Tropical Rain Forest

Tropical rain forests support more species of plants and animals than any other habitat. They are found in lowlands near the equator, where temperature and day length show little seasonal variation. The amount of sunlight is high and fairly constant throughout the year. Rain falls almost every day, and the humidity is always high. Average rainfall is about 200 cm (79 in) per year. Vegetation is dense and occurs in horizontal layers through which many woody vines weave. The tallest trees provide a dense canopy of foliage that permits little light to reach the ground. Beneath the tallest trees are shorter trees that can tolerate shade. Beneath these are still others that are even more shade tolerant. Low light intensity limits the growth of vegetation on the forest floor and limits the number of animal species that live there. Along the trunks and branches of the trees and the twisting stems of the vines are many epiphytes, plants that use the tree branches for support but not for nourishment. Mosquitoes, frogs, and various aquatic insects may live in such treetop puddles. In the warm, moist environment, huge numbers of insects, fungi, and bacteria eat vegetation and decaying material, so the remains do not build up on the ground. The soils are quite fragile, especially if the trees are removed. Predators and parasites are abundant at all levels of the forest.

Large herbivores, such as hoofed mammals, are rare or live only near riverbanks because there is little vegetation on the forest floor. Most animals, including numerous species of birds and insects, live in the canopy layers, where there is more food than on the ground.

Common Organisms

kissing or assassin bug (*Rhodnius prolixus*)

Aye-aye (*Daubentonia madagascariensis*)

pink quill bromeliad (*Tillandsia cyanea*)

Pará rubber tree (*Hevea brasiliensis*)

slime mold (*Physarum polycephalum*)

leafcutter ant (*Atta sexdens*)

giant golden-crowned flying fox (*Acerodon jubatus*)

crinoline mushroom (*Dictyophora indusiata*)

Desert

Deserts are characterized by lack of moisture. Annual precipitation normally averages less than 25 cm (10 in), although some deserts receive much less than this. When precipitation does occur, it is likely to be heavy but brief. Much of the water flows away instead of sinking into the soil. The temperature range in deserts varies with latitude and altitude. For example, in hot deserts such as the Mojave in California, temperatures average 20–22°C (68–72°F), and Death Valley has reached 57°C (135°F) in the shade. Cold deserts, which cover most of Nevada, may experience seasonal temperatures well below freezing. Because desert air is dry, the heat that builds up in the soil during the day is quickly lost at night by radiation, so the contrast between daytime and nighttime temperatures is great.

Cactus plants resist drought by storing water in the tissues of their thick stems. They also have root systems that spread out in all directions from the stems but extend only a short distance into the ground. When it rains, these widespread, shallow roots rapidly soak up the moisture. The seeds of some plants are covered with a chemical that prevents their germination during unfavorable conditions. The chemical can be washed away during a heavy cloudburst, making germination possible. Still other plants have small leaves with a thick, waxy covering that reduces water loss, and some even shed their leaves when it is very dry. Some plants, such as the creosote bush, produce a substance that inhibits the growth of other plants that otherwise would compete for space and water.

Seed-eating animals, such as ants, birds, and rodents, are common in deserts. Many of these animals are specially adapted to living where there are extreme temperatures and little available water. Many desert animals live in burrows and are active only at night. Many animals have adaptations that enable them to conserve water. Kangaroo rats, for example, can survive without drinking any water, instead obtaining water from their food.

Common Organisms

saguaro cactus (*Carnegiea gigantea*)

kangaroo rat (*Dipodomys phillipsii*)

desert locust (*Schistocerca gregaria*)

Welwitschia plant (*Welwitschia mirabilis*)

Mojave yucca (*Yucca schidigera*)

yucca moth (*Tegeticula yuccasella*)

stone plant (*Lithops fulviceps*)

Swamp

Swamps are a type of wetland that is wooded. The trees are surrounded by standing or slowly flowing water at least part of the year. The water is shallow enough, usually less than a meter, to permit full penetration of sunlight and seasonal warming. Swamps usually are highly productive and support a diversity of life. They serve as breeding, nesting, and migratory staging areas for many shorebirds and waterfowl. Swamps support animal populations similar to those found on nearby upland sites, but diversity and density are usually higher in the swamps. Along coastal areas, mangrove swamps and salt marshes provide habitats for a variety of organisms that can live in a saline environment. Estuaries are highly productive habitats that are found where rivers enter the sea and, therefore, contain a mix of saltwater and freshwater.

Swamps are but one type of wetland. Some of the other common wetlands include marshes, bogs, and estuaries. Marshes are wetlands without trees that are dominated by grassy vegetation. Bogs are wetlands that are characterized by poor drainage and acidic soil. Only a few types of plants such as mosses and heaths can tolerate the acidic conditions. Consequently, few animal species remain in bogs on a permanent basis.

Common Organisms

baldcypress tree (*Taxodium distichum*)

Anhinga (*Anhinga anhinga*)

Florida apple snail (*Pomacea paludosa*)

ghost orchid (*Dendrophylax lindenii*)

giant sphinx moth (*Cocytius antaeus*)

freshwater crocodile (*Crocodylus johnsoni*)

swamp fungus (*Hygrocybe cantharellus*)

red mangrove (*Rhizophora mangle*)

purple pitcher plant (*Sarracenia purpurea*)

Coral Reef

Coral reefs are one of the most productive types of ecosystems on Earth. The reefs are built by large numbers of tiny colonial marine animals that secrete external skeletons of calcium carbonate. These little corals protrude from their skeletons to capture food and expose themselves to sunlight. Single-celled algae live within the body of corals and carry on photosynthesis. This mutually beneficial relationship between the two species, a strategy known as mutualism, provides both the coral and the algae with necessary nutrients. Corals require warm water to grow, so these reef communities are found only in tropical waters. The algae that live within the corals require sunlight to carry on their photosynthesis, so corals also are restricted to clear, shallow water.

The skeletons of the corals provide a habitat that supports many different types of organisms, such as sponges, clams, snails, crustaceans, and one-third of all marine fish species, many of which are brightly colored. In addition to the coral-alga relationship, several other species that inhabit coral reef habitats live in mutualistic relationships with other species.

Common Organisms

- crown-of-thorns starfish (*Acanthaster planci*)
- brain coral (*Diploria labyrinthiformis*)
- cactus algae (*Halimeda gracilis*)
- arrow crab (*Stenorhynchus seticornis*)
- cleaner shrimp (*Lysmata amboinensis*)
- giant clam (*Tridacna gigas*)
- red lionfish (*Pterois volitans*)
- magnificent sea anemone (*Heteractis magnifica*)
- blacktip reef shark (*Carcharhinus melanopterus*)

Tundra

The arctic tundra lies between the northern tree line and the North Pole. It has a permanently frozen layer of soil, or permafrost. Similar habitats are found above tree line in high mountainous regions where they are known as alpine tundra. Tundras are lands of low productivity in which trees cannot survive the conditions of extreme cold. The only plants found in tundras are short (usually less than 20 cm [8 in] high) and tend to hug the ground. Because of the short growing season, the vegetation requires a long time to regenerate after being disrupted. Plants in the alpine tundra often have deep pigmentation that shields their inner cells from the intense ultraviolet radiation present at high altitudes. The alpine tundra experiences greater day-night temperature fluctuations and higher wind velocities than the arctic tundra.

Because of its polar latitudes, arctic tundra has very long winters and brief summers of only about six weeks. There are few permanent animal residents of this harsh environment. Those that do inhabit the tundra are well insulated by fur, feathers, and often a layer of fat beneath the skin. Mammals and birds such as musk ox, reindeer, arctic hare, lemming, and ptarmigan can survive on tundra plants. The small mammals support predators such as the arctic fox and snowy owl. Some of these animals have coats that change color with the season and blend into the environment. No reptiles or amphibians can survive this extreme environment, although the long days during the brief summer bring a profusion of life. The waterlogged soils above the permafrost provide an excellent breeding habitat for insects, which in turn provide a rich food supply for migratory birds.

Common Organisms

reindeer lichen (*Cladonia rangiferina*)

Norway lemming (*Lemmus lemmus*)

Antarctic pearlwort (*Colobanthus quitensis*)

Kea parrot (*Nestor notabilis*)

Arctic moss (*Calliergon giganteum*)

bearberry (*Arctostaphylos uva-ursi*)

Cities as Habitats

Should urban areas be considered ecosystems? They certainly are a habitat in which a majority of people in many parts of the world now live. If we use a simple, common definition of "ecosystem" as "a community of organisms interacting with one another and with their environment," then a city meets this definition. But cities differ from natural ecosystems in several important respects. For example, cities do not have enough producers (green plants) and other organisms to support the human populations that live there. Food must be imported from outside the city. Cities often have some trees and park areas, but they are not major sources of food. Cities also must obtain most of their freshwater and energy resources from external ecosystems. Many of the wastes generated in cities must be exported or discharged to ecosystems outside their boundaries. Cities usually are not self-sufficient ecosystems because they must depend on other ecosystems for their survival. Still, they may provide a variety of microhabitats, not only for humans, but also for other organisms such as birds, insects, and rats, not to mention the animals that humans keep as pets. Some cities are fortunate enough to include within their boundaries large, seminatural ecosystems in the form of parks that support wild plant and animal populations.

Common Organisms

peregrine falcon (*Falco peregrinus*)

sick building mold (*Stachybotrys chartarum*)

Asian bark fungus (*Cryphonectria parasitica*)

oyster mushroom (*Pleurotus ostreatus*)

pill bug (*Armadillidium vulgare*)

ginkgo tree (*Ginkgo biloba*)

chestnut tree (*Castanea dentate*)

hairy crabgrass (*Digitaria sanguinalis*)

penicillin mold (*Penicillium chrysogenum*)

Oceanic Bays

Oceanic bays, also known as gulfs, are areas of ocean surrounded by land on three sides. They occur in all of the coastal areas of the world and provide habitat to a great diversity of shallow-water species. The abundance of phytoplankton, sea grasses, and algae in bays makes them common nursery grounds for fishes and other marine life. Famous gulfs and bays include the Gulf of Mexico (southeast North America), the Bay of Bengal (along India, Bangladesh, Myanmar, and the Malay Peninsula), Shark Bay (Australia), San Francisco Bay (California), and the Chesapeake Bay (Maryland and Virginia). The land around bays is frequently favored by humans for settlement. As a result, waterborne pollution is a common human impact upon bays.

Common Organisms

harbor seal (*Phoca vitulina*)

box jelly (*Chironex fleckeri*)

Pacific rock crab (*Cancer antennarius*)

giant kelp (*Macrocystis pyrifera*)

bay pipefish (*Syngnathus leptorhynchus*)

canary rockfish (*Sebastes pinniger*)

brittle star (*Ophiopholis aculeata*)

eelgrass (*Zostera marina*)

winter flounder (*Pseudopleuronectes americanus*)

sea otter (*Enhydra lutris*)

Copymaster 3.18 *Environmental Change Cards*

Environmental change 1: A huge meteor hits Earth, and dust from the resulting impact fills the atmosphere and blocks out the Sun for months. This event induces an ice age. Over a period of thousands of years, glaciers gradually grow from the poles to cover all but the equatorial landmasses. Tropical areas become much colder. Sea levels drop as water is taken up into glaciers. All shallow-water ocean habitat becomes exposed.

Environmental change 2: Two continental plates collide and cause a mountain range to form over a period of millions of years. Some habitats gain up to 1,524 m (5,000 ft) of elevation. Some forested areas become uninhabitable by trees. Other areas experience changes in rainfall, colder temperatures, and greater differences between seasons. Populations of small and slow-moving organisms become isolated on either side of the mountain range.

Environmental change 3: A large volcano erupts, destroying thousands of miles of habitat and covering everything in magma and ash. After a few years, some plant and animal species survive, but your critter's main food source does not.

Environmental change 4: The process of global warming induces a drought, causing all the freshwater streams to dry up. A few rivers remain, but they are very small and often dry up in the summer months.

Environmental change 5: A new predator that is very good at catching your critter migrates into the area.

Environmental change 6: Continental drift causes the peninsula that your critter is living on to become an island.

Environmental change 7: Humans discover your critter's habitat and decide to build a community there. Unfortunately, the humans have determined that the critter's primary food source is a weed and therefore is not desirable. All these plants and those similar to it in the area are destroyed by pesticides and weed eaters.

Environmental change 8: A new species of animal similar to your critter migrates into the area. This new species reproduces quickly and begins to use up all the food that your critter depends upon.

Environmental change 9: A gradual uplift due to colliding continental plates next to your critter's habitat has caused a mountain range to form about 160 km (100 miles) away. The mountains cause gradual change in weather patterns over thousands of years, increasing the rainfall in the area by 12–25 cm (5–10 in) per year.