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**Earth Science Handout: Intro to Ecology & Ecosystems**

**Acid Rain**

Vocabulary in this section includes:

Acid:

Acid Rain:

Pollutants:

Air Pollution:

 **Acid rain** is a term used to describe precipitation (or rain) that contains acids. **Acids** are corrosive liquids and have a pH value of less than 6 on a scale from 1 to 14. The pH scale is used to measure the acidity of liquids, where neutral water has a value of 7. Acid rain causes many problems. Many plants can only grow in soils within a certain pH range. Acid in the soil removes the nutrients plants need. This can slow a plant's growth or kill it. In addition, acid rain can damage a plant's leaves, causing the plant to turn yellow or brown and die. Organisms that live in or near water bodies, such as lakes, rivers, and wetlands, are also affected by acid rain. Many aquatic organisms are very sensitive to the pH of the water and certain fish, insects, and algae will die in acidic water. Also, animals that depend on these organisms will suffer a decline in their food source. Finally, acid rain can damage buildings, statues, and other structures that are exposed to the weather. These structures can change colors or deteriorate because of acid rain's corrosive nature.

 **Pollutants** in the air, such as sulfur dioxide and nitrogen oxide, combine with water in the atmosphere to form acids. These acids fall to the earth as precipitation, such as rain, snow, or fog. The cause of this **air pollution** is the burning of fossil fuels, including coal, oil, and natural gas. Since automobiles, power plants, and even outdoor grills burn fossil fuels, they all contribute to air pollution. In the United States, power plants are the leading contributors to this type of air pollution.

**Succession**

Vocabulary included in this section:

Ecosystem:

Succession:

Climax Community:

Point Source Pollution:

Non-Point Source Pollution:

Runoff:

An **ecosystem** refers to all the living and non-living things in a given area that interact with each other. All ecosystems constantly undergo change. **Succession** is a gradual change in an ecosystem where the number and variety of organisms increases. Succession often begins after an ecosystem has been affected by a damaging event: a fire, a volcanic eruption, or clear-cutting (when all the trees in an area are removed). The ecosystem at this point is fairly barren, but through succession, will eventually result in a diverse and stable community called a **climax community**. During succession, new and increasingly larger plants will emerge and more and more wildlife will populate the area until a completely stable ecosystem with a large variety of organisms is established. The more diversity an ecosystem has the more stable it is, as it is less susceptible to impacts from changes in the environment.
 For example, during succession in a forest ecosystem that began as a barren field, mosses, and small plants, such as grasses, begin to grow and a sparse community of insects and other small animals move into the area. In the next stage of succession, shrubs and small trees begin to grow. Also, larger and a greater variety of wildlife, such as rabbits and foxes, begin to inhabit the area. The final stage of succession is a climax community, where many large trees and many species of wildlife populate the forest.
 Another scenario where succession occurs is in the case of a lake or pond that gradually turns into a forest. The lake may begin growing larger types of plants and start filling in with sediment, which causes the lake to become shallower. After a long period of time, the area will become a swamp, then a meadow, and finally a climax community forest like the one described above.
**Point and Non-Point Source Pollution
*Pollution in an area can be categorized as either point source or non-point source***. Students should understand these two types of pollution and be able to distinguish between them. **Point source** pollution refers to pollution in an area that comes from a specific, known location. A particular factory's discharge pipe, a leaking storage tank, and an overflowing sewage treatment plant are all examples of point source. The origin of the pollution from point sources can be pinpointed and the pollutants can often be measured.

 **Non-point source** pollution is pollution that comes from many different places or widespread activities. The origin of non-point source pollution cannot be attributed to one particular location. Examples of non-point source pollution include exhaust from all of the cars in a city, runoff from the farms in an area, and soil erosion. **Runoff** is a term used to describe the soil, water, or other material on the earth's surface that is washed away into other areas as a result of rain and erosion. This can cause bodies of water and areas of soil to become polluted. If the fertilizers that were put on farm fields are washed away by the rain (runoff) into a local stream, instead of being absorbing into the soil and plants they were intended for, the stream may become polluted.

**Marine Environments**

Vocabulary in this section includes:

Ocean Zones:

Inter-tidal Zone:

Sub-tidal Zone:

Plankton:

Sunlight (Euphotic) Zone:

Twilight (Disphotic) Zone:

Midnight (Aphotic) Zone:

Reef:

Coral Reef:

 The Ocean is divided into several sections, sometimes called marine ecosystems that can be differentiated by their characteristics. These divisions are called **ocean zones**. Each ocean zone has its own particular depth, temperature range, type of organisms, and amount of sunlight. Students should be able to identify the various ocean zones, understand the properties of each zone, and know the components and characteristics of a particular marine environment, the coral reef.

**There are five ocean zones labeled in the diagram below.** 

 The first two ocean zones are defined by the water's edge and the tides. They are called the inter-tidal zone and the sub-tidal zone. The **inter-tidal** zone is a shallow-water marine environment that touches the coast. The water temperature in this zone changes often. It is home to algae, or seaweed. Like plants, algae are able to make their own food, but only in areas with shallow water where there is plenty of sunlight. Small fish, mussels, barnacles, clams, sea anemones, crabs, urchins, sea stars (starfish), snails, eels, and octopi live in the intertidal zone.

 Ocean tides greatly affect life in the intertidal zone. During high tide, the area is submerged. During low tide, the entire intertidal zone, or parts of it are not underwater. They are exposed. However, water does collect on the rocks during the low tides, forming tide pools. When the tide comes in, it refills the water and nutrients in the tide pools. Animals often use the tidal change to move from one pool to another or to swim into a cove where algae and other organisms provide shelter and nutrients. Animals and plants that live in the intertidal zone are able to survive the strongest waves of a winter storm, as well as dry periods when tide changes may not refill tide pools regularly. Sea birds, such as sandpipers and gulls, feed on the animals that live in the rocks and on the sandy bottoms of the intertidal zone.
 The **sub-tidal zone** is also a coastal zone, but it is constantly submerged during both high and low tides. The temperature changes and wave forces in this zone are not as great as in the intertidal zone, and therefore a greater diversity of organisms can be found there. The organisms that live in the sub-tidal zone include kelp (large seaweed that can grow in groups to make kelp forests), sea otters, fish, and lobsters.
 The three other ocean zones in the diagram are defined by the amount of sunlight each zone receives, which is determined by depth. All three of these zones contain different types of fish and plankton. **Plankton** is drifting forms of plants and animals that are found in all healthy marine environments, including the inter-tidal and sub-tidal zones. Many organisms rely on plankton for food.
 The **sunlight zone**, also called the **euphotic zone**, receives the most sunlight. Sunlight penetrates through the entire zone, so plants are able to grow there. The water is relatively warm in the sunlight zone and more ocean life can be found in this zone than in the twilight or midnight zones. Organisms in this zone include dolphins, jellyfish, and seaweed.
 The **twilight zone**, or **disphotic zone**, receives some sunlight, but not enough for plants to be able to grow. Whales, squid, and fish are among some of the animals that live in the twilight zone.
 Finally, the **midnight zone**, or **aphotic zone** receives no light at all. It is very cold in this zone, which contains the fewest living things of all zones, and it is under a lot of pressure from the water above. Animals living in this deep ocean ecosystem have physical adaptations that help them live in these dark, cold environments under high pressure. Large sharks, giant squid, worms, crabs, and fish live in the midnight zone, and even in the deepest areas, there is life on the ocean floor. Many animals in the midnight zone rely on plankton and nutrients that "fall" from the layers above.
 Within the sub-tidal and sunlight zones, reefs can be found. Reefs are formed by the build-up of living and non-living materials under the surface of the water. A coral reef is formed by living and dead coral. Coral is an animal that develops a hard base and has a soft body of many colors and forms. Coral live together in colonies and feed on microscopic plankton in the water around them. They can also make some of their own food, using energy from the sun and the algae in their tissues. Coral reefs form in warm, sunlit waters near the coastlines of continents or islands where the water is not too deep. Animals such as small and medium sized fish, sea anemones, crustaceans, eels, and octopi use coral reefs for shelter and food. Large fish, sharks, dolphins, turtles, and sea birds visit coral reefs to hunt for food.