Green-Schools

Towards a sustainable lifestyle

BIODIVERSITY

An Taisce – *The National Trust for Ireland* is the foremost environmental organisation in Ireland. Its range of interests extends from the natural heritage of land, air, water, flora and fauna, to the heritage of buildings and gardens. Through its local, national and international networks, it seeks to educate, inform and lead public opinion on the environment and influence policy and development. Strategies to achieve these aims include awareness and education projects, for example:

- *Green-Schools:* an international FEE programme promoting responsible behaviour among school children and the wider community towards the environment. It is also a learning resource raising awareness of environmental issues through activities that link curriculum subjects.
- *Blue Flag:* Co-ordinating the international FEE Blue Flag Awards campaign in Ireland. The goal of Blue Flag in this regard would be towards integrated coastal zone management and sustainable development in coastal areas.
- The 'Clean Coasts Project' has been established to improve the environment of the Irish and Welsh coasts, and to restore the aesthetic appeal and increase the amenity and economic value to the community and visitors. The project organises 'Coastcare' groups who take part in coastal conservation and management and also administers the 'Green Coast Award' which rewards excellent water quality and sound environmental management.
- *National Spring Clean:* A yearly campaign promoted by An Taisce with the aim of encouraging and assisting clean-ups during the month of April, as well as increasing awareness of litter and waste issues and to promote sustained practical involvement in the environment.

FEE (*The Foundation for Environmental Education*) – seeks to promote environmental education by carrying out campaigns and improving awareness of the importance of environmental education. It is composed of a network of organisations which undertake individual projects in their own countries and participate in international efforts. An Taisce as the Irish member of FEE co-ordinates these campaigns in Ireland.

Repak are proud lead sponsors of the Green-Schools programme in Ireland and recognise the important role our younger generation plays in maintaining and sustaining our earth's natural resources. Repak is a not-for profit voluntary member's based packaging recycling scheme established under a voluntary agreement between industry and the Department of the Environment, Heritage and Local Government. It was established as industry's response to the obligations places on Ireland by the EU directive on Packaging Waste (94/62/EC) and is the only government approved packaging compliance scheme under the Waste Management (Packaging) Regulations 2007. Repak, Ireland's Green Dot company, was established to acquire membership from such obligated companies to drive Ireland's packaging recycling rates. Repak succeeded in reaching and exceeding Ireland's EU National Packaging Recovery and Recycling Target of 25% of packaging waste in 2001 and is well on the way to achieving our 2005 EU packaging recovery target of 50%.

The Wrigley Company Ltd. is delighted to support the *Green-Schools* Programme as part of their on-going commitment to promote anti-littering strategies. Other examples of their commitment to schools and young people include sponsorship of ECO UNESCO's CD Rom and web management system and Foróige's Citizenship Programme Awards. All these programmes are designed to promote proper disposal of chewing gum within the overall context of anti-littering strategies and environmental education initiatives.

An Taisce operates Green-Schools in Ireland in partnership with **Local Authorities.** Local Authorities not only provide funding for the programme but also provide an excellent on the ground support network for schools through their Environmental Education and Awareness Officers. This partnership is seen as the key to the success of the Green-Schools programme in Ireland.

"The Green Schools programme is an excellent way of reaching our young people at a time when we are increasingly concerned about environmental issues. The Programme engages their interest and encourages them to adopt practical measures to protect and conserve the environment. In the 13 years since it was launched, it has gone from strength to strength and its success can be measured by the fact that over two thirds of the schools in the country are now participating. I am pleased that my Department continues to support the scheme and I wish to acknowledge the commitment and hard work of all those involved – An Taisce, local authorities, parents and particularly the schools".

Mr. John Gormley, T.D.,
Minister of the Environment, Heritage and Local Government

An Taisce
Green-Schools
AN GRADAM COSTA GLAS
GWOBR ARFORDIR GLAS | GREEN COAST AWARD
NATIONAL SPRING CLEAN
Fee
Comhshaol, Oidhreacht agus Rialtas Áitiúil
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Local Authorities

The world's biological diversity is an essential natural resource which humans have used and benefited from for thousands of years. Biodiversity keeps us alive! Therefore, it is vital we conserve it.

GREEN-SCHOOLS **BIODIVERSITY**

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This booklet is designed as a resource for teachers and students. It aims to inform and guide the successful implementation of the Biodiversity theme of the *Green-Schools* programme. The booklet is divided into 5 main sections:

Section 1 reviews the reasons for choosing Biodiversity as a topic to be undertaken as part of the *Green-Schools* programme. It highlights the importance of biodiversity, why biodiversity should be conserved and examines ways in which it is being protected at a global and European level.

Section 2 looks specifically at the seven steps and actions that can be taken both at school, in the home and at a community level to help conserve biodiversity. It also examines the possible links that can be made to the curriculum through the programme.

Section 3 provides some information about Biodiversity in Ireland, examining the history of protected areas in this country.

Section 4 looks at biodiversity as a global resource and the impacts of losses in biodiversity.

Section 5 contains worksheets on the theme of biodiversity.

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Section 1 **INTRODUCTION**

1.1 General

As described in the *Green-Schools* Handbook that accompanies the themed booklets, there are seven elements to the *Green-Schools* programme: Committee, Environmental Review, Action Plan, Monitoring and Evaluation, Curriculum Work, Informing and Involving, and Green Code. You will have already successfully implemented the seven steps of the programme in relation to the first four themes. This booklet will give you background information, ideas for activities, useful contacts and practical case studies from other Irish schools.

Don't forget that you should be maintaining and improving upon the success of your previous themes as you develop the Biodiversity theme, and linking these themes where possible. To successfully implement the *Green-Schools* programme for Biodiversity, you will be expected to establish the seven steps of the scheme as described in the Handbook and to have made progress in developing an appreciation and understanding of biodiversity and its importance to us. *Remember, the activity ideas described in the booklet are just a starting point. It is probable you will develop some interesting and innovative ideas of your own. Don't forget to check out the Green-Schools website* (www.greenschoolsireland.org) *for more ideas.*

Further information and examples of activities for the school that are outside the remit of this booklet can be obtained from a variety of other sources. A list of contacts where such information can be acquired is given at the end of this booklet.

1.2 What is biodiversity and why should we be concerned about it?

Biodiversity is the variation of living organisms from all sources, terrestrial, marine and other aquatic ecosystems and all the habitats of which they are part; this includes diversity within species, between species and of ecosystems.

Imagine if our daily diet consisted of only one food source, for example apples, now imagine having to eat only apples every day for the rest of our lives! If the variety of life forms was reduced to just a small number of species of plants and animals, how boring would this be! Just like having to eat apples for the rest of our lives!

Common terms to know

- ***Species*** *- a group of organisms capable of interbreeding and producing fertile offspring. For example, the ash is a species of tree, the squirrel is a species of mammal.*
- ***Habitat*** *- the natural environment in which an organism lives, or the physical environment that surrounds, influences and is used by a species population. For example, a woodland or a bog is a habitat.*
- ***Ecosystem*** *- the physical and biological components of an environment which is considered a unit, for example; a freshwater ecosystem includes animal, plant and microbial (minute organisms) life in lakes, rivers and ponds. Another example is a valley with some woodlands and a river, and all the life they contain.*

Did you know? Ireland is home to about 815 flowering plants, about 80 native ferns, more than 700 mosses and liverworts, 3,500 fungi, over 1,000 lichens and 1,400 algae. There are 32 terrestrial mammals, ten bat species, two species of seals and about 24 whales and dolphins. About 425 species of birds have been recorded in Ireland, about half of these birds breed here. Many of these species are already under threat, some are even endangered. Why not see if you can find out what these species are and why they are under threat. Then try to find out what we can do to help these species!

Visit The National Parks & Wildlife Service website to learn more http://www.npws.ie/en/Biodiversity/

Biodiversity was chosen as a theme for the following reasons:

- Biodiversity is the basis for all our lives and without it we would cease to exist
- We are currently losing biodiversity at alarming rates
- Simple steps can help maintain and perhaps even enhance the biodiversity that surrounds us
- Biodiversity as a subject slots easily into the curriculum in both primary and secondary schools

Note: See Section 3 and 4 of this handbook to learn all about the value of biodiversity, what is happening to it and why we need to conserve it.

1.3 What schools can do to help

Every school can help to ensure all students and staff have an opportunity to engage with nature. Biodiversity is essential in keeping the environment healthy and fit for human life. Not only do we rely on biodiversity; our activities also have an effect on it. So whether your school is based in a city or in the countryside the biodiversity theme hopes to connect you, your school and your wider community with the natural environment and cultivate a sense of wonder, appreciation and value for all the biodiversity around us. **The first important objective of this theme is to develop awareness of biodiversity and understand its importance to our everyday lives**. This can be achieved through improving or preserving your local biodiversity whether it is in your school garden, at home, a green space in the town or city, your local beach or a river. Your school will have the opportunity to play a vital role in promoting and preserving biodiversity both locally and globally.

Some of the other aims of the theme are to:

- Encourage students to take ownership and responsibility for their actions
- To utilise information technology as far as it is feasible
- To include social and cultural aspects of biodiversity
- To raise awareness of local biodiversity issues through audits and surveys
- To formulate an Action Plan based on the results of the review
- To work locally and think globally, encouraging schools to make choices that improve biodiversity in their local surroundings and to use natural resources in a more sustainable manner
- To encourage links with other schools around the country and even internationally to explore the perspectives of others towards biodiversity and sustainable living
- To tie Biodiversity in with the other themes of the Green-Schools Programme

Unlike the previous themes where you may have implemented a few simple steps in order to reduce your school's impact on the environment, the biodiversity theme is a little more concept based. However, in saying this, schools can still help preserve biodiversity. In fact, many of the schools at this stage of the programme may have already developed a Green-Schools garden, have been composting for some time or may have even have set up bird tables. These are all great ways of encouraging biodiversity on your school grounds!

Section 2 **THE BIODIVERSITY THEME & THE SEVEN STEPS**

2.1 Introduction

This section will take you through the seven steps and provide you with lots of helpful ideas to kick-start the biodiversity theme in your school. As your school develops new ideas and initiatives, please let us know how you get on. This way other schools can learn from your experience. Why not email your story to the Green-Schools Team so we can post it on our Green-Schools Biodiversity webpage! Email your story to greenschools@antaisce.org

2.2 Step 1 – Establishing a Biodiversity Committee

As you have already successfully implemented the *Green-Schools* programme for the previous themes, your school will understand that the development of an effective committee is the most important driving force for successfully implementing the programme. When creating a committee for the Biodiversity theme, **remember that you will still be maintaining and developing the work carried out for all the previous themes**. You may wish to use your current committee to tackle biodiversity as well as maintaining the other themes, or you may wish to develop a specific committee dedicated to the Biodiversity theme. As is detailed in the *Green-Schools* Handbook, you will need the help and support of students, teaching, and non-teaching staff and it is important that all groups are represented on the committee. ***Remember, the committee should be as student-led as possible!*** Your Local Authority can also provide additional information and support. For more ideas on who should be involved, as well as the purpose and function of the committee, you should refer back to the relevant pages of your *Green-Schools* Handbook. At this stage it is important to decide on your general aims and objectives. They should be realistic and achievable. Success increases confidence and encourages further success.

2.3 Step 2 – The Review

There are two main aims of the review. Firstly, to identify the initial levels of awareness of biodiversity amongst the students and staff. Secondly, to assess current existence and levels of Biodiversity within the school grounds. For example, what habitats exist in or near the school grounds? What species are living in these habitats? Your review should be used as a benchmark against which future monitoring can be compared. Therefore, it is a good idea to make sure that your review is repeatable, which will enable you carry out your monitoring as a number of 'mini' reviews.

Start off on a positive note and see what you are already doing to help biodiversity. Revisit the previous themes and see if what you have done so far has helped biodiversity in any way and record previous achievements on a new list. See the table on the following page for some ideas. Revisit all your previous themes in relation to biodiversity as you move forward, monitoring and evaluating as you go.

Direct and indirect links with the other Green-Schools themes

Litter & Waste

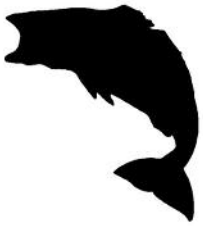
Waste can be dangerous if it is not disposed of properly. Litter poses **huge problems** to wildlife, on land and in the waterways and seas. Each year millions of wildlife dies from our litter. As schools are required to keep school grounds tidy and litter free as part of the L&W theme this has a direct positive impact on biodiversity Schools often take part in clean ups outside the school grounds, improving the litter situation even further. One of the many projects schools undertake while working on the Litter and Waste theme is composting and as a result they have developed school gardens using their own compost, this in turn can lead to an increase in biodiversity such as, butterflies, insects and birds.

Energy

If schools across Ireland are working towards reducing their energy usage this will lead to an overall reduction of the burning of fossil fuels which is often linked to habitat loss, such as peatlands. As with the previous theme students and staff are encouraged to take the themes outside the school boundaries and are required as one of the steps of the programme to inform and involve the wider community. For example, students often carry out energy audits in the home which results in increased levels of awareness in the surrounding community, which in turn may lead to a greater reduction in energy consumption.

Note: Some alternative sources of energy are often blamed for affecting biodiversity in a negative way for example, windfarms. Careful consideration is needed in the planning process and in particular with their location.

Water



Freshwater is a valuable resource; we use huge amounts of water every day for cooking, cleaning, washing etc. As demands increase water supplies get lower, reservoirs can dry up and sometimes water may be pumped out of rivers and lakes which can have a negative effect on freshwater ecosystems and the biodiversity that live there. Not only are schools reducing the amount of water they use but they are also helping protect and keep waterways clean if they are situated near a river, lake or the sea. Schools often partake in beach clean ups as part of their Action Day. Students can learn about the various 'water' habitats and gain an appreciation and understanding for all the biodiversity associated with them. Many schools working on the Water theme also make efforts to reduce the amount of harmful chemicals they use on a day to day basis, thus resulting in less pollution of the waterways and therefore helping to protect biodiversity.

Travel

The promotion of sustainable travel to school encourages less cars which in turn means less road development. In the past, the building of roads often resulted in negative impacts on sensitive species and habitats as a consequence of fragmentation and change in the landscapes. This can be compounded by ongoing maintenance and upgrading requirements. Walking and cycling to school may be seen as sustainable alternatives to private vehicle based travel which contributes to pollution in local environments and negative the effects of climate change on ecosystems. Travel and Biodiversity can be linked by organising nature walks and cycles. Investigating the impact of importing foods on local indigenous produce, and the contribution of 'food miles' to climate change is a good way at looking at the links between Travel and Biodiversity.

Case Study: Murrisk National School, Co. Mayo carried out a big clean up with their local community on the sea shore, helping biodiversity in their area and keeping up their Litter and Waste theme.

Once you have revisited your previous themes you can begin to assess the levels of awareness and find out what biodiversity surrounds your school. Here are some ideas to get you started on your Biodiversity review!

- **Carry out an awareness survey –** Be sure to include as many of the students and staff as possible to get a clear picture. Surveys can be used to examine the level of awareness and people's attitudes to biodiversity. Discuss the proposed questions in class and agree on their purpose. Take into account the age and ability of the user. The table below includes some general questions relating to biodiversity that you may choose to include. See if you can come up with an alternative set of questions as part of your review process. You may also wish to return to the same list of questions at a later stage, as part of the monitoring and evaluating step, to see if levels of awareness have improved. A similar survey could be brought home in order to investigate the levels of awareness in households and the wider community. Remember to publicise your results as this improves awareness in itself!

- Have you ever heard of the term 'biodiversity'?
- What is biodiversity?
- Why is biodiversity so important to us?
- Do any of the activities you carry out utilize natural resources?
- If so, what resources and where do they come from?
- Do our activities have an impact on biodiversity?
- Do you know of any plants/animals/fish that have become scarce or extinct in recent years?
- Do you know why they have become scarce or extinct?
- Why is there a need to preserve biodiversity?
- Can you list any threats to biodiversity?
- Are you aware of any measures being taken to protect biodiversity?
- Do you know of any protected areas near your school/home?
- If so, why are they being protected?
- What is a habitat?
- What is an ecosystem?
- What is a species?
- What is an introduced species?
- What are the problems associated with introduced species?

- ***Create a Habitat Map*** —Take a walk outside, draw up a map of the school grounds. Take note of all the biodiversity around you, in the garden, ditches, hedgerows, on the stone walls (e.g. lichens), in your pond and flower pots etc. Use identification keys to help you with this exercise e.g. plant, bird, invertebrate keys. See Section 5 Worksheet 1 on how to create a habitat map of your school grounds. Remember to always make a note of the weather, the time and the date as biodiversity may change with the seasons!

- ***Make a list*** —discover how much biodiversity is actually around you. Look at the food in your lunchbox and try finding out where it comes from. Have a look at how many children live in town/countryside/farm etc. Make a list of all the biodiversity your classmates may come in contact with at home and on their way to school.

Case Study: Scoil Naomh Treasa, Ballintogher, Co. Sligo carried out a survey amongst all the students and staff in order to assess the levels of biodiversity awareness. They surveyed the school grounds and identified what trees were growing around their school and in the hedgerows. They also constructed a habitat map of the school grounds.

- ***Investigate your local area –*** and find out what types of habitats surround your school? Find out if any of these are areas of special interest or protected by legislation in any way? For example, is your school near a Special Area of Conservation (SAC), a Special Protected Area (SPA) or a Natural Heritage Area (NHA). For information on designated sites see Section 4.2. Is your school by the coast, near a Blue Flag or Green Coast beach? You could draw a map of your county and mark out all the protected sites. Visit http://www.npws.ie/en/ProtectedSites/ and click on 'Protected sites' then click on 'Various designations'. Next click on your county and see what protected sites are there under the various designations. Investigate why they are protected. You could produce a large scale collage of your county as part of Art class. This could also be a good mapping exercise for a Geography class..

Case Study: Scoil Bhride National School, Lisdowney, Co. Kilkenny visited Castlecomer Discovery Park to learn all about river life. The students went on a 'minibeast' hunt and were shown how to riffle stones in the river to look for different species in order to establish the quality of the water. Following this the whole school undertook a survey of their local river. They took water samples and investigated in and around the river. The school plans to monitor the changes of the river at regular intervals.

- ***Discover how your garden grows –*** find out how your green areas are being managed. For example, how often is the grass cut? When and how often are the hedgerows trimmed? Is there any planting done annually? Are you using your own compost? Would it be possible to leave an area 'unmanaged' and discover what happens? Find out if an 'unmanaged' area attracts more biodiversity.

Case Study: St. Angela's National School, Castlebar, Co. Mayo decided to leave a section of their lawn uncut. Teachers use this area as a learning resource to see what changes occur over time. They also made bird feeders out of old milk cartons and hung them outside the windows. The children recorded the birds they saw feeding.

- **Species surveys –** survey the birds, trees, 'minibeasts, lichens, etc. around your school. Look at both species richness (diversity) and species numbers. Check out BirdWatch Ireland's website (http://www.birdwatchireland.ie). Visit the Bird Atlas Schools Section and Mapping Bird Activity Around your School plus much more! Another informative website to look at is Biology.ie

  Note: 'minibeasts' – include arthropods and other invertebrates such as spiders, ants, butterflies, bees, wasps, flies, woodlice, and many others!

- ***Indicator species –*** learn how some species are used to identify changes in our environment Carry out a *Lichen survey*! *(note: this activity may be more suitable for secondary schools)* Many lichens species are sensitive to environmental change. Lichens can be used to indicate the levels of air pollution. In general, the more lichen cover the better the air quality. Check out www.lichens.ie to learn all about lichens and how they can be used as indicator species! See if you can find out about other species that are used as indicator species and why.

2.4 Step 3 – Action Plan

Top 2 Actions!

Increase levels of awareness throughout the whole school and wider community

If possible increase the number of native species and the species diversity in the schools environs

The environmental review should have helped pinpoint some issues of concern in your school, perhaps even locally or nationally. It is now time to take action! Once you understand the concept of biodiversity and the importance of it, you can think up ways of encouraging biodiversity and preserving it. Have a brainstorming session where everybody comes up with lots of ideas. It is better to have modest targets that can easily be reached than too ambitious targets that may not.

As with previous themes your Action Plan should:

- Be in **table format**
- List **specific ideas for action**
- Be clear on **who** is undertaking each action
- Give the **times** for each action to occur
- Include **quantifiable realistic targets**
- Be **displayed** on your Green-Schools Notice Board and throughout the school

Some ideas to get you started:

- Get the committee together and have a **brainstorming session** in light of the results of your Review and begin entering your actions into your Action Plan.
- **Inform** the whole school about the new theme. Why not kick-start it by coming up with a new Biodiversity Green Code? Have a whole school poster/slogan competition using recycled materials, keeping in mind the L&W theme. Be sure and display the winning slogan on the Green-Schools Notice Board. Discuss with the students whether they think their own environment is important to them and why they think it is important or not. Move onto the concept of diversity within the classroom, and ask students to discuss with each other what diversity means to them. Next you could expand this to biodiversity. Each student could discuss what they think biodiversity means and why it is or is not important to us. Discuss how biodiversity might be measured.
- **Make a connection with nature** – learn about the huge diversity that surrounds us. Make sure everyone is aware of the importance of biodiversity in our everyday lives. Look at what is happening to biodiversity locally, nationally, internationally and see what we can do to help it.

Case Study: Balla National School, Co. Mayo. Students from 4th class visited a local bog and produced an extensive project on the wildlife and the eco-system of the area.

- Carry out a **habitat mapping exercise** in school, at home or even in the local area if it is safe to do so. See Section 5 Worksheet 1 on how to conduct the exercise.
- Continue surveying the species throughout the school year and take particular note of the changes through the seasons.

Case Study: Brackloon National School, Co. Mayo. Students surveyed insect species around the school grounds and neighbouring woodland. They used identification keys to name the various species they found.

PLEASE NOTE: '**Biodiversity Bingo**' is a fun competition being run by the National Biodiversity Data Centre beginning around the month of April. It is a popular action for Green-Schools working on the Biodiversity theme. Biodiversity Bingo encourages people to get out and search for interesting species, learn how to identify them and have fun while doing so! Visit http://www.biodiversityireland.ie/home-page/biodiversity-bingo/ or contact An Taisce's Green-Schools Office for further information.)

Case Study: Rockfield National School, Coolaney, Co. Sligo constructed bird feeders out of yogurt pots. They made their own bird cake to feed the birds during the winter months. The infant classes took photographs of the wildflowers around their school and used keys to identify them.

How to make 'Bird Cake'

This quick and easy bird cake is a tasty and nutritious treat for small birds such as blue-tits, great tits, green finches and gold finches. See if you can spot these or other birds, eating your bird cake.

Ingredients and equipment:

- Suet or lard at room temperature, bird seed, raisins, peanuts, some grated cheese
- Clean yogurt pots, a pencil, string, scissors and a mixing bowl

Instructions:

- Using the pencil or the scissors, make a small hole in the bottom of the yogurt pot
- Cut a length of string about 40 cm longer than the yogurt pot, thread it through the hole and tie a knot on the outside so the pot hangs on the end of the string
- Make sure the lard is at room temperature, then cut it into pieces and put it in the mixing bowl
- Add the other ingredients and mix them together. Keep mixing until the fat holds the mixture together
- Fill your pots with the mixture, pressing it in firmly
- Put in the fridge, or somewhere else cold, for at least an hour
- Use the string to tie your bird cakes to the branch of a tree or to your bird table. Make sure it's a safe place where cats won't get the birds

Enjoy watching the birds enjoying your bird cake!

- **Discover a chain reaction** – Examine the interactions between plants and species, geography and landscapes, climate, accessibility to humans, population concentrations. Look at similarities and differences between various areas for example, the Antarctic and Arctic.

The chocolate trail! Discover the botanical source of chocolate. *Theobroma cacao,* is a small tree of the tropical rainforest interior. Explore the ecological connections between people, plants, insects, and other animals within the tree's habitat. Investigate cultural interactions and conservation concerns resulting from the cultivation, processing, exchange, and consumption of cacao and other foods. Recognise the changing economic and cultural roles of cacao and chocolate in local and global economies over time. Visit www.fieldmuseum.org/chocolate/education to learn more.

- Take a **virtual field trip**! Twin your school with another school on the migration paths of certain birds and follow their trip. Check out the 'Schools Godwit Project' (http://www.scoiliosaefnaofa.com/Godwit.htm) for an example of how an Irish school has linked up successfully with a school in Iceland to follow the trail of the Godwit. Also, have a look at World Class World on the Move (http://www.bbc.co.uk/radio4/worldonthemove).
- Search the **Internet** to find examples of conservation programmes. Choose a programme and write up how the success of this programme has helped biodiversity. Consider the economic, recreational, human health, human rights, spiritual and intrinsic value this programme has had.

The school grounds are typically made up of grass and concrete areas. The grass areas are often constantly mowed, watered, and perhaps even have pesticides applied. Not only is this an unhealthy environment for children but also it may not be a great place for biodiversity. Biodiverse school grounds can provide students with stimulating and healthy areas for learning and play. Often we associate biodiversity with the national parks, rainforests and coral reefs, instead we need to make sure everyone is aware that biodiversity surrounds all of us, and is in need of our help!

You may not be able to re-landscape the entire school yard but you could create a more suitable area for biodiversity. Here are some top tips:

- ***Concrete yard*** - Fill old buckets, tyres, raised beds with soil and native, wild plants. Make sure you use a wildflower seed mix that is suitable for your local area, some commercial seed mixes are imported and may not be beneficial to existing biodiversity. Make sure you are not damaging a fragile local ecosystem while doing so.

Case Study: Bellmullet National School, Co. Mayo constructed a raised bed garden on the tarmac area in their school grounds.

- ***Lack of space*** – As part of your arts and crafts work, you could make some window boxes and hanging baskets out of recycled material. Create a log pile or build an insect hotel out of old pallets. Use an old lid of a bin, turn it upside down in the garden and leave it to fill with rainwater so the birds have a place to bath. Create a wildlife area, plant some native flowers that will attract butterflies and bumblebees. Check out The Irish Peatland Conservation Council's website for helpful hints on wildlife gardening (http://www.ipcc.ie/wildlifegardening.html).

Case Study: Gaelscoil Uileog de Burca, Co. Mayo adapted their vegetable garden to be more wildlife friendly by planting comfrey and borage, both of which attract bumble bees and are dynamic accumulators.

Dynamic accumulators are plants that mine nutrients from the soil through their roots, they act as a fertilizer

MAKE YOUR OWN BIRD FEEDER

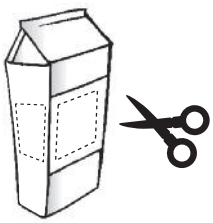
Equipment:

A clean, dry cardboard milk carton, string and a scissors

Instructions:

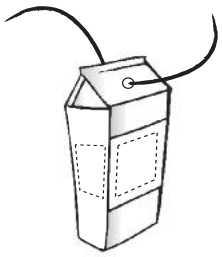
1 Use the scissors to cut a "window" out of one side of the milk carton

2 Do the same on the other three sides



3 Using the scissors, pierce two holes opposite each other at the top of the carton

4 Tie a piece of string through the two holes to close up the top of the carton



5 Fill the carton with bird seed and tie to a branch of a tree or to your bird table

- ***Waste ground*** – Many wild plants love 'waste' ground. You could scatter new seeds on the ground. Make sure the seeds are native and if possible have been gathered locally. Try to find out about the species that are already common to the area. See **www.wildflowers.ie** for further information.
- ***No trees in your school*** – If you have suitable space in your school why not plant a native tree as part of National Tree Week which takes place in March each year.

See Section 5 Worksheet 2 'School Gardens for People and Wildlife' to find out what to plant in your school to attract more biodiversity to your school grounds and tips on how to go about it.

Did you know? A single mature tree can absorb carbon dioxide at a rate of 22 kg a year and release enough oxygen back into the atmosphere to support 2 human beings!

Case Study: Burriscarra National School, Co. Mayo planted native trees on their school grounds during National Tree Week. They also visited a local Coillte Woodland to study the plant and bird life there.

Excerpt of sample Action Plan

Keep in mind the Action Plan below is not an extensive Action Plan. Your own plan should be quite succinct, and should also include some further details on how and when monitoring is to be carried out, and by whom.

Objective 1

To ensure the whole school is fully aware of the Green-Schools Biodiversity programme and to encourage their participation in the programme by December of year 2.

Action	Person/Group Responsible	Time Frame
Send a **letter** home to parents informing them that the school is now participating in Green-Schools Biodiversity.	Green-Schools Coordinator	Early September
Carry out a **survey** to examine the level of awareness among students and staff	Green-Schools Committee	Early to mid September
Habitat Map the school grounds and draw up a list of the biodiversity in our school	Green-Schools Committee	Early to mid September
Quantify & display the results of the surveys on the Green-Schools Notice Board	Green-Schools Committee	Mid September
Analyse the survey and suggest recommendations	5th & 6th Classes	During maths periods in mid-late September
Hold a **poster/slogan competition** to come up with a new Green Code relating to biodiversity	Whole school	Late September – early October
Organise and put in action a system that will enhance biodiversity levels in the school	Whole school action - This system will be explained to all students and indicated in a letter sent home to parents	October-November
Carry out **'mini' reviews**	Green-Schools committee	Ongoing

Objective 2

To identify & investigate biodiversity in our school/local area and further afield.
To help preserve and enhance biodiversity in our school

Action	Person/Group Responsible	Time Frame
Conduct species surveys	3rd, 4th, 5th and 6th class	September/October
Plant a native tree or shrub to a attract more wildlife to the school	Senior classes	November
Build a nesting box for birds out of old unused wood	6th class	During Art & Craft or Woodwork - Oct/Nov
Start an organic gardening project	Green-Schools Committee	Ongoing
Develop a nature trail around the school	3rd & 4th class	As part of the Geography curriculum
Create a leaf pile to provide a habitat for the 'minibeasts'	Junior classes	Autumn
Twin the school with another school on the migration path of a certain bird and follow their trip. E.g. 'On the trail of the Godwit '	5th & 6th class	Ongoing
Discuss the importance of maintaining ecosystems and the various arguments for preserving particular habitats	Whole school	Ongoing

Biodiversity is the variety of all life, from the tiniest bugs living in the soil, to the butterflies in your garden, to the plants they feed on, to the biggest whales in the sea. Think about how we would feel if we had little or no diversity or variety in our lives. Having plenty of choice is equivalent to the variety that is biodiversity. All your actions will have a positive effect on the biodiversity that surrounds you, be proud of all your hard work!

Remember, it is vital not to take on too much. Small and successful actions build confidence and encourage more success. The actions may raise issues and indicate a wide choice of areas that need attention, but they should be discussed widely, put in the context of other factors (time, money, skills), and grouped by priority. You should allocate responsibilities and monitor and publicise progress. It is important to maintain your success in enhancing biodiversity and to continually develop an awareness of the importance of biodiversity. In order to achieve this, your biodiversity Action Plan should be ongoing.

2.5 Step 4 – Monitoring and Evaluating

From the beginning you should plan how you will measure the success of your biodiversity Action Plan. The monitoring process is extremely effective when it comes to identifying progress and comparing past and present behaviour and attitudes. It is important that changes in behaviour and practical measures are measured over an extended period of time. One way of doing this is to repeat the awareness survey asking the same questions that were asked during the review process, to see if there has been an increase in awareness levels. See if enhancements to your school have made a difference to the diversity of plant and animal species in your grounds from one year to the next.

Evaluate levels of awareness

- Are students and staff more aware of the importance of biodiversity?
- Are students and staff more aware that their habits and actions may have a positive or a negative impact on biodiversity?
- Are students, staff and parents more conscientious when buying products? Are they aware that purchasing a particular product may have an adverse effect on the environment or not?

Did you know? Ireland is responsible for the importation of tens of thousands of cubic metres of illegally felled tropical timber each year! Illegal felling is a major contributor to global deforestation. At an international level, the Forest Stewardship Council (FSC) promotes the sustainable management of the world's forests. Through their certification and labeling, a consumer can purchase materials that are harvested, processed and manufactured in a sustainable manner.

Evaluate progress on practical improvements

- Has the number of individual sightings increased? For example have you recorded more birds visiting your school garden?
- Has species richness, the number of individual species, increased?

Measurements

Examine and compare maps of the school to see if your improvements to the schools grounds led to an increase in biodiversity findings or sightings. Compare biodiversity recordings between successive weeks or months and corresponding weeks or months of different years. Remember to always make a note of the weather.

2.6 Step 5 – Curriculum Work

The following ideas provide an outline as to how the Biodiversity theme of the Green-Schools programme can be integrated with subjects throughout both the primary and secondary curricula.

PRIMARY SCHOOL LINKS

SPHE

- National, European and Wider Communities: promote communication, co-operation, and working with others and explore what other Eco-Schools are doing to help preserve biodiversity
- Media Education: encourage media awareness; submit an article to the local press about a particular issue related to biodiversity in your area. Find stories about biodiversity in local and national press
- My school community: develop citizenship and a sense of personal and social responsibility for your environment and the other living things in it

SESE Science

The biodiversity theme is particularly relevant to the Living Things strand and the Environmental Awareness and Care strand of the SESE Science curriculum.

- Study of habitats and species and how they interact
- Study of changes through the seasons
- Study of life cycles of various species
- Learn about food chains and how easily they can be disrupted
- Develop a scientific approach to problem-solving through a biodiversity-enhancing project in the school grounds
- Learning through observation: Watching how species change their behavior through the seasons
- Encourage responsibility for the environment and promote sustainable development
- Promote communication of ideas, report writing, and presentation
- Study of a particular species or group of species: Where do they live, what resources do they need, what do they eat, what eats them etc.
- Food: where it comes from

SESE Geography

- Develop a critical understanding of environmental issues relating to biodiversity at local and global level; look at land use, waterways, litter and pollution in the area
- Study of human and natural environments (sustainable management of biodiversity, etc.)
- Promote communication of ideas, report writing, and presentation
- Discover how what we do in one country may have a knock on effect on biodiversity in other countries around the world. For example, some of the food we import may be grown in countries with water shortages, contributing to their water problems
- Conservation: Looking at maps and aerial photographs to identify protected sites around your county/country and even the rest of the world. Understand why these sites were chosen and how the process works
- The built environment: Examine how this may affect biodiversity. For example, buildings take up land and displace wildlife. Some buildings provide nesting and roosting spaces for bats and birds
- Weather watchers: How the change in climate may affect biodiversity both nationally and internationally
- The school environment: Look at what impacts your school may be having on the environment that surrounds you. For example, what cleaning products do you use in your school? Do these have a negative impact on the environment or not?
- Study of Humans and their impact on the environment: Pollution, greenhouse gas emissions, climate change, the built environment
- Maps: Using and creating maps to show different habitats, locate features such as national parks and show species distribution

Language

- Write a new Green Code for biodiversity
- Source of topics for essays, poetry, etc.
- Learn the names of local species in English, Gaeilge and any other languages taught in your school
- Promote communication skills, public speaking, debates
- Potential for many activities involving speaking and writing
- Link with schools in other countries and discuss how other countries look after their biodiversity

Arts-Visual

- Creation of posters/murals/fashion to aid awareness of the importance of biodiversity
- Use natural found materials such as feathers, shells and stones to make art
- Use nature as a subject and inspiration for art work

Arts-Music

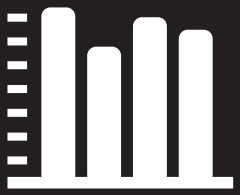
- Songs about biodiversity
- Sounds of biodiversity, recreate the sounds of nature

History

- Local history: Asking parents, grandparents and older members of the community about how the local environment and wildlife has changed in their life time.
- Examination of losses of habitats and species past, present and future
- Explore different cultures throughout history and how they regard biodiversity and its importance
- Relate biodiversity loss to changes in lifestyles and society

Mathematics

- Provide real life situations for mathematical analysis e.g. (predator/prey interactions, species loss, bird migration – distance travelled, speed etc,)
- Use of charts and graphs- For example to record bird species present in the school grounds over a number of months
- Introduction to database management



SECONDARY SCHOOL LINKS

CSPE

The Green-Schools programme is recognised as a suitable Action Project for Junior Certificate classes. Below are some examples of possible Action Projects:

- If possible arrange a visit to the school by a Local Authority Biodiversity, Heritage Officer or NPWS Conservation Ranger and invite them to give a talk
- Visit to an SAC/NHA/SPA and take a biodiversity tour of the area
- Write a report on the biodiversity in the school grounds and take on enhancing the biodiversity of the school grounds. Monitor and evaluate any changes
- Invite members of the local Tidy Towns group to speak to the class and plant native perennial flowers, helping the Tidy Towns group and increasing the variety of flowers and insects in the locality. This in turn would promote communication, co-operation, and working with others and also tie in nicely with the citizenship and personal and social responsibility aspects of C.S.P.E.
- All the above suggestions would also be of interest to the local media who could be invited to attend any of the events

Home Economics

- Examine where our food, clothes and textiles comes from
- Examine the food chain
- Look at what we do in our everyday lives and see how it may affect biodiversity. For example, the use of chemicals in beauty and cleaning products and how it damages our environment. As a solution make natural cleaning products. Visit the Biodiversity page of the Green-Schools website for some simple recipes
- Food science, soil science, food miles
- Organic Foods and the benefits to our environment

Woodwork

- Promote awareness of sustainable wood sourcing. Check out the FSC or more specifically in Ireland the the National Standards Authority of Ireland (NSAI). Look at what trees the wood has come from, see if you can source wood from sustainably managed forests and maybe plant some native trees in your school or at home if there is space to do so
- Design and construct an insect hotel, bat box, bird box or bird table. See **www.greenschoolsireland.org** in the biodiversity section for photos

Metalwork

- Make something to enhance the biodiversity in the school grounds. For example, a mini poly tunnel frame, bird feeders, bird tables, or a light metal support for upright plants like peas, tomatoes etc.

Irish and Foreign languages

- Pupils could prepare a piece on biodiversity and the involvement of the school in the Green-Schools programme for their oral language exams

English

- Creative writing
- Poetry to create a Green Code
- Drama being different plants and animals
- Show a documentary on biodiversity and do a critical analysis of it

Science

- Pollination
- Interdependence of all animal and plant life
- Seed dispersal

- Study of specific ecosystems near the school
- Characteristics of life
- Animal and plant groups, families
- Plant reproduction
- Parts of flower and Seed Dispersal
- Soil components
- Ecology-habitats, conservation, interrelationships, habitat study, competition, food webs adaptations for survival

Biology

- Study of life
  Characteristics of life, Scientific method, Ecology/Ecosystems, Nutrient recycling, Energy flow, Ecological relationships, Population dynamics
- The Cell
  Structure, Metabolism, Continuity, Diversity, Genetics
- The Organism
  Diversity, Organisation, Transport & Nutrition, Breathing, Excretion, Response, Reproduction & Growth

Chemistry

- Periodic table
  Atomic structure, Radioactivity (carbon dating)
- Acids & Bases (as they occur in our natural environment)
- Hydrocarbons (Fossil fuels)
- Rates of reactions
- Environmental Chemistry (Water)
- Atmospheric Chemistry

Physics

- Energy (Renewable/Non renewable, Transfer from one form to another), Density & Pressure (weather)
- Temperature (Measurement, Thermometric Properties, a physical property that changes measurably with temperature)

Geography

- Habitat map the school and its surroundings, marking in various plant and animal life
- Migration of birds
- Climate change and its effects on biodiversity
- Develop a critical understanding of environmental issues relating to biodiversity at local and global level
- Study of human and natural environments and sustainable management of biodiversity, etc.
- Promote communication of ideas, report writing, and presentation
- Discover how what we do in one country may have a knock on effect on biodiversity in other countries around the world. For example, Irish fish-farms use fish caught in South American seas to feed their fish. This impacts directly on biodiversity and livelihoods in countries thousands of miles away
- The importance of biodiversity in our food production systems
- Study maps of your local area to identify areas that are important to biodiversity

Mathematics

- Produce an accurate to scale map of school grounds/garden
- Plot data on graphs and charts from wildlife surveys
- Calculate ratios of predators to prey in an ecosystem
- Exponential growth of flower and animal populations
- Bird migration- distances travelled by various birds

History

- Contact your local Heritage Officer or go online to get information on the history of biodiversity in Ireland and the changes that have occurred over time
- Darwin and the theory of evolution

Art

- Drawing and labeling various plants and insects
- Poster design promoting biodiversity
- Photography
- T-shirt printing and stencils of images in nature
- Sculpture of various species
- Nature trail design, or exhibition for school walls

Case Study: Coláiste Iascaigh, Co. Sligo designed and constructed bird feeders in woodwork class. They also held a Day of Action where all subjects were integrated to include the theme of biodiversity.

'In the end we will conserve only what we love. We will love only what we understand. We will understand only what we are taught.' **Baba Dioum (Senegalese Ecologist)**

2.7 Step 6 – Informing and Involving the Wider Community

As the biodiversity theme impacts both inside and outside the school community, it is important that you tell others about all the great work you are doing and any events that you may be planning. Success of your biodiversity theme should be publicised as it is good positive media coverage which may help inform and encourage others to make changes and help protect biodiversity in their local area!

Below is a list of just some of the ways you can help keep people informed of and involved in your biodiversity programme:

- All students and staff should be aware of what is going on and be encouraged to contribute to the process
- Use the Green-Schools notice board and/or newsletters to report on barriers and progress
- Produce a large-scale habitat map of the school and use it to record the results of your species surveys
- Display weekly recordings/sightings. Raw figures need interpretation for different audiences, so simple graphical representation is important
- Highlight trends in recordings/sightings caused by changes in season and human activities; these can be illustrated in the form of graphs
- Arrange events for your "Day of Action" that involve families, friends, and neighbours of the school
- Create a "biodiversity trail" around the school and neighbourhood (only if it is safe to do so), explaining the variety of life and its importance
- Organise drama, music, and art productions
- Host discussions
- Write articles for the local paper
- Encourage links with existing networks and build new networks
- Photograph biodiversity in your school and local area, throughout the seasons, and put it up on display along with some information describing it

Any school that can demonstrate improvement should take real pride in its achievement. This success should be drawn to the attention of both the school and of the local community!

Case Study: Stokane National School, Enniscrone, Co. Sligo set up a biodiversity themed Green-Schools notice board and displayed images of all the species they had recorded around their school. They also got involved in a fund raising event with the local community in order to construct a pond habitat.

Remember that the Department of Education school inspectors should also be informed of the school's achievements. The Board of Management controls the budget and therefore, ultimately controls any practical improvements. Presentations by students may have greater effect than reports by school staff! Presentations should take account of constraints (money/practicalities) so as not to demotivate students with the response from the decision-makers.

2.8 Step 7 – The Green Code

The Green Code is a statement of the schools committment to environmental good habits. Why not hold a whole school poster/slogan competition and come up with a new and exciting Green Code for your biodiveristy theme!

Here are some examples!

'Ballintogher has the Biodiversity Factor' Scoil Naomh Treasa, Ballintogher, Co. Sligo

'Let our generation protect all creation' Stokane National School, Enniscrone, Co. Sligo

'More plants so more insects so more birds' Killocraun National School, Ballina, Co Mayo

Developing a Green Code for biodiversity will increase awareness among students and can involve the whole school. Display your Green Code in classrooms and on your Green-Schools notice board so it is highly visible and informs visitors of your good habits.

Section 3 **BIODIVERSITY – GENERAL INFORMATION**

3.1 Introduction

The word biodiversity became increasingly popular in the mid 1980's for a number of reasons and over recent years it has fuelled awareness of a global environmental crisis. Environmental concerns spread and environmental campaigning increased. Bodies such as the World Wide Fund for Nature (WWF), Greenpeace and Friends of the Earth began combining research, funding conservation projects and heightening public awareness. The media played an important part in increasing public awareness, interest in and familiarity with the wealth of biodiversity on our planet. Global threats such as ozone depletion and acid rain highlighted the interdependence of the natural environment and human systems.

In 1992, Biodiversity was brought to the forefront of the global sustainability agenda by the Rio Earth Summit, which was held in response to urgent environmental problems such as species extinctions and ecosystem loss. Very rapid human population growth in the last few centuries has affected the natural world to the extent that massive alteration of habitats and biological changes threaten the existence of millions of species and basic ecosystem processes. Biodiversity can be examined at different levels: genetic variation, the number of species and the variety and extent of ecosystems. As with climate change, human pressures have accelerated the loss of biodiversity around the world. In response, a number of conservation measures have come into place such as changes in wildlife protection legislation, the creation of more nature reserves and for some critically endangered species, refuges in captivity.

3.2 The Value of Biodiversity

The world's biological diversity is an essential natural resource which humans have used and benefited from for thousands of years. Biodiversity keeps us alive! Therefore, it is vital we conserve it. Conservation biologists treat the value of biodiversity as a given. However, for many people the value may not be so obvious.

There are five main categories for looking at the value of biodiversity. These include:

Goods – food, fuel, fiber, medicine

Services – carbon storage (sequestration), pollination, recycling of nutrients, nitrogen fixation etc.

Information – pure and applied biology; engineering often mimics processes from nature, like Velcro!

Spiritual – aesthetic beauty, religious awe

Information - scientific knowledge

Did you know? 'Velcro' or the 'hook and loop' fastener was originally based on burdock seeds. A Swiss engineer, called George de Mestal, came up with the idea after noticing how these tiny seeds had attached themselves to his dog's fur! Under close inspection he saw how hundreds of 'hooks' had caught onto the 'loops' of the fur!

Task: Ask the students to write up a list of all the 'values of biodiversity' they may come across on a day to day basis and compare it at a later stage to see if their level of awareness has increased.

3.3 The importance of biodiversity and why we should conserve it

Ecosystems and their species perform important biological services, for example, green plants remove carbon dioxide and release oxygen into the atmosphere, which helps keep the environment healthy and fit for human life. These 'biological services' which we refer to are generally based on a human-centred viewpoint. Although we still have much to learn about the often complex function of ecosystems, and about which species perform critical roles, we know that if an ecosystem is altered in any way, it might not be able to perform some of its important services.

Stop & Think! What would happen if we were to cut down all the rainforests around the world? An area of tropical rainforest cut down for a one-off sale of timber will yield one economic return, but the same area of rainforest could have much greater economic value if managed as a long term resource and left as a sustainable source of income. The loss of crucial ecosystem services could lead to unknown risks to humans in the future.

Biological Services Performed by Ecosystems

Protecting areas from soil erosion, floods and other harmful weather conditions: Trees and other plants deflect rain, helping to reduce the amount of water that runs off the land, regulating stream flow and reducing the risk of flooding in the surrounding areas.

Did you know? The peat bogs of Ireland play a vital role in preventing localised flooding. The sphagnum mosses growing on the bogs absorb huge amounts of water during periods of heavy rainfall, and then release it slowly into the nearby streams and rivers. As a result, it helps prevent flooding.

Vegetation cover also helps to protect soils from erosion and to keep the water which runs off the land into rivers and lakes clean and sediment-free. Clean run-off water maintains the diversity of life in these freshwater habitats, and provides a clean source of water for domestic and industrial uses. Vegetation also protects areas from other harmful weather conditions. Woodlands and hedges provide useful windbreaks in farm areas, and the vegetation on mudflats and sand dunes can help protect coastal areas from erosion by the sea and wind.

Reducing the risk of local and global climate change: Trees and other plants lose water to the atmosphere, causing the build-up of clouds. Ecosystems help maintain a healthy balance of gases in the atmosphere and so regulate the climate. Trees and other plants store carbon and help prevent the build-up of carbon dioxide in the atmosphere, reducing the risk of global warming.

Recycling nutrients: Bacteria and fungi play a crucial role in recycling nutrients in ecosystems. They break down dead plants and animals and release nutrients back into the soils to be used again for more plant growth. Think about your compost bin! Some plants play a crucial role in the fixation of nitrogen in the soil. Nitrogen fixation is the process of converting atmospheric nitrogen into ammonia.

Pollination and biological control: Some animals, such as birds, bats and insects perform important functions as pollinators of food plants such as vegetables and fruit, and act as the natural enemies of unwanted plants, pests and diseases that can harm crops. See Section 5 Worksheet 3 for a fun lesson on 'Pollinators' that could be used in the classroom.

Controlling pollutants: Plants like reeds act as natural filters, helping to remove waste from surface waters and many bacteria can help break down low level pollutants. However, it is important to keep in mind that higher levels of pollutants can be very harmful to the environment.

Monitoring the health of the environment: Some species within ecosystems can be used to monitor the environment and to indicate when change or damage is occurring. For example, the breeding failure among birds of prey can point to a build up of pesticides in the system. Lichens such as those found growing on your school walls and on the trees may be sensitive indicators of levels of air pollution.

There are a number of compelling reasons for preserving biodiversity. However, a lack of knowledge and understanding of such complex systems and the difficulties of placing market values on these ecosystem services can often make it difficult to recognise the immediate benefits of conserving and enhancing biodiversity. As a result, ecosystem services are often undervalued.

Economic Value

Different species of plants, animals, fungi and micro-organisms provide us with food, medicines, fuel, building materials, fibre for clothing and industrial products. Economic arguments provide compelling reasons for conserving species. Some species have been so under-valued that species such as Californian condor and the white rhino have been hunted to the point of extinction.

In 2008, the Biodiversity Unit of the Department of the Environment, Heritage and Local Government commissioned a report to attempt to quantify the price of replacing *ecosystem services*. Although only an estimate, it was calculated at over €2.6 billion per year. According to this report the humble earthworm is said to be worth €1 billion a year to Irish agriculture and pollination a further €52 million per year. Put simply, the world cannot afford to replace these services. Therefore, we must work to protect our ecosystems!

For more information see 'The Social and Economic Aspects of Biodiversity in Ireland' published by the Department of Environmental Heritage and Local Government, 2008.

Food: The provision of food is the most fundamental benefit that humans get from biodiversity, and humans have always depended on animals and plants for meat, fruit, vegetables, nuts, and other natural products. At least 20,000 species of flowering plants are known to be edible, but only about 150-200 species have been cultivated. Most of the world's food comes from only about 20 plant species, and more than half of the food consumed in 'developing' countries comes from just 3 species, wheat, maize and rice. It is important to conserve not only the species we know to be of value in providing food, but also other species which have not yet been cultivated or domesticated so we do not limit the agricultural options for future generations. Unfortunately, the value of many species as a source of food is often under-estimated. Due to over exploitation and mismanagement of the fishing industry many marine species, including fish, whales, and sea turtles are facing extinction.

Medicines: Wild species have been used as sources of drugs for thousands of years. Approximately 25% of modern drugs are derived from plant species. Most people in 'developing' countries still rely only on natural sources of medicines. Some discoveries, such as the discovery that *Penicillium* moulds yield the valuable antibiotic penicillin, have revolutionised medical treatments through the ages. In addition, studies of traditional folk medical practices have led to significant discoveries. For example, leeches yield a blood-clotting agent, bee venom is used to treat arthritis, frogs and toads yield nerve and muscle drugs.

The medicinal potential of plants and animals is often considered a compelling reason to conserve biodiversity as some species are highly valued for their medicinal properties. Although highly controversial, various species also have medical benefits in providing animal models for health research, especially for testing drugs or techniques for possible human disease cures.

Did you know? A substance called vincristine is extracted from the sap of the Madagascar periwinkle, a herbaceous perennial plant, that has been used as a treatment for leukaemia since the 1950s. Madagascar has a huge number of unique plants and animals which are becoming extinct at an alarming rate as Madagascar's entire environment is being threatened by wholesale destruction. The natural vegetation is being destroyed in order to plant crops to feed an exploding population. There may be many more plants not just within Madagascar but globally, with undiscovered potential medicinal properties that could disappear before we know their 'value'.

Only about 5,000 species of higher plants have been investigated as potential sources of drugs. The conservation of biodiversity is important, since most of the tropical flora is yet to be screened for medicinal properties; it is likely that future discoveries of great value may be made in the years to come.

Commercial uses: Human societies have traditionally used plant and animal products like wool and fur for clothing, and wood for building construction and fuel. Many of these products are harvested from the wild, but increasingly, over the last century, they are produced commercially and used in modern industries: for example, wood is used for building, making furniture, as a fuel and for making paper. Other plant and animal products used in industry include feathers, skins, glues, rubber, oils, waxes, starches and dyes. Ironically, the most valuable species are often harvested intensively, sometimes to the point of extinction, or commercial extinction. Therefore, the loss of biodiversity may represent a considerable loss of known commercial value.

Cultural and aesthetic values: Historically, some species have played an important role in the folklore and traditions of many cultures. Plants are often used as decorations and some have strong symbolic associations: for example, the wreath of holly, used to decorate Christian houses at Christmas, represents the crown of thorns, the red berries symbolising the blood on the forehead of the crucified Christ. Species may also have heritage value as national symbols: for example, in Ireland, the three leafed clover (Trifolium) symbolises the nation's identity and heritage. Biodiversity also has important recreational and aesthetic values. Access to attractive species, habitats and landscapes provides pleasure and enriches our lives, and there may be local economic benefits from ecotourism. Leisure activities like bird watching, walking, orienteering, gardening or visiting botanic gardens can all contribute to human happiness and well-being. Biodiversity also has educational and inspirational value. Species and ecosystems provide us with opportunities for studying them and gaining information about their history and their functions. This information can be used to help decide how best to use and conserve biological resources. Many of our tools and designs in engineering and architecture are derived from nature. Writers, artists and composers all over the world have been, and still are, inspired by the natural world around them.

Task! Develop connections with biodiversity! Ask the students to draw up a list of all the things they enjoy doing in the classroom, at home and outdoors that involves biodiversity, from eating their lunch to playing in woods and see what headings they come under!

Intrinsic values: Most people recognise that species and whole ecosystems, have intrinsic value, regardless of their economic or other values. For example, knowing that something exists is satisfying in itself, and the loss of a charismatic species, such as giant pandas and blue whales, represents a considerable loss of 'existence value'. Whilst existence value is important to many people, it is impossible to quantify and, unfortunately, many species, such as slugs, will never enjoy 'existence value'. Many people also hold strong personal beliefs, feeling a great respect for the whole of nature and a responsibility to hand on to the next generation a world that is as rich in life as the world we live in today. For example, the Native Americans and the Tibetans, who have an appreciation for nature beyond that of many societies, which forms the basis of their lives. Intrinsic values are increasingly being recognised as important today, by politicians and economists.

Task! The importance of biodiversity affects all areas of our lives. See if you can come up with some historic, current and foreseeable values under the various headings above. For example, medicine: historic-penicillin antibiotic, current-horse shoe crab used in bioassays of toxins, foreseeable-rainforest plants, new drugs to combat new and existing diseases.

In summary, the four main reasons for conserving biodiversity are:

- 'Ecosystems services', biodiversity provides critical indirect benefits to humans. These benefits are very often difficult to quantify because we have never had to put a price tag on them! These benefits include air and water purification, climate regulation, and the generation of moisture and oxygen.
- Some species are of known value to us
- Many species have values which are undiscovered, but which could offer future generations new opportunities in agriculture, health care and industry
- The biodiversity of life on earth is intrinsically valuable for itself as well as for what it contributes to human life.

It is up to every individual to ensure we use and live in our environments in a sustainable manner. To be sustainable, nature's resources must only be used at a rate at which they can be replenished naturally.

Common terms to know!

- ***Exploitation*** *– is the harvesting or removal of individuals from a population for human use (e.g. fishing for cod). The term is generally used where the habitat is not specifically managed for the organism being exploited (e.g. agriculture & aquaculture)*
- ***Sustainable exploitation*** *– is exploitation that involves using resources at rates within their capacity for renewal, birth and growth of individuals. This is when natural population growth replenishes losses to exploitation, and the population suffers no long-term reduction.*
- ***Over exploitation or unsustainable exploitation*** *– is the removal of individuals from a population at a rate which exceeds the rate at which those individuals can be replaced.*

3.4 Major Threats to Biodiversity Globally and Within Ireland

- **Habitat loss/destruction/fragmentation** – These are the main threats to biodiversity around the world and here in Ireland. Very often large scale construction occurs in 'fragile areas', for example, wetland drainage and infilling. Habitat destruction changes the conditions needed for particular plants and animals to survive. Globally, deforestation, an example of habitat loss, has accelerated at an alarming rate in recent years. 70 million hectares of forest was lost between 1990 and 2005 alone! Most of this deforestation has occurred in South America which is home to some of the greatest concentrations of biodiversity in the world. Major deforestation has also occurred in Ireland over the years.

Did you know? Ireland has among the lowest woodland cover in Europe as only 9% of land is covered with woodland!

- **Invasive non-native species** – Species that are non-native to a particular area can sometimes spread very quickly, for example the zebra mussel and japanese knotweed have spread rapidly in Ireland in the past two decades. As a result, these species can destabilise an ecosystem by altering habitats affecting food webs. Red squirrels which are native to Ireland, are in decline. On the other hand the grey squirrel, a non-native species, which was introduced from North America in 1911, is increasing steadily and is pushing the red squirrel towards extinction in Ireland. In the EU, in order to prevent further biodiversity loss, tackling invasive species is considered a top priority. Invasive species can arrive into Ireland through various human activities such as recreational marine activities and trade and shipping with other countries.
- **Pollution/litter** – As you will remember from the Litter and Waste theme, pollution is always caused by humans. Pollution can have a huge impact, altering the balance within ecosystems, and is the cause of death for millions of animals and plants around the world every year. It is estimated that over one million sea birds and 100,000 turtles and sea mammals are killed by litter pollution every year! Eutrophication, the over enrichment of lakes and seas by nutrients, is causing huge problems for aquatic and marine life around the world and here in Ireland.
- **Land use change/increased infrastructure development** – This is the alteration of natural areas by humans, for example, the clearing of huge areas of rainforest in South America for farming. In Ireland, upland open habitats, such as rough grassland, scrub and heath, have been changed by agriculture and afforestation. Throughout Ireland, the landscape has changed dramatically in recent years due to the construction of new roads and inappropriate building developments.
- **Intensive farming practices** – Extensive use and concentrations of chemical and/or biological pesticides and the removal of hedgerows are typical practices in modern-day intensive farming. Often large areas of land are planted with a single crop (monocultures) which greatly reduces the level of biodiversity in that area. In Ireland, for example, almost 80% of farmland is devoted to grass-based farming. As a result, the numbers and diversity of bees, birds and other species of insects and plants have declined substantially.
- **Climate change** – It is now widely accepted that the current global rate of change in climate is as a result of human activity. As global air or sea temperature changes, even by just 1 or 2 degrees, the habitats in which species live will also change and may even become uninhabitable to some species. According to the Intergovernmental Panel on Climate Change, 70% of species could be put at a greater risk of extinction if temperatures continue to change.

Map & list Why not investigate your locality and see if it has been or is being affected by any of the above scenarios.

National Biodiversity Week is held in the middle of May. Perhaps your school could organise a Biodiversity Action Day (or even a week) in your school around this date. You could celebrate biodiversity in your school, home or your local neighborhood, educating everyone on the values of biodiversity, threats to biodiversity and what we can do to help it! (Visit www.noticenature.ie for information on National Biodiversity Week)

Section 4 **BIODIVERSITY IN IRELAND**

4.1 Conservation in Ireland

The Irish government aims to conserve habitats and species, through designation of conservation areas. This is required of us under European law, such as The Convention on Biological Diversity (CBD), and our own national laws. The Department of the Environment, Heritage and Local Government is responsible for the designation of conservation sites in Ireland. The Department works with farmers, other landowners and users and national and local authorities, trying to achieve the best balance between farming and land-use on the one hand, and requirements for conserving nature in these selected areas, on the other.

The **National Parks & Wildlife Service** looks after the conservation of much of Ireland's habitats and species.

The International Union for the Conservation of Nature (IUCN), 1969, recommended that all governments agree to reserve the term 'National Park' for areas with the following characteristics:

- Where one or several ecosystems are not materially altered by human exploitation and occupation; where plant and animal species, geomorphological sites (relating to the geological structure)and habitats are of special scientific, educational and recreational interest or which contain a natural landscape of great beauty;
- Where the highest competent authority of the country has taken steps to prevent or eliminate as soon as possible exploitation or occupation in the whole area and to enforce effectively the respect of ecological, geomorphological or aesthetic features which have led to its establishment;
- Where visitors are allowed to enter, under special conditions, for inspirational, educational, cultural and recreational purposes.

It is the policy of the Department of the Environment, Heritage and Local Government, to abide by the criteria and standards for **National Parks** as set by the IUCN. Ireland has six National Parks: Glenveagh, Co. Donegal, Ballycroy, Co. Mayo, Connemara, Co. Galway, The Burren, Co. Clare, the Wicklow Mts. and Killarney, Co. Kerry.

See if your school can arrange a visit to your nearest National Park. Most of the National Parks in Ireland run Environmental Education Programmes. You could make it part of your Biodiversity Action Day. If this is not possible you can find out more by visiting their websites (see Section 6 for Useful Contacts & Links).

Case Study: St. Brendan's National School, Co. Sligo took a trip to a nearby protected woodland and studied the trees in that area.

4.2 Protected Sites

The three main types of conservation designation are:

Special Area of Conservation (SAC) is a prime wildlife conservation area in the country which is important both at national level and a European level. These sites generally contain the most special, rare, and endangered species and habitats in Ireland and Europe. In Ireland, roughly 13,500 square kilometers are protected; this includes land, marine areas and lakes. These SACs are selected under the EU Habitats Directive. These areas include raised bogs, blanket bogs, turloughs, sand dunes, machair (flat sandy plains), heaths, lakes, rivers, woodlands, estuaries, and sea inlets. Some of the species which must be protected include: the otter, the bottlenose dolphin, the atlantic salmon and the killarney fern. So far Ireland has put forward 381 sites for designation.

Special Protection Area (SPA)
An SPA is an area that is important for birds and is designated under the EU Birds Directive. Birds listed as rare and vulnerable species such as the whooper swan, the peregrine falcon and the corncrake and migratory birds, such as ducks, geese and waders are protected by a wildlife act and the SPAs are designated to protect the habitats of those birds. Wetland habitats, especially those of international importance, which attract large numbers of migratory birds each year, are also protected. *(Internationally important means that 1% of the population of a species uses the site or more than 20,000 birds regularly use the site.)* 121 sites have been designated since 1985. In Ireland, our coastlines provide safe breeding grounds and wintering sites for large numbers of seabirds. We also have many resident species which are scarce or rare in other parts of Europe. Since birds travel long distances between countries it is important that the Directive ensures protection across Europe.

Natural Heritage Area (NHA) is the basic designation for wildlife in Ireland. NHAs are areas that are considered important habitats or areas which hold species of plants and animals whose habitat needs protection. It was only since an amendment to the law in 2000 that NHAs became legally protected. Some of these areas can be very small, for example, a roosting place for rare bats. Others are much larger areas such as a raised bog or a lake. So far there are 75 raised bogs listed as NHAs, one example is Tullaghan bog in Co. Roscommon, this bog was once much larger in size but over the years much has been modified for agriculture.

4.3 Other Relevant Conservation Designations

A **Nature Reserve** is an area of importance to wildlife, which is protected under Ministerial order. There are currently 78 Statutory Nature Reserves. Most are owned by the State but some are owned by organisations or private landowners.

Flora Protection Order Under the **Wildlife Act, 1976**, particular plants are protected under a Flora Protection Order. It is an offence to cut, uproot or damage these plants unless under license from the Minister for the Environment, Heritage and local Government. It is also an offence to willfully damage or interfere with the habitat in any way except under license. The Flora Protection Order lists 68 species for strict protection.

Refuge for Fauna or Flora Under the Wildlife Acts, the Minister may designate refuges for wild birds or wild animals or flora and impose protective measures to conserve both the species and their habitats. Seven such refuges already exist; they are mainly islands or cliff faces.

Wildfowl Sanctuaries These sanctuaries are areas that have been excluded from the Open Season Order, so that birds which are hunted for sport can rest and feed undisturbed. There are 68 sanctuaries in the state. Shooting of such birds is not allowed in these sanctuaries.

4.4 The Current Situation in Ireland

Ireland is home to 32 species of land mammal, 24 cetaceans, this includes whales, dolphins, porpoises, over 400 species of birds, more than 4,000 plant species and over 12,000 species of insects. If we want all of these species to survive, we must ensure that there are enough suitable areas for all to flourish. In Ireland, there are currently 95 bird species whose population is considered threatened or in serious decline and 120 plant species are endangered. The freshwater pearl mussel, which lives in Irish rivers and is Ireland's longest living animal, is facing extinction. These reductions in Ireland's biodiversity have serious economic and social consequences. In 2001, Ireland agreed along with other EU countries, to 'halt the loss of biodiversity by 2010'. In order to achieve this we need to make a concerted effort on a local and national level. Individuals, schools and communities can all play their part in halting this alarming loss of biodiversity. Ireland has come a long way in the past decade but we are still a long way off. Failure to protect our most endangered natural habitats and species will result in substantial fines for Ireland by the EU.

The IPCC *Intergovernmental Panel on Climate Change* has warned of a 3.6 °C rise in the average global temperature; as a result we will see rising temperatures, earlier Springs, changing rainfall patterns and changing water levels, all of which have huge consequences for biodiversity. The Stern Review, 2006, which examined the effects of climate change and global warming on the world economy, forecasts that a rise in average global air temperature of just 3°C could result in 20-50% of land species facing extinction. Pressures on biodiversity from human activities are greater than ever before and as a result we are seeing an acceleration of biodiversity losses. In Ireland, recent economic success has put huge pressure on our environment. Furthermore, as agricultural trends change, conditions for much of our wildlife will also change. Many "green" technologies have environmental pros and cons. For example, windfarms produce no carbon emissions once they are up and running, but their construction and maintenance may cause disturbance in isolated mountain areas. Therefore the most environmentally correct thing to do might not always be clear and feasible and may require extensive investigation before an agreement is reached.

Hot topic! The hen harrier is one of Ireland's rarest birds of prey and is protected under Irish and European law. It is an example of how a species can be adversely affected by land-use change. In Ireland, hen harriers generally nest in pre-thicket second rotation conifer plantation, which is a man made habitat. Large-scale afforestation in the 1950s led to a recovery in the Irish hen harrier population. The newly-established conifer plantations provided nesting and hunting habitat for hen harriers because they provided protection from predators and they helped increase prey numbers.

Since the 1970s, however, numbers of hen harrier breeding pairs have declined again due to human modification of upland open habitats, such as rough grassland, scrub and heath, for agriculture and the maturing of the large-scale forests. Once a forest grows to form a closed canopy, it is no longer suitable as a foraging and nesting habitat for the hen harrier. According to the National Parks and Wildlife Service and BirdWatch Ireland, they only nest in the new forests for the first five years or so of forestry, and are then excluded from the rest of the rotation.The afforestation results in a net habitat loss for the hen harriers, who will move on to newly-established stands. The main threats to hen harriers in this country are thought to be loss of breeding habitat, developments in upland areas and persecution. The impact on hen harrier populations of wind farm development in uplands is unclear, and continues to be the subject of debate..

Task! Use this 'Hot Topic' as a subject for debate in order to develop language skills

Conserving species in their natural habitats requires a long term plan with specific targets in order to succeed. One of these is to ensure the adequate conservation of habitats where many of our plants and animals live. Rare and fragile species such as the corncrake were once found all over the country but now have almost disappeared. The decline of these species is linked to changes in agricultural practices. To succeed in conserving our native species we need the support of landowners and people who use or visit the land.

As already mentioned, Ireland has an extensive coastline rich in biodiversity and so we should not forget our surrounding seas. There is a huge array of life in our seas, most of which we may never see. Unfortunately, this too is being negatively affected in a variety of ways; overfishing, coastal activities and pollution are some examples, and so it is important that our marine habitats are also protected. The coastline itself is made up of many different types of shores; saltmarshes and mudflats are of particular importance for a number of waders and migrating birds. Machair is a highly specialized and complex coastal habitat of flat or gently undulating sandy plains. It is one of the rarest wildlife habitats in Europe and therefore Ireland has an international responsibility to protect these areas.

Did you know? The only places in the world where you will find Machair habitats are along the northwest coasts of Ireland and Scotland!

Did you know? Birds of prey are still relatively uncommon in Ireland and are only now beginning to recover. In fact, due to our geographical location and factors such as persecution, Ireland has the lowest number of breeding birds of prey of all countries in the European Union. Ireland has lost many of its breeding birds of prey, in particular the White-tailed Eagle, Osprey, Golden Eagle, Red Kite, Marsh Harrier and Goshawk. These extinctions were a result of persecution and habitat loss. (Source: The Golden Eagle Trust) Although birds of prey have very few natural predators, they are a vulnerable group of species at the top of a fragile food chain. They are affected by things such as egg collection, illegal killing, pollution and habitat destruction. The success of breeding birds is also affected by environmental changes such as climate change which in turn can affect the timing of life-cycle events of plants and animals. For example, leaves appearing on trees earlier, migrant birds arriving earlier, animals breeding earlier etc.

Please see appendix for further information relating to the various conventions and legislations mentioned in this booklet.

Section 5 ACTIVITIES & WORKSHEETS

WORKSHEET 1 Habitat mapping

Whether you are simply looking to familiarise yourselves with your surrounding environment or considering to care for it, compiling a **habitat map** of the area is a great starting point.

A **habitat map** shows the geographic distribution of different habitats and species within a particular area.

The purpose of a habitat map

Before you start, ask yourself the following questions; what is the purpose for the habitat map? What improvements would you like to see around your school in relation to biodiversity? How might these improvements benefit your local environment? For example, are you looking to increase the levels of biodiversity in the school or local area? Are you looking to help protect a particular species or preserve an area of natural beauty for example, the oak tree in the corner of the school yard? Are you simply interested in what surrounds you?

Preparation – in the classroom

You may wish to consider the issues below before you start mapping:

- How might I measure the area and how do I make my map more accurate?
- What level of detail do I need?
- Could I create a collage and use recycled materials to create the final map?

Next

- Divide the students into groups depending on their age and ability
- Each group should be given a sheet of paper and clipboard to lean on
- Before mapping the area decide on codes and symbols to represent what you might find before you begin mapping the grounds. For example, decide on symbols for the trees, hedgerows, concrete area etc. The codes and symbols and what they represent should be outlined on the side of the page
- Mark in the boundaries of the school grounds before you begin mapping

Note: You will already be very familiar with your school grounds. However, if you decide to venture further afield please visit the Green-Schools website for further details on how to create a habitat map of an area outside your school grounds. If you are simply creating a habitat map of your school grounds feel free to come up with your own codes and symbols. However, if you are mapping areas outside your school, the Fossitt habitat classification system is recognised as the national standard. Visit http://irishbutterflymonitoringscheme.biodiversityireland.ie/ - Click on 'Resources' and go to 'Fossitt habitat classification'.

Write up **a list** of what you will need to bring with you.

Each group should bring with them:

- Instructions
- Notebook and clipboard
- Pencils, pens, markers
- Camera if possible
- Your list of codes and symbols

Outside

- **Walk** the area once before you begin mapping
- **Record** the weather/date/exact location on you data sheets
- Begin mapping by marking out the school building itself, any paved areas, green areas, football pitch or playing field, marking the boundaries as you go
- Wherever possible, identify the dominant species in each of the habitat units mapped and record these on the map using the chosen **species codes** (letter codes to represent the species present) or use the common name for the species.
- Mark any areas or features of special concern or of conservation interest on the map using target symbols. **Target symbols** should be recorded and numbered while habitat mapping your area, see example list below. Number each target symbol and enter a corresponding numbered target note into a notebook. Target symbols can be denoted on your map with the following symbol •

Sample List:

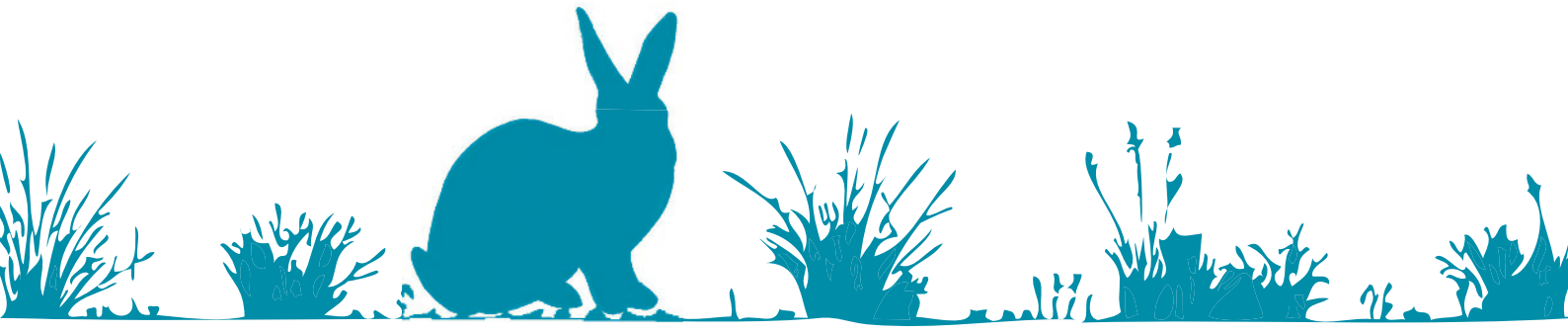
1. Litter hotspot
2. Fly-tipping
3. Potential Hazard
4. Rocky outcrop covered with various lichen species
5. Rabbit

Follow up (work as a group or individually)

1. Construct a full colour habitat map of the school grounds

2. Add codes for the habitat units and the dominant species using species codes or their common names

3. Add target symbols and accompanying notes (annotating your map with brief notes)



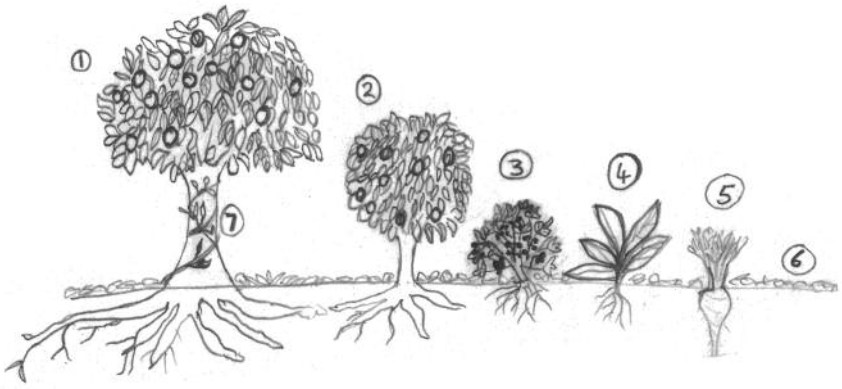
WORKSHEET 2 School gardens for People and Wildlife

Introduction

When we create gardens, we often make a distinction between ornamental gardens, food gardens for humans and wildlife gardens which provide food and habitat for birds, insects and small mammals. School gardens are often annual vegetable gardens with some annual flowers. Unfortunately, the school year doesn't fit very well with most annual vegetable crops as schools are closed for a crucial part of the growing and harvesting season. An ideal garden for a school is based on perennial plants, as it needs less maintenance than an annual vegetable garden, it doesn't need much attention during the summer and it combines wildlife habitat and food with human food, natural beauty and lots of learning opportunities. It also looks beautiful.

The idea is to recreate the structure of a native woodland, using some native wild plants and some fruit and vegetables. A native woodland consists of 7 layers:

1. Canopy trees
2. Understorey trees
3. Shrub layer
4. Herbaceous layer
5. Root vegetables
6. Ground cover layer
7. Climbers



The plants in Table 1 are all particularly good for attracting wildlife and some of them have other uses too.

The plants in Table 2 are all edible plants that are suitable for school gardens. They have harvest times either before June or after September and require little maintenance during the summer. Plants from both tables can be planted together using the forest structure in the diagram.

Table 1- Plants to attract wildlife for school gardens

Plant	Wildlife Value	Other Uses	Annual or Perennial	Forest Layer
Comfrey	Nectar for insects- especially bumble bees	Add to compost heap or use as mulch*. Make a plant feed - especially good for fruiting plants	Perennial	Herbaceous
Elder	Nectar from flowers for insects. Berries for birds and insects	Insect repellent - from leaves Fruit - Litmus test Planted near compost heap it helps the process	Perennial	Canopy
Calendula/Marigold	Nectar for insects	Insect deterrent in garden.Weather forecaster - flowers close before rain	Annual, will self-seed	Herbaceous
Soapwort	Food plant for some butterfly and moth caterpillars	You can make a mild soap from the whole plant	Perennial	Herbaceous
Bluebell	Nectar for bees and other insects	You can make a glue from the bulbs	Perennial	Root layer

** Mulch is anything a gardener uses to cover the ground around the plants. Mulch keeps in moisture, stop weeds from coming up and some even fertilise the soil. An easy mulch for a school is wet cardboard or layers of wet newspaper topped with grass clippings, straw, seaweed or bark mulch.*

Plant	Wildlife Value	Other Uses	Annual or Perennial	Forest Layer
Privet	Nectar for butterflies	Ink from berries	Perennial	Understorey
Alder	Food plant for caterpillars	Dye/ink from bark	Perennial	Canopy
Sloe (blackthorn)	Food plant for black and brown hairstreak caterpillars	Ink from bark Ripe fruit - facemasks	Perennial	Understorey
Guelder Rose	Nectar and red berries for insects and birds	Dye/ink from dried berries	Annual, will self-seed	Shrub
Nettle	Food plant for caterpillars	Very rich in nitrogen. Makes a good liquid plant feed to promote leafy growth	Annual, will self-seed	Herbaceous
Borage (starflower)	Nectar for bees		Perennial	
Bramble	Nectar and berries: Very important food source for insects, birds and mammals.		Perennial	Shrub
Crab apple	Fruit for birds		Perennial	Understorey
Holly	Berries for birds. Winter shelter for birds		Perennial	Understorey
Ivy	Berries are an important source of winter food for birds. Being evergreen, it provides excellent winter shelter for small birds		Perennial	Climbers and ground cover
Honeysuckle	Nectar for birds and insects. Berries for birds and small animals		Perennial	Climber
Primrose	Nectar for insects, seeds for finches		Perennial	Herbaceous
Cotoneaster	Food plant for the caterpillars of some moth species. Nectar attracts bees and butterflies and the fruit is eaten by birds		Perennial	Ground cover

Table 2- Food crops for schools

Name	Perennial/Annual	Sow seeds indoors	Plant out	Harvest	Care
Autumn Fruiting raspberries	Perennial		Buy canes and plant in January	September/ October	Cut canes back after fruiting in November
Brussels sprouts	Annual	Early March	Early-Mid May	October to January	Water well and mulch after planting out
Purple sprouting broccoli	Annual	Early March	Early-Mid May	Following February/March	Water well and mulch after planting out
Lettuce	Annual	From March onwards	When plants have 5 leaves	May/June	Slug control-beer traps or other organic methods
Pumpkins	Annual	April	Late May	September/ October	Water well and mulch after planting out
Early peas	Annual	Early March	April	June	Keep watered. Support with canes or twigs
Broad beans	Annual	Sow directly into ground in February		May/June	
Fruit trees	Perennial	Plant young trees in the winter months		August-October depending on variety	Mulch well when planting. Mulch again once a year in Spring. Prune once a year in Winter

WORKSHEET 3 Pollinators 'Flower helpers'

Introduction

Pollinators are animals which transfer the male pollen grain to the female part of the flower enabling fertilisation of the flower. They include insects, bats, non-flying mammals, birds and reptiles. Ireland has only insect pollinators which include bees, butterflies, moths, wasps and hoverflies. Pollinators pollinate over 90% of all flowers and are, therefore very important, economically, for the production of agricultural crops and, ecologically, for the conservation of our native wild flowers. However, pollinators are in severe decline worldwide. This decline is primarily due to habitat loss e.g. road building, house building, agricultural intensification. Common agricultural practices which reduce foraging resources and nesting sites for pollinators include the use of fertilisers, cutting the grass frequently and intensive grazing. Pesticides directly kill pollinators. Other causes of decline of pollinators include parasites, disease and climate change.

Research has shown that fields containing a large number and variety of flowers have more pollinators than fields containing fewer flowers. Research has also shown that fields surrounded by large proportions of natural and semi-natural lands have more pollinators that fields surrounded by small proportions of natural and semi-natural lands. Natural and semi-natural lands benefit pollinators by providing them with nesting/larval habitats and flowers for foraging. Examples of natural and semi-natural lands consist of broad-leaved forests, natural grasslands, heathlands, woodland scrubs and peat bogs.

Lesson on pollinators

This lesson can be taught using the Pollinators' PowerPoint presentation which can be found on the Green-Schools website on the Biodiversity page.

Pollination and pollinators

- Discuss the flower parts with the students
- Explain that pollination is the process of moving the pollen grain from the male part of the flower (stamen) to the female part of the flower (carpel).
- Biotic pollination is pollination which requires the help of biotic agencies such as birds, insects, bats, snails and other animals. Abiotic pollination is pollination which requires the help of abiotic agencies such as wind and water.
- Define pollinators as animals which carry pollen from the male part of the flower to the female part of the flower. They include insects, bats, non-flying mammals, birds and reptiles. Indicate that Ireland only has insect pollinators including bees, hoverflies, butterflies, moths and wasps

Flower Life Cycle

- Pollination leads to fertilisation. The pollen grain fuses with the egg to form a seed which is known as fertilisation. The ovary develops into a fruit which protects the seed(s) inside. Plant reproduction is important to the plant species because it ensures the continuation of the plant species. Pollinators pollinate over 90% of all flowers and are, therefore, very important for the production of agricultural crops and for the conservation of our native wild flowers. Samples of fruit and vegetables which are pollinated by pollinators are apples, pears, tomatoes, coffee, almonds, mangoes, sunflowers, beans, melons, mustard, cashew nuts, figs and passion fruit.

Flower life cycle: Plant->Flower->Seed->Fruit

The Bumblebee

Ireland only has insect pollinators including bees (bumblebees & solitary bees), hoverflies, butterflies, moths and wasps. Ireland's most well known pollinator is the bumblebee. Bumblebees are insects with 6 pairs of legs, and head/thorax/abdomen. You can tell bees apart from other insects because they have 2 pairs of wings as opposed to 1 pair of wings found on insects.

Decline of bumblebees and other pollinators

- Indicate that habitat loss is one of the main factors contributing to the decline of bumblebees and other pollinators e.g. agricultural intensification, road building and house building
- Discuss how humans can lessen the negative effects of habitat loss e.g. by planting flowers in the garden, by planting hedgerows in fields, by leaving long grass in gardens/fields, haymaking

Conclusion

- Discuss what students can do to help pollinators to survive. For example, plant native flowers in Spring, plant ivy and nettles in Spring as a food source for caterpillars, leave some long grass in the garden for bumblebees to nest, try to avoid pesticides and spreading fertilizer, which deters wildflowers from growing, record butterflies and bumblebees you observe between May and August. A list of flowers for pollinator garden can be found on the Green-Schools website on the Biodiversity page. Native flowers can be bought online from the organic centre www.theorganiccentre.ie.
- The students can conduct butterfly and bumblebee surveys a few times during the summer. Details of these surveys can be found in Section 5 Worksheet 4.

Scope For Interactivity

Pollination and pollinators

- Discuss the flower parts with the students using a giant flower and individual flowers with hand lens. Ask the following questions:
  - How big is the flower?
  - What is the shape of the flower?
  - Does the flower have a colour?
  - Does the flower have an odour?
  - What flower parts can you see?
- Explain the pollination process with the aid of an interactive web-based video on pollination. This "pollination video" can be found on the Green-Schools website on the Biodiversity page.
- Define pollinators with the aid of pollinator pictures
- Ask the students to look at a picture of a pollinator (butterfly/hoverfly/bumblebee/fruit bat/humming bird) on their desk and discuss what type of pollinator it is, how does it pollinate and where does it come from

Flower Life Cycle

- Explain the flower life cycle with the aid of a diagram
- Have the flower life cycle cut into 4 parts, and ask the children to rearrange correctly
- Pass some animal-pollinated fruits e.g. strawberries and apples around the class

The Bumblebee

- Show the students a picture of the bumblebee's body parts
- Students can complete the "Bumblebee body parts" activity sheet which can be found on the Green-Schools website on the Biodiversity page. The students can then colour the bumblebee representative of one of the common bumblebee species using the "Common Bumblebee ID key" which can be found on the Green-Schools website on the Biodiversity page.
- Show the students pictures of a bumblebee's nest
- Students can complete the "Things which bumblebees like best" activity sheet which can be found on the Green-Schools website on the Biodiversity page.

Decline of bumblebees and other pollinators

- Show photographs of activities which cause habitat loss for pollinators e.g. road building, house building and agricultural intensification

Conclusion

- Ask the students to write a short paragraph on how they can help pollinators to survive. The students can take it in turns to read their paragraphs to the rest of the class

WORKSHEET 4 Survey Techniques for bumblebees, butterflies and flowers

How to carry out bumblebee and butterfly surveys

Decide on safe area where you can walk along a hedgerow or fence and identify and record the number and type of butterflies and bees you observe.

Note: *Only conduct the bumblebee and butterfly surveys between May and August, when it is not raining or windy (>4 on the Beaufort scale), and when it is warm (≥13˚C).*

1. Record the date, start and finish times, temperature, time since last rainfall (hrs) and wind speed using the Beaufort scale using the "bumblebee and butterfly survey sheet" which can be found on the Green-Schools website on the Biodiversity page.
2. Walk at a slow, steady pace along the hedgerow or fence counting all the butterflies and bumblebees seen within 1m either side of the hedgerow or fence. Bumblebees can be identified using the "Common Bumblebees ID key" which can be found on the Green-Schools website on the Biodiversity page. You can identify butterflies by using a butterfly key. Visit the Butterfly Ireland website www.butterflyireland.com.
3. Data should be recorded in the "bumblebee and butterfly survey sheet". If you observe 10 large white butterflies and 5 small white butterflies you record these butterflies as follows:

Butterfly species	Number of butterflies
Large White	IIIII IIIII
Small White	IIIII

How to carry out a flower survey using a quadrat

1. The flower survey could be conducted the same day as the bumblebee and butterfly survey to identify the flowers available to the bumblebees and butterflies for foraging
2. A quadrat can be made from four metre sticks to form a square shape
3. This quadrat is placed randomly on the ground beside where you did the butterfly and bumblebee survey. All the flowers within the quadrat are counted and recorded in the "flower quadrat survey sheet" which can be found on the Green-Schools website on the Biodiversity page.
4. See www.irishwildflowers.ie for details on Irish flowers and when they are in bloom

WORKSHEET 5 Discover what 'minibeasts' live in your school grounds

'Minibeasts' *– include arthropods and other invertebrates such as spiders, ants, butterflies, bees, wasps, flies, woodlice, and many others!*

Minibeasts live everywhere – All organisms need a place to live. Explore the idea that different 'minibeasts' live in different places!

Activity: Making and exploring a habitat, students can make or identify a habitat in the school grounds and investigate what species live there!

Objective: To observe, over time, the numbers, characteristics and behavior of the 'minibeasts'.

Materials: Old logs, old carpet, tape measure, pencils & paper, pooters/clear trays for collecting insects

Method *(Note! Always wash your hands after your investigation!)*

1. Begin by asking students if they think there might be any areas in the school grounds that could provide a home for minibeasts (e.g. spiders, ants, earthworms etc.)
2. Any existing minibeast habitats can be examined and the insects found can be compared to those attracted to the new habitat the students make
3. Ask students to collect small sections of old carpet or old logs. You can make the habitat as small or as large as you wish
4. Find a damp, shaded well-protected area of the school grounds
5. Place the old logs and carpet in the area (if the weather is dry, dampen with some water)
6. Measure the area, draw up a map and date it
7. Leave the habitat for a week and return with the original map of the area
8. Note any changes on your map, using a different colour and make a note of the date
9. Carefully lift up the carpet, rocks and/or old logs to see if there are any minibeasts to be found! Place the objects back in the same place
10. Use pooters/clear trays for collecting the minibeasts. Be sure and remove them very carefully and return them to their 'home' after observation!
11. Use identification keys to identify and study any minibeasts found.
12. Return on a weekly or monthly basis and record the weather, plant growth and any minibeasts found
13. You can then keep a record of your findings and present them on a chart to the rest of the school

Things to investigate:

1. What effect does the weather, changing seasons and the presence of plants have on the habitat?
2. Are there more minibeasts as the weeks go by? Does this level off?
3. Draw bar charts to show the number of minibeasts over time and display it on your Green-Schools notice board
4. Can you indentify a food chain or food web in the habitat?

Examples of food chains

Tree Sun → Leaves → Beetles → Blackbirds

Grassland Sun → Buttercup → Bee

Woodland Sun → Plant → Seeds → Mouse → Owl

WORKSHEET 6 Web of Life

This activity encourages students to think about a natural eco-system, how the elements in it interact and the inter-connectedness of everything in the natural world. It demonstrates the consequences of human actions on the biodiversity of an eco-system.

Resources:

- One ball of string or wool (at least 20m)
- Approximately 15 labels, each with the name of an organism or element in an eco-system. Here is an example list from a woodland river ecosystem - rain, river, oak tree, soil, fish, frog, heron, otter, spider, fly, beetle, bat, bluebell, bee, squirrel
- For a smaller group, leave out the ones at the end of the list, for a larger group add a few extra species such as bramble, mouse, owl, etc.

Step-By-Step Procedures:

- Each student is given a label to stick on the front of their jumper
- Each group is given a fairly large ball of string/wool
- One student (e.g. the squirrel) holds the end of the string, then hands the ball to another student (e.g. the oak tree), while making a statement about the relationship between the two things on the stickers (e.g. the squirrel eats acorns from the oak tree). Now, the "squirrel" is holding the end of the string, and the "oak-tree" is holding the ball
- Next, the oak-tree passes the ball to a third child, again making a statement, but holding on to the string (e.g. the oak tree needs water from the rain in order to grow). Now two children are holding onto the string at different places and the third is holding the ball
- The activity continues like this, with the ball being passed back and forth, but each child holding onto the string. Every time the string is passed the child passing it must make a statement
- Some elements, such as the river and the rain in the above example, will have multiple connections to other elements. In this case, a child may be holding the string in 3 or 4 different places
- Soon a web of string will have been created.

Note *It's important that everyone holds the web taut*

You can demonstrate how strong the web is by pushing the middle of it gently

To demonstrate how the web can be disrupted, you can remove one of the key elements from the web

Examples: The **river** has been polluted; the **oak tree** has been cut down.

Then the student with that sticker lets go of all the bits of string he or she is holding. The web is no longer resilient, but weak and the threads are loose

You can also ask the students to make statements about the consequences of these elements being removed (e.g. without the river, the frogs will disappear from the forest, without the oak trees, there will be no leaf-litter so the soil will not be as rich and the bluebells won't grow etc.) so more and more of the elements are disconnected from each other and the web is weaker and weaker

USEFUL CONTACTS & LINKS

Green-Schools

- www.greenschoolsireland.org – Check out our website as it has up to date news, worksheets, casestudies and some great photos too!
- www.eco-schools.org – For news of Green-Schools internationally

General

- An Taisce – The National Trust for Ireland – www.antaisce.org
- National Biodiversity Data Centre - www.biodiversityireland.ie – here you can learn all about getting involved in national surveys and submit your records for the 'Biodiversity Bingo'. This site can also provide access to valuable data relating to Ireland's biodiversity
- The Heritage Council - www.heritagecouncil.ie/education - you can find a link to 'Wild things at school', a great book for primary schools working on the biodiversity theme and 'Exploring Biodiversity – A Guide for Educators Around the World'
- The Enviroment Protection Agency - www.epa.ie – for information on Secondary Schools 2020 Vision visit http://www.epa.ie/researchandeducation/ education/educ/protectedsoilbiodiversity/ a great site specifically for secondary schools and biodiversity
- National Parks & Wildlife Trust - www.npws.ie/Biodviersity
- ENFO - www.askaboutireland.ie - you'll find lots of useful information here
- Irish Wildlife Trust - www.iwt.ie
- Nature's Web - www.naturesweb.ie –online newsletter on nature and the environment
- Department of the Environment and Local Government - www.environ.ie
- Biology.ie - www.biology.ie – an interactive tool for those interested in submitting sightings
- The Woodland Trust - www.naturedetectives.org.uk – is a great UK website with lots of activity packs that can be downloaded
- Contact www.biology.ie or www.ispynature.com for nature surveys
- Contact www.epa.ie/researchandeducation/education/educ/protectedsoilbiodiversity/ a great resource for secondary schools

Trees

- Crann Ireland - www.crann.ie
- Irish Seed Savers Association - www.irishseedsavers.ie
- The Woodland League - www.woodlandleague.org
- Coillte - www.coillte.ie/coillteforest/environment/learn_about_trees/ - a useful website with worksheets for children
- The Native woodland Trust - www.nativewoodlandtrust.ie

Flowers

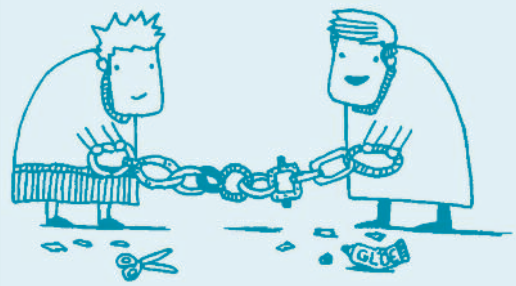
- Irish Wildflowers - www.irishwildflowers.ie – a useful site to help identify the flowers growing around you

Birds

- BirdWatch Ireland - www.birdwatchireland.ie – click on 'Kids Zone' for lots of fun things to do
- Bird Atlas - www.bto.org/birdatlas - get involved in recording birds
- Bird Track - www.birdtrack.net
- The Godwit Project - www.scoiliosaefnaofa.com/Godwit.htm - check out how two schools are monitoring the movements of the Godwits
- Sherkin Island Marine Station - www.sherkinmarine.ie – resources on coastal habitats/birds/wildflowers

Other

- The Irish Butterfly Monitoring Scheme http://irishbutterflymonitoringscheme.biodiversityireland.ie/
- Butterfly Ireland - www.butterflyireland.ie
- The Irish Bat Conservation – www.batconservationireland.org
- Irish Whale & Dolphin Group - www.iwdg.ie
- Friends of the Irish Environment - http://friendsoftheirishenvironment.net
- Moths of Ireland - www.moths.ie
- Lichens of Ireland - www.lichens.ie
- Irish Peatland Con. Council www.ipcc.ie
- Central Fisheries Board - http://www.somethingfishy.ie/index.html - a great educational website for schools



APPENDIX

INTERNATIONAL

International Conventions and Agreements *('Convention'-formal agreement)*

The Convention on Biological Diversity (CBD) was one of the key agreements adopted in 1992, at the Earth Summit in Rio de Janeiro. At that summit, 189 countries and the EU as Parties, agreed on a comprehensive strategy for "sustainable development", meeting our needs while ensuring that we leave a healthy and viable world for future generations. In other words, the protection of biodiversity allied with promoting sustainable exploitation. In 1996, Ireland ratified the agreement and so is obliged to meet the aims set out in the Convention.

In January 2000, a second agreement to the CBD known as the **Cartagena Protocol on Biosafety** was adopted by the Conference of the Parties. The protocol aims to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology practices.

CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora) is an international agreement between Governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival.

The Bonn Convention The Convention on the Conservation of Migratory Species of Wild Animals (CMS) aims to conserve terrestrial, marine and avian migratory species throughout their range. It is an intergovernmental treaty, including 92 Parties from around the world, which was settled upon under the sponsorship of the United Nations Environment Programme, concerned with the conservation of wildlife and habitats on a global scale. The main pieces of legislation include the Birds Directive and the Habitats directive (see page 43).

Bern Convention 1979 the aim of this convention is to ensure the conservation of European wildlife and natural habitats by means of cooperation between member States. The Bern Convention co-ordinates the action of European States in adopting common standards and policies for the sustainable use of biological diversity,

Ramsar Convention The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are presently 147 Contracting Parties to the Convention, with 1524 wetland sites, totaling 129.2 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance.

The World Heritage Convention The 1972 World Heritage Convention links together in a single document the idea of nature conservation and the preservation of cultural properties. The Convention recognises the way in which people interact with nature, and the fundamental need to preserve the balance between the two.

OSPAR Convention The 1992 OSPAR Convention is the current instrument guiding international cooperation on the protection of the marine environment of the North-East Atlantic. It combined and up-dated the 1972 Oslo Convention on dumping waste at sea and the 1974 Paris Convention on land-based sources of marine pollution

EUROPEAN LEGISLATION

The European Community formally sanctioned the CBD in December 1993. The main pieces of legislation, within which the EU ensures that its member states meet their legal obligations to the CBD, include the European Biodiversity Strategy, and the Bonn Convention.

EU Biodiversity Strategy in 1998, the European Commission adopted a Communication on a European Biodiversity Strategy. This strategy aims to anticipate, prevent and attack the causes of significant reduction or loss of biodiversity at the source. With the aim of reversing present trends in biodiversity decline and to place species and ecosystems, including agro-ecosystems, at a satisfactory conservation status, both within and beyond the European Union (EU). There are Action Plans developed for each of the following: Conservation of Natural Resources, Agriculture, Fisheries and Economic and Development cooperation.

NATURA 2000 sites are protected habitats for flora and fauna of European importance. They include Special Areas of Conservation, designated under the Habitats Directive and Special Protection Areas, designated under the Birds Directive.

Habitats Directive Council Directive 92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive)

In 1992, the European Community adopted the EC Habitats Directive. This was drawn up to protect habitats and species that are threatened throughout Ireland and the rest of Europe. In Ireland, there are 58 listed habitats and 24 species protected under the Directive. Many of these are within SACs (Special Areas of Conservation).

Birds Directive (Council Directive 79/409/EEC on the conservation of wild birds)

In 1979, the European Community adopted the Birds Directive. The Directive was drawn up to protect wild bird populations, and their habitats, throughout Europe. Furthermore, certain activities that may threaten bird species are banned.

IRISH LEGISLATION

The **National Parks & Wildlife Service** (NPWS), of the Department of the Environment, Heritage & Local Government (DEHLG) is in charge of the implementation of both national, European and international conservation legislation. Other responsibilities include the management of national parks and reserves,

National implementation of the CBD is the main legislative framework for Ireland's implementation of the conservation and sustainable use of biological diversity:

Ireland's National Biodiversity Plan was launched in April 2002. Under fifteen themes and sectors, the plan sets detailed actions through which Ireland will aim to conserve and sustainably use biodiversity, over a five-year period.

Interim Review of the National Biodiversity Plan An interim review of the implementation of the National Biodiversity Plan was launched in November 2005. This review outlines the level of progress we have made in implementing the 91 actions of the National Biodiversity Plan and identifies the areas where further efforts are required.

National Report Ireland Under the CBD, we are required to produce a national report on the implementation of the Convention. This first national report, which was published in April 1998, it focused on information available on biological diversity in Ireland and measures for its conservation and sustainable use.

Ireland's National Plant Conservation Strategy includes 16 targets, which are based on The Global Strategy for Plant Conservation, which focuses on understanding and documenting and conserving Ireland's plants and fungi.

Species Action Plans outline actions/strategies which are set out to conserve certain species within Ireland, for example, the Irish hare and the corncrake.

Invasive Species Ireland report 2004 sets out recommendations on how to deal with invasive species. Invasive species pose huge treats to Ireland's biodiversity, for example, the ruddy duck which threatens the endangered white-headed duck, Japanese knotweed, chub which competes with native fish species etc.

Wildlife Act 1976 & Wildlife (Amendment) Act, 2000 Much of Ireland's biodiversity is protected by the Wildlife Acts. This allows the Minister to enter into voluntary management agreements with private landowners. Under these agreements, landowners will manage their lands to ensure that certain wildlife habitats are protected.

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