ENERGY PRODUCERS-CONSUMERS

A trophic network

Trees (and plants) are the basis of all living food webs (correctly referred to as trophic networks). A food web includes innumerable types of living organisms (plus their dead remains and/or their waste products) inhabiting every aboveground or belowground niche – many discernible, many more invisible. Aside from plants, organisms range from microscopic bacteria and saprophytic/parasitic fungi to miniscule soil fauna (decomposers, detritivores, insects, nematodes and worms) then herbivorous/omnivorous animals and birds to, ultimately, apex predators (those animals and birds that are not predated). All of which cycle and recycle energy as a result of their activities and interactions.

Biologists and ecologists consider organisms as occupying a position (at a 'trophic' level) within any given network. Each trophic level equates to the number of steps beyond the first (which begins with plants). Living things are intrinsically interdependent/interrelated. Briefly, energy enters the food chain from the sun – since it is electro-magnetic energy (light) that enables plants to convert raw ingredients (water/nutrients) into refined bio-chemical energy (sugars) through a process of light-synthesis (photosynthesis). Plants, with their capacity to photosynthesise, are the basis of the entire food web. See Figure 54.

- A fraction of energy and/or biomass is lost or reduced at each stage of the food chain – in the various forms of decomposition, degradation, faeces (solid waste), movement energy and heat energy (especially by birds and mammals). As a result, only a small amount of energy and biomass is incorporated into each consumer's body and transferred to the next feeding level in the food chain, or web (a fundamental process ecologists term a Pyramid of Biomass).

- Food chains – in a diagrammatic or visual sense – are frequently over-simplistic in expressing what occurs in Nature. Invariably, pictorial representations of food chains shows only one pathway of energy and material transfer. It is important to acknowledge that most consumers feed on numerous species and are, in turn, fed upon by multiple other species. The relations of detritivores and parasites are seldom adequately understood or characterised in food chain descriptions. Typically, a food chain includes producers, consumers, herbivores, carnivores, omnivores and decomposers – each having a critical role within the process.

Interrelated producers, consumers and decomposers

Trees (and plants) – whether wild or planted – are both contributors to and recipients of the essential energy within a food web. Their fundamental capacity to undertake complex reactions involving biological/physical absorption and conversion make them pivotal to all life on Earth. For simplicity, organisms can be categorised into three groups: primary producers (autotrophs); secondary consumers (heterotrophs); and decomposers (detritivores).

Briefly, these terms mean:

***Autotrophs* (producers) are organisms able to make their own energy-rich molecules out of simple non-organic materials**

- An autotrophic organism is one that has evolved a system to make direct use of the sun's energy – that is, via the process of photosynthesis – therefore, they are the 'primary producers'.
- This category of organism includes all living things classified as plants or phytoplankton and many of the multi-celled organisms (most algae and bryophytes).
- **Trees (and plants) are autotrophs.**

***Heterotrophs* (consumers) are organisms that satisfy their energy requirements by consuming the organic compounds produced by external sources**

- A heterotrophic organism is one that is dependent on an outside source of organic molecules for its energy – therefore, they are the 'secondary consumers'.
- This category of organism includes all living things classified as animals or fungi and many of the single-celled organisms (most bacteria and protists).
- **Humans (and animals) are heterotrophs**.

***Decomposers* (detritivores) are organisms that satisfy their energy requirements by consuming the detritus of autotrophs and heterotrophs**

- A decomposer organism is one that feeds on dead remains and waste products derived from producers/consumers, releasing/recycling energy/nutrients.
- This category includes micro/macroscopic bacteria, fungi, invertebrates and insects.
- **Bacteria, fungi, invertebrates and insects are decomposers**.

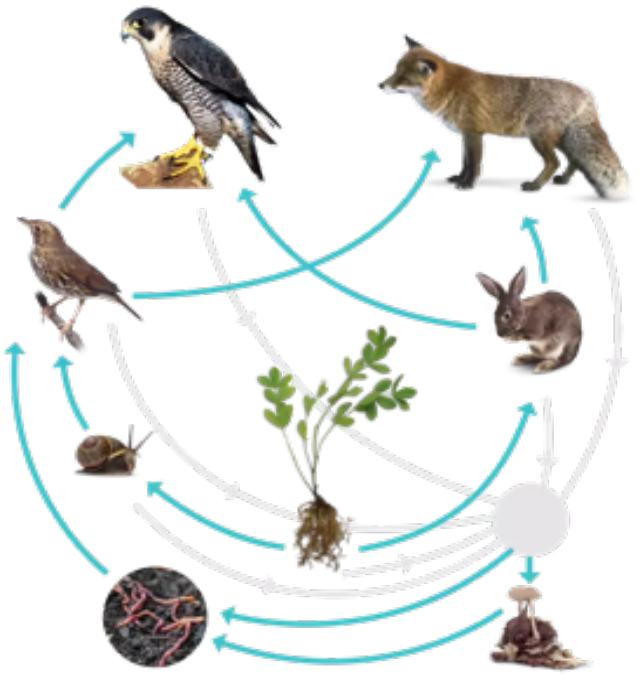

Figure 54: the living (and dying) food web

An example, from typical woodland in Britain, of the energy creation and exchange network – where, in simple terms: plants/trees are primary producers (autotrophs); animals are secondary consumers (heterotrophs); and bacteria/fungi/worms are decomposers (detritivores).

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