

Sir Joseph Banks, 1st Baronet, GCB, PRS. 1743 – 1820 was a British naturalist, botanist and patron of the natural sciences.



## **THE LINCOLNSHIRE PLANT HUNT**

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## **Introduction**

To mark the 250th anniversary of the launch of Endeavour and the amazing voyage around the world with Captain James Cook the Joseph banks Society together with Lincolnshire Wildlife Trust, the Lincolnshire Naturalists' Union and the Natural History Museum have created a Lincolnshire Plant Hunt the result of which will be a new Herbarium for Lincolnshire and the opportunity to carry out scientific research. This exciting project will encourage children to explore the natural world around them and help schools to engage children in natural sciences. The initial project and collecting stages has been funded by the Heritage Lottery Fund, however the project is envisaged to last many years.

The project encourages children to draw inspiration from the life and work of

Sir Joseph Banks the famous botanist and President of the Royal Society. Banks was fascinated by the natural world, and collected many thousands of plants and specimens, perhaps more importantly he encouraged and financed many other great "Plant Collectors" to go out into the World and collect plants, his work formed the basis of the great plant collections at Kew Gardens.

Banks travelled widely, collecting information about many diverse plants, however his later interests included all aspects of the natural world. His collections were housed at his homes at Soho square in London and Revesby Abbey in Lincolnshire where all learned people were welcome.

Banks was the first botanist to recognize the value of moving plants around the world and amongst his many achievements convinced the East India Company that India and Ceylon would be good places to grow tea.

The Lincolnshire Plant Hunt activities will guide children through a range of scientific processes, build technical skills and understanding, support the development of critical thinking and help contribute to scientific knowledge and conservation work in Lincolnshire and the UK.

## **About the plants**

The Lincolnshire Plant Hunt offers safe yet stimulating opportunities for school or home-based enquiry and investigation into fascinating native UK and Lincolnshire plants. There will also be the possibility of trans-national work with schools in Australia or New Zealand.

The plant species highlighted in this project were chosen because they:

- are non-toxic and can be found across the UK.
- flower and fruit in our summer or autumn school terms.
- are useful: they have interesting past or present uses or can be used as food.

Understanding the native flora of a country, the variety in and between species and how plants adapt to their environment is critical for the sustainable management of the planet. It is vital that a new generation of botanists learn to work like Banks and identify, look after and collect data on the wild plants around us.

## **Real scientific research**

The children will mirror the kind of science contemporary plant hunters are carrying out all over the world, and echo the work of Banks. For children aged 9-10 there is a special mission asking them to contribute to real scientific work by collecting seeds for the Lincolnshire seed bank which will be managed by the Lincolnshire Wildlife Trust.

This year group, 'Bank's Eton Explorers' are asked to observe daisies over time in their area, spot when they come into fruit, and photograph and record the location and date on The Lincolnshire Plant Hunt website. The data will automatically be plotted on a map, and recorded by the Lincolnshire Naturalist Union. Dried flower collections can also be DNA matched with the Victorian Peacock Herbarium based within the Natural History Museum giving real information about the effects of global warming on plants

It's every school's chance to help build a unique scientific archive, with research potential for years.

## **About the resources**

The Lincolnshire Plant Hunt Handbook and resources support a series of plant science activities for primary year groups across Lincolnshire but is also developed to complement UK national curricula.

Each year's activities follow a 3-stage format over 5/6 lessons. They use familiar teaching processes – specialist training and support is not needed.

The Lincolnshire Plant website at [www.....](http://www.....)

The Lincolnshire Plant Hunt is supported by online resources. These include:

- Engaging educational interactive challenges for all age ranges. These can be used by the children independently or on a whiteboard as a whole class.
- High-quality support materials: pictures, video clips and Powerpoints
- PDF downloads of all the resources and the latest hints and tips.
- Tools for children, supervised by teachers, to record their own discoveries and see other schools' achievements on a map of Lincolnshire.

The Lincolnshire Plant Hunt Identikit (x2)

The colour photos on these card sets show the life cycle and characteristic features that will help children identify some common plants.

### **The Mini Seed Bank**

This scientific kit is based on those used by Kew Gardens Seed Bank scientists for collecting seeds around the world. As part of The Lincolnshire Plant Hunt, 9 to 10-year-olds are encouraged to collect seed, and send it to the Lincolnshire Wildlife Trust Seed Bank, contributing to real conservation work. The kit contains everything needed to store seed safely for many years.

Following in Bank's footsteps (storybook)

Explore Bank's life and work by reading a chapter in assemblies or in class.

Each chapter links Bank's work to one of the year group challenges: observing, recording, collecting, thinking hard and solving puzzles.

More Endeavour Endeavour Treasure Chest contents!

Two magnifiers, a plant press and seeds for germination experiments.

### **The Nature Walks**

The development of critical thinking skills is key to understanding science.

Banks was a keen observer of the natural world. He collected lots of plants and spent much time thinking about how to share his knowledge. He wrote thousands of letters to other scientists all over the world.

As a young boy Banks spent many hours walking through the Lincolnshire countryside and when he attended Eton school he would pay old women to tell him the names of the plants that they were collecting to use for medicine.

Walking and other movement can stimulate thought; it helps you feel immersed and involved in what you are doing and helps you focus. It also offers opportunities for quiet reflection.

The 'Nature Walks' in The Lincolnshire Plant Hunt project activities will:

- Provide good opportunities for focused, detailed observations as well as data collection.
- Support the development of critical thinking skills.
- Provide a 'real world' learning experience.
- Allow time for reflection.
- Provide opportunities for children to work in pairs or trios.
- Help implement the Learning Outside the Classroom, but also improve health and wellbeing.

To ensure that the 'Nature walks' achieve their objectives, consider the following:

- The teacher may want to 'walk' the route first to ensure that it meets the needs of the particular activity.
- Children should know the purpose of the walk and what activities they will carry out. Set a target number of observations, sketches or collections to carry out and report back on.
- Enough time should be set aside to ensure that the children can complete the activities on the walk.
- LWT staff may be available to act as guides if required (booking essential)

### **The Lincolnshire Plant Hunt can be a whole school project**

The details below show how to use the resources as a programme of activities for the entire school, using assemblies to connect the work of each age group to the whole. A detailed connectivity plan can be found on the Lincolnshire plant hunt website.

Material for assemblies includes: the Following in Bank's footsteps storybook, a Following in Bank's footsteps poster for display of children's work, and video and presentation resources on The Lincolnshire Plant Hunt website at [www.lincolnshireplanthunt.org.uk](http://www.lincolnshireplanthunt.org.uk).

### **Assembly 1**

Assembly 1 forms the starting point for the project and is an invitation to the whole school to join in. The Lincolnshire Plant Hunt Endeavour Treasure Chest can be opened and the contents explained to the children. Key points to get over are that the children are participating in the biggest ever mass science event for primary school children in Lincolnshire, that it is inspired by Banks, and that the activities represent real plant science and support conservation.

Read the first chapter of the Following in Bank's footsteps storybook. This explains the role of Banks as an inspirational scientist, and introduces the children to the idea that scientific processes are useful, important and enjoyable. Open and display the Following in Bank's footsteps poster, which will be used at forthcoming assemblies to showcase and celebrate the children's work over the coming weeks.

Lastly, download and watch the first video from The Lincolnshire Plant Hunt website at Lincolnshire plant hunt website. It shows David Attenborough talking about Joseph Banks, and acts as an invitation to the children to start their Lincolnshire Plant Hunt activities.

### **Assemblies 2-7**

Assemblies 2-7 have a similar format to 1, with year groups also presenting their work. Assemblies can stand alone or be used as part of a full programme. Timing should suit school needs— assemblies can be staged when a year group is ready to present.

1. Read the relevant chapter (2-7) of the Following in Bank's footsteps storybook to set the context of Bank's life and work. There is a chapter supporting each year's activities, though not exclusively. They are also designed for reading in any assembly in any order.
2. Show the video clip of the Plant Hunter downloaded from The Lincolnshire Plant Hunt website at [www....](http://www....) and read out the Plant Hunter's postcard for the year group found in the teacher's booklets. This sets the challenge to another year group.
3. Invite one year group that has already been doing their activities to present what they have been doing, and how they responded to the challenges.
4. Attach some of this work to the relevant part of the Following in Bank's footsteps poster for everyone to see, and add other contributions to the Endeavour Treasure Chest. Work can be offered as a 'present' to celebrate Bank's birthday or added to the chest for future year groups to see and use as reference for further work.

### **Final assembly**

This final celebratory assembly is to mark the whole school's achievements.

Read the last chapter of the Following in Bank's footsteps storybook, and show the final concluding Plant Hunter video clip downloaded from The Lincolnshire Plant Hunt website at [www....](http://www....)

Display the Endeavour Treasure Chest with its wealth of work on show, and celebrate the completed poster, explaining the contributions of each year group to the whole school. The 9-10 age group children can discuss their activities around collection, processing and delivery of seed from the school to the Lincolnshire seed bank. Selected year group representatives should make prepared presentations about their work and point out some of the highlights and favourite moments during the project activities.

The children should be thanked for their hard work and asked to commit to working on the project again next year, both to celebrate Banks, the great scientist in whose footsteps they are following, and to continue to make a really important contribution to science and conservation in the UK.

## **Alternatives**

As this is a whole school project, the ideal would be to have whole school assemblies as above. As this is not always possible, teachers may wish to bring together aspects of the assemblies to best suit their situation. For example, if the school has only year group assemblies or Key Stage assemblies then the following simple options could be applied.

- Each year could start off with the introductory assembly, and could do their celebratory assembly in the appropriate week of the project.
- The chapters of the storybook *Following in Bank's footsteps* could be read each week, one per week of the project.
- Use the *Bank's Footsteps* poster to display and celebrate each year's work, and add contributions from each age group to the Endeavour Treasure Chest.

In the final assembly, invite representatives from each group, perhaps in particular ages 9-10 as they will be collecting seed to send to the Millennium

Seed Bank, to show what their contribution and favourite activity was over the entire project.

- It is recommended that even if the school usually holds individual year assemblies that at least the first and final assemblies are done as a whole school.

About the video resources

- **Introduction:** A clip introducing the project, Banks, the need for conservation, plants and seed banking, the important role of science and scientific processes and an invitation to the children to participate.
- **Six year group clips:** Videos that can be used to set the scene for the activity sets for each age group. The messaging on these video clips focuses on the processes that the children will cover in their activity work. They also reflect the 'postcard' starter that can be found at the start of each year's activity set in this handbook.
- **Conclusion:** A final video clip explaining the value and importance of the participatory work that the school has been involved with, a thank you for the key mass participation and conservation work by the children and an invitation to revisit the project in future years.

## **Cross-curricular links**

There are lots of opportunities to use The Lincolnshire Plant Hunt materials and activities across the curricula of all UK regions.

## **Literacy**

- Banks kept diaries, field and research note books and communicated by letter. Materials from The Lincolnshire Plant Hunt could provide inspiration for any of these methods of writing.
- The Banks nature notebook could also be developed as part of a Literacy programme.
- There is also scope for creative writing based on Nature walks or episodes from Bank's life as told in the Following in Bank's Footsteps storybook.

## **Numeracy**

- Handling data is a big part of many of The Lincolnshire Plant Hunt activities.
- See the various data activities on The Lincolnshire Plant Hunt website at [Lincolnshire plant hunt website](#)

## **History**

- The material around Joseph Banks can be used as an example of the life of a famous person or of wealthy Victorians.
- One suggestion is contrasting Revesby Abbey where the Banks family lived with homes today.
- Another option would be to contrast the Banks family life with life today– what clothes the family wore, the food they ate, their hobbies, medicines, health and modes of travel.

## **Healthy eating**

- Plants as food

## **Geography**

- Study the local area as a development of the Nature walks.
- Study place like the the Banks Islands.
- What would you pack if you were going on an expedition?
- Connecting ourselves to the world, by looking at the places where the Plant Hunters are or following the voyage of the Endeavour.
- Improving the school environment as a development of the Nature walks or study in the school grounds.
- Creating maps based on the route taken on the Nature walk.
- Mapping out the area of the Endeavour and imagining what it would be like living in the space with all the other people who were on board.

### **Art, Design and Technology**

- Looking at seeds and plants would provide the inspiration for a large variety of different types of art activities such as sculpture, model making, painting, printing and photography.
- Banks made many collections of plant and animal material and the containers used could inspire the children to design their own containers for collections that they could make.
- Make a book using some aspect of The Lincolnshire Plant Hunt to write a story or research something to do with Banks, his life and work.
- Create puppets to tell some of the stories.

### **PE, Dance and Drama**

- Dances based on sailors working on the Endeavour pulling ropes, swabbing the deck, carrying supplies.
- Create characters from the Endeavour through movement and gesture, for example the ship's captain, the cook, and the lookout.
- Use the script for Joseph's Technicolor Dreamboat for a school play.

### **Music**

- Singing sea shanties.
- Listening to sounds in the environment while on a Nature walk.

### **RE**

- What does it mean to belong? e.g. belonging to a ship's company.
- Discuss the theories of creation and Bank's theory of evolution.

### **Citizenship and PSHE**

- Plants are vital for life on earth and have many uses.
- Conservation of habitats.
- Adopt healthy and hygienic routines and understand how to keep safe.
- Taking part, developing skills of communication and participation.
- What are different places like? Links with other schools as part of the project
- Developing the school grounds.
- What is in the media relating to the coverage of the project.

- Understanding that many substances can be dangerous, for example, never touch, taste or smell unknown substances.
- Knowing the safety rules that apply when taking medicines.

### **Health and safety information**

These guidelines are to assist in planning activities in the handbook.

### **Outdoor activities**

The Lincolnshire Plant Hunt activities can be done in school or on school grounds, even if there is not much green space. Activities outside the school grounds need planning.

It is important to visit the site in advance. Get to know the site and become familiar with locations of telephones (mobile phones are not always reliable), appropriate pick-up and drop-off points and the location of the nearest A&E department. It may be worth finding out how long it would take an ambulance to get there and if there are any access issues for emergency services such as narrow lanes or locked gates.

Planning is key to an outdoor activity running smoothly. As well as the usual logistics of getting children and helpers to and from sites with appropriate clothing and equipment, a risk assessment should be carried out as part of planning, whether inside your school grounds or elsewhere.

### **Risk assessment for Nature walks**

These are some of the things you should consider when assessing risk:

#### **General:**

- Children should be appropriately dressed.
- Assess the risk of children slipping.
- Assess the risk of children contacting potentially harmful or irritant matter.

#### **Working with plants:**

- Close supervision is required at all times.
- Plants are normally harmless but may cause an allergic reaction.
- A few common plants have thorns, prickles or stinging hairs.
- Do not allow the children to eat any plant material.
- Do not allow children to put any plant material (such as berries or seeds) in their mouths, up their noses or into their ears.
- Children should avoid putting fingers in mouths as some plant material is poisonous.
- Children should always wash their hands at the end of an activity.

- Insects particularly bees and wasps may be around plants.
- Any cuts or open wounds should be covered with a plaster.

The plants in the species guide for teachers and in The Lincolnshire Plant Hunt

Identikit have been assessed to make sure they are not poisonous. In addition to these points, teachers should also consider the following points when assessing risk for trips outside school grounds. The Lincolnshire Plant Hunt activities can be done in school or on school grounds, even if there is not much green space.

**General:**

- The area may not be secure. Please follow government guidelines for ratios of adults to students. Close supervision is required.
- Consider the locations where you will be studying habitats. What are the hazards and how can the risks be minimised.
- There may be moving vehicles.
- There may be water hazards such as ponds, streams or rivers.
- There are likely to be additional trip hazards and an abundance of wild plants such as stinging nettles and brambles. Children should be warned to be alert to their presence.
- Overhanging and low branches can be a hazard.
- Children may need to carry extra water and food.
- Children should wear clothing and footwear appropriate for the weather conditions.
- Sturdy footwear is more appropriate than open sandals.
- Wet weather clothing or sun hats and sun block should be considered.
- If using a trowel or hand fork to dig up plants, advise children on using the tools with care and the dangers of flicking soil into eyes.

**Classroom activities**

When undertaking activities in the classroom, normal health and safety protocol should be adhered to.

When working with plant material and soil the following points should be considered:

- Plants are normally harmless but may cause an allergic reaction.

- Do not allow children to put any plant material (such as berries or seeds) in their mouths, up their noses or into their ears.
- Children should avoid putting fingers in mouths as some plant material collected may be poisonous.
- Children should wash their hands at the end of an activity.
- Any cuts or wounds should be covered with a plaster.

### **Pressing plants, making herbarium specimens**

A few specific points should be considered when pressing plants and making pressed plants into herbarium specimens (as well as the guidelines about handling plants).

- Ensure children don't trap fingers between plant press boards when pressure is applied.
- If using a belt or strap to tighten the press, take care with metal prongs on the buckle.
- Make sure children don't strain themselves by pulling too tightly on straps to close press.
- If using books or heavy items to weight the press, avoid lifting these awkwardly.
- When gluing the plant onto the display sheet, appropriate non-toxic glue should be used and children should be supervised.

### **Codes of conduct**

The Lincolnshire Plant Hunt activities can be done in school or on school grounds, even if there is not much green space. When studying habitats and the wildlife in them, children (and adults) should be encouraged to consider and discuss appropriate ways of behaving.

Drawing up a code of conduct is a useful class exercise before undertaking an activity.

The following points should be covered:

- Habitats are homes to lots of different types of plants and animals. Some of them may be very sensitive to noise, disturbance or damage. Think about creatures that might be scared by movement or loud noise, and plants and creatures that might be harmed by trampling and moving stones or logs.
- Litter can be harmful for wildlife. It can smother plants, trap small animals, and harm larger animals that eat it or step on it. Discuss attitudes to litter and devise appropriate solutions. The organisation ENCAMS ([www.encams.org](http://www.encams.org)) can provide lots of educational materials and ideas.
- It is not normally acceptable to pick or remove wild flowers from their habitat.

The plants chosen for this project are all very common. Stress to children that they are allowed to collect for this project.

- There are laws relating to habitats and wildlife that teachers and children should be aware of. For example, it is illegal to dig up any wild plant without the landowner's permission.

Lincolnshire Wildlife trust nature reserves will be available for plant hunting expeditions

Who else to involve

If you are exploring wild habitats outside the school grounds, you need the landowner's permission before visiting, unless the area is obviously open to public access. This is particularly important on farmland. Landowners and other local people may be very interested in what you are doing, and able to help. Genuine community involvement is mutually beneficial, especially in a large project such as The Lincolnshire Plant Hunt.

## BANKS NATURE NOTEBOOK

Inspired by Banks

Banks was an extraordinary man who by his work helped to create Kew Gardens and was a patron of the great plant collectors of his age. He took a huge interest in the development of Australia and changed the way people think about plants.

His determination, enquiring mind and way of recording accurate detail is what makes him stand out as a botanist. Yet from an early age Banks was not a scholar and he loved to explore the fields and track ways in Lincolnshire and around the Thames where he attended Eton school. He was regarded as a rather disappointing student at school and at university.

Despite his unpromising start, Banks had a passion for natural sciences particularly botany and he paid for excellent lecturers such as Israel Lyons who had studied with Carl Linnaeus and who invented the method of plant identification which we still use today.

After a voyage of exploration to Newfoundland Banks was elected as a Fellow of the Royal Society and it was here that he learned of a secret round-the-world voyage to Tahiti to witness the transit of Venus across the face of the sun, Banks was determined to be the scientist on board.

After convincing the Admiralty and gaining the approval of the King HMB Endeavor was procured and James Cook was appointed as Captain. The Endeavour set sail on 25th August 1768 and was not to return until 1771 after a voyage which was to establish Australia and New Zealand as part of the British Empire,

Amazed by the wealth of species in the South Seas, Australia and New Zealand, Banks made many wonderful discoveries and set about collecting a huge number of plant and animal specimens for study, many of which still exist in collections around the World and in the United Kingdom.

Banks and his artists including Sydney Parkinson made of thousands of observations and drawings of plants, today these can be seen in a large publication called the Florilegium.

After his return to England in 1771, Banks continued his love of botany and natural science and was made President of the Royal Society in 1778 a position he was to hold until his death in 1820. Over the next few years Banks brought Britain to the forefront of botanical learning and with the support of George III transformed the Royal garden at Kew into a hub for collecting and exploring the world's flora for economic and scientific purposes.

Banks was a prolific letter writer. He wrote to many of his friends and colleagues asking for their views and observations on scientific phenomena many of these were scientists and politicians based all over the world and he used his position of influence to help create the world we know today. His vast correspondence of which 20,000 letters survive are still used today by scholars of social, economic and political spheres of influence spanning the 18th and 19th centuries. His correspondents include heads of state, government ministers and people prominent in science, the arts, agriculture and public life.

Joseph Banks (1743 – 1820) is now recognized as one of the most influential Englishmen of his day. As President of the Royal Society, friend of King George III and a Privy Councillor he had a hand in nearly all of the scientific initiatives of the time and particularly the voyages of exploration.

### Seed dispersal

Here are some ideas for building models in the classroom to show seed and fruit dispersal mechanisms that exist in nature. After building the models, children could see how effective they have been - for example, which seed floats the furthest or travels the longest distance.

Agent of dispersal	Special structure	Plant examples	Model	Materials needed
Wind	Parachute and balloon structures	Coltsfoot, dandelion, spear thistle, white campion (bladderlike calyx acts as a balloon)	Handmade parachute	A polystyrene ball, square of material, length of thread or string, sellotape.

<b>Wind</b>	Wings or rotor	Sycamore, conifer, silver birch, sorrel	Sycamore seed shape cutout.  Rotor device.	Card and scissors, propeller / wing device from party or toy shop.
<b>Animals (digestion)</b>	Attractiveness (Colourful, tasty, juicy)	Tomato, elder, hawthorn, shepherd's purse	Ball covered in sweets	One polystyrene ball, adhesive like double sided tape, small sweets.

## Habitats

Nature reserves are excellent places in which to study a range of native plants. They usually hold a large diversity of plants showing key adaptations to the environment.

For more examples of plants from all the habitats below, go to The Great

Plant Hunt website at Lincolnshire plant hunt website for downloads, powerpoints and whiteboard resources.

UK habitats (temperate zone)

Macro-habitats

Meadow

Woodland

Marshland

Upland areas (such as fells or mountains)

Large school fields or recreation areas

Churchyards, pathways, derelict land, parks

Coastal (sand dunes, beaches and cliffs)

Beside water courses or lakes

### **Micro-habitats**

Verges or roadside edges

Cracks in the pavement or walls

Path or field edges, in and along hedgerows

Under logs

Along the edges of walls or fences

Plants that can be grown up other plants – for example oak trees supporting ivy

### **Exotic habitats**

Desert

Rainforest

Swamp

Alpine

Mediterranean

Seed banking using the mini seed bank

You can use the mini seed bank to store any seed - from the school garden, or for next year's Investigators and Plant hunters to use in The Lincolnshire plant hunt activities.

### **Initial drying**

- After harvesting, leave seeds in paper bags or spread on newspaper on trays in a dry, airy place with no drafts or direct sunlight for 3-4 days or until seeds appear visibly dry.
- Aerate/shake daily to speed up this phase.
- If seeds or fruits have been collected before completely ripe, leave in the classroom for 7-10 days to ripen. They may change colour as they ripen.

### **Seed cleaning**

- Except for fleshy fruits (like elder and hawthorn), seeds can often be removed from capsules or pods by gently shaking seed heads (see picture above) or opening the capsules.
- For most species seed heads will separate more easily after initial drying.
- Ripe, fleshy fruits - like tomato - should be opened carefully with a knife and the seeds gently scraped out onto a sieve held under running water to remove the flesh.
- Extracted seeds should then undergo initial drying before the main drying step.

### **Main drying using mini seed bank**

- Silica gel absorbs water from the air. It is used in the mini seed bank to dry out the air and the seeds. Dry seeds can last for years in the mini seed bank.
- Preparing the drying box (main box): Open the large bag of clear silica gel(dessicant). Pour it into the empty box. Add the contents of the orange (dry) indicating silica gel sachet and mix.
- Label each seed pot with the name of the species and the date.
- Pour cleaned seeds into labelled seed pots. Add one green (damp) indicator sachet to each pot and put the open pot into the mini seed bank on top of the desiccant.
- Leave the pots open during seed drying but reseal the box to create an airtight drying environment. Keep in a cool place out of direct sunlight (room temperature is ok).
- Open the box and check the colour of the green indicating sachets inside the pots every 3-4 days. Gently shake the seed pots each time they are checked to mix the seeds and allow even drying. The seeds will be dry when the green indicator turns orange. Drying time will vary according to the quantity and original moisture content of the seeds.
- Replace the lids on the seed pots containing dry seeds, each with its own orange indicator sachet, and seal the lid tightly.

- The silica gel desiccant in the main box will need re-drying from time to time in an oven when the indicator beads mixed in with it begin to turn green.

### **Storage**

- Each sealed and labelled seed pot can now be safely stored in the mini seed bank held in a cool place.
- If the mini seed bank is placed in a fridge or freezer the seeds will remain alive for many years.
- During the collecting season when the mini seed bank is being used for seed drying, the sealed pots of seeds can be left on a shelf in a fridge and placed back in the box when it becomes available.

### **Seed collecting guidelines**

Seeds need to be collected when fully ripe. Warm, dry weather is best for collecting.

#### **1. Get permission**

It is illegal to uproot any wild plant without the landowner's permission. It is not illegal to collect seeds, but as a matter of courtesy the landowner should be approached.

#### **2. Identification tools**

Use The Lincolnshire Plant Hunt Identikit to identify the right plants to collect seeds from.

#### **3. Find a suitable population**

One plant is unlikely to provide enough seed for any study, and will only have a limited range of genetic diversity. Collect seeds from as many different plants of one species as possible (for example from twenty different daisy plants). This helps maximise genetic variation within the collection.

#### **4. Assess the state of ripeness**

- It is important to time collection appropriately. Too early and the seeds will not have matured sufficiently. Too late and the seeds will have gone!
- Visit the collection site several times to monitor the development of the seeds. Try cutting some open to make sure they are not empty – some species often produce empty seeds.
- As seeds and fruits approach the point of natural dispersal, they often undergo colour changes. Familiarise yourself with the colour of ripe seeds of the target plant.
- Allow seeds to ripen fully on the plant whenever possible. For fleshy fruits like elder and hawthorn this is after fruits change colour (green to black and green to red respectively).
- Other Identikit species have dry seeds and fruits. Capsules or pods should be left on plants until they go brown or straw coloured and feel dry, rattle or start to split. At this stage in their

development, seeds will become more loosely attached to the parent plant and will be easier to remove.

- If not able to wait until the seeds or fruits are fully ripe, collect those that appear the most ripe. Follow the 'initial drying' instructions to encourage ripening in the classroom.

#### 5. Make your collection

- Avoid collecting seeds in plastic bags – use paper ones.
- Take a sample of seeds from each of your target plants. Try not to take more than 20% of the seeds available on the day, to ensure the continued survival of the population.
- Taking care not to pull up or damage the plants in any way, remove ripe capsules, pods and fruits by hand or by snipping with a scissors or secateurs.
- Take data sheets along for labelling the collections and fill them in.
- To regenerate the desiccant, spread on a baking tray and place in the oven at 100°C / 212°F for 1-2 hours or until the indicator beads have turned from green to orange. Avoid over-cooking as this will discolour the indicator.
- Allow the silica gel desiccant to cool slightly before replacing in the bottom of the plastic drying box and sealing the lid. However, do not leave it in the open air for more than a few minutes because the warm silica gel will quickly absorb moisture.

#### Seed collection data form

This is the kind of collection data that a scientist might complete on or just after a collecting trip. The tear-off label below also allows you to put some reference information in the same container as the collected seed.

#### SEED COLLECTION DATA FORM

#### Tear-off collection label

(for putting inside a seed container with drying seed)

## **How to press plants and make a herbarium specimen**

Pressing plants helps preserve them indefinitely. This lets us study roots, leaves, flowers, stems and fruits all year around. Drying and pressing plants is the way scientists create materials to form a 'herbarium'. For a botanic garden or natural history collection, a herbarium is the reference library that scientists use to compare and contrast plant specimens and identify them.

### **Using a press**

To make dried and pressed specimens, you need:

- The plant press from the Endeavour Treasure Chest (please add corrugated cardboard sheets)
- Several sheets of newspaper or kitchen roll.
- Wood glue and brushes to stick the specimen to paper.
- Sheets of A4 paper to glue specimens onto for display.

### **What to press**

Plant material that is being pressed will usually include the flowering (or fruiting) stem and any leaves attached to this.

- If leaves at the base of the plant are different to those along the flowering stem, collect and press some of those too.
- Try to press the whole plant.
- If there are spare or loose flowers or fruits, press them alongside the plant. They can be preserved along with any seeds in an envelope or package attached to the voucher.

### **Arranging the plants in the press**

- Children should press each picked plant specimen between two sheets of newspaper.
- It doesn't matter if the specimen is folded while laying it flat for pressing and drying, as long as it is arranged so that once it is dry and flat it can all be glued onto an A4 page without dangling over the edges.
- All the parts should be clearly visible. Label each sheet with the name of the plant (if known) the date it was collected, where it was collected and by whom.
- If the specimen is very large, it may be sensible to split it into 'top' and 'bottom' sections and press each half separately. Make sure to keep the two sections together and label them accurately. To help avoid separation, the labels should say something like 'Bellis perennis upper section (1), collected by Sally Smith, 12th June 08' and 'Bellis perennis lower section (2), collected by Sally Smith, 12th June 08'.
- It can be useful to turn a couple of leaves so that both back and front of the leaves are visible.

- Don't forget to press any flowers, fruits or basal leaves in the newspaper sheets.
- Some parts of specimens may be a bit bulky, especially if permission has been given to dig up the plant and the roots are also being pressed.
- To 'even out' the drying and pressing process, scrunch up some spare newspaper around the outside of the bulky part to raise the surrounding areas to the level of the highest section of plant.

### **Pressing the plants**

- Pile the specimens in their newspaper sheets on top of one another, separating with extra newspaper sheets for absorbency and corrugated cardboard sheets (if available) after every few sets of plants. Corrugated cardboard is not essential but helps the drying process by allowing air to circulate between the specimens.
- Put the plant press ends on the top and bottom of the set of pressed specimens
- To compress the sheets, fasten and tighten the wingnuts.
- You can also use strong string or twine to do the same thing or add straps – especially useful if pressing lots of layers of plants. Use old belts with extra holes punched in and tighten them to compress.
- Compress the pile with heavy books
- Make sure the press is really tight.

If using a belt, straps or string, ask a child to sit on the press to push it down firmly while tightening it!

### **Pressing processes**

- Check regularly to see how the plant specimens are drying - ideally reasonably quickly and evenly. If specimens take too long to dry they can become mouldy. To prevent this, remove dry specimens daily to reduce the bulk and change the newspaper every few days. Alternatively, keep the press on a radiator or in a warm dry place.
- As plants dry out they shrink and curl up, so remember to keep them tightly compressed so that they stay very flat. If using string or straps to compress the press, remember to check that they are still tight every day.

### **Making a herbarium specimen**

- After around ten days all the plants should be dry and flat, or sooner if a radiator or airing cupboard has been used.
- To 'mount' the plants for an assembly or class display, each plant should be glued onto a clean sheet of A4 paper.

- Transfer all the information about when, where and who collected each plant.
- If there is any spare or extra plant material, make a little envelope or package, put the plant material in, and glue it to the sheet as well.
- If the plant is a bit bulky, try placing a beanbag over the glued plant to hold the specimen firmly in place while the glue dries.
- The herbarium specimen will now be ready to use in a display or as a reference item.

### **Making your own press at home!**

Use:

- Two stiff pieces of board or heavy duty card.
- Sheets of corrugated cardboard cut to the same size as the outer boards/ card
- Several sheets of newspaper or kitchen roll paper.
- Strong twine or string to tightly compress the press; alternatively two belts with buckles with some extra holes punched in could be used, or a pile of heavy books.
- Wood glue and brushes to stick the specimen to display sheet.
- Sheets of A4 paper to glue specimens onto for display.
- If it is not possible to make or get hold of a press, use an old telephone directory and sheets of kitchen roll. Open the telephone directory and lay a piece of kitchen roll onto the open page. Place the plant specimens face down on the kitchen roll and place another piece of kitchen roll on top of the leaf. Close the book. Put something heavy on top of the phone directory.

### **Home recycling to make a plant pot**

Most garden centers sell plastic trays and pots, soil blocks, or peat pots to use for starting seeds indoors, but if you'd like to start your seeds without having to go purchase a bunch of new stuff, there are a bunch of inventive DIY seed pots that can be made from items you probably have in your recycle bin right now.

#### **1. Newspaper pots:**

Small seedling pots can be made by rolling doubled-up sheets of newspaper around a small jar then gluing the bottom together with wheat paste, or by folding the paper into a square pot and stapling the edges together. The entire pot can be planted in the ground once the soil is warm and the seedling is mature enough to be put in the ground.

#### **2. Egg cartons:**

Cardboard egg cartons can be used to start a dozen seedlings, and then cut apart to plant each one when it's time to plant them in the garden. As with newspaper seedling pots, there's no need to

remove the plants from the pots before planting, as the cardboard will break down in the soil as the plant grows.

### 3. Egg shells:

If you've got egg cartons, you probably have egg shells as well, and while they can be crushed to make a great soil or compost pile additive, egg shell halves can be used as seedling pots as well, and naturally, they fit perfectly inside an egg carton tray. A small hole will need to be punched in the bottom of each shell for drainage.

### 4. Paper towel or toilet paper tubes:

Not everyone uses paper towels, but pretty much everybody buys toilet paper, and the paperboard tubes in the center of both of these items can be cut to form small seedling pots. There are two different methods of making pots from these paper tubes, one of which is to just leave the bottom open and fit the tubes tightly together in a tray (easiest), and the other is to cut several vertical slits in the bottoms of the tubes and to fold the resulting flaps to form the bottom of the pots (takes more time, but the soil won't come spilling out the bottom if you pick these up).

### 5. Yogurt cups:

If you're going to indulge in single-serving packaged foods such as yogurt cups, at the very least you can give them a second life by making the plastic containers into small seedling pots. The larger yogurt containers will work as well, but take up much more room, so in this case, the smaller yogurt cups offer more versatility. Cut a series of small holes around the bottom edge for drainage, and after planting the seedling into the garden, wash and dry the cups for use again and again.

### 6. Paper coffee cups:

If you regularly get coffee or tea in a paper to-go cup (because you keep forgetting your reusable mug, of course), or can raid the office trash or recycle bin for these, they make great seedling pots as well. Be sure to punch some small drainage holes in the bottom, and when you're ready to plant them in the garden, you can pull off the bottom of the cup and plant the rest, or remove it entirely and add the old cup to your compost pile.

### 7. To-go containers:

Clamshell containers, especially those with a clear lid, can make great planting trays for seedlings. Simply punch a few holes in the bottom for drainage, fill with soil, plant the seeds, and use the clear lid as a mini-greenhouse until the seedlings have emerged. Planting seeds into trays like this is best suited for starting a lot of plants that you can then repot into individual pots once they have their first true leaves, or for growing microgreens for the kitchen, such as sunflower sprouts, buckwheat "lettuce", or wheatgrass.

### Seed pot trays:

You'll want to have trays to hold your DIY seedling pots and keep water and soil contained, which is another good use for the to-go containers. Cases of soda or canned goods come in conveniently sized trays for holding seedling pots, which can also be lined with a used plastic shopping bag to

keep counters and windows tidy. If you have access to really thick cardboard boxes (such as the cases that bananas are shipped in), both the top and the bottom of the boxes can be trimmed down into trays, which are thick enough to stand up to being dampened frequently without coming apart. Old plastic Tupperware-type containers can often be found at thrift stores and garage sales, and also make great seedling trays.

Making your own homemade seedling pots is a great way to repurpose common household items and get a headstart on gardening season, without having to go out and spend a bunch of money at the garden center for new pots and trays. It's also a bit of an art to learn which pots are the most convenient for you to use, based on how easy they are to get or make, as well as which trays work the best for holding the most amount of pots in each sunny spot in your house.

### **About Lincolnshire seed bank**

Saving seeds represents long term, low cost insurance against the threats to plants from climate change, pollution, habitat loss, over exploitation and invasive alien species.

Seeds are more efficient to store than plants – they are small and they undergo a period of dormancy naturally. In the future it may be possible to re introduce natural seed into areas of Lincolnshire where populations have become extinct. The Lincolnshire seed bank will be kept and managed by Lincolnshire Wildlife Trust, the Trust regularly sow new wild flower meadows and churchyards with wild flower seeds.

A seed bank (also seed bank or seeds bank) stores seeds to preserve genetic diversity; hence it is a type of gene bank. There are many reasons to store seeds. One reason is to have on-hand the genes that plant breeders need to increase yield, disease resistance, drought tolerance, nutritional quality, etc of plants used in agriculture (i.e., crops or domesticated species). Another reason is to forestall loss of genetic diversity in rare or imperiled plant species in an effort to conserve biodiversity ex situ.

Many plants that were used centuries ago by humans are used less frequently now and seed banks offer a way to preserve that historical and cultural value. Collections of seeds stored at constant low temperature and moisture guard against loss of genetic resources that are otherwise maintained in situ or in field collections.

Seeds may be viable for hundreds and even thousands of years. The oldest carbon-14-dated seed that has grown into a viable plant was a Judean date palm seed about 2,000 years old, recovered from excavations at Herod the Great's palace in Israel.

Seed banks provide long-term safe havens for species by removing them from threat.

### **About the Lincolnshire Wildlife Trust**

Lincolnshire Wildlife Trust is part of the influential UK-wide partnership of 47 Wildlife Trusts.

The Trust has worked for more than 60 years to protect wildlife and wild places, and educate, influence and empower people. We manage almost 100 of the best sites for wildlife in Lincolnshire, North Lincolnshire and North-East Lincolnshire. Our work is helping to secure the future of many important habitats and species, which might otherwise be lost.

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### **About the Lincolnshire Naturalist Union**

The Lincolnshire Naturalists' Union was founded in 1893 and so has over a hundred years' experience and information in Lincolnshire's wildlife and geology.

In that time they have seen the county change almost beyond recognition, and have a wealth of observations on just how those changes have affected our wildlife – made on over 800 field meetings all over the county.

The LNU is the only amateur Natural History Society covering the whole of Lincolnshire. Members study, record, hold meetings, supply information, publish books, exhibit, discuss and learn. We welcome new members

### **About the Joseph Banks Society**

The influence of Sir Joseph Banks, one of Lincolnshire's most famous sons and one of the greatest figures in Georgian England, is to be found worldwide yet he is still not adequately recognised.

The aim of the Sir Joseph Banks Society is to stimulate interest in his life and achievements through education, research, publications and events, and by strengthening Lincolnshire links with Australia and New Zealand.

### **Useful references**

#### Websites

The Lincolnshire Plant Hunt: Lincolnshire plant hunt website (for even more useful sources)

Lincolnshire Wildlife Trust - <http://www.lincstrust.org.uk>

Lincolnshire Naturalist Union – <http://www.lnu.org>

Sir Joseph Banks Society – <http://www.joseph-banks.org.uk>

Royal Botanic Gardens, Kew and Wakehurst Place: [www.kew.org](http://www.kew.org)

Countryside Classroom: <http://www.countrysideclassroom.org.uk>

Royal Horticultural Society: [www.rhs.org.uk](http://www.rhs.org.uk)

## Books

Plant (2004) RBG Kew/Dorling Kindersley

Plant (Eyewitness Guides series, 2003). Dorling Kindersley Lewington, A. Plants For People (2003). 2nd ed. Eden Project Books.

Joseph Banks at Revesby. Joseph Banks Society

Plants and people

<http://www.plantcultures.org/>

Plant Science websites for schools

<http://plantscafe.net/en/home.htm>

<http://www.saps.plantsci.cam.ac.uk/index.htm>

UK Wild Plants/Habitats

<http://www.kew.org/education/wildlifezone>

<http://www.bbc.co.uk/breathingplaces/schools/>

<http://www.nhm.ac.uk/natureonline/life/plants-fungi/postcode-plants>

<http://www.woodlandtrust.org.uk/learning/index.htm>

<http://www.wildlifewatch.org.uk>

Seeds

<http://theseedsite.co.uk/> and <http://theseedsite.co.uk/weeds4.html>

<http://tomclothier.hort.net/>

How to make herbarium specimens

<http://www.botany.unimelb.edu.au/herbarium/Make%20Your%20Own%20Herb%20spec.pdf>

General support for gardening and countryside projects

<http://www.teachernet.gov.uk/Growingschools/>

Making your own plant pots

[http://www.ehow.com/video\\_1745\\_createseed-starting.html](http://www.ehow.com/video_1745_createseed-starting.html)

<http://www.feesworld.com/how2make/paperpots>

## Revesby Rovers

Hello,

My name is Adrian and I am working at the Lincolnshire Wildlife Trust.. Lincolnshire produces lots of food from its many farms but we also have lots of nature reserves where there are lots of different plants, trees and animals. The reserve I work on is called Whisby Nature Park near Lincoln, we have a nature blog to keep you up to date about what is happening on the reserve.

<http://www.lincstrust.org.uk/blog/whisbywarden>

I have been looking out for plants and seeds that I want to find and collect for the new Lincolnshire herbarium and seed bank.

I need to look out for the leaves, stems and flowers of these special plants. When I find them I write down where I have found each plant, we then dry and save them these collections are called herbariums.

The Revesby Rovers can help me by looking out for some of your local plants. Perhaps you could draw and write about their leaves, flowers and stems like I do.

Good luck,

Adrian



Cornfield flowers at Whisby Nature Reserve.

## **Curriculum links**

English curriculum (Year 1)

- That there are different plants in the local environment
- To treat growing plants with care
- To make careful observations of one or two plants and where they grow and to communicate these observations
- That plants have leaves, stems, roots and flowers
- That plants grow
- That plants need water

## **Northern Irish curriculum (P2)**

Foundation stage: The world around us

- Strand 1: Interdependence: What else is living? (Activities 1 and 2)
- Strand 1: Interdependence: How do living things survive? (Activity 3)
- Strand 3: Place: What is in my world? (Activities 1 and 2)

### **Progression:**

- show curiosity about the living things, places, objects and materials in the environment;
- identify similarities and differences between living things, places, objects and materials;
- be aware of the local natural and built environment and their place in it

## **Scottish curriculum (P2)**

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

Living things and the processes of life: Level A

- Strand: Variety and characteristic features (sort living things into broad groups according to easily observable characteristics)
- Strand: The processes of life (to give the conditions needed by plants in order to remain healthy)

- Strand: Interaction of living things with their environment (to recognise and name some common plants found in the local environment; to give examples of how to care for living things and the environment)

Skills in science – Investigating: Level A

- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

### **Welsh curriculum (Year 1)**

Scientific enquiry: Key Stage 1

- Strand: The nature of science (to ask questions about their ideas in science; to consider information obtained from their own work and other simple sources)
- Strand: Communication in science (to present scientific information in a number of ways, through diagrams, drawings, tables and charts)
- Strand: Investigative skills (to decide what is to be observed or measured)

### **Life processes and living things: Key stage 1**

- Strand: Green plants as organisms (that plants need light and water to grow; to recognise and name the leaf, flower, stem and root of flowering plants)
- Strand: Living things in their environment (to find out about the different kinds of plants in the local environment; that plants can be grouped according to observable similarities and differences)

Welcome to The Lincolnshire Plant Hunt

Learning outcomes

- Can identify and name some common UK plants.
- Can describe by drawing or simple language what plants are like and where they grow.
- Know the names of parts of a plant.
- Recognise that plants are living organisms and need to be cared for.
- Use the results of their investigation to show that plants need water to survive.

## Concepts

Plants are made up of a number of parts. Most flowering plants we see around us have roots, stems and leaves. During the year many produce flowers and later fruits containing seeds. The seeds are distributed to form new plants. Each type of plant or animal is called a species and is different from any other, but even within the same species there is lots of variation. This provides the wonderful variety of living things around us.

As a good botanist Banks spent much of his time searching out and looking closely at plants and other living things. He made careful records of the items he found in his journals. He also made many collections. Joseph Banks voyaged around the world with captain Cook and collected hundreds of plants.

In these activities, children are asked to be 'Lookouts' – looking out for a number of plants in their local environment and then examining them carefully to see if they can recognise the plant parts, see for themselves the variety within plants and develop their abilities to look closely and notice things which are the same and different. Observation is one of the key processes that Banks used in his botanic work – so the children will be well on their way to becoming a 'good botanists'.

## Meet the Plant Hunters

- Read aloud Chapter 2 called 'Banks the Lookout' from the Following in Bank's footsteps storybook to introduce ideas around how Banks worked and set the context for the childrens' work.
- Introduce Adrian the Plant Hunter by reading out his letter and download the introduction video from Lincolnshire Plant Hunt website.
- Watch Adrian, a real life Plant Hunter, working in the field doing just the kind of observing and recording the children will be doing.
- These resources can be used for an assembly about the project, or to present in class to introduce the project.

## Activity 1: Nature Walk

Activity 1 should be spread over three lessons.

### 1) Make a Banks nature notebook

- Use the Banks nature notebook template page from the binder.
- This will be the project notebook for Bank's Lookouts.

## 2) Plant parts

- Review the parts of a plant with the children, using the 'Plant parts' page overleaf.

## 3) Plan the Nature walk

- Ask the children to think about how they should behave on a Nature Walk. Talk about respecting the plants and other living things that they will observe on the walk.
- Ask the children to think about what equipment they will need – like macs or sunhats, pictures of plants to help with identification, Banks nature notebook Books, pencils, magnifiers, and bags to collect flowers and plants.

## 4) Go on a Nature walk

- Spend about thirty minutes walking in the school grounds, local park, churchyard or anywhere in the neighbourhood.
- Try to avoid formal planted areas and look for wild native plants (weeds!)
- The children should be looking out for different types of plants at this point. On the walk:
- Discover: How many different types of plants can the children find during their walk?
- Observe: Look closely at some of the plants. What differences can the children see and record?
- Record: Using a camera or by drawing in the Banks nature books record some of the different plants that have been found on the walk. Ask the children to think about how the plants are different.
- Collect: Ask the children to collect a few appropriate living plants to take back to the classroom (with the owners' permission). Try and find a range of types, especially different leaf types.

## 5) Back in class

- Ask the children for descriptive words about the plants they saw on their walk and have collected - for example: green, pretty, big, spiky, hairy, stem, flower.

## 6) Use the description words in a creative project

- Ask the children to write the words onto an outline of a leaf. They can make the outlines by drawing round leaves picked up on the walk or using the 'Leaf templates' page.

## 7) Show and tell

- Decorate the leaves and use them to make a descriptive display about plants or a poem, to show to others in the class or the rest of school.

## Helpful Hints

- Take care when picking wild flowers. Please pick only the species from The Lincolnshire Plant Hunt Identikit. The species in the Identikit are common.

- Emphasise that in general, wild flowers should not be picked and the children are doing this as part of a special project where it has been allowed.
- Permission should be sought to dig up plants if they are not on school land.
- Put any picked plants into water as soon as possible.
- If using plastic bags for collecting plants, make sure children are aware of the dangers. Follow appropriate procedures after handling plant material. Health and safety information can be found in the main handbook binder.
- Images from The Lincolnshire Plant Hunt Identikit and in the image bank species folders at Lincolnshire plant hunt website can be used to help children spot different kinds of plants. These can be useful for a preparatory activity and to jog childrens' memories after the walk. If your walk is delayed by the weather they may also come in handy.

## Resources

<p><b>What else is in the handbook?</b></p> <ul style="list-style-type: none"> <li>- Health and safety information</li> <li>- How to press plants and make a herbarium specimen</li> </ul> <p><b>What's in the Endeavour Treasure Chest?</b></p> <ul style="list-style-type: none"> <li>- The Lincolnshire Plant Hunt Identikit</li> <li>- Plant press to press collected plants (optional)</li> <li>- Magnifiers</li> </ul>	<p><b>Things you need to collect</b></p> <ul style="list-style-type: none"> <li>- Make sure the children have project notebooks</li> <li>- Paper bags and a trowel as per Activity 1</li> <li>- Material to create the class picture</li> </ul>
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## Activity 2: Spot the plant

Activity 2 should be spread over two lessons.

### 1) A second Nature walk

- Take the children on a second walk, this time to discover some specific plants.
- In this activity the children will be using their observation skills to help them match or compare living plants with an image.

On the walk:

- Discover: Look for plants in the chosen environment.
- Observe: Challenge the children to find a selection of the listed plants by matching them to The Lincolnshire Plant Hunt Identikit provided. This could be just one or two plants depending on timing and the ability of the children.
- Record: The children should record any details about where they found the plants by drawing in their Banks nature notebooks or taking photographs.
- Collect: Choose one plant and collect several of them to look at how different they are. For example, some daisies have pink tips on the petal-like structures while others are all white.

### 2) Back in class

- Look at the collection the children have made and see how many things you can see that are the same and how many that are different in one species.
- The collected plants could be made into a display.

Helpful hints

- Take a small trowel or old spoon on the walk to dig up one or two plants to see roots. These should be weeds. Children should understand that they shouldn't normally dig up plants.
- If you are collecting on someone else's land, please get permission.

## Activity 3: Help!

Activity 3 should be take one lesson.

### 1) What's wrong with the plant?

- Show children an actual plant that has wilted. (If not available, use the images below, images from The Lincolnshire Plant Hunt website at Lincolnshire plant hunt website or the wilted plant cartoon overleaf).

- Ask the children what they think is wrong with the plant. Get them to make suggestions about how to revive the plant.

## 2) Picture sequence

- Ask the children to cut out the 'Plants need water' cartoon sequence overleaf and rearrange it into the correct order to explain what is happening to the plant.
- Ask the children to explain the thinking behind their choices.

## Resources

What else is in this booklet? The fun stuff

- Childrens worksheet: - Pictures of a wilted and watered plant at

Plants need water cartoon sequence Lincolnshire plant hunt website

- An interactive game about plant health at

Lincolnshire plant hunt website

Lookouts worksheet

What's happening here?

Can you cut out the cartoon pieces and arrange them into the right order?

Plant parts

Find these images in the image bank at Lincolnshire plant hunt website

## Harrow Hunters

Hi there!

My name is Gregg and I come from Adelaide in South Australia, it is a very special place with lots of interesting plants and animals. When I was a child I used to explore and find lots of plants and seeds. I hope that you can find lots of plants on your Lincolnshire Plant Hunt

Where I live I mostly hunt for plants in hot dry places and I need to wear a sun hat. There are lots of different places where plants grow - by the sea, on mountain ranges and in dry inland desert areas. I have to be prepared for all sorts of places and weather when I am collecting.

Each time I find one of the plants that I am hunting for, I take a good look at its leaves and flowers and make a note or a drawing in my book. I also write down exactly where I find each plant so that other Plant Hunters will know where to come in the future.

I hope that we can do the same project in Australia that you are doing in Lincolnshire, Joseph Banks is famous in Australia he sailed here with Captain Cook and discovered lots of new plants that people in England had never seen before.

By the way I play a didgeridoo its cool.

Good luck!

Gregg

Curriculum links

English curriculum (Year 2)

- That there are differences between local habitats
- That flowering plants produce seeds
- That seeds make new plants
- How to make a fair test
- Know the parts of a plant
- Can compare plants

### **Northern Irish curriculum (P3)**

Thinking skills and personal capabilities

- Managing information (All activities)
- Thinking, problem-solving and decision making: (All activities)

KS 1: The world around us:

- Strand 1: Interdependence: How plants and animals rely on each other within the natural world (S&T) (All activities)
- Strand 1: Interdependence: Interdependence of people, plants, animals and places (S&T, G) (Activities 2 and 3)
- Strand 2: Place: How place influences plant and animal life (S&T, G) (All activities)
- Strand 3: Place: Ways in which living things depend on and adapt to their environment (S&T) (Activities 2 and 3)

### **Scottish curriculum (P3)**

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

Living things and the processes of life: Level A/B

- Strand: Variety and characteristic features (sort living things into broad groups according to easily observable characteristics)

- Strand: The processes of life (to recognize stages in the life cycles of familiar plants; to identify the main parts of flowering plants; to give the conditions needed by plants in order to remain healthy)
- Strand: Interaction of living things with their environment (to recognise and name some common plants found in the local environment)

### **Skills in science – Investigating: Level A/B**

- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

### **Welsh curriculum (Year 2)**

#### Scientific enquiry: Key Stage 1

- Strand: The nature of science (to consider information obtained from their own work and other simple sources)
- Strand: Communication in science (to present scientific information in a number of ways, through diagrams, drawings, tables and charts)
- Strand: Investigative skills (to turn ideas into a form that can be investigated; to decide what is to be observed or measured)

#### Life processes and living things: Key stage 1

- Strand: Green plants as organisms (that plants need light and water to grow; to recognise and name the leaf, flower, stem and root of flowering plants; that flowering plants grow and produce seeds which, in turn, produce new plants)
- Strand: Living things in their environment (to find out about the different kinds of plants in the local environment; that plants can be grouped according to observable similarities and differences)

#### Welcome to The Lincolnshire Plant Hunt

#### Learning outcomes

- Seeds come from a fruit, which comes from a flower
- Seeds carry all the information needed to make plants
- There are a huge variety of seeds from which plants grow
- Seeds need water to grow
- Can identify and name some common UK plants

- Can identify parts of a plant and can point out how they differ
- Can identify differences between two habitats and suggest reasons for this difference

### **Concepts**

Plants are found all over the world, in hot and cold places, in wet and in dry places, at sea level and on mountains. Plants have adapted to survive in many different environments. By looking around our local environment we can see the marvelous ways that plants survive in the most amazing places.

Every plant has lots of things in common with other plants as well as its own special survival structures. Banks was lucky to have the chance to sail on the Endeavour and discover many amazing plants in other countries. He collected many plants and their seeds and brought them back to the UK.

Today plant scientists around the world are still discovering amazing plants and collecting them in order to study them.

In these activities, the children are the 'Discoverers', hunting for the amazing plants that grow in their part of the world. They will see the similarities and differences between plants in different habitats, collect specimens and study them in simple experiments.

### **Meet the Plant Hunters**

- Read aloud Chapter 3 called 'Banks the Discoverer' from the Following in Bank's footsteps storybook to find out how Banks worked and to set the context for the children's' work.
- Introduce Gregg the Didgeridoo player by reading out his postcard and download the video from Dan from The Lincolnshire Plant Hunt website at [Lincolnshire plant hunt website](http://Lincolnshire plant hunt website)
- Watch Adrian, a real life Plant Hunter, working in the field doing just the kind of observing and recording the children will be doing.
- These resources can be used for an assembly about the project, or to present in class to introduce the project.

### **Activity 1: Nature walk**

Activity 1 should be spread over two lessons.

#### **1) Make a Banks nature notebook**

- Use the Banks nature notebook page from the binder.
- This will act as the Discoverers' project notebook.

#### **2) Go on a Nature walk**

- Spend about thirty minutes walking in the school grounds, local park, churchyard or anywhere in the neighbourhood.

- Two contrasting areas are needed, for example grassy areas, walls with plants growing on them, or shady areas.
- Try to avoid formal planted areas and look for wild native plants (weeds!).

The walk:

Encourage the children to:

- Plan: Think about what equipment is needed - for example macs or sunhats, The Lincolnshire Plant Hunt Identikit to help with identification, Banks Doodle

Books, pencils, magnifiers, bags and envelopes to collect plants.

- Discover: How many different types of habitat there are in the area?
- Observe: Look closely at each area. What is it like for a plant to live here?
- Record: Draw or write words to describe the areas seen on the walk in the

Banks nature notebooks.

- Collect: Take photos of the different habitats. Make a list of the words to describe the habitats and how they differ. Note which plants grow in each place. Collect whole plants and look out for anything interesting to relate to

Activity 2. Please make sure to get the owner's permission to collect.

Helpful Hints

- Different habitats might include shady, sunny, damp and dry.
- Not all plants have seeds - mosses and ferns do not, for example. This could be a good opportunity to show children that seeds are produced by plants which have flowers – such as buttercup, daisy and dandelion.
- Collect seeds for Activity 3 if possible.
- Flowers that are pollinated by wind like grasses do not have showy, coloured petals.
- If using plastic bags for collecting plants, please make sure children are aware of the dangers. Follow appropriate procedures after handling plant material.

- The image bank on The Lincolnshire Plant Hunt website at Lincolnshire plant hunt website can be used for a preparatory activity or to jog children's memories when they get back. One image set shows a range of different habitats with plants growing in them. Some of them are very common in the UK and others are further afield. These may also come in handy if the walk gets rained off!

## **Resources**

What's in the binder? Things you need to take

- Banks nature notebook
- Health and safety information. Banks nature notebooks (project
- Habitats information notebooks)

What's in the Endeavour Treasure Chest?

- Paper bags for plants and seeds.
- The Lincolnshire Plant Hunt Identikit
- A small trowel or spoon to dig up plants
- Magnifying glass

## **Plant life cycle**

Find these images in the image bank at Lincolnshire plant hunt website

Activity 2: Spot the plant

Activity 2 should be spread over two lessons.

1) Spotting differences

Encourage the children to:

- Observe: Look closely at the range of different plants collected in Activity 1.

Use photos from The Lincolnshire Plant Hunt Identikit or from the website at Lincolnshire plant hunt website if no plants have been collected, though these will not show the range of smells and textures of the real thing.

- Examine: Take at least three plants preferably with roots and flowers attached – any weed will do! Look at roots, stems, leaves and flowers in turn. How different are they? Discover the different colours, lengths, textures, shapes, smells. Does the shape of leaves and the structure of flowers and stems differ in plants from different places? Ask the children if they can think of reasons for these differences.
- Record: Draw two of the plants and label them to point out their differences.
- Create: Make a class picture or models of the plants with the named parts and the differences.

## Helpful hints

Plants will adapt to shady or dry places. In shady places they need to capture more light, so they need large leaves. In dry places they need to conserve water so they have small leaves. Humans can affect how plants grow too - dandelions and daisies growing in lawns may have short stems and flat circles of leaves that avoid the mower - in other places they have long stems and upright leaves.

Many people are confused about the differences between flowers and fruits. Once pollinated, part of the flower (the carpel where the ovary and eggs sit), develops into a fruit that contains seeds. Some fruits and seeds are big and showy, like tomatoes or the dandelion 'clock'. Some are tiny and easily missed. You may find some plants with fruits on your walk.

## Resources

- Plant life cycle Check the Lincolnshire Plant Hunt website at

Things you need to collect      Lincolnshire plant hunt website for images of

- Plants or pictures of plants from the two      different habitats and plant life cycles,  
areas visited on the walk      plus interactive games.

- Material to create the class picture or What's in the Endeavour Treasure Chest?  
models.- The Lincolnshire Plant Hunt Identikit

## Activity 3: Sorting and sprouting

Activity 3 should be spread over two lessons.

### 1) Sorting

- Observe: Look carefully at a display of seeds and pictures of seeds to see the amazing variety of shapes, sizes and colours. If possible have some pictures of the fully grown plant as well, like for example acorn and oak tree. This is to introduce the idea that a seed contains a baby plant (embryo) with all the necessary ingredients to grow into a plant given the right conditions.
- Record: Draw a few seeds in your Banks nature notebooks and describe their colour, size and other characteristics.
- Create: Children could create their own seed display with a range of collected seeds

### 2) Sprouting

This activity considers what seeds need in order to sprout (germinate) and start growing. The concept of a fair test is introduced.

- Plan an investigation to see what conditions seeds need to germinate
- Ask for suggestions – water, light, warmth, air might be mentioned
- Take one suggestion at a time and discuss how to set up the investigation
- Make it 'fair' by having two identical sets of seeds, and only varying the condition being tested. Using sets of two there would be a set with and without water; a set with and without light; a set with varying temperature (one in a warm place the other in cold place – preferably somewhere cold but light, or if not possible in the fridge).
- Set up, observe and record: Look at the seeds each day and record the changes in the Banks nature notebooks and perhaps as a class results graph using stickers. Note that not all the seeds, even of one type, will sprout on the same day.

Helpful hints: Sorting

- Good seeds for observation might include acorns, conkers, sunflower, poppy, coriander, runner beans, kidney or mung beans, cress, sesame, coffee, brown rice, or coconut.
- Remember to look at any seeds you may have collected - dandelion for example.

Helpful hints: Sprouting

- Try sprouting seeds the class has collected, or fast-growing seeds like rocket or flax.
- Mung beans are excellent and grow very quickly. They are not too small for small fingers to handle, but are small enough to allow 10-20 seeds to be used in each dish.
- Dried beans or peas from a supermarket are cheaper than packet seed from a garden centre. Before the lesson soak the seeds overnight in cold water. Use the same type of seed in each of the two dishes.
- Different groups in a class could use different types of seeds but their results must be kept separate. This could show that seeds from some plants germinate more quickly than others. If all groups use the same type of seeds the results may be pooled.
- Use seed compost or damp cotton wool or paper towels or even wet newspaper as the growing medium. As the seeds are not buried, sprouting can be observed immediately. To grow them on, transfer to yoghurt pots or pots made from newspaper.
- Most seeds do not need light in order to germinate.
- Water and temperature are the best conditions to investigate.
- This could link well to a school gardening project. Use leftover seed from the school garden, or grow on sprouted seed in the garden if it is the right time of year.

## Resources

What else is in this booklet?      What else is in the binder?

- Seed pictures on the back page      - Newspaper pot instructions

Things you need to collect      The fun stuff

- Dishes, labels, cotton wool, paper      Check the Lincolnshire Plant Hunt website at

towels or potting compost      Lincolnshire plant hunt website for images of

- Seeds different habitats, time lapse video of

- Black paper      plant life cycles and interactive games.

Discoverers worksheet

Big plants don't always have big seeds. Can you help Lily and Ash match the right seed to the right plant?

Seeds from the kitchen

Find these images in the image bank at Lincolnshire plant hunt website

## Dear Bank's Thinkers

Hello

I have spent a lot of my life travelling around the World and seen some wonderful plants in many different countries.

It is amazing how in many places the people use plants as medicines and as material to make ropes and clothing. I have just been collecting the seeds of a plant which is used as a local medicine. I think it would be really exciting to grow this back in the UK where the scientists can experiment to see if this plant really can be used in a new medicine.

We have lots of plants in our tribute garden in Horncastle which we know had many uses by the indigenous people of the countries where they came from. You can see and read about these plants in our tribute garden booklet which is in your pack.

You must remember to take notes about how the plant grows and what type of conditions it likes, are there plants that grow in some parts of the world that will not grow here in the UK.

We would like to know why we have lost lots of our plants here in Lincolnshire, can you think of some of the reasons for this?

Thanks a lot

Sally BG

## **Curriculum links**

English Curriculum (Year 3)

- People use plants e.g. for food or medicine
- To collect evidence in a variety of contexts to test an idea or prediction based on their scientific knowledge

Northern Irish Curriculum (P4)

Thinking skills and personal capabilities

- Managing information (All activities)
- Thinking, problem-solving and decision making: (All activities)

KS1 The world around us:

- Strand 1: Interdependence: How plants and animals rely on each other within the natural world (S&T) (All activities)
- Strand 1: Interdependence of people and the environment (G) (Activity 1)
- Strand 1: Interdependence: Interdependence of people, plants, animals and places (S&T, G) (All activities)
- Strand 3: Place: How place influences plant and animal life (S&T, G) (All activities)
- Strand 3: Place: Ways in which living things depend on and adapt to their environment (S&T) (Activity 2)
- Strand 3: Place: Features of the immediate world and comparisons between places (S&T) (Activity 3)
- Strand 3: Place: Positive and negative effects of people on places (G) (Activity 1)

## **Scottish Curriculum (P4)**

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

Living things and the processes of life: Level B

- Strand: Variety and characteristic features (sort living things into broad groups according to easily observable characteristics)
- Strand: The processes of life (to recognize stages in the life cycles of familiar plants; to identify the main parts of flowering plants; to give the conditions needed by plants in order to remain healthy)
- Strand: Interaction of living things with their environment (to recognise and name some common plants found in the local environment)

Skills in science – Investigating: Level B

- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

### **Welsh Curriculum (Year 3)**

Scientific enquiry: Key Stage 1

- Strand: The nature of science (to consider information obtained from their own work and other simple sources)
- Strand: Communication in science (to present scientific information in a number of ways, through diagrams, drawings, tables and charts)
- Strand: Investigative skills (to ask questions about their ideas in science; to turn ideas into a form that can be investigated; to decide what is to be observed or measured)

Life processes and living things: Key stage 1

- Strand: Green plants as organisms (that plants need light and water to grow; to recognise and name the leaf, flower, stem and root of flowering plants)
- Strand: Living things in their environment (to find out about the different kinds of plants in the local environment)

Welcome to The Lincolnshire Plant Hunt

Learning outcomes

- Understand the importance of plants in everyday life.

- Recognise a 'fair test.'
- Plants need water, nutrients, space and warmth to grow.
- Understand that plants can adapt to their environment.

### Concepts

Plants are extraordinary resources and affect our lives in many ways. We use them as medicines, food, shelter, cosmetics, fuel and flavouring. We even use them as inspiration for art and music. They also have an impact on our wellbeing. We rely heavily on plants for our everyday needs and should make sure that we look after plants as best we can.

Banks spent much of his time thinking about problems, asking questions and reflecting on what he had seen in nature and sharing ideas with other scientists.

These activities offer a range of opportunities for children to think critically. The 'Thinkers' can pool their ideas and reflect on their findings. These activities will enable children to explore how we use plants in an everyday setting as well as investigate how they grow successfully.

### Meet the Plant Hunters

- Read aloud 'Banks the Thinker' from the Following in Bank's footsteps section on the Lincolnshire Plant Hunt website to introduce Banks and his ways of working, and to set the context for the children's work.
- Introduce Sally BG the traveller by reading out her postcard and discovering how many countries she has visited and some of the best plants she has seen. A full profile of Sally is on the Lincolnshire Plant Hunt website
- See the Joseph Banks Tribute Garden handbook
- These resources can be used for an assembly about the project, or to present in class to introduce the project.

### Activity 1: Nature walk

Activity 1 should be spread over two lessons.

#### 1) Make a Banks nature notebook

- Use the Banks nature notebook page from the binder.
- This will act as the Thinkers' project notebook.

#### 2) Go on a Nature walk

- Go on a Nature walk for about thirty minutes to think about how plants help us to feel good. This could be in the school grounds, local park, churchyard or anywhere in the neighbourhood. You could use formal garden planted areas or areas where wild native plants (weeds) grow. Local Lincolnshire Wildlife reserves would be excellent places to visit they have lots of different habitats and are situated across the whole of the county.

On the walk:

Encourage the children to:

- Think: Reflect on what makes them feel good while on the walk. Do plants play a part in making them feel good in the same way as for Carly the Plant Hunter?
- Record: Find an area where the class can carry out detailed observation. Children can take photographs, record thoughts onto a handheld tape recorder if available, or be asked simply 'to remember'. Memories and thoughts can be recorded in the field using the Banks nature notebook and tidied up back at school.

Ask questions:

- Ask the children what it is about the plants that makes them feel good.
  - Get them to also consider what this walk would be like with no plants.
  - Think about colour, shape, form, texture and smell.
- Back at school, draw up a list in a plenary session to show how our lives are affected by plants. Keep these to refer to in Activity 3 and as assembly display material.

Resources

What else is in the binder?      Things you need to collect

- Banks nature notebook      - Banks nature notebooks

- Health and safety information - A camera

- Photos of plants that that make you feel      - Handheld tape recorder (optional)

Lincolnshire plant hunt website

**Thinkers worksheet**

Think about what Lily, Ash and Joseph are saying. So, are plants useful? What do you think?

Now think of as many things as possible that we get from plants. Afterwards, why not colour in Lily, Ash and Joseph!

## Activity 2: Living well

Activity 2 should be spread over two lessons.

### 1) Discussing plant health

When we collect plants we always need to think about how to look after them when we come back from collecting trips. Discuss what is needed for successful plant growth and generate a list. Ask children how they would test any of these requirements.

### 2) Observing plant health

For this activity the teacher needs a tray of eight of the same plants - for example tomatoes, radish or runner beans. At least two plants per condition are needed for exposure to each of the conditions below.

Setting up:

Don't forget to label each plant with the condition it is kept in!

- Plants 1a/1b: Control plant kept in light, watered well, warm.
- Plants 2a/2b: As plants 1a/b but without water.
- Plants 3a/3b: As plants 1a/b but kept in a dark place.
- Plants 4a/4b: As plants 1a/b but overcrowded (see helpful hints).
- Discuss: Ask the children to discuss in pairs how each of these plants might look if they were kept in the conditions listed above.
- Observe: Bring out all the trays of plants that have been kept in different conditions. Ask the children to observe how the plants look, and match each plant to a circle on a template page of 'conditions'.
- Analyse: From their observations children should check whether their conclusions match their original ideas and share their findings.
- Record: Children should record their findings in their project books.

### 3) Learning from observation

Following on from the previous activity, ask the children to remake their list about what plants need in order to grow well.

- Hypothesise: If all plants need water, space and light, challenge the children to explain how plants adapt to live in: i) deserts and very dry places, and ii) dark areas underneath the big trees in rainforests.
- Record: Discuss their responses in a plenary session and ask the children to record their findings about how plants can adapt in their Banks Doodle Books.

#### 4) Adaptation

Give the children either a mixture of herbs like sage, thyme and mint, or bring in a collection of different types of plants showing adaptations (see list on adaptations page).

- Challenge: Ask the children to suggest what types of conditions these have to live in.
- Record: Ask children to record their findings and share them in their pairs.

#### Helpful hints

- Two weeks ahead of the lesson, set up two sets of young plants under the sets of conditions as above. For plant 4a/b put three plants in each pot to simulate overcrowding. We suggest using tomato or runner beans. Instead of setting up your trays ahead of time you could cheat here and buy small/big/weedy looking plants.
- Plants all need water, some warmth and space to grow well – however many have evolved clever strategies to enable them to live in particular habitats and even extreme climatic conditions. Water plants have flotation aids, plants in poor soils can trap insects (carnivorous) and alpiners are low and streamlined to avoid extreme cold and the high winds. Plants in the dark understoreys of rainforests adapt to a) climb up tall trees to reach the light b) grow perched high up on the tree branches like some orchids, ferns and urn plants c) arrange their leaves in ‘spirals’ so as to catch the little sunlight that filters through the dense canopy d) have big leaf surface areas to catch any light!

Children may come up with one or more of these solutions.

- Many herbs like thyme, mint, bay and sage live in dry, sunny Mediterranean climates. They have small leaves to stop water loss and are sometimes quite tough and leathery for the same reason. Several have ‘greyish’ or ‘whitish’ hairs to reflect sun and to help slow down water loss from the leaves.
- Using herbs offers an excellent link to the next activity.

## Resources

- Plant adaptations
- Banks nature notebook page
- Tray of plants set up and grown as described above

Check the Lincolnshire Plant Hunt website at [www.lincolnshireplanthunt.co.uk](http://www.lincolnshireplanthunt.co.uk).

- Sheets of paper to place the plants on.

## Activity 3: The feel good factor

Activity 3 should be spread over two lessons.

### 1) Listing plant products

In a discussion, talk with the children about how plants are used and produce a list.

Children could research this list using the internet or other resources. These might include food packaging, cosmetics, medicine and clothing.

### 2) Collecting plant products

Invite the children to collect items from outside school that include plant products and bring them into class. Send parents a note asking them to supervise the collection of materials so that children do not bring in anything harmful. Use the collection to create posters or collages about plant uses.

### 3) Using plants

The teacher should set up a 'show and tell' where the children make the connection between plant, product and usefulness - how it makes you feel good. Familiar plant uses include makeup, beautiful cotton clothes, wooden toys, chocolate, and antiseptic cream.

- Record: Lists can be recorded and illustrated in the children's' Banks nature notebooks.

## Resources

- Plant uses information and images.
- Banks nature notebook
- Images and interactive games
- Health and safety information plant products

## **Plant uses**

People use plants every day in an amazing variety of ways. As well as providing the oxygen in the air we breathe, plants feed us, clothe us, shelter and protect us and provide a variety of leisure items to help us enjoy ourselves.

### **Plants for food and flavouring**

Remember that we eat plants both directly and indirectly. Our meat, including poultry and fish also eat plants as part of their food chain.

- Fruits, vegetables and leaves, fruit juices
- Tea, coffee, cocoa, coca-cola, chocolate, beer and wine
- Breakfast cereals, rice, flour and flour products such as bread and biscuits
- Margarine and vegetable oils
- Chutneys, jams and sauces (like tomato sauce)

### **Plants as fibre and clothing**

- Cotton, linen, ramie, viscose (made from cellulose from Eucalyptus or conifer trees)
- Sisal (string products), hemp, jute (cloth sacks), coir (coconut matting)

### **Plants for work and play**

- Books and paper, wood products
- Paintings and art including frames, paper, canvas and some paints
- Board games, jigsaw puzzles and darts (dartboards are usually made of sisal fibre)
- Make-up and cosmetic products, perfumes, soaps and bath products
- Dyes for decoration such as woad, madder, and henna
- Flowers in the garden and natural habitats in the countryside to walk through

### **Plants for health**

Many plants are used to maintain healthy bodies as well as medicines.

- Plants for flavouring toothpastes include mint and cinnamon
- Cough syrups often include liquorice
- Soothing gels may contain plants such as aloe vera and witch hazel

- Products containing salicylic acid. This chemical is found in *Salix alba* (white willow) though originally isolated from *Filipendula ulmaria* (rose family). It is used to produce aspirin.

Children should not be encouraged to explore medicine cabinets though could investigate and research plants used as medicines. Parents should supervise children doing research.

Plants that would be interesting to research include:

- *Digitalis* (foxglove) for heart complaints (MUST NOT HANDLE)
- *Catheranthus roseus* (Madagascan periwinkle) for leukaemia
- *Cinchona* species (quinine) for malaria

### Plant adaptations

<p><b>Habitat</b> Rainforests: wet and hot, with poor light at ground level and poor soil.</p> <p>Plants: Rubber plants, Ferns, Orchids, Banana, Coffee.</p>	<p><b>How plants have adapted</b></p> <ul style="list-style-type: none"> <li>• Big leaves to capture as much light as possible.</li> <li>• Some leaves have a waxy surface, so excess water runs off.</li> <li>• Some plants climb up to the upper branches.</li> </ul>
<p><b>Habitat</b> Desert, hot with little water.</p> <p>Plants: Cacti, Yucca, Tumbleweed, some types of flowers, stone plants.</p>	<p><b>How plants have adapted</b></p> <ul style="list-style-type: none"> <li>• Small leaves or spines</li> <li>• Storing water in large stems</li> <li>• Opening breathing pores at night</li> <li>• Disguise to look like stones to avoid being eaten.</li> </ul>
<p><b>Habitat</b> Peat bogs: poor soils, low nutrition.</p> <p>Plants: Carnivorous, Venus flycatcher, sundew, water lilies, pickerel weed, cranberries and blueberries also grow in bogs.</p>	<p><b>How plants have adapted</b></p> <ul style="list-style-type: none"> <li>• Sticky hairs and traps to catch insects</li> <li>• Long tubes where insects fall into</li> <li>• Very long roots</li> <li>• Will tolerate low oxygen levels</li> </ul>
<p><b>Habitat</b> Alpine – very cold with short summers, strong winds, dry when water freezes.</p> <p>Plants: Alpines, Gentians, Saxifrages</p>	<p><b>How plants have adapted</b></p> <ul style="list-style-type: none"> <li>• Tightly packed small leaves</li> <li>• Waxy leaves to store water</li> <li>• Small size, ground hugging.</li> <li>• Large roots</li> </ul>
<p><b>Habitat</b> Mediterranean – dry hot summers</p> <p>Plants: Thyme, Rosemary, Olives, Oranges</p>	<p><b>How plants have adapted</b></p> <ul style="list-style-type: none"> <li>• Small leaves packed with oils to stop water loss.</li> <li>• Plants are shrubby, able to grow again after fires.</li> </ul>

## Discoverers worksheet

Big plants don't always have big seeds. Can you match the right seed to the right plant?

Plant adaptations

See - [http://www.botanic.co.uk/FCKfiles/File/13\\_1aaaAwesome\\_Adaptations\\_worksheets.pdf](http://www.botanic.co.uk/FCKfiles/File/13_1aaaAwesome_Adaptations_worksheets.pdf)

## Dear Bank's Collectors

Hi there!

I am a volunteer who enjoys walking and discovering plants and animals on Lincolnshire Wildlife Trust Nature Reserves.

I have been busy making collections of seeds for the Lincolnshire seed bank and also collecting and pressing the plants that the seeds have come from. Using my field notes, we will be able to put all the information about the plant, its location, its habitat, the date and my name as collector on to the pressed plant sheet, which we call a specimen. This will get done when I get back to Horncastle.

I must be really careful not to lose my notebook, otherwise all these collections will be worthless!

I have noticed how different the plants are when they grow in different places. . The ones growing in the seashore look quite different from the ones growing inland on the flat fens or in the woodlands.

This must be true where you live. Have a look at the different habitats near your school and collect and press some plants from them to show the differences. It would be interesting to find out what you have observed.

Thanks for your help!

Richard

## **Curriculum links**

English Curriculum (Year 4)

- That different plants and animals are found in different habitats
- That plants are suited to the environment in which they are found
- Use a key to identify plants

## **Northern Irish Curriculum (P5)**

Thinking skills and personal capabilities:

- Managing information: (All activities)
- Thinking, problem-solving and decision making: (All activities)
- Working with others (Activities 2 and 3) KS2 The world around us:
  - Strand 1: Interdependence: How living things rely on each other within the natural world (S&T) (Activities 1 and 2)
  - Strand 1: Interdependence: The effects of people on the natural and built environment over time (S&T) (Activity 3)
  - Strand 3: Place: How place influences the nature of life (S&T) (All activities)
  - Strand 3: Place: Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment (S&T, G) (Activities 1 and 2)
  - Strand 3: Place: Features of and variations in places, including physical, climatic, vegetation and animal life (S&T) (Activity 2)
  - Strand 3: Place: Positive and negative effects of natural and human events upon place over time (S&T, G) (Activity 3)

## **Scottish Curriculum (P5)**

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

Living things and the processes of life: Level B/C

- Strand: Variety and characteristic features (to name some common plants using simple keys)

- Strand: The processes of life (to describe the broad functions of the main parts of a flowering plant)
- Strand: Interaction of living things with their environment (to explain how living things and the environment can be protected and give examples)

Skills in science - Investigating: Level B/C

- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

### **Welsh Curriculum**

Scientific enquiry: Key Stage 2

- Strand: The nature of science (to consider information obtained from their own work and other simple sources)
- Strand: Communication in science (to use a range of methods including drawings, tables and charts to record and present information)
- Strand: Investigative skills (to decide what information should be collected) Life processes and living things:

Key stage 2

- Strand: Living things in their environment (to find out about the variety of plants found in different habitats including the local area; how plants can be identified and assigned to groups by making and using keys)

## **Welcome to The Lincolnshire Plant Hunt**

### Learning outcomes

- State that certain plants (and animals) are found in some places and not in others.
- Recognise the different conditions in different habitats.
- Recognise that plants have adaptations that make them more suited to their environment.
- Understand that habitats can be lost and we need to protect them. Plants can become extinct if their habitat is removed and we save seeds in case those habitats are lost.
  
- Know how plant hunters keep a record.
- Can identify and name some common UK plants.

### **Concepts**

Habitats are places where plants and animals live together. Plants and animals are adapted to suit the particular environment in which they live. Plants that live in deserts look very different from those that live in wet places, as they have to save water. For example, to combat water loss some plants have waxy coats or reduce their leaf surface area to form narrow spines.

In woodlands, where there is a lot of shade in the summer, flowering plants such as primrose and wood anemone that live on the woodland floor (understorey) produce flowers before the leaves shade them out. Banks was very interested in this concept and made lots of collections, observations and recordings to document how plants and animals adapted to their surroundings. The 'Collectors' will do this too!

### **Meet the Plant Hunters**

- Read aloud Chapter 5 called 'Banks the Collector' from the Following in Bank's footsteps storybook to introduce ideas around how Banks worked and set the context for the children's' work.
- Introduce Richard the Plant Hunter by reading out his postcard and download the video from Richard from The Lincolnshire Plant Hunt website at Lincolnshire plant hunt website
- Watch Richard, a real life Plant Hunter, working in the field doing just the kind of observing and recording the children will be doing.
- These resources can be used for an assembly about the project, or to present in class to introduce the project.

### Activity 1: Nature walk

Activity 1 should be spread over two lessons.

## 1) Make a Banks nature notebook

- See the Banks nature notebook page in the binder.
- This will act as the Collectors' project notebook.

## 2) Nature walk

Spend about forty-five minutes walking in the school grounds, local park, churchyard or anywhere in the neighbourhood. You are looking for different kinds of habitat (see habitats table). Visiting a very different habitat like a wood, beach or moor would be fun.

### On the walk

Encourage the children to:

- **Observe:** Ask them to spot as many different types of habitat as possible, like shady areas, a grassy field, waste ground, or a crevice in a wall with only a few plants.
- **Think:** Think about the conditions in each place and how this might affect the plants which live there. Think about how plants have adapted to these habitats.
- **Compare:** Compare the conditions found in two different habitats you have found.
- **Record:** Count the number of different kinds of plants found in each and record these. Make sketches and take photographs.
- **Collect:** Look specifically for plants from the Identikit and list these in the

Banks nature notebook. Collect as many kinds as you can - with the owner's permission!

- **Label:** Plants should be put in a plastic bag as they are collected, with a label recording what they are and where they were found. Blow into the bag and knot the top so the plant does not dry out before returning to school.

Children may need supervision.

### Helpful hints

- Before you go out it, talk about the ways in which plants adapt to different habitats. Introduce the idea of a habitat – a particular place with its own set of conditions. This may be a big place – a macrohabitat – like a beach, cliff or meadow, or it may be a small place – microhabitat – like a crack in a wall, or the spot where the drainpipe leaks. Plants can live in almost any habitat, but only if they are adapted to cope with the conditions. Use images from the habitats folder on The Great Plant website's image bank at Lincolnshire plant hunt website to help explain these differences.

- If appropriate apparatus is available, measure some of the differences in the different habitats like temperature or light level. Or make simple observations like: the ground is damp/dry, it is shady/sunny.

- Use images from the habitats folder on The Great Plant website's image bank at Lincolnshire plant hunt website to get the children spotting different kinds of habitats. These can be useful for a preparatory activity and to jog childrens' memories after the walk.

If your walk is delayed by weather this will be useful.

- When using plastic bags for collecting plants, please make sure children are aware of the dangers. Follow appropriate procedures after handling plant material.

- See Activity 2 in the Thinkers booklet (ages 7-8) and adapt some of this activity if needed for revision of some key ideas.

## Resources

What's in the binder? Things you need to collect

- Banks nature notebook page - Make sure the children have project

- Health and safety information notebooks

- Habitats information - Cameras (optional)

The fun stuff - Newspaper, secateurs, plastic bags.

Check the Lincolnshire Plant Hunt website What's in the Endeavour Treasure Chest?

at Lincolnshire plant hunt website for images - The Lincolnshire Plant Hunt Identikit

of different habitats. - Paper bags or envelopes for plants

## Activity 2: Fitting in

Activity 2 should be spread over two lessons.

In this activity the plants collected on the Nature walk will be observed carefully, measured and recorded, then pressed to preserve them. If the same plant is found in the two different habitats, make a special note if they are different in any way.

- Plan: In pairs, ask the children to look at the plants they have collected and choose at least two from different habitats to study in detail.

- Compare and record: Record and compare conditions found in

the two different habitats, and features of the plant(s) found in each, like height, leaf size, colour of leaves, whether they have flowers or fruits and the general health of the plant.

- Think: Compare the different conditions in the two habitats. Try to think of reasons for any differences you have found between the types of plants found there and any differences between the same type of plant growing in two places. Think about threats there might be to these habitats, like drying out in summer.
- Process: Follow the instructions on pressing plants to preserve the specimens collected. If any seeds or other extra plant parts are available, collect them in small paper packages so you can add them to your herbarium specimens – just like Banks did.

### Helpful hints

- Press plants straight after collecting - before they wilt.
- Plants that grow in different places often end up with very different forms.

For example, where dandelions are growing in mown grass they are mainly flat rosettes, while those in flowerbeds are quite tall. Similarly a plant that is in a shady spot might be long and lanky and one in a sunny spot, quite short.

- Some plants have specialised so much that they only succeed in one spot.

Plants with big leaves are happy in the shade where their leaves catch the little light there is, but in the sun they dry out too fast. Plants with tiny leaves stay moist in the sun but can't catch enough light to live in the shade. Even plants have to make compromises!

### Resources

What's in the binder? What's in the Endeavour Treasure Chest?

- Banks nature notebook page - The Lincolnshire Plant Hunt Identikit
- Health and safety information - The Lincolnshire Plant Hunt Plant Press
- Habitats information Things you need to collect
- How to press plants and make a herbarium specimen - Banks nature notebooks
- Newspaper

### Activity 3: Collecting specimens

Activity 3 should be spread over two lessons.

### 1) Are you collecting your specimens?

Make a herbarium specimen using the pressed plants collected in Activity 2 (group or class activity depending on number of plants collected).

### 2) Envelopes for seeds and parts

If any seed was collected ask the children to make and label a small envelope like those Banks made and put the seed in it. Attach the packet to the appropriate specimen.

### 3) Comparing specimens collected 200 years apart

Using the images on the back cover or from the website at Lincolnshire plant hunt website, ask the children to study the differences between the two herbarium specimens.

- **Observe:** Print out the worksheets. Ask children to look for similarities and differences in the way each plant has been pressed and displayed. Ask them to compare this with their own specimens. Design a new stamp for their own specimen based on Kew's official stamp.
- **Think:** Challenge children to say why it is important to collect and record plants. Why is it particularly important for conservation?
- **Extension activity:** As an extension activity, ask children to make a key to separate all or some of the different plants the class has collected and pressed. Ask another pair or trio to try their key out!

#### Helpful hints

- If no photos were taken, sketch using images from the website or Identikit.
- Herbarium specimens, as used by Banks are not very different today.

These dried specimens are a formal record of what a plant is and where it can be found. Scientists from all over the world use specimens from Kew to identify known species and find out if they have discovered a new one. They are also useful when working out if a plant can be safely used in a product. (See also plant uses resources in the Bank's Thinkers booklet and on the website at Lincolnshire plant hunt website).

- Banks and other Plant Hunters made seed packets from paper, occasionally fixed with pins but more often held together by careful folding. By looking at the photograph below you should be able to copy it or work out other ways of making them.
- Collecting and recording data about plants allows us to check whether plants and their habitats are there over time and what changes. There are many threats to habitats and plant species and some disappear.
- Suggested differences between the specimens:

- Bank's specimen is hand written, modern day specimen is printed.
  - Seed packet shapes differ.
  - The plants are attached in different ways.
  - The amount of information presented differs.
  - Stamps are present on Bank's specimen.
  - There is more than one stem with labels on Bank's specimen.
  - Different plant names appear on the labels of Bank's specimen.
- 
- The plants are different.
  - The state of the paper differs.

#### Resources

What else is in this booklet?    Things you need to collect

- Herbarium specimen images    - Make sure the children have project
- Childrens worksheets    notebooks

What else is in the binder?    The fun stuff

- How to press plants and make a    Check the Lincolnshire Plant Hunt website
- herbarium specimen    at Lincolnshire plant hunt website for videos

What's in the Endeavour Treasure Chest?    about how herbarium specimens are

- The Lincolnshire Plant Hunt Identikit    used by scientists

#### **Collectors worksheet**

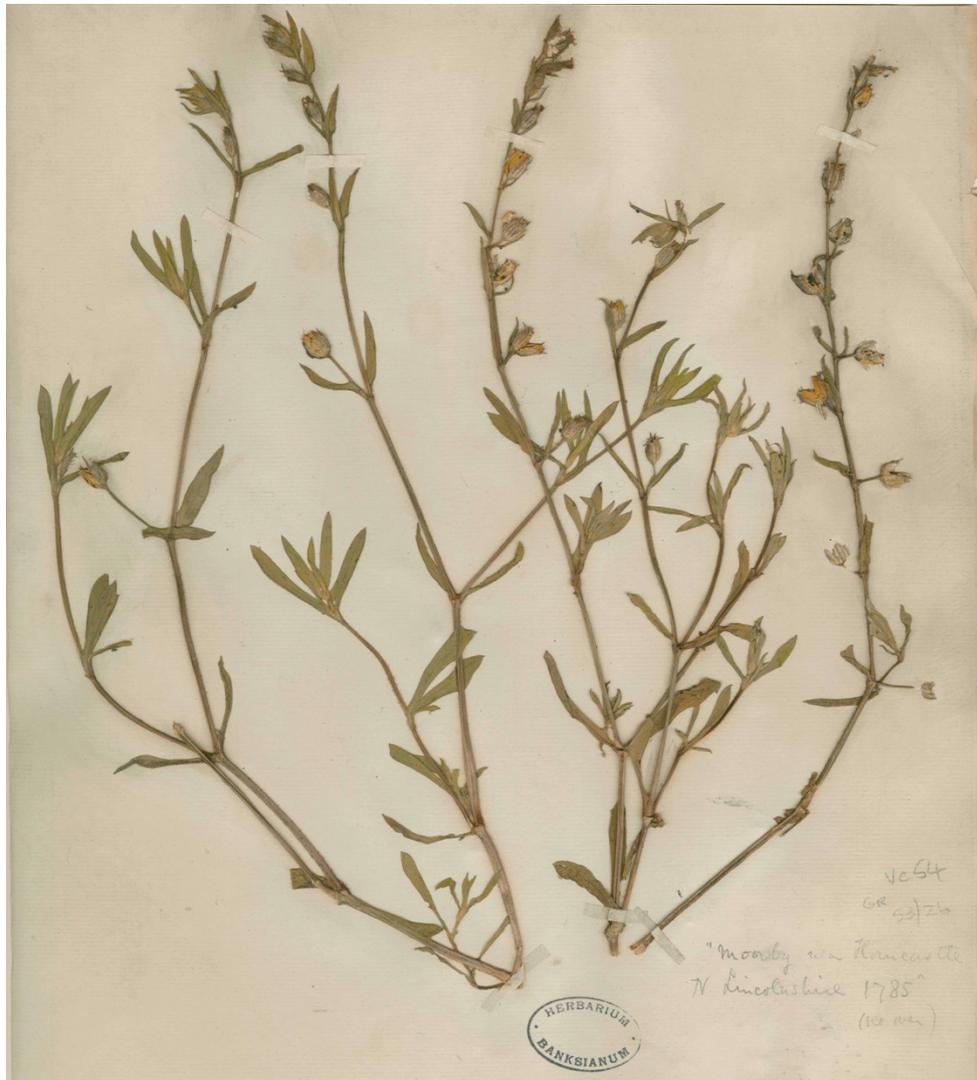
1) Look at the photos of the two plant specimens. One was collected and pressed 170 years ago. The other is a recent example. Can you spot the differences between the sheets and describe them? How do they compare with your own specimen?

2) Herbarium specimens usually have an official stamp like the round one here. Why don't you have a go at designing a new 'stamp' for the pressed plant specimens you are making at school

**A Banks herbarium specimen**

A specimen of Bank's collected in a cornfield at Moorby in Lincolnshire

*Silene Gallica* Small-Flowered Catchfly - thought to be extinct in Lincolnshire until recently discovered on Woodhall Spa airfield.



Among the corn at Moorby near Horncastle Lincolnshire 1785.

## Dear Bank's Investigators

My name is Paul, and I like to walk along rivers and around lakes and ponds. I have been thinking about how I might collect waterside plants and aquatics for the Lincolnshire plant hunt.

Have you noticed how many similar plants spread along the banks of rivers for miles and miles

They must have some special way of making sure that their seed can be spread down the river.

It would really help me if you could have a look at some seed for me at school and try and work out how they travel from one place to another. Perhaps you could also check out how the seeds germinate as well.

All that information might provide some clues as to how my plant gets spread around the World.

Happy experimenting!

Paul

## Curriculum links

### English Curriculum (Year 5)

- That seeds can be dispersed
- Some plants produce many seeds and some few
- Consider conditions that might affect germination and how to test them
- The life cycle of flowering plants including pollination, fertilisation, seed production, seed dispersal and germination

### Northern Irish Curriculum (P6)

Thinking skills and personal capabilities: Managing information: (All activities) Thinking, problem-solving and decision making: (All activities)

KS2 The world around us:

- Strand 1: Interdependence: How living things rely on each other within the natural world (S&T) (All activities)
- Strand 1: Interdependence: The effects of people on the natural and built environment over time (S&T, G) (Activity 2)
- Strand 3: Place: How place influences the nature of life (S&T) (All activities)
- Strand 3: Place: Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment (S&T, G) (Activities 1 and 2)
- Strand 3: Place: Features of and variations in places, including physical, climatic, vegetation and animal life (S&T) (Activity 2)
- Strand 3: Place: Positive and negative effects of natural and human events upon place over time (S&T, G) (Activity 2)
  
- Strand 4: Change over time: How change is a feature of the human and natural world and may have consequences for our lives and the world around us (S&T) (Activity 1)

### Scottish Curriculum (P6)

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

## **Scottish Curriculum (P6)**

Living things and the processes of life: Level C/D

- Strand: Variety and characteristic features (to name some common plants using simple keys)
- Strand: The processes of life (to describe the main stages in flowering plant reproduction)
- Strand: Interaction of living things with their environment (to give examples of how plants and animals are suited to their environment) Skills in science - Investigating: Level C/D
- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

## **Welsh Curriculum (Year 5)**

Scientific enquiry: Key Stage 2

- Strand: The nature of science (to consider information obtained from their own work and other sources)
- Strand: Communication in science (to report their work clearly in speech and writing using relevant scientific vocabulary; to use a range of methods including drawings, tables and charts to record and present information)
- Strand: Investigative skills (to turn ideas into a form that can be investigated; to ask questions when planning what to do; to decide what information should be collected) Life processes and living things:

Key stage 2

- Strand: Green plants as organisms (the main stages in the life cycle of flowering plants including pollination, seed production, seed dispersal and germination)
- Strand: Living things in their environment (to find out about the variety of plants found in different habitats including the local area; how plants can be identified and assigned to groups by making and using keys)

## Welcome to The Lincolnshire Plant Hunt

### Learning outcomes

- Know that flowers produce seeds.
- Can predict how unknown seeds disperse according to their structure and shape.
- Can devise and carry out a fair investigation.
- Understand that not all seeds and seedlings survive – some would die from lack of light/water/space.
- Know seeds need warmth and water for germination.
- Know that a collection of seeds represents a population of individuals that vary just as much as we do.
- Recognise that germination and seed dispersal are part of a life cycle.
- Can identify and name some common UK plants.

### Concepts

Plants have a number of mechanisms that allow them to spread their seed over a wide area. This gives seeds a better chance of finding enough space and other resources to grow well. Seed dispersal means that similar plants may be quite far from each other.

The life cycle of a plant is the process from seed through germination, growth, flower production, pollination, fruit production and back to seed. This set of activities covers the germination and dispersal aspects of the life cycle. You could weave in subject areas of reproduction, pollination and so on to complete the full plant life cycle.

In these activities the 'Investigators' will explore seed dispersal and germination and set up a fair test to explore the germination of collected seeds. The investigation will also show children that variation exists in plants, a concept integral to Bank's work. They will also be able to collect, prepare and send seed to the Kew's Lincolnshire seed bank.

- These resources can be used for an assembly about the project, or to present in class to introduce the project.

### Activity 1: Daisy observation

Activity 1 should be spread over two lessons.

#### 1) Make a Banks nature notebook

- See the Banks nature notebook in the binder.
- This will act as the Investigators' project notebook.

## 2) Using a quadrat

- This involves visiting the same patch outdoors over a period of weeks, and carefully observing changes and thinking about them, just as Banks did. The Investigators will watch a patch of daisies as they grow, flower and fruit.
- It can be difficult to find daisies in fruit. They are usually found in mown short grass or lawn areas, but mowing cuts off the flowering head and stops it from reaching fruiting stage. To get round this, find a patch of grass 1m by 1m square with a good number of daisy plants. Protect the spot from interference by cordoning it off. This is known as a 'quadrat'. Make sure it stays untouched for observation over time. Here, daisy flowering heads can mature into fruiting heads, and there will be seed for the children to collect.
- Banks used many such 'set aside' pieces of ground to help him with his observations, often leaving bare patches of ground to see what plants would suddenly appear from seed in the ground. An experiment of this kind would make a good extension activity.

## 3) Daisy seed collection

- Observe: Children should look at the daisy plants regularly and discover how they change over time.
- Record: Look closely at daisies. How can you tell when they are in bud, in flower and when they have set fruit? Take photos of a daisy at all these stages and upload the photos to the website at Lincolnshire plant hunt website to share with other schools.
- Collect: Tell the children to collect seed when the daisies have set seed. It is important to record exactly where the daisy seeds were collected. This can be done using an Ordnance Survey map (1:50,000 land ranger series) giving grid references, or using Google Maps to pinpoint where you are ([maps.google.com](https://maps.google.com)). If the seed is collected in the school grounds, the school postcode is enough.
- Back in class: The daisy seed should be processed. See the guide to banking seed and using the mini seed bank.
- Send daisy seed to Lincolnshire seed bank:

### Helpful Hints

- Care should be taken when working with wild flowers. Please make sure that the children work to good practice protocols. (See seed collection guidelines).
- Do not use plastic bags for collecting seed as they can quickly go mouldy.

- Follow appropriate procedures after handling plant material. Health and safety information can be found in the binder.
- The seed collecting protocol and the mini seed bank can be used to preserve and store any seed. You could collect wild flower seed or seed from the school garden to use in germination experiments.

## Resources

What else is in this booklet?      What's in the Endeavour Treasure Chest?

- Collecting daisy seed and sending it      - Collecting bags

back to Kew's Millenium Seed Bank      - Mini seed bank

What else is in the binder?      - The Lincolnshire Plant Hunt Identikit (you

- Banks nature notebook page      will need to refer to images of daisies

- Health and Safety information in fruit)

- Seed collecting guidelines      The fun stuff

- Seed collection data form      - Check the Lincolnshire Plant Hunt website

- Seed banking using the mini seed      at Lincolnshire plant hunt website for details

bank      of what to do with your daisy

Things you need to collect      collection and data, videos about

- Banks nature notebooks      Kew's Lincolnshire seed bank, and

- More collecting bags if needed interactive games

Collecting daisy seed and sending I to Kew's Lincolnshire seed bank

When is daisy seed ready to collect?

- As the seeds of the daisy approach maturity, its ray florets (the white 'petals' round the outside) wither and may disappear completely.
- The disc florets (the yellow part in the centre) turn golden-brown and become loosely attached.
- In a fully ripe seed head, the disc florets should come away quite easily when rubbed with a finger. This leaves behind a green conical structure (the receptacle).
- The tiny seeds are contained within the brown remains of the disc florets.

- Seed should be collected once seeds have reached the ‘point of natural dispersal’, meaning they are being shed naturally – like in the picture above.
- Collect the seed either by rubbing the seeds free into a bag, or by removing individual flower heads intact. The former method ensures that all the seeds being collected are ripe – if they are difficult to rub off the receptacle, it is probably too early to collect the seed.

#### Sending daisy seed Lincolnshire seed bank

Please process (dry) and bank your daisy seed according to the instructions on seed banking using the mini seed bank before sending it. After drying, daisy seed collections should be sealed in the small seed envelope and posted using the addressed envelope – both found in the mini seed bank.

#### Data to send with your seed

Kew’s Lincolnshire seed bank would like schools to enter data on the form below and send it along with the daisy seed collection.

#### Activity 2: Shaking, flying, sticking!

Activity 2 should be spread over two lessons.

#### Nature walk

- Plan: Ask the children to plan their Nature walk. What will they need to take? How can they avoid damaging plants or living things when on their walk? Ask children to draw up a code of conduct for working with living things.
- Discuss: Children discuss how many ways they think seeds can be spread.
- On the walk: Go on the Nature walk for about thirty minutes. Children should look out for plants with seeds and think about how they spread seed.
- Observe: Look closely at different plants with fruits and seeds. Is it obvious how seed is spread? Can the children spot more than one way seeds spread?
- Collect: Tell the children to collect seed from any plants in the Identikit.
- Record: Using a camera or by drawing in the Banks nature notebooks, record some of the different ways in which seeds are spread, such as parachutes on dandelions, wings on sycamore seeds.
- Back in class: Children should think about how they can replicate some of the seed dispersal techniques. These ideas can be written up in their Banks nature notebooks along with a list of equipment needed and anything else they will need to test out their ideas.
- Create: Children should produce and test out models of seed dispersal.

## Helpful hints

- A fun way to show how seeds can be moved from place to place by humans or animals is to get the children to put an old sock over their shoe and take a walk through some grass, playing field nearby. Once back indoors, you can remove the sock and have a look to see if any seeds or fruits have been caught up in the material.
- Care should be taken when working with wild flowers. Make sure the children create and work to a code of conduct. See the guide to seed collection in the binder.
- Check with the 'Discoverers' teacher (ages 6-7) if they saw daisies.
- Do not use plastic bags for collecting seed as they can quickly go mouldy.
  
- Follow appropriate procedures after handling plant material. Health and safety information can be found in the binder.
- Any seed can be processed and banked for future use like germination experiments. See the guide to banking seed using the Mini Seed Bank.

## Resources

What else is in the binder?      Things you to collect

Seed dispersal table with model-making ideas      Materials to make models

### Activity 3: Time for seeds!

Investigating Bank's theory on variation using sunflower

Activity 3 should spread over three lessons. Also allow for observation time.

## Materials

- Sunflower seed from mini seed bank. This is the same as you can buy in any garden centre. Give each child one or two sunflower seeds.
- Newspaper pots (see binder for how to make these), small flowerpots or yoghurt pots.
- Multi-purpose compost or soil.
- Sunflower info and germination images on the back cover.

### 1) Looking at the seeds

- Ask children to plan an experiment to see how long seeds take to germinate and think what they will need to help the seed germinate.
- Ask the children to draw round a seed on their Investigators worksheet

- Measure the length and width of the outline in mms and compare seed sizes from the class.
- Pool the class measurements and plot the length and width of each seed on a bar chart.
- What can you say about the range of sizes?

## 2) Germinating seed

- Get each child to fill their pot to within 2cm of the top with compost and tap the pot to settle the contents.
- Plant one or two seeds in each pot, pointed end down, and push it 2cm into the compost.
- Label each pot with the pupil's name and date. Water until compost is damp.
- Place on a tray on a light window ledge, avoiding hot south facing windows.
- To be a fair test, everyone must plant seeds in the same way and agree what point counts as germinated (see photos on the back cover).
- Count the number of days for each seed to germinate (show 'green' above the compost) and plot the number of seeds germinating each day on a frequency histogram
- Data from the class should be combined and the number of seeds germinating for each successive day of the test plotted on a bar chart.
- Ask the children what this range of results shows.
- Use the tools on the Lincolnshire Plant Hunt website at [Lincolnshire plant hunt website](#) to share your germination data with schools across the country! How does yours compare?

## 3) Planting, growing and saving seed for next year

- When the second set of leaves appear the sunflower plants may be planted in the school garden or taken home and planted in a sunny spot in the garden or in a large pot on a patio. Remind the children to water them regularly.
- The height of sunflowers can be measured when they flower and further class comparisons can be made
- After the flower has finished, the seed head may be hung outside in a dry place to feed birds during the winter. Alternatively, seeds may be processed, dried and saved in the Mini Seed Bank ready to be grown next year

## Helpful hints

- Germination occurs in approximately 2-5 days, so time planting to suit the class.
- It is unlikely that any more seeds will germinate after 14 days.
- The histogram should be bellshaped as shown, illustrating a normal distribution of emergence times. This shows that there is variation even between plants of the same species – a key finding that Banks worked on. This means that if there is a disaster like a snail coming to feed or a very sunny day that shrivels them up, some seeds that come up later will still be OK.
- Plotting length and width of all the individual seeds and the heights of each plant when they flower will provide more evidence of variation even in one type of plant.
- As an extension activity, children can explore what difference size of seed makes to the time it takes to germinate. Which germinated first, large or small seeds?

## Resources

### About sunflower

The sunflower is a large annual plant that can grow up to three metres tall, depending which variety you plant. The tall, rather hairy stem carries many large oval and bristly leaves. The large head is actually a group of flowers (like daisy, dandelion, thistle and coltsfoot), with sets of non-fertile florets around the outer edge (ray florets) and many inner smaller flowers across the flat central disc (disc florets). When fertilised, the single egg develops into a fruit, covered with a thin papery skin. These fruits - often called the 'sunflower seeds' – are arranged in amazing interconnected spiral patterns across the central flat disc of the flowering head.

### Sunflower uses

- The seeds are good to eat and contain Vitamin E and a chemical called linoleic acid which helps to reduce cholesterol.
- Sunflower is frequently an ingredient in breakfast cereals and snack bars as well as a topping for breads and salads.
- The seeds also make very good bird-food or can be kept to sow the following year.
- Sunflowers are grown by farmers for the valuable seeds which are added to animal feed and also as a source of oil.
- Sunflower oil has a pleasant flavour and is one of the best all-purpose oils. It is suitable for frying, for making salad dressings and can be used to make margarine.

## Fun facts

- The enormous nodding sunflower head inspired Van Gogh's famous paintings.
- The flowering and fruiting spirals you see across the head are consistent in number, with 34 in one direction and 55 in the other. On large sunflowers you may find 89 and 144. This mathematical patterning, shown by many plants, was first written about by Fibonacci – try an internet search to find out more about his fun mathematics.
- Sunflowers have been domesticated for almost 5000 years. They were probably first cultivated in Mexico.
- Many peoples throughout history, including the Aztecs and Incas, have worshipped the sunflower as a symbol of the sun god.
- The botanical name is made up from the Greek word 'helios' which means sun and 'anthos' which means flower.

#### Germinating sunflower

When has the seed germinated? It's important to agree what counts - like as soon as some green shows above the soil.

When the second set of leaves appears the sunflower plants may be planted in the school garden or taken home and planted in a sunny spot.

Dear Bank's

Plant Detectives

Hi there!

I am collecting seeds for the seed bank here in Lincolnshire. It is really important that we collect a lot of seed of each type of plant wherever it grows in the UK. That way we have a record of how varied the plant can be.

This week I had a bit of a problem, where all the seeds I had collected fell out of my bag and some of the labels got lost. What a disaster! I have spent ages collecting these and it is really important that we know exactly which seed is which. I will just have to sort it out somehow.

I think one of the unlabelled packets is in the chest you received. Perhaps you could help by identifying those for me. It will be one less job for me to do! Part of our work is also to find out about how plants are used. If you have time, it would be fun if you could do some research on the mystery plant, once you know what it is.

Thanks a lot!

Tammy

Curriculum links

### **English Curriculum (Year 6)**

- Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest explanations

### **Northern Irish Curriculum (P7)**

Thinking skills and personal capabilities: Managing information: (All activities) Thinking, problem-solving and decision making: (All activities)

Working with others (Activity 1) KS2 The world around us:

- Strand 1: Interdependence: How living things rely on each other within the natural world (S&T) (All activities)
- Strand 3: Place: How place influences the nature of life (S&T) (All activities)
- Strand 3: Place: Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment (S&T) (All activities)

### **Scottish Curriculum (P7)**

These resources will be reviewed against specific experiences and outcomes in the new Curriculum for Excellence frameworks in 2009.

Living things and the processes of life: Level D

- Strand: Variety and characteristic features (to give the main distinguishing features of the major groups of flowering and non-flowering plants)
- Strand: The processes of life (describe the main stages in flowering plant reproduction)
- Strand: Interaction of living things with their environment (to give examples of how plants and animals are suited to their environment)

Skills in science - Investigating: Level D

- Strand: Preparing for tasks (understanding, planning, designing tests and predicting)
- Strand: Carrying out tasks (observing, measuring and recording findings)
- Strand: Reviewing and reporting on tasks (presenting, evaluating and understanding the significance of findings)

## **Welsh Curriculum (Year 6)**

### Scientific enquiry: Key Stage 2

- Strand: The nature of science (that scientific ideas can be tested by means of information gathered from observation and measurement)
- Strand: Communication in science (to report their work clearly in speech and writing; to use a range of methods to record and present information)
- Strand: investigative skills (to turn ideas into investigations; to know that in situations where factors can be identified and controlled, a fair test can be carried out)

### Life processes and living things: Key stage 2

- Strand: Green plants as organisms (to investigate the effect on the growth of plants of changing their conditions; that plants need light to produce food for growth)
- Strand: Living things in their environment (to find out about the variety of plants found in different habitats including the local area; how plants can be identified and assigned to groups by making and using keys)

## **Welcome to The Lincolnshire Plant Hunt**

### Learning outcomes

- Can devise and carry out a fair investigation.
- Know how to use identification tools.
- Can recognise variation in plants.
- Can identify and name some common UK plants.

### **Concepts**

Banks tried to solve many mysteries. In order to resolve these mysteries he chose to work very methodically as all scientists do. He often made a hypothesis and then devised ways to test this out. His testing involved experiments, data collection, data recording and analysis of the evidence.

Scientists at Kew regularly identify fresh seed to confirm that it is what they think it is!

Recently, the seed scientists were able to identify seeds that had been found in an old notebook and which were over 200 years old.

The children will be asked to solve a similar mystery. They will be asked to identify the plant that grows from the mystery seeds in the packet in the Endeavour Treasure Chest.

Children will need to consider how to combine evidence from observation and measurement with creative thinking to suggest explanations.

### **Meet the Plant Hunters**

- Read aloud Chapter 7 called 'Banks the Plant Detective' from the Following in Bank's footsteps storybook to introduce ideas around how Banks worked and set the context for the childrens' work.
- These resources can be used for an assembly about the project, or to present in class to introduce the project.

#### Activity 1: Nature walk

Activity 1 should be spread over three lessons.

##### 1) Make a Banks nature notebook

- See the Banks nature notebook from the binder.
- This will be the Plant Detectives project notebook.

##### 2) Introducing the mystery – **needs completing**

- Challenge the children to find out what the mystery seed is (from the Endeavour Treasure Chest).

#### Nature walk

Take the children on a Nature walk. Looking at plants and seedlings may offer inspiration for resolving the problem, and help rule out some of the options. Children can work in pairs to discuss it. Ask them to discuss and write up ideas into their Banks nature notebooks.

- Plan: Get the children to think about what equipment they will need for the walk.
- Observe: Look out for plants with seeds. Do any seeds look like the mystery seeds? Can any be ruled out? Look closely at plants. What do they need to grow well? Light? Space?
- Record: Children can record any thoughts about what plants need to grow or about how they will find out what the mystery seed is and what it needs to grow.
- Back in class: The children should explain their thoughts about how to unravel the mystery. Ask the children to plan how they are going to detect which plant these seeds are from. Ask them to write up a set of procedures for the next stage.

## Resources

What's in this booklet? Things you need to collect

- Mystery seeds grow after 200 years
- Banks nature notebooks
- Paper bags for plants and seeds.

What else is in the binder? - Alternatively, use plastic bags. Inflate

- Banks nature notebook
- the bag before closing. This helps keep

What's in the Endeavour Treasure Chest? plants 'fresher' for examination in class

- Magnifiers
- A small trowel or spoon to dig up

The fun stuff plants

Check the Lincolnshire Plant Hunt website at

Lincolnshire plant hunt website for videos about

identifying mystery seeds

Activity 2: Name that plant!

Activity 2 will take two lessons - one for setup, one for observation and results.

- 1) Count the seeds in the mystery packet and share them out. The children should examine the seeds against the Identikit species for clues from their appearance. The Identikit will also help with ideas about the different conditions different seeds need to germinate. How could you use this information to help identify the plants?
- 2) The experiments should use light and at least one other variable and be a 'fair test'. Plant the seeds and make sure all plants and test options are labelled well.
- 3) Seed germination should be observed and recorded. Children should compare the emerging seedling with the Identikit and draw a conclusion on the identity of plant.
- 4) Children should pool results (identification and germination requirements) and make a display to show the school how they solved the mystery.

Helpful hints

- Draw on children's knowledge of what might be needed for successful germination.

They should all know that water will be essential so you should not need to test this.

- You may need to set up some control options to make sure at least some seeds grow.

- The mystery seeds need light for germination. The simplest test would compare germination in complete darkness and in light. A classroom experiment in dishes with seeds sown on wetted paper towel and covered in cling film for the light test and foil for the dark test would reveal this nicely. The seedlings can be potted into newspaper pots to grow on to see the first leaves and so identify the plant.

## Resources

What else is in the binder?      Things you need to collect

- Newspaper pot instructions      - Equipment enough to test out
- Species guide for teachers      germination of seeds using light and

What's in the chest?      dark; trays, water sprays, labels and

- Mystery seeds (in mini seed bank)      newspaper to make pots
- The Lincolnshire Plant Hunt Identikit

## Activity 3: Find that plant

Activity 3 should be spread over two lessons.

### 1) Nature walk

Children should go out and try to identify their mystery plant in the local environment.

- Observe: Where does the mystery plant grow? Do individual plants differ?

Check for variation in leaf shape/size, height of plant, hairiness, colour etc.

- Collect: Take photos or specimens of plants and seeds and their differences.

2) If seed is collected, children need to process and bank the seed using the seed harvesting and processing notes. This banked seed can be left as a mystery for the following year's Plant Detectives.

3) Use the Plant Detectives worksheet for a seed packet design activity.

4) Research uses of the identified plant; pool information on the plant in a plenary session.

## Helpful hints

- If you have not done Activity 2, you can still do this activity once you have told the children the name of the mystery seed.
- It might be useful to carry out a search ahead of time for this plant. The many plants within this group (genus) Rumex (dock) all look quite similar. Use a similar looking dock to work with if Rumex acetosa can't be found. If there are no plants locally, or no seed of this species available to bank, ask the children to research this and one other selected plant from the Identikit.
- Children could collect seed from the school garden and bank this for the next year's Plant Detectives – along with the seed packet and instructions they have created. If they bank seed from the listed plants they could choose to leave the packet unlabelled as a mystery for the next year.

## Resources

What else is in the binder?      What's in the Endeavour Treasure Chest?

- Seed collecting guidelines      - The Lincolnshire Plant Hunt Identikit
- Seed collection form      Things you need to collect
- Seed banking using the mini seed bank - Cameras to photograph plants
- How to press plants and make a      (optional)  
herbarium specimen)      - Collecting bags

## Plant Detectives worksheet

- 1) Look at the examples of seed packets. What are the differences between modern seed packets and the ones Banks made by hand?
- 2) Now design a seed packet for the mystery seed, including some useful instructions for sowing and growing the mystery seed for next year's Plant Detectives. Don't forget to include some of the information you've worked out or researched – like the germination conditions. This sort of information is usually provided on seed packets to help people sow their seeds properly.

Seed packet

Mystery seeds grow after 200 years

The discovery

In 2006, Kew seed scientist Matt Daws was presented with some unidentified seeds that had been found by Roelof van Geider, a Dutch researcher working at The National Archives.

Some serious detective work was needed to find out how the seeds came to be among papers in the archives. How old were the seeds? Where had they come from? What types of plants were the seeds from?

Forty small packets of seeds were found inside a red leather-bound notebook inscribed with the name Jan Teerlink.

Each packet had a Latin name on the outside. The names suggested the seeds were from thirty-two different plant species.

A few seeds of each type were given to Matt who works at Kew's Millennium Seed Bank. He set about trying to identify them correctly and to see if any would germinate.

Meanwhile, Roelof used his detective skills to investigate Jan Teerlink and how his notebook and seeds came to be in the archives.

### **How the seeds came to Kew**

Jan Teerlink was a merchant from Vlissingen in Holland who travelled the world looking for interesting things to bring back to sell in Europe. In Jan's notebook with the seeds were small pieces of silk from China. He had sailed on the ship Henrietta to China and Java in 1802 and called into Cape Town, South Africa for provisions for the journey back.

Many lovely plants native to the Cape of Good Hope region of South Africa grew in the Dutch East India Company's beautiful garden in Cape Town. The names on the packets showed they were from this region. Did Jan's seeds come from this garden? Was he hoping to sell them to collectors in Holland?

On the way home in 1803, the Henrietta was intercepted by the British Navy and captured. Papers, logbooks and maps were confiscated and later handed over to the Admiralty. The sailors claimed prize money for bringing the ship and its men back to Britain. The seeds in their paper packets inside the notebook had a long damp sea voyage before they came to land. The High Court of the Admiralty put the seeds and the other documents in the Tower of London where conditions were not ideal for seed storage.

The seeds stayed there for nearly 200 years until they were handed over to the National Archives which moved into new buildings near RBG Kew. Here at last the notebook containing the seeds was kept in conditions where the temperature and moisture levels helped preserve them.

### **Detective work at the Lincolnshire seed bank**

At the seed bank, Kew scientists have over a billion seeds safely stored, so this was a good place to investigate the mystery two hundred-year-old year old seeds.

The names on the packets showed they were from the Cape of Good Hope region of South Africa. Matt and his colleagues thought about what the climate and the conditions were like in that area and how they could simulate these conditions in the laboratory.

In the Cape of Good Hope region, the winters are cool and wet and the summers are hot and dry. There are sometimes fires which burn all the plants in an area leaving it bare for seeds to germinate. Many seeds from this region need the heat of the fire to crack open their seed coats so that they can then absorb water and start to sprout. Some seeds need the chemicals in the smoke to wake them up and get them growing. The cooler winter season is the time for germination as the little seedlings would quickly be burnt up in the very hot sun.

Matt simulated the fire opening the seeds by chipping them with a file or a scalpel, like gardeners do with sweet peas, to let water enter the seed. To simulate the smoke for the seeds that might need the chemicals in the smoke, the scientists bubbled smoke through water and then soaked the seeds in that water. A cool winter-like temperature below 200°C was used to try to get the seeds to germinate

How many seeds germinated?

Of the 32 species of seeds that were planted, only three have germinated:

*Liparia villosa*

25 seeds were planted and 16 germinated. *Liparia* is a small shrub-like member of the Bean family.

*Leucospermum*

The second seed packet had the wrong name on it. By comparing the seeds with other seeds at the seed bank Matt could tell that the label was incorrect.

From eight seeds only one germinated. It has grown into a lovely healthy plant. It is a *Leucospermum* plant, a member of the pincushion flower family.

*Acacia*

Matt was given only two seeds for this species. One seed failed to grow because it had been damaged by insects, the other has grown into a healthy young *Acacia* tree 50cm tall. As there are many different species of *Acacia* we have to wait until our *Acacia* has flowers before we can finally know which one it is.

The importance of this detective work

The painstaking detective work done by Matt Daws and his colleagues has shown just how important it is to store seeds correctly so that they can survive for many years. The mystery seeds had not been stored in ideal conditions and the fact that three species were able to germinate confirms that seeds are remarkable little time capsules which are very resistant to harsh conditions.

### **Jan Teerlink's 200-year-old mystery seeds**

Germinating and growing Jan Teerlink's mystery seeds

A mystery sprout and a mystery plant grown from Jan Teerlink's seeds. It turned out to be *Liparia villosa* Find these images in the image bank at Lincolnshire plant hunt website