

The Four Questions

Carbon Pools

Question

Where are the carbon pools in our environment?

Rules to Follow

Atoms last forever! Atoms cannot be created or destroyed, but atoms can be rearranged to make new molecules.

Carbon atoms stay in pools unless a process moves them in or out.

Evidence We Can Observe

The air has carbon atoms in CO₂. Organic materials are made of molecules with carbon atoms:

- Living and dead plants, animals, and decomposers
- Fossil fuels

Carbon Cycling

Question

How are carbon atoms cycling among pools?

Rules to Follow

Carbon cycles! Carbon atoms cycle and recycle within Earth systems. Carbon-transforming processes move carbon atoms among pools.

If carbon atoms leave one pool, they must enter another pool. Atoms never disappear.

Evidence We Can Observe

Evidence of carbon movement or carbon-transforming processes:

- Organisms eating, breathing, growing, moving, dying or decaying
- Burning

Energy Flow

Question

How does energy flow through environmental systems?

Rules to Follow

Energy flows!

Energy flows through Earth systems. Carbon-transforming processes change energy from:

- Sunlight to
- Chemical energy to
- Work or motion energy and eventually to
- Heat radiated into space.

Evidence We Can Observe

We can observe indicators of different forms of energy:

- Chemical energy stored in organic materials
- Light energy
- Heat energy
- Work or motion energy

Stability and Change

Question

How do carbon fluxes change the size of carbon pools?

Rules to Follow

Fluxes change pools! A pool size only changes when fluxes into and out of that pool are unbalanced.

The carrying capacity is an upper limit to the photosynthesis flux in every ecosystem

Evidence We Can Observe

Disturbances such as fires, floods, droughts, or human management can change pools and fluxes.

Some disturbances change the carrying capacity of ecosystems or the Earth's biosphere