

Plants and Climate Change taster activity

Can plants influence climate?

Welcome!

Welcome to this interactive taster activity from the upcoming **Plants and Climate Change course**.

The content in this taster is an extract from a longer, free course that will be released soon. The full course will look at what climate and climate change are, why climate change is happening, then at some of its effects and how these impact on the natural world. It will discuss some of the ways in which plants are impacted by a changing climate, followed by some ways in which plants themselves have an effect on the climate. It will also explore a selection of the many ways in which we can all help to reduce climate change and its effects.

This extract focuses on the influence of plants on our climate.

This taster should take around 20 minutes.

Can plants influence climate?

So, can plants really have an influence on the global climate, or even on the climate of their local area? The short answer is "Yes!"

From the composition of the atmosphere to the reflection of solar energy from the land surface, vegetation is helping to maintain the environment in which all life can survive.

Plants **take in carbon dioxide** during photosynthesis and **store it** as solid matter. This carbon is **released** upon their death and decay - or destruction. This makes plants both **sources** and **sinks** for carbon (sources are things that give off greenhouse gases and sinks are things which absorb them).

This cycle generally exists in a balance, with the carbon being taken in by plants balanced with the carbon being released by plants. There is a yearly variation caused by the seasons: plants take in more carbon dioxide during growth in spring and summer, and less in autumn and winter as growth slows or stops.

A monitoring station in Hawai'i has been recording the carbon dioxide concentration in the air since 1958. It produces data that show this seasonal variation. These data can be used to create a graph showing carbon dioxide concentrations in the air. This graph is known as the Keeling Curve, after the man who instigated the recording, Charles David Keeling. The graph shows a upward curve made up of small zig-zags. These zig-zags show the yearly up and down caused by seasonal plant growth. It also shows that the overall levels of carbon dioxide are going up over time.

This is because human activity is causing extra carbon dioxide to be released into the atmosphere. Vegetation can only soak up so much of this extra carbon dioxide.

Plants as sources of carbon

Burning plants

When plants are burned, they release carbon dioxide, just like their fossil counterparts in oil and coal. The burning of plants can either be:

- a natural occurrence e.g. wildfires started by lightning
- caused by humans e.g. bushfires started by arson; grassland or moorland deliberately burned to clear vegetation; or forest deliberately burned to clear space for growing crops; or burning wood for fuel.

The wildfires that devastated Australia recently released huge amounts of carbon dioxide into the atmosphere. Annual wildfires also occur in many other countries. Over time, the regeneration of plants in these burnt areas will help pull carbon back out of the atmosphere. Increased fires due to the trend towards hotter and drier conditions can affect the ability of plants to regenerate properly.

Wetlands and decomposition

When microorganisms (like bacteria) break down dead vegetation, carbon is released into the ground. This breaking down and recycling is necessary to allow other plants (and animals) to live. Sometimes this breaking down takes place in wet, airless conditions, such as those in wetlands and waterlogged areas. When this happens, the bacteria release the carbon in the form of methane.

Agriculture

The impacts of agriculture on the environment and climate are many and varied. It is one of the main contributing factors to climate change. Here we will take a brief look at a few aspects relating to plants. In these cases, it is not necessarily the plants themselves releasing greenhouse gases, but the practices used to grow them.

1. Destruction of natural vegetation to clear space for cattle farming or cropland (including slash and burn agriculture) is a large source of agricultural emissions.
2. Once converted, farmland captures far less carbon than natural vegetation
3. The growing of crops, especially in intensive modern agriculture, relies on huge inputs of fossil fuels and artificial fertilisers
4. Cultivation of soil for crops on a large scale using machinery exposes the soil to drying. This means the organic matter in it decomposes faster
5. Rice farming leads to the release of methane: soil is flooded to provide the growing conditions for the rice plants

Plants as sinks for carbon

Forests, grasslands and mangroves

Plants store carbon taken from the air. This means that forests, grasslands, mangroves and other habitats are a major carbon sink.

Although many people focus on trees when talking about vegetation as a sink, the carbon is stored not only in the trees. It is also stored in the shrubs, the herbaceous plants, the fungi, the animals, the invertebrates and the leaf litter as well...

...and the soil that lies under these ecosystems.

These habitats are immensely important for the species that live in them, for climate regulation and for providing for human needs.

Soils

The soil underneath forests, grasslands, mangroves, farmlands and other habitats is as important as the plants for carbon storage. Without taking the soil into account, the storage potential of these habitats is a lot lower.

Soil stores carbon in organic matter held within it, both fresh and in various stages of decomposition.

Organic matter in soil also has beneficial effects on the soil. It improves the structure, creating a better mix of air and water and allowing soil to hold onto water better.

Farming and gardening practices can be carried out in ways that help the soil to store carbon.

Soil loses carbon when it is exposed to the air and dried out, so the cultivation and erosion of soil leads to the escape of carbon.

Peatlands

Peat is an accumulation of partially decomposed plant matter that builds up in wet conditions.

Peat accumulates very slowly, at a rate of about 1mm per year. The areas of deep peat that exist have taken thousands of years to reach this depth.

The peat bogs of the Flow Country in Scotland can be up to ten metres deep in places.

Peatlands include blanket bogs, raised bogs and tropical peat soils. These store a massive amount of carbon. In Britain, peat bogs store far more carbon than the woodlands and forests.

Peat, like forests, can become a source rather than a sink. If peat bogs and peat soils are damaged and allowed to dry out, the carbon they store is liberated.

It is important when considering plants as sinks to think about how long the carbon they store is locked up for. Peat bogs store carbon slowly, but hold onto it for a long, long time if they remain intact. Crop plants only store it for a short amount of time before they are harvested and consumed or turned into something else.

Ecosystem services

The ecosystems that plants are part of also provide benefits other than acting to collect and store carbon, and being a home for the species that are part of them. These include:

- filtering water
- acting to reduce floods
- sheltering coastal areas
- providing food, fuel and medicine to people
- providing fodder for livestock
- benefiting our physical and mental health
- recycling nutrients and keeping soils fertile

Influence of plants on local climate

Plants can also influence the local climate. For instance, tropical rainforests help to create the clouds above them by evapotranspiration. This is the process by which plants take water from the ground, pull it through their bodies and release it as water vapour from their leaves.

Some of this water vapour condenses as it rises to form clouds. This helps keep the forests cooler than they might otherwise be - evaporating water carries away some heat with it - and the clouds provide rain.

The silver lining

The current world situation is an amazing opportunity for us to reflect, both as individuals and as a society.

The COVID-19 virus has changed the way we live and the way our society and economy function.

We have seen that governments and people can change their behaviours quickly and radically in response to a threat that affects everyone. While the current pandemic has drawn a lot of attention away from the climate emergency, the emergency itself has not lessened or gone away.

What matters to you and your loved ones? Changing our behaviour to combat climate change and stop biodiversity loss is not just about what we are against: imagining a better world is about what we want to protect, what we care about and what we want to see.

This is a chance to build back better. Is that what we want, or do we want to go back to business as usual?

Learn more

You have reached the end of this activity. We hope you found it interesting and want to find out more.

Why not try some of the Royal Botanic Garden Edinburgh's other online courses?

Keep Edinburgh Buzzing

Our free online short course, [Keep Edinburgh Buzzing](#), focuses on pollinators. This course is suitable for everyone, not just people in Edinburgh!

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How Plants Fight Back!

Find out how plants have evolved adaptations to the places they live in with the free online short course, [How Plants Fight Back!](#)

Horticulture and botany courses

If you want to learn more about plants, we have a range of horticultural and botanical courses, from garden design and garden history to botany and botanical illustration, to RHS qualifications. Find out about these [here](#).

Thanks for completing this activity and we hope to see you back soon.