1. How do location of mountains and plateaus decide the climate of a region? Illustrate.

Approach

A simple and straightforward question where in the candidate needs to illustrate how the location of mountains and plateaus decides the climate of a region.

Introduction

Mountains provide freshwater to half of the world's population and are home to half of all global biodiversity hotspots whereas plateaus provide for greater availability of same elevation land over large stretches. Climate is affected by mountains and plateaus both.

Body

Impact of Mountains and Plateau on climate –

- The Topography of an area can greatly influence our climate. Mountain ranges are natural barriers to air movement. In California, winds off the Pacific Ocean carry moisture-laden air toward the coast. The Coastal Range allows for some condensation and light precipitation.
- Mountains themselves play a major role in influencing regional and global climates. They act as barriers for wind flow, which induces enhanced precipitation on the windward side, and reduced precipitation and warmer temperatures on the leeward side.
- Changes in atmospheric wind flow patterns may induce large and locally varying precipitation responses in mountain areas, which could be much stronger than average regional climate change.
- Mountains receive more rainfall than low lying areas because as air is forced over the higher ground it cools, causing moist air to condense and fall out as rainfall.
- The higher the place is above sea level the colder it will be. This happens because as altitude increases, air becomes thinner and is less able to absorb and retain heat. That is why you may see snow on the top of mountains all year round.
- Normally, climatic conditions become colder as altitude increases. "Life zones" on a high mountain reflect the changes, plants at the base are the same as those in surrounding countryside, but no trees at all can grow above the timberline. Snow crowns the highest elevations.
- Mountain weather conditions can change dramatically from one hour to the next. For example, in just a few minutes a thunder storm can roll in when the sky was perfectly clear, and in just a few hours the temperatures can drop from extremely hot temperatures to temperatures that are below freezing.

- Plateaus, if sufficiently high enough, can reverse the Hadley cell convection cycles and divert the winds. For example, Tibetan plateau and monsoon winds in Indian subcontinent.
- Some plateaus are known for their groundwater which is under positive pressure and causes the emergence of springs called Artesian wells. For example, intermontane plateau like Colorado plateau.
- The higher parts of the plateaus even in tropical and sub-tropical regions have a cool climate. For example, average temperature in Bengaluru is lot cooler than that in Chennai.

Conclusion

Thus, it is clear that the physiology of a region affects the local climate and in the era of climate change, it is necessary to safeguard the biodiversity of the sensitive ecosystem from the ravages of human greed and materialism for a sustainable future.

2. What are sand dunes? How do they get formed? Discuss with the help of suitable examples.

Approach

Candidates are expected to write about sand dunes, and how they are formed with help of suitable or examples.

Introduction

Sand Dunes are geological depositional landforms created by action of winds. Sand dunes are heaps or mounds of sand found in deserts. Generally their heights vary from a few metres to 20 metres but in some cases dunes are several hundred metres high and 5 to 6 km long.

Body

Formation of sand dunes:

- Dunes are made of sand-sized particles, and may consist of quartz, calcium carbonate, snow, gypsum, or other materials. The upwind/upstream/up current side of the dune is called the stoss side; the down flow side is called the lee side. Sand is pushed (creep) or bounces (saltation) up the stoss side, and slides down the lee side. A side of a dune that the sand has slid down is called a slip face (or slipface).
- Dunes are found wherever loose sand is windblown: in deserts, on beaches, and even on some eroded and abandoned farm fields in semiarid regions, such as northwest India and parts of the south-western United States.
- Coastal dunes form when wet sand is deposited along the coast and dries out and is blown along the beach. Dunes form where the beach is wide enough to

allow for the accumulation of wind-blown sand, and where prevailing onshore winds tend to blow sand inland. The three key ingredients for coastal dune formation are a large sand supply, winds to move said sand supply, and a place for the sand supply to accumulate. Obstacles for example, vegetation, pebbles and so on tend to slow down the wind and lead to the deposition of sand grains.

Various sand dunes:

- Crescent shaped dunes called barchans with the points or wings directed away from wind direction i.e., downwind, form where the wind direction is constant and moderate and where the original surface over which sand is moving is almost uniform. A group of dunes moved more than 100 metres per year between 1954 and 1959 in China's Ningxia Province, and similar speeds have been recorded in the Western Desert of Egypt. The largest crescentic dunes on Earth, with mean crest-to-crest widths of more than three kilometres, are in China's Taklamakan Desert.
- Parabolic dunes form when sandy surfaces are partially covered with vegetation. That means parabolic dunes are reversed barchans with wind direction being the same.
- Seif is similar to barchan with a small difference. Seif has only one wing or point. This happens when there is shift in wind conditions. The lone wings of seifs can grow very long and high.
- Longitudinal dunes form when supply of sand is poor and wind direction is constant. They appear as long ridges of considerable length but low in height.
- Transverse dunes are aligned perpendicular to wind direction. These dunes form when the wind direction is constant and the source of sand is an elongated feature at right angles to the wind direction. They may be very long and low in height.
- When sand is plenty, quite often, the regular shaped dunes coalesce and lose their individual characteristics. Most of the dunes in the deserts shift and a few of them will get stabilised especially near human habitations.
- The Khuri Sand Dunes are situated at a distance of 40 Km to the southwest of Jaisalmer, Rajasthan. It is one of the most acknowledged and pristine beauty in the middle of the vast Thar Desert, which offers many ideal locations for tourists to get an experience of dunes in India. The Thar Desert is home to numerous sand dunes which offer tourists with options for camping and desert safari.

Conclusion

Dune habitats provide niches for highly specialized plants and animals, including numerous rare species and some endangered species. Due to widespread human population expansion, dunes face destruction through land development and recreational usages, as well as alteration to prevent the encroachment of sand onto inhabited areas.

3. With the help of suitable examples, discuss the differences between temperate and tropical flora. How does temperate flora shape the local economy? Explain.

Approach- Question is straight forward. Candidate can give describe the temperate and tropical flora with the help of examples and discuss how temperate flora shapes the local economy in the second part.

Introduction

The word "flora" refers to the plants occurring within a given region as well as to the publication of scientific descriptions of those plants. Flora in Latin means the goddess of the flower. Flora is also derived from the word floral, which means relating to flowers. Therefore flora is a group of indigenous plants in an ecosystem of a geographical region.

Body

Temperate flora

- The temperate zones comprise those regions of the Earth's surface that are located between the Tropic of Cancer and the Arctic Circle in the Northern Hemisphere and between the Tropic of Capricorn and the Antarctic Circle in the Southern Hemisphere.
- Temperate forests are diverse ecosystems composed of mixtures of conifers, broad-leaved evergreen and broad-leaved deciduous trees. Latitude, temperature, moisture and elevation define the distribution of various temperate forests and trees.
- Temperate forests
    1. Mediterranean forests- occur in areas where the climate is characterized by warm, wet winters and hot, dry summers. They are located along the western coastal regions of the continents. a canopy of holm oak (Quercus ilex) and other evergreen broad-leaved trees dominated the original forest cover.
    2. WARM TEMPERATE EVERGREEN FORESTS- These forests are found where the mean temperature is between zero and 18 degree Celsius for the coldest month of the year. A classic example is the Pacific Coast of North America, north of 36°N latitude. This forest is dominated by giant conifers including redwood, hemlock, and western red cedar.
    3. The temperate deciduous forests- undoubtedly the best known of the various types of temperate zone forests. Restricted to the Northern Hemisphere apart from a small area at the southern tip of South America and are found where the average temperature is below 0°C for the coldest month of the year. The temperate deciduous forests of western Europe have been reduced to fragments of the original forest due to agriculture, grazing and other human activities. These forests are poorer floristically.

4. BOREAL FORESTS- encircles the globe at the northern limits of forests and covers vast areas of North America and Eurasia. The winters are colder and longer than in the temperate deciduous forest zone and much of the region is dominated by extension.
5. Conifer forests composed of species of Abies, Larix, Picea and Pinus or extensive areas of bog or peatlands.

Tropical flora

- Tropical vegetation is any vegetation in tropical latitudes. Plant life that occurs in climates that are warm year-round is in general more biologically diverse that in other latitudes.
- Tropical forests
    1. Tropical rainforest ecosystems include significant areas of biodiversity, often coupled with high species endemism. Flora- Orchids, Philodendrons, Ferns, Bromeliads, Kapok Trees, Banana Trees, Rubber Trees, Bam- boo Trees, Cassava Trees, and Avocado Trees.
    2. Tropical seasonal forest- generally receives high total rainfall, averaging more than 1000 mm per year, but with a distinct dry season.
    3. Tropical dry broadleaf forests are territories with a forest cover that is not very dense and has often an unkempt, irregular appearance, especially in the dry season. These forests often include bamboo and teak as the dominant large tree species.
    4. Tropical grasslands, savannahs, and shrub land- are spread over a large area of the tropics with vegetation made up mainly of low shrubs and grasses, often including sclerophyll species.

Economy of temperate forests

- Temperate forests in all regions of the globe have been significantly altered by human activities for thousands of years. Their moderate climates, fertile soils, and vegetation productivity have been favourable to human settlement and clearing for agriculture, as well as direct use of trees themselves for lumber and fuels.
- Agricultural and settlement activities have included development of urban areas, widespread grain and other crop (e.g., corn, vegetables) cultivation, livestock grazing, gathering of mulch, and alteration of natural water drainage.
- The vast majority of temperate forest land cover is in secondary forest responding to human harvest or other human-induced disturbance.
- They serve as the world's major source of timber and wood products and are perhaps the only forests with some proven potential for sustainable management.
- Managed forestry has maintained existing temperate forest lands by re-planting after harvest, and sustainable forestry practices are receiving increasing attention.

Conclusion

Temperate and tropical fauna is a rich source of livelihood for millions of people around the globe. 300 million people live in forests, including 60 million indigenous people and they are directly dependent on the forest resources. Over exploitation of the temperate forests has been done to meet the energy demands but more efforts are being done to mitigate this crisis and to build the sustainable future.

4. What are the changes being observed in the Arctic region in recent decades? How will impact the global weather pattern? Explain.

Approach

Since the question is asking you to explain you are supposed to expect to clarify with relevant facts and implications.

Introduction

Scientists first started to see evidence of changes in Arctic climate in the 1980s. Since then, the changes have become much more pronounced. Over the past 30 years, the Arctic has warmed at roughly twice the rate as the entire globe, a phenomenon known as Arctic amplification. Most scientists agree that this rapid warming is a signal of human-caused climate change.

Body

THE CHANGES BEING OBSERVED IN THE ARCTIC REGION IN RECENT DECADES

- The floating sea ice cover of the Arctic Ocean is shrinking, especially during summer.
- Snow cover over land in the arctic has decreased, notably in spring, and glaciers in Alaska, Greenland, and northern Canada are retreating.
- In addition, frozen ground in the arctic, known as permafrost, is warming and in many areas thawing.
- Sea ice has also become thinner in recent decades, with arctic-wide average thickness reductions estimated at 10-15%, and with particular areas showing reductions of up to 40% between the 1960s and late 1990s.
- Some of the strongest warming is projected for land areas, such as northern Russia, which are adjacent to oceans in which sea ice is projected to decline sharply.
- Melting glaciers, decline in snow cover extent over arctic land areas, increased temperature and rising sea level all provide strong evidence of recent warming in the arctic.

HOW WILL IMPACT THE GLOBAL WEATHER PATTERN

- Researchers say that the changes in the Arctic are worrisome, because they could lead to feedback effects that lead to further warming. For instance, when the White Sea ice melts in summer, areas of dark open water are exposed this can absorb more heat from the sun. That extra heat then helps melt even more ice.
- The loss of sea ice is known to be one of the drivers of Arctic amplification. Permafrost may also be involved in feedbacks. As permafrost thaws, plants and animals that were frozen in the ground begin to decay. When they decay, they release carbon dioxide and methane back to the atmosphere that can contribute to further warming.
- The changing vegetation of the Arctic also affects the brightness of the surface, which then influences warming. As the Arctic atmosphere warms, it can hold more water vapour, which is an important greenhouse gas.
- Some of the changes in the Arctic could also be involved in feedback effects, or effects that reduce the amount of warming. For example, if warm temperatures make the Arctic growing season longer, more plants can survive and take up more carbon from the air. However, most evidence suggests that the positive feedback effects that hasten warming outweigh the negative feedbacks.

Conclusion

Changes in the Arctic have effects that cascade through the food chain, from phytoplankton to marine mammals such as seals, walrus, whales, and polar bears. Changes in the Arctic climate are important because the Arctic acts as a refrigerator for the rest of the world—it helps cool the planet. Changes in the Arctic climate are important because the Arctic acts as a refrigerator for the rest of the world—it helps cool the planet and hence these changes could affect the climate in the rest of the world.

5. Discuss the anthropogenic factors causing water crisis in different parts of world. Is there a sustainable way to address it? Examine.

Approach:

As the directive in the question is examine students are expected to address the question directly without writing pros and cons of the issue also the question given has two parts and each part needs to be addressed equally with proper use of examples.

Introduction:

Water covers 70% of our planet, and it is easy to think that it will always be plentiful. However, freshwater—the stuff we drink, bath in, irrigate our farm fields with—is incredibly rare. Only 3% of the world's water is fresh water, and two-thirds of that is

tucked away in frozen glaciers or otherwise unavailable for our use. As a result, some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarce for at least one month of the year. Inadequate sanitation is also a problem for 2.4 billion people—they are exposed to diseases, such as cholera and typhoid fever, and other water-borne illnesses. Two million people, mostly children, die each year from diarrheal diseases alone. According to WWF, some 1.1 billion people worldwide lack access to water, and a total of 2.7 billion find water scarcity for at least one month of the year.

Body:

Anthropogenic factors causing water crisis-

- Water pollution, the release of substances into subsurface groundwater or into lakes, streams, rivers, estuaries, and oceans to the point where the substances interfere with beneficial use of the water or with the natural functioning of ecosystems. In addition to the release of substances, such as chemicals or microorganisms, water pollution may also include the release of energy, in the form of radioactivity or heat, into bodies of water.
- Domestic sewage is the primary source of pathogens (disease-causing microorganisms) and putrescible organic substances. Because pathogens are excreted in faeces, all sewage from cities and towns is likely to contain pathogens of some type, potentially presenting a direct threat to public health. Putrescible organic matter presents a different sort of threat to water quality. As organics are decomposed naturally in the sewage by bacteria and other microorganisms, the dissolved oxygen content of the water is depleted. This endangers the quality of lakes and streams, where high levels of oxygen are required for fish and other aquatic organisms to survive. Sewage-treatment processes reduce the levels of pathogens and organics in wastewater, but they do not eliminate them completely.
- Petroleum (oil) pollution occurs when oil from roads and parking lots is carried in surface runoff into water bodies. Accidental oil spills are also a source of oil pollution—as in the devastating spills from the tanker Exxon Valdez (which released more than 260,000 barrels in Alaska's Prince William Sound in 1989) and from the Deep-water Horizon oil rig (which released more than 4 million barrels of oil into the Gulf of Mexico in 2010). Oil slicks eventually move toward shore, harming aquatic life and damaging recreation areas.
- The technology of fracking has been in use since the 1940s, when liquids such as gasoline and crude oil were injected into poorly performing gas and oil wells in the central and southern United States with the aim of increasing their flow rate. Over the following decades, techniques were improved—for instance, treated water became the preferred fracturing medium, and finely graded sand or synthetic materials were adopted as a "proppant" to hold open the fractures. While fracking has increased domestic fuel supplies and has made it easier for natural gas to displace dirtier coal in electricity generation, fracking has also raised concerns about contaminated drinking

water supplies, increased air pollution, toxic waste disposal, impairment of rivers and streams, and destruction of landscapes and wildlife habitat.

- Irrigation and drainage, artificial application of water to land and artificial removal of excess water from land, respectively. Some land requires irrigation or drainage before it is possible to use it for any agricultural production; other land profits from either practice to increase production. Some land, of course, does not need either. 70% of global water withdrawals are dedicated to agriculture.
- 19% of global water withdrawals are dedicated to industrial uses which puts pressure on the already stressed water sources fit for human use thus creates crisis as in India as well Industrial use of water has led to crisis in many southern states like Tamil Nadu.

Ways to address the water crisis-

Education

- There are plenty of opportunities out there that people can use to learn more about the world around them. By educating those who are not dealing with water scarcity, they can be in a position to help. Those who are dealing with it can get educated on how they can prevent the problem from becoming even worse in the future.

Recycle Water

- There are plenty of technologies available that allow you to recycle rainwater and other water that you may be used in your home. Consider learning about how you can recycle water. Not only does it help to prevent scarcity, but it can be of financial as well.

Improve Practices Related to Farming

- Farming and irrigation is often a huge culprit when it comes to water scarcity. Because of that, we need to improve practices so that we don't use as much water and those who are using water are using it to its fullest potential. Technology also needs to advance in this manner.

Improve water catchment and harvesting

- Water catchment systems are essential for areas with no other reliable water sources. Pakistan and India—two countries that contend with some of the worst effects of climate change—are overhauling rainwater harvesting systems. These efforts provide independent control of water resources.

Shrink corporate water footprints

- Industrial water use accounts for approximately 22 percent of global consumption. The corporate footprint includes water that is directly and indirectly consumed when goods are produced. As sustainable manufacturing becomes more important, given the increasing severity of water scarcity.

Climate change mitigation

- Climate change and water scarcity go hand-in-hand to cause some of the biggest contemporary challenges to the human race. These issues have a reciprocal relationship, identified by the Intergovernmental Panel on Climate Change (IPCC), in which, "water management policies and measures can have an influence on greenhouse gas (GHG) emissions." As renewable energy options are pursued, the water consumption of these mitigation tactics must

be considered in producing alternatives ranging from bio-energy crops to hydropower and solar power plants.

Conclusion:

Water is a foundation of life and livelihoods, and is key to sustainable development. Successful water management will serve as a foundation for the achievement of many of the 17 Sustainable Development Goals (SDGs), as well as for SDG 6 - which is to 'Ensure availability and sustainable management of water and sanitation for all'. Despite this, water is becoming a pressing societal and geopolitical issue – in some regions, it is already of critical national concern. 'Business as usual' will mean the world will miss water-related SDGs by a wide margin; up to 40% of the world's population will be living in seriously water-stressed areas by 2035; and the ability of ecosystems to provide fresh water supplies will become increasingly compromised.