Ecosystems and the Biosphere

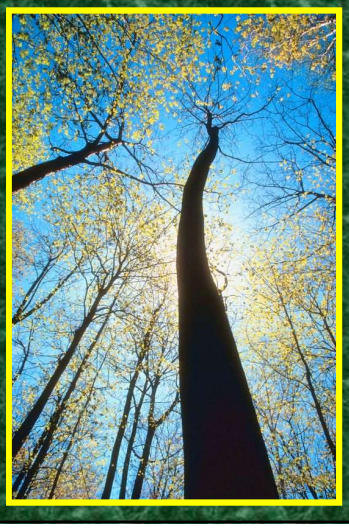
Energy Flow and the Recycling of Matter

Overview

An ecosystem is….
….all the living organisms in a given area as well as the abiotic factors with which they interact.

All of the organisms living on Earth need **energy** to carry out life processes such as growth, movement, and reproduction. In an ecosystem, the ultimate source of energy is the **sun**.

The sun's energy is converted from one form to another and passed through the various levels of the ecosystem.



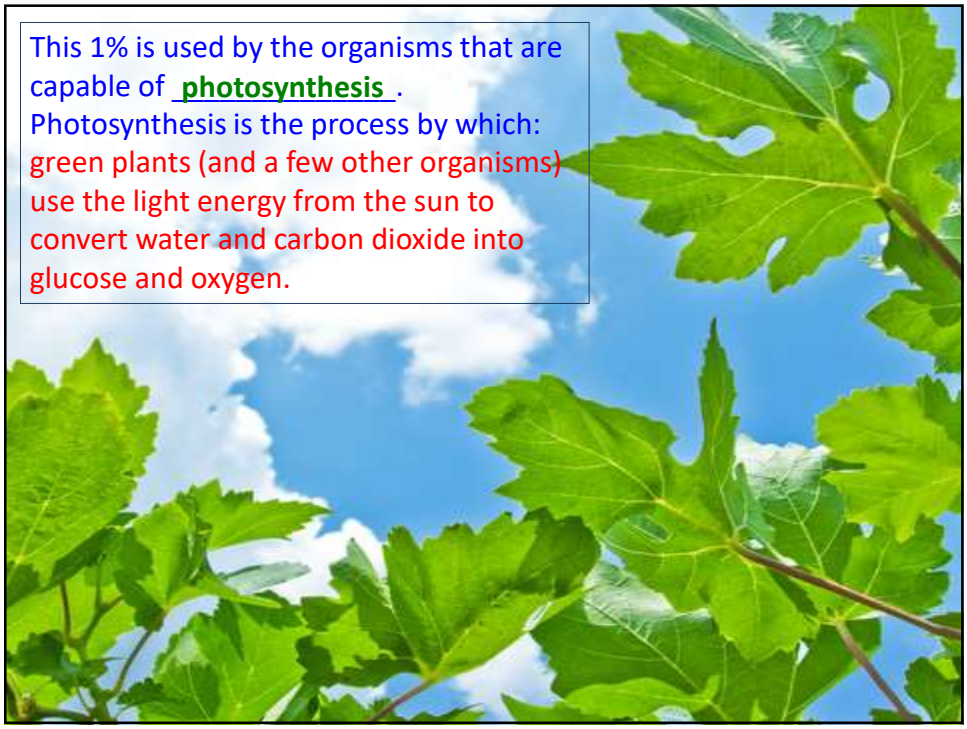
The flow of energy through an ecosystem is crucial to the ecosystem's ability to sustain life.

Energy Flow Through the Ecosystem

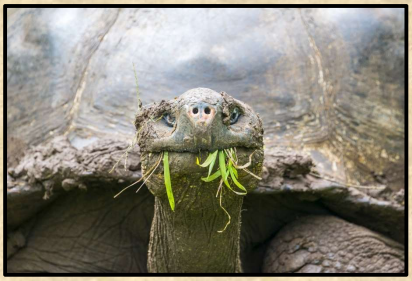
Sunlight is the *main energy source for life on Earth*.

Without this energy from the sun: life on Earth could not exist.

Of all the sun's energy that reaches the earth, less than 1% is actually used by living organisms.



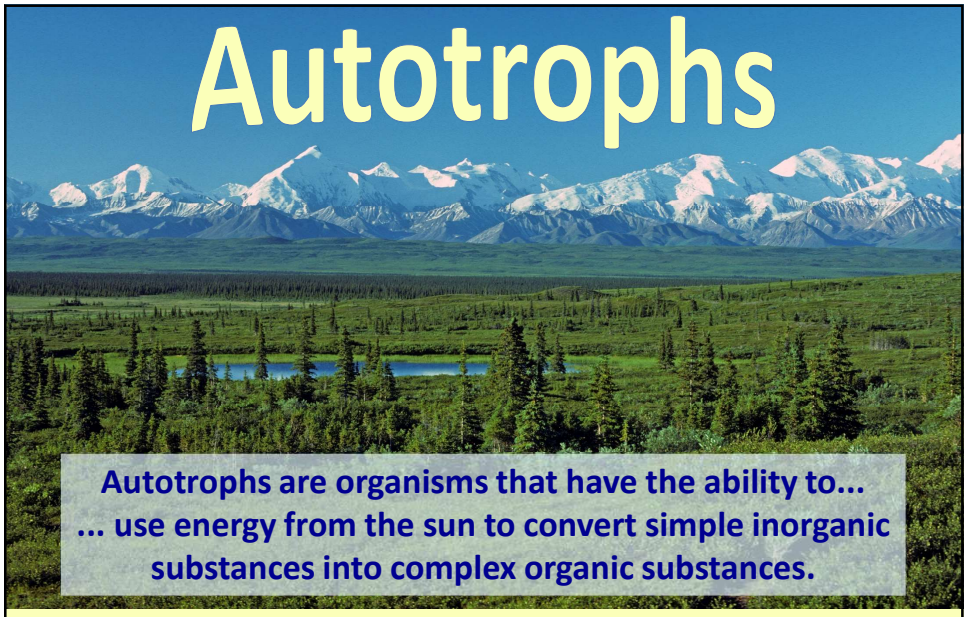
This 1% is used by the organisms that are capable of **photosynthesis** .
Photosynthesis is the process by which: green plants (and a few other organisms) use the light energy from the sun to convert water and carbon dioxide into glucose and oxygen.



The organisms on Earth that cannot carry out photosynthesis rely on: the energy that has been stored in the organic compound glucose (a type of sugar) as their source of energy.

Not only does photosynthesis provide food in the form of sugars and starches for many of the organisms on Earth, but it also removes carbon dioxide from the atmosphere and releases oxygen into the atmosphere.

Autotrophs



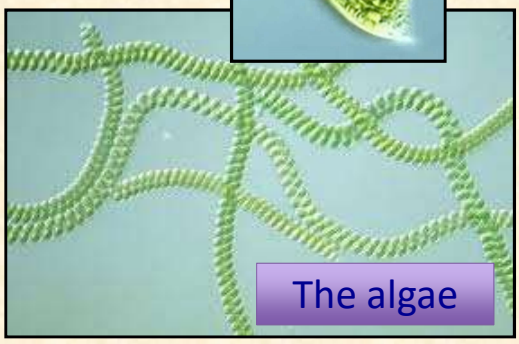
Autotrophs are organisms that have the ability to...
... use energy from the sun to convert simple inorganic substances into complex organic substances.

Autotrophs convert:
carbon dioxide and water into carbohydrates (glucose).

The only organisms that are autotrophs are:

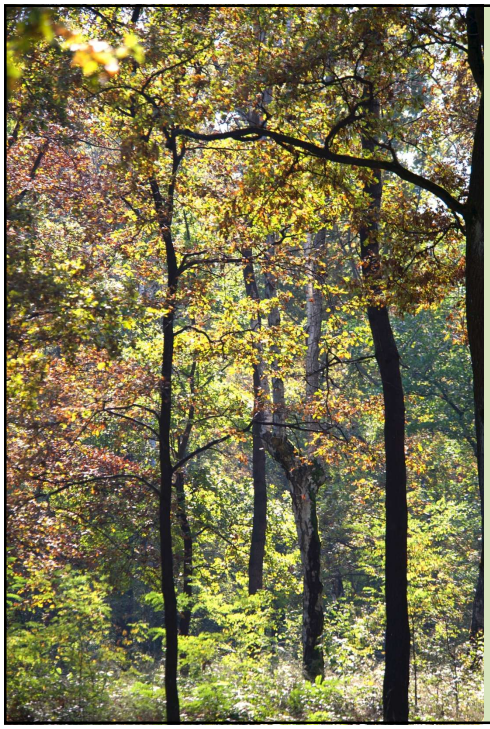
Green plants

A few protists



The algae

A few species of bacteria



On land, the green plants are the main autotrophs.
In aquatic ecosystems, algae are the main autotrophs.

Photosynthetic bacteria (cyanobacteria) are also important oxygen producers.

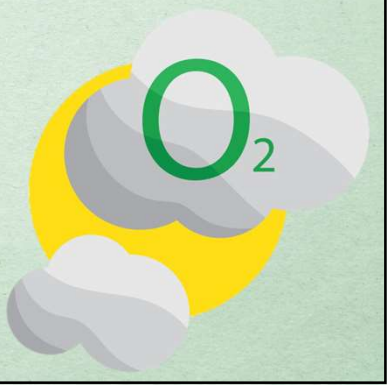
Autotrophs are also called "**producers**".

The autotrophs are essential to the flow of ENERGY through the ecosystem.

Our very life is **dependent** on these autotrophs.

Without them, we would not have…..

……food to eat……



…….or oxygen to breathe.

A few autotrophs can produce food in the absence of light.
Through a process called chemosynthesis, these autotrophs use the energy contained in the chemical bonds of inorganic molecules such as hydrogen sulfide to produce food.

Chemosynthesis is a process that is carried out by several types of bacteria.

Heterotrophs

Many organisms cannot directly use the energy from the sun as the autotrophs do.

These organisms acquire their energy from other organisms.

Heterotrophs are organisms that:
cannot make their own food.

They rely on other organisms for their:
energy and food supply.

Heterotrophs are also called "consumers."

There are many types of heterotrophs:

Herbivores obtain energy by *eating only plants*.

Carnivores obtain energy by *eating other animals*.

Omnivores obtain energy by *eating both plants and animals*.

Detritivores

Detritivores feed on: plant and animal remains, animal wastes, and other dead matter.

Examples of detritivores include:

vultures, mites, earthworms, snails, and crabs.

Decomposers

Decomposers are a class of detritivores that cause: decay by breaking down organic compounds.

Decomposers include bacteria and fungi.

Some of the molecules released during decay are consumed by the decomposer, and some of these molecules are returned to the soil or water.

The action of the decomposers makes the nutrients contained in the dead bodies and wastes of organisms available to autotrophs.

The process of decomposition…..

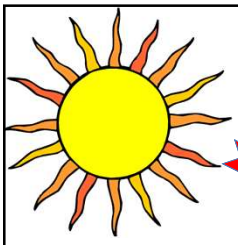
…..recycles chemical nutrients.

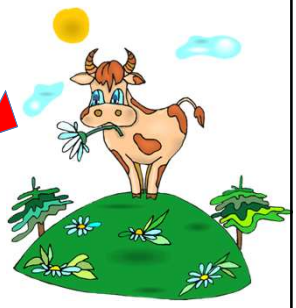
Decomposers

All life on Earth would cease as detritus (dead organic matter) piled up and the supply of chemical elements needed to build new organisms was exhausted.

What would happen if there was no decomposition?

Chemical elements such as carbon, nitrogen, and phosphorus must be recycled to be used again in new organisms.

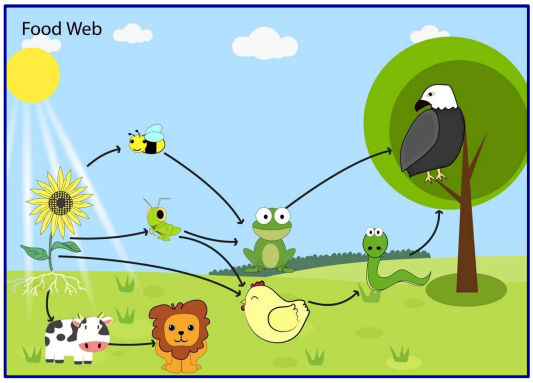




In summary, ENERGY enters the ECOSYSTEM in the form of SUNLIGHT.

It is converted to CHEMICAL energy by AUTOTROPHS and passed to HETEROTROPHS in the form of: organic compounds (molecules of glucose).

Feeding Relationships



What happens to energy in an ecosystem as one organism eats another?

The energy flows in a one-way path through the ecosystem.
Energy enters the ecosystem in the form of sunlight.

Photosynthetic organisms convert the sun's energy into molecules of glucose.
This energy is then passed on to the animals that eat the plants and to the animals that eat other animals.