions like Nainital, Almora, and Uttarkashi favour fruit cultivation. The state produces over 400,000 metric tonnes of apples annually, with a significant portion exported to other states.

Vegetables: Off-season vegetable cultivation is a major agricultural activity in Uttarakhand, particularly in the valleys. Commonly grown vegetables include potatoes, tomatoes, peas, and beans. The production of off-season vegetables is lucrative, as they can be sold at premium prices in major markets like Delhi. Uttarakhand produces around 2.5 million metric tonnes of vegetables annually.

Spices and Medicinal Plants: Uttarakhand's diverse climatic zones support the cultivation of spices like ginger, turmeric, and garlic, as well as aromatic and medicinal plants such as ashwagandha, tulsi, and lemongrass. The state is a key supplier of these high-value crops to both domestic and international markets.

Cash Crops:

Sugarcane: Mainly grown in the Terai region, sugarcane is a significant cash crop that supports the local sugar industry. It is cultivated over an area of about 50,000 hectares, with an annual production of around 2.5 million metric tonnes.

Tea: Tea cultivation has been gaining traction in Uttarakhand, especially in areas like Kausani and Nainital. The state's tea is known for its unique flavour, influenced by the high-altitude growing conditions. Efforts are underway to expand tea plantations to boost local employment and export potential.

Floriculture: Uttarakhand's climate is suitable for growing flowers such as marigolds, roses, and gladiolus. Floriculture is emerging as a profitable sector, providing employment and income to farmers, particularly in the hilly regions.

Challenges in Agricultural Production

Terrain and Topography: The hilly terrain of Uttarakhand poses challenges for mechanized farming and large-scale agriculture. Terracing is often required to cultivate the steep slopes, which increases labour and input costs.

Climate Change: Variability in monsoon patterns, rising temperatures, and increased frequency of extreme weather events pose significant threats to agricultural productivity in the region. Farmers are increasingly facing issues such as water scarcity, soil erosion, and crop failures.

Limited Irrigation Facilities: While the Terai region benefits from irrigation infrastructure, many hilly areas still rely on rain-fed agriculture. Efforts to develop micro-irrigation systems, such as drip and sprinkler irrigation, are crucial to enhance water use efficiency.

Soil Degradation: Overuse of chemical fertilizers, deforestation, and unsustainable farming practices have led to soil degradation in some areas. Organic farming is being promoted to restore soil health and ensure sustainable agricultural production.

2.6 IRRIGATION

Agriculture in Uttarakhand is largely dependent on the monsoon rains. However, the irregularity and unpredictability of rainfall due to changing climatic conditions necessitate reliable irrigation systems to ensure stable agricultural production. Irrigation is crucial for:

Enhancing Crop Yields: Irrigation helps maintain soil moisture, ensuring that crops receive adequate water during dry spells, thus improving yields and reducing the risk of crop failure.

Supporting Multiple Cropping: With reliable irrigation, farmers can cultivate more than one crop in a year, increasing their income and food security.

Promoting Horticulture and Cash Crops: Consistent irrigation is essential for the cultivation of high-value crops like fruits, vegetables, and flowers, which are economically significant for the state.

Irrigation Methods in Uttarakhand

The irrigation infrastructure in Uttarakhand is diverse, catering to different geographical zones from the plains to the hills:

Canal Irrigation:

Ganga and Yamuna Canals: The fertile Terai and Bhabar regions, which are part of the Indo-Gangetic plains, benefit significantly from canal irrigation. Major canals such as the Upper Ganga Canal and its distributaries, the Haridwar Branch, and the Roorkee Canal play a crucial role in irrigating vast agricultural areas. These canals derive water from the Ganga and Yamuna rivers and support both the Kharif (monsoon) and Rabi (winter) cropping seasons.

Bhimal and Nainital Canals: In the hill districts, smaller canals and channels, often originating from natural lakes like Bhimal and Nainital, provide water for irrigation. These canal systems are crucial for terraced farming, which is common in the hilly areas.

Lift Irrigation:

Lift irrigation is increasingly used in regions where water is available at a lower elevation than the farmland. This method involves pumping water from rivers, lakes, or wells to higher ground. Lift irrigation schemes are particularly beneficial in areas with undulating terrain, ensuring that water reaches higher-altitude fields that cannot be served by gravity-fed canals.

Tube Wells and Bore Wells:

Groundwater Irrigation: In the plains of Uttarakhand, tube wells and bore wells are common sources of irrigation. The alluvial soil in these regions holds substantial groundwater reserves, which are tapped for irrigation through electric and diesel-powered pumps.

Sprinkler and Drip Irrigation: To promote water efficiency, farmers in water-scarce regions have adopted micro-irrigation techniques like sprinkler and drip irrigation. These systems help reduce water wastage, target the root zones of crops directly, and are particularly useful for high-value horticultural crops.

Traditional Methods:

Guls (Gravity Channels): In the hilly regions of Uttarakhand, traditional irrigation systems known as 'Guls' have been in use for centuries. Guls are small, community-managed canals that divert water from streams to terraced fields. These systems rely on gravity to carry water over long distances and are essential for subsistence farming in the mountains.

Naulas and Dhara Systems: Naulas (small spring water ponds) and Dharas (natural water springs) are traditional sources of water in rural areas. These sources are crucial for irrigation in villages where modern infrastructure is not feasible.

Challenges in Irrigation Management

Despite the importance of irrigation, several challenges hinder the optimal utilization of water resources in Uttarakhand:

Topographical Constraints: The rugged terrain of the Himalayan region makes the construction and maintenance of irrigation infrastructure difficult and costly. Building and maintaining canals, lift irrigation systems, and reservoirs are challenging tasks in steep and inaccessible areas.

Climate Change and Water Scarcity: Erratic rainfall patterns, glacial retreats, and shrinking water bodies due to climate change are affecting the availability of water for irrigation. The increasing frequency of droughts and dry spells poses a significant threat to the water security of the state.

Limited Groundwater Resources: In some regions, excessive use of groundwater for irrigation has led to a decline in water tables, causing wells and tube wells to dry up. Sustainable management of groundwater resources is crucial to prevent over-exploitation.

Poor Maintenance and Siltation: Many irrigation canals and structures suffer from poor maintenance, leading to problems like siltation, leakage, and inefficiency in water distribution. This results in a loss of water and reduced irrigation coverage.

Fragmented Landholdings: The small and fragmented landholdings in Uttarakhand make it difficult to implement large-scale irrigation projects. Individual farmers often lack the resources to invest in modern irrigation systems.

2.7 LIVESTOCK AND FISHERY

Livestock farming plays a crucial role in the agrarian economy of Uttarakhand for several reasons:

Livelihood Support: Livestock provides a steady source of income for farmers through the sale of milk, meat, wool, and other animal products. It acts as a financial buffer during crop failures or adverse climatic conditions.

Nutritional Security: Livestock products such as milk, eggs, and meat are essential sources of protein and other nutrients, contributing to the nutritional security of rural households.

Agricultural Support: Livestock, especially cattle and buffaloes, provide draught power for ploughing fields and transporting goods, particularly in remote and hilly areas where mechanization is limited.

Cultural and Social Significance: Livestock is deeply integrated into the cultural and social fabric of rural communities, with certain animals playing symbolic roles in traditional ceremonies and festivals.

Types of Livestock in Uttarakhand

Uttarakhand's livestock population is diverse, comprising cattle, buffaloes, goats, sheep, pigs, and poultry. Each type of livestock has its significance and adaptation to the region's geography and climate.

Cattle:

Indigenous Breeds: Indigenous cattle breeds like Badri (or Pahadi) are well-suited to the hilly terrain of Uttarakhand. These cattle are hardy, resistant to local diseases, and capable of surviving on limited fodder resources. The Badri breed, known for its milk quality, is integral to traditional dairy farming practices in the region.

Crossbreeds: To improve milk production, crossbreeding programs involving Jersey and Holstein Friesian breeds have been introduced. These crossbred cattle are more productive in terms of milk yield but require better management and feeding practices.

Buffaloes:

Buffaloes are primarily reared in the Terai and Bhabar regions of Uttarakhand, where the climate and availability of water resources are suitable for their management. The Murrah breed, known for its high milk yield, is common in these areas. Buffalo milk is a major source of dairy products such as ghee, butter, and paneer.

Goats:

Mountain Breeds: Goats are well-adapted to the hilly and mountainous regions of Uttarakhand. The state is home to indigenous breeds like the Chegu and Gaddi, known for their hardiness and ability to thrive on sparse vegetation. Goats are primarily reared for their milk, meat, and fibre.

Economic Importance: Goat farming is economically significant due to the high demand for goat milk and meat, both locally and in urban markets. Goats are also important for their manure, which is used as a natural fertilizer.

Sheep:

Sheep farming is common in the higher altitudes of Uttarakhand, particularly among the nomadic and semi-nomadic communities. The Gaddi and Bhakarwal breeds are reared for their wool, which is a valuable commodity in the production of woollen garments and traditional crafts.

Wool Production: Wool from Uttarakhand is known for its quality, and the state has a tradition of wool weaving and handicrafts. Sheep farming contributes significantly to the livelihood of pastoral communities.

Poultry:

Poultry farming is increasingly popular in Uttarakhand, both for egg and meat production. Indigenous chicken breeds, as well as commercial broiler and layer varieties, are reared in both rural and peri-urban areas. Poultry farming offers quick returns and requires less space and capital investment, making it attractive to small-scale farmers.

Pigs:

Pig farming is practised in some regions of Uttarakhand, particularly among tribal communities. Indigenous and improved breeds are reared for meat production, catering to both local consumption and market demands.

Economic and Social Significance of Livestock

The livestock sector is a vital contributor to Uttarakhand's rural economy:

Income Generation: Livestock products like milk, wool, meat, and eggs provide a steady source of income for rural households. The sale of surplus livestock and products at local markets offers financial stability and opportunities for economic diversification.

Employment Opportunities: Livestock farming generates employment opportunities in rural areas, particularly for women and marginalized communities. Activities such as milk collection, dairy processing, and marketing create jobs and promote rural entrepreneurship.

Cultural Heritage: Livestock is central to the cultural identity of various communities in Uttarakhand. Traditional practices, festivals, and rituals often involve livestock, reflecting the deep-rooted relationship between people and animals.

Challenges in Livestock Farming

Despite its significance, the livestock sector in Uttarakhand faces several challenges:

Limited Grazing Land: Overgrazing and deforestation have led to the degradation of grazing lands, affecting the availability of fodder for livestock. This issue is exacerbated by the growing human population and agricultural expansion.

Low Productivity: Indigenous livestock breeds, while hardy, have lower productivity in terms of milk and meat yield compared to improved breeds. This limits the economic returns from livestock farming.

Disease Management: Livestock in Uttarakhand is vulnerable to diseases, with limited access to veterinary services in remote areas. Disease outbreaks can lead to significant economic losses and impact food security.

Climate Change: Changing climatic conditions, including altered rainfall patterns and rising temperatures, affect livestock health and productivity. The availability of water and fodder resources is also impacted by climate change.

Inadequate Infrastructure: The lack of adequate infrastructure, such as cold storage facilities, processing units, and transport networks, hampers the development of the livestock sector. Farmers face challenges in marketing their products and accessing markets.

Fishery

Fisheries are crucial to Uttarakhand's economy for various reasons:

Livelihoods: Fishing and related activities provide employment and livelihood opportunities to many people, especially those living near rivers, lakes, and reservoirs. It is a primary source of income for many indigenous communities and local fishermen.

Nutritional Security: Fish is a rich source of protein, vitamins, and omega-3 fatty acids, contributing to the nutritional diet of the people. With increasing health awareness, the demand for fish as a dietary staple has grown.

Economic Development: The fisheries sector contributes to the state's economy by generating revenue from fish sales, fish-based products, and angling tourism. The sector also supports allied industries, such as fish feed production and equipment supply.

Tourism: The picturesque lakes and rivers of Uttarakhand, teeming with fish, attract tourists for recreational fishing and angling. This not only promotes tourism but also creates additional income avenues for local communities.

Types of Fish Found in Uttarakhand

Uttarakhand's diverse aquatic ecosystems, ranging from rivers and streams to high-altitude lakes, support various fish species. These can be broadly categorized into cold-water and warm-water fish species.

Cold Water Fish:

- 1) **Mahseer (Tor spp.):** The Golden Mahseer, Bluefin Mahseer, and Snow Trout are some of the significant cold-water fish species found in Uttarakhand. These fish are highly valued for their game fishing and are a major attraction for anglers from around the world.
- 2) **Snow Trout (Schizothorax spp.):** Snow Trout is native to the Himalayan waters and thrives in cold, fast-flowing streams and rivers. It is a popular fish among locals and tourists for its taste and sporting value.

- 3) **Brown Trout (*Salmo trutta*):** Introduced from Europe, Brown Trout has adapted well to the cold streams of Uttarakhand. It is a prized catch for recreational anglers due to its challenging nature and flavorful flesh.

Warm Water Fish:

- 1) **Rohu (*Labeorohita*), Catla (*Catlacatla*), and Mrigal (*Cirrhinus mrigala*):** These species are commonly found in the warmer waters of the plains and low-lying reservoirs. They are widely cultured in aquaculture ponds and are popular for commercial fishing.
- 2) **Common Carp (*Cyprinus carpio*):** Carp is another warm water species that has been introduced and is widely cultivated in the state for its adaptability to different water conditions and high market demand.
- 3) **Indian Major Carps:** These include species such as catfish and mussels, which are found in the reservoirs and ponds of the state and are important for their commercial value.

Challenges in the Fisheries Sector

Despite its potential, the fisheries sector in Uttarakhand faces several challenges:

Habitat Degradation: Deforestation, pollution, and construction activities along riverbanks have led to habitat degradation, adversely affecting fish populations and diversity. Siltation and reduced water quality are major concerns.

Overfishing: Unregulated fishing practices, including the use of illegal fishing methods such as explosives and fine mesh nets, have led to overfishing in many rivers and lakes, threatening the sustainability of fish stocks.

Climate Change: Alterations in water temperature, flow regimes, and the frequency of extreme weather events due to climate change impact fish habitats and breeding patterns, particularly for cold water species like trout and Mahseer.

Lack of Infrastructure: Limited access to modern fishing equipment, cold storage facilities, and fish processing units hampers the efficient marketing and distribution of fish products. This results in post-harvest losses and reduced income for fish farmers.

Inadequate Technical Knowledge: Many local fish farmers lack the technical know-how to implement modern aquaculture practices, which affects fish production and profitability. Training and extension services are often insufficient.

2.8 SUMMARY

Agriculture is the backbone of Uttarakhand's economy, supporting nearly three-quarters of the state's population. Given its diverse climatic zones, ranging from subtropical to alpine, the state has a wide range of agricultural practices. The unique topography of Uttarakhand, characterized by its mountainous terrain, influences the types of crops grown and the agricultural methods used. Subsistence farming is predominant, especially in hilly areas, where traditional techniques and organic farming are common. However, the plains of the Terai and Bhabar regions facilitate more commercial-scale agriculture, producing higher crop yields.

Uttarakhand's crop diversity is a reflection of its varied climatic conditions. The state produces a variety of food crops, including cereals such as rice, wheat, and maize, which are staples in the local diet. Pulses, millets, and oilseeds are also grown, supporting the nutritional needs of the population. Plantation crops like tea, primarily in the regions around Almora and Nainital, contribute to both domestic consumption and export markets. Commercial crops such as sugarcane, potatoes, and ginger are cultivated mainly in the lower foothills and plain regions. Additionally, horticultural crops, including apples, pears, plums, and apricots, are vital for the state's economy, supporting local livelihoods and attracting agritourism.

Agriculture production in Uttarakhand is largely dependent on the monsoon rains, although irrigation plays a crucial role in ensuring crop sustainability, especially in areas where rainfall is less predictable. The state has a network of traditional irrigation systems such as "guls" (water channels) in hilly regions, as well as modern irrigation methods, including canals and tube wells in the plains. The development of micro-irrigation systems, such as drip and sprinkler irrigation, is gaining popularity among farmers, enhancing water use efficiency and supporting higher crop yields. Despite these advancements, challenges such as water scarcity, soil erosion, and limited access to irrigation facilities in remote areas continue to impact agricultural productivity.

Livestock raising is an integral part of Uttarakhand's agricultural landscape, providing supplementary income and nutrition to rural households. The state's livestock includes cattle, buffaloes, sheep, goats, and poultry, which are reared for milk, meat, wool, and eggs. The hilly terrain and alpine pastures are well-suited for sheep and goat farming, which support the production of wool and meat. Dairy farming is widespread, with initiatives to improve cattle breeds and milk production through artificial insemination and veterinary services. The

promotion of organic dairy products is also gaining traction, tapping into the health-conscious market segment. Livestock raising not only contributes to food security but also plays a significant role in the socio-economic development of rural communities.

Fishery is an emerging sector in Uttarakhand, leveraging the state's abundant natural water resources, including rivers, lakes, and reservoirs. The fisheries sector supports livelihoods and provides nutritional benefits, particularly in rural areas. Cold-water fish species such as trout and Mahseer are prominent, especially in the higher altitudes, while warm-water species like rohu and catla are found in the plains and low-lying areas. The state has been promoting aquaculture through the establishment of fish hatcheries, fish seed production centres, and training programs for local fish farmers. Fishery cooperatives and government initiatives are vital in enhancing fish production and ensuring sustainable practices, contributing to the economic upliftment of the state's rural population.

2.9 GLOSSARY

- **Agriculture:** The primary occupation in Uttarakhand, involves the cultivation of crops and the rearing of livestock to sustain the livelihood of the majority of its population.
- **Food Crops:** Staple crops such as rice, wheat, and maize that are grown primarily for local consumption and form the dietary base in Uttarakhand.
- **Plantation Crops:** Commercial crops like tea that are grown on large estates, particularly in the hilly regions, contributing to both local economy and export.
- **Commercial Crops:** Crops such as sugarcane, potatoes, and ginger are grown mainly for sale rather than for personal consumption, playing a key role in the state's economy.
- **Horticulture:** The cultivation of fruits, vegetables, and flowers, with key produce including apples, pears, and plums, which are important for local livelihoods and agritourism.
- **Irrigation:** The artificial application of water to support crop growth in areas where rainfall is insufficient. In Uttarakhand, it includes traditional methods like "guys" and modern systems like drip irrigation.
- **Guls:** Traditional water channels in Uttarakhand are used for irrigation in the hilly regions, channelling water from rivers to agricultural fields.

- **Livestock Raising:** The practice of rearing animals such as cattle, sheep, and goats, which is a crucial aspect of Uttarakhand's agricultural economy, providing dairy, meat, wool, and eggs.
- **Dairy Farming:** The breeding and raising of cattle for milk production, which is widespread in Uttarakhand, contributing significantly to the rural economy.
- **Mahseer:** A species of cold water fish native to the Himalayan rivers of Uttarakhand, known for its significance in recreational fishing and conservation efforts.

2.10 ANSWER TO CHECK YOUR PROGRESS

1. Which of the following is the most widely grown food crop in Uttarakhand?

- a) Maize
- b) Wheat
- c) Rice
- d) Barley

Answer: c) Rice

2. What is the primary purpose of plantation crops in Uttarakhand?

- a) Subsistence farming
- b) Export and commercial sale
- c) Local consumption
- d) Animal fodder

Answer: b) Export and commercial sale

3. Which traditional irrigation system is commonly used in the hilly regions of Uttarakhand?

- a) Tube wells
- b) Canals
- c) Guls
- d) Drip irrigation

Answer: c) Guls

4. What is the main focus of livestock raising in Uttarakhand?

- a) Meat production
- b) Dairy production
- c) Wool production
- d) Egg production

Answer: b) Dairy production

5. Which fruit is a major horticultural product in Uttarakhand?

- a) Mango
- b) Apple
- c) Banana
- d) Pineapple

Answer: b) Apple

6. What is the primary challenge faced by agriculture in the hilly regions of Uttarakhand?

- a) Excessive rainfall
- b) Soil erosion
- c) Lack of sunlight
- d) Over-irrigation

Answer: b) Soil erosion

7. Which fish species is commonly farmed in the cold waters of Uttarakhand?

- a) Rohu
- b) Catla
- c) Trout
- d) Tilapia

Answer: c) Trout

8. Which crop is considered a major commercial crop in the plains of Uttarakhand?

- a) Wheat
- b) Sugarcane
- c) Rice
- d) Millet

Answer: b) Sugarcane

9. Which of the following is a key advantage of micro-irrigation systems in Uttarakhand?

- a) Reduced labour costs
- b) Increased water use efficiency
- c) Higher crop diversity
- d) Increased soil fertility

Answer: b) Increased water use efficiency

10. What is the significance of fish hatcheries in Uttarakhand?

- a) They promote marine fishing.
- b) They support recreational fishing.
- c) They help conserve endangered fish species.
- d) They enhance fish production and local fisheries.

Answer: d) They enhance fish production and local fisheries.

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2.12 TERMINAL QUESTIONS

1. Discuss the role of agriculture in the economy of Uttarakhand and how it influences the livelihoods of the local population.
2. Analyze the impact of varying climatic zones in Uttarakhand on the diversity of crops grown in the region. Provide examples of specific food, plantation, and commercial crops.
3. Explain the traditional and modern irrigation techniques used in Uttarakhand. How do these techniques address the challenges posed by the state's diverse topography?
4. Evaluate the importance of horticulture in Uttarakhand, particularly the cultivation of fruits like apples and pears. How does horticulture contribute to the state's economy and tourism?
5. Examine the challenges and opportunities associated with livestock raising in the mountainous regions of Uttarakhand. How does livestock contribute to the socio-economic development of rural communities?
6. Discuss the significance of aquaculture in Uttarakhand, with a focus on cold water fish species like trout. What are the main challenges faced by the fishery sector in the state?

7. How has the introduction of micro-irrigation systems like drip and sprinkler irrigation impacted agricultural productivity in Uttarakhand? Provide specific examples.
8. Analyze the role of government policies and initiatives in promoting sustainable agriculture and livestock farming in Uttarakhand. How effective have these measures been?
9. What are the environmental and socio-economic implications of shifting from subsistence farming to commercial agriculture in Uttarakhand?
10. Describe the relationship between agriculture production and food security in Uttarakhand. How do fluctuations in agricultural output affect the state's food supply and economy?

UNIT 3: INDUSTRIES: FOOD, FOREST AND AGRO-INDUSTRIES, INDUSTRIAL REGIONS, MINERALS AND POWER RESOURCES

3.1 OBJECTIVES

3.2 INTRODUCTION

3.3 FOOD INDUSTRIES

3.4 FOREST AND AGRO-INDUSTRIES

3.5 INDUSTRIAL REGIONS

3.6 MINERALS AND POWER RESOURCES

3.7 SUMMARY

3.8 GLOSSARY

3.9 ANSWER TO CHECK YOUR PROGRESS

3.10 REFERENCES

3.11 TERMINAL QUESTIONS

3.1 OBJECTIVE

After reading this unit, you will be able to:

- Understanding the Food Industries of Uttarakhand Himalaya.
- Learn about the Forest and Agro-industries of Uttarakhand Himalaya.
- Gain knowledge of Industrial regions of Uttarakhand Himalaya.
- Understanding the Minerals and power resources of Uttarakhand Himalaya.

3.2 INTRODUCTION

The food sector within Uttarakhand is intricately linked to the agricultural yield of the region, predominantly concentrating on the processing of locally sourced commodities such as cereals, fruits, and dairy products. The fertile valleys of the Himalayan foothills provide optimal conditions for the cultivation of staple crops including rice, wheat, and millets, in addition to fruit varieties such as apples, plums, and apricots. A multitude of food processing facilities have been established to capitalize on this potential, encompassing activities related to packaging, storage, and the enhancement of food items through value addition. The state government has actively endorsed the establishment of food parks and agro-processing units, thereby positioning Uttarakhand as an emerging nucleus for the food industry, particularly in rural locales where traditional agricultural practices are being augmented with contemporary processing technologies.

Uttarakhand's extensive forest cover underpins a diverse array of forest-based industrial activities, including the extraction of timber, resin, and medicinal plants. Agro-industries are pivotal in harnessing the region's rich biodiversity. Traditional crafts, such as the formulation of herbal remedies and the production of handmade paper, are prevalent in regions adjacent to forests. The agro-industrial sector also underscores the necessity for sustainable extraction and processing of forest-derived products, including organic honey and herbal cosmetics, thereby contributing positively to the economic framework of the state. Industries reliant on forest resources are closely interconnected with the conservation of local ecosystems, emphasizing a balance between industrial advancement and environmental sustainability.

Uttarakhand has established several principal industrial zones, primarily located in the foothills and plains of the Himalayas, leveraging its advantageous geographical position and natural assets. Areas such as Haridwar, Dehradun, and Rudrapur have evolved into industrial epicenters, attracting capital investment in domains such as automobile manufacturing, pharmaceuticals, and electronics. These regions profit from state-sponsored initiatives that provide tax incentives and infrastructure enhancements through various industrial development policies. The establishment of industrial estates and special economic zones (SEZs) has facilitated the attraction of large-scale industries, thereby transforming these locales into vibrant centers of economic activity while simultaneously enhancing employment opportunities.

The rugged topography of Uttarakhand is abundant in mineral resources, including limestone, dolomite, and gypsum, which are critical for the cement and construction sectors. Nonetheless, mining operations are constrained by ecological considerations. Uttarakhand is also recognized for its considerable hydroelectric power potential, with rivers such as the Ganga and Yamuna offering the requisite flow for multiple hydroelectric ventures. These projects not only fulfill the energy requirements of the state but also extend power supply to adjacent states. In recent years, there has been a growing focus on renewable energy sources such as solar and wind, reflecting the state's commitment to the advancement of sustainable energy development.

3.3 FOOD INDUSTRY

The food industry in Uttarakhand is an integral part of the state's economy, driven by its rich agricultural resources, diverse topography, and a government keen on promoting agro-processing and food parks. Uttarakhand's food sector mainly focuses on horticulture, cereal production, dairy farming, and organic farming, all of which contribute to its emerging food processing industry.

Agricultural Diversity and Food Production

The agriculturally rich valleys of Uttarakhand, notably in regions such as Nainital, Almora, and Dehradun, provide a favourable environment for the cultivation of diverse crop species. The predominant cereals cultivated in this area encompass rice, wheat, and a variety of millets, including barnyard millet and finger millet. Additionally, the climatic conditions prevalent in the state are conducive to the cultivation of fruits such as apples, pears, peaches, apricots, and plums, alongside vegetables including potatoes, tomatoes, and various leafy greens.

Horticulture serves as a significant economic contributor, particularly in elevated regions where fruit orchards flourish. The state's organic agricultural products, notably basmati rice and various herbal items, have attracted considerable interest both domestically and on an international scale. The organic farming movement, especially prominent in districts like Uttarkashi and Chamoli, underscores the importance of sustainable agricultural practices and the adoption of chemical-free farming approaches, which are increasingly becoming prevalent trends within the food industry.

Key Segments of the Food Industry

Dairy Industry: The dairy sector is an essential part of the food industry in Uttarakhand. The state is known for its production of milk and dairy products like butter, ghee, and curd. Cooperative societies, such as the Uttarakhand Cooperative Dairy Federation, play a significant role in the collection, processing, and distribution of milk. There has also been a rise in organic and high-value dairy products such as flavoured milk, cheese, and yoghurt.

Fruit Processing: With an abundance of fruits, the fruit processing industry in Uttarakhand has been gaining momentum. Products such as jams, jellies, juices, and fruit concentrates are being manufactured, with a focus on export markets as well. Fruit processing units can be found in areas like Haldwani and Ramnagar, where local fruits are processed and packaged for sale in domestic and international markets.

Organic and Health Foods: The increasing demand for organic and health-conscious products has led to the growth of organic food processing in the state. Products such as organic pulses, cereals, spices, and herbal teas are being processed and sold under various local brands. Organic certifications from bodies like the Agricultural and Processed Food Products Export Development Authority (APEDA) have helped build trust in Uttarakhand's organic products.

Food Grains Processing: The state has several units involved in processing grains like rice, wheat, and millet. Modern milling techniques are employed in these units to produce high-quality rice and wheat flour, which is sold across the country. Traditional grains such as amaranth and buckwheat are processed into health foods, aligning with the growing trend of millet-based diets in India.

Despite its growing potential, the food industry in Uttarakhand faces several challenges. The mountainous terrain makes transportation difficult, and the state's infrastructure, though

improving, is still developing in remote areas. Moreover, seasonal fluctuations in agricultural production due to climate change can affect the stability of supply.

3.4 FOREST AND AGRO-INDUSTRIES

The state of Uttarakhand is endowed with vast forest resources and a rich agricultural landscape, especially in the hilly regions of the Himalayas. These natural resources have paved the way for forest-based and agro-industries to flourish in the region. The forest and agro-industries are not only vital for the state's economy but also serve as a means of livelihood for a significant portion of the population, particularly in rural and tribal areas.

Forest-Based Industries

The forest sector in Uttarakhand is deeply intertwined with the state's culture and economy. Forests cover nearly 65% of Uttarakhand's geographical area, making it a key resource for multiple industries. The forest-based industries in Uttarakhand can be classified into three main categories:

Timber and Wood-Based Industries: Uttarakhand's forests are home to valuable tree species like pine, oak, deodar, and sal. The timber industry is a significant part of the state's forest economy, providing raw materials for construction, furniture, and other wood-based products. However, to maintain ecological balance, the government has put strict regulations on timber extraction, leading to a rise in alternative forest-based industries.

In addition to timber, Uttarakhand has a growing market for bamboo products. Bamboo, known as "green gold," is being used in handicrafts, furniture, and construction materials. Bamboo-based industries have great potential for rural employment and sustainable economic growth, with programs supporting local bamboo cultivators and artisans.

Resin and Rosin Industry: The Himalayan pine forests produce resin, which is extracted for industrial use. Pine resin is processed into rosin and turpentine oil, both of which have applications in industries like paper, varnishes, and pharmaceuticals. Uttarakhand has several resin extraction units, particularly in the foothills and middle Himalayan ranges. The resin industry is a major source of income for local communities and cooperatives involved in forest produce collection.

Non-Timber Forest Products (NTFPs): Non-timber forest products include a range of resources such as medicinal plants, herbs, wild fruits, and honey. Uttarakhand is rich in

medicinal plant species like turmeric, ashwagandha, and Shatavari, which are widely used in Ayurvedic and herbal medicine. The forest industry has tapped into this resource through the collection and processing of these plants for pharmaceutical and nutraceutical products.

The Uttarakhand Forest Development Corporation and various community-based organizations play a crucial role in the sustainable harvesting of these resources, ensuring that the exploitation of medicinal plants does not harm the fragile ecosystem. Honey collection and processing also play a significant role, with organic, forest-derived honey gaining popularity in markets across India.

Agro-industries in Uttarakhand

Agro-industries in Uttarakhand are closely linked to the state's agricultural and horticultural activities, which are a significant part of rural livelihoods. The mountainous terrain, while challenging for large-scale farming, has fostered the development of unique agro-industries focusing on local crops, horticulture, and organic farming.

Horticulture-Based Industries: The agro-climatic conditions of Uttarakhand are ideal for growing a variety of fruits and vegetables. The state is particularly known for its apples, pears, apricots, plums, and kiwis. In the high-altitude regions, horticultural produce is processed into jams, juices, pickles, and other value-added products.

Fruit processing industries in areas like Nainital, Dehradun, and Ramgarh have developed significantly, with a focus on both domestic and export markets. Cold storage units and food processing plants have been established to preserve and process these fruits, thus reducing post-harvest losses and ensuring a stable market for farmers.

Organic Farming and Agro-Processing: Uttarakhand has emerged as a leader in organic farming, particularly in districts like Almora, Uttarkashi, and Chamoli. The state's organic certification programs have empowered local farmers to shift toward sustainable farming practices, avoiding the use of harmful chemicals and fertilizers. The organic produce from Uttarakhand, which includes cereals, pulses, spices, and herbs, is processed and packaged for sale under various brands, both in Indian and international markets.

Several agro-industrial units focus on organic food processing, including the production of organic rice, millet, herbal teas, and health foods. These units also specialize in processing minor millets, which are grown in the hilly regions of Uttarakhand, contributing to the state's food security and biodiversity conservation.

Herbal and Medicinal Plant Industry: The cultivation and processing of medicinal plants are integral to Uttarakhand's agro-industry. The high-altitude areas of the state are home to numerous rare herbs used in traditional Ayurvedic medicine. Industries based on the extraction of these herbs have grown over the years, with products like herbal medicines, essential oils, and dietary supplements.

The state government, along with organizations like the Uttarakhand Herbal Research and Development Institute (UHRDI), promotes the cultivation and sustainable harvesting of medicinal plants. Processing facilities for herbal products are being set up to cater to the growing demand for natural and Ayurvedic health products, both in India and abroad.

Tea Industry: Uttarakhand is home to a growing tea industry, particularly in areas like Champawat, Bageshwar, and Almora. The state's climate and elevation are ideal for tea cultivation, and organic tea production has gained momentum in recent years. Processing units for tea leaves have been established, producing organic green tea, black tea, and herbal blends. Uttarakhand's tea industry is relatively small but holds significant potential for growth in the future.

Despite its growth, the forest and agro-industries of Uttarakhand face several challenges. Deforestation, over-exploitation of forest resources, and unsustainable agricultural practices pose threats to the environment and the livelihoods of local communities. Additionally, the mountainous terrain makes transportation and infrastructure development difficult, affecting the efficient processing and marketing of agricultural and forest products.

To address these challenges, the state has adopted policies aimed at sustainable development. For example, joint forest management initiatives involve local communities in forest conservation efforts while allowing them to benefit from forest resources. Similarly, organic farming initiatives emphasize soil health and biodiversity conservation.

3.5 INDUSTRIAL REGIONS

The industrial landscape of Uttarakhand is defined by its unique geographical and natural features, which range from the plains in the southern region to the hilly and mountainous areas in the north. Since gaining statehood in 2000, Uttarakhand has undergone rapid industrialization, largely supported by government initiatives, natural resource availability, and improved

infrastructure. The state's strategic location, connecting the northern and central parts of India, has also made it a significant hub for various industries.

The major industrial regions in Uttarakhand can be broadly classified into two categories: the industrially developed foothills and plain regions, and the emerging industrial regions in the hilly areas. These regions are driven by sectors like manufacturing, agro-based industries, pharmaceuticals, and hydropower.

Haridwar Industrial Region

Haridwar, located in the southern plains of Uttarakhand, is one of the most prominent industrial regions in the state. Haridwar's industrial growth has been fueled by its inclusion under the Special Industrial Package Scheme announced by the Government of India, which offers incentives such as tax exemptions and subsidies.

Key features of Haridwar's industrial region include:

Integrated Industrial Estate (IIE) in Sidcul: The State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIDCUL) developed a large industrial estate in Haridwar, spread over 2,034 acres. This industrial hub houses industries ranging from automobiles and electronics to food processing and pharmaceuticals.

Pharmaceutical Industry: Haridwar has become a hub for the pharmaceutical industry with companies like Patanjali, Hindustan Unilever, and others setting up large production units. The availability of land, improved transportation, and tax incentives have encouraged pharmaceutical giants to invest in this region.

Automobile Industry: Major automobile companies, including Hero MotoCorp and Ashok Leyland, have their manufacturing plants in Haridwar. The industrial zone's proximity to the National Capital Region (NCR) and a well-developed transportation network contribute to its success as an automobile hub.

Haridwar's industrial region has become one of the fastest-growing industrial zones in India, benefiting from both the state and central government policies designed to promote industrial development in Uttarakhand.

Pantnagar Industrial Region

Pantnagar, situated in the Terai region of Uttarakhand, is another major industrial zone. Historically known for its agriculture and the famous Govind Ballabh Pant University of Agriculture and Technology, Pantnagar has transformed into a thriving industrial centre.

Key features of the Pantnagar Industrial Region:

Pantnagar SIDCUL Industrial Estate: The industrial estate in Pantnagar is one of the largest in Uttarakhand, covering over 3,339 acres. The presence of a strong agro-based industry, supported by agricultural research from the nearby university, has helped the region become a leading hub for agro-industrial activities.

Automobile Manufacturing Hub: Pantnagar is home to major automobile manufacturing units, including Tata Motors and Bajaj Auto. Tata Motors plant in Pantnagar is one of the company's key manufacturing sites, particularly known for producing light commercial vehicles.

FMCG and Agro-processing: Several FMCG companies, such as Nestlé and Britannia, have set up manufacturing units in Pantnagar. The region benefits from its proximity to agricultural areas, making it an ideal location for food processing industries.

Pantnagar's development as an industrial region is supported by its excellent connectivity via rail and road to major cities like Delhi and Lucknow, making it an attractive destination for industries looking to benefit from Uttarakhand's favourable policies.

Dehradun Industrial Region

As the capital of Uttarakhand, Dehradun plays a central role in the state's economy. While traditionally known for its educational institutions and tourism, Dehradun has witnessed a surge in industrial growth in recent years.

Key features of the Dehradun Industrial Region:

Pharmaceutical and Biotech Industries: Dehradun has become an important centre for pharmaceutical and biotech industries. Companies like Windlas Biotech and Medipol have established production units in the region. The clean environment and access to skilled labour from local institutions make Dehradun an attractive location for health-related industries.

IT and Software Development: Dehradun is emerging as a hub for the IT industry, with software companies and IT parks being established in the region. The development of Information Technology Parks by the state government is aimed at attracting software development companies to the area.

Small and Medium Enterprises (SMEs): Dehradun is home to a large number of SMEs, especially in sectors like handicrafts, textiles, and paper manufacturing. The region's proximity to hilly areas makes it a key centre for agro-based industries and the processing of local forest produce.

Dehradun's industrial growth is supported by its strategic location and the state government's efforts to make it an attractive destination for businesses across various sectors.

Rudrapur Industrial Region

Rudrapur, located in the Udham Singh Nagar district, is another important industrial hub in Uttarakhand. Situated in the fertile Terai region, Rudrapur has capitalized on its agricultural base to become a centre for agro-based industries.

Key features of Rudrapur Industrial Region:

SIDCUL Industrial Estate: Like Haridwar and Pantnagar, Rudrapur also hosts a large industrial estate developed by SIDCUL. The industrial estate covers over 2,000 acres and houses a variety of industries, from food processing to automotive and electronics.

Agro-based Industries: Rudrapur's agro-industrial sector is driven by its proximity to agricultural lands. Food processing, packaging, and cold storage facilities have developed in the region, contributing to its status as an agro-industrial hub.

Manufacturing and Electronics: The industrial region is home to companies like Dabur and LG Electronics. The availability of land, infrastructure, and incentives has attracted a variety of manufacturing companies to Rudrapur.

Rudrapur's industrial growth has been enhanced by its well-developed transportation network, connecting it to major cities in northern India. The region benefits from state support for agro-industries and manufacturing.

Kashipur Industrial Region

Kashipur, located in the Kumaon division of Uttarakhand, has developed into a key industrial region due to its proximity to the agricultural heartland of the Terai region.

Key features of the Kashipur Industrial Region:

Chemical and Paper Industries: Kashipur is known for its chemical and paper manufacturing units. Companies like India Glycols Limited (IGL) and Century Pulp and Paper have significant operations in the region.

Agro-processing: Kashipur's agricultural surroundings have fostered the growth of agro-processing industries. Units that focus on processing grains, dairy, and other farm produce are central to the local economy.

Kashipur's development as an industrial region is supported by state-led infrastructure projects and its advantageous location near major agricultural centres.

Hilly and Remote Industrial Regions

While most of Uttarakhand's industrial development is concentrated in the plains and foothills, the state government has made efforts to promote industries in the hilly regions as well. These efforts are aimed at decentralizing economic activity and creating employment in remote areas.

Almora, Pithoragarh, and Chamoli: These high-altitude regions have potential for agro-based industries, including organic farming, medicinal plant cultivation, and herbal product processing. The government is encouraging small-scale industries like wool processing, handicrafts, and tourism-related services to develop in these areas.

Hydropower and Renewable Energy: Uttarakhand's hilly regions are ideal for hydropower projects due to the presence of fast-flowing rivers. Several hydropower plants, including small and micro hydropower projects, are being developed in the region. Renewable energy initiatives, such as solar and wind power projects, are also being explored to create sustainable industrial development in remote areas.

Uttarakhand's industrial regions are positioned for significant growth, but they also face challenges, particularly in hilly and remote areas. Infrastructure, including transportation and communication networks, needs improvement to facilitate industrial growth in the mountains. Additionally, ensuring sustainable development in eco-sensitive zones is crucial to protecting the fragile Himalayan environment.

3.6 MINERALS AND POWER RESOURCES

Uttarakhand, located in the heart of the Himalayan region, is rich in natural resources, including minerals and abundant water sources that serve as a foundation for its energy sector. The state's diverse geological formations, ranging from the foothills to the high-altitude regions of the Himalayas, house valuable minerals. At the same time, its rivers and terrain provide a vast potential for hydropower development. These resources play a critical role in the state's economy, providing employment opportunities, energy security, and revenue generation.

Minerals in Uttarakhand Himalaya

Though not as mineral-rich as some other states in India, Uttarakhand's hilly regions contain several important minerals, especially in the form of construction materials and minor minerals used in industry and infrastructure development.

Limestone: Limestone is one of the most abundant minerals found in Uttarakhand, particularly in the districts of Dehradun, Pithoragarh, and Almora. The limestone deposits are primarily used in the cement industry and lime production for construction, agriculture, and industrial purposes. The state has several operational limestone quarries, especially in regions like Nainital, Dehradun, and Tehri Garhwal, which supply materials to local cement factories.

Magnesite: Magnesite is found primarily in the districts of Pithoragarh and Almora, particularly in the Munsiyari and Bageshwar areas. Magnesite is used in the manufacture of refractory materials, fertilizers, and as a raw material for the production of magnesium salts. The high-quality magnesite deposits in Uttarakhand have significant industrial importance, although mining activities are somewhat restricted to protect the fragile ecosystem.

Soapstone: Soapstone is another important mineral found in the state, especially in areas like Bageshwar, Pithoragarh, and Chamoli. Soapstone is primarily used in the cosmetic and talcum powder industry, as well as in sculptures and handicrafts due to its soft texture and ease of carving.

Copper: Uttarakhand has been known for its small-scale copper mining, especially in the Almora and Pithoragarh districts. The copper reserves are relatively small, but they have historical significance, with copper mining being an important activity in these regions during earlier times. Today, the extraction of copper is limited due to environmental concerns and the depletion of easily accessible deposits.

Graphite: Graphite deposits in Uttarakhand are found primarily in Almora, Chamoli, and Pithoragarh districts. Graphite is used in various industrial applications, such as in the production of pencils, lubricants, and batteries, and as a refractory material in high-temperature environments. Although mining activity is relatively small, the graphite deposits in the state hold potential for future industrial use.

Marble and Granite: Marble and granite deposits in the region, particularly in Bageshwar and Pithoragarh districts, are used primarily for construction and decorative purposes. The marble industry, though small in scale, provides material for local construction, flooring, and carving industries.

While Uttarakhand has a variety of minerals, environmental restrictions, and sustainable development concerns have limited large-scale mining operations in the state. The focus remains on extracting minerals in a way that does not harm the delicate Himalayan ecosystem.

Power Resources in Uttarakhand Himalaya

Uttarakhand's energy resources, especially hydropower, are a key part of the state's economy. The numerous rivers that flow through the state, including the Ganga, Yamuna, Bhagirathi, and Alaknanda, provide immense potential for hydropower generation. In addition to hydropower, the state has also begun exploring other renewable energy sources, such as solar and wind energy, to meet its growing energy needs sustainably.

Hydropower Resources

Hydropower is the most significant power resource in Uttarakhand, as the state has abundant rivers that provide the necessary flow and elevation differences needed for efficient hydropower generation. The Himalayas' rugged terrain creates an ideal setting for both large and small hydropower projects. Uttarakhand is often referred to as the "Energy State" due to its hydropower potential.

Large Hydropower Projects: Uttarakhand has developed several large hydropower projects that supply electricity to the state and other parts of the country. The state's installed capacity for hydropower is over 3,600 MW, and several large-scale projects are in operation, including the Tehri Dam project on the Bhagirathi River. The Tehri Dam is one of the largest hydropower projects in India, with an installed capacity of 1,000 MW and an additional pumped-storage capacity of 1,000 MW.

Medium and Small Hydropower Projects: Apart from large dams, Uttarakhand has also focused on developing small and medium hydropower projects. These smaller projects are less invasive and more sustainable, providing power to remote and hilly areas where large transmission networks are difficult to build. Examples of small hydropower projects include the Maneri Bhalu Hydropower Project on the Bhagirathi River and the Dhauliganga Project in Pithoragarh.

Potential for Future Growth: Uttarakhand's total hydropower potential is estimated at over 25,000 MW. However, only a fraction of this potential has been tapped so far due to concerns over environmental degradation, displacement of local communities, and the impact on the region's biodiversity. As a result, the government is carefully evaluating future projects to ensure they align with sustainable development goals.

Solar Power Resources

While hydropower is the dominant source of energy in Uttarakhand, the state is also investing in solar power to diversify its energy portfolio. Uttarakhand receives substantial sunlight, especially in the lower and middle Himalayan regions, making it suitable for solar power generation.

Rooftop Solar Programs: The state government has launched initiatives to encourage the installation of rooftop solar panels in urban and rural areas. The Uttarakhand Renewable Energy Development Agency (UREDA) has been active in promoting solar power across the state, with a focus on off-grid areas that are not connected to the main power grid.

Solar Parks: Uttarakhand has identified several locations for the development of solar parks, where large-scale solar power plants can be set up. These solar parks are being developed with the aim of meeting the state's renewable energy targets and reducing its reliance on hydropower, which can fluctuate with seasonal water availability.

Wind Power Resources

Wind power in Uttarakhand is still in its nascent stages, as the hilly terrain presents challenges for large-scale wind farm development. However, certain areas with consistent wind patterns, such as high-altitude ridges, have been identified for potential wind energy projects. Wind energy generation remains a small component of the state's energy mix, but with advancements in technology, it could become a viable source of renewable energy in the future.

Biomass and Other Renewable Energy

Biomass energy, which utilizes agricultural waste, forest residues, and other organic materials, is another potential energy source in Uttarakhand. Biomass energy is particularly relevant for rural areas, where agricultural waste can be converted into energy for cooking, heating, and electricity generation.

Biogas Projects: The state government has supported the development of biogas plants in rural areas, especially for small-scale energy production. Biogas projects help reduce the dependency on firewood for cooking, which in turn helps preserve forests.

3.7 SUMMARY

Uttarakhand's industrial landscape is deeply shaped by its rich natural resources and unique geography, making it an important region for food processing, forest and agro-industries,

industrial development, and energy generation. Each of these sectors contributes significantly to the state's economy while also posing challenges due to environmental concerns and the region's fragile ecosystem.

Uttarakhand's food industry has emerged as a major sector due to the state's agricultural base and the availability of raw materials. The region's diverse climate enables the cultivation of a wide range of crops, including grains, fruits, and vegetables. Consequently, food processing industries, particularly in areas like Haridwar and Pantnagar, have flourished. The state government, through initiatives like Mega Food Parks, aims to boost food processing capabilities, attracting investments in the packaging, storage, and value-added processing sectors. Key products include processed fruits, dairy products, and grain-based foods, with companies like Nestlé and Patanjali leading the way in the sector.

Uttarakhand's extensive forest cover supports various forest-based industries, including those that process timber, resin, medicinal plants, and aromatic oils. The forest and agro-industries in the state are largely small to medium enterprises, focused on sustainably utilizing forest resources while providing livelihoods to local populations. Medicinal and aromatic plants (MAPs) form an important part of Uttarakhand's agro-industries, and the cultivation of organic crops and herbs is also gaining popularity. In addition, agro-industries related to wool processing, dairy farming, and horticulture are vital in hilly areas where agriculture alone may not be sufficient for income generation.

The industrial development in Uttarakhand is primarily concentrated in the southern plains, particularly in regions like Haridwar, Pantnagar, and Rudrapur. These areas have been designated as Special Industrial Zones under the State Infrastructure and Industrial Development Corporation of Uttarakhand Limited (SIDCUL), which has attracted significant investments in the manufacturing, pharmaceuticals, automobile, and FMCG sectors. Haridwar is a key hub for pharmaceuticals and FMCG products, while Pantnagar is known for its automobile and agro-processing industries. Dehradun is also emerging as a centre for IT, education, and small-scale industries. In the hilly regions, small-scale and cottage industries, focusing on local resources such as handicrafts, agro-based products, and herbal processing, play a central role in the economy.

Uttarakhand's mineral resources include limestone, magnesite, soapstone, and copper, though mining activities are limited due to environmental concerns. The state's mineral wealth

primarily supports local industries, such as cement production and refractory materials. In addition, Uttarakhand is abundant in hydropower resources, owing to its fast-flowing rivers and rugged terrain. The state's total hydropower potential is estimated at over 25,000 MW, with significant projects like the Tehri Dam playing a key role in the state's energy generation. However, hydropower development is balanced by concerns over environmental impact, including risks posed by seismic activity and biodiversity loss. Additionally, Uttarakhand is exploring solar, wind, and biomass energy as part of its renewable energy portfolio, particularly in rural and remote regions.

3.8 GLOSSARY

- **Food Processing:** The transformation of agricultural products into consumable food items. This includes processes such as canning, packaging, and freezing of fruits, vegetables, grains, and dairy products.
- **Mega Food Park:** A government initiative designed to facilitate the establishment of modern food processing facilities along with necessary infrastructure for value chain integration, from farm to market.
- **FMCG (Fast-Moving Consumer Goods):** Products that are sold quickly and at relatively low cost, such as packaged foods, beverages, toiletries, and other consumer goods.
- **Forest-based Industries:** Industries that rely on forest resources like timber, resin, medicinal plants, and herbs for producing goods. Examples include paper, furniture, and medicinal product manufacturing.
- **Agro-based Industries:** Industries that process raw materials derived from agriculture, including wool processing, dairy farming, and the production of herbal products and essential oils.
- **Medicinal and Aromatic Plants (MAPs):** Plants used for medicinal, aromatic, or therapeutic purposes, often processed into essential oils, pharmaceuticals, or cosmetic products.
- **Organic Farming:** A method of farming that avoids the use of synthetic chemicals and emphasizes environmentally sustainable practices.
- **SIDCUL (State Infrastructure and Industrial Development Corporation of Uttarakhand Limited):** A government corporation that promotes industrial development

by establishing industrial estates and attracting investment through tax incentives and infrastructure development.

- **Special Industrial Zones:** Designated areas with specific economic benefits and infrastructure designed to promote manufacturing and industrial activities, typically offering tax incentives and subsidies.
- **Cottage Industries:** Small-scale, home-based industries that produce goods using traditional methods, often focusing on local resources such as handicrafts, textiles, and local foods.
- **Limestone:** A sedimentary rock composed mainly of calcium carbonate, used in the production of cement, lime, and building materials.
- **Magnesite:** A mineral containing magnesium carbonate, used in making refractory materials, fertilizers, and magnesium salts.
- **Soapstone:** A soft metamorphic rock used for carving, as well as in the production of talcum powder and other industrial products.
- **Gypsum:** A soft sulfate mineral used in construction materials like plaster and drywall.
- **Copper:** A metal used extensively in electrical wiring, electronics, and alloy production.
- **Graphite:** A crystalline form of carbon used in pencils, lubricants, batteries, and as a refractory material.
- **Hydropower:** The generation of electricity by harnessing the energy from flowing water, typically through dams and turbines. Uttarakhand is rich in hydropower potential due to its many rivers.
- **Tehri Dam:** A major hydropower project on the Bhagirathi River, with an installed capacity of 1,000 MW, one of the largest in India.
- **Solar Energy:** Energy derived from the sun, typically captured using solar panels, and increasingly used in Uttarakhand for both grid-connected and off-grid applications.
- **Biomass Energy:** Energy produced from organic materials such as agricultural waste, forest residues, and other biological matter, commonly used in rural areas for cooking and heating.
- **Renewable Energy:** Energy sourced from natural processes that are continually replenished, such as solar, wind, hydropower, and biomass.

3.9 ANSWER TO CHECK YOUR PROGRESS

1. Which industry is the most prominent in Uttarakhand's agricultural sector?

- A) Automobile Industry
- B) Food Processing Industry
- C) Textile Industry
- D) IT Industry

Answer: B) Food Processing Industry

2. What is the primary mineral used in cement production found in Uttarakhand?

- A) Magnesite
- B) Copper
- C) Limestone
- D) Soapstone

Answer: C) Limestone

3. Which district in Uttarakhand is well-known for the extraction of magnesite?

- A) Almora
- B) Dehradun
- C) Pithoragarh
- D) Haridwar

Answer: C) Pithoragarh

4. What is the main purpose of the "Mega Food Park" initiative in Uttarakhand?

- A) Promote organic farming
- B) Develop advanced food processing infrastructure
- C) Promote tourism in the state
- D) Boost timber-based industries

Answer: B) Develop advanced food processing infrastructure

5. Which of the following regions is a major industrial hub in Uttarakhand?

- A) Haridwar
- B) Mussoorie
- C) Rishikesh

D) Almora

Answer: A) Haridwar

6. Which hydropower project is one of the largest in Uttarakhand?

A) Dhauliganga Hydropower Project

B) Bhakra Nangal Dam

C) Tehri Dam

D) Maneri Bhali Project

Answer: C) Tehri Dam

7. Which mineral found in Uttarakhand is commonly used in the production of talcum powder?

A) Graphite

B) Soapstone

C) Copper

D) Marble

Answer: B) Soapstone

8. What organization is responsible for promoting industrial development in Uttarakhand?

A) NITI Aayog

B) SIDCUL (State Infrastructure and Industrial Development Corporation of Uttarakhand Limited)

C) IRDAI

D) FCI

Answer: B) SIDCUL

9. Which renewable energy source is most widely utilized in Uttarakhand for electricity generation?

A) Solar Energy

B) Wind Energy

C) Hydropower

D) Biomass Energy

Answer: C) Hydropower

10. Which of the following industries benefits the most from Uttarakhand's forest resources?

- A) Automobile Industry
- B) Agro-based Industry
- C) Forest-based Industry
- D) Textile Industry

Answer: C) Forest-based Industry

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3.11 TERMINAL QUESTIONS

1. Discuss the role of the food processing industry in the economic development of Uttarakhand. How has the Mega Food Park initiative contributed to this sector?
2. Explain the importance of forest-based industries in Uttarakhand. What measures are being taken to ensure the sustainable use of forest resources?
3. How do agro-industries in Uttarakhand support the livelihoods of the rural population? Provide examples of specific agro-based products and industries.

4. Examine the distribution of industrial regions in Uttarakhand. How have industrial zones like SIDCUL helped boost manufacturing in the state?
5. What are the major minerals found in Uttarakhand, and how are they utilized in different industries? Discuss the challenges faced in mineral extraction due to environmental concerns.
6. Hydropower is the largest source of renewable energy in Uttarakhand. Analyze the benefits and challenges of hydropower projects in the state, using the Tehri Dam as an example.
7. How has the state government encouraged investment in industrial development, particularly in sectors like food processing, automobiles, and pharmaceuticals in Uttarakhand?
8. Discuss the role of renewable energy sources like solar, wind, and biomass in Uttarakhand. How do they complement the state's reliance on hydropower?
9. Evaluate the impact of cottage industries on the economy of the hill regions of Uttarakhand. How do these industries promote local culture and craftsmanship?
10. What is the significance of sustainable resource management in Uttarakhand's industrial and energy sectors? Discuss how balancing industrial growth with environmental preservation is crucial for the state's development.

BLOCK-2 POPULATION AND DEVELOPMENT ACTIVITIES

UNIT- 4 POPULATION DENSITY, DISTRIBUTION AND URBANIZATION

4.1 OBJECTIVES

4.2 INTRODUCTION

4.3 POPULATION DENSITY, DISTRIBUTION AND URBANIZATION IN UTTRAKHAND

4.4 SUMMARY

4.5 GLOSSARY

4.6 ANSWER TO CHECK YOUR PROGRESS

4.7 REFERENCES

4.8 TERMINAL QUESTIONS

4.1 OBJECTIVES

After reading this unit you will be able to

- Understand the geographical distribution of the population of Uttarakhand
- Understand the population density of Uttarakhand.
- Know about the trends of urbanization in Uttarakhand.

4.2 INTRODUCTION

The state of Uttarakhand, located in the northern part of India, presents a distinctive demographic and urban profile due to its diverse historical context, topography and socio-economic development. As a region characterized by a mix of mountainous and plain terrain, its population dynamics reflect the complex interplay of geographical constraints and socio-economic factors. The economic development process of a region is governed by the spatial nature of the population of that region. Since population is the main factor of economic development of a region, population is the producer, consumer and manager of various resources. Population plays a vital role in shaping the society, economy and various environmental aspects of a region. If we consider the history of the population of Uttarakhand, it is known that the immigrant streams coming to Uttarakhand from all four directions of the Indian subcontinent became a part of the society here. This region was the abode of many castes like Kol-Mund, Kirat, Mongol, Khas, Sakas, Dravidians, Aryans, Gujars, Huns etc., evidence of which is found in many historical documents like cave paintings, inscriptions, copper plates, remains of temples, origin stories etc. The initial settlement of population in Uttarakhand started mainly from the river valleys where there was availability of agriculture and water, which moved towards the interior and higher regions after the arrival of migrants due to increase in population and fear of wars.

4.3 POPULATION DENSITY, DISTRIBUTION AND URBANIZATION IN UTTARAKHAND

Population distribution in any area provides information about the spatial and regional nature of the settlement area chosen by humans. Situational and proportional density pattern is included in population distribution. Population density refers to the number of people living in a unit area of a particular area. Whereas population distribution refers to the spread of population in an area. This distribution depends on geographical features, climate, resources, employment

opportunities and historical reasons. Distribution and density mainly depend on regional geographical conditions. The population pattern, distribution, density etc. of any area is affected by the natural environment and immediate socio-economic, cultural, religious and political environment of that area. Population distribution and density determine the economic development of a region. The physical structure of Uttarakhand is extremely uneven. On one hand more than 20 percent of the area is more than 5000 meters high, while on the other hand 20 percent of the area is 500 meters high or almost flat above sea level. Different types of favorable or unfavorable climate as well as topographical variations determine the population distribution of Uttarakhand. Therefore, topography and climate have the greatest impact on the population distribution and density of Uttarakhand.

4.3.1 Population Density in Uttarakhand:

Population density is a figure that is the ratio of the number of people in an area and the size of that area. It is often measured in terms of per square kilometer. That is, the density of the population living in a particular geographical area (such as a city, village, country, etc.), that is, the number of people living per square kilometer or per square mile.

Formula: Population Density = Total Population / Area

The average population density in Uttarakhand is 189 persons per square km whereas the average density of entire India is 368 persons per square km. Among the districts of Uttarakhand, Uttarkashi district has the lowest population density of 41 persons per square km whereas Haridwar district has the highest population density of 801 persons per square km. Like other Himalayan states, the rate of population growth in Uttarakhand was very slow in the initial period, the main reasons for which were superstitions in natural social customs and migration etc. During that time, incidents like attack of wild animals, floods, avalanches, landslides, epidemics etc. have been common in Uttarakhand Himalaya, due to which a large number of people have been getting injured. The population growth in this state has been positive from 1901 to 2011. During this period, the population here has decreased by about 0.6% only in 1911. Between 1901 and 2011, the total population has increased by about 511.26%. Thus, the total population has increased by an average of 4.61 percent per year. The trend of population growth from 1901 to 2011 under Uttarakhand state has been shown in the following table.

Table 4.1: Population Growth 1901-2011

Year	Total Population	Growth (%)
1901	16,50,087	-
1911	18,30,822	10.95
1921	18,19,881	-0.60
1931	19,77,065	8.64
1941	22,41,498	13.28
1951	25,18,355	12.35
1961	31,06,356	26.51
1971	38,22,010	23.04
1981	48,48,403	26.85
1991	71,13,483	46.72
2001	84,89,214	19.34
2011	1,00,86,292	18.81

After: (S. C. Kharkwal, 2008)

Table 4.2: District wise population density in Uttarakhand (person per square km)

District	1991	2001	2011
Uttarkashi	30	37	41
Chamoli	43	48	51
Rudraprayag	106	120	125
Tehri	128	148	151
Dehradun	332	414	550
Pauri	124	129	127
Pithoragarh	59	65	68
Bageshwar	99	108	113
Almora	198	205	202
Champawat	107	126	146
Nainital	149	198	247
U. S. Nagar	332	424	467
Haridwar	485	612	817

After: (S. C. Kharkwal, 2008)

The trend of population distribution in the state has already been clarified. In table no. 1, the trend of population density over the last 30 years (1991 - 2011) has been studied. It is clear from the data that there has been a continuous positive increase in population density in all the districts of the state.

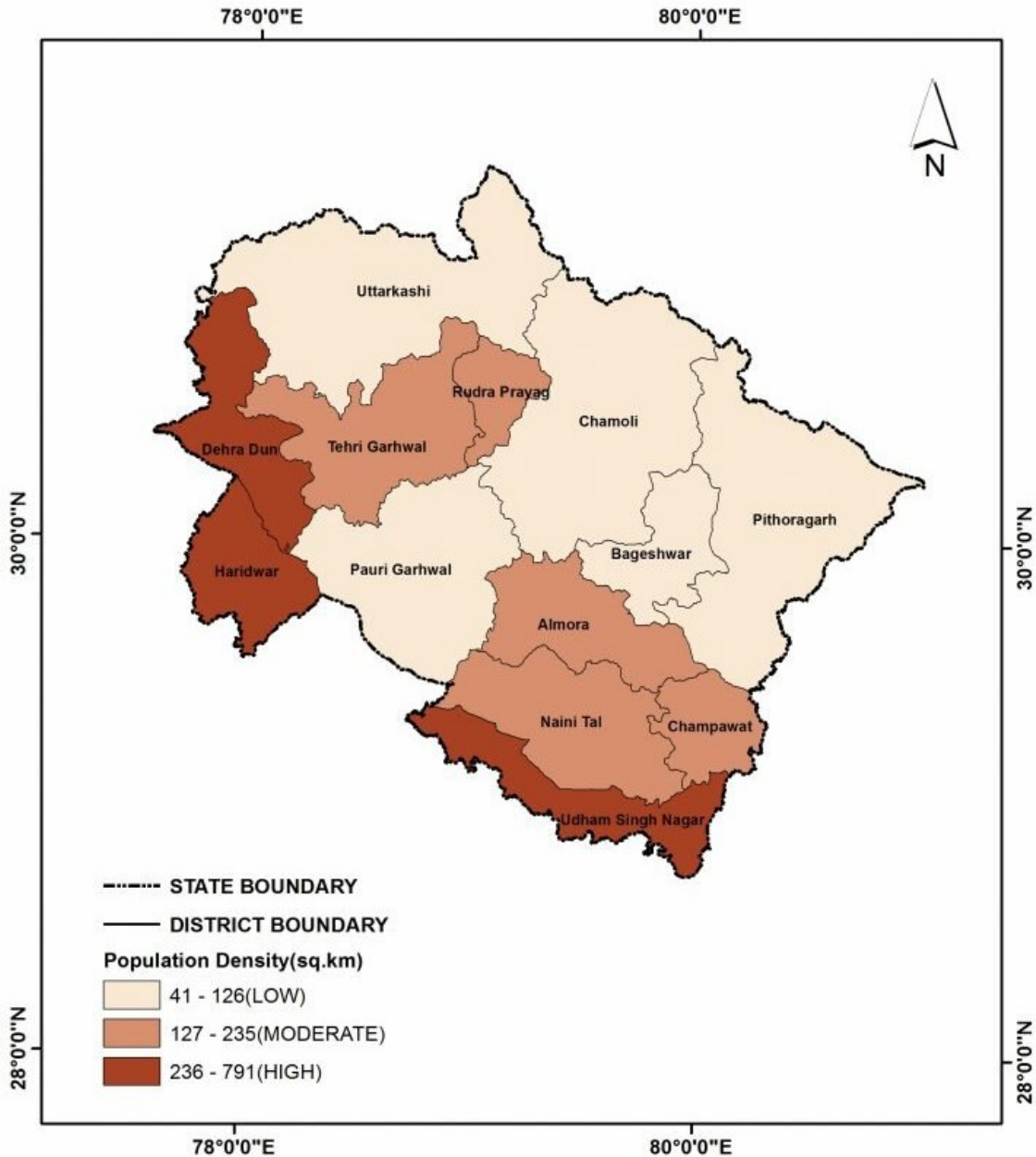


Fig 4.1: Population Density, Source: Google (*TheyMapsGuidein*)

4.3.2 Population Distribution in Uttarakhand

Table 4.3: District wise population distribution in Uttarakhand

District	Total Population	%
Uttarkashi	330086	3.27
Chamoli	391605	3.88
Rudraprayag	242285	2.40
Tehri	618931	6.13
Dehradun	1696694	16.82
Pauri	687271	6.81
Pithoragarh	483439	4.79
Bageshwar	259898	2.57
Almora	622506	6.17
Champawat	259648	2.57
Nainital	954605	9.46
U. S. Nagar	1648902	16.34
Haridwar	1890422	18.74
Uttarakhand	1,00,86,292	30.2

After: (B.R. Pant, R. Chand and B.S. Mehta, 2022)

Table 4.4: Population Distribution in Plains and Hill areas in Uttarakhand 1901-2011

Year	Plains	Hills	Uttarakhand
1901	32.28	67.72	100
1911	30.23	69.77	100
1921	29.33	70.67	100
1931	29.23	70.77	100
1941	28.97	71.03	100
1951	31.42	68.58	100
1961	34.21	65.79	100
1971	37.83	62.17	100
1981	40.53	59.47	100
1991	43.61	56.39	100
2001	46.7	53.03	100
2011	51.91	48.09	100

After: (B.R. Pant, R. Chand and B.S. Mehta, 2022)

Population distribution: On looking at the distribution of Uttarakhand's population district-wise, it is clear that most of the population lives in the plain districts. After that, it is found in the tehsils with mountainous river valleys. To understand the regional nature of population distribution, it is necessary to understand the proportional percentage of population distribution. The highest 18.74 percent population of Uttarakhand lives in Haridwar district, which is also the most populated district in the entire Himalayas. After this come Dehradun (16.82 percent) and Udham Singh Nagar (16.34 percent) districts. More than half (51.9 percent) of the total population lives in the above three districts of Uttarakhand. Haridwar and Udham Singh Nagar districts are completely plain and only the Doon region of Dehradun is plain. The remaining population lives in 9 districts of Uttarakhand. The lowest 2.4 percent population lives in Rudraprayag and 2.40 percent in Champawat and almost the same 2.57 percent population lives in Bageshwar district. Nainital district has 9.5 percent of the population and a large part of it is in Haldwani, Lalkuan and Ramnagar tehsils. Similarly, some part of the population of Pauri and Tehri is in the plains of Bhabar. The reason for Almora's population being more than other hill districts is the river valleys located there. Which are densely populated? Along with this, people from other states of India, mainly Rajasthan, Gujarat, Maharashtra and Tibet, China and Mongolia also came to the high Himalayan regions. The proof of this is that the population of the villages of the high Himalayan regions was once more than the villages of the Himalayan regions.

4.3.3. Urbanization in Uttarakhand:

The state of Uttarakhand, which is mainly surrounded by hilly terrain, has seen a rapid urbanization process over the last few decades. This process has been an important part of the changes in Indian society and economy. The process of urbanization in Uttarakhand has many dimensions, including population growth, economy, infrastructure development, and socio-economic changes.

What is Urbanization?

Urbanization is the process that involves the migration of people from rural areas to cities and adopting an urban lifestyle. This process indicates social, economic, and cultural changes. In

which most people move away from agricultural work and seek employment in sectors such as industry, services, and trade.

In India, the following criteria have been set for an area to be recognized as an urban area:

- Population: The population of the area should be 5,000 or more.
- Population density: The population density in the area should be at least 400 persons per square kilometer.
- Economic activity: Most of the people in the area are engaged in secondary, tertiary and quaternary (business, industry, service sector or government work) activities and agricultural activities are less.
- Urban amenities: Basic urban amenities such as water supply, roads, electricity supply, sanitation and health services should be available there.
- Administrative structure: The urban area should have a municipality, town panchayat, Municipal Corporation or any other urban administrative body which controls the development, administration and amenities of that area.

The main reason for urbanization in Uttarakhand is the increasing demand for employment opportunities, expansion of education, health services, and the desire for a better standard of living. The following are the major reasons for the process of urbanization in Uttarakhand:

Expansion of economic opportunities: The growing number of industries and businesses in Uttarakhand attracted people to urban areas. Employment opportunities have increased especially in cities like Dehradun, Haldwani, Rudrapur, Pantnagar, and Bhimtal Nainital.

Education and Health Services: Higher education institutions and better health services are available in the big cities of the state. This is also a reason why people are migrating to urban areas.

Transportation and Communication: The means of road and rail transport have improved, making travel easier and people have been able to reach the cities.

Developmental Schemes: Many schemes have been made by the government to develop infrastructure in urban areas, such as the Smart City Project, which has accelerated the process of urbanization.

Process of Urbanization in Uttarakhand: Uttarakhand was formed on 9 November 2000. Till this time, most of the population of the state was settled in rural areas and the level of urbanization was very low. Most of the people of the state were engaged in agricultural work and the lifestyle was quite traditional. Till this time only a few major cities had developed in the state, such as Dehradun, Nainital and Haldwani, which were major business centers located among the hilly areas. The process of urbanization in Uttarakhand has unfolded in different stages-

Initial Phase: When the state was formed, most of the people were engaged in agricultural work. The size of the cities was small and the level of urbanization was very low. After getting the status of a separate state, administrative and political activities increased in Uttarakhand, which led to the development of cities like Dehradun. Due to Dehradun being made the capital of the state, government offices, institutions, and services expanded here. Also, tourism based services expanded in cities like Nainital, Mussoorie, and Haridwar.

Middle Phase: The middle phase (after 2000) of the process of urbanization in Uttarakhand saw acceleration in the pace of urbanization in the state. By this time, many important changes had taken place in the development of the state, which further accelerated the direction of urbanization. The biggest change of this time after the formation of the state was that many factors related to urbanization started acting simultaneously, the government emphasized on infrastructure, employment, and industrialization, industrial parks and industrial areas were developed especially in cities like Haldwani, Rudrapur, and Haridwar, national highways and state highways were expanded in the state, seeing the increasing housing needs in urban areas, the government and private sectors developed large-scale housing schemes. New apartments, colonies, and multi-story buildings were built, which increased living space in cities, improved education, health, and other basic services, as a result of which urban areas expanded and the migration of population from rural areas to cities increased. The networks of water supply, sewage systems, and electricity supply expanded in urban areas. This improved the quality of urban life and attracted people to settle in cities.

Current situation: The rate of urbanization in Uttarakhand has increased rapidly in the last few years. Which is a positive sign for the development of the state? According to the 2011 census, the urban population of Uttarakhand was around 30%, while now this figure may increase to

between 35-40%. Along with this, the population is increasing in the major cities of the state, and signs of urbanization are also visible in small towns and municipalities. However, many new challenges are also rising, such as housing crisis, pollution, and infrastructure pressure. If the state government and citizens succeed in finding solutions to these problems, then Uttarakhand's urbanization can move towards a stable and prosperous future.

Table 4.5: District wise urban population in Uttarakhand

District	Total Urban Population				
	Total Population	Person	Man	Woman	% Total Population
Uttarkashi	330086	24305	13222	11083	7.4
Chamoli	391605	59396	33622	25774	15.2
Rudraprayag	242285	9925	5849	4076	4.1
Tehri	618931	70139	38605	31534	11.3
Dehradun	1696694	941941	499308	442633	55.5
Pauri	687271	112703	58800	53903	16.4
Pithoragarh	483439	69605	36376	33229	14.4
Bageshwar	259898	9079	4711	4368	3.5
Almora	622506	62314	33722	28592	10.0
Champawat	259648	38343	20283	18060	14.8
Nainital	954605	371734	194409	177325	38.9
U. S. Nagar	1648902	586760	308313	278447	35.6
Haridwar	1890422	693094	371511	321583	36.7
Uttarakhand	1,00,86,292	30,49,338	1618731	14,30,607	30.2

After: (B.R. Pant, R. Chand and B.S. Mehta, 2022)

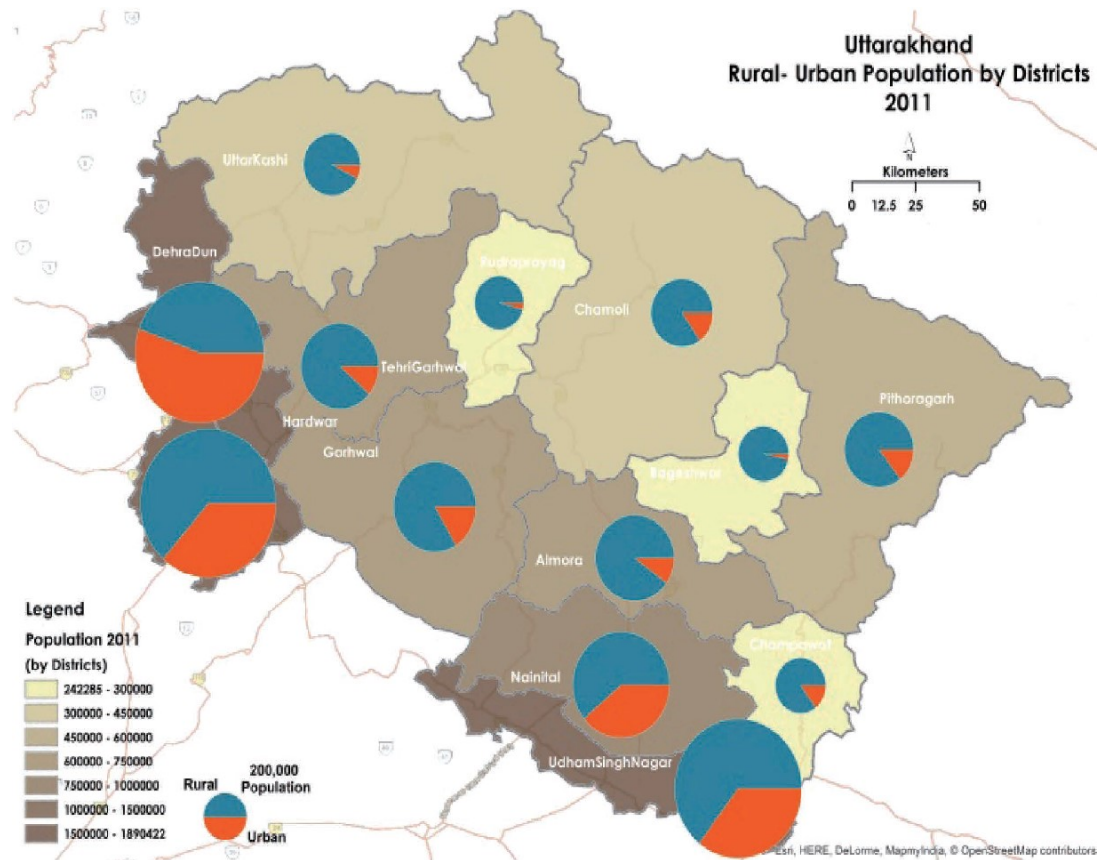


Fig. 4.2 : Rural Urban Polpulation of Uttarakhand, Source: Google

According to the 2011 census, 30.2 percent of Uttarakhand's population lives in urban areas. Due to the inaccessibility of the mountainous regions and unfavorable geographical conditions, cities have developed more in the plains. Small towns in the mountainous regions have transformed into cities over time and some cities have been formed due to administrative needs. According to the 2011 census, Dehradun district has the highest urban population in the state at 55.5%, followed by Nainital 38.9, Haridwar 36.7, U.S. Nagar 35.6, Pauri 16.4, Chamoli 15.2, Champawat 14.8, Pithoragarh 14.4, Tehri 11.3, Almora 10.0, Uttarkashi 7.4, Rudraprayag 4.1 and the district with the lowest urban population of 3.5% is Bageshwar.

4.4 SUMMARY

The state of Uttarakhand, located in the northern part of India, presents a distinctive demographic and urban profile due to its diverse historical context, topography and socio-economic development. As a region characterized by a mix of mountainous and plain terrain, its population dynamics reflect the complex interplay of geographical constraints and socio-

economic factors. The physical structure of Uttarakhand is extremely uneven. On one hand more than 20 percent of the area is more than 5000 meters high, while on the other hand 20 percent of the area is 500 meters high or almost flat above sea level. Different types of favorable or unfavorable climate as well as topographical variations determine the population distribution of Uttarakhand. The average population density in Uttarakhand is 189 persons per square km whereas the average density of entire India is 368 persons per square km. Among the districts of Uttarakhand, Uttarkashi district has the lowest population density of 41 persons per square km whereas Haridwar district has the highest population density of 801 persons per square km.

On looking at the distribution of Uttarakhand's population district-wise, it is clear that most of the population lives in the plain districts. After that, it is found in the tehsils with mountainous river valleys. According to the 2011 census, 30.2 percent of Uttarakhand's population lives in urban areas. Due to the inaccessibility of the mountainous regions and unfavorable geographical conditions, cities have developed more in the plains.

4.5 GLOSSARY

Urbanization: Urbanization is the process by which a place or region transitions from a rural lifestyle to an urban lifestyle. In this, people from villages move to cities where better employment, education, health services and other facilities are available. During urbanization, the population increases and along with it the infrastructure, such as buildings, roads, schools, hospitals, commercial centers, etc. also develops.

Population density: Population density refers to the number of people living in a particular area per square kilometer or per square mile. This figure is obtained from the ratio of the population of that area to its area. Population density shows how many people are living in a particular area and what the land use of that area is.

Population Distribution: Population Distribution means the distribution or spread of individuals or population in a particular geographical area. It refers to the way people are located in a place. Population distribution is influenced by various factors, such as natural resources, climate, economic opportunities, employment, transportation facilities and other physical and social factors.

4.6 ANSWER TO CHECK YOUR PROGRESS

1. What is the population density in Uttarakhand?

- (A) 180 persons per sq km
- (B) 189 persons per sq km
- (C) 200 persons per sq km
- (D) 210 persons per sq km

Answer: (B)

2. What is the rate of urbanization in Uttarakhand?

- (A) 25%
- (B) 35%
- (C) 30%
- (D) 40%

Answer: (C)

3. What is the population ratio of rural and urban area in Uttarakhand?

- (A) 60% urban, 40% rural
- (B) 70% rural, 30% urban
- (C) 50% urban, 50% rural
- (D) 80% rural, 20% urban

Answer: (B)

4. Which district has the highest population density in Uttarakhand?

- (A) Tehri
- (B) Nainital

(C) Haldwani

(D) Dehradun

Answer: (D)

5. What is the type of population distribution in Uttarakhand?

(A) Uniform

(B) Uneven

(C) Very uniform

(D) No special distribution

Answer: (B)

6. What is the main reason for population growth in urban areas in Uttarakhand?

(A) Growth in agriculture

(B) Means of transportation

(C) Availability of water

(D) Better living standards and employment opportunities

Answer: (D)

7. What is the main reason for urbanization in Uttarakhand?

(A) High population growth in rural areas

(B) Search for employment, education and health facilities

(C) Reduction in natural disasters

(D) Increasing popularity of tourism

Answer: (B)

8. Which city of Uttarakhand has seen the highest urbanization?

- (A) Haridwar
- (B) Dehradun
- (C) Roorkee
- (D) Nainital

Answer: (B)

9. What is the main reason for urban-rural migration in Uttarakhand?

- (A) Better health services
- (B) Higher education facilities
- (C) Employment opportunities
- (D) Climate change

Answer: (C)

10. Which is the district with the lowest population density in Uttarakhand?

- (A) Haridwar
- (B) Chamoli
- (C) Nainital
- (D) Dehradun

Answer: (B)

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4.8 TERMINAL QUESTIONS

(A) Long Question

1. Describe in detail the trends of Urbanization in Uttarakhand.
2. Describe in detail the population density and distribution of Uttarakhand.

(B) Short Question

1. What are the main reasons for the rapid Urbanization in Uttarakhand in the last two decades?
2. What are the geographical reasons for the distribution of population in Uttarakhand?
3. Briefly describe the trend of urbanization in Uttarakhand?
4. What kind of problems are arising due to urbanization in Uttarakhand?
5. Describe the difference between urban and rural life in Uttarakhand.

UNIT 5 - MULTIPURPOSE PROJECTS, REGIONAL
DEVELOPMENT AND PLANNING REGIONAL
DISPARITIES

5.1 OBJECTIVES

5.2 INTRODUCTION

***5.3 MULTIPURPOSE PROJECTS, REGIONAL DEVELOPMENT
AND PLANNING REGIONAL DISPARITIES.***

5.4 SUMMARY

5.5 GLOSSARY

5.6 ANSWER TO CHECK YOUR PROGRESS

5.7 REFERENCES

5.8 TERMINAL QUESTIONS

5.1 OBJECTIVES

After reading this unit you should be able to:

- To understand the contribution of multipurpose projects in the state of Uttarakhand.
 - To describe in detail the importance of multipurpose planning in the regional and economic development of the state of Uttarakhand.
 - To make the learner understand the possibilities and complexities of the regional development of the state.
-

5.2 INTRODUCTION

Uttarakhand is a rich state in terms of water and forest resources, where nature has inherent immense possibilities for multipurpose water projects. The river systems flowing in the state, Ganga, Yamuna and Kali provide water throughout the year through continuous water sources, the use of whose water power started being used in multipurpose works from the time of undivided Uttar Pradesh. Due to the mountainous structure of the state, the rivers flowing here provide immense possibilities for multipurpose projects, due to which the construction of small and large dams has the potential to provide self-reliance and permanent means of livelihood to the citizens of the state through the power and economic development resources in the state.

The immense water resources flowing in Uttarakhand are obtained from natural water sources and glaciers, which we have received free of cost for irrigation, drinking water and power generation in the state. Along with this, physical conditions for the use of this water resource have also been created by nature. According to a survey of the state and central government, if hydroelectric projects are developed here on the lines of China, then more than 40,000 megawatts of hydroelectricity can be produced here. Due to the immense potential of hydroelectricity, many small hydroelectric multipurpose projects were established in the state even before independence. The first multipurpose project of the state was Glogi Hydroelectric Project established in 1906-07 on Mussoorie Dehradun road between Kyarkuli and Bhatta villages, which was formally inaugurated in 1909. This project has earned the credit of being the first hydroelectric project in North India. As multipurpose projects in the state, Pathri, Mohammadpur, Khatima, Lohiahead, Kulhal, Dhakrani, Dhalipur, Chhibbro Project, Ramganga, Khadiri, Cheela, Tanakpur, Urgam, Pilangad, Kaliganga, Dhauliganga, Kishau, Pali, Meneri, Bhagirathi, Loharinag, Tehri are currently producing electricity and Bhagirathi, Tapovan,

Vishnugarh, Dhauri Ganga, BawalaNandprayag, Soug, Kotli BHEL, Jamrani Dam projects are proposed for fulfilling electricity and other purposes. Apart from this, Mori Hanol, Hanuman Chatti, SyanaChatti, Barnigad-Nayangaon, ChunniArdh, MarkulaLataDholiganga, LataTapovanVishnugadPipalkotiUtyasu, Hanol-Tuini, ArakotTuini, JakholSankhari, Bhairon Valley First, Second Bhagirathi, Badkot-Kuwa, SyanaChattiGangani, Karnaprayag, Pindar, Bhilangana, Pancheshwar, Purnagiri, ChamagadBalighat, Babas, Khairna, Barsimi, Kwarbh, Eastern Ramganga and HardhawaChhina sites have been selected for multipurpose projects, where multipurpose plans can be made.

Thus, in Uttarakhand state, apart from various developmental schemes of the state, multipurpose projects are helping in developing infrastructure along with other needs like water resources, energy resources, irrigation facilities, and tourism. For example, the Tehri Dam Project is currently fulfilling needs like drinking water, irrigation, flood control and electricity supply in the state as well as in the Union Territories of Uttar Pradesh and Delhi. Apart from hydroelectric multipurpose projects in the state, the perennial road project, the Chardham project, the Karnaprayag rail line scheme and the Manasmala multipurpose projects have been operated with the cooperation of the state and the centre since the last decade, which have been operated jointly for tourism development, renovation of religious places, road development, migration control and livelihood improvement.

For the regional development of Uttarakhand state, natural diversities are present in physical form, where different types of schemes are made and implemented for mountainous and plain areas. About 86 per cent of the state's land area is mountainous and the remaining 14 percent is included in the Bhabar and Terai plains. None of the thirteen districts is completely plain except Udham Singh Nagar. Therefore, it is natural to have differences in regional development, the result of which is that Dehradun, Haridwar, Udham Singh Nagar and Nainital have achieved more success in development plans than the hilly districts. The only basis of development in the hilly districts of the state can be multipurpose projects based on water and forest resources and the pillars in the field of tourism, although the government is working to bring the perennial road scheme and the Mandirmala project to the surface level. But in reality, environmental and religious tourism have a special role in the developmental work of the state. With tourism and pilgrimage development, infrastructure development can be developed in all the districts of the state as well as the economy can be improved, as at present, Veer Chandra

Singh Garhwali Swarojgar Yojana is a multi-employment scheme through which unemployed youth of the state are running many of their enterprises.

Due to regional differences in the state, there is a huge developmental difference, for which the natural and economic conditions of the state are particularly responsible. The plans made for the plains before the formation of the state were not suitable for the hilly areas, due to which they lagged in infrastructure and economic development. After the formation of the state, due to more attention being given to developmental and other economic activities in the plains, the hilly areas were again deprived of the mainstream of development, due to which problems of migration have arisen in the entire state, while the plains are facing pressure from unplanned urbanization, industrialization and excess population. At present, the regional inequality in the plain and hilly areas of the state has become so complex that it has become impossible to eradicate it because while there are immense possibilities for improving the economic standard in the plain areas, there are limited resources for improving livelihood in the hilly areas. Therefore, to balance the speed and direction of the state's development, multi-purpose plans should be managed based on the availability of natural resources in the state, which should include all the plans related to large, small and cottage industries and regional knowledge, which can play an important role in the development of the hills and the cultural imbalance which is becoming a hindrance in the developmental work can be corrected to some extent.

5.3 MULTIPURPOSE PROJECTS, REGIONAL DEVELOPMENT AND PLANNING REGIONAL DISPARITIES

5.3.1 MULTIPURPOSE PROJECTS

It is clear from the name of the multipurpose project that it is a project that fulfils various objectives through a single construction work. For example, most of the hydroelectric projects constructed in the state are specially designed for water resource management, irrigation, water supply, power generation and flood control, which work to achieve several objectives simultaneously. Thus, the construction of multipurpose projects started in the state about 120 years ago and will continue in the future as well. In the initial period, the objectives of the multipurpose schemes were not as wide as the current projects in the state, because at present, along with the requirements of the state, multipurpose projects of national and international level are being constructed with joint efforts of the state and central governments, in which the Tehri

multipurpose dam project is a major example. Apart from this, the proposed India-Nepal joint Pancheshwar Dam project is included in the major schemes of the world, most of whose land area will be in the state of Uttarakhand. But in the current multipurpose schemes of the state, not only hydroelectricity generation is being included in the multipurpose project, but schemes like perennial road project, tourism development scheme, mountain rail line scheme, smart city scheme and temple garland development have been prominently included. Unlimited multipurpose potential is present in the physical features of the state of Uttarakhand, which remains to be developed as livelihood resources along with economic development in future.

An assessment by the state and central government has revealed that if small hydroelectric projects are developed in the state on the lines of China, then about 40,000 megawatts of hydroelectricity can be produced in the state, which can employ hundreds of people. A brief description of the major multipurpose projects of the state of Uttarakhand is as follows.

1. Tehri Dam Project- The Tehri Dam Hydroelectric Project has been constructed at the confluence of the Bhagirathi and Bhilangana rivers at Ganesh Prayag and old Tehri town. This dam project is the fourth largest multipurpose dam in the world with the first place in the continent of Asia, due to which the city of Tehri has completely drowned in water. The construction of the Tehri Multipurpose Project was started in the year 1972 and it was completed in 2006 and dedicated to the nation. This project has been completed after a long struggle. In the year 1978, the irrigation department started its work, but due to the slow pace of work, in the year 1988, the Central Government established the Tehri Hydroelectric Corporation and took the responsibility of its construction into its own hands and constructed the dam in the form of a coffer dam (filled with soil and stones).

Since the Tehri Dam Project is highly sensitive from an environmental point of view, the Department of Science and Technology has given suggestions to stop the construction of this dam. On the other hand, the Forest Ministry of the Government of India also did not give full consent for the construction of this dam, but the Central Government continued the work of the dam due to spending more money on the construction of this multipurpose project. The target of producing 1000 MW of electricity in the first phase and 1400 MW of electricity in the second phase was set. At present, the height of this reservoir is 260.50 meters and the area spread is 42 square kilometers. Due to the vastness of the dam, it is called the village of the nation. The Tehri

Dam project was designed by Prof. James Brown. Financial assistance was provided by Russia in building this dam. Another feature of this dam project is that a second concrete dam of 97.5 meters in height has also been built 22 km downstream from the main dam. Four separate units are operated through four tunnels from the main reservoir. The total water holding capacity of Tehri reservoir is 354 crore cubic meters, through which, along with electricity generation, drinking water is being supplied to about 70 lakh people of Delhi and Uttar Pradesh daily, in which 300 cusecs of drinking water is given to 40 lakh people of Delhi and 200 cusecs of drinking water are given to rural areas of Uttar Pradesh daily. After the establishment of the state, Delhi, Uttar Pradesh and Uttarakhand states have got a 12 percent share in this multipurpose project. Thus, the Tehri Dam Project is the largest multipurpose project in the state of Uttarakhand.

The first objective of this project was to generate 2400 MW of electricity, the second was to provide 12 per cent of the electricity to the state of Uttarakhand for free. The second objective is to provide drinking water to the states of Delhi and Uttar Pradesh, the third objective is to control the floods that occur every year in Uttar Pradesh and Bengal, and the fourth objective is to accelerate tourism, transport, fisheries, afforestation and infrastructural development in the Garhwal region. Apart from this, to internationalize the Tehri Lake, the State Government and the Tehri Dam Development Authority organized the Tehri Lake Festival in the year 2021, in which the lake will be further developed for Rs 1200 crore based on the policy of Tehri Lake Comprehensive Development with the cooperation of the Central Government.

2. Ram Ganga Multipurpose Project- Ramganga Dam Project has been built in the Ramganga River 3 km above a place called Kalagarh in Pauri Garhwal district of Uttarakhand state, which is also known as Kalagarh Dam. This project is located in Jim Corbett National Park, through which both irrigation and electricity production works are being done. At present, this project is producing 198 MW of electricity and providing irrigation water to 57,500 hectares of land. Apart from this, this dam is also currently fully doing the work of preventing floods in Ramganga. The construction of the Kalagarh Dam of Ramganga started in the year 1961 and it was completed in 1974. The height of this dam is 128 meters and its length is 715 meters, its water storage capacity is 10,000,000 cubic meters, which is controlled through five security gates.

3. Maneri Bhali Project- The Maneri Bhali multipurpose project has been constructed in the Bhagirathi river. It is completely located in Uttarkashi district. The hydroelectric power

generation capacity of this dam is 304 megawatts. It was started in the year 1976 but was closed in 1990 due to lack of funds and was started again in 2002 and has been producing electricity since 2008. The main objective of this dam project is to produce electricity.

4. Lakhwar-Vyas Project- This multipurpose project is under construction in the Yamuna river in the name of Lakhwar Vyas, 75 kilometres away from Dehradun city. Its power generation capacity will be 420 megawatts. This project will not only produce electricity but will also irrigate 40,000 hectares of undeveloped land in Uttarakhand and Uttar Pradesh. Vyasi and Lakhwar are two separate dams of which Lakhwar has 300 MW and Vyasi has 120 MW power capacity. The estimated cost of this project was Rs. 227 crores at the time of construction. The main purpose of the construction of this project is irrigation and power generation.

5. Dhauliganga Hydroelectric Project- The Dhauliganga Dam Project has been constructed in the form of a concrete face rock and soil-filled embankment on the river Dhauliganga flowing near Dharchuna in Pithoragarh district. It is operated through run-of-the-river technology. Its power generation capacity is 280 MW. This project also mainly fulfils the purposes of power generation, flood control and drinking water. Due to the flood in June 2013, a large amount of debris had accumulated in this reservoir.

6. Lohari Nagpala Hydroelectric Project- This project is established on the Bhagirathi river in Uttarkashi district in the name of LohariNagpala, whose hydroelectric power generation capacity is 600 MW, which supplies electricity only to the residents of Uttarakhand state.

7. Vishnuprayag Hydroelectric Project- It has been constructed as a multipurpose project in Pipalkoti of Vishnuprayag on the AlaknandaRiver in Chamali district, which has been incorporated by Uttarakhand, Uttar Pradesh government and Jaiprakash Power Batchers. 444 MW of electricity is being generated from this project. This dam is a 65-meter-high diversion dam, whose water storage capacity is 3.63 million cubic meters. The main objective of the construction of the Vishnuprayag project is to generate electricity and supply drinking water. Apart from this, this project is also important from the environmental point of view, because this area is also the main source of clean and green energy.

8. Lohiahead Power House, Tanakpur Project- This project was built in the Sharda River at a place called Lohiahead in Champawat district, which was constructed in the year 1955. In the year 2012, it was modernized and the production capacity of this project has been increased by 10 percent. Currently, this project is generating 120 megawattsof electricity. Along with

electricity generation, this project is also controlling the floods in the Sharda River along with irrigation and drinking water supply in the Tanakpur, Khatima and Pilibhit districts of Uttar Pradesh.

9. Pancheshwar Multipurpose Project- The Pancheshwar Hydroelectric Project is an international-level project which is a joint venture of India and Nepal, which is proposed to be built in the Mahakali Sharda River. This power project will generate 5040 megawatts of energy daily and is based on run-of-river technology, it will reduce human displacement and environmental problems and increase quality. The hydroelectricity produced from the dam project will be divided equally between India and Nepal. Pancheshwar Dam Authority has been formed to monitor this dam project. This project is bigger than the Tehri Dam project in which fisheries, tourism, irrigation, drinking water and floods in the Sharda River will be controlled on a large scale.

10. Jamrani Dam Multipurpose Project- The Jamrani Dam Multipurpose Project is being constructed with a concrete wall in the Gaula River at a place called Jamrani, 9 km above Kathgodam in Nainital district. This multipurpose project will store water at a height of 130.6 meters and about 9 km in length, which will provide drinking water and irrigation water to Haldwani city and nearby villages. 52 percent of the irrigation water of the Jamrani Dam Project will be given to Uttar Pradesh and 48 percent to Uttarakhand state for irrigation purposes. Jamrani Dam Project is a joint venture of Uttarakhand and Uttar Pradesh state which will generate 130 MW of electricity which will not only supply electricity to Kathgodam, Haldwani and the surrounding hilly areas but will also recharge the drying water sources in this hilly region and increase the green cover. The main objective of the Jamrani Dam Project is to solve the biggest problem of drinking water and electricity in Haldwani city. Apart from this, it will directly provide irrigation water to 60,600 hectares of the total 1,50,302 hectares of agricultural land, as well as reduce the damage caused by flood and erosion by the Gaula River in Haldwani and other areas every year, and will play an important role in developing means of tourism and self-employment in Haidakhan and the nearby affected villages (Pestola, Udhuwa, Siuda).

11. Rishikesh-Karnprayag Rail Project- This project is also multi-purpose which will increase tourism and employment opportunities along with the rail line in the development of the state. It is being expanded in Dehradun, Tehri, Pauri Rudraprayag and Chamoli districts. This is the first mountain rail line of Uttarakhand state whose length is 125.20 km. 12 stations are being

constructed in this mountain rail line which will be based on local folk art and will increase the self-employment of residents.

11. Veer Chandra Singh Garhwali Yojana- This is a multipurpose project created by the state government for self-employment in different areas in which cheap loans are provided to the natives of the state for setting up homestay, floating hotels, herbal tourism, kayaking, orange biking, caravan, angling star gazing, bird watching, bakery, laundry, hotel, passenger vehicle, paying guest house, restaurant, fast food centre, tent, motor workshop, adventure tourism equipment, yoga meditation centre development and cottage industry, the main objective of which is to employ maximum youth of the state in different areas.

12. All-weather road project- This project is a dream project of the Government of India, after the construction the tourists coming to the state will get tourism facilities throughout the year without any traffic and road transport problems, which will also increase the means of employment in the state. Apart from this, the second objective of this project will be the smooth movement of security vehicles and soldiers for the security of the country during an emergency. The All Weather Road Project aims to develop religious tourism on a large scale in the four holy places of the state, Kedarnath, Badrinath, Gangotri and Yamunotri, and make them work as satellite cities for the nearby areas and make them economically capable. A cost of 12000 crores is being spent on the development of this multipurpose project, whose length is 8890 kilometres. Thus, multipurpose projects in Uttarakhand state are indicators of economic, social and environmental progress of the state and are determinants of the state's development because these multipurpose schemes are not limited to power generation only but are also carrying out multi-dimensional development like irrigation, drinking water supply, flood control, water conservation, tourism development, self-employment, infrastructural development and are also making the citizens of the state self-reliant, apart from this, underdeveloped areas of the state are also to be developed through these projects so that problems of migration can be resolved and agricultural resources can be saved.

5.3.2 REGIONAL DEVELOPMENT

Due to the mountainous and plain physical structure of the state of Uttarakhand, bringing uniformity in regional development is not only not possible but also a complex task. Due to the difference in development models and costs in plain and mountainous areas, the schemes implemented in plain areas are not able to succeed in the mountainous areas. To solve this

problem, at the time of planning, separate policies and budgets are required for both mountainous and plain areas. Apart from the physical characteristics of the state, cultural, economic and demographic diversities also emphasize the difference in regional development. Keeping all these aspects in mind, for the regional development of the state, uniformity can be brought to some extent in the development of the state through the participation and coordination of tourism activities, agriculture, industry, multipurpose schemes and private businesses. Keeping in mind the regional, physical, cultural, demographic and biodiversity diversity of the state, the policymakers will have to include the stakeholders and responsible institutions of the state in the policies of developmental work. As the State Planning Commission is currently working as a think tank in determining the development and policies of the state, it is working towards achieving the goals of sustainable development through modern technology by strategically incorporating policy and directional suggestions in these diversities, but due to lack of inter-departmental coordination, there is not much success in achieving the set goals of development, for which active participation and mutual coordination of various departments is necessary for regional planning in the interest of the state, which will be able to implement the developmental plans of the nation and the state with priorities.

In the difficult circumstances of the state of Uttarakhand, it is necessary to have coordination among all the departments of infrastructure development at the regional level, whereas in reality, due to a lack of mutual coordination between the various departments working in the state, there is a hindrance in regional development. From the in-depth study of the difficult physical conditions of the state of Uttarakhand and the evaluation of the previous plans, it is known that to accelerate the development work at the regional level in the state, some important points need to be assimilated in the interest of the state for inter-departmental coordination. Regional plans should be implemented based on regional demarcation of the physical regions of the entire state and available resources.

- The development grants provided by the state and the centre should be determined in different proportions for the hilly and plain areas of the state.
- Transparent technology should be used with a reliable chain to deliver the benefits of the scheme from the village to the district level so that the beneficiary can get the direct investment benefits.

- There is a need to give separate emphasis on regional plans based on the availability of physical resources of the state. Local indigenous knowledge and technology should be included in the use of physical resources so that the state can be saved from environmental damage.
- Keeping in mind the present and future needs of the state, educational, technical and research coordination should be done with local stakeholders in technical and construction works.
- Development works should be allowed only under the agenda of sustainable development without harming the environment. □To inspire self-employment among local youth, along with making them proficient in various skills, financial facilities will have to be provided.

Before starting new development works in the state, it is very important to analyze its success and failure in other Himalayan states.

To take forward the regional development agenda in the state, local resources will have to be given priority based on the policy of scientific use. The development of physical and cultural infrastructure on a large scale depends on the availability of local resources in any state, which all the residents of our state Uttarakhand have received as a gift, which mainly includes natural beauty, forests, glaciers, spiritual, cultural heritage, agricultural products and multipurpose projects etc. These elements can be adopted as development in the regional variations of the state. At present, for the development of the state, many administrative units are mainly classified as municipal bodies and Panchayati Raj, in which the municipal bodies include Nagar, Panchayat, Nagar Palika, Municipal Corporation and the rural bodies include Gram Panchayats, Development Block and District Panchayats. Which is currently engaged in the work of delivering various public utility schemes of Central and State Governments to the common citizens in urban and rural areas.

In the Municipal bodies, development works are carried out through the Mayor, Mayor and Councilors and Municipal Commissioners respectively and in the rural bodies through the Village Head, Village Panchayat Members, Block Head, District Panchayat Members and District Panchayat Presidents through Panchayat Secretaries, especially under the Five Year Plans, development works are being carried out in the form of regional development in all the rural and urban areas. Apart from this, development work is being done in different areas in the state by centrally funded schemes such as multipurpose hydropower projects, perennial road

projects, Mandirmala project, and SIDCUL Corporation along with national and international financial agencies, whereas Uttarakhand being a newly formed hilly state and due to uneven geographical elements, one has to wait for a long time to reach the heights of regional development, but the state has achieved development work rapidly in a short time, as per the report of NITI Aayog for the year 2023-24, Uttarakhand state has become the first state in the country to do development work by the goals of sustainable development. Along with this, the government is rapidly moving forward to achieve all the goals of sustainable development in construction works, in which the all-round development of the state with coordination between ecology and economy is the priority. For the development of Uttarakhand state, the following supporting elements of local development resources will have to be adopted. Elements that help in local development

1. Tourism Development- Based on the immense possibilities of tourism development in the state of Uttarakhand, tourism in the state has been given the status of tourism industry. The mountain ranges, rivers, lakes, glaciers, biodiversity, natural beauty, religious places, cultural heritage and hill cities located in the state are the pillars of tourism development and play an important role in regional development with the goals of sustainable development in the geographical diversity of the state. The state government is rapidly developing infrastructure in the entire state through various schemes, for which the Uttarakhand Tourism Policy was announced on 26 April 2001 and an action plan was made to develop natural tourism more. Institutional and adventure tourism is being developed through information technology to promote tourist places at national and international levels. Since the regional development of the state is inherent in tourism development, work is being done rapidly on the expansion of basic facilities for tourists through road, rail and air transport, hotel and city development. The main objective of tourism development is to develop the state and provide self-employment to the youth.

For tourism development in the state, with the announcement of the new tourism policy by the state government in the year 2018, it has been given the status of tourism industry, under which 28 tourism-related activities are being developed by recognizing them as micro, small and medium industries. To develop tourist areas, the years 2001 and 2015 have also been declared as tourism years. By developing tourism in the state, efforts are being made to make the state the best tourism state among the states of India along with Devbhoomi, so that all the border and

backward areas of the state can be developed, for which Public Private Partnership (PPP model) has also been included to give it an advanced form. With this help arrangements are being made for the ropeway, development of hotel facilities, tourism website, CD-ROM, books and electronic media, Uttarakhand festival, winter carnival, tourism fairs, listing and promotion of cultural heritage, establishment of Uttarakhand Tourism Board, capital investment, tourism employment scheme, tourism education institute and financial grants. To promote investment in the state through the new tourism policy, development of new tourist places and categorization of areas important from the tourism point of view up to 50 percent grant is being given for investing in the development of tourist places which have remained deprived of the tourism stream.

For environmental tourism development, especially for those investing in the field of heli tourism, tourism, adventure, and cab operator, 100 percent grants are being provided to businessmen to promote tourism activities and create employment opportunities. For regional development of tourism areas, tourist places have been divided mainly into three categories at present.

1. First category - Those tourist areas have been included which were tourist places even before the formation of the state, whose infrastructural development has been done, they only need to be given a modern look, like Haridwar, Nainital, Dehradun, Mussoorie, Ranikhet, Almora Bazaar, Kashipur, Ramnagar etc.

2. Second Category- Those regional areas have been included in the second category which was tourist areas but has not been able to develop much in terms of infrastructure development such as roads, markets, housing and communication services, such as other areas apart from Almora city, ChitaiGolu temple, Jagannath, Kasar Devi, lakes of Nainital, Nanakmatta, ChampawatPoonagiri, Lohaghat, PithoragarhThal, Munsiyari, Berinag, Kotgadi, Garun of Bageshwar, Kotdwar of Pauri district, Lansdowne, Yamkeshwar, Dhumakot, Kalsi of Dehradun district, Chakrata, Srinagar, Dhanaulti of TehriGarhwal, Narendranagar Chamoli, Gopeshwar, Rudraprayag etc.

3. Third category- This category includes those states where the possibilities of natural tourism are prevalent but the infrastructural works and basic facilities have not been developed here, for which more financial investment is required because these are naturally more difficult areas where the basic facilities for tourism development cannot be developed at a fast pace, which

mainly includes the mountainous areas of Uttarkashi, Pithoragarh, Bageshwar, Rudraprayag, Pauri, Nainital, Chamoli and Tehri districts, which have specialities such as glaciers, natural scenery, bughyals, spiritual centres and the speciality of local folk art and culture, which are currently being developed jointly by the state and central government, such as Mana, Sufi, Jageshwar are being developed as heritage. The third category mainly includes all those tourist places which are not included in the first and second categories, such as Harishtal, Lokhamtal, Devguru in Nainital, Almora Bhikiyasain, Syalde, Kausani, Garun, Milan, Ghanshali, Ghuttu Karna Prayag, NandPrayag, Nanda Sain, Mana, Badrinath, Pandukeshar, Govindghat, Vishnuprayag, Joshimath, Gopeshwar, Maithana, Nandprayag, Karnaprayag, Gangotri, Bhairoghati, Harsil, Bhatwadi, Maneri, Dharasu, Ganesh Prayag, Gulghati, Shivpuri, MamunikiReti, Janaki Chatti, Naugaon, Nainbagh, Lakhamandal, Kedarnath, Rambada, Ukhimath, Guptakashi, Bhatwadi, Augustmuni, Rudraprayag, New Tehri, Nandkeshari, Tharali, Narayanbgarh, Tapoban, Gunji, Tawaghat, Dharchula, Jauljibi, Jhulaghat, Seraghat, Mawani, Virthi, Gochar, Thal, Rameshwar, Baijnath, Bageshwar, Gairsain, Chaukhutia, Khairna, Dwarahat, Party, Garud, Kapkot, Kara, Gwaldam, Muwani, Berinag and Devidhura are included in these areas.

For the development of the above areas, on capital investment as per the new tourism policy by the government, 25 percent subsidy is being given to first-class tourist areas, 35 percent to second-class tourist areas and 50 percent subsidy to third-class tourist areas on the invested capital, so that all tourist areas can be developed in the entire state. People investing in the tourism sector are being provided facilities like 100 percent exemption in stamp duty, marketing promotion, skill training, incentive amount for waste management, and air service to increase tourist attraction, apart from this, regional development is being strengthened by including houses built in local style in the state in the homestay scheme.

2. Multipurpose Hydroelectric Projects- The state has the natural capability of generating hydroelectricity in all the rivers of the Ganga river system from nature. According to the assessment of the Central and State Governments, about 40,000 MW of hydroelectricity can be generated in the state, by which, along with meeting the electricity demand of the state, electricity can also be sold to other states, thus improving the economic condition and increasing employment opportunities.

From the inception of the state till date, many multipurpose and hydroelectric power generation schemes have been constructed and new schemes are proposed to be constructed in many places. Major hydroelectric projects in the state include Pathri, Mohammadpur, Khatima, Lohiahead, Kulhal, Dhakrani, Dhalipur, Chhibbro project, Ramganga, Khadiri, Cheela, Tanakpur, Urgam, Pilangad, Kaliganga, Dhauliganga, Kishau, Palameneri, Bhagirathi, Loharinag, Tehri and multipurpose projects are currently being operated and many projects are proposed in which Bhagirathi, Tapovan, Vishnugad, Dhauri Ganga, BawalaNandprayag, Soug Dam, Kotli Bhel, Jamrani etc. projects are proposed, apart from this Mori Hanol, Hanuman Chatti, Syana Chatti, Barnigad - Nayangaon, Markula Lata Dhauliganga, Tapovan Vishnugad Pipalkoti Utyasu, Hanol-Tuini, Arakot Tuini, Jakhol Sankhri, Bhairon Valley First, Second Bhagirathi, Badkot-Kuwa, Syana Chatti Gangani, Karnaprayag, Pindar, Bhilangana, Pancheshwar, Purnagiri, Chamagad Balighat, Babas, Khairna, Barsimi, Kwarbh, Eastern Ramganga Hardhawa Chhina sites have been selected as multipurpose schemes. If all these multipurpose schemes are operated normally, then it will be easy to establish balance in the regional development of the state. Because in some places tourist places are being developed, while in some places hydroelectric projects will increase the development works and means of self-employment and will provide relief from problems like migration.

3. Road and Transport Facilities Development- Road and transport development plays an important role in the regional development of Uttarakhand state. Before the formation of the state, the areas where basic facilities like road, rail and air transport had been developed, cities are currently the most densely populated and are playing an important role in economic development along with providing employment, such as Haldwani, Ramnagar, Lalkua, Rudrapur, Haridwar, Dehradun and Kotdwar. Due to the development of transport facilities in the plain areas, economic development is taking place at a faster pace here than in the areas where transport facilities are currently being developed. Due to easy access to roads, many cities have developed in the hilly areas along with the plain areas. For example, in the hilly areas, Pithoragarh, Almora, Srinagar, Nainital, Raipur, Mussoorie, Pauri, Tehri, Dhandera, Gopeshwar, Bageshwar, Ranikhet, Landora, Uttarkashi, Rawal, Town, Jashimath, Rudraprayag, Gochar, Someshwar, : Garun, Beringag, Thal, Didihat, Mafi, Bhimtal, Karnaprayag, Chamba, Dharchula, Mawani, Barkot and in the plain areas Mangalore, Dehradun, Ramnagar, BHEL, Ranipur, Kichha, Sitaganj, Bajpur, Clementown, NaglaPantnagar, Laksar, Gadarpur, Khatima,

TanakpurJagjitpur, Roorkee, Mohanpur, Muhammadpur, Vikasnagar, Doiwala, Raipur, MahuaKhedaganj, Jeevangarh, Bandia, Dineshpur, Kalinagar, Jaynagar, Jhabreda, Shafipur, KelaKheda, Muni kiReti, Haripur, Gulbarga, Bahadarabad, PiranKaliyar, Padampur, Sultanpur, Pratitnagar, Lalkua, Kaladhungi, Bhagwanpur, Gumaniwala, Khanjarpur, ShaktigarhNagla, Shantipuri, Bindukhatta, Imarti, Shahpur, Lansdowne, Saidpura, Khatyadi And Chakrata area has developed as a city centre with transportation, communication and road development. In other areas, with the availability of transport and roads, the road network is being strengthened for the establishment of new areas, especially for the development of development blocks and tehsil complexes, in which mainly Pati, Jaunk, Kanchal, Landour, Dwarahat, Mukteshwar, Badrinathpuri, Dugdada, Devprayag, NandPrayag, Jageshwar, Gangotri, Kedarnath, Khansyu, PadampuriJagaliagaon and Ramgarh etc. areas are being connected with modern all-weather roads and transport facilities.

At the same time, the development of air transport in mountainous areas is being developed at a rapid pace, local air services are being developed through six national airports and small aeroplanes. Apart from this, for the development of rail traffic in the mountainous region, the RishikeshKarnaprayag rail line is under construction in the Garhwal division, while in the Kumaon division, the TanakpurBageshwar rail project is proposed for construction in future, which will contribute significantly to establishing balance in the regional development of the state, in those areas of the state where roads are easily accessible. The problem of migration is less there as compared to the areas lacking roads, therefore strengthening the road network is a very important task for developing the transport and road infrastructure in the state.

4. Education and health development- Education and health have become an absolute necessity at present, counted in the category of the most urgent needs of humans because the goals of human life can be achieved only through health and education. Due to the limited expansion of education and health services in the state, many villages have migrated and many are ready to migrate, due to which the population size and pattern of both the mountainous and plain areas have also started changing, for which continuous efforts are being made for improvement, development of primary to higher education institutions and technical institutions for modern education in the mountainous region can become the biggest agency in regional development, on the other hand, balance can be established in the regional development of the

state by setting up facilities like construction of small scale hospitals, mobile vans, telemedicine in remote areas in health services.

5. Agriculture and organic farming- The agricultural system and crops of Uttarakhand state are of different types based on the physical diversity of the state such as mountainous and plain areas. While modern farming is being adopted in the plains, traditional agriculture has still been adopted on terraced fields in the mountainous areas, whose products have their own distinct identity not only in the country but also abroad due to their taste and natural qualities, among which Dehradun's Basmati, litchi, mandu, koni, jhangora, pulses, vegetables are prominent, which has been granted Geographical Indication Certificate to 18 products by the state government on 4 December 2023, which is the first state in the country with such a large number of agricultural products, including Uttarakhand's chickpea, jhangora, mandua, red rice, almond lakhorichilli, Berinag tea, Burashansharbat, Nainital Ramnagar litchi, Ramgarh peach, Malta, Pahadi Tor, Gahat, Kala Bhatt, Bichhubati fabric, Nainital'sMaangbatti, RangoliPichhoda and Chamoli Raman Mask are the main ones. Apart from this, farming and its products are done in the hilly areas of the state are almost 100 percent organic, which are considered to be good food items from the point of view of health, the demand for which has been increasing rapidly for the past years. Because these organic products can be produced only in the state of Uttarakhand, which is determined by the physical environment and climatic conditions of the state, for agricultural products there are natural possibilities in different areas of the state.

If the state government provides financial, agricultural medicine, market, minimum support price and physical resources to the farmers for increasing the production of agricultural products in the state in the suitability of natural conditions for organic i.e. special type of agricultural products, then the agriculture-based mountain farmer community can become economically strong along with taking interest in farming activities on a large scale. The residents of the state will move towards self-reliance and traditional farming business will become the strongest pillar of regional development for the present and future because most of the crops of the state are of gardening and medicinal type, whose production method and agricultural products have been given to the residents here as a heritage based entirely on Indigenous knowledge, which is the strongest basis for the livelihood resources and fulfilment of the stomach of the local mountain farmer families.

5. Animal husbandry business - Uttarakhand state has been a state with animal husbandry business along with farming, the fulfilment of primary needs like farming, transportation, food (milk, curd, ghee, meat and wool) has been adopted by the residents of the state for a long time to run their livelihood through animal husbandry. Because being a mountainous region, mechanized farming cannot be done here and neither can modern animal husbandry be done in the absence of road facilities, hence the farming business has been completely dependent on animal husbandry for a long time. But for the last two decades, the livestock and animal-related business of the state has been moving towards its decline due to a lack of basic facilities, in which a decline of about 50 percent has been recorded. Only in the plain areas, the animal husbandry business is moving towards its development for milk production. While the milk products, wool and leather products of the animals in the state have been world-famous, which handmade blankets, clothes and carpets of high Himalayan regions have been a means of livelihood for a long time, which about 17 thousand families are associated as ancestral business, but due to lack of basic facilities, this business has now become a loss-making business, due to which it is difficult to earn a livelihood. If the schemes run for animal husbandry businesses in the mountainous areas of the state are implemented with more strength, then the animal husbandry business can once again provide economic prosperity in the mountainous areas because at present the entire human race is moving more towards organic products.

6. Forest and environmental protection- Based on the forest area and characteristics of the forests of Uttarakhand, it is included in the list of major forested states of India, as a result of which the state is given a special green bonus every year by the Government of India. The dense forests of Uttarakhand state provide more prosperity to the forests through the diversity of various types of vegetation, grasses and fauna. The Himalayan region of Uttarakhand state has a unique charm with alpine, evergreen, deciduous and monsoon forests and many species of soft grasses. Many types of mixed vegetation are found in 45.44 percent of the total forest area of 24,295 sq km of the state, which presents a unique ideal sample of biodiversity (from small bushes to trees of 30-40 meters in height). Since most of the state is located in the lap of the Himalayas, climatic diversities are seen in every physical division, which is directly proved by the species of forests found in the state. Along with botanical diversity, faunal diversity is also found on a large scale in the forests. Due to these characteristics, despite being a small state, the number of national parks, sanctuaries, wildlife reserves and other bio-reserved areas for forest

and wildlife wealth is also found to be high here and at present the forests of the state are acting as a fund for the state economically because wildlife tourism and natural tourism is flourishing on a large scale in the state, for which it is becoming very important to conserve forests in the state, which contribute significantly to the regional development of the state. Because there are immense possibilities for increasing employment opportunities in the state by running employment-oriented schemes in the forest sector.

7. Uttarakhand Wildlife and Protected Area Development- All the policies made at the national level for biodiversity conservation have been adopted in Uttarakhand, in which mainly national parks, wildlife sanctuaries and biosphere reserves have been implemented to protect and safeguard dimensions like biodiversity. Biodiversity is a natural gift which is very difficult to restore once it is damaged i.e. it becomes extinct forever. Other conservation efforts of wild biodiversity wealth include Asan Wetland Reserve, Jheelmill Lake, Pawalgarh Conservation, Nanda Devi Himalayan Bird Conservation Reserve, High-Level Zoological Park as Biosafe Area and World Heritage, Nanda Devi and Valley of Flowers National Park have been protected for biosecurity. Apart from this, community-based programs like Snow Leopard, Tiger, KachulaKhark and GFMM have been started for eco-friendly tourism development and conservation of biodiversity. This provides new means of income in the form of tourist development and employment to the economic aspect in the regional development of the state and will continue to strengthen the state economically in the present and future.

8. Self-employment and entrepreneurship development schemes- There is a need to give more emphasis on skills based on self-employment in the regional development of Uttarakhand state because in the state, apart from handicrafts, natural forest products, organic farming, animal husbandry, medicinal products, cottage and small scale industries are the strongest pillars of self-employment in the field of tourism as heritage through which regional development can be taken to greater heights and the concept of holistic development in the regional diversities of the state can be realized, apart from this, by making the youth more proficient in skill development fields like IT, tourism, hotel management, traditional crafts and handicrafts, these traditional businesses can be spread throughout the state, for which government and non-government organizations should be involved in these businesses which can contribute in removing the anomalies of regional development in the state.

9. Natural Disaster Management- Due to Uttarakhand being a completely new Himalayan region, some or other natural disasters keep occurring here throughout the year, especially earthquakes, landslides, cloudbursts and forest fires occur mainly due to which the residents of the state and the state government suffer a huge loss of life and property every year, due to which many times there is a hindrance in the implementation of development works and schemes and there is loss on a large scale, such as Malpa, Kedarnath floods, Joshimath landslide, Tapovan Reni floods and forest fires occurring every year. To deal with disasters in the state, technical support, public awareness, disaster training, maximum use of warning devices can reduce the damages caused by disasters and the community here can be saved from the government and private economic losses occurring every year and by investing the expenditure incurred in reconstruction in new constructions, development works can be done in the areas of the state which have been deprived of development.

10. State Heritage Conservation and Cultural Development- If the rich cultural heritage of Uttarakhand state is preserved and developed, it can make a major contribution to the regional development of the state. All the residents in every part of the state have their cultural heritage which mainly includes festivals, folk arts, folk dances, and cultural and spiritual places, which the tourist, religious and cultural places located in most parts are still deprived of the mainstream due to lack of information, which need to be brought to the world stage so that along with the development of currently invisible places and cultures, the economic, social and cultural development of the residents of the state living in inaccessible areas can be done.

Thus, through the above joint efforts, the possibilities of regional development in the state of Uttarakhand can be given a concrete form by the state government and youth skill development and the inequalities of regional development in the state can be taken towards a balanced direction.

5.3.3 Planning Regional Inequalities- As the state of Uttarakhand is located in the lap of Himalayas, 86 percent of its land area is mountainous, due to which it is natural to have inequalities in the implementation of development-related schemes of the state. The geographical diversity of mountainous and plain areas is the most troublesome in delivering the benefits of schemes equally, as in the concept of state formation, the matter of separate planning and financial management for plain and mountainous regions was prominently raised by the agitators

and the citizens of the state. The major points giving concrete form to the regional inequalities in the state can be described as follows.

1. Geographical challenges - Being a hilly state, many types of geographical problems arise in establishing the infrastructure of the state more money has to be spent on establishing roads, industries, railway lines and towns in the hilly areas, along with this, environmental problems arise on a large scale and many times permission is not given by the Ministry of Environment to build roads through forest areas, due to which it becomes not only difficult but impossible to develop infrastructure in the hilly areas of the state, whereas it is easy to develop infrastructure in the plain land of the plain areas because due to easy connectivity and economic opportunities, the plain areas are developing rapidly, such as Udham Singh Nagar, the plain area of Champawat district Tanakpur, the plain area of Haridwar and Dehradun, Bhabar region of Nainital, BhabarKotdwar area of Pauri and Narendranagar of Tehri can be seen as major examples.

2. Economic inequality - While physical diversity in the state creates many inequalities in the development of infrastructure, economic inequality is also increasing day by day based on physical form. For example, plain districts like Haridwar, Dehradun and Udham Singh Nagar have become economically developed, due to which establishment of small, medium and large-scale industries, rapid development of transport facilities and development of many means of employment have made these states economically strong and are even acting as the economic capital of the state. On the other hand, mountainous regions like Chamali, Pithoragarh, Uttarkashi, Rudraprayag, Tehri, Pauri, Bageshwar, Almora and Champawat are becoming economically weak due to being backwards in terms of industrial and urban areas. The main source of livelihood in all these mountainous districts is agriculture, animal husbandry and tourism business, which can provide equality in the regional inequalities in the development of the state after modernization.

3. Tourism and Rural Development - There are immense possibilities for tourism development in hilly areas as compared to the plain areas of the state, due to which the plain areas are poor in terms of tourism activities as compared to mountainous areas. Except for the Haridwar district, adventure tourism, pilgrimage, culture and festivals, wildlife sanctuaries, nature and landscape, health, wellness and spiritual, bio and rural tourism, water sports, ancient heritage and ropeway development are the main possibilities for tourism development in hilly areas, while the plain areas are deprived of these possibilities. At the same time, the success of

the implementation of rural development schemes and construction works is seen more in plain areas as compared to mountainous rural areas.

4. Migration - Migration under migration in the state for the last two decades has created a complex problem in the state, there is rapid migration from rural areas towards plain areas or cities, according to the report of Migration Commission 2022, in the last 5 years, 3 lakh people from 6436 villages of 92 blocks have migrated temporarily and 28631 people from 2067 villages of 72 blocks have migrated permanently. In the report of the same year 2011, 1034 villages in the state have become uninhabited, from the year 2008 to 2018, the average number of people doing permanent and permanent migration per day was 138, while in the year 2022, this number reached 193 on average. According to the new data, Almora has become the first and Pauri the second migration district, which is giving rise to the biggest inequality in regional development.

5. Uneven distribution of resources - In terms of natural resources, the condition of Uttarakhand state is not good, apart from forest and water resources, no wealth is available in sufficient quantity in our state. The distribution and use of resources available in the state is also not happening completely, because forest and water resources are not equally distributed in all the districts, nor have humans been able to reach all the places to date, due to which the full potential of natural resources is not being used in the interest of the state, nor are the economic benefits being derived by the residents of the state. The state is currently getting limited benefits such as an average of 25 percent of tourism and hydropower projects, and that too is limited to only hilly districts, whereas in the plains, these possibilities are negligible. This inequality is currently acting as an obstacle to regional development.

6. Climate and environmental inequality - The climate of the state is of monsoon temperate type. In the high mountainous regions, there is snowfall and severe cold during winter. The middle Himalayan region provides normal climatic conditions while the plains are covered with dense fog. In summer, the temperature of the plains is more than 42 degrees Celsius and the middle Himalayan region becomes a healthy climatic region due to which tourists come here on a large scale. In the rainy season, due to heavy rainfall, many types of natural environmental problems like landslides, floods and cloudbursts arise and in summer, the state faces forest fires and droughts. These climatic and environmental impact inequalities act as a hindrance to the development of the entire state.

7. Developmental policies - A large part of the central and state schemes for state development are being spent on the development of plain areas. Whereas the hilly areas are being deprived of these basic facilities, due to which there is a developmental inequality between the plain and mountainous regions. By giving importance to the needs of the hilly areas in government schemes, the hilly areas can also be developed like the plain areas. Apart from this, natural disasters occurring in the state, unemployment, lack of health facilities, insufficient availability of educational resources, agricultural diversities and tourism development possibilities give rise to inequalities in the development of regional development in the development of schemes. Thus, to balance the speed and direction of development in the state of Uttarakhand, improvements can be made in regional development at the local level by keeping in mind the goal of multipurpose projects and regional plans and maximum sustainable use of available natural resources and removing the inequality arising from the physical and cultural diversity of the state, the government and policy-makers need to make long-term plans, especially focusing more on the hilly areas.

5.4 SUMMARY

The state of Uttarakhand is situated in the Himalayan region and is a rich state in terms of water resources. It provides immense possibilities for multipurpose water projects through the continuous water sources of the Ganga, Yamuna and Kali river systems. This water resource has been used for multipurpose works since the time of undivided Uttar Pradesh. We have immense possibilities for multipurpose projects in the state from nature, due to which many small hydroelectric multipurpose projects were established here even before independence. The first multipurpose project of the state, Glogi Hydroelectric Project, was established in 1906-07 between Kyarkuli and Bhatta villages on Mussoorie Dehradun road, which has received the status of being the first hydroelectric project in North India. Even in most of the small and big rivers of the state, multipurpose projects can be developed which can prove to be a milestone in the economic development of the state. Pathri, Mohammadpur, Khatima, Lohiahead, Kulhal, Dhakrani, Dhalipur, Chhibbro Project, Ramganga, Khadiri, Cheela, Tanakpur, Urgam, Pilangad, Kaliganga, Dhauliganga, Kishau, Palameneri, Bhagirathi, Loharinag, Tehri etc. are included in the multipurpose projects in the state. Apart from this, Hanol-Tuini, ArakotTuini, JakholSankhri, Bhairon Valley I, II Bhagirathi, Badkot-Kuwa, SyanaChattiGangani, Karnaprayag, Pindar, Bhilangana, Pancheshwar, Purnagiri, ChamagadBalighat, Babas, Khairna, Barsimi, Kwarbh,

Eastern RamgangaHardhawaChhina site have been selected as multipurpose projects where multipurpose plans can be made, which apart from developmental plans are helping in developing infrastructure along with daily needs like water resources, energy resources, irrigation means, tourism. In the state, since the last decade, the perennial road scheme, Chardham project, Karnaprayag railway line scheme, Badrinath and Kedarnath reconstruction project, and MandirManasmala scheme have been jointly implemented as multipurpose projects for tourism development, religious place renovation, road development, migration control and livelihood improvement. Are being operated in. In the form of regional development, there is natural diversity in the physical form of the state, where plans are made and implemented in different ways for both mountainous and plain areas.

About 86 percent of the state's land area is mountainous and the remaining 14 percent is included in the Bhabar and Terai plains. Out of the thirteen districts, no district is completely plain except Udham Singh Nagar. Therefore, it is natural to have differences in regional development, due to which the local community has been able to get more development in Dehradun, Haridwar, Udham Singh Nagar and Nainital and the benefits of schemes on a limited scale in the mountainous districts. Along with regional diversity in the state, the diversity in developmental works is also at its peak for which the natural and economic conditions of the state are particularly responsible. Apart from this, natural disasters occurring in the state, unemployment, lack of health facilities, and lack of adequate availability of educational resources, agricultural diversities and tourism development possibilities also give rise to inequalities in the development of plans for regional development.

5.5 GLOSSARY.

Multipurpose projects - Multipurpose projects are those man-made projects which are capable of fulfilling several objectives simultaneously.

Natural sources - Sources of water provided by nature in which perennial water flows.

Glacier Snow - Clad mountain peaks situated in the high Himalayan regions.

Glogi - Glogi State's first multipurpose hydroelectric project.

All weather road scheme- Multipurpose project of the Government of India for tourism development and providing road facilities to tourists throughout the year.

Karnprayag rail line-	State's first mountain rail line project under construction from Rishikesh to Karnaprayag.
Manasmala scheme-	Multipurpose project to connect the temples situated as ancient heritage of Kumaon division with modernization and road with the cooperation of the Central and State Governments.
Tehri Dam project-	The largest project of the continent of Asia built at the confluence of the Bhagirathi and Bhilangana rivers in Tehri district.
Nation's Village-	Tehri Hydroelectric Multipurpose Project has been named the Nation's Village in the country.
Ramganga Dam Project-	Multipurpose project located in PauriGarhwal district of Uttarakhand state.
Run-of-the-River Technology is used to run electric turbines through underground tunnels.	
Pancheshwar Project-	5040 MW multipurpose hydroelectric project proposed in a joint partnership of India and Nepal.
Jamrani Dam Multipurpose	130 MW hydroelectric project under construction in GaulaRiver at a place called Jamrani in the Nainital district.
Regional Development Inequality-	Regional development inequality is the difference in regional development in the state based on geographical, cultural and demographic diversities of the state.
New Tourism Policy-	Tourism policy made by the state government in the year 2018 for new reforms in the tourism sector. 1st class tourist area Tourist places established before the formation of the state like Haridwar, Nainital, Dehradun, Mussoorie, Ranikhet, Almora Bazaar, Kashipur, Ramnagar etc.
Geographical Indicator-	18 products of Uttarakhand state got special geographical identity at national and international levels like- Jhangora, Mandua, Red

Rice, LakhoriMirch, BurashSharbat, Litchi of Ramnagar, Peach of Ramgarh etc.

National Park Wildlife

Parks are reserved for the protection of wildlife and environmental conservation in which no kind of human intervention is allowed.

5.6. ANSWER TO CHECK YOUR PROGRESS

1. Multipurpose schemes aim to fulfil many objectives with one construction like power generation, flood control, drinking water and irrigation supply an increase in green cover etc.
2. Uttarakhand state's first multipurpose hydroelectric project Glogi was established in 1906-07 in Kyarkuli and Bhatta villages of Mussoorie.
3. The objective of the Char DhamVikas Project is to connect the four Dhams of the state, Yamunotri, Kedarnath, Gangotri and Badrinath with all-weather four-line roads and to promote tourism.
4. Ganesh Prayag was the confluence of the old Tehri town Bhagirathi and Bhilanganarivers, which were completely submerged in water.
5. The ManeriBhali multipurpose project has been constructed in the Bhagirathi River.
6. Dhauliganga Hydroelectric Project is a concrete face rock and soil-filled embankment reservoir.
7. Pancheshwar Dam International Project is a 5040 MW power project to be built in Mahakali Sharda with the joint partnership of India and Nepal. □ The first tourism development policy in the state was announced by the government on 26 April 2001.
8. The third category tourist areas includes those tourist areas which have not been promoted for tourists to date and lack basic infrastructure. Example: Harishtal, Devguru, Bhikiyasen, Kausani, Garun, Milan, Ghanshali, NandPrayag, Nandasen, Mana, Badrinath, Pandukeshwar and Vishnuprayag etc. in Nainital.
9. According to the report of Uttarakhand State Migration Commission 2022, 3 lakh people from 6436 villages of 92 blocks have migrated in the last 5 years.
10. In the state of Uttarakhand, 18 products have been awarded the certificate of geographical indication on 4 December 2023.

11. There is a possibility of generating about 40,000 MW of hydroelectricity in the state, this is the estimate of the research institutes of the state and central government.
12. For the development of third-class tourist places, the state government is giving a subsidy of up to 50 percent on the invested capital.

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5.8 TERMINAL QUESTIONS

1- Long Type Questions

- Q. 1- Explain the meaning of multipurpose projects and describe in detail the major multipurpose projects of Uttarakhand state?
- Q. 2- Uttarakhand state is backward in infrastructure development despite being a state rich in tourism and water resources. Give a detailed description of the main responsible elements?

2. Short Answer Questions

- Q. 1- What do you mean by multipurpose projects? Describe in your own words giving brief examples?
- Q. 2- Describe the Tehri Dam multipurpose project in detail?

Q. 3- What is the perennial Chardham project?

Q. 4- Explain the main objectives of the proposed Jamrani Dam project?

Q. 5- Give your suggestions to bring uniformity in developmental works in Uttarakhand state.

Q. 6- What is the perennial road project?

Q. 7- Describe the main elements helpful in the local development of Uttarakhand state?

Q. 8- In how many parts are tourism areas classified based on regional differences and development, describe them briefly?

Q. 9- Describe the main points given as suggestions for regional development in Uttarakhand state?

Q. 10- Describe the main problem elements in regional planning of Uttarakhand state.

Q. 11- How are physical and cultural differences a hindrance in the development of Uttarakhand state, explain.

3. Multiple Choice Questions

Q. 1- Which of the following is the first multipurpose project of Uttarakhand state?

- a. Lohiahead
- b. Tehri
- c. Glogi
- d. Maneri

Answer- C

Q. 2- Which of the following is the objective of a multipurpose project?

- a) To generate electricity
- b) To control floods
- c) To supply drinking water and irrigation water
- d) All of the above

Answer: D

Q. 3-Tehri Dam Project has been constructed at the confluence of which rivers?

- a. Alaknanda and Bhilangana
- b. Bhagirathi and Alaknanda
- c. Bhagirathi and Bhilangana
- d. Nadakini and Bhagirathi

Answer: C

Q. 4-Manasmala Project is related to which of the following?

- a) Road construction
- b) Temple renovation
- c) Renovation of temples of Kumaon region
- d) All of the above

Answer: C

Q. 5- Which multipurpose project is given the title of the village of the nation?

- a) Pancheshwar
- b) Jamrani
- c) Vyas
- d) Tehri

Answer: D

Q. 6- Which will be the first mountain rail line project of Uttarakhand state?

- a) Tanakpur-Bageshwar
- b) Rishikesh-Karnprayag
- c) Kotdwar-Srinagar
- d) Kathgodan-Nainital

Answer: B

Q. 7- In which district is the Song Dam project located?

- a) Haridwar

- b) Uttarkashi
- c) Tehri
- d) Dehradun

Answer: D

Q. 8- On which technology is the state's hydroelectric project currently working?

- a) Open canal technology
- b) Run-of-the-river
- c) Closed canal technology
- d) All of the above

Answer: B

Q. 9- What are the major obstructing factors in the development of Uttarakhand?

- a) Physical Diversity
- b) Cultural diversity
- c) Demographic diversity
- d) All of the above

Answer: D

Q. 10- Which of the following is not included in the oldest tourist places of Uttarakhand?

- a) Mussoorie
- b) Nainital
- c) Ranikhet
- d) New Tehri

Answer: D

Q. 11- How many products have been given Geographical Indicator Certificates as local products in Uttarakhand state?

- a) 15
- b) 18

- c) 20
- d) 22

Answer: B

Q. 12- According to the Uttarakhand Migration Commission Report 2022, how many people are to migrate on an average every day?

- a) 138
- b) 151
- c) 193
- d) 197

Answer: C

Q. 13 Total power capacity of potential hydropower projects in Uttarakhand state has been estimated to be?

- a) 42,000 thousand MW
- b) 40,000 thousand MW
- c) 45,000 thousand MW
- d) 51,000 thousand MW

Answer: B

BLOCK 3: ECONOMY

UNIT 6: INTEGRATED RURAL DEVELOPMENT PROGRAMME, COMMAND AREA AND WATERSHED MANAGEMENT

6.1 OBJECTIVES

6.2 INTRODUCTION

6.3 INTEGRATED RURAL DEVELOPMENT PROGRAMME

6.4 COMMAND AREA

6.5 WATERSHED MANAGEMENT

6.6 SUMMARY

6.7 GLOSSORY

6.8 ANSWER TO CHECK YOUR PROGRESS

6.9 REFERENCES

6.10 TERMINAL QUESTIONS

6.1 OBJECTIVES

After studying this chapter you will be able to understand:

- The Integrated Rural Development Programme (IRDP) includes its objectives, target beneficiaries, eligibility criteria, and implementation process.
- Regarding the effects of the IRDP, Command Area Development (CAD), and watershed management initiatives.
- The different poverty alleviation programs offered by both State and Central Governments.
- The relevance of the Command Area Development Programme, its operational procedures, benefits, and overall impacts.
- The importance of watershed management, including its goals, foundational principles, and key components.

6.2 INTRODUCTION

The Integrated Rural Development Programme (IRDP) was launched by the Government of India in 1978 to reduce poverty by creating employment opportunities and providing financial support, particularly for rural populations. Officially initiated in 1980, the program offers subsidies and aims to improve living conditions for economically disadvantaged individuals. By participating in the IRDP, marginalized groups gain access to job opportunities and skill development, making it a key strategy for poverty alleviation. Overall, the IRDP provides essential resources to help underprivileged communities achieve economic independence and improve their quality of life.

Command Area Development and Watershed Management represent two distinct methodologies for managing water resources in India. The former emphasizes the irrigation of agricultural lands, whereas the latter is concerned with the conservation and management of water resources within specific watersheds. Command Area Development was initiated in India during the 1970s to address the complexities associated with irrigation management in extensive irrigation schemes. This approach sought to enhance the efficiency of irrigation systems and boost agricultural output. Conversely, watershed management arose in response to issues such as soil erosion and water scarcity prevalent in hilly and semi-arid regions of the nation, with the

objective of fostering the conservation and effective management of water resources within designated watersheds.

The Command Area Development Programme (CADP) was initiated in India during the 1970s with the objective of enhancing the efficiency of irrigation systems and boosting agricultural output. This initiative encompassed the establishment of water storage facilities, the lining of irrigation canals, and the adoption of innovative irrigation methodologies.

Launched in the 1990s, the Watershed Development Programme in India aimed to foster the conservation and management of water resources within specific watersheds. This programme included a variety of interventions, such as soil and water conservation practices, afforestation efforts, and the development of water storage infrastructures.

6.3 INTEGRATED RURAL DEVELOPMENT PROGRAMME

This unit explores the Integrated Rural Development Programme (IRDP), a national initiative to alleviate poverty among specific beneficiary groups. Before discussing the IRDP, it's important to review the foundational programs that preceded it. In the 1950s and 1960s, there was a belief that economic growth in agriculture and industry would benefit all societal segments through a trickle-down effect. The Community Development Programme aimed for holistic rural development, expecting that improvements in activities and infrastructure would alleviate poverty. In the 1960s, the focus shifted to agricultural development due to food shortages, leading to the Green Revolution and self-sufficiency in food production in favorable regions.

The Green Revolution reduced dependence on foreign food supplies but created two major issues: regional disparities and income inequality. Fertile areas thrived while less productive regions fell behind. Larger farmers benefited from better resources, leaving smallholders and laborers excluded, which worsened income inequality. Mechanization displaced unskilled laborers, despite creating opportunities for skilled workers, leading to a decline in total employment relative to the growing labor force. This period saw the rise of "Growth with Social Justice" in developing nations facing poverty, highlighting both relative inequality and absolute poverty. This understanding led to the establishment of the poverty line as a tool for assessing and addressing rural poverty. The Fourth Five-Year Plan proposed measures to tackle these issues, resulting in two special rural development programs: one for reducing regional imbalances and another for addressing income disparities.

The strategies from the Fourth and Fifth Plans to combat poverty can be grouped into three types: 1. A nationwide initiative for minimum essential needs; 2. Efforts to reduce regional inequalities and develop underdeveloped areas; 3. Targeted anti-poverty programs for specific demographic groups.

The Fourth Five-Year Plan, following the 1969 All India Credit Review Committee Report, aimed to empower small and marginal farmers and agricultural laborers through initiatives like the Small Farmers Development Programme, launched in 1973. Small farmers typically owned 1-2 hectares of irrigated land and up to 3 hectares of non-irrigated land, while those with less than 1 hectare were considered marginal farmers. The program aimed to enhance farming viability by providing access to credit, irrigation, price support, and marketing assistance. Small Farmers Development Agencies (SFDAs) were established to implement this program, governed by representatives from institutional agencies and district administration, with the Collector or Deputy Commissioner as Chairman. The SFDAs' main functions included: identify target beneficiaries, specifically eligible small-scale farmers; assess their challenges to understand their needs; develop appropriate schemes to address these needs; seek support from relevant institutions for implementation; encourage institutional credit sources to provide medium- and long-term financing; and allocate financial assistance as follows: (a) small farmers receive 25% of project costs; (b) other eligible groups receive 33.33%; and (c) individuals from Scheduled Castes (SCs) and Scheduled Tribes (STs) receive 50%. Finally, organize extension services and supply chains to support these farmers.

The main goal of these initiatives was to help the rural poor increase their income by promoting advanced agricultural technologies, improving irrigation access, and diversifying the agricultural economy through activities like animal husbandry and horticulture. They also aimed to enroll beneficiaries in credit cooperatives for better access to credit. During the Fourth Plan, forty-six pilot projects under the Self-Financing Development Agency (SFDA) were launched, but after two years, it was clear that mainly small farmers benefited, leaving marginal farmers, agricultural laborers, and artisans underserved. To address this, the Marginal Farmers and Agricultural Labourers Development Agencies (MFAL) scheme was introduced in 1975, mirroring SFDA's objectives but was later integrated into SFDA in 1976-77. A 1978 study by the Programme Evaluation Organization (PEO) assessed twenty-one SFDAs and thirteen MFALs across seventeen states, revealing several operational shortcomings.

The SFDA and MFAL initiatives aimed to benefit the target population, but programs like the Drought Prone Area Programme (DPAP), Command Area Development Agency (CADA), and Hill Area Development Agency (HADA) offered limited direct support to beneficiaries and primarily focused on land size for selection, ignoring other income sources. They also emphasized land-based activities, neglecting alternative employment opportunities. To address these issues, the Integrated Rural Development Programme (IRDP) was launched in 1978, consolidating beneficiary-oriented aspects of existing programs and covering 2300 blocks from SFDA, DPAP, CADA, and HADA. The Draft Sixth Plan (1978-83) highlighted the need for integration across sectoral programs, spatial planning, and alignment of policies to enhance growth, poverty alleviation, and job creation, particularly for small farmers, agricultural laborers, and rural artisans.

6.3.1. Goals of IRDP

As previously stated, the goal of IRDP is to raise the standard of living in disadvantaged rural regions above the poverty line. IRDP's additional goals are as follows:

- To enhance rural living standards by providing long-term employment.
- Increasing agricultural output and supporting small businesses in rural areas is vital.
- To foster sustainable development in rural communities.
- Prioritizing the reduction of poverty and the improvement of quality of life in rural areas.
- To Access healthcare, education, and clean water.
- To broaden economic opportunities for rural residents.
- Empowering rural communities to participate in decision-making and development processes.
- Promoting self-sufficiency and sustainability.
- To address the social, economic, and environmental challenges comprehensively faced by rural areas.

6.3.2. Beneficiaries under Integrated Rural Development Program

The Integral Rural Development Programme (IRDP) aims to support impoverished rural areas of the block, focusing on the rural poor in India, especially those from scheduled castes, scheduled tribes, and other backward classes. Beneficiaries are categorized into distinct groups under the scheme.

- Rural artisans

- Land less labourers
- Small and marginal farmers
- Scheduled castes and scheduled tribes
- People living below the poverty line
- Women and female-headed households
- Scheduled Castes and Scheduled Tribes
- Other Backward Classes

6.3.3. Subsidies Provided Under Integrated Rural Development Program

The government provides financial support through subsidies and loans or credits to targeted populations. These financial aids are made available by a range of government-sanctioned financial institutions. The allocation of subsidies is determined by the specific needs of the target population. The distribution is carried out in accordance with the following guidelines:

- The government provides subsidies and bank loans as financial aid.
- Approved banks offer financial assets.
- Subsidies are allocated based on the needs of target groups.
- Banks provide a 25% subsidy to small farmers.
- For rural artisans, marginal farmers and labourers, 33.5% subsidy.
- SC/ST and physically handicapped get a 50% subsidy.
- The ceiling for SC/ST and disabled groups is set at ₹6000.
- For DPAP and non-DDP areas, ₹4000 is charged.
- For DPAP and DDP areas, ₹5000 is charged.
- SC/ST gets a 50% subsidy. Women get a 40% subsidy. Differently abled get a 3% subsidy.
- Priority gives to groups with excess limits and Green Card holders under free bonded labour programs.

The effective execution of IRDP necessitated the development of Comprehensive Block Plans integrated with district and state strategies, highlighting the importance of community involvement and the support of voluntary organizations.

6.3.4. Eligibility of Integrated Rural Development Program

The Integrated Rural Development Programme (IRDP) is a Central Government initiative that receives equal financial backing from central and state governments. The allocation of funds from the Central Government to the states is based on the ratio of the poor rural population within each state to the overall poor rural population across the nation. This funding mechanism has been utilized in all Indian states since its inception in 1980. Various financial institutions, including cooperatives, commercial banks, and regional rural banks, provide financial assets and subsidies to beneficiaries. For the effective execution of the IRDP, it is essential to develop Comprehensive Block Plans that are integrated with district and state-level strategies while also prioritizing community engagement and collaboration with voluntary organizations.

6.3.5. Implementation of Integral Rural Development Programme

The Integrated Rural Development Programme (IRDP) necessitated the creation of District Rural Development Agencies (DRDAs) in every district, transforming existing entities such as the Small Farmers Development Agency into DRDAs. Each DRDA is led by a Project Director, supported by Assistant Project Officers and staff. The governing body, chaired by the District Collector or Deputy Commissioner, includes sector heads, elected representatives, and members from banks and NGOs. DRDAs function as registered societies under the Societies Registration Act of 1860, with national supervision from the Ministry of Rural Development and state administration by the State Level Coordination Committee (SLCC). At the district level, DRDAs implement the program through various blocks and departments.

The Block Development Officer (BDO) leads planning at the block level, aided by Extension Officers and Village Level Workers (VLW), while voluntary organizations and action groups also contribute, supported financially by the Council for People's Action and Rural Technology (CAPART).

(A) Procedure for Implementation

The IRDP is executed via a decentralized framework that engages various stakeholders across multiple tiers. Some of the key features of the implementation process of the IRDP include:-

- **Decentralized administration:** The program operates under a decentralized framework, with the District Rural Development Agency (DRDA) executing it at the district level.

- **Formation of self-help groups:** The initiative encourages the formation of self-help groups (SHGs) to support beneficiaries in accessing credit and assistance.
- **Identification of beneficiaries:** Beneficiary identification is done through a participatory approach, involving Gram Sabhas and local entities.
- **Definition of the Poverty Line Income:** The poverty line income is the minimum annual expenditure for a family of five to meet daily nutritional needs of 2400 kilocalories. The Planning Commission set the poverty line at Rs. 3,500 during the Sixth Plan, raised it to Rs. 6,400 for the Seventh Plan, and to Rs. 11,000 for the Eighth Plan. For the Ninth Plan, state-specific figures ranged from Rs. 16,000 to Rs. 18,000.
- **Priority List Creation:** The priority list is created after enumerating Below Poverty Line (BPL) families in each village, focusing on specific groups like those with ceiling surplus land, released bonded labourers, and persons with disabilities. Subsequently, the list is submitted for deliberation and ratification during a Gram Sabha meeting organized by the Block Development Officer (BDO).
- The BDO identifies beneficiaries from this list, requiring approval from the District Rural Development Agency (DRDA) for assistance. Over time, the beneficiary selection process has been streamlined, allowing for quicker project decisions and the organization of loan-cum-subsidy programs through meetings with block and banking officials, along with support from voluntary action groups.
- **Asset creation:** The initiative facilitates the development of income-producing assets, including land, livestock, and equipment, to help the rural impoverished population in establishing sustainable means of livelihood.
- **Credit and financial support:** The initiative offers financial assistance and credit facilities to rural entrepreneurs by leveraging a network of rural financial entities, including banks, cooperatives, and microfinance organizations.
- **Training and capacity building:** The initiative offers training and capacity-building assistance to rural communities, enabling them to acquire the skills and knowledge essential for engaging in development activities.
- **Monitoring and evaluation:** The program is equipped with a monitoring and evaluation framework designed to evaluate its impact and pinpoint opportunities for enhancement.

(B) Funding and Financing

The framework's initiatives are funded through subsidies and institutional credit. Since 1986, the Central Government has used a quarterly budgeting system for fund disbursement: 15% in the first quarter (April-June), 20% in the second, totaling 35% by September. Any shortfalls are deducted from the next installment. Funds are allocated to District Rural Development Agencies (DRDAs), with costs shared equally between Central and State governments; Union Territories receive full funding from the Central Government. The Department of Rural Development typically disburses funds in two installments, except for cold, snow-bound districts, which receive a single installment.

The subsidy framework to female groups in the DWCRA and TRYSEM initiatives, providing in-kind support linked to credit, except for working capital, which may be cash for viable projects. For capital investments under Rs. 1,000, credit linkage is not required. The subsidy-to-credit ratio is typically 1:2, with most credit sourced from institutional financing at a 10% interest rate. The DRDA sponsors loan applications, processed by bank managers, with a designated day for IRDP credit disbursement. Additionally, infrastructure support for the program will be provided by state sectoral departments, with the IRDP allocation for infrastructure increasing from 10% to 20%, and 25% for hilly, tribal, and North-Eastern regions.

On April 1, 1988, a government-funded group life insurance program was launched for beneficiaries of the Integrated Rural Development Programme (IRDP) for three years following asset distribution. The IRDP combines subsidies and credit, with the subsidy funded equally by Central and State Governments, while loans come from various banks. Although total credit mobilized has increased, funding from cooperative institutions has declined. In 1988-89, Rs. 1232 crores in credit was disbursed, with Rs. 1056 crores from commercial banks and Rs. 176 crores (16.7%) from cooperatives. The loan and subsidy disbursement began in 22 blocks on April 1, 1986, expanding to 50 blocks by January 1, 1989. The Service Area Approach for better service delivery was implemented on April 1, 1989.

IRDP with Reference to Uttarakhand

The IRDP was launched by the Government of India in 1978 and lasted until 1999, after which it was restructured and renamed the Swarnjayanti Gram Swarozgar Yojana. This program aims to create self-employment opportunities for the rural poor, crucial for economic growth and

social change, as about 75% of the state's population lives in rural areas. Key strategies include enhancing community engagement, decentralizing planning, implementing land reforms, and improving access to financial resources. Both state and central governments are adopting a holistic approach, collaborating with NGOs, community groups, and the private sector to promote sustainable self-employment by leveraging local resources and skills. The focus is on fostering wage employment, self-employment, and infrastructure development.

Centrally Sponsored Schemes (CSS)

1. The Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) is designed to improve the livelihood security of individuals residing in rural regions by ensuring the provision of 100 days of wage employment annually.
2. The Deendayal Antyodaya Yojana – National Rural Livelihoods Mission (NRLM) seeks to alleviate poverty by facilitating access to sustainable self-employment and skilled wage employment opportunities for impoverished households, thereby significantly enhancing their livelihoods through the establishment of robust grassroots organizations.
3. The Pradhan Mantri Awaas Yojana-Gramin (PMAY-G) is focused on providing durable housing with essential amenities to all households without shelter, as well as those living in temporary or deteriorating structures in rural areas, to achieve this by the year 2022.
4. The Pradhan Mantri Gramin Sadak Yojana (PMGSY) is a key initiative in India's rural economy, where about 74% of the population lives in villages. Launched in 2000, PMGSY aimed to provide all-weather road access to the estimated 330,000 villages lacking, enhancing rural connectivity to improve access to essential services, boost agricultural productivity, and create jobs, thus aiding in sustainable poverty alleviation. The scheme is centrally sponsored, with 90% funding from the central government and 10% from state governments.
5. The Shyama Prasad Mukherji Rurban Mission (NRuM) acknowledges that many rural areas in India have clusters of settlements with growth potential and economic advantages. To develop these 'Rurban' clusters, the Government of India launched the Shyama Prasad Mukherji Rurban Mission (SPMRM) to provide essential infrastructure and amenities. The mission focuses on leveraging resources through various government schemes and offers Critical Gap Funding (CGF) for targeted development in these areas.

6. The Deen Dayal Upadhyaya Grameen Kaushalya Yojana (DDUGKY) is a skill development initiative by the Ministry of Rural Development focused on empowering underprivileged rural youth in India for sustainable employment. In Uttarakhand, the Department of Rural Development implements this scheme through the Uttarakhand State Rural Livelihood Mission (USRLM), aiming to enhance skills and facilitate job placements for economic independence.
7. The Border Area Development Programme addresses the developmental needs of residents in remote border regions, aiming to improve infrastructure through a collaborative approach across various government levels. It focuses on six key areas: Basic Infrastructure, Health, Education, Agriculture and Water Resources, Financial Inclusion, and Skill Development. In Uttarakhand, the State Project Management Unit oversees the program, working with district administrations to enhance services in nine blocks across five districts: Pithauragarh, Champawat, Chamoli, Uttarkashi, and Udham Singh Nagar.

Central Schemes (CS)

1. The Members of Parliament Local Area Development Scheme (MPLADS) is a Government of India initiative established on December 23, 1993, empowering MPs to propose developmental projects in their constituencies that create sustainable community assets. Initially managed by the Ministry of Rural Development, the scheme ensures projects serve the public interest, with final approval from District Authorities.
2. New National Biogas Organic Manure Programme (NNBOMP)
 - Biogas Beneficiary List (2013-14)
 - Biogas Beneficiary List (2014-15)
 - Biogas Beneficiary List (2018-19 & 2019-20)

State Sponsored Schemes (SSS)

1. Vidhayak Nidhi: Launched in 2000-01, the MLAs Local Area Development Scheme allows Members of the Legislative Assembly (MLAs) to propose minor development projects in their constituencies. Each MLA can recommend initiatives to the Chief Development Officer, with the state allocating Rs 3.75 crore annually.
2. Dendayal Uttarakhand Gramin Awas Yojana: Initiated on September 25, 2007, this scheme aims to provide permanent housing for families below the poverty line living in inadequate conditions. It offers one-time financial assistance for durable housing construction to

Scheduled Castes, Scheduled Tribes, bonded labourers, and individuals from the general caste, based on the 2002 BPL survey.

3. The State Credit Cum Subsidy Gramin Awas Yojana (CCS) is a fully state-funded program providing financial support to all rural households with incomes up to Rs 32,000, including both below and above the poverty line. It offers Rs 50,000 per eligible family for housing construction, comprising a Rs 40,000 loan and a Rs 10,000 government grant. The initiative targets homeless families in rural areas within 20 kilometres of urban centres and villages at least 5 kilometres away, aiming to address homelessness by promoting home construction for families capable of loan repayment.
4. The Mera Gaon Meri Sadak (MGMS) initiative, launched by the Uttarakhand Government in 2014-15, aims to provide all-weather road connectivity to villages lacking proper access. It focuses on villages within 1 kilometre of National Highways, State Highways, or district roads, without land compensation or forest clearance issues. The project involves constructing 6-foot-wide cement concrete roads, funded equally by the MGMS and the Mahatma Gandhi NREGA scheme, to enhance rural infrastructure.
5. The Rural Business Incubator (RBI) supports young entrepreneurs with innovative ideas, startups, and small businesses in achieving their goals. Our mission is to help them overcome common challenges in starting and managing their ventures through various support services, mentorship, and training.

External Aided Project (EAP)

The Integrated Livelihood Support Project (ILSP), a collaboration between the Government of Uttarakhand and IFAD, is being implemented in 44 blocks across 11 hill districts. Its main goal is to alleviate poverty by empowering rural households to pursue sustainable livelihood opportunities linked to the broader economy.

Others

1. Saansad Adarsh Gram Yojana (SAGY)
2. Mission Antyodaya
3. RSETI :
4. DISHA
5. USAATA(Social Audit Unit)
6. Indira Amma Bhojnalaya Scheme

6.4 COMMAND AREA

Since planning began in the nation, a major irrigation development program has led to the construction of large dams and canals. The focus has been on addressing the gap between established irrigation potential and its actual use. Launched in December 1974, the Command Area Development Programme (CADP) aimed to accelerate the use of this potential and boost agricultural output, responding to recommendations from the Irrigation Commission and other bodies. The program's goal was to reduce delays in utilizing irrigation potential and enhance productivity in irrigated areas, but actual utilization and productivity have fallen short of initial expectations.

A broad-based area development authority is essential for coordinating activities to enhance the utilization and productivity of irrigation projects across various sectors, including irrigation, agriculture, credit, and cooperatives. The Command Area Development Authorities (CADA) are responsible for modernizing and maintaining irrigation systems, developing drainage systems, and implementing on-farm development initiatives. Their tasks include land consolidation, enforcing warabandi, promoting efficient resource use, and selecting suitable cropping patterns. The centrally sponsored Command Area Development Programme, launched during the Fifth Five-Year Plan, initially targeted 60 major and medium irrigation projects in 16 states. By the Sixth Five-Year Plan, it was active in 76 projects, with 29 new projects added in 1983-84 and three ongoing projects completed.

The establishment of a comprehensive area development authority is crucial for coordinating activities that enhance irrigation project utilization and productivity, involving various Departments and Organizations such as irrigation, agriculture, credit, and cooperatives. The Command Area Development Authorities (CADA) are responsible for modernizing and maintaining irrigation systems, developing drainage systems, and implementing 'on-farm' development initiatives. Their tasks include land consolidation, enforcing warabandi, promoting efficient resource use, and selecting suitable cropping patterns. The centrally sponsored Command Area Development Programme was launched during the Fifth Five-Year Plan, initially targeting 60 major and medium irrigation projects across 16 states. By the Sixth Five-Year Plan, it expanded to 76 projects, with 29 new projects added in 1983-84, although three ongoing projects were discontinued after completing their development activities.

6.4.1. Functions of CADP

The initiative emphasizes 'on-farm' development strategies, employing the Warabandi rotational water distribution system to ensure equitable and prompt irrigation water delivery. A primary objective of the Command Area Development (CAD) Programme is to maximize the efficiency of irrigation practices. Its principal functions encompass:

- a) Modernizing and managing the irrigation system and improving drainage,
- b) Constructing field channels and drainage systems,
- c) Shaping, leveling, and consolidating land,
- d) Lining field channels and watercourses,
- e) Installing tubewells for groundwater use,
- f) Implementing an appropriate cropping pattern,
- g) Establishing an effective irrigation rostering system,
- h) Ensuring timely provision of agricultural inputs like fertilizers and seeds, and
- i) Enhancing extension training programs.

The effectiveness of irrigation infrastructure and a well-designed water policy are key factors in farm-level water usage. Additionally, initiatives like road construction and processing facilities are important in Command Area Development (CAD) Programs.

6.4.2. State and Central Government Contribution

The current framework includes around 155 irrigation initiatives covering nearly 19 million hectares across 20 states and 2 Union Territories, managed by 54 Command Area Development Authorities (CADAs). A total financial commitment of about Rs 2600 crores has been made since the program's inception, with the Government of India contributing around Rs 900 crores. Institutional financing has also been vital for various activities. Capacity utilization improved from about 70% at the end of the Fifth Plan to 77% in 1986-87 but fell to 73% in 1987-88 due to severe drought. Notable productivity gains have been seen in projects like Girna in Maharashtra and Sharda Sahayak in Uttar Pradesh, particularly for crops like paddy, wheat, and sugarcane, though overall productivity growth remains unsatisfactory.

6.4.3. The Implementation Process of the CADP

The execution of the CADP follows a systematic, step-by-step approach that encompasses preparation, execution, monitoring, and assessment. This process generally consists of several essential phases:

- Preparation Phase: This stage involves developing a detailed project plan that outlines the objectives, methods, budget allocations, and timeline for the CADP.
- Execution Phase: In this stage, the planned strategies are implemented. This may include constructing irrigation systems, educating farmers on efficient water usage, and participating in other relevant activities.
- Monitoring Phase: This phase focuses on the ongoing evaluation of the program's progress in relation to the established goals and timeline.
- Assessment Phase: The final stage includes a thorough evaluation of the CADP's outcomes. Performance indicators are analyzed to identify any shortcomings and to provide suggestions for future improvements.

6.4.4. Benefits and Impact of the CADP

The CADP offers numerous advantages that extend beyond agriculture, positively influencing the wider economy and society:

- Improved Irrigation Techniques: The CADP equips farmers with knowledge of advanced irrigation techniques, resulting in more effective water management and reduced water loss.
- Increased Agricultural Production: Improved irrigation methods enable farmers to achieve greater crop production, which in turn enhances their income and elevates their overall quality of life.
- Economic and Social Advancement: The increased income generated from higher crop yields bolsters local economies and fosters socio-economic progress in areas where the CADP is active.
- Environmental Protection: By advocating for the responsible use of water resources, the CADP plays a significant role in conserving this essential resource, thereby contributing to environmental sustainability.

6.5 WATERSHED MANAGEMENT

A watershed is a geo-hydrological unit defined as the area that provides water to a particular stream or collection of streams. Often called a drainage or catchment area, it is an essential measure for evaluating water resource balance and plays a vital role in various planning and management strategies for sustainable development. This concept is broadly acknowledged in different methods of planning, developing, and managing surface land. In a nutshell, a

watershed includes all physical and human elements, such as land, rivers, forests, settlements, and infrastructure.

Types of Watershed

A watershed is classified depending upon the size, drainage, shape and land use pattern.

- Macro watershed (> 50,000 Hect)
- Sub-watershed (10,000 to 50,000 Hect)
- Milli-watershed (1000 to 10000 Hect)
- Micro watershed (100 to 1000 Hect)
- Mini watershed (1-100 Hect)

6.5.1. Watershed Management

Watershed management refers to the systematic approach of implementing land use and water management strategies to safeguard and enhance water quality and other natural resources within a watershed. This process involves a comprehensive management of land and water resources to ensure their sustainable use. Watershed management encompasses various characteristics of a watershed to achieve a sustainable allocation of its resources. It includes the development and execution of plans, programs, and projects designed to maintain and improve the functions of the watershed, which in turn impacts the flora, fauna, and human populations residing within its boundaries. The key aspects that management agencies focus on include water supply, water quality, drainage systems, stormwater runoff, water rights, and the overall strategic planning and utilization of watershed areas. Various stakeholders, including landowners, land use authorities, stormwater management professionals, environmental experts, and local communities, play crucial roles in the effective management of watersheds.

A watershed comprises both its physical and hydrological natural resources, as well as human resources. Consequently, effective watershed management involves the judicious use of land and water resources to achieve optimal productivity while minimizing risks to both natural ecosystems and human communities. This process is fundamentally about directing and organizing land use and resource allocation within a watershed to deliver desired goods and services, all while preserving the integrity of soil and water resources. Central to this approach is the acknowledgement of the interconnectedness of land use, soil, and water, as well as the relationships between upland areas and downstream regions.

6.5.2. Objectives of watershed management

The different objectives of watershed management programmes are:

- Mitigate damaging runoff and degradation to conserve soil and water resources.
- Manage and utilize runoff water for beneficial purposes.
- Safeguard and enhance land for sustainable production.
- Protect and improve water resources.
- Prevent soil erosion and reduce sediment yield.
- Restore degraded lands.
- Moderate downstream flood peaks.
- Enhance rainwater infiltration.
- Boost timber, fodder, and wildlife production.
- Promote groundwater recharge where possible.

6.5.3. Principles of Watershed Management:

Effective and sustainable management of watersheds is based on several fundamental principles:

- **Participatory Approach:** Facilitate the active engagement and involvement of local communities, stakeholders, and institutions throughout planning, implementation, and decision-making.
- **Integrated Planning:** Employ a comprehensive and holistic strategy that considers the interconnections among various elements of the watershed, such as land, water, vegetation, and socio-economic factors.
- **Watershed as a Unit:** Recognize the watershed as a distinct hydrological entity, understanding that actions taken in one area can affect the entire watershed.
- **Adaptive Management:** Adopt a flexible and learning-oriented approach by consistently monitoring and assessing the effects of management actions and adjusting strategies in response to new insights and evolving conditions.
- **Sustainable Use of Resources:** Advocate for the prudent and sustainable management of natural resources, ensuring their availability for current and future generations.

- **Collaborative Governance:** Promote partnerships, cooperation, and coordination among diverse stakeholders, including government bodies, local communities, non-governmental organizations, and research institutions.

6.5.4. Components of Watershed Management:

Watershed management encompasses a range of interconnected components aimed at achieving sustainable environmental outcomes:

- **Land Management:** Adopt practices designed to mitigate soil erosion, enhance soil conservation, and improve land productivity. Techniques such as terracing, contour ploughing, agroforestry, and conservation tillage are integral to this process.
- **Water Management:** Prepare strategies for the efficient utilization, storage and distribution of water resources. This includes the construction of reservoirs, check dams, water harvesting systems, and irrigation networks.
- **Vegetation Management:** Promote afforestation, reforestation, and the maintenance of adequate vegetation cover to improve water infiltration, decrease soil erosion, and support the conservation of biodiversity.
- **Infrastructure Development:** Build and sustain essential infrastructure, including roads, bridges, irrigation channels, and drainage systems, to support effective land and water management practices.
- **Conservation Measures:** Employ conservation techniques such as contour bunding, contour trenches, and vegetative barriers to minimize runoff, enhance groundwater recharge, and manage sedimentation.
- **Capacity Building and Awareness:** Strengthen the knowledge and skills of stakeholders through training initiatives, workshops, and awareness campaigns focused on sustainable watershed management practices.
- **Policy and Governance:** Create supportive policies, regulations, and institutional frameworks that encourage integrated watershed management, promote stakeholder engagement, and ensure effective governance.
- **Monitoring and Evaluation:** Develop monitoring systems to evaluate the success of management interventions, observe changes in water resources, soil health, and biodiversity, and guide adaptive management approaches.

6.5.5. Factors Affecting Watershed Management

Watershed management is influenced by various natural, social, economic, and institutional factors that impact the success of initiatives. Understanding these elements is crucial for identifying challenges, developing effective strategies, and promoting sustainable watershed management.

- **Physical Factors:** The physical attributes of a watershed, encompassing its topography, soil composition, and geological features, play a crucial role in determining water runoff, the potential for erosion, and the capacity for water retention.
- **Climatic Factors:** climatic factors, such as precipitation trends, temperature variations, and rates of evaporation, significantly influence the availability of water, the moisture content of the soil, and the likelihood of experiencing floods or droughts.
- **Land Use Land Cover Change:** changes in land use and land cover within a watershed, such as the processes of deforestation, urban development, or the expansion of agricultural activities, exert considerable effects on water resources. Changes in vegetation cover, rates of soil erosion, and the dynamics of the hydrological cycle can lead to diminished water quality, heightened sedimentation, and alterations in flow dynamics.
- **Population growth and demographic Factors:** Population growth and demographic changes like migration and urbanization increase water demand, fragment land, and alter land use. This strain on water resources can lead to overexploitation, environmental degradation, and conflicts over water distribution.
- **Socio-economic factors** such as poverty and inequality influence how communities utilize natural resources in watersheds. Livelihood activities, including agriculture, industry, and mining, can pressure water resources and affect watershed management.
- **Institutional and Governance Factors:** Effective watershed management depends on strong institutional frameworks and governance systems, including policies, regulations, and coordination strategies. Engaging stakeholders, fostering collaboration, and implementing sound decision-making are crucial for successful management.
- **Knowledge and awareness:** The availability and dissemination of knowledge and awareness of watershed management practices are crucial. Providing scientific research and best practices helps stakeholders make informed decisions, adopt sustainable methods, and participate in management activities.

- **Financial resources**, technology advancements, and appropriate tools significantly enhance the effectiveness of watershed management. Adequate funding and commitment to research can improve water resource management and conservation.
- **Stakeholder involvement**, including local communities, government, NGOs, and the private sector, is essential for effective watershed management. Engaging stakeholders in decision-making and planning fosters ownership, collaboration, and shared accountability for sustainability.

6.5.6. Advantages of Watershed Management

The primary benefits of watershed management include the following:

- It enhances agricultural productivity.
- It contributes to the mitigation of pollution.
- It aids in the replenishment of groundwater resources.
- It is managed and maintained by local communities, ensuring that the primary advantages accrue to them while minimizing the mismanagement of natural resources.
- It promotes the efficient utilization of forest wasteland.
- It supports the economic advancement of the nation.

Watershed Management with Reference to Uttarakhand

In Uttarakhand, resources like pastures, forests, and water sources within a watershed are often seen as common property, while agricultural land is usually managed individually. Effective collaboration among stakeholders is needed to enhance productivity due to the hydrological connections among these resources. However, watersheds do not align with human social structures (Rhoades 1999, Swallow et al. 2001), making their hydrological links often invisible beyond small scales. Consequently, self-organization among users is unlikely outside small watersheds, complicating the assessment of watershed impacts or governance without specific projects or management initiatives.

The land is prone to erosion and landslides in Uttarakhand, which can block river valleys and create temporary dams. A significant event occurred in 1970 when a landslide-created lake on the Alaknanda River overflowed after heavy rainfall, causing destruction and loss of life in downstream villages. Following a devastating flood on the Bhagirathi River in August 1978, a high-level Working Group was formed to investigate flooding causes and propose flood control

solutions in the Ganga-Yamuna Basin. In 1979, the government committed to addressing watershed areas in the upper Ganga basin. In November 1981, the Uttar Pradesh Forest Department developed a management plan for northern regions, now Uttarakhand. By March 1982, the state government established a Watershed Management Directorate to implement integrated management practices across watershed regions. This Directorate aimed to manage the mountainous area through mini-watershed units focused on soil and water conservation. During this time, Two major projects were launched: the South Bhagirathi Phase – I (1982-88) funded by the European Economic Community and the Integrated Watershed Management Project (1983-92) supported by the World Bank. After Uttarakhand State was formed in 2000, the Directorate was reconstituted in 2005 to oversee all watershed management initiatives, including the Integrated Wasteland Development Programme, the Drought Prone Area Programme, and the National Watershed Development Project based on Rain.

Until the late 1980s, watershed management in Uttarakhand was fragmented, with interventions lacking hydrological connectivity and upstream resource use not aligned with downstream scarcity. The watershed paradigm for water conservation emerged in the late 1980s and early 1990s, recognizing watersheds as integrated units. Various donors and organizations, including government bodies and the World Bank, promoted watershed development initiatives, leading to large-scale government projects and smaller NGO-led initiatives. Most projects in the state involve NGOs to implement activities at the village level.

The Uttaranchal Decentralized Watershed Development Project (UDWDP), which operated from 2004 to 2011, sought to implement effective practices across roughly 300,000 hectares in the middle Himalayas at elevations ranging from 700 to 2000 meters. It received an interest-free credit of US\$ 69.6 million from the International Development Association, with a 0.75% service charge, a ten-year grace period, and a thirty-five-year maturity. The project prioritized social mobilization, community-led decision-making, participatory watershed management, and improved livelihoods for marginalized groups through better farming practices and marketing assistance. Additionally, it aimed to strengthen local institutions, particularly Gram Panchayats (GPs) and included educational programs. The initiative targeted approximately 461 GPs across 18 blocks in 11 hill districts, benefiting around 9,200 villages.

Uttarakhand, with its mountainous terrain and rich forest and water resources, is vital for environmental conservation, essential for both state and national development. However, the

Himalayan watersheds face threats from erosion and mass wasting due to deforestation, unsustainable agriculture, hydrological imbalances, and natural disasters. Increasing population demands further strain these resources. In response, the Uttarakhand government is focusing on watershed-based planning, identifying eight watersheds, 116 sub-watersheds, and 1,110 micro-watersheds for systematic regeneration and sustainable development.

6.6 SUMMARY

In this unit, we discussed the Integrated Rural Development Programme (IRDP), a national strategy to alleviate rural poverty. The IRDP was planned to create employment opportunities for impoverished populations. This initiative not only offers essential subsidies to individuals living below the poverty line but also aids in enhancing their overall living standards. However, several challenges persist that need to be addressed to ensure the program's long-term success. These challenges encompass issues related to access to credit, infrastructure development, capacity building, and the necessity for improved monitoring and evaluation mechanisms. An in-depth analysis of the IRDP was discussed here, covering its goals, target beneficiaries, subsidy structures, eligibility criteria, funding for implementation, financial considerations, and various recent poverty alleviation initiatives in Uttarakhand.

The analysis of the Command Area Development Programme has provided us with valuable insights. This initiative represents a transformative approach that could significantly alter agricultural practices and enhance community well-being. It transcends traditional policy frameworks, addressing fundamental aspects of sustainable development and empowerment. A thorough comprehension of its intricacies, obstacles, and achievements equips us to recognize its substantial influence on society. In this unit, we have examined the various functions, implementation strategies, advantages, and overall effects of the Command Area Development Programme. Additionally, we have analyzed the roles played by both State and Central Governments in this initiative.

In this unit, we also discussed the watershed management. This process involves the implementation of land use and water management strategies aimed at preserving and enhancing water quality and other natural resources within a watershed through a comprehensive approach. The primary objective is to capture and retain water at its source within each village, guided by the village watershed committee, thereby extending its usability over time. Effective watershed management is crucial for ensuring the sustainability of water resources for future generations.

To maximize its effectiveness, a comprehensive strategy that integrates both land and water resources is essential. The adoption of conservation practices, strategic land use planning, and collaborative efforts is imperative to safeguard water quality, manage flood risks, and promote the health of the overall ecosystem. Our analysis delved into various aspects of watershed management, including its goals, principles, components, advantages, and the factors influencing its effectiveness, with a particular focus on the context of Uttarakhand.

6.7 GLOSSARY

- **Trickle-Down Effect:** The Trickle-Down Effect is an economic theory suggesting that benefits given to the wealthy or corporations will eventually reach the broader population, promoting economic growth and improved living conditions.
- **Marginal Farmers:** Marginal farmers are defined as small-scale agricultural producers who possess or manage a minimal area of land, generally less than one hectare (2.5 acres).
- **Agricultural Laborers:** Agricultural labourers are individuals who work on farms or agricultural lands without owning the land. They contribute manual labour to a range of farming tasks, including planting, nurturing crops, harvesting, and occasionally managing livestock.
- **Horticulture:** Horticulture is a specialized sector of agriculture focused on cultivating plants such as fruits, vegetables, flowers, herbs, and ornamental species for food production, medicinal use, and aesthetic purposes.
- **Green Revolution:** The Green Revolution was a significant agricultural transformation in the mid-20th century, mainly in developing nations. It involved high-yield crop varieties, modern farming practices, and technological advancements aimed at increasing food production to combat hunger, especially in countries like India, Mexico, and the Philippines facing rapid population growth.
- **Skilled workers:** Skilled workers are professionals with specialized knowledge and training, allowing them to perform tasks requiring specific proficiency.
- **Natural resources:** Natural resources are materials or substances present in the natural environment that can be used for economic gain, playing a crucial role in the survival and development of human societies.

- **Animal husbandry:** Animal husbandry is a specialized agricultural sector focused on breeding and caring for domesticated animals to produce products like meat, milk, wool, leather, and eggs.
- **Rurban Clusters:** Rurban clusters are semi-urbanized areas that blend rural and urban features, acting as transitional zones affected by rapid urbanization. They combine agricultural practices, rural economies, and urban infrastructure, creating a mixed socio-economic environment.
- **Agroforestry:** Agroforestry is a sustainable land-use approach that integrates agriculture and forestry by growing crops and livestock alongside trees and shrubs, enhancing environmental health, economic viability, and social well-being.
- **Deforestation:** Deforestation is the large-scale clearing of forests, often degrading land quality. It can result from logging, agricultural expansion, urbanization, and infrastructure projects.
- **Afforestation:** Afforestation is the practice of establishing a forest in an area that previously lacked tree cover. It is vital for ecological restoration, combating climate change, and enhancing biodiversity.
- **Biodiversity:** Biodiversity includes the variety of life forms, species, genetic diversity, and ecosystems on Earth. It is vital for the planet's health, ecosystem services, and human well-being.

6.8 ANSWER TO CHECK YOUR PROGRESS

1. When was the Integrated Rural Development Programme (IRDP) initiated?

- a. 1978
- b. 1976
- c. 1977
- d. 1975

Answer: a.

2. When was the Command Area Development Programme established?

- a. 1970
- b. 1969
- c. 1971

d. 1972

Answer: a.

3. Which budgetary framework has the central government employed for fund disbursement since 1986?

- a. Weekly
- b. Monthly
- c. Quarterly
- d. Annualy

Answer: c.

4. When was the Small Farmers Development Programme (SFDP) launched?

- a. 1971
- b. 1981
- c. 1973
- d. 1983

Answer: c.

5. In how many blocks did the disbursement of loans and subsidies commence under the IRDP?

- a. 20
- b. 21
- c. 22
- d. 23

Answer: c.

6. What is the maximum land area that marginal farmers can possess?

- a. less than 2 hectare
- b. less than 1 hectare
- c. less than 3 hectare
- d. less than 5 hectare

Answer: b.

7. When was the Watershed Development Programme initiated?

- a. 1970
- b. 1980
- c. 1960
- d. 1990

Answer: d.

8. Under the IRDP, what percentage of subsidy can banks extend to small farmers?

- a. 15%
- b. 25%
- c. 35%
- d. 55%

Answer: b.

9. Under which initiative is 100 days of employment guaranteed annually to individuals residing in rural areas to enhance their livelihood security?

- a. DDUGKY
- b. PMGSY
- c. NRLM
- d. MGNREGA

Answer: d.

10. Under which program is durable housing provided to individuals living in temporary or dilapidated structures in rural regions?

- a. PMAY-G
- b. PMGSY
- c. NRLM
- d. MGNREGA

Answer: a.

11. Which mission was initiated by the Government of India to foster the development of Rurban clusters?

- a. PMAY-G
- b. NRuM
- c. NRLM
- d. PMGSY

Answer: b.

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1.10 TERMINAL QUESTIONS

1. Outline the goals of the Integrated Rural Development Programme (IRDP).
2. What was the financial structure established for the IRDP?
3. Discuss the different poverty alleviation schemes implemented in Uttarakhand.
4. Highlight the benefits associated with the IRDP.
5. What is your interpretation of the Command Area Development Programme (CADP)?
6. Explain the functions of the Command Area Development Programme.
7. What types of subsidies are available under the IRDP?
8. Describe the implementation process of the IRDP.
9. Analyze the roles of both State and Central Governments in the Command Area Development Programme.
10. Discuss the benefits provided by the Command Area Development Programme.
11. Define watershed management and elaborate on its fundamental principles.
12. Identify and describe the key components of watershed management.
13. Discuss the various factors that influence watershed management.
14. Explain the significance of watershed management in relation to Uttarakhand.
15. Describe the initiatives launched by the central government aimed at poverty alleviation.

UNIT 7: TRANSPORTATION: ROADS AND RAILWAYS, AIR TRANSPORTATION, SPECIAL ECONOMICS ZONES.

7.1 OBJECTIVES

7.2 INTRODUCTION

***7.3 TRANSPORTATION: ROADS AND RAILWAYS, AIR
TRANSPORTATION, SPECIAL ECONOMICS ZONES.***

7.4 SUMMARY

7.5 GLOSSARY

7.6 ANSWER TO CHECK YOUR PROGRESS

7.7 REFERENCES

7.8 TERMINAL QUESTIONS

7.1 OBJECTIVES

After reading this unit you should be able to:

- To study the transport infrastructure of Uttarakhand in detail.
 - To discuss the possibilities and problems of transport development in detail.
 - To understand the role of air transport in Uttarakhand.
 - To understand the importance of the role of transport resources in the development of special economic zones.
-

7.2 INTRODUCTION

Based on the geographical diversities of Uttarakhand, the development of means of transport has been established in different ways based on the physical structure of the mountainous, valley and plain areas. The pattern of means of employment and human habitation is being established based on transport means and road development in the state. Many towns and cities are being established in the mountainous region only after the development of transport means and the biggest problem of the state, the form of migration is also being formed from rural areas towards the road i.e. in a linear pattern. The natives of rural areas are abandoning their livelihood and farming activities and migrating to the main transport routes or urban plains, which makes it clear that the areas with road, railway and air service facilities in the state determine the economic condition of the state.

Road transport, railway, highway and ropeway development are the pillars that determine the direction of the state economy and encourage socio-cultural development in determining the economic development of the state of Uttarakhand, tourism industry and local livelihood means and the standard of living of the residents of Uttarakhand. Since the establishment of the state, road transport projects have been developed rapidly by the state and central government, in which the construction of roads, traffic management, security and environmental balance are to be strengthened to strengthen the economy, tourism and regional connectivity of the state, especially while achieving the goal of sustainable development. In the transport development of Uttarakhand state, due to the uneven geographical diversities and new Himalayan conditions of the state, the development of road, rail and air routes is very complex and full of challenges. Except for limited plain areas, even today most of the mountainous areas in the state are deprived of basic facilities like transport. In the plain areas, due to fertile land and high population,

unplanned urban development is becoming an obstacle in the development of road and rail transport because the limited 14 percent plain areas in the state cannot be used much for the development of transport facilities.

The present transport network development and population residence of the state is making the mountainous region a backward area in comparison to the plains, due to which the dream of a separate state cannot be fulfilled. The roads in the mountainous structure of the state are narrow and winding, which leads to an increase in many road accidents, whereas, in the plains, all transport is easy due to the straight and flat roads. While in the state road transport, 21 national highways and 37 state highways have been constructed as per the tourist guide. At present, the development of most of the transport means in the state is being made employment-oriented by building roads in the geographical and geological structure of the state.

Developing rail and air transport in the mountainous region is very difficult and risky, while the first rail line was developed in the state in 1884. At present, there are 5 main stations Haridwar, Kathgodam, Dehradun, Roorkee and Lalkua, while 19 small stations have been established. The state's first mountain rail line Rishikesh-Karnprayag is under construction, while the Tanakpur-Bageshwar rail line is proposed. The economic means of transport to accelerate industry and economic development in the state is a railway, which brings raw materials from different parts of the country for the manufacturing industries of the state and provides employment to lakhs of people in industries. For the development of air transport in the state, the government is constructing airports like Naini Saini Pithoragarh, Gochar Chamoli, Chinyalisound and providing air services in the mountainous regions of the state, although they are not as developed as the plains, whereas in the plains, national services are being provided to Delhi, Mumbai and other cities through Pantnagar and Dehradun airports. In other districts of the state, held air services are currently being provided to the people of the state to develop air transport in the state. Dehradun and Pantnagar airports are being prepared for international flights because air services in mountainous regions are very easy and time-saving.

The main objective of transport development in the state is to connect the citizens of the entire state to villages with a minimum population of 50 through road transport. The air service is being done with the ideology of every citizen of the state being able to fly, which will lead to the development of means of employment in the mountainous region and will become a new source of financial resources for the state. Because Uttarakhand is a tourist state in which

religious tourism is the main one. Natural tourism is in second place which depends on the state's transport system. Industrial activities in the state are to be promoted through Special Economic Zones (SEZ), foreign investment is to be attracted and exports in the state are to be developed on a large scale.

Efforts are being made at many levels to develop all the facilities of Uttarakhand State Transport Development for the citizens of the state and to create a new path for economic development, tourism, trade and industries in the state, which will prove to be helpful in the overall development of the state. Along with this, special economic zones are also to be developed through road, rail and air transport development, but the mountainous and environmental structure poses the biggest obstacle in all these developmental activities.

7.3 Road Transport: Railway, Air Transport and Special Economic Zone

7.3.1 Road Transport-

Based on the geographical diversities of the state of Uttarakhand, the means of transport have been developed in different ways based on the physical structure of the mountainous, valleys and plain areas. The pattern of means of employment and human residence is being established based on the development of means of transport and routes in the state. Many towns and cities are being established in the mountainous region only after the development of means of transport and the form of migration, which is the biggest problem of the state, is also developing from rural areas towards roads i.e. in a linear pattern. The natives of rural areas are abandoning their means of livelihood and agricultural work and are migrating towards the main routes of transport or towards the urban plain areas, which makes it clear that the areas with road, railway and air service facilities in the state determine the economic condition of the state.

In determining the economic development of Uttarakhand state, tourism industry and local livelihood means and the standard of living of the residents of Uttarakhand, road transport, railway, highway and ropeway development are the pillars that determine the direction of the state economy, encourage socio-cultural development. Since the establishment of the state, the state and central government are rapidly developing road transport projects, in which the construction of roads, traffic management, security and environmental balance are to be

strengthened to strengthen the economy, tourism and regional connectivity of the state, especially while achieving the goal of sustainable development.

Road transport is the most widespread and easy mode of transport in the development of the state which is the only basis for the security of the residents living in villages, tourist areas and strategic security. In the plains, road transport is the easiest means of transport and is the lifeline of urban development because the economic condition of the state is not good and transport development determines the use and development of natural resources. Therefore, road transport is working like the arteries of the human body for the residents of Uttarakhand state. Due to the physical structure of the state being very uneven and mountainous, at present 40 per cent of the land here is suffering from a lack of roads. Because geographical challenges are the biggest problem in the construction and maintenance of roads such as landslides in the rainy season, avalanches in winter excessive crowding during the tourist period etc., the state has to face many types of environmental problems due to construction against the geological conditions. A dense road network is being built in the plains, due to which the uneven distribution of roads in the state is increasing, even though the Uttarakhand government is adopting various schemes to strengthen transportation, such as rural road development, national highway upgradation and use of modern construction material, for sustainable and safe road transport. At the same time, more attention is being given to ropeway development to get rid of road-related problems in the mountainous areas.

In those parts of the state where road has not reached at present, transportation is still being done through footpaths and horses. Because there is limited human habitation here, a greater financial burden has to be borne, which is not possible in the economic conditions of the state, although at present the state government is working on a plan to connect villages with a population of 50 people by road, while in most of the mountainous regions of the state, road construction work is being done in areas with a population of 250 people under the Pradhan Mantri Gram Sadak Yojana. Apart from this, roads are being constructed by the Border Roads Organisation in areas of strategic importance because most of the areas of strategic importance are in the middle Himalayas, have steep slopes, hard rocks and valleys, where roads can be built only with the help of special technology, for which a large amount of finance is required, which is being constructed by the Central Government to provide strategic security to the residents of the state.

After the establishment of the state, the development of roads is happening rapidly. According to the road development data of the state government, by the year 2020, about 48471.56 km long roads have been constructed in the hilly and plain areas of the state, in which 37,319 km of road has been constructed by Public Works, 3638.46 km by local bodies and 7541.10 km by Border Roads Organization and other departments. Road transport in the state is the main means of carrying both passengers and goods. Even the economy of the state is dependent on road development and road network. A new type of migration from the fled villages and inaccessible areas of the state has emerged from village to road. Rural residents have started settling in a linear pattern near the road, leaving their original place, farm barn and ancestral business. They have started moving more towards shops, restaurants, hotels and other businesses as a means of livelihood. The state which was a rural farming and money-order economy is now becoming a broad-based economy. Therefore, road development is very important in the mountainous areas of the state so that the natives can protect their farming and animal husbandry business.

Most of the road transport in the state has been in the Garhwal region, while in the Kumaon region, emphasis is being laid on widening and building new roads under the Manasmala project. The network of roads in the plains has assumed its advanced form. After the year 2024, there has been a large-scale widening and new construction of national highways in the plains, even a super expressway is being prepared between Dehradun and Delhi. In the state of Uttarakhand, roads contribute more than 80 per cent to the road transport business, in which the work of passenger and goods transport is being provided by Uttarakhand Transport Corporation, Kumaon Motor Owners Union Ltd., Garhwal Motor Owners Union Ltd. and private businessmen. Transport services are being provided mainly in the hilly areas for a long time, while in the plains, transport and goods are being done in the local cities by private vehicle owners only and in other states, passenger and goods transport services are being provided to the residents of the state by Uttarakhand State Transport Corporation and private transporters.

Most of the roads in the state are being developed by the government system, in which transport services are being provided by private businessmen residing in the state, while the remaining 20 percent includes government and other state transport means. Although Kumaon Mandal Vikas Nigam has been providing transport services in very remote places since 1939 and Garhwal Mandal Vikas Nigam since 1941 since before independence. In hilly areas, less than 10

percent of government transport services are being operated, whereas in plain areas, 50 percent of passenger buses and in other states, almost 90 percent of transport is being operated.

Road transport is the most widespread and easy mode of transport in the development of the state which is the only basis for the security of the residents living in villages, tourist areas and strategic security. In the plains, road transport is the easiest means of transport and is the lifeline of urban development because the economic condition of the state is not good and transport development determines the use and development of natural resources. Therefore, road transport is working like the arteries of the human body for the residents of Uttarakhand state. Due to the physical structure of the state being very uneven and mountainous, at present 40 percent of the land here is suffering from a lack of roads. Because geographical challenges are the biggest problem in the construction and maintenance of roads such as landslides in the rainy season, avalanches in winter excessive crowding during the tourist period etc., the state has to face many types of environmental problems due to construction against the geological conditions. A dense road network is being built in the plains, due to which the uneven distribution of roads in the state is increasing, even though the Uttarakhand government is adopting various schemes to strengthen transportation, such as rural road development, national highway upgradation and use of modern construction material, for sustainable and safe road transport. At the same time, more attention is being given to ropeway development to get rid of road-related problems in the mountainous areas.

In those parts of the state where road has not reached at present, transportation is still being done through footpaths and horses. Because there is limited human habitation here, a greater financial burden has to be borne, which is not possible in the economic conditions of the state, although at present the state government is working on a plan to connect villages with a population of 50 people by road, while in most of the mountainous regions of the state, road construction work is being done in areas with a population of 250 people under the Pradhan Mantri Gram Sadak Yojana. Apart from this, roads are being constructed by the Border Roads Organisation in areas of strategic importance because most of the areas of strategic importance are in the middle Himalayas, have steep slopes, hard rocks and valleys, where roads can be built only with the help of special technology, for which a large amount of finance is required, which is being constructed by the Central Government to provide strategic security to the residents of the state. After the establishment of the state, the development of roads is happening rapidly.

According to the road development data of the state government, by the year 2020, about 48471.56 km long roads have been constructed in the hilly and plain areas of the state, in which 37,319 km of road has been constructed by Public Works, 3638.46 km by local bodies and 7541.10 km by Border Roads Organization and other departments. Road transport in the state is the main means of carrying both passengers and goods. Even the economy of the state is dependent on road development and road network. A new type of migration from the fled villages and inaccessible areas of the state has emerged from village to road. Rural residents have started settling in a linear pattern near the road, leaving their original place, farm barn and ancestral business. They have started moving more towards shops, restaurants, hotels and other businesses as a means of livelihood. The state which was a rural farming and money-order economy is now becoming a broad-based economy. Therefore, road development is very important in the mountainous areas of the state so that the natives can protect their farming and animal husbandry business.

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Most of the roads in the state are being developed by the government system, in which transport services are being provided by private businessmen residing in the state, while the remaining 20 percent includes government and other state transport means. In the transport sector in the state, road routes are being developed rapidly. At the time of the formation of the state, there were only 9 national highways in the state, whose number has increased to 21 at present. The same 889 km long road connecting the four Dhams is being constructed as an all-weather

road scheme. Under the ManasKhandMandir Mala Yojana, renovation of 16 temples in Kumaon Mandal and 201 km long road from Kashipur-Ramnagar-Mohan to Buakhaat in Garhwal, 171 km from Jyolikot-AlmoraRanikhet to Gairsain-Karnprayag and 288 km two-line wide roads from Simli-Gwaldam to Baijnath-Munsiyari-Joljibi in Kumaon. The Himalayan Highway Project from Lohaghat to Tyuni is also proposed. Apart from this, the state government has made a plan to widen seven state highways to about 350 km with the help of the Public Works Department. Its main objective is to promote religious tourism as well as natural resources in these areas. The infrastructure for tourism has to be developed so that the width of the roads can be increased along with smooth traffic.

At present, the maintenance of the state roads is being done mainly by the Border Roads Organisation, D.G. B. R. Public Works Department, Forest Department, District Council, Municipal Corporation and Municipalities. The roads of strategic importance are constructed and maintained by Border Roads Organisation and the national highways are maintained by Central Public Works, state highways and rural roads by State Public Works and in urban areas by the Municipal Corporation. The longest road in the state is National Highway No. 7 and the shortest highway is Sitarganj National Highway No. 30 whose length is 402.60 km and 2.90 km respectively. At present, the Public Works Department is the most responsible for the development of road infrastructure in the state, which works in 17 circles in the entire state under which there are 72 divisions. According to the Public Works Official Website, Government of Uttarakhand, year 2019-20, 4,516.91 km of roads have been constructed as state highways, 2,113.17 km of major district roads, 2714.60 km of other district roads, 23,953.58 km of village roads, 315.77 km of light vehicle roads and 3,580.25 km of narrow tracks, in which more than 1000 bridges have also been constructed on rivers and large drains.

Thus, road transport in the state of Uttarakhand is not only a means of connecting the internal structure of the state, but it is also becoming a link to measure the development, livelihood means, employment and economic level of the state. Keeping in mind the sensitivity of the state and the environment in road construction, road construction, tree plantation compensation and civil interests should be specially adopted so that safe transport and road network can be laid and developed in the state.

7.3.2 Rail Transport

The development of rail transport in Uttarakhand state started in the year 1886. Due to the large mountainous terrain of the state, it is almost impossible to develop rail transport in the mountainous region. But at present, the first mountain rail line of the state Rishikesh-Karnprayag is under construction, while the second rail line Tanakpur-Bageshwar is proposed to be built in the future. Whereas in reality, rail transport has been developed mainly in the plain areas of Haridwar, Dehradun, Rishikesh, Udham Singh Nagar, Pantnagar, Lalkua, Haldwani, Kathgodam, Ramnagar and Tanakpur, large-scale capital investment is required to develop rail transport in other areas, which slows down the work of rail development in the state due to being under the Central Government. Due to the complex geographical conditions of the state, only 344.91 km of railway lines have been constructed which 283.76 km of broad gauge lines, and 61.15 km of narrow gauge lines are there in which 41 railway stations have been built which are 100% operated by electricity.

The district having the maximum rail track in the state is Haridwar which was first connected to Laksar Junction on 1 January 1886 and was included in the Northern Railway. In the year 1897, the Kashipur-Ramnagar railway line from Moradabad of Uttar Pradesh was going to connect both Kumaon and Garhwal divisions, in the year 1900, Dehradun district was also connected to Haridwar by rail line, later Rishikesh city was also included in this railway line.

The first railway line of the state was laid in 1884 from Rampur in Uttar Pradesh state to Kichha and Kichha to Lalkua-Kathgodam. It was constructed by the former Northern Railway. It was built as a narrow gauge line at that time, but at present, work is being done to make all the railway lines double-tracks and all the lines are being built as broad gauge. The major railway stations in the Kumaon division are Ramnagar, Kashipur, Rudrapur, Kichha, Lalkua, Kathgodam and Tanakpur and in the Garhwal division, Haridwar, Rishikesh, Dehradun, Kotdwar, Roorkee and Doiwala, where passenger and goods are mainly transported, while there are 43 railway stations in the entire state. At present, Kathgodam, and Kotdwar are big rail line power stations and Tanakpur is the terminal of a small line. Tanakpur, Kathgodam, Kotdwar, Rishikesh and Haridwar are the last railway stations of the state and Rishikesh-Karnprayag will be the first and last mountain railway station of the state. A proposal has been given to the Railway Ministry to build the second major mountain rail line Tanakpur-Bageshwar in Kumaon, which will provide rail transport benefits to local people and tourists coming for tourism in the entire Kumaon,

Pithoragarh, Bageshwar, Champawat and Almora. At present, this scheme is running in its initial form. Model stations have been constructed in the state since the year 2000, and are based on the quality certificate of ISO. At present, trains are being operated from Dehradun station to distant cities like Lucknow, Delhi, Kolkata, Jaisalmer and Mumbai in the northern, central and western parts of the country.

Among the railway lines under construction, to develop the Rishikesh-Karnprayag rail line for the Chardham Yatra, a detailed project is being prepared by the Railway Administration in Harrawala Dehradun to run a 24-coach train in 3600 acres of land between Rajaji National Park, which is being monitored by the Prime Minister's Office. For the development of rail transport in the Chardham, rail lines are to be constructed at two places. In the first phase, 125 km long Rishikesh to Karnprayag will be built in which 16 tunnels and 18 bridges will be built, the main objective of which is to provide easy travel facilities to the pilgrims and tourists coming to the state to Dhardham and in the second phase, a railway line is to be constructed from Harrawala to Gangotri-Yamnotri. Work is also being done on the action plan to run metro rail lines between the crowded cities of the state, which will be operated as a 73 km corridor of Dehradun, Haridwar and Rishikesh Metro Project. The first phase of this project includes a 32 km metro line from Haridwar to Rishikesh, which will have 10 stations, the first station of which will start near Jatwada Bridge in western Haridwar and the last station will end at Chandrabhaga Bridge in Rishikesh, while in the second phase, 41 km metro line will be constructed in other cities. Thus, Uttarakhand, along with Dev Bhoomi, is also a tourist state where the need for railway development is high.

To make the rail transport in the state faster and of a higher level than other cities of the country, ambitious projects like the construction of Delhi-Dehradun Express Rail Link will provide high-speed train service which will complete the journey between Delhi and Dehradun in 2.5 hours. Rail transport is a safe, easy and cost-effective mode of transport which makes it easy for passengers to travel, but the complex geographical conditions of the state, high construction cost, central control and environmental conditions and financial constraints provide obstacles in its development, but there are many possibilities for the expansion of railways in the state which will also determine the direction for the economic and social progress of the state in future.

7.3.3 Air Transport-

Due to the geographical location of the state and being a tourist state, the importance of air transport is also increasing. Being a hilly area, air transport can be a boon in making road and rail development easy in these complex areas because developing road and rail transport in mountainous areas is more risky, and building roads in many border areas is impossible. Especially in such areas where air distance is limited, passengers can reach there easily by air transport and it acts as a link to connect with developed urban areas, air transport can become a convenient and quick means for passengers in the state of Uttarakhand, the only need is cheap air transport. In terms of air transport in the state, at present, the main airports established in the plains are Jolly Grant Airport of Dehradun under Garhwal Mandal and Phoolbagh Airport of Pant Nagar in Kumaon Mandal from where flights are operated by domestic aircraft, while in the mountainous regions, the airports of Naini Saini Pithoragarh, Gochar Chamoli, Chinyalisaur Uttarkashi are the main ones. Jolly Grant Airport Dehradun is the biggest and main airport in the state. Being located near Dehradun, it provides air services to the state capital and other nearby areas like Rishikesh, Haridwar, Narendranagar, and Kotdwar.

At present, direct flights are also operated from here to the major cities of the country Delhi and Mumbai. Pantnagar Airport Udham Singh Nagar provides air services to the mountainous regions of Kumaon region like Nainital, Almora, Ranikhet, Bageshwar and Pithoragarh, etc., apart from this, regular flights are operated from here to Delhi International Airport. For the development of air transport in the state, plans are being run by the state government to build domestic-level airports in all the districts, which will provide transport services to the residents of the state as well as air transport facilities to tourists coming from the country and abroad and many means of employment will also be developed and the problem of migration in the state will be solved. At present, Heli

Services are expanding rapidly in the form of air services. The importance of heli services here is to provide air services to tourists and pilgrims mainly in Kedarnath, Badrinath, Yamunotri, Gangotri, Kailash, Munsiyari and border areas, for the development of which continuous efforts are being made in the state. In particular, the work of constructing small airstrips, developing heliports, and expanding air services in rural areas under the Udan scheme of the Central Government is being done by the State Government because heli services provide fast and safe transport services even in very highly inaccessible hills and in bad weather

conditions. Especially Sahastradhara, Sirsi and Phata are the main successful examples of the expansion of transport services.

In this way, air transport in the state is not only saving time but also increasing the number of tourists. Also, at the time of natural disasters and man-made accidents, fast services are being taken in the state through small helipads. At present, air ambulance services have been started in the entire state to provide high and quick medical treatment to seriously ill persons, which is becoming a boon for seriously ill persons of the state. Therefore, the expansion of air transport services is becoming a new means for the economic development of the state. The priority of the state government should be to provide cheap air services to every citizen so that a maximum number of residents of the state can avail the benefits of air transport services. Also, since most of the state borders are adjacent to the borders of other countries, it is strategically important where reaching and monitoring by road and rail transport is not possible in times of emergency, for which the only means of transport is air transport service. Therefore, the expansion of transport services in the state has become more strategically important because air transport is acting as a bridge connecting the rural and inaccessible areas of the state.

7.3.4 Special Economic Zone-

In determining the Special Economic Zone of Uttarakhand, the state's transport means road, rail and air transport along with the plain and mountainous region have an important contribution which has a deep impact on the development and economic condition of the state. Economically emerging areas in the state have become stronger in terms of population settlement and employment sources only after the development of road and rail transport. Therefore, strengthening the transport network is very important in the interest of the state, because the transport means of the state, road, railway and transport are the basic infrastructure necessary for the economic development of Uttarakhand. These not only promote tourism and trade in the state but are also playing an important role in socio-cultural development. Along with the development of transport means, the special economic areas of the state are also developing at a fast pace.

The economic development of the state, export, foreign investment and means of employment depend on transport development. The special economic areas of the state have developed based on the natural and biological wealth of the state, industrial development

potential and tourism development because the economic strength in the areas lacking transport means has been low. The Government of India passed the Special Economic Zone Act in the year 2005 which has given the states the right to develop SEGs according to their regional resources, which the state of Uttarakhand has specially encouraged the industrial sector SIDCUL, mining and tourism development by incorporating the industrial policy framework. The major special economic zones of the state have been classified as follows.

1. Haridwar Special Economic Zone- The Haridwar region has the largest number of industrial units in the state and hence is contributing significantly to the state's economy. The major ones are automobiles, pharmaceuticals, consumer goods, machinery and large manufacturing units such as Hindustan Unilever, and Hero MotoCorp.

2. Dehradun Special Economic Zone- The Dehradun Special Economic Zone is being developed primarily as a centre for information technology and pharmaceuticals, with the main centre being Dehradun's IT Park being the centre of attraction. This economic zone has been developed as an integrated industrial establishment, PharmacistSelaqui Dehradun IT Park Sahastradhara under the State Industrial Development Corporation Ltd. SIDCUL for the development of industrial infrastructure facilities. Its main objective is to focus on information technology and to establish startups and multinational companies here to increase self-employment among the youth.

3. Pantnagar Special Economic Zone- This special economic zone has been developed under the State Industrial Development Corporation Limited SIDCUL Phase I as the major industrial centre of North India with manufacturing industries like Tata, Ashok Leyland, Bajaj and Electronic units. Apart from this, due to the abundance of crops in Udham Singh Nagar, there is an abundance of agro-based industries like Parle, Bitrinia, Nestle, plywood, FMCG (fast-moving consumer goods), electronics and other sectors like sugar, paper and paper industries.

4. Sitaganj Special Economic Zone- Sitaganj Industrial Area has been developed under the State Industrial Development Corporation Limited SIDCUL Phase 2, where 9 large manufacturing industries and 21 mini industrial establishments have been established, in which agro-based Parle, Bitrinia, Syzygy Food and Electronics industries have been established.

4. Kichha Smart City Park- For the Smart Industrial City, about 1002 acres of land at Khurpiya Farm in Kichha Tehsil is proposed for development for industry under the National

Industrial Corridor Policy, in which an investment of Rs. 6,180 crore is to be made and about 75,000 people are to be given direct employment in the state, in which automobile hub, engineering and fabrication related industrial units will be established, which will become the centre of economic activity in the state. Thus, after the formation of the state, to establish a special economic zone in the state, the Micro, Small and Medium Enterprises Industrial Act 2006 was made in the year 2006 to accelerate the work of the manufacturing and production industries in the state.

Apart from this, the Mega Textile Park Policy was made in the year 2014, the Mega Food Park Promotion Policy in 2015, the Mega Industrial and Investment Policy in 2015, the Micro, Small and Medium Industries Policy in 2018, the Large Industrial Policy in 2018 and the Start-up and Electric Vehicle Manufacturing Policy in 2018. In the year 2020, “Vision Plan 2020” has been made to give a fast pace to the industries, in which industries have been given exemption in duty and other taxes, along with 24-hour electricity, easy bank loans have been provided to strengthen the industries of the state, which will improve the economic condition of the state and increase the number of industries in the state, as well as increase in the number of export-based industries. The aim is to increase employment generation by increasing the income of the state. Along with this, the special economic sector of the state has to be improved by adopting dimensions like the use of the natural resources of the state based on sustainable goals, development of tourism-based industries, increase in bioproduction and investment in the green energy sector and new employment opportunities have to be created in the state so that Uttarakhand state can be recognized as a global industrial centre. Uttarakhand is a state with the potential for the development of special economic zones due to its geographical features and availability of natural resources. Development of various regions of the state and expansion of industries should be the first goal of the state government and entrepreneurs by maintaining environmental and social balance.

7.4 Summary

The development of transport facilities in the state is established in different ways based on the geographical diversities of Uttarakhand, as the linear pattern of present human habitation is being formed, which makes it clear that the areas with road, railway and air services in the state determine the economic condition of the state. Since the establishment of the state, the state and

central government have been rapidly developing road transport projects. Due to the physical structure of the state being very uneven and mountainous, even today 40 percent of the land here is suffering from a lack of roads. The biggest problems in the construction and maintenance of roads are landslides during the rainy season, avalanches during winter and environmental disparities. While the dense road network in the plains increases the uneven distribution of roads in the state, in most of the mountainous areas of the state, road construction work is being done in areas with a population of 250 persons under the Pradhan Mantri Gram Sadak Yojana. Apart from this, roads are being constructed by the Border Roads Organisation in areas of strategic importance. From the establishment of the state till the year 2020, approximately 48471.56 km long roads have been constructed in the hilly and plain areas of the state. 4,516.91 km as state highways, 2,113.17 km as major district roads, 2714.60 km as other district roads, 23,953.58 km as village roads, 315.77 km as light vehicle roads and 3,580.25 km as narrow tracks.

The development of rail transport in the state of Uttarakhand started in the year 1886, but due to the large mountainous terrain of the state, it is almost impossible to develop rail transport in the mountainous region. The Rishikesh-Karnprayag is under construction and the proposed Tanakpur-Bageshwar railway line will be mountain rail lines. Rail transport is mainly limited to the plain areas of Haridwar, Dehradun, Rishikesh, Udham Singh Nagar, Pantnagar, Lalkua, Haldwani, Kathgodam, Ramnagar and Tanakpur. Due to the complex geographical conditions of the state, only 344.91 km of rail lines and 41 railway stations have been constructed. Under air transport in the state, at present, Jolly Grant of Dehradun in Garhwal Division and Phoolbagh of Pant Nagar in Kumaon Division are the main airports and Naini Saini Pithoragarh, Gochar Chamoli, Chinyalisaur Uttarkashi airports are included. Haridwar, Dehradun, Pantnagar and Sitaganj are the main special economic zones of Uttarakhand whereas Kichha Smart City Park is the proposed new special economic zone in which manufacturing, agriculture, automobile, electronic and agricultural product export industries have been established where there is a high population density.

At present, the biggest problem in the development of transport facilities in the state is the physical infrastructure and environmental features of the state which are not suitable for the development of road, rail and air transport.

7.5 GLOSSARY

Transport means	The means of road, rail and air transport used in the infrastructure development of the state which carries passengers and goods from one place to another.
Linear pattern:	The form of human settlements being built on both sides of the transport routes, especially the road, in the state of Uttarakhand.
Tourism industry:	The Uttarakhand state government has given the status of tourist industry to the tourism of the state by propounding the tourism policy in the year 2001.
Local livelihood resources	Are the state's water, forests, natural resources, cultural and religious sites, natural organic products handmade goods industries etc.
Sustainable development:	Sustainable development is development established in coordination with the environment for a long time and for a long time.
Special economic zones:	Special economic zones are the economic zones of the state which are developed to provide employment and development resources of the state, which mainly include Dehradun, Haridwar and Sitaganj areas.
Border Roads Organisation:	Border Roads Organisation is a road organization which builds roads in strategic and highly complex physical structures.
Manasmala Yojana:	Manasmala Yojana is a scheme to modernize 16 temples of religious and mythological importance in Kumaon Mandal and to widen the roads along with religious tourism development.
Chardham Rail Yojana:	Chardham Rail Yojana is to connect tourism in the four Dhams of Garhwal Mandal, Gangotri, Badrinath, Yamunotri and Kedarnath

through railway lines, in which Kotdwar-Karnprayagrailway line is being constructed as the first mountain rail scheme of the state.

All Weather Road Scheme: A four-lane wide road scheme is being constructed to facilitate uninterrupted tourism and road transport in the state throughout the year.

7.6 ANSWER TO CHECK YOUR PROGRESS

- Based on the geographical diversities of Uttarakhand state, the means of transport are developed in the mountainous, valleyous and plain areas.
- Transport means like road, rail and air transport are more developed only in the 14 percent plain areas of the state.
- The development of rail transport was first started in the state in 1884 which was Kichha, Lalkua and Kathgodam.
- The main railway stations of Uttarakhand state are Haridwar, Kathgodam, Dehradun, Roorkee and Lalkua.
- Tourism in Uttarakhand state has been given the status of tourism industry.
- The biggest problems in transport route maintenance are mountain structure, landslides, and avalanches.
- Kumaon Mandal Vikas Nigam was established in 1939 before independence.
- The state's first mountain rail line Rishikesh-Karnprayag is under construction which is being developed as Chardham Rail Project.
- Jolly Grant of Dehradun under Garhwal Division and Phoolbagh of Pant Nagar in Kumaon Division are the biggest airports of the state.
- Dehradun, Haridwar and Pantnagar areas are mainly included in the special economic zone of Uttarakhand.

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7.8 TERMINAL QUESTIONS

1. Long Answer Questions

Q-1: Explain the major problems of transport development in Uttarakhand state by describing the transport facilities in detail with pictures?

2. Short Answer Questions

Q: 1. Briefly describe the major transport facilities of Uttarakhand?

Q: 2. Explain that road transport acts as the backbone of Uttarakhand's transport facilities?

Q: 3. Describe the major challenges of road transport development in Uttarakhand state?

Q: 4. What is the Border Roads Organisation? Tell us the main functions of this organisation at present?

Q: 5. Write a brief essay on the history of rail transport development in Uttarakhand state?

Q: 6. Describe in detail the state's first mountain rail line Rishikesh-Karnprayag?

Q: 7. Explain the reasons for the inequality present in the development of transport facilities in Uttarakhand.

Q: 8. Explain the possibilities of air transport development while describing the air transport of Uttarakhand.

Q: 9. What do you understand by special economic zone?

Q: 10. Describe the Dehradun special economic zone in detail.

Q: 11. Explain the Pantnagar and Sitaganj economic zones.

Q: 12. What is the proposed Kichha Smart City Park area?

3. Multiple Choice Questions

Q: 1. Transport development of Uttarakhand is determined by?

- a) Geographical diversity
- b) Financial resources
- c) Population
- d) All of the above

Answer: D

Q: 2. Which of the transport modes of Uttarakhand state includes?

- a) Road, rail transport
- b) Air transport
- c) Roadways
- d) All of the above

Answer: D

Q: 3. What is the number of national highways in Uttarakhand state at present?

- a) 19
- b) 20
- c) 21
- d) 27

Answer: C

Q: 4. When was the first railway line constructed in the state?

- a. 1884
- b. 1994
- c. 1890
- d. 1897

Answer: A

Q: 5. Which of the following is not included in the major railway stations of the state?

- a. Haridwar
- b. Dehradun

- c. Lalkua
- d. Pantnagar

Answer: D

Q: 6. On State Foundation Day, 9 November 2024, what is the minimum population of villages to be connected with the road project?

- a) 100
- b) 50
- c) 150
- d) 200

Answer: B

Q: 7. What is the total length of roads constructed in the state by the Public Works Department?

- a) 37,319 km
- b) 38,412 km
- c) 39,122 km
- d) 42,237 km

Answer: A

Q: 8. Kumaon Mandal Vikas Nigam was established in?

- a) 1941
- b) 1939
- c) 1950
- d) 1960

Answer: B

Q: 9. In which year was Garhwal Mandal Vikas Nigam established?

- a) 1941
- b) 1939
- c) 1951
- d) 1971

Answer: A

Q: 10. What is the length of the all-weather road scheme connecting the four Dhams?

- a) 887

- b) 888
- c) 889
- d) 894

Answer: C

Q: 11. How many temples are to be renovated in Kumaon Mandal under the Manas Khand Mandir Mala Yojana?

- a) 18
- b) 16
- c) 17
- d) 21

Answer: B

Q: 12. Which is the longest national highway in the state?

- a. Highway number 7
- b. Highway number 9
- c. Highway number 11
- d. Highway number 13

Answer: A

Q: 13. Which is the second proposed mountain rail line in the state?

- a) Tanakpur-Pithoragarh
- b) Tanakpur-Bageshwar
- c) Tanakpur-Champawat
- d) Tanakpur-Almora

Answer: B

Q: 14. What is the total length of Rishikesh-Karnprayag, the first phase of the Char Dham railway line?

- a) 120 km
- b) 125 km
- c) 126 km
- d) 152 km

Answer: B

Q: 14. The proposed metro rail project in Uttarakhand state will not be operated in which of the following cities?

- a) Dehradun
- b) Haridwar
- c) Rishikesh
- d) Mussoorie

Answer: D

Q: 15. What is the total number of airports in Uttarakhand state?

- a) 5
- b) 4
- c) 6
- d) 7

Answer: A

Q: 16. How many major special economic zones are there in Uttarakhand?

- a) 5
- b) 4
- c) 3
- d) 7

Answer: C

BLOCK 4: UTTARAKHAND - PHYSICAL BACKGROUND

**UNIT 8: GEO-ENVIRONMENTAL BACKGROUND:
GEOLOGY, PHYSIOGRAPHY, CLIMATE, DRAINAGE,
SOILS, FAUNA, NATURAL AND BIO-GEOGRAPHIC
REGIONS**

8.1 OBJECTIVES

8.2 INTRODUCTION

***8.3 GEO-ENVIRONMENTAL BACKGROUND: GEOLOGY,
PHYSIOGRAPHY, CLIMATE, DRAINAGE, SOILS, FAUNA,
NATURAL AND BIO-GEOGRAPHIC REGIONS.***

8.4 SUMMARY

8.5 GLOSSARY

8.6 ANSWER TO CHECK YOUR PROGRESS

8.7 REFERENCES

8.8 TERMINAL QUESTIONS

8.1 OBJECTIVES

After reading this unit you should be able to:

- To do a comprehensive study of the environmental and geological features of the state of Uttarakhand.
 - To understand the water, soil and life resources of the state and their importance.
 - To identify natural and biogeographical regions.
-

8.2 INTRODUCTION

Geographically, Uttarakhand is a Himalayan state located in the northern part of India, which is completely situated in the lap of the Himalayas, most of which is mountainous and hence absorbs the mountainous climate. As an independent state, this state became the 27th and 11th Himalayan state of the country on 9 November 2000, It borders Nepal in the east, Himachal in the west, Tibet in the north and Uttar Pradesh in the south. Geographically, this state is spread over 53,483 square km. Physically, the state exhibits the characteristics of mountain ranges, Bugyal, Ghatia, riverine plains, Bhabar and Terai land, where on one side lies the Nanda Devi mountain peak and on the other side lie the flat plains of Bhabar-Terai, developed glaciers like Gangotri, Yamunotri and Milan, alpine grass below the snow line, evergreen, deciduous dense forests, natural beauty, mountain terrace farming, on the other hand, the flat fertile agricultural land of the plains adorns it with physical features in the form of food grain storage and gives it a distinct identity from other Himalayan states, even after the same uneven physical landforms, it provides favourable climatic conditions for human habitation along with the lush green forest region with the best environmental conditions in the world.

From the geological point of view, this state is a land mass formed in the three phases of depression of Tethys geosyncline and Himalayan upliftment, which are unstable even today due to their formation process. On the other hand, the Trans Himalaya Fault, Central Boundary Fault, Main Boundary Fault and Himalayan Front Fault are also geologically active, due to which earthquakes, landslides and other natural incidents keep occurring in the state every year. Physically, the state of Uttarakhand is divided into eight parts the Gangetic plain, Terai region, Bhabar region, Shivalik region, Doon, Lesser Himalayas and Greater Himalayas. In climatic features, the climate of the state is divided into summer rain and winter climate based on seasons.

Generally, the climate of the state is of temperate type where extreme cold and snowfall in winters, extreme heat in summers and hot winds are found in the plains. In the drainage system, the entire state of Uttarakhand is the area of the Ganga river drainage system in which mainly Yamuna, Ganga and Kali rivers flow, apart from this many small rivers and rivulets flow in all the mountainous and plain regions of the state, most of the rivers of the state originate from the continuously flowing Himalayan regions.

In terms of soil type, the soil of the state is made up of sediments deposited as a result of the upliftment of the Himalayas which are divided in terms of colour as black, red, yellow and stony soil. But the soil of the plain areas is formed from the alluvium deposited by the rivers originating from the Himalayas. In reality, there is still no universally accepted scientific division of the soils of Uttarakhand, because the physical diversities of the entire Himalayan region are so great that microscopic-level study is not possible. However, in known studies, the soil of the state is considered to have been formed in an immature form from the disintegration of local rocks, vegetation fragments and remains of limestone. The state is a world museum in terms of flora and fauna, where, despite being a small state, many types diversities of flora and fauna are spread over 71.05 percent of the geographical area of the entire state, in which more than 500 types of wild species (medicinal plants, aromatic herbs and rare orchids) and fauna (102 mammals, 623 types of avifauna, 124 types of fishes, 19 types of amphibians and 69 types of reptiles) are found. As a biogeographical region, the high Himalayan region which is the snow-clad northern part of the state has a limited number of fauna and flora, while the other regions are divided into the mid-Himalayan region, Shivalik and Bhabar-Terai, valley and biodiversity hotspot regions which are biodiversity and resource-rich regions as well as the densest regions of human habitation.

8.3 GEO-ENVIRONMENTAL BACKGROUND: GEOLOGY, PHYSICS, CLIMATE, DRAINAGE, SOIL, FAUNA, NATURAL AND BIOGEOGRAPHICAL REGIONS.

8.3.1 Uttarakhand: Geo-environmental background

The state of Uttarakhand is a north-western piece of land in the physical division of India, which is completely situated in the lap of the Himalayas, which is called a special place of

special divine and natural power residing on the earth. The Himalayan region is counted among the newest land areas of the world and is a state with natural mountain ranges, in which the state of Uttarakhand occupies a central position, due to which the geo-environmental characteristics of the state cannot be separated from the physical and environmental characteristics of any Himalayan state. It assimilates all those characteristics which are found in the entire Himalayan region. Physically, the environmental elements present in the state are mainly divided into the mountainous and plain landform of the state, all types of mixed forest areas, immense water reserves of snow-clad glaciers and snow-originated rivers, pure natural air and resources containing many types of animals.

Despite having adverse physical and environmental characteristics, this Himalayan State provides optimum natural conditions for human habitation through its environment, which has registered its place among the most densely populated mountainous states of the world, the State, the mountainous communities of which have their livelihood resources provided by nature to most of the residents residing here and they have been self-dependent, self-employed since a long time, whereas the plains naturally provide the physical conditions for the present cultural and economic progress, due to which at present, by establishing the maximum population and industrial units of the State, they are developing as the major special economic regions of the State. Physical environmental feature - In terms of landform, it provides a place to the world's highest mountain ranges and glaciers, on the other hand, along with being the region of soft plains of mid-Himalayan grass, it provides the most favourable conditions for biodiversity. The Shivalik forest land located in the south of the state is dense, and the Bhabar-Terai region is the food grain and residence of the highest population, which also reveals the climatic features of the types of mountain cold and plain temperate climate, due to which mountainous regions are considered to be the summer-friendly human residence area, whereas the rainy and cold regions become the centres of ideal human residence in the plain areas, which is the unique identity of the physical environment of the state.

Thus, the unique geo-environment of the Himalayas can be seen as a soul in the state of Uttarakhand. The natural beauty, biodiversity and geographical diversity of the state is the meeting point of the world, due to which lakhs of tourists come here every year for natural beauty and mental peace, due to which the state government has given the status of the tourism industry to the state of Uttarakhand and the Government of India provides green bonus every

year by keeping the state under the green belt so that the environmental balance can be maintained in the Himalayan region and the state. Thus, despite being endowed with all the natural resources, this state is afflicted with many types of natural problems due to a lack of complete balance in the geological condition, due to which the natural environment of the state also remains disorganized, which is currently becoming more active due to human activities, which is currently considered to be the most environmentally sensitive state of the world.

8.3.2 Geology of Uttarakhand

Geologically, the Uttarakhand Himalayas are an integral part of the Himalayan mountain ranges and a landmass located in the centre of the Himalayan region, which is formed from the sediments deposited in the Tethys Sea. Most of the Himalayas located in the state were formed in the Arshiyari era, which was formed after the Pleistocene era, due to which it is the world's newest mountain and state from a geological point of view, this region is considered to be the world's weakest and unstable landmass, due to which the topography of the Himalayas keeps on forming and deteriorating, many evidences of which are the deepening of river valleys, reduction in the depth of lakes, landslides and earthquakes in the Himalayan regions. It is known from the geological history of the Earth that where the Himalayas are situated today, there was a huge sea called Tethys 120 million years ago, to the north and south of which were the hard landmasses of Angaraland and Gondwanaland respectively. According to geologists, this mountain range is the developed form of the Tethys geosyncline, whose present form was fully formed by the folding process due to the collision of Indian and Eurasian plates in the Tertiary period.

The Bhabar and Terai regions situated in the foothills are formed by the deposition of rivers originating from the Himalayas. The abundance of coarse stones and concrete-rich soil in the Bhabar region and the alluvial soil of the Terai region describe the construction material of the Himalayas. In the geological structure of the state of Uttarakhand, a mixed form of Dharwad igneous, sedimentary and metamorphic rocks is seen. In the construction process, the uplift of the Himalayas has also happened in different periods, which is known from the faults present in the state of the Himalayas that there is a difference in the sediments and biological evidence of Tibet, Great, Small and Shivalik Himalayas. From the structural point of view, the state has not yet reached a completely stable state, in which many types of geological and tectonic activities

keep taking place from time to time, due to which many types of natural disasters like earthquakes, floods, landslides and cloudbursts keep occurring, which also present evidence of its instability.

The place where the state of Uttarakhand is located, geologically, the Trans Himalayan Fault, Main Central Fault, Main Border Fault and Himalayan Fore Fault come out, which separate the land area formed after each new uplift of the Himalayas. Due to these uplifts, the location of most of the 11 districts of the state is completely mountainous. Except for Dehradun, Nainital, Pauri and Champawat, Haridwar and Udham Singh Nagar are located in the plains, but no landmass is in its equilibrium state. The internal structure of the Himalayas consists of granite and volcanic rocks and many fossils that are of Cretaceous age. Geologists believe that the rocks within the Himalayas were formed during the Cambrian and Miocene eras. They are spread in an arc about 2400 km in length and 250-300 km in width in the Himalayan mountain range.

8.3.3 Physical Division of Uttarakhand Himalayas

Based on the physical configuration of the surface, relief forms and physical characteristics of the Uttarakhand state and the Himalayan region, the Uttarakhand Himalayas are mainly divided into seven geographical regions in the order of north to south.

1. Trans Himalayan region
2. Large or High Himalayan region
3. Small or Middle Himalayan region
4. Shivalik Himalayan region
5. Doon Valley
6. Bhabar region
7. Terai Plain region

1. ***Trans Himalayan region*** - This region is located on the border of Tibet in the north of the Great Himalayas of the state at an altitude of 2500 to 3500 meters and a width of 20 to 30 km, which includes the areas with passes like Mana, Niti, Chorhoti, Kingri-BingriDarma, Lipulekh etc. of Chamoli, Uttarkashi and Pithoragarh districts of the state. Great Himalayan region- It is situated to the south of Trans Himalayas and north of Lesser Himalayas, which is also known as Greater Himalayas, Himadri Himalayas, whose width in the state is 15-30 km and height is 4500 to 7817 meters i.e. up to Nanda Devi mountain peak, which is spread over 6

districts of Uttarkashi, Tehri, PauriGarhwal, Rudraprayag, Chamoli, Pithoragarh and Bageshwar. The huge glaciers of this range present evidence of the Pleistocene era. This is the coldest Himalayan region. The peaks here remain covered with snow throughout the year. In winter, rainfall here occurs in the form of snow. Vegetation is lacking in most of the region. Nanda Devi, Kamet, Nanda Devi East Mana, Badrinath, Trishul, Nandakot, Panchachuli, Kedarnath, Yamunotri, Bandarpunch and Nainyan mountains are mainly included in the Great Himalayas, which connect the glaciers in the state in the form of a garland. In terms of surface features and topographical development, it is more complex in its diverse physical diversity. This physical division is geologically separated from the Trans Himalayas by the main central fault boundary.

2. Middle or Lesser Himalayan Region - This Himalayan region exists to the south of the Great Himalayas and the north of the Shivalik Himalayas with a width of 70 to 100 km and a height of 1200 to 4500 meters, which includes 9 districts of the state including Champawat, Nainital, Almora, Pauri, Rudraprayag, Tehri, Uttarkashi and Dehradun. The main feature of this region is that it is partially covered with snow due to which the weather here is very pleasant except during winters, for which many foreign tourists along with domestic tourists come here. The main tourist areas are Nainital, Ranikhet, Almora, Bhawali, RamgarhDevvan, Naggatibba, Rewa, Mussoorie, PauriChakrata Lansdowne, Musa KaKotha, Chandrabadni, Binsar area. Most of the lakes of the state are also located in this part. The major lakes include Nainital, Naukuchhiyatal, Sattal, Poonatal, Khurpatal, Sukhatal, Bhimtal, Harishtal and Garhwal region's Sahastratal, Yamtal, Dodi Tal, Bayantal, Vishnugal and Phachkandi Tal etc. In these mountain ranges, there are small grasslands called Bugyal and Payar which are velvety soft grassy areas where cattle grazing is done by the herders of the upper middle Himalayas during the summers. In this range, agriculture is done on a large scale in terraced fields which are famous for organic farming in the whole country. Due to the process of erosion and denudation, this region shows maturity in the surface structure and flat view in the peaks of the mountains. This geographical region is separated from the Great Himalayas by the Central Fault in geological form.

3. Shivalik Himalayan region is spread between 10 to 20 km in width and 700 to 1200 meters in height to the south of the Lesser Himalayas and north of the Bhabar region. This is the newest part of the Himalayas which is believed to have been formed 30 million years ago. This region is separated from the middle Himalayas by the main boundary fault. This range is spread from east to west in 7 districts including southern Dehradun, northern Haridwar, southern Tehri,

central Pauri, southern Almora, central Nainital and southern Champawat which is cut in many places by rivers. In terms of minerals, this is the richest region of the state where sand, marble, gypsum and phosphatic rocks and minerals are found. Also, the Shivalik mountain ranges are spread almost everywhere parallel to the smaller Himalayan ranges of the north. Being formed at the end of the mountainization of the Himalayas, the topography of this range is relatively young in which fault lines, anticlines and synclines are found in abundance.

4. Doon and Dwar Valleys - This physical division is spread in the form of 24 to 32 km wide and 350 to 750 meter high flat and horizontal structural valleys between the north of Shivalik ranges of the state and south of Middle Himalayas i.e. Shivalik and Middle Himalayas, which is called Doon in the central part and Dwar in the eastern part, such as Kothari, Chowkham in Dehradun, Patli and Kota in Pauri and Pachhwa, PurbiChandi and HarkiDoon in Nainital, while in the eastern part, it is called Kotdwar, Haridwar. Doon Valley of Dehradun is spread over an area of 75 km square, whose average width is 25 km. This valley was formed in the Pleistocene era by the deposition of unorganised sediments of the Lesser Himalayas, but at present, this valley is divided into many small and big flat terraced land areas and is getting eroded due to landslides at many places.

As this region is made up of alluvial soil, it is very famous for intensive agricultural production, in which Dehradun's Basmati rice and litchi are mainly famous. Bhabar region- This region is spread in the southern part of the Shivalik Himalayas as an outer belt at the foot of the mountain which is formed by thick rocks and sediments of the rivers originating from the middle and great Himalayas which are spread in a fan-shaped form in which seasonal rivers disappear. Water flows in the rivers only when there is excess water during the rainy season. During the rest of the time, rivers remain extinct in this part. The north-south part of this region is wider than the eastern part. This part is spread in the form of a 10 to 12-km wide strip of soil consisting of pebbles, stones and coarse sand which is spread in the areas of Haldwani, Khatima, Sintarganj upper part, Chaugaliya, Tanakpur, Ramnagar, Kotdwar and Rishikesh. Due to a lack of pebbles and water, this region is not considered suitable for agriculture. This region is separated from the Shivalik range by the Himalayan front fault. Bhabar region is considered to be the trough of the Himalayan mountain range which is formed by the filling of the depression of the Himalayas.

5. Terai region - The Terai region is a low flat narrow land area made of fine-grained soil in the south of Bhabar region, which is believed to have been formed from the soil deposited by

the slow flow of rivers originating from the Himalayas. The width of the Terai region is between 20 to 30 km, which includes the limited southern part of Nainital and Pauri districts, the northern belt of Udham Singh Nagar and Haridwar districts. All those rivers of the Shivalik region of the Himalayas which disappear in the Bhabar region, rise again in this Terai region, which reveals the water availability of the Terai region. This region is also known as a marshy area due to the abundance of water. Due to the abundance of alluvial fertile soil, it is the most suitable area of the state for agriculture and crop production.

8.3.4 Uttarakhand: Climate

Climate is a special element that has a physical effect on the earth, which not only affects humans and ecology but also contributes to the physical form of the earth as well as atmospheric conditions. The climate of the state of Uttarakhand is determined differently in different regions based on physical structure and different ecological conditions. While the high mountain Himalayan region experiences severe cold throughout the year, the middle and Shivalik regions absorb a temperate climate favourable for human health in the summers. In the same valley, Bhabar and Terai regions, the rainy and winter climate remains moderate from the health point of view, whereas due to high temperatures during summer, the state is included in extremely hot and warm climate types and is included in the regions with the highest temperatures.

To understand the climate of the state of Uttarakhand, it is very important to know the vertical height of the state because there is an inverse relationship between height and temperature, which is well seen in the state of Uttarakhand. The temperature, rainfall and humidity levels are different in the mountainous and plain regions of the state, due to which there is a difference in the daily, monthly and annual temperatures as well. Generally, in winter, the temperature variation is slow up to a height of 1600 meters and decreases rapidly in areas above that, while from 4000 to 45000 meters, it again decreases at a normal rate. Due to dense fog in the plains, the temperature reaches negative levels like in the high Himalayan regions. Snowfall starts in the state (in areas above 1500 meters) from December to January. Along with this, hailstorms also occur in the state due to western cyclones. On an average, 12.5 cm of rain also occurs. In summer, the temperature in Shivalik and outer areas ranges from 29.4 to 38 degrees Celsius and in the southern parts, this temperature reaches 42 degrees Celsius. If we look at the pattern of rainfall in the state, then the variation in rainfall also depends on the physical

conditions of the state. In the higher Himalayan regions, rainfall occurs in the form of snow in winter, while in the middle and lower plains, it occurs in normal form.

During the rainy season, the state receives rainfall from the southwestern monsoon, which reaches the state between 15th and 25th June and averages 150 to 200 cm. Based on rainfall distribution, the state is mainly divided into four parts; the area with less than average rainfall is the Greater Himalayas, where rainfall is 40 to 80 cm, the middle Himalayan and northern regions, where rainfall is 80 to 120 cm, the area with more rainfall is Doon/Dwar, Kali Basin and southern region of the middle Himalayas, and the area with maximum rainfall is Shivalik, Bhabar and Terai region, which averages more than 200 cm of rainfall. Whereas Dr S.C. Kharkwal has divided the state into six climatic regions based on the state's height, temperature and vegetation.

- 1. Subtropical climate** - It is found in Bhabar, Doon and Terai regions with a height of up to 900 meters, where the average temperature ranges from 18.9 to 21.1 degrees Celsius and rainfall ranges from 1645 to 1840 mm.
- 2. Warm temperate climate** - Shivalik and middle Himalayan regions with a height of 900 to 1800 meters, where the average annual temperature ranges from 10.3 to 13.9 degrees Celsius and rainfall ranges from 1125 to 2400 mm.
- 3. Cold-temperate climate** - Areas with an altitude of 1800 to 3000 meters where the winter season is 5 months, the average annual temperature ranges from 4.4 to 10.3 degrees Celsius and the rainfall is 370 to 500 mm.
- 4. Alpine climate** - Areas with an altitude of 3000 to 4200 meters, most of the months of the year have a severe cold, average temperature is 6.1 degrees Celsius and annual rainfall is up to 1565 mm.
- 5. Glacial climate** - Areas with an altitude of more than 4200 meters where the temperature remains below zero for about 10 months in a year, the hottest months of July-September have an average temperature of 6.5 degrees Celsius and annual rainfall is up to 720 mm, incidents of sun-stroke occur here.
- 6. Cold dry climate**- This climate zone is found in the trans-Himalayan regions at altitudes of 2500 to 3500 metres.

Thus, it is not possible to classify the climate of the state based on any one average temperature and rainfall and other climatic factors because of local altitude, vegetation cover,

mountainous and valley form, local lakes and effects of climate change etc. effect, due to which climatic variations found in the entire state are a common feature.

8.3.5 Uttarakhand: Drainage System

In terms of physical structure and location, Uttarakhand state is the central part of the Himalayan mountain range which is included in the region of Ganga-Indus, Meghna drainage system. These drainage systems are eastward flowing which cross the peaks of the Great Himalayas, cross the Shivalik ranges in the south and enter the plains of Bhabar following the structural troughs parallel to the mountain ranges, over time flow southwards through deep gorges as continuously flowing river. Being a continuously flowing river, the drainage system of the state is rich in water resources in which the ravines act as tributary water streams along with the rivers of the Ganga, Yamuna, and Kali systems. The water systems of the state flow according to the structure of the physical surface, the major river systems of the state are mainly divided into three parts.

1. Yamuna-Tons Drainage System- The main river of the Yamuna Tons system is Yamuna which originates from a place called YamunotriKantha of Yamunotri glacier situated in the south-west of Bandarpunchmountain and after flowing for 136 km in the state, it goes out of the state at Dehradun. The main tributaries of the Yamuna river system are Hanuman Ganga, Krishnagad, Banadgad, Kamalgad, Barnigad, Tons and Asan rivers. The biggest tributary of the Yamuna river system is Tons which carries two and half times more water than the Yamuna river and originates from the Swargarohini glacier. This river flows from the border of Uttarakhand and Himachal and flows for 148 km in the state and meets Yamuna between Kalsi and Dakpathar. Yamuna-Tons drainage is spread over a total area of 4794 sq km in the state.

2. Bhagirathi-Alaknanda Ganga River Drainage System- This is the drainage area that provides the most water in the state of Uttarakhand, although, in terms of length, it is the smallest system among the major river systems. This river system mainly includes Bhagirathi, Alaknanda, Nayar, Sog, Chandrabhaga, Ratmau, Solani, Banganga and Ganga river sub-systems. Bhagirathi's tributary Rudra Ganga, Milun Ganga, Kedar Ganga, Jahvi, Siya Ganga, Bhilgana and Alaknanda's tributary rivers Laxman Ganga, Saraswati, Vishnu Ganga, Western Dhauliganga, Patal Ganga, Garun Ganga, Nandakini, Pidar, Mandakini, Kanchan Ganga, Ksheer Ganga, Amrit Ganga and Sondhara and Ganga system Nayar's tributary rivers Eastern and

Western Nayar rivers together form Bhagirathi-Alaknanda river drainage which brings water from an area of 18,831 square km in the state. The Ganga river system flows in the state for a total length of 96 km from Devprayag to Haridwar, while along with its tributary rivers, the total length of this drainage is 400 km which Bhagirathi is 205 km and the Alaknanda river system is 195 km. Bhagirathi, the main river of the Ganga river system, originates from the Gomukh place of Gangotri glacier near the Shivling peak situated 19 km away from Gangotri in the far north-east of Uttarkashi district.

20 small and big rivers join this system till Ganesh Prayag, Bhilangana and Bhagirathi Sangam. The Alaknanda River originates from the Alakapuri glacier and Satapath lake of Satapath Peak situated in the northern part of Chamoli district, which merges with the Bhagirathi river at Devprayag. Apart from this, Nayar river from the left side at a place called Phoolchatti at Byasghat in Pauri, Western Ramganga, Birma, Ganga, Bina and Kosi originating from Doodhatoli range, Bhakra, Gaula, Deoha and Nandhaur etc. are all part of the Ganga river system, which merge with Ganga river after coming out of the state.

3. Kali Sharda River System- This river system is also known as Eastern Drainage. This river originates from Kalapani Beas Ashram situated near Lipulekh of Jaxar range situated in the far north of Pithoragarh. It is locally named Kalapani Gad or Kaliganga. It flows for a length of about 252 km from Kalapani to the state border Tanakpur. The major tributaries of the Kali River System are Kuthiyangti, Eastern Dhauliganga, Goriganga, Saryu, Lohawati, Ladhia, Sangchumna, Darma, Ramalgad, Madkani, Gonkagad, Gomti Eastern Ramganga and Panar whose total area is 11,467 sq km. This river system flows forming the border of India and Nepal. After BaramdevMandi in Tanakpur, it is named as Sharda River which is considered as an impure river in SkandaPurana. Its main tributaries are Eastern Dhauliganga, Gauriganga which is Jauljivi, which joins Gori Ganga from the right side at Kaliganga, the same Saryu which is the tributary of Kali providing the maximum water, which originates from a place called SarmoolJhundhi in Bageshwar district, flows for 146 km in the state and joins Kali River from the right side at Pancheshwar. Apart from this, the last river of this river system is Ladhiya which joins Kali River at a place called Chuka in Champawat. This is the only river which flows from west to east in the state.

Thus, the drainage system of the state through the major river systems flowing in the state originates from Bhagirathi, Chorabari, Gangotri, Dronagiri, Kafni, Jandhar, Khatling,

Kalabaland, Milap, Nanda Devi, Panchachuli, Pindari, Ralam, Satapanth, Yamunotri and Sunderdhunga glaciers which provide water throughout the year and also provide water for agriculture, drinking water, electricity and other needs of the state. Along with this, the establishment of fertile plains in the Bhabar and Terai regions has also been a result of these rivers.

8.3.6 Uttarakhand: Soils

Soil is the main basis of agriculture and forest produce, which has its effect in both physical and economic forms. Soil is formed from the combination of base rocks, fauna and vegetation. From various studies of the soils of Uttarakhand state, it is clear that the entire Himalayan region does not have a suitable environment for soil formation because most of the area is rocky hence soil formation takes place in a limited layer and that too due to the mountain structure is washed away by water every year during the rainy season, due to which the soil of the mountainous regions is still immature. Whereas in the plains, due to limited erosion and transportation, most of the soil is found to be of mature and fertile alluvial type, which is mainly seen in Bhabar, Terai and valleys, in which new soil is deposited every year due to glaciers, glacial aloft as well as glacial water process and seasonal erosion. In the Bhagirathi, Alaknanda, Gauri and Dhauri river valleys of the Uttarakhand state, the soil is formed by mixed glaciers, moraines and snow-water streams. There is a thin layer of soil on mountain slopes of more than 30 degrees. In the Lesser Himalayas, there is deposition of residual soil which is rich in organic elements. Whereas in the Bhabar region, the soil layer ranges from 1 meter to 1.5 meters and in the Terai region, Bangar and Khadar soil is more than 100 meters deep, which increases towards the south in the form of the Ganga plain. In the water-deficient areas of this region, due to the abundance of alkaline elements, Reh soil has been formed. However, due to local diversity in the geo-ecological conditions of the state, the soils are not included in the complete category anywhere in the mountainous region. The soils of the state are classified as SC. Kharkwal has classified it into six main parts.

1. Terai-Bhabar and plain soils- This soil is found in the foothills of the Himalayas and the adjoining Terai regions, which include Bangar and Khadar soils. Black coarse particles are found in the Bhabar region and fine particles are in the Terai region.

2. Brown, red and yellow soils- This is present in the southern mountain ranges of the Himalayas. It contains sandstone, mica mixed rocks and sediments of tertiary age. The pH value of this soil is found between 6 to 7.6, which is fertile and absorbs relatively more moisture. Its colour is brown.

3. Submountainous soils - These are brown, red and yellow soils found in forests of deodar, spruce, blue pine, chir etc. whose pH value is up to 5. Humus is predominant in this soil.

4. High mountain grassland soils - These soils are found in high mountainous regions in which vegetation is sparse. These are found in the Bugyals of the state. This soil lacks nitrogen, phosphorus and potassium.

5. Shallow mountainous soils - These are found in dry and cold regions of mountains which are deposited in the form of eroded thin surfaces of parent rocks which are found in unorganized and immature states.

6. Ancient alluvial soils- These are the soils deposited in the reservoir of the Himalayas, which are the soils deposited in the southern Doon and river valleys, in which nitrogen, organic and other plant elements are found in abundance. The pH value of this soil is found between 6.5 to 7.2. (Mukherjee and Das 1940-1942) have divided the soils of the Kumaon Himalayas into four main parts.

1. Meadow soil - This soil is mainly found in the lower valley region of the Kumaon Himalayas.

2. Brown forest soil - This soil is especially found in the pine forest area, whose pH value is between 6.1 to 6.3.

3. Pedasol soil - This soil is found especially in bog forest areas, whose pH value is between 5.7 to 5.9 and this soil is best for agricultural production.

4. Red loamy soil - This soil is not particularly useful for agricultural work, whose pH value is 6.4. These soils are generally found mainly in all basins.

8.3.7 Uttarakhand flora and fauna

Based on the forest area and characteristics of the forests of Uttarakhand, it is included among the major forested states of India, as a result of which the state is given a special green bonus every year by the Government of India. The dense forests of the state of Uttarakhand provide more prosperity to the forests through a variety of vegetation, grasses and fauna. Alpine, evergreen, deciduous and monsoon forests and many species of soft grasses are found in the Uttarakhand Himalayan region. Many mixed types of vegetation are found in 45.44 percent of

the total forest area of 24,295 sq km of the state. This presents an ideal sample of biodiversity (from small bushes to trees of 30-40 meters in height) since most of the state is located in the lap of the Himalayas, climatic diversities are found in every physical division, as a result of which botanical diversity is seen in the forests, which is directly proved by the species of forests found in the state. Along with botanical diversity, faunal diversity is also found on a large scale in the forests. Due to these characteristics, despite being a small state, it is a rich state in terms of forest and wildlife wealth in terms of the number of 6 national parks, 7 sanctuaries, wildlife reserves and other biosphere reserves and at present the forests of the state are acting as a fund for the state economically because wildlife tourism and natural tourism is flourishing on a large scale in the state, for which conservation of forests is becoming very important. Apart from this, forests are also making an invaluable contribution to the climate and weather of the state. Thus, many species of different types of vegetation, grass, parasites, creepers, shrubs/bushes are found in the state, in the details of the major forest species of the state have been clarified in table number (8.1).

Uttarakhand State Forest Species 2017-18

Botanical Name	Botanical Name	Botanical Name
Juglans regia	Cedrus deodara	Ricinus communis
Fraxinus micrantha	Cenchrus	Usticaria
Ficus polymorpha	Woodfordia	Cascabela thevetia
Spondias pinnata	Pyrus communis	Daphne papyracea
Cassia fistula	Piper nigrum	Pachyrhizus
Lyonia ovalifolia	epidermis	Smilax aspera
Mangifera indica	Aesculus	Eucalyptus
Emblica officinalis	Buxus	Asparagus racemosus
Alnus nepalensis	Cleistanthus	Hedychium spicatum
Picrasma quassoides	Casipourea	Mussaenda
Flacourtia rukh	Mitragyna	Rubus
Bahunia acuminata	Grewia	Trichilia
Zizyphus	Melia azadirachta	Ficus
Acacia nilotica	Gypsophila	Terminalia

Holoptelea	Bellisica	Besberis
Myricaesulent	Quercus	Holasshena
Marusserrata	Rhododendron	Nyctanthes
Acenoblongum	Zizyphus	Rosa srunonii
Euonymus	Aegelmasmelos	Pysacarthacrenulata
Schleicher	Grewiaasiatica	Datura
Pinuswallichiana	Cqrylus	Viscum album
Heteropogonconfronts	Milletiaextensa	Dioscoreadeltiodea
Phoenix	Litsea	Digeramuricata
Cetisaustarpifolia	Euphorbia chamaesyee	tirosporasiensis
Quescus semecospifolia	Swidamacropluylla	Trachelospermumaxillare
Acacia catechu	Sapindns	Bauhinia valid
Acer	Mallotus	Sinarundinaria
Slaix	Cordia dichotomy	Dendrocalamus
Rumexnepalensis	Symplocos	Barleriacristata
Swertia	morus alba	Tectonagrandis
Elaeagnus	Dalbergia	Ougeinia
Ficus racemose	Albizia	Lindera
Shorearobusta	Clauses	Lindera
PrunusArmenia	Mentha	Achyranthesaspera
Saurauia	Potentilla	Zanthoxylum
Carpimus	Micromeria	Schefflera
Gentiana	Thespesia	Corchorus
Pinus	Adhatuda	Cusulla
Wendlandiahoney	Martynia	Korthalsella
Alexandra	Cannabis sativa	Ficusauriculata
Prunuscornuta	Gavae	Phoenix
Syzygium	Lanea	Verbascum
Ficusauriculate	Saulsurea	Saccharumspontaneum

Wendlandia	Cyanodon	Albiziachinensis
Quercusfloribunda	Taxusbaccata	Cupressns
Toorhexandra	Bombaxceiba	PunicaGranatum
Cinnmomum	Terminalia chebnla	Echinochloa
Ficusnerifolia	Haldinia	Heteropogonlontortus
Syzygiumvenison	Rubusbiflorus	Miliusa

Table No 8.1 Source: Tarai East Forest Office Haldwani 2018

The geographical structure and Himalayan position of Uttarakhand reveals the richness of flora and fauna. While the physical disparity in the northern part produces biodiversity with the characteristic snow-covered polar feature and assimilates complex environmental conditions, in which limited species of animals and plants reveal different biodiversity, the middle higher part has the characteristic of temperate climate and is the origin place of rivers, many river valleys have been formed, with the help of which many types of diverse flora and fauna reside. This region is going to assimilate the characteristics of both the high and middle Himalayas. Due to snow cover in winter, the decrease or transfer of the number of animals gives a special identity to this region. Along with this, the summer fauna gives a unique form to the diversity in the middle Himalayan region and has been providing shelter to many types of organisms for a long time at an altitude of **800 to 1200** meters in the entire Himalayan region. The southern parts of Shivalik, Doon-Dwar valleys, Bhawar and Terai regions are plains characterized by a unique climate. Many types of animals are found here, which is the optimum natural and human residential region for micro to giant creatures, while the vegetation cover is less, rich than in the Shivalik region.

According to the Uttarakhand Forest Research Institute, in terms of fauna diversity, there are about **102** species of mammals, **623** types of avifauna, **124** types of fishes, **19** types of amphibians and **69** types of carnivores living here. Due to human cultural intervention, some special species of the state rich in biodiversity are becoming extinct, the major ones of which are the Asian elephant, snow leopard, tiger, musk deer, Himalayan monal, king cobra and jackal. According to the **2023** census of flora and fauna, **3167** tigers have been found here, which is third after Madhya Pradesh and Karnataka. Apart from this, many micro-organisms are found here.

8.3.8 Uttarakhand Biogeographical Region

Biogeographical regions in Uttarakhand are also demarcated like other Himalayan states of India. This region is divided into different biogeographical regions due to its natural diversity, climate and geographical features, which are mainly divided into the following regions.

1. **High Himalayan region-** This region mainly includes the high Himalayan region in which glaciers, snow-clad mountain ranges and alpine grasslands are found. As geographical specialities, temperate and alpine grass bugyals, rare vegetation like blue poppy, Brahma kamal, animals like snow leopard, musk deer and snow cock are found here. The state's national parks Nanda Devi and Valley of Flowers are located in this part, which have been protected as a world heritage by UNESCO.

2. **Middle and Shivalik region-** Middle and Shivalik ranges are included in this geographical unit, in which this region is included in the world's densest mountain regions with the highest biodiversity and human habitation. Most of the tourist places and tourism possibilities of the state are also present here, as a geographical speciality, mixed forest, biodiversity includes tiger, leopard, bear, monkey, langur and many other kinds of animals, the climate of this state is of subtropical and temperate type.

3. **Sub-alpine and alpine region -** This region includes the areas above the height of **2120** meters in the state, in which there is an abundance of mixed types of forests, along with many kinds of bushes covering the entire Himalayan region. Many species of forest medicines are found here, especially in this area is known for KiadaJhadi.

4. **Terai-Bhabhar region-** This is a region located at the foot of the fan-shaped Shivalik Himalayas deposited by rivers in which a mixed form of Bhabar and Terai region is seen. It is the most developed and most populated area of the state and the habitat of big wild animals. Due to excessive human intervention, this region is currently facing the threat of its existence. Apart from deciduous forests, grasslands, marshy areas, elephants, deer, jackals, and reindeer, many types of reptiles are found here.

5. **Glacial region -** Apart from stability in the water resources and weather of the state, it is a future accumulated fund in the form of immense potential for tourism development. These regions are included in this region which is an area of snow cover spread over thousands of square meters in the mountain peaks located around the Great Himalayas. This region provides water throughout the year to the continuously flowing rivers in the state. Thus, this geographical

region having snowy area is considered to maintain the balance of climate and is also considered to be an indicator of seasonal and climatic changes in the Himalayan region, which plays an important role in determining the climate of the country along with the state, because all the highest mountain ranges of the world are present in this part.

8.4 Summary

The state of Uttarakhand is a Himalayan state which is completely situated in the lap of the Himalayas. Most of its part is mountainous. It is the 11th Himalayan state of the country. Physically, the features of mountain ranges, bugyals, valleys, riverine plains, Bhabar and Terai land are visible here. In relief features, where on one side Nanda Devi mountain peak is situated, on the other side there are the plain plains of Bhabar-Terai. The state of Uttarakhand imbibes all those features which are found in the entire Himalayan region. Physically, the environmental elements present in the state mainly include the mountainous and plain landforms of the state, all types of mixed forest areas, snow-clad glaciers and snow-originated river systems, resources containing many types of fauna are found here. Despite having different physical and environmental features, this Himalayan state provides optimum natural conditions for human habitation through its environment in the plains as well as in the mountainous region, which is the region with the most dense mountain population in the world, but from the geological point of view, Uttarakhand Himalaya is an integral part of the Himalayan mountain ranges and the landmass situated in the centre of the Himalayan region, which is formed from the sediments deposited in the Tethys Sea.

Being the newest mountain in the world, it is considered an unstable landmass, due to which the topography of the Himalayas keeps on forming and deteriorating. According to geologists, this mountain range is the developed form of the Tethys geosyncline, whose present form was completely completed by the folding process due to the collision of the Indian and Eurasian plates in the Tertiary period. Based on the state's physical surface configuration, relief forms and physical characteristics, Uttarakhand Himalaya is divided into seven geographical regions from north to south, namely Trans, Vrihad, Chhutti, Shivalik, Doon Ghatia, Bhabar region and Terai plain region. In terms of climate, the state has different types of diversity and large differences in daily, monthly and annual temperatures. Hot and temperate types of climate are especially seen here. The drainage system flowing in the state is a part of the Ganga-Indus,

Meghna drainage system which is considered to be the predecessor. The major river systems of the state are mainly divided into three parts (Yamuna, Ganga and Kali River). The soil of the state is formed based on these. The soil of the mountainous regions is immature and fertile alluvial soil is found in the plains.

In terms of forest and life resources, this state is included in the country's highest forest resource-rich list, as a result of which the state is given a special green bonus every year by the Government of India. The dense forests, diverse types of vegetation, grasslands and fauna of the state of Uttarakhand provide more prosperity to the state. Many mixed types of vegetation of forests are found in 45.44 percent of the total forest area of 24,295 sq km of the state. Along with botanical diversity in the forests, fauna diversity is also found here on a large scale. According to the Uttarakhand Forest Research Institute, in terms of fauna diversity, about 102 species of mammals, 623 types of avifauna, 124 types of fishes, 19 types of amphibians and 69 types of carnivores reside here. According to the 2023 census of flora and fauna, 3167 tigers have been found here. Based on all these diversities, the state is also demarcated into biogeographical regions which are mainly divided into five parts (High Himalayan, Middle and Shivalik Himalayan, Sub-Alpine and Alpine, Terai-Bhabar and Glacial regions).

8.5 Glossary

Uttarakhand:	27th state of India and 11th state of the Himalayas, situated in the North East of India.
Midos:	Bugyal Summer soft grasslands found in high Himalayan regions.
BhabarShivalik Fan:	Shaped plains of coarse gravel and soil situated at the foot of the Himalayas.
Glaciers:	Snowy mountains spread over hundreds of km in the Great Himalayan range, such as Gangotri, Milan, Khatling, and Yamunotri.
Snow line:	The line of snow situated in the Great Himalayas, from where trees, grass and snow are separated, due to which snow accumulates upwards.

Isthmus:	Shallow, narrow depression in the ocean in which river sediments keep accumulating for millions of years, such as Tethys, from which the Himalayas were born.
Trans Himalaya:	The northernmost mountain range of the Himalayas in the physical division of the Himalayas, which separates from the Great Himalayas. Fault The line separating two geologically different landforms formed in different periods.
Central Boundary Fault:	The geological fault line separating the Great and Lesser Himalayas.
Main Boundary Fault:	The geological fault line separating the Lesser and Shivalik Himalayas.
Himalaya Front Fault:	The fault line separating the Shivalik and the foothill plains.
Pleistocene Era:	The largest period of ice cover in the history of the Earth, which is known as the Ice Age.
Biogeographical Region:	The physical division of the Uttarakhand Himalayas based on natural structure, diversity and uniqueness of natural flora and fauna is called the Biogeographic Region.

8.6 Answer to check your progress

1. Uttarakhand state is the 11th state among the Himalayan states.
2. The Himalayan mountain range is considered to be one of the most unstable regions in the world.
3. The Himalayan mountain range is spread in the form of an arc of about 2400 km in length and 250-300 km in width.
4. based on the physical configuration of the surface, relief forms and physical characteristics of the Uttarakhand state and the Himalayan region, the Uttarakhand Himalayas are divided into seven geographical regions from north to south.

5. The Lesser Himalayas are spread over 9 districts of the state, Champawat, Nainital, Almora, Pauri, Rudraprayag, Tehri, Uttarkashi and Dehradun.
6. The major tourist places in the Kumaon region of the Middle Himalayas include Nainital, Ranikhet, Almora, Bhawali, and RamgarhDevvan.
7. Doon and Dwar valleys - are spread over a 24 to 32-km wide strip to the north of the Shivalik ranges and south of the Middle Himalayas.
8. The width of the Terai region in the Uttarakhand state is between 20 to 30 km.
9. Uttarakhand state is the central part of the Himalayan mountain range in terms of physical structure and location.
10. Kali Sharda river system originates from Kalapani located near Lipulekh in the Jaxar range in the far north of Pithoragarh district.
11. Brown, red and yellow soils are present in the southern mountain ranges of the state in which sandstone, mica mixed rocks and sediments of tertiary age are found.
12. The forest area in the entire area of Uttarakhand state is 24,295 square km.

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8.8 Terminal Questions

1. Long Answer Questions

- Q-1. Discuss the geo-environmental background of the state of Uttarakhand, and describe the physical regions of the state in detail?
- Q-2. What do you understand by the drainage system, give a detailed description of the major drainages of the state?
- Q-3. Explain the major bio-geographical regions of the state of Uttarakhand, and explain the diversity of the state's soil, natural vegetation and fauna?

2. Short Answer Questions

- Q-1. Give a geo-environmental introduction to the state of Uttarakhand?
- Q-2. Describe the geological structure of the state of Uttarakhand in detail?
- Q- 3. Briefly divide the major physical regions of the state of Uttarakhand?
- Q- 4. What kind of geographical similarities are there in the Shivalik and Bhabar regions? Explain?
- Q- 5. There are diversities in the climate of Uttarakhand, describe the climatic regions of the state?
- Q- 6. What is a drainage system? Give a brief introduction to the major drainage systems of Uttarakhand.
- Q- 7. Describe the Ganga drainage system flowing in Uttarakhand?
- Q- 8. Divide the soils of Uttarakhand?
- Q- 9. Discuss the natural vegetation and fauna resources of Uttarakhand in your own words?
- Q- 10. What do you understand by the Terai region?
- Q- 11. Give a geographical description of the Doon valleys?
- Q- 12. Describe the biogeographical regions of the state of Uttarakhand?

3. Multiple choice questions

- Q- 1. In which part is the state of Uttarakhand included in the regional division of the Himalayas?
- a) Northern part
 - b) Central part
 - c) Southern part
 - d) North-eastern part

Answer: a

Q- 2. The Himalayan mountain range was formed in?

- a) Angaraland
- b) Tethys Sea
- c) Southern plateau
- d) All of the above

Answer: d

Q- 3. What is the east-west length of the Himalayas?

- a) 2400 km
- b) 2600 km
- c) 2500 km
- d) 2200 km

Answer: a

Q- 4. Geographically, the Himalayas in Uttarakhand have been divided into how many parts?

- a) 5
- b) 6
- c) 7
- d) 8

Answer: c

Q- 5. What is the average height of the Shivalik Himalayan region?

- a) 1200-1800
- b) 1800- 2500
- c) 1500-1800
- d) 700-1200

Answer: d

Q- 6. In which shape has the Bhabar region expanded?

- a) Rectangular
- b) Fan-shaped
- c) Bounded Triangular
- d) Square

Answer: b

Q- 7. What is the average date of arrival of South-West monsoon in the state?

- a) 15 to 25 June
- b) 20 to 30 June
- c) 1 July
- d) 15 July

Answer- a

Q- 8. Upto what height on an average sub-tropical climate exists in the state?

- a) Upto 900 meters
- b) Upto 1000 meters
- c) Upto 1500 meters
- d) Upto 1800 meters

Answer: a

Q- 9. What is the length of the drainage area of the Bhagirathi and Alaknanda river systems respectively?

- a) 205 km and 195 km
- b) 200 km and 195 km
- c) 205 km and 198 km
- d) 205 km and 208 km

Answer: a

Q- 10. What is the total length of the Kali river drainage system in the state?

- a) 253 km
- b) 252 km
- c) 280 km
- d) 270 km

Answer: b

Q- 11. What is the average pH value of brown, red and yellow soils?

- a) 5 to 6
- b) 7 to 9
- c) 5 to 7
- d) 6 to 7.6

Answer: d

Q- 12. In which part of Kumaon Himalaya is meadow soil found?

- a) Lower valley region
- b) Central Himalayan region
- c) Terai and Bhabar region
- d) All of the above

Answer: a

Q- 13 What is the total number of species of mammals in the state?

- a) 105
- b) 102
- c) 623
- d) 107

Answer: b

UNIT 9: STRUCTURE, COMPOSITION AND DYNAMICS OF POPULATION; TRIBAL GROUPS AND THEIR SPECIAL DISTRIBUTION, SETTLEMENTS: TYPES AND PATTERNS

9.1 OBJECTIVES

9.2 INTRODUCTION

9.3 STRUCTURE, COMPOSITION AND DYNAMICS OF POPULATION; TRIBAL GROUPS AND THEIR SPECIAL DISTRIBUTION, SETTLEMENTS: TYPES AND PATTERNS

9.4 SUMMARY

9.5 GLOSSARY

9.6 ANSWER TO CHECK YOUR PROGRESS

9.7 REFERENCES

9.8 TERMINAL QUESTIONS

9.1 OBJECTIVES

After reading this unit you should be able to:

- To study the population structure, composition and mobility of Uttarakhand state in detail.
 - To study the tribal groups in the population of the state and to know the settlement areas of the population.
 - To do an in-depth analysis of the settlements, types and patterns of Uttarakhand state in the geographical, social and economic scenario of the state.
 - To provide knowledge to the learners about the population, population pattern, settlement and tribal groups of Uttarakhand state.
-

9.2 INTRODUCTION

As Uttarakhand is a mountainous state, the population structure, composition and mobility are not found to be by the geographical conditions of the state. Since Uttarakhand state is a completely Himalayan state located in the northern part of India, 86 percent of which is mountainous, it absorbs the Himalayan climate. Geographically, this state is spread over 53,483 sq. km., in which features of mountain ranges, Bugyals, valleys, riverine plains, Bhabar and Terai are naturally present. 30% of the total area of the state is snow-covered and rocky, 64% is forest area and hence is not suitable for human settlement. The population resides and life-sustaining activities are carried out in a limited portion only. Nevertheless, despite adverse physical conditions, it provides the best environmental conditions for human habitation among the mountainous regions of the world, due to which it is counted among the world's densest mountainous regions. The administrative division and demarcation of the state have been done from time to time based on the spread of the population. The state is administratively divided into two divisions (Kumaon and Garhwal), thirteen districts, 95 development blocks, 110 tehsils, 102 municipal bodies and 15,745 villages. According to the 2011 census, the total population of the state including all caste groups is 1,01 crores, while in the 2023 estimates, it is estimated to be around 1.15 crores.

Like other Himalayan states, in Uttarakhand too, the level of population growth was low in the initial period, but there has always been positive growth in population. In the period from 1901 to 2011, only the year 1921 had negative growth. From 1901 to 2011, an increase of 410.50 percent has been estimated in the rural population, which is increasing at an average rate of 3.70

percent per year, which has been divided by demographers into four phases: 1. Very slow growth rate (1901-31), 2. Slow growth rate (1931-51), medium growth rate (1951-81) and rapid growth rate (1981-2011). According to the census of 2011, the population density of the state has been 189 persons and in the plain densely populated areas, this density has been 247 persons. The current population composition and pattern of the state can be determined based on its geographical diversity, historical background and cultural prosperity. The availability of physical and livelihood resources, meANSWER of employment and level of health facilities are increasing the mobility in the population of the state. Apart from this, the tribal groups of the state have played a very important role in the composition of the population and have cultural uniqueness. The tribal population contributes 3% to the population structure. Five tribes Jaunsari, Tharu, Raji, Buksa and Bhotia reside in the state, of which Tharu is the largest tribal group.

In this way, geographical diversity affects the distribution of the population. While Terai and Bhabar are densely populated regions, the mountainous region has been sparsely populated. In the last two decades, there has been rapid mobility in the population, which is causing migration from mountainous regions to plains, giving rise to situations like changes in the population pattern and population explosion. In the same social structure, Muslim, Christian and Buddhist communities live along with Hindus. Many tribal groups reside in the Hindu population, whose life, culture and customs give a distinct geographical identity to the state in other states and nations. Also, since the state is a Himalayan region, the nature of human settlements is different in both mountainous and plain regions. Whereas in the mountainous regions, there are sloping, kutcha and scattered houses or settlements in groups, all of which were built in unplanned form on terraced fields.

In the plain rural areas, houses of both flat roofs and sloping roofs are being built at present in the agricultural fields. For the last 2-3 decades, pukka and flat-roofed houses have been built in the mountainous and plain regions. In the urban plain areas, human settlements are being established in dense and rowed or linear patterns in the form of multi-storey buildings. On the other hand, unplanned slums are spreading on a large scale in the urban areas. Thus, the geographical location of the state of Uttarakhand, the structure, concentration and mobility of the population and the tribal diversity preserve the heritage of the state and at the same time, the task of providing security to the strategically sensitive areas is being provided by residing in difficult areas.

9.3 POPULATION STRUCTURE, COMPOSITION AND DYNAMICS, TRIBAL GROUPS AND THEIR SPECIFIC DISTRIBUTION, SETTLEMENTS: TYPES AND PATTERNS.

9.3.1 Uttarakhand Population Structure and Composition

The population structure and composition of Uttarakhand are based on the geographical, geological and climatic structure of the state as well as religious, and socio-economic aspects, as a result of which the population structure is found to be completely different in both quantitative and qualitative forms in the mountainous and plain regions. The Himalayan region of the state has long been the meeting point of the Central Asian Tibeto-Mongol tribes and the tribes living in the Indus-Ganga and Brahmaputra valleys, who have established a special place in many cultures and have established interrelationships with many cultures by living in the state, as a result of which at present this region has become the residence centre of many human communities and human races. The reliable collection of population data in the state was first started during British rule, which was based on the revenue unit in 1841. Like other Himalayan states of the country, in the initial period, the rate of population growth in Uttarakhand has been very slow, due to which the adverse geographical conditions, natural disasters, customs and social systems have generally been responsible, which the community residing here has also suffered and even today is living in the absence of basic facilities or is forced to migrate from the original place of residence.

An analytical study of the population pattern of the state shows that from the year 1901 to the year 2011, the population has always been positive in all the years except the year 1921. Like other Himalayan states, Uttarakhand also has a majority of the rural population, in the census data of the year 1981, 81.7 percent of the state's population was rural population. But after the year 1981, due to an increase in the number of cities, the rural population started decreasing. According to the census of 2011, 30.23 percent of the state's population lives in cities and the remaining 69.77 percent in rural areas. Thus, based on various aspects of population, the population of the state is studied based on the following points.

1. Aspects of Population Study - The geographical study of the state's population, human population, male-female ratio, percentage of children, young, and old people i.e. age composition, population engaged in different occupations, rural and urban ratio, their education,

science and technological progress etc., is used to estimate the actual assessment of the state's population and its ability to progress. Apart from this, in a population study, the socio-economic characteristics of the population include the social organization system of the people, residence, economic production, level of education, professional status, religious beliefs, rural-urban residence health etc. The study of population is becoming very important in the context of the uneven geographical features of Uttarakhand, uneven distribution of population, socio-economic diversity and business activities. In the last 10-15 years, problems like continuous population growth in the plains and destruction of fertile agricultural land, decrease in water availability, development of slums, unplanned urbanization growth, migration from rural and mountainous areas and food are mainly included in a population study.

Uttarakhand Migration Commission 2018. It has been clarified that according to the Census 2011, till now 734 villages are completely devoid of population and 565 villages have lost 50 percent population. Due to shrinking agriculture and lack of essential facilities, those who had some kind of capability have left almost all the villages of mountainous origin. Mountainous areas are becoming devoid of people due to migration.

2. Population growth - It is known from the general study of population in the state that in the year 1901 the total population was 19,79,866 persons, whereas after independence it became 29,45,929 persons in the year 1951 and 1,00,86,292 persons in 2011 which has increased by 97,140,363. If the growth of population is studied comparatively before and after independence, then it was 19,79,866 in the year 1901 which increased to 21,42,258 in the year 1911 which is the highest in the Himalayan states in this decade, while in the year 1921 due to epidemics and other reasons, there was 3.83 percent negative growth in population, 8.7 percent growth in 1931, 13.6 percent growth in 1941 percent and in 1951 it has registered a growth of 12.7 percent, in which the period till 1951 after independence has also been added. In the second census after independence in 1961, this growth rate was 22.6 percent, in 1971 it was 24.4 percent, in 1981 it was 27.45 percent, in 1991 it was 24.23 percent, in 2001 it was 20.41 percent and in 2011 it was 18.81 percent. Thus, in the 54 years after independence, the population of the state has increased by around 188.17 percent, which has achieved a three to four-times increase from the pre-independence level. The current census data of 2011 shows that only an 11.5 percent increase has been recorded in the rural population of the state, whereas in the urban areas, it was 39.9 percent and the population in the hilly rural areas is in a negative status. Whereas, in the urban

areas, the population has increased by an average of 4.5 percent between 2001 and 2011. The highest population in the state is in Haridwar district with 18.74 per cent population.

3. Population distribution - Due to the unevenness in the geographical structure of Uttarakhand, the distribution of the population is also found to be uneven. 20% of the total geographical area is more than 5000 meters high and is devoid of population. The same 20% is 500 meters high above sea level which includes 14% of the plain area of the state and about 51.8% of the population of the state resides here. Less than 1% of the population resides in the extremely inaccessible mountainous region which includes 55 tehsils of the state. In terms of population distribution, the population scenario in the state is different in both mountainous and plain areas. While 53 people used to live in the mountainous region in the year 2001, in the year 2011, these people have reduced to 48, while in the plains, 47 people used to live in the year 2001 and the year 2011, this has reduced to 53 people. In percentage growth, this hilly region has registered a decrease of 13.80 percent in the year 2001 and 6.60 percent in the year 2011, whereas in the plains it has registered a growth of 32.06 percent.

4. Population Density - The population density of a state is determined based on population distribution. Most of the area of the state is inaccessible and hence is not conducive for population accumulation. Forests, high mountain peaks and snow-covered areas, swamps and resource-less areas are deprived of human habitation. According to the census of 2011, the average population density of Uttarakhand has been 189 persons per square km. In which this density was 159 persons in the year 2001, which has increased by 20 persons from the year 2001 to 2011. In which the highest population density was 801 in Haridwar and the lowest was 41 persons in Uttar Kashi district. If we look at the population density of the state after independence, it was 53 people in 1951, 69 people in 1961, 86 people in 1971, 90 people in 1981, 133 people in 1991 and 159 people in 2011 which ranks 25th in the country in terms of population density.

5. Age structure - To know the number of people of different age groups in the population of Uttarakhand state, we have to know the number of births, deaths and migration which are mainly responsible for the age structure. Apart from this, the physical conditions of the state which create obstacles in the development of basic facilities for humANSWER affect the level of age structure. According to the census of the year 2011, 31.02 percent population is in the age group of 0-14 years, 28.80 percent in the age group of 15-29 years, 19.14 percent in the age group of

30-44 years, 11.95 percent in the age group of 45-59 years and 8.93 percent in the population group of more than 60 years. While in rural areas, about 57.79 percent of the state's population is included in the youth category of 18 to 59 years.

6. Population Sex Ratio - The sex ratio is a mathematical calculation which is determined by the number of women per thousand men and which explains the ratio of equality and inequality between men and women. In the state of Uttarakhand, the number of women per thousand men was 907 in 1941, 940 in 1951, 947 in 1961, 940 in 1971, 936 in 1981, 936 in 1991, 962 in 2001 and 963 in 2011, which the highest sex ratio is in Almora district at 1139 and the lowest is in Haridwar at 880 women per thousand men. Out of a total of 13 districts of the state, a sex ratio of more than 1000 is found in 7 districts. A decrease in the number of women has been found only in the remaining 6 districts. Still, the sex ratio of the state has been higher than the national average because the sex ratio of the country is 943 per thousand men whereas the ratio of the state is 20 women more. If we look at the sex ratio in mountainous and plain areas, then in the mountainous regions of the state, where there were 973 women per thousand men in the year 1901, it was 1,037 per thousand in the year 2011, whereas in the plain areas, it was 812 in the year 1901 and 900 per thousand in the year 2011, in which there has been an increase of 88 women from 1901 to 2011. In the entire state, there has been an increase from 918 to 963 respectively, which has achieved an increase of 45 women.

7. Literacy- Literacy is the biggest asset of a person living in a village, state and nation which is an indicator of economic, and social-cultural progress. The society which has a greater number of literate people achieves the highest height in material progress instead of the society which has less literate people. Therefore, education and literacy are the strongest pillars to bring every person from animal life to human life. According to the Indian Census, a person above 7 years of age is included in the literacy list. Despite the complex geographical features of the state of Uttarakhand, the literacy rate has gained momentum in the last decades. According to the census of the year 2011, the state is in the 17th position in the country. 78.40 percent of the total population of the state is literate, which the number of men 87.40 percent and female literacy is 70.00 percent. In terms of male and female literacy, the state is in the 13th and 20th position respectively. In which the district with the highest literacy is Dehradun with 84.25% and the district with the lowest literacy is Udham Singh Nagar with 73.10% in which 76.31% of the rural

population and 84.45% of the urban population are literate which is more than the national average.

8. Occupational structure - The population engaged in economic activities reveals the occupational nature of the population of a country. 40% of the total population of Uttarakhand state is working population which men 66.2% and women 33.8%, 79.8% of the total working population is rural and 20.2% of urban workers are engaged in primary, secondary and tertiary jobs which shows that even today more working population resides in the rural areas of the state and is engaged in their primary and secondary jobs, whereas despite the availability of all facilities in the urban areas, there is a decrease in the number of workers. The study of the working population shows that the number of dependent populations in the state is high. Classification of the population according to occupation shows that a large section of the state from both mountainous and plain areas goes to urban areas or outside the state for employment. Most of them work as labourers in industries. Under the primary category, about 49.8 percent of the working population in the state is engaged in agricultural work, 8.3 percent in agricultural labour, 2.2 percent in secondary work and 39.7 percent in tertiary occupations. It is often seen that in the districts where the percentage of literacy is high, the population is engaged in secondary and tertiary occupations as compared to the areas suffering from a lack of education and employment. Along with this, in the mountainous areas of the state, most of the women are engaged in agriculture, animal husbandry and labour work, while the men migrate to other places in search of employment.

8. Caste structure of population

According to Census 2011, 21,84,419 persons in the total population of the state are jointly of Scheduled Caste and Scheduled Tribe, in which Jaunsari, Tharu, Bhotia, Boksa and Vanraji are mainly included in the Scheduled Tribes. About 65 castes are included in the list of Scheduled Castes, in terms of population percentage, it is 21.65 percent of the state's population. The highest number of Scheduled Castes reside in Haridwar and the lowest in Champawat district. Among the Scheduled Tribes, the highest population is of the Tharu caste and the lowest is of the Vanraji tribe, in which the highest population is in Udham Singh Nagar and the lowest in Rudraprayag district. In literacy percentage, 74.4% of the Scheduled Caste and 73.9% of the Scheduled Tribe population are educated. The areas inhabited by Scheduled Tribes in the state are mainly backward or remote mountainous border areas or are located in the form of a narrow belt in the southern parts of the state. At present, this class is becoming economically and

socially strong due to reservations provided by the state and central government, whereas Scheduled Castes are spread across the entire state, in which even today 82.28% of the population is living in rural areas.

9.3.2 Population mobility-

The rapidly increasing population of Uttarakhand state explains the mobility of the population of the state, which has increased by 81,06,426 lakhs from the year 1901 to the year 2011. In percentage terms, it is more than 80%. But this is not very beneficial in the adverse conditions of the state, because at present, along with the increase in population, the nature of population mobility has also changed. Till 2 decades ago, most of the residents of the state were living in their original place.

In the 2011 census, 44.2 percent of the population was classified as migrants, which is 7 percent more than the migration percentage of the country, in which 30.04 percent is of the male population. It has also been learned from the migration survey data that about three-fourths of the rural migrants in the state have migrated from village to village and one-fourth of the migrants have migrated from city to village, while among urban migrants, three-fourths have migrated from city to city and one-fourth from city to village. According to the report of Uttarakhand Rural Development and Migration Prevention Commission, from the year 2018 to 2022, 3,07,310 persons have migrated to the state, out of which 28,531 persons have left the state permanently. While 1,034 villages were empty in the year 2011, their number has increased to 1,058 in the year 2022, while the number of deserted villages has reached 1,792, where migration could not be stopped even after government efforts.

Thus, the mobility of the population in the state cannot be measured only by population growth, but the changing pattern of population in the hilly and rural areas as a result of migration in the current decades has been included in this category. Thus, the main reason for the mobility of the population of the state is migration from internal and external areas, which is considered to be the movement of people from their native places to other places in search of employment and better living standards. In some places, disaster and lack of basic facilities have also led to the migration of residents of the state on a large scale. In the same remote and extremely remote areas, only poor and low-standard people live. Economically strong communities are either migrating from village to village by building houses near the road or have settled permanently in

the plain areas. Thus, the mobility of the population has given birth to a new stream of migration in the state, which is from rural roadless areas to rural road-equipped areas.

9.3.4. Tribal Group

A tribal group is that human group which creates a distinct identity in the entire state due to its social and cultural uniqueness, some of its physical characteristics are different from the humans of other regions, at one time this human group was isolated from the mainstream of the society, which at present has been improved economically by the government by improving the level of preservation and education. In the initial period, this society used to live in separate mountainous and plain Terairegions, but at present, it has started settling in the urban areas of the state as well and the cultural diversity of the tribals is considered from the mythological times itself. In the context of the state, the tribal society has its definite region, boundary, language, religious activities, settlements and food habits, which are very strong in religious beliefs, for they were earlier called by the name of tribal society, but at present the government has given them constitutional status and called them by the name of scheduled tribe. According to the 2011 census, 2.89 percent of the state's population belongs to the scheduled tribes, most of whom reside in the plain areas of the state, Udham Singh Nagar, Dehradun. Apart from this, they also reside in the hilly districts of Chamoli, Uttarkashi, Pithoragarh and some in Nainital district. Tehsil-wise, the highest population lives in Dharchula, Munsiyari, Jortimath (Joshimath), Sitaganj, Kichha, Bajpur, Gadarpur, Ramnagar, Nainital, Kalsi, Chakrata and Didihat tehsils. At present, tribal groups live in all parts of the state, but even today, most of the tribes in the state live in hilly and rural areas. According to Census 2011, 90.7 per cent of the population lives in villages, while 9.3 percent lives in urban areas, with which the highest percentage is in Almora, Tehri, Chamoli, Nainital, Rudraprayag and Champawat districts respectively, while Uttarkashi has the lowest population of 3.9 percent living in urban areas. At present, the sex ratio of the Scheduled Tribe community is 929 per thousand males and literacy is 19.7 percent, while 71.50 percent of the community is engaged in agriculture and animal husbandry business, for whose upliftment many tribal upliftment schemes are being run by the government.

The major tribal groups living in the state are mainly divided into four parts.

1. Jaunsar group: mainly Dehradun and Uttarkashi
2. Bhotiya: High Himalayan community Chamoli and Pithoragarh

3. Tharu: TeraiBhabar region Udham Singh Nagar, Nainital

4. Boksa Van Raji: Udham Singh Nagar, Pithoragarh

Jaunsar group- The Jaunsar tribal group is a class belonging to Indo Aryan family which shows its distinct identity with its unique costumes, traditions, socio-cultural diversities and economy. At present, the residence of this tribe is mostly in the north-western part of the lesser Himalayas, Chakrata, Kalsi, Tyuni, Lakhamandal of Bhabar, Jaunpur of Tehri, PargNekana area of Uttarkashi. Most of the Jaursars live in the Bhabar region which is spread over 39 Pattis and 358 revenue villages of the Bhabar region. The language of this group is similar to Jaunsari, BawariDevghari and Himachalidialects and the people of the Jaunsar tribe have been considering themselves worshippers of the Hindu religion since ancient times and Mahasu are devotees of Lord Shiva who also consider themselves descendants of Pandavas and even today live in the patriarchal type of joint families and participate in cultural activities like Vaishakhi, Panch.

Bhotiya Group-TheBhotiya tribe is placed in the non-dwelling Rajput tribe category. In the Pithoragarh district of the state, they are known by the surnames Bhotiya, Marcha, Tolcha, Johari, Shauka, Darmiya, JadBakhariya etc. Presently, the residents of the Bhotiya tribe are in Pithoragarh, Chamali and Uttarkashi districts. This tribe resides mostly in the central and large Himalayan regions of the state. There are 291-gramsabhas of the people of this tribe in the state. The people of the Bhotia community are considered to belong to the Tibetan Burmese language family. In the physical structure of this tribe, a mixture of Tibetan and Mongolian castes is seen in the form of species. Their height is short, their head is big, their face is red, their eyes are small, their nose are flat and their complexion is fair. This tribe is known more for seasonal migration in the state, which is recognized separately in the entire state for winter and summer migration. In food, they use rice, madua, wheat and meat along with pulses, vegetables and milk products. In the same social system, this society believes in a patriarchal Hindu religion, but at present some people have also adopted Buddhism. This tribe worships Bhumyal, Gwala, Bag Rag Chim, Nandadevi, Durga, Kailashpati and Dronagiri for their protection. Along with this, handicrafts, clothes and sheep rearing are adopted as the main occupation. At present, this class is gradually turning towards education and giving more importance to self-employment along with employment in other fields and is trying to propagate Bhotiya culture and art throughout

India through Johar festivals. At present, the government is making many efforts and providing facilities for the upliftment of this tribe.

Tharu group-Tharu tribe resides in Khatima, Kichha, Nanakmatta and Sitaganj areas of Udham Singh Nagar district of Uttarakhand state. At present, 141 villages of this tribe have been settled. The Tharu tribe considers itself to be of the Kirat clan. In physical structure, they are small, yellow in colour, and have broad faces and flat noses, which are included in the Mongol class in human species classification. This tribal community is the largest population community of the Kumaon region and is also the tribal community with the highest number in the state. They do not have any special language or dialect of their own. They use a mixed language and at present have become Hindi-speaking. They use rice, fish, roti, vegetables and pulses in their food. In their social structure, they are divided into several clans and castes. The custom of revenge marriage, the custom of widow remarriage and the joint family system are still prevalent. This tribe completely believes in the Hindu religion. Festivals like Dussehra, Holi, Magh Khichdi, Kanhaiya Ashtami and Bajhar are celebrated with great fanfare. For livelihood, animal husbandry, agriculture and labour work is done. Being settled in the Terai region, they mostly do paddy and sugarcane farming, cow, buffalo and poultry farming. Their other occupations include wood cutting, cottage industry and labour work in industries. Some educated Tharus are already employed in government jobs.

Boksa and Van Raji-Boksa are settled in the Terai-Bhabar region of Uttarakhand state. They have settled mainly in 137 villages in Bajpur, Kashipur, Gadarpur, Dineshpur and Ramnagar of Nainital district, Dugra of Pauri, Vikas Nagar of Dehradun, Doiwala and Sahaspur development blocks. Due to the predominance of the Boksa tribe in Udham Singh Nagar district, it is also known as Bukasad. The Boksa tribe considers itself as Pawar Rajput. This tribe was first settled in the Banbasa area of the state. In their physical structure, they are short in height, have thin lips, flat noses, thick jaw, wheatish complexion and mixed species. In the social system, they are divided into 5 clANSWER. Their society is also collective and patriarchal like Bhotiya and Tharu. The main occupations of the people of the Boksa tribe are farming, animal husbandry and labour. The Raji tribe has the smallest population in the state, which is settled in 7 villages of Dharchula, Kanali, Chhina and Didihat development blocks of the state, whose number was 528 according to the census of the year 2011. Those who consider themselves to be the descendants of Kol-Kirat tribes are also known by the names Vanraut, Banraut, Jungle Ka

Raja etc. In social traditions, they adopt Sang Jangi and Pintha rituals and migration marriage, bride price marriage etc. These people are mostly uneducated but now the new generation is getting educated due to government efforts. In customs, they believe in the Hindu religion, in which Cancer and Makar Sankranti are celebrated with great pomp. They are highly skilled in their woodcraft and most of the people of the Vanraji tribe are still leading a nomadic life, due to which they are becoming victims of malnutrition and their number is decreasing day by day.

9.3.5 Settlements and Patterns

Settlements are those places where mainly availability of climatic elements (temperature, rainfall), natural and cultural security, surface similarities and availability of water are present in geographical conditions. Elements of the natural environment of the physical aspect, i.e., regional location, landform, amount and direction of the climatic gradient (sunny, shady), mineral wealth, soils, aquatic resources, natural vegetation, flora and fauna are included. In the cultural environment, adjustment processes, state of technology, the progress of science, art, literature, handicrafts, style of crafts, philosophy, religious beliefs, superstitions, belief in witchcraft, social traditions, code of social behaviour, cultural contacts with other regions and political rules are present, where human settlements are established. According to the settlement, shape, distance and human activities of those settlements, human settlements are classified based on urban and rural characteristics. Based on the physical characteristics of the state and the structure of human settlements, human settlements are divided into two main types in the state.

1. Rural settlement
2. Urban settlement

1. Rural settlement- The physical structure, climate and primary activities of the state play an important role in the study of rural settlements in the state. The rural pattern of settlements is determined by mountain structure, village structure, physical village layout and external appearance, functional structure, land use, social structure, and various demographic aspects of the population. In the mountainous regions, the establishment of settlements in the form of projections and sloping shapes started from the time of human settlements and it is still the same even though changes have been made in the construction material on a large scale. Since time immemorial, the form of settlements in the mountainous regions has been similar to the ecology of the Himalayan regions, because being part of the Himalayan region, due to extreme cold and

snowfall in the upper and middle regions, most of the houses have been built with small and steep slopes, wood and stones, whose roofs have mostly been made of stone, grass and straw and the settlements were of two types, seasonal and permanent.

At present, the size and shape of houses in the middle and Shivalik Himalayan ranges have started becoming bigger with flat roofs. Which is not by the ecology of the state and is also not suitable from the point of view of human health. Being a hilly region, due to a decrease in human population, the houses here are scattered and settled far away or in some places they are also settled in the form of groups. This form of housing is seen in all the 11 hilly districts of the state, whereas in the plain areas, even today, raw sloping houses are built by the poor and rural communities. In the state, due to technological development and climate change in the last 2-3 decades, the size and shape of houses, construction materials, technological expansion and access to modern facilities have brought about changes in both the hilly rural and urban residential forms, due to which the traditional form of rural settlements has started changing like the plains. Based on the traditional distance of the houses, they have been divided into four types,

1. Compact settlement 2. Semi-compact settlement 3. Pally settlement 4. Dispersed settlement

2. Urban settlement - In the plains, the form of human settlements has been relative to agricultural land. Most of the farmer families have built their houses and cattle sheds in the cultivable land itself. The size of the houses is bigger and higher than in the mountainous areas, whereas the size and construction material of the houses of the poor community settled in rural areas are still seen in traditional form. The middle and upper-class communities have made extensive changes in the size and construction material of the houses, which completely incorporates modernity in the rural areas, the reason for which can be said to be urban areas due to urban and industrial development, due to concrete and multi-storey houses have started being built in rural areas like in big cities. With the rapid expansion in the urban areas, both planned and unplanned settlements have been established in all small and big urban units which are several storeys high. Especially these settlements have been formed in the cities situated in the plain areas. Many problems have arisen and there is no possibility of a problem solution and human settlements are continuously being created on agricultural land. Because physically the land here is more useful for the construction of human settlements, thus the form of human

settlements is found to be different in the plain and mountainous areas of the state. Which is ultimately determined based on the geographical characteristics of the state due to which different patterns of urban and rural settlements are seen culturally. The classification of urban settlements of the state is mainly divided into the following five types. **1.** Nagar Panchayat **2.** Municipality **3.** Municipal Corporation **4.** Notified Area **5.** Cantonment Area

Patterns of settlements- The patterns of settlements in Uttarakhand are also determined based on geographical, social, economic and environmental conditions of the state, which are mainly divided into rural and urban patterns.

1. Patterns of rural settlements- The patterns formed by the settlements found in both mountainous and plain areas are mainly classified as follows.

1. Parish pattern
2. Terraced pattern
3. Linear pattern
4. Compact pattern
5. Cluster pattern
6. Terai concentrated pattern

2. Patterns of urban settlements- The patterns of urban settlements in the state are determined based on population distribution, economic activities and historical background, which are mainly divided into 6 types.

1. Linear pattern
2. Square strip pattern
3. Rectangular pattern
4. Fragmented pattern
5. Unplanned amorphous pattern
6. Stair-shaped pattern

9.4 SUMMARY-

Being a mountainous state, Uttarakhand's population structure, organization and mobility are not found to be by the geographical conditions of the state. Since Uttarakhand is a completely Himalayan state, 86 percent of which is mountainous, it absorbs the Himalayan climate. 30 percent of the total area of the state is not suitable for human settlement due to snow cover, rocky and 64 percent forest area, due to which the population resides in a limited area. The population structure and composition of Uttarakhand are based on the geographical, geological and climatic structure of the state as well as religious, and socio-economic aspects, as a result of which the population structure is found to be completely different in both quantitative and qualitative forms in the mountainous and plain areas. Reliable collection of population data in the state was first started during British rule which was based on revenue unit in 1841. Like other Himalayan states of the country, in the initial period, the rate of population growth in Uttarakhand state has been

very slow, for which the adverse geographical conditions, natural disasters, customs and social systems have generally been responsible. An analytical study of the population pattern of the state shows that from the year 1901 to the year 2011, the population has always been positive in all the years except the year 1921.

The rapidly increasing population of the state explains the mobility of the population of the state, which has increased to 81,06,426 lakh from the year 1901 to the year 2011. At present, with the increase in population, the form of mobility of the population has also started changing by migration in the form of permanent and temporary residence. Similarly, the tribal groups in the state, which have a distinct identity in the entire state due to their social and cultural uniqueness, mainly reside in Jaunsar, Tharu, Boksa, Bhotia and Van Raji, whose some of their physical characteristics and customs are different from the people of other regions, who got separated after being left out of the mainstream of development, who are currently being taken forward by the government by improving the level of preservation and education. Based on the physical characteristics of the state and the structure of human settlements, the human settlements here are mainly divided into two parts. Rural, hilly and plain settlements and rural and urban settlements based on which the settlement patterns are also determined in many types (linear, square, rectangular, fragmented, unplanned amorphous and stepped pattern).

9.5 GLOSSARY

Population Structure:	In a population study, total population, male-female ratio, literacy, population density and age structure are population structure.
Population Mobility:	The study of changes in the population structure of the native places due to the annual increase in population and migration.
Population Study Aspects:	For the geographical study of population, the population of humans were, male-female ratio, percentage of children, young, old i.e. age composition, population engaged in different occupations, and rural and urban ratio are the main aspects of a population study.
Population Growth:	The number of people growing in proportion to the birth and death rate in a decade is population growth.

Population Density:	The number of people living per square kilometre shows the population density.
Population:	Population is the mathematical number of people living in a nation, state and village, which includes men, women, children and old people.
Sex ratio:	The sex ratio is the ratio of the number of women per thousand men.
Literacy:	According to the Indian Census, a person above the age of seven years who can read is called literate.
Tribes:	Tribes are those human species which provide their unique identity among humans due to their biological and cultural characteristics and are economically weak and deprived of the stream of development such as Bhotiya, Tharu, and Boksa.
Rural settlements:	Rural settlements are those human areas which are settled in the mountainous and plain areas of the state, whose main occupation is farming, animal husbandry and labour.
Urban settlements:	Urban settlements are those dense settlements of the state where there is a predominance of secondary and tertiary works. The forms of housing where buildings have been built with many floors are urban settlements.
Settlement Pattern:	The form of cultural landscape formed by rural and urban settlements which are located in the form of roads, railway lines, hilly terraced fields and scattered and clustered settlements is known as settlement pattern.

9.6 ANSWER TO CHECK YOUR PROGRESS

1. The hilly structure of Uttarakhand state does not match the population growth and mobility as per the geographical conditions of the state.
2. 86% of the Himalayan state of Uttarakhand is included in the hilly category.
3. The total geographical area of the state is 53,483 sq km.
4. From the year 1901 to 2011, only the year 1921 has had negative growth.
5. The population density of the state has been 189 persons as per the census of 2011.
6. The tribal population contributes 3% to the population structure of Uttarakhand. □ Five tribes Jaunsari, Tharu, Raji, Buksa and Bhotia reside in the state.
7. Under the primary category, about 49.8 percent of the population in the state is engaged in primary works of the state.
8. Uttarakhand Rural Development and Prevention Migration Commission was earlier named Uttarakhand Migration Commission.
9. About 51.8 percent of the population resides in 14 percent of the plain area of the state.
10. The major tribal groups residing in the state are mainly divided into four parts.
11. The Bhotia tribe is placed in the semi-nomadic Rajput tribe category.

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9.8 TERMINAL QUESTION

1. Long Answer Question

- Q- 1. Explaining the population structure or composition of Uttarakhand state, give a detailed analysis of the population growth of the state?
- Q-2. What do you understand by population mobility, describe the major tribal groups of Uttarakhand in detail?

2. Short Answer Questions

- Q- 1. What do you understand by population structure?
- Q-2. Describe the major elements to be included in the study of population composition?
- Q-3. Write an essay on the population distribution of Uttarakhand?
- Q- 4. What do you mean by scheduled castes and unscheduled tribes?
- Q-5. Describe the main characteristics of tribes?
- Q-6. Describe the Jaunsar tribe?
- Q-7. What do you understand by settlements, what is the role of geographical diversity in the settlements of Uttarakhand?
- Q- 8. Describe the rural settlements?
- Q- 9. What is the functional difference between urban and rural settlements, describe?
- Q-10. Describe the settlement patterns?
- Q- 11. Describe the Tharu, the largest tribal group of Uttarakhand?

3. Multiple Choice Questions

- Q- 1. What percentage of the total area of Uttarakhand state is covered by snow-covered and rocky terrain?
- a) 20 percent
 - b) 30 percent
 - c) 40 percent
 - d) 50 percent

Answer: b

Q- 2. What percentage of total growth was recorded in the rural population in Uttarakhand state from 1901 to 2011?

- a) 410.50 percent
- b) 411.50 percent
- c) 416.10 percent
- d) None of the above

Answer: a

Q- 3. Which was the fastest phase of population growth in Uttarakhand?

- a) 1901-31
- b) 1931-51
- c) 1951-81
- d) 1981-2011

Answer: d

Q- 4. According to the Census 2011, what was the population density in the plains of the state?

- a) 189 persons
- b) 247 persons
- c) 188 persons
- d) 289 persons

Answer: b

Q- 5. What is the percentage of the tribal population in the population of Uttarakhand?

- a) 3 percent
- b) 6 percent
- c) 8 percent
- d) 10 percent

Answer: a

Q- 6. What is the total percentage of the population engaged in tertiary occupations in the state?

- a) 39.7 percent
- b) 40.20 percent

- c) 52 percent
- d) 26 percent

Answer: a

Q- 7. According to the report of Uttarakhand Rural Development and Migration Prevention Commission, how many villages have become vacant from the year 2018 to 2022?

- a) 1,050
- b) 1,058
- c) 1,600
- d) 1,700

Answer: b

Q- 8. According to the census of the year 2011, what percentage of scheduled tribes in the state live in rural areas?

- a) 90.7 percent
- b) 99 percent
- c) 97 percent
- d) 86 percent

Answer: a

Q- 9. Jaunsar group comes from which tribal category?

- a) Tibetan
- b) Mongolian
- c) Indo Aryan
- d) Dravidian

Answer: c

Q- 10. What are the other names of the Bhotiya tribe?

- a) Marchha
- b) Johari
- c) Shoka
- d) All of the above

Answer: d

Q- 11. What are the main settlements found in Uttarakhand?

- a) Rural settlement
- b) Urban settlement
- c) Both of the above
- d) None of the above

Answer: c

UNIT 10: AGRICULTURAL CHARACTERISTICS AND TRENDS; LAND HOLDING; LAND REFORMS; CROPPING PATTERN; IRRIGATION; AGRICULTURAL PRODUCTIVITY AND AGRICULTURAL REGIONS.

10.1 OBJECTIVES

10.2 INTRODUCTION

10.3 AGRICULTURAL CHARACTERISTICS AND TRENDS; LAND HOLDING; LAND REFORMS; CROPPING PATTERN; IRRIGATION; AGRICULTURAL PRODUCTIVITY AND AGRICULTURAL REGIONS

10.4 SUMMARY

10.5 GLOSSARY

10.6 ANSWER TO CHECK YOUR PROGRESS

10.7 REFERENCES

10.8 TERMINAL QUESTIONS

10.1 OBJECTIVES

After reading this unit you should be able to:

- To study the physical and cultural characteristics of the state of Uttarakhand.
 - To explain the major agricultural products of the state in detail.
 - To study the agricultural methods and irrigation resources.
 - To present suggestions and strategies for the possibilities of expanding the agricultural resource area.
-

10.2 INTRODUCTION

Agriculture is the biggest basis of living for modern Homo sapiens humans. In the state of Uttarakhand also, it is the direct source of livelihood for most of the residents and an indirect source of livelihood for some people and has been the natural occupation of all the residents of the state. Because agriculture is the physical characteristics of the state, topography, drainage pattern, climate, soil, vegetation, means of irrigation and socio-cultural elements are not directly or indirectly suitable for agricultural work, yet the community here has kept the agricultural work alive for a long time, whereas the geological, climatic and economic elements do not help in making the agricultural work successful even a bit in the mountainous areas of the state. The residents of this place have been successful on a large scale by creating human knowledge and technological development in the natural possibilities of agricultural development in the valley and plain areas. Physically, the only suitable place for agriculture in the state is the Terai land, where the productivity of crops is affordable compared to the cost.

On the other hand, in the Shivalik mountain foot Bhabar region, the work of growing all the crops through irrigation has been going on for a long time. The agricultural land area in the state's total area is only 12.6 percent, which includes 93.1 percent of the state's net sown area. The remaining part is unsuitable for agricultural work because the mountain structure, the abundance of hills, forests, snow and forest areas and wild animals make it impossible to do agricultural work. Directly 70 percent of the population in the state is still engaged in agricultural work, while in the mountainous areas, it is being finalized in terraced fields and the plains, and farming business is being finalized in a modern form. Although the size of the farms is small (less than one hectare), agricultural activities are being carried out continuously here. While there is a difference in the agricultural land pattern of the state, the climatic variations affect the

agricultural resources the most. Due to the harsh and dry climate, in the mountainous regions, where food crops are traditionally grown, on other hand, horticulture, vegetables, pulses and coarse grains are also being grown by the mountainous community for their consumption for a long time. Whereas the physical conditions are not at all conducive to agriculture. On the other hand, the production of naturally occurring agricultural food grains in the plains, such as wheat, paddy and commercial crops such as sugarcane, mustard and vegetables, per hectare is many times more than in the mountainous regions. Under the agricultural crop pattern, Rabi and Kharif crop patterns are mainly being adopted in the state in traditional and modern times, but due to urban and urban development, the Zaid crop pattern is now being adopted in the Terai regions. Rabi crops mainly include wheat, barley, mustard, gram, peas, lentils; vegetables include potato, onion, cabbage and green vegetables; Kharif crops include paddy, maize, millet, sorghum, mada and jhangora; pulses include horse gram, soybean, cowpea, black gram, kidney beans; and vegetables only in hilly areas, cabbage, capsicum, tomato, kidney beans, ladyfinger, ginger, gaderi, arbi; and Kharif crops (Terai region) include pumpkin, ridge gourd, bottle gourd, bitter gourd, watermelon, cucumber and ladyfinger.

Apart from crops, horticultural products such as apple, peach, apricot, plum, lemon, malt, and walnut are produced in the hilly areas of the state; and mango, guava, litchi and gooseberry fruits are produced in the plains. Apart from this, tea and cinnamon plantations have also been established in the state in hilly slopes and moist areas, which demonstrate the innovations of modern agriculture. Agricultural types in the state are divided into Talao, Upaaron and Katil based on the production capacity of agricultural land i.e. soil. The level of agriculture in the state is low compared to other Himalayan states of the country because the agricultural system is completely dependent on irrigation and rainwater, due to which more than 80 percent of agriculture in the mountainous areas is irrigated by rain. Due to this the farming community of the state faces major challenges in agricultural work and production every year. High labour and cost in agricultural products, lack of agricultural facilities, crop damage by wild animals, lack of irrigation water, lack of roads and agricultural markets, agricultural land barrenness and farmers' reluctance towards agriculture are currently acting as the biggest obstacles for the agricultural business of the state, due to which a large amount of cultivable land in the mountainous areas has become barren and desolate.

On the other hand, the fertile land of the plains is being acquired for housing and other basic infrastructure development, due to which the food production in the rich state is decreasing. Whereas 17 types of organic products produced in the mountainous areas of the state have been given Geographical Indicators Certificate by the State Government, which are famous in all parts of the country along with the entire Himalayan regions due to their taste and medicinal properties. Many efforts being made by the government to stop the commercial and barrenness of agricultural land are not being very successful in the agricultural sector.

10.3 AGRICULTURAL CHARACTERISTICS AND AGRICULTURAL TRENDS, LAND HOLDINGS, LAND REFORMS, CROPPING PATTERN, IRRIGATION, AGRICULTURAL PRODUCTIVITY AND AGRICULTURAL AREA.

10.3.1 Uttarakhand Agriculture and Agricultural Characteristics

Like our country India, Uttarakhand is also an agricultural state where more than 70 percent of the population of the state is engaged in agriculture and agriculture-related activities as a livelihood resource, which contributes about 23.4 percent to the state's gross domestic product. Whereas only 13.52 percent of the total agricultural land area of the state is being used for agricultural purposes because the geographical conditions of the state are mountainous and plain, agricultural land is also used in different ways, such as agriculture being done in terraced fields in the mountainous areas, while in the plains, due to the plain land, modern agriculture has become possible, which is suitable for the production of both food grains and commercial crops, while under mountain farming, horticulture is the main commercial agricultural crop, other agricultural products reach the big markets only in nominal quantities. The rest of them are not able to fulfil the demand in local small markets. Uttarakhand is famous for biodiversity due to the assimilation of both mountainous and plain characteristics, which can produce many species of agricultural produce that is why most of the farmers here adopt the mixed cropping format. In the mountainous region, along with being traditional, the agricultural system is grown even today through traditional seeds, which are seed species preserved for several hundred years, in which many types of medicinal properties are present, which are also capable of withstanding natural disasters, most of them are grown in the form of dry agriculture.

On the other hand, in the plains, agriculture is being done through modern seeds and irrigation means, which is producing food grains on a large scale for the residents of the state. Due to most of the state being mountainous, poor conditions are seen in the field of farming and production, in the residents here have to face many types of problems in the field of agriculture. The main points in the major agriculture-related problems of the state can be described as follows.

1. Geographical challenges- Mountainous and sloped structure, flood, landslide, snowfall and drought problems.

2. Limited and small land area, land fragmentation- Mountainous regions have small farms inheritance-related divisions and scattered farms.

3. Irrigation problem- While sufficient irrigation water is available in the plain Terai region, there is a water shortage in the Bhabar region and dry farming is mostly done in the mountainous regions.

4. Migration and urbanization- Due to migration from mountainous regions to plains in the state, agricultural land in the mountainous region is becoming barren, while in the plains, due to residential and urban expansion of agricultural land, shrinkage in agricultural land has become the biggest problem of agricultural land.

5. Lack of agricultural infrastructure development- Lack of development of basic infrastructure of agriculture according to geographical conditions and climate such as horticulture, wild animal control, lack of agricultural service centres, agricultural medicine and lack of market and transport facilities etc.

6. Climate change- For the last 2-3 decades, the effects of climate change have been seen more in agriculture in the state, due to which diseases in crops and changes in the weather cycle have caused more diseases in crops and a decrease in crop production and decrease in crop productivity.

7. Prevalence of traditional agriculture- Even today, in the mountainous regions, 90 percent of the farming community produces traditional crops through traditional methods, due to which the cost of the crop is high and farmer savings are low, due to which farmers are abandoning agriculture and moving towards other works.

8. Lack of crop diseases and seeds- Along with modern farming in the plain areas of the state, many types of diseases and soil-related problems are arising in the crops. Apart from this, the

agricultural crisis is arising on a large scale due to farmers not getting seeds, fertilizers and medicines on time.

9. Lack of government services- Only the big farmers of the state are taking advantage of most of the agricultural services, while medium and small-scale farmers do not get the full benefit of government agricultural services and schemes.

10. Soil erosion- Due to mountain structure and steep slope, thousands of tons of soil of the state flow into the river every year which is destroying the most fertile layer of soil, while a 1 cm thick layer of soil takes more than 100 years to form.

Thus, many types of problems related to agricultural land and agriculture are arising in the hilly and plain areas of the state. No farmer is willing to take the risk of investing in the agricultural resources of the state. Along with the lack of basic agricultural services, the changing weather and the menace of wild animals are becoming a big problem for the farming community at present. Whereas, in the plain areas, high cost and commercial use of agricultural land is emerging as the main problem. 10.3.2 Agricultural Trends

The geographical and biological diversity of the state of Uttarakhand provides possibilities for the production of all types of crops. While in the hilly areas, farming has been carried out for generations in terraced fields using traditional seeds, with animal and human labour, farming is carried out in both traditional and modern forms in the valley areas, while in the plains, modern farming is carried out with the help of humans and machines and all innovations are being incorporated in agricultural production. Thus, the agricultural trends in the state are changeable, and are ready for adjustment with time, even though seasonal and climatic changes are not able to bear the changing agricultural trends. In the hilly areas, there are trends of horticulture and animal husbandry along with food crops, while in the plains, commercial crops, horticulture and fish production, poultry farming, and advanced animal husbandry, i.e. dairy production, are being given priority. Approximately 90 percent of the cultivable land in the plains is used for farming, whereas 90 percent of the land in the hilly areas has turned into barren land at present. Being a hilly region, change in agricultural trends is a natural trait, thus the agricultural trends being carried out in the state can be understood as follows.

1. Traditional Farming Vs Modern Farming- From human settlement in the state till the present time, traditional farming is done especially in the hilly areas, in which traditionally human labour and dependence on oxen and local agricultural equipment like local wooden

plough, hoe, spade, sickle have been prominent. Organic cow dung manures have been the main fertilizers in which crops were grown traditionally from local seeds of wheat, barley, sorghum, millet, maize, mada, unirrigated chetti rice, jhagora, pulses (Bhat, soybean, horse gram, black gram), potato, arbi, gaderi, turnip seeds, whereas at present, modern agricultural equipment, tractor, thresher, weeder, iron plough, spade, shovel, khurapi, improved high productivity seeds are being used up to 90% in the plain areas, modern irrigation techniques, agricultural experts and commercial crops wheat, transplanted rice, horse gram, marigold, Glodollia flower, strawberry, hemp, green vegetables, horticulture production and use of modern irrigation means canals, multipurpose irrigation tanks, pipelines and electric pumps and use of chemical fertilizers, medicines have started in the plain areas and it is also slowly spreading in the mountainous areas. 2. Trends of food grain crops vs. commercial crops- Food grain crops were mainly grown in the Rabi and Kharif seasons in the state. Rabi crops included wheat, barley, peas, lentils, potatoes, gram, radish, onion, garlic, mustard and Kharif crops included maize, paddy, mada, sorghum, millet, koni, soybean, horse gram, urad, Bhat, kidney beans, arbi, turmeric, gadri, ginger, desi bhindi, amaranth, ogal, turnip, bottle gourd, pumpkin, cucumber, chilli, brinjal, ridge gourd. Commercial crops included apple, peach, plum, mango and litchi. However, at present, apart from the above-mentioned food grain crops, off-season paddy and cultivation of vegetables and flowers in playhouses have been promoted. Also, the production of horticultural crops in warm regions in mountainous regions is making horticulture successful even under the effect of climate change. Thus, major changes in farming trends are taking place in the state according to natural and human needs, due to which efforts are being made at the national level to promote organic farming in the hilly areas, while on the other hand, for the rapidly increasing population in the plains, the production of crops is being continuously increased by using modern technology and fertilizers.

10.3.2 Agricultural land

The state is poor in terms of agricultural land despite having both Himalayan hills and plains. The total agricultural area is 7.41 lakh hectares in the average size of land holdings is 0.98 hectares, which is about 13 percent of the total agricultural area of the state which along with agriculture, and animal husbandry is also done. The gross sown area is 11,88,462 hectares in which 4,91,349 hectares area come under the hilly area, while in the plain districts, 2,62,362

hectares area is included under the total net sown area. Division-wise gross sown area in the agricultural area: Cultivation is done in 521,460 hectares in the Kumaon Division and 666,602 hectares in the Garhwal Division. In the net sown area of the state, 43.9 percent area under Kumaon Division and 56.1 percent area under Garhwal Division is included in agricultural land. Nearly 36 percent of the cultivable land of the state is in Haridwar, Udham Singh Nagar, Nainital and Dehradun districts under two crops wheat and paddy. Thus, due to the physical and cultural diversity of the state, agricultural land in the state is being used on a large scale for horticulture, and tea cultivation apart from agricultural food crops. Due to the physical diversity in the state, there is a difference in the agricultural area district-wise, which is the biggest reason for the failure of agricultural land. Determination of agricultural land in the state is done based on the nature of the soil of agricultural land in plain areas and the availability of water resources in mountainous areas. The land is classified mainly into 3 types.

1. Talau land- This land is found in plain valley areas where there is sufficient water for irrigation. It is three times more fertile than upland land.

2. Non-irrigated land- This is the unirrigated land of mountainous areas which is considered to be one and a half times better than the Abbhal land. It is mostly found in the central and Shivalik region of the state.

3. Ijran land- This is an immature land area where natural vegetation and horticulture can be developed. This land is not suitable for cultivation. It has an abundance of stones.

10.3.4 Agricultural Land Reforms

Agricultural land reforms are an important initiative in the context of Uttarakhand state whose objective is to increase the agricultural land use of the state, agricultural management, increase in crop productivity, promotion of organic farming and increase agricultural cover in the state by achieving agricultural goals in the form of sustainable development. Since most of the population of the state is dependent on agriculture, land reforms are very important for bringing stability to the residents of the state. This work was started by the British government even before the formation of the state in the form of land reforms. The first land reform in the state was done in the Gorkha period in 1812 in the form of land settlement.

While till date, 12 land reforms have been carried out in the state, in which wicket settlement was the first scientific method, by adopting which the agriculture of the state was divided into 5 parts (Talau, Uprau, Abbhal, Aparau Doyam and Izran, Kantil) and the inheritance

was registered in the name of the land owners. The last land settlement in the form of land reform in the state was done in 1960-1964, in which land up to 3 acres was exempted from land revenue liability, due to which 90 percent of the farmers of the state were freed from rent liability. Due to the exemption in rent to small farmers in agricultural land, farmers in most of the areas had abandoned farming and land, due to which barren land expanded on a large scale in the state, which is still going on. Before the formation of the state, the total size of active land holdings was 9.26 lakh which has now reduced to 8.91 lakh hectares in which a reduction of 3.5 percent has been registered which is being seen more in the hilly areas. Till now 35 thousand land holdings have become barren in the hilly areas of the state for which arrangements for re-settlement should be made and land should be provided to the landless so that agricultural land and forest cover can be increased. At present, the government is taking up the land of the hilly areas for leaching and is doing the work of horticulture development, while on the other hand, many types of welfare schemes are being implemented to bring back the migrated farmers to farming. Along with this, work is being done to bring a provision like land law in the state to stop the commercialization of cultivable land.

Apart from this, for agricultural land improvement in the plains, along with organic farming, a ban is being imposed on the construction of houses on agricultural land. Along with this, the state government is providing financial assistance to farmers for the development of irrigation systems, water conservation, horticulture on slope land and medicinal farming in agricultural reform for land conservation under the Pradhan Mantri Kisan Samman Nidhi Yojana, Kisan Loan Waiver Scheme and for organic farming development, the main objective of which is to improve the economic condition of farmers, agricultural land conservation, increase in agricultural productivity, horticulture and sustainable agricultural expansion, technological inclusion for land reform, the results of which are gradually being seen, as many farmers in the hilly region have again adopted farming as a traditional occupation by returning home.

10.3.3 Agricultural Crop Pattern

The traditional crop pattern has been a widely followed form of growing crops in the state of Uttarakhand for a long time, which is not provided by any science or trained class but is the result of the filtration done by many generations through the local people living in difficult conditions, being able to do agricultural work following the physical conditions, ecology,

biodiversity and climate of the Himalayan region, leaving its influence in most of the Himalayan states. Thus, the Himalayan traditional agricultural pattern revolves around the climate of the Himalayas, because it has been an integral part of the Himalayan society and environment, which forms an interconnected system between agricultural work and animal husbandry.

The cropping system of Uttarakhand is a process that follows a mixed crop pattern, in which the agricultural crop area is used by growing crops separately and in a mixed form, which makes farming possible even when the seasonal conditions are not favourable. In this way, a strong pillar of livelihood in Himalayan regions has been provided to Himalayan residents free of cost through nature, which is continuing uninterrupted, even though the pattern of agriculture in the state has started changing due to changes in the Himalayan climate and traditional means of living and settlement patterns of the local community in the last four-five decades.

Being a Himalayan region, the traditional agricultural system here mainly adopts Rabi and Kharif crop cycles, but at present, the Zaid pattern is being adopted in the plains, apart from this, in the form of mixed farming, plantation agriculture, floriculture, medicinal farming, seasonal farming, advanced animal husbandry, poultry farming and beekeeping have also become integral parts of agriculture. In the state, the Rabi crop cycle is considered to be a very busy agricultural pattern, which runs from October to April to May, while the Kharif crop period is from May-June to October-November and Zaid is from February to May-June. The sowing and harvesting of off-season crops is done throughout the year, especially in the plains. According to agricultural experts, the sowing and production of crops that take less time is being done by progressive farmer groups and other farmers throughout the year by constructing greenhouses and using artificial methods and medicines in irrigated areas. The crop pattern of the state of Uttarakhand has been influenced by the state's topography, agro-climatic conditions and the resources available in the state. The main crops of the state are wheat and rice, whereas sugarcane is the main agricultural product among commercial crops. In the state, wheat is grown in 29 percent, paddy in 24 percent and sugarcane in 10 percent of the land.

The major patterns being adopted as agricultural crop patterns are classified as follows.

1. Rabi Crop Pattern
2. Kharif Crop Pattern
3. Zaid Crop Pattern
4. Horticultural Agricultural Pattern

Rabi Crop Pattern- Based on the climatic characteristics of the state, the Rabi crop starts from the first week of October in the mountainous region and in the plains from November which continues till April, under which mainly wheat, barley, gram, lentil, pea, mustard, potato and onion vegetables are grown. **Kharif Crop Pattern-** Sowing of Kharif crop depends on the onset of pre-monsoon and the arrival of monsoon in the state, especially in the hilly areas where there is a shortage of irrigation water and starts from May-June and continues till September-October, in which mainly Chaiti paddy hilly areas, maize, paddy, Kouda, Maduwa, Jhawra, Kauni, pulses soybean, Bhatt, Lobia, Rajma, Gahat, Arbi, Gaderi, Turmeric, Bhindi and Radish are cultivated mainly, whereas sugarcane is the main crop in the plain areas.

Zayed Crop Pattern-The Zayed crop pattern is done in the riverine region of the state in the Bangar and Khadar areas of the river which is completed from March to June, under which gourd, ridge gourd, cucumber, pumpkin, bitter gourd, muskmelon and watermelon are cultivated, whereas in the Bhabar region, bhindi vegetable is also grown at some places. **Horticulture farming pattern-** Horticulture has been adopted in the state for a long time, which was earlier limited to self-use only. But at present, the horticulture products of the state have made their mark in the international market of the nation. Also, with the support of the state government, the farming community here has achieved great success in the field of horticulture. Where apple, apricot, plum, pear, sapota, lemon, walnut and peach are being cultivated in the mountainous region, special efforts have been made for the horticulture of mango, litchi, papaya, guava, cinnamon and amla in the plains and success has also been achieved on a large scale. Apart from this, medicinal (belladonna, geranium) and tea gardens have been established in many parts of the state.

Many traditional horticulture crops have been affected due to the increase in temperature due to the effect of climate change in the upper and middle Himalayas, in place of which horticulture crops that tolerate higher heat and produce more fruits have started being grown. But in the present times, the Himalayan agriculture system of the state is changing rapidly. Farmers are moving towards modern advanced crops leaving the traditional crops, which is not favourable from the point of view of human health and farming because the mountainous region of the state is suitable only for the cultivation of traditional crops. Other modern crops cannot be grown here for a long time. Therefore, the state government is trying to declare it an organic agriculture state, while the plains are suitable for modern farming.

10.3.4 Irrigation Resources

Due to the mountainous and plain Bhabar-Terai structure of the state of Uttarakhand, the irrigation system of the state could not be developed even after the availability of sufficient water resources here, because except for the plain land, the state has river valleys, hills, steep slopes and the lack of water resources is the biggest hindrance in the irrigation system. While in the plains, irrigation is being done through tube wells and irrigation canals, in the Terai region, irrigation is being done through boring and artisan wells. Also, irrigation is being done by creating small reservoirs in the rivers. Whereas, the huge dams being built in the mountainous region are not giving much benefit in the field of irrigation. Instead of dams, irrigation work is being done in most of the areas of the state through small drains and raw canals from continuously flowing ravines for a long time. In the same Bhabar region, the irrigation needs of the Bhabar and Terai regions are being fulfilled by taking out canals from the rivers, and due to uneven geographical structure, modern means of irrigation have not been developed in many parts even today.

Especially in the mountainous regions, most of the means developed by modern technology have not been very successful because they have become more expensive and have become more burdensome than the carrying capacity of the farmers due to lack of electricity supply. Thus, even today, traditional irrigation water resources such as continuous drains, springs, ponds, lakes, rivers natural water sources etc. are being used mostly in the state.

The main means adopted under irrigation means in the state are described as follows.

1. Canals- Canals are the first means of maximum irrigation in the state of Uttarakhand. Till the current year 2024, irrigation work is being done in the state through 13335.12 km long canals, which mainly Upper Ganga Canal 30 km area in Haridwar, Sharda Canal in Tanakpur and Khatima of Champawat, Jamrani, Haldwani and Golapar area, Ramganga Canal Kotdwar, Kosi Canal Ramnagar, apart from this, irrigation canal has been constructed in the Terai region by laying a network of canals from Nanak Sagar, Haripura, Baur, Dhora reservoirs.

2. Tubewells - After canals, the second biggest means of irrigation in the state is tubewells which are an electricity-based scheme in which irrigation work is done in the Terai and Bhabar regions of the state by extracting underground water with the help of an electric motor. The work of converting the Bhabar-Terai land into 100% irrigated land has been done with the help of tubewells in the state. Currently, 1725 tubewells have been installed by the state government and

private individuals, besides this, irrigation work is also being done with the help of a boring, Samarsewell motor in the Terai region.

3. Lakes- At present, irrigation work in the areas around the lakes situated in the mountainous regions of the state is being done through canals which are useful only for limited areas because due to the low water holding capacity in the lakes, it is not possible to carry out irrigation work on a large scale. The major irrigation lakes are Bhimtal, Khurpatal, Naukuchiatal, Sadiyatal, Harishtal, Dodi Tal and Nichketatal.

4. Gul and Gadhera- Irrigation work is being done by taking out many raw gullies from the continuously flowing gullies flowing in the mountainous regions of the state which supply irrigation water in a limited length and are used in small areas. It is the oldest means of irrigation in the state which is used today in all the mountainous regions of the state.

5. Multipurpose Water Storage Tanks - These have been built by various departments of the state government around small natural continuous flowing water sources to promote agriculture and conserve water in the hilly areas of the state, whose water holding capacity ranges from 10 thousand litres to 52,000 litres. At present, such small irrigation tanks are being constructed in all agricultural irrigated areas through the Gramya World Bank-funded scheme.

As a part of irrigation resource development in the state, by the year 2022-23, 56, 625 boring pump sets, medium depth tube wells 731, Dam 1230, irrigation tanks 41,467 irrigation canals 31929 km and 51 solar lift schemes have been prepared for agricultural irrigation. 10.3.7

Agricultural Production

In the state of Uttarakhand, crops are produced mainly from the crop products of Rabi and Kharif crops as well as horticultural crops, which mainly include wheat, paddy, maize, gram, peas, lentils, potatoes, mustard and onion etc., through which the production and demand of crops is estimated every year. The production capacity of the state's crops is determined by the weather and the amount of rainfall here. If the rainfall and other climatic factors are favourable, then there is a good production of crops. If the seasonal conditions are unfavourable, then its effect is seen on a large scale in farming and agricultural production. In the last 10 years, due to the reduction of about 130 hectares of agricultural land area in the state, there has been a decrease in the production of food grains. Among the main crops, Maduwa and Jhangora are grown more in the mountainous areas, whereas wheat, paddy and sugarcane are cultivated more in the plains. While apple, apricot, plum, peach, walnut and lemon are mainly grown in the hilly

horticulture products and mango, litchi, guava and papaya are mainly grown in the plains. Apart from this, pulses and vegetables have also being grown for commercial use for many years. The production of major food crops in the state from the year 2012 to the year 2023 is made clear in the following table 10.1. It has been grown for commercial use for many years.

Table No. 10.1

Year	Agricultural Area in hectares MT	Crop production	Productionper hectare MT
2011-12	909.305	1804.03	1.98
2012-13	898.974	1811.84	2.02
2013-14	872.75	1775.08	2.03
2014-15	875.38	1612.96	1.84
2015-16	886.78	1756.38	3.03
2016-17	887.88	1874.50	2.16
2017-18	842.389	1920.590	2.28
2018-19	814.833	1860.206	2.283
2019-20	806.681	1892.029	2.345
2020-21	782.969	1976.631	2.525
2021-22	751.384	188.652	2.511
2022-23	753.014	177.473	2.357

Source: Agriculture Department Uttarakhand

Analysis of the above table shows that the production of various food crops in the state has been gradually decreasing since the year 2021 as compared to the increase every year, while many corrective works are being done by the government and non-government organizations in the agricultural sector.

10.3.5 Agricultural Problems

The agricultural problems of Uttarakhand are emerging from the physical features of the state and the rapidly increasing population. The state which was known as an agricultural state is now completely plagued by many agricultural problems like migration, disaster due to changes

in seasonal elements, agricultural land contraction, agricultural barrenness soil erosion etc., in which success is being achieved even after many efforts. Looking at the physical, cultural and spiritual aspects of the state, details of some problems of agriculture are described as follows.

1. Geographical problems
2. Climate change and seasonal problems
3. The problem of the limited size of agricultural holdings and land fragmentation
4. Problem of agricultural land desertification and migration
5. Problem of soil erosion and landslides
6. Problem of conservation of traditional seeds and agricultural techniques
7. Problem of crop seeds and low productivity
8. The problem of agricultural labour and high-cost
9. Problem of agricultural innovation and research
10. Problems of irrigation
11. Problem of market, mandi, road and transport facilities
12. The problem of farmer innovation and training
13. Problem of crop treatment and disease diagnosis
14. Agricultural price and middleman problem

10.3.6 Agricultural Reform Schemes

To improve the agricultural resources of the state, many schemes have been implemented by the state and central government at present, which mainly include the National Insurance Scheme, Agricultural Credit and Crop Insurance, Organic Farming Training Program, Organic Certification and Marketing, Agricultural Mechanization, Post Harbour Technology Program, Agriculture Many welfare schemes like organizing Mahotsav, National Watershed Development Program, National Agricultural Development Scheme, Agriculture Policy 2011, Prime Minister Kisan Samman Nidhi, Kisan Credit have been implemented whose main objective is to improve the livelihood of the farming community and to strengthen the citizens of the state economically and to make Uttarakhand an organic agricultural state by incorporating innovations in the agricultural sector, the proof of which is the geographical indicators given to 17 agricultural food items of the state. On the other hand, the fertile land of the Terai is to be made more fertile and produce more and more agriculture. All the institutions working in the agricultural sector in the

state have the same objective that along with fulfilling the current objectives, the future needs can also be fulfilled through the agricultural resources of the state, for which coordination is being done between all the departments so that through mutual coordination of responsible institutions, farmers, stakeholders, non-farmers and agricultural experts involved in the field of agricultural development, farming and agricultural land can be improved on a large scale.

10.4 SUMMARY

Uttarakhand is an agriculture-based state where more than 70 percent of the state's population is engaged in agriculture and agriculture-related activities. Out of the total agricultural land area of the state, only 13.52 percent of the area is used for agriculture. In the hilly areas, agriculture is being done in terraced fields, while in the plains, modern agriculture is being done due to the presence of flat land. Uttarakhand is a state that has assimilated the characteristics of both the hilly and plain regions, due to which many varieties of agriculture are produced. In the hilly region, the agriculture system is traditional and even today, crops are grown through traditional seeds, which are the result of seed varieties preserved for several hundred years. Apart from having many medicinal properties, they are also capable of withstanding natural disasters because they are mostly grown in dry farming in complex geographical and climatic conditions. While there is a difference in the agricultural land structure of the state, the climatic variations affect the agricultural resources the most.

Due to the harsh and dry climate, traditionally, in the mountainous regions, along with food crops, horticulture, vegetables, pulses and coarse grains are also being produced by the mountainous community for their consumption for a long time. In the plains, agricultural work is being done for food and commercial purposes. Apart from crops, in the mountainous regions of the state, horticulture includes apple, peach, apricot, plum, lemon, malt, and walnut and in the plains, mango, guava, litchi and amla are grown. Along with tea and cinnamon gardens have also been established on the mountain slopes of the state, which demonstrate the innovations of modern agriculture. In the state, agricultural types are divided based on the production capacity of the soil as Talao, Upaon and Katil based on the characteristics of the soil. Thus, the trend of agriculture in the state is changing which is ready to adjust with time even though seasonal and climatic changes are not able to bear the changing trend of agriculture. The state has a total of 7.41 lakh hectares of agricultural land in which the average size of holdings is up to 0.98

hectares, which is about 13 percent of the total agricultural area of the state. The gross sown area in the state is 11,88,462 hectares of which 4,91,349 hectares are in the hilly region and 2,62,362 hectares in the plain districts. In terms of agricultural crop patterns,

10.5 Glossary

Agricultural structure:	The pattern of crops and farming systems are carried out based on the physical features of the state.
Irrigation resource:	Traditionally, irrigation is done in the hilly and plain areas by adopting artificial methods for higher production of agriculture (kachhigul, canal, pond, tube well)
Terrace farming:	Farming is done by making terraced fields in hilly areas when the slope is high.
Livelihood resources:	Means of running human life like agriculture, hunting, animal husbandry, government and private service etc.?
Traditional method of agriculture:	Farming is done by human discretion and refined knowledge after a long period, in which crop production is done organically by giving more importance to human and animal labour and local seeds.
Land fragmentation:	The division of ancestral property among the family members is land fragmentation, which is generally the division of land by the father among his sons.
Soil Erosion:	Soil erosion or land erosion is the layer of soil that flows away with water from the fields due to excessive rainfall in hilly-sloping areas.
Innovation:	Innovation is the use of new agricultural seeds, technology, medicine, and irrigation means adopted in traditional crops, seeds and techniques.

Commercial crops:	Sugarcane, mustard and all horticultural products are the major horticultural crops of the state.
Multipurpose tanks:	At present, to improve the economic condition of agriculture and farmers, tanks are being constructed in the mountainous areas near natural water sources as a means of minor irrigation by the state government to fulfil many purposes like irrigation, drinking water and fish production.
Organic farming:	Agriculture is produced naturally through biochemicals, cow dung and vermicompost, which is especially done in the mountainous districts of Uttarakhand. 10.6 Answer to check your progress

10.6 ANSWER TO CHECK YOUR PROGRESS

1. The physical features of the state, landform, drainage pattern, climate, soil, vegetation, means of irrigation and socio-cultural activities affect the agricultural system here.
2. In the state of Uttarakhand, only 12.6 percent of the total area is included under agricultural land.
3. 70 percent of the population in the state is directly engaged in agriculture.
4. The agricultural system and agricultural products of Uttarakhand include both mountainous and plain characteristics, which is considered a famous state for agricultural diversity.
5. In the last 2-3 decades, due to the effects of climate change on agriculture in the state, an increase in diseases and natural risks in crops has been observed.
6. It takes more than 100 years for a 1 cm thick layer of soil to form.
7. In traditional farming, along with human labour and oxen, local agricultural equipment like wooden ploughs, hoes, spades, and sickles are mainly used.
8. The total agricultural area in the state of Uttarakhand is 7.41 lakh hectares.
9. 11,88,462 hectares of land is included in the gross sown area in the state.
10. Talau land is found in flat valley areas where there is ample water for irrigation.
11. The first land reform in the state was done in the form of land settlement in the Gorkha period in 1812.

12. Under the Rabi crop pattern, mainly wheat, barley, gram, lentil, pea, mustard, potato and onion vegetables are grown.
13. The oldest traditional means of irrigation in Uttarakhand was Kachhi Gul which was from the natural water source and continuously flowing stream to the field.

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10.8 TERMINAL QUESTIONS

1. Long Answer Questions

- Q-1.** Explain that the agriculture business of Uttarakhand is a boon for the residents of the state and describe the agricultural characteristics of the state in detail?
- Q-2.** What are the effects of fragmentation of agricultural land on the agriculture of the state? Give details of the efforts being made for land reform?
- Q-3.** The crop pattern of Uttarakhand is diverse. Explain with the help of various examples and describe the agricultural irrigation system and agricultural productivity of the state?

2. Short Answer Questions

- Q-1.** What do you mean by agriculture? Introduce the agricultural resources of Uttarakhand state.
- Q-2.** How do natural and cultural elements contribute to the agricultural diversity of Uttarakhand state? Describe.
- Q-3.** Describe the agricultural problems of Uttarakhand in detail.
- Q- 4.** Describe the agricultural trends of the state?
- Q- 5.** Explain how the traditional agricultural system of Uttarakhand is helpful in environmental adjustment?
- Q-6.** What do you understand by agricultural land holdings? Describe the problems of agricultural holdings of the state?
- Q-7.** Why is land reform required in the context of Uttarakhand? Briefly describe the land reform works done in the state?
- Q-8.** What do you understand by crop pattern? Explain the crop patterns of the state.
- Q- 9.** Describe the irrigation means of Uttarakhand state?
- Q- 10.** Describe the types of agricultural land division of Uttarakhand state?
- Q-11.** What do you understand by agricultural productivity? Describe the major agricultural crops produced in the state?
- Q-12.** Agricultural business is the backbone of the residents of Uttarakhand. Describe in your own words?

Q. 3. Multiple Choice Questions

- Q-1.** Agriculture in Uttarakhand is affected by?
- a) Physical structure
 - b) Climate and seasonal elements
 - c) Social and cultural elements
 - d) All of the above

Answer: D

- Q-2.** What is the percentage of agricultural land in the total area of the state?
- a) 15.2 percent

- b) 12.6 percent
- c) 16 percent
- d) 22 percent

Answer: B

Q-3. What is the percentage of the population dependent on agriculture in the state?

- a) 70 percent
- b) 72 percent
- c) 70 percent
- d) 69 percent

Answer: A

Q-4. What percentage of land in the plains of the state is brought under cultivation?

- a) 94.5 percent
- b) 96.3 percent
- c) 93.2 percent
- d) 93.1 percent

Answer: D

Q-5. What are the main challenges faced by agriculture in hilly areas?

- a) Drought
- b) Snowfall
- c) Flood
- d) All of the above

Answer: D

Q- 6 Generally, how much time is taken for the formation of 1 cm thick soil?

- a) 50 years
- b) 100 years
- c) 25 years
- d) 150 years

Answer: B

Q-7. What is the total area included under the gross sown area in the state?

- a) 11,88,462 hectare
- b) 11,88,562 hectare
- c) 11,88,666 hectare
- d) 11,88,468 hectare

Answer: A

Q-8. In which part of the state is flat agriculture found?

- a) Valley
- b) Plain plain
- c) Both of the above
- d) Mountainous region

Answer: C

Q-9. By whom and when was the first land reform done in the state?

- a) British 1912
- b) Gorkha period 1812
- c) Panwar 1826
- d) All of the above

Answer: B

Q -10. The agricultural land of the state is mainly divided into?

- a) Talau and Uprau second
- b) Uprau and Abbal
- c) Izran, Kantil
- d) All of the above

Answer: D

Q-11. When was the last land settlement of land reform done in the state?

- a) 1960-1964

- b) 1960-61
- c) 1950-51
- d) 1975-76

Answer: A

Q-12. What is the total length of irrigation canals being used for irrigation in Uttarakhand?

- a) 13343.12 km
- b) 13335.12 km
- c) 13338.12 km
- d) 13665.12 km

Answer: B

BLOCK 5: UTTARAKHAND RESOURCES

**UNIT 11: MAJOR MINERAL DEPOSITS:
DISTRIBUTION AND PRODUCTION, ENERGY
RESOURCES: DEVELOPMENT OF HYDRO-
ELECTRICITY**

11.1 OBJECTIVES***11.2 INTRODUCTION******11.3 MAJOR MINERAL DEPOSITS: DISTRIBUTION AND
PRODUCTION, ENERGY RESOURCES: DEVELOPMENT OF
HYDRO-ELECTRICITY******11.4 SUMMARY******11.5 GLOSSARY******11.6 ANSWERS TO CHECK YOUR PROGRESS******11.7 REFERENCES******11.8 TERMINAL QUESTIONS***

11.1 OBJECTIVES

Understand mineral distribution in Uttarakhand.

1. Learners will be able to understand the types of minerals.
 2. Learners to know about the development of Hydro-Electricity in Uttarakhand.
 3. Learners will be able to understand the benefits Hydro-power energy.
 4. Understanding of sustainable resource management and energy production practices.
-

11.2 INTRODUCTION

The history of mineral mining in Uttarakhand State is extensive and intriguing. Over a century ago, very small-scale mining and extraction of placer gold, copper, and iron ores took place in this region of the Himalayas. In Garhwal division, copper ores were mined on a relatively modest scale before 1900. Small-scale mining is also declining as a result of the development of contemporary technologies and falling costs. Between 1920 and 1930, mining activity further decreased for a number of socioeconomic causes. In order to find industrial and metallic mineral reserves that can be developed in terms of technology and economics in the modern era, geologists have been searching the ground.

The development of the agricultural front and the construction of the necessary infrastructure for the slow development of industries were the primary concerns and areas of attention following independence in 1947.

The enterprises Development Regulations Act, 1951 was passed by the Indian government in 1950–51 in order to regulate the granting of industrial licenses and encourage the development of enterprises in the targeted sectors. This move also marked the beginning of significant attempts to explore and utilise the nation's abundant resources. The Geological Survey of India increased and broadened its operations. Several departments were established to manage specialised investigations for coal, atomic energy, oil and gas, and natural gas exploration and development. The highest priorities were given to minerals and energy. In the following five or six years, numerous departments for mineral surveys were set up in practically every state in order to conduct extensive mineral resource exploration.

When a cement plant capable of producing 700 tonnes of cement per day was created in Churk, District Mirzapur, in 1953, the State Government of Uttar Pradesh made its first investment in the mineral-based industry during the latter portion of the First Five Year Plan.

The Directorate of Geology and Mining (DGM) was established in 1955 to investigate the state's mineral potential and ensure the appropriate growth of sectors reliant on minerals. In the following plan periods, the State Directorate progressively increased its efforts to assess and delineate mineral reserves in various regions of the State, building on its broad reconnaissance and preliminary inquiry in the first few years of the second Five Year Plan.

The State Directorate's actions during the subsequent plan periods have significantly altered the state's mineral and, consequently, economic makeup.

Growth: In 1955, the Directorate of Geology & Mining was established in the former state of Uttar Pradesh, with a core personnel dedicated to geological investigation of the state's natural resources. Since 1963, the Directorate has also been charged with advising the State Government on issues pertaining to the granting of mineral concessions and regularising mining operations in order to (2) maximise government revenue through royalties and (3) ensure the proper development of minerals and mineral-based industries. (i) Geochemical Survey (ii) Geophysical Survey (iii) Surveying (iv) Chemical Analysis (v) Petrological Studies (vi) Drilling (vii) Ore-dressing (viii) Draughting (ix) XRF Laboratory, and (x) Remote Sensing and Photo-geology were the other sub-sections that helped with these.

In 1984, two Engineering Geology Cells were established in Srinagar (Garhwal), District Pauri and District Almora, the then hilly areas of Uttar Pradesh to cover up geotechnical aspects of the various Civil Works in Garhwal and Kumaon Divisions respectively.

At the time of the creation of the State of “Uttaranchal” on 9th November 2000 (renamed as ‘Uttarakhand’ from 01-01-2007) both the Regional Offices at Haldwani (District Naini Tal) and at Dehra Dun were being headed by the Deputy Directors. The Deputy Director posted at Regional Office, Dehradun, who was earlier functioning as the Nodal Officer also, was made Officer-in-charge of the Department of Geology and Mining, renaming it as “Geology and Mining Unit” and attaching it to the Directorate of Industries to bring it under the control of the Director, Directorate of Industries, who was, ex officio, the Secretary of the Industrial Development, Government of Uttarakhand.

The restructuring of the “Geology and Mining Unit”, taken up by the Government of Uttarakhand, was finalised on 3rd December 2001 in which the office at Dehra Dun was elevated to the level of Head Quarter and six District level offices were deemed fit and the organization (Geology and Mining Unit) was attached to the “Directorate of Industries”, Uttaranchal. An

‘Additional Director’ was made the head of the Unit who had to function under control of the Director, Directorate of Industries, Uttaranchal.

11.3 MAJOR MINERAL DEPOSITS: DISTRIBUTION AND PRODUCTION, ENERGY RESOURCES: DEVELOPMENT OF HYDRO-ELECTRICITY

Minerals are inorganic substances that contain one or more elements. Rocks consist of minerals. It is a common belief that Himalaya as a whole is rich in mineral wealth. Though minerals are not found in rich quantity, many minerals are excavated. Minerals are basically classified into two types: metallic and non-metallic mineral.

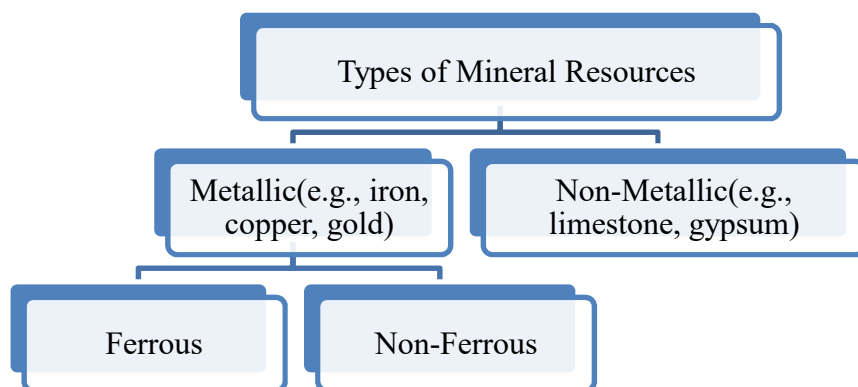


Fig 11.1: Types of Mineral Resources

Important Minerals of the Uttarakhand

Magnesite: Kumaun region has India's largest known deposits of Magnesite. It is found at Jhirouli, Dewaldhar, Belakuchi, Chandak.

Dolomite: Dehradun and Nainital

Limestone and Marble: Almora, Dehradun, Tehri, Pithoragarh

Phosphorite: Dehradun and Tehri

Talc and Soapstone: Almora and Pithoragarh

Graphite: Nainital, Dehradun, Tehri and Almora

Lead: Dehradun, Almora, Tehri Garhwal and Chamoli

Gold: It is found in the sands of Sharda, Ramganga and Alaknanda rivers.

Silver: Almora

Asbestos: Garhwal and Almora

Gypsum: Garhwal, Dehradun and Nainital

Copper: Chamoli, Nainital, Almora, Pithoragarh, Pauri Garhwal and Teri Garhwal

Iron: Almora, Nainital and Garhwal

Uranium: Teri Garhwal

Chalk: Almora

Rock Phosphate: Mussoorie, Tehri Garhwal



Fig 11. 2: Mineral Map Uttarakhand, Source: Google

i. Magnesite: The Kumaon region of Uttarakhand is home to India's largest magnetite storage. It is also widely distributed in the Garhwal region's Chamoli District. Jhirauli, Devaldhar, Tapovan, Pokhari, Belakuchi, Joshimath, Mandakini Valley, Pinder Valley, and other are the primary locations for magnetite. On October 26, 1977, the magnesite project's first furnace began operations in Chandak. Magnesite has many uses and is frequently employed as a heat - proof material in massive furnaces found in iron, steel, and cement plants. It is mixed with copper, nickel, zinc, aluminium, and other metals to create a variety of mix-metals. It is also employed in the production of acid and the purification of oil.



Fig 11.3: Almora Magnesite Company, Source: Google

ii.Chalk: The districts of Dehradun, Tehri, Pauri, Chamoli, Pithoragarh, Bageshwar, and Almora in Uttarakhand are the main locations for chalk. Due to their genetic ties, chalk and magnetite are typically found together. located in Uttarakhand's hilly regions of Jakhera, Aagar-Girichhina, Lohar Valley, Muwani, Devasthal, Kanda, Rai-Aagar, Tarosi, and Huyena. Chalk is utilised in the creation of statues, decorations, grease powders, art paper, fertilisers, and insecticides.



Fig 11. 4: Chalk Minning in Uttarakhand, Source: Google

iii. Lime-Stone and Marble: Kumaon and Garhwal are home to lime-stone and marble. Oukhimath tehsil, the Alakhanda valley in the centre of the Pinder and Lohaba strip, the nearby regions of Tehri and Dehradun, the vicinity of Neelkanth, and the area east of Rishikesh are all home to large deposit of it, also mostly found in the districts of Nainital, Almora, and Gangolihat in Pithoragarh. Marble can be found in the Viraji Ganga Valley and the Alakhanda Valley of Chamoli Tehsil.



Fig11.5: Limestone and Marble, Source: Google

iv. Rock Phosphate: Rock phosphate is mainly found in Mussoorie and Tehri-Garhwal of Uttarakhand. Pyrites Phosphates & Chemical Limited is responsible for the rock phosphate excavation in Mussoorie and Tehri-Garhwal in India. It may be found in Chamasari, Maldevata, Kimoi, Masarana, and Durmala. In recent time some Rock phosphate discovered in the Nainital district. Rock phosphate is used to remediate acidic soil and in the fertiliser industry.



Fig 11.6: Rock Phosphate, Source: Google

v. Gold: It is found from the sands of the Ramganga and Sharda rivers, as well as particles found in the Pindar river sands of the Alaknanda and Sone rivers. It's an expensive metal. Gold is utilised in the production of medications, electroplating, photography, glass bangle polishing, and ornamentation.

vi. Iron: It is found in some quantity in Nainital, Pauri, Tehri, and Almora districts of Uttarakhand. In some quantity Hematite and Magnetite are found in kaladungi and Ramgarh region of Nainital, Uttarakhand.



Fig 11.7: Magnetite and Hematite types of Iron, Source, Google

v. Coal: Coal digging work is being done in Kumaon and Garhwal regions of Uttarakhand. the digging of coal is being done in Kumaon and Garhwal regions under the direction of Indian geological survey department.

vi. Stone and Slab: in ancient time, the stone used in the roofs of houses of hilly region- represents that it is found everywhere in Uttarakhand. Good quality of slabs is found in Almora. used for construction of roof, courtyards, drains, roads etc.

vii. Lead: found at Chandak, Devalgarh, Ralam and Bhainskhal of Pithoragarh, Ranei of Almora, Nagpur region of Garhwal, Kuma-burela and Mughaul in Tons river valley of Dehradun district. it used in transport appliances and fertilizers. It is a heavy and elastic metal.

viii. Gypsum: It is found near Khiyarkuli and Bhata villages in Dehradun, KharariChatti region of Pauri Garhwal, and GarurChatti, Gugthani area, Mahipur area, Rangargaon, Khemsar and Narander Nagar region of Tehri Garhwal districts.

ix. Sulphur: It is found near Sutaal village 50 km east of Nandprayag.

x. Uranium: Found in Tehri Garhwal region.

Silver: Small quantity in Almora.

Talc (Soap Stone): Talc a very soft mineral. It is found in Pithoragarh, Chamoli, Bageshwar and Almora districts of Uttarakhand. It is used in making talcum powder, paints, soap, pesticide powder, textile and paper etc.



Fig 11.8: Soap Stone (Talc), Source, Google

Asbestos: Asbestos found in Pauri Garhwal (Ookhimath and Kandhera) and Almora district of Uttarakhand. chiefly used in cement manufacturing and electric appliances. its capacity to bear high heat-stroke and does not react too much chemical reaction due to this it used in industrial area on a large scale. Mixture of lime and magnesium is found in it.



Fig 11.9: Asbestos, Source, Google

Energy Resources: Development of Hydro-Electricity in Uttarakhand

The history of hydroelectric power plants in Uttarakhand, a northern Indian state, is closely linked to the region's hilly landscape and plentiful water supplies. Uttarakhand has enormous potential for hydropower generation because of the various rivers that flow through the area, including the Ganga, Yamuna, Bhagirathi, and Alaknanda. Dehradun, the state capital, is 22 km from Galogi Power Station. When the British put the Galogihydel power station into service in 1907, it was one of the first hydroelectric facilities. At the same time, three other plants were put into service in Mysore, Karnataka; Darjeeling, West Bengal; and Chamba, Himachal Pradesh. On November 9, 1912, Galogi became the first hydel power plant to produce electricity and illuminate homes.

Early 20th-century hydroelectricity development in the area started with modest initiatives like the Kulhal Hydropower Station, which was founded in 1926. Using hydropower became more important after independence, as seen by the building of bigger projects like the Tehri Dam on the Bhagirathi River. One of the biggest hydroelectric projects in India, Tehri was built in stages beginning in the late 20th century and produced more than 1,000 MW of energy in addition to being a vital resource for water management.

Some of the major Department work in field of development of Hydro-electricity in Uttarakhand is;

a.Uttarakhand Jal Vidyut Nigam Limited (UJVNL): Uttarakhand Jal Vidut Nigam was formed on 9 Nov 2001 with it main motto of developing and harnessing the hydro potential of Uttarakhand State. Uttarakhand Jal Vidyut Nigam Limited (UJVNL) is a government-owned organization in the state of Uttarakhand, India.

Uttarakhand Jal Vidyut Nigam limited is primarily responsible for the Small Hydro development in Uttarakhand & is nodal agency to speed up this development. Formerly the small hydro projects were in Uttar Pradesh Laghu Jal Vidyut Nigam limited and thereafter transferred to UP Jal Vidyut Nigam but after formation of Uttarakhand these projects came under UJVNL, since then UJVNL (Uttarakhand Jal Vidyut Nigam Limited) has shown serious interest in development of these projects.

Small Hydro Power Projects (up to 25 MW) by UJVNL

- i. The Madhyamaheshwar Small Hydro Project is located on the river Madhuganga, a tributary of river Mandakini in Rudraprayag district of Uttarakhand.
- ii. The Suringad-II Small Hydropower Project is located on Suringad which is a tributary of river Goriganga. Project is located in Munsyari tehsil of Pithoragarh district in the state of Uttarakhand.
- iii. The Kaliganga-II Small Hydel Project is located on the river Kaliganga, just upstream of Kalimath temple in the Rudraprayag district of Uttarakhand.
- iv. The Kaliganga-I Small Hydro Project is located on the river Kaliganga, between the bridge over Kaliganga on Jaltala to Chilan road and Kotimaheshwari temple. The project is located in the Ukhimath tehsil of Rudraprayag district of Uttarakhand.

- v. Mohammadpur small hydro power station is located on the Upper Ganga Irrigation canal that takes off from the Bhimgoda Barrage near Haridwar at a distance of 49.5 km downstream of Pathri, 22 km south of Roorkee, 3km off Dehradun – Delhi high way.
- vi. Pathri small hydro power station is located Near Bahadrabad, Distt. Haridwar.
- vii. The Dunao Small Hydel Project has an installed capacity of 1500 kW with two (02) units of 750 kW project. The project is located near the village Dunao in Dhumakot Tehsil of District Pauri Garhwal at a distance of 150 kms from Kotdwar and 100 km from Ramnagar.
- viii. The Dunao Small Hydel Project has an installed capacity of 1500 kW with two (02) units of 750 kW project. The project is located near the village Dunao in Dhumakot Tehsil of District Pauri Garhwal at a distance of 150 kms from Kotdwar and 100 km from Ramnagar.
- ix. Urgam Small Hydro Project, 2 X 1500 kW is situated near Helong at the Joshimath tehsil in of District Chamoli in Uttarakhand.

Large Hydro Power Projects (beyond 25 MW) By UJVNL

- i. Vyasi Hydro Power Station (2X60MW) constructed at Hathiyari, is a run of river with pondage scheme at Juddo. Vyasi Hydroelectric Project envisages the utilization of head available in the river Yamuna. In Vyasi Hydro Power Station, water is diverted through a Dam at village Juddo, five Km upside of Hathiyari Village and nearly 63 Km from Dehradun.
- ii. Chibro HEP is a Run-of-River scheme with an underground Power Station. It was the first underground Power Station in North India and was commissioned in year 1975. The Power station draws water from Ichari dam located on the river Tons, one of the major tributary of river Yamuna.
- iii. Chilla Hydro Power Station is a run of river scheme constructed on river Ganga 5 km upstream of holy town Hardwar and is situated in District PauriGarhwal of Uttarakhand state.
- iv. Dhakrani HEP is a Run-of-River scheme with surface power station. It is located downstream of the Dakpathar Barrage at a distance of 8 km on the power channel which

takes off from the Dakpathar Barrage constructed on river Yamuna at Dakpathar. River Tons is a major tributary of Yamuna and meets just before the location of Barrage.

- v. The Dhalipur HEP is a Run-of-River scheme with a surface type power station and is located on the downstream of the Dhakrani Power Station at a distance of 5 km from Dhakrani Power Station on the power channel which takes off from the Dakpathar Barrage.
- vi. Khatima Power Station 41.4 MW (3X13.8 MW) is situated at Lohiahead (Khatima), District Udham Singh Nagar of Uttarakhand. Khatima hydro power Station is an irrigation canal-based project.
- vii. Khodri HEP is a Run-of-River scheme with a surface Power Station. It was commissioned in year 1984. Water discharged from the Chibro Power Plant is returned into the Tons River just 100 m upstream of the intake for the Khodri Power Station.
- viii. Maneri Bhali-I Hydro Power Station) is a run of river with pondage scheme constructed on river Bhagirathi, a major tributary of river Ganga and situated in District Uttarkashi of Uttarakhand state.
- ix. Maneri Bhali-II Hydro Power Station is a run of river with pondage scheme. Maneri-Bhali Hydroelectric Project II envisages the utilization of head available in the river Bhagirathi between the tail waters of Maneri-Bhali Stage I and Stage II Projects.
- x. Ramganga Power Station is a Reservoir based scheme on river Ramganga located near the famous Jim Corbett Park in district PauriGarhwal. Ramganga Power station is a multipurpose project and it serves the purpose of power generation and irrigation in the command area of the canal.

b.Tehri Hydro Development Corporation Limited (THDC): THDC also known as Tehri Hydro Development Corporation Limited, is a prominent power utility in India and a joint venture between the Government of India and the Government of Uttarakhand. Headquartered in Rishikesh, Uttarakhand, THDC focuses primarily on generating hydroelectric power. It was initially established to develop, operate, and maintain the Tehri Hydro Power Complex and other hydroelectric projects in the country. THDC is responsible for managing and expanding hydroelectric projects in Uttarakhand, such as the Tehri Dam and Koteshwar Dam. These contribute significantly to the state's energy needs.



Fig 11.9: Teri Dam, Source, Google

c. Satluj Jal Vidyut Nigam Limited (SJVN): Satluj Jal Vidyut Nigam Limited has several projects in Uttarakhand, including: Devsari hydropower project on the Pinder River in Chamoli district. Naitwar Mori Hydro Electric Project on the Tons River in Uttarkashi district.

d. The National Hydroelectric Power Corporation (NHPC): The National Hydroelectric Power Corporation (NHPC) is a major public sector undertaking under the Government of India, focusing on hydroelectric power generation across India. In Uttarakhand, NHPC plays a crucial role in developing hydroelectric projects, leveraging the state's abundant water resources to produce renewable energy and contribute to regional power stability.

Major NHPC Projects in Uttarakhand:

- i. Tanakpur Hydroelectric Project: Located on the Sharda River, this project has an installed capacity of 94.2 MW and also supports local irrigation and water supply.
- ii. Dhauliganga Hydroelectric Project: This 280 MW project on the Dhauliganga River in Pithoragarh district plays a critical role in stabilizing the region's power supply.
- iii. Pancheswar Dam: A joint Indo-Nepal venture on the Mahakali River (also known as Sharda River), this project is expected to generate substantial power while also providing irrigation benefits to both countries. However, this project is still in the planning and negotiation phases due to diplomatic, environmental, and technical considerations.

NHPC's efforts in Uttarakhand are crucial in addressing the state's energy needs, promoting sustainable development, and supporting flood control and agricultural irrigation through multipurpose hydropower projects.

Uttarakhand Renewable Energy Development Agency (UREDA)

In Uttarakhand, where over 63.10% of the population lives in rural regions and the majority of them are below the poverty line, the relationship between energy and development has many social and political ramifications. The state's geographical characteristics vary only a short distance apart. The majority of the region is hilly, with roughly 66% of it covered by forests. Villages are dispersed, and there is little home coverage in any settlement. In this case, either the exorbitant cost of coverage or forest rules prevent grid lines from being installed. Another problem with this pattern is operation and maintenance. The best and most appropriate approach to address this issue is to offer energy to the forest periphery through Decentralised Distributed Generation (DDG) Micro & Mini Hydro Projects. Following rigorous instruction, the local population may easily operate and maintain standalone MHPs. MHPs are being built in the State of Uttarakhand by the Uttarakhand Renewable Energy Development Agency (UREDA) for both grid feeding and distant village electrification. Through these initiatives, more than 300 villages and hamlets have been electrified, and 44 MHPs with a combined capacity of 4.29 MW have been put into service thus far. Previously, the projects were built on a turn-key basis, but starting in 2005, the Uttarakhand government chose to build MHPs for village electrification with community involvement. UREDA, Alternate Hydro Energy Centre (AHEC), IIT, Roorkee, and Concern User Energy Committee (UEC) have all signed tripartite agreements for the construction of MHPs.

According to the tripartite agreement, UREDA provides its services for monitoring, funding, and advising UECs, while AHEC, IIT, Roorkee, and others provide technical specialised services for building MHPs, preparing DPRs, etc. MHPs are being built using funding provided by the Indian government's Ministry of New and Renewable Energy (MNRE).

Uttarakhand's abundant water resources and mountainous terrain present a significant opportunity for hydro-electric power generation. Recognizing the potential of these natural resources, the state has prioritized the development of hydroelectric projects to meet its energy needs, reduce dependency on fossil fuels, and contribute to the national grid. The state is home to several large and small hydroelectric projects that harness the power of its rivers, providing a

sustainable and renewable energy source. This focus on hydroelectric power not only aids in achieving energy security but also supports economic development and environmental sustainability. However, the development of hydroelectric projects comes with its own set of challenges, including environmental impacts, displacement of local communities, and the need for robust infrastructure. Addressing these challenges through strategic planning and community engagement is crucial for the successful and sustainable development of hydro-electric resources in Uttarakhand. This section delves into the key hydro-electric projects in the state, their capacities, significance, and future prospects, offering a comprehensive view of Uttarakhand's journey towards energy sustainability.

11.4 SUMMARY

Energy resources and mineral deposits are essential for sustainable growth and economic development. The world's major mineral deposits, including those of coal, iron ore, bauxite, and copper, are not uniformly distributed; South America, Africa, and Asia are home to large reserves. These minerals serve as the foundation for construction, industry, and technological development. Mining, refinement, and distribution are all part of their production and extraction processes, and these processes have a big influence on both domestic and international markets. However, energy resources—in particular, hydroelectricity—are becoming more and more important for sustainably supplying the world's energy needs. Using dams and turbines to capture the energy of falling or flowing water, hydroelectricity is created. It is a clean, renewable energy source that helps manage water resources, lessens reliance on fossil fuels, and helps electrify rural areas. All of these resources work together to shape economies and guarantee global energy security.

11.5 GLOSSARY

Mineral: a naturally occurring inorganic material that was created by geological processes and has a distinct chemical composition and crystalline structure.

Metallic: minerals that are usually mined for their metallic components and include one or more metals. Gold, copper, and iron ore are a few examples.

Non-Metallic: minerals that are prized for their physical and chemical characteristics yet do not contain metals. Mica, gypsum, and limestone are a few examples.

11.6 ANSWERS TO CHECK YOUR PROGRESS

Do you know the Tehri Dam, located in the state of Uttarakhand, is the highest dam in India with a height of 260.5 meters?

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11.8 TERMINAL QUESTIONS

Long Questions

1. Give an explanation of the main mineral deposits in Uttarakhand.
2. Evaluate the progress of Uttarakhand's hydroelectricity project.

Short Questions

1. Write a short note on The National Hydroelectric Power Corporation (NHPC).
2. Write a short note on National Hydroelectric Power Corporation (NHPC).
3. Write down about the metallic and non-metallic found in Uttarakhand.
4. Write down about the Vyasi Hydro Power Station.
5. List the advantages of hydroelectric plants.
6. List the advantage of small hydroelectric plants in the context of Uttarakhand.
7. Note down the excavation of Magnesite in Uttarakhand.
8. Name the Uttarakhand district where the specified minerals are found.
 - i. Soap stone
 - ii. Limestone and Marble
 - iii. Magnesite
 - iv. Rock Phosphate
 - v. Gypsum

MCQ's

1. Which of the following surveys are not part of the sub-sections under the Directorate of Geology and Mining?
 - a) Geochemical Survey
 - b) Drilling
 - c) Astronomy Survey
 - d) Petrological Studies

2. Which technology was introduced by the Directorate of Geology and Mining for geological investigations?
 - a) Artificial Intelligence
 - b) Remote Sensing and Photo-geology
 - c) Blockchain Analysis
 - d) Satellite Navigation Systems

3. What was the main priority of the Directorate of Geology and Mining after its establishment?
 - a) Building roads and infrastructure
 - b) Maximizing government revenue through royalties

- c) Training geologists for foreign projects
- d) Establishing nuclear energy plants

4. What is full form of THDC.

- a) Tehri Hydro Development Corporation Limited
- b) Tehri Hydro Development Corporation
- c) Tehri Hydro Development Company Limited
- d) Tamil Hydro Development Corporation Limited

5. Which is the first hydro-electric plant in Uttarakhand.

- a) Galogi power station
- b) Dhauliganga Hydroelectric Project
- c) Naitwar Mori Hydro Electric Project
- d) None of the above

6. Which organisation constructed the Teri Dam.

- a) Tehri Hydro Development Corporation Limited
- b) Tehri Hydro Development Corporation
- c) Tehri Hydro Development Company Limited
- d) Tamil Hydro Development Corporation Limited

7. What is full form of UREDA?

- a) Uttarakhand Renewable Energy Development Agency
- b) Uttarakhand Revenue Energy Development Agency
- c) Uttarakhand Renewable Energy Developing Agency
- d) Uttarkashi Renewable Energy Development Agency

8. Which river hosts the Devsari hydropower project in Uttarakhand?

- a) Ganga River
- b) Sharda River
- c) Pinder River
- d) Tons River

9. Dhauliganga Hydroelectric Project constructed on which river.

- a) Ganga

- b) Dhauliganga
- c) Tons
- d) Kosi

10. Which of the following is not a metallic mineral.

- a) Iron,
- b) Copper
- c) Gold
- d) Gypsum

Answer) 1.c, 2.b, 3. b, 4.d, 5. a, 6. a, 7. a, 8.c, 9. c, 10. d

UNIT 12: INDUSTRIES: LOCALIZATION AND SPATIAL DISTRIBUTION, PRINCIPAL INDUSTRIES OF THE REGION, INDUSTRIAL REGIONS, TRANSPORT, TOURISM AND FORESTRY, POTENTIALS AND PROSPECTS

12.1 OBJECTIVES

12.2 INTRODUCTION

12.3 INDUSTRIES: LOCALIZATION AND SPATIAL DISTRIBUTION, PRINCIPAL INDUSTRIES OF THE REGION, INDUSTRIAL REGIONS, TRANSPORT, TOURISM AND FORESTRY, POTENTIALS AND PROSPECTS

12.4 SUMMARY

12.5 GLOSSARY

12.6 ANSWERS TO CHECK YOUR PROGRESS

12.7 REFERENCES

12.8 TERMINAL QUESTIONS

12.1 OBJECTIVES

1. Understand Industry Localization and Spatial Distribution
 2. Identify Principal Industries and Regional Specialization
 3. Analyze Industrial Regions and Economic Impact
 4. Comprehend the Role of Transport, Tourism, and Forestry
 5. Assess Industrial Potentials and Future Prospects
-

12.2 INTRODUCTION

Uttarakhand is one of the most beautiful states in India characterized by magnificent Himalayan scenery and an economic backdrop mixing traditional industry with modern industries. Some key sectors of the economy are agriculture, handicrafts, tourism, hydropower and manufacturing that provides jobs and regional growth. Government measures along with availability of skilled workforce, and other aspects have contributed the development of major industrial hubs such as Haridwar, Rudrapur, Dehradun. Transport networks supporting economic integration are an important function as they link the industrialized areas with remote mountainous ones.

Tourism is one of the key industries in Uttarakhand, capitalising on its stunning natural beauty and diverse wildlife and spirituality to attract millions of tourists each year. It is a sector that spurs economic development, generates jobs and drives hospitality and retail, while at the same time preserving culture. Forestry, another critical sector provides sustainable ecosystem services for timber and non-timber product extraction which aid in livelihoods but also protects biodiversity and climate change mitigation through ecological balance. The prospective industries, especially hydro-transport-energy hubs and eco-development need segregation on the account of unique geography and bounteous natural assets available within Uttarakhand territory for horizontal upliftment by breaking water and energy limitations to longer time bound sustainable growth across sectors.

12.3 INDUSTRIES: LOCALIZATION AND SPATIAL DISTRIBUTION, PRINCIPAL INDUSTRIES OF THE REGION, INDUSTRIAL REGIONS, TRANSPORT, TOURISM AND FORESTRY, POTENTIALS AND PROSPECTS

Localization and Spatial Distribution of Industries in Uttarakhand

Factors Influencing Industrial Localization

The localization of industries in Uttarakhand is shaped by its unique geographical, economic, and environmental characteristics. Several factors play a crucial role in determining where industries are concentrated within the state:

- i. Availability of Raw Materials
- ii. Labor Supply
- iii. Transportation and Infrastructure
- iv. Market Proximity
- v. Government Policies
- vi. Climate and Environmental Factors



Fig 12.1 Factors Influencing Industrial Localization, Source: Google

The localization and spatial distribution of industries in Uttarakhand are influenced by a combination of natural resources, labour availability, infrastructure, market proximity, government policies, and environmental conditions. These factors have led to the emergence of specific industrial hubs within the state, each with its own unique set of advantages that contribute to the overall economic development of Uttarakhand.

Spatial Distribution Patterns

The distribution of industries is not uniform across a region; instead, it is concentrated in specific areas because of the reasons provided above. Because of this concentration, industrial centers or regions are created. The spatial distribution of industries can be divided into:

- a. **Concentrated Distribution:** This is characterized by the clustering of industries in one area due to natural resource availability or favorable economic policies.
- b. **Dispersed Distribution:** This describes a situation wherein the industries are located in a wide region that is less developed industrially.

c. **Linear Distribution:** This can be found in regions that require transportation such as highways, railways, and rivers, whereby the industries locate themselves along these transportation systems.

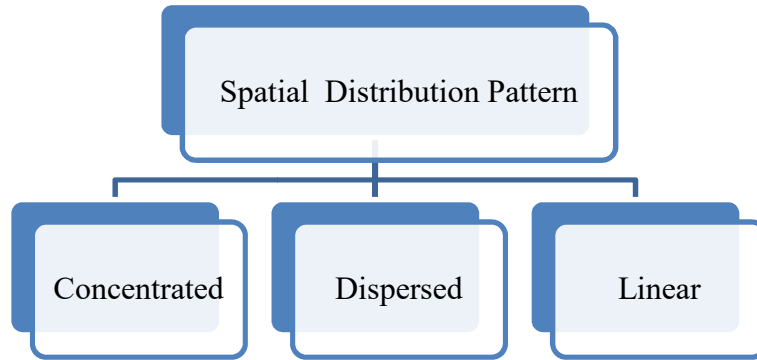


Fig 12.2: Spatial Distribution Pattern

The industrial package offered by the government of India renders Uttarakhand a preferred state for investment. Many of the top industrial house like TATA, Bajaj, Hero Honda, Hindustan liver Ltd, Nestle, Britannia, ITC, Birla Tyres, Ashai Glass and many more have factories located in Uttarakhand.

Principal Industrial Region of Uttarakhand

1. Integrated Industrial Estate: An Integrated Industrial Estate (IIE) is a planned industrial area that provides infrastructure, utilities, and support facilities in a single location to promote industrial growth. It is designed to accommodate various industries, streamline operations, and enhance productivity by offering amenities like roads, power supply, water, waste management, and connectivity to markets and transport networks. In the cities of Pantnagar, Haridwar, Dehradun, Selaqui, Kotdwar, Sitarganj, and Kashipur, SIIDCUL has constructed seven Integrated Industrial Estates. It has constructed cutting-edge infrastructure across a huge land area.

a. Integrated Industrial Estate: Pantnagar: It is one of the nation's main automotive hubs. The total area of its spread is 3233.52 acres. The SIIDCUL (State Infrastructure and Industrial Development Corporation Of Uttarakhand Ltd.) Government of Uttarakhand owns the largest Integrated Industrial Estate. Bajaj Auto Limited, Ashok Leyland, Fedders Lloyd

Corporation Limited, Idea Mobile Communication Limited, Nestle India Limited, Britannia Industries Limited, Dabur India Limited, and other brands are present.



Fig 12.3: Integrated Industrial Estate: Pantnagar, Source: Google

- b. Integrated Industrial Estate, IIE Haridwar:** It is dispersed throughout roughly 2038 acres of land. It has good access to the Delhi NCR area. It meets all of an investor's business demands and is equipped with cutting-edge infrastructure. Mahindra, Hero Moto Corp, ITC Limited, Hindustan Uni Lever, Akums Drugs & Pharmaceuticals, Hamilton Houseware, Lotus Beauty Care Products, and other brands are present.



Fig 12.4: Integrated Industrial Estate: Haridwar, Source: Google

- c. Integrated Industrial Estate, Kotdwar (Sigaddi Growth Center):** The total area of IIE Kotdwar is 102 acres. It has non-polluting industries including Paramount Green, Baluni

Engineering Limited, Wipro Limited, SimpexPharma Limited, Print Pack Industries, and Kanak Biotech, among others, and top-notch physical infrastructure.

- d. **Integrated Industrial Estate, Dehradun (IT Park):** The primary purpose of IIE Dehradun (IT Park), which spans 98.38 acres, is to serve the requirements of industrial facilities in the information technology sector. The industrial area has drawn businesses over the years, including Canara Bank, UCO Bank, NABARD, and Software Technology Park of India.



Fig 12.5: Integrated Industrial Estate: Dehradun(IT), Source: Google

- e. **Integrated Industrial Estate, Selaqui (Pharma City):** Keeping in mind the needs of the Pharma sector, SIIDCUL had developed IIE Selaqui as a Pharma City. It is spread in an area of 50 acres. It is well connected to the Delhi-NCR region. It has presence of Pharma companies such as Translumina Therapeutics, India Glycols Limited, East African Overseas, HAB Pharmaceuticals & Research Limited, NATCO Pharma Limited, Suncare Formulation Limited etc.



Fig 12.6: Integrated Industrial Estate, Selaqui (Pharma City, Source: Google

- f. Integrated Industrial Estate, Kashipur (Escort Farm):** IIE Kashipur occupies 310.96 acres of land in total. IIM Kashipur is located near the Industrial Estate. About 40 acres in Kashipur are being turned into an Aroma Park.
- g. Integrated Industrial Estate, Sitarganj Phase II:** IIE Sitarganj Phase-II is situated in Uttarakhand's Udham Singh Nagar district. It occupies a total of 1763.57 acres. Yoyogo India, La Opala, Parle Agro, and DS Group are among major industries.

2. **SIDC:** The Government of Uttarakhand established SIIDCUL, a Government of Uttarakhand Enterprise, as a Limited Company in 2002 with an authorised share capital of Rs. 50 crores. It was founded largely to support the state's overall economic growth by building the required infrastructure and industry in Uttarakhand, either directly or through special purpose vehicles, investment-assisted businesses, etc.

Our goal at SIIDCUL is "Ease of Doing Business" by offering a transparent and investor-friendly system that totally does away with any physical touchpoint. The land allocation process and other SIIDCUL procedures have been made faster and more accountable with the help of our e-auction application and a completely automated land allocation process via a single window clearing system.

- a) SIDC-Haridwar-Site-II: The State Industrial Development Corporation is referred to as SIDC. Companies owned by the government that support and grow medium-sized and big industries are known as SIDCs. Under the Companies Act of 1956, they were founded in 1995.
- b) SIDC Bahadrabad Site II
- c) GanganagriAwasiya Coloney, Bahadrabad
- d) SIDC, TatasuMazadi, Karnaprayag
- e) SIDC Khatima
- f) SIDC Kashipur
- g) SIDC Bajpur 1
- h) SIDC Bajpur 2
- i) SIDC Pipalsana
- j) SIDC Mohan
- k) Textile Park,Kashipur
- l) Textile Park, Jaspur
- m) Textile Park, Jaspur
- n) SIDC, Selaqui
- o) SIDC, Muni Ki Reti
- p) SIDC Jasodharpur

3. Plastic Park, Sitarganj: Under the "Scheme for promotion of Plastic Parks in India," Plastic Park Sitarganj has received approval from the Ministry of Chemicals and Fertilisers and the Department of Chemicals and Petrochemicals. The needs of Pantnagar's well-established auto sector as well as other plastic-related industries in the area would be met by Plastic Park. The Central Institute of Plastic & Engineering Technology (CIPET) will also be involved in skilling, toll room maintenance, test labs, etc. within the park, while the State Infrastructure and Industrial Corporation of Uttarakhand Limited (SIIDCUL) will be advertising the SPV.

The Plastic Park will also see the establishment of a Plastic Products Evaluation Centre (PPEC), complete with testing facilities, a processing hall/shop floor, a tool room, a design and product development facility with assistance for simulation and evaluation, and a facility for training and skill enhancement. Additional planned infrastructure facilities include a flatted

factory, a warehousing facility, a facility for recycling plastic waste, etc. The location has good access to NH-74; the National Capital Region is only 250 kilometres distant, and the Pantnagar airport is only 60 kilometres away.

4. Aroma Park Kashipur: The purpose of the Aroma Park is to support specialised industries such as Herbs & Aromatics, where the state benefits from a sufficient supply of aromatic produce and an agro-geoclimate that is conducive to the growing of aromatics. With the establishment of sector-specific institutions like G.B. Pant University, the Forest Research Institute, and a specialised state department called the "Centre for Aromatic Plants," the state has access to skilled labour and R&D capabilities. The Aroma Park is eligible for the Uttarakhand MSME Policy's Category A region incentives, as well as an extra year of funding to finish the project's construction instead of two years.

5. Madan Negi: With an aim to develop a five star tourism property (Hotels & Resorts) SIIDCUL has a land of Approx. 27 Acres which is on the bank of Tehri Lake.

6. Electronic Manufacturing Cluster, Kashipur: According to the guidelines of the Modified Electronics Manufacturing Clusters (EMC 2.0) Scheme, which were announced by the Ministry of Electronics and Information Technology (MeitY), the EMC will be developed with top-notch common infrastructure and facilities, such as Ready Built Factories (RBF) sheds, warehousing facilities, Employee Hostels, Fire Stations, Medical Facilities, Business Complexes, Plug & Play Facilities, etc., with the goal of supporting the current ESDM ecosystem and luring international electronics manufacturers and their supply chains. The National Capital Region has excellent rail, road, and aviation connections to the projected EMC. An advantage for logistics is the close proximity to the Amritsar Kolkata Industrial Corridor (AKIC), the well-established Multi Modal Logistics Park (MLLP), and the Inland Container Depot (ICD).

7. Transport: "The south part has good communication and transport facilities owing to the geography. But the north side is much more complicated and has poor road connectivity. The existing distribution system largely depends on transportation by road connecting major markets and a few villages."

The Modes of Transport available in the northern state of Uttarakhand are classified into the following categories:

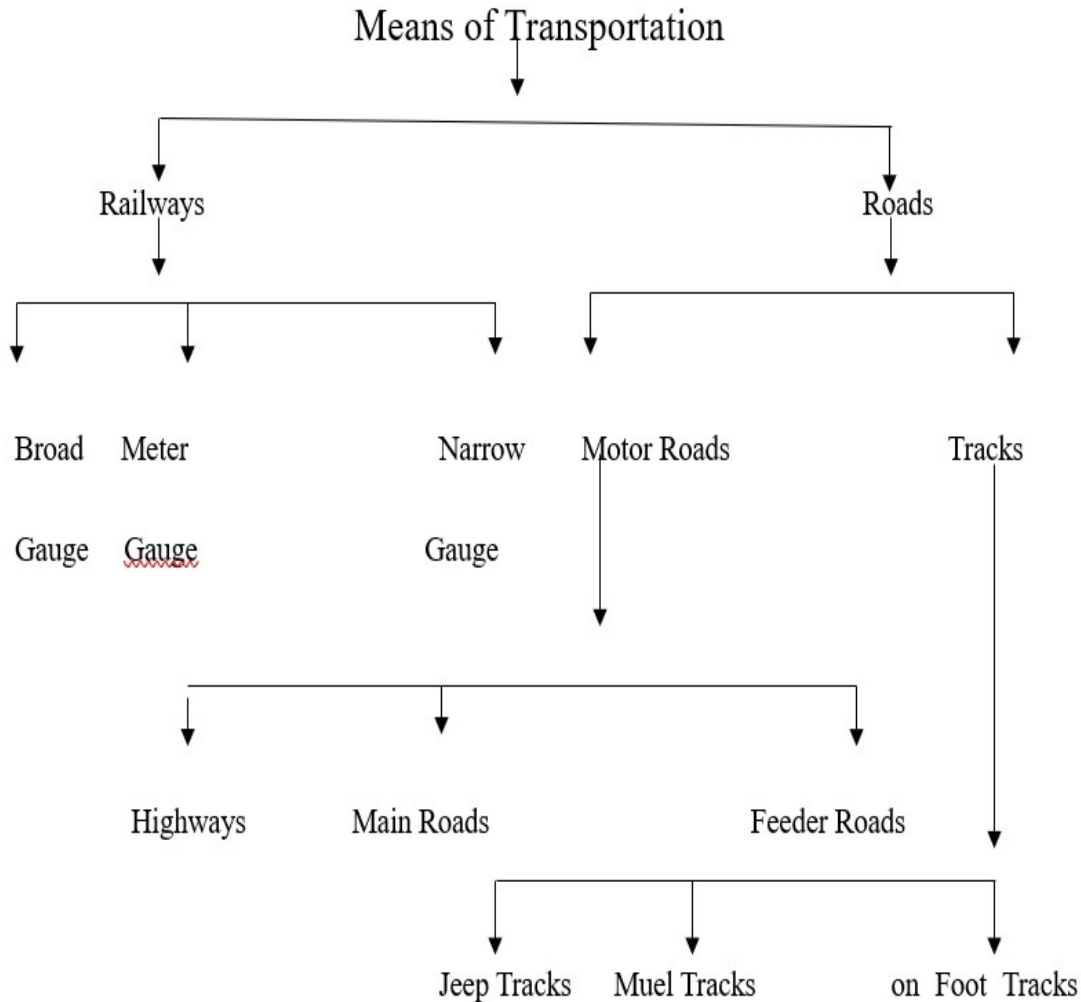


Fig 12.7: Means of Transportation in Uttarakhand, Source: Dr. S.C kharkwal

i. Road Network: Uttarakhand has a wide-ranging road network that links its different cities, towns, and distant places. The state is indeed noted for its mountainous terrain, which is a serious obstacle in road building and maintenance. Despite that, several activities have already been initiated for the improvement of road links such as road widening, construction of new highways, and the introduction of measures to stop landslides.



Fig 12.8: Means of Transportation in Uttarakhand

ii. Railways: Much of Uttarakhand is still difficult to reach by rail because of the severe mountainous terrain. The Northern and North Eastern Railways are in charge of the few railway stations that are situated in the foothills, including Dehradun, Haridwar, Kathgodam, Kotdwar, Rampur, and Rishikesh. In Uttarakhand, Kathgodam and Tanakpur are important gateways to the Kumaon region, while Dehradun and Haridwar are the main railheads in the Garhwal region.



Fig 12.9: Kathgodam Railway Station, Source: Google

Main railway stations of Uttarakhand are:1. Hardwar, 2. Roorkee, 3. Kotdwar, 4. Kashipur, 5. Haldwani, 6.Kathgodam

iii. Air Transport/Civil Aviation: It is true that extending runways and airports can be extremely important for Uttarakhand's industrial and tourism growth. The state can increase tourism earnings and job prospects by increasing air connectivity, which will draw more tourists from both domestic and foreign markets. Better aviation services can also make it easier to carry commodities, which will promote regional trade and industrial development.

a. Jolde343ly Grant (Dehradun): Jolly Grant Airport, also known as Dehradun Airport, is Uttarakhand's primary aviation hub, situated approximately 25 kilometers east of Dehradun amidst the Himalayan foothills. Serving as a key gateway to prominent cities and towns like Rishikesh, Haridwar, Mussoorie, and pilgrimage sites such as Yamunotri, Kedarnath, Badrinath, and Gangotri, it plays a crucial role in facilitating tourism and pilgrimage activities in the region.



Fig 12.10: Means of Transportation in Uttarakhand, Source:Google

b. Pantnagar Airport (US Nagar):Pantnagar Airport in Uttarakhand is a key domestic airport serving the Kumaon region. It connects tourists to popular destinations like Nainital, Ranikhet, Jim Corbett National Park, Bhimtal, and Almora.



Fig 12.11: Means of Transportation in Uttarakhand, Source: Google

- c. **Chinyalisaur Airport (Uttarkashi):** Chinyalisaur Airport, also known as Bharkot Airport, stands out as one of India's most picturesque airports. Nestled on the banks of the breathtaking Tehri Lake and embraced by verdant mountains, it offers travellers a panoramic vista of nature's splendor in every direction.
- d. **Gauchar Airport (Chamoli):** Located on the banks of the River Alaknanda in the Himalayas, Gauchar airfield (Chamoli) is an essential airfield for emergency situations. The site's advantageous location on one of the biggest flatlands in Uttarakhand's mountainous region made it possible to build a 4,000-foot airstrip between 1998 and 2000, which was later expanded. During the June 2013 floods in North India that devastated Uttarakhand, Gauchar Airport was essential to rescue and relief efforts.
- e. **Naini Saini Airport (Uttarakhand):** Pithoragarh, a charming city in Uttarakhand's Kumaon Region, is home to Naini Saini Airport. The airport provides a picturesque view of the surrounding hills and is tucked away in the charming Naini Saini Hill region.



Fig 12.12: Naini Saini Airport, Pithoragarh Source: Google

Tourism

Tourism has been the backbone of Uttarakhand's economy, but recent trends show a shift towards sustainable and ecotourism, driven by the increasing global focus on environmental conservation. Key opportunities include:

Eco-Friendly Tourism Infrastructure: There is a growing demand for eco-resorts, homestays, and offbeat trekking routes. Building sustainable infrastructure that minimizes environmental degradation while promoting local culture and heritage is a major opportunity.

Adventure Tourism: With its mountainous terrain, Uttarakhand is ideal for adventure sports like trekking, mountaineering, paragliding, rafting, and skiing. The government and private players are investing in improving adventure tourism facilities, creating opportunities for businesses catering to adventure seekers.



Fig 12.13: Adventure Tourism, Source: Google

Spiritual and Wellness Tourism: Rishikesh and Haridwar are globally recognized for yoga and spiritual tourism. With increasing awareness around mental and physical wellness, yoga retreats, meditation centers, and Ayurvedic wellness resorts are experiencing heightened demand.



Fig12.14: Spiritual and Wellness Tourism:Source: Google

Astro-tourism in Uttarakhand:

Astro-tourism refers to travel experiences centered around viewing celestial events, stargazing, and exploring astronomy. It typically involves visiting places where light pollution is low, offering clear night skies for astronomical observations.

Starscapes and the Uttarakhand Tourism Development Board have partnered to launch "Nakshatra Sabha," an astro-tourism initiative in Mussoorie, with plans to extend it to Uttarkashi, Pithoragarh, Nainital, and Chamoli. The project focuses on preserving dark skies, stimulating local economies, and providing training opportunities for the community.



Fig 12.15: Astro-Tourism, Source: Google

Forest

Nearly 80% of the population depends either directly or indirectly on woods for their nutrition or survival, making Uttarakhand's forests a vital component of the state's growth. Forests supply fuelwood, fodder, a variety of wild edibles, building materials and human and animal medications. In addition, the woodlands provide a microclimate that allows the hill's many crops to be grown. For forest fringe areas, forests and their products thus represent a significant source of income. Bamboo and medicinal plants are the two main non-wood forest products (NWFPs) that are becoming more and more important in providing greater livelihood prospects.

Classification of Forests

On the basis of the dominant tree species, forest department has classified the forests of the Uttarakhand into 8 major types. These are

Deodar Forests

Blue Pine Forests

Chir Forests

Bamboo Forests

Oak Forests

Fir and Spruce Forests

Sal Forests

Potential and prospects of tourism and forestry in Uttarakhand**Definition of Potential:**

Potential refers to the inherent capacity or ability of a resource, system, or individual to grow, develop, or achieve something in the future.

It represents the latent possibilities that can be realized under favourable conditions.

For example:

In tourism, potential could mean unexplored destinations or activities that could attract visitors.

In forestry, it could refer to the unused ability of forests to provide resources like timber, biodiversity, or ecosystem services.

Definition of Prospects:

Prospects refer to the likelihood or expectation of success, growth, or development in a particular area.

It is a forward-looking term indicating the chances or future possibilities of achieving specific goals.

For example:

In tourism, prospects could involve the expected increase in visitors due to new infrastructure or marketing efforts.

In forestry, prospects might relate to upcoming policies or technologies enhancing sustainable forest management.

Prospects of Tourism in Uttarakhand

Eco-Tourism: Abundant natural beauty with forests, mountains, and rivers supports eco-friendly travel.

Adventure Tourism: Opportunities for trekking, rafting, skiing, and paragliding attract thrill-seekers globally.

Spiritual Tourism: Sacred sites like Char Dham, Haridwar, and Rishikesh draw millions of pilgrims.

Wildlife Tourism: National parks like Jim Corbett and Rajaji provide rich wildlife experiences.

Cultural Tourism: Traditional festivals, fairs, and local handicrafts enhance the cultural tourism experience.

Health and Wellness Tourism: Yoga and Ayurveda hubs, particularly in Rishikesh, appeal to global wellness enthusiasts.

Prospects of Forestry in Uttarakhand:

Biodiversity Conservation: Rich flora and fauna support environmental and scientific interests.

Eco-Tourism Development: Forest reserves and sanctuaries promote tourism while conserving resources.

Sustainable Livelihoods: Community-based forestry creates employment for local populations.

Carbon Sequestration: Forests act as carbon sinks, contributing to climate change mitigation.

Raw Materials: Timber, medicinal plants, and non-timber forest products boost industries and livelihoods.

Research and Education: Opportunities for forestry research, environmental studies, and biodiversity exploration.

Synergies Between Tourism and Forestry:

Sustainable Tourism: Forest conservation enhances the state's appeal as a green destination.

Community Empowerment: Joint forest and tourism initiatives improve local economic conditions.

Climate Resilience: Both sectors can promote practices that mitigate the effects of climate change.

12.4 SUMMARY

Natural endowments of a region create its dominant industries; agriculture zone attract agro based industries whereas mineral-heavy area are economic hubs and attracting many mineral based industries leading to regional growth. Due to the spatial distribution and localisation of industries, which is determined by labour, access to market, transportation networks (infrastructures), availability of raw materials, as well as energy resources – industries are recognized as powerful engines for regional development. Transportation infrastructure plays a key role in the flow of resources and goods, enabling industrial growth and connectivity. Tourism and forestry also enhance economic prospects by utilizing natural and cultural assets, as well as creating many jobs while promoting sustainable development. Strategic planning can help regions achieve their potential and prospects through infrastructure expansion, industrial diversification and investment and innovation promotion Policies.

12.5 GLOSSARY

- **Eco-tourism:** Supporting local communities and preserving the environment are the goals of ecotourism, a form of nature-based travel.
- **IT Park:** IT parks are places that have infrastructure, including buildings, general and industry-specific infrastructure, and business support services, to attract and assist IT-related knowledge and service industries.

12.6 ANSWERS TO CHECK YOUR PROGRESS

Do you know? Travel experiences focused on stargazing, astronomy exploration, and witnessing celestial occurrences are referred to as astro-tourism. Usually, it entails going to locations with minimal light pollution, excellent night skies for astronomical studies.

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12.8 TERMINAL QUESTIONS

Long Questions

1. Write about the localisation and spatial distribution of the principal industrial region in Uttarakhand.
2. Explain in detail about the status of transport, tourism and forestry in Uttarakhand.

Short Question

1. What is Astro-Tourism?
2. Explain the term adventure tourism.
3. What elements affect how an industry is established in a given area?
4. What do you mean by spatial distribution of industries? Explain it
5. Write about the Integrated Industrial Estate (IIE) in Uttarakhand.
6. Write about Integrated Industrial Estate (IIE) Pantnagar and Haridwar.
7. Write about Uttarakhand's primary transportation options.
8. Write about the air transport in Uttarakhand.

MCQ's

1. What does NWFP stand for?
 - a. Non-Wood Forest Products
 - b. No-Wood Forest Products
 - c. Non-Wood Flower Products
 - d. None of the above
2. Which airport is located in Pithoragarh?
 - a. Naini Saini Airport
 - b. Gauchar Airport (Chamoli)
 - c. Chinyalisaur Airport
 - d. Pantnagar Airport
3. Gaucher Airport located in which district of Uttarakhand?
 - a. Chamoli
 - b. Nainital
 - c. Dehradun
 - d. Almora
4. Pantnagar Airport located in which district of Uttarakhand?
 - a. Chamoli
 - b. Nainital
 - c. Dehradun
 - d. US Nagar
5. Which of the following is not a means Transport in Uttarakhand?
 - a. Bus
 - b. Aeroplane
 - c. Train
 - d. Metro Train
6. What is full form of SIIDCUL?
 - a. State Infrastructure and Industrial Corporation of Uttarakhand Limited
 - b. State Institute and Industrial Corporation of Uttarakhand Limited
 - c. State Infrastructure and Industrial Corporation of Uttarakhand Link
 - d. None of the above

7. In which district of Uttarakhand Selaqui (Pharma City) is located?
 - a. Chamoli
 - b. Nainital
 - c. Dehradun
 - d. Almora
8. Which of the following factors is/are Influencing Industrial Localization?
 - a. Availability of Raw Materials
 - b. Labor Supply
 - c. Transportation and Infrastructure
 - d. All of the above
9. Which of the following is/are planned Integrated Industrial Estate (IIE) in Uttarkhand?
 - a. Selaqui
 - b. Kotdwar
 - c. Sitarganj
 - d. All of the above
10. In which district of Uttarakhand railway station is not exist?
 - a. Pithoragarh
 - b. Dehradun
 - c. Haridwar
 - d. Nainital

Answer) 1.a, 2. a, 3. a, 4.d, 5.d, 6.a, 7.c, 8.d, 9.d,10. a

UNIT 13: DEVELOPMENT UNDER FIVE YEAR PLANS,
SUSTAINABLE DEVELOPMENT PLAN FOR
UTTARAKHAND, ENVIRONMENTAL HAZARDS AND
MANAGEMENT IN UTTARAKHAND

13.1 OBJECTIVES

13.2 INTRODUCTION

***13.3 DEVELOPMENT UNDER FIVE YEAR PLANS,
SUSTAINABLE DEVELOPMENT PLAN FOR UTTARAKHAND,
ENVIRONMENTAL HAZARDS AND MANAGEMENT IN
UTTARAKHAND***

13.4 SUMMARY

13.5 GLOSSARY

13.6 ANSWERS TO CHECK YOUR PROGRESS

13.7 REFERENCES

13.8 TERMINAL QUESTIONS

13.1 OBJECTIVES

- Gain knowledge about the evolution and impact of five-yearplans on India's development, with a focus on Uttarakhand.
 - Evaluate the strategies and outcomes of various five-yearplans in promoting economic and social development in Uttarakhand.
 - Identify and analyze the major environmental hazards affecting Uttarakhand, such as landslides, floods, and deforestation..
 - Enhance critical thinking skills by examining the successes and challenges of development and environmental management plans.
-

13.2 INTRODUCTION

Uttarakhand, a state nestled in the Himalayas, is characterized by its breathtaking landscapes, rich biodiversity, and deep cultural heritage. However, its development trajectory has been influenced by the region's complex geography, economic challenges, and environmental vulnerabilities. Since its formation in 2000, Uttarakhand's growth has been closely tied to India's Five-Year Plans, which have provided a framework for addressing the state's unique needs. These plans have sought to enhance infrastructure, promote economic diversification, and improve social welfare, all while recognizing the critical importance of sustainable development.

Sustainable development in Uttarakhand involves not only economic growth but also the careful stewardship of natural resources and the promotion of social equity. Given the state's ecological sensitivity, with its fragile mountain ecosystems and dependence on natural resources, the need for sustainable practices is paramount. The focus on sustainable tourism, organic agriculture, renewable energy, and disaster-resilient infrastructure reflects the state's commitment to balancing development with environmental conservation.

Moreover, Uttarakhand's susceptibility to environmental hazards, including landslides, floods, and earthquakes, presents ongoing challenges that require robust management strategies. Effective environmental hazard management is crucial for protecting both the environment and the livelihoods of the state's inhabitants. This expanded discussion delves into the development strategies implemented under the Five-Year Plans, the sustainable development initiatives tailored specifically for Uttarakhand, and the comprehensive measures needed to manage and mitigate environmental hazards, ensuring a secure and sustainable future for the region.

13.3 DEVELOPMENT UNDER FIVE YEAR PLANS, SUSTAINABLE DEVELOPMENT PLAN FOR UTTARAKHAND, ENVIRONMENTAL HAZARDS AND MANAGEMENT IN UTTARAKHAND

India's Five-Year Plan refers to the primary and strategic framework for economic development that outlines the country's economic goals and priorities for a five-year period. These plans were designed and implemented by the Planning Commission (now replaced by NITI Aayog) and set the direction for national development, covering sectors such as agriculture, industry, education, health, infrastructure and social services. The aim of each Five-Year Plan is to achieve balanced economic growth, reduce inequality and improve the overall quality of life by allocating resources, setting targets and directing public and private sector activities to achieve these goals. The Five-Year Plan has been an important tool in India's economic development planning since its inception in 1951.

The development of Uttarakhand under India's Five-Year Plan is a story of concerted efforts to address the region's unique challenges and realize its potential. Formerly part of Uttar Pradesh, Uttarakhand became an independent state in 2000 during the Ninth Five Year Plan. Since then, the state has received targeted attention in subsequent programs to promote equitable regional development, environmental sustainability, and social well-being.

The State Institution for Empowering and Transforming Uttarakhand (SETU), also known as the State Planning Commission (SPC), serves as the government of Uttarakhand's top policy think tank, offering guidance and policy recommendations. SETU was established on July 21, 2022, replacing the Uttarakhand Planning Commission and modelled after NITI Aayog. The SPC offers pertinent technical advice to the State's developmental departments in addition to creating long-term, strategic plans and programs.

Pre-Statehood (Before 2000)

1. First Five-Year Plan (1951-1956) to Eighth Five-Year Plan (1992-1997):

a) During this period, Uttarakhand was part of Uttar Pradesh, and the region received limited attention under the broader state plans.

b) The focus was on infrastructure development, particularly in the areas of road connectivity and basic services like healthcare and education. However, the hilly terrain and difficult access meant that development was slower compared to the plains.

c) Some investment was made in harnessing the region's hydropower potential, and agriculture was supported through initiatives like soil conservation and irrigation projects.

Post-Statehood (After 2000)

2. Ninth Five-Year Plan (1997-2002):

Context: Uttarakhand was created as a separate state in 2000, towards the end of the Ninth Plan period. This plan, therefore, initially focused on the development needs of Uttar Pradesh as a whole.

Post-Creation Focus: After statehood, there was a shift in focus towards addressing the specific needs of Uttarakhand. The plan prioritized basic infrastructure development, particularly roads, to improve connectivity in the hilly regions. Special attention was given to improving healthcare and educational facilities, which were inadequate at the time of state formation.

Hydropower and Tourism: The Ninth Plan marked the beginning of more focused efforts to develop the state's hydropower potential and promote tourism, especially eco-tourism, as a key economic activity.

3. Tenth Five-Year Plan (2002-2007):

Infrastructure Development: A significant portion of the plan's resources was allocated to improving road connectivity and electrification in rural areas. The construction of new roads and the upgrading of existing ones were crucial for integrating remote villages with the rest of the state.

Hydropower Development: The state government, with support from the central government, pushed forward several hydropower projects. These were seen as vital for both meeting local energy needs and generating revenue through the sale of surplus power.

Tourism Development: Recognizing Uttarakhand's potential as a tourism destination, the Tenth Plan emphasized the development of infrastructure to support tourism, including hotels, transportation, and tourist services. The Char Dham pilgrimage circuit was a particular focus.

Agriculture and Horticulture:The plan also focused on improving agricultural productivity through better irrigation facilities and promoting horticulture and floriculture as alternatives to traditional farming.

4. Eleventh Five-Year Plan (2007-2012):

Sustainable Development:The Eleventh Plan emphasized sustainable development, balancing economic growth with environmental conservation. The focus was on promoting eco-friendly tourism, organic farming, and renewable energy.

Disaster Management:With increasing instances of natural disasters like landslides and floods, disaster management became a priority. The state invested in early warning systems, emergency response infrastructure, and community-based disaster preparedness programs.

Education and Health:There was significant investment in expanding educational facilities, particularly in rural and hilly areas, and improving healthcare services. The plan aimed to enhance the state's Human Development Index (HDI) by addressing gaps in health and education.

Urban Development: The plan also addressed urban development issues, with investments in water supply, sanitation, and housing in growing urban centers like Dehradun, Haridwar, and Nainital.

5. Twelfth Five-Year Plan (2012-2017):

Climate Change Adaptation: The Twelfth Plan placed a strong emphasis on addressing the impacts of climate change, particularly given Uttarakhand's vulnerability to extreme weather events. Projects focused on improving the resilience of agriculture, water resources, and infrastructure.

Rural Development:Rural development was a key focus, with initiatives aimed at improving livelihoods through skill development, better access to credit, and support for small-scale industries like handloom and handicrafts.

Infrastructure Expansion:Continued investment in infrastructure, particularly roads, bridges, and rural electrification, was a priority. There was also a push for improving telecommunications and internet connectivity to bridge the digital divide in rural areas.

Hydropower and Renewable Energy:While hydropower development continued, there was also a greater emphasis on diversifying the energy mix by promoting solar and wind energy projects.

Social Welfare Programs: The plan expanded social welfare schemes, including those targeting women, children, and marginalized communities. The state government also worked on improving the delivery of public services through better governance and use of technology.

Challenges and Future Prospects

Despite significant progress, Uttarakhand still faces challenges, particularly in balancing development with environmental protection. The state's landscape makes infrastructure expensive and difficult to maintain, and the region is vulnerable to natural disasters. Looking ahead, sustainable development strategies should focus on:
Climate resilience: making buildings and communities more resilient to climate change.
Inclusive development: ensuring that marginalized communities benefit from development measures.

Sustainable tourism: continuing to develop tourism in ways that protect the environment and cultural heritage.

Renewable Energy: Expand the use of renewable energy while controlling the environmental impacts of water projects.

Disaster Management: Improve disaster preparedness and prevention, especially due to the increasing number of extreme weather events.

Overall, Uttarakhand's development under the Five-Year Plans reflects a steady progression towards addressing the unique challenges of the region, while leveraging its natural and cultural resources for sustainable growth.

Sustainable Development Plan for Uttarakhand

Sustainable development in Uttarakhand, a mountainous state in northern India, involves balancing economic growth with environmental conservation, social equity, and cultural preservation. The state's unique geography, rich biodiversity, and cultural heritage present both opportunities and challenges for sustainable development.

Key Areas for Sustainable Development in Uttarakhand:

1.Environmental Conservation:

(i) Forest Management: Uttarakhand is home to significant forest cover, including parts of the Himalayas. Sustainable forestry practices, reforestation, and community-based forest management can help preserve biodiversity and prevent deforestation.

(ii) Biodiversity Protection: The state has many protected areas and wildlife sanctuaries. Conservation efforts should focus on protecting endangered species, preventing habitat loss, and promoting eco-friendly tourism.

(iii) Water Resource Management: The state's rivers, including the Ganges, are vital for both local communities and millions downstream. Sustainable water management practices, such as rainwater harvesting and watershed development, are crucial to maintain water quality and availability.

2. Sustainable Agriculture:

(i) Organic Farming: Promoting organic farming practices can help reduce the environmental impact of agriculture, improve soil health, and increase the resilience of local farming communities.

(ii) Agroforestry: Integrating trees and shrubs into agricultural landscapes can enhance biodiversity, improve soil fertility, and provide additional income sources for farmers.

(iii) Water-Efficient Practices: With the challenges of water scarcity, particularly in mountainous regions, promoting water-efficient irrigation practices like drip irrigation can help optimize water use.

3. Renewable Energy:

(i) Hydropower Development: Uttarakhand has significant potential for hydropower, but projects must be developed responsibly to minimize environmental and social impacts, particularly on river ecosystems and local communities.

(ii) Solar and Wind Energy: Expanding solar and wind energy projects can help reduce the state's dependence on non-renewable energy sources, particularly in remote areas where grid connectivity is challenging.

4. Sustainable Tourism:

(i) Eco-Tourism: Promoting eco-tourism can help conserve natural resources while providing income for local communities. This involves developing tourism infrastructure that minimizes environmental impact and emphasizes local culture.



Fig13.1: Ecotourism, Source: Google

(ii) Regulated Pilgrimage Tourism: With places like the Char Dham, pilgrimage tourism is significant in Uttarakhand. Sustainable practices, such as regulating the number of visitors and improving waste management, are essential to prevent environmental degradation.

5. Disaster Risk Reduction:

(i) Climate Resilience: Uttarakhand is vulnerable to natural disasters like landslides, floods, and earthquakes. Strengthening early warning systems, building resilient infrastructure, and promoting community-based disaster preparedness are key to reducing disaster risks.

(ii) Sustainable Urban Planning: In cities and towns, especially in hilly areas, sustainable urban planning can help prevent unregulated construction and reduce vulnerability to natural disasters.

6. Social and Cultural Sustainability:

Preserving Cultural Heritage: Uttarakhand has a rich cultural and spiritual heritage. Sustainable development should include efforts to preserve traditional knowledge, practices, and languages.

Inclusive Development: Ensuring that marginalized communities, such as indigenous groups and women, benefit from development initiatives is crucial for social equity.

7. Education and Awareness:

(i) Environmental Education: Promoting environmental awareness and education, particularly among the youth, can foster a culture of sustainability.

(ii) Skill Development: Enhancing local skills in sustainable practices, such as organic farming, eco-tourism, and renewable energy, can empower communities and improve livelihoods.

Sustainable development in Uttarakhand requires a holistic approach that integrates environmental conservation, economic growth, and social equity. By focusing on these key areas, the state can ensure a balanced and resilient development trajectory that benefits both current and future generations.

Environmental Hazards and Management in Uttarakhand

Environmental hazards in Uttarakhand, a mountainous state in northern India, pose significant challenges due to the region's unique geography, climate, and socio-economic conditions. The state is prone to various natural disasters, including landslides, floods, earthquakes, and forest fires, all of which have profound impacts on its environment, economy, and communities. Effective management of these hazards is crucial to ensure the safety, well-being, and sustainable development of the state.

1. Landslides:

Causes: Landslides are a frequent hazard in Uttarakhand due to its steep terrain, fragile geological conditions, and high levels of seismic activity. They are often triggered by intense rainfall, snowmelt, deforestation, and unplanned construction.



Fig 13.2: Landslide, Source: Google

Impacts: Landslides can cause significant loss of life, damage to infrastructure (including roads, bridges, and buildings), and disruption to local communities. They also contribute to soil erosion and degradation of the land.

Management Strategies:

Afforestation and Vegetative Cover: Planting trees and maintaining vegetation on slopes helps stabilize the soil and reduce the risk of landslides.

Slope Stabilization: Engineering solutions, such as retaining walls, terracing, and drainage systems, are implemented to stabilize vulnerable slopes.

Early Warning Systems: Developing and deploying early warning systems, including monitoring rainfall and ground movement, can provide timely alerts to communities at risk.

Land Use Planning: Restricting construction in high-risk areas and promoting safe building practices are essential for reducing vulnerability.

2. Floods:

Causes: Floods in Uttarakhand are primarily caused by heavy monsoon rains, glacial lake outburst floods (GLOFs), and the overflowing of rivers, particularly the Ganges and its tributaries. Deforestation, land degradation, and unplanned urbanization exacerbate the severity of floods.



Fig13.3: Flood, Source: Google

Impacts: Floods result in widespread destruction of homes, infrastructure, and agricultural land. They also lead to water contamination, loss of life, and displacement of communities.

Management Strategies:

River Embankments and Flood Channels: Constructing embankments and flood channels along rivers can help control the flow of water and reduce flood risks.

Watershed Management: Effective watershed management, including reforestation and soil conservation, can reduce runoff and minimize flood risks.

Glacial Lake Monitoring: Regular monitoring of glacial lakes, especially those prone to outbursts, is critical for predicting and mitigating GLOFs.



Fig13.4: Glacial Lake Outburst, Source: Google

Disaster Preparedness: Community-based disaster preparedness programs, including evacuation plans and flood drills, enhance the resilience of local populations.

3. Earthquakes:

Causes: Uttarakhand lies in a seismically active zone, making it highly vulnerable to earthquakes. The state is located near the boundary of the Indian and Eurasian tectonic plates, which leads to frequent seismic activity.



Fig13.5: Damage of property after earthquake, Source: Google

Impacts: Earthquakes can cause massive destruction of infrastructure, landslides, and loss of life. They also disrupt essential services like electricity, water supply, and communication.

Management Strategies:

Earthquake-Resistant Construction: Implementing and enforcing building codes that mandate earthquake-resistant construction is vital to minimize damage and casualties.

Seismic Monitoring: Enhancing the network of seismic monitoring stations improves the ability to detect and respond to earthquakes quickly.

Public Awareness and Training: Educating the public on earthquake preparedness, including how to respond during and after an earthquake, can save lives and reduce panic.

4. Forest Fires:

Causes: Forest fires in Uttarakhand are often caused by a combination of natural factors, such as lightning, and human activities, including agricultural burning, careless disposal of smoking materials, and the use of fire for land clearing.



Fig13.6: Forest Fire, Source: Google

Impacts: Forest fires lead to the loss of biodiversity, destruction of habitats, air pollution, and soil degradation. They also pose risks to human settlements and infrastructure near forests.

Management Strategies:

Firebreaks and Controlled Burning: Creating firebreaks and using controlled burns can help prevent the spread of wildfires.

Forest Management: Sustainable forest management practices, including reducing the accumulation of combustible material (like dry leaves and fallen trees) and promoting mixed-species forests, can reduce fire risks.

Community Involvement: Engaging local communities in fire prevention efforts, such as monitoring and rapid response teams, enhances early detection and control of fires.

5. Climate Change and Glacial Retreat:

Causes: Climate change is accelerating the retreat of glaciers in Uttarakhand, leading to changes in river flows, increased risks of GLOFs, and long-term impacts on water availability.

Impacts: The retreat of glaciers can lead to the loss of a critical source of water for rivers and communities, increased frequency of floods and droughts, and changes in local ecosystems.

Management Strategies:

Climate Adaptation Measures: Implementing climate adaptation strategies, such as promoting water conservation, diversifying agriculture, and developing alternative livelihoods, helps communities cope with the impacts of climate change.

Glacial Monitoring: Continuous monitoring of glaciers and associated glacial lakes is essential for predicting potential hazards and planning mitigation efforts.

Renewable Energy: Shifting towards renewable energy sources, such as solar and wind, reduces reliance on hydroelectric power, which can be affected by glacial changes and water flow variations.

6. Disaster Management Framework:

Institutional Framework: Uttarakhand has established disaster management authorities at the state and district levels to coordinate response efforts, develop disaster management plans, and ensure effective implementation of hazard mitigation strategies.

Capacity Building: Ongoing training and capacity-building programs for government officials, emergency responders, and communities are crucial for improving disaster preparedness and response.

Integrated Approach: A comprehensive approach to disaster management in Uttarakhand involves integrating traditional knowledge with modern technology, promoting community-based risk reduction, and ensuring that development plans consider environmental risks.

The management of environmental hazards in Uttarakhand requires a multi-faceted approach that combines infrastructure development, community engagement, technological advancements, and sustainable practices. By addressing the root causes of these.

13.4 SUMMARY

Uttarakhand's development under the guidance of India's Five-Year Plan is a concerted effort to address the state's unique challenges while promoting sustainable growth. Uttarakhand's development trajectory has focused on improving infrastructure, promoting tourism, expanding agricultural productivity and hydropower under the state's blueprint since its creation in 2000. Sustainable development of Uttarakhand is important due to the state's weak

mountain status and dependence on natural resources. Key measures include promoting eco-friendly tourism, organic farming, renewable energy and disaster-resilient infrastructure. However, Uttarakhand is vulnerable to environmental hazards such as earthquakes, floods and landslides, which necessitates sound management strategies. Effective environmental management is essential for the protection of the natural environment and human survival. Together, the strategic guidance of the Five-Year Plans, sustainable development efforts, and proactive hazard management form the foundation for Uttarakhand's ongoing pursuit of balanced and resilient growth.

13.5 GLOSSARY

- **Climate Change:** Long-term changes in weather patterns and temperatures are referred to as climate change. These changes may occur naturally as a result of significant volcanic eruptions or variations in the sun's activity. However, human activity has been the primary cause of climate change since the 1800s, mostly as a result of the combustion of fossil fuels like coal, oil, and gas.
- **Glacial Retreat:** When glaciers lose more ice and snow than they receive, they undergo a process known as glacial retreat, which results in a reduction in their mass and size. Several things can cause this to occur.
- **Renewable Energy:** Energy from natural sources that refill more quickly than they are used up is known as renewable energy. Examples of such sources that are continuously replenished are sunlight and wind. We are surrounded by abundant renewable energy sources.
- **Landslides:** A large-scale movement of debris, rock, or earth down a slope is called a landslide. They may occur gradually over extended periods of time or abruptly. A landslide happens when a slope collapses due to the force of gravity pushing on it being greater than the slope's resisting forces.
- **Eco-Tourism:** Every type of nature-based tourism where visitors are primarily drawn to see and appreciate the natural world and the customs that are prevalent in natural settings.
- **Sustainable Development:** The idea of sustainable development is to balance the demands of the environment, the economy, and social well-being for the benefit of present and future generations.

- **Five-Year Plan:** A five-year plan is a document that lists a government's revenue and outlays for the next five years. India adopted the Soviet Union's Five-Year Plans idea and implemented it from 1951 until 2017. The Five-Year Plans were created, carried out, and governed by the Planning Commission.
- **Biodiversity:** The range of life forms found in a single location, including the many flora, fauna, fungus, and even microorganisms like bacteria that comprise our natural environment, is known as biodiversity. To preserve equilibrium and sustain life, these species and organisms cooperate in ecosystems, which resemble a complex web.
- **NITI Aayog:** A government organisation and policy think tank, the National Institution for Transforming India (NITI Aayog) seeks to further India's economic growth.
- **Hydropower:** One of the earliest and most significant renewable energy sources is hydropower, often known as hydroelectric power, which produces electricity by harnessing the natural flow of flowing water.
- **Hazards:** Any human activity, process, or phenomena that has the potential to result in death, serious injury, negative health effects, property destruction, social unrest, economic disruption, or environmental degradation.

13.6 ANSWERS TO CHECK YOUR PROGRESS

Did you know that the State Planning Commission (SPC), also known as the State Institution for Empowering and Transforming Uttarakhand (SETU), is the leading policy think tank for the Uttarakhand government, providing recommendations and advice? Modelled after NITI Aayog, SETU was founded on July 21, 2022, to replace the Uttarakhand Planning Commission.

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13.8 TERMINAL QUESTIONS

Long Question

1. Write about Uttarakhand's post-1951 development plan.
2. Write about Uttarakhand's Environmental hazards and management.

Short Question

1. Write about the Uttarakhand's Environmental hazards.
2. What is the aim of NITI Aayog.
3. What is the role and responsibility of the State Institution for Empowering and Transforming Uttarakhand (SETU) in development plans of Uttarakhand?
4. Write about the Sustainable agriculture plan in Uttarakhand?
5. Write about Uttarakhand's plan for the growth of sustainable tourism.
6. Write about the Development plan of Uttarakhand before the year 2000 (Pre-Statehood).
7. Write about the developments in Uttarakhand during the eleventh five-year plan.
8. What is Uttarakhand's plan to manage environmental hazards?

MCQ's

1. What is the full form of NITI Aayog.
 - a. National Institution for Transforming India
 - b. National Institutional for Transforming India
 - c. National Institution for Transform India

- d. National Institution for Transforming Isreal
2. When did the first five-year plan implemented in India after Independence.
- a.1950
 - b.1951
 - c.1955
 - d.1954
3. What is the full form of SETU.
- a. State Institution for Empowering and Transforming Uttarakhand
 - b. State Institution for Empowering and Transforming Uttar Pradesh
 - c. State Institution for Empowering and Transform Uttarakhand
 - d. None of the above
4. The Planning Commission of India is dissolved and replaced by which organisation?
- a. NITI Aayog
 - b. Election Commission of India
 - c. State Institution for Empowering and Transforming Uttarakhand
 - d. None of the above
5. What is the duration period of first five plan of India.
- a. 1951-1955
 - b. 1950-1955
 - c. 1952-1957
 - d. 1951-1956
6. In which year Uttarakhand was separated from Uttar Pradesh?
- a. 2000
 - b. 2001
 - c. 2007
 - d. 2002

7. What is the duration period of tenth five-year Plan.
- 2002-2007
 - 2001-2006
 - 2007-2012
 - 1997-2002
8. What is agro-forestry?
- Integrating trees and shrubs into agricultural landscapes can enhance biodiversity, improve soil fertility, and provide additional income sources for farmers.
 - Agro-forestry is the practice of covering a sizable tract of land with trees and other vegetation.
 - Agro-forestry is a development approach that enhances the environment and local communities' livelihoods by involving them in forest management.
 - Agro-forestry is a type of woody perennial plant that ranges in size from small to medium.
9. Eco-Tourism definition.
- Ecotourism “is responsible travel to natural areas that conserves the environment and promotes the well-being of local people.
 - The act of visiting a new location for business or pleasure, as well as the related commercial endeavours, is known as eco-tourism.
 - Travelling to places of worship or engaging in spiritually enlightening activities is known as ecotourism.
 - Ecotourism is the practice of going to watch celestial occurrences, such as stars, meteor showers, and auroras.
10. Which of the following not a type of Natural disaster.
- Cyclone
 - Earthquake
 - Oil Spill
 - Volcanic Eruptions

Answer) 1.a, 2.b, 3.a, 4.a, 5.d, 6.a, 7.a, 8.a, 9.a, 10. C



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