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Comhairle Contae County Council

Biodiversity

Education Pack

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Biodiversity Education Pack by Dean Eaton Designed & Illustrated by Sinéad & Sorcha Prior

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Contents

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Introduction

Thank you for taking the time to use the Dún Laoghaire-Rathdown County Council Biodiversity Education Pack. This is the third pack we have produced, and as with the other packs (Water and Litter and Waste), the Biodiversity pack is intended to provide resources and inspiration to support your students learning objectives in a fun and informative manner.

The pack is designed with both primary and secondary school students in mind. Not all the worksheets will be suitable for the age group you teach. With this in mind if you wish to explore a particular subject using a worksheet designed for a different age the Environmental Awareness staff will gladly support you in adapting material for your class.

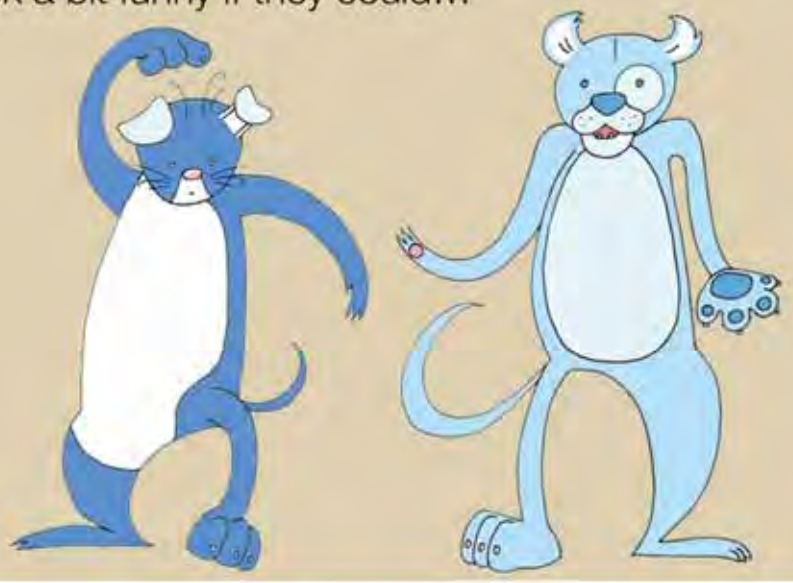
At all times we welcome your feedback. If you feel the content can be improved in any way we will endeavour to make the necessary changes and issue updates when feasibly possible.

Definitions

Bio = Life
Diversity = Variety
Biodiversity = The incredible variety of life on our planet.

Species = A group of organisms capable of interbreeding and producing fertile offspring.

Cats and dogs are from different species and therefore can't have children. They might look a bit funny if they could…

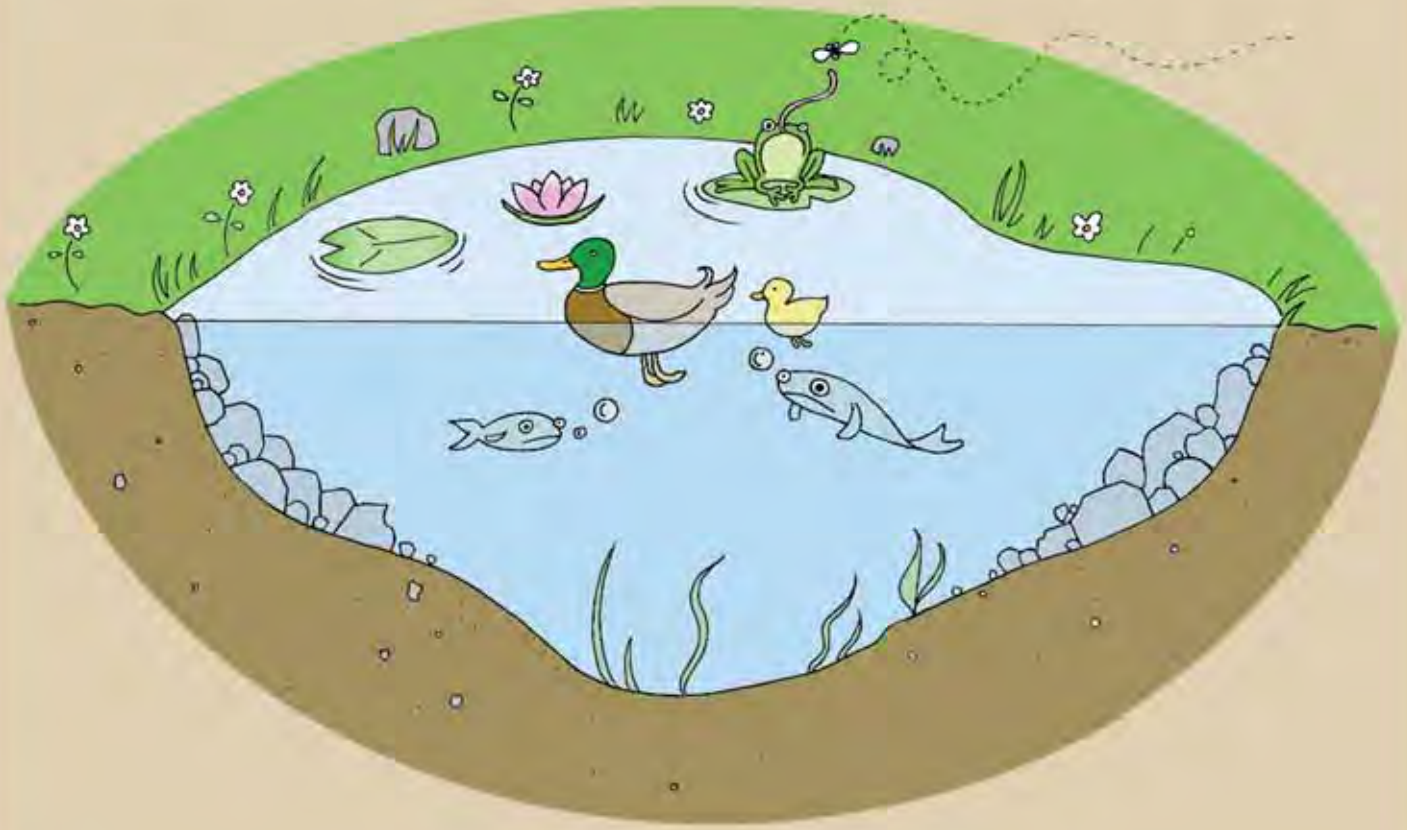


Organism = A living thing. Plants and animals are living things.

Habitat = A habitat is a place where a group of organisms live together. An example is a marine habitat.

Ecosystem = An ecosystem (Ecological System) is a physical place that includes all the living elements (biotic factors) such as plants and animals and all the non-living physical elements (abiotic factors) such as rocks, water, air and soil. In an ecosystem all the living and non-living elements function together as a unit.

An ecosystem can be very small, like a school pond or vey big like an ocean.



Definitions activity

Biodiversity

In small groups draw the letters of the word Biodiversity on pieces of A4 paper or A4 card (one letter per page). Then using a pair of scissors cut the letters out.

Cut out pictures of plants and animals from wildlife magazines, travel brochures and old calendars and stick the pictures onto your letters.

Looking at the definitions worksheet, what does biodiversity mean? Write your own definitions of the word.

organisms

Discuss in groups or pairs how we know something is alive? Think of animals, plants and microorganisms.

Habitat and Ecosystem

Close your eyes and visualise your home. How many windows does it have, what colour is it, how many bathrooms and bedrooms does it have?

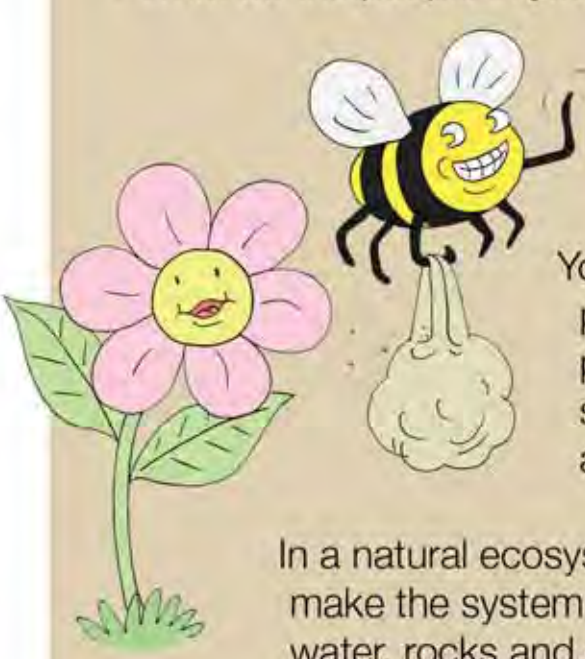
Draw your house onto a small piece of paper and label your drawing 'My Habitat'.

A habitat is a place where people or animals live. You probably share your habitat with your family, you might even have a few plants and some creepy crawlies hiding around the place.

Collect all the house drawings from your table and display them on a large poster. Your poster probably looks like a small town with all the different houses.

Small town needs more than just houses to work properly though.

- What else do you need to make your town work?
- What other buildings are needed?
- How do people get around your town?
- What do the people in your town need to stay safe and survive?



Draw small pictures of the things you need to make your town work and add these pictures to your town poster.

Your town is similar to a natural Ecosystem. It has people performing different tasks, buildings to perform some of the tasks in safely, air to breathe, soil to grow crops and water to help plants grow and to keep us alive.

In a natural ecosystem different animals perform different tasks to make the system work. A natural ecosystem might also require air, water, rocks and soil to work properly.

Task: Answer these questions

- Does your home habitat provide a safe place to live?
- Do people move between habitats?
- Do people leave their habitat to find food or to play?
- Do some people have jobs that help other people in the town habitat?
- Can you think of a couple of examples where people help others?
- Do some people have jobs that help keep the town healthy?
- Do we need other people to perform tasks to help us survive?

Task: Answer these questions

- In nature can you think of examples of a safe habitat?
- Can you think of animals that move between habitats?
- Can you think of animals that have to leave their habitat to find food?
- Can you think of something which an animal does that is helpful to other animals in the habitat?

Ecosystems

Look at a natural ecosystem like a grassland, river or woodland.

Think of the animals and plants (biotic factors) that live in your chosen ecosystem.

- Do any of the animals perform useful tasks?
- How do the animals interact?
- Are there any predators in your ecosystem? What do you think they eat?
- Are any of the animals grazers, what do you think they eat?

Imagine that you are one of the animals in the ecosystem. What would you need in order to survive? What dangers are present?

Definitions activity- Teacher notes

organisms- how do we know something is alive?

Living organisms can **take in energy from the environment**. This energy, in the form of food, is transformed to maintain metabolic processes and for survival.

Life can reproduce. Life can only come from other living creatures.

Life can respond. Think about the last time you accidentally stubbed your toe. Almost instantly, you flinched back in pain. Life is characterised by this response to stimuli.

Life can adapt and respond to the demands placed on it by the environment.

Life grows and develops. This means more than just getting larger in size. Living organisms also have the ability to rebuild and repair themselves when injured.

Secondary school students might research Virus's and debate if a virion (dormant virus) is alive.

In nature do animals need each other to survive?

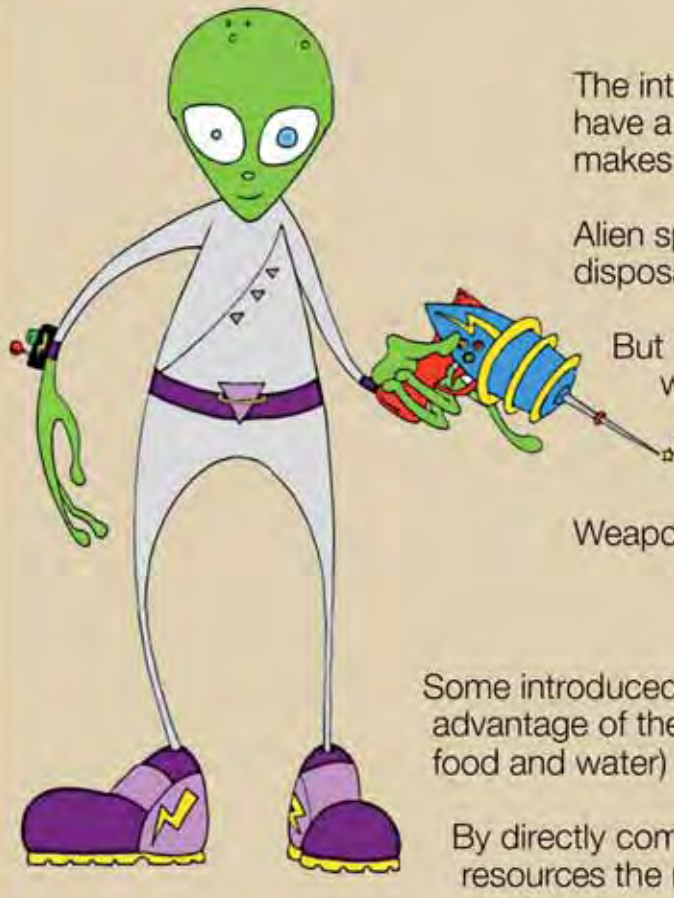
Yes. Food webs are an excellent example. If one part of the food web is removed it can affect many other parts of the food web.

An excellent example would be what might happen if the predators were removed from an eco-system, the danger would be that their prey population would increase rapidly. This could have devastating effects on an eco-system.

Activity - Ecosystems

Print off the various habitat posters (found in the additional resources section) for the children to use during this activity.

Alien Invasion!



The introduction of non native (or alien) species can have a devastating impact on Irish wildlife. So what makes these aliens so bad?

Alien species have a range of weapons at their disposal to defeat the native wildlife.

But it's not just the species in direct competition with the invader that are affected. The whole food chain can suffer as a result of the introduction of invasive species.

Weapons employed by alien invaders include:

Competition

Some introduced alien species can be better at taking advantage of the resources needed to survive (such as food and water) than the native species.

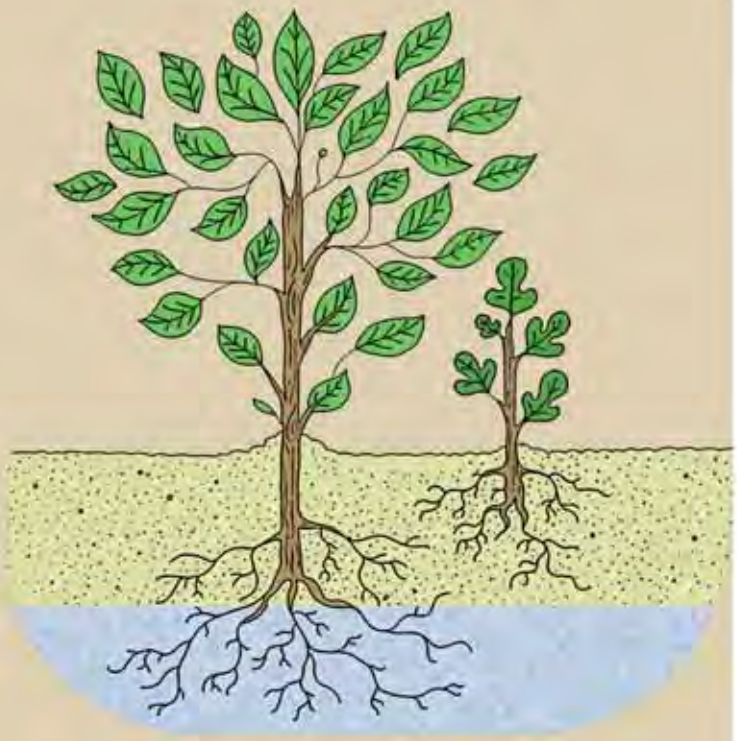
By directly competing with the native species for these resources the native species is weakened. This can lead to localised extinction of the native species.

Herbivory

Some alien species destroy the local wildlife by eating the vegetation. This can drastically alter the biodiversity of an area. Not only are the plants that are eaten by the alien species lost, the local wildlife which relies on those plants for food and shelter will be lost too.

Predation

Some introduced species may like to eat the local wildlife. This can have a major knock on effect to all the native organisms in the area, especially if the prey (the thing eaten) was performing an important task within the community



Habitat alteration

Invading herbivores and predators can drastically alter the natural habitat by interfering with the food web of an area. But so can invading plant species.

By growing faster and larger than native plants species they can eventually cut off the native plants access to sunlight or water.

Introduction of diseases

Some alien species carry disease which although have little effect on themselves can be devastating to native species.

Dilution of the gene pool

Some alien species are so similar to the native species, such as the Red Deer and the alien Sika Deer that they can breed and produce offspring. This can result in the characteristics of the native species being lost.

Task one

Can you find an example of an invasive species that uses each of the weapons above?

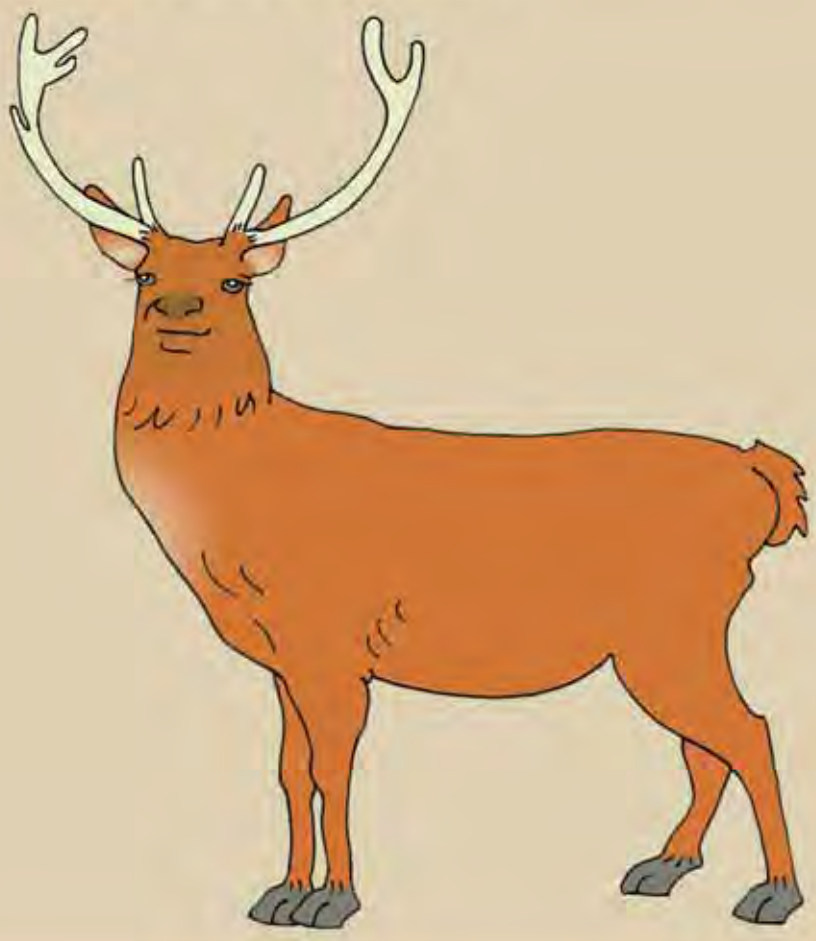
Why not check out the Invasive Species page on the Notice Nature ot the Invasive Species Ireland websites for some hints.

http://www.noticenature.ie/Invasive_Species_Homepage.html

http://invasivespeciesireland.com

Task Two

For one of the alien species on the notice nature or invasive species Ireland web-sites write a paragraph explaining how the alien arrived in Ireland and what action you believe could be taken to stop their attack.

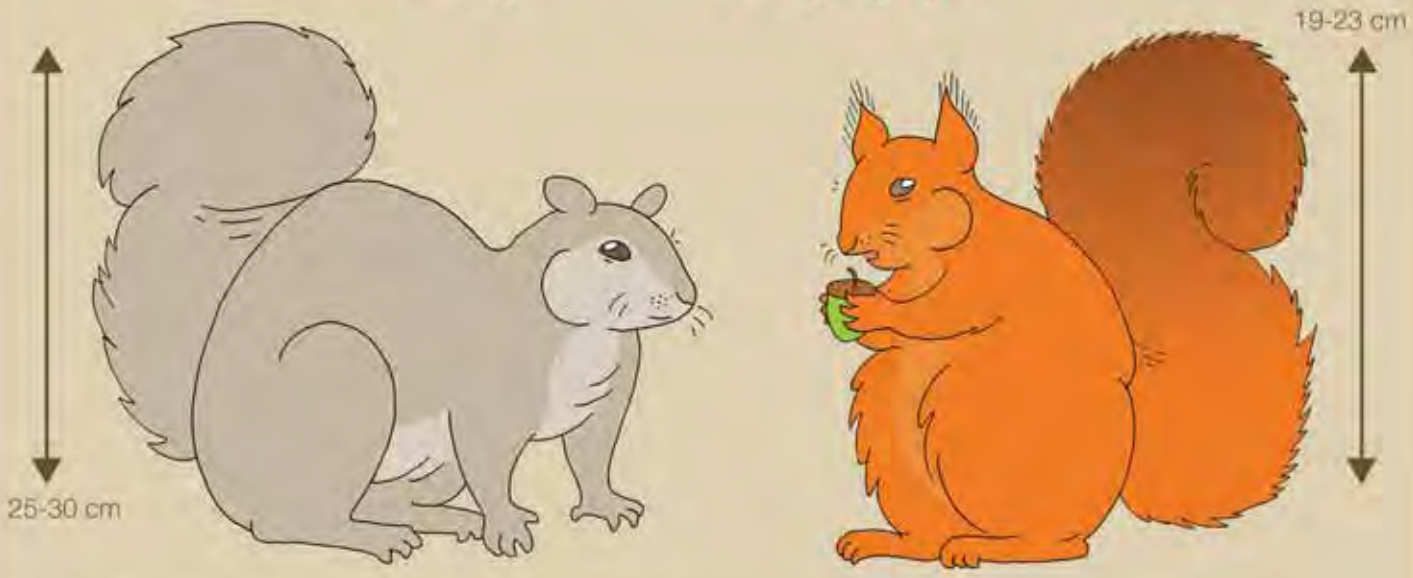


Alien Invasion: Attack of The Killer Squirrels!

In 1911 six pairs of Grey Squirrels were given as a wedding gift to a newly married couple at the Castleforbes estate in Co. Longford. When the basket carrying the grey squirrels was opened the greys made a quick break for the nearby trees, making good their escape.

Since then the Grey Squirrel population has grown dramatically which has been really bad news for the native red squirrels. Why you might wonder? Well the grey squirrels have two secret weapons which help them defeat the native reds.

Weapon one: Competition



The grey squirrels are bigger than the red squirrels and are better able to compete for the available food.

Weapon two: Disease

Many grey squirrels carry the Parapox virus which doesn't cause harm to the grey squirrel but can kill the red squirrel if they contract it.

Grey squirrels are also a threat to our native trees, as they are known to strip and eat bark when food becomes scarce.

Grey squirrels can now be found in half the counties in Ireland whilst the red squirrel is extinct in several Irish counties.

Best Buddies?

Mutualism is the relationship between organisms from two different species in which both species benefit.

Mutualism occurs rarely in nature, an excellent example of a mutually beneficial relationship is that shared between aphids and ants.

Aphids are the enemy of all gardeners, sucking the sap from plants in order to extract the nutrients they need to survive. This can greatly weaken and often kill the host plant.

The aphids secrete (poop) a sugary waste called honeydew which ants really like. In order to ensure they have a plentiful supply of honeydew the ants will vigorously defend the aphids from predators even going as far as destroying the eggs of ladybirds which prey on aphids.

Some ants are even known to care for the aphids during the winter carrying the aphids eggs to the ant nests to keep the aphids warm until the spring when the aphids are carried to plants in order to start feeding and producing honeydew.

The relationship isn't all good. The aphids are known to develop wings and fly elsewhere when food becomes scarce.

This would be bad news for the ants, so to stop the aphids flying away the ants have been known to tear the wings off the aphids.

I Am A Little Fish

I am a little fish swimming in the sea,
wondering why that big cave is smiling at me.

I like to explore the sea by day,
the coral reef looks better that way.

I am a little fish swimming in the sea,
wondering why that big cave is smiling at me.

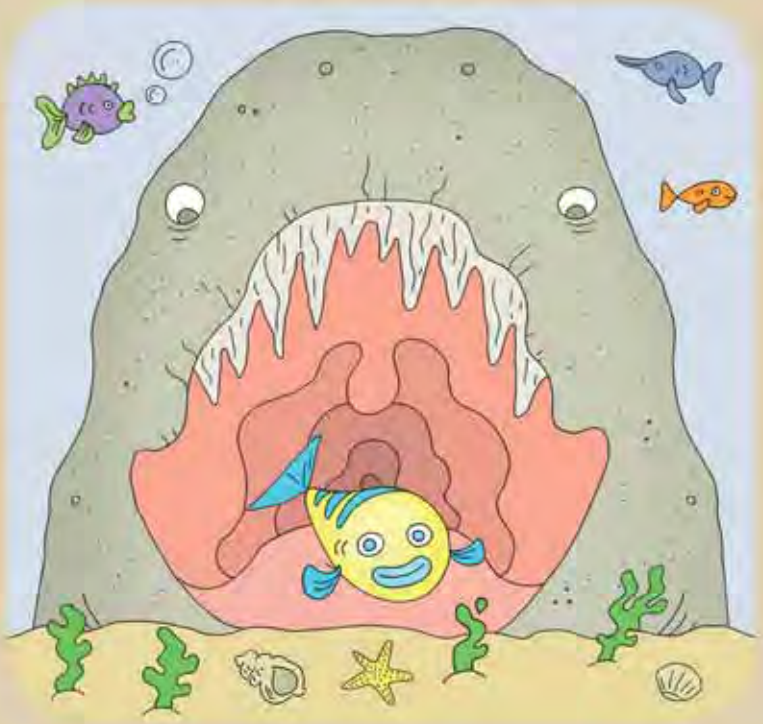
I like to explore the sea by day,
The pirate ship looks better that way.

I am a little fish swimming in the sea,
wondering why that big cave is smiling at me.

I like to explore the sea by day,
chase all the other little fish away

I am a little fish swimming in the sea,
wondering why all the other little fish
are swimming so fast past me.

Song by Dean Eaton



Fish (Eat them into extinction)

Fish fish fresh from the sea
Omega Fatty acids for you and me
Fish fish fresh from the sea
Eat them with chips Eat them with peas

Will they be there in ten years or more
Will they still swim all round our shores?
When they're not here who will answer?
Do we even care if we eat them into extinction?

Sustain abil ity
Food for today and 20 50
Sustain abil ity
Will Keep us fed will keep us free
Sustainability
Go catch some but leave some be
Sustainability
Please take care of the fish in the sea

Will they be there in ten years or more
Will they still swim all round our shores?
When they're not here who will answer?
Do we even care if we eat them into extinction?

Bio di versity
Another long word but bear with me
Bio di versity
If you wanna make money
Bio diversity means
Lots on land loads in the sea
Bio diversity
So please take care of the fish in the sea
Ki Ki Ki Sha Ma Bo Sha Ma Bo

Fish fish fresh from the sea
Omega Fatty acids for you and me
Fish fish fresh from the sea
Eat them with chips Eat them with peas

Song by Enda Reilly 2012

How to Design a butterfly garden

Gardeners may not be overly enthusiastic about attracting butterflies or more specifically one of their life cycle stages (the caterpillar) to their garden, yet butterflies add colour, movement and beauty to the garden and are also beneficial pollinators for many of our favourite flowers.

Understanding butterflies, particularly their life cycles will help attract butterflies to your garden because you will be better equipped to meet their food, shelter, and other needs.

Egg stage and host plants

Butterflies begin life as an egg deposited singly, or in clusters on or near the host plant. Most caterpillars have a limited number of hosts from which they can feed. It's vital that you plant native plants which the caterpillars feed upon such as the Cuckoo flower for attracting Orange-tips and Holly and Ivy for the Holly Blue butterfly.

Adult Stage

Flower nectar is the primary food source for most butterflies, it is therefore important to provide a range of native flowering plants that flower when the butterflies are active. A native wildflower meadow can be an attractive addition to any school garden wishing to attract butterflies.

Habitat

Butterflies require sunny gardens because they are cold-blooded and need sunlight to warm their bodies before flight. Providing sheltered sun spots for them to bask will be a big help.

Butterflies thrive best in a sheltered garden, by planting tall shrubs, vines or trees around the perimeter will provide a natural windbreak (Better still provide tall plants that provide shelter and nectar).

overwintering

Butterflies can overwinter as a chrysalis (pupa) or as larvae (caterpillar). Providing a log pile or a bug hotel with vertical slits can help butterflies overwinter in your garden.

Vegetable Gardens and Chemicals

To protect vegetables and herbs, put netting over the crop you wish to protect. The netting will prevent the female from laying her eggs on the plants.

Do not use chemicals on your garden, particularly insecticides which butterflies are highly sensitive to.

Seamus and Aoife go on Seed Safari

Seamus and Aoife are brother and sister and always play together, even if they seem to argue about everything. This weekend they are going to the Park to take part in a Seed Safari with 'Mouse'.

"Have you packed everything?" their mum asks.

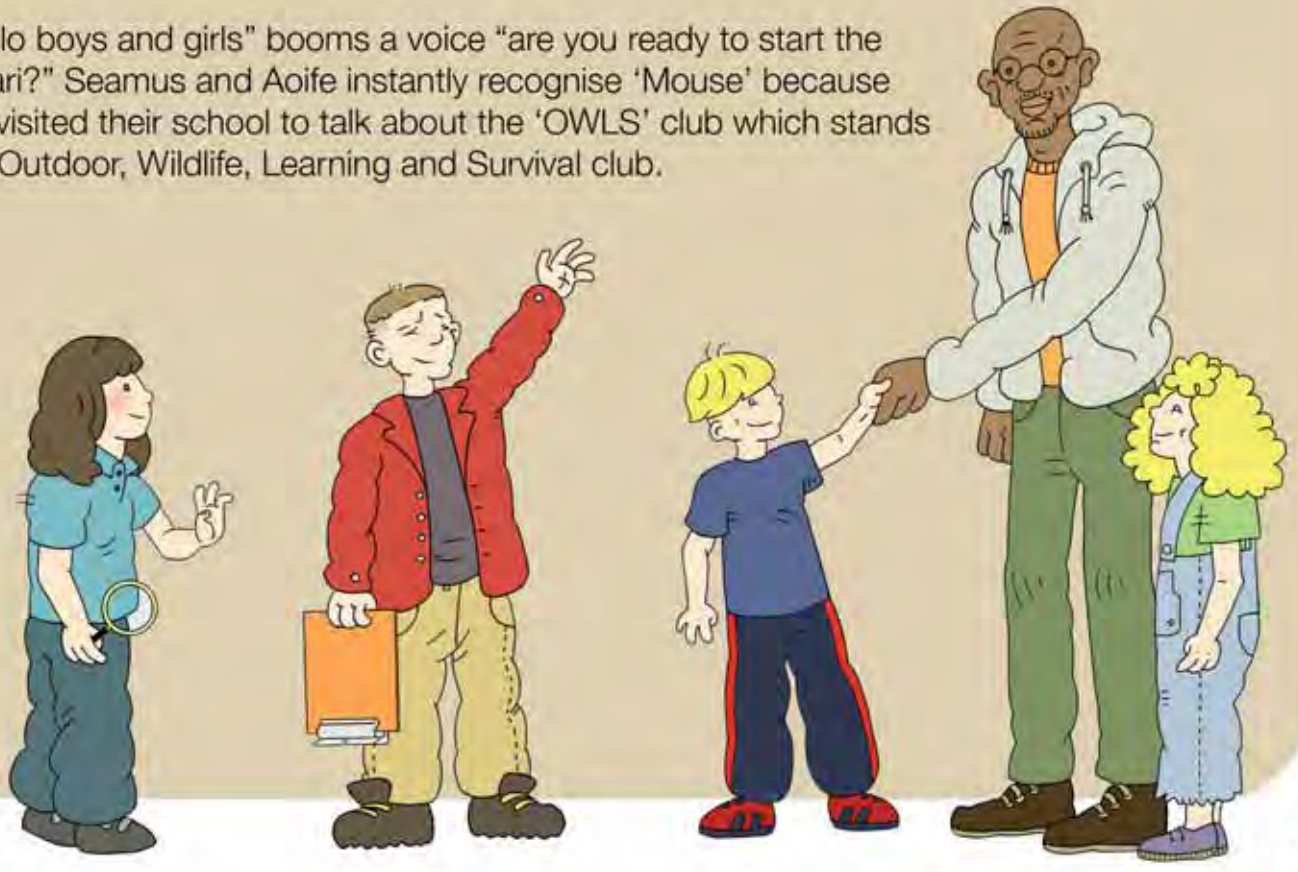
"We both have our clipboards, pencils, paper and magnifying glasses. I also have my lunch and some waterproofs just in case it rains" says Aoife.

"I have my lunch and a couple of extra apples for when I get hungry" says Seamus "I don't have any room in my bag for waterproofs and anyway it's sunny outside so I won't need them".

"Ok, have fun, but if it starts raining Seamus you have to come home straight away, I don't want you getting a cold" says their mum before giving them both a big hug.

Seamus and Aoife walk to the Park which is only five minutes from their home. When they get to the Park they see several other boys and girls with clipboards and magnifying glasses waiting to start the Safari.

"Hello boys and girls" booms a voice "are you ready to start the Safari?" Seamus and Aoife instantly recognise 'Mouse' because he visited their school to talk about the 'OWLS' club which stands for Outdoor, Wildlife, Learning and Survival club.



"Yes" shouts the boys and girls who are really excited to be starting the Safari.

"I want you to think of the weeds that sometimes appear in your garden." says 'Mouse' "Nobody came along and planted them, so how do you think they got there? Plants can't walk they are literally rooted to the ground!"

"Perhaps they flew" says Seamus "and then parachuted in" which has all the children laughing.

"Correct!" says 'Mouse', which causes the children to look dumbstruck!

"We're going to look for an example of the Paratroopers of the Plant Kingdom which it uses to invade new territories."

"Cool" says Seamus "where do we start?"

"If you all pair up we are going to start by looking for dandelions in the grass" says 'Mouse', this should give us our first clue."

Seamus and Aoife get their magnifying glasses out and start investigating the grass nearby. Soon Aoife squeals excitedly "Wooooooohoooooo. Seamus, quick I've found some".

Seamus runs over with his magnifying glass and the children get down on their knees to study the flowers.

"I don't get it" says Seamus "how could this give us a clue about the Plant Kingdom's Paratroopers? They're just a bunch of yellow flowers"

"What have you found?" asks 'Mouse'

"Aoife's found some dandelion flowers, but we can't figure out how they have anything to do with the Paratroopers of the Plant Kingdom". "It doesn't make sense" says Seamus.

"Flowers produce seeds after they have been pollinated." says 'Mouse' "Dandelion flowers are pollinated by insects such as bees. You'll have to find the seeds, they should be close by".

Seamus quickly scans the area and spots some weird looking white flower amongst the dandelions.

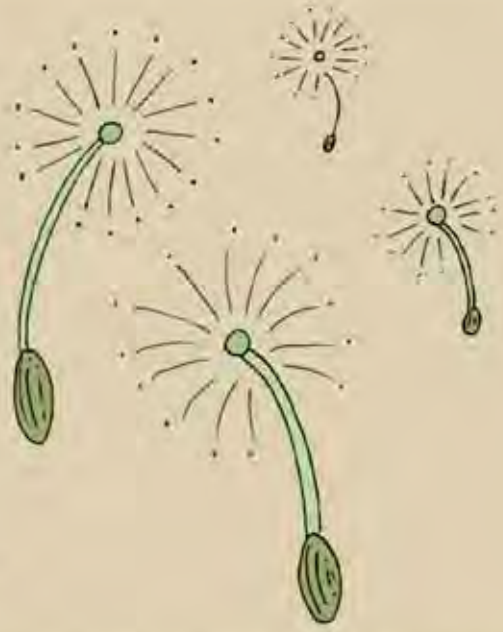
""Mouse, what are these weird looking flowers?" he asks.

"That's the first clue Seamus" says 'Mouse' before picking one and gently blowing on the weird looking flower. Suddenly mini white parachute's fly into the sky and disappear quickly on the breeze.

"Wow that's amazing!" says Seamus.

Looking at the flower under the magnifying glass the children are able to see the miniature parachutes with their tiny seeds.

"Wow, there are hundreds of tiny parachutes each carrying a tiny seed!" says Aoife.



The children have fun sending armies of dandelions seeds into the air by blowing on the weird looking white flowers.

"Ok" says 'Mouse' "Our next task is to find another way seeds use to invade new territories, this time we're going to look for the helicopter squadron".

"Plants don't have helicopters" says Aoife "do they?"

"Well I bet you didn't think they had Paratroopers, but yes, they do have helicopters, but maybe not the kind you imagine. We're going to have to look at the Sycamore trees to find the answer and I know just where to find them".

'Mouse' leads the children to another part of the Park with lots of tall trees. "You should be able to find the helicopter squadron here" says 'Mouse'.

Aoife and Seamus hunt around for what seems like ages hoping to find a helicopter seed, unfortunately they don't have any luck until suddenly something spins past Aoife's head before hitting the ground."Wow Aoife!" exclaims Seamus "Did you see that?"

"See what?" asks Aoife

"These small leaves were spinning around as they fell past your head"

"Perhaps that could be our second clue?" says Aoife and the two children pull out their magnifying glasses to investigate the unusual looking leaves.

"I don't think they are leaves" says Aoife,"they could be the Helicopter Squadron 'Mouse' was talking about".

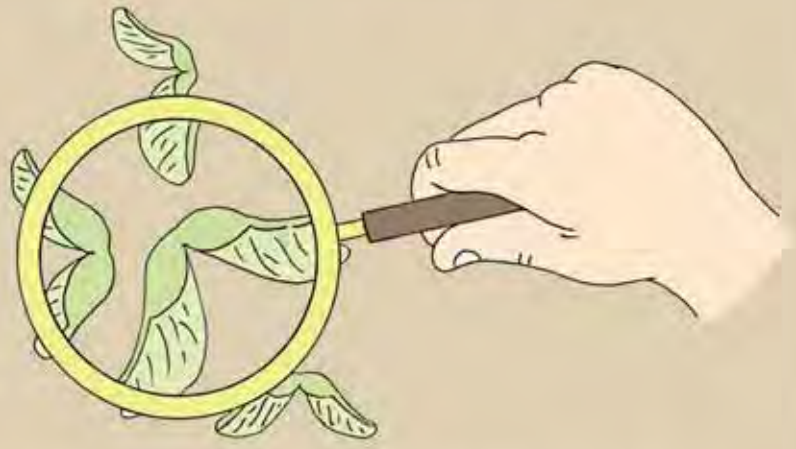
"Cool! They look like helicopter blades, do you think we could make them fly?" asks Seamus

"We can give it a go" and with that Aoife holds the seeds in her hands and throws them into the air before watching them spin to the ground.

"Excellent!" shouts 'Mouse' "you managed to get the Spinning Jimmy's to fly"

"Spinning Jimmy's?" Asks Aoife.

"Yes, that's what we call them in the part of England where I'm from" explains 'Mouse'.



With that all the children have great fun throwing the 'Spinning Jimmy's' into the air before watching them spin like helicopter blades as they fall to the ground.

After a while Mouse calls the children over. "Now we're going to undertake a really dangerous mission, I hope you're all prepared" says 'Mouse' "We're going into the long grass beside the wild flower meadow to look for the plant kingdom's Bomb Squad. Be careful and try not to set off any booby traps".

The children walk gingerly on 'tip-toes' towards the long grass beside the wild flower meadow.

There are a few giggles as the children imagine exploding plants.

"Watch out Aoife" calls Seamus "Mum won't be happy if you blow everyone up".

"It's not me that has the big feet!" laughs Aoife.

As the children get closer all they can see is a few weeds at the edge of the long grass, lots and lots of long grass and a few red poppies.

"I don't get it" says Seamus "What could possibly be dangerous about this?"

"Oops" says 'Mouse' "You've already set off one of the plant kingdom's booby traps! Look at your trainers"

Sticking all over the laces of Seamus's trainers are lots of little balls.

"You must have picked them up whilst walking through the grass under the trees earlier." explains 'Mouse' "The seeds have lots of little hooks that catch onto clothing or attach themselves to animals in order to get a free lift".

"Wow that's clever! I'm glad they are not real booby traps" says Seamus. "Are there any more traps around here?"

"Yes" explains 'Mouse' "Some poppy seed cases explode sending the seeds flying into the air, although most poppy seeds are dispersed by the wind after the seed cases have popped open. If you look at the tiny poppy seeds with your magnifying lens you can see if they have tiny wings which help them fly in the breeze. If the Poppy seeds have wings then they are not part of the exploding bomb squad, they are part of the Plant Kingdom's excellent Air Force!"

Seamus and Aoife shake the seeds from a poppy seed case onto a piece of paper and use their magnifying glasses to investigate the seeds.

"They are definitely from the Air Force" says Seamus "there are hundreds of seeds and they all have tiny wings".

"So far we've found seeds from the Para-troopers, Helicopter Squadron, the Booby Trap Squad, the Bomb Squad and the Air force. Are there any more members of the Plant Kingdom's army?" asks Seamus.

Just then it starts to rain, and 'Mouse' and the children quickly run back towards the trees.

"Oh no" says Seamus, I'll have to go home, I forgot to bring my waterproofs"

"No you don't" says Aoife, I packed them for you, but you really should be more careful when packing your bag, you can fit a lot more in if you don't stuff everything in at the last minute".

"Thanks Aoife" says Seamus "You can have one of my spare apples".

"That's interesting Seamus" says 'Mouse' "Did you know that apple trees use another method to disperse their seeds. In fact lots of plants produce tasty fruit for us and animals to eat as a method of ensuring the seeds can get to new places.

Birds are the Plant Kingdoms best allies, acting as their Flying Bomb Squad. Although none of us will really want to investigate that method of attack!"

"Yuuuuuuuuck!" says Aoife "no thank you".

"The rain has made me think of another method of attack used by the Plant Kingdom" says 'Mouse' "although for safety reasons we're going to have to observe them from the bridge across the river".

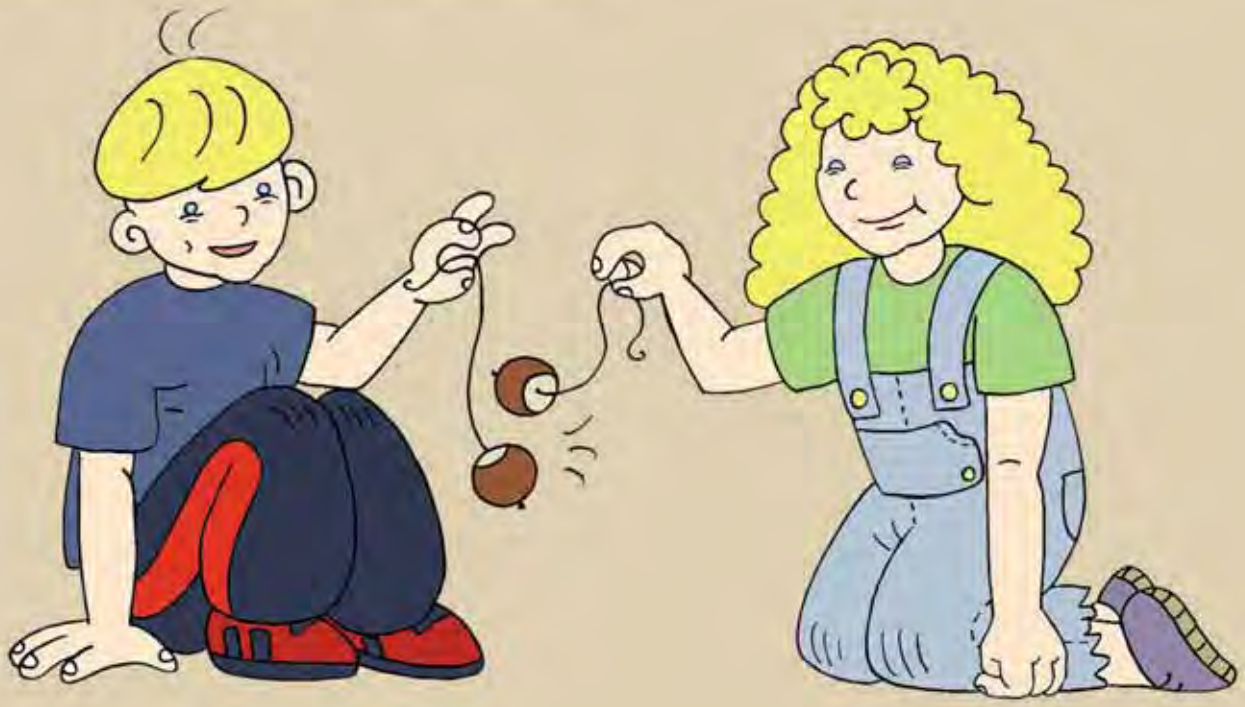
Thankfully the rain eases off and the children and 'Mouse' walk the short distance to the bridge that crosses the small stream running through the park.

"The Plant Kingdom's has a fantastic navy which it uses to invade new places all over the world" says 'Mouse'. "Did you know that the coconut is a seed and can travel up to 2000km and spend months at sea if necessary? Here when the river is flowing fast the seeds that fall into the water can be carried great distances. Some of those seeds will wash up on new land and as the river drops the seeds can start to grow.

Ok the Seed Safari is over, there is just enough time to have a game with one of my favourite seeds." says 'Mouse' "Who wants to play conkers? The winner gets a special medallion to take home with them and gets to call themselves the Conker Champion".

"Yes please" shouts Seamus "I want to be the Conker Champion".

With that all the boys and girls are given their own Conker which 'Mouse' has prepared by threading a piece of string through them.



All the children head home after the Conker championship, a little tired but having had great fun. When Seamus and Aoife get home their mum is waiting for them.

"Did you have fun today?" she asks.
"It was amazing, we learnt amazing things about how plants invade new places" says Seamus

"Fantastic Seamus! What did you learn Aoife?" asks Aoife's mum.

"I learnt lots of thing today mum, but most importantly of all, I learnt that girls are better at conkers than boys"

Seed Safari Activity

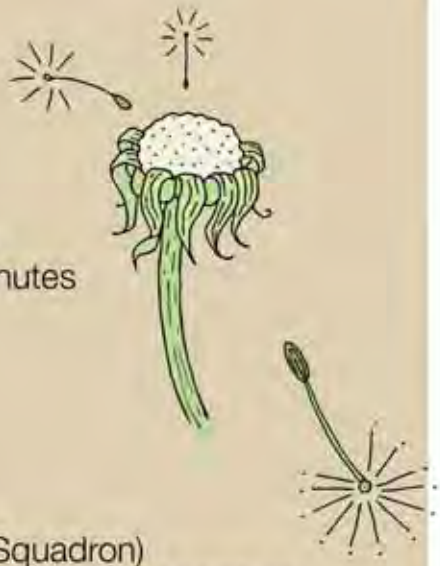
Plants use amazing methods to enable their seeds to grow in new places. By undertaking the Seed Safari you can discover some of their excellent tactics. Your task should you choose to accept it is to investigate the tactics plants use to grow in new places. Making sketches of the seeds will help you keep a record of your discoveries.

Checklist of equipment needed for the Safari:

- ☑ A clipboard
- ☑ A few sheets of plain paper
- ☑ A pencil
- ☑ A rubber
- ☑ A pencil sharpener
- ☑ A hand lens or magnifying glass

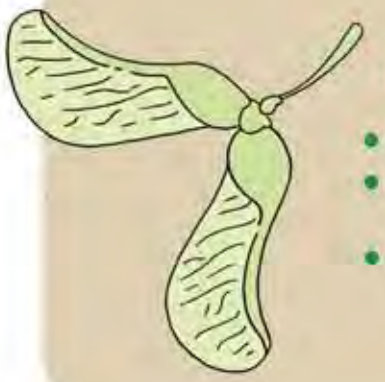
There are lots of different places you will need to look for these amazing plants so please ensure you are prepared to do lots of trekking. Good shoes are really important.

The following are areas you might consider exploring:



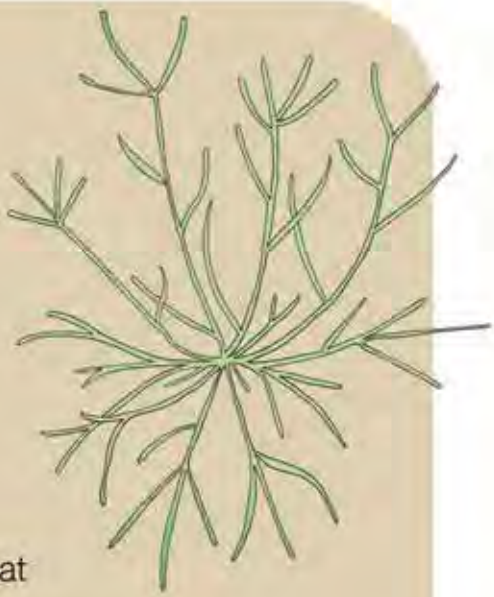
Short grass:

- Specialist plant- the Dandelion (Parachute Unit)
- Special tactic- parachutes carry the seeds great distances.
- Key features- Tiny seed carried by specially designed parachutes that catch the wind.



Woodland:

- Specialist plant- Sycamore Tree (Helicopter Squadron)
- Specialist tactic- the seeds spin away from the tree, especially in high winds.
- Key feature- the seed are shaped like helicopter propellers.

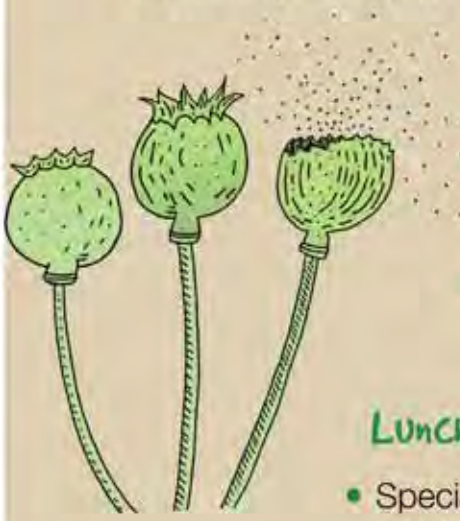


Hedges:

- Specialist plant- Goosegrass/Cleavers plant (Booby Trap)
- Specialist tactic- leaves and stems sticks like Velcro to clothing
- Key features- the seed is small hard and round, they also stick to animals and clothing for transport to new places.

Hedgerows:

- Specialist plant- Hawthorn (Flying Bomb Squad)
- Specialist tactic- hundreds of tiny berries that are a tasty treat for birds
- Key feature- red berries containing a single seed eaten whole by birds before depositing as they fly.



Wildflower meadow or disturbed ground:

- Specialist plant- the Poppy (Booby squad and Air force).
- Specialist tactic- pods carry lightweight seed with tiny wings. The seed pods of some varieties of poppies explode to scatter their seeds.
- Key feature- tiny wings to carry the small seeds on the wind.

Lunchbox:

- Specialist seed- fruit from the banana plant (Spy)
- Specialist tactic- delicious fruit eaten by apes, the apes are unaware that they carry the seeds to new locations.
- Key feature- delicious fruit.

Supermarket:

- Specialist seed- the coconut (Navy)
- Specialist tactic- seeds float on the sea and are carried to new locations.
- Key feature - air space in the seed for buoyancy.

one good thing

Monoculture farming is of benefit to Ireland? Debate.

You may have seen large fields full of golden flowers, or a stand of uniform trees as far as the eye can see but is monoculture farming beneficial to Ireland?

There has been considerable debate concerning the use of monoculture farming, below you will find some of the points used to argue for and against monoculture farming in Ireland.

Additional research is advised to support your argument for and against monoculture farming by reviewing goods that are imported to Ireland using monoculture crops grown in other parts of the world.

Advantages

Monocultures are unnatural occurrences, left to their own devices they would revert to a mixed plant community. Although certain advantages exist that has resulted in the widespread practice of monoculture farming.

- When farmers produce only one crop they can reduce their capital costs by purchasing less machinery thereby saving money.
- Labour costs can be reduced with fewer workers required to manage the crop thus improving efficiency and saving money.
- Potential to increase yields.
- When selling their crop farmers only need to market one product, spending less time dealing with potential buyers.
- Farmers can grow crops that take advantage of the market such as growing out of season.
- If the farmer chooses to use chemicals or fertilisers on the crop they can be purchased in bulk potentially saving money.
- Farmland provides a home and food for some native animal species.

Disadvantages

Being unnatural occurrences monoculture farms require additional care to safeguard the crop which can have a significant impact on the natural environment.

- Monoculture farming supports less wildlife than a more diverse farm. This is particularly the case where the crop is a non-native species such as the Sikta Spruce (*Picea sitchensis*).

- An increase in chemical usage is usually required to fight pests and diseases. These chemicals can have a significant impact on the natural environment.
- Monoculture farming may not be conductive to the maintenance of soil fertility. This can lead to a reduction in production or an increase in chemical usage.
- Increased dependency on market forces, if demand is low prices will fall.
- Crop failure can lead to huge losses with no other income to fall back on.
- The crop may be more susceptible to attack from pests and diseases. The potato famine of 1845-1850 is an example of the potential consequences.
- Growing out of season to take advantage of market conditions often require additional expenditure such as on heating or chemicals. This will result in an additional impact on the environment.
- Reduction in employment opportunities.
- Economic disadvantage for small farmers. Economies of scale prevent small farms from benefitting from the cost savings of monoculture crops. Therefore small farms are at an economic disadvantage compared to large farms.

Butterflies life cycle

Butterflies life cycle

1. The eggs are laid by the females on or close to the plants which the caterpillar will eat when they hatch.

2. The caterpillar (or larvae) emerges from the egg 4 to 10 days after the eggs were laid. The caterpillar feed on the host plants for 3-4 weeks and sheds its skin four or more times as its body grows.

3. The caterpillar then forms a chrysalis (also known as a pupa). It is in the chrysalis that the caterpillar transforms into a butterfly. This stage usually takes two or three weeks.

4. The butterfly emerges from the chrysalis to feed and find a mate. Many butterflies feed on the nectar of flowers and by doing so help to pollinate plants.

You can find educational Butterfly Kits at http://www.greengardener.co.uk

Honey I lost the money!

Honeybees are having a bad time of it with Honeybee populations declining dramatically all over the world. This could prove very bad for the world economy.

A UN report claims 70% of the food produced in the world is pollinated by bees.

Some scientists (and economists) are concerned that if bee populations continue to decline, food prices will increase because farmers will have to find other ways of pollinating their crops or change their crops to those pollinated by other insects.

In parts of China they are pollinating pear trees with feather dusters because the bees have become locally extinct. People are now doing the job bees use to do for free and as a result the pears they produce are costing more.

The UK government researched the true value of honeybees to their economy and discovered bees contributed £200m a year by pollinating crops.

Research activity

? What do scientists believe is causing the decline in bumble bee populations?

Woodwork Class - Making a bird box

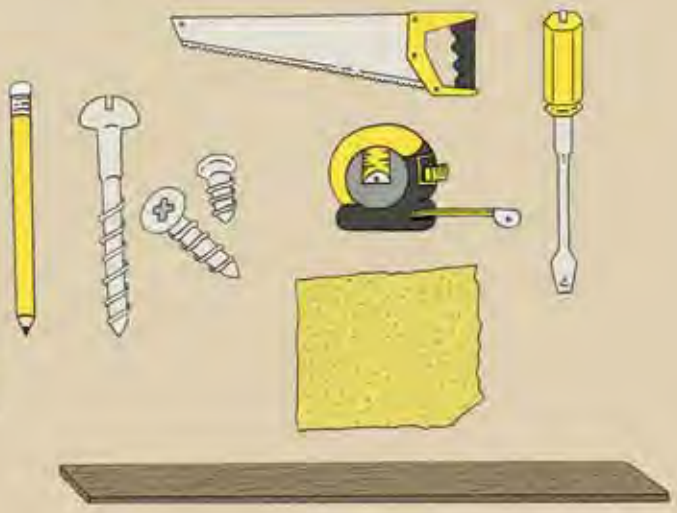
Bird boxes make excellent substitutes for natural nests especially around modern homes which have few holes or crevices for nesting.

It is possible, by making minor adjustments to the diameter of the entrance hole to design a bird box that perfectly caters for the birds that visit your garden.

It is therefore worth spending a little time observing the birds visiting your garden and matching your design to suit the needs of your visitors. This will increase the chances of your bird box attracting nesting birds.

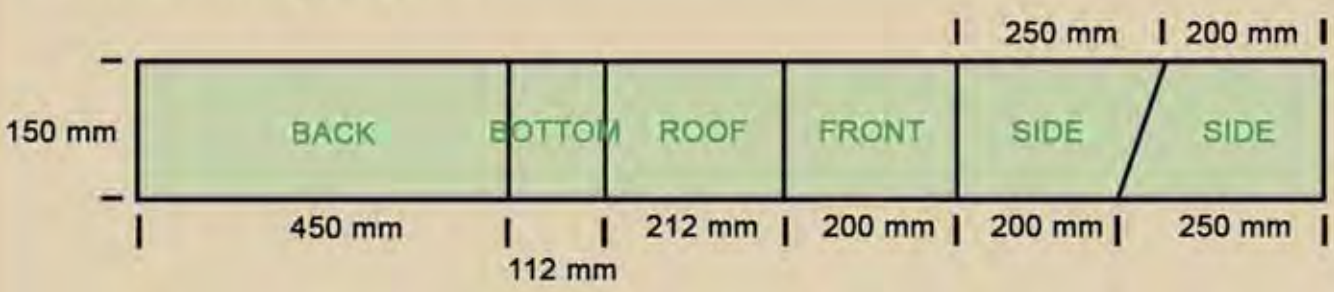
You'll need the following to construct your bird box:

- Pencil
- Galvanised wood screws (rather than nails)
- Hand saw
- Tape measure
- Screwdriver
- Sandpaper
- Marine plywood or untreated sawn timber (150mm wide x 15mm thick x 1.5m long.)



Step one

Using a pencil to mark the timber as shown below, be sure to mark each of the sections top, side etc.



Step two

Cut the timber along the pencil lines using a hand saw.

Step three

Preassemble the box to ensure all the dimensions fit correctly, make any necessary adjustments.

Step four

Screw one side to the base of the bird box.

Tip: drill holes where you intend to insert the screws using a drill bit with a smaller diameter than the screw. This will make inserting the screws easier and help prevent the timber from splitting

Step five

Screw the side and base to the back section, before repeating the process with the opposite side section. Your bird box should look like this.

Step six

Before fixing the front panel drill the entrance hole using a wide drill bit. Choose the correct diameter (see below) to ensure you cater for the birds visiting your garden.

Step seven

Affix the top panel. It is vital that screws are used on this section as you will need to remove the top in order to clean the box of old nesting material prior to the start of the new nesting season.

Step eight

Drill two 5mm holes in the sides of the box close to the roof for ventilation. Then drill a couple of 5mm holes in the bottom of the box for drainage.

Step nine

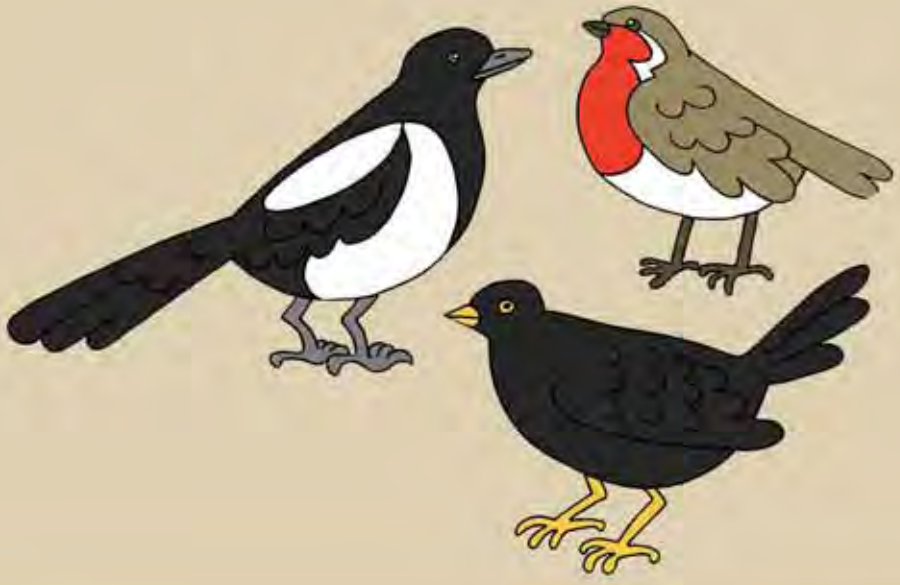
Your marine plywood box should not need treating, if you have used rough sawn timber a non toxic preservative such as raw linseed oil (not boiled linseed oil) can be used to help preserve your bird box.

Note: Only use a preservative if you are absolutely sure it is non toxic.

Step ten

Drill a hole in the top of the nest box ready for fixing to your chosen location. Choose a sheltered North East facing location to affix your bird box. The box should be tilted slightly forward to keep water from entering the hole.

For more information check out www.birdwatchireland.ie



How to make bird feeders

How to make a Bird Cake Feeder

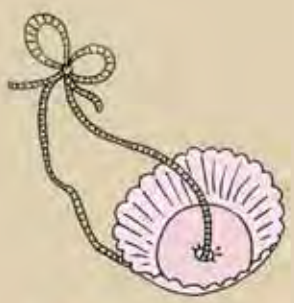
Most of us like cake, even birds like cake! Well special bird cake...

We're going to learn how to make bird cakes to help keep our birds bellies nice and full this winter.

What do you need?

- Small foil cake cases (which can be reused)
- Scissors
- String
- Lard
- Birdseed and peanuts*

Instructions:



1. Make a hole in the foil cake case using the scissors.
2. Thread the string through the hole and tie in a knot.
3. Take some lard and place in a bowl.
4. Pour in the birdseed and peanuts and mix into the lard.
5. Take a spoonful of the mix and add to the foil cases.
6. Place in the fridge over night or until the lard goes hard.
7. Hang the bird cakes from a tree and watch as the birds enjoy the cake.

* please be aware of nut allergies

How to make a Pine Cone Bird Feeder

What do you need?

- Pinecones
- String
- Crunchy Peanut butter
- Birdseed

Instructions:

1. Tie some string around the bottom of a pine cone.
2. Spread some peanut butter over the pine cone, make sure you squash the peanut butter into all the spaces.
3. Sprinkle some birdseed on a plate and roll the peanut butter coated pinecone over the seeds.
4. Hang the pine coats from a tree close to the classroom window and watch the birds enjoy their peanut butter treats!

* please be aware of nut allergies

Note: The peanut butter is not for teachers (or children)!

Making a bug a home

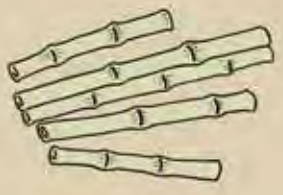
Bugs are really important to the ecosystem performing all manner of important tasks like eating rotting vegetation to turn into compost, pollinating flowers or as food to be eaten by birds and bats. A few insects, like the butterfly even look quite nice!

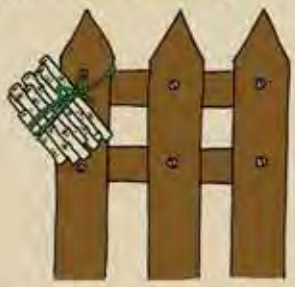
There are lots of things we can do to help attract bugs to our garden. Here are a few ideas.

Bug apartments:

'The bamboo/twig penthouse'

Collect a bundle of bamboo canes or twigs about 6 to 12 inches in length. Tie the bundle together with a piece of string before hanging the bundle can from a tree, attaching to a fence or fixing on a balcony.





The best place for the bug penthouse is a relatively warm place and out of the rain which could get in and drown the occupants.

'The busy bee's basement'

What you'll need:

- 2 x plastic flower pots
- Gaffer tape
- 40cm2 of chicken wire
- 2 x 20-30cm lengths of hose
- 2 x flat stones
- Some nesting material
- Scissors
- 2 pins
- Bedding (grass)

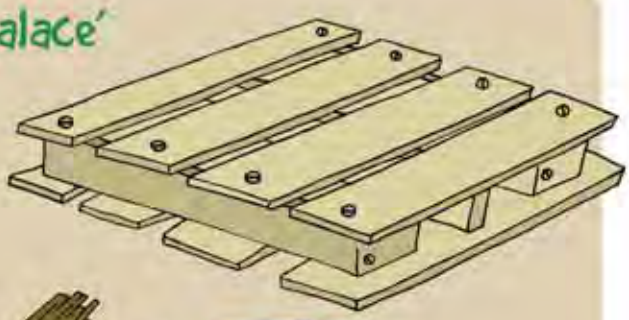
1. You're going to insert the length the end of the hose into the base of each flower pot, use the scissors to make a hole wide enough to take the hose. The gaffer tape is then used to secure the hose to the flower pot.

2. The bees will want to snuggle up during the cold winter months so providing some bedding is essential. Grass makes excellent bedding, pack the grass loosely together and wrap it in the chicken wire. Place the bedding wrapped in chicken wire into the flower pot. Place a couple of stones between the chicken wire and the plastic flower pot. This helps the bedding to stay dry.

3. Tape the flower pots together and then bury the pots in a sheltered shady location. Leaving only the ends of the hose showing at ground level.

4. Place a pin through the centre of the hose ends. This stops snails from getting in and blocking the entrance. Then cover the hose with a flat stone. This will help stop water from getting into the Bee's Basement abode.

'The mini beast palace'



If you really want to create a palace for mini beasts you'll need some help and some more unusual equipment.

Here's what you need:

- 4 or 5 large used wooden pallets
- Nesting material
- Straw and Hay
- Dead wood and dry sticks
- Terracotta plant pots
- Bamboo canes
- Fir cones, dry leaves and bits of bark
- Stones, bricks and old roof tiles

1. You'll need to locate a spot that's slightly damp and in semi-shade close to overgrown plants or a pond.

2. Place one of the pallets upside down on the ground, the rest of the pallets are going to be stacked on top of the first. You might want to secure the pallets together with wire or string.

3. The next task is to stuff the gaps full of the nesting materials.

You might think the bug palace is a bit of a mess, but the palace is perfect for bugs, who like some teenagers like their place to be a little messy!

Nature watch detectives (Junior classes)

Being a Nature Watch Detective can be lots of fun. But it also requires the very best detective skills.

Can you help discover when the first daffodil will flower in spring or when the first leaf will fall in the autumn? If the answer is yes, you can become a Nature Watch detective.

Equipment required:

Notebook or diary
Pencil or pen

When you see something new happen in the school garden just make a note in your notebook or diary. The entries might look something like this:

Date	*What I saw*	*A picture of what I saw*
February 1st	*First daffodil flower opened.*	
June 5th	*First dandelion spotted.*	
October 23rd	*First leaf fell from the tree in the garden.*	

You might also like to record the number of animals and insects you see.:

Insect or animal	*How many?*	*A picture of what I saw*
Butterfly	𝍸	
Bee	𝍸 II	
Robin	I	

Nature watch diary (senior/secondary schools)

Some scientists study changes to our seasons to help them understand climate change, they call this Phenology. By discovering when the first flower appears in spring or the first leaf drops in the autumn scientists can learn about changes affecting our own climate.

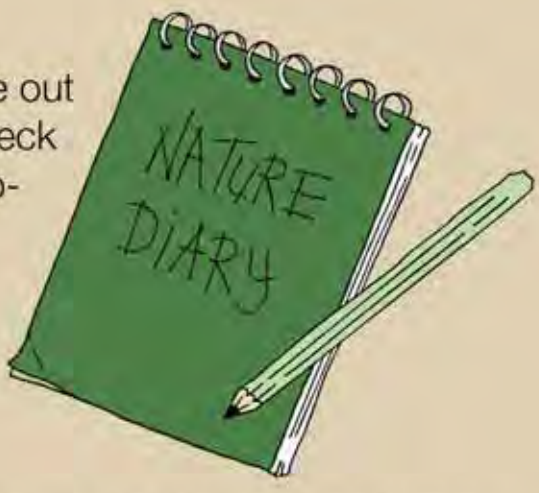
In Ireland, scientists at Trinity College are asking people to help them with their research by keeping a record of nature events observed in their own gardens.

What can you do to help?

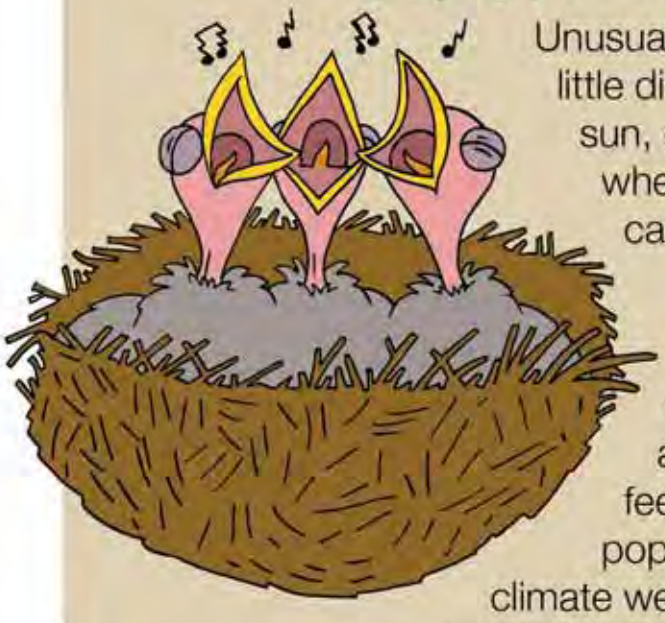
The scientists are asking you to keep a nature diary to record when you see the first flowers open in spring (or winter) or when you see the first bumble bee, butterfly or swallow.

There are lots of things you can keep an eye out for throughout the year. To find out more check out the phenology pages of the National Biodiversity Data Centre website:

http://phenology.biodiversityireland.ie/



Why study phenology?



Unusual weather patterns might make our lives a little difficult, such as too much rain or not enough sun, or it might even bring some fun especially when we get lots of snow. But these changes can be devastating for wildlife.

If as an example bird's eggs hatch early because of a mild winter but just as the chicks are looking for food from their parents a sharp frosts kills most of the insects they feed upon this could be a disaster for the bird population. By knowing more about our own climate we can learn how best to help our local wildlife cope with climate change.

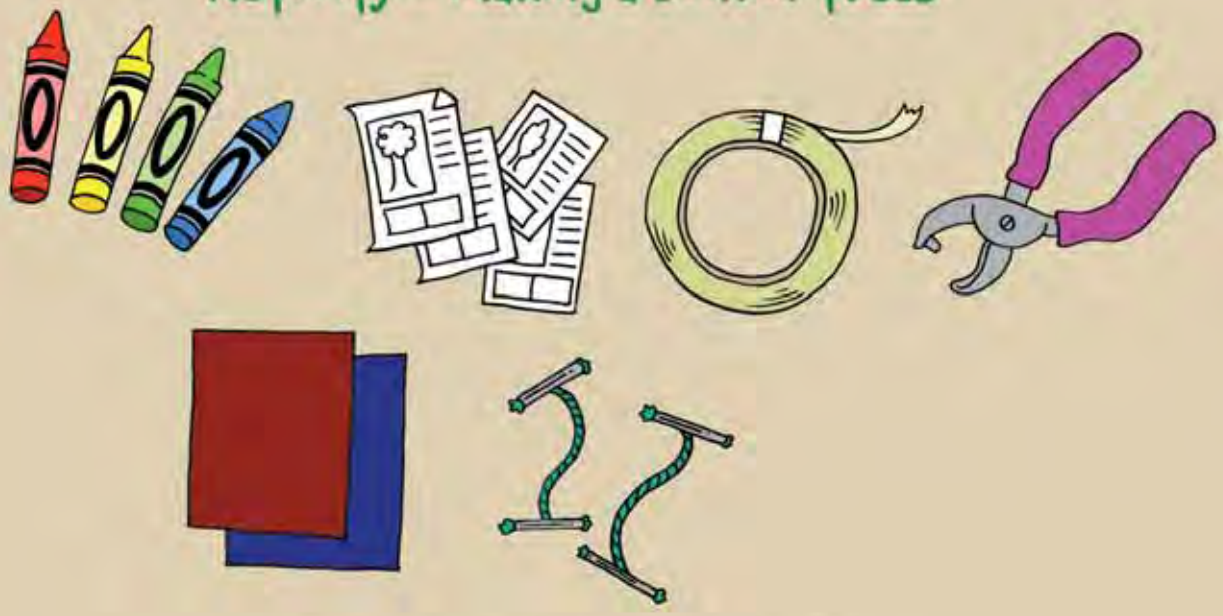
Tremendous trees! How to make a book about trees

Trees are magnificent! In fact I'm sure you'll agree, trees are 'Tree-mendous'!

They can be taller than houses, and some are even taller than your school! Some trees might even be hundreds of years old!

Not all trees are the same. They might have different leaves, different bark and different shapes.

Activity - Making a book of trees



Checklist of equipment needed:

Crayons
'Book of Trees' worksheets (one for each tree)
Sellotape
2 x pieces of construction paper (for the covers)
Hole punch
2 x Treasury tags or pieces of string

1. With the help of your teacher find some trees in or close to your school
2. Choosing one of the trees can you tell how tall it is? Have a friend stand next to the trunk.

3. Try drawing the tree. What kind of shape does the tree have? Is it triangular, or thin? Or maybe it's round?

4. Using the 'Bark Rubbing' box from the 'Book of Trees' worksheet. Place the paper against the tree and use your crayons to gently rub over the paper. Hopefully you'll see the pattern of the bark appear on the page.

5. Pick a leaf from the tree, and Sello-tape the leaf into the 'Tree leaf' box.

Does anyone know the name of your tree? You might need to ask an adult for help. Your teacher or a parent or grandparent might know the answer.

6. Find a different tree and do the same again until you have enough pages for your book or you might like to make a class book with everyone's pages collected together.

7. Write your name or class name onto the front cover of your book. Ask the teacher to help you use the whole punch before using the string or tags to tie your pages together.

You now have your very own book all about trees!

Treemendous Trees worksheet

_____ 's Book of Trees

Name of Tree: _____

Draw the shape of the tree below:	Tree leaf:

Use this box for your bark rubbing:

Spring Clean, it's really easy!

Modern cleaning products can contain a host of chemicals that are not only harmful to the environment but potentially dangerous to us. It's really easy to make your own cleaning products that won't cause harm to you or the environment using household items like lemons, baking soda, baby oil and white vinegar.

It's really easy to make a **general purpose cleaner**. What you'll need:

2½ litre container
White vinegar
Baking soda (Sodium Bicarbonate)
Borax (Sodium Borate)

1. Add 2 litres of water to your container, and then add ½ a cup of white vinegar and a ½ cup of baking soda (or two teaspoons of Borax).

2. Replace the lid on your container and shake vigorously to mix the ingredients. You can now use your general purpose cleaner to clean showers, bathroom fixtures, windows, mirrors and many other surfaces.

It's really easy to make your own **Floor Cleaner**. What you'll need:

4 litre container
White vinegar
Baby Oil

Add 3 ¾ litres of warm water to your container before adding a cup of white vinegar. Finally add a few drops of baby oil to the mix.

You are now set to clean your floor!

It's really easy to make your own **Furniture polish**. What you'll need:

Lemon oil
Warm water

Mix a few drops of lemon oil to a ½ cup of warm water. Mix well and spray your furniture polish onto a cloth.

Wipe the damp cloth over the surface you wish to polish before using a dry cloth to remove excess moisture.

The Great Debate: Are biofuels good or bad?

Biofuels are considered by many as an excellent alternative to fossil fuels. But some people are blaming biofuels for the rise in food prices and for food shortages in developing countries.

So this poses the questions. Are biofuels good, or bad?

Pro debate

With fossil fuels running out, bioethanol and biodiesel can be used as a substitute reducing our dependency on non renewable fuels.

Because the plants from which the fuel is derived capture carbon from the atmosphere while growing there is no increase to atmospheric CO^2 as a result of using biofuels.

Biofuels are not responsible for food price increases. Take rice as an example- rice is not directly used in biofuel production, yet rice prices have increased at a similar rate to that of corn which is used for biofuel production.

Only 3% of palm oil production is used to make biofuels, therefore claims that biofuels are responsible for large scale deforestation in Southeast Asia is incorrect.

Biofuels have reduced the production of 1 million barrels of crude oil a day. Without this biofuel production, fuel prices would be 25% higher.

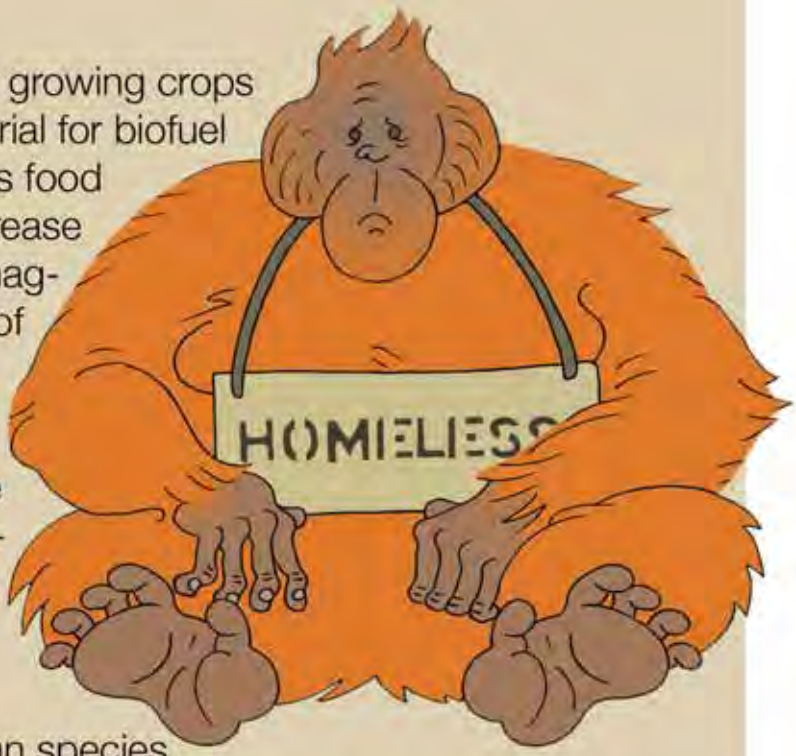
Crop residue could be used to produce biofuels, therefore no additional land would need to be used for crop production.

Biofuels are a relatively new technology, as efficiencies in crop production and manufacture is improved less land will be required for each unit of biofuel that is produced.

Anti debate

Because of an increasing demand for biofuels, new land is required to grow the crops needed for biofuel production. As a consequence it is believed that biofuels are a major driver of deforestation. The result in net carbon in our atmosphere through deforestation, manufacture and shipping far outweighs the potential gain.

Large areas of land that were used for growing crops have been converted to provide material for biofuel manufacturers, as a result there is less food available which has resulted in an increase in food prices. This is particularly damaging in countries where large sections of the population live on or below the poverty line.



The loss of biodiversity in area's where rainforests have been cleared is devastating. This is compounded by large swaths of monoculture crops being grown for use as a biofuel.

One of the most iconic Southeast Asian species, the Orang-Utan is seriously under threat as a result of deforestation.

Maize prices have increased as a result of farmers in the US switching to corn production. Any additional cost of maize for food production can be borne by the developed world but not by the developing world where food is becoming unaffordable.

Over 80 million hectares of land is now used to grow biofuel crops leaving less land for food production.

Filling a range rover once with biofuel derived from grain requires as much grain as it takes to feed an African person for a year.

As long as Westerners are happy to pay more to fuel their vehicles than the poor are able to pay for food crops, it's

likely that more farmers will switch to biofuel cash crops from traditional food crops.

Crop residue left in the field helps prevent soil erosion. The use of crop residue for biofuel production would significantly increase soil erosion and reduce soil quality.

http://www.organicmattersmag.com/features/199-food-or-fuel

http://www.primatehandshake.org/latest/debate-biofuels-pros-cons/

The Great Debate II: GM crops, good or bad?

GM or genetically modified crops have received plenty of bad press as a result of protests from a host of concerned environmental groups. But could GM crops be the answer to possible food shortages?

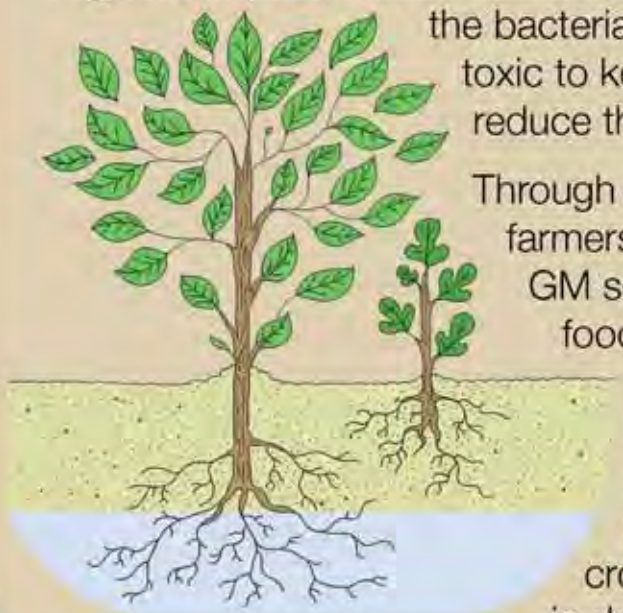
Pro GM debate

Genetic modification is nothing new, farmers have been 'selecting' individuals for breeding based on desired characteristics for generations. Genetic engineering is just the latest version of this trend.

There is no inherent difference between foods produced from GM crops and non-GM crops. All living things contain DNA and all DNA consist of the same four building blocks. By moving a gene from one organism to another, scientists are not introducing a "foreign" substance. The new gene merely prompts the organism to express a desired trait.

Companies that wish to release a GM seed or the product of a GM crop are required to test the safety of that product. If the product is made from an organism containing a known allergen, it must be tested for safety. No one has substantiated a single human death, or even illness, as a result of consuming GM foods.

As it's practiced today, agriculture damages the environment more than any other human activity. Genetically engineered crops will ease that negative impact. Insect resistant GM crops, such as those containing the bacterial Bt gene (which makes the plant itself toxic to key pests), allow farmers to dramatically reduce their use of spray insecticides.



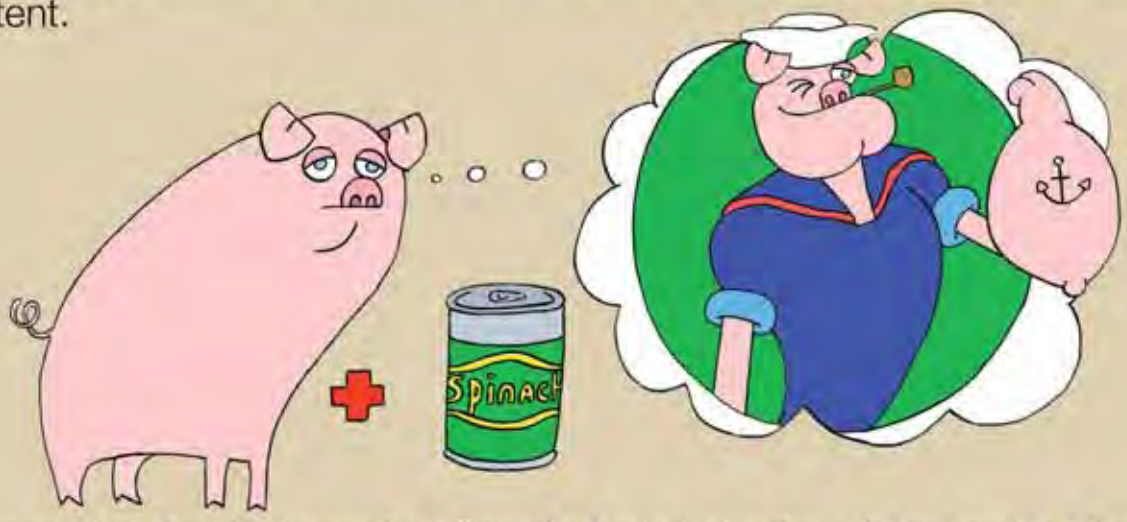
Through GM seeds even the smallest subsistence farmers can produce bigger, more reliable crops. GM seeds will help poor farmers grow more food for themselves and more profitable crops for the marketplace. Nutrition-enhanced GM crops now in development can directly address the effects of malnutrition, both for the farmers who grow those crops for themselves and for poor consumers in developing-world cities.

Farmers benefit from GM crops that deliver enhanced production traits. For example, pesticide resistance reduces the need for the farmer to mix and apply dangerous chemicals. Consumers will soon benefit from GM products offering traits such as enhanced nutritional content, taste, and shelf-life.

Protection of intellectual property is necessary to foster the research and development of new, beneficial products.

Anti GM

Genetic engineering is fundamentally different from plant and animal breeding because it crosses biological barriers. One example was pigs engineered to contain a gene found in spinach plants in order to reduce saturated fat content.

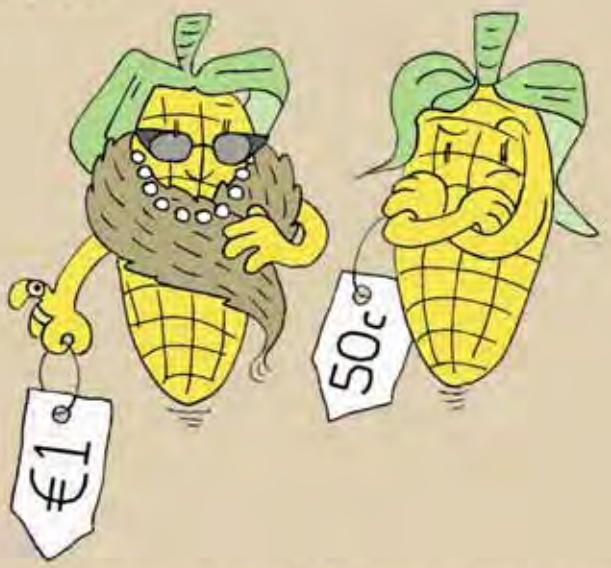


There are too few independent (non-industry) studies of the health effects of GM foods to have confidence in their safety. In an experiment in Scotland, rats fed GM potatoes containing a gene for a protein, lectin, fared poorly and suffered internal organ damage. Pro-GM scientists have attacked the study, but at the very least it highlights the need for more research.

Bioengineered crops will do wide-reaching damage to the environment. Insect-resistant crops may harm species that are not their target, such as monarch butterflies. On the other hand, the insects that GM crops are designed to kill could develop resistance to those crops, ultimately requiring farmers to use more aggressive control measures, such as increased use of chemical sprays.

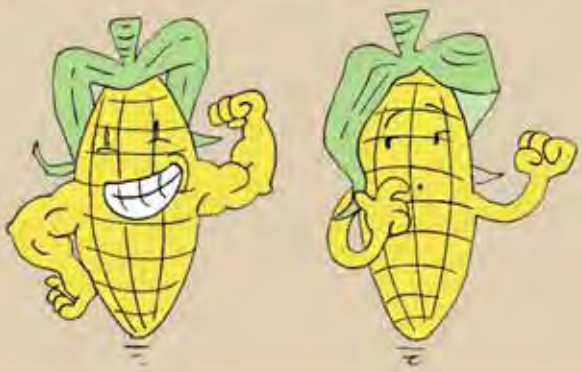
The real causes of hunger are poverty, inequality, and lack of access to food and land. Bioengineering will do nothing to alleviate these problems. Most GM crops available so far do not address the needs of food production in developing countries. They offer conveniences to the farmer—the ability to apply more or less pesticide spray—but do not produce higher yields.

Biotech companies themselves reap the benefits of GM technology. Farmers pay a premium, a "technology fee," when purchasing GM seeds. Crop yields are not greatly improved.



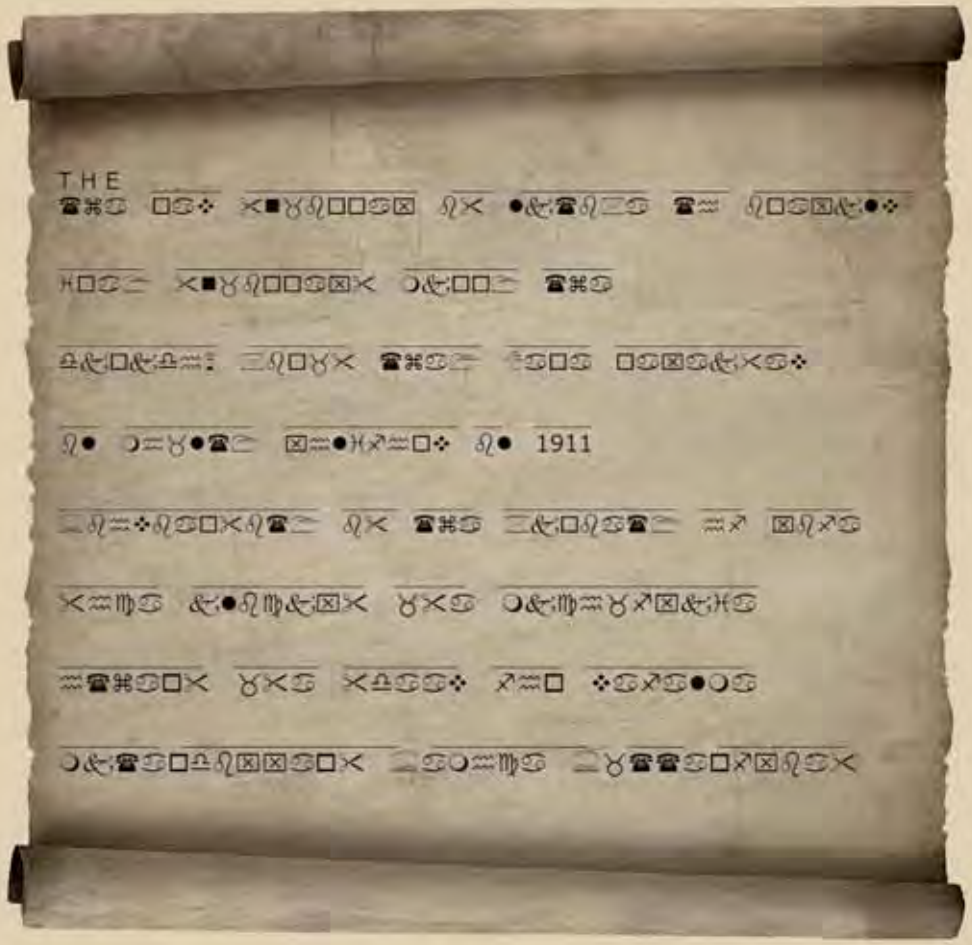
A biotech company may take a plant from a public seed bank, a seed variety that's been saved and protected by the stewardship of local farmers for many generations. After introducing a new gene into the plant, a biotech company can gain a patent on its "creation" and profit from it. This is unethical.

http://americanradioworks.publicradio.org/features/gmos_india/pro_con.html



Break the code to learn biodiversity secrets

Use the code to work out the hidden messages



Conservation - CITES

The Convention on International Trade in Endangered Species

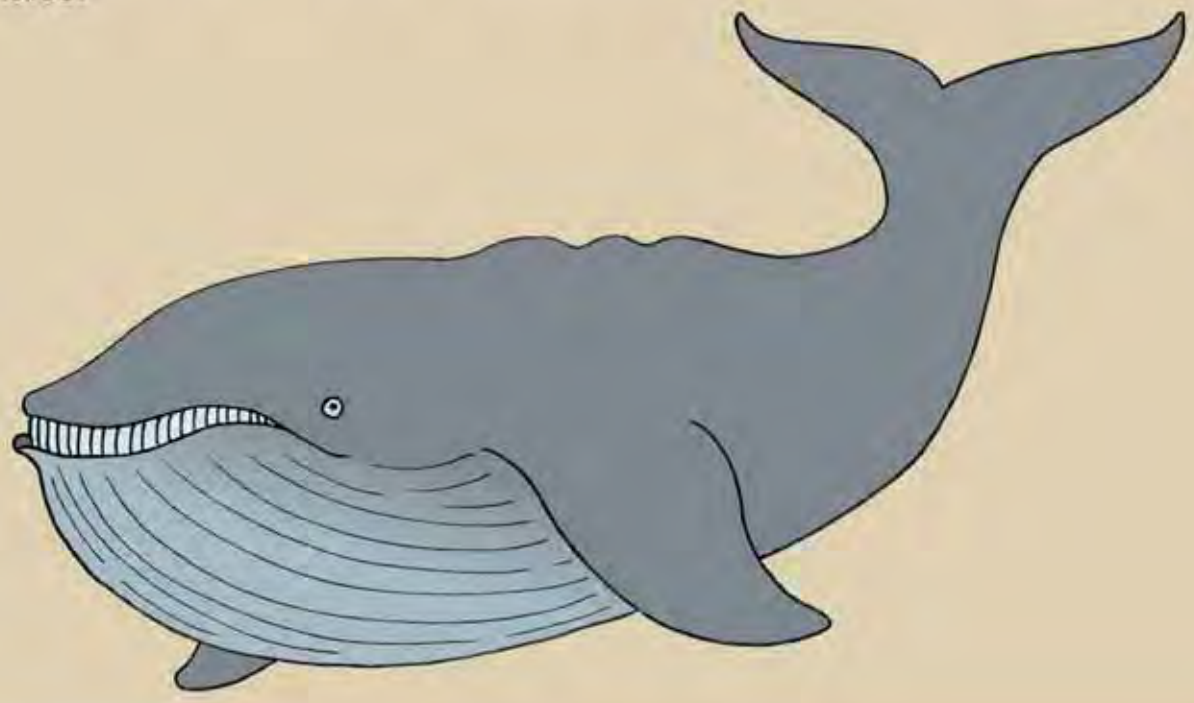
There are a number of conventions and agreements between states which aim to protect endangered species, including CITES.

CITES came into force on the 1st July 1975, and has been signed by 176 parties (countries). Its aim is to ensure that any trade in animals and plants (both living and dead) do not threaten the survival of the species.

Although CITES is legally binding by signatory parties it does not take the place of national law, instead it is used as a framework by each party to adopt their own legislation.

Parties signed up to the convention are required through a licensing system to control the trade of species identified within three groups, namely appendix 1, 2 and 3.

Appendix 1 includes species threatened with extinction. Trade in these species is only permitted in exceptional circumstances. Nearly 1000 species are listed under appendix 1 including elephants and most of the big cats and whales.



Permits can only be issued if the purpose of the transfer is not primarily for commercial purposes and that the transfer is not detrimental to the survival of the species. The exporting and importing country have to issue permits to enable the transfer. These transfers usually occur when animals are transferred between zoos for breeding purposes.

Appendix 2 includes those species although not threatened with extinction that requires careful management in order to avoid destabilising the population. Over 33,000 species are listed under appendix 2 including the American Black Bear and the African Grey Parrot.

Only an export licence is required for appendix 2 species.

Appendix 3 covers those species that are protected in at least one country and has asked other CITES parties to assist in controlling the trade. Over 250 species are covered under appendix 3 including the two toed sloth of Costa Rica and the alligator snapping turtle of the USA.

Exceptions

CITES allows for parties to make certain exceptions, including the hunting of specimens destined for scientific research…

Only Japan holds a special permit. Its current research programme, which started in 2000 and is run by the Japanese Institute of Cetacean Research (ICR), proposes to kill more than 1000 whales a year in the Antarctic and the western north Pacific. The stated objectives are to determine the population structure and feeding habits of several whale species, including endangered fin and sei whales, in order to "manage" stocks.

Japan has already been widely criticized for its whaling, which is generally seen as a thinly disguised hunting operation.' New Scientist June 17th 2009.

Although CITES is a useful weapon in the protection of endangered species by certifying the trade or transfer of species, it can be circumvented legally as highlighted by the Japanese Institute for Cetacean Research (ICR) and illegally by poachers and smugglers trying to gain financially from the illegal trade in endangered species.

See http://www.cites.org for more information about CITES.

Junior lichen awareness guide

An unusual type of life: LICHEN

Life on Earth exists in many different forms.

Animals vary from tiny ants to slugs to cats and dogs, elephants and lions.

Plants can be as tiny as the green slimy stuff that grows on ponds and walls to flowers and trees. Even the mould that grows on jam is alive.

Name three other things that are alive:

1. _____
2. _____
3. _____

Here you will learn about a special type of living thing called **lichen**. You can pronounce it as *'like- en'* or *'litch- en'*. Both are correct. In Gailge lichens are often called 'scab na cnoc' or 'scab ar an gcarraig' which means 'the scab on the rock'.

Lichens are everywhere around us, but very few people notice them or even know they are alive!

Above *Is a photograph of a tree covered in lichens. Some look like splashes of paint and others look like scabs. Have you ever seen a tree covered like this?*

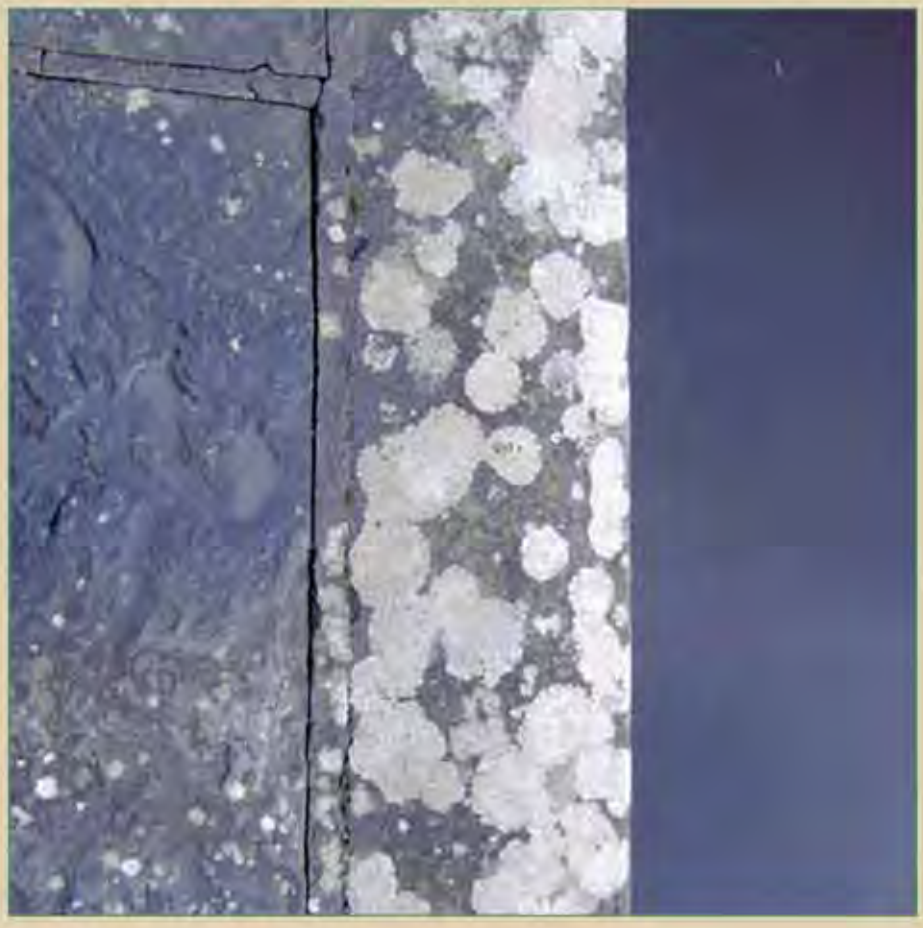
So you can see that lichens grow on trees. They also grow on bits of sawn wood like on fences and gate posts. Lichens are also found on rock and stone in walls and buildings.

On rocks and stone they often look like splashes of white paint or grey crusty bits. On trees they often look like leafy bits stuck onto the branches or trunk of the tree, sometimes yellow or orange coloured and sometimes grey or green.

Activity

Look at the photos below carefully and answer the questions about them.

Lichen 1 – Aspicilia



1. What colour is it?

2. Do you think it looks like splashed paint?

3. Is it growing on stone or wood?

Lichen 2 - Xanthoria

1. What colour is it?
2. Is it like a splash of paint or is it leafy or like a scab?
3. What do you think it is growing on?
4. Can you see the little circles that look like cups of orange juice? How many can you see?

Lichen 3 - Physcia

1. What colour is it?
2. Is it like a splash of paint or is it leafy or like a scab?
3. What do you think it is growing on?
4. Can you see the little circles that look like cups of coffee? How many are there?

Lichen 4 – Evernia

This looks very different than all the lichens above. It hangs down the side of the trunk of a tree or off the branches.

1. Can you describe it to someone who has not seen the photograph? You could tell them about its colour and how the tips of the branches fork out.

Evernia does not like too much nitrogen in the air!

Lichen Project for a tree near you

Select a broadleaved tree. Evergreen trees have fewer lichens.

If there are several trees in you area select the one with the most lichens on the trunk.

Write down the name of the tree.

Then carry out the following:

1. Measure a distance of 1 meter up the side of the tree and mark the height with a pin.
2. At that height measure the circumference of the tree.
3. Measure up a distance of 45cm from the ground and mark the height with a pin.
4. Count the number of lichen patches you can see on the tree between the two pins. Do not include the lichens below 45cm.
   a. How many lichens are like dabs of paint?
   b. How many lichens are like Evernia?
   c. How many lichens are orange or yellow like lichen 2 (Xanthoria)?
   d. How many lichens are grey like lichen 3 (Physcia)?

Use this table to record your results:

Like dabs of paint	Like Evernia	Like Xanthoria (yellow or orange)	Like Physcia (grey with coffee cups)

What your results might mean:

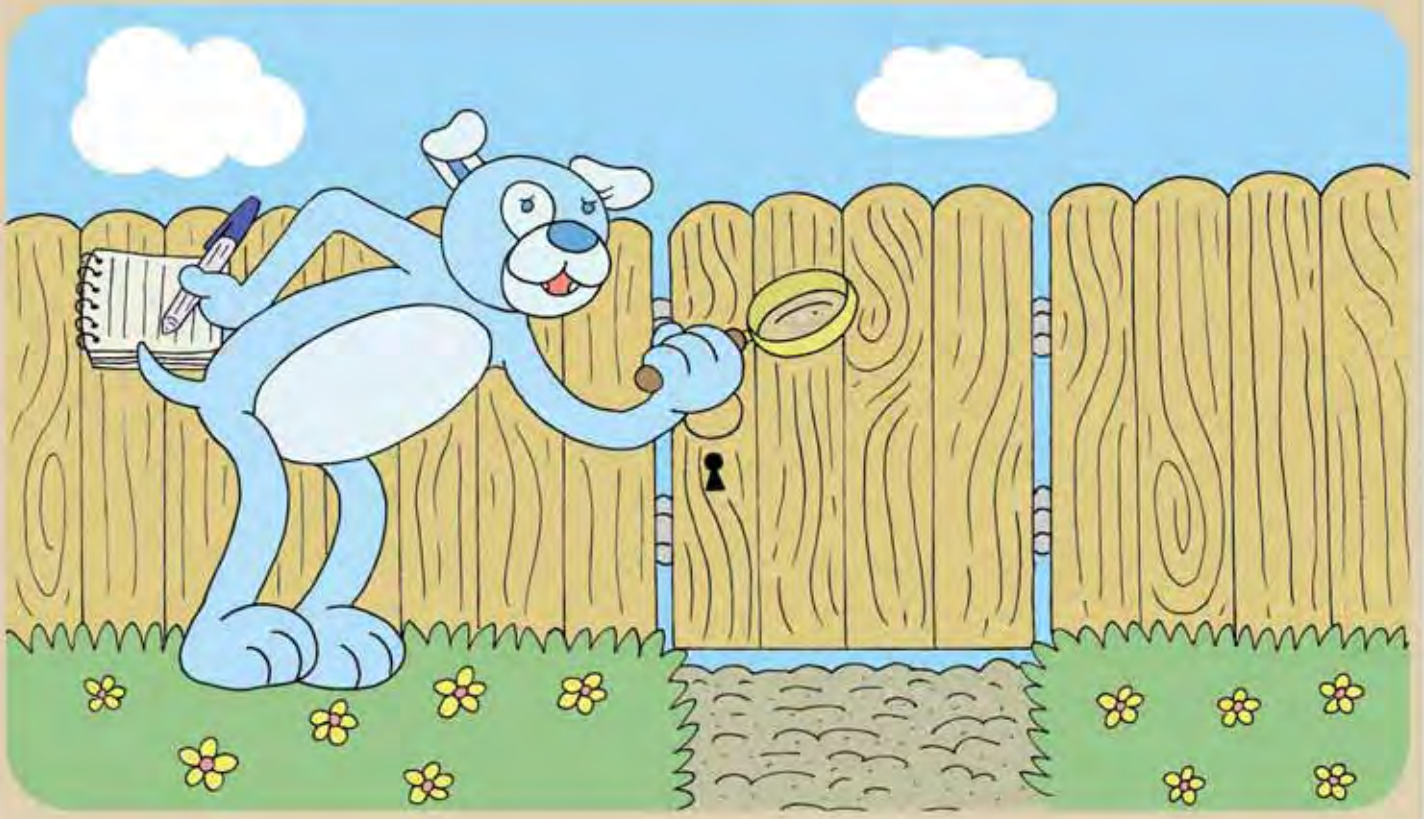
If you have lots of Evernia type then the tree is in an area with very little pollution. If you have lots of Xanthoria, then the air is polluted with too many nitrates (fertilizers). If you have lots of Physcia then there is a moderate amount of pollution in the air. The 'dabs of paint' lichens will not indicate air pollution.

Suggestions for other lichen work

Try the same project on different types of trees. Always record the tree name.

You can then compare trees.

Try the project on branches near the ground, especially in the autumn or winter when there are no leaves on the trees.



About this lichen awareness guide

Created by Paul Whelan to increase lichen awareness among primary school children.

Further information can be found at **www.lichens.ie**

Senior lichen awareness guide

Introduction

You can pronounce it as *'like- en'* or *'litch- en'*. Both are correct. In Gailge lichens are often called 'scab na cnoc' or 'scab ar an gcarraig' which means 'the scab on the rock'.

Lichens are very ancient life forms. They are not single species, like most organisms, but consist of two and sometimes three different species living together. All the members of a lichen benefit in some way from living together. Such a relationship is a beneficial symbiosis (see best buddy worksheet for an example).

The three organisms that can make up a lichen belong to the fungi, algae and cyanobacteria groups (see classification worksheet).

Note: *the fungi act as a mycobiont and is found in all lichens, while the algae and/or cyanobacteria act as photobiont partners (can photosynthesise).*

Lichen distribution and Light

Observation about lichens and light can be made by mapping the distribution of lichens on a wall.

Select a wall where you have access to both the sides and the top.

1. Draw a simple plan of the wall showing compass orientations.
2. Mark areas that are shaded to different degrees such as all the time, part of the day or not at all.
3. Describe the material the wall is composed of, for example stone, stone with mortar, plaster, blockwork etc. The material will influence the type of lichen found on the wall and is particularly apparent in walls composed of stone and mortar.
4. Take close up photographs.

Although not necessary, you might like to try and identify some of the lichens present. Use the web sites **www.lichens.ie** or **www.irishlichens.ie** or a book such as the Lichens of Ireland by Paul Whelan.

If you cannot name the lichens then give them temporary descriptive names as 'white lumpy one' or 'black dots'. Label your photographs with the name or description.

Examine all aspects of the wall in conjunction with your shading plan: north, side, south, top of the wall and record your observations

If available you can use a photographic light meter (for greater accuracy) to measure light intensity.

Your report

Your data should allow you to discuss and write up a report. Include the following:

1. Lichen distribution: are the same lichens found on all aspects of the wall or not?
2. Comment on the compass aspects, include your data (and light meter readings).
3. What is the % cover on the compass aspects of the wall? You may wish to run a chi-square statistical test of your results.

Pollution monitoring using lichens

Lichens allow all sorts of air born material to enter their thallus. Some of this material can change their colour (some metals can make them reddish) while other substances can kill them out right. In some cases material in the air can help them grow faster.

One of the biggest threats to lichen biodiversity is from nitrates and ammonia which can cause some lichens to grow too aggressively resulting in less aggressive and rarer species being overgrown. This is happening in many parts of Ireland.

You might like to review the EU Nitrates Directive, see:
http://www.environ.ie/en/Environment/Water/WaterQuality/NitratesDirective

Note: *very high nitrate levels can kill lichens.*

A little more background on air pollution

Lichens have been associated with 'air pollution' for many years now. The air pollution referred to the levels of sulphur dioxide in the air. Sulphur dioxide is produced by industrial activity. It made rain acid and this fell on woodlands and walls making the substrate acid. This killed off many lichens.

Today sulphur dioxide is thankfully not a major problem because of the controls imposed on industry. However, since then a new air pollution problem has developed. Lichens are again important in monitoring it. This new air pollution is due to the amount of nitrate and ammonia in the air. Nitrates and ammonia are water soluble so they stick to water molecules and are carried around in the air to land on trees and buildings. They cause the landscape to become alkaline. This is the very opposite of the effect of the sulphur dioxide problem.

The alkaline environment influences lichen growth. The lichens that like the nitrates grow rapidly and overgrow other lichens. These fast growing lichens are the 'weeds' of the lichen world. They blot out many other lichens and cover branches and walls taking over the substrate. A common nitrate loving lichen is *Xanthoria parietina* or the orange lichen. In the countryside you can see it covering the branches of trees. It is easiest to see in the winter time when the leaves are absent from most trees.

Nitrates cause other problems in the environment for many plants and animals. Nitrates in drinking water are a major problem in Ireland. The main source of nitrate pollution is from its use as a fertilizer.

Activity to Monitor Nitrates/Ammonia in your immediate environment using lichens

Use the following species:

Nitrogen sensitive species: *Usnea, Evernia prunastri, Hypoymnia*

Nitrogen-loving: *Xanthoria parietina and Physcia*

Can tolerate a little nitrogen: *Melanelixia, Flavoparmelia and Parmelia*

See *Lichens of Ireland* by Paul Whelan for examples.

This activity should cover a large area; local parks provide an excellent location for such research. Annotate a map to keep track on the species you find in each area.

1. Select at least two habitat types such as a wall, conifer trees, old gate or oak trees.
2. Map the distribution of the lichens (from the list supplied) for each habitat type. For each habitat type investigate at least three different locations within your chosen site.

3. For each location estimate the % cover of each species on a twig/bole of a tree or branch or random section of a wall or gatepost.

Note: *the species of tree you work with as this will give a clue as to the pH of the substrate. (conifers are acid, oaks more acid than sycamores and ash which are more neutral; elms are basic)*

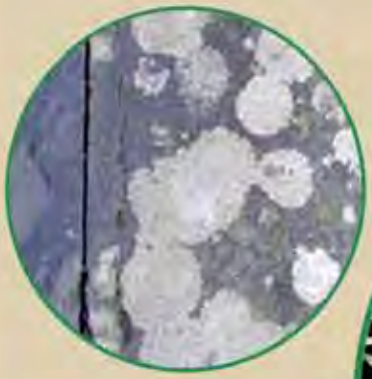
4. Examine your data statistically (apply the null hypothesis) using the chi-square test. Your statistical data will allow you to make a conclusion on the level of nitrates/ammonia pollution for your chosen area.

Resources:

Lichens of Ireland by Paul Whelan.

www.lichens.ie

www.irishlichens.ie by Jenny Seawright

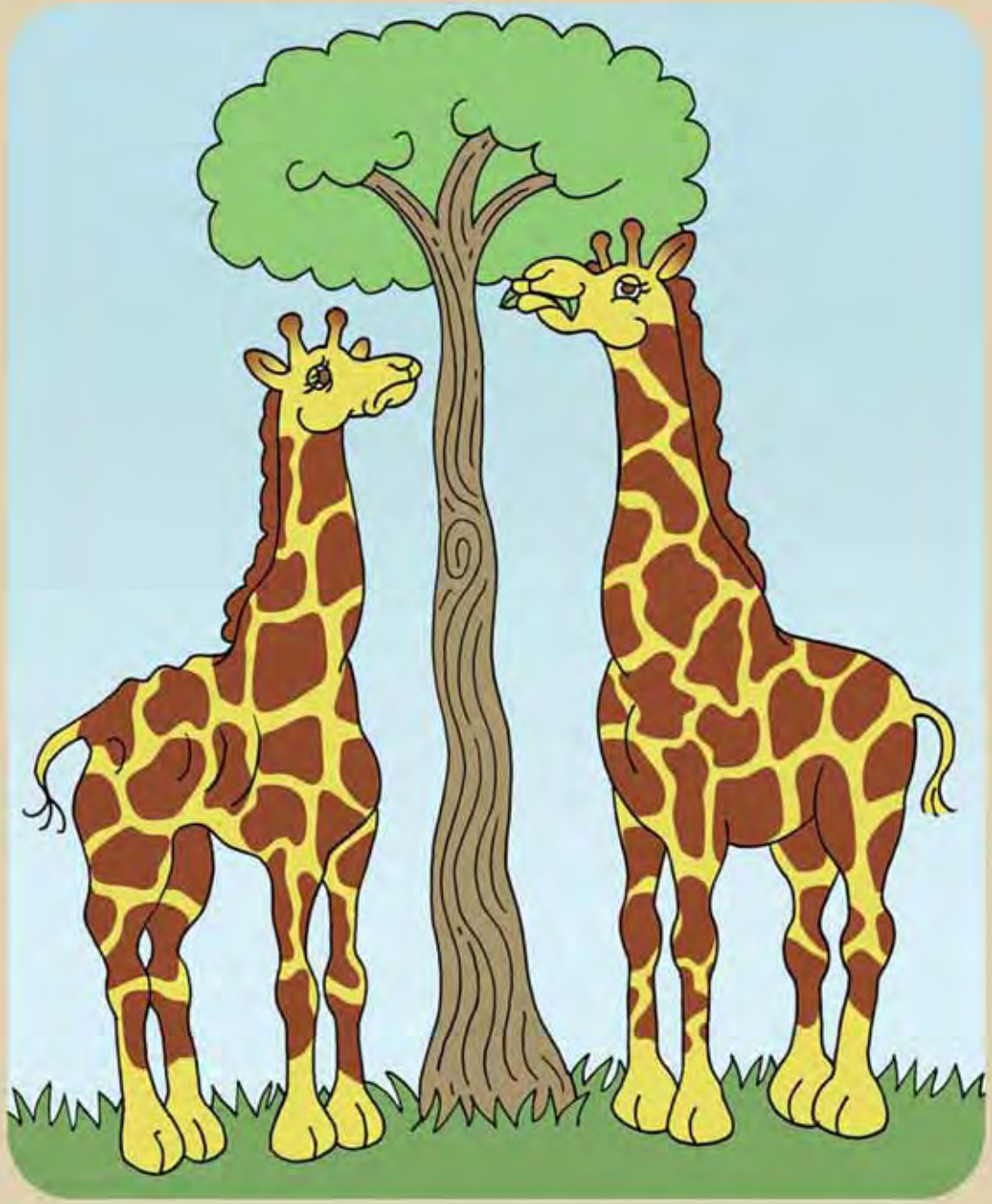


Classification

Biological classification takes its roots from the Greek Philosopher, Aristotle who classified animals by their method of reproduction.

In the 18th Century Carolus Linnaeus worked out a system of classifying species according to their physical characteristics.

Plants and animals are now classified on principals of common descent based on evolutionary relatedness. It could be argued that this is based on Charles Darwin's 'Natural Selection' theory.

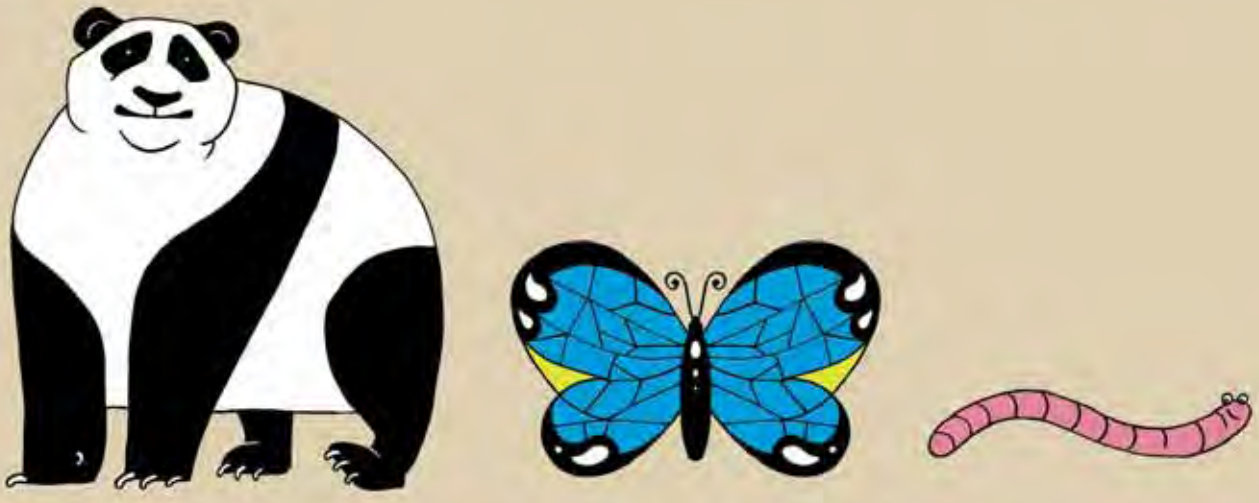


Every organism can be classified at 7 different levels – Kingdom, Phylum, Class, Order, Family, Genus and Species.

The kingdom level holds the greatest number of organisms and the greatest diversity between those organisms.

As organisms are classified from Kingdom through to species their similarities increase.

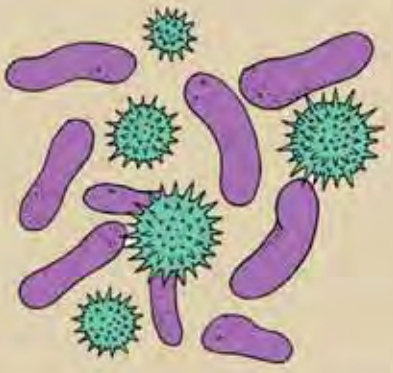
Based on current thinking there are 6 kingdoms although scientists have argued over the number and make up of the kingdoms for many years. The 6 kingdoms are: **Animalia**, **Plantae**, **Fungi**, **Bacteria**, **Protozoa** and **Chromista**.



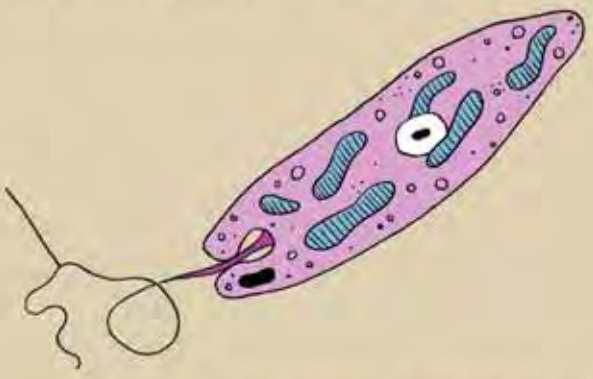
Animalia: All members of this kingdom are multicellular (made up of many cells) and are heterotrophic (get their nourishment by eating other organisms). All animals require oxygen for their metabolism.

Plantae: A multi-cellular organism that produces food through photosynthesis.

Fungi: A multi-cellular organism requiring oxygen to metabolise nutrition received by absorption



Bacteria: A multi-cellular organism that produces food through photosynthesis



Protozoa: Single eukaryotic cell (nucleus is enclosed by a membrane)

Chromista: Single eukaryotic cell, chloroplasts contain chlorophylls.

Every organism has a unique Latin or scientific name defined by the lower levels of the classification system (i.e. the Genus and the species). This is important because organisms can be known by many different common names around the world. By having one Latin/Scientific name scientists can talk about the same organism without any confusion.

Sample Classification

The Panda

Kingdom: *Animalia*

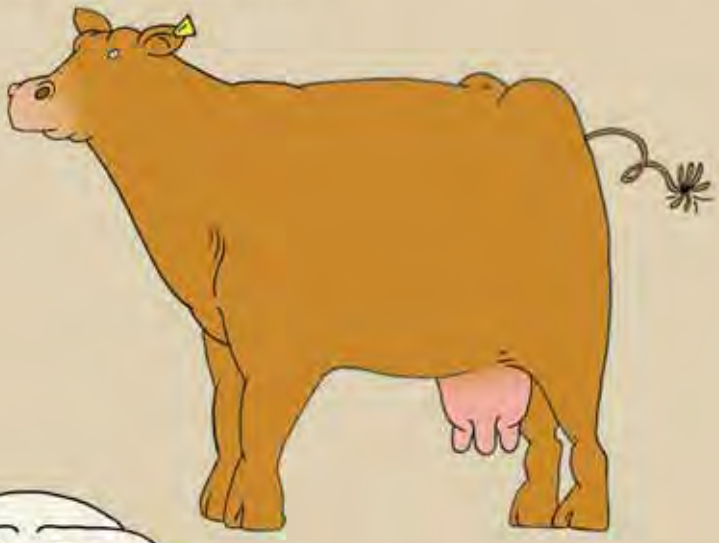
All members of this kingdom are multicellular (made up of many cells) and are heterotrophic (get their nourishment by eating other organisms). All animals require oxygen for their metabolism.

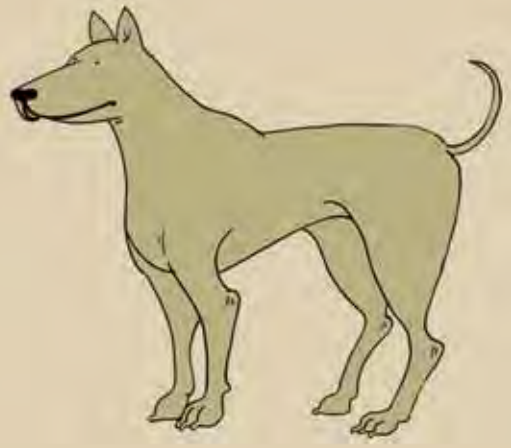
Phylum: *Chordata*

Chordates are all bilaterally symmetrical with distinct heads. At some point in their development, they possess a notochord (a rod-shaped supporting axis, or backbone).

Class: *Mammalia*

All mammals have hair, are able to regulate their body temperature and the females produce milk.





Order: *Carnivora*

Not all members of Carnivora eat meat (pandas eat almost nothing but bamboo), but all have well-developed teeth for shredding foods. In general, these animals have strong limbs and claws and acute senses.

Family: *Ursidae*

Members of the bear family have five toes on each foot and some can walk upright for short distances. Bears are intelligent animals with a great sense of smell.

Genus: *Ailuropoda* (meaning cat footed)

The panda is the only member of the genus ailuropoda because it is not closely related to any other bears.

Species: *Melanoleuca* (meaning black and white)

The Genus and species are written in italics, the Genus always starts with a capital letter while the species is always lower case.

The Panda's Latin/ Scientific name is Ailuropoda melanoleuca which is unique to it.

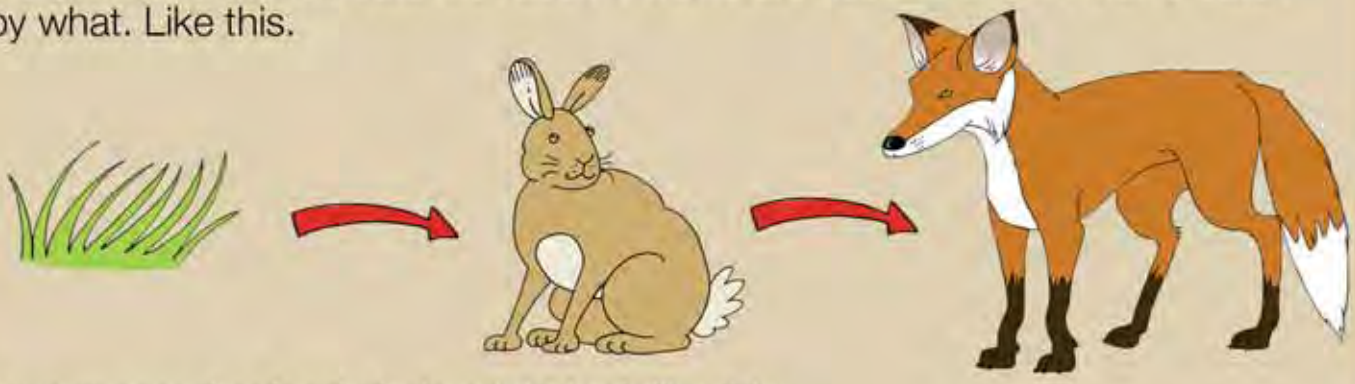
Food Chains & Food Webs

Living things need energy in order to live. Energy is used up by running, jumping, growing or just breathing.

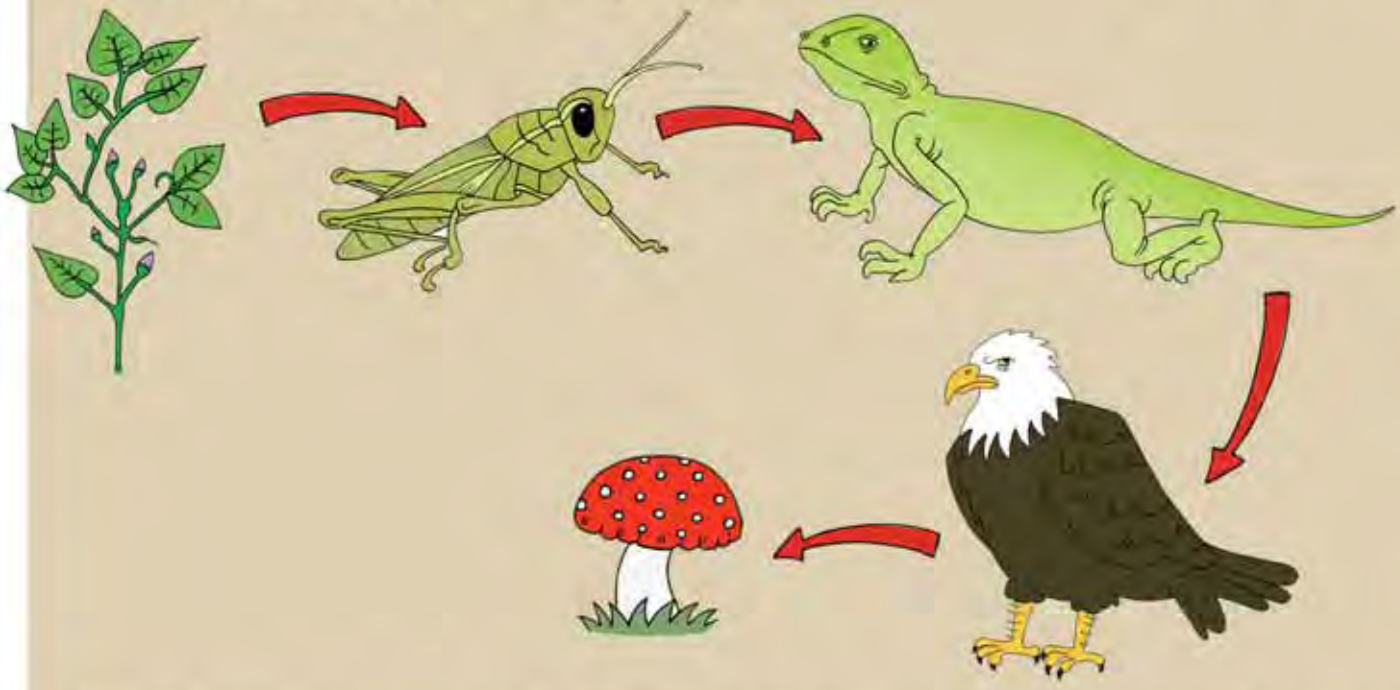
Plants get their energy which they need for growing and producing seeds from the sun in a process called photosynthesis, while animals eat other organisms, be that plants or other animals to get their energy.

A food chain shows how each animal in the chain get their energy.

A simple food chain might consist of a plant a rabbit and a fox. The rabbit eats the plant and the fox eats the rabbit. Arrows are used to show what is eaten by what. Like this.

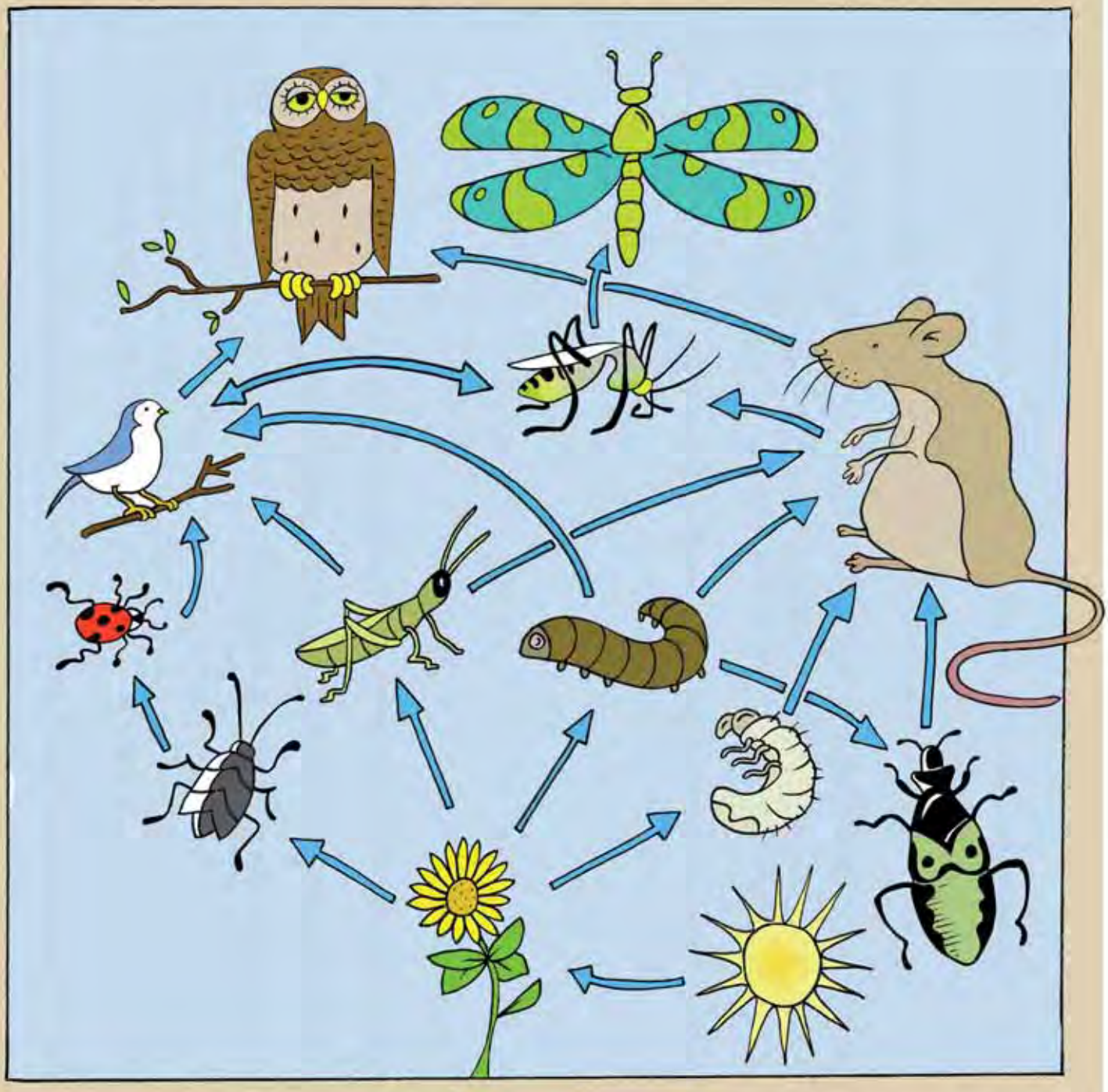


A more complex food chain might look like this:



In this food chain, we see that when the eagle, the top predator dies, the body might be eaten by fungi in this case mushrooms.

Food webs are made up of several connected food chains and are even more complex. A simple food web might look like this:

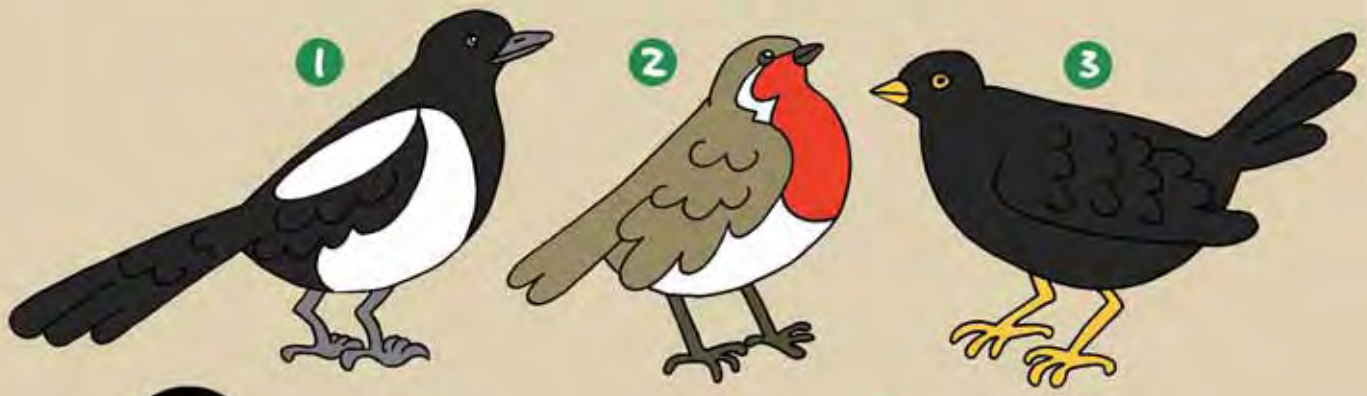


The animals in this food web include owls, mice, finches, grasshopper, flies, caterpillars, ladybirds, aphids, (beetle) larvae, beetles, plants and dragonflies.

As you can see there are many more arrows on a food web to show that some organisms can be eaten by and may eat many different organisms.

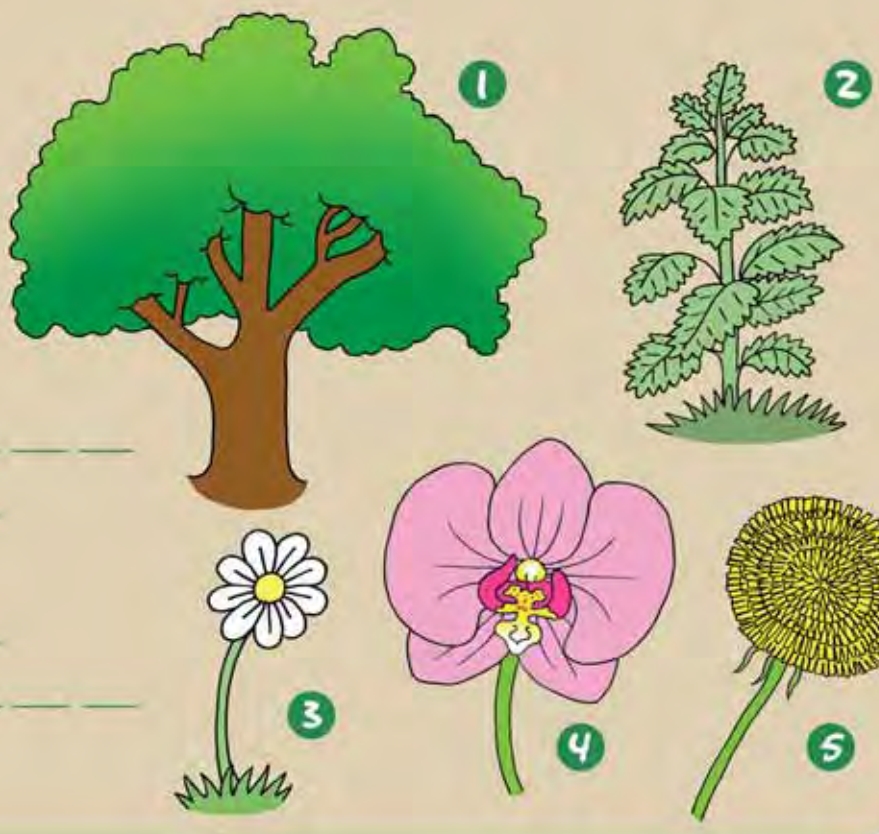
Biodiversity Quiz

Can you name the following?



Birds

1. _ _ _ _ _ _
2. _ _ _ _ _
3. _ _ _ _ _ _ _ _ _
4. _ _ _ _ _ _
5. _ _ _ _ _ _ _ _

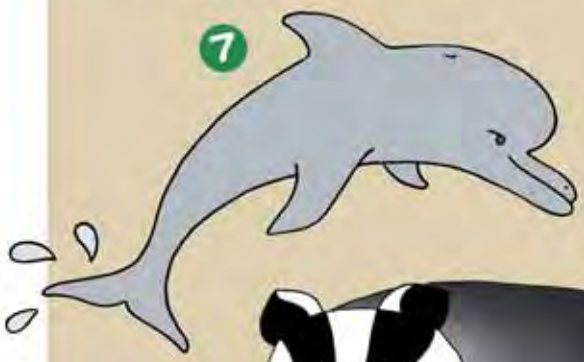


Plants

1. _ _ _ _ _ _ _
2. _ _ _ _ _ _
3. _ _ _ _ _
4. _ _ _ _ _ _
5. _ _ _ _ _ _ _ _

Animals

1. ____ ____ ____ ____
2. ____ ____ ____ ____ ____ ____ ____ ____ ____ ____
3. ____ ____ ____ ____ ____ ____ ____ ____
4. ____ ____ ____ ____ ____
5. ____ ____ ____ ____
6. ____ ____ ____ ____ ____ ____ ____ ____ ____
7. ____ ____ ____ ____ ____ ____ ____
8. ____ ____ ____ ____ ____ ____
9. ____ ____ ____
10. ____ ____ ____ ____ ____



Answers: **Birds** 1=Magpie, 2=Robin, 3=Blackbird, 4=Puffin, 5=Blue Tit **Plants** 1=Oak Tree, 2=Nettle, 3=Daisy, 4=Orchid, 5=Dandelion **Animals** 1=Bat, 2=Red Squirrel 3=Hedgehog, 4=Otter, 5=Seal, 6=Irish Hare, 7=Dolphin, 8=Badger, 9=Fox, 10=Mouse

Biodiversity word Puzzle

Across

1. A very tall woody plant

3. The incredible variety of life on Earth

6. A place where a group of organisms live together

9. A community of organisms where there are several interrelated food chains

10. The life of an organism from beginning to end

11. Non native plant or animal

12. A living thing

Down

2. The species is gone forever

4. Part of the plant used for sowing

5. Living matter used to make a renewable energy source

7. A hairy insect that stings. Varieties include the honey and bumble...

8. An organism that preys on other organisms

Answers:
Across: 1.Tree 3.Biodiversity 5.Biofuels 6.Habitat 9.Foodweb 10.Life cycle 11.Alien species 12.Organism Down: 2.Extinction 4.Seed 7.Bee 8.Predator

Habitat Destruction

Whenever we buy something we impact on the environment. Be that through the extraction of minerals, use of chemicals (on crops), processing or manufacture of goods and their subsequent distribution. Further impacts occur through use of goods and their eventual disposal.

Palm Oil which many consider a 'wonder product' because of its use in hundreds of products including chocolate, crisps, bread, cakes, toothpaste, detergents, shampoo and lipstick, is having a major impact on wildlife in Malaysia and Indonesia because of habitat destruction.

Large areas of rainforest are being cleared to make way for Palm Oil plantations to satisfy our demand. As a result the wildlife living in these rainforests are faced with the threat of extinction.

These monoculture plantations support a very small biodiversity when compared to the rich biodiversity that inhabit rainforests.

One particular inhabitant of the dwindling Asian rainforests is the orang-utan, Asia's only great ape. Dr. Ian Singleton of the Sumatran Orang-utan Conservation Programme claims that tens of thousands of orang-utan have already been lost because of the palm oil industry with many more under threat.

But as consumers do we have a choice, can we buy non palm oil products to help stop the destruction of rainforests? Friends of the Earth claim that we can't because most products do not differentiate between palm oil and other vegetable oils.

How can we protect the orang-utan?

Perhaps we could write to the government to ask for better labelling?

Perhaps we could write to the Malaysian and Indonesian governments to ask them to protect the rainforests?

Maybe we could write to the big supermarkets to ask them not to sell palm oil products?

Or maybe we could buy locally produced goods?

Eco-Tourism

There are a growing number of people who are mindful of how their actions impact on the planet. For many their concerns extend beyond their day to day life and into recreational activities.

As a result, interest in eco-tourism has been growing by over 20% a year since the 1990's.

Eco-tourism provides tourists with an opportunity to experience natural unspoilt areas whilst minimising their impact on the environment, in some cases it can involve conservation activities that go some way to supporting the preservation of these locations.

Eco-tourism gives economic value to natural unspoilt locations, providing an incentive to preserve and protect these sights.

Ireland is well suited to cater to this form of tourism with its many unspoilt natural locations and its worldwide recognition as 'The Emerald Isle'.

Tourist attractions in Ireland can gain eco-tourism accreditation from Eco-tourism Ireland (a not for profit organisation) by proving that they support sustainable practices and provide an educational element promoting sustainability for the attraction to its visitors.

To learn more about Eco-tourism Ireland please check out their website:

www.ecotourismireland.ie/

Conservation- Irish Raptors Return!

In 1912 the last Irish Golden Eagle was seen flying in County Mayo. It would be nearly 100 years before these magnificent birds with their 6 – 8 feet wingspan were seen flying over Irish soil again.

The Golden Eagle was not the only raptor to become locally extinct in Ireland. Around 10 years before the last Golden Eagle was seen, the last White Tail Sea Eagles disappeared from Irish soil and a hundred years before then the last Red Kite's were observed in Ireland.

Thanks to the Golden Eagle Trust reintroduction programme, all three of these magnificent raptors have been given a chance to re-establish themselves in Ireland.

Golden Eagles can now be seen flying in Donegal and the surrounding counties, while White Tailed Sea Eagles can be seen in Cork and Kerry with Red Kites regularly observed soaring over the Wicklow and Dublin countryside.

To find out more about the Golden Eagle Trust and their continued work to reintroduce raptors back into Ireland check out their website www.goldeneagle.ie

Activity

All three raptors were present in Ireland for hundreds, if not thousands of years, before the extinctions in the 19th and 20th centuries.

Q: What do you think might have caused their extinction?

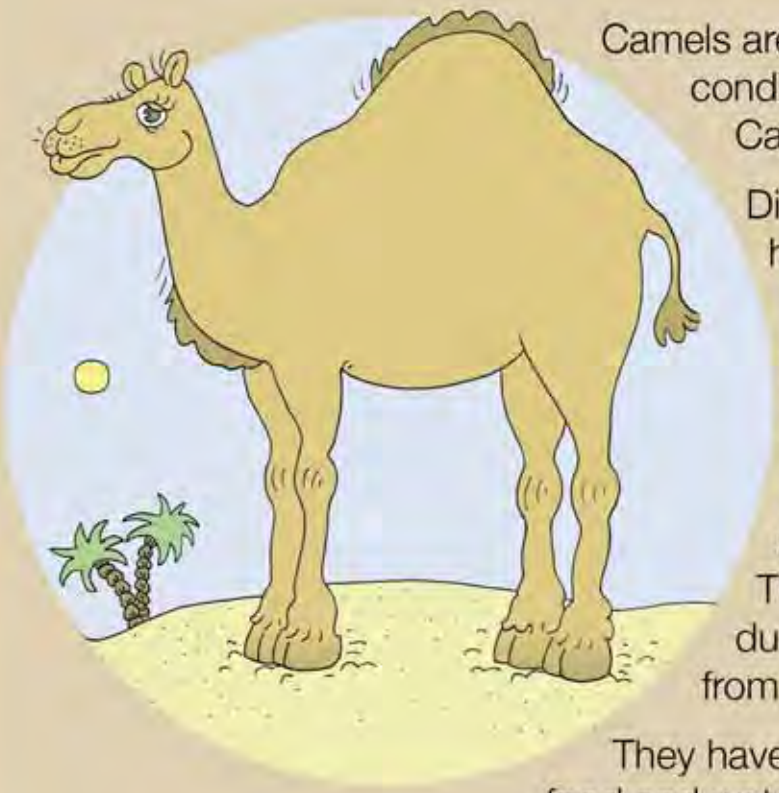
Q: Has anything changed since the 19th and 20th century or are these magnificent birds still at risk?

You might need to do some research in books or on the internet to fully answer these questions.

Perfectly Adapted: Information Sheet

Animals are amazing, but did you know they look and act the way they do for very good reasons. You could say they are perfectly adapted for their environment.

Camels



Camels are adapted to survive in dry desert conditions. So what's so special about Camels?

Did you know that Camels have 2 sets of long eye-lashes? It's not to help them look pretty but to protect their eyes from the glaring sun and from sand during sand storms. They can even close their nostrils during sandstorms to stop the sand from getting up their nose!

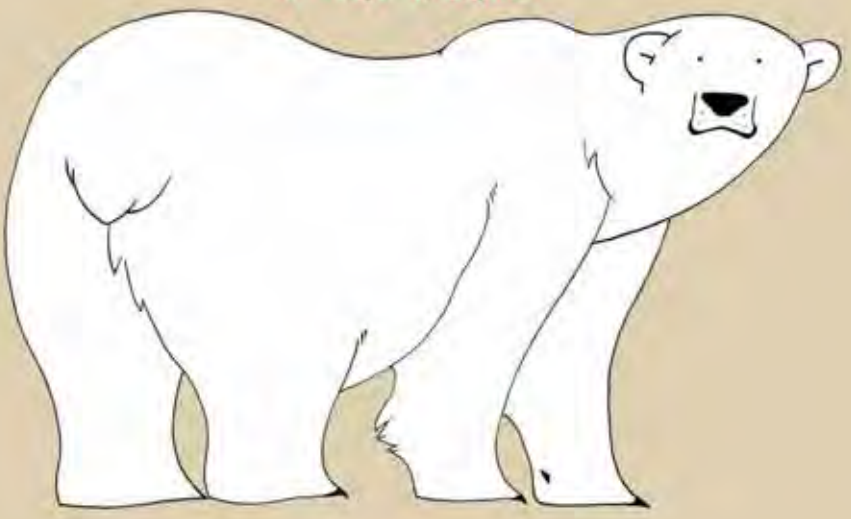
They have humps which are used to store food and water. This helps the Camel survive for long periods without food or drink.

Camels have thick fur which you might think is bad for the hot desert sun, but the fur insulates against the heat during the day and keeps the Camel warm at night when temperatures can fall below freezing. Their fur is sand coloured to help camouflage them in the desert.

Camels have patches on their knees which help protect them from getting burnt by the hot desert sand. They also have broad, flat, leathery pads at the bottom of their hooves which prevent them from sinking in sand.

So you see, Camels are just perfect! Don't let anyone tell you otherwise!

Polar Bears



Polar bears are perfectly adapted to their environment.

Polar bears fur is white camouflaging them in the snow and ice of the Arctic, this makes hunting easier. Polar bears have an excellent sense of smell and good eyesight both important features for hunters.

The claws are sharp which helps to prize open their prey.

The fur is hollow this helps the bears to stay buoyant when swimming, and also traps a layer of air which helps insulate the polar bear from the cold.

The skin beneath the fur coat is black, this absorbs heat when the sun is shining.

Polar bears have a thick layer of blubber which insulates them when swimming.

Polar bears have large wide paws which help them to walk on snow and ice and their paws are also webbed which help them to swim. Polar bears have been known to swim as far as 100km.

Polar bears nostrils close whilst swimming.

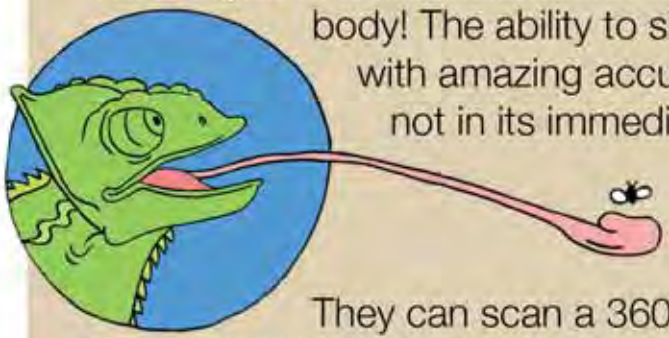
Polar bears have small rounded ears, this helps prevent water entering the ear and freezing the eardrums.

Chameleons

Chameleons are perfectly adapted to their environment.

Chameleons can change color, using most backgrounds as camouflage, to hide from potential predators. Chameleons tend to move very slowly to avoid detection by predators. Changing colour also helps to regulate its body temperature, as darker body colours absorb heat and lighter colours reflect, and thus repel, heat.

The tongue of a chameleon can extend one and a half times the length of its body! The ability to shoot its tongue over such a distance and with amazing accuracy allows the chameleon to reach food not in its immediate vicinity.



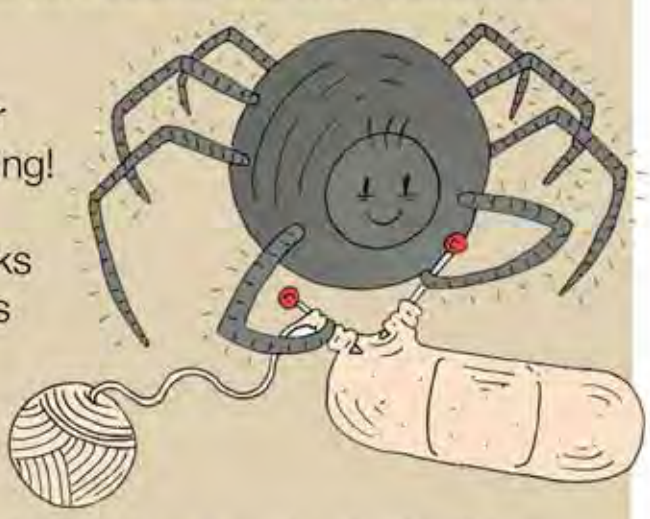
Chameleons possess independent eyes that can focus on two separate images. They can scan a 360 degree area without moving their heads. Chameleons can therefore remain still and camouflaged while locating prey and keep a look out for potential predators.

The long tails are used to grip onto branches to prevent them from falling as they traverse through the tree canopy. These reptiles curl their tail up when it is not used for balance or grip. A chameleon's feet are also designed to help it hold onto branches.

Traditional Medicine

In 1937-38 the Irish Folk Lore Commission (IFC) undertook a special project in partnership with the Department of Education and the Irish Teachers Organization (INTO). The project asked all school children to talk to their parents and grand parents about plants they used to make medicine. Over 4500 note books were returned to the IFC detailing all manors of cures for major and minor ailments.

The notebooks collected by the IFC can still be studied and are available on microfiche in county libraries.



You might be interested to learn that spider webs were used as plasters to stop bleeding!

Some plants described in the IFC notebooks were considered 'cure all's' because it was believed they could cure many ailments.

Take the Nettle for example.

Stinging nettles are traditionally used as a spring tonic. It is a slow-acting nutritive herb that gently cleanses the body of metabolic wastes. It has a gentle, stimulating effect on the lymphatic system, enhancing the excretion of wastes through the kidneys.

Nettle's iron content makes it a wonderful blood builder, and the presence of vitamin C aids in the iron absorption. It is a wonderful herb for anemia and fatigue, especially in women.

Stinging nettle is beneficial during pregnancy due to its rich mineral value and vitamin K, which guards against excessive bleeding. It is also a good supplement to strengthen the foetus.

As a diuretic, stinging nettle increases the secretion and flow of urine. This makes it invaluable in cases of fluid retention and bladder infections. It is also anti-lithic and nephridic, breaking down stones in the kidneys and gravel in the bladder.

All of these ancient cures were passed down from generation to generation and would have been widely used before doctors and medicine became readily available here in Ireland.

Do any of your older relatives know any cures that may have been passed down from their parents or grandparents?

Modern Medicine

Even today we use many plant extracts in our medicine for example a substance taken from Foxgloves is used to treat heart conditions.

Traditional medicine for modern ailments

The Kalahari bushmen would eat a succulent whilst on long hunting trips because it stopped them feeling hungry. Extracts from the succulent are now used as a treatment for obesity.

Future research using plants

While scientists working on a cure for Alzheimer's are hopeful they may be closer to a possible cure after discovering an extract from Daffodil's that had positive results in initial tests.

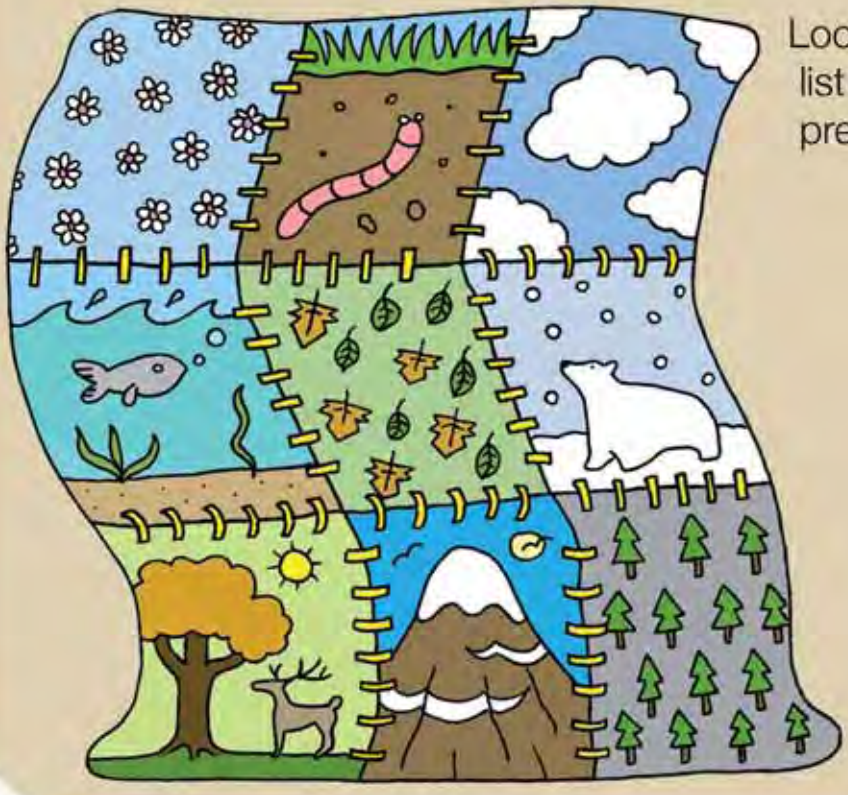
Identifying and mapping habitats

Background

Habitats provide places for plants and animals to live. Different habitats may support different species. Mobile species such as birds may rely on more than one habitat (e.g. a blackbird uses a bush for nesting and grassland for feeding). In order to learn about and protect local wildlife it is necessary to be able to identify the valuable habitats in the area.

Making a map of your local area (e.g. school or park) will help you to identify and record valuable habitats for wildlife. Some habitats will be more valuable to wildlife than others as they support a greater diversity of species.

But even habitats, which at first may appear to have very little wildlife, can be important for certain species (e.g. buildings can be important for bats, mosses and lichens).



Research

Look around your chosen area and list the different types of habitats present, such as:

- Woodland
- Hedgerow
- Long grass
- Wildflower meadow
- Short grass
- Stream
- Wet/ dry ditch
- Pond
- Flower bed
- Vegetable garden
- Buildings
- Paths

Step one:

Draw a map of your study area showing the habitats present and label each habitat.

Step two:

Choose 3 habitats in your study area and observe how many different plants or animals you can see using these habitats.

- Which habitat has the most species using it?
- Which habitat has the fewest species using it?

Step three:

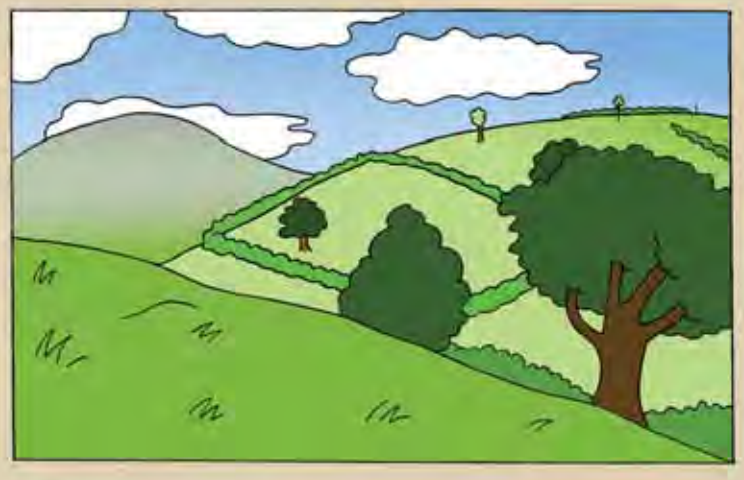
Choose one habitat from your study area and using online resources, research the ecology of one plant and one animal associated with this habitat.

Important places for wildlife

Background

Certain places and certain types of habitats are very important for wildlife because they support such a diversity of species, or because they support rare species, or species which have been declining and are in need of protection.

Many of these places are given protection under European or Irish law in order to conserve the habitats and species that they contain. There are two types of European designations that are used to protect important wildlife sites. These are:



1) Special Protection Areas (SPAs):

Which are designated for the protection of bird populations and their habitats.

2) Special Areas of conservation (SACs):

Which are designated for certain habitats and certain species (other than birds) which are important and in need of conservation.

In Ireland, we also protect certain sites under national legislation for the diversity of habitats and species they support. These sites are called **Natural Heritage Areas (NHAs)**.

The National Parks and Wildlife Service is responsible for identifying sites, which should be protected under European or Irish law. Information on all three types of site (including a map showing their location and a summary of the habitats and species of interest) can be found on their website **www.npws.ie.**

Research

Using the information available on the National Parks and Wildlife Service website, look up the following information:

1. Identify how many SPAs, SACs and NHAs are present in the Dublin area and list them.

2. Determine which SPA, SAC and NHA are closest to your school.

3. What are the main habitats and species for which these sites were designated?

4. Using other online resources, research the ecology of one habitat and one species that is protected within these sites.

Colour Me In!

Colour Me In!

Colour Me In!

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