

# **BBOWT Wild Oxford Project**

## **Lye Valley North Fen**

**Report on the fourth and fifth years 2018-2019**



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*All photographs in the account that follows are my own except where indicated*

## GENERAL INTRODUCTION AND AIMS OF THE PROJECT

The **Wild Oxford Project** is a collaborative initiative of BBOWT and Oxford City Council (OCC) grant-funded by a local charitable trust.

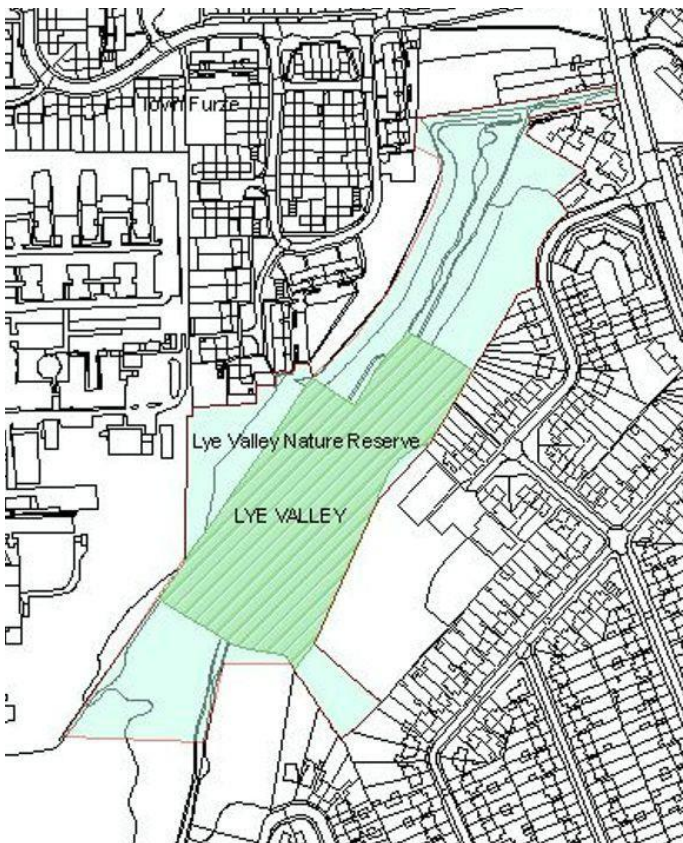
Its aims are to:

- Introduce local people to the wildlife on their doorstep
- Enable local people to take an active role in enhancing and protecting the sites
- Deliver improvements to the fen and other key habitats.

### Introduction to Years 4 and 5 of the Wild Oxford Project in the Lye Valley

The background to this project, i.e. the type and importance of the Lye Valley alkaline fen habitat and the problems facing it in its now partially urban location, were explained in my reports for previous years (2014-2015, 2016, 2017). Those reports also covered the fen's historical and current management, as well as the habitats and local and national species of importance found within it. Its appendices provided information on the biological heritage of the site and extensive species lists. Please see my first report (May 2015) for all such detail.

The map below is included again to provide a clear picture of the LNR/LWS/SSSI limits and Wild Oxford target work areas in the Lye Valley North Fen.



**Figure 1:**

*Lye Valley Local Nature Reserve*

All the shaded area (total 4.5 ha), including the section marked with parallel lines, is owned by Oxford City Council and is part of a much larger Local Wildlife Site known as '**Lye Valley and Cowley Marsh LWS**'.

Within these boundaries is the **North Fen section (Unit 1)** of the **Lye Valley SSSI** (1.8 ha), indicated by the parallel lines. Site centre of SSSI: SP 548057

This report details work carried out throughout 2018 and the early part of 2019 and gives an assessment of the habitat change that has resulted from this conservation work in the various target areas.

For records of species from these years, see the Appendix that features species findings to 2019, **including especially a full re-recording of all plants on site for the BSBI atlas 2020.**

## BBOWT WILD OXFORD PROJECT HABITAT ENHANCEMENT AREAS

The potential for habitat enhancement in the Lye Valley North Fen area by the project work was identified in 2014 as follows:

### A. Alkaline fen restoration in LWS/LNR areas outside the SSSI

The LWS section at the head of the valley, previously Lye Valley Scrub SLINC, has been recognised as having numerous calcareous spring-fed peat and tufa-forming areas on the valley sides. However, their interest had declined because, without grazing, succession had progressed from short fen to shady secondary wet woodland. Even if restoration to high-grade short fen is not possible in the short term, restoration to floristically diverse tall herb fen, with abundant nectar and pollen-producing flowers (e.g. angelica, marsh woundwort, ragged robin, purple loosestrife) would be of great benefit to insects of all kinds in the valley and to all pollinators within reach in the Headington area in general. The target for the project work – a more biodiverse wetland community – might be met by establishing a tall herb community of unshaded conditions, such as NVC M27 (*Filipendula vulgaris* – *Angelica sylvestris*) mire.

### B. Assistance with restoration of a greater area of short fen in the SSSI area

Whilst the high-grade short fen on the east side of the SSSI fen has been well managed by cutting and raking for more than 20 years by OCC staff and volunteers, it is a small area in total. Other SSSI fen areas were not in an ideal condition due to lack of OCC staff time. For example, at the start of this project little progress had been made in restoring the large area of dense common-reed-dominated, spring-fed, peat and tufa areas on the slope on the west side of the SSSI ('hanging-fen').

### C. Glades and sunny, open, flower-rich areas on drier slopes and banks

Common lizards, slow worms and grass snakes are present in the Lye Valley in several areas (Town Furze allotments, the North Fen and Churchill Hospital field). All of these reptile species benefit from undisturbed sunny areas for essential basking. Provision of open, sunny, glades with refuges and hibernacula for all these reptile species on currently wooded or scrubbed-up secluded banks to the fen wetland would enable the reptiles to bask undisturbed and would result in more successful breeding.

Additionally, the importance of more nectar-rich flowers in the area cannot be over-stated. Whilst the fen wet peat and shallow fen pools provide good breeding areas for important insects, with aquatic larvae such as some hoverflies, soldier flies, crane flies and beetles, the fen vegetation can be dominated by rushes, sedges and reed at certain times of the year and be completely lacking in flowers that are good nectar and pollen sources. Many insects that breed in fens need the nectar and pollen sources in adjacent dry-land areas to complete their life cycles. Brown hairstreak butterfly reproduction will also be enhanced by some cutting of old blackthorn to encourage the young sucker growth preferred for egg-laying.

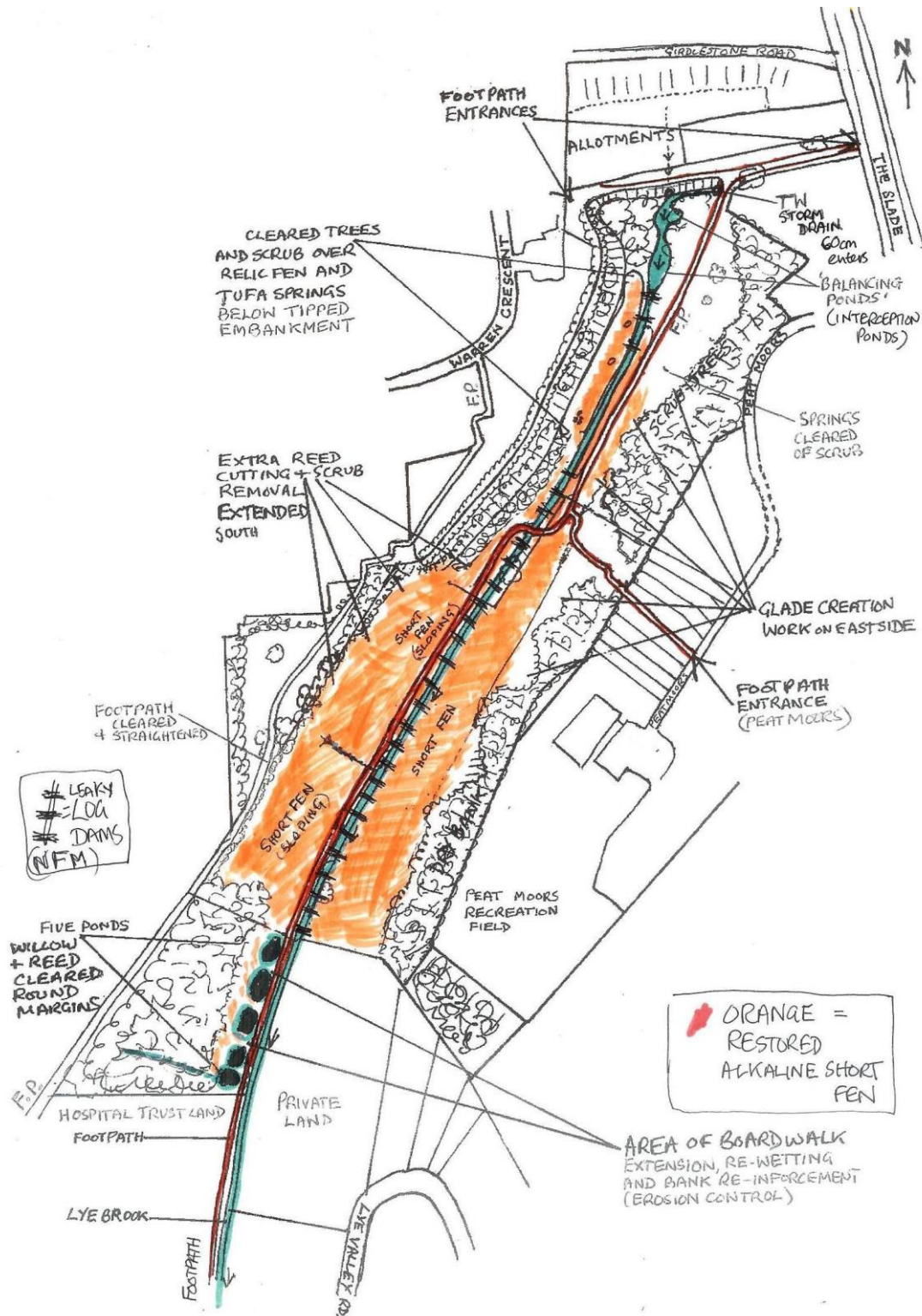
### D. Pond enhancement in LWS south western area

Five previously-excavated ponds on the south-west side, which are breeding sites for the common frog, had become filled in with sediment and reed vegetation, but fortunately these had been re-excavated by work for a Freshwater Habitats Trust project in spring 2014. Since then a good diversity of submerged aquatic vegetation has recurred, but this regeneration was threatened by increasing shade from trees and reed re-invasion. Some removal of crack willow trees and scrub, along with cutting back of marginal reed, was identified as beneficial to pond-water plant diversity and thus to aquatic invertebrate diversity. Unshaded ponds are warmer and can therefore be colonised by some of the rarer insects, such as water beetles and soldier flies breeding in the shallow fen pools on the other side of the brook. Thus their populations will be more secure.



# WILD OXFORD PROJECT RESULTS FOR THE FOURTH AND FIFTH YEARS 2018 – 2019

Figure 2: Sketch map indicating Wild Oxford work areas in the Lye Valley in 2018-2019



## **Volunteer input to the project in 2018-2019:**

Volunteers under the leadership of Andy Gunn contributed to remedial work on the SSSI North Fen west side and on the relic fen areas in the LWS/LNR to the north and south of the SSSI. Further progress has been made with clearing vegetation over tufa-forming springs and glade creation on the east side of the SSSI and LWS/LNR area. Pond marginal clearance work continued, scything back reed and removing shading willows plus raking out excessive growth of pond vegetation to maintain open water. A lot of progress has been made with improving the steep path access to Peat Moors road thanks to student volunteers from Headington School.

Wild Oxford project volunteer work (mainly on Saturdays) in the Lye Valley was supplemented by additional occasional work sessions by the BBOWT midweek team under the leadership of Andy Gunn, who also assisted with willow tree felling in separate sessions.

A team from Oxford City Council's Parks and Open Spaces Department gave help with felling larger trees needing removal to let light in. The City Council's Thursday Parks Volunteers team led by Carl Whitehead devoted some of their work sessions to scrub removal and fen-raking, as well as clearing and re-establishing the route of the footpath along the top of the west bank at the margin of the Churchill Hospital site. Oxford Conservation Volunteers (OCV) helped with scything, raking and scrub work on two Sundays; their work is funded by Oxford City Council.

Additional work sessions in 2018 involved volunteers from the Oxford University Environmental Sustainability Department and Oxford Brookes University.

Friends of Lye Valley (FoLV) held separate volunteer sessions every Wednesday morning throughout the year in the north fen area, focusing on scything reed, removing scrub and fen re-wetting, combined with brook bank restoration and defence using handmade hazel wickerwork structures.

As regards habitat change, progress at this site has been particularly fast due to the involvement throughout the year of several different volunteer groups working at different times (Wild Oxford, BBOWT midweek team, OCC Thursday group, OCV and Friends of Lye Valley). Volunteers are not necessarily dedicated to only one group. Many join in with the work sessions of two or three groups.

Monitoring of the progress of work in terms of vegetation response or species recorded took place either during the sessions or on separate visits after work sessions.

## **Details of work carried out on specific areas**

### **A. Work on the fen and drier scrub bank at head of valley**

The removal of so much woody growth and the reduction in shade encouraged the abundant flowering of a variety of wetland herbs, especially hemp agrimony, meadowsweet, tufted vetch and greater bird's foot trefoil. This benefitted many insects and especially bees and butterflies.

It has also opened up a much more attractive and interesting view down the valley. Visitors enjoying a walk along the valley bottom no longer feel 'hemmed in' by dense bramble and scrub as they did before. Retention of spring water flow by small bunds has resulted in much wetter fen conditions .



### **Access - footpath Improvement from the Valley to Peat Moors road**

An area needing attention in the LWS was the footpath from the fen in the valley bottom up a steep slope to Peat Moors road. This had really become so overgrown, it resembled a tunnel through dense scrub, and had steep steps, which were very difficult for some people to negotiate.

A target has therefore been the removal of scrub either side of the steps and construction of a winding path up the slope, which is longer but has a much shallower gradient with no steps. This makes ascending and descending the bank easier, particularly for visitors with pushchairs. My last report in 2017 mentioned how scrub had been cleared from either side of the path to enable it to meander over a greater width of the slope. Work on the re-designed path started in October 2018 with BBOWT midweek team volunteers and later benefitted from the involvement of a work party of school students from the local Headington School.



*Before work, path steps were very steep and hemmed in by scrub 04.10.2012*



*BBOWT midweek team working on the access path 17.10.2018*





*Students from Headington School helping with the improvements to the footpath to Peat Moors under the direction of Andy Gunn.*

*Photos by Tony Gillie*

## **B. Fen work in the SSSI, west side**

Work has focused on restoring the sloping fen on the west side. This area was previously mostly densely reed-dominated, but there is a strong spring emerging half way up the bank; this is marked 'well' on old maps.

Restoration scything and raking has now extended south to include the whole of the previously reed-dominated area on the west side of the SSSI. Three sessions of cutting are necessary during the reed's growth period, when it is softer and green (in April-May, late June to early July, and September-October). Cutting and raking is becoming noticeably easier with each session, as the reed re-growth weakens. However, the spring/seepage zone at the top of the west side has undesirably high nitrate levels, so reed re-growth is much faster than in low-nutrient areas.





*Scything the west sloping fen is easier, now the reed is weaker and shorter – volunteer at work, May 2019.*

The work has also included a good deal of digging-out of clumps of pendulous sedge, a dominant plant that can shade out the more desirable small species of short fen. All vegetation cut from or dug out of this west bank has been raked downslope and positioned on the brook banks, where it performs a useful function in rebuilding the eroded bank behind the wickerwork bank defence structures (**photo page 21**). This cut material will eventually rot down to produce new peat, going some way to replace that lost to flash flooding erosion.

### **Detailed vegetation monitoring**

As soon the old, tall, reed on the western fen slopes had been cut and raked off a couple of times in 2017, it was thought useful to set up a more detailed monitoring system for herbaceous vegetation to obtain more accurate records and enable repeat recording of a defined area in order to chart fen restoration progress over future years.

The 2017 study provided a baseline of the vegetation composition, immediately after the return of the area from dense reed to short turf fen, to compare with future similar assessments. Over time, with better management and when the area is regularly shorter, lost species will be able to re-colonise it.

In order to obtain a frequency value for each plant species, two 20m x 20m square sections of the cleared west fen slope within the SSSI were marked out and vegetation within each square was assessed by recording the presence or absence of species in 40 random 28cm diameter quadrats (actually circular 'roundrats'). This vegetation recording method has recently proved useful in Cothill Fen SAC (Snowdon 2017).

The two 20 x 20m squares can be re-located fairly accurately in the future for re-recording using the same method. They are separated by a strong spring flowing down this western slope.

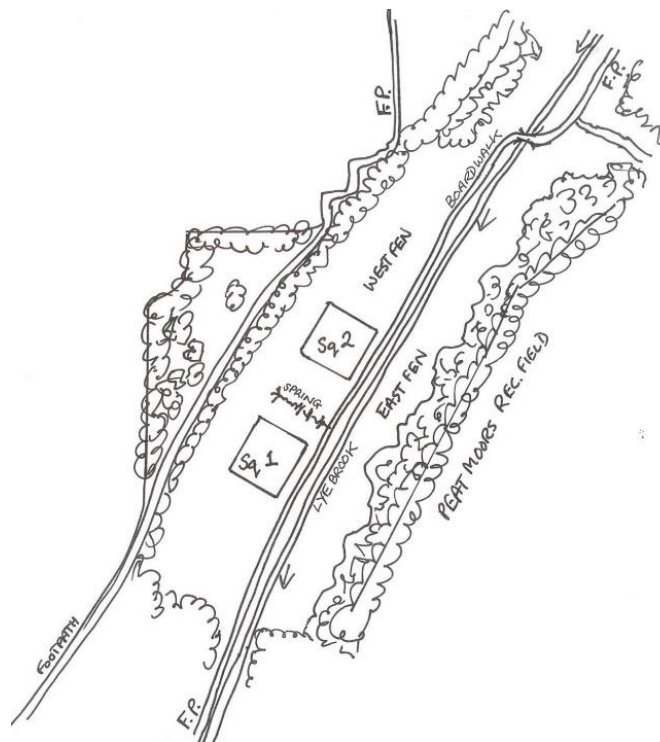


*West bank Square 2, marked up for recording 08.08.2018*

The southern square 1 is in a very damaged area on this bank. It had been subject to repeated arson incidents when dominated by tall, unmanaged, reed. The last burns of this area I witnessed were in 2006 and on 1 June 2014 but I am informed that there had been regular previous burns (pers. comm. Countryside Rangers) requiring the OCC staff to attempt to control fire-spread by cutting a fire break through the middle of the reed on this western slope annually.

The northern monitoring square is in the fen section immediately north of the sewer hatch on that side, which had not been subject to previous arson incidents in 2006 and 2014. Both squares had previously been mainly tall, unmanaged, reed up until the end of 2016. Plant species diversity here had been very low, with mainly four species: reed, nettle, great bindweed and hemp agrimony.

**Figure 3:** *Sketch map of location of plant-monitoring squares on the sloping, western-side, fen.*



**Table 1:** Percentage frequency of plant species in 40 random quadrat samples in each of two separate 20 x20m squares of the restored west bank fen in 2017 and 2018

For each square, species presence/absence scored for each random quadrat and total for each species is expressed as % frequency, i.e. total no of presences/40x100.

**Square 1** Ex-arson square - centre SP54705 05783

**Square 2** North sewer-hatch square - centre SP54738 05827

DETAILED VEGETATION MONITORING IN RESTORATION AREA, WEST FEN 2017			
Frequency in 40 random quadrats in 20 x 20m squares in sloping west fen in 2017		Ex Arson square 1	North sewer-hatch square 2
Scientific name	Common name	% Freq	% Freq
<i>Ajuga reptans</i>	bugle		10
<i>Angelica sylvestris</i>	wild angelica	2.5	
<i>Brachythecium rutabulum</i>	rough-stalked feather-moss	32.5	
<i>Buddleja sp</i>	buddleia	7.5	
<i>Calystegia sp</i>	greater bindweed		5
<i>Cardamine flexuosa</i>	wavy bittercress	65	12.5
<i>Carex pendula</i>	pendulous sedge	2.5	2.5
<i>Cirsium arvense</i>	creeping thistle	15	
<i>Cirsium palustre</i>	marsh thistle	2.5	7.5
<i>Cirsium vulgare</i>	spear thistle	2.5	
<i>Conyza sp</i>	a Canadian fleabane	7.5	
<i>Cratoneuron filicinum</i>	fern-leaved hook moss		22.5
<i>Epilobium hirsutum</i>	great willowherb		2.5
<i>Epilobium sp</i>	willowherbs	27.5	
<i>Eupatorium cannabinum</i>	hemp agrimony	10	20
<i>Funaria hygrometrica</i>	bonfire moss	7.5	
<i>Galium aparine</i>	cleavers	10	2.5
<i>Hypericum tetrapterum</i>	square-stalked St John's wort		7.5
<i>Juncus articulatus</i>	jointed rush		5
<i>Juncus inflexus</i>	hard rush	2.5	
<i>Juncus subnodulosus</i>	blunt-flowered rush		5
<i>Lythrum salicaria</i>	purple loosestrife		10
<i>Marchantia polymorpha s.l.</i>	umbrella liverwort	5	
<i>Nasturtium officinale</i>	watercress	2.5	
<i>Pedicularis palustris</i>	marsh lousewort		2.5
<i>Pellia sp.</i>	pellia liverwort		2.5
<i>Phragmites australis</i>	common reed	95	100
<i>Picris echioides</i>	bristly ox-tongue		2.5
<i>Plagiomnium sp</i>	a thyme moss		2.5
<i>Poa annua</i>	annual meadow grass	2.5	
<i>Poa trivialis</i>	rough-stalked meadow-grass	22.5	5
<i>Ranunculus repens</i>	creeping buttercup		2.5
<i>Rubus fruticosus</i>	bramble	2.5	5
<i>Rumex obtusifolius</i>	broad-leaved dock	2.5	
<i>Scrophularia auriculata</i>	water figwort	5	27.5
<i>Senecio jacobaea</i>	common ragwort	5	2.5



DETAILED VEGETATION MONITORING IN RESTORATION AREA, WEST FEN 2017			
Frequency in 40 random quadrats in 20 x 20m squares in sloping west fen in 2017		Ex Arson square 1	North sewer-hatch square 2
Scientific name	Common name	% Freq	% Freq
<i>Senecio vulgaris</i>	groundsel	2.5	
<i>Silene flos cuculi</i>	ragged robin		5
<i>Solanum dulcamara</i>	bittersweet	2.5	10
<i>Sonchus arvensis</i>	perennial sow thistle	2.2	10
<i>Sonchus asper</i>	prickly sow thistle	2	
<i>Sonchus oleraceus</i>	common sow thistle	10	15
<i>Stellaria media</i>	chickweed	5	
<i>Taraxacum sp</i>	dandelion	10	2.5
<i>Trichodon cylindricus</i>	cylindric Ditrichum	7.5	
<i>Urtica dioica</i>	common nettle	32.5	
<i>Veronica beccabunga</i>	brooklime		2.5
<b>Number of wetland species</b>		<b>9</b>	<b>17</b>
<b>Number of non-wetland species</b>		<b>23</b>	<b>12</b>
<b>Total number of species</b>		<b>32</b>	<b>29</b>
<b>TOTAL NUMBER OF SPECIES IN BOTH SQUARES COMBINED 47</b>			

DETAILED VEGETATION MONITORING IN RESTORATION AREA, WEST FEN 2018			
Frequency in 40 random quadrats in 20 x 20m squares in sloping west fen in 2018		01.08.2018 Ex-arson square 1	08.08.2018 North sewer-hatch square 2
Scientific name	Common name	% Freq	% Freq
Acer seedl	sycamore		2.5
<i>Agrostis capillaris</i>	common bent grass		2.5
<i>Agrostis stolonifera</i>	creeping bent grass	2.5	5
<i>Ajuga reptans</i>	bugle		12.5
<i>Amblystegium sp</i>	a feather-moss	2.5	
<i>Anagallis tenella</i>	bog pimpernel		5
<i>Angelica sylvestris</i>	wild angelica	5	2.5
<i>Aster sp</i>	Michaelmas daisy		2.5
<i>Bellis perennis</i>	common daisy	2.5	
<i>Brachythecium rutabulum</i>	rough-stalked feather moss	47.5	
<i>Bryum pallens</i>	pale thread moss	5	
<i>Calliergonella cuspidata</i>	common spear moss	17.5	
<i>Calystegia sp</i>	a great bindweed	12.5	2.5
<i>Cardamine flexuosa</i>	wavy bittercress	20	
<i>Carex distans</i>	distant sedge	5	
<i>Carex flacca</i>	glaucous sedge		2.5
<i>Carex pendula</i>	pendulous sedge	2.5	7.5
<i>Carex sp</i>	sedge, probably yellow sedge		5
<i>Carex lepidocarpa</i>	long-stalked yellow sedge		2.5
<i>Cerastium fontanum</i>	mouse ear	5	
<i>Cirsium arvense</i>	creeping thistle	17.5	2.5

**DETAILED VEGETATION MONITORING IN RESTORATION AREA, WEST FEN 2018**

Frequency in 40 random quadrats in 20 x 20m squares in sloping west fen in 2018		01.08.2018 Ex-arsen square 1	08.08.2018 North sewer- hatch square 2
<i>Cirsium palustre</i>	marsh thistle	12.5	27.5
<i>Cirsium vulgare</i>	spear thistle	2.5	
<i>Clematis vitalba</i>	wild clematis	2.5	5
<i>Conyza sp</i>	a fleabane	5	
<i>Cratoneuron filicinum</i>	fern-leaved hook-moss	2.5	30
<i>Epilobium hirsutum</i>	great willowherb	2.5	
<i>Epilobium parviflorum</i>	hoary willowherb	10	2.5
<i>Epilobium sp</i>	willowherbs	20	
<i>Epilobium tetragonum</i>	square-stalked willowherb	7.5	
<i>Equisetum arvense</i>	field horsetail		2.5
<i>Eupatorium cannabinum</i>	hemp agrimony	22.5	55
<i>Filipendula ulmaria</i>	meadowsweet	15	
<i>Funaria hygrometrica</i>	bonfire moss	5	
<i>Galium aparine</i>	cleavers	7.5	
<i>Galium uliginosum</i>	fen bedstraw		2.5
<i>Geum urbanum</i>	wood avens		2.5
<i>Holcus lanatus</i>	Yorkshire fog grass	7.5	2.5
<i>Hypericum tetrapterum</i>	square-stalked St John's wort	7.5	22.5
<i>Juncus articulatus</i>	jointed rush	2.5	25
<i>Juncus inflexus</i>	hard rush	5	
<i>Juncus subnodulosus</i>	blunt-flowered rush		17.5
<i>Lemna minor</i>	lesser duckweed	12.5	
<i>Lythrum salicaria</i>	purple loosestrife		22.5
<i>Mentha aquatica</i>	water mint		10
<i>Nasturtium officinale</i>	common watercress	2.5	
<i>Oenanthe lachenalii</i>	parsley water-dropwort	17.5	
<i>Pedicularis palustris</i>	marsh lousewort	2.5	7.5
<i>Pellia sp.</i>	pellia liverwort		10
<i>Phragmites australis</i>	common reed	100	100
<i>Physcomitrium pyriforme</i>	common bladder-moss	7.5	
<i>Plantago major</i>	greater plantain		2.5
<i>Poa trivialis</i>	rough-stalked meadow grass	25	
<i>Ranunculus repens</i>	creeping buttercup		2.5
<i>Rubus fruticosus</i>	bramble	5	
<i>Salix seedling</i>	willow	5	
<i>Scrophularia auriculata</i>	water figwort	12.5	35
<i>Senecio jacobaea</i>	common ragwort	25	7.5
<i>Solanum dulcamara</i>	bittersweet		2.5
<i>Sonchus sp seedling</i>	a sow-thistle	2.5	55
<i>Sonchus oleraceus</i>	common sow-thistle	22.5	
<i>Stachys palustris</i>	marsh woundwort		7.5
<i>Succisa pratensis</i>	devil's-bit scabious	2.5	
<i>Taraxacum sp</i>	dandelions	15	10
<i>Urtica dioica</i>	common nettle	17.5	
	<b>Total number of species</b>	<b>46</b>	<b>38</b>
	<b>Number of wetland species</b>	<b>27</b>	<b>22</b>
	<b>Number of non-wetland species</b>	<b>19</b>	<b>16</b>
	<b>TOTAL NUMBER OF SPECIES IN BOTH SQUARES COMBINED</b>	<b>65</b>	

## Interpretation of vegetation square data for 2018

### Square 2 (northern square, no additions)

Comparing 2018 with 2017, it can be seen that cutting and raking of Square 2 for three years has resulted in the total number of species rising from 29 to 38. The total number of wetland species increased from 17 to 22. There is a continued return and increase of the following desirable wetland species: blunt-flowered rush, purple loosestrife, bugle, hemp agrimony, ragged robin, square-stalked St John's wort, marsh thistle, brooklime, water figwort, marsh woundwort and especially the fern-leaved hook moss.

Long-stalked yellow sedge and bog pimpernel are the best of the species returning from the seed bank, as both are rare in the county (Erskine et al., 2018). There is still a small representation of common weedy species, such as ragwort, cleavers, sow thistles, bristly ox-tongue and great bindweed. Whilst reed still occurs in every sample, what is not shown in this data is that it is actually only a quarter of the height and biomass it was in the previous year, so its suppressant effect on other species is much less. Marsh lousewort seems to have arrived in the square on its own – seed was not spread there but it may have been brought to the square in mud on the feet of volunteers, as they scythed and raked the area.

### Square 1 (southern square, subject to previous arson, in receipt of hay and collected seed from the east side fen)

In contrast, the cutting and raking of square 1 for 3 years has produced different results. It should be remembered that this area had been subject previously to repeated arson in the years prior to 2017. Therefore the seed bank might have been reduced by heat, and the ash from burning would have produced a flush of phosphate and nitrate, enriching the peat and stimulating the regrowth of reed and other species with a high-nutrient requirement, such as common nettle.

By the time of the assessment in summer 2018 the total plant species number in square 1 had increased from 33 to 46 species, with the number of wetland species increasing from 9 to 27. Water figwort, distant sedge and square-stalked St John's wort were back from the long-lived seed bank in the peat, and marsh lousewort, devil's bit scabious and parsley water dropwort had germinated from seed spread deliberately by hand (these species have no seed bank). Marsh thistle, creeping thistle and spear thistle have arrived naturally from wind-blown seed, as have desirable wetland species, such as wild angelica, hemp agrimony and common fleabane. Whilst common, all these provide much-needed pollen and nectar sources for all types of flying insects.

The vast majority of the species found were still non-wetland ones, with a big component of common weedy species such as willow herbs, creeping thistle, ragwort, groundsel, sow thistles, a Canadian fleabane, buddleia, dandelion, chickweed and cleavers. The rough-stalked feather-moss is still frequent; this is a common species very typical of nutrient-enriched sites and the bonfire moss is always one of the first to specifically colonise burnt areas. Newly recorded are many colonies of the common bladder moss *Physcomitrium pyriforme*, a common moss species, which quickly expands in new, bare, peaty areas.

Indicators of nutrient enrichment like watercress and nettle are still present and nettle is quite frequent, typical of enriched soils – a consequence of past arson. The presence of lesser duckweed *Lemna minor* (a sign of enrichment) in some wet seepage areas may be a relic effect of previous arson liberating nutrients, or possibly a sign that seepages emerging here are contaminated by high amounts of nitrate from a contaminated catchment upslope (an additional problem for this area of fen). Again, reed occurred in almost every sample but was only a quarter of its previous height and biomass.

It will take more years for the new regime of cutting and raking to have a significant effect on the vegetation. There are encouraging returns of species from the seed bank, but often plants need to grow for a couple of years to be big enough to flower and be identifiable; this applies particularly to difficult plant groups, such as sedges and rushes.



### Future monitoring

Both squares 1 and 2 will have the same cutting and raking regime as the rest of the west-side fen in future years. Re-recording for each of the two squares in future years will provide important evidence of the relative success of the two restoration methods in achieving a short-turf, biodiverse, fen.

### The problem of willow seedlings

Frequent germination of *Salix* species was noticeable in the fen restoration area – these seedlings need pulling at a young stage to prevent development of willow scrub. Cutting will not get rid of them, as they will always re-grow, resulting in dense patches of short willow scrub, which will eventually need digging out. Hand-weeding is also helpful to reduce undesirable species, such as buddleia, cleavers, ragwort and hard rush, in order to give the desirable wetland species more chance of thriving.

### Fen restoration by re-introduction of seed

Experience and consultation of literature has shown that simply instituting a regime of cutting and raking or grazing may not be enough to restore some species to a wetland site that has lost them. These are species with very short-lived seed and therefore there will be no store of dormant seed left in the peat to germinate following vegetation reduction and peat disturbance – it could be up to 100 years since these plants last grew and seeded on site under the previous historic, light, extensive, grazing. The current shorter, wet, turf may now provide suitable conditions for these species, but the only way to get them back on site is by re-introduction.

One such example of a historic valuable fen species with very short-lived seed is the devil's-bit scabious *Succisa pratensis* (now on the New England Red List as 'Near Threatened'). This species exists on the east side of Lye Valley fen but has very poor seed dispersal, so is extremely unlikely to be able to colonise the west-side restoration areas without some assistance. In the past, under light extensive grazing, such species would have moved around to new areas in mud on the feet of grazing stock. Without stock movement they are 'locked into' the area they currently occupy and have no means of spreading.



*Devil's bit Scabious (purple) flowering on the west side fen restoration area where seed was spread two years ago, along with marsh lousewort, August 2019*

The east-side fen has been used as a source of seed. This is available from cut hay, raked up in normal October fen management, and from specific harvesting of selected species from the east-side fen. This hay was cut and bagged-up in October 2017 and then spread evenly over the western-side marked Square 1. It will contain seed from only a limited range of plant species; many species would have shed seed at least a month earlier, so seed may not be present in the hay. To overcome this limitation, a small amount of seed, which had been hand-collected separately, of the following species from the Lye Valley east-side fen was also scattered over the southern Square 1: marsh lousewort *Pedicularis palustris*, greater bird's foot trefoil *Lotus pedunculatus*, wild angelica *Angelica sylvestris*, meadowsweet *Filipendula ulmaria*, purple loosestrife *Lythrum salicaria*, tufted vetch *Vicia cracca*, yellow loosestrife *Lysimachia vulgaris*, parsley water-dropwort *Oenanthe lachenalii*, blunt-flowered rush *Juncus subnodulosus* and devil's-bit scabious *Succisa pratensis*.

Hay and seed spreading was carried out at the end of October 2017. No hay or seed was spread on the northern Square 2. This square will thus act as a control, and detailed recording of it will demonstrate what plants will return without any additional help from hay or seed enhancement from the east side fen.

### **Use of marsh lousewort *Pedicularis palustris* to aid fen restoration**

The inclusion of marsh lousewort (a naturally occurring plant in the fen, rare in the county) in the spread seed will speed fen restoration, as it is a hemi-parasite; this means its roots join with those of surrounding grasses, rushes and sedges, siphoning off water, sugars and other nutrients. This activity weakens surrounding species, reducing their height and shading ability, thus allowing other small plants to thrive.

As marsh lousewort is a biennial, when it dies it leaves a patch of bare peat, which is ideal for seed germination and seedling survival of other small plants with little competitive ability. In this way marsh lousewort is a key plant, which acts as an 'ecosystem engineer' (Decleer, Bonte & Van Diggelen, 2013). Its presence is likely to achieve a more biodiverse plant assemblage, as is clearly seen in the Lye Valley fen. Marsh lousewort flowers are also much enjoyed as a nectar and pollen source by bumble bees. Apart from the help it gives with fen restoration, it is worth spreading and increasing this plant to have a really large population to increase the pollen and nectar sources for bumble bees in midsummer (these are its specific pollinators and it is dependent on them for seed setting).



*Marsh lousewort, Pedicularis palustris, photos taken in the Lye Valley fen. Note bumblebee feeding.*

Whilst marsh lousewort's parasitism of rush and lesser pond sedge has been known since it was first observed by Druce (1897), it was student Will Millard of Oxford Brookes University, working for his undergraduate project on marsh lousewort in the Lye valley, Oxford, who actually found a connection (haustorium) between a marsh lousewort plant and the rhizome of reed growing adjacent to it (Millard, 2017). The introduction of marsh lousewort may in future reduce the need for a minimum of two volunteer cutting and raking sessions annually.



The results of this experimental introduction show us that it would be good to introduce seed of marsh lousewort at a very early stage of fen restoration in any site dominated by reed, sedge or rush. This should occur any time after the very first reed-cut when marsh lousewort seed is available, i.e. August to midwinter. It is not yet known if marsh lousewort seed needs a cold treatment in order to stimulate germination. If it does not, seeding with properly-stored marsh lousewort seed immediately after any reed/rush/sedge cutting and raking could probably be successful right from August through to the next February.

Remarkably, even the small first-year marsh lousewort plants seem able to cause a marked height reduction in adjacent reed, although the really big effect on reed is seen in the second year, when the marsh lousewort plants grow much taller and flower. They die, of course, after flowering, and shed seed to the ground any time from July to September.

Before shedding, it is advisable to pull the dead plants up whole and move them on to another area in need of reed/sedge/rush control. In the bare area left by dead marsh louseworts, the light getting to the peat stimulates the germination of a variety of fen species. In autumn 2018 a big bag of dead marsh louseworts were pulled to send to Chilswell fen restoration area (see Chilswell report).



*Collection of dead marsh lousewort plants with their seed by volunteers  
Hand-picking or, alternatively, whole dead plants can be pulled up and bagged  
for moving to new fen restoration areas to shed seed naturally 12.09.2018*



If marsh lousewort seed is dropped, all in one place, under the old dying plants it is observed that a swarm or complete 'lawn' of young lousewort plants germinates the next year. However, few of those that germinate so close together survive to the second year because of within-species parasitism between the young plants (they feed on each other). The largest plants drain the smaller ones and by the end of the second year only a few large 'winners' are visible. As most of the young plants in this crowded situation will die, to maximise the usefulness of the seed in fen restoration, with minimal wastage, it is best to collect the plants whole, before seed-drop, and spread the seed thinly over any area without marsh lousewort that needs tall-vegetation reduction.

Experience at other fen restoration sites has shown that the young first-year marsh lousewort plants do best if there is an early, fairly-high, scythe-cut over their heads in late April to early May, just when the reed shoots have emerged and are growing strongly upwards to about 40-50cm tall. This knocks the reed back and gives the marsh louseworts more light – but this treatment is not essential.



*An early stage in fen restoration from reed dominance, after marsh lousewort seed-spreading the previous autumn. A swarm of frilly-leaved first-year marsh lousewort plants can be seen growing between reed shoots in June 2018.*

Can a fen have too much marsh lousewort and what if it parasitizes desirable rare sedge species? No doubt we will find out the answers to those questions in future studies of fen restoration work in this project.

### **C. Glades and sunny, open, flower-rich areas on drier slopes and banks**

Good progress has been made in scrub removal, scything, raking and pulling undesirable plants that can become too dominant (nettle, creeping thistle and bittersweet) at the head of the valley in the LNR/LWS areas. The response of the hemp agrimony has been a spectacular increase in flowering, with great benefit to all insects. There have also been big increases in greater bird's foot trefoil, marsh thistle, marsh woundwort, wild parsnip, tufted vetch and meadow vetchling. Blackthorn has been laid to rejuvenate it and provide brown hairstreak butterflies with egg-laying opportunities.

Patches of dense scrub are important for bird nesting and some spiny scrub has been laid specifically to provide a dense protective pile, attractive to nesting of birds like wren and dunnock. Most of the scrub-cutting arisings are being used in nearby brook bank restoration, but some log and brash piles are being left in areas above the spring line as habitat piles, which will benefit reptiles, amphibians and invertebrates as refuges.





*Wild Oxford volunteers felling old hawthorn scrub, scything and raking, in the drier bank area at the head of the valley 03.11.2018*



*Winter felling of willow scrub and dying ash on the west bank, Feb 2018*





*The felled trees provided material for the log dams and there is now a more pleasing view of an open sweep down the valley, here looking south, May 2018*



*View of head of valley from the Peat Moors access path. Wild parsnip (yellow-green flowers in foreground) has done particularly well after scrub removal. 24.07.2019.*



### New tree plantings

Ash trees in the valley are all dying from Ash Dieback (*Chalara*). English elm trees are all dead from the Dutch Elm Disease fungus. Alder trees show death from the specific *Phytophthora* fungus. Crack willows have been badly hit by an unknown pathogen, but the dying willows sprout honey fungus (*Armillaria* sp.), so it is possible that actually they have been killed by this. Replacement of trees in the drier marginal zone will benefit biodiversity and provide the opportunity to introduce species more resistant to the current wave of tree diseases. More Dutch Elm disease resistant elm whips were obtained via Butterfly Conservation (thanks are due in particular to Peter Cuss) and planted at the top of the west bank above the SSSI to benefit caterpillars of white letter hairstreak butterflies.



*Volunteers and Peter Cuss of Butterfly Conservation planting the last of the Dutch Elm Disease resistant elms*

*28 March 2018*

Andy Gunn sourced a set of young, well-grown, small-leaved lime (*Tilia cordata*) whips in March 2018 and Friends of Lye Valley carried out the planting of these in a line along the drier top of the west bank of the SSSI, adjacent to the line of disease-resistant elm whips planted there in 2017.



*FoLV Volunteers planting the last small-leaved lime tree at the top of the west bank above the SSSI on 28 March 2018*

### **Pond enhancement in the LWS south-western area**

Pond marginal work has continued, with regular removal of young willow and scything back reed regularly throughout the year. Gradually shade is being reduced, although tall willows on higher ground to the west and private land to the east still shade the ponds for a good proportion of each day. The ponds are small, so rampant growth of reed sweet grass and water cress, which threatened to completely fill one pond, has been reduced to maintain open water to favour dragonflies and damselflies.



*Raking fallen crack willow twigs out of one of the restored ponds, April 2019*

### **D. Brook bank defence and restoration, fen re-wetting**

In March 2018 grant-funding from Natural England enabled contract work to install 19 leaky log dams in the central section of the Lye Brook as it travels through the SSSI in the eroded and over-deepened channel.

The aim is to slow the peak water flow (flash flooding from the road surface drain entering at the head of the valley) and provide the first phase of wetting-up the dry sections of fen either side of the brook.

Volunteers have helped the contractor with this work by moving quantities of cut logs into dam positions, and in scrub removal, which has provided ample material (particularly hazel stakes and wands) for producing hurdle-like wattle structures to protect the brook banks from erosion by the stream, as it runs through the fen in its deep channel.

The small area behind the woven structure is filled with vegetation cuttings and brash stamped down. This stops the peat banks being further destroyed in storm-water flash-flooding. More cut vegetation and brash will be added behind the wattle each year. With compression and water-logging this material will eventually turn into new peat, held in place by the woven hazel structure.

In the second phase, due to start towards the end of 2019, re-wetting proper will happen. The peak water flow will be slowed by increasing the holding capacity of the interception ponds at the head of the valley by removal of accumulated silt. Once water flow is slowed, the water level in the brook can be raised by making the dams impermeable for much of their height. This will restrict spring water loss from the fen and effectively re-wet the dry zone near the stream edge.





*A leaky log dam in construction in the Lye Brook on 20.03.2018*



*A sequence of a leaky log dam and several woven hazel wattle leaky dams, newly installed in the Lye Brook, slowing peak flow after rain on 28.03.2018. Bank erosion defence wattle structure with cut reed packed in behind is also visible.*

The second phase of the re-wetting is commencing. Oxford City Council are using grant money from Thames Water to desilt the two interception ponds constructed at the head of the valley in the 1980s.

These receive the natural, gentle, Lye Brook spring flow but their real purpose is to collect and retain peak flow water from the Thames Water 60cm diameter storm surface water drain, which discharges into the Lye Brook at the head of the valley. Currently they are full of silt and do not hold back much water. Once desilted they should hold back a lot more water, reducing flow pressure on the leaky log dams. As the flow reduces after a storm, the dams can be made more impermeable, so they hold up water, and this can then rewet the adjacent dry brook banks with great benefit to the fen habitat there.



### Carbon storage, not carbon emission

Rewetting the dry peat margins to the brook benefits more than wildlife. As peat dries, it oxidises under the action of aerobic bacteria, liberating carbon dioxide. Thus, drying areas of the fen in the valley are significant carbon-emitters. Rewetting that peat and restoring anaerobic conditions with water-logging prevents this. Also, with enough rewetting, fen vegetation is stimulated to grow, removing carbon dioxide from the air in photosynthesis. When leaves of fen plants die, they lie in waterlogged anaerobic conditions where they do not decay but gradually become new peat, storing (sequestering) carbon removed from the air. **The main point here is that re-wetting Lye Valley fen stops carbon dioxide emission and enables more carbon dioxide removal from the air, a target of wider importance to the city as a whole, helping towards carbon neutrality.**

### Water-quality issues in the fen springs on the western side

Contamination by excess nitrate has been identified in the water issuing from the west-side springs in the SSSI and LWS by the use of the Freshwater Habitats Trust's water-testing kits and by detailed surveys by the Environment Agency and by contractors [WSP](#) in relation to the proposed Warren Crescent housing development. Since the source of this nitrate could be either leaking water mains or sewers in the developments to the west of the reserve, identifying the source and rectifying the pollution will prove difficult, but it should be a long-term aim. In the meantime, regular vegetation cutting with raking-off will remove nitrogen in plant material and go some way towards reducing the negative effect of this enrichment pollution (it stimulates rampant thug species like reed, to the detriment of smaller plant species and with the consequent loss of open, sunny, short vegetation).

### Removing fly tipping, and general attractiveness of the site

When vegetation dies down in the winter, any dumped material is clearly visible and can be removed more easily. In spring 2019, as a result of a joint Wild Oxford and Thames Valley Police volunteer workday, a great deal of material, including large quantities of metal, was removed.



*Volunteer collecting fly-tipped rubbish in the north end of the valley, January 2019*

Keeping the site cleaner and clearer by regular removal of such material discourages further dumping and raises its profile as a high value, special place.

## RECOMMENDATIONS FOR FUTURE CONSERVATION MANAGEMENT AND PUBLIC ENGAGEMENT WITHIN THE WILD OXFORD PROJECT AT LYE VALLEY

- Finishing the work on the footpath down to the valley from Peat Moors Road. Public access needs to be made easier and safer on this steep slope. This will enable further Friends Group Open Day events to operate with less risk of slips or trips.
- Repeat the transfer of species-rich hay and hand-collected seed from the east-side fen to Square 1 of the monitoring squares on the west-side fen, as this has resulted in desirable wetland species appearing.
- If spare hay and marsh lousewort are available, collect and transfer to other Wild Oxford sites that need plant biodiversity enhancement.
- Another 20m of recycled plastic boardwalk would complete the southern extension to the very edge of the land owned by Oxford City Council and would provide improved access over a very wet, muddy, area.
- Further planting of a greater range of species of useful scrub and tree species on the drier banks will add to the biodiversity. It will also compensate for loss of ash trees to Chalara and mature willows to honey fungus. These additions could include a few more Dutch elm disease resistant elms, spindle, guelder rose, blackthorn, purging buckthorn and some UK-sourced small-leaved lime.

## SUMMARY AND CONCLUSIONS

The BBOWT Wild Oxford Project continues to make a big difference to the habitats in the Lye Valley North Fen area in conjunction with work carried out by other conservation groups. All target areas continue to show positive change.

Volunteers' time has been spent on work removing scrub and willows growing out of wet peat and tufa-forming springs, reed cutting in the SSSI, and pond marginal work, with the biggest degree of change visible all along the western side of the site.

Considerable progress has been made with providing safer access to Peat Moors via the footpath on the east side of the valley. All the five ponds are open, less shaded, and surrounded by shorter vegetation. As a result, the wildlife is more visible and much enjoyed by all visitors. Log dams and bank defence and repair, achieved by contract work with the use of logs and hazel wickerwork, have reduced bank erosion from flash flooding in the Lye Brook. Volunteers have continued this essential work to re-wet dry fen areas. Low peat ridges on the fen surface have retained more spring water, re-wetting dry peat and creating a complex network of shallow, warm, pools, which will favour the breeding of many invertebrates.

A detailed method of assessing the vegetation response to the reed cutting and raking on the western slope of the SSSI has demonstrated the biodiversity improvement and can be repeated.

Fen remediation is being accelerated by spreading seed-rich hay and seed of specific key plant species, such as marsh lousewort, from the very biodiverse east side of the fen to the restoration area on the west side. The success of this is already evident in the quantitative survey results.

### Achievements are:

- **Short turf fen and biodiversity improvement.** Further reduction in reed-dominated fen on the west bank of the SSSI through reed scything and willow scrub removal. Further extension of the short turf fen all the way to the southern limit of the SSSI. Reed has been weakened, resulting in greater plant and invertebrate biodiversity returning to this west side.
- **Arson risk reduced.** The reduction of reed in the whole of the west-side sloping fen of the SSSI will prevent any possibility of future arson damage to the biodiversity in this area or arson damage to the recycled plastic boardwalk, as there will be no dead reed thatch to burn (assuming of course that the reed can be kept under control in future by annual cutting and raking).
- **Re-wetting.** Volunteers have assisted with the contract work of constructing leaky log dams in the brook in the SSSI section and with the construction of bank defence using staked woven hazel wattle structures. Now, peak flow in the brook after rain is slowed and peat loss from the banks due to flash flooding erosion is eliminated.

The stage is set for the second phase, which is raising the water level in the brook and re-wetting the fen by making the dams less leaky (after the interception pond work at the valley head).

- **Carbon storage.** Re-wetting is ensuring that previously dry peat areas in the valley are being changed from carbon dioxide emitters (as dry peat oxidises) to carbon storage areas where new peat can now form from waterlogged dead plant remains (carbon sequestration).
- **Sunny, flowery, areas have increased.** LWS areas in the northern section of the site have shown an increase in sunny, warm, conditions as a result of further scrub work and vegetation cutting and raking. A reduction in scrub and bramble enabled abundant flowering of tall herbs, which attracted a greater diversity of insects, including more bees and butterflies.
- **Open ponds.** Six ponds have had marginal scrub and reed reduced, producing open, sunny, warm conditions, which have resulted in greater aquatic plant diversity, increased use of the ponds by frogs and a diverse range of aquatic invertebrates, as well as attracting spectacular damselflies and dragonflies.
- **The valley has had a large volume of historic fly-tipped rubbish cleared** and now looks more attractive. The absence of rubbish will make it less likely to attract more dumping in future.

### ACKNOWLEDGEMENTS

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## APPENDICES

- Appendix 1** Complete Vascular Plant list for Lye Valley North Fen area to 2019 including horsetails and algae
- Appendix 2** Records of Bryophytes (Mosses and Liverworts) in the Lye Valley North Fen to 2019
- Appendix 3** Records of Animals and Fungi in the Lye Valley North Fen to 2019