# Climate and resources

IB DP Geography core units 2 and 3: climate vulnerability and resilience; resource consumption and security

# Climate and resources

- explain the **energy balance**, the **greenhouse effect** and the evidence for climate change;
- explain why some people and places are more vulnerable than others;
- evaluate **mitigation** and adaptation at different scales;

# Climate and resources (2)

- explain trends in resource consumption and the **ecological footprint**;
- explain water, food and **energy security** and the links between them;
- compare views on resources: Malthus, Boserup, the SDGs and the **circular economy**.

# Why the climate is changing

- The Earth gets energy from the Sun and loses energy as heat.
- If the two are equal, the average temperature stays the same.
- This is the **energy balance** .
- About 30% of the sunlight is reflected back to space by clouds, ice and the air.

$$\frac{425 - 317}{317} \times 100 \approx 34\%$$

# Consequences and vulnerability

- Climate change affects the whole Earth system: hotter heatwaves, heavier rain, longer droughts, warmer and more acidic oceans, coral bleaching, and rising seas.
- It affects people through health (heat stress, the spread of diseases such as dengue), food (lower yields in hot regions) and **migration** , when people leave land that floods or dries.
- Not everyone is affected equally. **Vulnerability** depends on three things:
- **Resilience** is the ability to cope and recover.

# Responding to climate change

- **Mitigation** reduces the cause: fewer greenhouse gases, or more carbon taken out of the air. Examples: solar and wind power, electric vehicles, planting forests, **carbon capture and storage** .
- **Adaptation** reduces the damage: living with the change. Examples: sea walls, heat-resistant crops, "sponge cities" that soak up rain, early-warning systems, moving people away from danger.

# Resource consumption

- The world population passed 8 billion in November 2022.
- Consumption grows faster than population, because more people join the **middle class** and buy more meat, cars and electronics.
- The **ecological footprint** is the area of land and sea needed to supply what a person uses and absorb their waste, in global hectares (gha).
- The world average is about 2.6 gha per person, but the Earth can supply only about 1.6 gha per person.

# Water, food and energy security

- A country has **water security** when people have enough safe water at a fair price.
- Farming takes about 70% of the fresh water that people withdraw.

# Water, food and energy security (2)

- Water insecurity can be **physical** (too little water, as in the Middle East) or **economic** (water exists but people cannot afford the pipes and pumps, as in parts of sub-Saharan Africa).
- **Food security** has four pillars: **availability** (enough food is produced or imported), **access** (people can afford it and reach it), **utilisation** (the food is safe and nutritious) and **stability** (all three last through bad years).

# Resource stewardship

- Thomas Malthus (1798): population grows faster than food, so famine, disease and war will stop growth.
- Ester Boserup (1965): when population grows, people find new ways to grow more food: "necessity is the mother of invention".

# Sources for this lesson

- International Baccalaureate, *Geography guide* (first assessment 2019).
- IPCC, *Climate Change 2023: Synthesis Report* (AR6).
- NOAA Global Monitoring Laboratory, Mauna Loa $CO_2$ record.

# Sources for this lesson (2)

- China Meteorological Administration and the State Council investigation report on the Zhengzhou rainstorm of 20 July 2021 (2022).
- Global Footprint Network, *National Footprint and Biocapacity Accounts* and Earth Overshoot Day 2024.
- FAO, *The State of **Food Security** and Nutrition in the World* (annual report).

# Common errors

- Confusing the **greenhouse effect** (natural and necessary) with the **enhanced greenhouse effect** (caused by human emissions).
- Using one storm as proof of climate change; the evidence is the trend in many events.
- Confusing **mitigation** (reducing the causes) with adaptation (living with the effects).

# Common errors (2)

- Writing about "developing countries" in general instead of a named place at a stated **scale**.
- Treating **vulnerability** as exposure alone; sensitivity and the capacity to cope matter as much.
- Presenting Malthus and Boserup as right or wrong; each fits some places and times better than others.

# Key terms

- **Enhanced greenhouse effect**: extra warming caused by human emissions of greenhouse gases.
- **Positive feedback loop**: a change that causes more of the same change, such as melting ice that exposes darker sea and causes more warming.
- **Vulnerability**: how likely people are to be harmed, from their exposure, sensitivity and capacity to cope.

# Key terms (2)

- **Mitigation**: action to reduce the causes of climate change, such as cutting emissions.
- **Adaptation**: action to reduce the harm from climate change, such as sea walls or drought-resistant crops.
- **Ecological footprint**: the area of land and sea needed to supply what a person uses and absorb their waste.
- **Water–food–energy nexus**: the links that make water, food and **energy security** depend on each other.

# Check yourself

- 1.
- $CO_2$ at Mauna Loa rose from 317 ppm in 1960 to 425 ppm in 2024.
- Calculate the percentage increase. 2.
- Give one **positive feedback** loop in the climate system. 3.