Topics

- Wave Formation
- Types of Waves
- Types of Rocks
- The Hydrosphere
- Weather and Climate
- Ecosystems
- Biodiversity
- Urbanization
- Resource Management

Wave Formation

Frictional force between the wind and the sea surface. Transfers circular motion to the water. In open water we get swells. As swells approach the shore waves are formed. Waves break when the depth of the water is less than the wave height. There are three main factors that affect wave formation: wind velocity, fetch, and duration. Wind velocity is the speed of the wind, fetch is the distance over the water that the wind can blow uninterrupted (which can be huge distances out at sea), and duration is the amount of time the wind blows over that patch of water. The greater the wind velocity, the longer the fetch, and the greater duration the wind blows, then the more energy is converted to waves and the bigger the waves. However, if wind speed is slow, the resulting waves will be small, regardless of the fetch or duration. It takes all three factors acting together to create big waves.

Type of Waves

There are two different types of wave - constructive and destructive. They can affect the coastline in different ways. When a wave reaches the shore, the water that rushes up the beach is known as the swash. The water that flows back towards the sea is known as the backwash. The energy of the swash and backwash determine the type of wave. The characteristics of a destructive wave are: weak swash and strong backwash**,** the strong backwash removes sediment from the beach and the waves are steep and close together. The characteristics of a constructive wave are: strong swash and weak backwash, the strong swash brings sediments to build up the beach, the backwash is not strong enough to remove the sediment and the waves are low and further apart.

Types of Rocks

There are three main types of rocks: sedimentary, igneous, and metamorphic. Each of these rocks are formed by physical changes—such as melting, cooling, eroding, compacting, or deforming—that are part of the rock cycle.

Sedimentary rocks are formed from pieces of other existing rock or organic material. There are three different types of sedimentary rocks: clastic, organic (biological), and chemical. Clastic sedimentary rocks, like sandstone, form from clasts, or pieces of other rock. Organic sedimentary rocks, like coal, form from hard, biological materials like plants, shells, and bones that are compressed into rock. Chemical sedimentary rocks, like limestone, halite, and flint, form from chemical precipitation. A chemical precipitate is a chemical compound—for instance, calcium carbonate, salt, and silica—that forms when the solution it is dissolved in, usually water, evaporates and leaves the compound behind.

Metamorphic rocks are rocks that have been changed from their original form by immense heat or pressure. Metamorphic rocks have two classes: foliated and non-foliated. When a rock with flat or elongated minerals is put under immense pressure, the minerals line up in layers, creating foliation. Foliation is the aligning of elongated or platy minerals, like hornblende or mica, perpendicular to the direction of pressure that is applied. An example of this transformation can be seen with granite, an igneous rock. Granite contains long and platy minerals that are not initially aligned, but when enough pressure is added, those minerals shift to all point in the same direction while getting squeezed into flat sheets. When granite undergoes this process, like at a tectonic plate boundary, it turns into gneiss.

Igneous rocks (derived from the Latin word for fire) are formed when molten hot material cools and solidifies. Igneous rocks can also be made a couple of different ways. When they are formed inside of the earth, they are called intrusive, or plutonic, igneous rocks. If they are formed outside or on top of Earth's crust, they are called extrusive, or volcanic, igneous rocks. Granite and diorite are examples of common intrusive rocks. They have a coarse texture with large mineral grains, indicating that they spent thousands or millions of years cooling down inside the earth, a time course that allowed large mineral crystals to grow.

The Hydrosphere

A hydrosphere is the total amount of water on a planet. The hydrosphere includes water that is on the surface of the planet, underground, and in the air. A planet's hydrosphere can be liquid, vapor, or ice. On Earth, liquid water exists on the surface in the form of oceans, lakes, and rivers. It also exists below ground—as groundwater, in wells and aquifers. Water vapor is most visible as clouds and fog. The frozen part of Earth's hydrosphere is made of ice: glaciers, ice caps and icebergs. The frozen part of the hydrosphere has its own name, the cryosphere. Water moves through the hydrosphere in a cycle. Water collects in clouds, then falls to Earth in the form of rain or snow. This water collects in rivers, lakes and oceans. Then it evaporates into the atmosphere to start the cycle all over again. This is called the water cycle.

Weather and Climate

Weather refers to the short-term conditions of the lower atmosphere, such as precipitation, temperature, humidity, wind direction, wind speed, and atmospheric pressure. It could be sunny, cloudy, rainy, foggy, cold, hot, windy, stormy, snowing. The sun drives different types of weather by heating air in the lower atmosphere at varying rates. Warm air rises and cold air rushes in to fill its place, causing wind. These winds, along with water vapor in the air, influence the formation and movement of clouds, precipitation, and storms.
The atmospheric conditions that influence weather are always fluctuating, which is why the weather is always changing. Meteorologists analyze data from satellites, weather stations, and buoys to predict weather conditions over the upcoming days or weeks. These forecasts are important because weather influences many aspects of human activity. Sailors and pilots, for example, need to know when there might be a big storm coming, and farmers need to plan around the weather to plant and harvest crops. Firefighters also keep track of daily weather in order to be prepared for the likelihood of forest fires. Weather forecasts are also useful for military mission planning, for features of trade, and for warning people of potentially dangerous weather conditions.

Climate refers to atmospheric changes over longer periods of time, usually defined as 30 years or more. This is why it is possible to have an especially cold spell even though, on average, global temperatures are rising. The former is a weather event that takes place over the course of days, while the latter indicates an overall change in climate, which occurs over decades. In other words, the cold winter is a relatively small atmospheric perturbation within a much larger, long-term trend of warming. Despite their differences, weather and climate are interlinked. As with weather, climate takes into account precipitation, wind speed and direction, humidity, and temperature. In fact, climate can be thought of as an average of weather conditions over time. More importantly, a change in climate can lead to changes in weather patterns.

Climate conditions vary between different regions of the world and influence the types of plants and animals that live there. For example, the Antarctic has a polar climate with subzero temperatures, violent winds, and some of the driest conditions on Earth. The organisms that live there are highly adapted to survive the extreme environment.

Ecosystems and Biodiversity

An ecosystem is a geographic area where plants, animals, and other organisms, as well as weather and landscape, work together to form a bubble of life. Ecosystems contain biotic or living, parts, as well as abiotic factors, or nonliving parts. Biotic factors include plants, animals, and other organisms. Abiotic factors include rocks, temperature, and humidity.

Every factor in an ecosystem depends on every other factor, either directly or indirectly. A change in the temperature of an ecosystem will often affect what plants will grow there, for instance. Animals that depend on plants for food and shelter will have to adapt to the changes, move to another ecosystem, or perish. Ecosystems can be very large or very small. Tide pools, the ponds left by the ocean as the tide goes out, are complete, tiny ecosystems. Tide pools contain seaweed, a kind of algae, which uses photosynthesis to create food. Herbivores such as abalone eat the seaweed. Carnivores such as sea stars eat other animals in the tide pool, such as clams or mussels. Tide pools depend on the changing level of ocean water. Some organisms, such as seaweed, thrive in an aquatic environment, when the tide is in and the pool is full. Other organisms, such as hermit crabs, cannot live underwater and depend on the shallow pools left by low tides. In this way, the biotic parts of the ecosystem depend on abiotic factors.

The whole surface of Earth is a series of connected ecosystems. Ecosystems are often connected in a larger biome. Biomes are large sections of land, sea, or atmosphere. Forests, ponds, reefs, and tundra are all types of biomes, for example. They're organized very generally, based on the types of plants and animals that live in them. Within each forest, each pond, each reef, or each section of tundra, you'll find many different ecosystems.

Biodiversity is a term used to describe the enormous variety of life on Earth. It can be used more specifically to refer to all of the species in one region or ecosystem. Biodiversity refers to every living thing, including plants, bacteria, animals, and humans. Over generations, all of the species that are currently alive today have evolved unique traits that make them distinct from other species. These differences are what scientists use to tell one species from another. Organisms that have evolved to be so different from one another that they can no longer reproduce with each other are considered different species. All organisms that can reproduce with each other fall into one species.

As human populations have grown, however, people have overtaken many ecosystems. The tallgrass prairie of the Great Plains, for instance, became farmland. As the ecosystem shrunk, fewer bison could survive. Today, a few herds survive in protected ecosystems such as Yellowstone National Park.

Human activity threatens all these rain forest ecosystems in the Amazon. Thousands of acres of land are cleared for farmland, housing, and industry. Countries of the Amazon rain forest, such as Brazil, Venezuela, and Ecuador, are underdeveloped. Cutting down trees to make room for crops such as soy and corn benefits many poor farmers. These resources give them a reliable source of income and food. Children may be able to attend school, and families are able to afford better health care.

However, the destruction of rain forest ecosystems has its costs. Many modern medicines have been developed from rain forest plants. Curare, a muscle relaxant, and quinine, used to treat malaria, are just two of these medicines. Many scientists worry that destroying the rain forest ecosystem may prevent more medicines from being developed.

Urbanization

Human populations have tended to increase over time. As more people were born, small groups of individuals found reasons to come together to form groups and, with the advent of agriculture, small sedentary communities. A small number of these settlements grew into what we now call cities. This kind of growth often corresponds with a shift from one way of organizing labor to another.

The world population has grown significantly, and our economies have become more industrialized over the past few hundred years, and as a result many more people have moved into cities. This process is known as urbanization. Even after cities emerged, however, a large majority of people lived and worked in rural areas. It was not until large-scale industrialization began in the eighteenth century that cities really began to boom. Nearly half of all people now live in urban areas. They are attracted by jobs in manufacturing and the professions, as well as by increased opportunities for education and entertainment.

Urbanization is often discussed in reference to countries that are currently in the process of industrializing and urbanizing, but all industrialized nations have experienced urbanization at some point in their history. Moreover, urbanization is on the rise all over the globe.

One effect of this huge increase in people living in urban areas is the rise of the megacity, which is a city that has more than 10 million inhabitants. There are now cities with even more than that. Tokyo, Japan, for example, has nearly 40 million residents. Another effect of urbanization is urban sprawl. Urban sprawl is when the population of a city becomes dispersed over an increasingly large geographical area. This movement from higher density urban cores to lower

density suburbs means that as cities expand, they often begin to take up significant tracts of land formerly used for agriculture. Sprawl also increases the need for travel infrastructure, such as roads, because people's homes are likely to be farther away from where they work and the amenities they enjoy.

Resource Management and Sustainability

Resource Management - The control and monitoring of resources so that they do not become depleted or exhausted. Food, water and energy have a huge significance in determining people's economic and social well-being across the globe. This is recognized by both the World Bank and the United Nations. However, access to these resources is unequal across the globe. Without access to these fundamental items, countries and people get trapped in the mire of poverty. Reliable energy supplies are vital to allowing a countries industry and economy to function, whilst human survival and well-being require clean and reliable food and water supplies. When food water and energy are abundant relative to the number of people living in a place, their quality of life increases. Where there are scarcities of these items there can be social and political unrest. As global population and rates of consumption increase there is a need to increase water, food and energy supplies, but to do so in a sustainable manner to meet the needs of all people. The world population crossed 7 billion in 2011, this puts increasing pressure upon resources.

Water supply and quality vary around the world and not everyone has the luxury of safe, clean drinking water on tap. Water quality can have a massive impact on people; this is why India has attempted to clean up the River Ganges. Poor water quality has a direct impact on people's lives as it is an essential element for life. Poor water quality can lead to disease, which weakens people and therefore has a direct impact on their productivity and hence economic development. Diseases related to poor quality water include Bilharzia (snail fever, where snails transmit flatworms to people causing internal organ damage), Yellow fever and Malaria (both related to mosquitos which breed around water) and cholera (extreme diarrhea). Water supply is another major issue because in many parts of the world unreliable water supplies limit agriculture and other development areas. If people are searching for and carrying water, they cannot focus their energies on other areas of the economy, limiting development further.

We use energy is a huge variety of ways including powering our homes, for transport, in our industries and to help produce and process our food. There are big gaps in who uses energy around the world and how much. More traditional forms of energy involve burning wood and coal for heat, but we can also use fossil fuels to produce electricity and many countries are increasing turning to renewable energy sources such as solar, wind and hydroelectric power to meet their energy needs.
There are other issues in energy, relating to the pollution of our atmosphere which can cause health issues and global changes in our climate, and issues related to the extraction of the resource and the damage that does to the environment. Another issue to consider is that of

biofuels, where we use farmland to produce oils to be used as fuel. Is this a good way to get a fuel when some people around the world do not have enough food to eat?

Everything we use comes from natural resources. However, many resources are being depleted faster than they can be replaced. Sustainability is the practice of using natural resources responsibly, so they can support both present and future generations.

Forests are one natural resource that sustainability groups are focused on conserving. Forests made up about 30 percent of Earth's land mass in 2015, but that number is at risk of decreasing. In 2018, studies showed that approximately 18 million acres of trees are cleared each year for lumber or agriculture. Deforestation destroys the habitat of other important organisms, including fruits, animals, and mushrooms that humans use for food or medicine. Deforested land also increases soil erosion, limiting the productivity of tree growth. The goal of sustainable forestry is to preserve forest ecosystems. Sustainable practices include planting new seedlings in deforested areas and reducing the number of trees cut down each year.

Especially as the human population grows, it is critical that we reduce our depletion of forests, precious metals, and other natural resources. The world population is expected to increase from 7.6 to 9.8 billion people by the year 2050. To decrease our dependency on fossil fuels, many scientists are researching renewable energy sources. The United States military is testing a vehicle fuel made from algae rather than petroleum. And concerns over freshwater sustainability have led to the development of rainwater harvesters, desalination machines, and even more incredible inventions. A European company has produced a drinking straw that filters bacteria, so people can safely drink water from contaminated ponds and lakes.