Science 10

Unit D: Energy flow in global systems

Human actions and climate evidence

Climate change in two centuries

- Burning fuels, clearing land, and draining wetlands have changed what the air and the biomes do.
- The scientific question is how much of that change is caused by people and how much is natural variability.

- Fossil fuel combustion → CO_2
- Land-use change → CO_2, CH_4
- Ice cores & tree rings → past CO_2 & temperature

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Greenhouse gases and past climates

- Carbon dioxide and methane are greenhouse gases because they absorb and emit outgoing infrared radiation.
- Air bubbles trapped in ice cores preserve samples of past atmospheres, while layer chemistry helps reconstruct paleoclimate.
- Tree-ring width and density can date past growing conditions.
- One proxy is only part of the climate record.

Key terms

greenhouse gas

A gas that absorbs and emits infrared radiation in the atmosphere.

paleoclimate

Climate conditions from before instrumental records, reconstructed from proxy evidence.

ice core

A cylinder of ice whose layers and trapped gases preserve evidence of past atmosphere and climate.

dendrochronology

Study of annual tree rings to date events and infer past environmental conditions.

Human actions that change climate

- Burning fuels, draining wetlands, forest fires, and clearing forests all change how much carbon stays in the air or in the land.
- Tie each action to a measurement, such as emissions, ice loss, or sea level, before you call it a cause.

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Paleoclimate archives

- Ice cores hold tiny samples of old air, so past carbon dioxide levels can be compared with temperature over thousands of years.
- Tree rings add a year-by-year record of wet and dry growing seasons from before thermometers existed.



Reading a climate graph

- Describe how atmospheric carbon dioxide has changed since industry expanded.
- Separate one unusual week of weather from a trend that lasts decades.

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Alberta connections

- Forestry, farming, and energy production change land and emissions in different ways.
- A measurement can inform a decision. The decision still depends on what a community values.

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Evidence triad

- Name three human actions that change climate, and one kind of evidence scientists use.
- A complete answer names greenhouse-gas emissions and land use, and uses ice cores or tree rings as evidence of past climate.

Climate evidence retrieval check

- Separate weather from climate in the claim: one cold winter disproves global warming.
- Name one direct modern record and two paleoclimate proxies.
- Climate also changed naturally in the past. Explain why human influence can still drive change today.

Image credits

Dargaud, Ice core extracted at Talos Dome showing an ash layer corresponding to the Toba eruption, CC BY-SA 4.0