

BE THE WAVE AR FRIG Y DON

Climate Change

Lesson Plan



cadwch keep
gymru'n wales
daclus tidy

**MARINE
CONSERVATION
SOCIETY**



UNDEB EWROPEAIDD
EUROPEAN UNION



Llywodraeth Cymru
Welsh Government

**Cronfeydd Strythurol a
Buddosoddi Ewropeaidd
European Structural
and Investment Funds**



Ariennir gan
Llywodraeth Cymru
Funded by
Welsh Government



Aims
<ul style="list-style-type: none"> • Understand connections between climate change and the ocean.
Objectives
<ul style="list-style-type: none"> • Identify how the ocean helps to reduce the effects of climate change • Explain how climate change is affecting the ocean • Discuss ideas to help reduce the effects of climate change on the ocean

Eco-schools topic	Global Goals
<ul style="list-style-type: none"> • Biodiversity • Global Citizenship 	<ul style="list-style-type: none"> • 13- Climate Action • 14 – Life Below Water

Links to the Curriculum for Wales	
Purpose	
<p>Ambitious, capable learners who:</p> <ul style="list-style-type: none"> • Can communicate effectively in different forms and settings • Understand how to interpret data and apply mathematical concepts <p>Ethical, informed citizens who:</p> <ul style="list-style-type: none"> • Engage with contemporary issues based upon their knowledge and values • Understand and consider the impact of their actions when making choices and acting • Show their commitment to the sustainability of the planet 	
What Matters Descriptions of Learning	Progression Step: Four
<p>Humanities</p> <ul style="list-style-type: none"> • Understand and explain how human actions affect the physical processes that shape environments overtime <p>Science and Technology</p> <ul style="list-style-type: none"> • Use methods of inquiry to investigate scientific questions • Use findings to draw valid conclusions • Explain how the impact of our actions contribute to the changes in the environment and biodiversity • Describe the interdependence of organisms in ecosystems and explain how this affects their chances of survival 	
LNF	Progression Step: Four
Writing	
<ul style="list-style-type: none"> • Make informed choices about vocabulary, idiomatic and figurative language, and syntax in order to express myself with fluency, accuracy and clarity. • Select and use appropriate strategies to plan and develop my writing for different purposes and audiences. • Adapt my writing style, choosing and using the best structures for different contexts and purposes, e.g., to successfully describe, explain, persuade, discuss. 	



- Write about my thoughts, feelings and opinions, using a range of techniques, e.g., emotive language, hyperbole, choice of pronouns (you, we), to show impact.
- Organise and construct my writing effectively, connecting and developing my ideas for a range of different contexts.

Measurement

- Read and interpret scales on a range of measuring instruments.

Interpreting Data

- Interpret graphs that describe real-life situations, including those used in the media, recognising that some graphs may be misleading.
- Draw conclusions from data and recognise that some conclusions may be misleading or uncertain.

Cynefin

Protection of Welsh waters

Activity One	Resources and Equipment
<p>Ocean Acidification</p> <p>Discussion on how climate change effects the ocean.</p> <p>Study the impact of Ocean Acidification in more detail. Watch the video that shows briefly what happens to calcium carbonate in acidic solutions.</p> <p>To investigate this further set up a class experiment. You will need 2 beakers, one with a water/vinegar mix (to mimic an acidic ocean) and the other just water. Record the pH of each solution on the Ocean Acidification Investigation worksheet. Sketch the calcium carbonate object and record its size and weight. Create a hypothesis of what will happen to a calcium carbonate object (shell or chalk) in the two different solutions over time. Refer to the video to help with the hypothesis. With a microscope or magnifying glass students can compare the structure of the object pre and post experiment. This experiment needs time and students should review and analyse results the following week.</p> <p>When analysing the results, students should repeat the measurements of weight, size and pH and sketch what the object finally looks like, using a magnifying glass/microscope to examine. Compare the results and discuss how this experiment relates to ocean acidification.</p>	<p>Climate change & the Ocean Presentation</p> <p>Ocean Acidification</p> <p>Investigation worksheet</p> <p>Shells or chalk Microscopes / magnifying glass Beakers Distilled water Vinegar/water mix Litmus paper/universal indicator/pH probe Balance Ruler</p>



Activity Two	Resources and Equipment
<p>Blue Carbon Ecosystems</p> <p>Watch the video and introduce students to blue carbon habitats and their role in helping to reduce carbon in the atmosphere.</p> <p>Interpret and analyse the three graphs in the presentation that show global carbon variation between ecosystems. Students should use the Blue Carbon Variation worksheet to explain what is being measured and what is being compared. They should describe patterns, trends and range in the data for each graph, quote figures and units and identify any anomalies. Students should explain the results of each graph and then compare the three graphs and draw a conclusion.</p>	<p>Climate change & the Ocean Presentation</p> <p>Blue Carbon Variation Worksheet</p>

Activity Three	Resources and Equipment
<p>How can we help reduce climate change?</p> <p>Introduce the various methods we can take to protect our ocean.</p> <p>In small groups, students should use the mind map template (1) to draw together everything they have learnt in activity 1, 2 &3.</p> <p>A completed example, mind map template (2) is provided.</p> <p>Students should summarise:</p> <ol style="list-style-type: none">1. The effects of climate change on the ocean2. How the ocean helps reduce climate change3. Threats to the ocean4. How we can manage our seas more efficiently5. How we can all make changes to benefit the ocean and reduce climate change. <p>Once students have completed their mind maps they should make links between the answers they gave for each question.</p> <p>For example</p> <ol style="list-style-type: none">1. Extreme weather causes storms which damage fragile habitats and destroys coastal properties.2. Plants in carbon storing habitats like saltmarsh, mangroves and seagrass take up and store carbon dioxide through photosynthesis.3. Coastal developments are destroying habitats like saltmarsh and mangroves.4. Action is needed to reduce coastal construction that damages climate smart habitats like saltmarshes.	<p>Climate change & the Ocean Presentation</p> <p>How can we reduce climate change – template 1</p> <p>How can we reduce climate change – completed example template 2</p>



5. Supporting marine conservation charities can help raise awareness.

Students should then use these links to come up with a campaign idea to help reduce climate change. They should write a persuasive text for why their campaign needs action. They could use the themes of each mini mind map to help structure their paragraph.



#BeTheWave

Apply the knowledge gathered in the lesson into action as ethical and informed citizens. It is an important aspect to ensure students know they have the power to enact and make changes within their own lives and within the school. It is also a positive step which helps to balance some of the negative impacts explored within the lesson.

Decide on any actions to take forward either as individuals or as a class, these are some suggestions, or the class could generate their own.

School:

- Improve ocean literacy within your school by introducing ocean topics into PSHE, geography, science, history, art, design technology, English and drama.
- Does your school have a green/eco club? It is a great way to help students learn more about our incredible natural environment including diversity within your school grounds and further afield. Your group could dedicate a term to explore the underwater world in Wales.
- If your school is near the coast, why not take your students out for a day trip to the beach. It could be linked to the curriculum or as part of an experience day. If you want a helping hand the Marine Conservation Society offer free seashore safaris for school groups.

Individual:

- Inspire your friends and family by sharing with them what you've learnt about the incredible diversity of habitats and species in coastal waters around Wales.
- The sea and coastline around Wales is fantastic. The best way to learn more about it and to stay inspired is to get out there and enjoy it.
- If you live near the coast there are several citizen science projects you can get involved with, to help record the diversity on the coast contributing to important science.



- Record seaweed diversity on the shore to help us understand how this is changing overtime: www.mcsuk.org/what-you-can-do/volunteering/big-seaweed-search/
- Report any sightings of jellyfish and turtles: www.mcsuk.org/sightings/
- Record quantity and variety of shark egg cases: www.sharktrust.org/great-eggcase-hunt

Alternative Activities	Resources and Equipment
<p>Activity One – Climate Diary</p> <p>If you have time to run this session over several classes start the topic with a diary exercise. Ask students to write down briefly what actions they have completed so far today. Then ask them to link these actions to energy consumption and climate change. For example, what did they eat for breakfast? How does this link to climate change and energy?</p> <p>To finish the topic, ask students to review their diaries. Students should think creatively and write down ideas for alternative greener diary entries. How could they make simple changes to the actions in their day to reduce their climate impact? For example, could they make changes to what they have for breakfast to make it a greener meal?</p> <p>Activity Two – Biofuels</p> <p>Shipping and ocean transport currently make up 3% of global anthropogenic greenhouse gas emissions. This is expected to double by 2050. One way to reduce emissions is by using alternative greener fuels such as biofuels. This experiment explores how we could reduce carbon emissions for our shipping and ferries and pleasure boats. Students will see how using biofuels can create green energy and is therefore a possible solution to reduce our dependency on fossil fuels in the transport industry.</p> <p>Full instructions can be found on page 11.</p> <p>https://bbsrc.ukri.org/documents/practical-biofuel-activities-complete-pdf/</p>	



Ocean Acidification Worksheet

Hypothesis:

Calcium carbonate sketch

Before experiment	After experiment

	Acidic water		Neutral Water	
	BEFORE	AFTER	BEFORE	AFTER
pH				
Size				
Weight				

This experiment shows:



Blue Carbon Variation

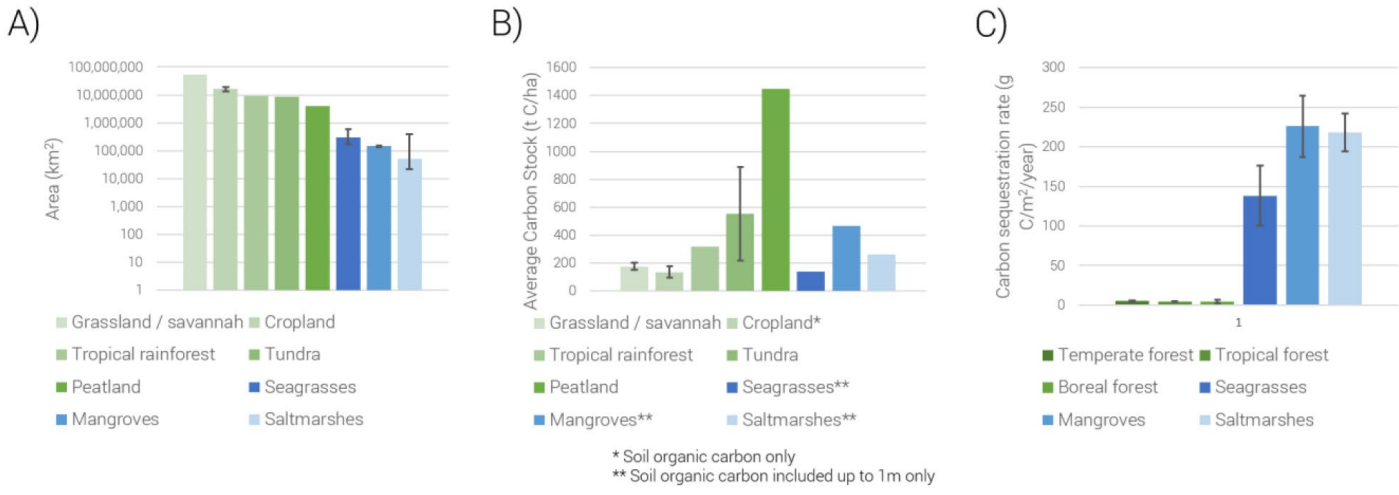


Figure 2: Variation among selected ecosystems important for terrestrial or blue carbon in: estimated total global area (A - note logarithmic scale); average carbon storage per area (B); and carbon sequestration rates (C). Error bars represent the range of estimates for A and B, and standard error for C. Sources: Epple et al 2016 for A and B; Mcleod et al 2011 for C

What is being measured in graph A?

Describe patterns, trends and range in the data for graph A. Quote figures and units, and identify any anomalies:



What is being measured in graph B?

Describe patterns, trends and range in the data for graph B: Quote figures and units, and identify any anomalies:

What is being measured in graph C?

Describe patterns, trends and range in the data for graph C: Quote figures and units, and identify any anomalies:

Compare all the results for all three graphs and summarise what the data is showing:

1.

How is climate change affecting the ocean? And how does this affect people?

2.

How does a healthy ocean help to reduce climate change?

3.

What threats to the ocean might affect it from being able to help reduce climate change?

4.

What management strategies can the government / business take to help protect the ocean and reduce climate change?

5.

What changes can you make to both protect the ocean and reduce climate change?

1.

How is climate change affecting the ocean? And how does this affect people?

Ocean acidification – affects corals, shellfish including scallops mussels and crabs – less seafood for fishers to catch

Sea level rise – causing floods & erosion – destroys coastal homes.

Ocean currents - change migration of species – effects fishing

Ocean currents – further effect whole weather system – wildlife’s, draughts, storms effecting land.

Extreme weather - causing storms which damage fragile habitats - floods destroy costal properties.

Plants & animals move – species could die out – less fish for fishers to catch & people to eat.

2.

How does a healthy ocean help to reduce climate change?

Plants in carbon storing habitats, like saltmarsh, mangroves and seagrass, take up and store carbon dioxide through photosynthesis.

Algae, like kelp and phytoplankton, take up carbon dioxide.

Carbon is built up in the marine food chain. When animals die this carbon might be transferred to ocean sediments.

3.

What threats to the ocean might affect it from being able to help reduce climate change?

Destructive fishing practices damaging habitats like seagrass beds and kelp.

Boat anchors damage seagrass beds.

Coastal development destroying habitats like saltmarsh and mangroves.

Pollution influences the health of plants and animals and reduces their ability to store carbon.

Fishing practices like trawling & dredging releases carbon dioxide from sediments.

Make sure fishing is sustainable and doesn’t damage marine habitats.

4.

What management strategies can the government / business take to help protect the ocean and reduce climate change?

Increase renewable energy like wind.

Reduce emissions from shipping.

Reduce coastal construction that damages climate smart habitats like

Increase highly protect marine areas that protect climate smart habitats.

5.

What changes can you make to both protect the ocean and reduce climate change?

Reduce electricity usage.

Walk, cycle, or get the bus to reduce greenhouse gas emissions.

Buy less stuff – less consumption, less transport.

Only eat fish that has been sustainably caught.

Shop local, to reduce emissions from shipping / flying.

Support marine conservation charities.



cadwch keep
gymru'n wales
daclus tidy

33-35 Heol yr Eglwys Gadeiriol, Caerdydd, CF11 9HB | 33-35 Cathedral Rd, Cardiff, CF11 9HB
029 2025 6767 keepwalestidy.cymru info@keepwalestidy.cymru

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