



Ponderful
PONDS FOR CLIMATE

UNITED KINGDOM 

PONDSCAPE : PINKHILL, FARMOOR, OXFORDSHIRE



Pond Ecosystems for Resilient Future Landscapes in a Changing Climate

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WHAT IS A PONDSCAPE ?

DEFINITION

A pondscape is a network of ponds with spatial proximity (“connectedness”) and the surrounding landscape matrix.

The boundaries of a pondscape may be determined by physical or ecological settings (a valley, a catchment, a set of ponds in a nature reserve) or even determined by societal or political criteria (urban ponds, provincial or national boundaries).

PRESSURE/THREATS ON PONDS AND PONDSCAPES

50-90% of pond have been lost from European countries over the past century. Furthermore, ponds are largely neglected in water- and nature-related national and EU policies and strategies, including the EU-WFD.

WHY IS IT IMPORTANT TO PROMOTE THEM ?



BIODIVERSITY ENHANCEMENT

Largely neglected and generally undervalued, ponds are remarkably important for biodiversity conservation. Pondscapes represent biodiversity hotspots.



DISASTER RISK REDUCTION

Ponds and pondscapes play a fundamental role in mitigating flooding and also constitute a water reserve to fight fires.



HUMAN HEALTH

Ponds and pondscapes provide a wide range of co-benefits for human societies such as support for human health and quality of life, spaces for physical activities, or social interaction, but also aesthetic experiences and educational and recreational activities.



CLIMATE CHANGE MITIGATION AND ADAPTATION

Given their abundance and their high productivity, ponds influence markedly the carbon cycle by acting as both carbon sinks and sources.



WATER MANAGEMENT

Pondscapes provide a water reserve that is particularly important in the context of water scarcity. It is particularly useful for watering animals and for irrigation.

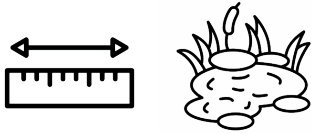
CONTEXT



Name of the pondscape : Pinkhill, Farmoor, Oxfordshire
Name of neighboring large town (in a 30 km radius):
Oxford (160'000 habitants)
Bioclimatic zone : Oceanic

Dominant land use :

Pondscape - Low intensity floodplain grassland
Surrounding environment - agriculture, water storage reservoir



Pondscape area : 12.3 ha

Pond : number: 42 (15 additional pools less than 10m²)

density: 342/km² if including only larger ponds more than 10 m², and 463/km² if including all ponds

surface areas : 5 m² to 0.45 ha

depths : 0.2 to 2.5 m

ages : 1 to 32 years

Land owner : Thames Water Utilities

Land Manager : Thames Water Utilities

Public access : 2 % of the area is fully accessible at all times. 5% has gated access for schools and other groups. The whole site is accessible for pre-arranged, accompanied tours.

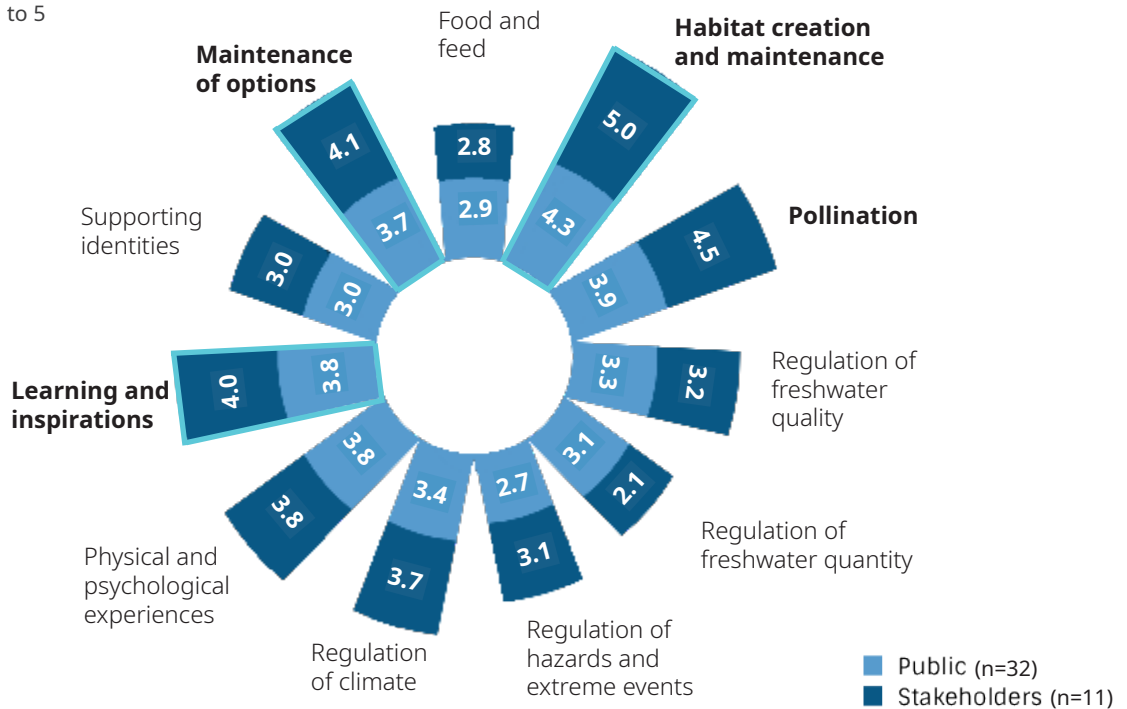
Public amenities : Two hides. Gated access to boardwalks and dipping platforms. Footpath network. 85% of the site is visible from viewing points.



LOCAL COMMUNITY EXPECTATIONS

The 11 Nature-contribution to people (NCPs)

Scale : scores from 1 to 5



The expectations are very high for habitat creation and maintenance for biodiversity, particularly amongst stakeholders. This value is amongst the highest for any Ponderful pondscape. Expectations are also high for pollination and the provision of opportunities for learning and inspiration, as well as the maintenance of options, which relates to ensuring that the habitats and species are resilient.

LOCAL POLICIES

The pondscape is owned and managed by the private utilities company Thames Water and is part of their large Farmoor Reservoir site. Management is undertaken to maintain site's conservation value, maintain visibility for visitors and increase scientific understanding. It includes: cattle grazing, managing scrub, cutting meadows, creating new ponds and managing/remodeling existing ponds. Management is led by Thames Water with additional partnership projects undertaken with the NGO Freshwater Habitats Trust.

The site is well protected through the long-term commitment of Thames Water. Ownership by a large company means that a part-time site manager can be employed and capital funds are available for management. Good collaboration and synergy between the site owner and wildlife NGOs are key factors in the effective implementation of the NCPs.

100% of the 9.5 ha pondscape is managed for Nature Conservation
(98% has restricted access).

100%

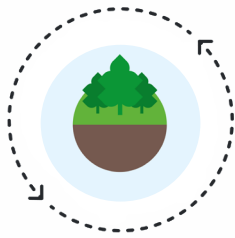
90% of the site classifies as Floodplain Wetland Mosaics which is a designated priority habitat type in England.

90%

100% of assessed ponds classify as Priority Ponds on the basis of their rich wild-life communities or PSYM score.

100%

MAIN CHALLENGES AND OBJECTIVES



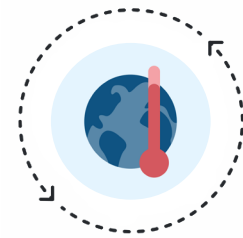
BIODIVERSITY ENHANCEMENT

New ponds which are exceptionally rich in freshwater plants and invertebrates



HUMAN HEALTH

A refreshing place to walk, watch birds and learn about nature.



GREEN SPACE MANAGEMENT

Creation of a diverse mosaic of water and wetland habitats.



NATURE BASED SOLUTIONS (NBS)

A new wetland reserve, comprising around 30 ponds, was created in a meadow next to the River Thames in 1990. Over the next 30 years the reserve was extended to two further meadows. The pondscape is managed for biodiversity but also has considerable value for nature watching, landscape enhancement, scientific research and education.

NEW POND CREATION

1990-1991

1998-1999

2011-2012

2015-2023

Creation of Pinkhill Meadow reserve for biodiversity: a network of around 30 ponds with wetlands and reedbeds

Creation Shrike Meadow reserve, with seven ponds, areas of wetland and a reed-bed

Creation of Buckthorn Meadow reserve: 15 ponds and small pools created for biodiversity

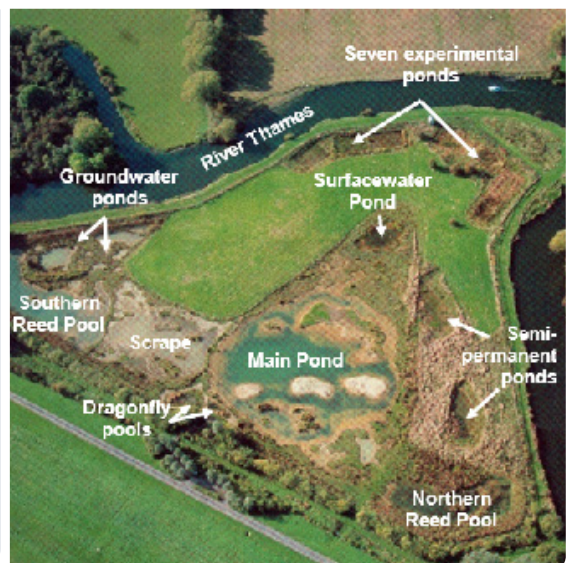
Pond reshaping, additional ponds dug, reed / scrub removal. Introduction of grazing animals. Translocation of rare plants.

PONDS AND PONDSCAPE MANAGEMENT

- Creation of clean water ponds and wetland areas
- Willow hedges and reed beds added as screening to reduce human disturbance
- Meadow management and re-seeding with local green hay
- Scrub removed from some heavily shaded ponds/wetlands
- Reeds removed from some ponds
- Some ponds re-shaped to add diversity
- Grazing cattle introduced
- Threatened plant species translocated to ponds
- Fish refuge created linked to the River Thames



- Bird hides and viewing points created
- Information boards created
- Boardwalk and dipping platform created
- Paths maintained



NATURE CONTRIBUTIONS TO PEOPLE AND MEASURED INDICATORS



AQUATIC BIODIVERSITY

SPECIES RICHNESS

Aquatic plants : 77

Amphibians : 3

AMOUNT OF

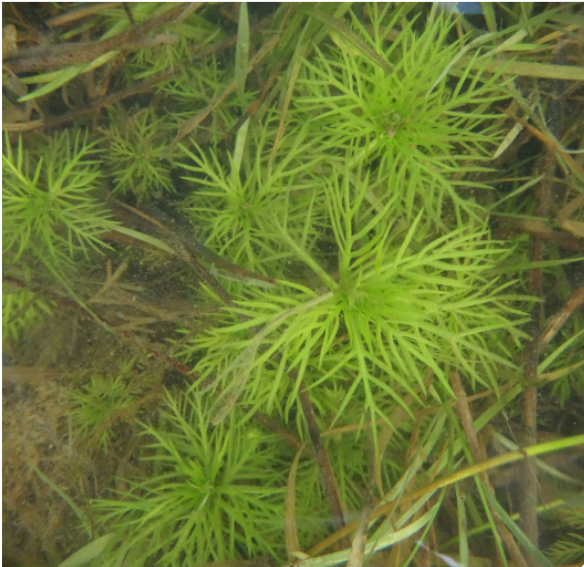
Conservation priority species (N) : 7

Round-fruited Rush (*Juncus compressus*), Blunt-leaved Pondweed (*Potamogeton obtusifolius*), Marsh Willowherb (*Epilobium palustre*) Common Toad (*Bufo bufo*), Water Vole (*Arvicola amphibius*), Otter (*Lutra lutra*), Breeding Grasshopper Warbler (*Locustella naevia*)

Translocated nationally threatened species (N) : 1

Invasive alien species : 2

FLAGSHIP SPECIES :



Hottonia palustris



Juncus compressus



Arvicola amphibius



Baldellia ranunculoides

NATURE CONTRIBUTIONS TO PEOPLE AND MEASURED INDICATORS



PHYSICAL AND PSYCHOLOGICAL EXPERIENCE

2 Wildlife hides for relaxing and for watching birds and other wildlife

2

85% Area inside the pondscape accessible to the public

3.5 km of paths around the 9.5 ha site.

3.5

Most popular activities :

wildlife observation (24%), relaxing (21%) and hiking (20%)



HABITAT CREATION AND MAINTENANCE

130 is the density of ponds (per km²) in this pondscape. Short distances between ponds means that plants and animals can easily move to other waterbodies when conditions change as a result of high temperatures, drought or floods.

130

GOOD

Pond water quality enables the waterbodies to maintain very rich wildlife communities which increases the pondscape's resilience to climate change.



LEARNING AND INSPIRATION

8

Groups per annum taken on guided walks. Including groups of nature conservation professionals, government bodies, NGOs, wildlife groups. Open days have also attracted hundreds of people. A volunteer group meets regularly to manage the site with benefits for learning and health.

Number of studies for acquisition of knowledge (per annum). Undertaken by NGOs, research students and government bodies: researching biodiversity, species introductions, carbon storage, and eDNA.

4

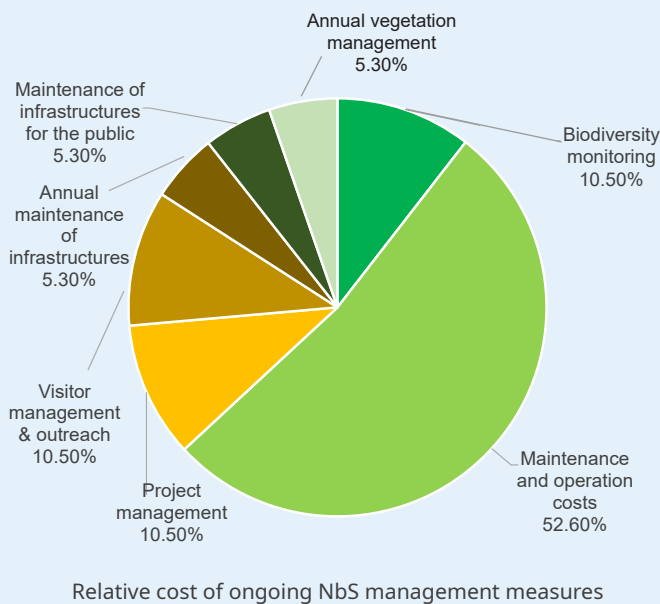
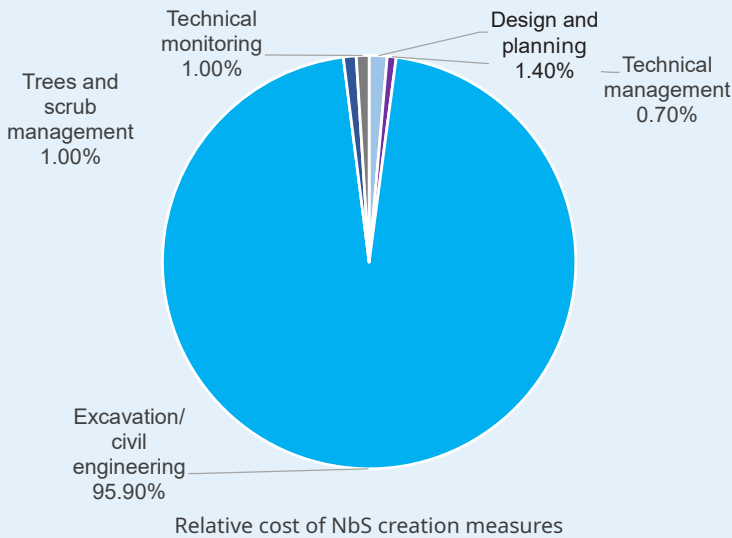


COSTS AND BENEFITS ANALYSIS

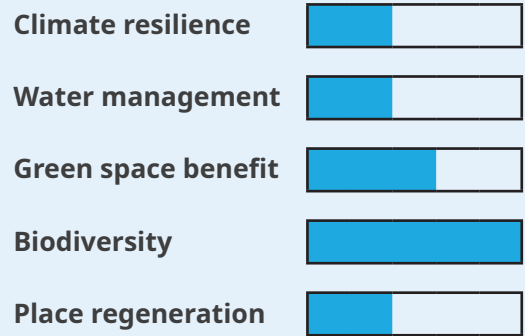
OVERALL COSTS ASSESSMENT



SHARE OF COSTS FOR NBS ACTION



BENEFITS ASSESSMENT



SUITABLE FINANCE INSTRUMENTS TO REDUCE THE GAP

- ✓ 1. Income instruments
- ✓ 2. Voluntary contributions /donations
- ✓ 3. Subsidies

FUNDING GAP ASSESSMENT



REMAINING THREATS

The polluted River Thames is flooding the meadows and their pond complexes with greater frequency (usually annually), probably because of climate change. This is increasing the nutrient burden in some ponds, making them less suitable for uncommon species and favouring the growth of invasive alien plants like Nuttalls Pondweed (*Elodea nuttallii*).

SUCCESS STORY AND TRANSFERABILITY



CREATING SMALL SITES OF HIGH BIODIVERSITY

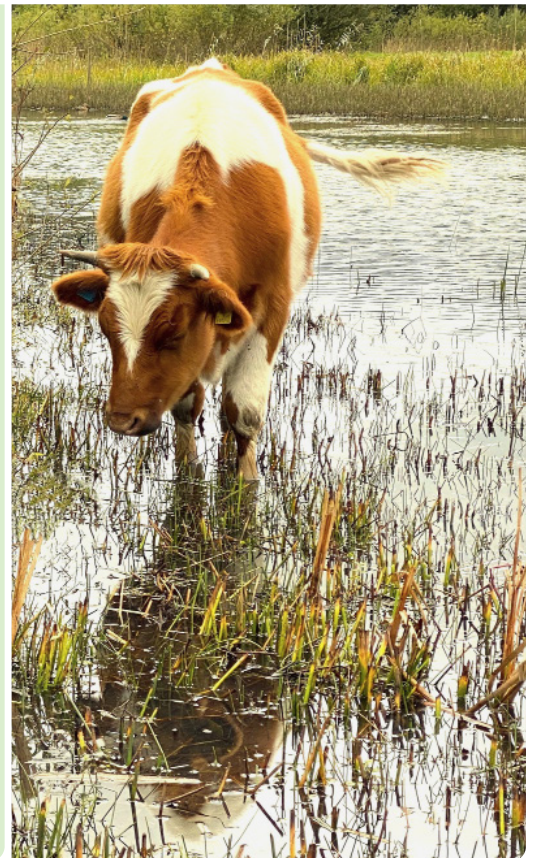
The first pond complex (created in 1990) is less than 3 ha in area but is exceptionally rich and now supports around 20% of all England's freshwater plant and larger invertebrate species. The site's richness is due to a range of factors: there are almost 30 pools of different sizes from 5 m² to 0.5 ha. Some pools dry every year, others are semi-permanent which provides many different habitats. Most ponds have extensive areas of shallow water and wetland around their edges, and the whole site is located on the ancient floodplain of the River Thames which has a long wetland heritage. It was important to design the ponds so their water quality was as clean as possible. To do this, none of the ponds have direct links to the polluted River Thames. In addition, most of the ponds are fed by groundwater which has low levels of polluting nutrients.

Pinkhill provides clear evidence that it is possible to create new pondscapes of exceptional biodiversity value even when there are quite limited areas of land available.

SUSTAINABLY MANAGING PONDSCAPES USING CATTLE GRAZING AND TREE SHADE

The pondscape has been used to investigate if it is possible to manage sites so that they maintain high biodiversity without needing extensive physical management. To do this, it has been important to introduce grazing cattle. The site has also been partly re-designed to make the most of their effect. For example, extending two ponds to create narrow pinch-points between them, focuses cattle trampling in these areas which creates the semi-bare ground needed by many rare plant species. Tree shade is also used in different ways: including to reduce the abundance of emergent plants which would dominate in full sun, and to attract cattle to particular areas of the site by creating shelter for them. The grazing density on this site is around 1 cow/ha, but on other sites the ideal density will vary considerably depending on factors such as the number, size and location of ponds.

The results from Pinkhill show that pond design and knowledge of natural processes can be valuable tools to maintain and enhance freshwater biodiversity with reduced need for human intervention. It is an area of study that has much promise.



SUCCESS STORY AND TRANSFERABILITY



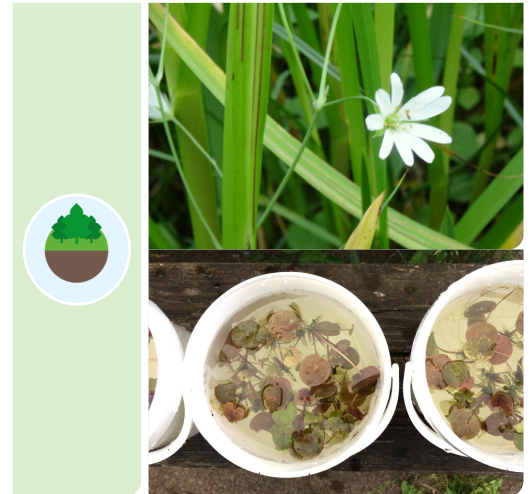
MANAGING POLLUTION RISK TO MAKE BIODIVERSE PONDS

Some areas of Pinkhill lie within 10 m of the polluted River Thames, and its flooding regularly brings poor quality water onto to the site. Despite this, the ponds still maintain a high biodiversity value. The ponds are surrounded by unfertilized grassland which ensures that the surface water which fills them during most of the year is clean. Boreholes also showed that a gravel aquifer occurs under the meadow at around 1m depth, so groundwater ponds were also created. As groundwater moves through the gravels it washes pollutants out of the ponds so they stay cleaner. Most ponds are not interconnected so that pollutants in ponds that are near the river and receive most floodwater don't spread to other ponds.

Finally, both cattle grazing and tree shade help to stop the adverse effects of pollution on pond communities by preventing tall nutrient-loving plants from dominating more nutrient-enriched ponds. Water quality is of critical importance for maintaining pond biodiversity. An implication from this case study is that a range of factors including pond design, water source and site management can all be used to reduce the impact of low to moderate water pollution on ponds.

INTRODUCING THREATENED PLANT SPECIES

Six freshwater plant species were successfully translocated to new ponds. All were traditionally found in the Thames Valley, but are now nationally threatened or regionally rare. Plants were not translocated to the site until it was more than 25 years old, so it was very unlikely that they would colonise naturally. They were added as seeds or small plants to locations where each species might be expected to thrive: Water Violet (*Hottonia palustris*) and Frogbit (*Hydrocharis mors-ranae*) were introduced to shallow water in slightly shaded pools. Lesser Marshwort (*Apium inundatum*), Lesser Water-plantain (*Baldellia ranunculoides*), and Tubular Water-dropwort (*Oenanthe fistulosa*) were added at the muddy pond edges which would be regularly grazed and poached by cattle. Marsh Stitchwort (*Stellaria palustris*) was planted in areas which would have occasional grazing, allowing it to scramble through other plants.



Wetland species translocations in Britain have often had a low rate of success. The introductions at Pinkhill seem to have worked well because water quality is good, and different levels of grazing disturbance and of shade are present across the pondscape. This means that likely habitats could be found in different locations, ensuring that at least one or two would be suitable.



MARSH LOUSEWORT: AN ECOSYSTEM ENGINEER

Marsh Lousewort (*Pedicularis palustris*) is a native plant that is a root parasite of sedges and reeds. It was once widespread on floodplains in Thames region but is now rare. In 2019 and 2020, seeds were scattered around pond edges next to beds of Common Reed (*Phragmites australis*). The aim was to see if the plant could control the spread of reed which was becoming a nuisance on the site. Marsh Lousewort has grown well, spread across the site and been effective at reducing reed growth, particularly when combined with grazing. This has opened up areas for other plants to grow and enabled more of the site to be visible to people. It is still early days, but Marsh Lousewort has the potential to become an effective ecosystem engineer in this and other sites: controlling troublesome reed, and possibly sedge growth in areas of damp ground, without the need for human intervention. The species is native to most of Europe, but may not be appropriate to introduce in all locations.



HANDBOOK :



APPENDIX :



PHOTOS CREDITS

Pinkhill Meadow aerial photo , p.3 ©A. Driver

AUTHORS

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