CHAPTER 4

Climate of Pakistan

Students' Learning Outcomes

- compare the climatic zones of Pakistan in terms of the distribution of temperature, precipitation, including monsoons, cyclones (Western Depressions), and convectional rain, using a variety of resources such as newspapers, weather charts, geographic representations and geospatial technologies.
- interpret the data collected on Pakistan's climatic zones to evaluate their impact on the country's physical and human geography, including agriculture, infrastructure, and transportation systems.
- analyze the characteristics of arid, semi- arid, humid, coastal and highland climates in Pakistan, including seasonal changes, and evaluate their impact on the physical and human geography of the country.
- assess the ramifications of seasonal shifts in temperature, pressure and wind patterns on Pakistan's economy taking into consideration the effects of cold ice, and snow on mountainous areas, as well as the effects of storms, floods and droughts on agriculture, industry and communication.

The mentioned SLOs are further classified into knowledge and skills for the better understanding of students.

Knowledge

- compare the significance of latitude, altitude, sea distance and precipitation on the climate of Pakistan.
- comprehend how latitude and longitude affects the day length and seasonal variation in different geographical regions of Pakistan.
- interpret extreme weather conditions (floods and droughts) in different geographical regions of Pakistan.
- explain and relate the causes and effects of drought and floods in Pakistan.
- describe the various climatic regions of Pakistan.
- evaluate the effects of climate on the lives of People.

Skills

- employ cutting-edge geographical tools and methodologies, including maps, GIS, and Google maps, to pinpoint and identify Pakistan's diverse climatic zones.
- identify various climatic factors in Pakistan, including precipitation, wind, temperature and air pressure.
- analyze, compare and contrast the climatic factors in Pakistan including rainfall, wind, temperature and pressure using maps and graphs.
- evaluate the impact of altitude, latitudes and longitudes on temperature, air pressure, and rainfall in Pakistan, using appropriate geographic representations and geospatial technologies.
- apply and analyze the influence of altitude and longitude on the climate zones and time zone of Pakistan respectively.
- analyze the impact of Altitude, Latitude and Longitude on the day length and seasonal variation in different geographical regions of Pakistan.
- evaluate, elucidate and infer the effects of extreme weather conditions (floods and droughts) in different geographical regions of Pakistan.
- analyze the effects of temperature and precipitation, including monsoons, cyclones (Western Depressions) and convectional rainfall on the lifestyle of people.
- compare the lifestyle, economic and human activities in different climatic zones of Pakistan.
- analyze the influence of environmental disasters, such as storms, floods, and droughts, on the agricultural, industrial, and communication sectors of Pakistan, assessing their economic and social consequences.
- design sustainable development plans for different climate zones of Pakistan to handle extreme climatic conditions (floods and droughts).

The climate of Pakistan is shaped by latitude, altitude, sea distance and precipitation, leading to diverse climatic regions. Latitude and longitude influence day length and seasonal variations across geographical zones. This chapter explores extreme weather events like floods and droughts, unravelling their causes and effects. Additionally, we delve into the distinct climatic regions of Pakistan and assess their impact on the lives of the people, emphasizing the intricate interplay between geography and human existence.

Knowledge 4.1 Climate of Pakistan

Climate is essentially the long-term average of weather conditions over 30 years. This is distinct from weather, which refers to the current state of these elements and their short-term fluctuations, typically over two weeks. To put it simply, "climate is what you expect over a long period, while weather is what you experience in the short term."

Climate is shaped by four main elements:

- Temperature
- Air pressure
- Humidity
- Precipitation(rainfall).
- These are like the building blocks of climate.
- Factors affecting climate include:
- The location's Latitude
- Distance from the Sea
- Elevation(altitude)
- Surface features
- Wind patterns

Unlike the constant elements, these factors change depending on the region. So, elements are the fixed parts always present, while factors are the variables that shift based on where you are. Understanding these elements and factors helps explain the diverse climates observed in Pakistan, from the coastal regions to the northern mountains and the inland plains. We will discuss the elements and factors of climate side by side.

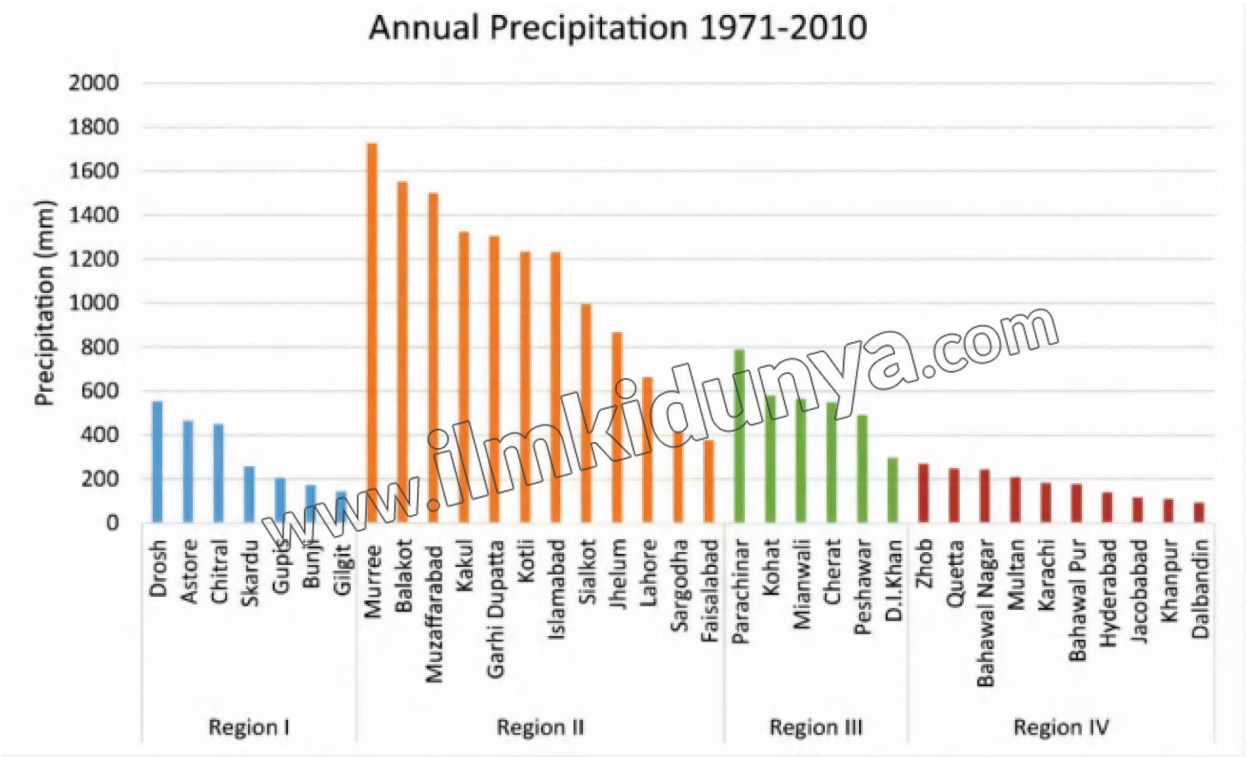
4.1.1 Precipitation in Pakistan

The major part of Pakistan experiences dry climate. Humid conditions prevail over a small area in the north. The whole of Sindh, most of Balochistan, the major part of the Punjab and central parts of Northern Areas receive less than 250 mm of rainfall in a year. There are two major sources of rainfall in Pakistan:

- The Monsoon (July to September)
- The Western Depression (December to March)

Teacher Note

Provide all the necessary resources like reading material, videos, web-links etc. to facilitate students to understand the climate of Pakistan.



Pakistan : Annual Rainfall

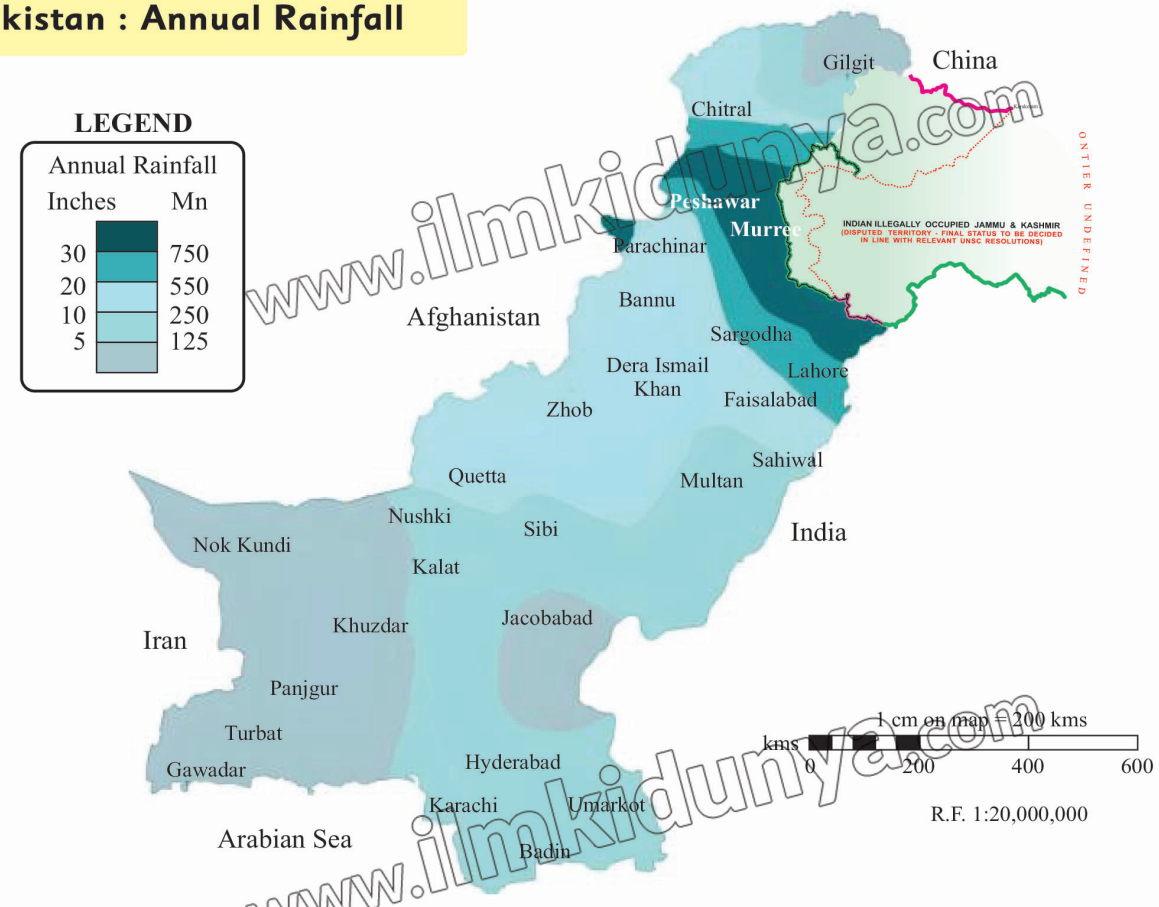


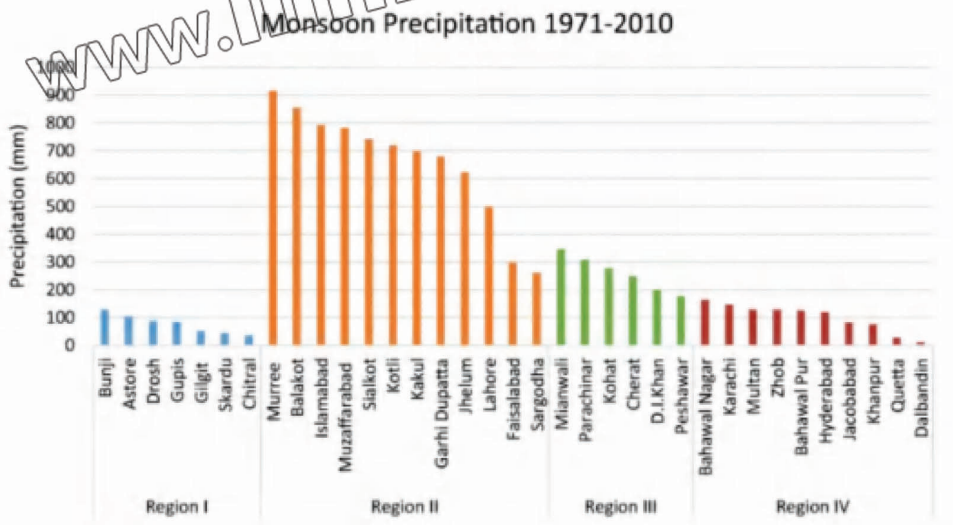
Fig 4.1 The Map shows the Annual rainfall areas of Pakistan

*Source: (https://www.shutterstock.com/image-illustration/annual-rainfall-pakistan-outline-map-1487023211) with modification of line of control AJ&K, and Jummu Kashmir region

Main sources of Rainfall in Pakistan:

Precipitation in Pakistan occurs through distinct mechanisms during various seasons:

- Rainfall through Monsoon winds (July – September).
- Rainfall through the western depression also called winter monsoon. (November – March).
- Rainfall through the thunderstorm also called convectional rainfall. (October, November, April, June).
- Relief rainfall, influenced by the topography of the terrain, contributes to precipitation in certain regions.
- The occurrence of tropical cyclones can lead to significant rainfall and weather disturbances in specific coastal areas.



Monsoon map of Pakistan

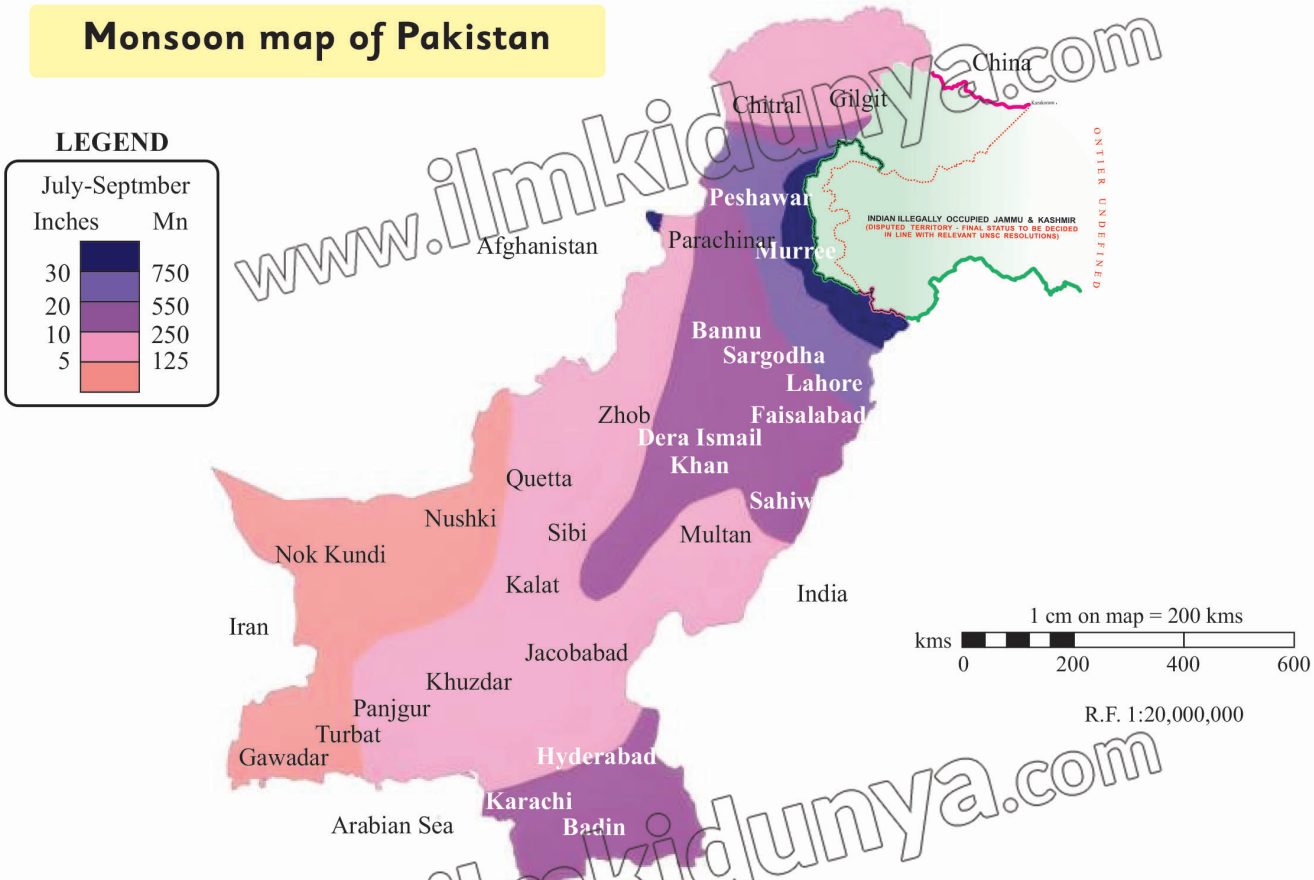


Fig. 4.2 The Map shows the Monsoon Map of Pakistan

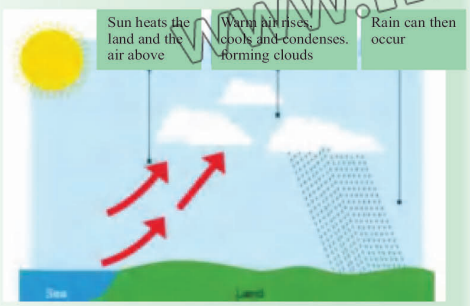
*Source: (https://www.shutterstock.com/image-illustration/map-monsoon-rainfall-pakistan-online-1486911650) with modification of line of control AJ&K, and Jummu Kashmir region

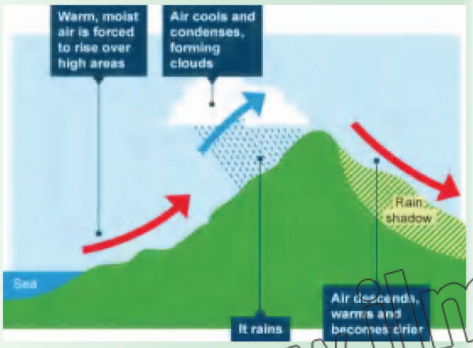
Fig 4.3 Map showing two Monsoon systems one originating from Bay of Bengal and second from Arabian sea.

*Source: Google images. Modified by Author

Fig 4.4 Rainfall due to Western Depression.

*Source: Google Images. Modified by author





Monsoons are seasonal winds that blow from sea towards land from July to August (summers). After that, they reverse their direction and blow from land towards the sea (winters). There are two monsoon systems, one originating from the Bay of Bengal and the other from the Arabian Sea. Moist-laden winds from high-pressure areas of the sea blow towards land. From the east, the monsoon clouds are deflected along the Himalayas from Nepal to Pakistan. Along the way, these clouds rise, cool and thus condense, eventually bringing rainfall to Pakistan. They affect northern Punjab, Khyber-Pakhtunkhwa, Gilgit-Baltistan and Azad Kashmir. On the other hand, another monsoon system that originates in the Arabian Sea also travels inland and delivers little rainfall to Sindh.

The Western Depression Rainfall (November ´March)

These are wind systems that originate from the Mediterranean Sea (Extra-tropical cyclones that develop in the Mediterranean Sea) and travel eastwards towards Middle-East Afghanistan and Pakistan. Since they make a long journey, they lose most of their water when they reach Pakistan. During the winters (Late November to March), they bring rainfall because the Arabian Sea retains its warmth, and thus, cold air from coastal areas flows towards the sea. These western depressions move from high-pressure areas (Mediterranean Sea) towards low-pressure areas (Indus Plains).

Convectional Rainfall or Rainfall through Thunderstorm :(April - June, Oct-Nov)

In contrast to the widespread patterns of monsoon and western depression rainfall, convectional rainfall in Pakistan is a localized phenomenon driven by locally evaporated winds. Through the processes of local evaporation and transpiration, water molecules ascend

to the atmosphere. Upon condensation, these molecules form clouds, leading to rainfall in nearby areas.

Convectional rainfall is often associated with windstorms or thunderstorms, occasionally causing uprooting of trees and destruction. This type of rainfall is not confined to specific regions and can occur in various parts of Pakistan, especially in the North and Northwest. For instance, Rawalpindi and Peshawar experience early summer rainfall due to convectional currents. While convectional rainfall may not be as abundant as that brought by the monsoon or depression, it serves as a vital source, filling the gap and contributing to the overall precipitation in the country.

Relief: Relief rainfall is primarily found in the northern mountainous regions, especially where dense forest prevails. Here, the high rate of evapotranspiration causes a significant amount of water molecules to

rise into the atmosphere, leading to increased rainfall. The side of the mountains facing the wind, known as the windward side, receives more relief rainfall compared to the leeward side. Moving further north in Pakistan, areas like Gilgit experience minimal rainfall, forming a rain shadow region.

4.1.2 Temperature in Pakistan

The primary driver of air temperature changes is the sun. Temperature variations are influenced by factors such as altitude, latitudinal effects, and the contrasting impacts of oceans and continents.

Warmer regions on Earth receive direct vertical sunlight, while cooler areas receive sunlight at an angle. The Tropic of Cancer (23.5 N Latitude) and Capricorn (23.5 S Latitude) experience the sun's rays most directly. The angle of the Sun affects temperature. There are various types of temperature measurements, including Mean Maximum Temperature, Mean Minimum Temperature, Diurnal (daily) Temperature, and Annual Temperature, measured in Celsius

Research and analysis

Divide students into small groups. Each group explores one type of rainfall including monsoons, western depressions, convectional and relief rainfall using information sheets. Groups mark regions on the map where their assigned rainfall type is common. Groups present findings, explaining marked regions and factors influencing rainfall.

— Developmental Activity

Discuss the importance of rainfall and briefly introduce monsoons, western depressions, convectional, and relief rainfall. Discuss differences between rainfall types and how geography affects them.

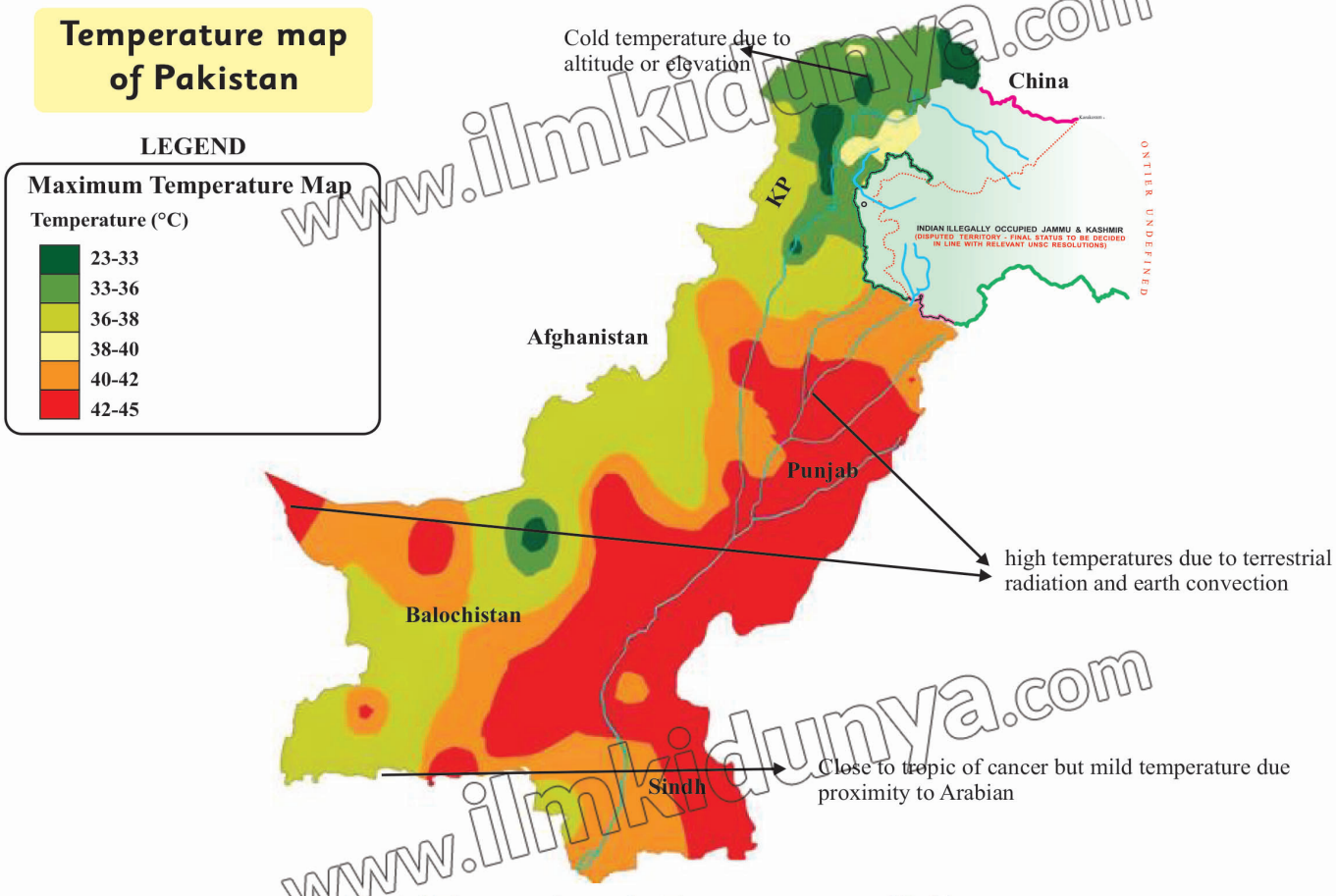


Fig 4.6 The map shows the Temperature map of Pakistan

*Source: (https://www.shutterstock.com/es/image-illustration/temperature-pakistan-map-location-1486907480utm_campaign=image&utm_medium=googleimages&utm_source=schema)
with modification of line of control AJ&K, and Jummu Kashmir region

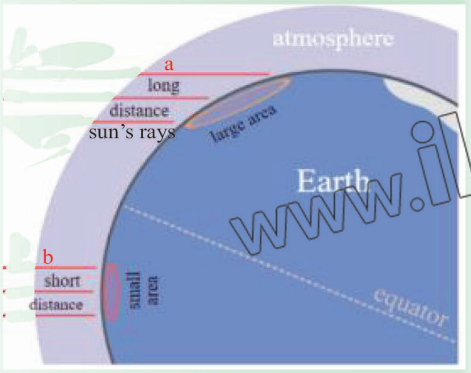


Fig 4.5 Variation in day length

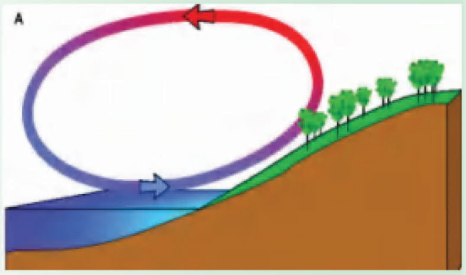


Fig 4.7 Moderate temperature due to Sea breeze

Project 1

Explore the significance of temperature variations in Pakistan through group discussions. Divide the class into groups and allocate each group a specific factor (latitude, altitude, proximity to water bodies). Instruct each group to identify and mark on a map the regions in Pakistan influenced by their assigned factor. Engage in a class discussion on the collective impacts of these various factors on temperature variations. Conclude the activity with students writing a brief reflection on their understanding of the influences of temperature in Pakistan.

or Fahrenheit. Isotherms are lines connecting areas with similar temperatures.

In Pakistan, temperature variations can be attributed to several factors:

Latitudinal Effect: Being near the Tropic of Cancer, Pakistan records higher temperatures due to latitudinal effects.

Altitudinal Effect: Mountainous regions experience mild summers and very cold winters.

Oceanic/Sea Influence: Coastal areas maintain moderate temperatures throughout the year due to the influence of the ocean.

Continental Effect: The Indus Plains and Balochistan Plateau experience high temperatures due to terrestrial radiation and earth convection.

Example: Sibbi (Balochistan), Jacobabad (Sindh) and Multan (Punjab) are among the hottest places in Pakistan, with Sibbi recording the mean maximum temperature. Minimum temperatures are typically recorded in December-January in the Northern Mountains and Quetta.

Types of Temperature in Pakistan

Categories of Temperature	Degree of Temperature
Hot	32 °C or more
Warm	21 °C to 31 °C
Mild	10 °C to 20 °C
Cool	0 °C to 9 °C
Cold	Below O C°

Record Breaker: Temperature and Precipitations Estimates in Pakistan	
Factors	Record
Highest Temperature	53 °C at Jacobabad on 12 June 1919.
Lowest Temperature	-16°C at Chitral on 27 December 1695
Highest Annual Precipitation	2560.8 millimeters at Murre in 1914
Lowest Annual Precipitation	No precipitation at Lasbela in 1971; Sibi in 1973; Kalat in 1981; Karachi, Nawabshah and Badin in 1987. No precipitation at Sukkur and Jiwa ni recorded over several years.

4.1.3 Air Pressure and Winds

Factors effecting Air Pressure

The amount of humidity in the air causes air pressure.

- Height/ Altitudinal effect
- Distance from the sun / Latitudinal effect
- Distance from the sea/ Oceanic Influence

Reasons for difference of Air Pressure in Pakistan

Temperature: Air pressure rises when temperature decreases. It decreases when the temperature rises. Air pressure is high in winter and low in summer.

Height: the air pressure rises in the highlands due to moisture in the air

Oceanic Influence: The amount of humidity is relatively very high near the sea so air pressure is high.

Continental Effect: Air pressure decreases in the Indus Plains, Deserts and Balochistan Plateau due to continental effect.

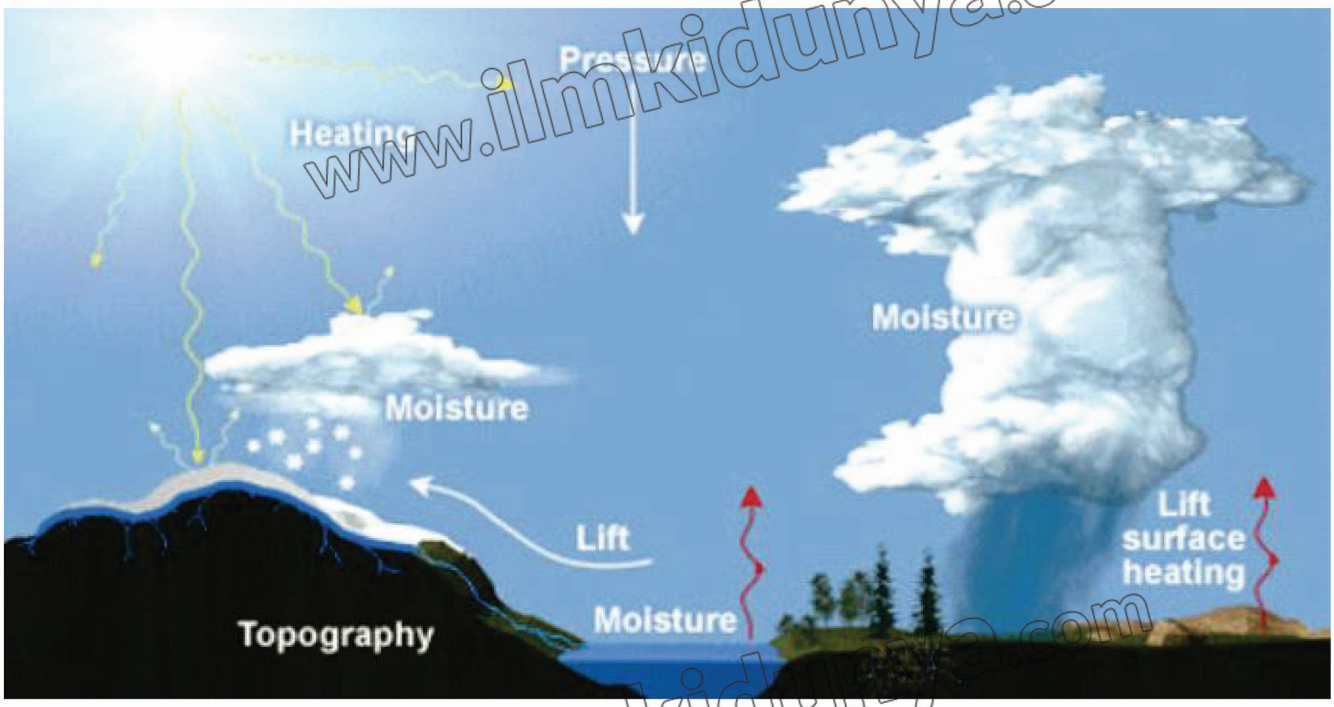
Effects of Air Pressure: Intense low air pressure areas can cause serious storms (Cyclones) and Monsoon Winds; Western Depressions are an example in Pakistan.

— Developmental Activity

Discuss the importance of temperature variations in Pakistan. Divide class into groups. Assign each group a factor (latitude, altitude, proximity to water bodies). Groups mark regions on the map influenced by their assigned factor. Discuss combined impacts of various factors on temperature variations. Students write a brief reflection on learned temperature influences in Pakistan.

—Interesting Fact

Air pressure is measured in inches, centimeters and milli-bars by an instrument known as Barometer. The air pressure is shown on map by a line which is called Isobar. Isobars connects the areas that experience the same air pressure.



Air Pressure and Winds in Pakistan

During the summer season, low air pressure prevails across Pakistan, with Sindh experiencing the lowest atmospheric pressure globally. This condition contributes significantly to the onset of the monsoon. Conversely, in winter, two notable phenomena occur: a high-

Skill: 4.1-4.2

- Identify various climatic factors in Pakistan, including precipitation, wind, temperature and air pressure. Skill sheet will be provided via QR code.
- Analyze, compare and contrast the climatic factors in Pakistan including rainfall, wind, temperature and pressure using maps and graphs. Skill sheet will be provided via QR code.

pressure belt forms over central Asia, giving rise to cold winds; simultaneously, Pakistan is influenced by western disturbances, occasionally bringing rainfall.

Knowledge 4.2 Effect of Latitude and Longitude in different geographical regions of Pakistan

Latitude and longitude play a significant role in determining day length and seasonal variation in different geographical regions. In the context of Pakistan, which spans a considerable latitudinal range, understanding these factors is crucial.

4.2.1 Latitude and Day Length

Equator (0° Latitude)

- Near the equator, day and night lengths are relatively constant throughout the year.
- There is a minimal difference between day and night, providing a consistent amount of sunlight.

Northern Regions (Higher Latitude)

- As you move towards higher latitudes, such as northern regions of Pakistan, there is more variation in day length between seasons.
- During summer, days are longer, and nights are shorter, resulting in more daylight hours.
- In winter, the reverse occurs, with shorter days and longer nights.

Southern Regions (Lower Latitude)

- Conversely, in southern regions like Karachi, which is closer to the equator, day length variation is less pronounced.
- Days and nights are more evenly distributed throughout the year, with a smaller difference in daylight duration between seasons.

4.2.2 Latitude and Seasonal Variation

Tropic of Cancer (23.5° N)

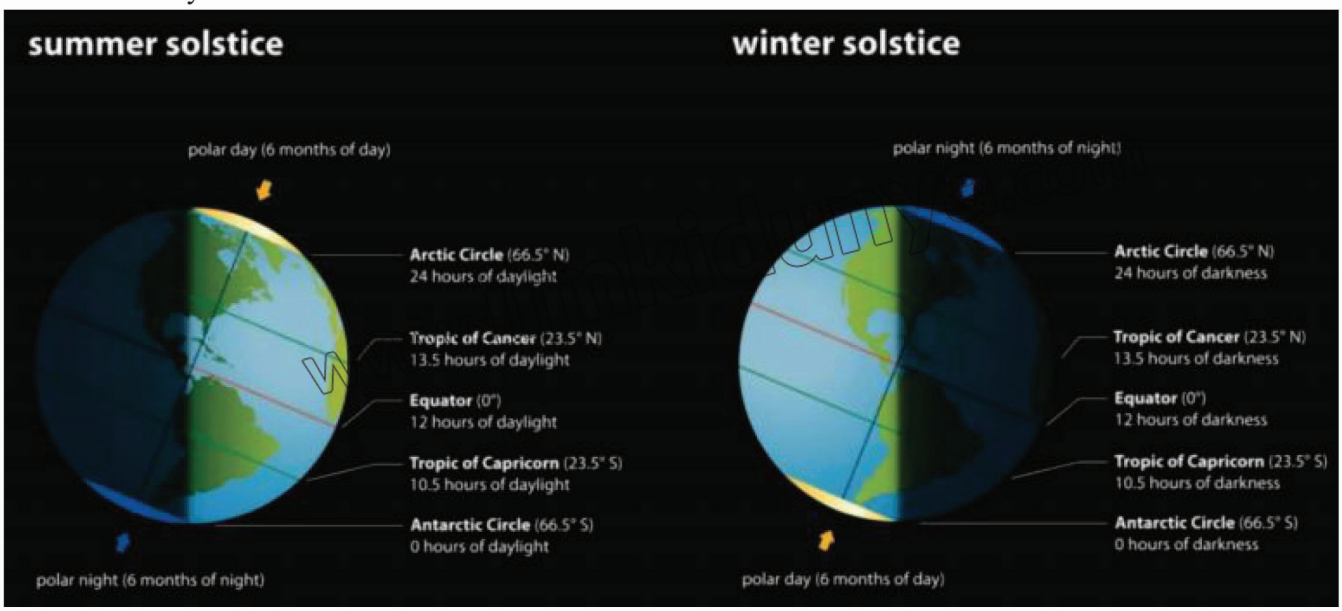
- Regions in Pakistan near the Tropic of Cancer experience distinct seasons.
- Summer (around June 21st) sees longer days, intense heat and shorter nights.
- Winter (around December 21st) has shorter days, milder temperatures and longer nights.

Polar Regions (Higher Latitudes)

- Areas in northern Pakistan, particularly in the mountainous regions, may exhibit characteristics of polar regions.
- Extreme seasonal variations, with prolonged daylight in summer (midnight sun) and extended darkness in winter (polar night).

Equatorial Regions (Near 0° Latitude)

- Southern regions like Karachi experience less seasonal variation.
- Instead of distinct seasons, there may be wet and dry periods influenced by monsoons.



4.2.3 Longitude and Local Time

Time Zones

- Longitude also influences local time, with each 15° of longitude roughly corresponding to a one-hour time difference.
- Different regions in Pakistan, especially in the east-west direction, may experience variations in local time.
- In summary, latitude primarily influences day length and seasonal variation in Pakistan. Regions closer to the equator generally have less variation in day length and milder seasons, while those at higher latitudes experience more pronounced seasonal changes and greater differences in day length between summer and winter.

— Developmental Activity

Examine the influence of latitude, altitude, proximity to seas, and precipitation on Pakistan's climate. Demonstrate how latitude and longitude contribute to variations in day length and seasons throughout the country.

Knowledge 4.3 — 4.4 Extreme Weather Conditions

Extreme weather conditions, such as floods and droughts, can have diverse impacts on different geographical regions of Pakistan due to its varied topography, climate and geographical features. Let's explore the interpretations for floods and droughts in different areas:

4.3.1 Floods

- Northern Mountainous Regions (e.g., Gilgit-Baltistan)
- Heavy monsoon rains or rapid snowmelt can lead to flash floods.
- Steep terrain exacerbates the intensity of floods.
- Glacial lake outburst floods (GLOFs) can occur due to melting glaciers.

——Skill: 4.3

Analyze the impact of Altitude, Latitude and Longitude on the day length and seasonal variation in different geographical regions of Pakistan. Skill sheet will be provided via QR code.

Punjab Plains

- The vast river systems, including the Indus, make this region prone to riverine floods.
- Intensive monsoon rainfall or upstream water releases can cause riverbanks to breach.

Sindh and Lower Indus Basin

- Riverine flooding can occur due to high water volumes downstream.
- Coastal areas may face additional risks from storm surges during tropical cyclones.

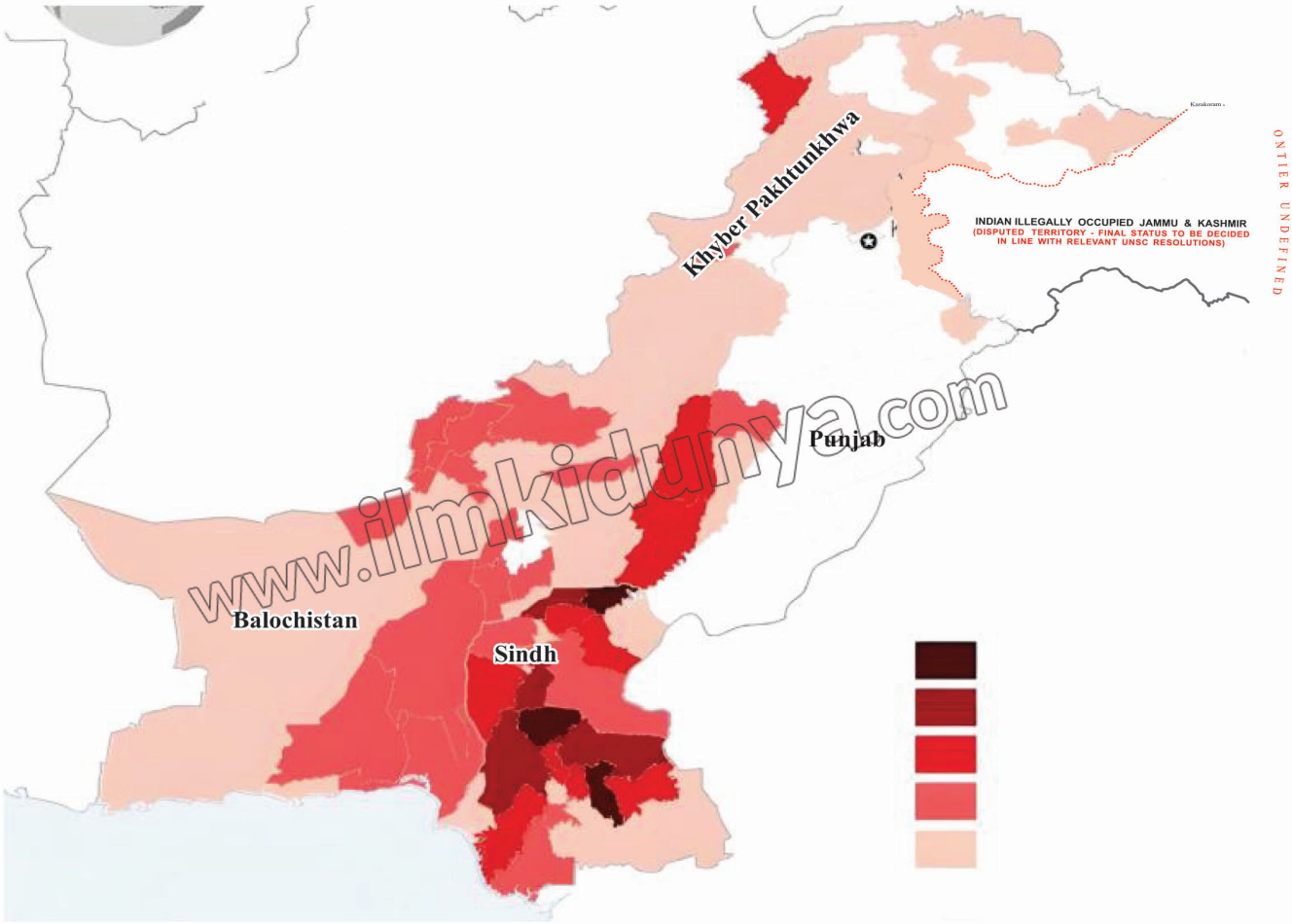


Fig. 4.8 Areas affected by 2022 floods in Pakistan.

*Source: https://newsin.asia/pakistan-floods

4.3.2 Causes and Effects of Floods in Pakistan:

Causes

Monsoon Rains

Intense monsoon rainfall, especially in the northern and eastern regions, can lead to riverine and flash floods.

Glacial Melt and River Runoff

Rapid melting of glaciers, particularly in mountainous regions, can contribute to increased river flow and floods.

Urbanization and Land Use Changes

Poor urban planning, deforestation, and changes in land use patterns can exacerbate flooding by reducing natural water absorption.

Cyclones and Tropical Storms

Coastal areas, especially in Sindh, are vulnerable to storm surges and heavy rainfall associated with

tropical cyclones.

Effects

Infrastructure Damage

- Destruction of roads, bridges and buildings due to the force of floodwaters.
- Disruption of transportation and communication networks.

Agricultural Losses

- Crop damage and loss of livestock due to inundation and waterlogging.
- Soil erosion and loss of fertile topsoil.

Displacement and Loss of Lives

- Forced migration of people from flooded areas.
- Loss of lives due to drowning, waterborne diseases, and other flood-related hazards.

Economic Impact

- Damage to businesses and industries.
- Costs associated with rescue operations, relief efforts, and rebuilding.

Environmental Consequences

- Disruption of ecosystems and loss of biodiversity.
- Contamination of water sources and soil.

Teacher Note

Share images and case studies of significant droughts and floods in Pakistan. Discuss the causes and effects of each event. Encourage students to identify patterns and recurring factors that contribute to these natural disasters.

Fig. 4.9 Floods

Research and analysis

Investigate floods and droughts in different regions, presenting their causes and effects. Discuss the factors leading to floods and droughts, making connections to climate change and human activities. Analyze the effects of climate on agriculture, livelihoods, and daily life in diverse regions. Compile research findings into a comprehensive presentation. Conclude by exploring the overarching impact of climate on Pakistani society.

Skill: 4.4-4.5

- Evaluate, elucidate and infer the effects of extreme weather conditions (floods and droughts) in different geographical regions of Pakistan.
- Analyze the influence of environmental disasters, such as storms, floods, and droughts, on the agricultural, industrial, and communication sectors of Pakistan, assessing their economic and social consequences. Skill sheet will be provided via QR code.

Teacher Note

Use a range of sources such as Google maps, satellite images, photographs, diagrams, GPS, GIS, newspaper articles, climatic maps to derive information about global warming, climate change and its effects on Pakistan.
Share images and case studies of significant droughts and floods in Pakistan. Discuss the causes and effects of each event. Encourage students to identify patterns and recurring factors that contribute to these natural disasters.

4.3.3 Droughts

Balochistan

- Arid and semi-arid conditions make Balochistan susceptible to drought.
- Lack of regular monsoon rains and dependence on limited water sources can lead to water scarcity.

Thar Desert (Sindh)

- Already a dry region, Thar can face severe drought conditions.
- Lack of regular rainfall and scarcity of water resources impact agriculture and livelihoods.
- Khyber Pakhtunkhwa (KP)
- These areas may experience drought conditions, especially in the rain-shadow regions.
- Dependence on rain-fed agriculture can be challenging during periods of water scarcity.

4.3.4Causes and Effects of Drought in Pakistan

Causes

Below-Average Rainfall

Irregular or insufficient monsoon rains, especially in arid and semi-arid regions like Balochistan and parts of Sindh, contribute to drought conditions.

High Evaporation Rates

Intense heat and high temperatures lead to increased evaporation, exacerbating water scarcity in already dry areas.

Deficient Water Management

Inefficient water management practices, such as over-extraction of groundwater and mismanagement of surface water, contribute to drought conditions.

Climate Change

Changing climate patterns, including variations in temperature and precipitation, can contribute to prolonged periods of water scarcity.

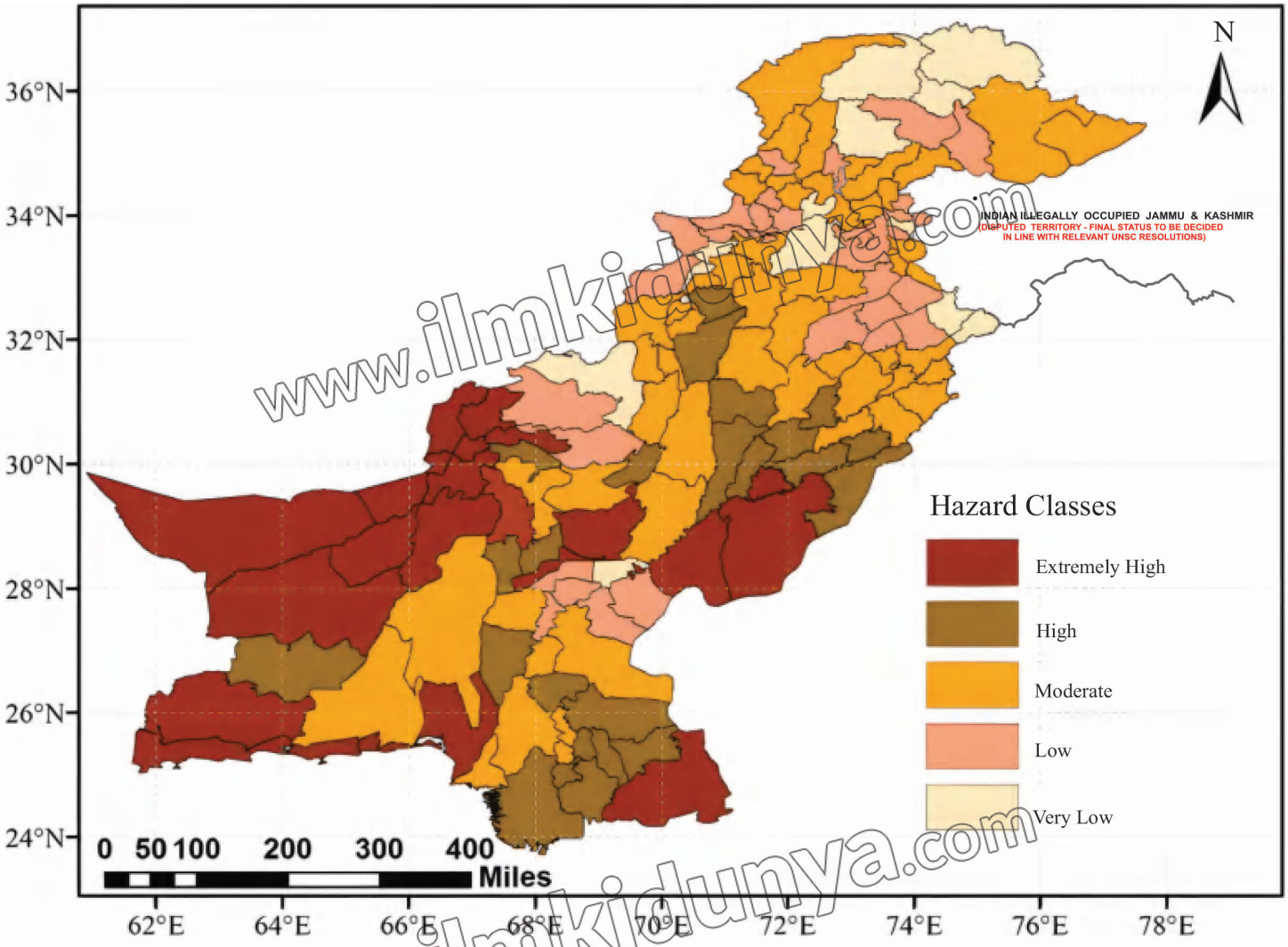
Effects:

Agricultural Impact

- Crop failure and reduced yields due to inadequate water for irrigation.
- Livestock face water shortages and scarcity of grazing areas.

Water Supply Shortages

- Reduced water availability for domestic, industrial and agricultural purposes.
- Depletion of reservoirs and groundwater levels.



Economic Consequences

- Loss of livelihoods, particularly for those dependent on agriculture.
- Increased poverty and food insecurity.

Health Issues

- Drought can lead to waterborne diseases as water sources become contaminated.
- Malnutrition and health problems due to food shortages.

— Developmental Activity

Provide each student or group with a world map or maps of Pakistan. Ask them to mark regions prone to droughts and floods. Discuss as a class the geographical factors that contribute to these occurrences in specific regions.

Teacher Note

Show images representing various climatic regions in Pakistan. Discuss the visual characteristics, vegetation, and topographical features that define each region. Encourage students to note any unique aspects they observe.

Understanding these regional variations is crucial for developing targeted strategies for disaster preparedness, mitigation, and sustainable water resource management in different parts of Pakistan. Additionally, climate change may further influence the frequency and intensity of these extreme weather events, necessitating adaptive measures.

Knowledge 4.5 Climatic Regions of Pakistan

Pakistan's geographical location encompasses both the temperate and dry zones, with a latitude range spanning approximately 27°N in the Northern Hemisphere. The southernmost point of the country, along the Arabian Sea coast, lies at around 23.6°N latitude. The northernmost point, which includes areas in Gilgit-Baltistan and Azad Jammu and Kashmir, adds to the geographical diversity of Pakistan. The country exhibits distinct climatic zones, contributing to its varied weather patterns. These zones can be categorized as follows:

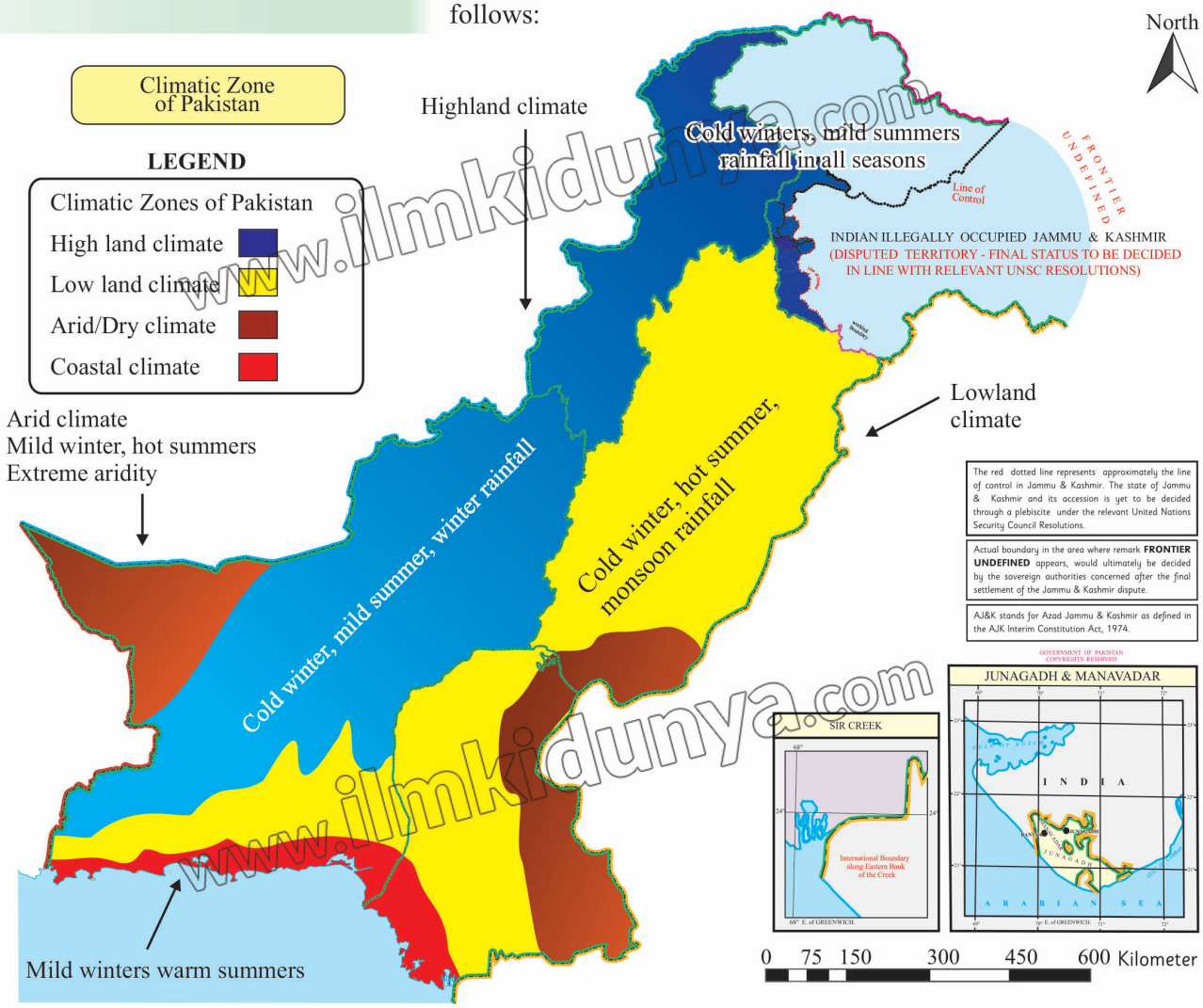


Fig. 4.10 The Map shows the Climatic regions of Pakistan. The Map outline is use which is provided by NCC. Modifications are done to show elaborated climatic regions, approval is required.

i. High Land Climatic Region

Pakistan's highland climate, encompassing the high-altitude regions of the north, northwest and west, is characterized by distinctive features that shape the region's environment, vegetation, and lifestyle.

Winters

The highland climate experiences prolonged, frigid winters, with temperatures often dipping below freezing. Snowfall is a regular occurrence, covering the landscape in a blanket of white. The harsh winter conditions pose challenges for both human and animal inhabitants, requiring adaptations in lifestyle and agriculture.

Summers

Summers in the highlands are a contrast to the harsh winters. In the Northern Mountains, summers are mild and short, with occasional rainfall. This allows for a brief growing season for vegetation and crops. In contrast, the Western Mountains experience drier and warmer summers, with less rainfall.

Altitude and Rainfall

Altitude plays a significant role in determining rainfall patterns in the highlands. The higher peaks of the Northern Mountains receive more precipitation due to their increased exposure to moisture-laden air masses. As a result, the vegetation in these areas is lush and more diverse compared to the drier Western Mountains.

Temperature Variations

Temperature conditions in the highlands are also influenced by altitude. As we move from north to south, the temperature generally decreases, reflecting the increasing elevation. This altitudinal gradient creates a range of microclimates, supporting a variety of vegetation types.

Vegetation

The highland climate supports a diverse range of vegetation adapted to the region's distinct temperature and rainfall patterns. In the Northern Mountains, coniferous forests thrive, while alpine meadows carpet the higher elevations. The Western Mountains, with their drier conditions, host scrublands and grasslands.

Lifestyle

The highland climate has shaped the lifestyle of the region's inhabitants. Traditional communities have adapted to the harsh winters by developing strategies for food preservation and shelter. Livestock rearing and agriculture play significant roles in the local economy, with adaptations made to suit the varying climatic conditions.

Teacher Note

Use Maps, GIS and Google maps to help students identify different climatic regions of Pakistan.

ii. Low-Land Climatic Region

Pakistan's lowland climate, encompassing the Indus Plain in Punjab and Sindh, is characterized by distinct features that influence the region's environment, vegetation, and lifestyle.

Summers

Summers in the lowlands are intensely hot and arid, with temperatures often soaring above 40 degrees Celsius. The region experiences extreme heat waves, particularly in the Thar Desert, where temperatures can exceed 50 degrees Celsius. The aridity during summers creates challenges for agriculture and water resources.

Monsoon Rainfall

The lowland climate receives its primary rainfall during the monsoon season, which typically lasts from July to August. The monsoon rains bring much-needed relief from the scorching heat and provide essential moisture for agriculture. The intensity of monsoon rainfall varies from year to year, sometimes leading to floods or droughts.

Winters

In contrast to the harsh summers, winters in the Lowlands are mild and cool, with temperatures ranging from 15 to 25 degrees Celsius. The pleasant winter conditions allow for outdoor activities and agriculture.

Fig. 4.11 Vegetation in Low-Lanads

Thunderstorms:

The northern and northwestern regions of the Indus Plain experience thunderstorms, particularly during the pre-monsoon and post-monsoon seasons. These thunderstorms can be accompanied by heavy rainfall, strong winds, and occasional hail.

Rainfall Variability

Rainfall patterns in the lowlands are variable, with some areas receiving more precipitation than others. The Thar Desert, located in the southern part of the Indus Plain, is the driest region, receiving as little as 100 millimetres of rainfall annually. In contrast, the monsoon rains are more intense along the foothills of the Himalayas, providing more abundant rainfall.

Vegetation

The lowland climate supports a variety of vegetation types adapted to the region's seasonal variations in temperature and rainfall. During the monsoon season, grasslands and scrublands flourish, while the arid summers promote the growth of drought-resistant plants like cacti and thorn bushes.

Lifestyle

The lowland climate has shaped the lifestyle of the region's

inhabitants. Traditional communities have developed strategies to cope with the extreme heat and water scarcity during summer. Agriculture is practised during the monsoon season, utilizing the available rainfall for crop production. Livestock rearing also plays a significant role in the local economy.

iii. Arid-Dry Climatic Region

Pakistan's arid climate, encompassing the desert regions of Kharan (South-west Balochistan), Cholistan (South-east of Punjab), Thar (South-east of Sindh), and Thal (north-east of Punjab), is characterized by distinct features that shape the region's harsh environment, resilient vegetation, and adapted lifestyle.

Summers

Summers in the arid regions of Pakistan are intensely hot and dry, with daytime temperatures often soaring above 40 degrees Celsius. The scorching heat is unrelenting, with little relief from humidity or cloud cover. Hot winds, locally known as "loo," blow across the plains, further intensifying the aridity.

Monsoon Rainfall

The arid regions of Pakistan receive minimal rainfall during the monsoon season, which typically lasts from July to August. The Thar Desert, located in the southeastern part of the country, is the driest region, receiving as little as 100 millimetres of rainfall annually. This scarcity of rainfall poses significant challenges for agriculture and water resources.

Dust Storms

The arid regions experience frequent dust storms, particularly during the pre-monsoon and post-monsoon seasons. These dust storms can be severe, reducing visibility to near zero and causing respiratory problems. The continuous blowing of dust from mid-May to mid-September further contributes to the dryness of the region.

Extreme Heat and Cold

The arid climate is characterized by extreme temperature variations. The scorching heat of summers is replaced by the chill of winters, with minimum mean temperatures dropping to around 4 degrees Celsius in January. The desert areas of southern Balochistan receive scanty rainfall during winters, further exacerbating the harsh conditions.

Vegetation

Despite the harsh environment, the arid regions of Pakistan support a variety of vegetation types adapted to the extreme conditions. Drought-resistant plants like cacti, thorn bushes, and desert grasses thrive in the arid landscape, while sparse trees provide some shade and shelter.

Lifestyle

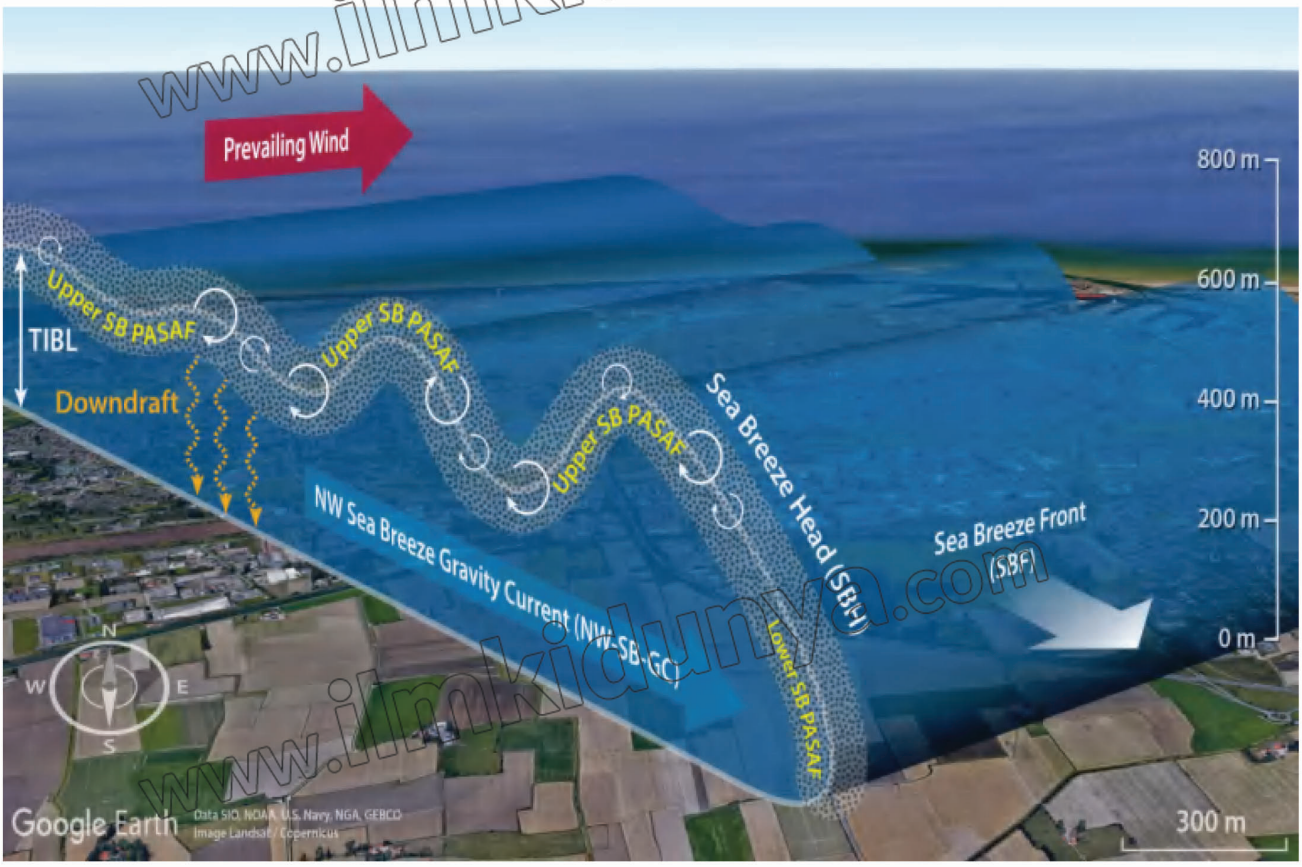
The arid climate has shaped the lifestyle of the region's inhabitants, who have developed strategies to cope with the extreme heat, water scarcity, and dust storms. Traditional communities rely on livestock rearing and nomadic pastoralism, adapting their movements to the availability of water and grazing land.

Coastal Region

Pakistan's coastal climate, encompassing the areas along the coast from the Ran of Kutch at the Pak-India border to the Makran Coast at the Pak-Iran border, is characterized by distinct features that influence the region's environment, vegetation, and lifestyle.

Sea Breezes and Warm Winds

The coastal strip of Pakistan experiences persistent sea breezes throughout the year, providing a refreshing contrast to the inland heat. These sea breezes moderate the temperature and humidity levels, making the coastal areas more comfortable than the interior regions. However, warm winds blowing from the Thar Desert in the east can sometimes raise temperatures and increase humidity, particularly during the summer months. This combination of sea breezes and warm inland winds can create a unique blend of air temperatures and humidity levels along the coast.



4.12 Sea Breeze.

High Humidity

The proximity of the Arabian Sea to the coastal strip of Pakistan contributes to high levels of humidity, particularly during the summer months. Humidity levels often exceed 50% between April and September, creating a more humid and muggier environment compared to inland areas.

Monsoon Rainfall

The coastal regions of Pakistan receive relatively scanty rainfall, with most precipitation occurring during the summer monsoon season. The monsoon winds bring moisture from the Arabian Sea, leading to rainfall in the coastal areas, typically during the months of July or August.

Western Depression Winds

The Makran Coast, located in southwestern Pakistan, receives even less rainfall due to the influence of western depression winds. These winds, originating from the Mediterranean Sea and entering Balochistan from Iran and Afghanistan, tend to lose their moisture before reaching the Makran Coast, resulting in minimal rainfall in the region.

Vegetation

The coastal climate of Pakistan supports a variety of vegetation types adapted to the unique conditions of the region. Mangrove forests thrive in the intertidal zones along the coast, providing a habitat for various marine and terrestrial species. Salt-tolerant plants and shrubs flourish in the saline soils along the coast, while coconut palms and other tropical vegetation add to the coastal landscape. The coastal areas also support a diverse range of grasses, herbs, and wildflowers.

Lifestyle:

The coastal climate has shaped the lifestyle of the region's inhabitants, particularly in terms of fishing communities and coastal agriculture. Fishing is a major source of livelihood for many coastal dwellers, and traditional fishing techniques have been adapted to the region's unique marine environment. Coastal agriculture also plays a significant role in the local economy, with crops adapted to the saline soils and humid conditions. Communities along the coast have developed strategies for managing water resources, irrigation, and crop selection to thrive in this challenging yet productive environment.

Research and analysis

Assign students specific topics related to the effects of climate on people's lives, such as health, agriculture, housing, or migration. Provide time for independent or group research using reliable sources, both online and offline. Instruct students to create a visual representation of their findings on poster boards or digital presentation tools.

— Developmental Activity

Create a map illustrating climatic regions based on temperature, precipitation, and vegetation.

— Developmental Activity

Provide each student or group with a map of Pakistan. Ask them to identify and mark the different climatic regions on the map. Discuss the geographical features and patterns that characterize each region.

——Skill: 2.1-2.2

- Apply and analyze the influence of altitude and longitude on the climate zones and time zone of Pakistan respectively.
- Design sustainable development plans for different climate zones of Pakistan
- Compare the lifestyle, economic and human activities in different climatic zones of Pakistan

Skill sheet will be provided via QR code.

Exercise

A Choose the correct option against each statement.

1. What geographical factor primarily influences the temperature variations in Pakistan?
   - **a.** a) Altitude
   - **b.** Latitude
   - **c.** Sea distance
   - **d.** Precipitation

2. In which region of Pakistan is the impact of sea distance on climate most significant?
   - **a.** Northern areas
   - **b.** Coastal areas
   - **c.** Southern Punjab
   - **d.** Western desert

3. Which factor is crucial in determining the amount of precipitation in a specific region of Pakistan?
   - **a.** Altitude
   - **b.** Latitude
   - **c.** Sea distance
   - **d.** All of the above

4. In which season do regions near the equator in Pakistan experience the least variation in day length?
   - **a.** Summer
   - **b.** Winter
   - **c.** Spring
   - **d.** Autumn

5. How do regions at higher latitudes in Pakistan experience day length during summer compared to winter?
   - **a.** longer days in summer, shorter days in winter
   - **b.** shorter days in summer, longer days in winter
   - **c.** Equal day length throughout the year
   - **d.** Day length remains constant, unaffected by latitude

6. Which geographical region in Pakistan is more prone to frequent droughts?
   - **a.** Coastal areas
   - **b.** Northern areas
   - **c.** Thar Desert
   - **d.** Eastern plains

7. What climatic conditions contribute to the occurrence of floods in Pakistan?
   - **a.** Prolonged droughts
   - **b.** Heavy rainfall and snowmelt
   - **c.** Low temperatures
   - **d.** High-altitude winds

8. What is a common cause of drought in Pakistan?
   - **a.** Excessive rainfall
   - **b.** Below-average precipitation
   - **c.** Melting glaciers
   - **d.** Strong winds

9. How do floods affect agriculture in Pakistan?
   - **a.** Enhance crop yield
   - **b.** Cause soil erosion and damage crops
   - **c.** Reduce temperature for crops
   - **d.** Increase nutrient content in soil

10. Which climatic region of Pakistan is characterized by high temperatures, low precipitation, and sandy terrain?
    - **a.** Coastal region
    - **b.** Northern areas
    - **c.** Thar Desert
    - **d.** Western Himalayas

B Write brief answers of the following questions.

1. How does latitude affect day length in different regions of Pakistan?
2. Which geographical region in Pakistan is more prone to frequent droughts?
3. What climatic conditions contribute to the occurrence of floods in Pakistan?
4. What is a common cause of drought in Pakistan?
5. Which climatic region of Pakistan is characterized by high temperatures, low precipitation, and sandy terrain?
6. In which region of Pakistan would you find a temperate climate with moderate temperatures and abundant rainfall
7. How does extreme heat in the Thar Desert impact the lifestyle of the local population?
8. What is a potential impact of climate change on coastal communities in Pakistan?

C Write comprehensive answers of the following questions.

1. Explore the combined influence of latitude, altitude, sea proximity, and precipitation on the diverse climates across the country.
2. Examine how latitude and longitude affect day length and seasonal variations in different regions of Pakistan.
3. Describe Pakistan's climatic regions, emphasizing unique characteristics and their effects on agriculture and human settlements.
4. Evaluate the diverse climate's effects on livelihoods, health, and vulnerability to climate-related challenges in Pakistan.
5. Describe Pakistan's climatic regions, emphasizing unique characteristics and their effects on agriculture and human settlements.