Impacts of Climate Change

Teachers notes

These lesson objectives are intended for the **KS3 Geography curriculum**, specifically focusing on the topic of **weather and climate**. However, the content can be tailored to suit different key stages, accommodating varying levels of prior knowledge and understanding.

The lesson on Impact of Climate Change can be worked through at any pace, and it can be split into multiple lessons if needed. This flexibility allows you to adjust the flow based on the class's understanding and time constraints. If some sections require more in-depth exploration, feel free to extend them over additional lessons to ensure students fully grasp the concepts before moving on.

The worksheets can be filled in during the lesson, as homework, or in individual sections, depending on the pace of the lesson.

Lesson Aim:
To explore and understand the diverse impacts of climate change on the environment, society, and economy at both global and local scales, and to evaluate how these changes influence natural systems, human health, and communities.

Lesson Objectives:
- Identify the environmental, social and economic impacts of climate change on both a global and local scale.
- Explain how climate change could shift the location of the Earth's climate belts.
- Understand the impacts of flooding due to climate change.
- Evaluate how climate change can lead to the spread of tropical diseases.

Assumed Prior knowledge:
- Students should know the difference between weather (short-term atmospheric conditions) and climate (long-term patterns over time).
- Awareness of the global distribution of different climate types (e.g., tropical, polar, temperate) would be helpful but can be reinforced during the lesson.
- Students should have a basic idea of what climate change is and its connection to greenhouse gases and human activities (e.g., fossil fuel use, deforestation).
- Understanding terms like "carbon dioxide," "methane," "greenhouse gases," and "atmosphere."

Resources:
- Lesson 7 worksheet
- Mini whiteboards and pen
- Scissors
- Glue stick

All the blank worksheets for this lesson can be found as a separate download within the 'Lesson 7' page of The Flood Hub KS3 Geography Weather and Climate Learning section. The answers for the worksheets can be found at the end of this document.

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Notes for Each Slide:
Teachers should decide what students should copy into their workbooks. While most content is provided on the worksheet, any additional information can be recorded in the workbooks.

Slide 1 - Learning Objectives
- Slide containing the aims and objectives of the lesson. Read these to the class to clarify the focus and expectations for the session.

Slide 2 - Starter Activity
- Have whiteboards and pens ready for each student.
- Ask students to write down the main causes of climate change, getting them to reflect on the last lesson.
- Look for terms such as: fossil fuels (coal, oil, gas), deforestation, transport emissions, agriculture (methane from livestock), industrial emissions, volcanic eruptions, solar activity.

Slide 3- Impacts of Climate Change Mind Map
- Ask for volunteers to share their thoughts on the impacts of climate change and write them on the board to create a mind map of ideas.
- Look for terms such as: flooding, droughts, wildfires, melting ice caps, rising sea levels, heatwaves, storms, habitat loss, food shortages, migration, disease spread, damaged infrastructure...

Slide 4- Impacts of Climate Change, rising Temperatures
- Read the slide aloud to ensure students grasp the key points.
- Emphasise the significance of the 1˚C increase, although 1˚C might not sound like much, but it has serious consequences. Even small temperature rises can disrupt weather patterns, ecosystems, and sea levels.
- Make it relatable and ask the students if they've ever heard of record-breaking temperatures in the UK or elsewhere?, or why do they think a small rise in temperature can have a big impact?

Slide 5 - 2018 UK Heatwave Fact File
- Introduce the slide – The 2018 UK heatwave was one of the hottest summers on record. Then look at how it impacted people, the economy, and the environment.
- **Task:** Ask the students to fill in the key figures from the mini case study onto their worksheets and choose 2 of each social, economic or environmental impacts to write down in the space on their worksheets.

Slide 6 - Sea Level Rise and Erosion
- Explain that the rate at which sea levels are rising is increasing. Over the last 30 years, the rate of sea level rise has doubled. This acceleration means that by 2100, sea levels could rise by 1 meter or more.
- Clarify the term “exponential” by explaining that it refers to growth that accelerates over time. In this context, it means that sea level rise doesn’t just increase at a constant rate; it speeds up and will continue to rise faster in the future.
- Emphasise the impact of rising sea levels on coastal communities: increased flooding, erosion, and loss of land. Erosion can damage beaches, infrastructure, and ecosystems.
- Provide real-world examples:
- Small islands in the Pacific are at risk of disappearing due to rising seas.
- Venice faces frequent flooding as sea levels continue to rise.
- Highlight the rate of change: Sea levels are currently rising at 3.3mm per year, but due to the accelerated rate, we could see up to 1 meter of rise by 2100, affecting millions globally.

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Slide 7 - Sea Level Rise and Erosion in the UK

- **Key points to cover:** Happisburgh, Norfolk is one of the fastest-eroding areas in the UK, with up to 250 metres of land lost since the 1600s.
- The coastline is retreating by up to 4 metres per year, forcing residents to abandon homes and businesses.
- Wider UK impact: By 2100, sea levels could rise by up to 1 metre, threatening low-lying areas like East Yorkshire with increased flooding and erosion.
- Discussion Question: How might coastal erosion impact local communities economically and socially? (e.g., loss of homes, businesses, tourism decline).

Slide 8 - Flooding of Coastal and Low-Lying Communities

- Read aloud the slide content to the class.
- Point out the cities mentioned (New York, Miami, Jakarta) and explain they're examples of places at risk from flooding.
- Ask students:
  - "Can you think of other cities or countries that might face similar risks?"
  - "What do you think happens to people who have to move because of flooding?"
  - "How might flooding affect the economy of a city?"

Slide 9 - Flooding in the UK

- Read aloud the slide content to the class.
- Emphasise the statistic: "6.3 million properties in England at risk" and explain the types of flooding involved.
- Refer to the 2015 Cumbria floods—ask students if they can remember any specific facts or details from the case study (e.g., impacts, response, recovery efforts).
- Discuss urban areas like London and Manchester and explain why they are more prone to flash floods due to impermeable surfaces like roads and pavements.

Slide 10 - Flooding in the UK

- Read aloud the slide content to the class.
- Explain that warmer temperatures lead to increased evaporation, which causes more rainfall. This is why we are seeing heavier and longer-lasting rain.
- Describe how rising sea levels from melting ice caps and warmer ocean water increase the risk of coastal flooding.
- Mention that stronger storms, due to climate change, can cause more intense storm surges along coastlines, worsening flooding.

Slide 11 - Impacts of flooding in the UK

- **Note:** These are general impacts, but remember that flooding will affect individual communities more intensely. Think back to the 2015 Cumbria flooding case study -how did these impacts specifically affect the people there?
- Read aloud the slide content.
- **Task**: Instruct the student to make a mind map on their sheets, noting down the impacts of flooding in the UK, categorise them into the social, economic and environmental factors.

Slide 12 - Greenhouse Gases

- Read aloud the slide content.
- Explain that rising sea surface temperatures (SST) are a result of global warming.

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- Coral Bleaching: Warmer waters stress coral reefs, causing them to expel algae, which can lead to the death of corals.
- Increased Hurricanes: Higher SSTs provide more energy for tropical storms, making hurricanes more frequent and intense.

Slide 13 - Shifting Climate Belts

- Read aloud the slide content.
- Explain that climate belts are areas with consistent temperature and rainfall patterns.
- Highlight how climate change shifts these belts, disrupting weather patterns.
- Impact on agriculture: Some regions may become too hot or dry for crops, while others may become more temperate, affecting food production.

Slide 14 - How might the change in climate belts impact local economies that depend on farming?

- Show the images and ask students to consider how each factor impacts local economies and communities dependent on farming. Starting from the top right hand side and working clockwise:
- Food Scarcity:
  - Social Impact: Increased hunger, poor nutrition, and displacement as people search for food.
  - Environmental Impact: Over-farming or environmental damage from trying to grow crops in unsuitable conditions.
  - Economic Impact: Decreased income for farmers, rising food prices, and strain on food distribution systems.
- Change in Growing Seasons:
  - Social Impact: Loss of jobs in farming communities and changes in rural life.
  - Environmental Impact: Disruption to ecosystems as plants and animals are affected by shifts in planting and harvest times.
  - Economic Impact: Reduced crop yields leading to financial instability for farmers and higher food prices.
- Economic Decline & Increased Food Prices:
  - Social Impact: Higher cost of living for families, especially in farming communities.
  - Environmental Impact: Overuse of natural resources (e.g., water) in an attempt to maintain crop production.
  - Economic Impact: Reduced income, increased poverty, and reliance on food imports.
- Crop Failure:
  - Social Impact: Displacement of people due to loss of livelihoods, social unrest from food shortages.
  - Environmental Impact: Soil degradation, loss of biodiversity, and ecosystem disruption.
  - Economic Impact: Financial losses for farmers, increased government spending on aid and relief, and a weaker economy.
- Spread of Disease & Pests:
  - Social Impact: Increased health risks for farmers and local populations.
  - Environmental Impact: Damage to ecosystems as pests and diseases spread, threatening crops and natural habitats.
  - Economic Impact: Higher costs for pest control, reduced crop yields, and increased pressure on farming to recover.
- Water Scarcity:
  - Social Impact: Reduced access to clean water for farming communities, affecting daily life.
  - Environmental Impact: Deterioration of water sources, loss of wetlands, and damage to local ecosystems.
  - Economic Impact: Higher irrigation costs, reduced agricultural productivity, and potential economic collapse for water-dependent areas.

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Slide 15 - Impact on Food Production

- Read aloud the slide content.
- Explain how climate change disrupts agricultural production due to shifting climate zones, extreme weather, and water scarcity.
- Discuss how droughts and heatwaves reduce crop yields, particularly in tropical and subtropical regions.

Slide 16 - Impact on Food Production in the UK

- Read aloud the slide content.
- Explain that crops like wheat, which cover 40% of UK arable land, are at risk due to unpredictable rainfall and heat stress.
- Discuss how farmers in East Anglia are adapting by trialling drought-resistant crops to cope with reduced water availability.
- Discussion: How might the changing climate affect the types of crops grown in the UK? Why is it important for farmers to adapt to these changes, and how can new technologies or crop varieties help?

Slide 17 - The Spread of Tropical Diseases

- Read aloud the slide content.
- Explain that malaria is a serious illness spread by certain mosquitoes. Not all mosquitoes carry malaria, just the Anopheles species.
- Clarify that malaria causes symptoms like fever and chills and can be deadly if not treated. It kills over 200,000 people each year, mainly in warmer countries.
- Mention that due to rising temperatures, malaria-carrying mosquitoes have been found as far north as Kent in the UK.

Slide 18 - Climate Change and Respiratory Health

- Read aloud the slide content.
- Explain that asthma is a condition where the airways in the lungs become narrow and inflamed, making it hard to breathe. It can cause symptoms like coughing, wheezing, and shortness of breath.
- Clarify that warmer temperatures and more pollution are causing an increase in asthma cases.
- Discuss how higher temperatures worsen air quality by increasing harmful substances like ozone and particulate matter in the air, which can irritate the lungs and trigger asthma attacks, especially in vulnerable people like children and the elderly.

Slide 19 - Impacts of Climate Change

- Read aloud the slide content, which serves as a reminder for students.
- Explain the three types of impacts:
- Social impacts: How an event affects people's lives, health, and well-being. This includes things like people losing their homes, public health issues, and changes in community life.
- Economic impacts: How the event affects money, businesses, and the economy. This includes things like property damage, business disruption, and costs of repairs.
- Environmental impacts: How the event affects the natural world, including wildlife, ecosystems, and pollution.

Slide 20 - Impacts of Climate Change Task

- **Task:** Instruct students to cut out the different impacts of climate change from the sheet provided. Explain that they need to sort these impacts into three categories: social, economic and environmental. Once sorted, they should stick them into their book under the correct headings.
- After completing the activity, review the categories together. Are there any impacts that could fit into more than one category?

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Slide 21 - Social Impacts of Climate Change

- Ensure students have the social impacts stuck in the correct category from the previous activity.
- Go through each impact and explain why it is a social impact, even if there's some overlap with other categories.

Slide 22 - Environmental Impacts of Climate Change

- Ensure students have the environmental impacts stuck in the correct category from the previous activity.
- Go through each impact and explain why it is an environmental impact, even if there's some overlap with other categories.

Slide 23 - Economic Impacts of Climate Change

- Ensure students have the economic impacts stuck in the correct category from the previous activity.
- Go through each impact and explain why it is an economic impact, even if there's some overlap with other categories.

Slide 24 - Homework Task

- Instruct students to complete the crossword on their worksheet, which involves identifying different impacts of climate change.
- Remind students to refer back to the notes they've made in class to help them fill in the crossword.

Slide 25 - Next Steps

- Read aloud the question on the slide: "We've explored the impacts of climate change, but how can we manage it?"
- Encourage students to think about possible solutions or actions that can be taken to reduce or manage climate change.
- Prompt students to consider different strategies, such as renewable energy, conservation, reducing emissions, or climate adaptation measures.

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2018 UK Heatwave Fact File

- The 2018 UK heatwave was one of the hottest summers on record.
- Average temperatures were _____ than usual, peaking at _____ in Faversham, Kent.
- Linked to climate change as extreme heat events are becoming more frequent and intense.

Social	Health: NHS saw a 15% increase in heat-related illnesses like dehydration and heatstroke.
Social	Water restrictions: Hosepipe bans were introduced in some areas to manage shortages.
Economic	Agriculture losses: Farmers reported up to 50% reductions in yields of key crops like wheat and potatoes.
Economic	Energy costs: Increased use of fans and cooling systems raised electricity demand, straining the National Grid.
Environmental	Drought: River flows in parts of England dropped to 40% below average.
Environmntal	Wildfires: Saddleworth Moor fire burned for weeks, damaging over 7 square miles of moorland.

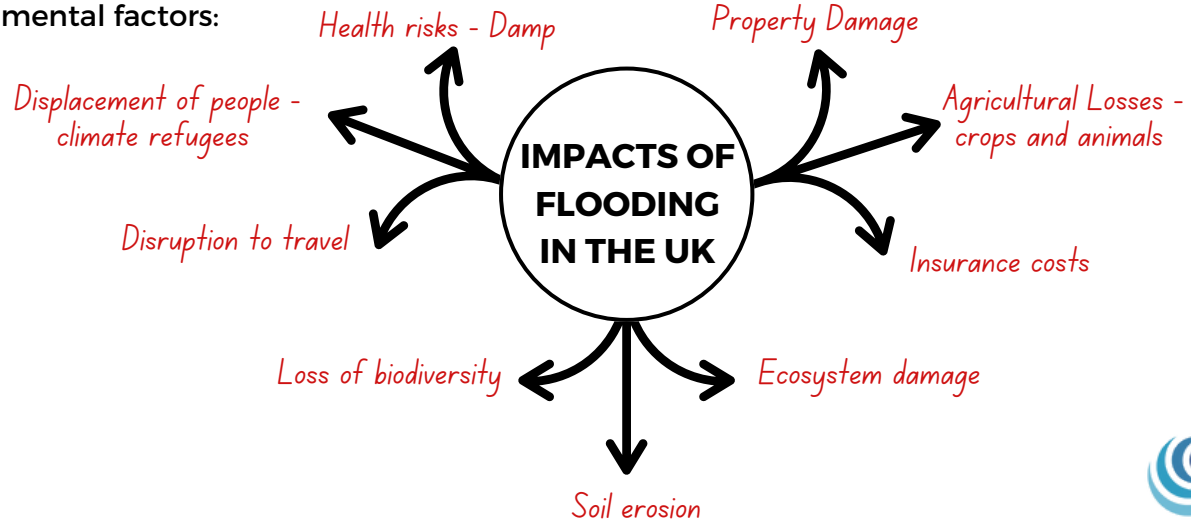
Fill in the Blanks: Sea Level Rise and Erosion

- Sea levels are rising by about _3.3 mm_ per year, and could increase by up to _1 metre_ by 2100.
- Rising sea levels are caused by the melting of _ice caps_ and the expansion of _seawater_ water.
- Coastal erosion is threatening areas like _Happisburgh_ in Norfolk, where up to _250_ metres of land have been lost since the 1600s.
- By 2100, sea levels around the UK are projected to rise by up to _1_ metre, putting areas like _East Yorkshire_ at risk.
- More intense _storms_ caused by climate change can lead to powerful surges along the coast.

East Yorkshire, 1, 3.3 mm, storms, seawater, Happisburgh, 250, 1 metre, ice caps

Impacts of flooding in the UK

Make a mind map on the impacts of flooding, categorise them into the social, economic and environmental factors:



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Social, Economic and Environmental Impacts of Climate Change :

Cut out the different impacts of climate change and organise them 3 categories, social economic and environmental impacts before sticking the in your book

Social Impacts	Environmental Impacts	Economic impacts
Migration due to climate change (climate refugees as people move to escape extreme weather events).	Coral bleaching (due to rising sea temperatures, impacting marine biodiversity).	Disruption of agriculture (crop failure due to droughts or flooding, leading to food insecurity).
Flooding of coastal and low-lying communities (displacement of people, loss of homes, communities under threat).	Rising sea levels (flooding of coastal habitats, loss of land and ecosystems).	Damage to infrastructure (costs of rebuilding and maintaining flood defenses)
Increased vulnerability of marginalised groups (e.g., poorer communities or elderly individuals being more susceptible to climate impacts).	Increased frequency of extreme weather events (e.g., more cyclones, droughts, and heatwaves).	Cost of disaster recovery (economic impact of recovering from extreme weather events like hurricanes, floods, or wildfires).
Health impacts (increased asthma cases due to air pollution and heatwaves, spread of diseases like malaria and dengue).	Loss of biodiversity (habitats disappearing, endangered species at risk).	Tourism losses (impact on tourist destinations due to extreme weather, beach erosion, or coral bleaching).
Water scarcity (lack of access to fresh water due to changing rainfall patterns).	Shifting climate belts (altering ecosystems, making some areas too hot or dry for certain species).	Rising insurance premiums (higher costs for businesses and homeowners in high-risk areas).
	Melting glaciers and polar ice caps (rising sea levels, loss of habitats).	

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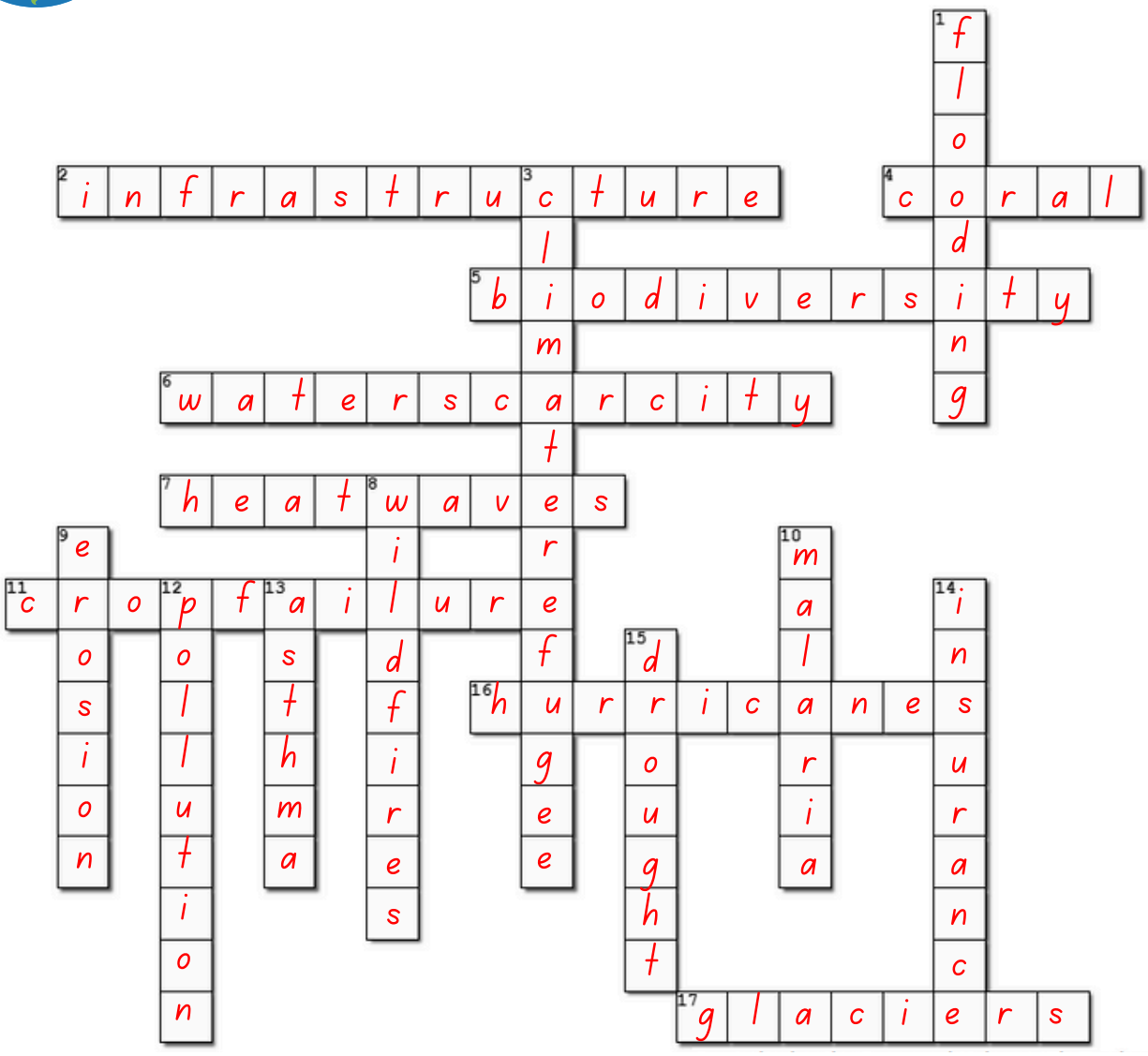

Across

2. Physical structures like roads, bridges, and buildings that are increasingly at risk of damage due to extreme weather events caused by climate change.
4. Marine species affected by rising sea temperatures and bleaching.
5. The variety of different species of plants, animals, and microorganisms in a specific habitat or on Earth, threatened by climate change.
6. When there is not enough clean, safe water available to meet the needs of people, animals and the environment.
7. Extended periods of excessively hot weather.
11. Term for widespread crop damage or loss.
16. Powerful storms with strong winds, intensified by warmer ocean temperatures.
17. Melting ice masses contributing to rising sea levels.

Down

1. Excessive water covering land, often due to heavy rain, sea level rise or storms.
3. People displaced due to environmental changes.
8. Uncontrolled fires in forests or grasslands, made more intense by high temperatures.
9. Gradual wearing away of the Earth's surface, often accelerated by rising sea levels.
10. Tropical disease spread by mosquitoes.
12. Contamination of air, water, or soil, often worsened by industrial activity and climate change.
13. Breathing condition often worsened by pollution and climate change.
14. Rising costs for coverage of properties and businesses in areas vulnerable to climate-related risks like flooding and storms.
15. Long period of abnormally low rainfall, leading to water shortages.