

NATURALLY NATIVE

Secondary Education
Programme Brochure



A partnership of:

DURHAM WILDLIFE TRUST
NORTHUMBERLAND WILDLIFE TRUST
TEES VALLEY WILDLIFE TRUST



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INTRODUCTION

Naturally Native is a partnership between **Durham, Northumberland and Tees Valley Wildlife Trusts** with an aim to prevent the loss of the UK's fastest declining mammal: the water vole.

The lessons outlined in this brochure have been developed by a secondary education specialist with funding from the National Lottery Heritage Fund.

Fully funded sessions are available from September 2021 – October 2023 and possibly beyond. All sessions are tailored to suit your group and delivered by our Naturally Native team.

To book one or more sessions or for more information please contact us on naturallynative@durhamwt.co.uk



Did you know?

Despite being sometimes referred to as a 'water rat', there is no such thing – water voles are part of the vole family, not the rat family.



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Naturally Native is a partnership of:



 **Northumberland Wildlife Trust**



www.durhamwt.co.uk www.teeswildlife.org www.nwt.org.uk



Did you know?

Water voles' grazing and burrowing behaviour creates greater diversity within bankside ecosystems which can benefit other wildlife.



1

AN INTRODUCTION TO THE WATER VOLE

- ▶ A brief video introduces students to the water vole and its plight, sparking interest in an animal the class are unlikely to know much about. The Naturally Native team will explain their role in supporting the water vole's recovery and emphasise the importance of raising awareness of species in need.
- ▶ Groups will then be challenged to create an information display board, each one focused on a particular theme relating to water voles (appearance, behavioural ecology, habitat and territory, field signs, population and distribution, threats and conservation).
- ▶ To create their display, pupils will search through a collection of laminated information cards and photographs, selecting those which are most relevant to their theme. Using blue tack, groups will arrange their chosen laminates on their board alongside supportive images. They will need to arrange the sentences into their own paragraphs and decide on the most logical presentation of the information. They may even write their own headings onto blank laminate cards to complete their display. Each group will present their information board to the rest of the class, summarising some of the key facts they have chosen to include.



Did you know?

Once widespread through mainland UK, the water vole has been lost from over 90% of its former range making it the fastest declining mammal in Britain.



2

WATER VOLE ANATOMY

- ▶ Students begin by attempting to label the internal organs of a water vole then go on to compare water vole anatomy to that of a human. Pupils may use the named human organs to help them complete their labelling task if it proves challenging. The class will be stretched further by questioning their understanding of the functions of particular organs.
- ▶ Following on from this, pupils will be introduced to the key characteristics of bird pellets, learn how they are formed and discuss the benefits of studying pellet contents. As a follow up to discussion, pupils will answer brief worksheet questions based on their new understanding.
- ▶ Pupils will then be taught how to dissect a pellet effectively and be given the opportunity to dissect artificial pellets for themselves. Students will use an identification chart to identify the species from the replica bones they discover in their pellet. Together, the class will analyse the key features of a vole skeleton and again, compare this to that of a human.

3

WATER VOLE IDENTIFICATION

- ▶ Students will begin the lesson discussing the reasons why we monitor the distribution of native animals like the water vole. The class will learn how to identify the species and where to look for individuals, exploring their habitat and territory. Pupils will also discover what field signs to look out for as an indication of the water vole's presence, such as feeding remains, latrines, footprints, burrows, aerial nests or runs.
- ▶ Pupils will go on to explore different kinds of dichotomous key diagram, using the distinguishable features of an animal's appearance to help them identify the species they belong to.
- ▶ Students will eventually create an identification key of their own, distinguishing between several similar, and often mistaken, small mammal species. They will then carry out a small mammal survey within the classroom, using their key to identify the correct species of 27 animals, from their pictures hidden around the room.



4

INVASIVE SPECIES

- ▶ The lesson begins by distinguishing between a number of confusable terms (invasive, introduced, alien, exotic, non-native, indigenous). Several species are referred to as examples of invasive species. The invasive American mink is discussed in detail and students are challenged to answer worksheet questions based on its introduction and the threat it poses to the native water vole.
- ▶ A group task requires pupils to read a collection of information cards, each describing an example of an invasive species and its impact on the environment. Students discuss the level of threat each species poses and award two scores on the front of each laminated card. The first score is based upon how seriously they believe it impacts native species / habitats and the second according to how difficult they consider the species is to control.
- ▶ Pupils then use the scores they have awarded to rank the species, laying them out in a diamond formation, with those of greatest concern towards the top and the least concern towards the bottom. Following this activity, the class shares their ideas and understanding about; how a species invades a new location, what makes a good invader, possible impacts and how an invasive species might be controlled.
- ▶ As an extension task, groups debate the pros and cons of reintroducing the native Eurasian beaver to their region. Each person taking on one of the four roles, using information laminates to help them put forward this individual's point of view.




5 ANALYSING MAMMAL FUR

- ▶ A practical lesson involving the use of microscopes, pupils explore how fur compares between different species. After describing the composition and layered structure of hair, students are then asked to suggest possible benefits of having fur in the animal kingdom. Pupils are shown how to create a simple 'hair tube' from a toilet roll as a means of surveying the species present in an area. Time dependent, students may be given the opportunity to make their own during the lesson or at home as a follow up activity.
- ▶ The class share ideas on why scientists might analyse hair in real life, leading to a discussion on electron vs light microscopy. Students are given guidance on how to use a microscope effectively and are reminded how total magnification is calculated by multiplying the eyepiece lens magnification by the magnification of the objective lens.
- ▶ After explaining what distinguishes one animal's fur from another, (most notably the variation of the central medulla), students use their microscopy skills to observe these key features for themselves. Pupils will analyse hair samples from a number of different species and record their observations.

PLEASE NOTE:

Schools must provide the microscopes for this lesson. Naturally Native team will bring variety of slides containing samples of different mammal hairs.



Did you know?
Water voles have water repellent fur which enables quick drying, preventing them losing too much heat.

6 INTRODUCTION TO ECOLOGY

- ▶ Pupils are introduced to the subject of ecology, beginning the lesson by distinguishing between biotic and abiotic factors. Students then take a look at the five kingdoms and the key characteristics of living things. After ordering the levels which organisms can be studied (biosphere, biome, ecosystem, community, population, individual), the class explores the meaning of the term 'niche'. The lesson goes on to distinguish between intra and interspecific competition and pupils suggest resources water voles might compete for.
- ▶ In order to better acquaint pupils with ecology related vocabulary, students will work in groups to solve tarsia jigsaw puzzles, correctly matching up keywords with their definitions. There are three puzzles of varying difficulty for pupils to choose from. Any groups who finish one can then attempt another which is more challenging. Pupils complete the lesson by trying to come up with the highest scoring scrabble key term from the ecology topic and may be awarded a prize if they can explain its meaning.



7

THE THREAT OF EXTINCTION

- ▶ Pupils begin by ordering the conservation status categories according to their severity. They then identify three statistics they find most shocking and categorise causes of extinction as either natural or human. Finally the class discusses what biodiversity is and its importance.
- ▶ Groups are then challenged to decide upon a new animal charity which aims to protect a particular species under threat. They will read the information packages describing three potential species and discuss which of these animals they want their charity to protect and how they might go about this. To help them make informed decisions they will use a technique called Edward de Bono's Six Thinking Hats which encourages students to use more than one thinking approach when considering an idea and helps them to view a concept from lots of different perspectives. Each member of their group will be allocated a 'metaphorical hat' to wear, representing which thinking approach each person should adopt. (For example, 'Black hat' should consider the negative aspects of choosing a particular species as the focus of their charity. 'Green hat' should think creatively about how they might protect this species).
- ▶ Laminated cards describe the nature of each coloured hat and provide pupils with potential sentence starters they might use in discussion. Groups should use the framework grid provided to help stimulate discussion and collate their ideas onto paper, using different coloured pens to represent ideas from each direction of thought.
- ▶ The lesson concludes with an emphasis on the power of social media to influence and drive change. Students read tweets from both a zoo keeper and a trophy hunter and pick one person to tweet back to, either in support or to confront them about something they disagree with.



Did you know?
Water voles are herbivores and need to eat 80% of their body weight each day.



8

COMPETITION & ADAPTATION

- ▶ The lesson begins with a 'one minute dash', pupils challenged to find sweets hidden around the room, introducing the idea of competition. Pupils suggest what resources water voles might compete for and distinguish between interspecific and intraspecific competition. The class explores different ways that animals compete. Pupils recognise that structural, physiological and behavioural adaptations play an important role in competition and go on to consider the adaptations of the water vole.
- ▶ As a way of comparing the impact of particular adaptations in different habitats, students take part in an 'Adaptations' game. One member of each group will take on the role of 'Nature' and the remaining pupils will become 'Animals', whose goal it is to survive different habitats by scoring as high as possible on the dice. The score on the dice represents their 'chances of survival' in each habitat. However each time an animal rolls the die, 'Nature' will either add points or remove points from the score rolled, depending on how well adapted that animal is for that particular environment. 'Nature' will explain the reason why this score was adjusted, reflecting their ability to find food, water, shelter from the environment or protection from animals.
- ▶ At the end of the game, the total score animals needed to survive a habitat will be revealed. Students discuss whether their scores were what they would have expected for each animal and why. The class discuss how effective the game is as a model for real life. A plant adaptation worksheet is available as an extension activity.

9

DEFENCE STRATEGIES

- ▶ To begin the lesson, pupils participate in a game of class Pictionary. Volunteers come to the front to draw the animal and its defence mechanism written on the card and their peers try their best to guess and explain the defence strategy represented. After attempting their own drawing for the person sat next to them, students go on to guess whether some obscure examples of defence described by the teacher are true or false. This leads to a discussion about the defence strategies of the water vole.
- ▶ In order to understand the concept of animal defence in greater depth, pupils work in groups to sort the laminated cards in front of them. By reading the information clues on the card they should be able to match the animal with its defence mechanism.
- ▶ Following a class debrief, students conclude the activity by writing a list of as many forms of defence as they can remember. Their knowledge should now stretch beyond examples they were already familiar with at the beginning of the lesson and include more unusual demonstrations of defence such as playing dead, bioluminescence, projectile vomiting, bluffing, detachable body parts and emitting electric shocks to deter predators.



COURTSHIP BEHAVIOUR

- ▶ Pupils begin by suggesting examples of courtship strategies, including those used by the water vole. Students go on to explore what is meant by 'successful' reproduction and the reason why animals like mules are sterile.
- ▶ Pupils then proceed to play an interactive 'mating' game, half of students representing females and the other half males. Students are assigned individual scores to represent their genetic quality which they display on themselves in the form of a sticker. As they circulate around the room, pupils choose which members of the opposite sex they want to exchange their sperm or egg tokens with, taking into consideration their own genetic quality score and the scores of potential mates. At the end of the 'breeding season' they calculate their individual reproductive success, based on the scores of the offspring they created.
- ▶ Students go on to summarise the reasons why courtship is important for successful reproduction and discuss how effective the game is as a model for real life, noting the similarities with nature and limitations as a model. Pupils answer questions based on the conclusions they have drawn from the game.
 - Why might some males have higher reproductive success than other males?
 - When comparing males and females, who has higher reproductive success and why?
 - Compared to males, why might females be more selective when choosing a mate?



Did you know?

Water voles are the largest species of vole in the UK, reaching up to 22cm long and can weigh up to 350g.



11

PEPPERED MOTH INVESTIGATION

- ▶ Pupils learn about the peppered moth and its susceptibility to predation. Pupils discover that it is one of the best-known examples of evolution by natural selection and is often referred to as 'Darwin's moth'. To demonstrate this, a volunteer will be asked to come to the computer and click on as many light and dark moths as possible, first on a dark and then on a light coloured background.
- ▶ Students go on to discuss the life cycle of moths and butterflies and suggest strategies a caterpillar might have to avoid being eaten. Pupils are made aware that peppered moth larvae actually mimic small branches to protect themselves from predators, remaining motionless, and rigidly positioning their body at an angle to the twig.
- ▶ The class then carry out an investigation to determine if the larvae resting position tends to be at a particular angle. They are given photographs of resting larvae, some tracing paper and a protractor to measure the angle each caterpillar is resting at. Pupils are required to calculate the mean, median and mode values of the angles and complete a table to show frequency. Depending on time, they may be asked to draw a suitable graph to represent their results. Finally, students analyse their data and evaluate their investigation, answering key questions on their worksheet.

12

CLIMATE CHANGE & THE FOOD INDUSTRY

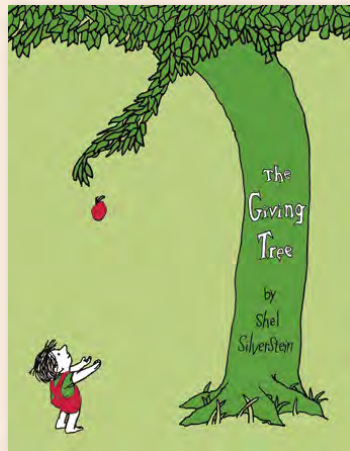
- ▶ Students are reminded that food shortage and food insecurity continue to be a huge problem in the world today, a problem exasperated by climate change. Furthermore, food production and farming contribute to climate change themselves, leading to a vicious cycle of challenges. Pupils are tasked with drawing a simple symbol or icon to represent each of the impacts of climate change on food production.
- ▶ The majority of the lesson is spent taking part in a 'poster memory challenge'. Groups attempt to reproduce a poster illustrating the impacts of climate change on food production, as accurately as possible, by taking it in turns to memorise pieces of information. One at a time, members of the group walk up to the poster and memorise as much of the information as they can in 30 seconds. Once the 30 seconds is up, they return to their group and pass on the information they have collected. Their peers will add these new details to the group's poster before the next person in the group takes their turn to memorise as much as they can. The process repeats, pupils continuing to take turns until they are told the task is over. At which point all groups will compete in a class quiz, using their replicated posters to help them answer the questions. The lesson concludes by sharing ideas about how young people can take action and listing ways they can reduce food waste at home.



13

SUSTAINABLE CONSUMPTION

- ▶ The lesson is based on a book by Shel Silverstein entitled “The Giving Tree”, first published in 1964. There continues to be great controversy around whether the relationship between the main characters (the boy and the tree) should be interpreted as positive or negative. Pupils are introduced to the story in the form of a narrated animation and are asked to identify the key themes they believe the story is trying to convey. They are also asked to write down a list of things we consume from plants and how we as individuals might give back to nature.
- ▶ Pupils are presented with the question ‘Does more stuff indeed equal greater happiness?’ leading to discussion on the idea of consumerism and sustainable consumption. Students come up with their own definition of the word ‘sustainable’ using pictures and quotations as stimuli. Finally, students are challenged to demonstrate their understanding of the story’s themes in one of the following ways (perhaps completed after the lesson or at home).
 - a) Present the giving tree story in the form of a storyboard (with or without words)
 - b) Illustrate the key ideas behind the story by drawing a single representative picture
 - c) Reinvent the story in the form of a poem
 - d) Write your own story around the same theme (perhaps an alternative version where it is the boy that gives to nature)



14

WATER POLLUTION

- ▶ In response to photos as stimuli, pupils suggest how they might be able to tell a river is polluted and what data scientists might collect in order to confirm their suspicions. It is made apparent that water pollution is not always obvious. Having acknowledged indicators of water pollution and recognised the value of indicator species, pupils go on to match up sources of water pollution with the correct descriptions. The effects of river sediment are explored as is the necessity of water treatment and purification.
- ▶ The majority of the lesson is spent taking part in a ‘Filter challenge’ whereby groups compete to create the most efficient water filtration system by the end of the lesson. To create their filtration system, groups choose a maximum of ten materials from those on offer and are able to filter the dirty water as many times as they like. Groups will be judged based on the volume of water they manage to filter off and the degree of turbidity. Turbidity is measured by placing numbers of varying size beneath the water and observing the point at which they are no longer visible. During periods of waiting for water to filter through their device, pupils work through the activities on their worksheet, solving a eutrophication cryptogram and contemplating ways we might protect our water sources.



15

USING YOUR VOICE

- ▶ The lesson begins by asking students to consider the girl in the photograph. Some may identify her as Greta Thunberg the well known environmental activist and public speaker. Pupils go on to suggest who one of her speeches might be aimed at. Individual students will be challenged to come to the front and use their powers of persuasion to convince the class to buy one of the seemingly useless products in the photographs. Pupils are then asked who might use the art of persuasion in real life.
- ▶ Time will be spent sharing various persuasive writing techniques with students, allowing them to analyse and annotate a persuasive article about protecting our oceans, identifying as many of these persuasive techniques as possible.
- ▶ Pupils will go on to write their own powerful and inspiring speech on any environmental topic of their choice. Support sheets will be provided with sentence starters and guidance on how to structure their speech, as well as a complete list of persuasive techniques discussed prior.
- ▶ Volunteers will be given the opportunity to read their speech to their peers, perhaps even recording their speeches in a later lesson or at home for homework.



16

CHARITY FUNDRAISING

- ▶ In order to generate an understanding of how charities like the Wildlife Trust operate, and emphasise the importance of fundraising to generate income, students will work in groups to organise a four day music festival. They begin the challenge by deciding on the best month to host their festival based on climate data.
- ▶ In the fictional scenario, the Wildlife Trust has received a funding grant of £12,000 to spend and budget accordingly. All artists have offered to perform for free, students paying just a fixed fee as a contribution to their expenses. This includes their transport to the venue, accommodation and entourage to accompany them (hair stylists, makeup artists etc). Naturally, the bigger the star, the higher the cost! Ticket prices will be set at £5 each. However, students will generate money from however many food stalls and merchandise shops they choose to hire for the festival. As well as extra income from business donations and charity boxes which will be distributed around the event to collect money from generous festival-goers.
- ▶ Leading up to, and throughout the duration of the event, students will be required to calculate expenses incurred and deduct these from revenue coming in. They will be expected to budget their money and should try to prioritise those things they consider most important to spend their money on. Groups will be offered a loan which should be paid back with interest should they decide to take it and be advised to keep a little money in the bank in case of unexpected circumstances as there will be unforeseen expenses along the way!
- ▶ The aim of the challenge is to make as much profit as possible for the charity, whilst ensuring the event is successful enough to secure future funding for a repeat event next year. At the end of the festival pupils may be asked to write a review article for their local newspaper describing its success and highlighting why fundraising is so important to charities like the Wildlife Trust.



ENDANGERED ANIMALS MATHS MARATHON

- ▶ Groups compete in a race to answer as many maths questions as possible within the time allocated, using relevant statistical data. Questions are based on six well known endangered animals. Depending on the age and ability of the class, the teacher will decide beforehand whether or not students will be allowed to use calculators or just whiteboards to work out their answers and if they are allowed to skip questions they find too tricky.
- ▶ The race begins with one member of each group coming to the front to collect a question at random. Once this person has returned to their group with their question, they work together to answer it as quickly and as accurately as possible. When a group think they have the answer, they write it in their answer table and take it to be marked by the designated 'checkers'. If answered correctly, the pupil returns to their group and tags the next person to collect a question. If incorrect, the group should attempt to answer the question again. Unless the teacher has decided students can skip unlimited questions, groups must attempt each question three times before giving up and moving on to another question. Depending on how many attempts it takes a group to get the answer correct, they will be awarded either one, two, or three points by the checker.
- ▶ To help students out, each group can choose any four of eight bonus tokens which they may use at any point in the game. Tokens include: **double points, triple points, use a calculator, free answer, skip a question, trade an answer, head start, pause your peers.**



18

OUR PLANET MATHS MARATHON

- ▶ Groups compete in a race to answer as many maths questions as possible within the time allocated, using relevant statistical data. Questions are based on the human population and its impact on the Earth. Depending on the age and ability of the class, the teacher will decide beforehand whether or not students will be allowed to use calculators or just whiteboards to work out their answers and if they are allowed to skip questions they find too tricky.
- ▶ The race begins with one member of each group coming to the front to collect a question at random. Once this person has returned to their group with their question, they work together to answer it as quickly and as accurately as possible. When a group think they have the answer, they write it in their answer table and take it to be marked by the designated 'checkers'. If answered correctly, the pupil returns to their group and tags the next person to collect a question. If incorrect, the group should attempt to answer the question again. Unless the teacher has decided students can skip unlimited questions, groups must attempt each question three times before giving up and moving on to another question. Depending on how many attempts it takes a group to get the answer correct, they will be awarded either one, two, or three points by the checker.
- ▶ To help students out, each group can choose any four of eight bonus tokens which they may use at any point in the game. Tokens include: **double points**, **triple points**, **use a calculator**, **free answer**, **skip a question**, **head start**, **pause your peers**.

19

BIRD BATHS AND FAT BALL MATHS

- ▶ Pupils begin the lesson by taking part in a bird identification quiz. Once they have tried to name all of the birds pictured they will then be challenged to order them by to how common they are, according to the 2021 Big Garden Birdwatch. The Naturally Native team will go on to explain why our gardens are so important to birds and what we can do to encourage them to visit. Students are asked what time of the year it is especially important to provide regular food and water for birds, emphasising that food shortage can occur all year round. Pupils suggest the types of food we might give our feathered friends and the class is warned of what NOT to give birds and why.
- ▶ The class are then given a recipe for making fat balls and a price list for the ingredients. In small groups they use a calculator to answer the multi-step maths questions on their worksheets. Questions require pupils to calculate quantities of ingredients for different numbers of fat balls as well as costs incurred.
- ▶ The final slides demonstrate to pupils how to make their own fat ball using yoghurt pots or pine cones. Depending on the duration of the lesson, this activity may be done at the end of the lesson, in a future lesson or at home.





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FROM TEES TO TYNE



TEES VALLEY



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