What's Under Your Feet?
Lesson plan

Join in our exciting citizen science campaign 'What's Under Your Feet? to help scientists at the British Trust for Ornithology (BTO) discover the impact climate change is having on bird populations across the UK.

Age range: 9-11, 11-14

Introduction

The British Trust for Ornithology (BTO) has found that many bird species are declining across the UK. The more scientists can find out about what is causing these declines, the better conservation efforts to protect them will be. One of the biggest gaps in knowledge is how food abundance affects bird populations and how this might be changing over time. Soil invertebrates are an important part of most birds' diets and so this project will greatly improve our understanding of bird populations.

What's Under Your Feet is a great example of 'citizen science' in action. Young people from Pod schools around the UK will make observations that are compiled into one large data set to be analysed by the BTO's scientists. This data will form the basis of a research paper, and participating schools and groups will be credited in this for their involvement.

Taking part is a great way to use your school grounds as a learning environment, find out more about the animals living in your school's habitats, develop real science skills and understanding, and by uploading your data, be a part of a real – and important – scientific project. It's a great way to inspire pupils through practical science.

The three 50-minute activities will help pupils aged 11-14 survey the invertebrate and bird populations in your school grounds over the course of a year. (You can also use the ideas with more able pupils aged 9-11 or adapt for younger children). Our detailed guidance minimises any planning you need to do yourself, and can be tailored to suit your needs.

Pupils are able to develop their:

- Practical skills and understanding of how to work scientifically
- Specific skills in sampling, measuring mass and length, data collection, observation, and pH measurement
- Understanding of what it means to take part in 'citizen science'
- Understanding of some of the birds and invertebrates that live in your school's habitats
- Literacy and numeracy skills in science.

Subjects

- **England:** Science
- **Scotland:** Science
- **Wales:** Science
- **Northern Ireland:** Science

Lesson Objectives

- To learn how to observe and record invertebrate populations through a soil sample survey.
- To apply practical science skills in sampling, measuring mass and length, data collection, observation, and pH measurement.
- To learn how to record bird populations through observations.
- To identify changes and differences in invertebrate and bird populations across a school year.
- To identify any correlations between invertebrate and bird populations.

What's Under Your Feet? Lesson plan

Preparation

Timings across the school year

Pupils should complete their invertebrate and bird surveys (optional) in October, March and June.
The bird surveys are optional, but should ideally take place within a week before or after each invertebrate survey, and your surveys should take place when it is not raining. Bird surveys can be done up to two weeks after the invertebrate survey if necessary (e.g. weather conditions prevent survey when planned). If you're signed up to the campaign on the Pod, you will receive reminders of when to do this.

Lesson timings

You may wish to devote more than 50 minutes to some or all lessons. Plan your timings accordingly.
Information pack

The BTO has worked with us to produce an information pack on birds, invertebrates and soil. The pack provides useful background information on how climate change may be affecting birds and invertebrates.

Invertebrate surveys

Pupils will count the earthworms and use a simple guide to identify the other larger invertebrates in and above the soil. There are also some optional extras that the class can record about the soil type and other factors that may affect invertebrate populations.

You will need to dig one or more 30cm x 30cm squares of soil on a playing field or similar grassy area. If your school grounds do not include areas of grass you may be able to obtain permission from your local Council to complete your surveys in a nearby public park.

It is OK to dig your holes at the edge of playing fields to avoid damage to any playing surfaces. However you may still wish to book access to your playing field or grassy area to ensure your pupils do not need to compete for space with pupils playing sports.

Invertebrate survey

Kit list

Spade or trowels – pupils will ideally work in groups (of up to five) but one spade can be shared around for each patch of soil

- 30cm rulers
- Trays, ideally white or pale coloured
- Containers. Plastic beakers, cups or yogurt pots would be ideal. Anything with sides too steep for lively invertebrates to climb.
- Identification guides
- Recording sheets

Optional:
- Weighing scales – accurate to at least 0.1g
- Measuring tape, metre sticks or some pre-measured string to measure 3m
- Litmus paper or pH paper and colour chart – one strip for each group
- 100ml beaker – one for each group
- Distilled water – one small bottle for each group.

You may also wish to provide tarpaulins or kneeing pads to help pupils keep their uniforms clean during their invertebrate surveys. Pooters, if available, may be useful for pupils who don't want to handle invertebrates, and a trundle wheel will help pupils to measure the area of the site you are sampling.

Bird survey (optional)

Kit list

- Identification guides
- Recording sheets

Optional:
- Binoculars
- A trundle wheel will help pupils to help measure the visible area of the site you are observing.

Health and Safety

Complete a Risk Assessment in line with your school's policies and guidelines. Pupils should wear sensible clothing and footwear suitable for digging in soil. Ensure all pupils wash their hands thoroughly with soap and hot water after completing their invertebrate survey, especially before eating.

What's Under Your Feet?
Lesson plan

Lesson timings and termly lesson content

You can complete the invertebrate survey and bird survey (if you are doing it) using any combination of lessons and extracurricular time.

The table below outlines suggested content to deliver at each stage. Each item in the table, for example the 'Introduction and starter', links to a section of detailed guidance for you to follow in the Delivery Guide in the following pages. Use this to deliver each lesson or extracurricular session.

October	March	June
Lesson 1 or extracurricular session Introduction and starter Planning and survey review	**Lesson 1 or extracurricular session** Review Invertebrate survey	**Lesson 1 or extracurricular session** Review Invertebrate survey
Lesson 2 or extracurricular session Invertebrate survey	**Lesson 2 or extracurricular session** Bird survey (optional) Data presentation and inputting	**Lesson 2 or extracurricular session** Bird survey (optional) Data presentation and inputting
Lesson 3 or extracurricular session Bird survey (optional) Data presentation and inputting	**Lesson 3 or extracurricular session** (None)	**Lesson 3 or extracurricular session** (Double session) Data analysis

Assessment for learning

- **Questioning:** Pupils could create a written plan for their sampling and observations
- **Pupil predictions:** Observation of pupils' invertebrate sampling and bird observations
- **Recording sheets:** Small group presentations of data interpretation
- **Discussion:** Follow-up work e.g. pupil displays, posters etc.

What's Under Your Feet? Lesson plan

Detailed delivery guide

The invertebrate and bird survey recording sheets are available from page 17.

Introduction and starter

- Introduce the activity and explain that pupils are going to put their practical science skills to work, to help the British Trust for Ornithology get a better understanding of the invertebrates that live in the ground around schools, and how these help the birds that visit school's across the year.
- Explain that this is a great example of 'citizen science' and ask pupils if anyone can explain what this term means.
- 'Real' science, leading to new discoveries, doesn't only have to be done by professional scientists. Citizen science is where volunteers take part in the scientific process and help with collecting, analysing and interpreting data. Anyone can take part! Citizen Science has lots of benefits for scientists and volunteers. Scientists can get lots of data from lots of locations, or by sharing data for other people to process, can get results a lot faster than would be possible if they worked as a small team. Volunteers get to have fun, learn some science as they take part, and feel a part of something big, and something that can make a difference – just like professional scientists!
- The BTO has been harnessing the power of citizen science for over 50 years. Thousands of people every year take part in bird surveys and send their data to the BTO. Those bird records are now one of the best wildlife datasets in the country and are used to keep track of UK bird populations. The data has been used by policy-makers to weigh up environmental decisions, by conservationists to work out how best to protect threatened species and by scientists to improve our understanding of birds.
- Briefly review pupils' understanding of the meaning of 'invertebrates'. Ask pupils to state the difference between an invertebrate and vertebrate.
- Divide the class into small groups. Ask each group to name, in one minute, as many invertebrate and bird species as they can think of, which might live in or visit your school's habitats.
- Help each group share their ideas with the class.
- Introduce the idea of food webs and chains and discuss how worms and invertebrates are an important food source for birds. Ask pupils to list what types of living things each chain or web should include (e.g. producer, primary consumer etc.).
- Extract and share a simple chain from the example food web below.
- Ask pupils to think of how many food chains they can design using the invertebrate ideas they listed, starting with a plant as producer and with each one ending with a bird as the tertiary consumer.
- Ask pupils how they think invertebrate populations might change across a school year, and what differences they might also see in the types and numbers of birds visiting your school grounds.

What's Under Your Feet?
Lesson plan

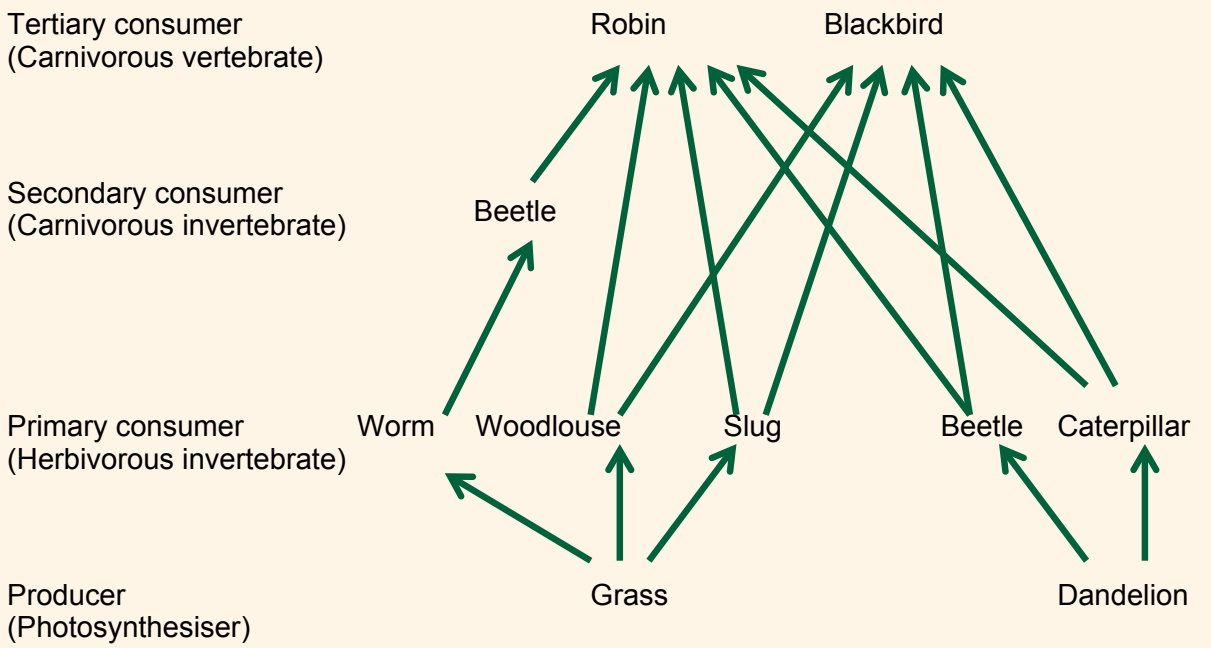
Make easier

- List some invertebrate and bird species or put them on cards and ask pupils to sort (Use the identification guides to help you).
- Demonstrate a simple food chain and invite pupils to suggest others.

Make harder

- Challenge pupils to think of at least five invertebrate and ten bird species they might observe during the year.
- Ask pupils to create a food web that includes other animals such as small mammals.

Example food web



What's Under Your Feet?
Lesson plan

Planning and survey review

- Explain that pupils need to consider how they might work scientifically to observe and record the numbers of invertebrates and birds they see.

Birds:

- Ask pupils to work in groups and agree how they might record bird visitors to your school grounds. What equipment or techniques might they use? Share ideas.
- Guide pupils to recognize that they should only record birds that land on the ground and not those they see fly overhead.
- Use questioning to help pupils identify that pupils observing a larger area of school grounds might see more birds than those observing a smaller area. How can pupils account for this? One answer is to measure each area under observation. This would allow BTO to adjust each school's observations to give the number of birds they would expect to see over a standardized area of grass.

Invertebrates:

- Now ask pupils to consider how they might record invertebrate numbers. Can pupils name some equipment and techniques they might need to use?
- Use questioning to help pupils identify that the number of invertebrates in areas of soil might vary because of small differences in habitat or just randomly. Taking several samples will let us make a better estimate of average numbers than just looking in one area, because unusual counts are likely to average out.
- Explain that even though pupils are making observations, it's still possible – and important - to ensure a fair test. This is important not only so your school can compare observations at each time of year, but also so that the observations made by lots of schools across the country can be combined into a single data set.
- Use these example questions to help you explore key ideas:
- What is the independent variable here? (The time of year)
- What is the dependent variable? (The numbers of each type of invertebrate or bird)
- What are the control variables? (The area observed (e.g. a square area of ground or the area of grass used to observe birds), location, weather conditions, time of day)
- If you have time, briefly review the two recording sheets pupils will use when they make their observations (you can do this during subsequent lessons or extracurricular sessions if you prefer).
- As a plenary, ask pupils to discuss in small groups what changes or differences they might expect to see in invertebrate and bird numbers across the year and make some simple predictions of how they think populations might vary across the seasons. What differences might they observe? Can pupils explain their ideas by telling a simple story of what happens, or by sketching a flowchart? Pupils can link their ideas to the life cycles of invertebrates and to how some birds are visitors to the UK, linking their ideas back to how the producers in their food chains and web, and different consumers, may vary during the year.
- Can pupils predict how these chains or webs might vary if, for example the producer plants flowered early in the year, or even all year round? What if they were to be unable to grow? How would this affect the food chains and webs, and the bird populations?

Make easier

- Use your school's rooms to explore the idea of density (pupils in a set area) – how widely spread out are pupils are if the whole class is in the hall compared to a small classroom? How does the density of invertebrates relate to how easy or difficult it is for birds to find food?
- Review only the basic recording sheet content.

What's Under Your Feet?
Lesson plan

Make harder

- Ask pupils to design a recording sheet for observing birds and justify how they would design tables to organise their data. Would the data be discrete, continuous or categoric? Explain that in practice pupils will use a ready-made recording sheet, so their data will match that from schools across the UK. (In the final optional session on data analysis pupils revisit this idea to identify that their data is:
  - Month - discrete
  - Invertebrate counts – discrete (or could be considered categoric, since they are counted in length bands)
  - Invertebrate masses - continuous
  - Bird counts – categoric.)

- After discussing sampling for invertebrates, ask pupils to suggest how they might use a different form of sampling when observing birds. The answer is that they can sample over time and observe for a small period of time that would be representative of what birds pupils might observe over a longer time.

- If you have already taught these concepts, help able pupils explore how they can make their investigations accurate, reliable and repeatable.

- Review all recording sheet content including the optional extras.

Invertebrate survey

The invertebrate survey recording sheet is available on page 17 (or it can be downloaded separately from www.jointhepod.org/resources/resource/445).

- Decide whether you will include the optional extra observations and measurements for some or all pupils to complete.

- You will need the equipment listed in the Preparation section.
- Before the lesson or extracurricular session, invite volunteer pupils to interview the caretaker or groundsman to find out whether the field has been treated with water, fertilizer, insecticide or herbicides in the last 12 months, and report back to the class.

- Starter: to get pupils focused on their task, ask pupils to recall the types of invertebrate they might expect to find under the ground at your school. Ask pupils to suggest how they might sort, store and count each type of invertebrate.

- Split pupils into groups and hand out the equipment and pupil sheets.

- Identify which groups, if any, will also complete the optional additional observations and measurements.

- Briefly review the pupil instructions sheet for the invertebrates survey, and the recording sheet onto which pupils should write the numbers of each type of invertebrate they find. Review the identification guide.

- Discuss how pupils can handle the invertebrates with care – they are living creatures, so ask pupils to treat them with respect.

- Ask pupils to suggest suitable ways to move invertebrates if they do not wish to touch them. Gently picking them up with the corner of a sheet of paper is one method, or use a pooter if you have any available (ask pupils to take care not to inhale any fine soil particles).

- Ask pupils to suggest how they can stay clean and safe while completing the activity. Remind pupils not to touch their mouths after handling any invertebrates and to wash their hands thoroughly at the end of the session.

Note: You can only upload data for up to five surveys, even if more groups take part.

What's Under Your Feet?
Lesson plan

- Give groups time to follow the instructions and complete their observations, selecting a spot at random and then digging a 30cm x 30cm survey square, 5cm deep (5cm below the turf but include invertebrates in the grass in counts). You may wish to pause early on and examine some sample invertebrates to demonstrate how to identify and handle them while measuring.
  - Ensure pupils ignore invertebrates under 0.3cm.
  - Optionally, remind pupils that they only need to weigh the total mass of all worms and the total mass of each of the other kinds of invertebrates, not individual creatures. Show pupils how to 'zero' their scale so they do not include the mass of the container.
- Once pupils have completed their survey, ask them to identify whether any trees or shrubs are within 3m of their sample square and record this on the recording sheet.
- For groups who will complete the additional observations and measurements:
  - Discuss whether pupils think their sample squares contain lots of roots or just a few.
  - Ask one pupil from each group to gather a handful of soil and squeeze it into ball. Examine these soil balls together and agree whether the soil appears to be sandy, loamy/ silty, clay or peaty.
  - When pupils squeeze their soil ball hard, does any water emerge? Agree whether the soil is dry, damp or wet.
  - Finally, ask each group to fill a beaker 1cm deep with soil and add distilled water to completely cover the soil. Swish the beakers to mix the soil and water then dip litmus paper strips in each sample. Use the colour guide on the litmus paper packet to identify the soil pH.
  - Pupils should record all their answers on the recording sheets.
- Before you leave the site ask pupils what they think it's now important to do: return the site to its original state (this is especially important if you have made your observations on or near any playing area or pitch - it's important to leave the ground level and firm to avoid risk of injury). Give pupils a few minutes to put invertebrates back in their sample squares, return the topsoil and any leaf litter and replace any turfs, pressing these gently into place.
- Ask pupils to keep or hand in their recording sheets until after you have completed your bird survey, after which pupils will be able to input their results online.
- Remind pupils to wash their hands thoroughly.

Make easier

- Make the basic observations and measurements.
- Assign tasks to pupils in their groups and manage their time using your own instructions.

Make harder

- Encourage groups to self-manage, planning how they will dig the soil, find and count invertebrates and organise their data.
- Include the optional extra observations and measurements.
- Ask pupils to reflect on how effective they were in their teams and recommend some changes to how they worked together.

What's Under Your Feet?
Lesson plan

Bird survey (optional)

The bird survey recording sheet is available on page 19 (or it can be downloaded separately from www.jointhepod.org/resources/resource/446).

- Completing the bird survey will help the scientists gain a better understanding of the bird populations visiting your area – but it is an optional activity, so you don't have to do it.
- You should complete your bird survey within the week before or after your invertebrate survey and at the same location. Each group's bird survey should happen at a different time within the fortnight. (Bird surveys can take place up to two weeks after the invertebrate survey if necessary, e.g. if rain prevents you from running the activity).
- You will need the equipment listed in the Preparation section.

Note: You can only upload data for up to five surveys, even if more groups take part.

- Starter: to get pupils focused on their task, ask pupils to recall the types of bird they might expect to find visiting your school at this time of year. What birds have they seen around the school recently?
- Ask pupils how they might ensure they don't miss any birds that land in the area you are going to observe. (You could divide the area into smaller sections, with one group observing each section; or pupils in each group could concentrate on one size of bird, with two looking for small birds, two for medium etc.). Use questioning to help pupils understand why they should only record birds that land on the ground – they are the ones most likely to be looking for soil invertebrates to eat.

Use questioning to help pupils identify that in order to observe birds they need to be still and quiet – even if they are discussing species ID. It's better to get a good count with more unidentified birds than worry about difficult-to-identify birds.

- Split pupils into groups and hand out the pupil sheets and if you are using any, pairs of binoculars.
- Briefly review the pupil instructions sheet for the birds survey, and the recording sheet onto which pupils should write the numbers of each type of bird they observe. Remind pupils to only record birds they see land on the grass. Review the bird identification guide.
- Briefly discuss the weather conditions and ask pupils to mark these on their recording sheets.
- Give groups 15 minutes to complete their observations.
- You may also wish to ask selected pupils to measure and calculate the total area of the site you are sampling using trundle wheels.

Make easier

- Assign tasks to pupils in their groups, e.g. to observe one section of the area under observation, or one type of bird (e.g. small) and manage their time using your own instructions.

Make harder

- Encourage groups to self-manage, planning how they will assign tasks (e.g. whether to observe one section each or one type of bird each), and organise their data.
- Ask pupils to reflect on how effective they were in their teams and recommend some changes to how they worked together.

What's Under Your Feet?
Lesson plan

Data presentation and inputting

- Groups will need internet access in your classroom or your ICT suite.
- Ask pupils to retrieve the recording sheets for their invertebrates and birds observations, or hand these out if you looked after them.
- Give groups a few minutes to review their recording sheets.
- Ask pupils to recall that they are taking part in a 'citizen science' project and that their observations will be added to those of schools from across the UK to give the British Trust for Ornithology data (BTO) to analyse.
- Optionally, visit the campaign map **(www.jointhepod.org/pod-community/map)** to see how many schools are taking part so far across the UK.
- Ask pupils to recall that the invertebrate and birds surveys will help scientists to understand how things like soil and weather affect how many soil invertebrates there are, and how that affects the bird population.
- As time permits, discuss what pupils observed and any surprises or points of interest. Ask pupils to suggest what they found easy or difficult, and how they might improve their technique next time (remembering not to fundamentally change how they make their observations, in the interest of fair testing).
- Direct pupils to **www.jointhepod.org.uk/wuyfdata**.
- Assist pupils as they complete the data entry form and upload their observations.
- Congratulate pupils and remind them that they have been doing some real science that will increase BTOs understanding of invertebrate populations across the UK, and how these are helping support native and visiting birds.
- Remind pupils that they will repeat their observations again to discover how these populations change over the seasons.

Make easier

- Ask pupils to list what they think they need to do to upload their data. How could they explain this to someone else?
- Help pupils upload their data.

Make harder

- Challenge more able pupils when discussing results and possible improvements. How many ways could they make their investigation better? Could they rewrite the instructions in their own words?
- Ask pupils to discuss how understanding the links between weather, soil invertebrates and birds will help us to predict how birds might do in the future. Can pupils predict how bird populations might change as producer or primary / secondary consumer populations changed? Pupils can also discuss what could be done to help threatened species and devise some solutions to help them thrive in your grounds.

Review

- Complete this activity when returning to complete your next series of observations.
- Remind pupils of the project. Ask them to recall what they did before and how they worked scientifically to make their observations.
- Invite pupils to recall some of the invertebrate and bird species they observed, and which were most and least common.
- Ask pupils to recall what they should keep the same this time to ensure fair testing. (Note that for the invertebrates observations, pupils should again use randomly selected spots for their sample squares on the same area of grass – it's not necessary to use the exact spots again for their sampling to be representative).

What's Under Your Feet?
Lesson plan

- Discuss how the current season is different from the last time of sampling. What might pupils expect to be different this time? Link your discussion to their ideas of invertebrate lifecycles and of how the species of visiting migrant birds may now differ.

Make easier

- Ask pupils to tell you what they did last time.
- Vary your questioning to suit pupils' abilities.
- List some factors that pupils may need to keep the same to ensure fair testing. Ask pupils to state why it's important to keep each one constant.

Make harder

- Vary your questioning to suit pupils' abilities.
- Ask pupils to recall and explain the independent, dependent and control variables (see 'Planning' delivery guide).
- Ask pupils to devise better ways to work together as they complete their observations and recording. How can they improve this time? What changes do they propose, and why?

Final data analysis

- You can deliver this optional double session when you have completed your series of observations in October, March and June.
- Pupils will need their recording sheets from each pair of observations.

Starter:

- Split the class into small groups. Make sure each group has its recording sheets from your three pairs of observation sessions.
- Ask each group to imagine they are going to present their findings at a scientific conference. What are the main patterns and trends in:
  - How invertebrate populations changed across October, March and June?
  - How bird populations changed in the same period?
  - How these two sets of changes might be related, and why?
- Ask pupils to discuss how they will present their data. Is it discrete, continuous or categoric?
  - Month - discrete
  - Invertebrate counts – discrete (or could be considered categoric, since they are counted in length bands)
  - Invertebrate masses - continuous
  - Bird counts – categoric.
- Give pupils 10 minutes to come to their conclusions in their groups.

Present findings:

- Invite groups to share their headline findings. You may wish to allow pupils time to create charts to bring their data tables to life and illustrate their key points, a good way to help them explore how the data must support their conclusions.
- Identify the data types
- Discuss what different groups have to say about the class's observations.
  - Did all groups spot similar patterns and trends and come to the same conclusions?
  - Did what the class observe match the predictions they made back in October?
  - How reliable are groups' conclusions? What else might groups need to investigate?

Suggest improvements:

- Ask pupils review their methods and suggest improvements to their technique.
- Optionally, if you have taught these concepts, ask pupils what would make their observations:
  - More accurate?
  - More reliable?
  - More repeatable?
- Consider how pupils might make observations more often (for example every half term or month). How might this improve the results?

What's Under Your Feet?
Lesson plan

Explore the UK picture:

- If online data is available 'live', pupils can review the wider UK picture and compare how you school's data compares to what pupils observed elsewhere in the UK. (Live data will be available after the first surveys in October. Check back at **www.jointhepod.org/wuyf** for more information.
- What similarities can pupils identify, for example overall numbers of invertebrates and birds, and any differences in the species they saw? Can pupils suggest some reasons for these differences?

Plenary:

- The observations pupils have made will help BTO understand more about not only how populations of two types of animal vary across the year (invertebrates and birds), but how these are correlated.
- Ask pupils to identify other habitats that exist in or near your school grounds, and a food chain or web that might exist within one.
- Invite pupils to suggest how they might make observations of how the plants and animals in this food chain or web might vary across the school year. What else could pupils learn about your school's environment in this way?

Make easier

- Vary your questioning to suit pupils' abilities.
- List each data type. Ask pupils to describe each one and give examples that distinguish between them, and relate the descriptions to the variables they recorded.

Make harder

- Vary your questioning to suit pupils' abilities.
- If you have taught these concepts already, explore ideas of accuracy, reliability and repeatability.
- Discuss how the optional extra observations and measurements can help BTO interpret data from different schools. Can pupils predict how soil type, water content or the proximity of trees might affect the numbers of invertebrates and in turn, birds?
- Pupils could write a brief report summarising their findings.
- Pupils could create a brief video to train other pupils how to make the same observations in the future.

Taking this further

Discuss and share ideas for other citizen science projects that could help pupils, and scientists, learn more about issues that are affecting wildlife in the UK.

Pupils can share their ideas and understanding with parents, peers and other pupils by creating a display, posters, slide presentation, assembly sketch, video or podcast to share the results of their sampling and observations and to 'train' other Citizen Scientists or help other people in your community observe invertebrate and bird life.

Pupils could complete a bird survey at home, to create a local map of the bird species that visit your community across the year.

Pupils could also complete other wildlife surveys in and around your school. What could pupils discover about how wildlife changes across the year in:

- your school garden?
- your pond?
- a local river?
- hedgerows or woodland?

Pupils can blog about their observations and results on your school's Pod web page or on your own website. Tell us all about your experiences and what pupils learned!

What's Under Your Feet? Lesson plan

Curriculum links 11–14:

England KS3

Science

Working scientifically:

- Make predictions using scientific knowledge and understanding
- Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety
- Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements
- Apply sampling techniques
- Present observations and data using appropriate methods, including tables and graphs
- Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
- Present reasoned explanations, including explaining data in relation to predictions and hypotheses
- Evaluate data, showing awareness of potential sources of random and systematic error.

Biology

The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops as example

Wales KS3

Science

Skills – Enquiry: planning, developing and reflecting; Communication.

Range - the interdependence of organisms and their representation as food webs, pyramids of numbers and simple energy-flow diagrams; how and why food webs are affected by environmental factors, e.g. light intensity, water availability, temperature, and their fluctuations.

Scotland

Science

Pupils will develop their inquiry, investigative and scientific analytical thinking skills.

I can sample and identify living things from different habitats to compare their biodiversity and can suggest reasons for their distribution. **SCN 3-01a**

Northern Ireland KS3

Science

Develop skills in scientific methods of enquiry to further scientific knowledge and understanding: planning for investigations, obtaining evidence, presenting and interpreting results.
Organisms and Health: Interdependence of plants and animals.

Curriculum links 9–11 (if delivering to more able younger pupils):

England KS2

Science

Working scientifically:

- Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
- Taking measurements, using a range of scientific equipment, with increasing accuracy and precision
- Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, and bar and line graphs.

What's Under Your Feet?
Lesson plan

Wales KS2

Science
Skills – Enquiry: planning, developing and reflecting; Communication.

Range - through fieldwork, the plants and animals found in two contrasting local environments, e.g. identification, nutrition, life cycles, place in environment; the interdependence of living organisms in those two environments and their representation as food chains.

Scotland

Science

Pupils will develop their inquiry, investigative and scientific analytical thinking skills.

I can identify and classify examples of living things, past and present, to help me appreciate their diversity. I can relate physical and behavioural characteristics to their survival or extinction. **SCN 2-01a**

I can use my knowledge of the interactions and energy flow between plants and animals in ecosystems, food chains and webs. I have contributed to the design or conservation of a wildlife area. **SCN 2-02a**

Northern Ireland KS2

The world around us
Interdependence:
- How living things rely on each other within the natural world.

Place:
- Ways in which people, plants and animals depend on the features and materials in places and how they adapt to their environment
- Features of, and variations in places, including physical, human, climatic, vegetation and animal life.

Change over Time:
Ways in which change occurs over both short and long periods of time in the physical and natural world.

What's Under Your Feet?
Lesson plan

Invertebrate survey

Pupil Instructions

You will need:

- Spade or trowel
- 30cm ruler
- 1 tray
- 10 or more containers
- How to identify soil invertebrates guide
- Invertebrate survey recording sheet

You may also need:

- Weighing scales
- Measuring tape or a metre stick
- Litmus paper or pH paper and colour chart
- Distilled water

What you need to do:

In small groups choose a random survey spot. Ask someone in your groupto stand at the edge of the area, looking away, and throw one of your plastic containers gently behind them.

Dig the soil survey square – 30cm x 30cm, 5cm deep under the turf. Measure out a square around where your container landed. Each edge should be 30cm long. You can use pens or sticks to show where the corners should be. Use the spade or trowel to remove the turf and then dig 5cm down. Put the soil you remove into a tray. Include the turf and any leaf litter that was on top of the soil.

Are there any trees or shrubs close to your sample square? (A shrub is a plant with a woody stem that's less than 2m tall.) Use the measuring tape or metre stick to measure the distance. Write down how many less than 3m away.

Collect the earthworms and other invertebrates. Sift carefully through the soil and leaf litter in the tray and look carefully through the turf. Put all the earthworms you find, and all other invertebrates more than 0.3cm long, into your containers. Use a different container for each kind of invertebrate you find.

Use your ruler to measure the length of each earthworm. This can be difficult as they wriggle around and stretch to different lengths. Don't try to stretch them out, just measure their approximate length when they are resting on a flat surface. Record how many of each size category you find on your recording sheet. If you are also using weighing scales, measure the total weight of all the worms and write this on your recording sheet.

Use the **How to identify what's under your feet poster** to identify the invertebrates you find. Count how many of each kind and write these on your recording sheet.

What's Under Your Feet?
Lesson plan

Invertebrate survey

If you are also using weighing scales, measure the total weight of each kind of invertebrate and write these on your recording sheet.

Tidy up – carefully put all the worms and invertebrates and soil back into the hole, ideally with any leaf litter and turf on top.

Optional extras:

Record your soil characteristics

Write down whether there are a few roots or lots of roots in your sample square's soil.

Take a handful of soil and squeeze it into a ball.

Decide what type of soil it most resembles:

- Sandy soil: it falls apart straight away and feels gritty.
- Loam & silty soil: it holds its shape a bit and feels fairly smooth.
- Clay soil: it holds its shape very well and feels sticky.
- Peaty soil: it feels spongy.

How much water could you squeeze out of your handful of soil?

- Dry: no water, soil falls apart.
- Damp: you can feel the dampness but no water drips off.
- Wet: water drips out the soil when you squeeze it.

Measure the soil's pH (how acidic it is):

Fill the beaker up to about 1cm with loose soil. Add distilled water until the soil is completely covered. Swish the beaker to mix the soil and water. Dip the litmus paper or pH paper in. Compare the colour the paper turns with the colour chart on the packet.

Record the pH reading and the other soil characteristics you have measured on your Invertebrate survey recording sheet.

Find out who looks after the field and ask whether they have added any water fertiliser, insecticides or herbicides in the past year.

What's Under Your Feet?
Lesson plan

Invertebrate survey recording sheet

Date: _____ Group: _____

Describe your location: school playing field OR elsewhere: _____

Postcode: _____ Optional – 6-figure grid reference:_____

Earthworms

Size (cm)	How many?	Total weight (g) (optional)
0 – 2		
2 – 4		
4 – 6		
6 – 8		
8 – 10		
10 or longer		

Other invertebrates

	How many?	Total weight (g) (optional)
Slugs		
Snails		
Woodlice		
Centipedes and millipedes		
Spiders and harvestmen		
Beetles		
Ants		
Earwigs		
Maggots		
Grubs		
Caterpillars		
Unknown or other		

What's Under Your Feet?
Lesson plan

Habitat

Type of area (circle one)			
	Playing field	Flower bed	Garden
	Public park	Other grassy area	Other

Trees and shrubs

How many trees within 3m?	
How many shrubs within 3m?	

Rain

How many days since it last rained?	

Management

In the last 12 months has this area had...

Water added?	Yes	No	Don't know
Fertiliser added?	Yes	No	Don't know
Herbicide added?	Yes	No	Don't know
Insecticide added?	Yes	No	Don't know

Optional extras

Soil

Soil type: (circle one)	Sandy	Loam and silty	Clay	Peaty
Soil moisture: (circle one)	Dry	Damp	Wet	

Soil pH: (circle one below)

3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10

What's Under Your Feet?
Lesson plan

Bird survey (optional)

Pupil Instructions

You will need:

- How to identify birds guide
- Bird survey recording sheet

You may also need:

- Binoculars
- A measuring tape or trundle wheel could help to estimate the visible area of your playing field.

What you need to do:

As a class discuss where the best spot might be to observe birds landing on your playing field. Estimate or measure the area of your playing field that's visible from this spot, using a measuring tape or trundle wheel if it would help.

Write down the weather on your Bird survey recording sheet:

- **Not cloudy** (less than half the sky covered by cloud), **not windy** (small branches in trees not moving much)
- **Not cloudy** (less than half the sky covered by cloud), **windy** (small branches in trees moving)
- **Cloudy** (more than half the sky covered by cloud), **not windy** (small branches in trees not moving much)
- **Cloudy** (more than half the sky covered by cloud), **windy** (small branches in trees moving)

In your groups, count the birds you see land on your playing field during a 15 minute period.

Don't count birds that do not land, and don't 'double count' birds that land, take off, then land elsewhere on the field. If you can't identify a bird easily don't discuss the identification while you are counting, mark it down as "Not sure or other". You can always go back and change your records afterwards if you work it later.

Decide how you'll count and record the data on your Bird survey recording sheet.

- Who will observe and who will record?
- Will different pupils look for different kind of bird (e.g. large, medium or small)?

Things to count:

Goldfinch, Chaffinches, House Sparrows, Dunnocks, Wrens, Robins, Pied Wagtails, and any other small birds.

Blackbirds, Fieldfares, Mistle Thrushes, Song Thrushes, Redwings, Starlings and any other medium-sized birds.

Magpies, large Corvids (Jackdaws, Carrion Crows and Rooks, you don't need to distinguish between these), Gulls (there are several species and you don't need to distinguish between them), Collared doves, Feral Pigeons, Woodpigeons and any other large birds.

Remember to upload your results to www.jointhepod.org.uk/wuyfdata

What's Under Your Feet?
Lesson plan

Bird survey recording sheet

See the **How to identify birds guide** to help with this survey.

Date: _____ Group: _____

Describe your location (school playing field OR elsewhere): _____

Postcode: _____ Optional – 6-figure grid reference: _____

Weather

- Not cloudy (less than half the sky covered by cloud), not windy (small branches in trees not moving much)
- Not cloudy (less than half the sky covered by cloud), windy (small branches in trees moving)
- Cloudy (more than half the sky covered by cloud), not windy (small branches in trees not moving much)
- Cloudy (more than half the sky covered by cloud), windy (small branches in trees moving)

Area you are observing measure the area you can see in m^2: _____

Small birds

Bird	How many?
Goldfinch	
Chaffinch	
House Sparrow	
Dunnock	
Wren	
Robin	
Pied Wagtail	
Not sure or other	

What's Under Your Feet?
Lesson plan

Medium birds

Bird	How many?
Blackbird	
Fieldfare	
Mistle Thrush	
Song Thrush	
Redwing	
Starling	
Not sure or other	

Large birds

Bird	How many?
Magpies	
Jackdaw, Carrion Crows and Rooks	
Gulls	
Collared Dove	
Feral Pigeon	
Wood Pigeon	
Not sure or other	

Remember to upload your results to www.jointhepod.org/wuyfdata