

Trophic Level

Trophic Level Definition

A trophic level is the group of organisms within an [ecosystem](#) which occupy the same level in a food chain. There are five main trophic levels within a food chain, each of which differs in its nutritional relationship with the primary energy source. The primary energy source in any ecosystem is the Sun (although there are exceptions in deep sea ecosystems).

The solar radiation from the Sun provides the input of energy which is used by primary producers, also known as autotrophs. Primary producers are usually plants and [algae](#), which perform [photosynthesis](#) in order to manufacture their own food source. Primary producers make up the first trophic level.

The rest of the trophic levels are made up of consumers, also known as heterotrophs; heterotrophs cannot produce their own food, so must consume other organisms in order to acquire nutrition.

The second trophic level consists of herbivores, these organisms gain energy by eating primary producers and are called primary consumers.

Trophic levels three, four and five consist of carnivores and omnivores. Carnivores are animals that survive only by eating other animals, whereas omnivores eat animals and [plant](#) material.

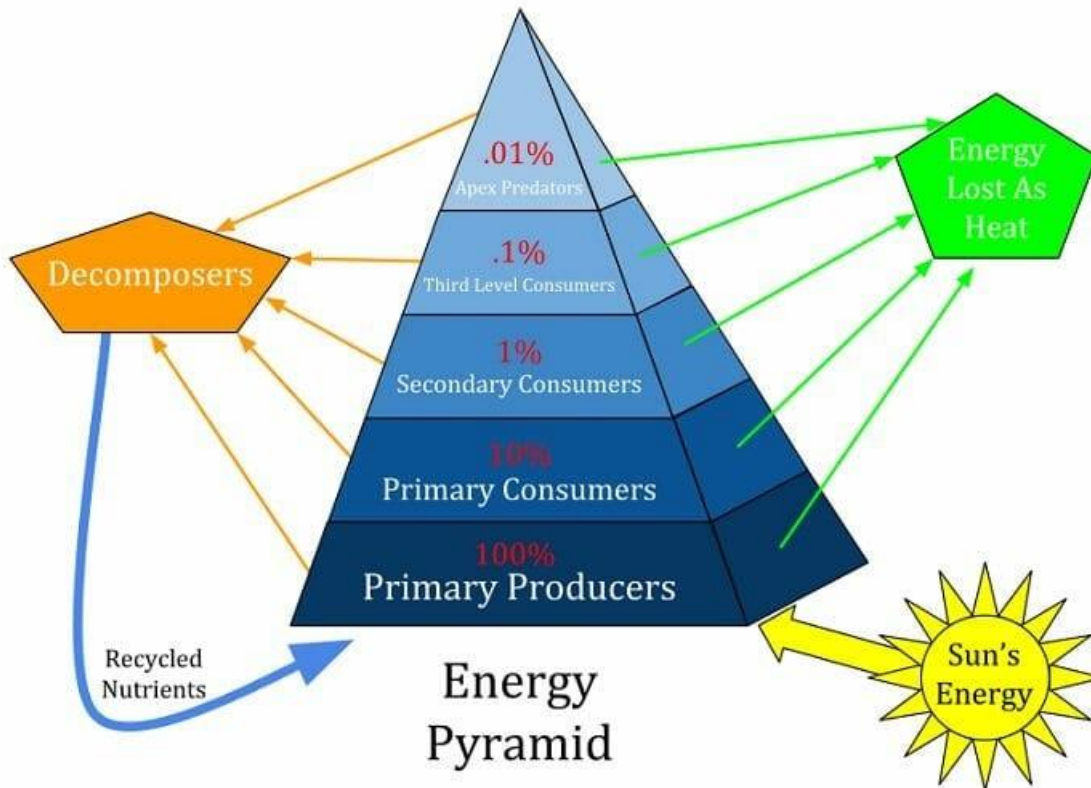
Trophic level three consists of carnivores and omnivores which eat herbivores; these are the secondary consumers.

Trophic level four contains carnivores and omnivores which eat secondary consumers and are known as tertiary consumers.

Trophic level five consists of apex predators; these animals have no natural predators and are therefore at the top of the food chain.

Decomposers or detritivores are organisms which consume dead plant and animal material, converting it into energy and nutrients that plants can use for effective growth. Although they do not fill an independent trophic level, decomposers and detritivores, such as [fungi](#), [bacteria](#), earthworms and flies, recycle waste material from all other trophic levels and are an important part of a functioning ecosystem.

Due to the way that energy is utilized as it is transferred between levels, the total biomass of organisms on each trophic level decreases from the bottom-up. Only around 10% of energy consumed is converted into biomass, whereas the rest is lost as heat, as well as to movement and other biological functions. Because of this gradual loss of energy, the biomass of each trophic level is often viewed as a pyramid, called a trophic pyramid.



It is important to note that organisms within the trophic levels of natural ecosystems do not generally form a uniform chain, and that many animals can have multiple prey and multiple predators.

Examples of Trophic Level

Primary Producers

Primary producers, or "autotrophs", are organisms that produce biomass from inorganic compounds. In general, these are photosynthesizing organisms such as plants or algae, which convert energy from the sun, using carbon dioxide and water, into glucose. This

glucose is then stored within the plant as energy, and oxygen, which is released into the atmosphere.

In terrestrial ecosystems, almost all of the primary production comes from vascular plants such as trees, ferns, and flowering plants. In marine ecosystems, algae and seaweed fill the role of primary production.

primary Consumers

Primary consumers are herbivores, that is, animals that are adapted to consuming and digesting plants and algae (autotrophs). Herbivores are generally split into two categories: grazers, such as cows, sheep and rabbits, whose diets consist at least 90% of grass, and browsers, such as deer and goats, whose diets consist at least 90% of tree leaves or twigs.

Primary consumers may also consume other forms of plant material. Many bats, birds and monkeys eat fruit (frugivores); birds, insects, bats and arachnids (spiders) eat nectar (nectarivores); and termites and beetles eat wood (xylophages).

In marine ecosystems, primary consumers are [zooplankton](#), tiny crustaceans which feed off photosynthesizing algae known as [phytoplankton](#).

Secondary Consumers

Secondary consumers, at trophic level three, are carnivores and omnivores, which obtain at least part of their nutrients from the [tissue](#) of herbivores. This includes animals and carnivorous plants that feed on herbivorous insects (insectivores).

Secondary consumers are usually small animals, fish and birds such as frogs, weasels, and snakes, although larger apex predators, such as lions and eagles, may consume herbivores, and can also exist within the second trophic level of an ecosystem.

In marine ecosystems, all species that consume zooplankton are secondary consumers; this ranges from [jellyfish](#) to small fish such as sardines and larger crustaceans such as crabs and lobsters, as well as whales, which filter feed, and basking sharks.

Tertiary Consumers

Tertiary consumers acquire energy by eating other carnivores but may be preyed upon. Owls are an example of tertiary consumers; although they feed off mice and other herbivores,

they also eat secondary consumers such as stoats. In turn, owls may be hunted by eagles and hawks, and are therefore not apex predators.

Apex Predators

Apex predators are organisms at the top of the food chain, and which do not have any natural predators. Eagles, wolves, large cats such as lions, jaguars and cheetahs, and marine animals such as sharks, tuna, killer whales and dolphins are all examples of apex predators, although there are many more. Apex predators often have specific adaptations, which make them highly efficient hunters, such as sharp [teeth](#) and claws, speed and agility and stealth; sometimes they work within groups, enhancing the success of their hunting abilities.

However, not all apex predators are vicious hunters. Whale sharks are large filter feeders, consuming only small fish and plankton, although because they have no natural predators, they are apex predators in their environment.

Apex predators play an extremely important role in an ecosystem; through [predation](#) they control populations of the lower trophic levels. If apex predators are removed from an ecosystem, organisms such as grazing herbivores can over-populate, therefore placing intense grazing and browsing pressure on the plants within a habitat. If there are fewer available plant resources, other organisms that depend on the plants (although are not hunted by the apex predator), such as insects and small mammals, will suffer [population](#) declines, and in turn can affect all trophic levels within an ecosystem. This disturbance is called a top-down trophic cascade, and can lead to ecosystem collapse.