

## Growing Green - exploring photosynthesis

Suitable for KS3 students, March to November

This programme is designed to explore the process of photosynthesis using the arboretum's diverse tree collection. Through a range of hands-on discovery activities students will also observe a variety of leaf adaptations before considering the role photosynthesis plays in ecosystems and the atmosphere.



### Key Concepts

Photosynthesis, gas exchange, adaptation, inter-dependence, climate change

### Learning Outcomes

By the end of the programme, students should be able to:

- Explain the role of leaves, chloroplasts and chlorophyll in the process of photosynthesis
- Name the reactants in and products of photosynthesis
- Suggest different ways leaves are adapted for photosynthesis
- Understand that human activity can alter the levels of CO<sub>2</sub> in the atmosphere, impacting on climate
- Recognise the role photosynthesis can play in reducing climate change

### Before you come

Discuss which types of organism photosynthesise, considering a range of ecosystems

Discuss the terms 'climate change', and 'emissions', and name a range of fossil fuels.

### Programme Outline

Learning Objectives	Activity
<ul style="list-style-type: none"> <li>• To identify the diversity of leaves and other photosynthetic organisms</li> <li>• To generate questions about leaves and the process of photosynthesis</li> </ul>	<p><b>The diversity of green</b></p> <p>In pairs, students explore an arboretum glade to discover the diversity of leaves, algae and lichen. Their questions will be collected and form part of the focus of the rest of the programme</p>
<ul style="list-style-type: none"> <li>• To state the process of photosynthesis as a word summary</li> <li>• To understand the role of chloroplasts in photosynthesis</li> </ul>	<p><b>Photosynthesis Game</b></p> <p>In interactive game that invites students to step inside a giant leaf to enact the process of photosynthesis, and representing it with a word summary.</p> <p>As an extension, working in small groups, the students will then be challenged to use a kit containing the reactant molecules (CO<sub>2</sub>, H<sub>2</sub>O) to create the product molecules (C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> and O<sub>2</sub>).</p>

<ul style="list-style-type: none"> <li>To explore a range of leaf adaptations for photosynthesis</li> <li>To state how a selection of leaf adaptations improves the efficiency of photosynthesis</li> </ul>	<p><b>Adaptation</b></p> <p>Observing leaves closely to identify different adaptations for photosynthesis. Includes differences between evergreen and deciduous, shades of green, waterproof or hairy layers, leaf arrangement within the canopy and canopy shape linked to position of the sun at different latitudes.</p>
<ul style="list-style-type: none"> <li>To identify how human activity can impact on the climate</li> <li>To consider how trees and forest can affect levels of CO<sub>2</sub> in the atmosphere, through the process of photosynthesis</li> </ul>	<p><b>Moving carbon</b></p> <p>An active approach to discovering how the process of photosynthesis in our forests can affect the levels of CO<sub>2</sub> in the atmosphere. Students consider different scenarios from humanity's past, present to explore the CO<sub>2</sub> emissions that can result from human activities, the impact on climate and role tree can play in reducing climate change for the future.</p>
<ul style="list-style-type: none"> <li>To assess understanding of the learning points of the programme</li> </ul>	<p><b>Conclusion</b></p> <p>An opportunity for students to summarise and take stock of learning so far.</p>

### Self-guided trails

To complement this half-day programme, we recommend our Growing Green Activity Pack. This can be viewed at [www.forestry.gov.uk/westonbirt-education](http://www.forestry.gov.uk/westonbirt-education)

### National Curriculum links

#### *Structure and function of living organisms*

- Cells and organisation– the function of chloroplasts
- Nutrition – plants making carbohydrates in their leaves by photosynthesis
- Gas exchange systems – the role of leaf stomata in gas exchange in plants

#### *Materials cycles and energy - Photosynthesis*

- The reactants in, and products of, photosynthesis, and a word summary for photosynthesis
- The dependence of almost all life on Earth on the ability of photosynthetic organisms such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere
- The adaptations of leaves for photosynthesis

#### *Chemistry – earth and atmosphere*

- The production of carbon dioxide by human activity and the impact on climate