



Agrifutures

A landscape photograph featuring a vibrant rainbow arching across a cloudy sky. In the foreground, a large, leafy tree stands in a green field. The background shows rolling hills under a bright sun that creates a lens flare effect.

Ecosystems



Ecology

Understanding ecosystems is a good place to start with the design of healthy organic farm systems that will provide a sustainable supply of resources.

An ecosystem is a distinct habitat with a range of organisms (plants and animals) adapted to that habitat. The plants and animal that share that habitat are engaged in a complex series of interactions where they compete for resources, prey upon each other and modify the habitat in ways that effect the other living things that share that habitat.

A healthy organic farm functions in a similar way to a natural ecosystem with complex interactions between the plants and animals that are on that farm. The main difference is we substitute the natural species with those that have agricultural use or support agricultural production.

This topic explores how we can break ecosystems into living things (biotic factors) environmental factors (abiotic factors), how interactions between the living things are organised within food webs and trophic levels and how species within an ecosystem are adapted to suit their habitat and survive competition from other species.



An ecosystem consists of a community of organisms together with their physical environment. Ecosystems can be of different sizes and can be marine, aquatic, or terrestrial. Broad categories of terrestrial ecosystems are called biomes. In ecosystems, both matter and energy are conserved. Energy flows through the system—usually from light to heat—while matter is recycled.

Ecosystems with higher biodiversity tend to be more stable with greater resistance and resilience in the face of disturbances, disruptive events.

Because terrestrial ecosystems are so diverse, it is difficult to make generalizations about them. However, a few things are true almost all of the time. For instance, most contain herbivores that eat plants (that get their sustenance from the sun and the soil) and all have carnivores that eat herbivores and other carnivores. Some places, such the poles, contain mainly carnivores because not plant life grows. A lot of animals and plants that grow and live in terrestrial ecosystems also interact with freshwater and sometimes even ocean ecosystems.

An ecosystem includes all of the biotic factors or living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, and atmosphere). The non-living aspects of an ecosystem are called abiotic factors.



At a basic functional level, ecosystem generally contains primary producers (plants) capable of harvesting energy from the sun through the process called photosynthesis. This energy then flows through the food chain. Next come consumers. Consumers could be primary consumers (herbivores) or secondary consumers (carnivores). These consumers feed on the captured energy.

Only producers can make their own food. They also provide food for the consumers and decomposers. The producers are the source of the energy that drives the entire ecosystem. Organisms that get their energy by feeding on other organisms are called consumers

Decomposers work at the bottom of the food chain. Dead tissues and waste products are produced at all levels. Scavengers, detritivores and decomposers not only feed on this energy but also break organic matter back into its organic constituents. It is the microbes that finish the job of decomposition and produce organic constituents that can

All organisms have adaptations that help them survive and thrive. Some adaptations are structural. Structural adaptations are physical features of an organism like the bill on a bird or the fur on a bear. Other adaptations are behavioural. Behavioural adaptations are the things organisms do to survive. For example, bird calls and migration are behavioural adaptations.

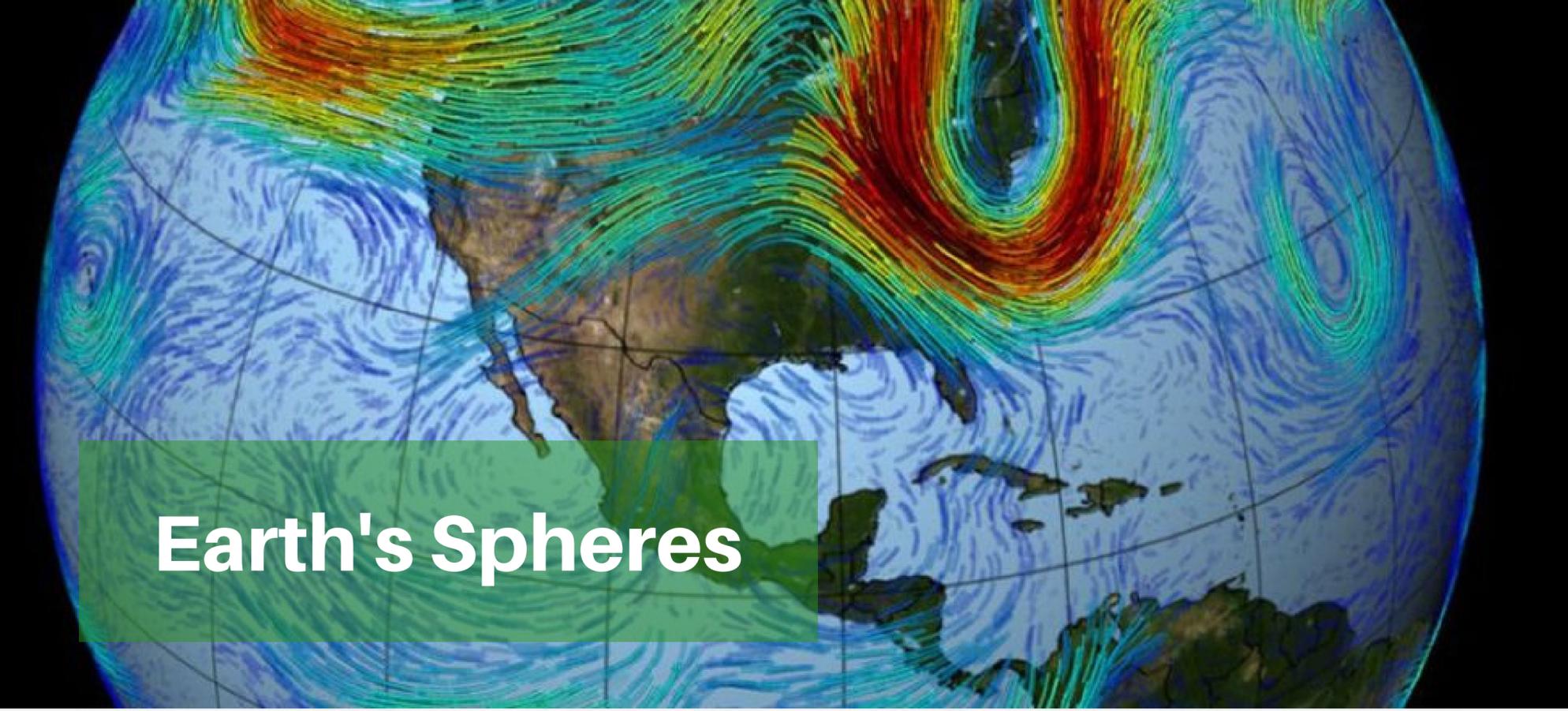


Adaptations are the result of evolution. Evolution is a change in a species over long periods of time. Adaptations usually occur because a gene mutates or changes by accident! Some mutations can help an animal or plant survive better than others in the species without the mutation.

A niche is a term that is used in ecological biology to define an organism's role in an ecosystem. Not only does a niche include the environment a given organism lives in, it also includes the organism's "job" in that environment. A niche may also encompass what the organism eats, how it interacts with other living things or biotic factors, and also how it interacts with the non-living, or abiotic, parts of the environment as well.

The survival of any individual organism in an ecosystem depends on how matter and energy flow through the system and through the body of the organism. Organisms survive through a combination of matter recycling and the one-way flow of energy through the system. Energy first enters Earth from the sun, where it is converted to many different types of energy before eventually being radiated out to space as heat. The energy that enters a particular ecosystem.

Within an agricultural system if there is more diversity, there is also more opportunity to transfer that energy within those systems. The other major benefit of having complexity within a system is that the complexity provides more stability and recycling of nutrients which feeds back into the other systems, like the soil, and stabilises those systems.



Earth's Spheres

Atmosphere – layer of gases that surround the Earth and held there by the power of gravity. Gases most dense close to the surface of the earth. Mostly nitrogen (70%). 20 % is oxygen which was created by photosynthesis of bacteria initially and late plants and algae.

Hydrosphere – All the water on Earth, primarily being salt water in ocean. A large proportion of the fresh water is locked up in ice caps at the poles of the Earth and the remainder mostly in ground water. A small fraction is available as flowing surface water within the rivers, streams, ponds, lakes and wetlands of Earth.

Lithosphere – Solid portion of Earth, which can be represented by a molten metal core, a semi-liquid outer core, and then a slowly churning mantle of semi-liquid rock and on the very surface a crust of solid rock. The sediments from the crust form the basis of soil, which is a complex of mineral particles and organic matter which when healthy is teaming with life.

Biosphere – The living things on Earth which moderate conditions on Earth to maintain a constant cycling of important nutrients and minerals, moderate temperatures, atmosphere composition and through complex interactions between living things slow the loss of energy from Earth that arrives from the Sun.

Magnetosphere – A magnetic field generated by the molten iron core of earth. This field deflects harmful radiation from the Sun which would otherwise kill life on Earth and strip away the atmosphere.



Carbon Cycle

Carbon flows between the spheres of Earth in an exchange called the carbon cycle. Any change in the cycle that shifts carbon out of one reservoir puts more carbon in the other reservoirs. Changes that put carbon gases into the atmosphere result in warmer temperatures on Earth. Over the long term, the carbon cycle seems to maintain a balance that prevents all of Earth's carbon from entering the atmosphere (as is the case on Venus) or from being stored entirely in rocks. This balance helps keep Earth's temperature relatively stable, like a thermostat.

Carbon plays an essential role in biology because of its ability to form many bonds (up to four per atom) in a seemingly endless variety of complex organic molecules.

The bonds in the long carbon chains contain a lot of energy. When the chains break apart, the stored energy is released. This energy makes carbon molecules an excellent source of fuel for all living things.

When we clear forests, we remove a dense growth of plants that had stored carbon in wood, stems, and leaves - biomass. By removing a forest, we eliminate plants that would otherwise take carbon out of the atmosphere as they grow. We tend to replace the dense growth with crops or pasture, which store less carbon. We also expose soil that vents carbon from decayed plant matter into the atmosphere. Humans are currently emitting just under a billion tons of carbon into the atmosphere per year through land use changes.



Water Cycle

The water cycle or hydrologic is a continuous cycle where water evaporates, travels into the air and becomes part of a cloud, falls down to earth as precipitation, and then evaporates again. This repeats again and again in a never-ending cycle. Water keeps moving and changing from a solid to a liquid to a gas, over and over again.

Precipitation creates runoff that travels over the ground surface and helps to fill lakes and rivers. It also percolates or moves downward through openings in the soil to replenish aquifers under the ground. Some places receive more precipitation than others do. These areas are usually close to oceans or large bodies of water that allow more water to evaporate and form clouds. Other areas receive less precipitation. Often these areas are far from water or near mountains. As clouds move up and over mountains, the water vapour condenses to form precipitation and freezes. Snow falls on the peaks.

Water on earth today has been here for millions of years. Because of the water cycle, water moves from the earth to the air to the earth again. It changes from solid to liquid to gas, over and over again.