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Highland climate zones are characterised by their high elevation and cooler temperatures compared to lowland areas. These zones are typically found in mountainous regions around the world, such as the Andes in South America, the Himalayas in Asia, and the Alps in Europe. The climate in these areas is influenced by factors such as altitude, latitude, and topography, resulting in unique environmental conditions. Highland climate zones are known for their rugged terrain, diverse ecosystems, and extreme weather patterns, making them both challenging and fascinating environments to study. Highland climate zones are often divided into different subtypes based on their specific characteristics, such as alpine, subalpine, and montane climates. These subtypes can vary in terms of temperature, precipitation, and vegetation, but they all share the common trait of being located at higher elevations. The unique combination of factors in highland climate zones creates a habitat that is home to a wide variety of plant and animal species, many of which are specially adapted to the harsh conditions found in these environments. Understanding the characteristics of highland climate zones is essential for conservation efforts and for mitigating the impact of human activities on these fragile ecosystems. Summary Highland climate zones are characterized by their high altitude, low temperatures, and unique ecosystems. These zones are home to a variety of flora and fauna that have adapted to the harsh conditions, including hardy plants and animals with thick fur or feathers. The challenges in highland climate zones include extreme weather, limited food sources, and competition for resources among species. Human impact on highland climate zones includes deforestation, overgrazing, and pollution, which threaten the delicate balance of these ecosystems. Conservation efforts in highland climate zones focus on protecting and restoring natural habitats, as well as promoting sustainable practices to mitigate human impact. Characteristics of Highland Climate Zones Climate Variability and Ecosystem Impact Additionally, highland areas often experience intense sunlight due to their elevation, which can further impact the local climate and ecosystem. Precipitation patterns in highland climate zones can also be highly variable, with some areas experiencing heavy snowfall while others may receive more rainfall. This variability can lead to the formation of glaciers and snowfields in some highland regions, which play a crucial role in regulating water flow and availability downstream. Habitat Diversity and Biodiversity The combination of these factors results in a diverse range of habitats within highland climate zones, from alpine meadows and coniferous forests to rocky slopes and barren peaks. These habitats support a wide array of plant and animal species that have evolved to thrive in the challenging conditions found at higher elevations. Unique Features of Highland Climate Zones Highland climate zones are distinct from other climate zones due to their unique combination of factors, including temperature, precipitation, and sunlight patterns. This distinctiveness supports a rich variety of plant and animal life, making highland regions some of the most biodiverse and fascinating ecosystems on the planet. Flora and Fauna in Highland Climate Zones The flora and fauna found in highland climate zones are uniquely adapted to the harsh environmental conditions present at higher elevations. Plant species in these areas often exhibit traits such as small leaves, dense growth habits, and the ability to withstand extreme temperature fluctuations. Many highland plants have also developed mechanisms to protect themselves from intense sunlight and strong winds, such as waxy coatings on leaves or low-growing forms that reduce exposure to the elements. Similarly, animal species in highland climate zones have evolved a range of adaptations to survive in these challenging environments. Some animals have thick fur or feathers to insulate them from the cold, while others have developed specialised respiratory systems to cope with lower oxygen levels at higher altitudes. Many highland animals are also adept climbers, allowing them to navigate the steep terrain and rocky landscapes found in these regions. The diversity of flora and fauna in highland climate zones is a testament to the resilience and adaptability of life in extreme environments. However, these species are also highly vulnerable to changes in their habitat, making conservation efforts crucial for protecting the unique biodiversity found in highland regions. Challenges and Adaptations in Highland Climate Zones Highland climate zones present a range of challenges for both the organisms that inhabit them and for human activities in these areas. The extreme temperatures, low oxygen levels, and variable weather patterns can make survival difficult for many species, leading to the evolution of specialised adaptations. For example, some plants have developed deep root systems to access water stored deep within the soil, while others have evolved mechanisms to protect themselves from frost damage. Similarly, animals in highland climate zones have developed a variety of adaptations to cope with the harsh conditions found at higher elevations. Many species have thicker fur or feathers to provide insulation from the cold, while others have adapted their behaviour to seek shelter during extreme weather events. Some animals have also evolved specialised diets to make use of the limited food sources available in these environments. Human activities in highland climate zones can also pose significant challenges for both the environment and local communities. Deforestation, mining, and tourism can all have negative impacts on highland ecosystems, leading to habitat destruction and loss of biodiversity. Additionally, climate change is causing shifts in temperature and precipitation patterns, which can further disrupt the delicate balance of highland ecosystems. Human Impact on Highland Climate Zones Human activities have had a significant impact on highland climate zones around the world. Deforestation for agriculture, logging, and urban development has led to habitat loss and fragmentation, threatening the survival of many plant and animal species. Mining operations in highland areas can also result in soil erosion, water pollution, and disruption of local ecosystems. Tourism is another major factor contributing to human impact on highland climate zones. While tourism can provide economic benefits to local communities, it can also lead to environmental degradation through activities such as littering, trampling of vegetation, and disturbance of wildlife. Additionally, the construction of infrastructure such as roads and hotels can further fragment habitats and disrupt natural processes. Climate change is also a significant threat to highland climate zones, with rising temperatures and altered precipitation patterns affecting ecosystems around the world. Glaciers are retreating at an alarming rate in many highland regions, leading to changes in water availability downstream and impacting local communities that depend on glacial meltwater for drinking water and agriculture. Conservation Efforts in Highland Climate Zones Protected Areas: A Key to Conservation One approach to conservation is the establishment of protected areas such as national parks and nature reserves, which can help to safeguard important habitats and provide refuge for threatened species. These protected areas also play a key role in promoting ecotourism as a sustainable alternative to traditional forms of tourism that may have negative impacts on the environment. Community-Based Conservation Initiatives Community-based conservation initiatives are another important aspect of protecting highland climate zones. Engaging local communities in conservation efforts can help to ensure that their needs are taken into account while also promoting sustainable land use practices. This can include initiatives such as sustainable agriculture, reforestation projects, and education programmes aimed at raising awareness about the importance of preserving highland ecosystems. International Cooperation: A Necessity for Conservation International cooperation is also essential for conservation efforts in highland climate zones, as many of these areas span multiple countries. Collaborative initiatives can help to address transboundary issues such as wildlife migration corridors, water resource management, and sustainable development planning. By working together, countries can share knowledge and resources to effectively protect highland ecosystems for future generations. Future Outlook for Highland Climate Zones The future outlook for highland climate zones is uncertain due to ongoing threats such as deforestation, mining, tourism, and climate change. However, there is also cause for optimism as conservation efforts continue to gain momentum around the world. By implementing sustainable land use practices, promoting ecotourism, and addressing transboundary issues through international cooperation, it is possible to mitigate the impact of human activities on highland ecosystems. Advances in technology and scientific research are also providing new opportunities for understanding and protecting highland climate zones. Remote sensing techniques can be used to monitor changes in land cover and vegetation health, while genetic studies can help to inform conservation strategies for threatened species. Additionally, innovative approaches such as rewilding projects and ecosystem restoration efforts offer hope for restoring degraded habitats and promoting resilience in highland ecosystems. Ultimately, the future of highland climate zones will depend on our collective efforts to address the challenges facing these environments. By working together to conserve biodiversity, promote sustainable development, and mitigate climate change, we can ensure that highland ecosystems continue to thrive for generations to come. FAQs What are Highland Climate Zones? Highland climate zones are areas of high elevation that experience cooler temperatures and unique weather patterns compared to lower elevations. These zones are typically found in mountainous regions. What are the characteristics of Highland Climate Zones? Highland climate zones are characterized by cooler temperatures, greater precipitation, and more variable weather conditions compared to lower elevations. They often have distinct seasons and can experience snowfall even in the summer months. Where are Highland Climate Zones found? Highland climate zones are found in mountainous regions around the world, including the Andes, the Himalayas, the Alps, and the Rocky Mountains. They can also be found in high plateaus and other elevated areas. How do plants and animals adapt to Highland Climate Zones? Plants and animals in highland climate zones have adapted to the cooler temperatures and variable weather conditions. They often have specialized adaptations such as thick fur or feathers, and the ability to store food for the winter months. What are the challenges of living in Highland Climate Zones? Living in highland climate zones can present challenges such as colder temperatures, harsh weather conditions, and limited access to resources. It can also be difficult to grow certain crops and sustain agriculture in these areas. Earth's climate zones—the horizontal belts of different climates that encircle the planet—consist of tropical, dry, temperate, continental, and polar zones. These major climate zones exist thanks to Earth's diverse landscapes. Each country is located at a specific latitude and elevation, next to either a particular landmass, body of water, or both. As a result, they are impacted differently by certain ocean currents or winds. Likewise, a location's temperatures and precipitation patterns are influenced in a unique way. And it's this unique mix of influences that yields different climate types. As abstract as climate zones may seem, they remain a key tool for understanding earth's many biomes, tracking the extent of climate change, determining plant hardiness, and more. The concept of climate zones dates back to ancient Greece. In the 6th century B.C., a pupil of Pythagoras was the first to suggest the idea. A few centuries later, the famous Greek scholar Aristotle hypothesized that the earth's five circles of latitude (the Arctic Circle, Tropic of Capricorn, Tropic of Cancer, Equator, and Antarctic Circle) divided the Northern and Southern hemispheres into a torrid, temperate, and frigid zone. However, it was Russian-German scientist Wladimir Köppen who, in the early 1900s, created the climate classification scheme we use today. Because little climate data existed at that time, Köppen, who also studied botany, began observing the relationship between plants and climate. If a species of plant needed special temperatures and rainfall to grow, he thought, then a location's climate could be inferred simply by observing the plant life native to that area. Maulucioni / Wikimedia Commons / Public Domain Using his botanical hypothesis, Köppen determined that five major climates exist worldwide: tropical, dry, temperate, continental, and polar. Tropical climate zones lie near the Equator and have continually high temperatures and high precipitation. All months have average temperatures above 64 degrees F (18 degrees C), and 59 plus inches (1,499 mm) of annual rainfall is normal. Dry or arid climate zones experience high temperatures year-round, but little annual precipitation. Temperate climates exist in Earth's middle latitudes and are influenced by both the land and water that surrounds them. In these zones, wider temperature ranges are experienced throughout the year, and seasonal variations are more distinct. Continental climates also exist in the mid-latitudes, but as the name implies, they're generally found at the interiors of large landmasses. These zones are characterized by temperatures that swing from cold in winter to warm in summer, and moderate precipitation that occurs mostly in the warmer months or as snowstorms in the colder months. Polar climate zones are too harsh to support vegetation. Both winters and summers are very cold, and the warmest month has an average temperature below 50 degrees F (10 degrees C). In later years, scientists added a sixth major climate zone—the highland climate. It includes the variable climates found in the world's high mountain regions and plateaus. As seen on Köppen-Geiger climate maps, each climate zone is abbreviated by a string of two or three letters. The first letter (always capitalized) describes the main climate group. The second letter indicates precipitation patterns (wet or dry). And if there's a third letter present, it describes the climate's temperatures (hot or cold). Köppen's five climate groups do a good job of telling us where the world's hottest, coldest, and in-between climates are, but they don't capture how local geographical features, such as mountains or lakes, influence seasonal precipitation and temperatures. Realizing this, Köppen split his main categories into subcategories called regional climates. Regional Climates at a Glance Rainforest Wet, winterless climate zones; averages over 2.4 inches (60 mm) of rainfall for all months of the year. Monsoon Receives bulk of annual precipitation from months-long monsoon winds; the remainder of the year is dry, and all months are winterless. Savanna Features high year-round temperatures, lengthy dry season, short rainy season. Desert Loses moisture through evaporation faster than rainfall can replenish it. Steppe (Semi-arid) Similar to deserts (moisture is lost faster than it is replenished), but slightly more humid. Humid subtropical Features hot, humid summers, and cool winters; precipitation varies. Humid continental Features large seasonal temperature differences; precipitation is uniform throughout the year. Oceanic Features mild summers, cool winters, and uniform precipitation throughout the year; temperature extremes are rare. Mediterranean Features mild, wet winters, and dry summers; temperatures of 10 degrees C (50 degrees F) and above are present for one-third of the year. Subarctic Features long, very cold winters; short, cool summers; and little precipitation. Tundra Features at least one month above 32 degrees F (0 degrees C), but none above 50 degrees F (10 degrees C); annual precipitation is light. Ice cap Features permanent ice and snow; temperatures rarely climb above 32 degrees F (0 degrees C). Some of the above climate subzones can be further classified by temperature. For example, deserts can be either "hot" or "cold" depending on whether their average annual temperature is above 64 degrees F (18 degrees C) or below it. When you consider the five major climate zones, plus this cornucopia of subzones, a total of more than 30 unique regional climate zones exist. As temperature and precipitation patterns across a region change, the region's climate zone, which is based on those parameters, will also change. Between 1950 and 2010, human-caused climate change shifted nearly six percent of the global land area toward warmer and drier climate types, according to a 2015 study in Scientific Reports. The main types of climates are tropical, arid, temperate, polar, and Mediterranean. These classifications are based on factors such as temperature, precipitation, and vegetation patterns. Each climate type has distinct characteristics that influence the weather and ecosystems in a specific region. Dr. Jitender Saroha Contents Introduction Learning Objectives Polar Climates: Bases and Types Polar Tundra Climate Distribution Temperature Precipitation Natural Vegetation Ice-cap Climate Distribution Temperature Precipitation Natural Vegetation Highland Climate Distribution Characteristics Summary and conclusions Multiple Choice Questions Answers References Web Links Introduction Polar climates are known for their long lasting cold. Polar climates have cold winters and cool summers. Polar winters are associated with periods of persistent night and temperatures are extreme. During summer, cool conditions prevail, though the days are long, but the oblique sun rays produce little warming. Further, high albedo of ice and snow cover reflects majority ofinsolation and some heat is also used in melting of the snow cover. Due to cool summers and extremely cold winters, the annual range of temperatures are excessive. The highland climates are different from adjoining lowlands. These climates reflect a great diversity over limited distance. The pattern of climates in highland areas is a very complex mosaic. The variety and changeability best describe the climates of highlands.The main climate controls which determine the climates of highlands are: latitude or location, altitude, shape and positioning of highland, exposure to winds, slope and direction of slope i.e. aspect. In this module, focus is on polar climates and climates of highlands. Learning Objective: After studying this module, you will be able to: understand the meaning of polar climates, differentiate between two major types of polar climates, describe the distribution and characteristics of polar climates, understand the variety and changeability of the climate of highlands, an explain the role of location, altitude, slope and exposure to winds as determinants of the climates of highlands. Polar Climates: Bases and Types Although polar climates are classified as humid, precipitation is generally scanty. As temperature remains low, the evaporation is limited. Normally, precipitation is most copious during the summer season when the humidity is the maximum. According to the Koppen's climatic classification, polar climates are those in which the average temperature of the warmest month is below 100 C. Therefore, the isotherm of 100C of the warmest month limits the polar climates.There are two well recognized sub-types in polar climates – (i) the polar tundra climate (ET) and (ii) the ice cap climate (EF). These are demarcated on the basis of 00C isotherm of the warmest month (Figure 1). Figure 1: Polar and Ice Cap Climates Source: Polar Tundra climate or Tundra climate Distribution: The polar tundra climate is largely restricted to the Northern Hemisphere. It is distributed in the latitudinal range of 600 – 75 0 N and S, except for the northern coast of Greenland where tundra climate occurs at latitude greater than 800 N. The poleward boundary of tundra climate is demarcated by 00C and equatorward by 100 C isotherms of the warmest month. This climate occupies the northern fringes of North America, including the Canadian islands and Eurasia and ice free shores of northern Iceland and coastal Greenland. In the Southern Hemisphere, no substantial land areas are present in the latitudes where tundra climate prevails. Further, the temperature ofthese small areas hasbeen moderated by proximity of surrounding oceans. In the Southern Hemisphere, Graham Land peninsula of the Antarctica is the only tundra area. The latitudinal situation and atmospheric stability of polar high pressure system are the major controls of the tundra climate. Temperature: In polar tundra climates, winters are long, bitterly cold and very severe. The summers are very short and mild. The average temperature of the warmest month is in the range of 00 to 10 0 C. The average annual temperature is – 120C.The mean monthly temperatures are below freezing for 7 to 9 months of the year (Figure 2). Even the warmest month is damp and chilly. The average temperature of the warmest month at Point Barrow, Alaska is 40C. At Upernivik, Greenland (730N), summer season monthly means are barely over 50C. Figure 2. Distribution of Temperature at Polar Tundra Climate Stations Source: Frederick K.L and Edward, J.T. (2010), P-446 and 488. Due to limited variation in day and night temperatures, the diurnal range of temperature is meager. The annual range of temperature is quiet large but not as large as in the taiga climate region. However, at coastal fringes the annual ranges of temperature are usually small due to the moderating maritime influence. For instance, the average temperature of the coldest month at Vardo is 6.10 C due to the warming effect of the North Atlantic Drift, whereas Point Barrow, Alaska, Hebron, Alaska and Ponds Inlet, Canada have respectively -280 C, -300C and -33.30C temperatures due to continentality.AtUpernivik, Greenland, the long, very cold winters bring monthly means as low as -200C. The average annual temperature at Barrow, Alaska and Valgach, Russia is -12.20C and -6.50 C, respectively (Figure 3). The ground surface remains snow covered for at least 7 to 8 months in a year. The cold and high velocity winds with powdery snow of this region are known as blizzards. The blizzards make it difficult to measure the actual snow fall received at a place. The continental polar (cP), maritime polar (mP) and continental arctic (cA) air masses play significant role in determining temperature and precipitation condition of tundra climate region. Figure 3. Temperature and Precipitation at Polar Tundra Climate Stations Source: Precipitation: The tundra climate is associated with low precipitation. The annual average precipitation is less than 40 cm. As temperatures remain low throughout the year, the evaporation is limited and consequently the absolute humidity is very low. It is noteworthy that advection of winds from the extremely cold subarctic region not only intensifies the severity of winter but due to stability dryness also prevails. Moreover, the tundra climate region is dominated by polar anticyclonic conditions and divergent system of air circulation. Figure 4. Distribution of Precipitation at Polar Tundra Climate Stations Source: Frederick K.L and Edward, J.T. (2010), P-446 and 488. The tundra region receives most of the precipitation during summer and autumn and relatively warmer conditions prevail. The precipitation is cyclonic in origin and it takes place due to more northerly route followed by cyclones in summer season. Precipitation generally takes place in the form of snowfall. Coastal areas are also prone to fog. In the Greenland, stations show higher precipitation and distribution is also throughout the year (Figure 4). It is because of considerable marine influence on these stations. The warm North Atlantic Drift keeps winter temperatures relatively warm, and maritime polar (mP) air masses bring precipitation throughout the year. Natural Vegetation: The natural vegetation of the tundra region includes lichens and mosses. In addition, there are different types of flowering herbaceous plants, small shrubs and grasses that mature during the cool and short summer season. The plants are mainly cryophytes. Due to enduring cold and the absence of minimum required threshold of sunlight only 3 per cent species of total world plant species could grow in tundra climate. The 100 C isotherm of the warmest month that demarcates the equatorward limit of tundra climate also demarcates the poleward limit of tree growth. Hence, the tundra is treeless and aregion of grasses, sledges, mosses and lichens. During the enduring cold winter season, plants become dormant or inactive, but as the short and cool summer season begins these plants mature and produce seeds with substantial swiftness. The growing season is less than 50 days in a year. Due to short and cool summers, the frozen soils of this region normally melt up to the depth of less than a meter. Therefore, the subsoil maintains permafrost position. These conditions obstruct the downward movement of water and consequently poorly drained boggy soils develop. The marshes, swamps and bogs make the summer tundra terrain difficult to transverse. In Canada and Alaska, this type of landscape is called muskeg. Vegetation is scarce on exposed dry slopes and summits – these rocky pavements are known as 'fell-field', the Danish term which means 'rock desert'. Tundra is a Finnish term which means barren land. The Ice-Cap Climate Koppen identified the ice-cap climate on the basis of criterion of temperature less than 00C for the warmest month. It means the mean temperature of every month is below freezing. Due to subfreezing temperatures the landscape has permanent ice and snow cover. There is limited information about climatic and weather conditions of this climatic regions because, the climate is extreme and weather stations are limited. Distribution: This climate is distributed mainly in the latitudinal zone of 650 to 900 N and S. This climate extends over a large area of about 15.5 million square km or about 9 per cent of earth's land area. It includes the ice sheets of Antarctica and Greenland and scattered areas in high mountains. Temperature: The EF climate has extremely low average annual temperatures.The polar ice-cap climate records the lowest annual average temperatures. For instance, the average annual temperature at Eismitte, Greenland is -30.50C. The average temperature of winter at Eismitte is -400C and the warmest month has -110C (Figure 5). The causes of extremely low temperatures in EF climate are following – (i) latitudinal position; (ii) the ice cover has high albedo and about 80 per cent of the limited insolation received is reflected back without utilization;(iii) the majority part of energy available in this region is used in melting of ice and not for increasing air temperature; the effectiveness of the warmth is lost by latent heatand (iv) finally, elevation also plays a significant role. For instance, Antarctica has the highest average height among the continents. Likewise in Greenland majority part is elevated except coastal fringes. Figure 5. Temperature and Precipitation at Ice-cap Climate Stations Source: The average annual temperature at the Russian Antarctic Meteorological Station, Vostok, Antarctica, is -570C. It is noteworthy that Vostok recorded the world's lowest temperature ever on August 24, 1960 as -88.30C. The air adjacent to ice cover gets very cold and inversion of temperature is normalaffair. Temperature of thesurface is as much as 250 to 350 C colder than air just a few hundred meters above surface. The cold and heavy air slides along slopes due to gravity resulting into strong winds and blizzards. These Katabatic winds are a common characteristic feature of the weather of highlands in ice-caps.The ice covered parts of Antarctica and Greenland have presence of thermally induced anticyclones. At still greater height, there are deep cyclonic vortices associated with high velocity westerly winds. These circulations are more persistent over Antarctica in winter. Precipitation: The average annual precipitation in EF climate is meager and normally less than 10 cm. These areas are also known as polar deserts. Although the precipitation is low but it is more than evaporation. Therefore, this climate is basically humid. The precipitation is received as snow or as small crystals of dry and hard ice. Some precipitation is received in the form of a mist of powdery ice when cyclones strike at the margins of the ice plateaus. Natural Vegetation and Animal Life: This climate is hostile to any form of vegetation. Due to presence of permanent ice cover it is nearly vegetation less. But various kinds of fish, seal, walrus and polar bears are found in these latitudinal belts. The coastal areas of Antarctica are inhabited by aquatic birds, dominantly penguins. Highland Climates The highland climates are different from adjoining lowlands. These climates reflect a great diversity over limited distance. The pattern of climates in highland areas is a very complex mosaic. The variety and changeability best describe the climates of highlands. Distribution: In North America, highland climates are found in the Rockies, Sierra Nevada, Cascade, Coastal ranges and the mountains and interior plateau of Mexico. In South America, the Andes represent a continuous zone of highland climate that extends over about 8000 km. The greatest extend of highland climates stretches from western China, across southern Eurasia, to northern Spain, and one of its branch join from the Himalayas to the Pyrenees i.e. also known as Mid Continental Belt region. Atlas Mountain in Africa is also part of this belt. In Africa, highland climates are also found in the Ethiopian highland or the Eastern highlands. In Europe, Alps, Carpathian ranges and Scandinavian highlands are the most significant. In Australia the Great Dividing Range and in New Zealand the Southern Alps have highland climates. Characteristics: The main climate controls which determine the climates of highlands are: latitude or location, altitude, shape and positioning of highland, exposure to winds, slope and direction of slope, i.e. aspect. At the same latitude or in same latitudinal zone next to the distribution of land and water, altitude is probably the most significant factor to produce climate differences. With increase in height, pressure, temperature and precipitation undergo some well defined changes. The well known climatic effects of highlands are that the pressure and temperature decrease with altitude. But winds, precipitation, fog and clouds show an increasing trend. The highlands are colder and often wetter than lowlands. The highland climates are characterized by their distinct zonation by altitude. For instance, in tropical highland the Andes Mountains (eastern slope), tropical rainforest climate is found in the foothills up to the height of 1200 m. In the height range of 1200 to 2400 m, subtropical climate prevails; the next zone of 2400 to 3200 m is characterized by mesothermal climate; the 3600 to 4800 m zone is occupied by microthermal climate. Beyond this altitude, there is permanent snow cover resembling the polar climates. The altitudinal zones positions in highlands also depends on latitudes (Figure 6). Location factor such as coastal location or interior location also plays a significant role. Towards poles, the tree line and snow line are found at lesser height in highlands. Climate changes with altitude are fast and complex. It is generalized that 300 m climb is equivalent to 500 to 1000 km towards the poles. The broad generalization is this that as climate changes from equator to pole similarly it changes with altitude. Figure 6A: Altitudinal Zones in Highland Climates Source: evation%20Temperature.png?height=381&width=400 Figure 6B: Altitudinal Zones in Highland Climates Source: The relief variations are common in highlands. Therefore, exposure is another important factor in highland climates. Every change in slope with respect of the Sun's rays results into a different micro climate. In Northern Hemisphere, south facing slopes are warmer as they receive direct insolation. The exposure affects the daily departureof temperature. East facing slopes have relatively warmer mornings and cooler afternoons as compared with the cooler mornings and warmer afternoons of west facing slopes. Slope aspect also plays an important role in determining the distribution of settlements, cultivation of crops and types of plants. Exposure to winds is another significant determinant of highland climates. The peaks and exposed slopes have stronger winds due to minimum friction as compared to lower slopes. In highlands, mountain and valley breezes are common. During day time valley breezes or anabatic winds operate up-slope from valley to mountain. These up-slopes winds result in to atmospheric instability and cumulus and cumulonimbus clouds bring precipitation normally in the afternoon. The down-slope winds normally induce the inversion of temperature condition by uplifting the warm and moist air of valleys. In winter the lower valley parts may have below freezing point temperatures resulting into fog and frost. Further, this uplifting may result into unstable conditions and clouds and precipitation may be the result. Magdalena valley and the Lianos of Columbia receive majority of their precipitation in this manner. Highlands obstruct the flow of winds. On the windward slopes winds are forced to ascend. The ascending warm and moist winds cause precipitation, whereas descending winds become warmer and dry due to adiabatic change and evaporation dominates. The chinook (snow eater) winds along the eastern slopes of the Rockies Mountains and foehn winds in Alps are hot and dry and result in to snow melting. In mountain areas,topography is the dominant factor in determining the distribution of precipitation. As relief variations are intense, the distribution of precipitation is complex. In low latitudes, generally the precipitation increases up to the height of about 1500 m and above this it starts decreasing. But in the middle latitudes the trend upto the peaks is increasing precipitation. In the highlands of arid areas greater amount of precipitation provides water for adjoining arid lowlands for drinking, irrigation and power generation. Normally, in highland areas more precipitation is received during summer as compared to winters and also more during day time as compared to nights. The windward slopes receive heavy precipitation. The leeward sides are generally rain shadow areas. The uprising air along the crest also produce precipitation on the higher slopes of leeward sides, but it is limited to a short distance (Figure 7). Figure 7. Distribution of Precipitation on the Windward and Leeward Sides Source: It is noteworthy that the seasonal temperature cycles and precipitation distribution of highland stations often resemble the adjoining lowland places. For instance, a peculiar characteristic of highland climate in the tropics is a larger diurnal than annual range of temperature. The temperature at Quito, Ecuador over the months shows almost no change, but its diurnal range of temperature is more than 100C (Figure 8). This characteristic feature is common to tropical equatorial climates where diurnal ranges are more than annual ranges of temperature. Likewise, the similarity in precipitation throughout the year is also clearly evident. Similarly the seasonal distribution of temperature and precipitation at Shimla (Highland) and Delhi(Lowland) is matching;the difference is only of valuesand not of pattern(Figure 9). Figure 8. Mean Monthly Temperature at Quito and Guayaquil Source: Figure 9: Temperature and Precipitation at Shimla and Delhi Source: Summary and Conclusions Polar climates have cold winters and cool summers. Due to cool summers and extremely cold winters, the annual range of temperatures isvery high.The polar climates are divided into two sub types on the basis of 00 C isotherm of the average temperature of the warmest month – tundra climate (ET) and ice-cap climate (EF). The polar tundra climate is largely restricted to the Northern Hemisphere. The poleward boundary of tundra climate is demarcated by 00C and equatorward by 100C isotherms of the warmest month. This climate occupies the northern fringes of North America, including the Canadian islands and Eurasia and ice free shores of northern Iceland and coastal Greenland. In the Southern Hemisphere, Graham Land peninsula of the Antarctica is the only tundra area.The latitudinal situation and atmospheric stability of polar high pressure system are the major controls of the tundra climate. The mean temperature of every monthin ice-cap climate isbelow freezingpoint. Due to subfreezing temperatures, the landscape has permanent ice and snow cover. This climate is distributed mainly in the latitudinal zone of 650 to 90 0 N and S. This climate extends over a large area of about 15.5 million square km or about 9 per cent of earth's land area. It includes the ice sheets of Antarctica and Greenland and scattered areas in high mountains. The EF climate has extremely low average annual temperatures. The polar ice-cap climate records the lowest annual average temperatures.The ice covered parts of Antarctica and Greenland have presence of thermally induced anticyclones. At still greater height, there are deep cyclonic vortices associated with high velocity westerly winds. These circulations are more persistent over Antarctica in winter. The average annual precipitation in EF climate is meager and normally less than 10 cm. These areas are also known as polar deserts. The highland climates are different from adjoining lowlands. These climates reflect a great diversity over limited distance. The pattern of climates in highland areas is a very complex mosaic. The variety and changeability best describe the climates of highlands.The main climate controls which determine the climates of highlands are: latitude or location, altitude, shape and positioning of highland, exposure to winds, slope and direction of slope, i.e. aspect. In this module,thefocus was on polar climates and climates of highlands.It is noteworthy that the seasonal temperature cycles and precipitation distribution of highland stations often resemble the adjoining lowland places. you can view video on Polar and Highland Climates Barry, R.G. and Chorley, R.J. (1998) Atmosphere, Weather and Climate, Routledge, London. Frederick, K.L and Edward, J.T. (2010) The Atmosphere – An Introduction to Meteorology, PHI Learning Private Limited, New Delhi. Husain, M. (2002) Fundamentals of Physical Geography, Rawat Publications, Jaipur. Lal, D.S. (1993) Climatology, Chaitanya Publishing House, Allahabad. Lal, D.S. (2009) Physical Geography, Sharda PustakBhawan, Allahabad. Singh, S. (2015) Physical Geography, Pravalika Publications, Allahabad. Strahler, A.N. and Strahler, A.N. (2001) Modern Physical Geography, John Wiley and Sons, Singapore. Trewartha, G.T. and Horne, L.H.(1968) An Introduction to Climate, McGraw-Hill, New York. Web Links The highland climate is characterised by its distinctive weather patterns and environmental conditions, which are influenced by the altitude and topography of the region. Highland areas are typically found at higher elevations, such as mountains, plateaus, and hills, and are known for their cooler temperatures and more extreme weather conditions compared to lowland areas. The climate in highland regions can vary greatly depending on factors such as latitude, proximity to the coast, and prevailing wind patterns. These areas often experience rapid changes in weather, including sudden temperature drops, strong winds, and heavy precipitation. The highland climate also tends to have a shorter growing season and a greater temperature variation between day and night. Highland climates are found all over the world, from the Andes in South America to the Scottish Highlands in Europe, and the Himalayas in Asia. These regions are often home to unique ecosystems and biodiversity due to their isolation and harsh environmental conditions. The highland climate presents both challenges and opportunities for human habitation, agriculture, and tourism, making it an area of great interest for researchers and environmentalists. Summary Highland climate is characterized by cool temperatures, high precipitation, and rugged terrain, making it a challenging environment for both flora and fauna. The flora in highland climate includes hardy plants such as heather and moss, while the fauna includes animals like mountain goats and eagles that have adapted to the harsh conditions. Human adaptation to highland climate includes the use of traditional building materials like stone and thatch, as well as the development of hardy livestock breeds and agricultural practices suited to the environment. Challenges of living in highland climate include limited access to resources, harsh weather conditions, and the need for sustainable land management practices to prevent environmental degradation. Tourism and recreation in highland climate are popular due to the stunning natural landscapes, outdoor activities like hiking and skiing, and the opportunity to experience traditional highland culture. Conservation efforts in highland climate focus on preserving the unique biodiversity and cultural heritage of the region, as well as promoting sustainable development and responsible tourism practices. Characteristics of Highland Climate Temperature and Elevation The highland climate is characterised by its cool temperatures, which are often significantly lower than those found in lowland areas. This is due to the higher elevation of these regions, which results in a decrease in temperature of approximately 0.6°C for every 100 metres increase in altitude. Climate Challenges The cooler temperatures also mean that the growing season is shorter in highland regions, making it more challenging for agriculture and plant growth. In addition to cooler temperatures, highland climates are also known for their rapid and unpredictable weather patterns. This can include sudden changes in temperature, strong winds, and heavy precipitation, which can lead to flooding and landslides. Environmental Consequences The combination of these factors makes the highland climate a challenging environment for both flora and fauna, as well as for human habitation. Despite these challenges, highland regions are often home to unique ecosystems and biodiversity, with many species adapted to the harsh environmental conditions. Flora and Fauna in Highland Climate The flora and fauna in highland climates have evolved to survive in the harsh environmental conditions, including cooler temperatures, rapid weather changes, and shorter growing seasons. In highland regions, plant life tends to be hardy and resilient, with species such as coniferous trees, heather, and mosses being common. These plants have adapted to the cooler temperatures and are often able to survive in nutrient-poor soils. In addition to plant life, highland regions are also home to a variety of animal species, including mountain goats, deer, birds of prey, and small mammals. Many of these animals have developed adaptations to survive in the highland climate, such as thick fur or feathers to insulate against the cold, and strong limbs for climbing steep terrain. The highland climate also provides important habitats for a wide range of species, including many that are unique to these regions. These areas often act as refuges for wildlife, providing a safe haven from human development and other threats. However, the flora and fauna in highland climates are also vulnerable to environmental changes, such as deforestation, climate change, and habitat destruction. Conservation efforts are therefore crucial to protect the biodiversity of these regions and ensure the survival of the unique species that call them home. Human Adaptation to Highland Climate Human adaptation to the highland climate has been shaped by the challenges and opportunities presented by these regions. Historically, highland communities have developed specific strategies to cope with the cooler temperatures, shorter growing seasons, and unpredictable weather patterns. This has included building sturdy homes and shelters to withstand harsh weather conditions, as well as developing agricultural techniques suited to the highland environment. In many highland regions, traditional farming methods such as terracing and crop rotation have been used to make the most of limited arable land. In addition to agriculture, highland communities have also relied on other natural resources such as forestry, hunting, and fishing to sustain themselves. These activities have often been carried out in a sustainable manner, with a deep respect for the natural environment and its limitations. In more recent times, modern technology and infrastructure have allowed for greater adaptation to the highland climate, including improved heating systems, transportation networks, and communication methods. However, human adaptation to the highland climate continues to be an ongoing process, particularly in the face of environmental changes such as climate change and increased tourism. Challenges of Living in Highland Climate Living in a highland climate presents a number of challenges for human communities, including those related to agriculture, infrastructure, and health. The cooler temperatures and shorter growing seasons can make it difficult to grow certain crops or raise livestock, leading to food shortages and economic hardship. In addition, the rapid and unpredictable weather patterns can pose a threat to human safety, particularly in terms of flooding, landslides, and extreme cold. This can make it difficult for communities to access essential services such as healthcare and education. The isolation of many highland communities can also present challenges in terms of transportation and communication. Remote locations and rugged terrain can make it difficult to access essential goods and services, as well as to connect with the outside world. This can lead to feelings of social isolation and a lack of economic opportunities for those living in highland regions. Furthermore, the increasing impact of climate change on highland climates is exacerbating many of these challenges, including more frequent extreme weather events and changes in traditional land use practices. Tourism and Recreation in Highland Climate Recreational Opportunities Highland regions offer a wide range of recreational opportunities such as hiking, mountain biking, skiing, and wildlife watching. Cultural Attractions and Economic Benefits Many highland areas also have cultural attractions such as historic sites, traditional crafts, and local cuisine that appeal to tourists. Tourism provides an important source of income for many highland communities, supporting local businesses and creating jobs. Sustainable Tourism and Conservation However, tourism also brings its own set of challenges such as increased pressure on natural resources, infrastructure development, and cultural preservation. Sustainable tourism practices are therefore crucial to ensure that the environmental and cultural integrity of highland regions is maintained for future generations. Conservation efforts play a key role in managing tourism impacts on highland climates while still allowing visitors to enjoy these unique environments. Conservation Efforts in Highland Climate Conservation efforts in highland climates are essential for protecting the unique ecosystems and biodiversity of these regions. Many highland areas are home to rare and endangered species that rely on intact habitats for their survival. Conservation initiatives focus on preserving natural landscapes through measures such as habitat restoration, wildlife protection, and sustainable land management practices. This includes efforts to reduce deforestation, prevent habitat fragmentation, and mitigate the impacts of climate change on highland ecosystems. In addition to protecting wildlife and habitats, conservation efforts also aim to support local communities living in highland regions. This includes promoting sustainable livelihoods that are compatible with environmental conservation goals, as well as providing education and training on conservation practices. Engaging local communities in conservation efforts is crucial for ensuring the long-term success of these initiatives. Furthermore, raising awareness about the importance of highland climates and their conservation is key for garnering support from policymakers, stakeholders, and the general public. In conclusion, the highland climate presents both challenges and opportunities for human habitation, biodiversity conservation, and tourism development. Understanding the unique characteristics of highland climates is essential for developing effective strategies to address these complex issues while ensuring the long-term sustainability of these regions. Conservation efforts play a crucial role in protecting the natural beauty and ecological integrity of highland climates for future generations to enjoy. FAQs What is a Highland or Alpine Climate? A Highland or Alpine Climate is a climate that is typically cooler and wetter than the surrounding lowlands, and it varies depending on elevation. What are the characteristics of a Highland or Alpine Climate? Highland or Alpine Climates are characterized by cooler temperatures, higher precipitation, and often the presence of snow and glaciers at higher elevations. Where are Highland or Alpine Climates found? Highland or Alpine Climates are found in mountainous regions around the world, typically at higher elevations. Examples include the Alps in Europe, the Andes in South America, and the Himalayas in Asia. How does elevation affect Highland or Alpine Climates? As elevation increases, temperatures generally decrease, leading to cooler conditions in Highland or Alpine Climates. Additionally, higher elevations often receive more precipitation, contributing to the wetter conditions. What types of vegetation are found in Highland or Alpine Climates? Highland or Alpine Climates are often home to vegetation such as coniferous forests, alpine meadows, and tundra, which are adapted to the cooler and wetter conditions at higher elevations. This article needs additional citations for verification. Please help improve this article by adding citations to reliable sources. Unsourced material may be challenged and removed.Find sources: "Highland temperate climate" – news · newspapers · books · scholar · JSTOR (July 2022) (Learn how and when to remove this message) This article possibly contains original research. Please improve it by verifying the claims made and adding inline citations. Statements consisting only of original research should be removed. (August 2022) (Learn how and when to remove this message) Distribution of these climates in the world The highland temperate climates are a temperate climate sub-type, although located in tropical zone, isothermal and with characteristics different from others temperate climates like oceanic or mediterranean where they are often are included without proper differentiation. The mainly difference is that it is isothermal, this mean that it has low termic range between months, whose cause is altitude and not latitude, no four seasons (spring, summer, autumn, winter) of temperate zone. However, there are rainfall variation (dry season and wet season). It is usually said that it have a Eternal Spring or a Eternal Autumn. These are sometimes called "tropical highland climates" or "highland tropical climates", though the name is a misnomer other than regional location. A letter "i" is added to indicate its isothermal condition (Cfb, oceanic climate, Cfbi, highland humid temperate climate).[1][failed verification][original research?] Rural scene on Tinjacá, Boyacá, Colombia, with the typic vegetation, highland wooded savanna It is characteristic of South and central Mexico highlands, Central America mountains, North Andes in South America and East Africa mountains, among a few other areas like Baguio city which is found in the Philippines and New Guinea highlands. Altitude generate a difference with lowlands. Temperature and atmospheric pression decrease, approximately 0,6 °C or 1 °C every 100 m. This s because to the adiabatic rate air. In summary, this climates are generate because of temperature decrease on tropical zone, at same latitudes where appear tropical climates, located between 0 and 1500 m, while from 1500 m until 3000 m (depending on latitude) appear highland temperate climate, semihumid and isothermal. Above 3500 m is the alpine tundra climate ETH, identified with páramo and puna vegetation. Andean forest of Colombia and Ecuador, in Podocarpus National Park. This climate often has been called oceanic Cfb or mediterranean Csb, however, it is not mediterranean since it is not found in temperate latitudes, do not limit with deserts and neither it is oceanic, because humidity here do not comes from ocean but of tropical rainforest near (Congo, Amazon, Chocó). Temperatures are cool all year, approximately between 12 °C and 19 °C mean all months and year. Nevertheless, there are high daily range termic, between day and night, around 10 °C. There may be high nubosity and air humidity. Clear skis are rare. Precipitations, only as rainfall, and often hail, it decrease with altitude, it is around 700–2,000 mm, that is, higher than temperate zone. The vegetation basically is Highland Forest, beside highland wooded savanna and scrubs. The particular location of this highlands, many of which are just north of the Earth's equator but South of the metereological equator, what added to low termic range, makes defining between winter and summer speculative, sometimes it is confunde Cfbi, Cwbi and Csbi, just like it happens between tropical climates Aw and As.[2][failed verification] Colonia Tovar scene, with typic vegetation of Cfbi climates. Constant precipitation throughout the year, no dry season. Its temperature oscillates between 10 °C and 20 °C. Precipitation is higher than other highlands, about 1500 mm. It is the tropical variation of the oceanic climate Cfb. It can appear anywhere within the tropical zone with much rainfall and adequate altitude. Cities: Colonia Tovar, Venezuela Mérida, Venezuela Scene of La Esperanza, Honduras Rainfall come in hipotetic summer (monsoon), (usually between March and June in North Hemipshere and November and February in South Hemisphere), dry season take place in winter or cold months. Temperatures around 12 °C y 19 °C and precipitations from 800mm. Of the three subtypes, it is the one that occurs at a higher latitude, extending to subtropical areas exceeding 15° north and south latitude, which is why it usually presents a greater termic range, between 3 °C and 4°. It is located in Peru and Bolivia highlands, mountains of Brazil, center of Mexico and mountains of Central America and East Africa. Because of that, its vegetation is variable, from savanna until forests. Most of the time it is simply called as Cwb, the Köppen classification for subtropical highland climates, because outside the intertropical zone it is existent. Cities: Kunming, China Addis Ababa, Ethiopia Nairobi, Kenya La Paz, Bolivia Cusco, Peru Scene of Loja, Ecuador, with typic vegetation of highland equatorial climate Dry season math with more hot and sunny months, it has a marked wet season, with bimodal regime, where one of them is stronger than the other. Precipitation normally between 700mm y 2000mm, humidity decrease with altitude, annual rainfall decrease 100 mm every 100 m altitude. Intertropical Convergence Zone appears twice yearly, while temperature depends on altitude, generally between 12 °C and 18 °C, very stable and unchanging throughout the year.[original research?] It is located in equatorial latitudes to no more than 5°S and 5°N of equator. It is almost exclusive of Ecuadorian-Colombian Andes, located from 1500 m altitude. It consists of tropical variation of oceanic mediterranean climate Csb. Common vegetation is the highland wooded savanna. Andean forests or cloudy forests appears above 3000 m of great biodiversity.[3] Cities: Bogotá, Colombia Cuenca, Ecuador Ibarra, Ecuador Manizales, Colombia Pasto, Colombia Popayán, Colombia Quito, Ecuador Tunja, Colombia Temperate climate Humid temperate climate Subhumid temperate climate Mediterranean climate Altitude Köppen climate classification ^ The Ceylon Forester, Ceylon Forest Department 1953 ^ Karina Martínez et al. eds. 2014, "Economic impact of climatic change in Colombia." Cap.2, p.14, BID, ONU, Washington DC ^ Northern Andean Montane Forests. Archived 2017-04-25 at the Wayback Machine WWF Global Retrieved from " scoresvideos Highland climates, also known as alpine or mountain climates, are characterized by high solar radiation, low temperatures, and high precipitation. These climates are found around high land, which means mountains, and can have a completely different climate at the bottom compared to the top. The highlands in Europe experience a specific climate characterized by high insolation (solar radiation), low temperatures, and high precipitation.Highland temperate climates are a sub-type of highland climates, located in tropical zones and isothermal. They have an average temperature range of -2°F to 50 degrees Fahrenheit and an average precipitation of 23 cm. The highlands are

home to guides called sherpas, who live in these climate zones, which are characterised by their high elevation and cooler temperatures compared to lowland areas.The ground surface remains snow covered for at least 7 to 8 months in a year, and the cold and high velocity winds with powdery snow are known as “snowy” winds. The highland climates are characterized by their unique weather patterns and ecological conditions found in elevated regions, playing a crucial role in influencing biodiversity.In summary, highland climates are characterized by high insolation, low temperatures, and high precipitation, with daily temperature fluctuations being higher than in lowlands. These climates play a crucial role in influencing biodiversity and are often found in mountainous regions.Useful Articles on the TopicArticleDescriptionSiteHighland ClimateHighland climate is often called Alpine Climate. Nearly every part of this climate–temperature, precipitation, etc. depends on the elevation level.climatetypesforkids.comHighland climate Meteorology, Temperature & PrecipitationKöppen climate classification map The major climatic types are based on patterns of average precipitation, average temperature, and natural vegetation.britannica.comHighland temperate climateThe highland temperate climates are a temperate climate sub-type, although located in tropical zone, isothermal and with characteristics different from others ...en.wikipedia.org Subtropical Highland Climate – Secrets of World Climate #3In the mountains and valleys of the tropics, a special place awaits... An escape from the heat and humidity of the surrounding ... (Image Source: Pixabay.com) What Is Highland Tropical Climate?In tropical highlands, there is minimal seasonal temperature variation, yet daily fluctuations are significantly more pronounced than in mid-latitude mountains, resulting in numerous freeze-thaw days. Highland temperate climates, a subtype within the tropical zone, display isothermal characteristics that distinguish them from other temperate climates like oceanic or Mediterranean. They are classified as highland climates, often referred to in the Köppen classification system, although not part of Wladimir Köppen's original systems.Tropical climates, identified as Type A in the Köppen system, maintain average monthly temperatures of at least 18 °C (64 °F) in the coolest month. Tropical highland climates, found in regions such as Hawaii and parts of Africa, usually have average temperatures between 10°C and 20°C (50°F to 68°F) year-round. These climates are characterized by high insolation, low temperatures, and high precipitation levels. Highland climates are typically found at elevations above 2, 000 meters (6, 500 feet) and are marked by rapid weather changes due to elevation differences, leading to distinct climatic conditions at varying altitudes.They often exhibit dry conditions with cold temperatures, although rain can occur on mountain slopes. The subtropical highland climate, particularly one with no dry season, resembles tropical rainforest conditions but retains cooler temperatures. Overall, highland climate characteristics vary significantly with elevation, influencing temperature, precipitation, and other climatic factors, making these regions uniquely diverse. (Image Source: Pixabay.com) What Climate Zone Is The Ice Cap In?An ice cap climate is a type of polar climate characterized by persistently low temperatures, with no mean monthly temperature exceeding 0°C (32°F). This climate occurs in high-latitude areas, typically between 60° and 90° north and south, encompassing regions like Antarctica and the northernmost islands of Canada and Russia.According to the Köppen climate classification, ice cap climates are designated as EF. It is important to differentiate the ice cap climate from tundra climates, which have at least one month where temperatures rise above freezing (denoted as ET). Ice cap climates experience long, harsh winters with average monthly temperatures remaining below freezing throughout the year, resulting in an accumulation of snow and ice.In the Northern Hemisphere, the ice cap climate is prevalent over Greenland's interior and parts of the Arctic Ocean, while in the Southern Hemisphere, it dominates Antarctica. Ice cap climates occupy roughly 1. 5 percent of Earth's surface, primarily found around the poles.These climates are marked by minimal precipitation, predominantly as snow, and features such as extremely cold winters and very short summers. Given its characteristics, the ice cap climate occupies regions that are inhospitable to vegetation, leading to a stark, icy landscape.Overall, polar climates, including ice cap and tundra climates, are defined by their prolonged cold and limited temperature variation, making them among the coldest climatic zones on Earth. The ice caps of Greenland and Antarctica, which have formed over thousands of years, exemplify the extreme cold conditions found in these climate types. (Image Source: Pixabay.com) What Distinguishes A Highland Climate?Highland climates, or type H climates, are primarily found in mountainous regions, characterized by significant variations in temperature and precipitation with elevation. This climate type, which is not part of Wladimir Köppen’s original classification, is defined by its cooler temperatures, variable precipitation patterns, and extreme weather conditions. Highland climates are typically located at altitudes above 2, 000 meters (6, 500 feet), where temperatures decrease by approximately 6. 5°C for every 1, 000 meters ascended.Read also: What Distinguishes Climate From Weather Quizlet?The distinctiveness of highland climates arises from rapid climate changes over short distances due to varying elevation levels. Unlike polar climates, which are expansive across the Arctic and Antarctic, highland climates are localized and affected by topographical features. They exhibit characteristics like high insolation, low temperatures, low air pressure, diurnal temperature ranges, and relatively substantial precipitation.Highland climates often fall within the subtropical or tropical zones and differ significantly from typical temperate climates, such as oceanic and Mediterranean varieties, primarily due to their isothermal nature. As such, understanding highland climates requires attention to specific variables like temperature, precipitation, wind, and solar radiation patterns.Although many aspects of highland climates are influenced by elevation rather than latitude, they can exhibit diverse precipitation regimes, leading to various types, including subtropical highland climates. This makes highland climates, often referred to as Alpine climates, distinct from their surrounding lowland areas and vital for understanding global climatic diversity. Overall, the highland climate is largely determined by the altitude and its associated environmental factors. (Image Source: Pixabay.com) What Does A Highland Climate Look Like?Highlands are marked by high insolation, low temperatures, and substantial precipitation. Daily temperature fluctuations are noteworthy, featuring cooler nights and warmer days. The climate in highland areas significantly varies with elevation, leading to unique weather patterns. Highland climates, often referred to as alpine or mountain climates, were added to the Köppen classification system despite not being part of Wladimir Köppen's original structure.They present harsh conditions, particularly at higher elevations, characterized by treeless alpine vegetation. Tropical highland climates, found in regions like Hawaii and parts of Africa, typically have temperatures ranging from 10°C to 20°C (50°F to 68°F). The climate changes rapidly over short distances due to elevation variations, with lower altitudes experiencing different weather than higher ground. Highland regions generally have a rainy climate, with rain possible year-round, though autumn and winter are usually the wettest seasons.Average temperatures can range from -2°F to 50°F, with average precipitation around 23 cm. Highland climates can also exhibit different vegetation zones, transitioning from lush forests at lower altitudes to alpine tundra at greater heights. Subtropical highland climates may feature monsoon influences, resulting in wet summers and dry winters. Sherpas, guides in the Himalayas, inhabit these highland zones, which are distinguished by their elevation and cooler temperatures compared to the surrounding lowlands. Highland climates play a crucial role in shaping local biodiversity and ecological conditions. Subtropical Highland Climate – Climates #11Discover the hidden wonders of the subtropical highland climate! In this episode of Planetic, we explore the perfect year-round ... Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. (most measurements in Fahrenheit and inches... sorry rest of the world)Highland climate is pretty simple. It is the climate found around high land. High land means mountains. Mountains can have a completely different climate at the bottom compared to the top. Highland climate is often called Alpine Climate. Nearly every part of this climate--temperature, precipitation, etc. depends on the elevation level. Highland climate is the climate of 'high' 'land'. So, this climate is found in high mountain areas. It is found on single mountains such as Mount Kilimanjaro and also large areas of high elevation such as the Plateau of Tibet. The Plateau of Tibet (below) averages 20,000 feet above sea level--it is the largest area of high land on Earth. This climate is sometimes called Alpine Climate. This is a map of Asia showing the Plateau of Tibet.There are no seasons in Highland climate. Any seasonal differences would only be felt at low elevations, near the bottom of a mountain. The reason mountains need their own climate type is because the "climate" changes as you move up the mountain. At the base (bottom) of a mountain it might be 80 degrees and sunny, but as you climb the mountain it will get colder and be rainy. As you keep climbing, it might be snowy and freezing cold. In fact, the temperature drops about 3 degrees every 1000 feet in elevation as you move up a mountain. So, the temperatures in Highland depends on the elevation.The amount of precipitation in Highland climate depends on the elevation. Sometimes the land around the base of a mountain is dry, but snow may cover the top of a mountain. This happens because high mountains force warm air to rise, where it cools and creates precipitation. The level of precipitation in a Highland climate depends on the elevation you want to measure.Highland Elevation TemperatureThis is a graphic showing a mountain and the temperature changes at different elevations.The type of vegetation that grows in Highland also depends on the elevation. At the base (bottom) of the mountain the vegetation will be the same as the surrounding climate type. So, a mountain in the rainforest will have rainforest at the base. As you move up in elevation it will change to plants that can survive colder weather, eventually there will be no vegetation at very high elevations. In fact, on high mountains you can see what is called a tree line or timberline. A tree line is a clear elevation line that divides where trees are able to survive from areas that are too harsh for them to live. Most mountains have different tree lines depending on temperature, soil, and moisture.Tree Line in the MountainsThis is a picture of the tree line of a mountain.Again, the types of animals will depend on the elevation and the surrounding area. Typically, different types of goats and sheep are common in Highland climate. Mountain Goats are common in the Rocky Mountains--their feet are adapted to walking and jumping on steep cliffs. Large cats such as Mountain Lions and Snow Leopards are also found here. Snow Leopards, found around the Himalayas, have large feet and big thick tails to give them better balance in mountain terrain. This is a picture of a snow leopard.This is a picture of a Mountain Goat. Highland climate, often referred to as alpine or mountain climate, is a unique climate type characterized by its dependence on elevation rather than latitude. This climate is typically found in mountainous regions and exhibits significant variations in temperature, precipitation, and ecosystem diversity based on altitude. Definition Highland climate is defined as the climate found in high-altitude areas, generally above 2,000 meters (6,500 feet). Unlike other climate types that are primarily influenced by latitude, highland climates can occur in tropical, temperate, or polar regions. In the Köppen Climate Classification system, highland climates are designated as “H,” indicating their mountainous nature and the variability of temperatures based on elevation and exposure[1][5]. Key Characteristics of Highland Climate Temperature Variation: – Temperatures decrease with altitude at an approximate rate of 6.5°C per 1,000 meters (3.6°F per 1,000 feet), known as the lapse rate. – High-altitude regions tend to be cooler than surrounding lowlands, even in tropical areas. Read more:Plug Power: The Key to a Sustainable Energy FutureSeasonal Variation: – Highland climates may experience distinct seasons, with colder winters and milder summers. – In tropical highlands, such as the Andes, seasonal variation is less pronounced, but significant daily temperature swings can occur between day and night. Precipitation Patterns: – Precipitation generally increases with altitude due to the orographic effect, where moist air rises and cools, leading to condensation and precipitation. Read more:Does Europe Have More Clean Energy?– Conversely, leeward sides of mountains may experience drier conditions due to the rain shadow effect[1][3][4]. Factors Affecting Highland Climate Altitude: – Altitude is the most defining feature of highland climates. As elevation increases, temperatures drop, air pressure decreases, and oxygen levels thin out. Latitude: – While elevation is crucial, latitude also influences highland climates. For instance, highlands near the equator may have warmer temperatures compared to those at higher latitudes[2][4]. Read more:How Many Private Clean Energy Companies?Aspect and Exposure: – The direction a slope faces can significantly affect its climate. South-facing slopes in the Northern Hemisphere receive more sunlight and are generally warmer than north-facing slopes[3][5]. Examples of Highland Climate Regions – The Andes (South America): Characterized by cooler temperatures at higher elevations and diverse ecosystems ranging from rainforests to glaciers. Quito, Ecuador exemplifies a temperate highland climate with mild temperatures year-round despite its equatorial location. – The Himalayas (Asia): Exhibit extreme variations in climate; areas near peaks like Mount Everest experience freezing conditions year-round. Lhasa in Tibet showcases a cold, dry highland climate. – The Rocky Mountains (North America): Known for cold winters and mild summers with significant snowfall in ski areas like Aspen, Colorado. Read more:What Are Clean Energy Sources?– The Alps (Europe): Feature a classic highland climate with distinct seasons; winter brings snow while summers remain cool[1][2][3]. Highland Climate Ecosystems and Vegetation Alpine Zones: – Characterized by hardy plants adapted to cooler temperatures and shorter growing seasons. Tundra at Higher Elevations: – Higher elevations may exhibit tundra-like conditions with sparse vegetation due to cold temperatures and thin soils. Read more:What Countires Are Pushing For Clean Energy?Forests in Lower Elevations: – Mid-altitudes can support temperate or tropical cloud forests depending on latitude and moisture availability[4][5]. Impact of Highland Climate on Human Life Agriculture: – Highland climates often limit intensive agriculture due to shorter growing seasons and thin soils. However, terrace farming is common in regions like the Andes where crops such as potatoes and quinoa thrive. Human Habitation: – Communities living in these climates have adapted to cooler temperatures and lower oxygen levels. Indigenous groups in places like the Andes have developed unique lifestyles suited to high-altitude living[1][3]. Tourism and Recreation: – The scenic landscapes and cooler summer temperatures attract tourists for skiing, hiking, and mountaineering activities[2][4]. Climate Change and Highland Climates Highland regions are increasingly affected by climate change: – Warming Temperatures: Rising temperatures lead to glacier melting and altered ecosystems reliant on cold conditions. – Glacier Retreat: Many communities depend on meltwater from glaciers for their water supply; retreating glaciers threaten this resource. – Changes in Vegetation: As temperatures rise, some species are migrating to higher elevations, impacting local biodiversity[1][3]. FAQs Section 1. What is highland climate? – A climate found in mountainous regions where elevation dictates temperature and weather patterns. 2. How does altitude affect highland climate? – Higher altitudes result in cooler temperatures and lower air pressure. 3. Where is highland climate found? – Commonly located in regions like the Andes, Himalayas, Alps, and Rocky Mountains. 4. What is the temperature like in highland climates? – Generally cooler than surrounding lowlands; freezing temperatures are common at higher elevations. 5. How does highland climate affect human life? – Influences agriculture practices, human habitation adaptations, and tourism opportunities[2][4]. Conclusion Highland climates are defined by their unique characteristics shaped primarily by altitude. They support diverse ecosystems and human adaptations that reflect the challenges posed by cooler temperatures and varied precipitation patterns. Understanding these climates is increasingly important as they face significant changes due to global warming impacts on mountain environments. Kyle Whyte is a notable scholar and professor at the University of Michigan, holding positions such as the George Willis Pack Professor in the School for Environment and Sustainability and Professor of Philosophy. Specializing in environmental justice, his work critically examines climate policy and Indigenous peoples’ ethics, emphasizing the nexus between cooperative scientific endeavors and Indigenous justice. As an enrolled Citizen Potawatomi Nation member, he brings a vital perspective to his roles as a U.S. Science Envoy and member of the White House Environmental Justice Advisory Council. His influential research is supported by various prestigious organizations including the National Science Foundation, and disseminated through publications in high-impact journals. Kyle actively contributes to global Indigenous research methodologies and education, with affiliations to numerous institutes and societies dedicated to traditional knowledge and sustainability. Recognized for his academic and community engagement, Kyle has earned multiple awards and served in various visiting professorships. His efforts extend to leadership positions on boards and committees focused on environmental justice nationwide. Posted by greenthoughtscience on December 27, 2010 · Leave a Comment case of study: Rocky Mountains of North America Earth’s Climate (GEO 416) Dr. Ashish Sinha 06December 2010 By Hadi Ardestani Introduction Climate is the average of weather over time and space and Weather is the current condition of the atmosphere including temperature, wind, moisture, and atmospheric pressure. The climate of a location is mainly governed by the factors of: Latitude, Position relative to continents and oceans, Position relative to large-scale atmospheric circulation patterns, Altitude, and Local geographical features. The accumulation of meteorological data has shown that winds and rainfall, as well as temperature, have a zonal arrangement. A climate zone is a region of the world in which the climate can be defined using a few key parameters. There are a number of different ways to classify the world’s climate zones, and a wide assortment of uses for climate zone information. One of the most widely used systems of climate zones is the Köppen climate classification, developed in the early 20th century by a German researcher. Köppen breaks the world’s climate up into tropical, dry, moderate or temperate, continental, and polar climate zones. The highlands climate zone was added to this classification later. Within each division, there are a number of subdivisions, such as dry arid and dry semiarid. Highlands’s climate descriptions The highland climate zone contains all highland areas or mountains and high plateaus which are not easily categorized by other climate types. It is abbreviated H in the Köppen-Geiger-Pohl system. These areas often have cold winters and mild summers. Due to their elevation, temperatures are lower than you would expect for their latitude and the main form of precipitation is snow, often accompanied by strong winds. These areas can be found in the high land and mountainous areas of the world such as the Cascades, Sierra Nevada, and Rocky mountains of North America, the Andes of South America, the Himalayas and adjacent range and the Plateau of Tibet of Asia, the eastern highlands of Africa, and the central portion of Borneo and New Guinea. Annual ranges in temperature decrease while diurnal ranges increases. Although, average monthly temperatures may classify a mountain area as a certain zonal climate, however, in highlands air pressure becomes a significant climatic element, because its rapid reduction with elevation strongly influences the physiology of humans and other living organisms. (1) Temperature Range: -18 °C to 10 °C (-2 °F to 50°F) Average Annual Precipitation: 23 cm (9 in.) Highland climates of North America The Appalachians, the coast range, the Alaska Range, the Cascade Range, the Sierra Nevada, and Rocky Mountains are the major highlands in United States and their climatic characteristic can be truly described in terms of Latitude, altitude, continentality, and exposure to regional circulations including winds and ocean currents. The North America Mountains are located latitudinally all the way from the Arctic Circle (66.5° N) to the tropic of cancer (23° N) A significant difference in day length and angle of solar radiation over this latitude belt result in a large seasonal and diurnal differences in weather from North to south. The climates of the coast range, the Cascade Range, and the Sierra Nevada, all near Pacific Ocean are primarily maritime. The Appalachian mountains of the eastern United States are subject to a maritime influence from the Atlantic Ocean and the Golf Mexico, but they are also affected by the prevailing westerly winds that bring continental climatic conditions. Only the climate of the Rocky Mountains that is far from both the Pacific Ocean and Atlantic Ocean is continental. Rocky Mountains climate The Rocky Mountains extend over 3000 miles (4800km) from northwestern Alaska to northern New Mexico and are the largest mountains rang in North America. The Rockies can be divided into two climatic zones, northern Rockies, which extend from Alaska’s Brooks rang to central Wyoming and the southern Rockies, which extend from central Wyoming into new Mexico. The highest mountains in the Rockies are in Colorado, where there are 54 peaks above 14000ft (4267m). The northern rookies of Canada are heavily glaciated and support extensive coniferous forest. However, the southern Rockies contain only remnants of glaciers and more open forests that are often limited to mountainsides because of low precipitation amounts in the valleys. The wide range of life zone such as prairie, foothills, montane, subalpine, and alpine are found in Rocky Mountains, which reflects the influence of altitude and latitude on climate.(4) Located in the interior of the continent the Rocky Mountains have a typical continental climate with large daily and seasonal temperatures ranges. The winter are cold, the summer are moderate and dry. Most of the moisture that reaches the Rockies is brought by the midlatitude westerlies. However, because much of the pacific moisture is released as storms are carried over the coast range, the Alaska Range, the Cascade Range, and the Sierra Nevada, the precipitation amounts in Rockies are much lower than in the rangers farther west. The highest mountains receive most of the precipitation, generally 40 inches or 100cm annually, with some high latitude sites receive as much as 100 inches or 250cm annually. The lower elevations intermountain valleys receive only meager amount of precipitations, approximately 12 inches or 30 cm annually. Because winter temperature is low at high latitude in the Rockies, precipitation often falls as powder snow, which has lower water content than heavier snow falling in the cascades. (4&3) In winter the northern Rockies are subject to storms that form near the Aleutians and move across the region from northwest to southwest. In summer, the northern part of northern Rockies and occasionally the southern part are affected by low-pressure storms that travel rapidly across the region from west to east setting off isolated afternoon thunderstorms. These thunderstorms also move rapidly and produce only light precipitation, which increases the hazard of lightning-ignited forest fires. At altitude above the southern Rockies, winds are generally from the west. The strength of the winds varies between winter and summer as the position of the jet stream shifts. when the strong westerly winds in the lower troposphere associated with jet streams cross north-south Rocky Mountains, precipitation is often produced on the windward side of the mountains as the air is lifted over the mountains. During winter, when the jet stream is over southern Rockies, wind aloft in the region is strong. When the jet stream is farther north, the westerlies aloft are weak and the weak southerly winds prevail at the ground on both the east and west side of Rockies. (4&3) East of the mountains, the southerly winds are driven by Bermuda- Azores High, which brings moist air northward from the Gulf of Mexico into the central part of the country. Enough low level moisture reaches the eastern foothills of the southern Rockies to produce the afternoon thunderstorms over Colorado’s range and foothills. As the thunderstorms grow to a higher level of the atmosphere, they encounter prevailing westerly winds, which carry the storm eastward over the plains. West of the mountains, summertime the winds are also southerly. (3) The Mexican Monsoon (also called the Arizona, southwest, or North American Monsoon) affects the southern United States. Spring and early summer are usually dry in southwest, but a change occurs in midsummer when dry westerly winds are replaced by moist southerly winds. The winds come up the Gulf of California, where they pick up the moisture from the warm (in about 29° C or 84° f) water before moving across Arizona and New Mexico The moist, low level winds feeds afternoon thunderstorms that develop over mountain barriers on the east side of Great Basin, particularly on Arizona’s Mogollon Rim .The moisture is distributed vertically in the atmosphere by the thunderstorms, and is subsequently carried throughout the intermountain area and the southern and central Rockies by prevailing mid-altitude and high-altitude winds. The inflow of this moisture is responsible for summertime precipitation in Arizona, New Mexico, and the southern halves of Utah and Colorado. The almost daily thunderstorms that occurs in the southern and central Rockies from late June through the end of summer , and the sheets of thick cirrus that can be observed in the afternoon or evening , remnants of thunderstorms that formed upwind earlier in the day, indicate the presence of low level Monsoon moisture. (4&3) El Niño affects some parts of united state and Canada primarily in winter. But it dose not have a significant impact on rocky mountain area. A ridge of high pressure typically forms over North America’s West Coast during El Niño’s winters, keeping temperatures above normal in western Canada and parts of northern United States and steering storms that would normally pass through Washington and Oregon northward into southern Alaska. El Niño also creates a favorable climate for storms to develop in the Gulf of Mexico, causing wet weather over much of the southern United States. (4) References: 1- The climate of the earth By Paul E. Lydolph, page 201 2- Physical Geography By Robert E. Gabler, James F. Petersen, L. Michael Trapasso, Dorothy Sack, chapter8, page 210 3- Mountain climate by A. Batch for Mountains and peoples, chapter 4,5 4- Mountain meteorology: fundamentals and applications By Charles David Whiteman, chapter 2, chapter 5, chapter6