Common toad © nutmeg66 CC BY NC ND 2.0

Ponds

Ponds are an extremely valuable habitat for wildlife on farmland. Species such as frogs, toads, and dragonflies rely on ponds for at least part of their life cycle, while others live in ponds for the whole of their lives. Other wildlife, including grass snakes, bats and birds, benefit from the plants and invertebrates that are associated with ponds. Many different pond types have wildlife value, but good water quality and shallow banks with emergent vegetation are especially important.

Key points

- **Farm ponds are very important wildlife habitats**
- **Good water quality and shallow banks are especially important**
- **Consider creating one or more ponds on the farm, in places where they will receive clean water, to help wildlife**

Ponds

© Katrin Wicker GFDL
Emergent plants such as yellow flag (above) and floating species such as broad-leaved pondweed (below) are good for wildlife

© Eva Raebel

Grass snakes are often found around ponds © Fafner GFDL

Ponds are one of the richest freshwater habitats. At a landscape scale, they will support more large invertebrates than rivers, ditches and streams. They vary greatly in their size and characteristics, but a healthy pond will contain a diverse community of plants and aquatic invertebrates.

Pond plants may include those that live submerged beneath the water (sometimes called oxygenators, such as hornwort), floating species (such as broad-leaved pondweed), and emergent species (such as reed mace), and all of these contribute to the health and diversity of the pond. Invertebrates that are found in or around ponds include mayflies, dragonflies and damselflies, water beetles, water bugs, caddis-flies and snails and these are, in turn, fed upon by species higher up the food chain, such as newts, frogs and toads.

Ponds provide a valuable source of water for other wildlife for drinking and bathing; for example, birds will regularly visit ponds, and ponds can provide an essential source of water for pollinating insects. Honeybees, for example, need water for diluting honey stores and for cooling the nest. Grass snakes are frequently found near ponds because they eat frogs, and bats visit ponds to drink and to feed on the many flying insects found there. The damp conditions around ponds may have their own distinct communities of plants and invertebrates, many of which have declined with the loss of farm ponds over the last century (Box 11). Many birds, such as tree sparrow and lapwing, also benefit from the soft pond margins as they are a good source of insect food for rearing chicks.

Creating ponds

Creating a pond for wildlife is straightforward if a few basic guidelines are followed. Once established, a pond should need little intervention for many years. As a pond matures, the plant and animal communities it supports will change; both young and old ponds are good for wildlife, and the more ponds in the landscape, the better (Box 12).

Good water quality is vital for a healthy pond © Eva Raebel

Ponds with poor quality water will support less wildlife
© Eva Raebel

Broad-bodied chasers are one of the first dragonflies to colonise a pond © Stever Hiner/Natural England

The three basic principles for creating a good wildlife pond are: first, find a place with a clean water source; second, leave the pond to be colonised naturally and third, ensure the pond is protected from damaging impacts once it is created.

Water quality is one of the key factors affecting the richness of the invertebrate community (Box 12). The best sources of water for ponds are rain and surface water draining into the pond from non-intensively farmed areas. Ponds should not be sited where land is likely to be high in nutrients, particularly where fertilisers and pesticides are applied and could run off into the pond. Water from ditches and streams can carry silt, nutrients or pollutants, so generally should not feed into ponds.

New ponds should not be planted up as they are best left to be colonised naturally. Some creatures, such as water bugs, will start to colonise ponds within hours of their creation and, over the years, many other species will arrive of their own accord. Some important and rare plants and animals are found only in new ponds, because they need bare mud without the competition of later colonists. It is tempting to accelerate the process if the pond looks bare, but introducing species to the pond risks the accidental transfer of invasive alien species, particularly plants, such as water fern or parrot's feather. These can dominate a pond, preventing native species from flourishing, and make the habitat unsuitable for other pond life.

Ponds that are good for wildlife can be many shapes and sizes. However, there are some broad guidelines that will help to make the most of a new pond for wildlife. Ideally, most of the pond margin should be broad and shallow (less than 1:5 and preferably <1:20) and the drawdown zones (the parts of the pond that are exposed when water levels drop during the drier summer months) should be broad and undulating. These shallows will be the richest part of the pond and water depths during the winter should be less than 10cm for as broad a zone as possible.

Ponds

Newts may arrive in ponds in spring
© Ruth Feber

In areas of clean unpolluted water, deeper sections of the pond will support many submerged and floating leaved plants. But ponds deeper than 1-1.5m provide little additional value for wildlife. Varying the depths across the pond will create a range of beneficial habitats for plants and animals.

If possible, create pond complexes or multiple pools including both permanent and seasonal ponds of varying areas and depths, rather than a single waterbody. It is important to remember that new ponds should not be dug where there are existing valuable habitats, such as species-rich wetlands, or where uncommon species already live. If there is any uncertainty, seek advice.

Pond management

Existing ponds may not always be in good condition. The most common problem is poor water quality due to fertiliser, pesticide and sediment run-off. Once polluted, ponds can be very difficult to clean up and it is often more cost effective to create new clean water ponds for wildlife. Similarly, eradicating invasive non-native plants can be difficult and it is better to take measures to stop them getting into the pond in the first place.

Temporary ponds are important too

Some ponds regularly dry out in the summer. These temporary, or ephemeral, pools often have historical and cultural significance and are home to a wide range of plants and animals that have evolved to survive and flourish in these conditions. One of these, the fairy shrimp, produces eggs that can survive desiccation when the pond dries out, and will hatch out and breed when the pond wets up again. High quality temporary ponds are now a rare habitat type in the UK, placing many of the plants and animals that depend on them under threat. Temporary ponds should not be filled in, or dug out to create permanent ponds, and they often benefit from some trampling by livestock.

Fairy shrimps need ponds that regularly dry out
© Dirk Ercken

A pond clogged with invasive parrot's feather
© Xavier Cervera

Buffer strips around ponds can help improve water quality
© Eva Raebel

There are lots of myths about the need to manage ponds. Most wildlife ponds don't need to be managed to keep their wildlife value, unless they contain a rare species which has very specific habitat requirements. Poor pond management has the potential to do more harm than good. Decide which ponds on the farm you want to be for wildlife, as you will manage these differently from ponds which have been created for other uses, such as drainage or fishing.

If the pond is to be managed for wildlife, take a cautious approach. Begin by making an inventory of important habitats that should be kept, including poached muddy margins and dense stands of emergent vegetation (large areas of deep open water will be the least valuable habitat for wildlife). Avoid making all ponds on the farm the same; for example, allow some ponds to become shallow and temporary as they slowly fill with sediments. Don't undertake drastic work, such as deepening the whole pond, cutting back all the trees or completely fencing off the pond from livestock. If management will affect more than 1/4 of the pond, seek advice.

It is important to remember that different species use different types of ponds, whether shaded, trampled, temporary or permanent. All sorts of ponds will have great value for wildlife and should be retained. The most effective way of maintaining wildlife ponds is to ensure that they are buffered by semi-natural habitat.

Ponds and the law

Creating a pond may require a licence from the Environment Agency or local authority, depending on the planned size, and where it is to be sited. Clean silt can be disposed of on land near the pond, as long as it is part of the same farm and won't cause damage to other habitats or get washed back into the pond. Pond management could impact upon sites with archaeological value, especially if the pond is over 50 years old. If in doubt, seek advice.

Healthy Oxfordshire farm pond © Eva Raebel

Ponds in the Upper Thames region

In the UK, 50% of farmland ponds have been lost over the past century and only 8% of the estimated remaining 482,000 ponds are of good quality. Pond loss in the Upper Thames region is no exception. Our research on dragonflies and damselflies suggests that up to 50% of recorded ponds have disappeared from the Upper Thames area over the same time period.

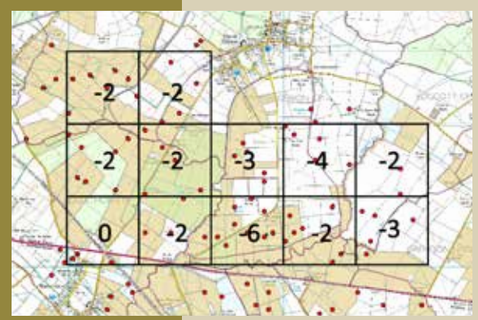
From a questionnaire survey of 90 farmers, 73% stated that they would consider pond creation, compared to 40% that would increase wet grassland, by considering in-channel enhancements such as bunds. Positive attitudes among farmers towards pond creation increased between 2003 and 2008, with 65% in favour in 2003 compared with 80% in 2008.

As part of our habitat creation work in the Upper Thames, we advised upon 28 pond creations, of which 18 were implemented. Of these, over half were created outside agri-environment scheme agreements. Support for the creation of new ponds currently comes through Countryside Stewardship, but other sources of help and funding may also be available (see Freshwater Habitats Trust Million Ponds Project website).

While many of the landowners we worked with took particular pride in their ponds and would maintain them in the absence of agri-environment scheme funding, these tended to be fish ponds with low conservation value. The uptake of pond options within Environmental Stewardship was low relative to other options.

Key results

- Over 50% of ponds have been lost from the Upper Thames Area
- Many farmers would consider creating new ponds
- Countryside Stewardship options provide support for pond creation and enhancement (pond buffering)



Grid shows numbers of ponds lost across the River Ray catchment, Oxfordshire © Eva Raebel

Large red damselfly © P.C. Watts

What makes a pond good for dragonflies and damselflies?

We studied ponds across the Upper Thames to find out which features are most important for dragonflies and damselflies. Ponds that were dominated by floating and submerged vegetation had the highest numbers, and the greatest number of different species, of dragonflies and damselflies. They also had the most transparent water. These good quality ponds were always surrounded by buffer strips (unfertilised grass strips).

Pond vegetation provides dragonflies and damselflies with refuges from predators and a variety of suitable sites for egg-laying. Vegetation and clean water will also encourage prey for the aquatic larvae of damselflies and dragonflies, such as insect larvae, water-fleas, crustaceans and tadpoles. Buffers of semi-natural vegetation around the pond help by providing roosting areas for adults, and may improve water quality by reducing surface run-off, encouraging species whose larvae cannot live in poor water-quality ponds.

Many dragonflies like open water, and newly created ponds were rapidly colonised by dragonflies and damselflies, with evidence of breeding in the year after their creation. We also found that having several good quality ponds within 100m of each other helped populations of dragonflies and damselflies, by acting as 'stepping stones' across the landscape.

Key results

- Dragonflies prefer ponds that have plenty of native submerged/floating vegetation and water with open pond surface areas
- Buffer strips around ponds provide roosting habitat and help improve water quality
- More good quality ponds across the landscape help dragonfly populations

An ideal pond for dragonflies
© Eva Raebel

Ponds

Management summary

	Key actions	Potential benefits
Pond creation	• Site pond where there is a clean water source	Water quality has biggest impact on pond wildlife
	• Leave to colonise naturally	Planting can introduce non-native, invasive plants which will dominate the pond
	• Protect from damaging farm operations	Livestock trampling, fertilizer and pesticide run-off reduce water quality
	• Seek advice	
Pond design	• Keep margins shallow and undulating	Encourages emergent vegetation and movement of animals
	• Create different depths within the pond	Provides a variety of habitats
	• If possible, aim for more than one pond	Networks of ponds act as 'stepping stones'
Pond management	• Leave ponds alone as much as possible	Leaves wildlife undisturbed and allows ponds to develop naturally
	• Plan pond management at the farm level	Ensures that there is a variety of habitat types across the landscape without trying to achieve everything in the same pond
	• Do not clear whole pond at the same time	Will allow elements of important habitats to remain

Options especially relevant for ponds

Code	Countryside Stewardship options / capital items	Tier
WT1	Buffering in-field ponds and ditches in improved grassland	Mid
WT2	Buffering in-field ponds and ditches on arable land	Mid
WT4	Pond management - first 100 sq m	Higher
WT5	Pond management (areas more than 100 sq m)	Higher
WN5	Pond management - first 100 sq m	Mid
WN6	Pond management (areas greater than 100 sq m)	Mid

Find out more at
www.freshwaterhabitats.org.uk www.buglife.org.uk www.environment-agency.gov.uk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Ditches

Ditches are highly valuable wet farmland features. Whether permanent or seasonally flooded, they support many types of farmland wildlife, including plants, invertebrates, amphibians, reptiles, birds and mammals. Ditches can sustain a range of rarer plants and invertebrates, and provide food, shelter and breeding areas for more common species throughout the year. They also act as a network of wildlife corridors across the landscape, linking other species-rich areas.

Key points

- **Ditches are valuable wetland areas for farmland wildlife, home to a rich community of plants and animals**
- **Ditches should have clean water and be managed on a little and often basis**
- **Field margins and well-managed hedgerows can add to the wildlife value of ditches**

Ditches

Blue-tailed damselflies are found in ditches
© P.C. Watts

Farmland ditches provide a range of wildlife habitats in the form of water (which can vary in quantity and permanence), channel substrate, and aquatic, bank side and bank top vegetation. Ditches provide important habitat for farmland birds, invertebrates, plants, amphibians and reptiles, and mammals. Some priority species are especially associated with ditches. Of the 70 Biodiversity Action Plan (BAP) species listed as being associated with ponds, around 20 are also associated with ditch habitats. Ditches may also support uncommon species and temporary water invertebrates due to their seasonality.

Frogs and toads will spawn in ditches
© Miles Wolstenholme

Ditches in cattle grazing marsh are often species-rich © Evelyn Simak CC BY SA 2.0

In intensively farmed landscapes, ditches can be highly valuable habitats for wildlife, particularly so if well managed. They can provide food, shelter and breeding habitats, for both common and uncommon species, where these resources might be scarce in the surrounding landscape. Ditches are home to a range of aquatic invertebrates, and the edges of ditches often have diverse plant communities which can support abundant insects, through food for insect larvae, and nectar and pollen for the adult stages (Box 13).

These invertebrates, in turn, supply birds with a particularly good source of food through the spring and summer. Ditches are known to be valuable for yellow wagtails, song thrushes, starlings and reed buntings. Taller vegetation at the fringes of ditches can provide nesting habitat for species such as grasshopper, sedge and reed warblers. Other animals that are particularly associated with ditches are the declining water vole, and amphibians and reptiles, such as common toads and grass snakes.

In some places that are prone to flooding, land drainage has created grazing marsh, which is damp pasture with networks of ditches. The wildlife interest of these coastal and floodplain grazing marshes generally lies in the water-bodies, rather than the grassland, with the ditches being particularly important for invertebrates. Grazing marshes throughout England and Wales have distinctly different habitats and species, so need to be managed in specific ways to protect their wildlife.

Hedges and margins can add to the wildlife value of a ditch © Rosalind Shaw

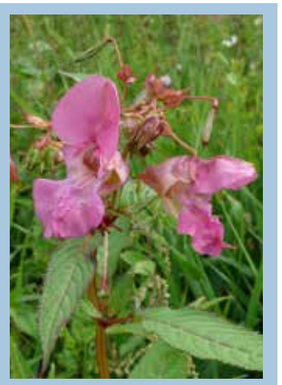
Where hedgerows are overgrown, ditches may become shaded and poorer for wildlife
© Rosalind Shaw

Ditches in more intensively farmed land are often found next to field margins and hedgerows (Box 14), which can act as important buffers for ditch communities, as well as adding to the range of habitats available for wildlife. The management of these adjoining habitats is important. Well managed hedgerows and field margins will add to the wildlife value of the ditch, but allowing hedgerows to become very overgrown can shade out the ditch, resulting in a poorer community of plants and animals.

Like hedgerows and field margins, ditches are a linear habitat and help increase habitat connectivity across the landscape. This facilitates species' movements, helping them disperse and expand their ranges, which may be especially important in the face of climate change.

Invasive plants

Some invasive plants will readily spread along ditches and watercourses. Examples include Japanese knotweed and Himalayan balsam. Himalayan balsam, first introduced in 1839, is now widely established in the UK. Its aggressive seed dispersal, coupled with high nectar production which attracts pollinators, often allows the Himalayan balsam to outcompete native plants. Today it is found throughout most of the UK.



Himalayan balsam
© Peter Roworth/Natural England

Recent research suggests that one way to help control the spread of riparian Himalayan balsam is to decrease eutrophication, thereby permitting the better-adapted local vegetation that gets outgrown by the balsam on watercourses with high nutrient load, to rebound naturally. However, where it is well established, other methods of control, either mechanical or chemical, may be needed. Advice should be sought from the Environment Agency. The use of herbicides in or near rivers, canals, lakes and drainage channels in England and Wales requires EA's prior agreement.

Ditches

Avoid clearing ditches in the summer to help leave plants and animals undisturbed © Ruth Feber

A recently cleared ditch with recovering vegetation
© Rosalind Shaw

Ditch management

In order to drain land effectively, ditches need to be routinely managed to prevent silt and vegetation building up, which will restrict the water flow. Ditches should be managed on a rotational basis to maintain habitat diversity. Many species have poor mobility, so management should aim to achieve a patchwork of ditches at different stages with a cycle of 5 years or more wherever possible. A 'little and often' approach, only working on one bank at a time and cutting or clearing different ditches in different years, will minimise the impact on wildlife and benefit the environment.

Ditches should not be cleared between March and the end of August; clearing in autumn will reduce the disturbance to birds, aquatic insects and the setting of seeds. As much vegetation as possible should be left on the ditch banks to help wildlife re-colonise the ditch.

Some species require particular ditch profiles, so aiming for a variety of ditch bank profiles around the farm will help a greater diversity of species to find suitable habitats. For example, water voles and kingfishers prefer steeper banks, but the majority of wetland plants and invertebrates prefer very shallow water. Shallow ditch edges are particularly important in areas where waders breed, to provide access to insect rich feeding areas and prevent chicks being trapped in steep-sided ditches. Where possible the shallower slopes should receive the most sunlight: gentle slopes on south-facing banks provide excellent habitat for a variety of plants and animals.

Reed buntings use ditches for feeding
© Thermos CC BY SA 2.5

High water quality benefits aquatic plants and invertebrates
© Peter Roworth/Natural England

Frog-bit in farm ditch © Paul Lacey/Natural England

Cattle create a variety of habitats by poaching shallow margins and grazing. Grazing the ditch edges benefits plants and a variety of invertebrates. However, fencing off some sections will permit the growth of taller vegetation, targeting species such as reed buntings and water voles.

High water quality is essential to the wildlife value of drainage channels. The agricultural management of the surrounding land strongly influences water quality. For example, it is important to keep pesticide and fertiliser inputs away from the water, and slurry and manure should not be spread within 10m of a ditch. Buffer strips adjacent to ditches help to keep inputs away, and timely application and appropriate rates of inputs will reduce leaching and wastage.

Good soil management on grass and cropped land facilitates the retention of valuable topsoil and minimises nutrient-loaded sediment entering water bodies. Visual monitoring of ditches can give an indication of quality: clear water, a range of plants and an abundance of insects are signs of good water quality.

As well as having benefits for wildlife, good ditch management can help to maintain optimum field drainage conditions for crop growth, minimise sediment and nutrient transport from the field to the river, improve the health of livestock, and be an early indicator of pollution problems.

Farm ditch in Oxfordshire © Rosalind Shaw

Ditches are important for bumblebees

The relative importance for bumblebees of three linear feature types - ditches, hedges and field margins - within an arable landscape was evaluated. Of the three features, bumblebee abundance was highest in ditches in late spring surveys, while hedges and field margins had similar, but lower, numbers of bumblebees.

Flower coverage was highest in ditches and field margins in late spring surveys, but bumblebee abundance in the different features was not a simple reflection of this. It appeared that suitable bumblebee foraging plants varied between ditches, hedges and field margins in a different pattern to the total flower coverage. For example, some plants found more often within ditches, for example, hedge woundwort and white deadnettle, provided important bumblebee foraging. Additionally, the shelter from wind provided by ditches relative to margins may have benefited bumblebees.

The finding that bumblebee abundance was greater in ditches than hedges and field margins at certain times of year is interesting as considerable emphasis has been placed on improving and protecting field margins for bumblebee conservation, while ditches have been largely neglected. It is also interesting to note that the importance of linear features to bumblebees changed over the season. Pollinators such as bumblebees are likely to use different habitats throughout the season as different flowers become available.

Key results

- Ditches can be rich sources of nectar and pollen for bumblebees
- Ditches may also be sheltered from wind and farm operations
- Ditch buffering and management is supported by Countryside Stewardship

Hedge woundwort is often visited by bumblebees
© Joysaphine
CC BY NC 2.0

Surveying a ditch © Ruth Feber

Biodiversity of farm ditches

Much of the information on ditches in lowland farmland has come from surveys in coastal grazing marshes which contain rich plant and invertebrate communities. There is much less information on the wildlife found in ditches on intensively managed agricultural land, and how it is affected by management. We carried out surveys of 170 ditches in Oxfordshire, and interviewed land managers, to investigate the factors affecting plant and invertebrate communities of farmland ditches.

The most important impacts on the species richness of ditches were water depth and amount of shade. Shallow, shadier ditches had fewer plant and invertebrate species than less shaded ditches with deeper water. Of the farmers surveyed, many carried out little management of ditches. The average time since ditches were last dredged was 15 years, and time since the vegetation was cut was around 8 years. Whether or not a ditch was entered into an agri-environment scheme (AES) appeared to have little impact on either the reported management regime or the biodiversity value of the ditch.

Increasing the amount of water in ditches, by increasing the water depth or retaining water in ditches for longer periods, could increase the biodiversity value of ditches in agricultural landscapes. Reducing the amount of shade over narrow ditches by managing adjacent hedgerows is also likely to increase the species diversity of plant and invertebrate communities within the ditch.

Key results

- We surveyed the biodiversity and management of ditches in Oxfordshire farmland
- Ditches with deeper water, and that were less shaded, had more species of plants and invertebrates
- Measures to increase water depth and reduce shade over ditches could increase their wildlife value

Ditch dredging and cutting of vegetation was very infrequent for many farm ditches
© Rosalind Shaw

Ditches

Management summary

	Key actions	Potential benefits
Ditch structure	• Aim for a range of ditch bank profiles, steeper areas and shallower areas	Species have different requirements
	• Create some places where grazing animals can access ditches, but restricting access in others is also important	Some cattle poaching can be very good for ditch wildlife, but water voles need dense bank vegetation and benefit from fenced areas
	• Aim to have field margins and hedgerows next to ditches	Provides a greater complexity of wildlife habitat and buffers the ditch
Ditch management	• Clear ditches in the autumn or winter rather than spring or summer, on a 3-5 year rotation	Will reduce disturbance to wildlife
	• Clear on a little and often basis	Leaves areas from which species can re-colonise Leaves some areas undisturbed at any one time
	• Keep pesticides, fertilizers and other inputs away from ditches	Good water quality is crucial for wildlife

Options especially relevant for ditches

Code	Countryside Stewardship options / capital items	Tier
SW1	4-6m buffer strip on cultivated land	Mid
SW2	4-6m buffer strip on intensive grassland	Mid
SW4	12-24m watercourse buffer strip on cultivated land	Mid
SW11	Riparian management strip	Mid
WT1	Buffering in-field ponds and ditches in improved grassland	Mid
WT2	Buffering in-field ponds and ditches on arable land	Mid
WT3	Management of ditches of high environmental value	Higher

Find out more at:
www.rspb.org.uk www.buglife.org.uk www.environment-agency.gov.uk www.naturalengland.org.uk
www.freshwaterhabitats.org.uk

Otter © Andrew Harrington

Rivers & streams

Rivers and streams support a great diversity of wildlife, and are important providers of other environmental and ecological services. As well as supplying water, rivers, streams, and their associated wetlands play a vital role in land drainage, retaining water, and in flood management. A healthy river has a rich community of plants and animals that depend on the water for their survival, and a range of other species will make use of riparian habitats for food and shelter. The protection and conservation of rivers and streams as they flow through farmed landscapes has great benefits for farmland biodiversity and the wider environment.

Key points

- **Many plants and animals depend on rivers and streams**
- **Management of the surrounding land affects the health of the river**
- **Controlling livestock access, management of bankside vegetation and keeping inputs away from the water are all important**

Rivers & streams

River Windrush © Peter J Dean CC BY NC ND 2.0

Streams and rivers are home to a wide range of plants and animals, which are dependent upon freshwater habitats for their survival. Submerged, emergent and floating plants, and a range of substrate types and water depths (for example, riffle pool systems), provide habitat for aquatic invertebrates, and shelter and cover for fish. As well as species that live within the water, many others rely on streams and rivers as foraging or breeding habitat. Riparian vegetation is especially important. Many birds depend on these habitats for foraging and nesting, and water voles need well vegetated banks for their burrows.

Daubenton's bats hunt along rivers
© Danielle Linton

Water voles need well-vegetated riverbanks
© Tom Moorhouse

Riparian corridors provide a crucial habitat for many wildlife species and a means of safe movement and dispersal. Watercourses provide rich hunting grounds for bats, as they support an abundance of their insect prey, and declining species such as damselflies and dragonflies will use riparian vegetation for the adult stage of their lifecycles. Other invertebrates and fish benefit from this vegetation as a source of food, cover and shade. As well as being good for wildlife, bankside vegetation plays an important role in limiting erosion and silt and nutrient run-off from adjacent fields.

Rivers and streams are under constant threat from a range of domestic, agricultural and industrial activities, and this has been reflected in the severe declines in many freshwater species. Dredging, channelisation and the removal of tree cover have caused the erosion of riverbanks, resulting in changes in the frequency and magnitude of flooding, and patterns of sediment transport and nutrient exchange. Flood defence structures prevent rivers functioning as dynamic systems, reducing their ability to create new habitats. Those rivers that have not significantly been modified represent a very valuable ecological resource.

Aspects of modern agriculture, such as high stocking rates, fertiliser and pesticide inputs, and drainage are among the factors putting pressure on the habitat for wildlife. Many of these

Too much grazing and trampling by stock can reduce water quality and degrade the bankside habitat © Rosalind Shaw

negative impacts can be mitigated through careful land management practices. For example, fencing and providing alternative drinking arrangements for cattle can reduce sediment and nutrient inputs, leading to improved water quality, stock health and productivity. Creation of buffer strips and the management of bankside vegetation help to protect the watercourse from agrochemical inputs and add to the wildlife habitat available, and selective coppicing of bankside trees can improve fisheries. Other threats to native wildlife, such as those from invasive or alien species, may need targeted management (Box 15).

Livestock impacts

The bullhead has been affected by silting of streams
© Hans Hillwaert CC BY SA 3.0

Unrestricted access to rivers by large numbers of livestock can have detrimental effects on wildlife habitats. Water quality may be lowered, the riparian habitat becomes degraded and typically the watercourse becomes wider and shallower.

Compacted and livestock-poached soils and eroded banks in unfenced areas lead to greater run-off and potential for sediment to reach the river, where it is detrimental to fish spawning areas and other habitats. The sediment settles out to smother river-bed gravels. This can reduce the flow of oxygenating water to fish eggs laid in these spaces, which can result in the death of large numbers of eggs. Sediment on the stream bed also reduces the range of habitats available for other organisms, such as invertebrates, and so reduces their abundance. These organisms tend to be at the bottom of the food chain and are the food source for larger predators and fish. Nutrient enrichment may occur both directly from livestock excreta and by the introduction of nutrients bound to soil particles. Over-grazing is also a threat to the quality of bankside vegetation.

Rivers & streams

Fencing to restrict access by livestock has many environmental and wildlife benefits © Alison Poole

Kingfishers will benefit from measures that improve water quality of rivers and streams © Paul Lacey/Natural England

In arable areas, buffer strips can act as barriers to run-off and pollution © Alison Poole

Bankside vegetation and buffer strips

Carefully designed fencing along watercourses can help to reverse detrimental effects of over-grazing. By managing stock access, erosion rates are reduced, and grasses and other vegetation are able to become established and help to stabilise the bank, thereby reducing the rate of bank erosion, soil loss and attached nutrients. The increase in long fringing grasses provides ideal habitat for young fish which require cover and hiding places. A reduction in contamination from animal waste can improve water quality and hence the survival rate of a wider range of aquatic wildlife.

On a local scale, well vegetated buffer strips along the water's edge can help trap topsoil from ploughed fields before it reaches the watercourse. The buffer strip acts as a physical and chemical barrier between modern agriculture and the river. Where buffers are present, manure, fertilisers and pesticides are less likely to be accidentally spread directly into the watercourse and soil bacteria can break down pollutants before they reach the river.

Ongoing management of bankside vegetation, by light grazing or cutting, is likely to be required to prevent the area scrubbing over, and may be needed to maintain capacity and reduce flow resistance. Mowing and cutting can radically alter the plant communities and habitat structure for invertebrates, birds and mammals. Where possible, it is best to cut on a rotational basis, on alternate banks, which allows wildlife to seek refuge in uncut areas. If channel vegetation needs to be removed this should be done as patchwork clearance rather than all at once.

Fencing guidelines and methods for providing alternative drinking sources are available from the Environment Agency and the Rivers Trust.

Coppicing lets light into the river
© Richard Webb CC BY SA 2.0

Coppicing bankside trees

The presence of woodland within 25m of a river is beneficial for aquatic invertebrates (Box 16). However, problems can be caused by over-shading of rivers by trees that have not been managed for several years. Heavy shading reduces photosynthesis for plant and algal growth and so reduces the numbers of dependant invertebrates. Erosion creates bays between trees which then become undercut and fall in, smothering the river bed in silt and reducing the value of fisheries and wildlife.

Bankside coppicing work can increase the amount of light getting through the canopy, which promotes the growth of aquatic vegetation, and terrestrial grasses and low growing plants that will stabilize the banks. Selective coppicing of bankside trees along over-shaded sections leads to significant increases in juvenile fish numbers, as well as increasing habitat diversity for other species.

Riparian habitats are important for bats, otters and water voles, all of which are protected by law. Any work could potentially cause damage or disturbance so checks should be made as part of planning. Advice on what to look for is available from Natural England.

Riverflies can indicate river health

Riverflies (mayflies, caddisflies and stoneflies), along with other freshwater invertebrates, are at the heart of the freshwater ecosystem and are a vital link in the aquatic food chain. Freshwater invertebrates spend at least part of their life cycle in rivers, streams, ditches or ponds, and provide a vital food source for fish, birds and mammals. They also help to break down organic matter.

Mayfly © David Hill CC BY ND 2.0

Riverflies are sometimes known as the 'canaries' of the waterways as they can be used to assess the health of freshwater systems. They have several characteristics which make them particularly useful as indicators of changes in water quality. These include limited mobility, relatively long life cycles, presence throughout the year and specific tolerances to changes in environmental conditions. There are a total of 278 species of mayflies, caddisflies and stoneflies, eight species of which have Biodiversity Action Plan status and therefore are recognised as a priority for conservation.


American signal crayfish © Tom Moorhouse

The invasive American signal crayfish

The American signal crayfish is a non-native species of crayfish now widespread in British rivers. It is damaging to our native biodiversity, directly predating on other species, and out-competing them for food resources. Signal crayfish burrow extensively into banks, having detrimental effects on riverine habitats, and fishing interests.

We conducted a large-scale project in the Upper Thames to see if signal crayfish could be controlled by trapping and removal. We found that efforts to remove signal crayfish by trapping were counteracted by immigration of large individuals from neighbouring stretches of water. Removal trapping also resulted in better body condition of the remaining crayfish. While our study was not long enough to discover whether survival or breeding success was greater as a result of lower numbers and better body condition, the results suggest that this could be a possible feedback mechanism.

However, signal crayfish remaining in areas that had been trapped were found to move around much less, perhaps because more food and shelter was available. This suggests that removal trapping at the edge of a colonisation front may be sufficient to slow the rate at which a signal crayfish population spreads. It is unlikely, however, that removal trapping would be sufficient to prevent the spread of signal crayfish populations.

Key results

- **Signal crayfish are a species invasive to Britain and damaging to the riverine ecosystem**
- **Removal trapping does not appear to be an effective way to control their numbers**
- **Large crayfish moved into the trapped areas, and the crayfish that remained had better body condition**


The native white-clawed crayfish has suffered huge declines since the arrival of the American signal crayfish © Paul Glendell/ Natural England


River and woodland in Oxfordshire ©Alison Poole

Nearby woodland benefits river invertebrates

Aquatic invertebrates are very important indicators of the health of a river. We used monitoring and mapping data from the Environment Agency, Natural England and Ordnance Survey, together with our own data, to investigate which features in a river catchment were most important for increasing the diversity of aquatic invertebrates in the river. We studied the Thames and its tributaries (including the Windrush, Oxon Ray, Cherwell and Evenlode) upstream of Wallingford. In total over 160 samples were used from 80 different sites located across the catchment. We looked at how surrounding land use affected different measures of aquatic invertebrate biodiversity, such as how rare the invertebrates were at a site and how pollution tolerant each species at a site was.

The amounts of both organic land and woodland upstream of the invertebrate monitoring site affected the invertebrate communities of the river. The most important effect was the amount of woodland within 25m of the river. The more woodland there was within 25m, the healthier the river, as indicated by the aquatic invertebrate community. The proportion of land in an organic scheme within 500m of the river upstream also had a positive effect, as indicated by the aquatic invertebrates, but not to the same extent as the woodland.

Key results

- **Riparian woodland has a positive effect on river quality, as indicated by aquatic invertebrates**
- **Woodland within 25m of the river was particularly important**
- **Preserving woodland may be more important than organic farming for river invertebrates**


Sampling rivers for invertebrates © Alison Poole

Rivers & streams

Management summary		
	Key actions	Potential benefits
Livestock protection	• Use fencing to restrict access and protect watercourses from heavy use by stock	Limits erosion, silt and nutrient run-off Benefits wildlife, especially species that need dense bank vegetation, such as water voles
Bank vegetation and buffer strips	• Establish buffer strips next to watercourses on arable land or ungrazed strips in livestock areas • Manage by topping or light grazing • Keep pesticides, fertilizers and other inputs away from rivers and streams	Provides a greater complexity of wildlife habitat, thicker vegetation, reduces siltation and pollution in the river Will reduce disturbance to wildlife Prevents scrubbing over Good water quality is crucial for wildlife
Coppicing bankside trees	• Where overshading is a problem, coppice bankside trees	Allows light to river, increases plant growth and invertebrate diversity, reduces erosion and silting

Options especially relevant for rivers & streams		
Code	Countryside Stewardship options	Tier
SW1	4-6m buffer strip on cultivated land	Mid
SW2	4-6m buffer strips on intensive grassland	Mid
SW4	12-24m watercourse buffer strip on cultivated land	Mid
SW8	Management of intensive grassland adjacent to a watercourse	Mid
SW11	Riparian management strip	Mid
SW12	Making space for water	Higher

Find out more at:
www.theriverstrust.org www.environment-agency.gov.uk www.naturalengland.org.uk
www.riverflies.org www.buglife.org.uk