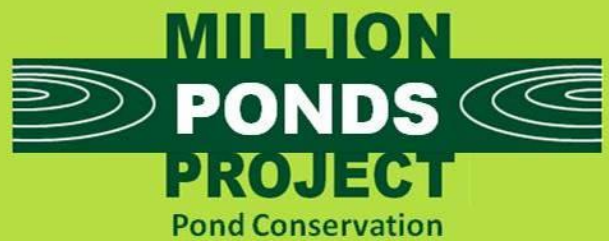


Designing wildlife ponds in grasslands



A 50-YEAR PROJECT TO CREATE A NETWORK OF CLEAN WATER PONDS FOR FRESHWATER WILDLIFE

1. The value of grassland ponds

Unimproved grasslands and their ponds are a valuable and increasingly rare habitat type in the UK. Grassland ponds are very variable, but they can broadly be divided into three categories: calcareous, neutral and acid. The pond community will also vary depending on how the pond receives and holds water (surface or groundwater-fed, permanent or temporary) and the type and intensity of grazing management (Figure 1).

Changes in land management, including the loss of traditional grazing and agricultural improvements (fertilisers, ploughing, reseeded, drainage and heavy stocking densities) are severe threats to grassland ponds. However, there are also many opportunities to create ponds in grasslands and provided good management is put in place, they can be amongst the best habitats for freshwater wildlife in the UK, supporting many of our rarest plants and animals.



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Figure 1. Ponds in historically grazed commonlands (left) on freely draining soils have year round grazing and characteristically close cropped turf. Lower grazing pressure and a high water table for most of the year leads to the development of species rich grazing marsh (right). Both management regimes can create great ponds.

2. Design principles for grassland ponds

- **Clean water.** New grassland ponds can be any size or shape but to really benefit freshwater biodiversity, they must be fed by a source of clean unpolluted water.
- **Pond complexes.** Create a number of ponds of varying sizes and depths, rather than a single waterbody.
- **Shallow margins.** In grasslands, ponds of almost any size, shape and depth will work; but some shallow margins and broad drawdown zones should be included in the pond design.
- **Grazing.** Grassland ponds are heavily influenced by the level of grazing. This is often the key to maintaining the desired pond community.

What's in this factsheet?

- The value of grassland ponds
- Design principles for grassland ponds
- The importance of grazing for grassland ponds
 - The development of grazed ponds
 - Grazing regimes
 - Cut grasslands
 - How to determine grazing pressure
 - The importance of heavily grazed and poached ponds
- Designing grassland ponds
 - Finding a clean water source
 - Pond substrate
 - Choosing pond location and avoiding sensitive areas
- Grassland pond profiles and pond complexes
 - Drawdown zone and shallow margins
 - Deeper water
 - Pond complexes
- Case study: Gallows Bridge Farm
- Further reading

3. The importance of grazing for grassland ponds

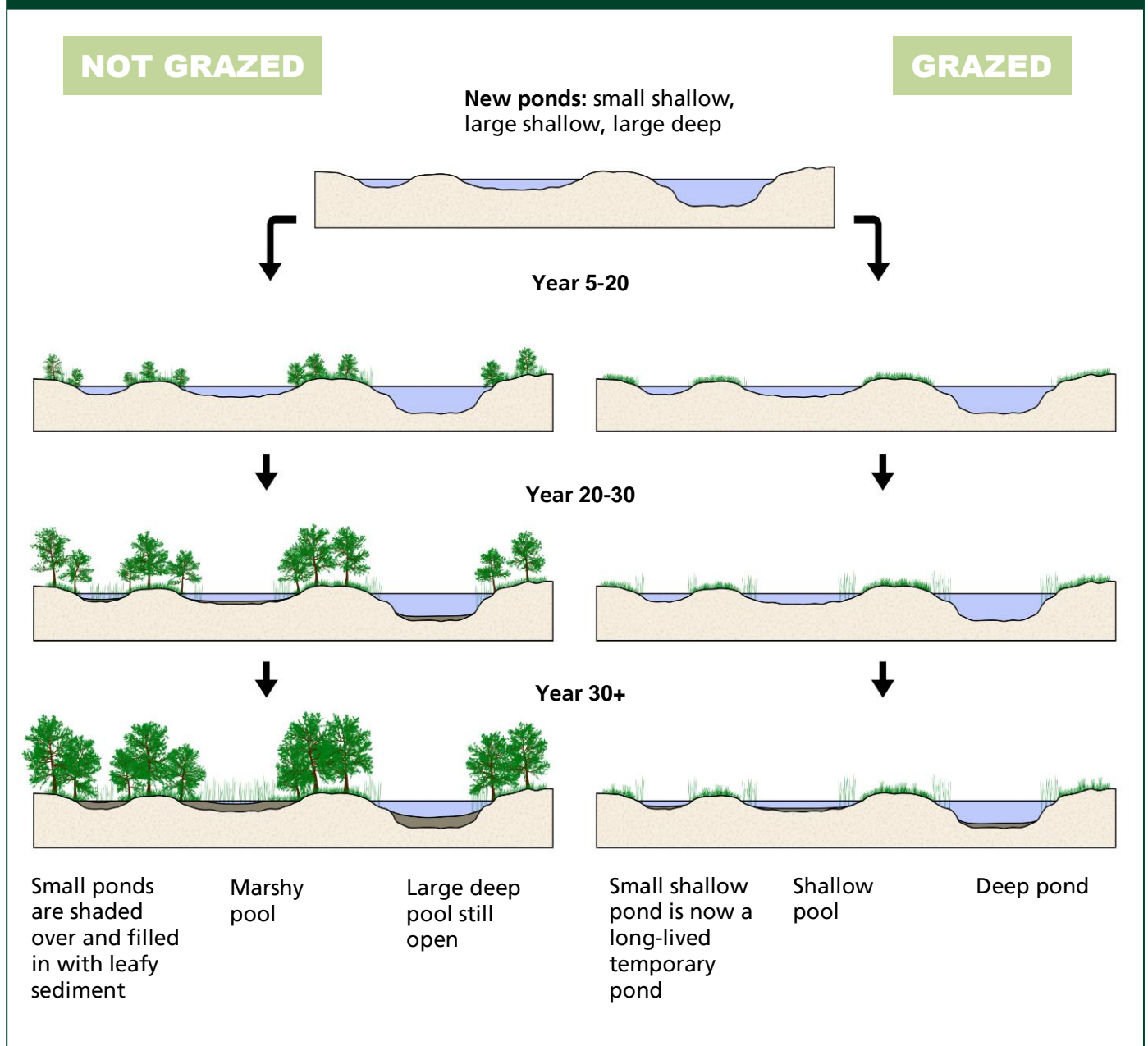
The development of grazed ponds

Grazed unimproved or semi-improved grasslands are excellent places for ponds. Their advantage is that 1) vegetation in the shallow margins will be grazed and 2) if the whole pond is shallow, grazing can occur across the entire surface area. This keeps ponds open and means that even subtle undulations in wet ground topography can be maintained for many decades (Figure 2).

Trampling and grazing by livestock also creates poached muddy margins, including a mixture of bare and vegetated ground with a micro-topography of tiny temporary pools and wet mud. This is the perfect habitat for many terrestrial, semi-aquatic and aquatic plants, including some very rare species, and invertebrates, such as shore bugs, many flies, ground beetles and some dragonflies.

Figure 2. The development of grazed and ungrazed ponds.

Grazing maintains the grassland habitat but is also essential in slowing down the rate of pond development giving it a longer life-span.





Grazing regimes

Pond creation schemes should include plans for management once the pond is finished. Grazing is important for creating bare patches in the pond margin which plants need to germinate and grow. Different plants flower, set seed and germinate at different times of the year which means that there is no optimum time to graze a pond.

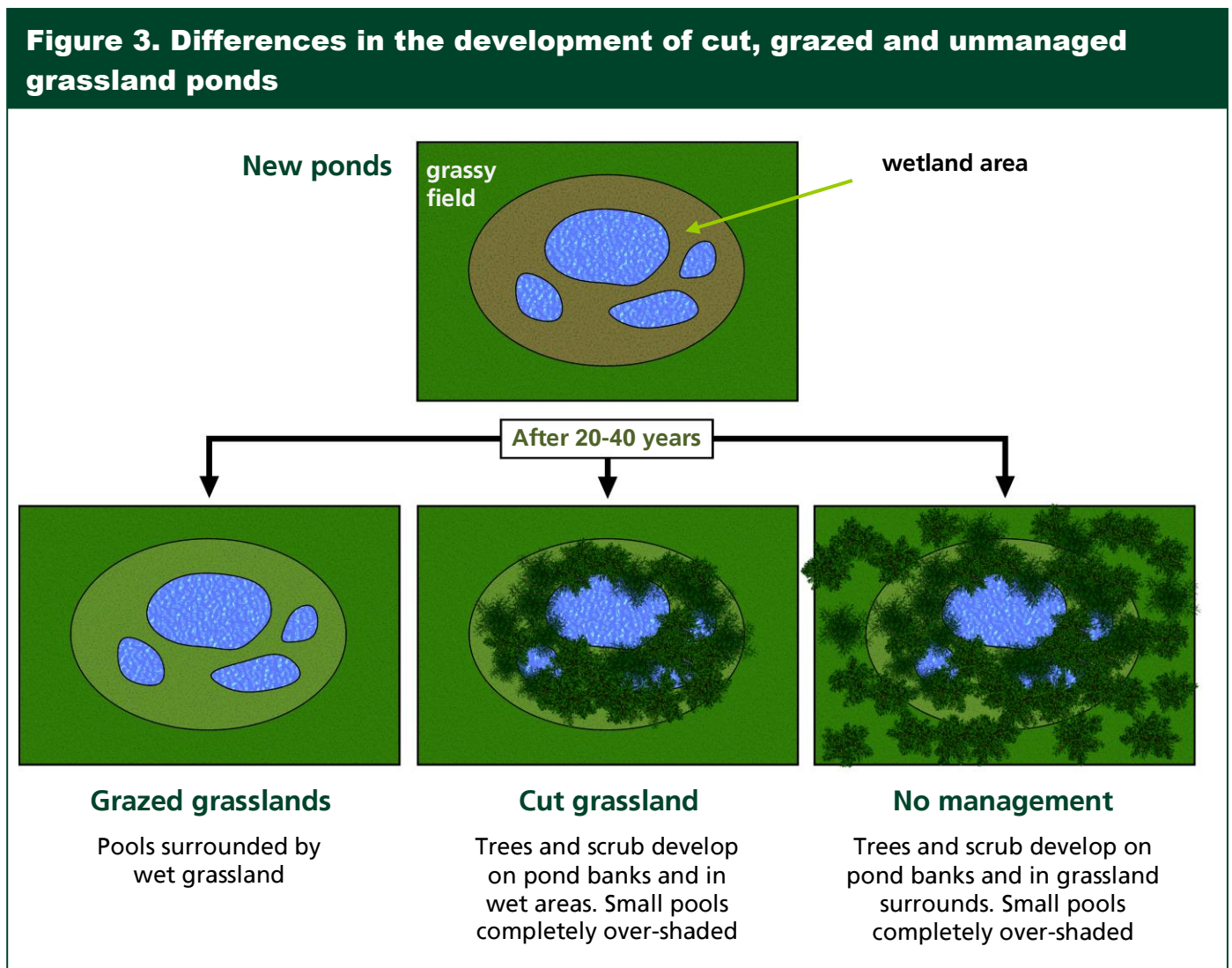
In very extensive landscapes, such as the New Forest, ponds are grazed throughout the year. Animals can move around to find food, creating a landscape mosaic of different habitats.

In smaller sites, rapid spring growth may be too much for low stocking densities, leading to the development of woody vegetation. In the winter, food availability may be too low to support the number of animals on the site. Therefore stocking densities will need to be adjusted within and between years to maintain the correct grazing density. To replicate the more traditional land management systems several regions have developed grazing schemes bringing together several sites (and even landowners) to manage them at a landscape scale. For more advice on all aspects of grazing and livestock management visit the Grazing Advice Partnership www.grazinganimalsproject.org.uk/.

Cut grasslands

Ponds in grasslands that are cut, rather than grazed can develop very differently to grazed ponds (Figure 3). Machines that cut or mow grass do not usually cut right to the waterline, particularly if the edges are wet or muddy. As a result ponds in cut grassland often develop a tree fringe.

Create small ponds with wide drawdown zones which can be better managed by cutting with a boom, or design and create woodland ponds (See the [Supplementary Habitat Factsheet: Woodland ponds](#) for more information).



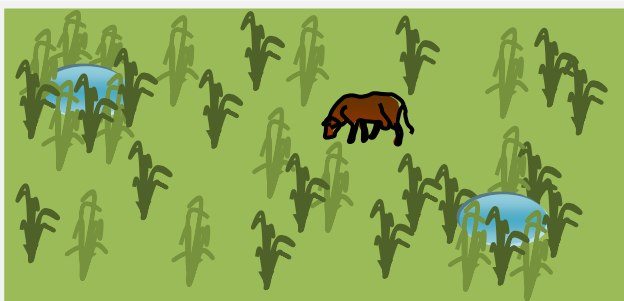
How to determine grazing pressure

Grazing pressure is not something to worry about – we don't have the knowledge to be prescriptive. In general the best policy is to base grazing levels on historical grazing practices which have resulted in the desired grassland community at a particular site. Be prepared to change plans if stocking densities are too high or too low for the target species.

It is important to note that ponds aren't like grasslands where the number of livestock per hectare is a good measure of grazing intensity. The grazing pressure upon a pond will depend on (i) the number and surface area of waterbodies, (ii) the head of stock *in the grazing unit as a whole* (Figure 4) and (iii) the type of livestock (Figure 5). This means that, given the same grazing density:

- As the number of stock increases the grazing pressure on a single pond will increase regardless of the size of the field, as stock will congregate around the pond rather than dispersing around a larger field.
- As the number of ponds in a field increases, grazing pressure per pond will decrease.
- As the size of the pond increases, grazing pressure will decrease as the animals have a greater perimeter or surface area to cover.
- Four ponds in one area of the field will be more grazed and poached, than four ponds spaced further apart, because animals will concentrate in the area with water rather than dispersing.

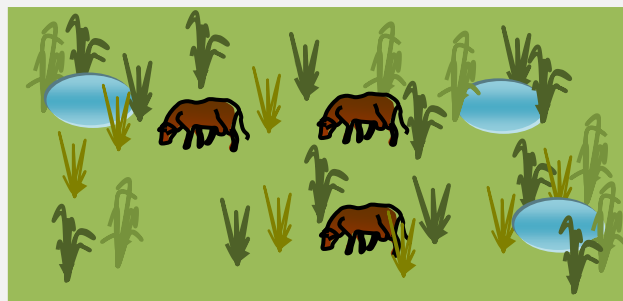
Figure 4. You can use the density of ponds and stock to get the correct grazing pressure for your target species.



0.5:1 Very low intensity grazing

Few livestock per pond - sward height tall and limited poaching.

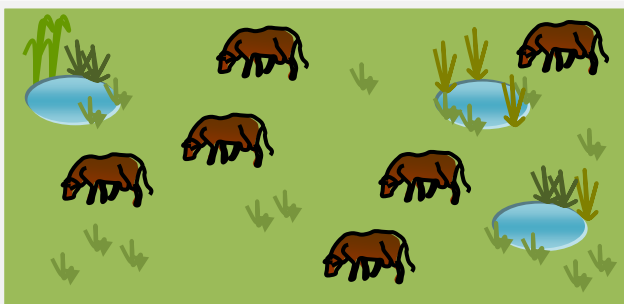
Some scrub/trees will develop → only deeper, larger ponds will remain open.



1:1 Low intensity grazing

More livestock, but grazing density per pond is still low, because pond number has also increased.

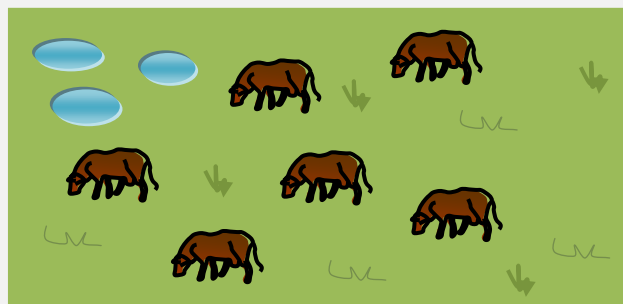
Shallow pond margins have greater diversity and structure. Vegetation height still tall → even shallow ponds usually remain unshaded.



2:1 Moderate intensity grazing

More livestock per pond – ponds widespread.

Produces a mosaic (e.g. rushy pasture) → shallow ponds gently poached, good for a wide range of pond species.



2:1 High intensity grazing

More livestock per pond - ponds grouped.

Produces a short open sward. In traditionally grazed grassland landscapes, rare plant communities can develop → small shallow ponds very heavily poached and margins or larger ponds moderately poached.



Figure 5. Management of ponds using different livestock

COWS



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Cattle are great for grazing ponds in grasslands. They are not very selective, pull up rather than crop herbage and readily poach the ground. This creates a mosaic of vegetation heights and a diverse sward.

They will eat tall vegetation and will trample bracken and scrub. Cattle tend to avoid rushes which can lead to the creation of rushy pasture at moderate stocking densities.

Cattle reared for beef are more suited to conservation grazing than dairy cattle because the latter requires high quality pastures, usually artificially fertilised, to produce a commercially viable product.

Because of their size, very few animals are needed to create the required conditions.

Cattle are drawn to ponds to drink and to wallow and can be used in winter waterlogged grasslands.

HORSES



© Jim Champion

Horses can produce an extremely close cropped turf, but they will preferentially eat grasses, rushes and sedges over herbs. This can allow some very rare plant species to thrive where horses graze, especially where the action of grazing creates bare poached ground.

They also graze areas preferentially, particularly around a water source. In extensive grazing systems like the New Forest, this will create areas of lawn interspersed with areas of taller vegetation across the landscape. In small sites they avoid latrine areas which can lead to patches of more rank vegetation.

They will have greater impact on the vegetation than cows because they do not ruminate and therefore eat more. Hardier breeds will eat woody vegetation, particularly during the winter months which can be important in controlling scrubby vegetation.

Horses will readily wade into shallow water to graze.

SHEEP



© Pond Conservation

Sheep are highly selective grazers, having a preference for sedges, rushes and seed and flower heads, but avoiding aromatic herbs and species such as sundews.

At high densities sheep produce a close cropped sward. But, at lower densities they can increase the diversity of the pond margin by removing dominant plants.

In the pond margin, the small feet of sheep will readily poach the ground and create areas of bare mud, but not to the same extent as bigger livestock.

Sheep are not suited to ponds in permanently waterlogged grasslands as they are prone to foot rot. They will also avoid areas where the existing vegetation height is tall.

Sheep can be encouraged to enter into ponds if the bank angles are very shallow, and the ground is firm, so shallow margins are also important for animal safety.

The importance of heavily grazed and poached ponds

There is sometimes concern about over-grazing and poaching of pond edges. But as a general rule - as long as grazing doesn't stop plant growth on the pond's margins *all year round*, the pond will be valuable. In some of our traditionally grazed grassland landscapes, like the New Forest, some plants and animals have become specialists of very bare muddy ponds.

- **Poaching from hooves creates a micro-topography.** This is excellent, as it adds an extra layer of topographic complexity which is an important habitat for many plants and invertebrates.
- **Heavily poached muddy ponds** can look awful at some times of year, but this is not necessarily bad for wildlife. Bare muddy areas are critical for some uncommon plant and animal species (Figure 6). Pond margins may be decimated in spring and gradually re-colonised in later summer to give a mixture of mud and vegetation which is perfect for many species.
- **Animal dung - a component of the pond ecosystem.** Unimproved grasslands are naturally low nutrient systems, because grazing animals consume the vegetation (biomass) and are then taken off the land; to graze new sites or to slaughter (i.e. a net loss in biomass from the site). Pond plants and animals in grazed grasslands are adapted to these low nutrient conditions and often rely on localised inputs from animal dung.

Figure 6. The importance of heavily grazed ponds for some of the UK's rarest plant and animal species

- 1 A shallow temporary pond in neutral grassland – the warm poached water supports Tadpole Shrimp *Triops cancriformis* and Fairy Shrimp *Chirocephalus diaphanus*.
- 2 A temporary pond in mildly acid grassland – in summer the entire pond basin is heavily grazed, creating bare ground on which Small Fleabane *Pulicaria vulgaris* flourishes.
- 3 A permanent pond on acid grassland with a broad shallow margin and wide drawdown zone – heavy poaching creates patches of bare ground for low growing plants including Pillwort *Pilularia globulifera*.
- 4 The margin of a permanent grassland pond on base rich clay habitat – poaching keeps the substrate open providing a habitat niche for rare stoneworts e.g. Strawberry stonewort *Chara fragifera*.





4. Designing grassland ponds

Finding a clean water source

Deciding where to put a pond will be the most important decision you take when creating a grassland pond. It will determine how good the pond will be for wildlife, which species the pond will support and the future management needs of the pond. Unimproved grassland catchments are low in nutrients and a good source of unpolluted water. However, there are a number of issues to be aware of:

- **Avoid stream, ditch or drain inflows into ponds.** Streams and ditches will bring in silt which will rapidly fill the pond reducing its lifespan. Streams and ditches may also bring in agricultural or other pollutants (nutrients, pesticides, sewage and the like), thereby reducing water quality. Grassland ponds in the floodplain may be particularly vulnerable to poor quality river water, which is often much higher in nutrients than groundwater or surface water (for further information on creating ponds in the floodplain go to [Supplementary Habitat Factsheet: Ponds in the river floodplain](#)).
- **Don't locate ponds in grasslands where additional fertilisers are added to the soil to increase grassland productivity.** Semi-improved grasslands may be good places for pond creation provided that nutrients are no longer added to the soil and the site is now managed favourably. If the pond is located in intensive grasslands, then an unfertilised buffer strip can be created round one or several ponds to protect them from nutrient leaching.
- **Consider the land use adjacent to the grassland.** Intensively managed areas may be part of the pond catchment area (the area which drains into the pond) and could introduce high levels of nutrients and pollutants into the pond. Grasslands surrounded by other low intensity habitats, such as fen, marsh, heathland or woodland will have the greatest wildlife potential.
- **The best sources of water for ponds** are usually (a) groundwater or (b) rain and surface water draining from non-intensively managed areas. See [Pond Creation Toolkit Factsheet 2](#) for information on creating clean water ponds for wildlife.
- **Don't add topsoil or leave it near the pond.** Topsoil is very high in nutrients. So, having made sure the pond water source is clean, don't then add pollutants from topsoil.
- **Don't connect ponds to one another.** There is a misconception that linked ponds will hold water better than isolated ponds. A complex of ponds with different water depths, which hold water for different lengths of time, will increase the diversity of a grassland pond complex.

Pond substrate

Grassland ponds can be created on a wide variety of different substrates. But, the trick is to choose locations where water will be naturally retained. Don't completely replace areas with standing water in winter; these are valuable habitats in their own right. Use existing ponds to identify how water is stored in the landscape. If there are no existing ponds, use bore holes and test pits to determine groundwater levels and the water holding capacity of the soil.

- Groundwater-fed ponds can be created on any geology by digging into the substrate to reach the water table. However, this is only feasible where the groundwater level is close to the surface, although some overburden can be removed to reach the groundwater level before constructing the pond.
- On impermeable substrates, such as some clays, pond creation can be easy, as they will fill from surface water and direct rainfall.
- On freely draining substrates, such as sand or gravel, clay particles may sometimes become compacted due to the action of grazing animals or vehicles and create an impermeable layer which can hold water creating a temporary pond. Clay lined dew ponds were historically created using the same principles to provide drinking water for the stock.
- Sandy clays are the most difficult substrate in which to create ponds, as they can be variably permeable. Pile the spoil from the pond's excavation (but not the nutrient rich topsoil) next to the pond. Clay particles from this will drain into the pond and can slowly create an impermeable barrier.

Ponds created for wildlife do not need to hold water all year. In fact, temporary ponds in grassland are a very valuable habitat type. See [Pond Creation Toolkit Factsheet 6](#) for information on making sure your pond will hold water.

Choosing pond location and avoiding sensitive areas

Well designed grassland ponds can remain in the landscape for thousands of years. Of course it is impossible to envisage secure land management over this timescale. Indeed it can be difficult to determine what will happen in the next 10–20 years with changes in agricultural policy and land ownership. Therefore it is important to design ponds to allow for future changes.

- **Zone the field for pond creation**, i.e. create ponds in field corners, in river meanders or along a field edge. Ponds located in the centre of the field can be fantastic wetland bird habitat, but they may create an awkward obstacle to machinery, unless it's a nature reserve or an area dedicated to conservation.
- **Create a complex of ponds including some larger bodies of water.** If grazing cannot continue in the future some ponds will remain open even if the site develops into scrub or woodland.

Pond location can also be used strategically to enhance habitat management:

- **Create ponds to maximise the amount of poaching.** Some species are poor competitors and need a very short sward and a lot of bare poached ground to germinate successfully. Locating ponds strategically in pinch-points e.g. by gateways, will increase the level of grazing pressure. This will only be beneficial in areas where these species occur.
- **Create ponds on hedge lines.** Partial shade can be useful for some species and field ponds were often created on hedge lines in the past, to provide water for livestock in more than one field. The partial shade created by hedges can also be useful for some species – and it keeps tough grasses at bay, so that other less competitive plants can thrive. But, avoid connecting ponds to ditches as these often bring in sediments, nutrients and pollution.
- **Zone grazing in space and time.** In heavily grazed fields it may be desirable to create some ponds – or some parts of the pond - which are protected from grazing pressure, if the target species are intolerant of disturbance.
 - A pond located in the field corner adjacent to a hedge or woodland will have at least two edges which are inaccessible to stock.
 - Use excavated/piled-up spoil to make some areas of the pond more inaccessible to grazing animals.
 - It is possible to fence ponds in fields which are grazed. However, it is important to allow grazing management of the pond margin at least once every 5 years to reduce scrub and maintain diversity.
 - Consider the pond resource at the landscape scale. In a complex of ponds consider grazing management on a rotational basis to achieve a range of age structures. You can also create new ponds in the landscape over time to increase the diversity of habitats but be aware of areas with existing wildlife and archaeological value (see Box 1).

Box 1. Avoiding sensitive areas

New ponds should be designed to enhance not replace existing wildlife habitats. Unimproved grasslands are amongst the rarest habitats in the UK - don't dig up habitats with existing high conservation value. But, there are many opportunities to create ponds *adjacent* to these habitats.

Many types of grassland have been in existence for hundreds of years and due to their association with human habitation they can be important archaeological sites (Figure 7). **Don't dig up our archaeological heritage.**

Figure 7. This ridge and furrow landform is an important archaeological feature and can also be important for species like True Fox Sedge *Carex vulpina*.



© Jim Champion



5. Grassland pond profiles and pond complexes

Ponds in unimproved and low intensity grasslands which are fed from groundwater or surface water will have very clean water. As a result there are few limits on the pond depth, pond size, or pond shape that will work. Deep clean water ponds can support abundant submerged and floating-leaved plants. Shallow grazed clean water ponds can be incredibly rich in emergent plants. But, it is important to be aware of the different habitats within the pond to ensure that they are designed to maximise their potential:

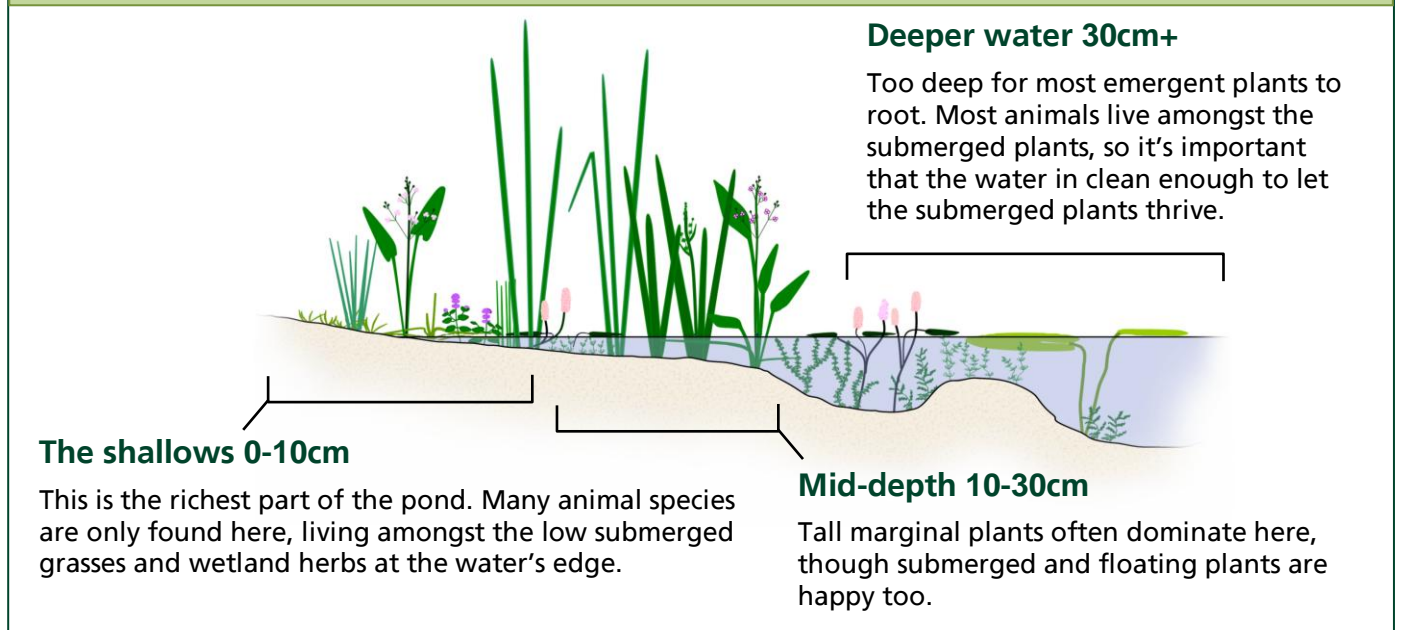
Drawdown zone and shallow margins

The poached shallow margins of ponds in grasslands are very important for many plants and animals. These shallows will ideally be less than 10cm deep and if the water fluctuates they will form an extensive drawdown zone (Figure 8a). Aim to create a margin which is broad and shallow, <math><1:5</math> (

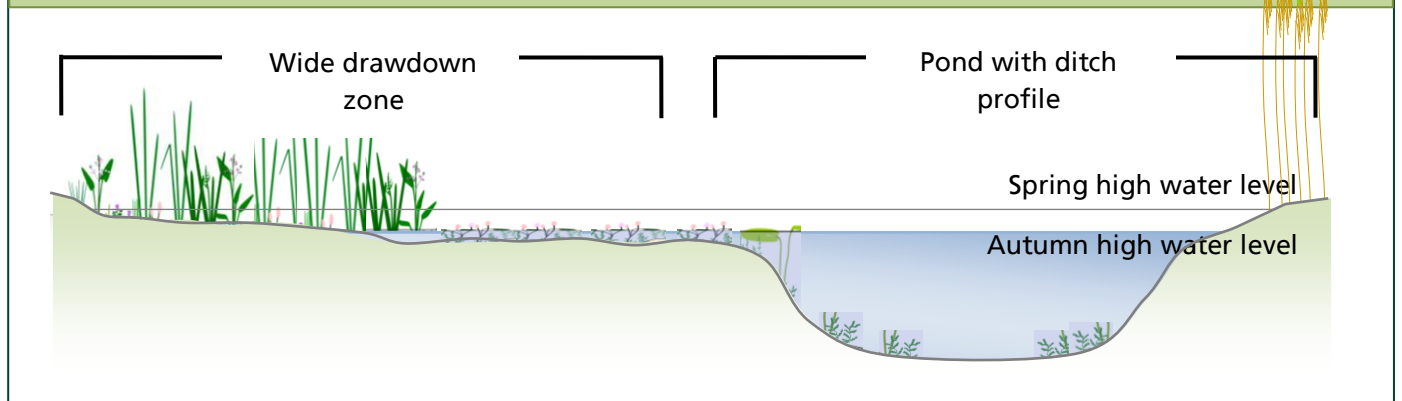
Exceptions to this rule may be used in floodplain grasslands where the designed pond profile can mimic that of existing ditch habitat. However, even here a broad undulating drawdown zone will have maximum wildlife value (Figure 8b). For more information on designing pond profiles see [Pond Creation Toolkit Factsheet 4](#).

Figure 8. Grassland pond profiles

8a. Pond margins should be shallow and undulating to maximise the habitat for freshwater plants and invertebrates.



8b. Design and create broad undulating drawdown zones – these will be poached by grazing livestock and provide one of the most important areas of the pond for wildlife. Even ponds with a ditch profile can include an area with an undulating micro-topography of small temporary pools.



Deeper water

The high water quality of unimproved grassland pools means that they can support areas of deeper water which are clean and clear. This habitat can be very important for many submerged and floating-leaved species. However, there is usually little value in creating ponds beyond 1-1.5m in depth as this provides little additional value for wildlife, and ponds would have to be very large in order to accommodate a gently shelving margin to these depths.

Pond complexes

The best pond designs include a complex of ponds of different sizes, shapes and depths; combined with an undulating topography of seasonally wet pools and scrapes in between the main ponds.

Seek to create a series of complexes across the landscape to allow the natural dispersal and spread of species between wetlands. As the number of ponds at a landscape scale increases, the need to micro-manage individual ponds decreases, because most species will move as conditions change – provided that there is good habitat connectivity between ponds (Figure 9).

Figure 9. Pond landscapes

The pingo pools of the Breckland landscape are some of the most wildlife rich grassland ponds in the UK. They were created following the last ice age, when lenses of ice collapsed under the soil and formed hollows which have filled with water. Additional value is afforded to those located on the edge of woodlands, as this provides terrestrial cover and shelter for rare amphibians including Pool Frog *Pelophylax lessonae* (Figure 9a).

Unfortunately many of the pingo pools in other parts of England are no longer good wildlife ponds, due to declines in water quality and changes in land management. This is the case for many of the pond landscapes which were once maintained by a long history of extensive grazing (Figure 9b).

Grassland ponds are very easy to design and create on clay. Therefore it is possible to reverse these declines and begin to restore pond landscapes – provided they are created in low intensity landscapes and fed by clean water.



Figure 9a. A wildlife rich pingo pond on Thompson Common.

© Tim Bernard



Figure 9b. The dew ponds of the Sussex Downs are a characteristic feature of this ancient sheep grazed landscape. Many are now neglected and surrounded by arable land – isolated and ungrazed ponds like this (dotted outline) become overgrown and lose their wildlife value.

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6. Case study: Gallows Bridge Farm

In Buckinghamshire, Gallows Bridge Farm, a Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust Reserve (BBOWT), is an area of low intensity floodplain grassland, adjacent to the River Ray – part of the Upper Ray Living Landscape. The site has high biodiversity value supporting a range of amphibians, breeding waders, nationally scarce invertebrates and Biodiversity Action Plan species including True Fox Sedge *Carex vulpina*, Tubular Water-dropwort *Oenanthe fistulosa* and Tree Sparrow *Passer montanus* (Figure 10).

In 2009, BBOWT with support from Biffaward and the Million Ponds Project created a complex of 40 new ponds on this grazed grassland site (Figure 11). There are a number of features at Gallows Bridge Farm which make the pond complex a particularly good example of best practice in pond design and creation.

- The ponds are dug into clay and receive water from direct rainfall and surface flow. There is no drainage from adjacent arable fields, the ponds are perched above the water table, and although the site is in the floodplain, it does not receive any floodwater. These factors ensure that the ponds will have **clean water**.
- The complex includes many **ponds of different shapes and sizes**, but most are **shallow** enough for cattle to graze across the entire surface during the summer months. This will increase the longevity of the ponds in the landscape and helps to reduce dominance of competitive species such as Bulrush *Typha latifolia*.
- The ponds have **wide convoluted shallow margins** which are poached by cattle. This ensures that there are bare substrates, the sward remains open and the pond retains the important micro-topography of miniature pools around the pond edge (Figure 12).
- **Spoil was moved** away from the new ponds thereby removing the risk that nutrients in the top soil would drain back into the ponds.



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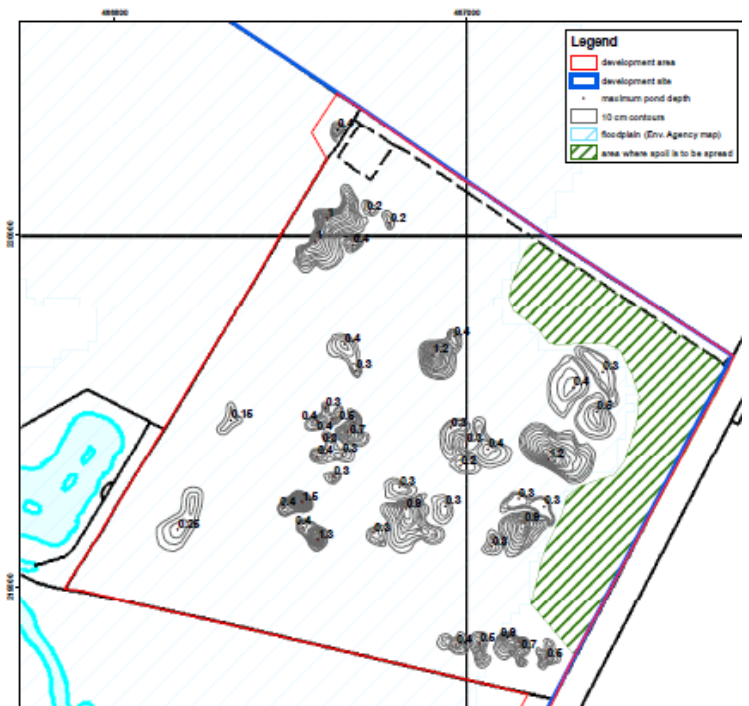
© Ron Porley

Figure 10. BAP pond species at found at Gallows Bridge Farm: True Fox-sedge *Carex vulpina* and Tree Sparrow *Passer montanus*.



© Pond Conservation

Figure 11. Newly dug ponds at Gallows Bridge Farm. A combination of broad drawdown zones, shallow margins and poaching from livestock creates a very important habitat for many pond species.



© Pond Conservation

Figure 12. Plan of ponds at Gallows Bridge Farm. The complex includes ponds from 0.15m to 1.5m deep and 60 to 2000 m².

7. Further reading

The term grassland covers a huge range of different habitat types. This factsheet concentrates on both wet and dry grasslands but it is worth noting that ponds in wetlands (reedbeds, fen and marsh habitat) and ponds within the river floodplain have specific issues due to the sensitivity of the habitat and the proximity of the river.

To address these issues we have created separate *Supplementary Habitat Factsheets* for these and other habitat types. We recommend that you refer to these factsheets and the other advice sheets in the [Pond Creation Toolkit](#) for more information.

Specialist species often have specific habitat requirements. The [BAP Species Map](#) gives a summary of the requirements and distribution of BAP pond species. *Species Dossiers* are also available in the [Pond Creation Toolkit](#), giving detailed pond habitat designs for key Priority Species.

Other sources of information:

- RSPB (1997) *The Wet Grassland Guide: Managing Floodplain and Coastal Wet Grasslands for Wildlife*. Eds. Treweek, J., Drake, M., Mountford, O., Newbold, C., Hawke, C., Jose, P., Self, M. and Benstead, P.
- RSPB (1994) *The new rivers and wildlife handbook*. Eds. Ward, D., Holmes, N. and Jose, P.

For further information about the Million Ponds Project and to consult other factsheets in the Pond Creation Toolkit, please visit www.pondconservation.org.uk/millionponds or email enquiries to info@pondconservation.org.uk

