Matter and energy in the environment slide deck

Science 14

Unit D: Matter and energy in the environment

Matter loops and energy moves on

Matter in a grassland

- Carbon in a grass leaf can become carbon in a hare and later carbon dioxide in the air.
- Sunlight that built that leaf leaves the food chain as thermal energy at each step.

A matter cycle and one-way energy

- A matter cycle returns water, carbon, oxygen, or nitrogen to a form life can use again.
- One-way energy flow starts at sunlight and leaves as thermal energy at each step.

Key terms

biosphere

The part of Earth where life exists, including organisms and the air, water and soil they use.

matter cycle

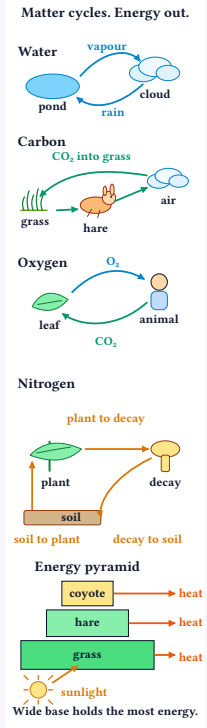
A pathway that returns carbon, water, oxygen or nitrogen to a form living things can use again.

one-way energy flow

The movement of energy from sunlight into living things and onward as thermal energy that leaves each step.

Four loops, one energy arrow

- Water, carbon, oxygen and nitrogen each return through living things and the environment.
- Energy enters from the Sun and leaves as thermal energy, so the flow keeps a direction.



One carbon atom

- A plant builds the atom into food and a hare takes it in.
- Respiration or decay returns it to the air as carbon dioxide.

Carbon after the coyote

- Respiration and decay return carbon to the air.
- The pathway continues after the coyote.

Four cycles and one mover

- Name the four matter cycles from this lesson.
- Name one living thing that moves carbon along a cycle.

Matter cycles and energy flow

- Matter charts name water, carbon, oxygen or nitrogen and the organism that moves each one.
- The energy arrow starts at sunlight and ends as thermal energy at each step.

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Biodegradable materials and farming

A plastic fork and an apple core

- An apple core can become soil material in a compost pile.
- A disposable plastic fork stays recognizable long after the meal is over.



Biodegradable and compost

- A biodegradable material is one decomposers can break into substances ecosystems already cycle.
- Compost is a pile where food scraps and yard waste become soil material.

Key terms

biodegradable

A material that decomposers can break into substances the environment already cycles.

compost

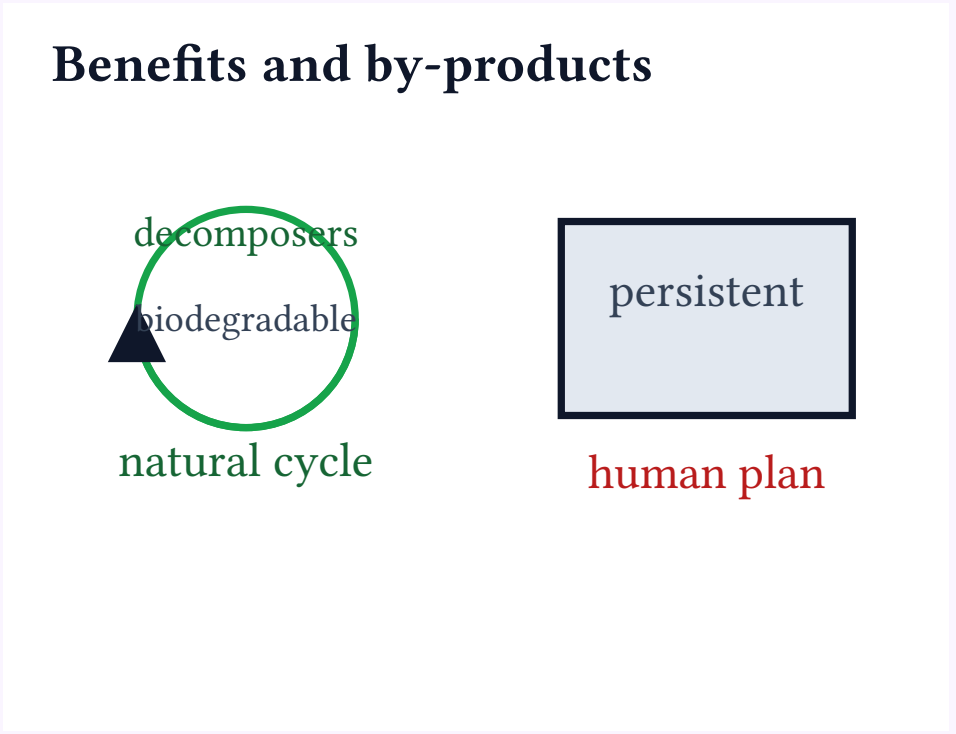
A pile of food scraps and yard waste where decomposers turn organic matter into soil material.

persistent material

A human-made or concentrated material, such as many plastics or heavy metals, that stays in the environment.

Benefits and by-products

- A biodegradable leftover can join a natural cycle through decomposers.
- A persistent leftover needs a human plan because it stays in place.



Apple core and plastic spoon

- The apple core breaks down in the compost.
- The plastic spoon stays intact.

A package from a store

- The store label leaves the question open.
- Watch whether decomposers change the material.

Core and plastic

- An apple core and a plastic fork leave the table.
- Say which leftover composts and which one needs a human recycling plan.

Needs and by-products

- Compost results tell you which samples decomposers can change.
- Fishing, pesticides, cars and fertilizers each have a need and a consequence.

Image credits

Niwrat, Compost bin with compost, CC BY-SA 4.0

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Alberta biomes and local ecosys-tems

Grassland and parkland biomes

- Alberta grassland is open grass with few trees and a drier climate.
- Parkland mixes aspen groves with grass where moisture is higher.



Biotic and abiotic factors

- A biome is a large region with its own climate and community, such as Alberta grassland.
- Biotic factors are the living things. Abiotic factors are the non-living conditions, such as rainfall.

Key terms

biome

A large region with a characteristic climate and a characteristic community of living things.

biotic factor

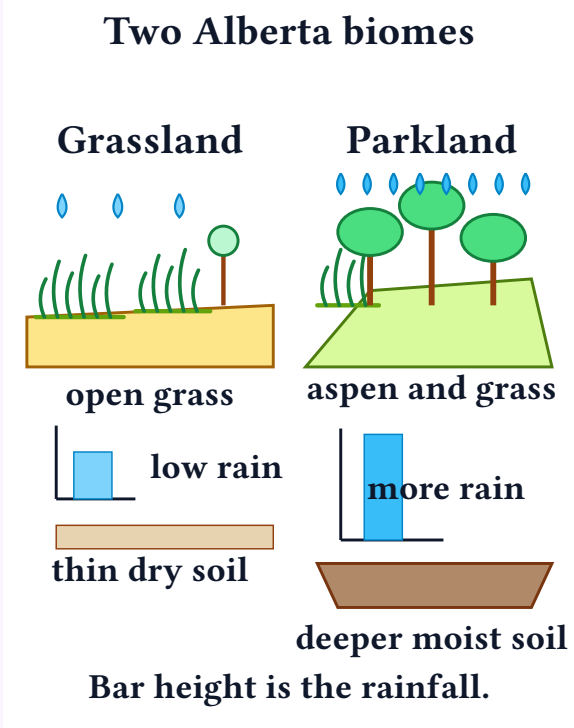
A living part of an ecosystem, such as a plant, an animal, a fungus or a bacterium.

abiotic factor

A nonliving part of an ecosystem, such as temperature, precipitation, soil, light or elevation.

Climate numbers beside the species list

- Temperature, rainfall, soil, and elevation help explain which species can live there.
- Write the living things in one column and the temperature, water, and soil readings in the other.



Grassland and parkland

- Grassland is drier and dominated by grasses.
- Parkland mixes those grasses with aspen where moisture is higher.

Moisture and aspen

- Higher moisture in parkland supports aspen groves.
- Open grassland stays treeless under drier conditions.

Two biomes and one difference

- Name grassland and parkland, or boreal forest and mountain.
- Name a difference such as moisture, temperature, or elevation.

Two biomes, one local table

- Name the climate and the plants, such as dry grass or aspen mixed with grass.
- Put the willows and the moose tracks beside the temperature and the soggy soil from that same spot.

Image credits

Just a Prairie Boy, Aspen forest and grassland in Alberta, Canada, CC BY 2.0

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Food webs and population size

A grassland food chain

- One chain is a single path: grass to grasshopper to meadowlark.
- A web adds the other meals those animals also eat and the animals that eat them.



Food web and energy pyramid

- A food web shows several feeding paths through an ecosystem.
- An energy pyramid stacks those levels, with less available energy toward the top.

Key terms

food web

A set of feeding links that shows several paths of matter and energy through an ecosystem.

energy pyramid

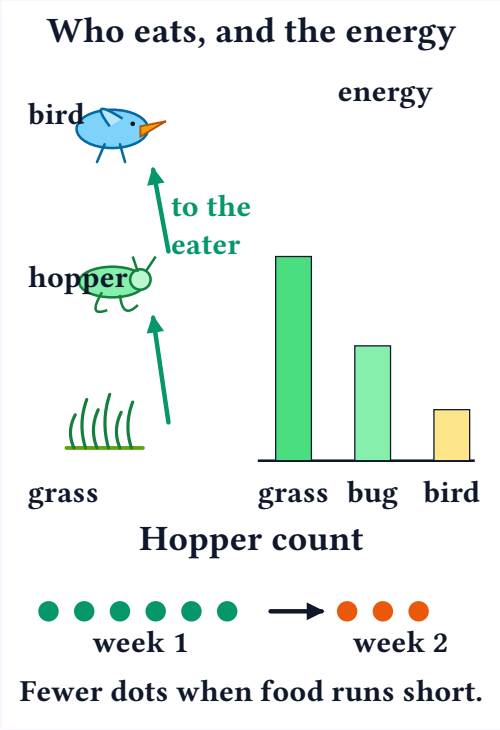
A diagram that stacks feeding levels, with less available energy at each higher level.

population

The individuals of one species living in a stated place at a stated time.

Food webs and pyramids

- Arrows in a food web point toward the eater, along the path of matter.
- When a count rises or falls, name a cause such as births, deaths, or food running short.



A grassland food chain

- Grass is the base, then the grasshopper, then the meadowlark.
- Available energy is smaller at each higher level.

The wide bar

- The bar shows available energy.
- The meadowlark level has less because energy was used and released as heat below it.

Web and pyramid

- A meadow has grass, grasshoppers, and meadowlarks.
- Say what a food web adds and what an energy pyramid shows about available energy.

Diagram the links, then the counts

- Draw who eats whom, and draw a pyramid that gets smaller toward the top.
- On the jar graph, write the reason beside the rise or the fall, such as food running short.

Image credits

USFWS Mountain-Prairie, Western Meadowlark, public domain

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Species people introduce and land people change

Purple flowers along a wetland edge

- Purple loosestrife can spread through a western Canadian wetland and crowd other plants.
- The wetland's food web changes when the plant community changes.

Exotic species and land use

- An exotic species is one people brought into a region, such as purple loosestrife in a western wetland.
- Land use is the way people change a place, such as draining a wetland or farming it.

Key terms

exotic species

A species people brought into a region where it had been absent, such as purple loosestrife in western wetlands.

altered ecosystem

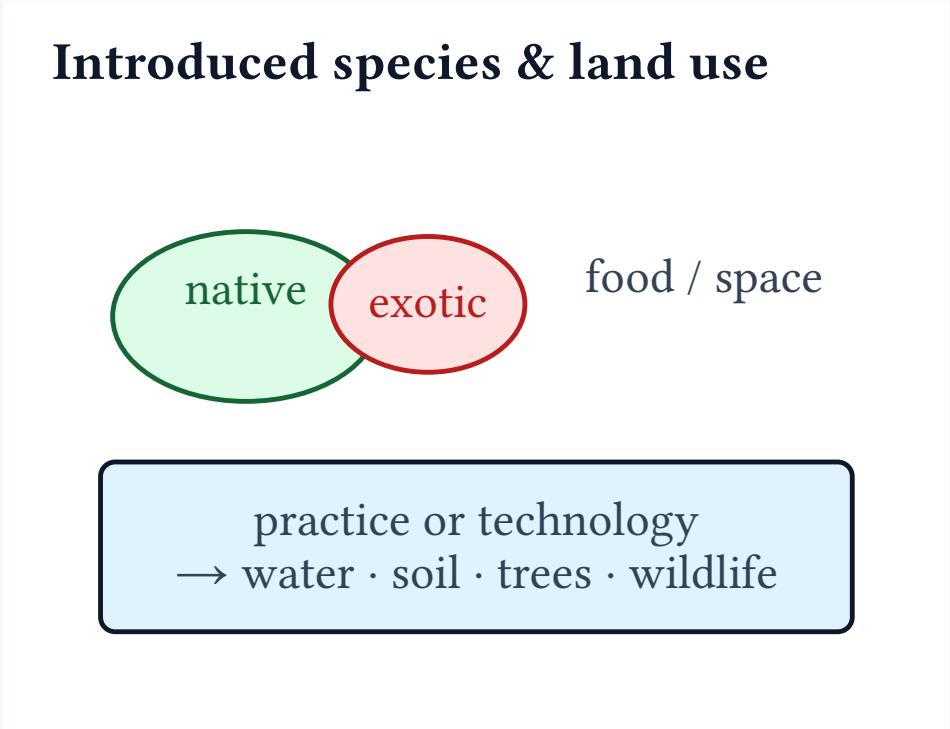
An ecosystem whose species, water or soil pathways changed after a technology or a land practice.

land use

The way people change a place, such as draining a wetland, logging, or farming.

Introduced species and land use

- An exotic species changes food or space for species already there.
- A land practice or a technology changes water, soil, trees or wildlife.



Zebra mussels

- They filter large amounts of plankton from Great Lakes water.
- Other animals then have less of that food.



A named ecosystem

- Name the species, the place, and the change in food or space.
- Purple loosestrife, English sparrows, and zebra mussels are the models.

One species, one place

- Choose purple loosestrife, English sparrows, or zebra mussels.
- Name the ecosystem and the change in food or space.

Introduced species report

- Say which ecosystem the new species changes, such as a wetland or the Great Lakes.
- Say what people needed, such as food or fuel, and what changed in the water, soil, or trees.

Image credits

U.S. Fish and Wildlife Service, Zebra mussels dreissena polymorpha on native mussel, public domain

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Ecosystem investigations

A warm jar of germinating seeds

- Germinating seeds release some thermal energy as they respire.
- A leaf kept in light can store energy as starch that an iodine test reveals.



Variables and a starch test

- The manipulated variable is the factor you change, such as paper waste or food waste.
- A starch test uses iodine: a blue-black colour marks starch in a leaf that has been in the light.

Key terms

manipulated variable

The factor the investigator changes on purpose.

responding variable

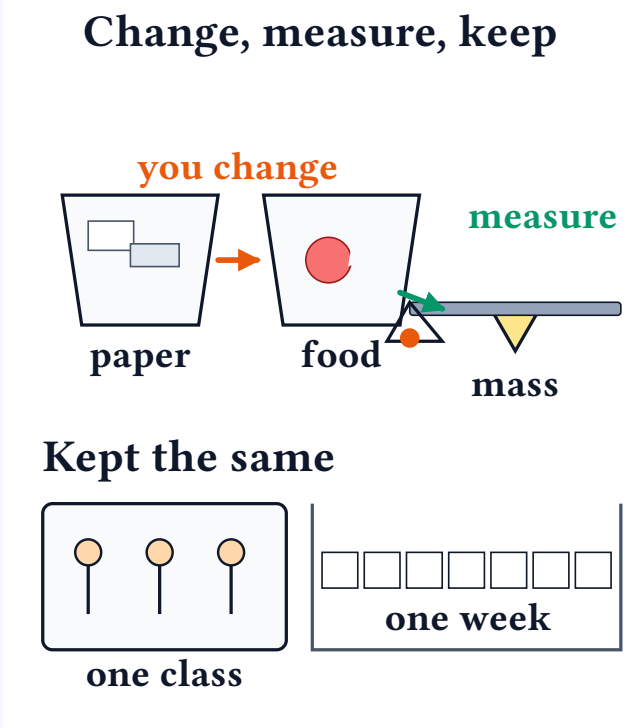
The factor the investigator measures to see the effect.

starch test

An iodine test: a blue-black colour marks starch stored in a leaf that has been photosynthesizing.

Variables and sources

- You choose the waste type, you measure the mass, and you keep the same class and the same week.
- Trust a source that names its author, shows a date, and gives evidence you can check.



Two seed jars

- The jars start at the same temperature.
- The jar of germinating seeds is warmer, so respiration released thermal energy.

Jars in different windows

- Sunlight on one jar is a second change.
- Keep the surroundings the same so respiration is the difference you measure.

Lit leaf and covered leaf

- One part of a leaf was in the light and one strip was covered.
- Say what the iodine colour tells you about stored starch.

Evidence and criteria

- Heat from seeds and starch in a lit leaf are measurable signs of energy transfer.
- A one-afternoon species list misses night animals. A source needs an author, a date, and evidence.

Image credits

pics pd, Mung bean sprouts, close-up, CC0 1.0