

APES in a BOX: The Review Sessions

Aquatic Biomes

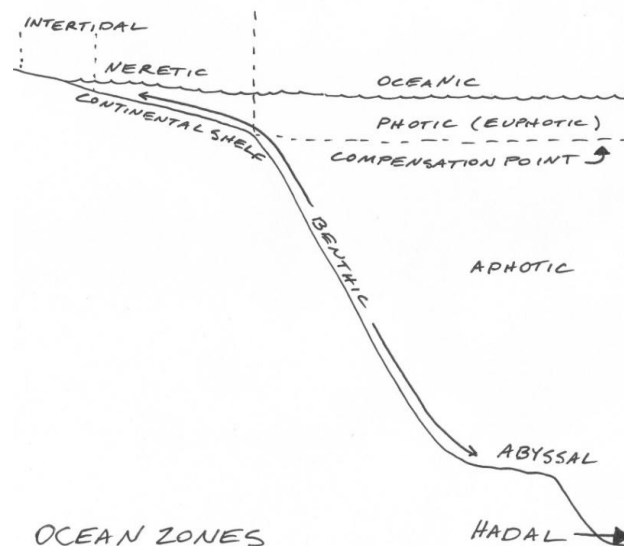
Aquatic biomes are defined based on the presence or absence of salt. **Freshwater biomes** have a salt concentration of less than 1 %; whereas **marine biomes** have a salt concentration greater than 3 %.

Marine Biomes

Oceans cover more than 70% of Earth's surface. Ocean currents, like the Gulf Stream of the Atlantic Ocean, moderate countries' climates by redistributing heat throughout the world.

Vertically, the ocean can be divided into three zones. The **intertidal** or **littoral zone** is the shore line that is covered by water at high tide and exposed at low tide. Barnacles, mussels and hermit crabs thrive here due to their tolerance of harsh, wide-ranging conditions. The **neretic zone** starts outside of the intertidal zone and stretches to the edge of the continental shelf. This area contains ninety percent of ocean life, but only accounts for ten percent of the ocean's area. The open waters past the continental shelf make up the **oceanic zone**. This area is much less productive per unit area than the other zones. However, it accounts for most of the photosynthetic production on Earth due to its vast area. **Nektonic** or strong-swimming organisms are abundant in the oceanic zone.

The ocean can also be divided horizontally into the **euphotic, aphotic, benthic, abyssal** and **hadal** regions.





APES in a BOX: The Review Sessions

Estuaries, mangrove swamps, coastal marshes, coastal seas, coral reefs, and the open ocean make up the unique life zones found in the ocean.

Estuaries occur where rivers empty into the ocean. This mixture of freshwater and saltwater creates a brackish environment that varies in temperature and salinity. Due to the constant supply of nutrients flowing into this area from the river, this ecosystem is highly productive. These conditions create nurseries for marine fish and provide critical habitat for migratory birds.

Chesapeake Bay is the largest estuary in the United States. In the early 1980s, seafood harvests began steadily declining. This is attributed to the pollution from the more than fifteen million people who live in the watershed of this estuary. The Chesapeake Bay Program was established to restore the bay, and even though it has made much progress, shellfish harvests are a fraction of those just fifty years ago.

Pollution from industrial waste, over-fishing, introduction of invasive species, and urban development have all greatly affected estuaries. Agriculture runoff has led to **cultural eutrophication**. In the Gulf of Mexico this has also led to **hypoxia** (reduction of dissolved oxygen) which has resulted in **“dead zones”**.

Mangrove swamps are coastal wetlands found in the tropical areas of the world. These salt-tolerant trees grow in thick forests along the shore. Their characteristic long roots, used for stability and oxygen attainment, help reduce erosion due to wave action and surges generated by tropical storms. These mangrove swamps also provide a “nursery” for many invertebrate and fish species. This makes these areas ideal sources of fish and shellfish for people.

Mangrove swamps are under immense pressure due to urban and recreational development. The conversion of mangrove swamps for shrimp farms has also led to loss of large tracts of these coastal wetlands. Approximately half of the mangrove swamps in the world have been destroyed.



APES in a BOX: The Review Sessions

Coral reefs are found throughout the tropics and subtropics in shallow, clear water. High productivity in these areas supports many species. The very diverse nature of these ecosystems has led to them being called the “rainforests of the seas”. The calcium carbonate secreted by corals to form their exoskeletons is the foundation of these ecosystems. Coral reefs are nurseries for many species of commercial fish. They also protect the coastline by absorbing the energy generated by waves and storms.

However, coral reefs are under attack! Pollution, destruction for shipping channels, and damage caused by divers are leading to the decline of healthy coral reefs. Another problem is a phenomenon called **coral bleaching**. This occurs when a section of reef loses photosynthetic algae and is left without a primary producer. Food chains begin to falter and it is left “bleached” white. This is happening in many parts of the world due to an increase in water temperature attributed to global climate change.

Terrestrial Biomes

Both latitude and altitude determine the distribution of heat and precipitation on land. Temperature and precipitation, in turn, determine the distribution of flora. And flora dictates the distribution of fauna. The relationships between these abiotic and biotic factors form the terrestrial biomes of the world.

Tropical Rainforests

Beginning at the equator, where the amount of sunlight and temperature are constant throughout the year, rainforests occur. Tropical rainforests receive over eighty inches of rain a year. The constant presence of sunlight and moisture makes the rainforest very productive. This productivity allows for over fifty percent of the world’s terrestrial species to be found in only three percent of the Earth’s land. Due to the high rate of decomposition and constant leaching, the soil of this biome is surprisingly very poor. Nutrients are simply recycled too quickly to stay in the soil. Tropical rainforest trees are typically broad-leaved, but are evergreen. There are dozens of different tree species per acre. Mature tropical rainforests typically have three layers of vegetation. The tallest layer consists of emergent trees, whose crowns stand alone above the rest of the forest. The second layer forms the canopy. This layer is a dense, blanketing layer that is about one hundred feet above the floor. The canopy is home to the majority of life found in the rainforest. The third layer is the understory and is dominated by shade-tolerant plants. Due to the intense competition for sunlight, epiphytes, like bromeliads, are abundant in the rainforest. These plants gain access to sunlight by living in the forks of branches



APES in a BOX: The Review Sessions

and wedged in the cracks of bark of taller trees. These relationships are commensalistic since they are not robbing nourishment from their hosts.

Due to population growth and industrialization of developing countries, deforestation of tropical rainforests is occurring at an alarming rate. **Subsistence agriculture**, where families produce enough food for themselves, accounts for the majority of the destruction. Farmers cut the trees down, burn them, and then plant crops in the ashes. This practice is referred to as **slash-and-burn agriculture**. Commercial logging and cattle-ranching for exports are also threatening the remaining rainforest.

Tropical Grasslands

Tropical grasslands also occur near the equator. However, they receive much less rainfall. They receive thirty to sixty inches of rain annually. Although this amount of rainfall is not enough to support the growth of trees found in the rainforest, in some areas of the world it does allow for wide-spread, arid tolerant species to exist. Tropical grasslands with these types of trees are called **savannas**. Savannas support the awesome herds of zebra, antelope, and wildebeest of Africa.

Due to the conversion of these grasslands into domestic animal rangeland, native fauna is decreasing. Due to overgrazing in these areas, desertification has become a major problem.

Deserts

Deserts cover one-third of Earth's land. Deserts typically receive less than ten inches of precipitation a year and have extreme temperature changes daily. Soil is practically nonexistent in deserts; instead it is dominated by sand and gravel. The vegetation found in deserts has to be adapted to a life of extreme temperatures and prolonged periods without water. Plants in the desert often have thick waxy cuticles, reduction of leaves, and photosynthetic stems. Many plants often have a reduction of stomata to minimize transpiration. The annuals of the desert may remain dormant for years and then cover the desert floor in a carpet of colors when rain finally arrives. Animal life of the desert is dominated by reptiles and rodents. Small, nocturnal animals are better fit to survive the extreme heat of the desert day. During times of prolonged heat, these animals often **aestivate** or remain inactive until conditions improve.

In North America, deserts have been damaged by the use of recreational vehicles. The lack of rain makes the recovery of a desert ecosystem almost nonexistent.



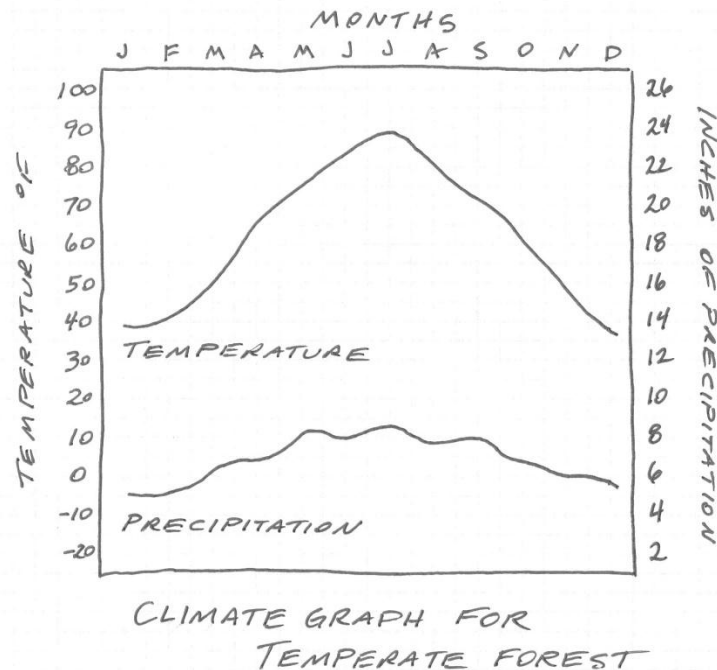
APES in a BOX: The Review Sessions

Urbanization of desert areas has also depleted aquifers to critical points in both Arizona and New Mexico.

Temperate Forests

Much like tropical grasslands, temperate forests occur in areas that receive thirty to sixty inches of precipitation annually. However soil conditions and seasonal variation allow deciduous trees to be abundant in this biome. Unlike evergreen trees, deciduous trees shed their leaves. The plant life here is not nearly as diverse as the rainforest. There may be more species of trees in one acre in the rainforest, than in an entire temperate forest. These broad-leaved trees provide excellent forage for large herbivores, like deer, which in turn attract large predators, like mountain lions. The rate of percolation and evaporation minimize the leaching of nutrients. This along with a steady rate of decomposition makes for excellent soil in this biome.

The deciduous forest of the eastern United States is one of the largest temperate forests in the world. This forest like many other temperate forests has been greatly disturbed for agriculture, logging, and recreation. **Secondary succession** occurs when abandoned farm land is allowed to return to deciduous forest. When this occurs, many native species have successfully reestablished populations.





APES in a BOX: The Review Sessions

Temperate Grasslands

Temperate grasslands occur in temperate areas of the world where precipitation falls between ten and twenty inches. In South Africa, temperate grasslands are known as the veld. In North America, they are referred to as the Great Plains. In Asia, they are called the steppes. And in South America, they are the pampas. These biomes have provided a vast, reliable food source for the largest herds of hoofed mammals on Earth. The soil of temperate grasslands is rich with organic matter. Grasslands are very resilient biomes and were maintained in the past with frequent fires and grazing.

In the United States, less than one percent of native grassland exists. Once people moved west, settlers discovered that this biome was excellent for agriculture. They replaced the native grasses with domesticated grasses like corn and wheat. Many of the native herbivores, like bison, were **extirpated** and replaced with cattle.

Taiga

South of the Arctic Circle lays a belt of evergreen trees called the taiga. These northern coniferous forests are also called **boreal** forests. Due to its northern location, winter offers only seven hours of sunlight, while summer offers up to nineteen. Taiga is derived from a Russian word that means "swamp forest". This describes the abundance of water, but typically it is locked up in ice and in deep glacier-gouged lakes. These forests are dominated by a few species of evergreen cone-bearing trees. The trees include spruce, fir, and pine. The soil called **podzol** is very poor. Decomposition of the conifer needles is slow and leaves the nutrient-poor soil very acidic. This and a freeze line that extends five feet below the surface further reduce the floral diversity. Fauna include moose, wolves, and martens. Summer months are active with migratory birds and abundant insects.

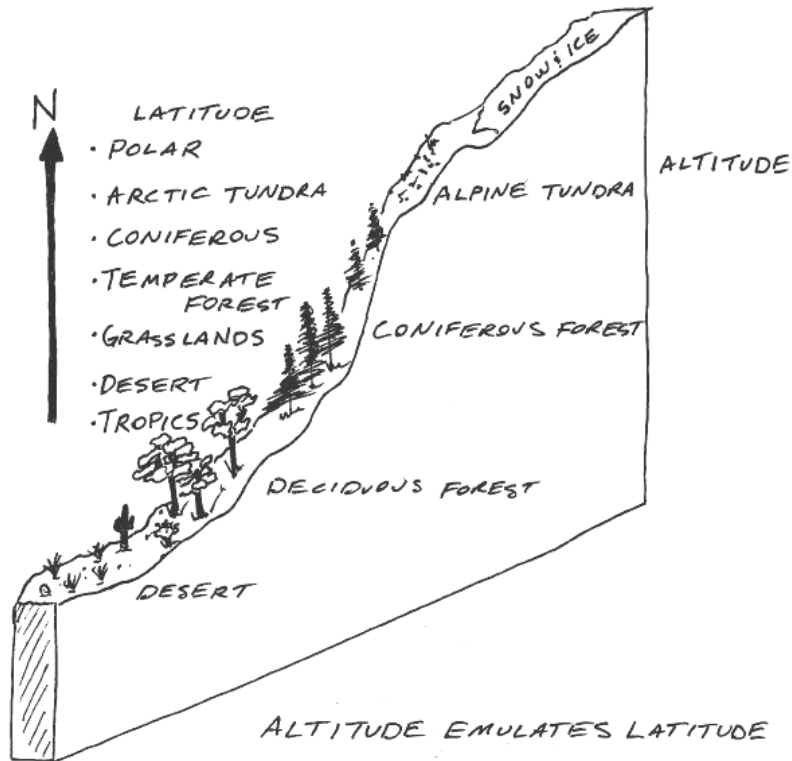
Tundra

The tundra is located north of the tree line and south of the arctic polar ice cap. This biome has sunless winters and very little falling precipitation. Due to the extreme cold conditions, a frozen layer of subsoil exists year round. This nutrient-poor soil is called **permafrost**. The frozen soil, extreme cold temperatures, and howling winds limit plant life to low growing plants. These include mosses and grasses and occasionally shrubs like dwarf willows. Prolific insect life during the summer beckons migratory birds. Wildlife found year-round includes lemmings, arctic fox, and snowy owls. Typically the animals have abbreviated appendages and small surface area to volume ratio to minimize heat loss. Animals also cope with the extreme winter by either hibernating or migrating.



APES in a BOX: The Review Sessions

As we travel from the equator to the poles, we find a familiar trend. Generally we find the same decrease in temperature and precipitation that we find with an increase in altitude.





APES in a BOX: The Review Sessions

Biome Review Questions

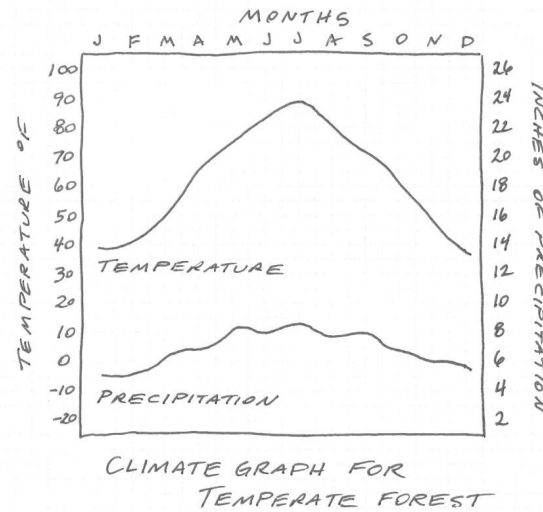
Use the following answer choices for questions 1-5

- A) Euphotic zone
 - B) Estuary
 - C) Mangrove swamp
 - D) Coral Reef
 - E) Abyssal Zone
1. Area where a river meets the ocean and freshwater and saltwater mix.
 2. Area characterized by densely growing trees whose many roots intertwine to provide nursery area for aquatic organisms
 3. Area of the ocean where sunlight penetrates.
 4. Deep ocean floor where no sunlight penetrates.
 5. Feature made of the calcium based remains of living organisms. Provides a protective barrier against storm surges.



APES in a BOX: The Review Sessions

Free Response



1. The graph above shows the temperature and precipitation for a temperate forest throughout the course of one year.

A. What is the approximate temperature and precipitation during the month of July?

B. Describe how the climate graph would be different if instead of a temperate forest, a tropical rainforest were shown.

C. Describe the general trend in precipitation that is seen as latitude changes from the equator towards the north or south pole.



APES in a BOX: The Review Sessions

Multiple Choice Scoring Guidelines

1. B	3. A	5. D
2. C	4. E	

Free Response Scoring Guidelines

1.A. (2pts total) One point each for correctly estimating the temperature and precipitation for the month of July. Temperature is approximately 90 degrees Fahrenheit and precipitation is approximately 8 inches.

2.B. (2pts total) One point for correctly describing that precipitation would be higher and more consistent throughout the year, and that temperature would be higher and more consistent throughout the year.

2.C. (1pt total) One point for correctly stating that temperature and precipitation generally decrease as you move from the equator toward the poles.