

# Broads Curriculum

## Geography Key Stage 2

### Climate change and flooding

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**This resource provides some ideas for:**

- physical and human geography (rivers, the water cycle and land use)

## What is happening to the Earth's climate?

Planet Earth is warm enough to sustain life because of a natural process whereby gases in the atmosphere allow heat from the sun to pass through it, but not to escape again freely. This is called the natural greenhouse effect and without this effect the average temperature on Earth would be minus 19 degrees Celsius.

The problem that is causing global warming is called the enhanced greenhouse effect. The most well-known greenhouse gas is carbon dioxide (CO<sub>2</sub>), which is given off when oil, gas and coal (fossil fuels) are burnt. This contribution by human beings to the greenhouse gases is widely accepted to be enhancing the greenhouse effect and temperatures on Earth are getting warmer.

There is still debate among scientists about the extent of climate change and its causes. The debate is complicated by the fact that weather is naturally unpredictable and goes through natural fluctuations over time.

## What specific changes are taking place?

Current scientific evidence suggests that the rate of climate change is increasing more rapidly than ever before in the Earth's history. Changes in the UK over the next 100 years are predicted to include:

- a two to five degrees Celsius rise in temperature
- a 60cm rise in sea level at Great Yarmouth (grid reference, TG 530060), taking into account the additional impact of a sinking coastline in the east of England
- 10-35% milder and wetter winters, with more frequent heavy precipitation and stronger winds
- 35-50% drier summers

The extent to which these changes occur will depend on society's response to the emission of greenhouse gases, particularly CO<sub>2</sub> from burning fossil fuels.

## What are the effects of the changes worldwide?

Developed countries such as the UK, the USA and Japan contribute huge proportions of the total CO<sub>2</sub> emissions because we use lots of energy in our homes and to manufacture products. People who live in developing countries tend to use less energy and therefore contribute less to the total

CO<sub>2</sub> emissions. However, it is often people in developing countries who suffer the effects of global warming the most. We should be taking urgent steps to reduce human-caused emissions of greenhouse gases such as CO<sub>2</sub>. The effects of climate change in countries such as the Gambia threaten to lead to:

- desertification
- decline in fish stocks
- malnutrition
- increased disease
- increased flooding
- a decline in tourism

## We can help by:

- using energy efficient appliances
- using fewer electrical appliances
- insulating buildings thoroughly
- buying electricity on a green tariff – electricity that has been produced from renewable sources
- using public transport
- walking or cycling for short journeys
- planting trees, which use CO<sub>2</sub> for photosynthesis

As well as taking the steps above we should also consider how to cope with the likely impacts of climate change. We will need to become better at coping with floods, droughts and salt water entering freshwater systems. We need to consider the impact it may have on local communities and businesses.

## Climate change in the Broads

The Broads is particularly exposed to the impacts of climate change. Climate change may result in the following changes here:

- greater demand for water resources
- increased risks from flooding

- siltation and erosion of low-lying arable land due to flooding
- intrusion of saline water into the freshwater system
- changes in the distribution of habitats and species, with some loss of native biodiversity and increase in invasive species
- more plant growth in the waterways, requiring more management
- habitats becoming wetter
- greater variability in the weather we experience, perhaps with more extreme weather events

Floodplains accommodate flood waters. Incursions of flood water are likely to be more frequent as the effects of climate change become more apparent. Some of the floodplains in the Broads have been used in inappropriate ways, for example to grow arable crops and for housing. In future, development on the floodplain will only be allowed if it is essential for the social and economic well-being of the community, and appropriate to the character of the landscape and risk from flooding. Flood alleviation works will also need to be investigated further in order to minimise threats posed to existing riverside homes. The reinstatement of appropriate land uses on floodplains will be a key area for the Broads Authority in the future.

Climate change may also result in some more positive outcomes for the Broads. It may mean that there are new opportunities for wetland creation and therefore new opportunities for tourism and public enjoyment.

## Flooding in the Broads

The Broads is close to the sea and some areas of the Broads are only separated from it by a thin strip of land. These are some of the flood events over the last 100 years and more:

**1897:** The sea flooded on to the Horsey Marshes (grid reference, TG 468235).

**1938:** It happened again and 7,500 acres of marsh were flooded around West Somerton (grid reference, TG 470198), Martham Broad (grid reference, TG 459205), Potter Heigham (grid reference, TG 415195) and Hickling Broad (grid reference, TG 416217). It took three years to close the breach in the shingle and to protect the marshes, but the effects of the saltwater incursions lasted much longer. The effects of salt water in freshwater systems can kill trees by stripping their leaves and bark. Salt water also has a devastating effect on freshwater fish populations.

**1953:** The great tidal surge in January caused widespread devastation along the coast of Norfolk and Suffolk. It destroyed dunes at Sea Palling (grid reference, TG 428269) and the salt water swept across Brograve Level (grid reference, TG 443244) via the dyke system, damaging property in the village of Sea Palling and killing seven residents.

**1993:** A high spring tide caused a surge of water two metres high along the River Yare. Many riverbanks were breached and the cost of the damage was estimated to be £500,000.

**2013:** The most recent severe flooding in the region took place in December. Hemsby, on the coast and close to the Broads, was very badly affected.

Sea defences are extremely costly to construct and maintain. The immense power of the sea can damage expensive sea defences. Governments have advocated 'planned retreat' in many areas. This means that sea defences will not be repaired or renewed. Lack of sea defences combined with the possibility of global warming may result in widespread flooding of low-lying areas such as the Broads. Widespread and regular incursions of sea water into the Broads could eventually destroy the Broads ecosystem.

## Find out more

- You can find out more about climate change from the Broads Authority's website, by going to the pages for the 2016 [Broads Climate Adaptation Plan](#), the pages for [planning policy and flood risk](#) in the Broads and the pages for the [Broads °Community](#)
- The website for the Environment Agency's [Broadland Flood Alleviation Project](#) will also tell you more
- The Land Use, Ecology and Conservation of Broadland is a book by Martin George (Packard Publishing, Chichester, 1992) with detailed historical information about flood events in the Broads
- For historical information on film about flooding, go to the website for the [East Anglian Film Archive](#)