

Population growth key terms

Carrying capacity (K)

Demographic transition: Moving between patterns of growth: high birth and death rates to high birth and low death rates, to low birth and death rates

Density-dependent factors: Limited resources limit population growth: food, space, mates, etc.

Density-independent factors: Indiscriminate forces that limit population: floods, earthquakes, fires, and other weather or geology-based calamities.

Exponential growth: $r * N$

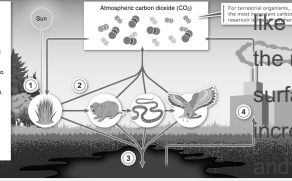
Logistic growth: $r * N ((K - N) / K)$

Maximum sustainable yield: Half the carrying capacity ($K / 2$)

Carbon Cycle

THE CARBON CYCLE

- 1 Plants use carbon molecules from atmospheric carbon dioxide and light energy from the sun to build sugars through photosynthesis.
- 2 Carbon moves through the food chain as organisms eat plants and animals. Carbon dioxide is released back into the atmosphere as a by-product.
- 3 When large numbers of organisms die, carbon dioxide is released into the ground. Over time, the organic remains can be transformed into coal, oil, and natural gas.
- 4 Burning coal, oil, and natural gas releases large amounts of carbon dioxide into the atmosphere.



Mycorrhizae

Tiny, thread-like fungi trap water like a sponge and hold it around the roots. The fungi's huge surface area dramatically increases the amount of water and minerals that can be absorbed. In exchange, they receive sugars, amino acids, and vitamins from the plant.

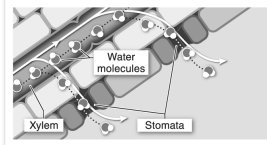
How water moves through plants

WATER TRANSPORT

Plants use a cohesion-tension mechanism to transport water and dissolved minerals from the roots and circulate them throughout the plant.

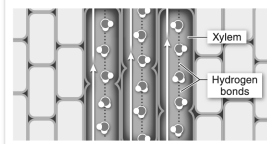
1 EVAPORATION

Due to low water concentration in the air relative to the water concentration in the leaf, molecules of water are vaporized, one by one.



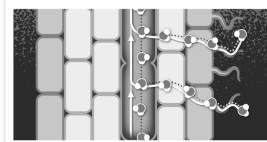
2 TENSION

Water molecules form hydrogen bonds with one another, causing the molecules to stick together. So as one molecule evaporates, it creates tension, pulling on the other water molecules stuck to it.



3 COHESION

The cohesion or stickiness of the water molecules links them together all the way down to the roots. As one molecule evaporates and pulls up the molecule next to it, that molecule pulls up the next, and so on, all the way down to the roots.



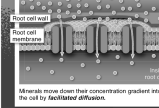
⚡ Moving heavy fluid—water and nutrients—around a plant could be energetically expensive. However, the cohesion of water molecules allows evaporation to do this work, and the fluids are "pulled" through the plant, from roots to leaves.

Chemical transport

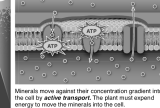
ABSORBING MINERALS

Because most minerals are chemically charged, they must pass through transport proteins embedded within the membranes of root cells.

WHEN MINERAL CONCENTRATIONS ARE GREATER OUTSIDE THE CELL



WHEN MINERAL CONCENTRATIONS ARE GREATER INSIDE THE CELL



⚡ The absorption of minerals through the cell membranes of plant roots requires the aid of transport proteins and sometimes energy.

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Plant tissues and structures

Epidermis

Guard cells Form the stoma, allowing gas exchange

Phloem Flows sugar down to roots through sieve tubes and distributes water and nutrients to cells in need

Xylem Dead cells that provide main structural support while moving water and nutrients up to the plant

Cork cells Create outer bark in trees, providing fire protection to inner living tree.

Apical meristems Think: APEX, at the top (upward, elongating growth occurs)

Lateral meristems Think: Lats get swole (lateral layers of cambium growth)

Pith Inner stem tissue

Cortex Outer stem tissue

Niches

WHAT IS A NICHE?

- NICHE FEATURES**
- The space an organism requires
 - The type and amount of food an organism uses
 - The timing of an organism's reproduction
 - An organism's temperature and moisture requirements and other necessary living conditions
 - The organisms for which it is a food source
 - Its influence on competitors

FUNDAMENTAL vs. REALIZED NICHE

An organism's fundamental niche is the full range of conditions under which the organism could potentially live.

An organism's realized niche is the subset of the fundamental niche in which the organism actually thrives. For the bald eagle, factors such as urban development and competition from other animals restrict it from much of the area within its geographic range.



Energy flow

Sun

Producer Plants which convert light energy into food through photosynthesis (Most abundant and energy-efficient food sources)

Primary consumer Herbivores- eat producers (most abundant consumer, second most energy)

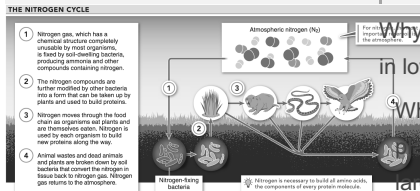
Secondary consumer Carnivores- eat primary consumers (fewer than primary consumers)

Energy flow (cont)

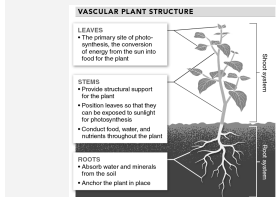
Tertiary consumer Top carnivores- eat other carnivores (very few in number, most energy-expensive)

Quaternary consumer APEX predators- very energy-expensive and seldom exist in typical ecosystems

Nitrogen Cycle

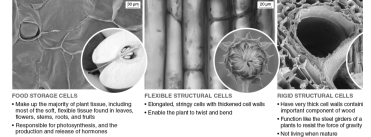


Vascular plant structure



Ground tissue

GROUND TISSUE CELLS



Q & A plants

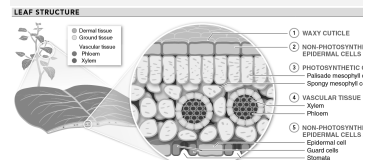
Which modified structure are all of the following examples of? Potatoes, runner vines, asparagus spears, daffodil bulbs

Stems

Why do carnivorous plants thrive in low-nutrient environments?

When given more nutrients, plants focused on building larger photosynthetic leaves and smaller or no carnivorous structures. When given little to no nutrients, plants focused more on building carnivorous structures.

Leaf structure



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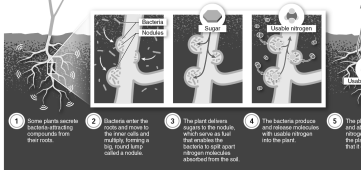
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Not published yet.
Last updated 16th March, 2023.
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Plants and Bacteria

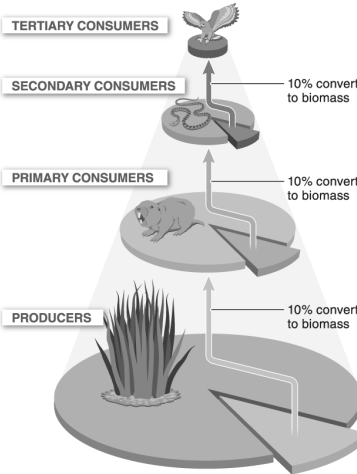
ALLIANCE BETWEEN PLANTS AND BACTERIA



Energy Transfer

ENERGY PYRAMID

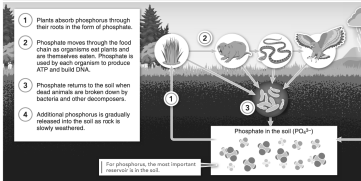
"The 10% rule": only about 10% of the biomass from each trophic level is converted into biomass in the next trophic level.



Inefficiencies in the transfer of energy from one trophic level to the next explain why there are so many more plants than animals.

Phosphorous Cycle

THE PHOSPHORUS CYCLE

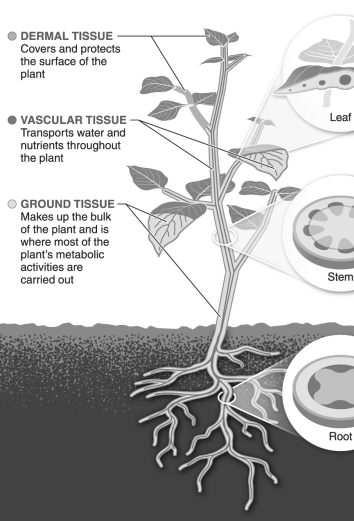


Phosphate in the soil (PO_4^{3-})

Plant tissue types

TYPES OF TISSUE IN VASCULAR PLANTS

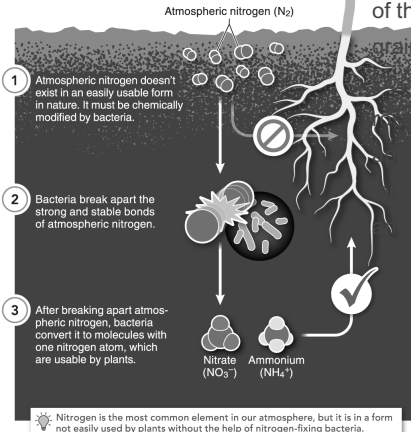
- **DERMAL TISSUE**
Covers and protects the surface of the plant
- **VASCULAR TISSUE**
Transports water and nutrients throughout the plant
- **GROUND TISSUE**
Makes up the bulk of the plant and is where most of the plant's metabolic activities are carried out



P. 577-578 in textbook goes over this, guard cells, cork cells, and epidermis

Nitrogen Fixing

NITROGEN FIXATION



Nitrogen is the most common element in our atmosphere, but it is in a form not easily used by plants without the help of nitrogen-fixing bacteria.

Monocots v Eudicots

MONOCOTS	EUDICOTS
SEEDS Embryos have one cotyledon	SEEDS Embryos have two cotyledons
LEAVES Generally have parallel veins	LEAVES Generally have branching veins
STEMS Vascular tissue is arranged in randomly scattered bundles	STEMS Vascular tissue is arranged in an orderly ring
FLOWERS Flower parts typically occur in multiples of three	FLOWERS Flower parts typically occur in multiples of four or five
ROOTS Generally have fibrous roots	ROOTS Generally have a taproot

Some common monocots are palm trees, orchids, lilies, and all of the grasses, including most grains used in food products. Common eudicots include daisies, coffee, potatoes, apples, strawberries, and most trees, including maples and oaks.

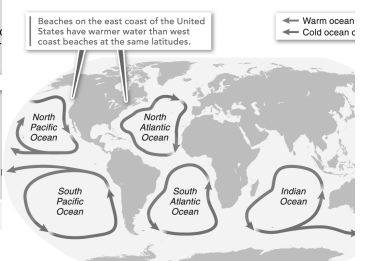
Soil contains:

- Minerals- 50% (in the form of weathered rock particles ranging in size from sand, silt, and clay)
- Water and air- 45-50% (fills space in-between particles)
- Organic materials- 1-5% (Humus- decomposed or partially decomposed bits of carbon-containing plants or animals)

Ocean Currents

OCEAN CIRCULATION PATTERNS

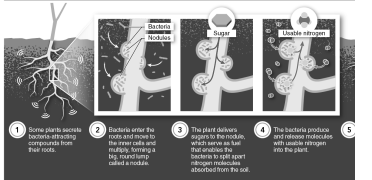
There are several large, circular patterns of flowing water in the oceans due to forces, including wind, the earth's rotation, the gravitational pull of the moon, and salt concentration.



Think: Red to blue, wet for you. Blue to red, dry ahead.

Plants and Bacteria

ALLIANCE BETWEEN PLANTS AND BACTERIA



Plants require...

REQUIREMENTS FOR PLANT NUTRITION



SUNLIGHT
Provides energy to build molecules of sugar



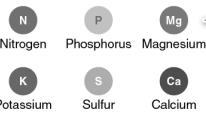
WATER
Essential to nearly every chemical reaction within a plant



AIR
Provides a source of carbon dioxide, from which carbon can be recovered and used in the construction of sugar



SOIL
Although soil itself is not necessary, it typically contains the minerals essential for building new cells and assembling them into new tissues



These six minerals are required in relatively large amounts for plant growth and metabolism.

Plants technically do not require soil, as hydroponic gardening is a possibility. They do require these other nutrients in trace amounts, however: chlorine, iron, boron, manganese, zinc, copper, and molybdenum.

Q & A

Why is it so much colder at the poles than at the equator?

The curvature of the Earth causes sunlight exposure to spread out over further swaths as it gets closer to the poles.

Q & A (cont)

Why is there so much more biodiversity along the equator?

1. The concentration of sunlight provides a lot of energy
2. Warm air holds more moisture than cold air, which increases the water circulating near the equator, and causes deserts around 30 degree latitude.

Which holds more heat: air or water?

Water holds 10,000 times as much heat as air, meaning it takes more energy and temperature change to heat water, and air temperature fluctuates more easily.

What is the rain shadow effect?

Water travels from the ocean over land through warm air. As the air moves up over mountains, the temperature drops, forcing the moisture out as precipitation. A rain shadow is left when the air drops back down behind the mountain and warms again, creating more arid climates with little annual rainfall.

Q & A (cont)

How do ocean currents work?

Ocean currents warm slowly as they travel through warmer areas and cool slowly as they travel through cooler climates. The currents travel in large, circular motions warming cooler land with warm currents and cooling warmer land with cool currents.