Pyramids of energy

Quantitative representations of energy flow using pyramids of energy.

The amount of energy converted to new biomass by each trophic level in an ecological community can be represented with a pyramid of energy. This is a type of bar chart with a horizontal bar for each trophic level. The amounts of energy should be per unit area per year. Often the units are kilojoules per metre squared per year (kJ m^{-2} yr^{-1}). The pyramid should be stepped, not triangular, starting with the producers in the lowest bar. The bars should be labelled producer, first consumer, second consumer and so on. If a suitable scale is chosen, the length of each bar can be proportional to the amount of energy that it shows.

Figure 8 shows an example of a pyramid of energy for an aquatic ecosystem. To be more accurate, the bars should be drawn with relative widths that match the relative energy content at each trophic level. Figure 9 shows a pyramid of energy for grassland with the bars correctly to scale.

Autotrophs convert carbon dioxide into carbohydrates and other carbon compounds

Autotrophs absorb CO2 and convert it into carbohydrates, lipids and all the other carbon compounds; has the effect of reducing the CO2 concentration in the atmosphere

The mean concentration is about 0.339% but it is lower above parts of the Earth's surface where photosynthesis rates are high

In aquatic habitats, carbon dioxide is present as a dissolved gas and hydrogen carbonate ions

CO2 is soluble in water; can either remain in water as a dissolved gas or it can combine with water to form carbonic acid; carbonic acid can dissociate and form hydrogen and hydrogen carbonate ions to reduce the pH of water

Both dissolved CO2 and H2CO3 ions are absorbed by aquatic plants and other autotrophs that live in water; use them to make carbohydrates and other carbon compounds

Carbon dioxide diffuses from the atmosphere or water into autotrophs

Autotrophs use CO2 in the production of carbon compounds by photosynthesis or other processes; reduces the concentration of carbon dioxide inside autotrophs

Threats to coral reefs from increasing concentrations of dissolved carbon dioxide

Emissions of co2 are affecting oceans; over 500 billion tonnes of carbon dioxide released by humans have dissolved in the oceans

The pH of surface layers of the oceans has fallen from 8.179 (18^{th} century) to 8.069 (Now)

This shows a 30% acidification; it will become more severe if the CO2 concentration of the atmosphere continues to rise.

Reef building corals that deposit CaCO3 need to absorb carbonate ions from water but these carbonate ion levels are low, emission makes them even lower

Carbon dioxide reacts with water to form carbonic acid, which dissociates into hydrogen and hydrogen carbonate; the already existing carbonate ions react with hydrogens to form more hydrogen carbonates; in the end, the carbonate ions are lowered.

If seawater ceases to be a saturated solution of carbonate ions, existing calcium carbonate tends to dissolve

2012, oceanographers from more than 20 countries met in Seattle and agreed to set up a global scheme of monitoring ocean acidification

Volcanic vents have been releasing carbon dioxide and lower carbonate ion levels, in the Gulf of Naples; there are no corals, sea urchins, or other such animals there

Sea grasses and invasive algae replace them instead;