Global warming

4.7.3.5 · Ecology · revision notes

Levels of carbon dioxide and methane in the atmosphere are increasing and contribute to global warming. In Biology you need the biological consequences: loss of habitats, changes in the distribution and migration of species, and loss of biodiversity.

Key facts

- Carbon dioxide and methane levels are increasing → global warming
- Methane sources: cattle, rice fields, rubbish decaying in landfill
- Consequence: changes in species distribution (away from the equator, uphill)
- Consequence: reduced biodiversity (species that cannot adapt or move become extinct)
- CO_2 sources: burning fossil fuels, deforestation, destroying peat
- Consequence: habitat loss as sea levels rise and low-lying land floods
- Consequence: changes in migration patterns
- Scientific consensus = systematic reviews of thousands of peer-reviewed publications

Notes

The cause

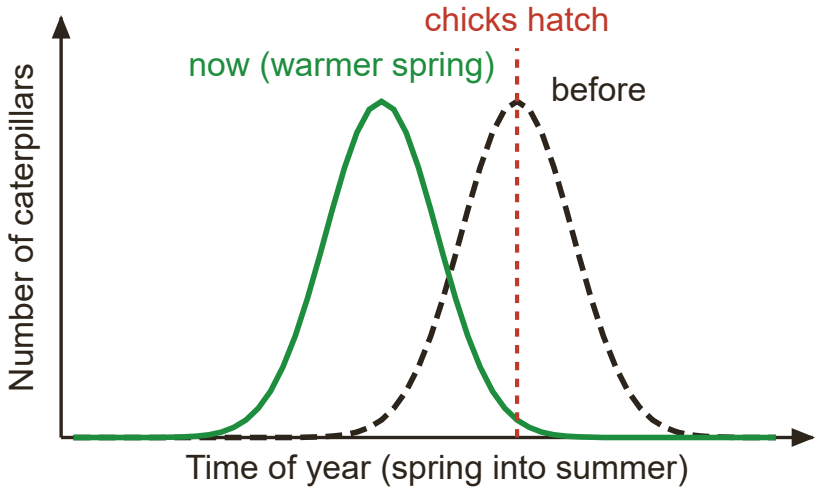
- Levels of **carbon dioxide** and **methane** in the atmosphere are increasing. These greenhouse gases reduce the amount of heat escaping from the Earth into space, so they contribute to **global warming**: a rise in the Earth's average temperature.
- Carbon dioxide comes from burning fossil fuels, deforestation and the destruction of peat.
- Methane comes from cattle, rice fields and the decay of rubbish in landfill sites.

Biological consequences

- **Loss of habitat**: sea levels rise, flooding low-lying coastal areas and destroying the habitats there. Melting sea ice removes the habitat and hunting grounds of animals such as polar bears.
- **Changes in distribution**: where temperature or rainfall changes, species spread into areas that become suitable and disappear from areas that do not. Many species are now found further from the equator or higher up mountains.
- **Changes in migration patterns**: e.g. birds may arrive earlier in spring, migrate at different times or stop migrating.
- **Reduced biodiversity**: species that cannot move or adapt quickly enough may become extinct.
- **Pests and pathogens** may spread into areas that have become warmer, affecting wild species and crops.

Knock-on effects

- One change leads to another: if a plant disappears from an area, the animals that depend on it for food or shelter are affected too.
- Timing matters: if insects appear earlier in a warmer spring but birds still breed at the same time, the chicks may hatch after their food supply has peaked.



If caterpillars peak earlier but chicks hatch at the same time, the chicks miss the food peak.

Evidence and uncertainty

- The **scientific consensus** on global warming and climate change is based on systematic reviews of thousands of peer-reviewed publications.
- **Peer review**: other scientists check a study's methods and conclusions before it is published.
- Evidence is uncertain or incomplete because the climate is complex, with many interacting factors, records from the past are limited, and predictions depend on models.
- Temperature varies naturally from year to year, so it can fall in some years while carbon dioxide rises. Conclusions need the long-term trend.
- A correlation between carbon dioxide and temperature does not prove cause on its own; the mechanism (greenhouse gases trap heat) supports the link.

How to answer each type of question

Recall: name greenhouse gases and their sources 1 to 2 marks **Grade 3**

1. The two gases in this part of the specification are carbon dioxide and methane.
2. Match each gas to a source if asked: carbon dioxide from burning fuels and deforestation; methane from cattle, rice fields and landfill.

Example. Name **two** gases whose increasing levels in the atmosphere contribute to global warming.

Model answer. Carbon dioxide (1); methane (1)

Describe biological consequences of global warming

3 to 4 marks | Grade 5

1. Give separate consequences: habitat loss, distribution changes, migration changes, loss of biodiversity.
2. Give a reason or an example for each one.

Example. Describe **three** biological consequences of global warming.

Model answer. Any three from: rising sea levels flood low-lying areas, so habitats are lost (1); species' distributions change as they move to areas where the temperature or rainfall suits them (1); migration patterns change, e.g. birds arrive earlier (1); biodiversity falls as species that cannot adapt or move become extinct (1); pests or pathogens spread to new areas (1).

Suggest how global warming could affect a species, using data

3 marks | Grade 7

1. Describe the change shown in the data.
2. Link it to the rise in temperature.
3. Explain the effect on food, survival or reproduction.

Example. Over 40 years, the date when a species of butterfly is first seen each spring has become 10 days earlier, as spring temperatures have risen. The caterpillars feed only on the young leaves of one plant.
Suggest how global warming could affect this butterfly.

Model answer. Any three from: warmer springs make the butterflies appear earlier (1); if the food plant does not produce young leaves earlier too, the caterpillars will have less food (1); so fewer caterpillars survive and the population could fall (1); warmer temperatures could allow the butterfly to live further north than before (1).

Explain how global warming could cause extinction

3 marks | Grade 5

1. Name the change (temperature, rainfall or sea level).
2. Explain its effect on the habitat or food.
3. Explain why the species cannot move or adapt in time, so it dies out.

Example. A species of small mammal lives only near the top of a mountain, where it is cool.
Explain why global warming could cause this species to become extinct.

Model answer. As the climate warms, the cool area near the top of the mountain gets smaller (1). The mammal cannot move higher because it is already at the top, so there is nowhere cooler to go (1). So its habitat is lost, fewer survive and breed, and the species may die out (1).

Don’t lose marks

- Confusing global warming with damage to the ozone layer. They are different problems.

- Only describing physical effects (hotter weather, melting ice) when the question asks for biological consequences.
- Saying animals 'adapt' within their lifetime. Species either move, change by natural selection over many generations, or die out.
- Writing 'the greenhouse effect is bad'. The greenhouse effect keeps the Earth warm enough for life; the problem is the increase in greenhouse gases.

More tips

Memory tricks

- Consequences, HDMB: Habitat loss, Distribution changes, Migration changes, Biodiversity loss.
- Warming pushes species 'up and away': up mountains and away from the equator.
- Carbon dioxide from burning; methane from cows, rice and rubbish.

Exam technique

- When asked for biological consequences, mention organisms, habitats or species in every point.
- Give different consequences, not the same one twice in different words.
- Link causes to biology you know: deforestation, peat, decay and farming.

What each grade needs

What you need to be able to do, from the first marks up to the top grade.

Grade 3 — **Name two gases that contribute to global warming**
Carbon dioxide and methane.

Grade 4 — **Give human activities that increase these gases**
Burning fossil fuels, deforestation and destroying peat add carbon dioxide; cattle, rice fields and landfill add methane.

Grade 5 — **Describe biological consequences of global warming**
Habitat loss as sea levels rise, changes in distribution and migration, and loss of biodiversity.

Grade 5 — **Explain why species distributions change**
As temperature or rainfall changes, species survive and breed in new areas and die out where conditions no longer suit them.

Grade 5 — **Explain how global warming reduces biodiversity**
Species that cannot adapt or move to suitable areas quickly enough may become extinct.

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