

Biosphere Explorers

A SENSE OF PLACE

Includes links to
C for E
E's and O's

Full
presentations
and
teacher notes

A teacher guide for
Curriculum for Excellence Second Stage (P5-7)

BIODIVERSITY

CLIMATE
CHANGE

Contains
games, quizzes
and activities
for
active
learning

Uses local
examples to
give learners
a sense of
place

SUSTAINABILITY

RENEWABLE
ENERGY



The
Holywood
Trust

BARFIL
CHARITABLE TRUST

crichton
carbon
centre

GALLOWAY AND
SOUTHERN AYSRSHIRE
BIOSPHERE

BIOSPHERE-EXPLORERS

GALLOWAY GLENS
Landscape Partnership

Workshop 1
WE ARE ALL CONNECTED!

Contents

- Explanatory notes for Slideshow
- Activity -Biosphere quiz

O's & E's - Literacy - discussion, valuing others contributions, making notes, understanding and evaluating - responding to questions and asking different questions in return.

Slideshow - 1 hour

Quiz & discussion - 45 minutes

Workshop 2
WE ARE UNIQUE!

Contents

- Explanatory notes for slideshow
- Activity - Biosphere poster

O's and E's - This activity is related to the Arts section of the C for E. These include to create and present work which shows awareness and recognition of detail – use a range of media and technologies to create images for specific tasks. The childrens can discuss each other's posters and offer constructive comment on their own and other's work.

Slideshow - 1 hour, Activity - 1 hour

Workshop 3
BIODIVERSITY AND THE BIOSPHERE

Contents

- Explanatory notes for slideshow
- Activity - food web game
- Biodiversity survey

Slideshow - 1 hour

Food web game - 45 minutes

Survey - as long as you have!

O's and E's - Biodiversity and interdependence are specific topics in Science in the Second Stage – learners should be able to identify and classify examples of living things, have knowledge of the interactions and energy flow between plants and animals in ecosystems, food chains and webs. They should also have the opportunity to contribute to the design or conservation of a wildlife area.

Workshop 4
CLIMATE CHANGE & THE BIOSPHERE

Contents

- Explanatory Notes for slideshow
- Activity - The Greenhouse Gas Board Game

Slideshow - 1 hour

Activity - 1 hour

O's and E's - Sciences - Planet Earth- "I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things". Technologies - "I can analyse how lifestyles can impact on the environment and Earth's resources and can make suggestions about how to live in a more sustainable way".

Workshop 5
SUSTAINABILITY IN THE BIOSPHERE

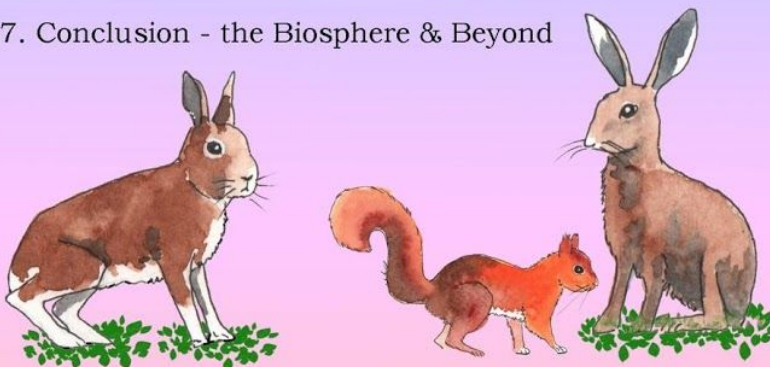
Contents

- Explanatory notes for slideshow
- Activity 1 - renewable energy in our Biosphere
- Activity 2 - Little Ways to Save the Planet
- Slideshow - 1 hour
- Activities - an hour each

O's and E's - Learning for Sustainability is a core entitlement for all learners, and should be embedded in all areas of learning. This workshop aims to give a basic knowledge that can then be utilised across the rest of the Curriculum.

Contents

3. Introduction to the Biosphere Explorers Project
4. Teacher notes for Workshop 1 - We are all Connected!
7. Slide by slide, Workshop 1
11. Teacher notes - examples of interconnectedness
12. Slide by slide, Workshop 1 - ctd. QUIZ
17. Teacher notes for Workshop 2 - We are Unique!
19. Slide by slide, Workshop 2
21. Teacher notes - UNESCO & Biospheres
23. Slide by slide, Workshop 2 ctd.
27. Teacher notes - poster activity
28. Teacher notes for Workshop 3 - Biodiversity & the Biosphere
31. Slide by slide, Workshop 3
33. Biodiversity in the Galloway & Southern Ayrshire Biosphere - slide detail
34. Slide by slide, Workshop 3 ctd.
35. Teacher notes - ecosystem engineers
36. Teacher notes - instructions for Food Web Game
39. Slide by slide, Workshop 3 ctd.
40. Teacher notes - carrying out a Biodiversity Survey
41. Slide by slide, Workshop 3 ctd.
42. Teacher notes - improving Biodiversity
43. Proud Supporter of the GSAB Information Sheet
44. Slide by slide, Workshop 3 ctd.
45. Teacher notes - Workshop 4 - Climate Change and the Biosphere
47. Slide by slide, Workshop 4
50. Teacher notes - Atmospheres of other planets
51. Slide by slide, Workshop 4 ctd.
52. Teacher notes - the composition of Earth's atmosphere
53. Slide by slide, workshop 4 ctd.
55. Teacher instructions for the Greenhouse Gas board Game
59. Teacher notes - Workshop 5 - Sustainability & the Biosphere
61. Slide by slide, Workshop 5
65. Teacher notes - renewable energy resources
66. Slide by slide, Workshop 5 ctd.
67. Conclusion - the Biosphere & Beyond



Introduction

Biosphere Explorers is an environmental education project set within the Galloway and Southern Ayrshire Biosphere which aims to educate and enthuse local children about the beautiful area that we live in, and reconnect them to nature and the environment, whilst helping them develop the tools they need to become responsible citizens in the challenging future that we all face.



This pack contains five workshops which were originally delivered by a Project Officer to primary 5-7's, but which have been made available to all teachers in the Biosphere. Workshop 1 focuses on defining a Biosphere, and goes on to discuss the connections between our Biosphere and others all over the World. Workshop 2 goes on to emphasise this uniqueness - why is our Biosphere so special? The third workshop uses our Biosphere to learn about Biodiversity and Conservation, and Workshop 4 discusses climate change. Workshop 5 brings it all together, focussing on Sustainability and Renewable Energy.



Learning for Sustainability is a core part of the Curriculum for Excellence, and is expected to be taught over all the core areas of the curriculum. This pack aims to help teachers do just that.

Outdoor learning is also a key focus of the C for E and this pack aims to assist and support teachers in getting their pupils outdoors more, reconnecting them with nature in direct and positive ways, while also learning about the History and Geography of their local landscape, and helping to give them a Sense of Place.



To this end, the second part of the pack is entitled Out & About in the Biosphere, and provides details of Outdoor Learning Opportunities available in our local area. Experiences like these are essential for children to learn respect and to care for their place in the world.



It is hoped that this learning resource, whilst providing the necessary tick boxes for parts of the Curriculum for Excellence, will also be fun for those involved. The lessons are designed to provoke class discussion, and concern topics which are on the top of everyone's agenda at the moment, not least the Scottish Government, who have set ambitious targets for all of us to work towards to mitigate and adapt to the effects of human-induced climate change. Although the issues can be daunting and frightening, it is only by discussing them and understanding them that we can provide the next generation with the tools they need to adapt and thrive in the future.

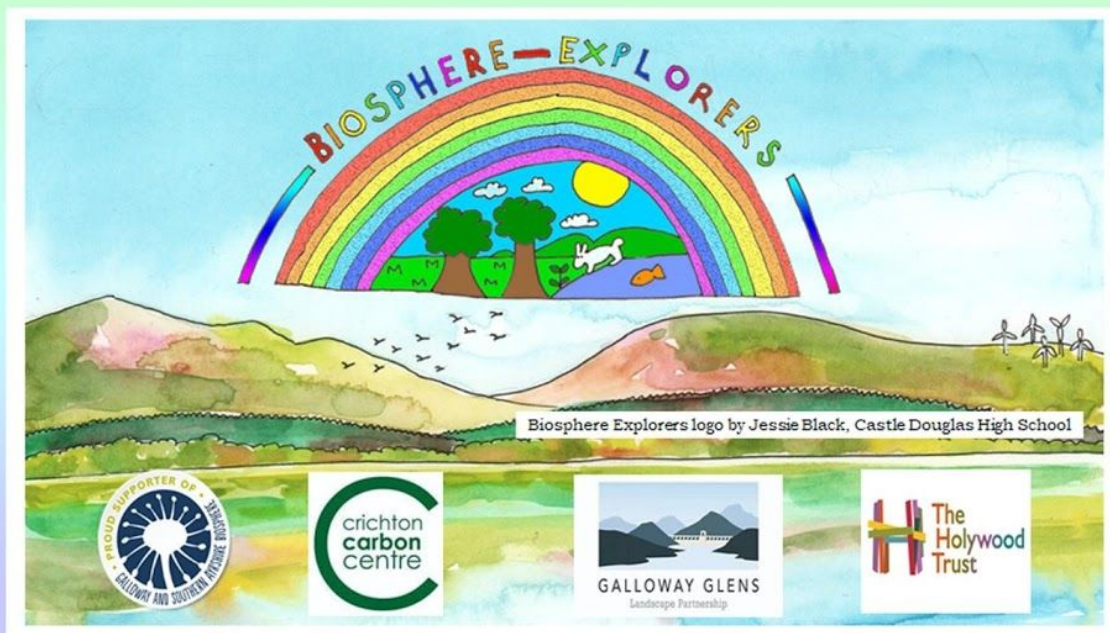
Workshop 1: An Introduction to UNESCO Biospheres

Teacher Background

The aim of this workshop is to introduce the children to the concept of UNESCO Biospheres - why they were invented, what they are, where they are and who lives there. This introduction can help introduce the class to the concept of 'A Sense of Place'. The session deliberately starts on a very grand scale, with Earth's place in the Solar System but focuses right down to us as individual humans, in our case, lucky enough to live in a UNESCO Biosphere. This gives the class the opportunity to develop a sense of scale to their place in the world.

A second focus of this session is to discuss the interconnectedness of all things; how we are all connected to each other as human beings, and also to all other life on Earth. This session takes the form of a powerpoint presentation to the class, with a lot of room for discussion, plus an associated activity.

The session should take approximately 1.5 - 2 hours to complete.



The powerpoint presentations are provided on a USB stick, the accompanying notes are saved there too (in the folder Primary Teachers Pack-Session 1- Introduction to UNESCO Biospheres).

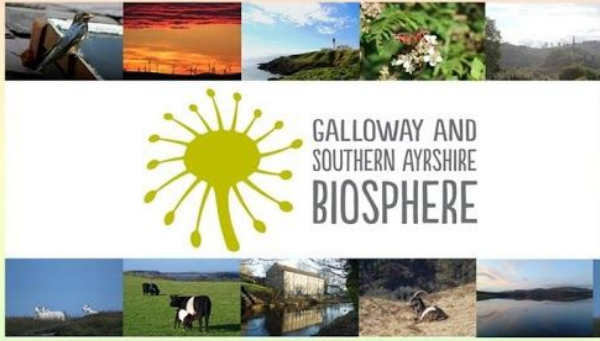
Slide 1, above, contains hyperlinks to the websites of the sponsors and funders.

In 2019, Biosphere Explorers held a logo competition to design a logo for the project.

The winning design, from nearly 50 entries, was the rainbow logo in Slide 1, designed by Jessie Black of Castle Douglas High School.



Introduction



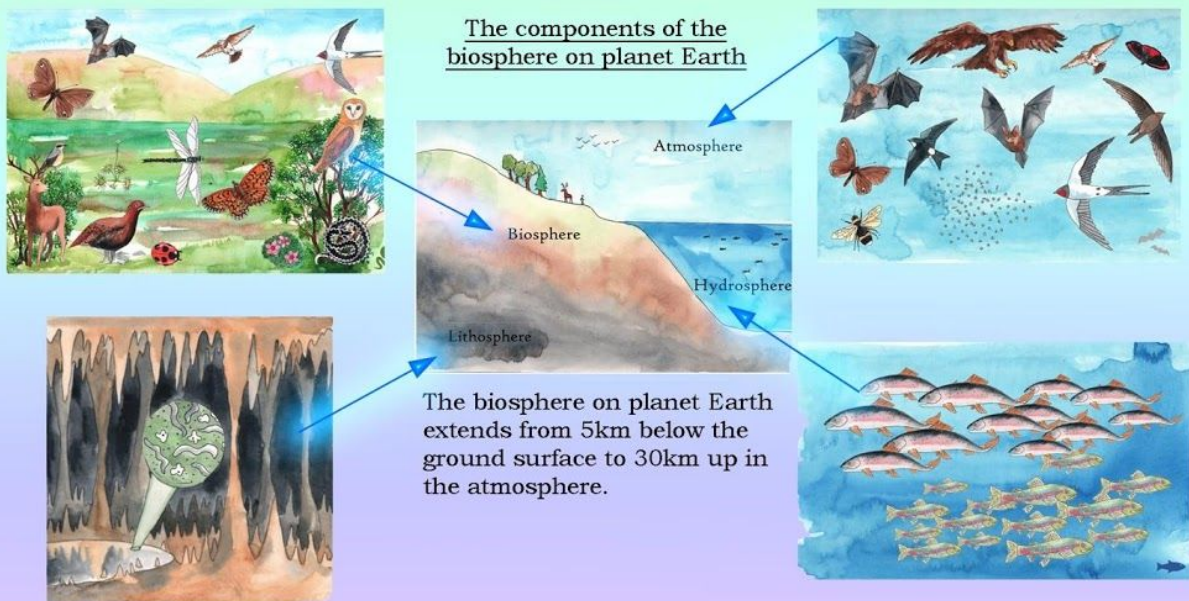
So what is the Galloway and Southern Ayrshire Biosphere (GSAB)?

Designated by UNESCO in 2011, the GSAB is a large landscape area in South West Scotland, which has been recognized at an international level for its **rare species** of animals and plants, its unique and globally **important landscapes and habitats**, and for its **commitment to sustainability** in the short and long term.

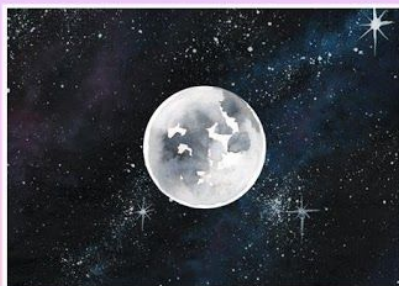
Much more information on the GSAB can be found at: www.gsabiosphere.org.uk

What is the biosphere?

The word 'biosphere' has two meanings in this context. 'Biosphere' as in the UNESCO designation mentioned above, and '**biosphere**' without a capital B, which can be defined as 'the place on a planet where life can exist'. As far as we know, in our solar system, only the planet Earth has a biosphere.



The moon is NOT in the biosphere!

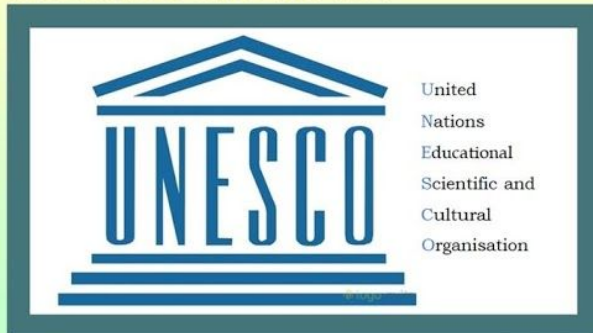


But, of course, humans are.



What is a Biosphere?

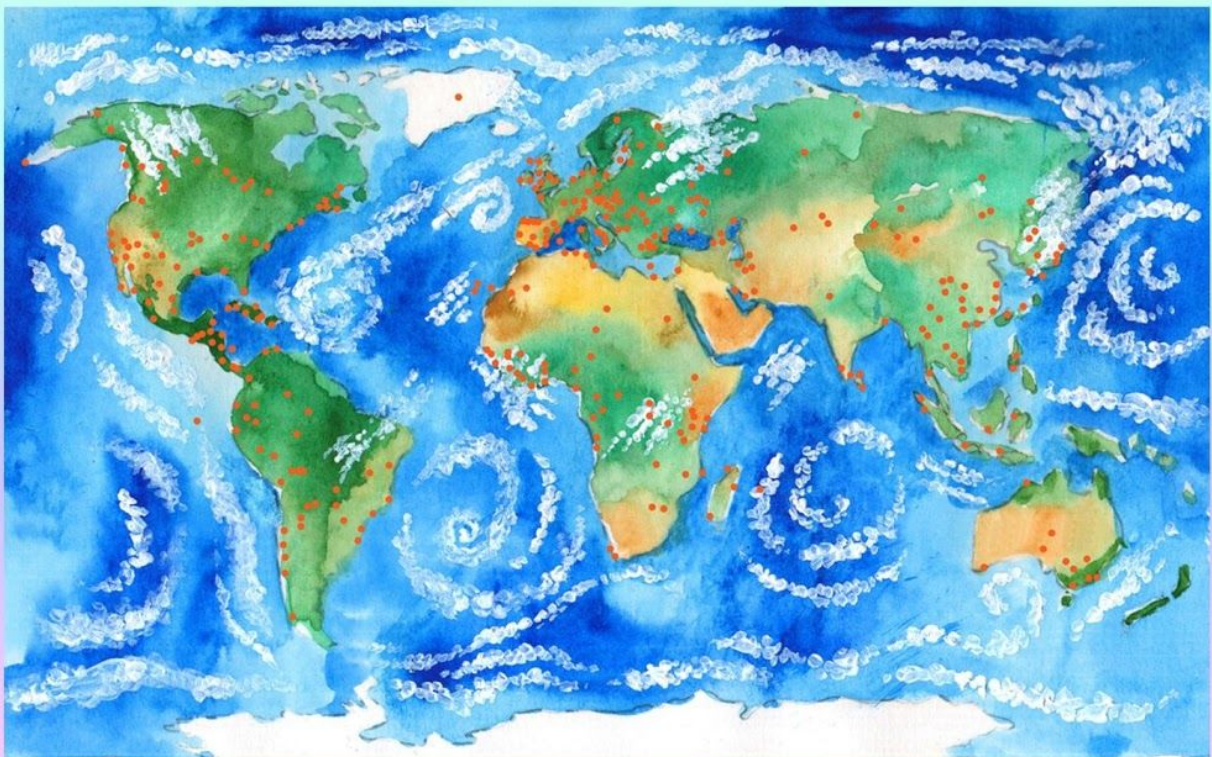
If the biosphere is the space where life on Earth exists, then what is a Biosphere? An organisation called UNESCO came up with the concept of Man and the Biosphere in 1971. This programme aims to establish the improvement of relationships between people and their environment. The first Biosphere Reserves were designated soon afterwards to fulfil this aim.



UNESCO's mission is to contribute to the building of peace, the eradication of poverty, sustainable development and intercultural dialogue through education, the sciences, culture, communication and information.

Visit www.unesco.org to find out more about the huge variety of work that UNESCO does worldwide.

Man and the Biosphere combines the natural and social sciences, economics and education to improve human livelihoods and the equitable sharing of benefits, and to safeguard natural and managed ecosystems, thus promoting innovative approaches to economic development that are socially and culturally appropriate, and environmentally sustainable.



This map shows as a selection of the current network of Biosphere Reserves. There are now 701 Biosphere Reserves in 126 countries across the globe. When looking at this map, it may help to ask the children to point out some of the countries or continents. Make sure that you ask them where Scotland is on this map! Children often ask if Antarctica is a Biosphere Reserve. The answer is that it is not, because Antarctica is part of the global commons and as such is heavily protected in other ways.

Workshop 1

WE ARE ALL CONNECTED!

Contents

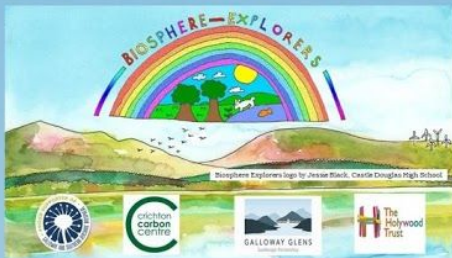
- Explanatory notes for Slideshow
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O's & E's - Literacy - discussion, valuing others contributions, making notes, understanding and evaluating - responding to questions and asking different questions in return.

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Quiz & discussion - 45 minutes

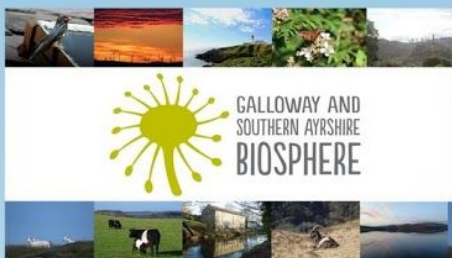
Slide 1:



Welcome to Biosphere Explorers! Today we are going to learn about the Galloway and Southern Ayrshire Biosphere Reserve; a special place, which just happens to be where we live!

EACH LOGO HAS A HYPERLINK TO THE WEBSITE OF THE FEATURED ORGANISATION

Slide 2:

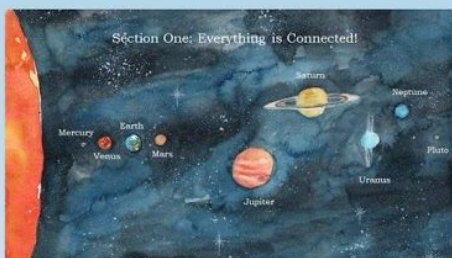


We live in the Galloway and Southern Ayrshire UNESCO designated Biosphere.

Hands up if you knew that. What is a Biosphere? Any ideas?

Today we are going to find out what a UNESCO Biosphere is, and why they are special. To find our place in the world, we need to start on a very big scale.

Slide 3:



Can anyone tell me what this is? It is a diagram of our solar system. **Can you name the planets as I point to them, starting at the sun?**

(CLICKING WILL REVEAL THE NAME OF THE PLANETS ONE BY ONE)

As far as we know, only one of these planets supports life. **Which one?**

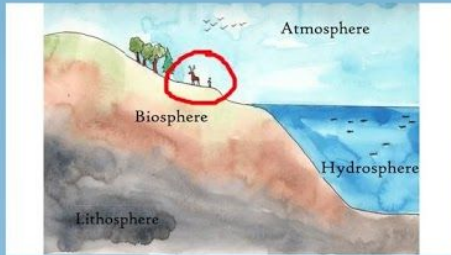
Slide 4:



Of course, Planet Earth! That means that, as far as we know, only Planet Earth has a biosphere. That is somewhere on the planet where the conditions are right to support life. As far as we know, no other planet or moon in the Solar System has a biosphere.

THERE MAY BE DISCUSSION HERE, AS CHILDREN MAY HAVE HEARD IN THE NEWS OF THE POSSIBILITY OF LIFE ON EUROPA (ONE OF THE MOONS OF JUPITER) OR OF FOSSIL BACTERIA BEING FOUND ON MARS. THE POINT HERE IS THAT AT THE TIME OF WRITING WE ONLY HAVE PROOF OF LIFE ON EARTH, NOWHERE ELSE.

Slide 5:



The biosphere is anywhere on a planet which can support life, whether plant, animal, fungi or bacteria.

CLICK ON THE DEER TO BE TAKEN TO THE LAND SURFACE SLIDE (SLIDE 6)

Slide 6:

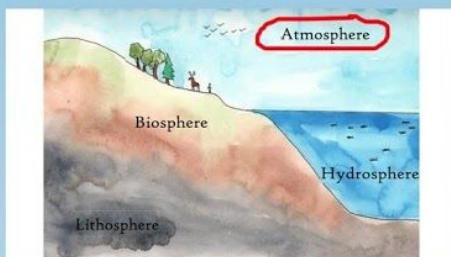


That includes the land surface, including the soil.

Can you name any of these animals? They all live in our Galloway & Southern Ayrshire Biosphere.

ONCE THE ANIMATION HAS PLAYED, RETURN TO SLIDE 5 BY CLICKING ON THE SNAKE ICON AT THE BOTTOM RIGHT OF THE SLIDE.

Slide 5:



Life is also found in the atmosphere.

CLICK ON 'ATMOSPHERE' TO BE TAKEN TO SLIDE 7

Slide 7:



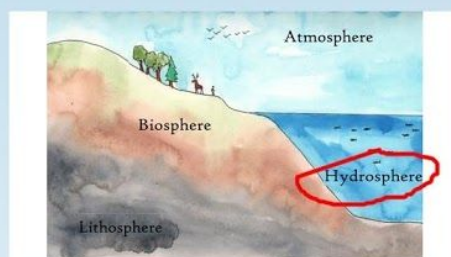
Can you name any of these animals?

Algae have been found floating 30 km up at the top of the atmosphere! What are algae?

Algae are microscopic plants.

CLICK ON THE BAT ICON BOTTOM RIGHT TO RETURN TO SLIDE 5

Slide 5:

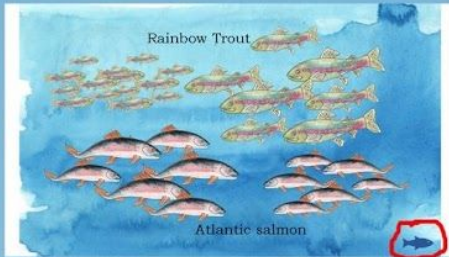


Life is also found in the hydrosphere - what do you think the hydrosphere is?

The Hydrosphere includes the oceans, seas, lochs, rivers, ponds and burns - both fresh water and salt water, where life is found.

CLICK ON THE WORD 'HYDROSPHERE' TO BE TAKEN TO SLIDE 8.

Slide 8:

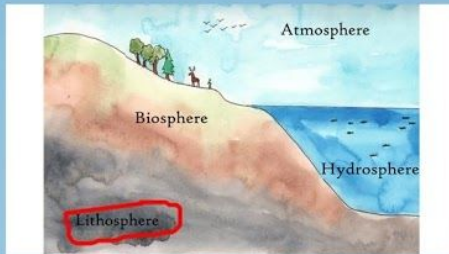


Can you name these fish?

Life has been found at the very bottom of the deepest parts of the ocean. Challenger Deep, the deepest part of the Marianas Trench in the Pacific Ocean, is 11 km deep and is now known to be abundant in animal life.

CLICK ON THE FISH ICON TO BE TAKEN BACK TO SLIDE 5

Slide 5:



And lastly, the lithosphere.

What do you think the lithosphere might be?

The lithosphere is the rocky outer part of the Earth, between the land surface and the molten mantle beneath.

CLICK ON 'LITHOSPHERE' TO BE TAKEN TO SLIDE 9

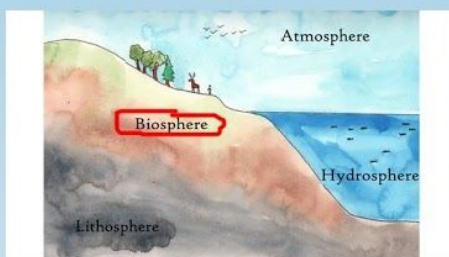
Slide 9:



The lithosphere is largely unexplored, but we know that there are nematode worms and bacteria living 4 km underground in caves and mines. Bacteria have also been found living in the tiny air spaces within rocks!

CLICK ON THE BEETLE ICON TO BE TAKEN TO SLIDE 5 FOR THE LAST TIME

Slide 5:



All these components make up the biosphere.

CLICK ON TO THE CENTRE OF THE SLIDE TO BE TAKEN TO SLIDE 10

Slide 10:



Is the moon in the biosphere? No!

Slide 11:



Are we in the biosphere? Yes!

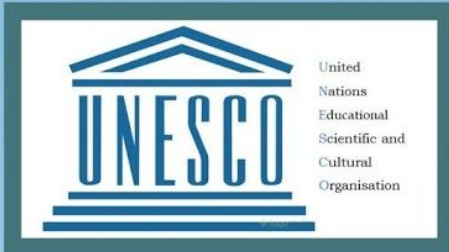
Slide 12:



So that's the biosphere on the big scale. Would you agree that it is a good idea to protect the biosphere? **How could we do that?** After all, the biosphere is huge! It would be very hard to protect all of it. Maybe a good idea would be to protect lots of little bits of it, and that would help to protect the whole biosphere.

YOU MIGHT WANT TO ALLOW TIME FOR A BIT OF CLASS DISCUSSION HERE.

Slide 13:



UNESCO stands for United Nations Educational Scientific and Cultural Organisation.

(CLICK TO START ANIMATION).

Their motto is 'building peace in the minds of men and women.' They do lots of things to promote peace and happiness, to help people in trouble and encourage people to look after our planet. And this is where we come in.

Slide 14:



The people at UNESCO decided that a good way of protecting the planet would be to protect lots of little bits of it. So they decided to create Biosphere Reserves; areas of land and sea that are extra special places on Earth. Little pockets of biosphere around the world where human would be encouraged to conserve nature at the same time as using the land and resources sensibly and sustainably.

THIS SLIDE SHOWS EXAMPLES OF BIOSPHERES AROUND THE WORLD, THE SLIDE STARTS AUTOMATICALLY, BUT WILL NEED A CLICK TO MOVE IT ON TO THE NEXT SLIDE

Slide 15:



There are now 701 Biosphere Reserves in over 120 countries.

Slide 16:



Each of these dots represents a very special place in the world that needs to be protected. We're going to look at a few of these Biospheres in more detail.

It's quiz time!!

Teacher Notes - We are all connected!

After the preceeding presentation and resulting discussions, the next part of the session is for the children to investigate further how we are all connected as part of the global biosphere. Before explaining the rules, and handing out the Quiz Cards, it might be interesting to ask the children if they can think of any connections between different countries or continents themselves.

Some examples:



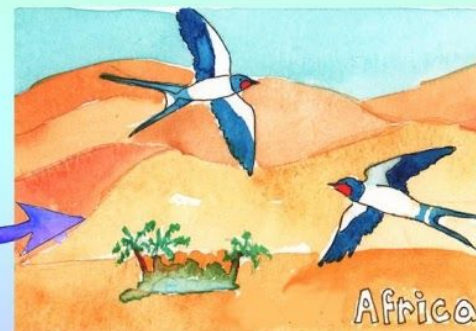
In 2010, the Icelandic volcano Eyjafjallajökull erupted, releasing millions of tons of volcanic ash into the atmosphere.



It was thought that the ash in the atmosphere could damage aircraft engines, leading to the cancellation of flights all over Europe.



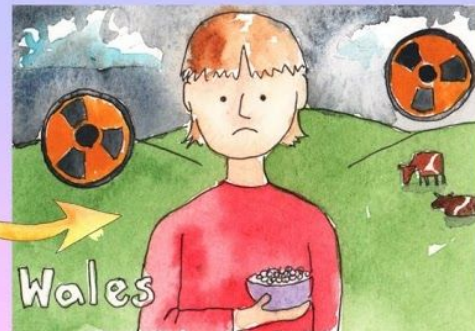
Swallows spend the Summer in Scotland to raise their babies, taking advantage of our long summer days and abundance of midges.



When the days begin to get shorter, swallows migrate thousands of miles to Winter in Africa.



In 1986, the Chernobyl Nuclear Power Plant suffered a catastrophic failure of its number 4 reactor, due to human error. The resulting explosion and fire released radiation into the atmosphere.



The radioactive cloud spread across Europe, with much of the contamination deposited on the Welsh mountains, the Scottish highlands and the Alps, contaminating water supplies and livestock. In some countries it was deemed unsafe to drink milk.

Slide 17



This is the first part of the quiz, and it focuses on interconnectedness. What do the Biospheres have in common? In what ways are they the same?

SPLIT THE CLASS INTO GROUPS (6 IN A GROUP MAXIMUM). EACH GROUP GETS A SET OF THE INFORMATION SHEETS - THERE ARE 6 BIOSPHERES IN TOTAL TO LOOK AT. THE CLASS GETS 10 MINUTES TO READ THROUGH THE SHEETS, SHARING INFORMATION, TAKING NOTES, AND SWAPPING THE CARDS WITHIN THE GROUP. THEY SHOULD BE FOCUSING ON SIMILARITIES BETWEEN THE DIFFERENT BIOSPHERES. ONCE THE CLASS HAS STARTED READING AND DISCUSSING THE INFORMATION, MOVE ON TO THE NEXT SLIDE AND LEAVE THIS UP FOR THE DURATION OF THE QUIZ.

Slide 18



Here are the names of the Biospheres to help you spell them.

The next four slides pertain to the answer sheet.

GIVE THE GROUPS A QUESTION SHEET EACH TO WRITE THEIR ANSWERS ON. THE BIOSPHERE INFORMATION SHEETS ARE NOT AVAILABLE TO LOOK AT DURING THIS TIME - THEY SHOULD ANSWER FROM MEMORY!

YOU CAN ALLOW BONUS MARKS FOR THE SUB-QUESTIONS, OR USE THEM AS POINTS FOR DISCUSSION.

Answers

WHEN DISCUSSING THE ANSWERS WITH THE CLASS, THERE ARE 3 SLIDES TO AID UNDERSTANDING

Question 1: What industry is important in all the Biospheres? **TOURISM**
What other industries are important? e.g **Farming**

Question 2: How many of the Biospheres are also Dark Sky Parks?

3, The Galloway & Southern Ayrshire Biosphere, the Rhon and Beaver Hills

What is a Dark Sky Park?

Slide 19



Dark Sky Parks are areas of land which have very low levels of light pollution at night. They are excellent places for viewing the stars, and usually have an observatory within them. In the centre of Dumfries at night, you would probably see less than 100 stars in the night sky, and if you looked at the constellation of Orion, you might only see the three stars of Orion's Belt. However, if you went to Clatteringshaws at night, because of the low light pollution, you should be able to see thousands of stars on a clear night, including 40 stars within Orion. People from cities travel to Dark Sky Parks to see stars, so they are important for tourism.

Question 3: Name the 2 smallest Biospheres. Maccabee and St. Mary's
 Which of these had no people living in it? Machabee
 Which Biosphere had the largest population? Dublin Bay

Question 4: Name the largest Biosphere Galloway & Southern Ayrshire Biosphere

Question 5: Which two Biospheres are important to protect the Marsh Fritillary (a rare butterfly)?
 Rhon & Dublin Bay.

Slide 20



The Marsh Fritillary is a species of butterfly in need of urgent protection across most of Europe.

Rhon is 1500km from Dublin Bay, and the butterfly does not migrate.

Why is the same species found so far apart?

The Marsh Fritillary used to be widespread across Europe, but due to habitat loss caused by humans, there are less places for the butterfly to live. The populations which are left are remnants of the original healthy population.

Which other Biosphere has damp grassland? The Galloway & Southern Ayrshire Biosphere.
 The marsh fritillary is not found here - why not? It used to be found in Scotland, but it has lost its habitat. It could be introduced with careful conservation.

Question 6: Which 2 reserves contain coral reefs? Maccabee and St. Mary's

Question 7: Name the only reserve which doesn't have forest or woodland as an important habitat.
 Dublin Bay

Forests and Woodlands are important habitats around the world. Why? Contain lots of species, remove pollution from the atmosphere, store carbon, produce oxygen, recreation, wood for building, fires.

Question 8: Name the 2 reserves important for conserving the Black Grouse.
 Rhon and the Galloway & Southern Ayrshire Biosphere.

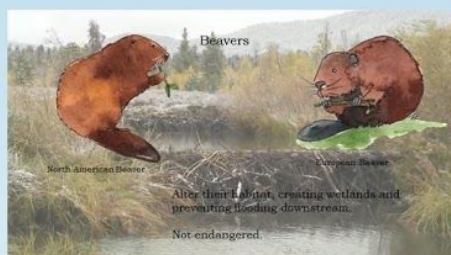
Slide 21



The Black Grouse suffers some of the same problems as the Marsh Fritillary. Through habitat loss it is very rare.

Question 9: Which 2 reserves contain beavers? How are the Beavers different? Rhon & Beaver Hills - they are different species.

Slide 22



Is there another biosphere which could support beavers? If the class find this tricky, remind them that beavers like wet places with lots of trees - this should jog their memories as to the correct answer, which is of course, the Galloway and Southern Ayrshire biosphere!

The European Beaver did used to live in Scotland until they were hunted to extinction about 400 years ago. People ate them, used their waterproof fur for clothing, and also used a substance they excrete called castoreum as it has medicinal properties.

There have been populations of beavers reintroduced to parts of Scotland, but not to the GSA Biosphere yet...

Question 10: Name 5 foods found in more than one Biosphere.
Beef, lamb, cheese, ice cream, beer, bread fruit, rum, berries

IF YOU HAVE A COMPETITIVE CLASS, YOU CAN ADD UP THEIR POINTS AND SEE WHICH TEAM GOT THE MOST ANSWERS RIGHT. THEN MOVE ON TO THE NEXT SLIDE.

Slide 23



So you can see that, although these Biospheres are far apart on a global scale, in fact they have lots of things in common. they are connected in many ways. **Can you remember some of the things that connected them?**

Slide 24



Part 2 of the quiz focuses on uniqueness, and prepares the class for the second workshop in the session. What makes these Biospheres different from each other, as that gives us reasons why they are special.

AS BEFORE, THE CLASS IS SPLIT INTO GROUPS AND HAS A SET OF THE INFORMATION SHEETS EACH. EACH GROUP HAS 10 MINUTES TO READ THE SHEETS AGAIN. THIS TIME, THEY SHOULD BE FOCUSING ON DIFFERENCES BETWEEN THE BIOSPHERES, IN OTHER WORDS, WHAT MAKES THEM UNIQUE. ONE THING IN PARTICULAR THAT PREVIOUS CLASSES HAVE FOUND TRICKY IS THE WORD 'ENDEMIC', IT MIGHT BE WORTH GOING THROUGH THE DEFINITION ON THE SHEET WITH THE GROUPS AS YOU GO ROUND. ONCE THE CLASS HAS STARTED READING AND DISCUSSING THE INFORMATION, MOVE ON TO THE NEXT SLIDE AND LEAVE IT UP FOR THE DURATION OF THE QUIZ.

Slide 25



Here are the names of the Biospheres to help you spell them.

The next three slides pertain to the answers and should be shown when you are going through the answers with the class.

GIVE THE GROUPS A QUESTION SHEET EACH TO WRITE THEIR ANSWERS ON. THE BIOSPHERE INFORMATION SHEETS ARE NOT AVAILABLE TO LOOK AT DURING THIS TIME, THEY SHOULD ANSWER FROM MEMORY!

AS BEFORE, YOU CAN ALLOW BONUS MARKS FOR THE SUB-QUESTIONS OR USE THEM AS POINTS FOR DISCUSSION.

Answers

Question 1: What does 'endemic' mean? **A species that is only found in one place in the world.**

Can you give an example from the sheets of a species that is endemic? Any of the Mauritian animals are. Where are these species likely to be found? Islands and very isolated parts of the world.

Question 2: Which Biosphere is the only one in the world found within a capital city? **Dublin Bay.**
What county is Dublin the capital of? **Eire or Southern Ireland.**

Question 3: Which Biosphere has a ski festival in the winter? **Beaver Hills.**

Question 4: Which Biosphere is especially important to protect the Leatherback Turtle? **St Mary's.**

Slide 26



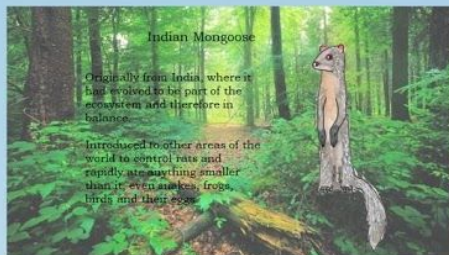
Can anyone tell me why St Mary's is so important to the Leatherback turtle? After all, these animals live in the sea and can go wherever they like. Turtles lay their eggs on tropical beaches, and so having these beaches protected from development by humans is very important for the future of the Leatherback, and other endangered turtles.

Question 5: Which Biosphere has the most tourist visitors? **Rhon.**
How many tourists visit each year? **6 million.**

Question 6: Name the 4 important species in the Mauritian biosphere of Macchabee & Bel Ombre. **The Mauritian Pink Pigeon, the Mauritian Kestrel, the Mauritian Flying Fox and the Mauritian Gecko.**
Why do they all have 'Mauritian' in front of their name? They are endemic to Mauritius and are found nowhere else in the world.

Question 7: What introduced animal is causing problems in St Mary's as it eats birds' eggs, reptiles and amphibians? **The Indian Mongoose.**

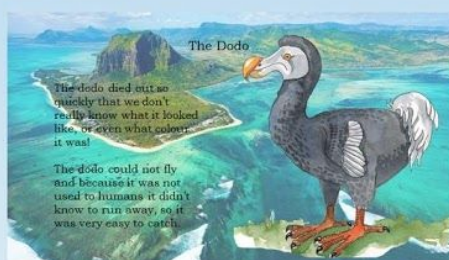
Slide 27



The Indian Mongoose was introduced by humans to a variety of islands around the world to control rats, but it also preys on native species of bird, reptile and amphibian. It has caused animals to become extinct on islands such as Fiji, Jamaica, Mauritius, Japan and Hawaii. Do the class know of any other animal that humans have introduced around the world which cause similar problems? There are many examples, including rats, the cane toad, even Rhododendron bushes introduced from the Himalayas to Britain crowd out native species of plant and reduce habitats for our native mammals.

Question 8: Where did the Dodo come from? **Mauritius.**

Slide 28



The dodo was endemic to Mauritius, and could not fly. It was about a metre tall, and laid its eggs on the ground. There was a perfectly healthy population on Mauritius until Dutch sailors arrived in 1598 and discovered Mauritius. The last recorded live dodo was seen in 1662, so in just over 60 years, the dodo was completely wiped out by the settlers, who ate the dodos and their eggs. There are no photos of the dodo, and the paintings that were made were from dusty, old museum specimens which have faded, hence no-one really knows what colour it was.

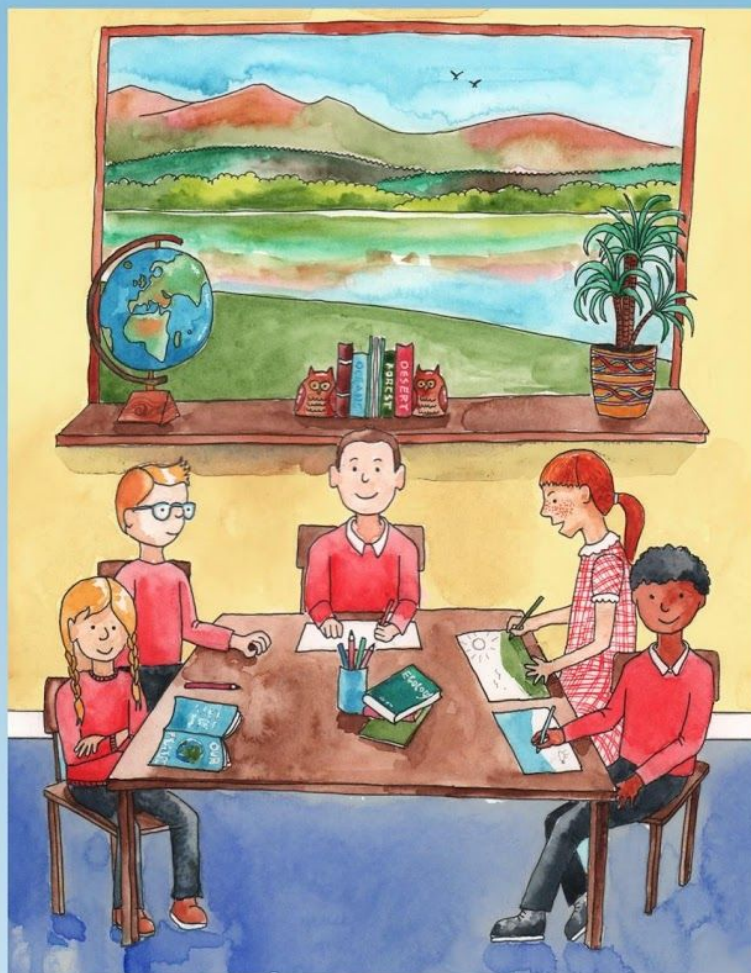
Question 9: Which Biosphere has cliffs as a core habitat? **Dublin Bay.**

What animals need cliffs as part of their habitat? Sea birds nest on cliffs to protect their eggs from predators.

Question 10: Which Biosphere is famous for its apples? **Rhon.**

What food do you think the Galloway & Southern Ayrshire Biosphere is most famous for? This is a subjective question with no correct answer!

This is the end of the first workshop. Please allow time for discussion by the class, as well as any questions that have arisen. You may wish to allocate these questions to children to research the answers themselves. The second workshop investigates why Galloway and Southern Ayrshire became a Biosphere; in other words, why is it so special and unique that UNESCO designated it a Biosphere



The quiz and subsequent discussion fulfil some of the Literacy O's and E's of the Curriculum for Excellence. At the second stage learners are expected to take part in discussions, valuing the contributions of others. They are expected to be able to take notes, and show their understanding of subjects by responding to questions and by asking questions of their own.

Workshop 2: An Introduction to the Galloway & Southern Ayrshire Biosphere- We Are Unique!

Teacher Background

The aim of this second workshop in the series is to ground children firmly within the Biosphere in which they live. We live in a unique and very special place, and this workshop aims to help children why that is the case. As with the first workshop, we start on a grand scale, with a discussion as to why the Earth itself is unique and special, before focussing right in on our Biosphere. The Powerpoint presentation ends with several slides of notable landmarks and people from the Galloway & Southern Ayrshire Biosphere, leading to an art activity where the children plan, design and create a tourist poster for the Biosphere from a brief.

The session should take approximately 1.5 - 2 hours to complete.



Examples from Castle Douglas Primary School p5's when asked 'What makes your Biosphere Special' before the project began.

The powerpoint presentations are provided on a USB stick, the accompanying notes are integrated into this teachers pack, but are also available as a digital copy (in the folder Primary Teachers Pack-Session 2- We are Unique!

This session is specifically targeted at achieving some of the significant E's and O's outlined in the Curriculum for Excellence for the Expressive Arts.

Introduction



Earth is a blue marble, floating in space. We know of no other planets or moons in the whole universe that support life. This is not to say that evidence will not be found in the future, but for now this is the only fact we know for sure - there is no Planet B. There is just us.

This fact is surprisingly difficult to remember as we are all brought up on a diet of science fiction and fantasy, from books, to cartoons, to movies.

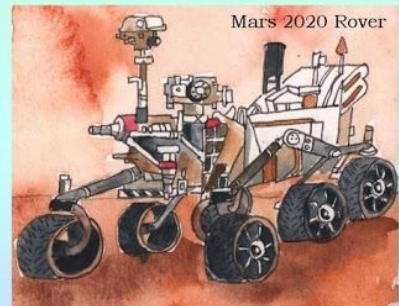
Evidence for Life Elsewhere



Magnification x 20,000

Mars - the classic planet for extra-terrestrial life. In 1996, a team of scientists analysed a Martian meteorite found in Antarctica, and found that it had what they believed were 'microfossils' of bacteria. This discovery made headline news. Sadly, the evidence has since been rejected, as further study showed that the structures in the rock could have been made by chemical processes, not just biological ones.

No Mars probe or rover has found any evidence of life, but it is hoped that Mars 2020 due to be launched by NASA this year will find such evidence. This rover is designed to search places where life may have existed on Mars and look for fossils. Excitingly, the rover will also have the task of demonstrating key technologies for life support and fuel for human expeditions to Mars in the future.



Mars 2020 Rover

Europa - one of Jupiter's moons. There is strong evidence for a liquid ocean under Europa's icy crust, which may therefore support life. NASA is due to launch the Europa Clipper later this decade to specifically look for evidence that Europa could have conditions suitable for life. The Europa Clipper will fly by the moon 45 times and use a variety of scientific equipment to look for this evidence.



Europa



NASA's Europa Clipper Logo

Elsewhere in the galaxy we are even more in the dark. Scientists are looking, but as yet there are no definitive signs of life out there. WE ARE UNIQUE!! On a planetary scale there is only us!

Workshop 2

WE ARE UNIQUE!

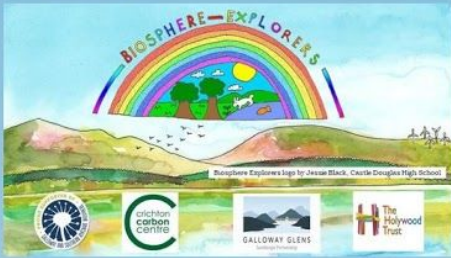
Contents

- Explanatory notes for slideshow
- Activity - Biosphere poster

O's and E's - This activity is related to the Arts section of the C for E. These include to create and present work which shows awareness and recognition of detail – use a range of media and technologies to create images for specific tasks. The childrens can discuss each other's posters and offer constructive comment on their own and other's work.

Slideshow - 1 hour, Activity - 1 hour

Slide 1:



Welcome to Biosphere Explorers! Today we are going to learn about the Galloway and Southern Ayrshire Biosphere Reserve; a special place, which just happens to be where we live!

EACH LOGO HAS A HYPERLINK TO THE WEBSITE OF THE FEATURED ORGANISATION

Slide 2:



If we had this view of Earth, where would we be standing? On the Moon! The Apollo astronauts had this view of our planet when they walked on the moon. How many people do you think have actually walked on the moon? Only 12! And do you know how many people in the whole of human history have seen the Earth from space? Only 500 people. All those astronauts say the same thing - this view changes their view of our planet - they see how unique and how fragile it is. A Blue Marble floating alone in the blackness of space.

Slide 3:



Looking at the Earth from a distance shows us that although it seems huge to us on a human scale, in fact compared to the vastness of the galaxy, it is very small. And, as far as we know, it is unique. We know of no other place in the Universe where life exists. Would you agree that it is important to try and protect something so unique?

Slide 4:



As we discussed in the first workshop, an organisation called UNESCO decided to find a way to help protect planet Earth. Can anyone remember what UNESCO stands for? United Nations Educational, Scientific and Cultural Organisation. They realised that it would be very difficult to protect the whole of the Earth, but that it might be possible to protect lots of little bits of it. They called these little bits Biosphere Reserves, and there are now more than 700 of them, in over 120 countries all over the world.

Slide 5:



Here are some of the Biospheres marked on a World Map. Each of these dots represents somewhere very special in the world, somewhere unique that needs to be protected.

CLICK ON EUROPE ON THIS SLIDE TO ZOOM IN ON EUROPE (SLIDE 6)

Slide 6:



This is a close up of Europe.

CLICK ON BRITAIN TO GO TO SLIDE 7.

Slide 7:



In the United Kingdom there are 6 Biosphere Reserves.

IF FOR ANY REASON YOU WANT TO RETURN TO SLIDE 5, CLICK ON THE GLOBE ICON AT THE BOTTOM OF THE SLIDE. OTHERWISE CLICK ANYWHERE ELSE TO FADE INTO SLIDE 8

Slide 8:



Here they are marked on a map of Britain. **Can you point to where we live on this map?** All these places have been made Biosphere Reserves because they are very special, unique places in Britain where people can protect their local wildlife and environment while at the same time living sustainably.

CLICKING ON EACH OF THE BIOSPHERES WILL TAKE YOU TO A PICTURE OF THE LOGO OF THAT BIOSPHERE. A DESCRIPTION OF EACH IS GIVEN IN THE TEACHER'S NOTES ON THE NEXT PAGE.

Slide 9:



Slide 10:



Slide 11:



Slide 12:



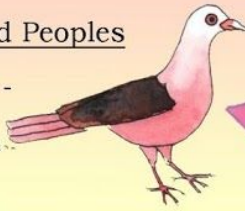
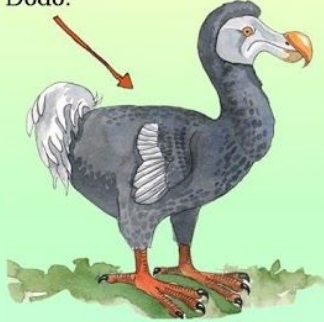
Slide 13:



CLICK ON THE ICONS AT THE BOTTOM OF EACH SLIDE TO RETURN TO THE MAP OF BRITAIN. CLICK ON THE CENTRE OF THE SLIDE TO VISIT THAT BIOSPHERE'S WEBSITE.

UNESCO Tries to Protect Unique Places and Peoples

In the last session we talked about endemic species - species that are only found in one place in the world. Examples include the Mauritian Pink Pigeon, and the Galapagos Tortoise, and the clue is in the name that these endemic species are usually found on islands, or otherwise isolated habitats. Endemic species are very vulnerable to extinction, as it can take only a small change to have a huge effect on the population as a whole; a perfect example here is the Dodo.



The Mauritian Pink Pigeon nearly became totally extinct, but with intensive conservation there are now about 400 individuals.

There were originally 16 different species of Giant Galapagos tortoise, now only 10 species remain.



However, it is not only endemic species that are worthy of protection. The growth of the global human society has led to huge changes in the natural world, and overall has led to more and more species of animal and plant becoming vulnerable to extinction. There has been a loss of diversity, both in the natural world (biodiversity, which we will look at in Workshop 3) and in the huge variety of human cultures. The globalisation of human culture has led to unique customs, cultures and languages also being lost.

These are some of the reasons why, in 1971, UNESCO set up the Man and Biosphere programme (see page 4 for more details). MAB aims to protect animals, plants, habitats, human history and culture in countries around the world, but also provide a platform for sustainable growth and development.

Galloway & Southern Ayrshire was granted Biosphere status in 2012. This internationally recognised designation means that GSAB is a world class environment for people and nature, and it should be protected for its uniqueness.



Biosphere designations are usually built around high focus species of animals and plant, as well as core habitats necessary for these species to thrive. In the GSAB, the core species are (not drawn to scale):

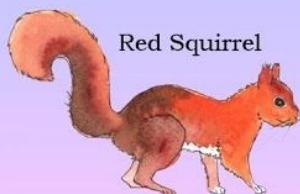
The logo of the GSAB is a Round-leaved Sundew, which grows in peat bogs.



Black Grouse



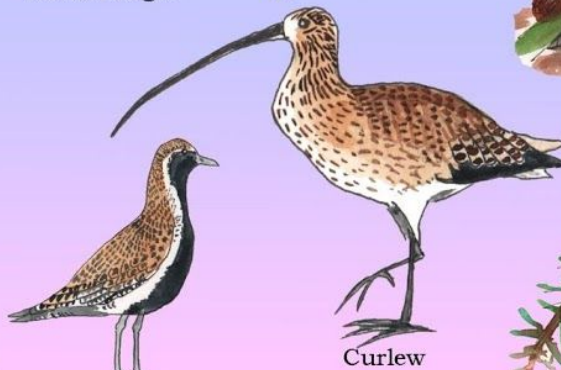
Golden Eagle



Red Squirrel



Water Vole



Curlew



Golden Plover



Downy Willow



Brown Trout



Juniper

Other UNESCO Biospheres of the United Kingdom



Wester Ross Biosphere in the North-West Scottish Highlands is home to a large remnant of ancient Caledonian pine forest, the native woods of Scotland.

Some of the trees are 400 years old, and are heavily protected.

The Biosphere area extends into the Atlantic Ocean, so includes many species of dolphin and whale as protected species, as well as very rare mosses and liverworts that are found nowhere else in Britain.



GALLOWAY AND
SOUTHERN AYRSHIRE
BIOSPHERE



The Isle of Man Biosphere is the only Biosphere to be an entire nation. There are no foxes, badgers, deer, otters or moles on the Isle of Man. The island has Celtic & Viking heritage, and many medieval castles. It is also famous for the Isle of Man TT Motorbike race which takes place every year around the whole island.



The Dyfi Biosphere shares many of the same habitats and animals as the Galloway & Southern Ayrshire Biosphere. It is well-known for its beautiful scenery and long-standing traditions of sustainable living. 12 of the 17 UK species of bat are resident there. Dyfi is a stronghold of the Welsh language, and is also home of the rare breed Welsh Black Cattle and Welsh Mountain Ponies. It has amazing sand dunes where the Ringed Plover nests, and where the Sand Lizard has been reintroduced.

The North Devon Biosphere is also famous for its sand dunes, which have over 470 species of flowering plant. It also has a very rare habitat known as Culm Grass-land which is unique to South-West England and home to Dormice and the Marsh Fritillary Butterfly. The Biosphere also includes the Isle of Lundy where the unique Lundy Cabbage and its pollinator beetles, the Bronze Lundy Cabbage Flea Beetle and the Lundy Cabbage Weevil are found.



The UK's newest Biosphere is the Isle of Wight. It has species which are found nowhere else in Britain. There are stable populations of Red Squirrel, Hazel Dormouse, Bechsteins Bat and Barbastrelle Bat.

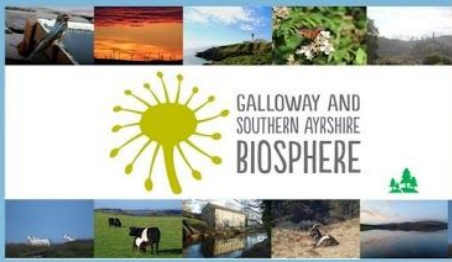


Man and
the Biosphere
Programme



The most populated UK Biosphere, Brighton & Lewes Downs is unique because of the Chalk deposits which are found there, and which support an unusual range of animals and plants. There are also chalk reefs in the sea which support rare seahorse populations. The Biosphere also contains the largest population of mature elm trees left in the world.

Slide 14



We are lucky enough to live in one of these Biospheres, the Galloway & Southern Ayrshire Biosphere.

Slide 15



The purple outlines the boundaries of our Biosphere. What is so special about it that UNESCO designated it as a Biosphere? BRAINSTORM HERE ABOUT WHAT THE CHILDREN THINK MAKES THEIR BIOSPHERE SPECIAL - SOMEONE COULD MAYBE TAKE NOTES FOR FUTURE REFERENCE.

Slide 16



There is an official way of deciding if an area should be a Biosphere. UNESCO uses what they call CORE AREAS to decide. Core areas are extra-special places within a region, usually already protected by other agreements and laws. they are marked here in red. The Biosphere boundary in purple is the zone that UNESCO feels is needed to protect the core areas, where people live and work sustainably.

The core areas in our Biosphere are:

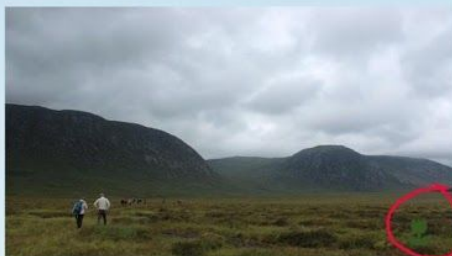
Slide 17



Cairnsmore of Fleet National Nature Reserve and Site of Special Scientific Interest. **Has anyone climbed Cairnsmore?** These designations mean it is heavily protected and managed to protect the animals and plants that live there.

[Click to return to Slide 16](#)

Slide 18



This is Silver Flowe. It is a peat bog which is also designated as a Site of Special Scientific Interest. It is also a RAMSAR site which means it is a wetland of international importance.

[Click to return to slide 16](#)

Slide 19



And the last core area of our Biosphere is Merrick-Kells. The Merrick is the highest mountain in Dumfries & Galloway. Has anyone climbed it? It is also a Site of Special Scientific Interest. So all three core areas are extra-special and need to be protected for the rare and unusual animals and plants that live there.

Slide 20



Lets have a closer look at one of these core areas. This is Silver Flowe, high up in the Galloway Hills behind Clatteringshaws Loch. (CLICK TO START ANIMATION) These are some of the animals and plants that live in or around Silver Flowe. Species that are particularly rare, and are therefore known as High Focus Species in the Biosphere are: Golden Eagle, Golden Plover, Brown Trout, Red Squirrel, Watervole, Curlew and the Black Grouse. ASK THE CLASS IF THEY CAN NAME ANY OF THE ANIMALS ON THIS SLIDE.

Slide 21



The Black Grouse for example is globally threatened. This means that the populations in our Biosphere are really important. **Can you remember another Biosphere that had Black Grouse populations? Rhon, Germany.**

Slide 22



But it isn't just the animals that need protected. Animals need places to live - these are called HABITATS. Silver Flowe is a peat bog, which is a very important habitat, not only because of the animals and plants that are found there, but because of the habitat itself. Scotland has 10-15% of the world's Blanket Bogs (a Blanket Bog is a type of peat bog). They are found in cool places with high rainfall. (CLICK) A cross-section through Silver Flowe would look like this. The main plant that grows there is Sphagnum moss. When the plants die, they don't rot away in the waterlogged ground, and layers and layers build up. (CLICK) This is called PEAT. Since living things are mostly made of carbon, peat bogs store carbon underground. **So why is carbon in the news right now? Variety of answers here, looking for something to do with climate change or global warming.**

Slide 23



So the fact that bogs store carbon and will help to prevent climate change is another reason why our Biosphere is special. We'll talk more about climate change another day, but now we're going to talk about other reasons why our Biosphere is extra-special.

Slide 24



So we mentioned the Red Squirrel earlier. The Galloway & Southern Ayrshire Biosphere is extremely important for the protection of Red Squirrels which are under threat. **Does anyone know why?** The Grey Squirrel was introduced from North America in the 1870's and is slowly pushing out the Red Squirrel by out-competing it for food, habitat and also by spreading a disease called squirrel pox. Because our Biosphere has lots of pine forests, which the Grey Squirrel doesn't like, the Red Squirrel is doing well here.

Slide 25



IN THE FOLLOWING SLIDES, ASK THE CHILDREN IF THEY CAN NAME ANY OF THE PLACES OR PEOPLE IN THE PICTURES. But our Biosphere has lots of other special things in it, and a lot of those things have been made by humans. There is 10,000 years of human history in our biosphere. This slide shows Cairn Holy, an ancient burial site near Gatehouse-of-Fleet. Round the edge of the slide are ancient cup and ring markings which are found all over the region, and can be seen in Dumfries museum.

Slide 26



We have castles and battlefields. (TOP LEFT IS BRUCE'S STONE AT GLENTROOL, BOTTOM LEFT IS THREAVE CASTLE, RIGHT HAND SIDE SHOWS DRUMLANRIG CASTLE)

Slide 27



We have churches, abbeys and ancient Pictish stones. (TOP LEFT IS KIRKOWAN CHURCH, BOTTOM LEFT IS DUNDRENNAN ABBEY AND RIGHT IS A PICTISH STONE WHICH CAN BE FOUND IN DUMFRIESMUSEUM.

Slide 28



We have famous poets, writers and singers. (FROM LEFT TO RIGHT, RABBIE BURNS, JM BARRIE, WHO WROTE PETER PAN, AND ROBYN STAPLETON, WHO IS A VERY WELL-THOUGHT OF FOLK SINGER WHO HAS WON MULTIPLE AWARDS.)

Slide 29



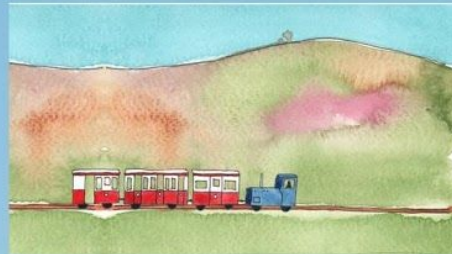
We have famous movies, TV shows and sports personalities. (THE VANISHING - A RECENT MOVIE STARRING GERARD BUTLER, OUTLANDER - A MASSIVELY SUCCESSFUL TV SERIES FILMED IN THE REGION AND USING A LOT OF TALENT FROM THE AREA TOO. THE CAR OF COURSE CONTAINS DAVID COULTHARD, ONCE A FORMULA 1 DRIVER FROM TWYNHOLM, NOW A PUNDIT).

Slide 30



We have a Forest Park and a Dark Sky Park!

Slide 31



We have two steam railway attractions! One at Leadhills & Wanlockhead (which is incidentally Scotland's highest village), and one is the Scottish Industrial Railway Centre near Patna.

Slide 32



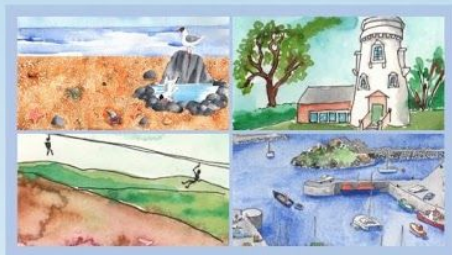
We have a Book Town, a Food Town and an Artists Town.

Slide 33



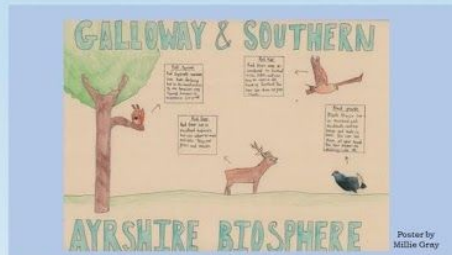
We have Forestry, Farming and Fishing.

Slide 34



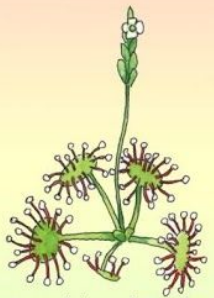
We have museums, lovely beaches, beautiful harbours and Scotland's longest zipwire!

Slide 35



So that's lots of reasons why our Biosphere is special. Now it's your turn to tell everyone why YOU think our Biosphere is special, by making a poster to advertise to visitors why the Galloway & Southern Ayrshire Biosphere is special.

What is a Species?



Round-leaved Sundew
Drosera rotundifolia

The word 'species' refers to a distinct variety of animal, plant, fungus, bacteria, or in fact anything alive. It's how we tell different types of life apart. It is estimated that there are 8.7 million species alive today on planet Earth, but this is only an estimate, as scientists believe there are still species to be discovered. It is also extremely difficult to distinguish between different species of bacteria, and, depending on the data used, some researchers have estimated the number of species at 30 million, or even higher! And of course, this number doesn't take account of all the species that have existed in the past and have since become extinct.



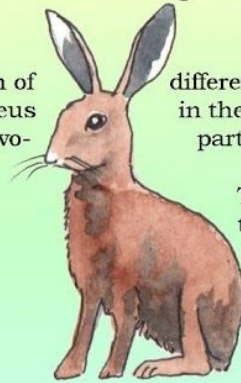
Long leaved sundew
Drosera intermedia

The naming and classification of Swedish botanist, Carl Linnaeus living things can be given a two-

different species is called taxonomy, and it was invented by a in the 18th Century. It is a binomial system, meaning that all part Latin name referring to their Genus, and their Species.



Mountain hare
Lepus timidus



European Hare
Lepus europaeus

The first word, the Genus, can indicate how closely related two different species are. For example, the European Brown Hare and the Mountain Hare share a Genus (*Lepus*) and the second word shows that they are in fact different species. The same is seen in the two species of Sundew (a carnivorous plant found in bogs) above.



Coal tit
Parus major



Great tit
Parus major



Blue tit
Cyanistes caeruleus

However, this is not always the case. Blue tits, Great tits and Coal Tits are all in the Tit family (family is the classification above Genus), but their Genus names are different.

The species living in the UK are, on the whole, very well documented. It is thought that we have about 90,000 species in Scotland, of which over 50,000 are invertebrates (animals without a backbone, such as beetles, spiders, butterflies, worms and snails).

Some invertebrates found in our Biosphere:



Azure Hawker Dragonfly
Aeshna caerulea



Zebra spider
Salticus scenicus



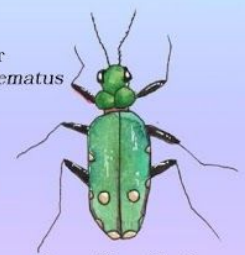
Heath fritillary Butterfly
Melitaea athalia



Orange-tip butterfly
Anthocharis cardamines



Garden spider
Araneus diadematus



Green Tiger Beetle
Cicindela campestris



Cinnabar moth
Tyria jacobaeae



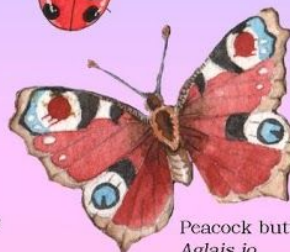
Highland midge
Culicoides impunctatus



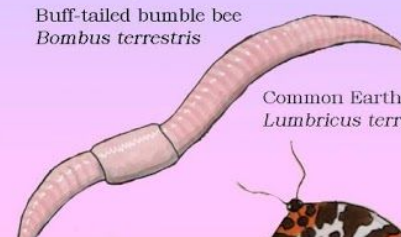
Seven-spot ladybird
Coccinella septempunctata



Buff-tailed bumble bee
Bombus terrestris



Peacock butterfly
Aglais io



Common Earthworm
Lumbricus terrestris



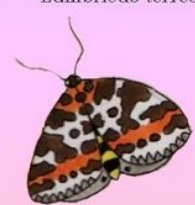
White-legged Snake Millipede
Tachypodoiulus niger



Common Woodlouse
Oniscus asellus



Two-spot Ladybird
Adalia bipunctata



Magpie Moth
Abraxis grossulariata

What is Biodiversity?

Bio = life, Diversity = Variety. Quite simply, biodiversity is a word meaning 'the variety of life'. We often take this to mean 'how many species are there?' Life has existed on Earth for billions of years. Species have evolved, lived, then become extinct. All these species, past and present are part of the biodiversity of the Earth.

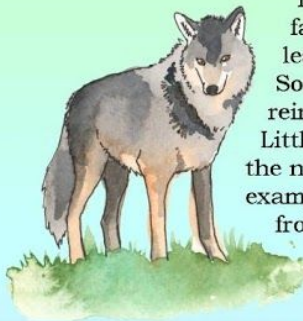


Why is Biodiversity in the News?

Sadly, biodiversity is topical because it is in trouble. Human activities destroy biodiversity. Examples of these activities include; destruction of natural habitats, pollution, over-hunting and over-fishing. Biodiversity is declining all over the world. When the Amazon rainforest is logged for its timber, it is not only the trees that are lost, but all the animals, plants, fungi, bacteria associated with those trees. It is thought that 10% of the world's biodiversity is found in the Amazon Basin. A good website with more amazon facts is the World Wildlife Fund:

wwf.panda.org/knowledge_hub/where_we_work/amazon/about_the_amazon

In the UK, biodiversity used to be much higher than it is now - for example, we used to have bears, lynx and wolves, just to name the big predators, hunted to extinction by humans. The



loss of habitats caused by the increase in intensive farming in Britain has led to the loss of many smaller, less obvious animals, such as the Marsh Fritillary Butterfly. Some animals lost for these reasons over history have been reintroduced, such as the Red Kite, the Eurasian Beaver, the Little Egret, and the Capercallie. However, the problems facing the natural world in Scotland today are still enormous. For example, in the last 100 years our forest cover has increased



from a low of 5% to almost 19%. However, this reforestation is not replacement of the original ancient woodland that was lost, it is the planting of low diversity, non-native timber trees such as Sitka Spruce, which support a much lower diversity of plants, animals and fungi as a habitat. The European average tree cover is 38%, so we are also well below that figure.

PHOTOS HERE OF ANCIENT WOODLAND COMPARED TO PLANTATION

Workshop 3: Biodiversity & the Biosphere

Why is Biodiversity Important?

Why does it matter if a species is lost? Does it matter if the squirrel on our feeder is native red or introduced grey? It's a really hard question to answer. An excellent discussion for adults on why biodiversity is important, written by Anup Shah can be found at:



www.globalissues.org/article/170/why-is-biodiversity-important-who-cares



This article also has a good further reading list. The slide in Workshop 3 which tries to demonstrate why biodiversity is important, simply shows the huge variety of things that humans use which are derived from the natural world. WWF has a good child friendly explanation:



wwf.panda.org/our_work/biodiversity_and_you/

There is also a great animated video on:



thekidshouldseethis.com/post/why-is-biodiversity-so-important-ted-ed



Important note: It cannot be stated enough how important the natural world is to our mental well-being. This importance is only just beginning to be recognised in this country, and of course is coinciding with the so-called 'indoor generation'. Children of today go outside 50% less than their parents did. The Scottish Government have embedded outdoor learning in the curriculum in recognition of this.

How Can We protect Biodiversity?

In Scotland we have already lost much of our natural heritage. The Industrial Revolution and two World Wars led to the loss of most of the native forests that were still left, and we have hunted and fished most of the animals that remain. We have put the natural world out of balance, for example by removing predators of red deer, we now have a problem with too many red deer. We run over horrendous amounts of birds, badgers and other animals in our cars. It is therefore really important to protect the habitats, animals and plants that we have left, and restore and improve existing habitats to be better for biodiversity.

Dumfries & Galloway council have declared a climate emergency (July 2019). Part of their 12 point plan, while focussing on climate change and carbon emissions, does include Biodiversity in Point 7:

“We recognise the importance of our biodiversity and natural environment in our drive to reduce the impact of climate change and will encourage and support practices to enhance and sustain the farmed and natural world.”

How this will translate into ground level policy remains to be seen, but at a national and local government level we can see that this issue is being recognized and acting upon.

What is Biodiversity?



Why is Biodiversity Important?

Why does it matter if a species is lost? Does it matter if the squirrel on our feeder is native red or introduced grey? It's a really hard question to answer. An excellent discussion for adults on why biodiversity is important, written by Anup Shah can be found at:



www.globalissues.org/article/170/why-is-biodiversity-important-who-cares



This article also has a good further reading list. The slide in Workshop 3 which tries to demonstrate why biodiversity is important, simply shows the huge variety of things that humans use which are derived from the natural world. WWF has a good child friendly explanation:



wwf.panda.org/our_work/biodiversity_and_you/

There is also a great animated video on:



thekidshouldseethis.com/post/why-is-biodiversity-so-important-ted-ed



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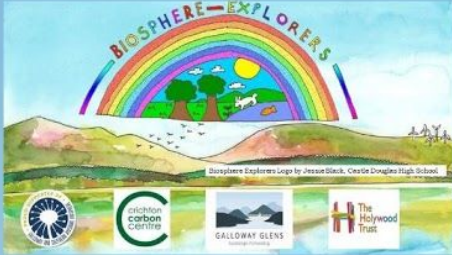
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Slideshow 3 - Biodiversity and the Biosphere

Explanatory Notes and Suggestions for Class Discussion

The indoor part of this workshop will take 1.5 - 2hrs to complete. The outdoor survey can take as long as you have available!

Slide 1:



Welcome to Biosphere Explorers! Today we are going to learn about Biodiversity and the Biosphere.

Can anyone remember what biodiversity is?

Slide 2:

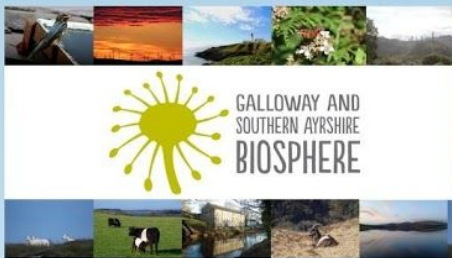


We have already discussed what the biosphere with a small 'b' is, and what a Biosphere with a capital 'B' is. What is the difference?

A biosphere is anywhere on a planet where life can exist.
A Biosphere is a special place on our planet where people work to live sustainably and protect the natural environment.

Here are some of the 701 UNESCO Biospheres.

Slide 3:



Can anyone tell me what this slide refers to?

Hopefully by the third session you will be getting some sensible answers here.

Slide 4:



This is the Galloway & Southern Ayrshire Biosphere, which is where we live! Why did UNESCO decide that our area is so special that it should be a Biosphere?

Again, hopefully you might be getting close to the correct answer here, which is that it is a special place here people can live sustainably while protecting the rare animals and plants that live here.

Slide 5



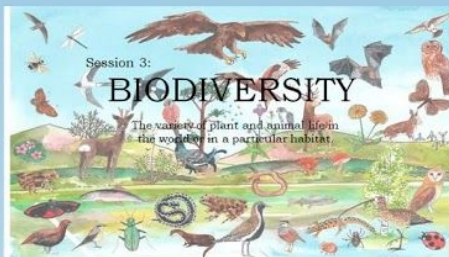
and curlew, and it also helps to provide clean rivers for the water vole and brown trout downstream from the bog. But not just those rare species live there do they? **Can you identify other animals that I haven't mentioned on the slide?** If you protect a habitat for the rare species, then all these other species benefit too.

Slide 6



But the Biosphere is special not just for its animals and plants, but also for its people – that's me and you! The people that live in our Biosphere are special because they want to help to protect and conserve the rare species at the same time as being able to live and work and go about their everyday business. Before we can do that though, we should ask the question – why? **Why do we want to protect and conserve animals and plants?** You can open this up to class discussion if you like and see what they come up with. We are going to look at this in more detail today.

Slide 7



Another name for the variety of plant and animal life that exists in a place is Biodiversity. All the animals and plants on this slide are found in our small corner of Scotland, and yet the species shown are still a tiny sample of the biodiversity that we have around us. **Can anyone think of an animal or a plant that I've missed out?** Again, there are many different answers here – farm animals are fine to include, and pets, and any other animals, birds, trees, flowers, insects that are found in Dumfries & Galloway. The only wrong answers are animals etc. not found here, like lions, elephants, bears etc. If you're not sure yourself, ask someone to look it up while the rest of the class continue to answer.

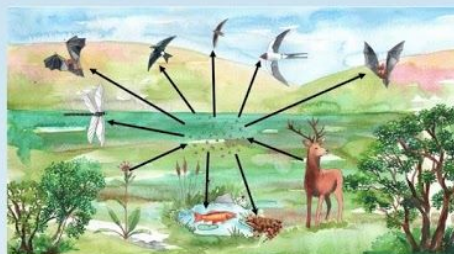
Slide 8



Can you see that we have a huge variety – there's no way I could fit them all into one picture! All the living things – the Biodiversity – in region, or even in the world, is linked in some way. **Can you think of ways in which the animals and plants on this slide are linked?** Answers include things like; owls eat mice, otters eat fish etc.

SEE NEXT PAGE FOR IDENTIFICATION OF EVERY ANIMAL ON THIS SLIDE

Slide 9



For example, female midges feed on mammal blood, but male midges feed on flower nectar. Midge larvae in ponds and streams feed loads of other aquatic life, like amphibians, fish and other insects, while adult midges are the main foodstuff of bats (night) and swallows, swifts and housemartins (day). It is the interconnectedness of everything that we are trying to get across, everything depends on everything else.



1. Swift
2. Azure hawk dragonfly
3. Buff-tailed bumble bee
4. Pearl-bordered fritillary
5. Swallow
6. Roe deer
7. Downy willow
8. Purple Saxifrage
9. Common toad
10. Cinnabar moth
11. Red grouse
12. Atlantic salmon
13. Wheatear
14. Green tiger beetle
15. House martin
16. Kestrel
17. Round leaved sundew

18. Long-leaved sundew
19. Barnacle geese
20. Black grouse
21. Adder
22. Otter
23. Common frog
24. Golden Eagle
25. Red kite
26. Scots Pine
27. Common butterwort
28. Sparrowhawk
29. Slowworm
30. Golden plover
31. Long-eared bat
32. Pipistrelle bat
33. Red deer
34. Chanterelle

35. Orange Birch Bolete
36. Rainbow Trout
37. Dotterel
38. Great Crested Newt
39. Common vole
40. Zebra spider
41. Skylark
42. Tawny owl
43. Meadow Brown butterfly
44. Mountain hare
45. Alpine hawkweed
46. Silver birch tree
47. Curlew
48. Barn owl
49. Seven spotted ladybird
50. Midge
51. Meadow thistle



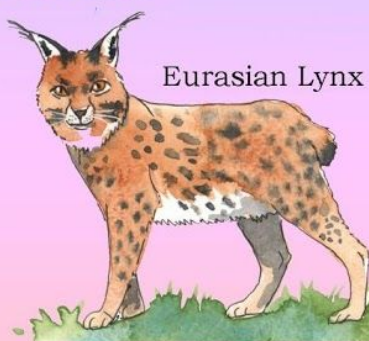
European Beaver



European Wild Boar



Grey wolf



Eurasian Lynx

These are all large mammals that used to live in Scotland but humans hunted them to extinction. These animals all still live in other parts of the world, so these animals are 'locally extinct' not 'globally extinct'. An animal which is made locally extinct is said to be 'extirpated'.

Large mammals such as woolly mammoth, cave bears and the Irish Elk also used to live in Scotland, but are now globally extinct (like the Dodo).

Slide 10



Beavers, wild boar, wolves and lynx could all have been in this picture too! They are all now extinct in Scotland because of being hunted by humans.

ALTHOUGH SOME HAVE BEEN REINTRODUCED, MORE OF THAT LATER.

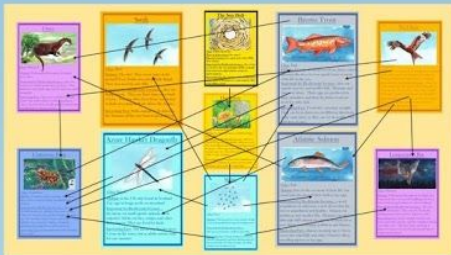
Slide 11



We're going to play a card game to help us understand some of the links between species that live around us in our Biosphere.

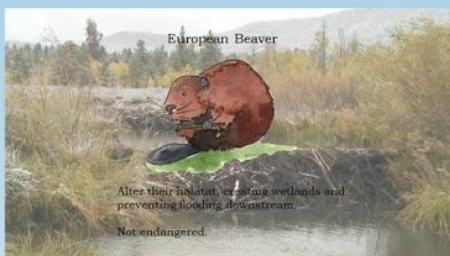
NOTE: MOST FOOD WEB GAMES ON THE INTERNET ARE NOT SPECIFIC TO SCOTLAND OR EVEN THE UK. SINCE WE ARE TRYING TO HELP THE CHILDREN FORM CONNECTIONS BETWEEN THEMSELVES AND THEIR IMMEDIATE ENVIRONMENT, IT IS IMPORTANT TO USE LOCAL SPECIES. PLEASE SEE P36 FOR INSTRUCTIONS ON HOW TO PLAY.

Slide 12



So we can see that the animals and plants of the biosphere are all linked in some way – **did anyone come across a card that they couldn't link with another card?** I would expect the answer to be no. This whole system of relationships between living things is what our survival as human beings is based on. **Have any of you heard the word biodiversity in the news recently?** Make some room for class discussion here? Well, along with climate change, which we'll talk about in the next session, biodiversity is also in the news.

Slide 13



Biodiversity is in the news because it is in trouble. It is a sad fact that human actions are reducing biodiversity in the world. Our species is destroying habitats, and making species become extinct. Humans have been doing this for thousands of years, mostly accidentally. Our forebears caused the extinction of species like the woolly mammoth, the cave bear and the Irish Elk when they first arrived in Europe. Some animals became extinct more recently, like the Beaver in Scotland. See p35 for teachers notes on the beaver, and why its story is important.

Slide 14



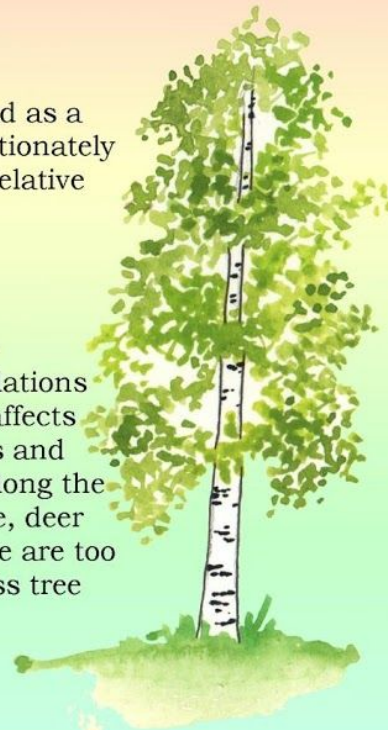
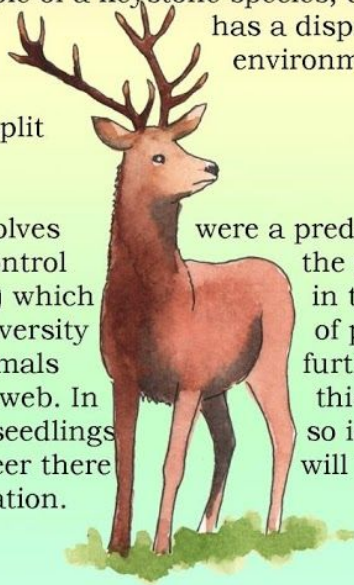
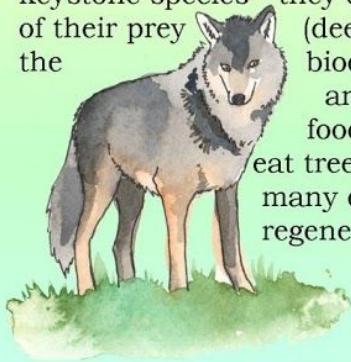
These animals became extinct for a variety of reasons. For example, beaver were hunted for their meat, their fur, and for a substance they produce called Castoreum which has medicinal properties. This is a picture of a Medieval Beaver Hunt drawn originally in the 13th Century. Other animals like the wolf, were hunted because they ate our livestock. Others, like the Red Kite, were killed simply because the king at the time didn't like them!

Teacher Notes - Keystone Species

Beavers are a great example of a keystone species; defined as a species whose presence has a disproportionately large effect on its natural environment relative to its abundance.

Keystone species can be split into three categories:

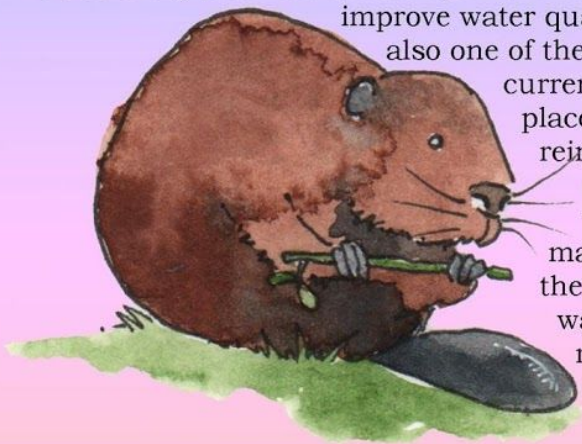
Predators - in Scotland wolves were a predatory keystone species - they control the populations of their prey (deer) which in turn affects the biodiversity of plants and animals further along the food web. In this case, deer eat tree seedlings so if there are too many deer there will be less tree regeneration.



Mutualists - when two or more species interact for each others benefit they are mutualists. The relationship between bees and flowers is an excellent example of this - flowers produce nectar to attract bees, which then spread pollen between plants to cross-fertilize them and produce seeds for the next generation. You may have seen in the news that bees are in serious decline worldwide with huge implications for both natural and agricultural ecosystems. This in turn will have negative effects on humans as a third of our food crops are pollinated by bees.



Ecosystem engineers - these are any species that creates, significantly modifies or maintains a habitat. This is where beavers come in! Beavers cut down dead and dying trees to use in their dams, creating gaps for new trees to grow. Beaver dams divert and slow down rivers, creating ponds and wetlands which support a wider range of biodiversity than the unaltered river. They can help prevent flooding downstream, improve water quality and improve woodland structure. They are also one of the few animals which eat bracken, which farmers currently have to control with herbicides. There are two places in Scotland where beavers have been reintroduced, one deliberately by conservation organisations in Argyll, and one accidentally in Tayside. Both populations are doing well and managing for the most part to live in harmony with the resident human populations. Dumfries & Galloway was originally suggested as a suitable place for a trial reintroduction - maybe this might be the case in the future!

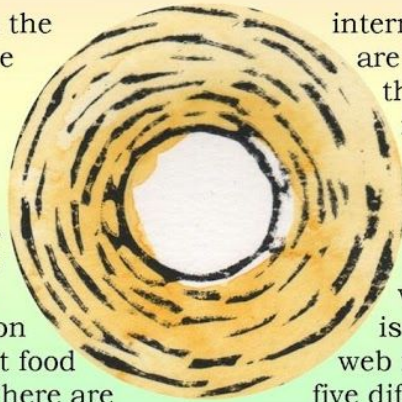


Instructions for Food Web Game – Full Version (15-20mins)

Most food web games on the internet are not specific to Scotland or even the UK. Since we are trying to help the children form connections between themselves and their immediate environment, it is important to use local species.

To keep printing costs down, the cards included with this pack for printing single possible food web, simply print and cut out will play the same game and suit groups of 8 pupils, a set for each group. Each group with the same cards. A black and white and a colour version produced with a different food colour and laminated. There are

extra discussion cards included. The full set of cards is available to borrow from the Crichton Carbon Centre – please email s.gray@carboncentre.org to organise this if you wish.



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How to Play



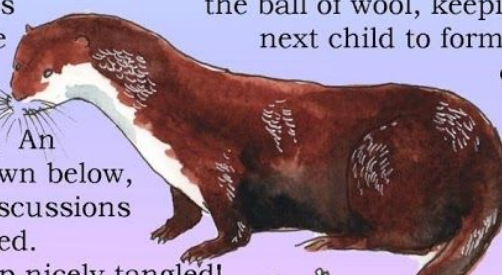
There are 8 cards in each set, so groups of 8 children are best suited for this game. You will also need a ball of wool or string for each group. In their groups, each child picks a card at random from the pile. The sun card starts, and this child should also keep hold of the end of the ball of wool.

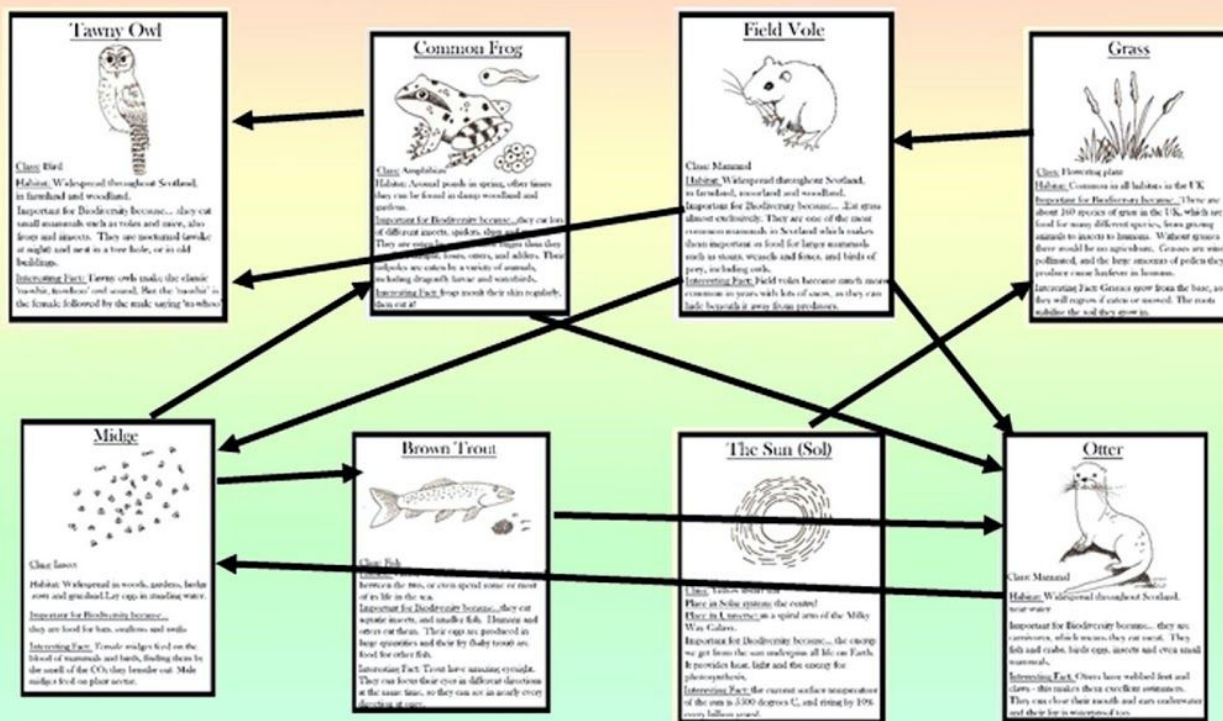
The sun card is read out to the group – the rest of the group looks at their card and tries to find a connection between themselves and the sun. If they can justify it there are no wrong answers in this game!

Let's take Set 3 (the set included as a photocopy resource) as an example. Say they pick the grass card – this is then read out and this child takes

passing it on to the network of the children end by the ball of wool. An connections is shown below, this game is the discussions things are connected.

They should end up nicely tangled!





Please note that in a diagram of a food chain or web, the flow of energy is represented by the direction of the arrow, so in the example above, energy flows from the frog to the owl, when the frog is eaten.

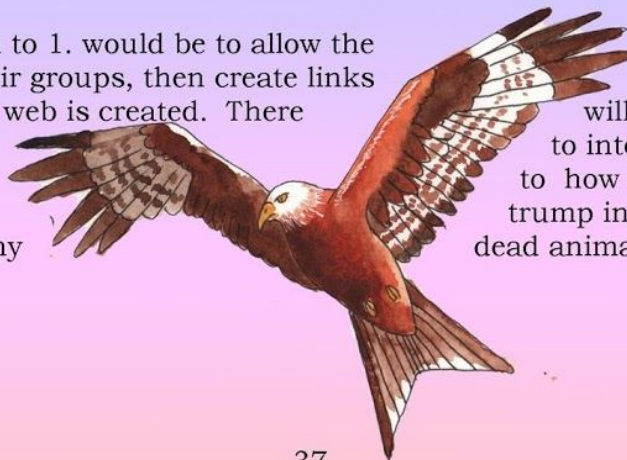
There are also connections which don't directly concern being eaten. For example, midges die in frosty conditions, so you could justify a connection between the sun card and the midge. You could even say that the owl and the sun are connected, as the owl comes out when the sun goes down!

Further Investigation

There are several options for further investigation using the full set of cards.

1. The children can use their cards to create one giant food web. To enable this you will need to remove the duplicate cards from the sets and add in enough extra cards from the Extra Cards envelope to make sure that every child has a card. This version of the game will take longer to play and may need more room (and wool!).

2. A different option to 1. would be to allow the children to create the food webs in their groups, then create links after the initial food web is created. There but this can lead between groups as Red Kite is the top game as Kites eat any



children to create between other groups will be duplicate suns then, to interesting discussions to how they are linked. The trump in this version of the dead animal.

3. A fascinating option for further investigation comes when you add humans to a food web. Five human cards have been included in the envelope. What happens when you add humans to a food web? Encourage the children to think of positive and negative effects. Some examples are listed here, but the possibilities are endless (admittedly easier on the negative side than the positive). The children may want to discuss what would happen if human action made one of their original species become extinct, as happened historically with the Red Kite. What effect would that have on the number of links in the food chain?

Some Positive Effects of Humans	Some Negative Effects of Humans
-Protection of important habitats -Feeding garden birds -Nature reserves -Garden ponds -Abandoned buildings good for owls & swifts to nest in.	-Overfishing -Deforestation -Persecution of birds of prey -Roadkill -Pesticides

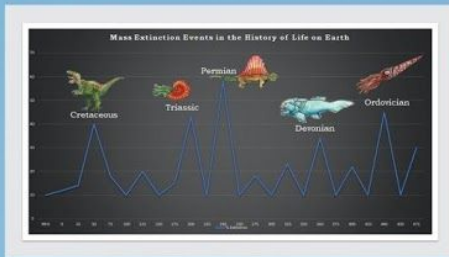
4. Another interesting investigation comes when top predators and ecosystem engineers are reintroduced to our ecosystem. As mentioned in the presentation, humans have extirpated many such animals from the UK. What would happen if these were reintroduced, as has been suggested for the lynx, and has already begun with the beaver? Give each group one of the cards (lynx, wolf x 2, beaver, wild boar) and ask them to discuss whether their food web becomes stronger (more links) or weaker (less links) when these animals are involved.

Learning Outcomes

- To be able to visualise the concept of a food web (C of E outcome)
- To be able to discuss the connections within an ecosystem (C of E outcome)
- To extrapolate their discussions into the future using the concept of 'what if...' i.e. 'what if we reintroduced beavers to Dumfries and Galloway?'
- To learn about some of the animals which live in the Galloway & Southern Ayrshire Biosphere
- To have a laugh getting tangled up in a ball of wool.



Slide 15



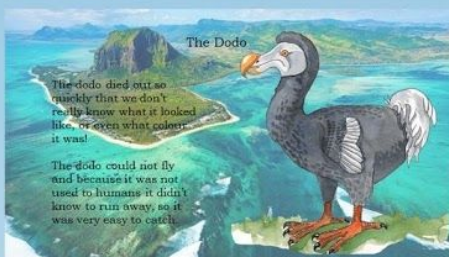
Species naturally become extinct all the time – there are many mass-extinction events documented in the fossil record – can you give me an example?

Slide 16



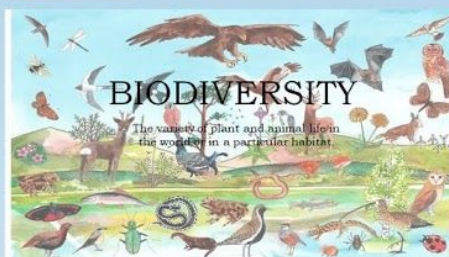
Of course the best known example is the extinction of the dinosaurs! The Earth has survived worse than us before – the meteorite that finished off the dinosaurs for example caused huge disruption to the natural processes of the Earth and wiped out millions of species, but life as a whole survived, and ecosystems adapted and evolved to fill the gaps that the dinosaurs left behind. But that was a natural disaster - no one species has ever had such a huge effect on the whole planet as humans have. The way that humans live is causing species to become extinct, like the beaver in Scotland.

Slide 17



Or the dodo. The dodo stood about a metre tall and could not fly. It was only ever found on the island of Mauritius and got along perfectly fine until Mauritius was discovered by Dutch sailors in 1598. The last sighting was in 1662, so in just over 60 years, the dodo was hunted to extinction, not only for food by the sailors, but also by rats, cats and monkeys brought to Mauritius by the settlers.

Slide 18



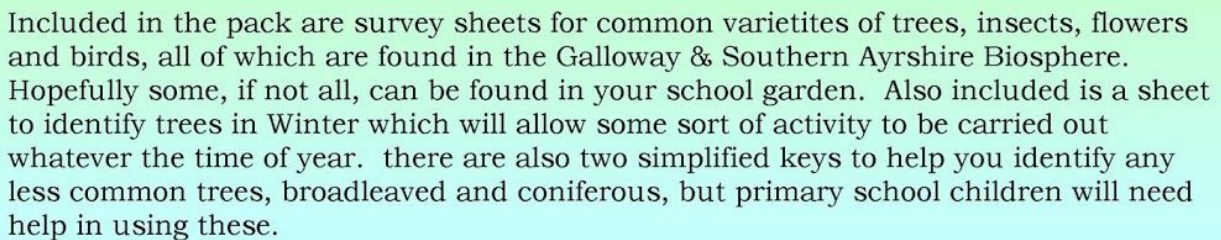
The loss of a species of bird or plant, or mushroom, or insect is a loss of biodiversity. It is a difficult thing to measure; scientists and conservationists try to come up with ways of measuring it all the time, but no one can agree on the best way. You could just count the number of species in an area, but that would be very difficult and take a long time. All the species on this slide come from our Galloway and Southern Ayrshire Biosphere, and it is only a tiny sample of the different species that live here. And some are really difficult to find. Imagine having to count every ladybird in Dumfries & Galloway!

Slide 19



So now we're going to take a sample of the Biodiversity that you have in your school nature garden.

This is an expected Experience for the C of E for second stage students. Hopefully your school will have access to some sort of natural green space. It would be best if the area has a variety of habitats, trees, hedges, walls, undergrowth, but it is possible to get the idea across with a less wild space. If your class has access to a community woodland, that would be perfect.



The benefits of outdoor learning are numerous. It increases enjoyment, awareness and understanding of our local environment. It will also begin to raise the children's awareness of science techniques such as fieldwork and environmental science. Getting outside in the fresh air will help mental health. Learning the names of the animals and plants around us can kindle a love of the natural world that will last a lifetime.

Slide 20



In a minute, we'll finish off by looking at your survey results, but before that we'll have a look at why we want to protect wildlife in the first place. **What does biodiversity do for us?** Well the same question asked a different way is 'how do humans rely on the natural world?' So what do we use the natural world for? Well...biodiversity gives us air to breathe, building materials (different woods), soft furnishings (cotton & wool), clean water, healthy crops (and a variety of different things to eat), food (vegetable and animal), clothes (silk from silkworms), jewellery (pearls, amber), medicine (aspirin, antibiotics), light (candle wax),

toiletries (scents derived from nature, like lavender or citrus), healthy soil, controlling pests, pollinators (bees and wasps), resistance to disease, clever ideas (would we ever have thought of flying if we had never seen other animals doing it?), new materials (rubber for tyres, carbon fibre), sport (horse riding, badminton shuttlecocks made from feathers, cricket), recreation (walking, playing musical instruments, art - pigments made from natural substances), natural beauty and culture. Everything is connected; and healthy, biodiverse ecosystems keep us healthy and happy too.

Slide 21



In the Galloway and Southern Ayrshire Biosphere we simply do not know what animals and plants we have. No one has measured either numbers of different species, or how these numbers are changing over time. **After what we've talked about, do you think that biodiversity is more or less than it was when humans first settled here 10,000 years ago?** The answer is probably less, but we just don't know. So what has changed? Well, forests have been cut down, bogs and fields have been drained, animals have been hunted, new animals have been

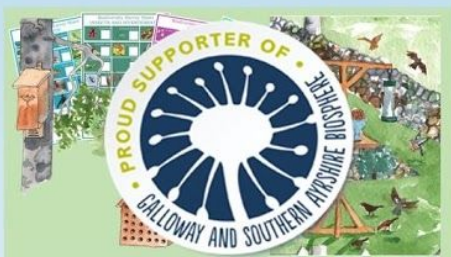
introduced, rivers have been polluted, seas have been polluted, natural habitat has been lost and fragmented, cities and towns have been built. All these things decrease the amount of species that live in a particular place.

Slide 22



Now the Galloway and Southern Ayrshire Biosphere is still a beautiful place to be and live, would you agree? **So what do you think? Should we try and conserve biodiversity in our Biosphere?**

Slide 23



What about our nature survey? **Do you think that the School Nature Garden has lots of Biodiversity?** Have a discussion here if you have time. **How could we encourage more wildlife to the garden? Is there anything else we can do?** Our school could become a Proud Supporter of the Biosphere.

SEE THE NEXT PAGE FOR FURTHER DISCUSSION OF THIS SLIDE

How to improve the Biodiversity of your School Grounds

C of E Outcome: "I have contributed to the design or conservation of a wildlife area"

Build a Pond



There are many ways that your class can improve their school grounds for wildlife, and thus improve the school's biodiversity. The most effective way of doing this is to create a pond. This can be as big or as small as you like, but the value for wildlife is huge. The Wildfowl and Wetlands Trust has an excellent page on their website on how to create a wildlife pond, and there are also plentiful youtube videos on the subject.

<https://www.wwt.org.uk/discover-wetlands/gardening-for-wetlands/how-to-build-a-wildlife-pond/>

Feed the Birds



About half of British households feed wild birds. The pleasure gained from quietly watching a busy bird feeding station is priceless and improves our connection and sense of responsibility for nature. However, it is very important in a school context to realistically consider the work involved in keeping the feeders topped up and clean. There is obviously a cost involved, but there are ways around this; why not ask a local shop, garden centre or wholesaler (such as Tarff or Harbro) to sponsor your feeder? Maybe the school eco-committee could hold a fundraiser to purchase bird food in bulk. There is also a time commitment; someone will need to be responsible for filling and cleaning the station regularly as birds will be more likely to use the feeders if they are well-maintained. The opportunities for

learning in different areas of the curriculum are many, for example a long-term survey or species visiting the feeders would be very interesting, as would taking part in the RSPB's annual Big Garden Birdwatch.

<https://www.rspb.org.uk/get-involved/activities/birdwatch/>

There are also practical activities such as making yogurt pot fat peckers - a good step by step recipe can be found at:

<https://www.gardenersworld.com/how-to/diy/how-to-make-fat-cakes-for-birds/>

And of course, the benefits to our bird population are huge. We have lost so much natural habitat and foodsources for our little birds, that providing supplementary food helps to redress the balance.

Provide Homes for Wildlife



Bumble
bee hotel



Corrugated iron sheet
for reptiles and amphibians
to shelter beneath



Nest boxes are
available for a whole
variety of bird
species, from Blue
 Tits to Tawny Owls



Bat boxes can be
made in school
with basic
woodworking
equipment

Why not increase biodiversity by providing places for animals to shelter and nest?

Become a Proud Supporter of the Galloway & Southern Ayrshire Biosphere



See the next page for details on how to become a Proud Supporter of the Biosphere. Schools, individuals and groups can all become Proud Supporters - it is easy to do and free of charge.

How Your Primary School Can Become A Proud Supporter of the Galloway & Southern Ayrshire Biosphere



Your school can easily become a supporter of the Biosphere. By agreeing to the 6 principles of the Biosphere Charter, your school will play an important part in increasing awareness and protecting the natural resources of the Galloway & Southern Ayrshire Biosphere.

It's easy to apply!

Just visit the website at www.gsabiosphere.org.uk, and register.

You will need to describe how your school intends to meet the following principles of the Biosphere Charter.

1. Help conserve the natural resources of the Biosphere
2. to support the economy to benefit people and nature
3. to promote cultural heritage and local produce
4. to contribute to the health & well-being of the community
5. develop knowledge, understanding, and promote research
6. to raise awareness of the GSAB



Your school will get a Proud Supporters certificate - join the growing number of schools who have already signed up, and help to protect our beautiful Biosphere!

Slide 20



What animals did we not survey? Mammals, such as red squirrel, foxes, bats, mice, deer, and badgers.

Why not? The main reason is that many are nocturnal - they only come out at night. Also most wild mammals fear humans and hide or run away.

Is it important to survey mammals? A healthy mammal population reflects a healthy ecosystem. We need to know how many red squirrels there are, for example, so that we can protect them. If their numbers are declining then we need to know so that we can try and help them. There may be too many red deer and that may

have negative impacts on forestry, but we need to know how many there are in the first place so control measures can be implemented.

How do we survey mammals? Difficult to survey shy and wary creatures - can find their poo, or other evidence of their presence, such as badger setts - could then use night-vision cameras to survey the inhabitants. Small mammals can be trapped and counted that way. Records provided by the public can also be an important way of recording the sightings of a mammal in an area. For example Saving Scotland's Red Squirrels have a website www.scottishsquirrels.org.uk where you can report a sighting of a red or grey squirrel, which also has maps comparing sightings for the current and previous years.

Slide 21



And to finish, let's go back to the Beavers. Beavers have been reintroduced to Scotland in two places. They 'accidentally' were reintroduced to the River Tay, and they were reintroduced by conservation experts to the Argyll peninsula. Both populations are doing well and are managing to live mostly in harmony with the humans that live there too. Maybe beavers could be introduced back into Dumfries & Galloway in the future! This presentation and workshop session has been written and designed by Shalla Gray, the Biosphere Explorers Project Officer, who really really would like to see Beavers in the Biosphere!

Castle Douglas Primary School Carrying out their Biodiversity Survey



Their most interesting discovery?
A bumble bee nest in a bird box!

Workshop 4 - Climate Change and the Biosphere

Teachers Notes

Climate change is a hot topic (pardon the pun) - and yet there is much conflicting advice and opinions surrounding this subject. In the presentation, the children will be shown some of the basic science behind climate change and then move on to actions they can take to help stop/prevent/reverse it. This subject can be emotional and overwhelming; it is easy to feel hopeless and powerless in the face of such a huge issue. Please take your time with presenting this topic and if possible allow lots of discussion. Any questions you don't know the answer to, encourage the children to research - there are many great Climate Change resources available, for example:

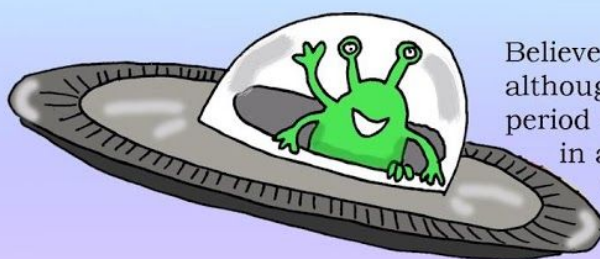
eschooltoday.com/climate-change/introduction-to-climate-change-for-children.html

hctfeducation.ca/lessons/energy-atmosphere-and-climate



The latter is a Canadian website with pdfs on specific aspects of climate for varying ages - it has good, detailed instructions on games and activities to do with the carbon cycle for example. There are also online courses for teachers to learn the science behind Climate Change; these change quite quickly but are easy to search for.

Although it is generally accepted now that human induced climate change is Science fact, there are people who do not believe in it. Often, their argument is that any fluctuations in climate that we are measuring today, are in fact natural changes which would have taken place without the presence of humans. It's ok to have differing opinions on this matter. Even now, because of the short time we've been measuring climate and because of the huge timescales that climate fluctuates in, we genuinely don't know for sure that it is humans that are causing this accelerated warming. Based on the evidence available, it seems likely, but it is definitely not irrefutable fact. So encouraging informed debate and discussion about this topic is a great thing.



Believe it or not, our Earth is currently in an Ice Age, although luckily for us, we are in an Interglacial period - a relatively short period of time (10,000 years) in a much longer sequence of Ice Ages. Some scientists think that we might prevent the next Ice Age period with our industrial activities, but of course we have no way of knowing if that's the case.

With all this uncertainty, it's very hard to say one way or the other whether humans are causing climate change or whether the warming of our planet over the last 100 years is merely a natural phenomenon. The point that scientists and commentators make in reply to this is that the planet is warming so fast that it would be safer to assume that we are at fault, and for our own well being as a species, if for no other reason, we should follow The Precautionary Principle and work to reduce greenhouse gas emissions just to be on the safe side.



Further Investigation

There are experiments which directly demonstrate the effects of increased carbon dioxide in the atmosphere. Two possible class experiments suitable for this age group are detailed in Appendix 1.

The first demonstrates the heating effect of CO_2 in the atmosphere, using the chemical reaction between Bicarbonate of Soda and vinegar to create CO_2 in plastic juice bottles, which are then placed beside a lamp (to simulate the sun).

When compared with a control bottle containing normal air, it can be demonstrated that the bottle containing CO_2 heats up more than the control.



Another interesting experiment demonstrates why increased CO_2 in the oceans is detrimental to living things. Step by step instructions for this are also found in Appendix 1. Increased CO_2 increases the acidity of the ocean, and this in turn affects marine life.

You will need some sea shells for this experiment. Why not combine a collecting trip with a beach clean? Details for organising a Beach Clean are given in the second part of this pack, Out & About in the Biosphere.



Workshop 4

CLIMATE CHANGE & THE BIOSPHERE

Contents

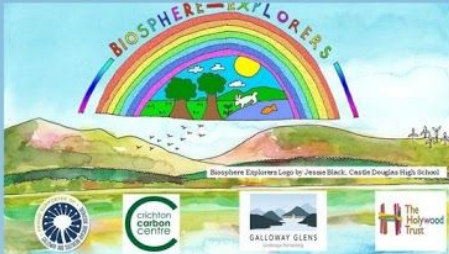
Explanatory Notes for slideshow
Activity - The Greenhouse Gas
Board Game

Slideshow - 1 hour

Activity - 1 hour

O's and E's - Sciences - Planet Earth- "I can explain some of the processes which contribute to climate change and discuss the possible impact of atmospheric change on the survival of living things".
Technologies - "I can analyse how lifestyles can impact on the environment and Earth's resources and can make suggestions about how to live in a more sustainable way".

Slide 1



Today in our Biosphere Explorers workshop we are going to discuss Climate Change. **Can any one tell me what Climate Change means?**

Slide 2



Climate Change is a hot news topic at the moment. **Can anyone think of any examples of problems in the news today which are caused by Climate Change?** Answers may include droughts, or wildfires in Australia, the icecaps melting, sea levels rising.

Today we're going to talk about why we think Climate Change is happening, how it is happening and what we can do to stop or reduce its effects on the planet and the human race. **CLICK TO REVEAL THE PICTURE BEHIND THE WORDS - AN ANIMATION OF THE INCREASE IN AVERAGE TEMPERATURES ON EARTH OVER THE LAST 100 YEARS..**

Slide 3



Here is a picture of our Solar System. **Can you name the planets when I point to them?** CLICKING WILL REVEAL THE NAMES OF THE PLANETS ONE BY ONE.

Slide 4



Have you ever heard of the Goldilocks Zone? This is the zone around a star which is neither too hot, nor too cold, but just right for liquid water to be present on an orbiting planet. Why is it called that? It's like Baby Bear's porridge from the fairy tale, neither too hot or too cold, but just right! This is important because it is believed that liquid water is necessary for any life to survive. In other words, if there is no liquid water present on a planet, then as far as we know, life can never evolve. Around our star, the Sun, the Goldilocks Zone includes Venus, Earth and Mars.

Slide 5



Is there life on Venus or Mars? Why not? It is worth taking a bit of time here to discuss the question of life on other planets. (see page 7 for more facts on this topic).

Slide 6



Well, there is a different reason for each of the planets, and it's all to do with their atmospheres. What would happen if there was no atmosphere around the Earth? Expect some whacky answers here, but don't let them get too carried away - these are tricky concepts though, so a bit of light relief won't hurt...

Slide 7



Heat from the sun would reach the Earth and...

...would be reflected straight back out into space again.

Slide 8



Slide 9



This is what happens on Mars, hence it has an average surface temperature of -63°C – too cold for liquid water. Can you imagine -63°C ? Is the temperature ever that low on Earth? Antarctica has recorded the 5 lowest ever temperatures on Earth. In 2010, the temperature reached -93°C at Dome Fuji in the interior of the Antarctic continent. However, that is our lowest temperature, when for Mars that is an average. What's the difference? Scientists think the temperature might get to -153°C at the poles of Mars.

Slide 10



Thank goodness the Earth has an atmosphere then...

Slide 11



When the sun's rays reach us...

Slide 12



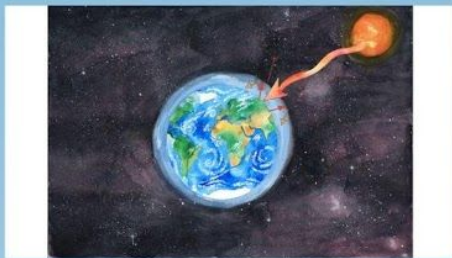
Some is reflected off the atmosphere back into space,

Slide 13



But most of the energy is trapped within the Earth's atmosphere.

Slide 14



Thus trapped, it bounces off gases and water vapour which make up our atmosphere (more of that later)

Slide 15



Over and over again, trapping the heat and making our planet a pleasant average of + 14oC (a nice warm Spring day in Scotland).

Slide 16



Warm enough for liquid water to exist on the planets' surface (thank goodness)

Slide 17



Something different has happened on Venus. It's atmosphere is so dense and full of gases that it has trapped too much of the sun's energy which has resulted in a 'runaway greenhouse effect'. This means that it is the hottest planet in our solar system at plus 462oC. So not enough atmosphere results in a planet too cold to support life, and too much atmosphere results in a planet too hot to sustain life. On Earth the balance is just right, just like Baby Bear's porridge!

Slide 18



To find out why that is, lets have a closer look at Earth's atmosphere. The atmosphere of our planet is approximately 480 km thick.

Teacher Notes - Atmospheres of Other Planets in Our Solar System

Galloway Dark Sky Park

Our Biosphere is the perfect place to look at our closest planets, and the differences in their atmospheres are apparent even with a pair of binoculars. Some rangers specialise in Dark Sky excursions - see the contacts page for more details, but you could take your pupils out yourself.

Telling the Difference Between Planets and Stars

It is fairly straightforward to tell the difference between planets and stars using the following rules:

1. planets tend to be brighter than stars
2. planets don't twinkle
3. planets rise in the East and set in the West, whereas stars move in a circle around Polaris the North Star.
4. planets follow roughly the path of the moon across the sky



How to find Polaris, the North Star. Find The Plough, then use the end two stars, 'the Pointers' to find the first reasonably bright star in a straight line up from them. Once you are facing this star, you are facing north.

Mars

The Red Planet - it does actually look orange in the sky, and binoculars will show this more clearly. Although you won't be able to see any surface detail with binocs, when you are looking at Mars you are actually seeing the orange oxidised rocky surface of the planet itself, as there is no atmosphere to speak of to block the view.

Venus

The Morning or Evening Star, Venus is by far the brightest planet. Before humans came with light pollution, the light of Venus actually cast a shadow! This brightness is because of Venus' thick atmosphere which reflects 65% of the sunlight which hits it. So unlike Mars, when you look at Venus you cannot see its surface, just the tops of the clouds which smother it. Depending on when you look at it, Venus shows phases like the moon!

Jupiter

It is possible to see Jupiter and its four largest moons through binoculars.



Jupiter

Saturn

Saturn looks oval through binocs due to its rings.



Saturn

Slide 19



480km is about the distance from Castle Douglas to John O Groats at the very top of Scotland.

Slide 20



but most of it is actually within 16km of sea level (PUT IN A LOCAL REFERENCE HERE _ THE ONE ON THE SLIDE IS HALF THE DISTANCE BETWEEN CD AND DUMFRIES), and it gets thinner as you go higher.

Slide 21



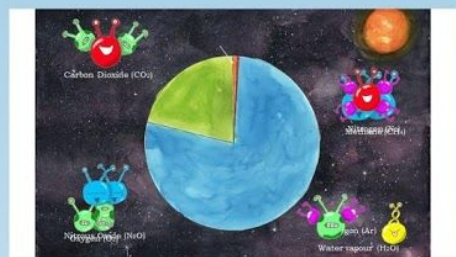
This is why it is hard to breathe at the top of Mount Everest (8 ½ km high) as it almost pokes out of the top of the breathable part of the atmosphere.

Slide 22



So our atmosphere is very thin. This is a satellite view of the UK at night taken by the astronaut Tim Peake from the International Space Station. See the multi-coloured line at the top? That's the atmosphere (the green lights are the aurora borealis - the Northern Lights)!

Slide 23



So what is our atmosphere made of? It's all around us but we can't see it. And without it there would be no life on Earth. Well it's made up of a variety of gases. Any ideas? The largest percentage is Nitrogen, followed by Oxygen – what's important about Oxygen? The tiny orange segment is Argon, and then the even smaller red segment – what could be in there? Basically everything else! And that includes the Greenhouse Gases – Carbon dioxide, Methane, Nitrous oxide and water vapour.

PLEASE SEE THE NEXT PAGE FOR A DETAILED DESCRIPTION OF THIS SLIDE

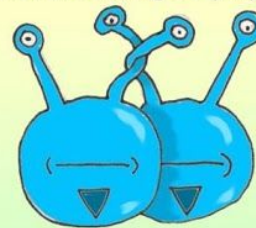
Slide 24



So what is a Greenhouse gas, and why are they important, given that they make up such a tiny percentage of our atmosphere. Well, they have a disproportionately large effect on the ability of the atmosphere to absorb heat from the sun, if you remember back to this slide. The sun's rays are bounced around by these gases, which warms the atmosphere.

Teacher Notes - The Composition of Earth's Atmosphere

Slide 23 shows the composition of our atmosphere. It starts with a view of the Earth and the atmosphere. CLICK to move on to a pie chart where the different colours represent the different gases which make up the atmosphere. Before every click, ask the class if they can guess which gas it is. The blue area of the chart is Nitrogen (N_2). 78% of our atmosphere is Nitrogen, which is an inert gas (that means it is non-reactive). Bacteria and some plants can remove Nitrogen from the atmosphere and fix it in the soil, making it more fertile. CLICK to reveal the Nitrogen molecule and make it move to the blue area of the chart.

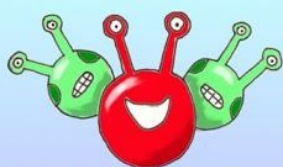


Next is the green part of the chart. It makes up 21% of the atmosphere. Oxygen is the gas we need to breathe of course, and we also need oxygen to create fire! CLICK to move Oxygen to its segment.



Next is Argon. It is unlikely that many of your class will have heard of this noble gas. Like Nitrogen, it is non-reactive - in fact its name comes from the Greek word for 'lazy'. Humans use Argon as an insulator, for example in diving suits, and also as a preservative for important historic documents, and in neon lights - a blue neon light has argon in it, not neon. CLICK to move Argon to its spot, and then ask the class what they think is contained in the tiny red segment.

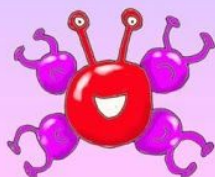
Actually it is everything else! Including the Greenhouse Gases - the ones we are concerned about affecting the climate of the Earth. Can any of the children name a Greenhouse Gas? CLICK to reveal them. Carbon dioxide (CO_2) is the gas which is talked about in the news. It does occur naturally in the atmosphere - does the class



know why natural Carbon Dioxide is crucial to us? Plants use Carbon Dioxide to photosynthesise (how plants create their energy from sunlight). A by-product of photosynthesis is Oxygen - essential to animal life on Earth. Burning trees releases stored CO_2 into the atmosphere, as does burning fossil fuels

such as coal, oil and gas (which are all made from the remains of fossilised plants). It is this huge release of Carbon Dioxide which is thought to be the main cause of climate change. Incidentally, 96% of the atmosphere of Venus is CO_2 .

The other main greenhouse gases are: Nitrous Oxide (N_2O) - also known as laughing gas, as if you inhale it, it makes you happy. It was historically used in dentistry to reduce pain. It is a greenhouse gas which is produced by agriculture in the form of artificial fertilizers and in manure from farm animals.



Methane (CH_4) is the main component of natural gas used in heating and cooking. Farm animals produce large quantities of Methane. It is also present in the thin atmosphere of Mars, but at too small concentrations to have a heating effect.

Water vapour is the most abundant greenhouse gas, and crucially important for all life on Earth. As the Earth heats up, more water vapour will be stored in the atmosphere, resulting in more heating. This is called positive feedback.



Slide 25



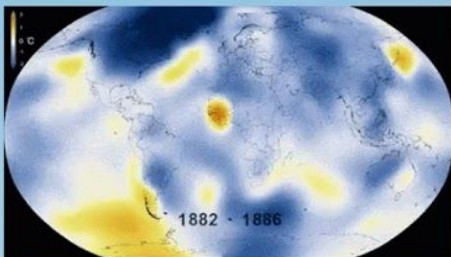
Here's a close up of what's happening. (CLICK)
The arrows show the heat from the sun being bounced around inside the atmosphere. Remember that without these gases our planet would be too cold to support life as we know it. BUT! The Greenhouse Gases in our atmosphere are finely balanced.

Slide 26



Too little and the planet is too cold... Too many and WHAT?? Yes, we think that the planet could become hotter if the concentration of Greenhouse gases increases, as there will be more molecules for the reflected heat to bounce off. This is already being demonstrated today.

Slide 27

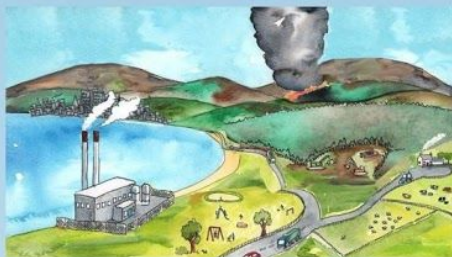


This animation shows the difference in average temperature over the years 1882 until 2017. A hot colour means the temperature is above average, while the blues show below average. As you can see, average global temperatures have risen steadily over the last 100 years. In fact Scotland recorded its highest ever temperature in 2019, an amazing 33.2°C on the 28th June in Motherwell.

Why is this happening? Why is the world becoming hotter?

Maybe allow a bit of discussion here before going on to the next slide.

Slide 28



TAKE YOUR TIME WITH THIS SLIDE

Greenhouse gases do naturally enter our atmosphere by various processes. This is a view of Dumfries and Galloway way before humans came along. **What things can you see that naturally put greenhouse gases into the atmosphere?** Volcanoes, wild animals, forest fires and the ocean all release greenhouse gases naturally. **Did you know that there used to be volcanoes in Scotland?** Most of the Galloway Hills were volcanoes – anywhere that you find the rock called granite which is a volcanic rock. (CLICK) So this is the landscape now. **What do humans do to put Greenhouse gases into the atmosphere?**

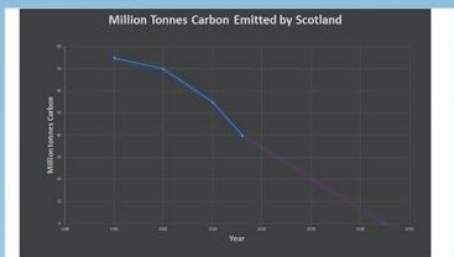
Well, there are still forest fires, so I've left them. There are still wild animals. But we have also brought: farms, (CLICK) cities and towns, (CLICK) power stations, (CLICK) deforestation, (CLICK) international travel, (CLICK) and local travel, (CLICK) and all these things release much more greenhouse gases into the atmosphere than would naturally occur, which may be why we have seen global temperatures increase so much in the last 100 years.

Slide 29



Will an increase in global temperatures cause human beings problems? After all it might be nice if Scotland was a bit warmer! The answer to that question is that scientists are just not sure what the effects of global warming are going to be. There are too many variables. These are just a few of the things that might happen.... (CLICK) there will be more storms and other extreme weather events such as heavy rainfall or droughts. (CLICK) Certain crops will not grow here anymore, and those that do will be more prone to disease. (CLICK) Believe it or not, in Scotland it might not even mean that the temperature goes up! It might actually get colder here due to the loss of the warm water current that flows across the Atlantic to our coast from the Caribbean. There will be other local effects that no one can foresee. It's hard to imagine that one species can have such a big effect on our planet.

Slide 30



The fact that things are so uncertain surely means that we should do everything we can to slow down our emissions of greenhouse gases. The Scottish Government wants Scotland to become carbon neutral by 2045. That means that every tonne of carbon that we release into the atmosphere, we have to remove one tonne of carbon. The problem here is that it isn't just one tonne of carbon – in 2016 Scotland emitted approximately 40 million tonnes of greenhouse gases! That works out to a carbon footprint of about eight tonnes of CO₂ per person in Scotland being released into the atmosphere. We have reduced this figure since we realised that global warming was a problem in the 1990's, which is great, but we need to keep going!

Slide 31



So how on Earth can we do that? How can we reduce our carbon emissions by such a huge amount in less than 30 years? Well there are lots of ways to reduce our carbon footprint, and they all involve a change in the way we live our lives. To show you some of these ways we're going to play The Greenhouse Gas Board Game. The first time you play the game, it will be to simulate how we have acted in the past, the second time is how we are acting now, and the third time we will play it as if we are determined to get our carbon emissions to zero by 2045. Let's see if it's possible...SEE PAGE 55 FOR INSTRUCTIONS

Slide 32



So can you see that there are lots of ways that we can make a difference? The hope is that if everybody works to make a small difference, they will add up to a big difference and hopefully we can slow down the rate at which our planet is warming. As we talked about before, the Earth will survive, life of some kind will survive, but may be not us! Or at least not so many of us. The ways of reducing our carbon emissions that we looked at in the game involved us living more sustainably. We will talk about this in the next workshop.

Teacher Instructions for Greenhouse Gas Board Game

THE FULL VERSION OF THE GREENHOUSE GAS BOARD GAME CAN BE BORROWED FROM THE CRICHTON CARBON CENTRE – EMAIL s.gray@carboncentre.org TO ORGANISE.

Contents of Game

Portfolio with 6 Greenhouse Gas boards & this instruction sheet

6 x Recycled Sweet Tubs containing:

- 16 x red-backed cards
- 16 x green-backed cards
- 1 x dice
- 6 x people counters
- 9 x CH₄ counters
- 8 x N₂O counters
- 25 x CO₂ counters
- Quick instruction sheet

Each group of children should play the game three times. Each round will take 10-15 mins with breaks between for discussion if required.

Round 1: Human greenhouse gas emissions in the past (i.e. from the start of the industrial revolution until the present day).

Round 2: The current situation - human greenhouse gas emissions right now.

Round 3: The future – how do we need to live in order to bring our greenhouse gas emissions back into balance.

Preparation:

1. Each group gets a game board and a sweet tub. Maximum of 6 players in each group.
2. Each player takes a wooden person as their counter.
3. Greenhouse gas counters are left in the box.



P5 Castle Douglas primary
starting Round 1

Procedure Round 1:

Only the red-backed cards are used in this round. Explain to the class that this first round will show how humans have affected the balance of gases in our atmosphere in the past.

1. Everyone puts their counters on the start square.
2. Put the red-backed pile of cards on the red square.
3. The youngest in the group throws the dice and then turns are taken clockwise from then on.
4. Each player throws the dice and moves forward the number of squares corresponding to the number on the dice.
5. If they land on a green square in this round, they do nothing.
6. If they land on a red square, they take a red card and read it out to the group.
7. The red cards contain human actions that release greenhouse gases into the atmosphere. Each card will tell the player to add a certain amount of gas tokens to the big Planet Earth in the middle of the board.
8. Because we are only using the red cards, the tokens will add up, equating to a build up of greenhouse gases in the Earth's atmosphere. This is a representation of what has happened to the Earth's atmosphere since the Industrial Revolution.
9. Each player takes their turn until all have made it round the board. They don't have to throw an exact number to finish. The group will end up with a pile of tokens sitting on the Earth WHICH SHOULD BE LEFT THERE UNTIL THE NEXT ROUND.

Once everyone has finished, take a wee break to discuss what the outcome shows, which is basically that the way we have used resources in the last 100-150 years has resulted in a build up of greenhouse gases in the atmosphere. From what we have discussed in the presentation so far, the children should be able to suggest effects of this build up of gases, namely that the atmosphere is becoming warmer.



Children of Dalry Primary ready for Round 2!

Procedure Round 2:

Both the red and green backed cards are used in this round. Explain to the class that this round will show the current situation in the world today.

The game proceeds as before save that both red and green squares are in play. The green cards show actions that result in greenhouse gases being removed from the atmosphere. This means that sometimes more counters will be added to the Earth, and sometimes (if they land on a green square) the counters will be taken away.

Overall as they go around the board, nothing much will change.

This is the current situation in the world today. We have realised there is an issue, we are trying to solve it, but there are still people and companies emitting greenhouse gases which is resulting in no change in the concentration of greenhouse gases in the atmosphere.

In reality the concentrations are still increasing due to factors including the massive deforestation of the Amazon, and the increasing use of fossil fuels by China for example, but it is up to you as the teacher as to how much emphasis you want to put on this.

The simple message might be enough for most primary classes.

Since the damage has already been done, we need to be reducing the amount of greenhouse gases in the atmosphere, not keeping it the same as it is now if we want to slow down or reverse human-caused climate change.



Procedure for Round 3:

Only the green-backed cards are used in this round. This is to demonstrate changes that we will all need to make if we want to bring the Earth's climate back into balance. This round therefore represents the future.

If the player lands on a red square, they do nothing. If they land on a green square, greenhouse gas tokens are taken away from the Earth. This will result, by the time everyone has completed this round, in a return to the beginning state of the atmosphere – there will be few or no tokens on the Earth.

The green cards represent actions that we can all take to reduce human emissions of greenhouse gases. All society needs to change in fundamental ways for this to happen. But with the ideas on the cards in the Greenhouse Gas Board Game, hopefully the class can take away the message that everyone can and should try to make a difference.



Workshop 5: Sustainability and the Biosphere

Teacher Background

When Galloway & Southern Ayrshire became a UNESCO Biosphere, the people involved had to agree to follow the aims of all Biospheres. These are:

Conservation - promotion and preservation of wildlife, habitats and landscapes. We discussed this aim in the Biodiversity Workshop.

Learning - education of the residents of the Biosphere as to what and why the Biosphere is. This is what these workshops aim to achieve!

Sustainable Development - the overarching paradigm of the United Nations. Defined as; 'development that meets the needs of the present without compromising the ability of future generations to meet their own needs.' It is a way of thinking of the future in which environmental, societal and economic considerations are balanced in the pursuit of an improved quality of life.

Biospheres are seen as sites for testing the interdisciplinary approaches needed to achieve sustainable development, and this makes it even more exciting and interesting that we live in a Biosphere!

The UN has split the topic of Sustainable Development into 17 Sustainable Development Goals. More details of these goals can be found on www.sustainabledevelopment.un.org.



These are an urgent call to action for all countries in a global partnership. They recognize that ending poverty and other deprivations must go hand in hand with strategies that improve health and education, reduce inequality, and spur economic growth - all while tackling climate change and preserving the natural environment.

Studying the Sustainable Development Goals would be a major set of workshops in themselves, but it is possible to incorporate them within everyday teaching. There is an excellent resource on the UN website with a variety of activities and suggestions on how to include the SDGs in teaching:

<https://www.un.org/sustainabledevelopment/student-resources/>

Within the scope of this workshop then, we are going to give a introduction to Sustainability and how it relates to the people that live in the Galloway & Southern Ayrshire Biosphere.

In Scotland of course we are very lucky to live in a country where some of the Goals have been achieved;



We are well on the way to achieving others:



The SDGs need a combination of approaches to achieve - there needs to be legislation at a national and local government level - a Top-down approach - but also there needs to be the commitment on an individual level - a Bottom-up approach. Both are equally important.

In our Biodiversity workshop we looked at how being a Biosphere can help us protect Biodiversity.



In Workshop 4 we looked at the Biosphere and Climate Change.



In our Biosphere, there are two areas which are especially interesting to look at regarding Sustainability, and we will focus on them in this workshop.



Workshop 5 SUSTAINABILITY IN THE BIOSPHERE

Contents

Explanatory notes for slideshow

Activity 1 - renewable energy in our
Biosphere

Activity 2 - Little Ways to Save the Planet

Slideshow - 1 hour

Activities - an hour each

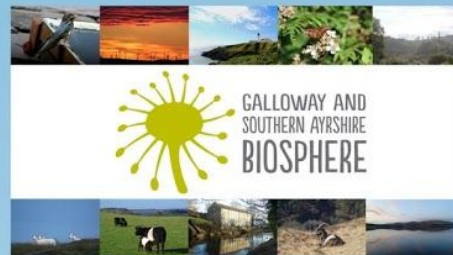
O's and E's - Learning for Sustainability is a core entitlement for all learners, and should be embedded in all areas of learning. This workshop aims to give a basic knowledge that can then be utilised across the rest of the Curriculum.

Slide 1



Welcome to Biosphere Explorers! Today we are going to learn more about the Galloway and Southern Ayrshire Biosphere Reserve.

Slide 2



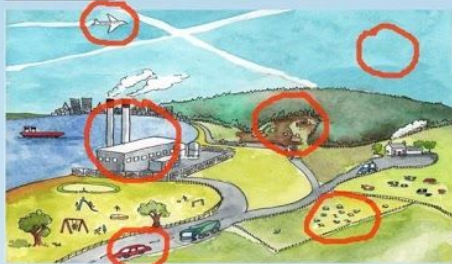
Can anyone tell me what the Galloway & Southern Ayrshire Biosphere is? Hopefully by now, you will be getting some good answers, about helping wildlife, and preventing climate change.

Slide 3



As well as conservation and climate change, the Biosphere is all about the people who live here. We need to live in harmony with the natural environment in order for the aims of the Biosphere to be achieved. Do we live in harmony with the environment at the moment?

Slide 4



Slide with icons which when clicked go to another slide with picture of the problem.

Plane = greenhouse gas emissions,

Power station = pollution,

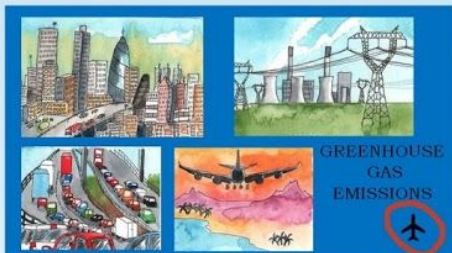
Forestry = habitat loss,

Sheep = over-consumption,

Car = Waste,

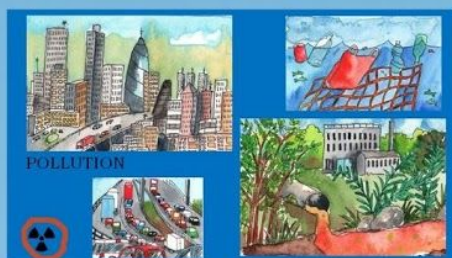
Blue sky = next slide

Slide 5



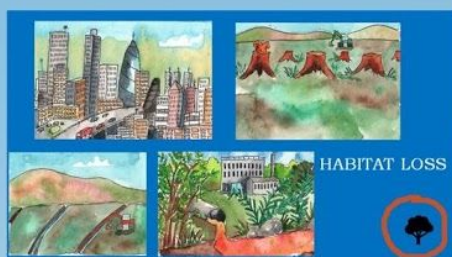
These are example of things that humans do which produce Greenhouse Gas emissions. These include power stations, electricity use by individuals and businesses, plane travel, whether for holidays or for carrying cargo around the world, cars, lorries and other traffic. Take time to discuss them with the class. Return to the main slide by clicking the plane icon at the bottom right corner.

Slide 6



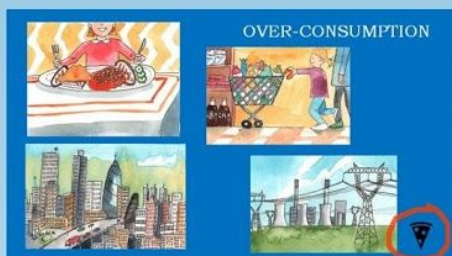
These are some examples of the things that humans do which cause pollution. These include heat and light pollution in cities, plastic pollution, exhaust fumes and run off and effluent into watercourses. Take time to discuss these with the class. Click on the Nuclear waste icon at the bottom left to return to the main slide.

Slide 7



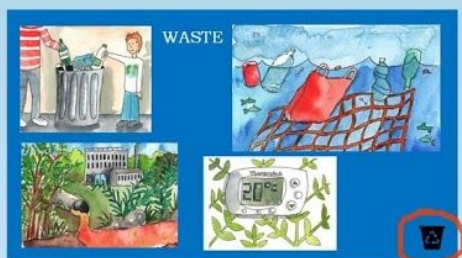
These are some examples of the things that humans do which cause habitat loss. These include deforestation, draining bogs, polluting waterways, building roads and houses. Take time to discuss these with the class. Click on the tree icon at the bottom right to return to the main slide.

Slide 8



Most people in the developed world consume more resources than they actually need to survive. The slide shows some examples of over-consumption. These include eating more than you need, buying more than you need, city life and being wasteful with electricity and other forms of power. Discuss this with the class. Click on the pizza icon to return to the main slide.

Slide 9



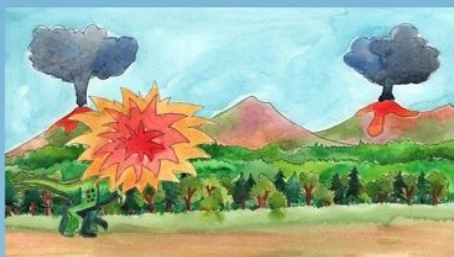
Human beings create a lot of waste. This slide shows examples of humans wasting things, for example, single-use plastics, not recycling, having your heating too high, dumping waste products in the wrong place. Discuss with the class. Click on the recycle icon to return to the main slide for the last time, then click on the area of blue sky to move on.

Slide 10



So humans as a species are currently using the Earth's resources unsustainably. What problems does this create? We've talked about humans causing loss of biodiversity, and our role in causing climate change. All human life is supported by the planet on which we live - if we use up the resources that the Earth has to offer without replacing them then we as a species will find it increasingly difficult to survive.

Slide 11



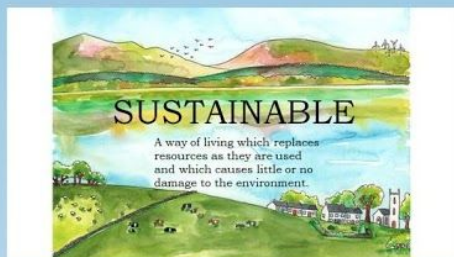
The Earth has survived worse than us before – the meteorite that finished off the dinosaurs for example caused huge disruption to the natural processes of the Earth and wiped out millions of species, but life as a whole survived, and ecosystems adapted and evolved to fill the gaps that the dinosaurs left behind. But that was a natural disaster - no one species has ever had such a huge effect on the whole planet as humans have.

Slide 12



So humans are changing the planet, and unfortunately not for the better. BUT it doesn't have to be this way. It's not too late to limit or even reverse the damage we've done. One answer is to preserve the core areas of biodiversity with Biosphere Reserves and then undertake to use the remainder of the biosphere sustainably and sensibly so that we can all live on planet Earth together. In fact, this is the second important function of a UNESCO Biosphere – promote a sustainable way of life.

Slide 13



So how will climate change affect us? In the Galloway and Southern Ayrshire Biosphere, there is a vision to make our community resilient and adaptive to climate change, whatever it may bring, from sea levels rising, to increased flooding, to hotter summers. We need to try and make ourselves ready for the changes to come, and to try and limit the effects of climate change on our communities. We can do this by upholding the principles of the Biosphere – protecting biodiversity and using our resources sustainably.

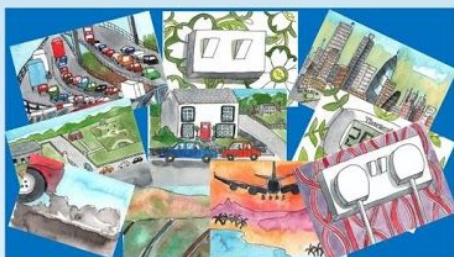
So what does sustainable mean? (CLICK) IT CAN BE USEFUL TO ASK A MEMBER OF THE CLASS TO TRANSLATE THE DEFINITION TO MAKE SURE THEY UNDERSTAND IT. ITS EASY TO JUST READ A DEFINITION AND NOT ACTUALLY TAKE IT ON BOARD! We are all so used to living unsustainably that it is going to be really hard work to change.

Slide 14



Do we live sustainably in Scotland just now? No we don't – in fact if everyone on Earth consumed resources at the same rate as Scotland does, one Earth would not be enough. In fact we would need three Earth's worth of natural resources (which includes biodiversity) to survive. Do we have three Earths?

Slide 15



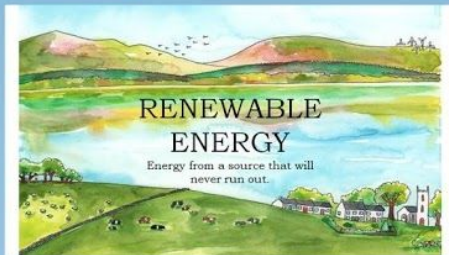
If you remember from the Greenhouse Gas Board game, a lot of the ways of reducing our emissions of Greenhouse gases had to do with our consumption of fossil fuels. Can anyone tell me what fossil fuels are? Fossil fuels are natural sources of energy such as oil, coal, natural gas and peat.

Slide 16



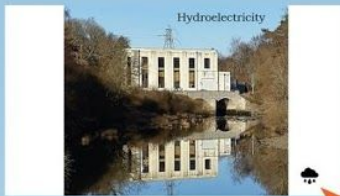
Do you know what fossil fuels are made of? Allow for answers here. They are basically carbon – made from the decomposed and geologically changed remains of the plants and animals which lived in the huge swamps and lakes that existed in the Carboniferous period 300 million years ago. This means that our whole society depends on fossil plant remains which locked carbon away in the Earth's crust, and which we are now burning to make power, releasing that carbon back into the atmosphere.

Slide 17



So how can we reduce our consumption of fossil fuels? We can use less of them, for example by using our cars less, or by switching the lights off, or we can generate our electricity in a different way, without burning fossil fuels. We've already talked about reducing consumption and how that can make a difference, so let's have a look at renewable energy – energy generated from sources which are sustainable.

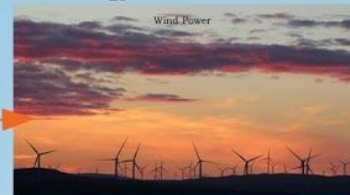
Slide 18, 19, 20, 21, 22, 23



This is a photo of Earlstown Power Station at Dalry which uses the Water of Ken to generate power, as part of the Galloway Glens Hydro Scheme.



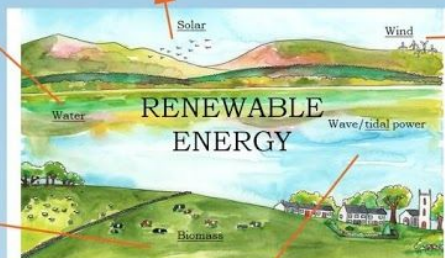
More and more houses are being built with solar panels, or having solar panels added on to their roofs. In some months of the year the panels produce too much electricity for the house to use, and the owners get paid by the Electricity companies for the extra energy!



Wind power – how many of you have seen wind turbines in our local area? All the wind turbines we have in Dumfries and Galloway helped Scotland last year generate three-quarters of its electricity from renewable sources.



Biomass energy – this is energy produced from waste or from sustainable forestry. The Eco Deco plant Dumfries takes household waste and turns it into pellets for burning in special power stations, and which is a renewable energy source as more trees are planted to replace the ones which are burnt. However, the trees are still burnt releasing their carbon so overall using this type of biomass will not reduce our carbon emissions. On a smaller scale, many farms now have biogas tanks which use cow poo to power the whole farm! The picture shows Cream O Galloway's tank.



Tidal and wave power have not fulfilled their potential yet in our Biosphere – but there are examples in other parts of Scotland, for example in Orkney and Shetland.

In Dumfries and Galloway, we are doing really well with renewable energy.

CLICK ON EACH TITLE TO GO TO A PHOTO OF THAT TYPE OF ENERGY PRODUCTION. TO GET BACK TO THE MAIN SLIDE CLICK ON THE ICON AT THE BOTTOM OF THE SCREEN.

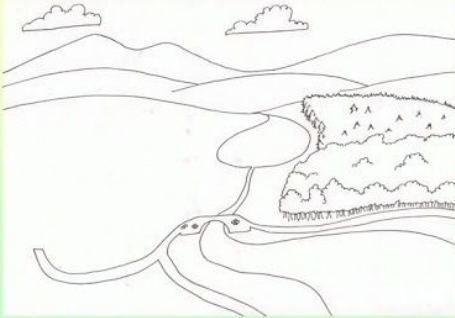
SUGGESTED ORDER IS:

HYDROPOWER, SOLAR POWER, BIOMASS ENERGY, TIDAL AND WAVE POWER, THEN LASTLY WIND POWER.

MAKE SURE YOU CLICK ON WIND POWER LAST, AS CLICKING ON THE WIND POWER PHOTO TAKES YOU ON TO THE NEXT SLIDE.

Renewable Energy Resources

Renewable Energy is a great topic to teach as there are so many different resources available. Included in the digital version of this pack is a blank landscape which the children can populate with renewables to show what our region would look like if it was entirely powered by renewable energy.



They can add in houses with solar panels, wind turbines, lorries carrying logs to a Biomass plant, wave turbines, a hydro-electric dam and building, to name a few. This could be done as a collage or as a drawing exercise. They could repeat the picture on a huge scale and carry it out as a group project.

There are many practical activities available to demonstrate how renewables work. For example

clearwaycommunitysolar.com/blog/science-cater-home-experiments-for-kids

have great practical experiments on how to build a water wheel from junk and also a wind turbine.

If you are doing a class project on renewables, the website:

<http://www.eschooltoday.com/energy/renewable-energy/what-is-renewable-energy.html>

is an excellent source of facts and figures suitable for primary school classes.

Because we have so many great examples of renewable energy production in our Biosphere, there are great opportunities for class trips. Drax host tours of the Galloway Hydro-electricity Scheme, based at Tongland Power Station where the kids have a guided tour of the building, followed by a trip up to the dam. Further details are in the 'Out & About' section of the Legacy Pack.



Slide 24



A new type of Wind Power has also been developed in Dumfries and Galloway. It generates power using kites! This technology is so promising that the Scottish company involved has recently been bought by a Norwegian company who will continue development there.

This is a picture from the company's website showing what they want the end result to look like.

Slide 25



So how can we live more sustainably in our Biosphere?
Reduce! Reuse! Recycle!

You will all have heard about the climate change strikes led by young people across the world. The aim of these is to make world leaders listen to young people's concerns about the future of humans on planet Earth. It is not your fault that planet Earth is in trouble! But we should all be part of the solution, not the problem.

Slide 26



We are going to make a wee booklet to show ways we can help reduce our carbon footprint. THE INSTRUCTIONS ARE STEP BY STEP ON THE SLIDE – THE SLIDE WILL REPEAT UNTIL YOU CLICK TO THE NEXT SLIDE. THE BOOKLET TEMPLATE IS INCLUDED IN THE DIGITAL PACK.

Slide 27



Businesses in the Biosphere are trying to be more sustainable. For example, a business in the Biosphere can apply for a Galloway & Southern Ayrshire Biosphere Chartermark. This award means that the business has agreed to follow the principles of the Biosphere in becoming more sustainable, protecting biodiversity and supporting other local businesses. Businesses with this chartermark include... (CLICK) Curly Tale Books, a small publishing company based in Kirkcowan, using local authors, promoting the local area and using 100% recycled paper for their books. (CLICK) Salad Brew, a small business in Borgue which uses organic farming methods and renewable energy to produce a variety of salad vegetables and chutneys. (CLICK) ACE – An outdoor adventure centre in Girvan which promotes sustainable tourism and beach cleans. (CLICK) Balkissock Lodge – a B&B near Ballantrae which uses local produce for its breakfasts and encourages sustainable tourism.

Slide 28



So, as you can see, the future of Planet Earth is in OUR hands. It is up to us to use resources sensibly and sustainably to make sure there is a future for the human race and all the other species we share our planet with. Can we do it? Well you and me, living in a UNESCO Biosphere are ideally placed to make sure that happens.

Conclusion

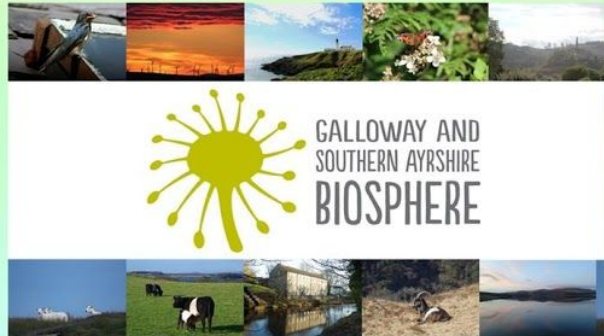
The Biosphere and Beyond!

Here we are at the end of the Biosphere Explorers workshops. I hope that you and your class got a lot out of them, and that you can all carry the message of the Biosphere on into the future.



Then we went on to discuss how our own Biosphere, the Galloway and Southern Ayrshire Biosphere is special, why it is unique and why we are lucky to live here!

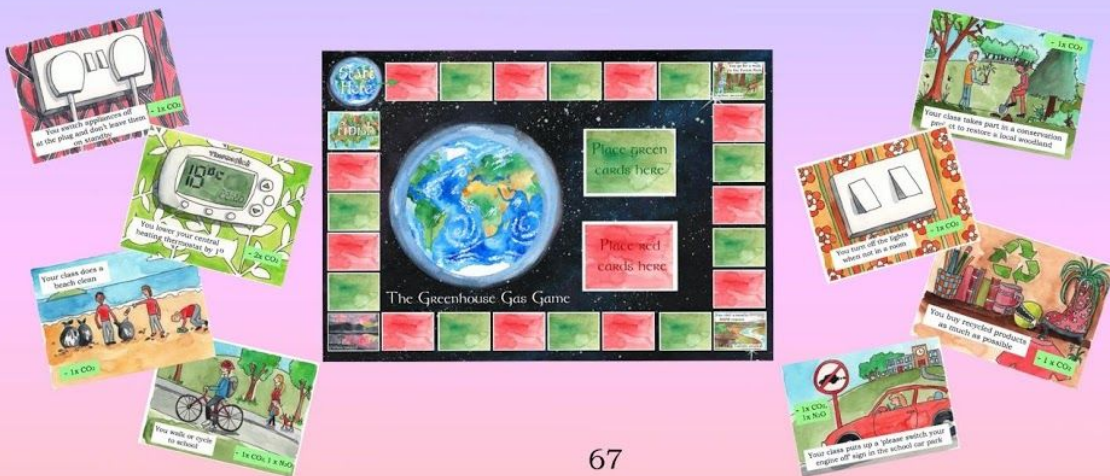
We've covered a wide variety of aspects of UNESCO Biospheres and what it means to live in a Biosphere, showing the connections between Biospheres all over the world, which share common aims and goals.



One of the reasons our Biosphere is so special is because of the wonderful biodiversity we have here. The third workshop focused on this biodiversity.



Then it was time to look at the topical subject of climate change. A huge topic to cover in one workshop, with a take home message for the children that there are practical actions they can take to make a difference and to make them feel empowered in the face of what seems an insurmountable challenge.



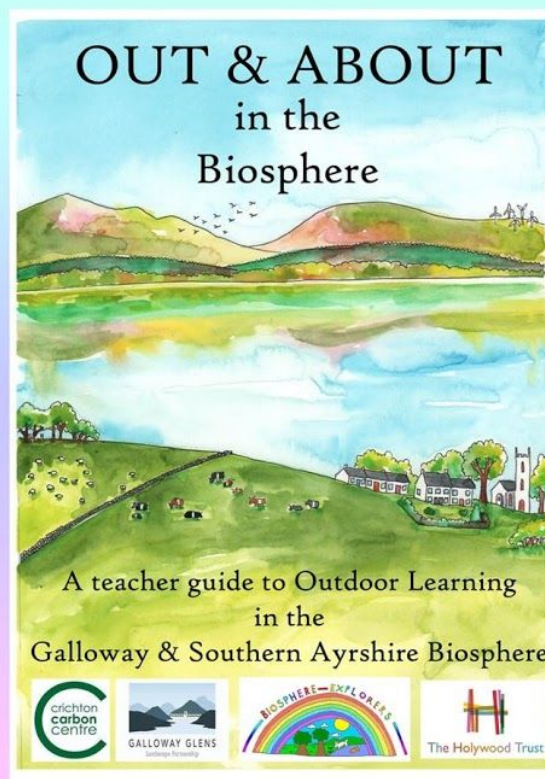


The final workshop focused on Sustainability - the way we need to live in order to achieve a healthy planet for all of us to live on. We looked at how our Biosphere is working towards sustainability - whether through renewable energy, recycling, or by the efforts of small businesses, and indeed individuals.

Next Steps

So now the workshops are finished - what next? How can you improve your class' connection with the Biosphere that they live in? Well, the best way to do this is to get out into the great outdoors to enjoy it!

To help you with this, a second part of the Legacy Pack, Out & About in the Biosphere, has been produced. With suggestions for low cost trips to attractions in the Biosphere which demonstrate some of the lessons learned in the workshops. As much detail as possible has been included in the pack to help make planning your trip as easy as possible. Where the trips help to fulfil the Curriculum for Excellence, this has also been highlighted.



Thank you very much for using this Legacy Pack, and thank you to our funders for making it possible.

This pack was developed, written and illustrated by Shalla Gray,
Biosphere Explorers Project Officer for the
Crichton Carbon Centre.

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