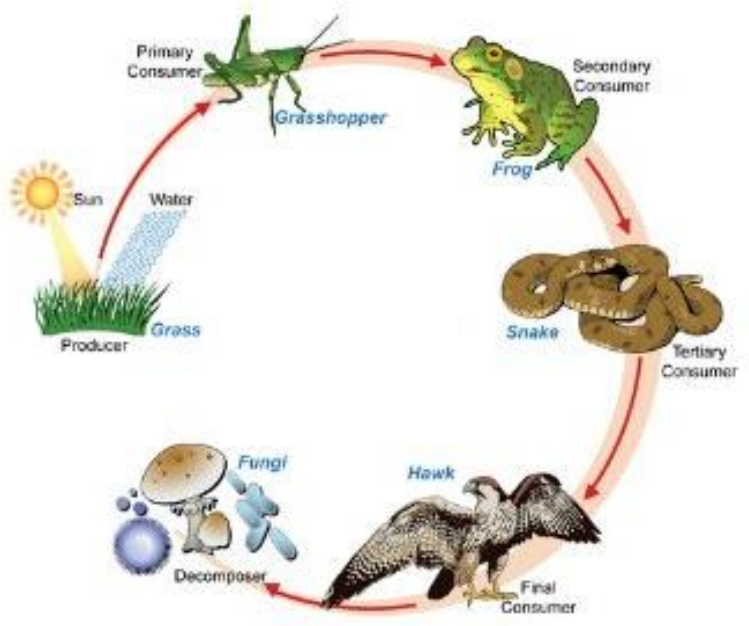
THE SCIENCE BEHIND THE GUIDED MEDITATION

At the next level of complexity, an ecosystem occurs within a location, a focused place. It can have boundaries that range from closed to quite open. Groups of creatures, also called *biotic units*, consist of animals, plants, fungi and microorganisms. These living creatures come together in harmony with their environment: the *abiotic units* of soil, water, minerals and air. Light and climate, of course, affects all ecosystems, whether they occur on land or in the sea. Larger areas usually contain a larger number of species and have more diversity within the environment.



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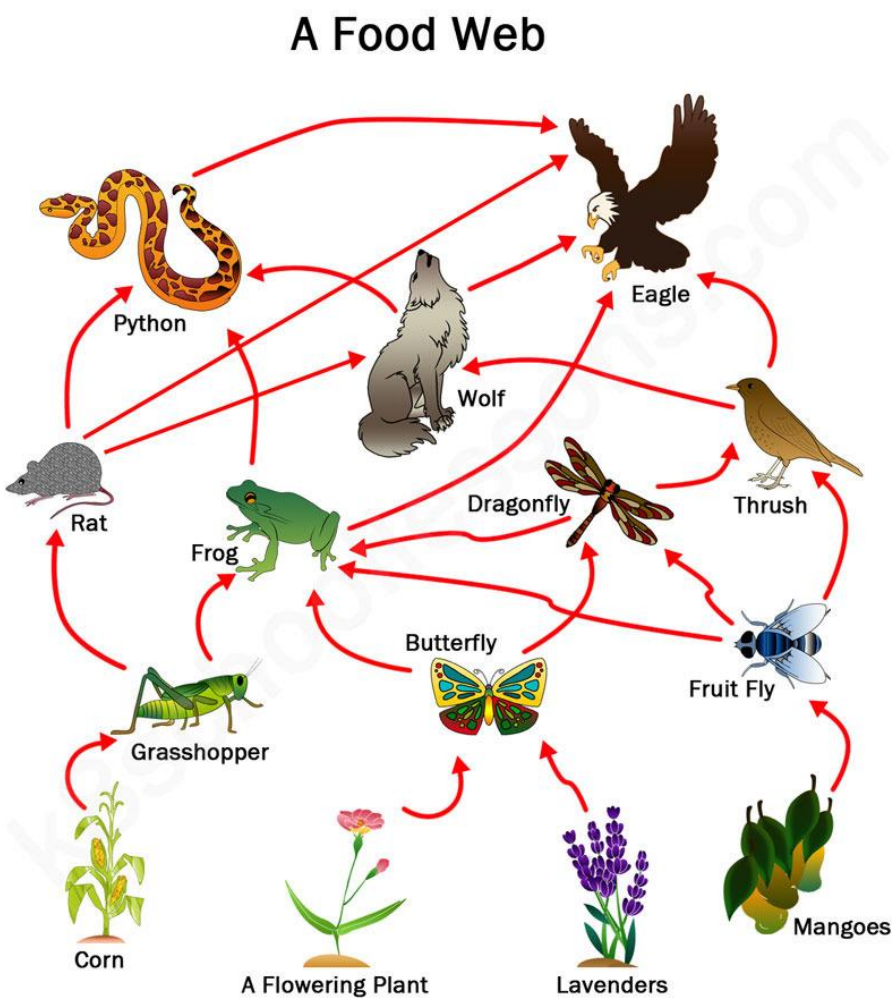
Most members of an ecosystem can be described as one of the following:

- *producers*: These use non-living sources of energy external to themselves to make chemical energy. These are also called *autotrophs*. Most producers use photosynthesis to take carbon dioxide, water and solar energy to produce oxygen gas and carbohydrates (sugar). A few producers, called *lithotrophs*, use chemical energy, instead of light energy, to produce sugars. Both these end up providing either directly or indirectly the energy needed for other organisms in the ecosystem to survive.
- *consumers*: These rely on the consumption of other organisms within the ecosystem. The general term for these is *heterotrophs*. Those consuming only producers are called *herbivores*; the ones consuming mostly other consumers, *carnivores*; those consuming both are called *omnivores*.
- *decomposers*: those microorganisms that feed on, usually dead, plants and animals.



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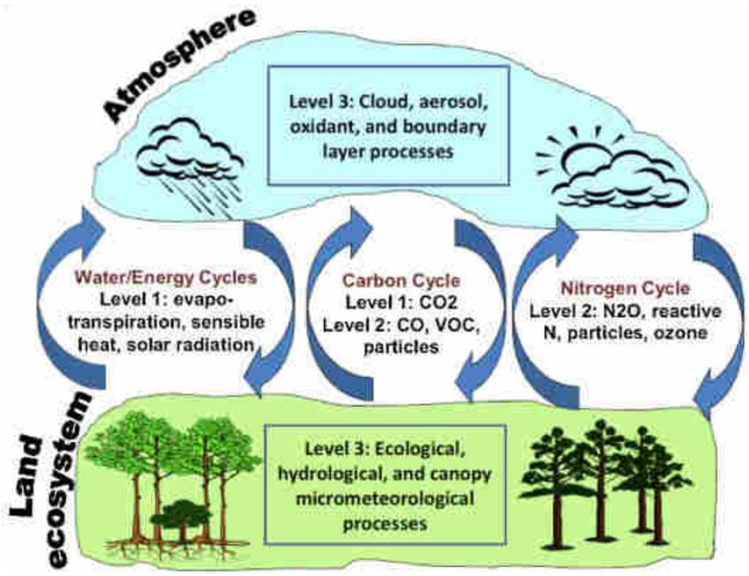
Together the members of an ecosystem create a *food web* that involves the transfer of sediments, chemicals, water and energy. Within the ecosystem are interactions where there can be *competition* between species for resources or a *niche* within which a species operates almost independently for resources. Often one consumer preys on another: one dies that the other might have the energy to live. In some other cases, species relate in various types of *symbiosis* or living closely together:

- In *mutualism*, both species benefit from the interaction. When a bird eats a tick from the back of a buffalo, the bird is fed *and* the buffalo is spared from a parasite.
- In *commensalism*, only one species benefits, and the other neither benefits nor suffers. For example, burrs are often caught up in the coats of animals. This helps the burrs to spread their seeds but does essentially no harm to the animal.
- In *parasitism*, one species benefits and the other suffers. For instance, bed bugs feast on the blood of their hosts, whether human or animal!



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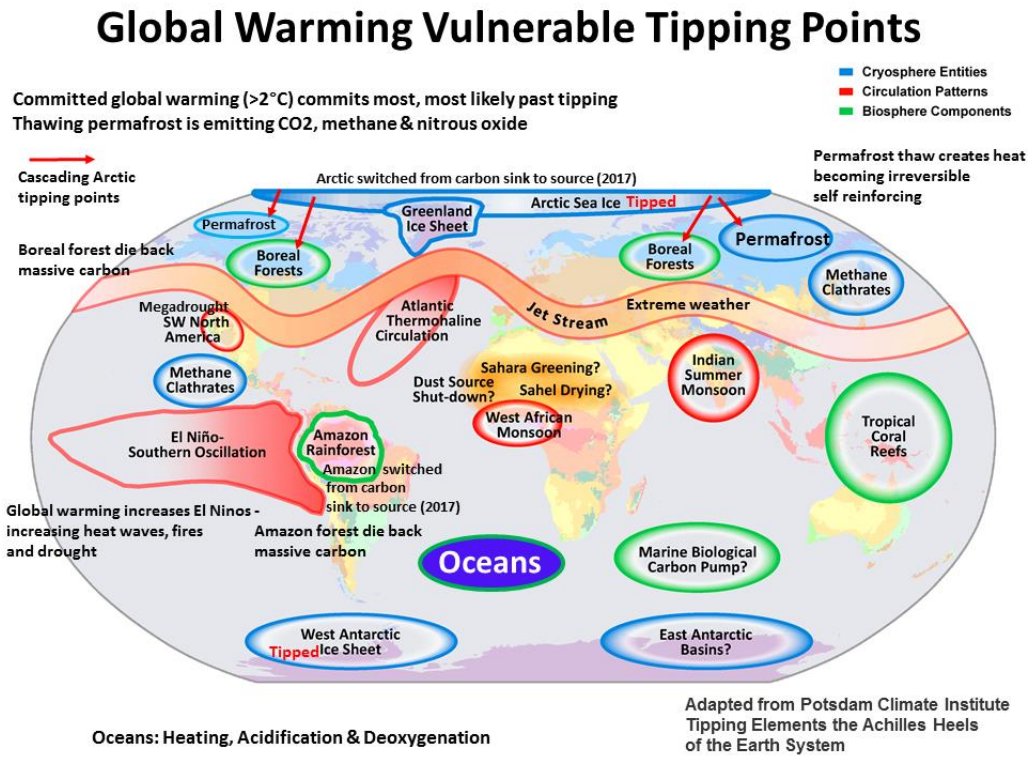
Ecosystems interact with the atmosphere through the well-known cycles of water, energy, carbon and nitrogen as well as phosphorus, calcium, magnesium, potassium and sulfur. These ensure the renewable nature of critical nutrients within the ecosystem. An imbalance in the ecosystem can affect the atmosphere and vice versa.

To summarize, ecosystems are networks of species in relationship to one another whose energy is ultimately obtained in most cases from the energy of the sun. This relationship is dynamic, with feedback loops for regulation and organization. Although the number of a specific species is not necessarily constant, it has a rhythm in its number that is natural to the system. Diverse species within the ecosystem need an environment that is supportive within a limited range of variation. That is, it has the right combination of soil, water, and/or atmosphere to support its species as well as an appropriate energy source, either from the sun, an autotroph or an another heterotroph.

The diverse species live interdependently at the ecosystem level, just as all creation lives interdependently at every other level of the universe. The fate of one is in some real sense invested in the fate of all in the ecosystem. Yet, it is possible to stress an ecosystem out of existence. This does not mean, however, that the ecosystem is unchangeable. The possibility of adaptation is written into the gene pool of the creatures comprising the ecosystem. Changing conditions within the environment allow robust variations within a species to thrive. In response to changing conditions, therefore, a species may evolve over generations to one that is quite different than its predecessors. This transition takes time and has its limits.



Tipping point. https://static.secure.website/wscfus/8154141/6845214/tipping-nov-17.png

Yet, every place has its tipping point, where it is impossible to find a new place of balance, let alone find a return to the previous balance. Today we are legitimately concerned with the health of many of our ecosystems, because there is a "tipping" point beyond which an ecosystem cannot adapt quickly enough to survive changes in the environment or its members. Some examples include:

- when resources are removed from the original ecosystem by the presence of a new species. This is often the result of human "development" which includes agricultural progress necessitating deforestation. Removal of only a crucial part of the ecosystem is necessary to "kill" the entire ecosystem, because an ecosystem has a minimum size necessary for its survival.
- when invasive species enter the ecosystem. Examples include when barnacles travel on ships or when seeds from trees are carried by water, wind, or creatures like birds to other areas outside their original ecosystem.
- when species are removed from an ecosystem by poaching or hunting.
- when feedback loops within the ecosystem are overloaded and can no longer bring the system back into balance. This also may lead to the extinction of a species.