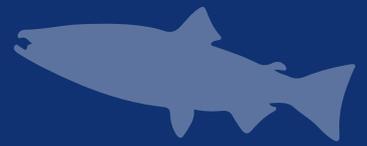


The Royal
Society of Biology:
**The UK's favourite
freshwater species
poll**

Educational resources
and activities



Activities and resources

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Introduction

Why is fresh water so important?

Fresh water is a renewable but finite natural resource that essentially supports much of life on Earth.

People depend on fresh water for drinking sources, agriculture and sanitation, as well as for a range of activities such as manufacturing, swimming, fishing and leisure. It is no surprise that big cities often have rivers running through them; society requires freshwater to function.

However, freshwater habitats are under threat; since 1970, freshwater species numbers worldwide have declined by 83%.

In the UK, where freshwater habitats cover around 12% of the total land, 69% of rivers and canals, and 62% of lakes, are classed as in a poor or bad condition.

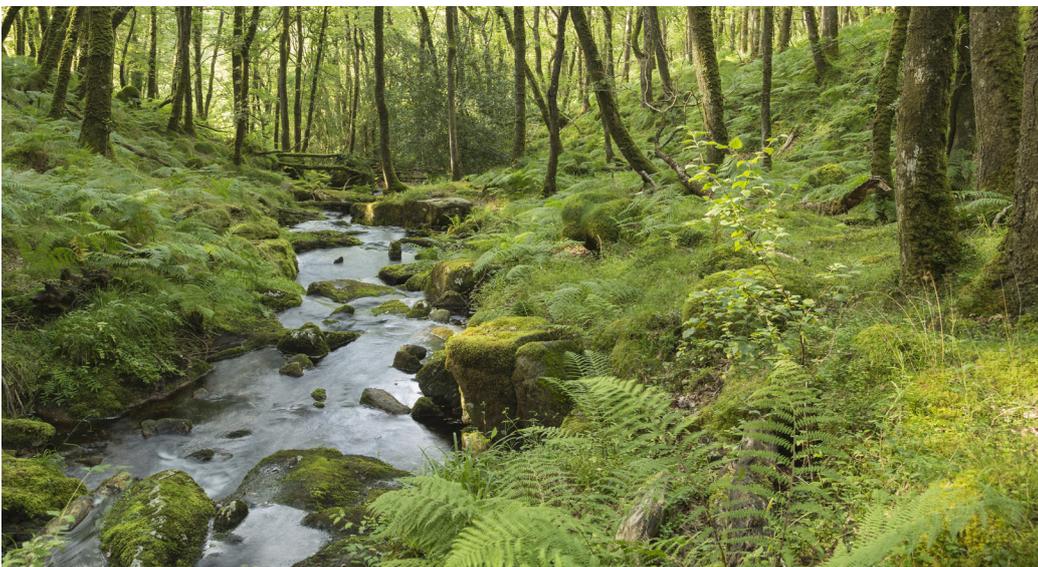
How to use these resources

These resources we have developed to support our annual species poll can be used in the classroom, at home, or for reference.

Each activity is matched to a suitable age group, and the information pages can be used as a starting point for understanding more about botany, or as a basis for other activities.

Each species that features in this year's Biology Week poll is reliant on freshwater to survive. Each species has its own factfile, including details on habitat, lifecycle, characteristics and more. You can download these separately at www.rsb.org.uk/biologyweekpoll

If you would like larger versions of our resources, or printed copies sent to your school or another UK based address, contact outreach@rsb.org.uk



Freshwater: an introduction

What is freshwater?

Freshwater refers to naturally occurring water, excluding sea water. Although more than two-thirds (71%) of the earth's surface is covered by water, 99% of this is unusable as drinking water for people or freshwater organisms.

Freshwater sources include ice sheets, ice caps and, more commonly, lakes, ponds, streams, flushes, rivers, canals, springs, wetlands and ditches.

Where does freshwater come from?

Freshwater starts out as water vapour evaporated from the surface of a body of water, that then collects in clouds then released back via different forms of precipitation such as rain or snow. When it reaches the ground it flows into streams, lakes, ponds and wetlands.

UK Freshwater

The UK is home to 85% of the world's chalk rivers – lowland rivers formed of crystal clear water that emerges from chalk aquifers underground.

The water is consistently cool in temperature and the streams are renowned for their biodiversity. For example, the European freshwater crayfish, one of our species in this year's poll, are often found in these chalk rivers, as they provide refuge against non-native crayfish species.

In England, less than a fifth of all rivers are considered to be healthy, with some drained almost dry in places, and others polluted by fertilisers, pesticides, herbicides or urban sewage.

One of the biggest problems facing our streams is 'over-abstraction' – taking too much water from rivers and streams. If consumption of fresh water exceeds the natural replenishment mechanisms, availability is reduced which can cause serious damage to surrounding and associated environments.

In addition, about a third of the water we take from these sources is actually wasted, meaning a lot of the damage done by this removal could be reduced.

Freshwater sources

Stream	A body of moving water
River	A large, natural stream of flowing water
Canal	Human made channels or artificial waterways
Springs	Point at which water flows from an aquifer to the Earth's surface
Wetland	Distinct ecosystem that is covered with water either permanently or seasonally
Lakes	Body of water that is surrounded by land. There are millions of lakes in the world
Ponds	An area filled with water, either natural or artificial, that is smaller than a lake
Ditches	A small to moderate depression created to channel water
Aquifer	an underground layer of rock or earth which holds groundwater

Freshwater activities: pond dipping

Suitable for ages 8 and upwards; supervision required

You will need

A selection of nets in different sizes
A tray in which to put organisms collected
Magnifying glass
Identification sheet
Pens, paper and or a camera
Waterproof shoes

Safety measures

Children should be supervised at all times
Do not enter the water
Wash your hands before and after the activity
Do not eat whilst pond dipping
Do not drink any water from the pond

Pond dipping is a great activity for all ages, and is a perfect way to find and identify freshwater species.

To ensure your activity has minimum impact on the environment, ensure you replace any organisms you find back in the water, and do not leave any equipment either in the pond or around the water's edge.

Keep contact with organisms collected to a minimum; handle them as little as possible and view them through lenses if you require a closer look.

Preparing to pond dip:

1. Ensure you have all the correct equipment ready, including a list of species you wish to spot.
2. Ensure your hands are clean and dry.
3. Approach the water quietly and slowly so you don't scare away any of the wildlife!
4. Fill the pond tray with water.



During:

5. Look in the water for movement.
6. Using the net, in a figure of eight motion, collect creatures by slowly circulating the net in water.
7. After a few loops, gently remove the net from the water and pour the contents into the tray.
8. Use an identification sheet to identify any species you have found.
9. When finished, return the contents of the tray back into the pond.
10. Move to different corners of the pond and see how the composition of the species collected changes.
11. Identify organisms that may be floating in the pond, hiding on or underneath leaves.

After:

12. Pour the contents of the tray pond back into the water as gently as possible; do not pour in from a great height or too quickly.
13. Collect all equipment up and make sure none is left behind.
14. Wash your hands with warm soapy water as soon as possible after the activity.

For older children, they may be interested in submitting their findings to one of the Freshwater Habitats Trust's PondNet survey options:

www.freshwaterhabitats.org.uk/projects/pondnet/survey-options



Freshwater activities: make your own pond

Suitable for ages 8 and upwards; supervision required

You will need

A large container such as an old kitchen basin,
plant pots or an old washing up bowl
Pond liner, preferably made of butyl rubber
Rocks, stones and gravel
Freshwater plants
Rainwater

If your garden is on the smaller size, you can still create your own freshwater pond using an old kitchen basin, garden troughs or even an old kitchen bowl. Spring is the best time to set up your own pond as it will develop quickest, but you can set up your pond at any time of year.

Before setting up your pond:

1. Choose your container and inspect for leaks using running water. A good container needs to be able to withstand weather conditions including frost. If you're using a plastic container, use a pond liner to increase its longevity.
2. Find a spot to place the large container, preferably in a warm and sunny area that is clear and easy for organisms to get in and out, but is not in a place where children are at risk of falling in if unsupervised.
3. Collect rainwater to fill your pond up, and ensure you have a reservoir to top the pond up in the warmer months.



Setting up your pond:

1. Once watertight, place your pond in its chosen spot.
2. Make the pond accessible for possible wildlife by layering rocks and stones around the outside.
3. Place a layer of clean gravel at the bottom of your pond, but avoid soil, as soil nutrients can lead to an algal bloom.
4. Fill the pond with rainwater – avoid using tap water as the chemicals in it aren't well suited to a pond.
5. Add in some freshwater plants using specialized aquatic pots and soil suitable for pond life. Submerged pond weed is essential to keep the pond clear.
6. Leave your pond to flourish and attract inhabitants! Don't bring in inhabitants from elsewhere, organisms will find the pond themselves and stay if they find it suitable.

Taking care of your pond:

1. As the pond matures and becomes inhabited, algae or blanket weed may accumulate at the surface, although this can be removed and disposed.
2. Ensure the water remains topped up with stored rainwater, especially during warmer months.

Further reading

The Royal Horticulture Society have published a guide on how to choose plants for your pond:

www.rhs.org.uk/advice/profile?pid=839

If you would like to make a larger pond for your Garden, instructions are available from The Wildlife Trusts:

www.wildlifetrusts.org/actions/how-build-pond

If your pond is 1m² to 2 hectares in surface area, you can register it with the Freshwater Habitats Trust as part of their Million Ponds Project:

www.freshwaterhabitats.org.uk/projects/million-ponds/register-your-new-ponds

If you need further help with your pond management, check out some of the resources available from the Freshwater Habitats Trust:

www.freshwaterhabitats.org.uk/projects/flagship/pond-management-info



Indoor activities: the water cycle

Suitable for 13 to 16 year olds

This activity can be conducted as a quick activity when done as a class, with the picture of the unlabelled water cycle and the blanks being filled in one at a time as a group.

For a more a fun approach, groups can be timed on how fast they complete all the labels, or a discussion can be had regarding the definitions of the different processes.

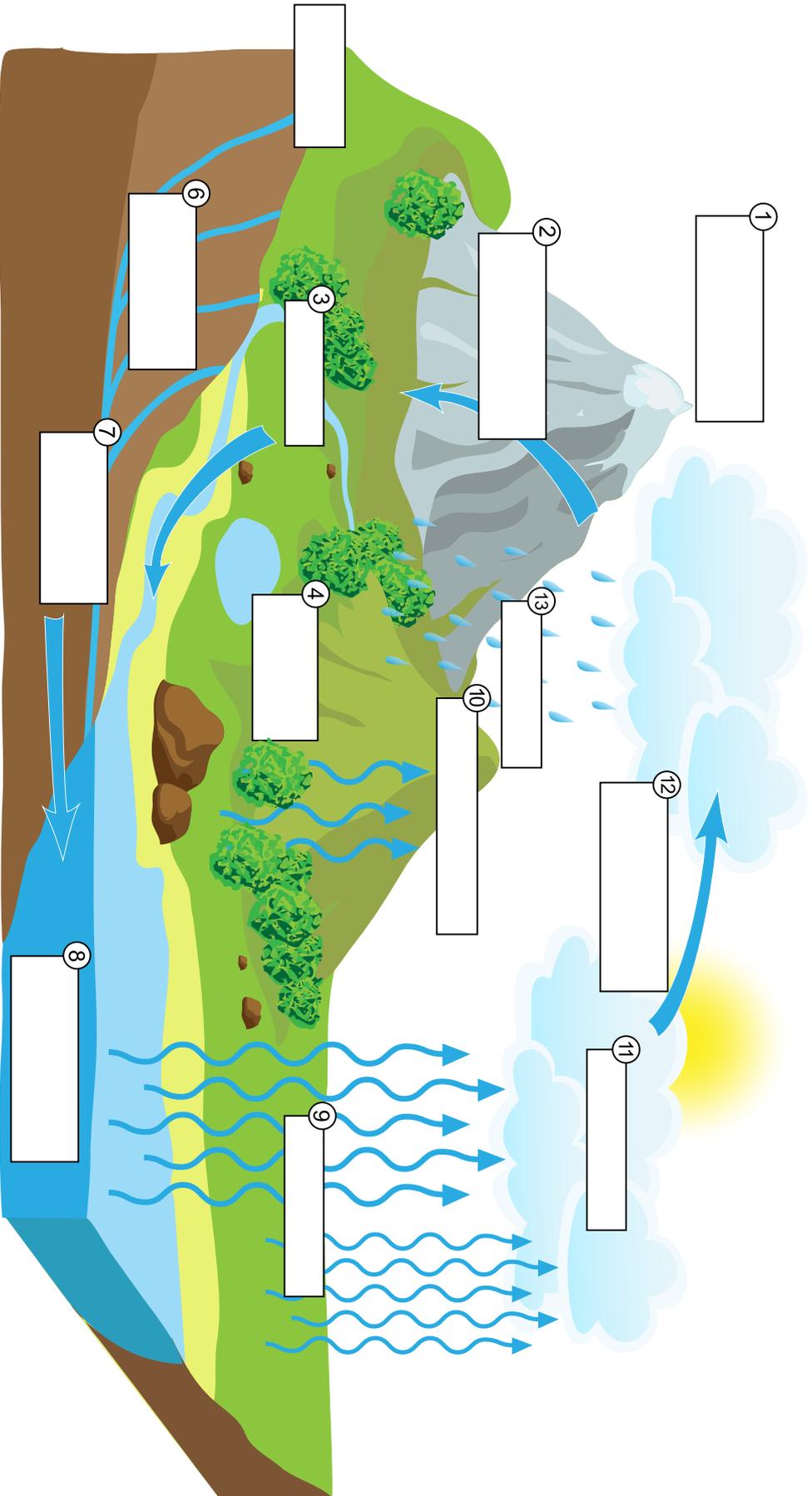
Activity notes:

1. Each group gets a print-out of the water cycle with no labels
2. Groups must fill in the blank spaces.
3. For a follow-up activity, pupils can write a sentence describing some of the processes in the cycle.



The watercycle worksheet

Place the correct labels in the empty boxes to complete all of the processes and water storage within the water cycle.

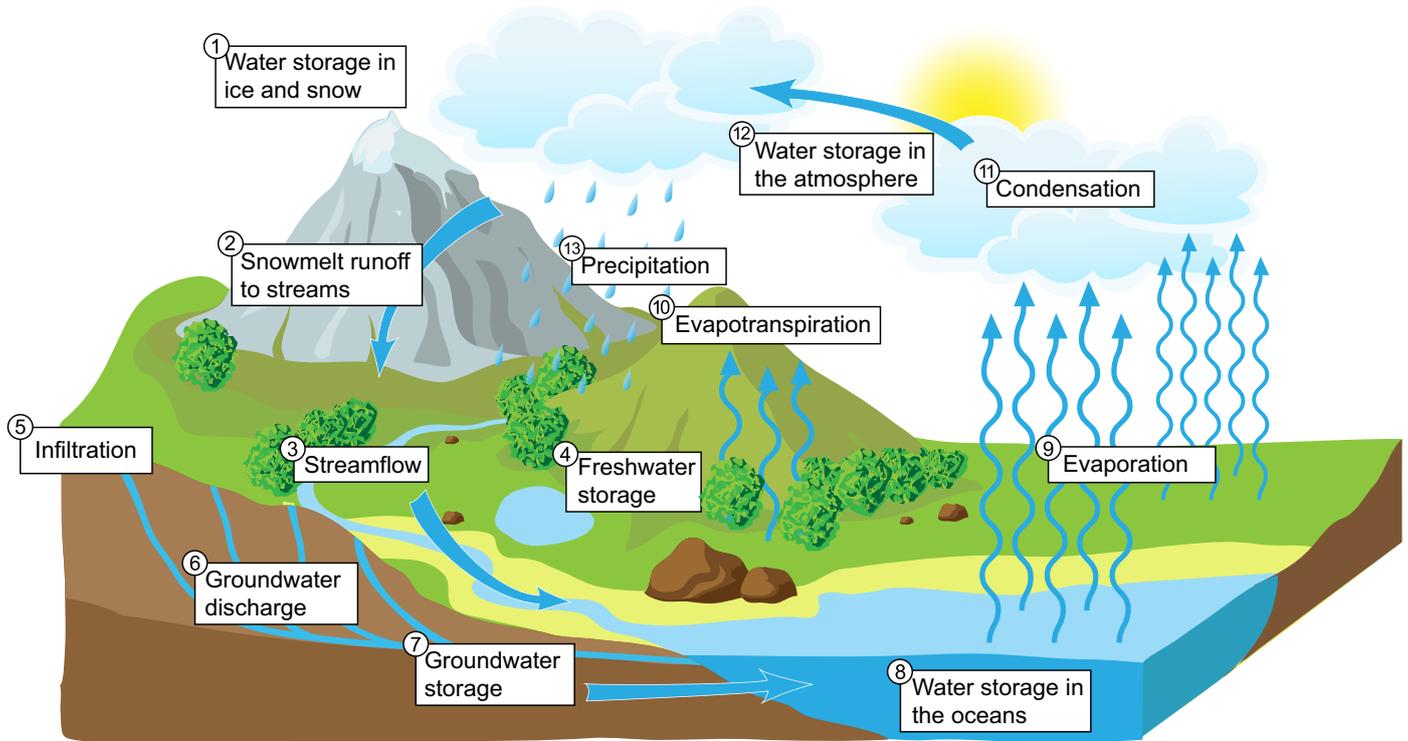


Groundwater storage
Water storage in the oceans
Infiltration
Streamflow
Evapotranspiration

Water storage in the atmosphere
Water storage in ice and snow
Snowmelt run off to streams
Freshwater storage
Evaporation

Precipitation
Groundwater discharge
Condensation

Water cycle and descriptions



Water is cycled through the atmosphere in a series of events and processes.

One way water enters the cycle is from the melting ice and snow at the top of mountains and other elevated terrain (1). Depending on the season, weather, and altitude, snow and ice melt, and this meltwater runs off the slopes and forms streams (2). These streams move down the hillside, sometimes merging with others and becoming larger rivers (3). They may also run into larger bodies of waters like lakes, which act as freshwater storage (4).

Freshwater can also be absorbed into porous rocks in the ground - a process known as infiltration (5). As the water moves slowly through rock, it may start to move from underground to nearer the surface due to changes in rock composition or topology, and becomes groundwater discharge (6). Water may also start to collect together as groundwater storage; sources of water where springs and wells get their water from (7). Groundwater may also flow into the oceans (8).

Energy from the sun heats up the surface of the earth causing the temperature of the water in our rivers, lakes and oceans to rise into the atmosphere, in a process called evaporation (9). Evapotranspiration is the process by which water is taken from the surface of plants, which produce water during transpiration (10). As water vapour rises, it cools and turns back into a liquid - a process called condensation (11).

This liquid water forms clouds, which act as water storage in the atmosphere (12). Different cloud formations are made up of different proportions of liquid water drops, ice particles and dry air. Clouds are usually mostly dry air with water droplets interspersed through.

Precipitation (13), when it rains, snows or hails, occurs when too much water has condensed in the clouds, and is too heavy for the rest of the cloud to keep it suspended.

This returns water back to rivers, streams, the sea and the ground, continuing the cycle.

Indoor activities:

Freshwater sources wordsearch

Suitable for year groups 5-11

This activity can be conducted as a quick activity when done as a class, with the different word searches catering to different age groups.

Pond	Water cycle
Lake	Canal
River	Rain
Stream	Snow
Ditch	Mist

G	L	N	V	W	J	R	Q	L	F	E	M	X	L	W
R	P	G	Z	S	M	K	D	O	L	O	N	S	N	J
H	N	P	H	N	Y	X	W	C	X	R	S	E	O	U
R	E	V	I	R	F	U	Y	L	T	T	N	N	B	P
L	G	M	P	G	C	C	W	Z	I	S	L	A	K	E
D	X	H	J	X	R	Q	F	K	M	X	I	U	R	P
H	O	X	Q	E	X	S	T	C	U	F	Y	M	I	S
C	I	U	T	X	T	S	C	U	Z	Y	I	D	R	O
G	G	A	L	R	H	A	E	G	I	A	N	N	A	G
X	W	V	E	Z	N	H	Y	R	P	E	D	O	I	W
O	Y	A	Y	A	C	Z	R	V	I	L	M	P	N	U
F	M	U	L	T	T	G	T	H	Q	F	Q	P	W	L
E	K	C	I	U	G	I	V	G	C	P	W	B	U	P
I	H	D	T	M	V	U	W	G	I	L	S	V	O	W
E	O	G	R	A	K	O	N	A	C	T	N	W	W	O

Further reading

The Wildlife Trusts provide information on UK wildlife alongside freshwater and wetland facts:

www.wildlifetrusts.org/water

The WWF on why rivers and chalk streams are important:

www.wwf.org.uk/where-we-work/places/uk-rivers-and-chalk-streams

The WWF Living Planet Report on the population numbers of species worldwide:

www.wwf.org.uk/updates/living-planet-report-2018

The Freshwater Habitats Trust aims to protect freshwater life for everyone to enjoy.

Their website has lots of educational resources and more information:

www.freshwaterhabitats.org.uk

They have a range of facts on freshwater creatures and plants:

www.freshwaterhabitats.org.uk/pond-clinic/identifying-freshwater-plants

The Wild life and countryside Act, 1981 lists all protected species in the UK:

www.legislation.gov.uk/ukpga/1981/69/contents

National Geographic resource library on Freshwater Ecosystems:

www.nationalgeographic.org/news/freshwater-ecosystem

The River Thames Catchment Project, which is working to improve the quality of the River Thames and its tributaries:

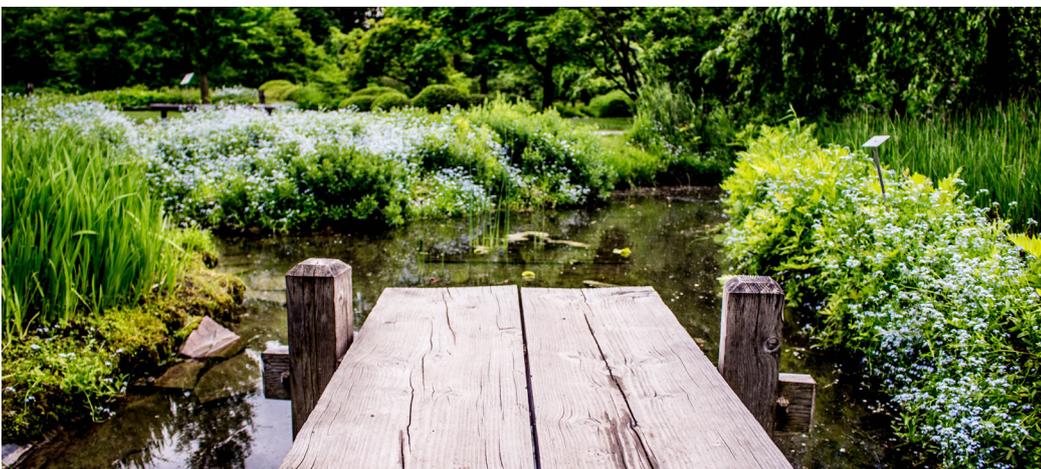
www.freshwaterhabitats.org.uk/projects/catchment-projects/river-thame-catchment-project

Want to get involved with some surveying? The Freshwater Habitats Trust has a number of PondNet survey options that anyone can get involved with, regardless of their experience or training:

www.freshwaterhabitats.org.uk/projects/pondnet/survey-options

The Clean Water for Wildlife citizen science survey, ran by the Freshwater Habitats Trust, issued over 30,000 kits for volunteers to submit levels of nutrient pollutants to understand the extent of pollution levels:

www.freshwaterhabitats.org.uk/projects/clean-water



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