How can rewilding help to restore biodiversity?

The activities in this pack support students' exploration of the threats to biodiversity and how natural processes can help to restore it. Focusing on the rewilding project at Knepp as a case study, students analyse data and identify what it shows us about the impact of rewilding on biodiversity restoration.

Key themes

Biodiversity
Natural Processes
Interdependence

Curriculum links

Knowledge

- the importance of maintaining biodiversity
- the interdependence of organisms in an ecosystem, including food webs

Skills

- present data using graphs
- interpret data, identify patterns and use data to draw conclusions
- present reasoned explanations, including explaining data in relation to a hypothesis

Key vocab

biodiversity, species, natural systems, abundance, variety, habitat, organism, ecosystem, food web, interdependence

Learning objectives

Knowledge

- I know what rewilding is
- I can explain what biodiversity means
- I can explain why maintaining biodiversity is important
- I can explain how organisms in an ecosystem are interdependent

Application

- I can discuss some threats to biodiversity
- I can explain how restoring natural systems supports biodiversity
- I can explain how biodiversity supports resilient food webs
- I can present data using graphs
- I can use data to identify patterns
- I can use data to support an explanation

Using this pack

This pack is presented as a series of activities that teachers can incorporate in lesson planning to best suit the needs of their students. Activity 1 can be used to familiarise students with the concepts of biodiversity and rewilding, and with the effects of rewilding on the landscape at Knepp. The Learning Summary activity at the end of the pack summaries key aspects of the learning from Activities 1 to 6.

Activity 1

Biodiversity and the rewilded landscape

Students will need:

Copies of Resource 1A
Copies of Resource 1B

Need to know

Biodiversity describes the variety of living things on Earth, or in a particular ecosystem or habitat. Ecologists use the term biodiversity to refer to both the number of individuals within a species in a habitat (abundance) and the number of species recorded there (species richness).

Rewilding, or ***nature recovery***, describes the restoration, enhancement and connection of natural spaces. It aims actively to reinstate natural processes – returning missing species to these systems, when needed – to facilitate ecosystem recovery at scale.

Whole class

Share with students the photos of the landscape at Knepp today (Slide 1A) that highlight its biodiversity. Using these as a stimulus, discuss the students' understanding of the term **biodiversity** (see 'Need to know', left, for a definition to share with them). Draw out in discussion keywords such as: species, variety, habitat. Encourage students to discuss the evidence of biodiversity they can see and the evidence of things that they think would support biodiversity.

Independent learning

Students annotate the images with their ideas about the evidence of biodiversity they can see and the evidence of things that they think would support biodiversity (Resource 1A).

Whole class

Discuss their ideas as a class. Draw their attention to: the range of heights of grasses and flowering plants; the presence of mature trees as well as younger, seasonal tree species; the diversity of flowers to attract a diversity of pollinators; the range of nesting opportunities for birds (including scrub nesters, ground nesters and tree nesters); and the presence of deadwood and the feeding and nesting opportunities it provides for other organisms. Share with students the photos of the landscape at Knepp prior to rewilding (Slide 1B). Introduce the term **rewilding** in relation to the process that has taken place on the Knepp Estate since the first photos were taken (see 'Need to know', left, for a definition to share with students). Discuss what they notice about the 'before' images.

Independent learning

Students annotate the 'before' photos (Resource 1B) with the differences evident between this and the present-day image of Knepp they have already explored (Resource 1A).

They should make specific reference to biodiversity. Students who have participated in one of the on-site educational visits to Knepp can draw on this experience to complete the activity.

Whole Class

Discuss as a class the students' thinking about the differences evident in the photos and model a fuller annotation, eliciting ideas as part of the modelling process. Draw out in this activity the following keywords, which can be adapted as necessary to the level of prior knowledge of the class: vegetation, biodiversity, abundance, species, variety, ecosystem, habitat, agriculture (farming).

Activity 2

Threats to biodiversity

Students will need:

Copies of Resource 2A
Copies of Resource 2B

Need to know

Biodiversity supports the processes that all living things, including humans, need to survive. We rely on a wide range of animals, plants and microorganisms for food, clean air and water, healthy soil, medicine, climate regulation – and much more. Ecosystems with greater species diversity, and species with greater variation between individuals, are more resilient and better placed to adapt to change, including climate change.

Whole class

Discuss as a class what the students think some of the main threats to biodiversity in the UK might be, drawing their attention to the images of Knepp that they have already explored to initiate this discussion (e.g. evidence of habitat loss linked to intensive farming). Draw out in the discussion other threats, including other causes of habitat loss due to infrastructure development, the expansion of urban areas, pollution and the introduction and spread of invasive species.

Share with students the comic strip on Slide 2A that explores the impact that intensive farming at Knepp had on biodiversity prior to the start of rewilding.

Independent learning

Drawing on the information presented in the comic strip on Resource 2A, students explore some of the actions associated with intensive farming and the impact these actions had on biodiversity on the Knepp Estate prior to rewilding. They record these actions and impacts in a table (Resource 2B).

Whole class

Take feedback, encouraging the students to explain their thinking, and address any misconceptions (see answer sheet, or display Slide 2B to support this discussion). Focus on the last sentence from the comic strip: 'Biodiversity is important because it helps make sure species and ecosystems are healthy and resilient.'

Discuss as a class what this means and why maintaining biodiversity is so important (see 'Need to Know', left, for a definition to share with students).

Activity 3

Biodiversity and natural processes

Students will need:

Copies of Resource 3

Need to know

Interdependence is used to describe the ways in which the organisms within an ecosystem rely on each other for their survival.

Whole class

Share with students the film clip on Slide 3A. It explores the impact that reinstating and supporting natural processes has had on biodiversity at Knepp since the start of rewilding. During the film, they should take notes about how the four natural processes featured (see Resource 3) help restore biodiversity at Knepp.

Introduce the diagram on Resource 3 and model how students might start filling it in.

Independent learning

Students complete the diagram on Resource 3 to show how natural processes reinstated at Knepp have benefited different species in different ways.

Whole class

Discuss how students have populated the boxes in the diagram (see answer sheet, or display Slide 3B to support this discussion). Introduce the term **interdependence** and discuss its meaning (see 'Need to know', left, for a definition to share with students).

Establish that there are many different ways that organisms within an ecosystem are interdependent. Display Slide 3D and discuss three examples:

For food – producers can make their own food, but consumers rely on them, or on other consumers, for food

For habitat creation – the natural behaviours of some organisms change the environment, creating new habitats for other organisms.

For nutrient recycling – some organisms in an ecosystem help recycle nutrients from dung, dead plants and dead animals, returning these nutrients to the soil. They include funghi, bacteria and invertebrates, and are known as decomposers.

Independent learning

Drawing on the information in their completed diagrams, students identify three examples of interdependence within the ecosystem at Knepp, giving reasons for their thinking. Challenge them to find one example of each type of interdependence on Slide 3C.

Whole class

Discuss their ideas as a class. For example: *When brambles are left to grow, their flowers and fruit provide food for butterflies. Beavers create new habitats for amphibians. Dung beetles help recycle nutrients in the ecosystem.*

Activity 4

Biodiversity and food webs

Students will need:

Copies of Resource 4A
Copies of Resource 4B

Whole class

Establish that in this activity students will focus on one of the ways that organisms within an ecosystem are interdependent: they rely on each other for food. Introduce the simple food web of species found at Knepp and discuss how to 'read' it (Slide 4A).

Focusing on one species, discuss what the effect on other species could be if the population increased or declined. Link this to the importance of maintaining biodiversity.

Independent learning

Using the food web on Resource 4A, students answer the questions on Resource 4B that explore the potential impact of an increase or decrease in the population of one species on the population of others.

Whole class

Discuss the students' responses as a whole class, addressing any misconceptions. See answer sheet for examples of possible answers or display Slides 4B and 4C to support this discussion. .

Activity 5

Biodiversity change over time

Students will need:

Copies of Resource 5A
Copies of Resource 5B

Need to know

Bird data sets
[SPECIES LIST TO FOLLOW]

Butterfly data sets
[SPECIES LIST TO FOLLOW]

Dragonfly and damselfly data sets
[SPECIES LIST TO FOLLOW]

Whole class

Share the data set on Slide 5A and explain that it shows the number of species of birds that have been counted at Knepp in different years. Draw the students' attention to the examples of some of these bird species using the images on this slide. Introduce the activity and model how to start plotting the data as a line graph on Slide 5B.

Share the data sets for the number of species of butterflies, and the combined number of damselflies and dragonflies counted at Knepp on Slides 5C and 5D.

Independent learning

Focusing on one of the data sets on Resource 5A (or more if they are able), students plot a line or bar graph to show the increase in species diversity over time. Whether students are assigned a data set to focus on or are allowed to self-select, ensure that all the data sets are being covered by the class so that the students can compare their findings. Challenge students to write simple summary statements describing the trends they notice in the data (Resource 5B).

Whole class

Discuss what the students have noticed about the data as a whole class, comparing different students' observations and identifying patterns. Display Slides 5E, 5F and 5G to support this discussion. Encourage students to draw on the data to give evidence for their answers.

As habitats mature and develop over time, a greater number of species stand to benefit.

Challenge students to suggest factors that could have resulted in a decrease in the number of bird, butterfly or dragonfly and damselfly species in some years. Factors such as variation in weather or the availability of food from one year to the next tend to affect the population size of individual species more than they affect the total number of species recorded. However, inconsistencies in data collection could be a contributing factor.

Activity 6

The impact of rewilding on biodiversity

Students will need:

Copies of Resource 6

Whole class

Share with students the statement: 'The rewilding project at Knepp has increased biodiversity there. Do you agree?'

Discuss with students how they might use their learning from the lesson to answer this question.

Independent learning

Students write responses drawing on the data they have already analysed to provide evidence using the prompts on Resource 6 to help structure their answer.

Whole class

Discuss the students' thinking as a class, encouraging them to give reasons for their ideas.

How can rewilding help to restore biodiversity?

Learning summary

Summarise

Summarise the key aspects of the learning from Activities 1 to 6 and explore different viewpoints and responses to the question: **To what extent do you think rewilding is helping to restore biodiversity on the Knepp Estate?**

Quiz

Assess the students' understanding with a quiz:

1 What does biodiversity mean?

2 Why is biodiversity important?

3 Give two reasons why biodiversity declined on the Knepp Estate?

4 Give two examples of how a natural process supports biodiversity.

5 What else could be done to boost biodiversity at Knepp, and elsewhere?

Answers

1 Biodiversity describes the variety of living things on Earth, or in a particular ecosystem of habitat.

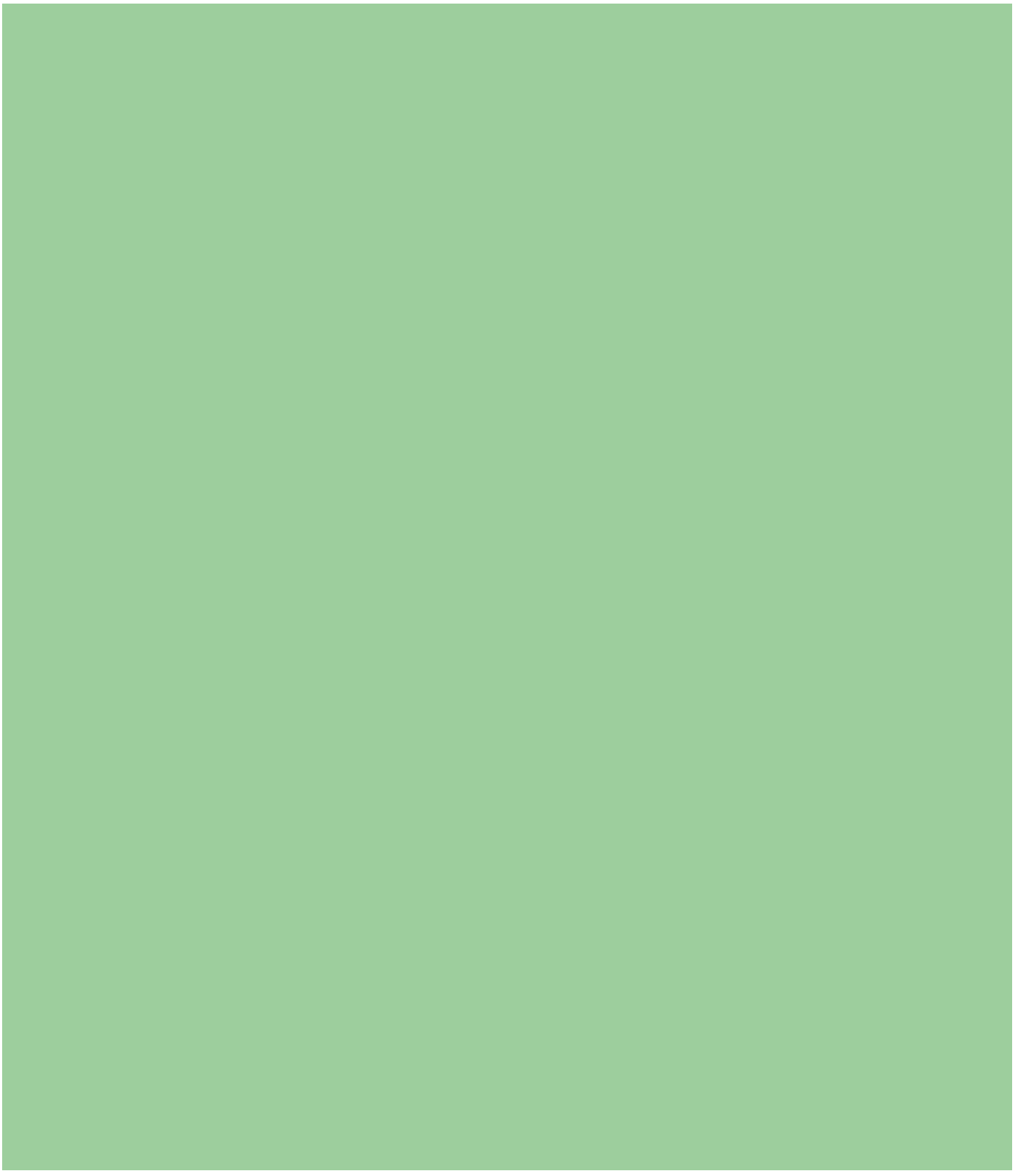
2 Biodiversity supports the processes that all living things, including humans, need to survive. We rely on a wide range of animals, plants and microorganisms for food, clean air and water, healthy soil, medicine, climate regulation – and much more. Ecosystems with greater species diversity are more resilient and better placed to adapt to change, including climate change.

3 Accept any two reasons associated with intensive farming:
- Hedgerows were removed
- Crops were sprayed with pesticides
- Streams and rivers were straightened
- Artificial fertilisers were used
- Soil was disturbed through repeated digging

4 Accept any examples from the answer sheet for Activity 3.

5 A greater area of land could be rewilded; other sites could put into practice some of the practices that have supported rewilding at Knepp.

1A The Knepp estate today

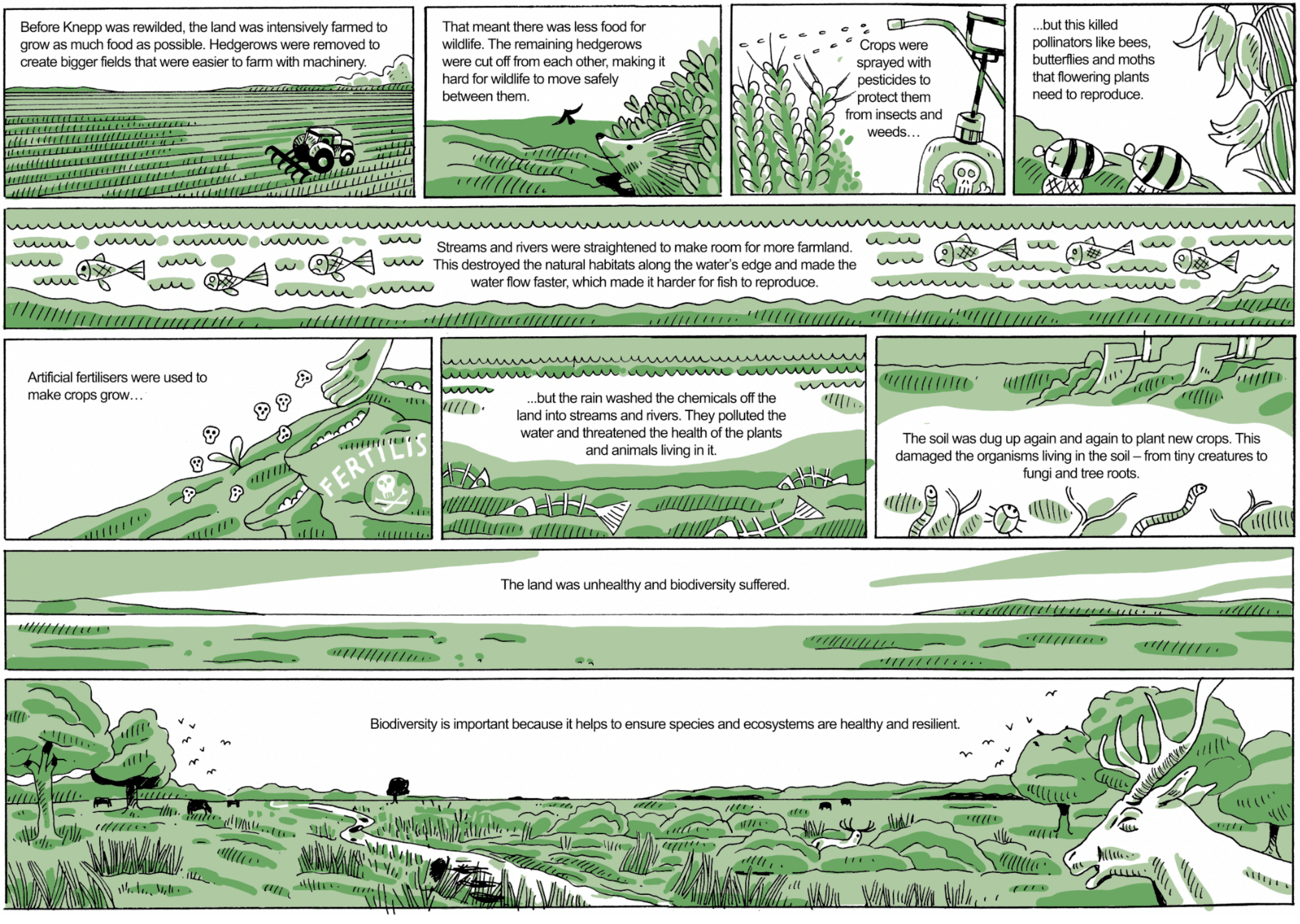


1A The Knepp estate today

1B The Knepp estate before rewilding

1B The Knepp estate before rewilding

2A Threats to biodiversity



2B Threats to biodiversity

Use the information in the comic strip to complete the table. List the actions linked to intensive farming in the left column and their impact on biodiversity at Knepp in the right column.

Actions linked to intensive farming	Impact on biodiversity

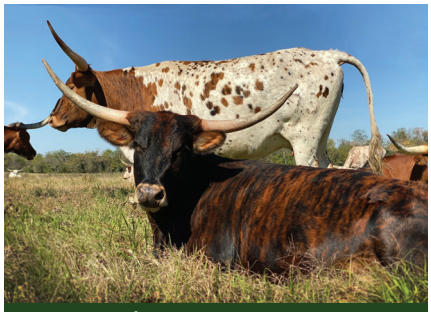
2B Answer sheet

Use the information in the comic strip to complete the table. List the actions linked to intensive farming in the left column and their impact on biodiversity at Knepp in the right column.

Actions linked to intensive farming	Impact on biodiversity
hedgerows removed to create bigger fields	less food for wildlife over winter hard for wildlife to move through landscape
use of pesticides	killed pollinators; harder for flowering plants to reproduce
streams and rivers straightened	destroys habitat along banks water flows faster; harder to fish to reproduce
use of artificial fertilisers	wash into streams and rivers and pollute them
soil disturbance	things that live in soil killed or damaged

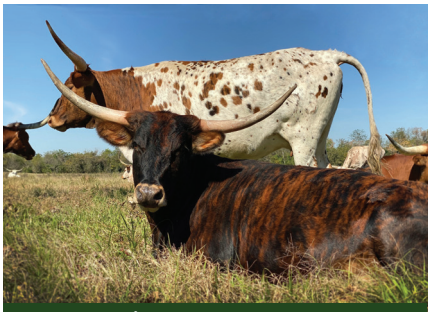
3 Biodiversity and natural processes

Complete the diagram with examples of how different natural processes at Knepp help different species to thrive.

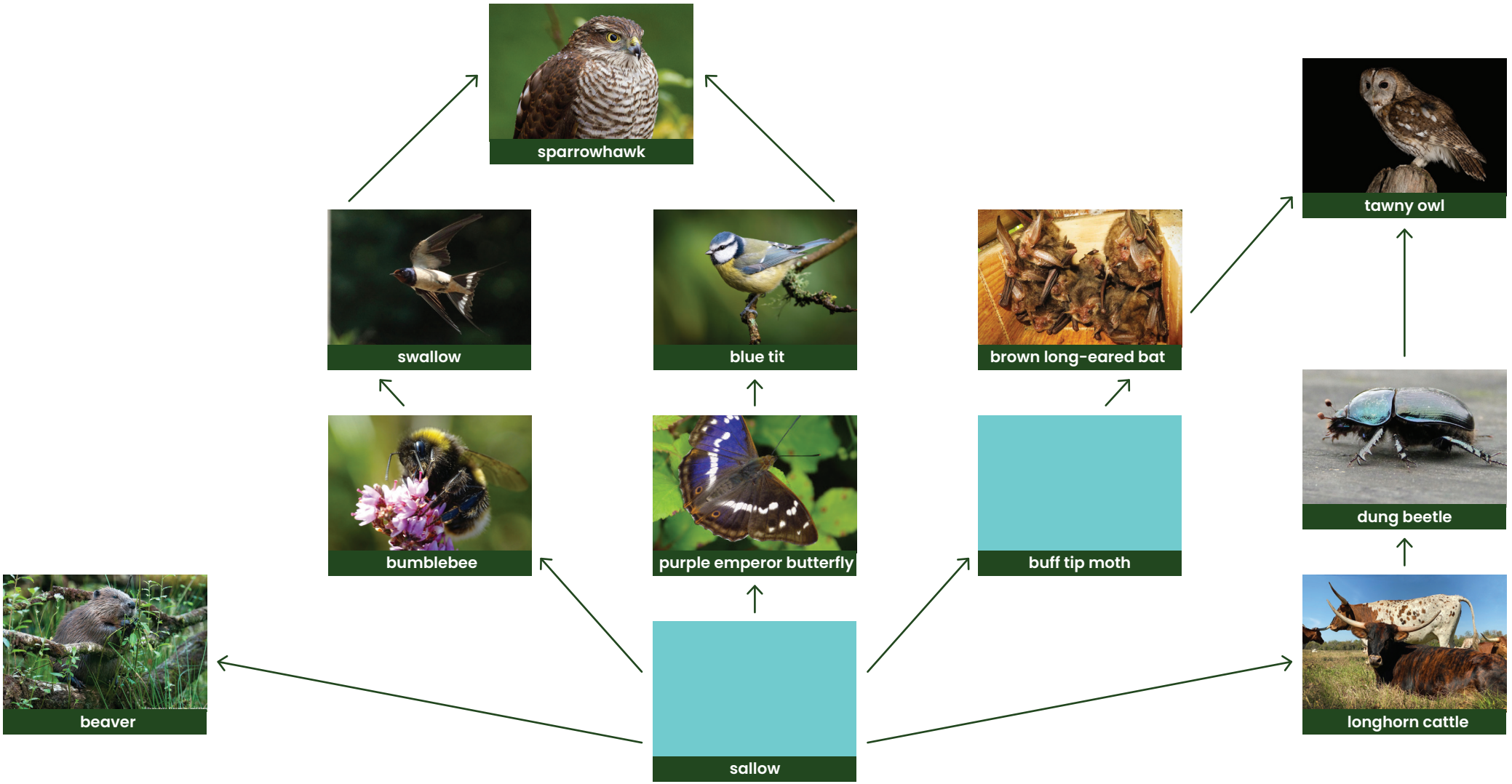
Natural processes	How species benefit
 Brambles are allowed to grow	
 Free-roaming longhorn cattle produce dung	
 Mycorrhizal fungi recover once the soil is no longer ploughed	
 Beavers create wetland habitats by damming streams	

3 Answer sheet

Complete the diagram with examples of how different natural processes at Knepp help different species to thrive.

Natural processes	How species benefit
 Brambles are allowed to grow	Nightingales have more places to build their nests. the brambles help protect their chicks from predators.
	Brambles protect young oak trees from deer. More trees grow.
	Some butterflies (gatekeeper, speckled wood) feed on the nectar of bramble flowers. Others (comma, peacock) feed on blackberries that grow on brambles.
 Free-roaming longhorn cattle produce dung	Dung beetles feed on the cattle's dung. The dung beetle population increases and more species of dung beetle are observed.
	Dung beetles bury the dung in the soil. The dung releases nutrients as it breaks down that support the growth of grasses.
 Mycorrhizal fungi recover once the soil is no longer ploughed	The mycorrhizal fungi help plants to absorb water and nutrients from the soil. Oak trees become healthier. They also help to break down organic matter, releasing nutrients into the soil.
 Beavers create wetland habitats by damming streams	TBC dragonflies

4A Biodiversity and food webs



4B Food web questions

a) The weather one spring is cold and rainy. As a result, many purple emperor caterpillars die.

What effect would this have on the population of adult purple emperor butterflies?

Explain how one other species in the food web might be affected.

b) Cows help to control the spread of sallow at Knepp because they feed on it.

If there were fewer cows, what effect might this have on the sallow?

Which other species might be affected? How?

4B Answer sheet

a) The weather one spring is cold and rainy. As a result, many purple emperor caterpillars die.

What effect would this have on the population of adult purple emperor butterflies?

The population of adult purple emperor butterflies recorded that year would decrease as fewer caterpillars mature to adulthood.

Explain how one other species in the food web might be affected.

There could be less available food for blue tits. The blue tits would need to find an alternative food source. The number of blue tits might decrease.

b) Cows help to control the spread of sallow at Knepp because they feed on it.

If there were fewer cows, what effect might this have on the sallow?

More sallow might grow. This might mean that there is less space available for other plant species to grow.

Which other species might be affected? How?

There could be more available food for beavers, bumblebees, purple emperor butterfly and buff tip moths. The populations of these species might increase. This, in turn, could mean there is more available food for swallows, blue tits and brown long-eared bats. If the populations of these species were to increase, there might be more available food for tawny owls and sparrow hawks.

5A Biodiversity change over time

The following data shows how the number of bird, butterfly and dragonfly species at Knepp has changed over time.

Need to know

Changing habitats play a huge role in increasing species richness. As new habitats mature and develop, more species move in (or move back in) and thrive!

Birds

Number of bird species counted at Knepp since 2007

2007	2009	2011	2013	2015	2017	2019	2021	2023	2025
22	35	26	32	36	42	50	40	47	51

Butterflies

Number of butterfly species counted at Knepp since 2005

2005	2010	2015	2020	2025
13	16	20	16	27

Dragonflies and Damselflies

Number of dragonfly and damselfly species counted at Knepp since 2020

2020	2021	2022	2023	2024
12	19	16	20	20

The figures in this table show the number of dragonfly and damselfly species combined.

5B Biodiversity data questions

a) Choose one set of data and use it to draw a line or bar graph.

b) Write a summary of what the data shows. For example, does it show an increase or a decrease in the total number of birds? Use evidence from the data to support your answer.

What change over time does the data show?

What evidence from the data supports this?

What effect does this suggest rewilding has on biodiversity?

6 The impact of rewilding on biodiversity

The rewilding project at Knepp has increased biodiversity there. Do you agree?

In your answer, you should:

- ☐ Explain what biodiversity means. Use the words **species** and **habitat** in your definition.
- ☐ Explain what patterns you would expect to see in data showing that there has been an increase in biodiversity.
- ☐ Use one of the data sets from Activity 5 to explain whether or not there has been an increase in biodiversity.
- ☐ Say whether or not you agree with the statement.