

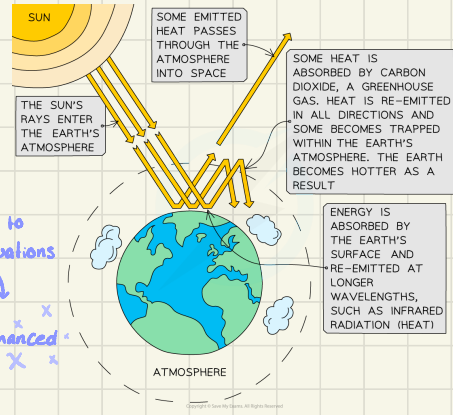
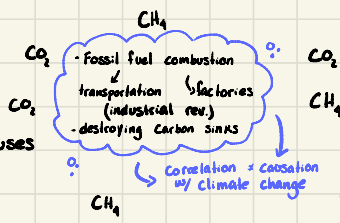
Climate Change

Causes?

D4.3.1 - Anthropogenic causes

Greenhouse effect steps:

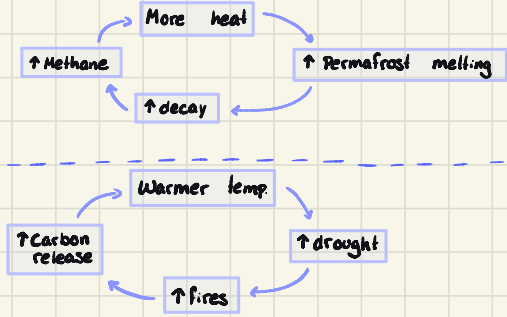
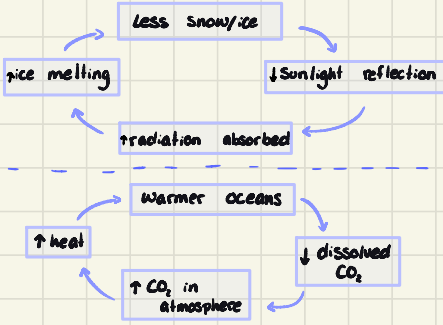
1. Sunlight hits Earth
2. Light - radiated back from Earth
3. Greenhouse gas absorbs re-radiated heat → trapping it



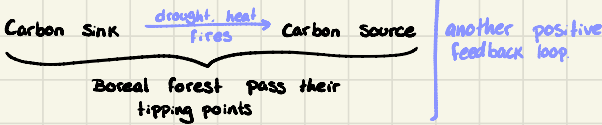
Important to avoid fluctuations

normal Enhanced

D4.3.2 - Positive feedback cycles



D4.3.3 - Shift from C-sink to C-source



Effect on poles

D4.3.4 - Melting ice

1. Emperor penguins

- ↳ Use ice as breeding ground
- ↳ Distance to/from sea is important
- ↳ Early icebreak can kill chicks

2. Walruses

- ↳ Use ice for resting
- ↳ Lack of ice
- ↳ Energy expenditure finding ice

Effect on ocean?

D4.3.5 — Changes in oceans

↳ Ocean currents — affected by wind, temp, salinity — redistributes heat across Earth's surface

Upwelling → cold, nutrient-rich water rises to the surface (driven by wind)

↳ Supports marine life

↳ Permanently warm water on surface prevents nutrient upwelling

↳ ↓ Primary production
↳ ↓ energy flow

D4.3.7 — Threats to corals

↳ CO_2 absorption in water prompts acidification

• ↓ pH

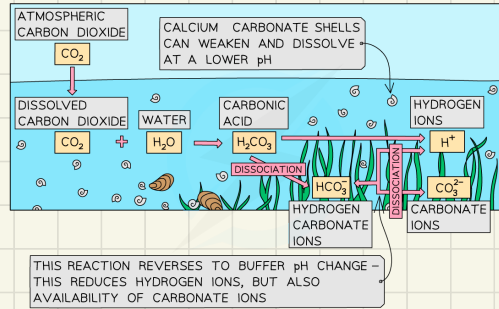
↳ More dif. for corals to absorb carbon from water

↳ CaCO_3 shells of marine organisms dissolve

↳ Warm water causes corals to expel mutualistic algae (bleaching)

Possible feedback

Coral reef ecosystem collapse



Phenology : habitat shifts

D4.3.6 — Shift of temperate species

↳ Upslope

• Species that inhabit mountain-tops have developed niches that allow them to live in the cold

• As temp. ↑ → species move upslope to find optimal temp.

• Moving organisms must compete for niches w/ species already @ top

↳ Poleward

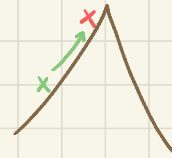
• Ranges have shifted towards poles

• Death of organisms seeking optimal temp.

• Competition for resources in occupied land

driving shift

Crested Satinbird in Papua New Guinea



D4.3.9 - Phenology

Phenology => study of seasonal timings of events in plants / animals

↳ Changes in timings = climate change

↳ Two factors: - seasonal

1. Temperatures

- Bud burst (new leaves)

2. Photoperiod (daylight hours per day)

- Bud set (growth stoppage)
- Flowering (short day vs. long day plants)
- Bird migration

D4.3.10 - Disruption of phenology

If events don't happen at right time, species won't have right resources and food chains will be disrupted.

E.g. Trees' processes need to coincide w/ emergence of pollinators

E.g. Caribou eat Arctic mouse ear and they time their migration to match peak development of plant. If there is mismatch, there won't be enough food supply.

E.g. Great tits need a lot food - caterpillars - during breeding season, but caterpillar populations peak earlier while Great tit breeding season stayed the same.

If...

Two species need to sync up

↳ cued by photoperiods

↳ cued by temp

temp = changing so it might throw off the timing of events necessary for successful interaction

D4.3.11 - insect life cycles

↳ Warmer temp. increases pest #, as they develop in weak trees

↳ Healthy trees limit spruce bark beetle population

↳ Drought ? warm temp → more spruce bark beetles

- 2 yr gen. time → 1 yr

↳ Trees > susceptible

Us vs. Climate Change

D4.3.8 - Forests

Carbon sequestration → capturing and storing carbon (sink)

↳ Process that sequesters carbon:

- a) Photosynthesis
- b) Plant growth
- c) Marine organism shell-building
- d) Fossilisation & peat formation

Promote to remove CO₂

Afforestation → planting trees in areas with no trees

Forest regeneration (reforesting) → planting trees that have been cut down

↳ usually fast-growing species

- Do not occur naturally
- No species diversity
 - ⇒ ✓ for sequestration
 - ⇒ ✗ for ecosystem stability

Peat → partially decomposed organic matter trapped under acidic, waterlogged soil

- ↳ In anoxic environment & can't decompose further
- ↳ Can happen quickly in tropical environment
- ↳ Can be restored by restoring drained wetlands

D4.3.12 - Evolution = consequence

Brown vs. white owls

Definition of "fit" changes as conditions change.

Natural selection	Food Shortage
Overpopulation Competition	feather color (gray vs. brown)
Survival of the fittest	Less snow cover changes ability to blend
Increase in trait frequency	Brown color = more common