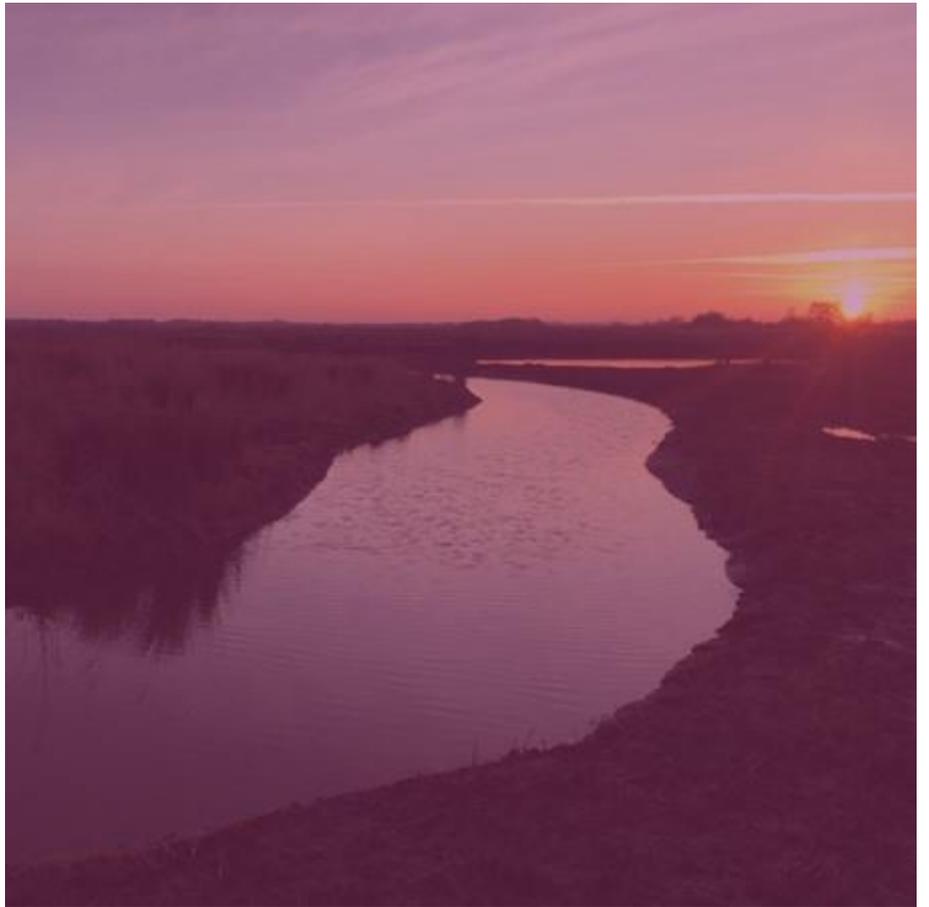


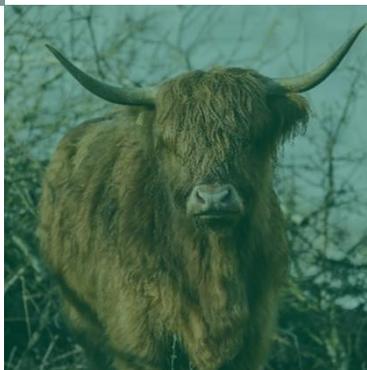
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# **Network for Nature Annual Report: Year 2 2022-23**

**June 2023**



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# 1 Introduction

This is the second annual Network for Nature monitoring report. It presents data submitted by projects about outputs achieved and progress towards outcomes during the year 2022-23.

National Highways (NH) and The Wildlife Trusts (TWT) have worked together to develop a programme of projects, a Network for Nature (N4N) with a joint ambition to unlock the biodiversity potential of habitats adversely impacted by historic road development.

The N4N portfolio now comprises 38 projects<sup>1</sup> that have been specifically designed to create, enhance, and restore habitats across England generating biodiversity units measured via the Defra 2.0 metric<sup>2</sup>. The metric is used to assess current habitat conditions and to measure any predicted uplift in condition following project interventions. Overall, the programme seeks to achieve **3,160 biodiversity units**, within the local planning authorities' areas which the strategic road network (SRN) passes through. Biodiversity units generated from N4N will play a role in mitigating historic road building activity and daily road management, as well as contribute towards NH's target of 'no net loss to biodiversity' by 2025.

The 38 N4N projects, joined the programme over three phases. The first 22 projects started between September and December 2021. A further five 'phase 2' projects started in early 2022, and one beginning in September 2022. Ten 'phase 3' projects joined the programme and began work in autumn 2022. One project, N4N22: Bringing Biodiversity Back to the Broads, completed work in early 2023. See Appendix 1 for list and summary of projects.

Total approved funding from NH for the delivery and co-ordination of the 38 projects within phases 1 to 3 is £8,518,566. A further £557,307 was approved in 2022-23 to assess the feasibility of a phase 4.

In 2022-23, the programme claimed £2.1 million, bringing the total spend since 2021 to £2.85 million. Within the most recent financial year, £1.8 million was by the individual Wildlife Trusts (projects), while £337,000 was claimed by the Royal Society of Wildlife Trusts (RSWT) for programme management and assessment/reporting.

Table 1.1: Total amount projects have claimed from N4N, financial year 2022-2023

	Year 1 spend	Year 2 spend	Cumulative total spend to date
Phase 1 Projects		£1,401,780.81	
	£598,494.64		£2,181,264.39
Phase 2 Projects		£180,988.94	
Phase 3 Projects	n/a	£217,292.86	217,292.86
RSWT	£110,663.25	£337,058.70	£447,721.95
All	<b>£709,157.89</b>	<b>£2,137,121.31</b>	<b>£2,846,279.20</b>

<sup>1</sup> As of May 2023.

<sup>2</sup> Natural England (2019) Biodiversity Metric 2.0 and the Biodiversity Metric 3.0  
<http://publications.naturalengland.org.uk/publication/5850908674228224>



The scope of this year 2 monitoring report is to record the progress that has been made delivering **outputs** and consider the achievement of **wider socio-economic outcomes**. It draws in evidence provided by projects via the Annual Outcomes Monitoring Reports submitted by projects during May 2023, and the Q4 Quarterly Monitoring Returns 2022-23. Data covers activity during the project year 2 of the programme (2022-23). The aim of this report is to provide the Programme Team with an overview of what N4N projects have delivered collectively, as well as use examples to demonstrate the outcomes at a project level.

## Metrics and Measures

Two types of monitoring data are considered outputs and outcomes.

### Outputs

Outputs measure project activity. Outputs provide an indicator of progress against project plans. Collectively they demonstrate the scale of programme activity. There are **10 core outputs** and projects are also invited to report project-specific outputs unique to their delivery plans.

<b>1. Habitats</b>	1a) Habitats restored, cleared, enhanced. b) New habitats: created, seeded, planted, engineered. c) Trees planted, 1d) Hedgerows managed/planted
<b>2. Ponds</b>	2a) Ponds improved, b) New ponds.
<b>3. Waterways</b>	3) Waterways cleared, managed, restored.
<b>4. Ditches</b>	4) Ditches/bunding managed, restored.
<b>5. Boundaries</b>	5) Fencing &/or security.
<b>6. Infrastructure</b>	6a) Visitor e.g. bird hides, b) Wildlife e.g. bat boxes
<b>7. Volunteers</b>	7a) Volunteers: individuals volunteering, b) Volunteer hours.
<b>8. Training</b>	8) People trained e.g., volunteers.
<b>9. Organisations</b>	9) Organisations engaged e.g., public sector stakeholders, landowners.
<b>10. Research</b>	10a) Ecology, environmental research. b) Feasibility, engineering study

### Outcomes

Outcome evidence seeks to capture the wider social and environmental benefits of N4N. These sit alongside the biodiversity metric, with biodiversity units remaining the core performance measure. Alongside biodiversity units, there are a further **eight outcome domains**. The outcome domains include both quantitative and qualitative evidence, some of which (but not all) can be monetised.

- **Carbon sequestration:** net change tonnes CO<sub>2</sub> of avoided emissions or sequestered.
- **Site designations:** SSSI status of site,
- **Species:** diversity and populations
- **Nature connectivity:** Project evidence
- **Waterways: quality and river morphology,** recreation, and aesthetic value of waterways
- **Flood and drought resilience**
- **Visitors:** recreational value, self-reported wellbeing, and connectedness to nature
- **Volunteering:** Value of labour contribution and self-reported wellbeing.

Not all projects seek to achieve all outcomes, typically 3 or 4 outcomes are associated with each project. It is therefore crucial to view the outcomes as a 'patchwork' of benefits which the N4N programme has achieved.



## 2 Outputs

N4N project activity has achieved a wide range of project outputs, progressing comfortably towards programme aims.

### Core outputs

The total outputs achieved across the whole programme in years 1 and 2 are summarised in [Table 2.1 overleaf](#). Full project data is available on request from the project team on request. A 'snapshot' of key figures and images provided by projects are included below.

**414ha**

Habitats: restored  
**48%**



Figure 2.1: N4N15, Blows Down, creation of bare ground scrapes within the quarry area



Figure 2.2: N4N29, Badley Habitats, clearing and fencing

**55ha**

Habitats: newly created  
**46%**



Figure 2.3: N4N2 M56-A56 Pollinator Networks, Belthorn hedge planting

**8,871**

Trees planted  
**47%**



Figure 2.4: N4N26 Reconnecting Fillongley, new hedgerows

**4,868m**

Hedgerows managed  
and/or planted  
**34%**

**52**

Ponds improved  
**70%**

**44**

New ponds created  
**84%**



Figure 2.5: N4N7, Lugg Wetlands, fixed point photography



**368**

Volunteers

**53%**

**2,593**

Volunteering hours

**48%**



Figure 2.6: N4N2 M56-A56 Pollinator Networks, moth trapping



Figure 2.7: N4N2 M56-A56 Pollinator Networks, Moth trapping

**125**

People trained

**71%**

**124**

Organisations engaged

**52%**



Table 2.1: Outputs achieved in 2022-2023, whole programme.

Theme	Output	Description & sub-sets	Metrics	Planned	Achieved Year 1 2021-2022	Achieved Year 2 2022-2023	Total achieved to date	% achieved
Habitats	1) Habitats Improved or created	1a) Habitats: <b>restored</b> , cleared, managed, enhanced	ha	847.36	31.91	381.72	413.63	48.8
		1b) Habitats: newly <b>created</b> , seeded, planted, engineered	ha	118.43	0	54.95	54.95	46.4
		1c) Trees planted	count, trees	18,825	0	8871	8,871	47.1
		1d) Hedgerows managed, planted	m	14,164	0	4868	4,868	34.4
Water	2) Ponds	2a) Ponds improved	count, ponds	74	2	50	52	70.3
			ha	25.18	0.35	1.5	1.85	7.4
		2b) New ponds	count, ponds	52	10	34	44	84.6
			ha	4.61	0	1.97	1.97	42.7
	3) Waterways	3) Waterways cleared, managed, restored	km	74.49	2.1	2.03	4.13	5.5
	4) Ditches	4) Ditches/bunding managed, restored	m	4,049	900	7,625.75	8,526	210.6
Physical Infrastructure	5) Boundaries	5) Fencing &/or security	m	24,433	913	12,906	13,819	56.6
	6) Site infrastructure	6a) Visitor infrastructure e.g., bird hides, interpretation boards	£	£64,500	£2,560	£10,008	£12,568	19.5
		6b) Wildlife infrastructure e.g., bat boxes, turn rafts	£	£230,394	£20,436	£37,026	£57,462	24.9
Engagement	7) Volunteers	7a) Volunteers: number of individuals (different people) volunteering directly on N4N project activity. At least 0.5 day.	count, people	695	34	334	368	52.9
		7b) Volunteer hours: directly contributing to N4N activity	hours	5,421	42	2,551	2,593	47.8
	8) Training	8) People trained e.g., volunteers	count, people	174	0	125	125	71.8
	9) Organisations	9) Organisations engaged e.g., public sector stakeholders, landowners	count, orgs	236	34	89	124	52.5
Knowledge Base	10) Research	10a) Ecology, environmental research papers.	count, papers	9	1	1	2	22.2
		10b) Feasibility, engineering study	count, studies	7	1	4	5	74.4



Overall, projects are performing comfortably towards their programme plans (targets) with many approaching 50 per cent achieved with two years of the programme remaining. The outputs showcase the wide range and depth of activities taking place. The output areas that have seen particularly notable progress are *ponds improved* and *new ponds* with 70 and 84 per cent of those planned already delivered. The programme has engaged over 350 volunteers during 2022-23, providing a valuable resource to the programme. Volunteer feedback from N4N volunteers provides insights into the wider benefits of volunteering for the individuals can be found in chapter 10.



### 3 Net change in CO<sub>2</sub> emissions

16 per cent of the total hectareage of the N4N programme is eligible for CO<sub>2</sub> emissions analysis using the NH Environment and Wellbeing Fund appraisal tool. It is estimated that, once delivered, post-intervention habitats will sequester 1222 t CO<sub>2</sub>-eq per year.

While this programme primarily focuses on impact on biodiversity, changes in land also impact a given habitat's ability to sequester CO<sub>2</sub> from the earth's atmosphere. This may be a small contribution in terms of national and international targets, but it still represents an important contribution that is being directly enabled by the N4N programme.

#### Methodology

The NH Environmental and Wellbeing appraisal tool is used to calculate the additional CO<sub>2</sub> sequestration brought about by N4N projects. The tool focuses on changes to woodlands and peatlands habitats only. This is due to these being the two habitats with associated emission factors (amount of CO<sub>2</sub> they sequester/emit each year) that are supported by high confidence data and literature. Whilst it is prudent to only include evidence that is robust and relevant, this limits analysis to only 28 per cent (254 ha) of habitats across the N4N programme. Specifically, the creation of bio-rich grasslands, heathland, reedbed and ponds are not included in this analysis. The total amount is reduced further to 16 per cent, due to a limitation of the model that is discussed further below.

The output of the Defra 2.0 biodiversity unit assessment was used to identify the woodland and peatland projects, and therefore projects suitable for the NH model. Once these were determined, they were mapped onto the available habitats in NH's model (see Appendix 2 for mapping assumptions). Whilst this is largely straightforward, a few assumptions were made based on information from interviews and correspondence with project managers. It should be noted that the classification for the biodiversity units' assessment differs from those available in NH's CO<sub>2</sub> model.

The biodiversity unit assessment considers three types of intervention, and each has implications for how assumptions in the NH CO<sub>2</sub> model are handled.

- **Creation:** Habitat creation is the removal or loss of an existing habitat to create a new, different habitat. It can also involve creating habitats where none were previously present (i.e., from bare earth).
- **Succession:** Habitat succession involves retaining and incorporating an existing habitat into a distinctly different and ecologically improved habitat, thereby reducing the time to maturity of the new habitat.
- **Enhancement:** Habitat enhancement increases the biodiversity value of an existing habitat, for example by improving its biodiversity capacity or removing factors that degrade its value.

The NH model includes the option to add in costs incurred because of the intervention. For this model we have included CO<sub>2</sub> assumptions associated with transformation of the land, as well as the ongoing maintenance emissions for habitats undergoing a transformation to a new type of habitat (succession and creation). We do not consider additional maintenance cost for interventions that are classified as enhancements.

Importantly, some habitats which are considered an *enhancement* cannot be added into the model. This is because the model does not have an option to input changes in habitat quality for the same type of habitat, albeit in an improved condition. The reasoning behind this limitation is the lack of evidence from the literature on whether there is a difference in the ability for a woodland in 'good condition' to



sequester more CO<sub>2</sub> than if it were in ‘poor condition’. As a result, 110 ha of enhanced woodland cannot be included in the model, reducing the scope of the calculation further, and meaning that the CO<sub>2</sub> results represent only 16 per cent (144ha) of the total programme area. As there are different options for peatlands it is possible to calculate the impact of enhancements for the latter type of habitat.

## Results

### Woodland

1.4 hectares (ha) of newly planted native broadleaf woodland are planned, derived from 1.1 ha of scrubland, 0.26 ha of grassland and 0.04 ha of arable/cultivated land. In the baseline 2.2 t CO<sub>2</sub> per year are emitted into the atmosphere. Post-intervention (including emissions of transformation and maintenance), 8.08 t CO<sub>2</sub> are sequestered per year. This results in a positive net change of 10.28 t CO<sub>2</sub> less per year – a combination of avoided emissions and sequestration.

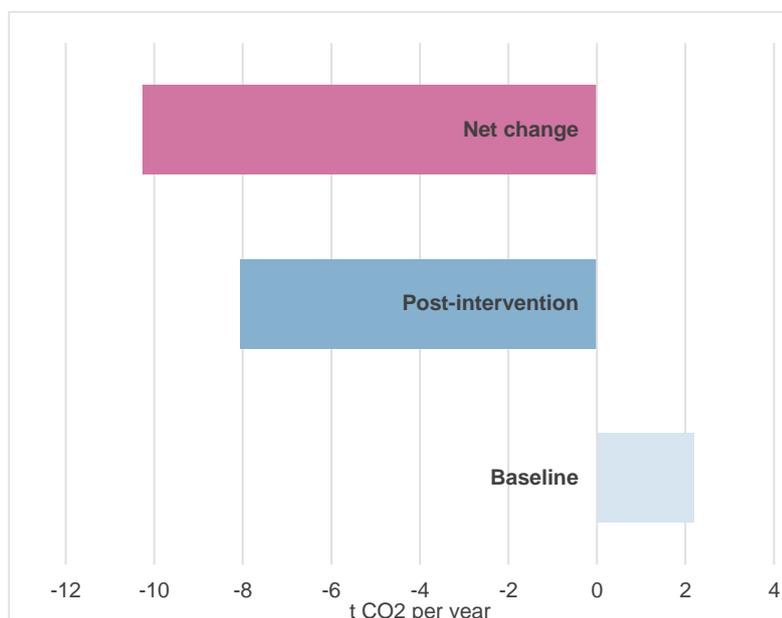


Figure 3.1: Net change in CO<sub>2</sub> emissions per year from woodland habitats

### Peatland

In total 142 ha of peatland habitats are in better condition (64 ha of near natural bog and fen, 1.7 ha of rewetted bog and fen, 56 ha of modified undrained bog, and 15 ha of eroding modified undrained bog) following enhancement. This results in a net positive change of 1,211 fewer tonnes of CO<sub>2</sub> per year. As shown by Figure 3.2, the habitats measured do not sequester CO<sub>2</sub> on aggregate. However, as the amount of CO<sub>2</sub> emitted is significantly reduced compared with the baseline, there is still a positive change known as “avoided emissions”.

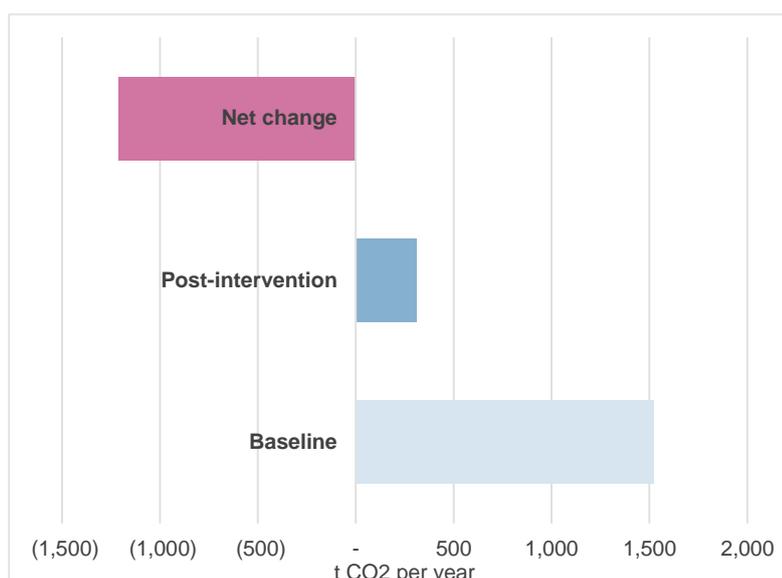


Figure 3.2 Net change in CO<sub>2</sub> emissions per year from peatland habitats.

It is estimated that, post-intervention, habitats will sequester 1,222 t CO<sub>2</sub>-eq per year. This value is dependent on the mapping assumptions between biodiversity unit analysis and the NH model. While best efforts have been made, changes to what the



baseline and post-intervention habitats are, and the assumptions built into the NH model, will impact the results presented here.

## Making CO<sub>2</sub> everyday

Post-intervention habitats for phase 1 and 3 of N4N are estimated to sequester 1,222 t CO<sub>2</sub>-eq per year. This saving is equivalent to driving 5.5 million miles per year in a car, assuming the average CO<sub>2</sub> emissions factors of vehicles in 2020: 221g CO<sub>2</sub> per mile. Other benchmarking comparisons are provided below, to give a sense of the sequestration capabilities of the programme. 1,222 CO<sub>2</sub>-eq per year is also equivalent to:



- Driving (in an average vehicle) 1,227 times the entire length of the strategic road network, which is 4,500 miles.
- 746 people's yearly driving, assuming the average yearly mileage is 7,400 miles<sup>3</sup>.
- 0.002 per cent of the total miles driven by UK cars and taxis in 2019, 262.9 billion vehicle miles<sup>4</sup>.

<sup>3</sup> [Average Car Mileage](#) 2023 (UK), NimbleFins.

<sup>4</sup> [Road traffic statistics](#), Department for Transport.



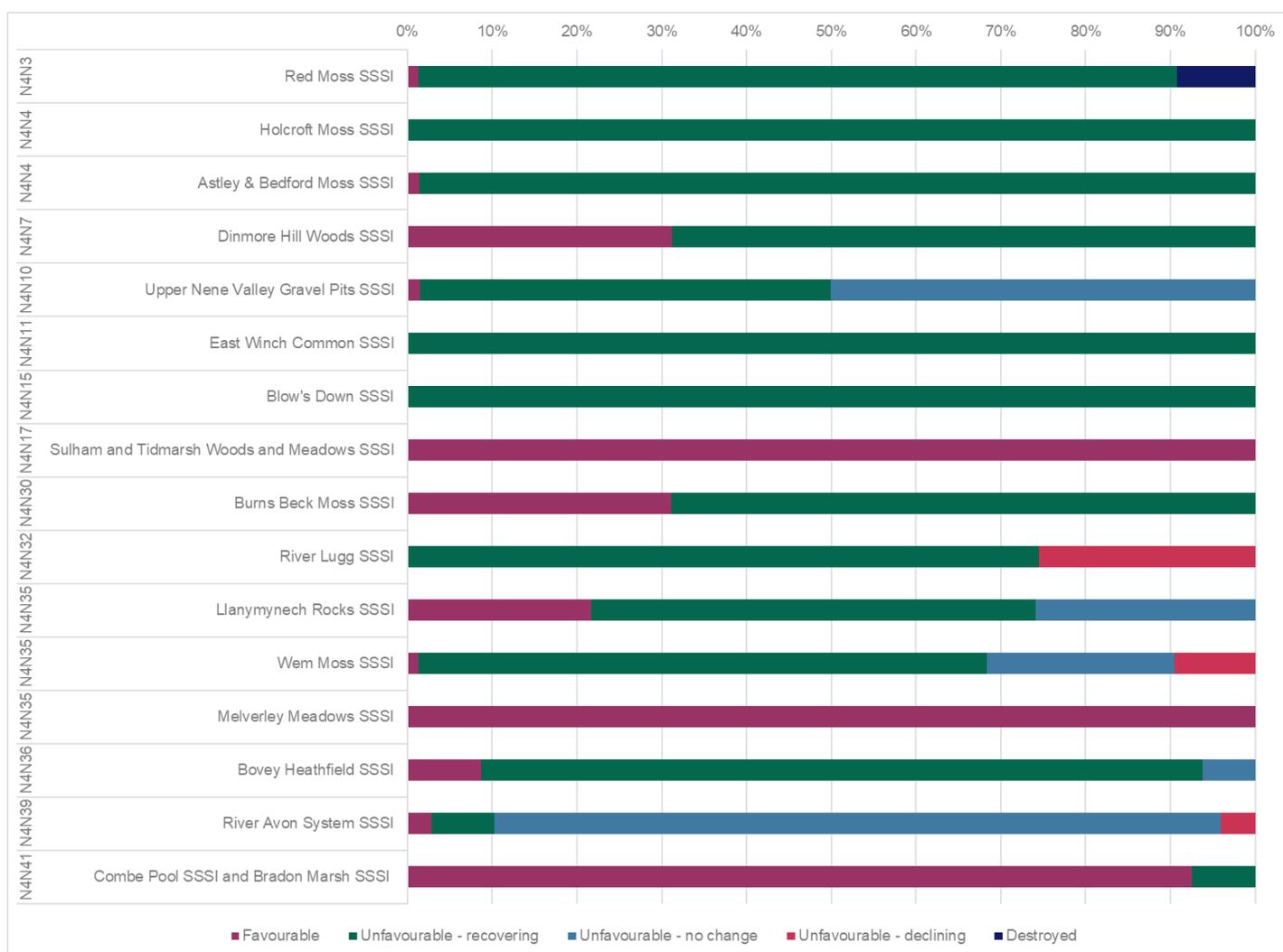
## 4 Designated sites

In total, 23 N4N project sites either form part of, or are adjacent to, a SSSI.

### Sites of Special Scientific Interest

In total, thirteen N4N project sites overlap to some extent with a Site of Special Scientific Interest (SSSI). A breakdown of the status of these sites is shown in Figure 4.1 below.

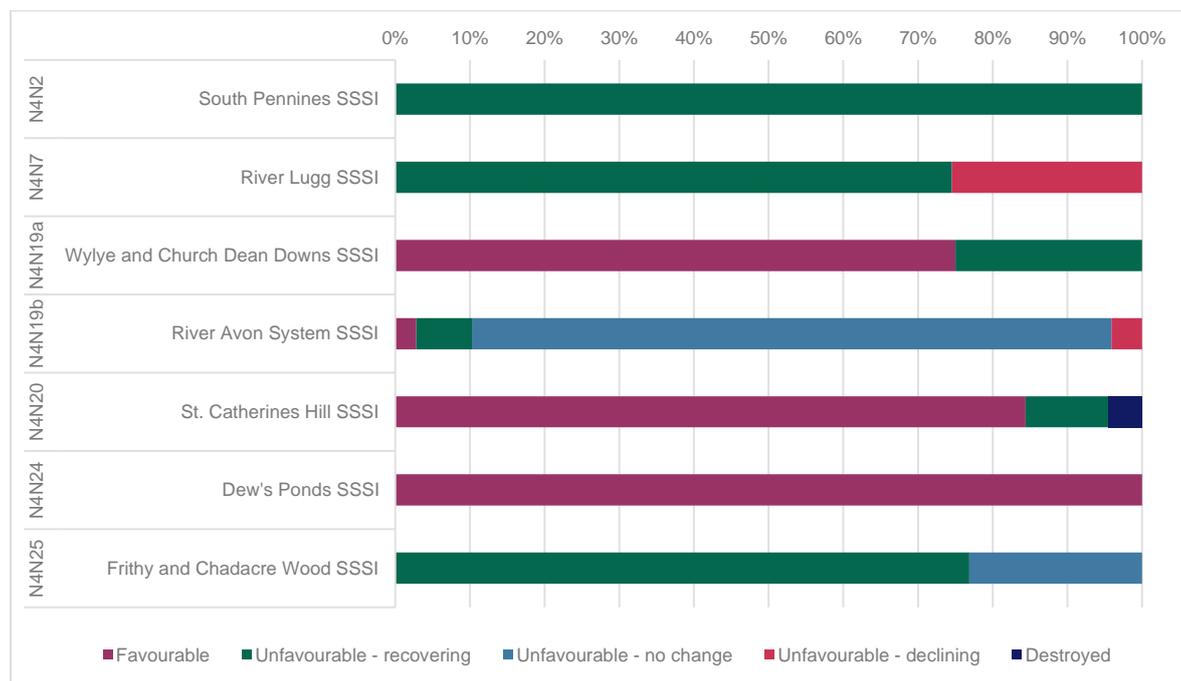
Figure 4.1: Status of SSSIs overlapping with N4N project sites



In addition, seven Phase 1 and 2 project sites are adjacent to SSSIs. The status of these sites is shown in Figure 4.2 overleaf.



Figure 4.2: Status of SSSIs adjacent to N4N project sites



A NH Regional Infrastructure Fund metric is: 'Count of the number of schemes: Site of Special Scientific Interest brought into a favourable condition'. While this is not a defined objective of the N4N programme, many projects aim to support or improve their local SSSI's status.

### Progress during 2022-23

- N4N32, Bodenham Reedbeds** in Herefordshire, aimed to increase the reedbed specialist species in the **River Lugg SSSI** by reducing toad mortalities and boosting habitat required for overwintering and breeding. This project, involving 32 volunteers, helped 780 toads cross the road enhancing the Lugg Valley wildlife.
- N4N35, Shropshire Road Networks Nature Retreats** is focused on enhancing habitats to promote the growth of aquatic and terrestrial invertebrates, attracting local bird, reptile, and small mammal populations. Condition of two SSSI units at **Llanymynech Rocks** and **Llyncllys Common** sites and Dolgoch Quarry LWS has been improved by reducing abundance of invasive plant species on 2ha of limestone grassland, through a first phase scrub removal. The project reports that the condition has been improved but target condition not been reached yet as more phases of scrub removal to come.
- N4N36, Bovey Heathfield SSSI Restoration** in Devon, aims to reintroduce cattle and improve infrastructure to enhance the habitat for various species. Positive responses have been received from local ecologists, and efforts have been made to improve habitats for butterflies, nightjars, warblers, beetles, bees, and reptiles. The project is also focused on maintaining and increasing the habitat for silver-studded blue butterflies and the narrow-headed ant. The works carried out this year have included scrub clearance, creating clearings, and implementing conservation grazing.
- N4N18, Dormouse Reconnected**, in Somerset, to safeguard dormice species while promoting community involvement in wildlife monitoring. The project has installed extra nesting boxes and footprint traps to monitor dormouse presence and population numbers. Ecological surveys were conducted on the **Local Wildlife Site (LWS)** and surrounding areas, while 720 trees were planted to enhance dormouse habitats.



## 5 Species

Many projects have conducted species baseline assessments during 2022. These assessments have highlighted some notable flagship species.

N4N projects collectively seek to support a whole range of species, with enhanced habitats and increases in presence and populations of target species an indicator of success. Project data is used to tell the stories of individual projects and showcase the varied nature of targeted species across N4N projects. Data has come from project-specific ecological/species monitoring. Some species baselines are yet to be undertaken. The following section provides a synopsis of the data provided by projects, and highlights the following flagship species:

- **Great crested newt** (N4N7, N4N14, N4N23, N4N24, N4N25, N4N35)
- **Water vole** (N4N16, N4N39)
- **Dormouse** (N4N17, N4N18)
- **Otter** (N4N7, N4N16)
- **Bittern** (N4N10, N4N19)
- **Golden plover** (N4N10)
- **Gadwall** (N4N10)
- **Emerald damselfly** (N4N11)
- **Nightingale** (N4N24)
- **Dartford warbler** (N4N36)
- **Silver-studded blue butterfly** (N4N36)
- **Narrow-headed ant** (N4N36)

Project(s)	Summary
N4N1 Whittle Dene Semi Natural Woodland Restoration	This project reported target species of ground flora and native broadleaved species in 2021, and in 2022 reported that baseline surveys for ground flora would be carried out in Summer 2023, along with invertebrate data. Bird species data were collected as part of an ongoing bird ringing effort. Importantly, invasive species were recorded: Himalayan balsam, Japanese knotweed, grey squirrel, and mink.
N4N2 M56-A56 Pollinator Networks	This project is specifically focused on pollinator networks, with several bee and butterfly species being noted in 2021 as targeted species (Bilberry mining bee, white tailed bumble bee, heath bumble bee, wall-brown butterfly, green hair streak



butterfly). Assessments have since taken place on designated species-rich grassland, and all species except the white-tailed bumble bee have been recorded on at least one of the working sites that were assessed. Over 1000 invertebrate records were collected through visual observations, and specimen collection and verification.



N4N2 Bumble bee

<p>N4N3 Red Moss SSSI</p>	<p>This project aimed to target various fen plant species, and bog characteristic plants, as well as the white-faced darter dragonfly specifically. Baseline data (vegetation) shows Molinia-dominated understory (i.e., reduced carbon capture capability) in areas where rewetting is intended, with Betula top canopy.</p>
<p>N4N4 Improving the Connectivity and Biodiversity of the Manchester Mosses SAC</p>	<p>This project also targeted several species, including the large heath butterfly, the white-faced darter dragonfly, and bog specialist plants including sphagnum moss. Baseline assessments have now been completed on all sites, and two sites have been identified where bog species will be planted over the next two years. A further two sites have been found to have c. 20% cover of bog species, such as Eriophorum (cotton grass) and sphagnum moss. Wider SSSI data for the project site will be analysed during Summer 2023, and so further species updates may become available following this.</p>
<p>N4N6 Rotherham Rivers 3</p>	<p>This project targeted a wide variety of species: wading birds and amphibians, dragonfly and damselflies, and wildflowers (yellow rattle). In addition, the project includes a focus on water vole. Recent wintering bird surveys revealed that 44 species were recorded during the visits, of which half were of conservation concern. Among other more common species, there was one Annex 1 listed (Kingfisher), 4 WCA (1981) listed (field fare, greylag goose, kingfisher, redwing), 9 Red-listed (field fare, house sparrow, lapwing, linnnet, mistle thrush, redwing, skylark, song thrush, starling) and 13 Amber-listed (black headed gull, bullfinch, dunnock, greylag goose, grey wagtail, kestrel, kingfisher, lesser black backed gull, little grebe, mallard duck, moorhen, reed bunting, teal, wigeon), species. Importantly, negative, and invasive species were also reported upon surveying of the sites: giant hogweed, Himalayan balsam, Japanese knotweed, and New Zealand pygmy weed.</p>



N4N7  
The Lugg  
Living  
Landscape

This project stated initial target flora species (hay rattle, oxeye daisy, and birds foot trefoil), wetland plants (common reed, yellow flag iris, purple loosestrife), and wetland species (wading birds, curlew, snipe, and oystercatcher otter). It is important to note that the otter is a European protected species. Upon receiving a habitat survey and baseline botanical



Figure 5.1 Example of N4N7 camera trap photography featuring **stoat**.

survey, the grassland has been classified 'semi-improved species poor'. A Swift Ecology survey regarding the otter specifically revealed that there are several areas of dense scrub near the river and along its banks that could offer infrequent resting places for otters. However, the regular presence of domestic dogs is seen as a direct deterrent to otters that may otherwise rest on the site. This project also benefitted from camera trap monitoring and volunteer species data collection, through which fallow, roe, muntjac deer, stoat, polecat, rabbit, snipe, toad, newt (including Great crested) and badger were identified.

N4N8  
M5 Clean  
Rivers  
Project

Fish and freshwater invertebrates are the primary target species of this project, and species data is to be provided upon completion of project interventions.

N4N10  
Nene Valley  
Wetland  
Restoration  
Project

This project is targeting many wintering water birds, including ducks and waders, such as the shoveler duck, which has an amber UK conservation status. Other targeted species noted by the project are gadwall, mallard, pochard, tufted duck, great crested grebe, cormorant, bittern, golden plover, lapwing, and coot. Many of these species have been designated as Amber or Red conservation status by the UK Birds of Conservation Concern (BoCC) report. Species data will be available in summer 2023. This project presents another example of one whereby volunteers have played an important role in species identification, given that species have already been recorded for further surveyance and exploration going forward.

N4N11  
East Winch  
Common  
SSSI

This project had target species of heather, sphagnum mosses, marsh gentian, and sundews. Surveys intended for use to target turf stripping detail evidence of many species, including birds (European nightjar, raven, common snipe, nuthatch, great spotted woodpecker, great white egret, green sandpiper, woodcock, little-ringed plover, and northern lapwing); vascular plants (petty whin, bristle club-rush, pill sedge, common milkwort, marsh thistle, glaucous sedge, cross-leaved heath, and colt's foot); moss varieties including the Greater fork-moss which is a new species for the site; fungi (blackening russula, clouded funnel, hoof fungus, false chanterelle, candlesnuff fungus – first record for site, c. fourth record for Norfolk); small nomad bee; ling tubic (first for site and third for Norfolk); odonata (azure damselfly, large red damselfly, and scarce emerald damselfly – listed as Near Threatened in the British Odonata Red List).



N4N14 Sillfield Newt Reserve	Project targets the Great crested newt, that have historically been surveyed by the National Wildlife Trust. Further surveys to provide evidence are being carried out later in 2023.
N4N15 Blows Down	The project targeted the following butterfly species: chalk hill blue, brown argus, and small blue (Protected in the UK under the Wildlife and Countryside Act, 1981, and Priority Species under the UK Post-2010 Biodiversity Framework). In addition, foodplants for these butterflies were noted as target species (horseshoe vetch, common rock rose, and kidney vetch), and have been identified. Butterfly data has not been reported, but it has been noted that slow worms have been observed and will form the basis of an academic study across the site this year. Rapid grassland assessments will take place in 2024.
N4N16 River Lea Habitat Restoration	This project noted targets of water voles, fish (barbel), macrophyte, and invertebrates. Water vole presence was confirmed in 2022 by HMWT staff, and the site will be resurveyed annually following project completion. A river corridor survey will also be completed to assess morphological changes along the priority chalk river. While surveys are yet to pick up signs of water voles, there have been otter signs recorded, as well as small vole signs recorded. The baseline ecological report is yet to be completed.
N4N17 The Woodland Wonders of Moor Copse	This project aims to protect and enhance bat and (hazel) dormouse species, as well as supporting ground flora (bluebells, wood anemones, primroses), and invertebrates (white admirals, silver-washed fritillaries). The site also notes invasive muntjac deer and roe deer damage are being controlled by inclusion fencing. Baselineing for this project has not yet been submitted following project completion in March 2023.
N4N18 Dormouse Reconnected	Project focussed on dormice (Protected in the UK under the Wildlife and Countryside Act, 1981, Priority Species under the UK Post-2010 Biodiversity Framework, Listed as a European Protected Species under Annex IV of the European Habitats Directive), and dormice records for 2021-22 identified the presence of dormice at 11 locations in the project areas via specific dormouse surveys. Additional nesting boxes and footprint traps have been installed to assess numbers and presence. The most recent survey identified the presence of weasel predation on the mice, which is being investigated to ensure that nesting boxes do not increase vulnerability.
N4N19 a) Langford Lakes Wetland Project  b) Smallbrook Meadows	The project noted several species that are protected or designated: sand martins (previously classified Red under UK Birds of Conservation Concern), overwintering bittern (Classified in the UK as Amber under the Birds of Conservation Concern, 5: the Red List for Birds 2021), Protected in the UK under the Wildlife and Countryside Act, 1981, Priority Species under the UK Post-2010 Biodiversity Framework), common tern (Classified in the UK as Amber under the Birds of Conservation Concern 5: the Red List for Birds 2021). Otters and the invasive non-native mink have been identified as a risk, due to being predators of terns. Target species have been observed, and the project aims to create breeding opportunities on the site for the large variety of bird species. N4N19(b) targets the water vole specifically, which were surveyed in May 2022, revealing high levels of activity along the stretch of the river marked for restoration. This has been further confirmed by sightings among reserve volunteers and members of the public.



N4N21 Shap Fells Peatland Restoration	This project is focussed on peatland restoration, through planting of sphagnum mosses by volunteers. Species data will be provided in 2022/23, though sphagnum moss presence/absence data is already held by the project.
N4N23 South Elmham Hall Wildlife Pond Network	This project targets the Great crested newt, as well as freshwater invertebrates and wetland plants. There is currently no baseline assessment data available, though the Great crested newt is “known to be present in the ponds”. In addition, stonewort and water plantain have been reported as having emerged from sediment exposed during pond restoration.
N4N24 & Bamfield- Blythburgh Farm Cluster	These projects focus specifically on the Great crested newt, which is a European Protected Species under Annex IV of the European Habitats Directive. There was previously evidence of the newts recolonising at ponds on project sites, which provides the rationale for restoring ponds to create a network of viable habitats for these newts. In addition, nightingales and turtle doves have been noted within one of the project sites, both of which has a UK conservation status: Red Protected by The Wildlife and Countryside Act 1981.
N4N25 Suffolk Wool Towns	
N4N26 Reconnecting Fillongley	This project has several species that have been identified for monitoring, including butterflies, waders, amphibians, barn owls, fish, willow tits and farmland birds. Decisions are yet to be made on which species will be focussed on. A butterfly survey and a botanical plant species survey are being undertaken to determine this, and results will be available in Autumn 2022.
N4N27 Riddy Connectivity Restoration	This project’s site previously had a water vole presence, but these have not been observed more recently. Observational monitoring is taking place to ascertain whether a spawning site upstream could be supported by the project (fish species TBC). Aquatic invertebrates are present, but there is no monitoring in place for them.
N4N28 Cumbria Wildflower Meadow Restoration	This project focusses on the restoration of wildflower species and grassland species but is yet to provide baseline data. The project’s focus is on improving connectivity within the site and create pollinator corridors between different areas. Further research is needed in order to assess which species have the lowest dispersal capabilities and therefore require the most support.
N4N29 Badley Habitat Mosaic Creation	This project is targeting woodland nesting bird species but is yet to collect species data. With regards to connectivity, this is not a specific focus for the project, as it more closely aimed at extending existing habitats.
N4N32 Bodenham Reedbeds	This project looks to increase reedbed specialist species, directly improving the toad population by reducing their mortality rates and enhancing the habitat required for overwintering and breeding. It has been confirmed through annual toad patrolling that 780 toads have been helped across the road that runs through the site.
N4N34 Huckerby's Meadows	Species currently supported by this project are the red kite and kingfisher birds. In addition to this, it aims to increase floristic diversity across the site, which it is hoped will increase the diversity of invertebrates and associated predators. In



future, it is possible that adder translocation is facilitated as the habitat quality improves. Grassland data will be collected and reported on in Summer 2023, and a water vole habitat condition assessment will be conducted in Spring 2023. This project has also progressed in removing invasive species (Giant hogweed, Himalayan balsam, and Goat's rue) present along the river located on-site.

N4N35 Shropshire Road networks Nature Retreats	This project – through increasing limestone grassland, lowland raised peat bog, and open water habitat – aims to increase species that inhabit these areas. In addition, pond expansion aims to increase existing Great crested newt populations, other wetland species, and aquatic and terrestrial invertebrates. An assessment on how improvements have affected species numbers is yet to be completed.
N4N36 Bovey Heathfield SSSI restoration	This project focusses on improving the site condition, to encourage increasing populations and breeding success of existing heathland species such as nightjar, Dartford warbler (Classified in the UK as Amber under the Birds of Conservation Concern, 4: the Red List for Birds 2021, protected in the UK under the Wildlife and Countryside Act, 1981, listed as Near Threatened on the global IUCN Red List of Threatened Species), stonechat, yellowhammer, heath potter wasp, Kugelann's green clock beetle (Nationally Rare, Endangered & Near Threatened – Red List pre 1994 & post 2001). In addition, the project works to maintain and increase the habitat for silver-studded blue butterflies (Protected in the UK under the Wildlife and Countryside Act 1981, Priority Species under the UK Post-2010 Biodiversity Framework), and the narrow-headed ant (Priority Species under the UK Post-2010 Biodiversity Framework, NERC Act Section 41 Species of Principal Importance, UK Red Data Book, Scottish Biodiversity List). Targeted species have been identified through volunteer observations and surveys. Beetle surveys carried out by volunteers this year show populations of the following species: <i>Abax parallelepipedus</i> , <i>Pterostichus madidus</i> , <i>Amara plebeja</i> , <i>Carabus nemoralis</i> .

For some projects, survey data has not yet been collected, nor have observations been formally recorded and/or submitted. These projects are as follows:

- **N4N26, Reconnecting Fillongley** (target species to be confirmed based on results from pond surveys, invertebrate species report, bird breeding surveys, and botanical surveys. Barn owls to feature as a targeted species)
- **N4N29, Badley Habitat Mosaic Creation** (target species noted as woodland nesting birds)
- **N4N30, Restoring Burns Beck Moss** (target species noted as insect species, roe deer, hare, heron, snipe, tawny owl, reed bunting, warblers, curlew and whinchat)
- **N4N31, Coast to Fell** (target species noted as northern hay, upland waders, invertebrates, pollinators, bats, and birds)
- **N4N39, West Chisenbury Wetland** (target species noted as European water vole - Protected in the UK under the Wildlife and Countryside Act, 1981; Priority Species under the UK Post-2010 Biodiversity Framework; listed as endangered on both the Great Britain and the England Red List for Mammals, grass snakes, bats, invertebrates, brown trout – Priority Species under the UK Post-2010 Biodiversity Framework, bullhead, brook lamprey, grayling, and birds including the marsh warbler)
- **N4N40, West Yorkshire INNS Restoration and Resilience** (target species noted as Ramsons, Wood avens, Opp gold sax, Wood anemone, Bluebell, Great wood rush, Herb



Robert, Cats ear, Broad buckler, Lesser celandine, Soft rush, Dog rose, Hemlock water dropwort, Broom, Red Campion, Mugwort, Common history, Snowdrops, Wood stitchwort, Creeping soft grass, Sweet Cicely, Cow parsley, Dryopteris affinis, Lady fern, wild angelica, Ground ivy, Horsetail, Wood forget me not, Dames Violet, Comfrey, Meadow sweet, and Large bittercress – to be supported by removal of Japanese knotweed in riparian habitats)

- **N4N41, Natural Highways and Homes** (target species noted as wildflowers, farmland birds, pollinators, kestrel, barn owl, song thrush, house sparrows and swallows)
- **N4N42, Creating Species Highways** (target species noted as pine marten, Greater horseshoe bat, and Great crested newt)

While biodiversity units are a key indicator of success for N4N projects, the summaries provided for each projects progress in terms of species highlights the work that N4N projects are doing to create, enhance and protect specialised habitats. Importantly, there are a number of species that are endangered or declining in population within the different sites, and projects are actively supporting their increase, or at least slowing their decline. Over time, this will positively contribute to greater biodiversity across many sites.



## 6 Nature Connectivity

An overarching aim of N4N is to enhance nature connectivity. Connectivity describes the relative ease with which typical species can move through the landscape between patches of habitat<sup>5</sup>. This definition draws on work of the Joint Nature Conservation Committee and is further described as being determined by: i) the number of individuals leaving patches (when **local abundance** is high), ii) the **intrinsic dispersal capability** of individuals, and iii) the **structure of the landscape** facilitating or hindering movement. A range of N4N projects are aiming to support the local abundance of species and enhancing the structure of the landscape to facilitate movement.

### Progress during 2022-23

Projects have been planning and designing site works. **N4N39, West Chisenbury Wetland** has completed hydraulic modelling and has confirmed that the proposed project will reconnect the river with its floodplain within the site area, without negatively impacting flood risk to surrounding areas.

Other projects have been undertaken preparatory works such as scrub removal, as well as planting/seeding, and creating new ponds.

- **N4N26, Reconnecting Fillongley:** The project has sown multiple new meadows providing stepping-stone for pollinators and increasing habitat suitability for wild nesting bees, butterflies, hoverflies moths. The new meadows aim to provide a link between hedgerows to ponds and streams. In addition, the new and restored ponds at Corley Moor aim to provide great crested newt habitat and help connectivity of amphibians across the site.
- **N4N35, Shropshire Road networks Nature Retreats:** Improvements to the limestone grassland habitat has begun through a first phase scrub removal.
- **N4N28, Cumbria Wildflower Meadow Restoration:** Scrub removal and planting of seven species chosen to provide a good mix of seed and berry bearing plants that will benefit a range of species. The reduced grazing within those scrub areas will allow the grasses and other plants to grow, providing a more diverse sward structure to benefit small mammals and invertebrates.
- **N4N36 Bovey Heathfield SSSI Restoration:** Staff and volunteers concentrated on scrub clearance on south facing slopes and created clearings/scalloped edges to benefit reptiles and invertebrate species like heath potter wasps and bees. The teams targeted dominant species such as gorse, bramble, and shade-casting conifers and birch, to give the seed bank opportunities to germinate. Conservation grazing aims to increase the amount of 'edge'/transition habitat and clearings and improve connectivity for butterflies, some of which cannot fly very long distances or high up from the ground. These works aim to improve connectivity for the Silver-Studded Blue butterfly, and birds such as Dartford Warbler.
- **N4N21 Shap Fells Peatland Restoration:** A core aim of the project is increasing the connectivity of the restored and rewetted peatland landscape. Previous projects rewetted peatland at three other sites at Bampton Common, Mardlae and upper part of Shap Fell. In 2022-23 the 50ha of peatlands has been restored, linking to a network of other sites within that area. Overall, this means that species that rely upon these habitats and the species that are specialised to peatlands such as Sphagnum, are able to have a much wider and more connected distribution within the whole area. See Figure 6.1 overleaf.

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<sup>5</sup> JNCC, available at: [UKBI - C2. Habitat connectivity | JNCC - Adviser to Government on Nature Conservation](https://www.jncc.gov.uk/information-and-services/our-work-programmes/habitat-connectivity)

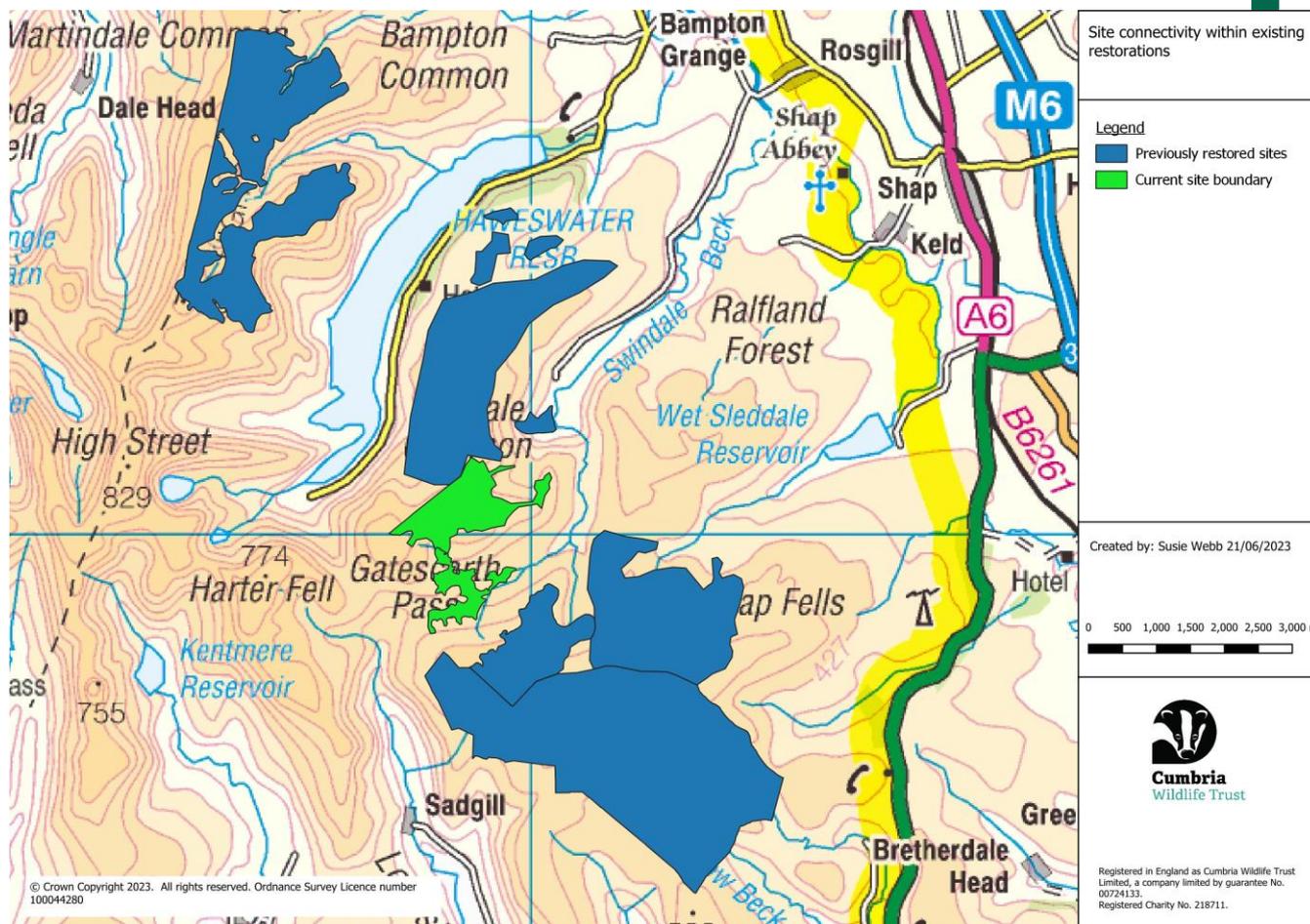


Figure 6.1 N4N21 Shap Fells Peatland Restoration, map of N4N project site (green) and previous peat restoration projects (blue).

Some projects have started to observe positive indicator species, for example **N4N11, East Winch Common SSSI**. Pond restoration and creation works have been carried out, linking several of the ponds along the south western margin of the open wet heath via the re-profiling of a shallow, meandering channel. The works carried out in December 2022 restored/created six ponds in total as well as restoring marginal wet peat draw-down zones. Follow up surveys in 2022 and early 2023 found positive indicator species, and it was evident that some species of Sphagnum moss are already colonising the newly restored pools and meanders providing encouraging evidence of enhancements to nature connectivity.



## 7 Waterways

Ten projects have specific objectives relating to water quality or river morphology, supporting nearly 21km of England’s waterways.

### Water objectives

10 N4N projects include project objectives directly related to waterways. Overall, N4N projects are supporting **nearly 21km** of England’s waterways.

Table 7.1: Waterway objectives

Ref	Project name	Relevant project objective	Length of river (m)
N4N1	Whittle Dene Semi Natural Woodland Restoration	Improve water quality in the Whittle Burn.	600
N4N6	Rotherham Rivers 3	1,290m river improved ecological condition.	2,580 <sup>6</sup>
N4N7	The Lugg Living Landscape	Reduction of pollutants entering Oak Tree Farm and the floodplain of the River Lugg from the A49.	465
N4N8	M5 Clean Rivers Project	Waterbodies will have improved ecological status.	11,740
N4N16	River Lea Habitat Restoration	2.3km stretch of chalk river in improved condition, demonstrated by improved/stabilised populations of key species.	2,300
N4N19(b)	Smallbrook Meadows	Re-meander the path of the river.	200
N4N27	Riddy Connectivity Restoration	Reconnection of habitats either side of the A1 road bridge on the River Ivel. Reduce the impact of grazing on water vole habitat and sedimentation.	30
N4N30	Restoring Burns Beck Moss	Hydrology of the river and peat restored	At least 500
N4N39	West Chisenbury Wetland	Diverse riparian planning to restore natural processes, improve nutrients of chalk stream and remove pollutants. Study of hydrological and phosphate offsetting, becoming a <b>lead example of chalk stream restoration</b> .	400

<sup>6</sup> The agreed objective only includes half of the section of the total restored section.



<b>N4N40</b>	West Yorkshire INNS <sup>7</sup> Restoration and Resilience	Improvements to Calder Upper, Calder Middle and Colne and Holme catchments. Restoring riparian habitat by <b>treating areas infested with INNS</b> .	2,000
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Project objectives fall in to two broad categories: those seeking to **improve water quality**, and those seeking to enhance the **physical habitat and hydro-morphological<sup>8</sup> functioning** of rivers and streams.

## Waterways condition

The baseline **water quality**, as captured by the Environment Agency’s river catchment data, is listed in Table 6.2. Environment Agency data is consistently available for 2019. It is not currently clear when the next river status assessments will be carried out, but potentially these could be as late as 2027, to coincide with the national target of ‘good’ ecological and chemical status of all rivers in UK.

Of the ten waterbodies associated with N4N water objectives, eight waterbodies are classified as ‘moderate’ overall, one is classified ‘good’ and one has a status of ‘poor’. Whilst any change in the status of a waterbody cannot be wholly attributed to N4N project activity, it provides a snapshot of the status of the waterbodies in scope.

Where water quality is a specific objective (N4N6, N4N7, N4N8 and 39), project teams will be asked to share water quality assessments as appropriate to the timetable of project delivery.

River morphology assessments were undertaken for projects N4N6 and N4N16.

Table 6.2: Baseline status of waterways

Ref	Water body name	Baseline Environment Agency Classification <sup>9</sup>	Baseline River condition MoRPh <sup>10</sup>
<b>N4N1</b>	Whittle Burn Catchment (tributary of Tyne) Water Body	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Not applicable
<b>N4N6</b>	Doe Lea to the Don confluence	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	<ul style="list-style-type: none"> <li>■ Parkway, subreach A: fairly poor</li> <li>■ Parkway, subreach B: moderate</li> <li>■ Blue Man’s Bower, subreach A: moderate</li> <li>■ Canklow, subreach A: moderate</li> </ul>
<b>N4N7</b>	Lugg - conf R Arrow to conf R Wye	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Not applicable: not working in channel

<sup>7</sup> Invasive Non-Native Species INNS

<sup>8</sup> The hydrological (water flow, energy etc) and geomorphological (surface features) and attributes of rivers, lakes, estuaries and coastal waters.

<sup>9</sup> <https://environment.data.gov.uk/catchment-planning/>

<sup>10</sup> Modular River Physical Habitat field survey (MoRPh): <https://modularriversurvey.org/river-condition/>



<b>N4N8</b>	Bourn Brook from Source to R Rea	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Not applicable: works are off the river to improve quality not morphology.
	Stour (Worcs) source to conf Smestow Bk	Classification in 2019 Overall: Poor Ecological: Poor Chemical status: Fail	
<b>N4N16</b>	Thames Lee Upper Lee Upper Lee (from Luton Hoo Lakes to Hertford)	Not applicable	<ul style="list-style-type: none"> <li>■ Lemsford Springs 1 &amp; 2 'moderate'</li> <li>■ Stanborough North Area 1 'fairly good'</li> <li>■ Stanborough North Area 2, Stanborough South, 'Moderate'.</li> <li>■ Stanborough South Area 2 'fairly poor'</li> </ul>
<b>N4N19 (b)</b>	Wylde Trib (The Were or Swan)	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical status: Fail	Moderate <sup>11</sup>
<b>N4N27</b>	Ivel (DS Langford to Roxton) Water Body	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Heavily modified
<b>N4N30</b>	Burns Beck (River Lune catchment)	Classification in 2019: Overall: Good Ecological status: Good Chemical status: Fail	<i>Non response</i>
<b>N4N39</b>	Hampshire Avon (Upper u/s Nine Mile River confl Water Body)	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Not designated artificial or heavily modified
<b>N4N40</b>	River Calder, River Colne and River Holme	Classification in 2019 Overall: Moderate Ecological: Moderate Chemical: Fail	Heavily modified

<sup>11</sup> Wiltshire Wildlife Trust Water Team conclude that a River Condition Assessment would class this stretch of the Were as 'moderate' given its straightened nature and uniform cross section.



## Progress during 2022-23

For projects, this year has been characterised by planning, scoping and/or commissioning contractors to undertake river works:

- **N4N6, Rotherham Rivers 3:** Progressed detailed designs including floodplain design and planning has taken place, as well as organising permissions and logistics planning.

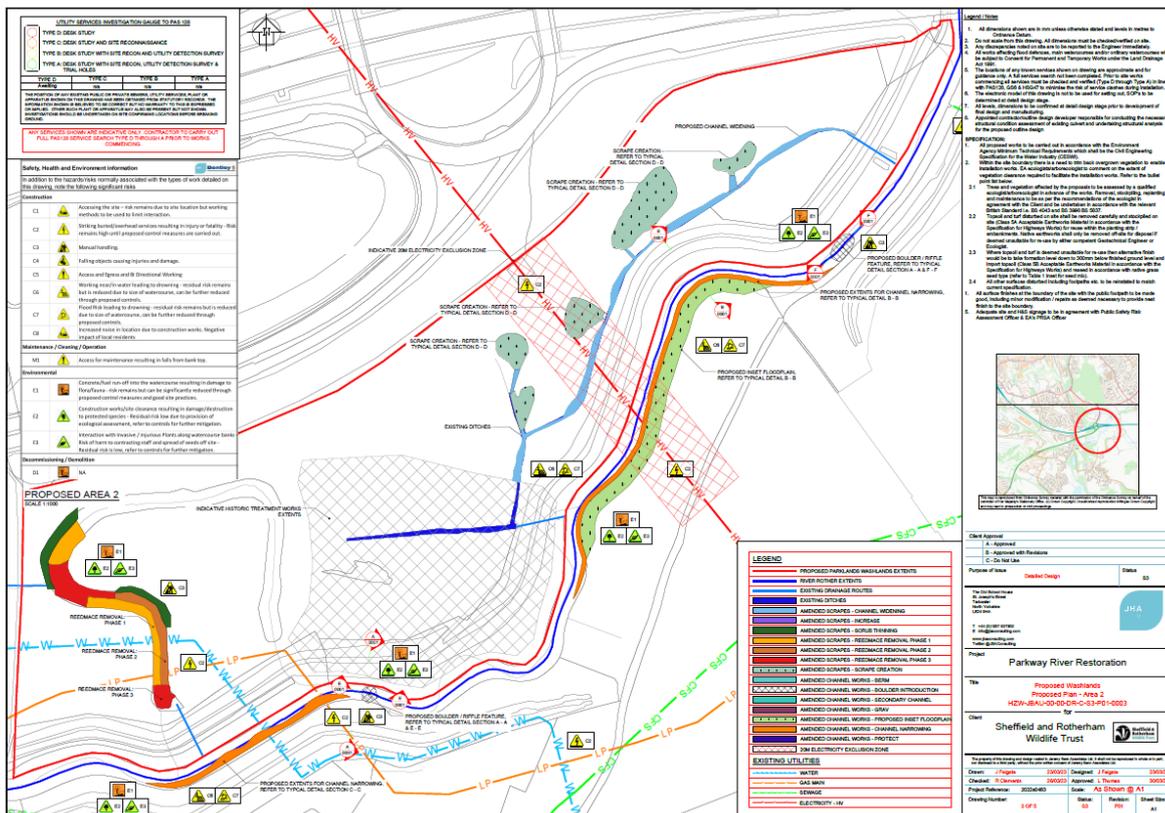


Figure 7.1: N4N6, Rotherham Rivers: parkway river restoration technical drawing (for illustrative purposes)

- **N4N8, M5 Clean Rivers Project:** The design of the interventions has been completed. The project is now awaiting landowner feedback and formal permissions prior to sign-off of final designs and issue of an invitation to tender for ground works contractors.
- **N4N40, West Yorkshire INNS Restoration and Resilience:** procurement of materials took place in the first part of the year, moving on to initial botanical and feasibility surveys for INNS management in riparian habitats.
- **N4N7, the Lugg Living Landscape** has completed the creation of wetland scrapes and is about to begin a programme of monthly water quality monitoring. The site is designed to improve wetland connectivity between larger wetland site on the river Lugg. The wetland creation work was only finished in early 2023 so the overall impacts of this aren't yet apparent but we have recorded snipe on our camera traps and had our first sighting of a green sandpiper using one of the new scrapes. Over the next 12 months we will continue to monitor the bird populations through WeBS surveys and camera trap monitoring.



## 8 Flood

During 2022-23, flood risk modelling has explored the potential benefits of N4N projects. More practically, hedge planting has taken place to support flood risk management.

### Flood objectives

Four N4N projects have stated project objectives related to flooding. A further two are actively considering how flood risk management will form part of the project.

Table 8.1: Project objectives relating to flooding

Project Ref	Project Name	Flood objective or comments
N4N1	Whittle Dene Semi Natural Woodland Restoration	Slow run-off from arable land and improve water quality in the Whittle Burn <i>Works to commence 2023.</i>
N4N8	M5 Clean Rivers Project	Potential opportunities to address scour and localised flooding.
N4N16	River Lea Habitat Restoration	Working with the Environment Agency, exploring natural flood risk management and some modelling of it.
N4N19 (b)	Smallbrook Meadows	Flood water storage improved.
N4N26	Reconnecting Fillongley	Slow the run-off from the M6.
N4N32	Bodenham Reedbeds	Although not a core aim of the project, the water permeability of the meadows to increase water filtration contributing to reduce flooding.

### Progress during 2022-23

Three projects have undertaken flood risk modelling:

- **N4N16, River Lea Habitat Restoration:** A flood model and hydraulic report was completed in May 2023. The conclusion was that, if all design options are introduced during construction, then overall there would be a minor flood relief benefit to several notable structures or built areas throughout the project site and downstream.
- **N4N19 (b), Smallbrook Meadows:** Updated flood risk modelling has indicated a small increase in targeted flooding within the site area. This is consistent with the aim of reconnecting the river with its immediate floodplain habitat, without negatively impacting flood risk to surrounding areas. The larger marginal areas and wetland scrapes should provide some flood risk benefits as they will increase the storage capacity of the floodplain. However, N4N19(b) highlighted the challenges of drought with the very hot, dry summer in 2022 leading to incredibly low flows, likely negatively impacting fish and invertebrate populations. Anecdotal evidence from local people suggested that that summer was the lowest the stream had ever been.



- **N4N26, Reconnecting Fillongley:** With match funding from the Environmental Agency (EA), 4 leaky dams have been built on Corley Moor alongside several scrapes within the wood to retain water. Direct funding and match from EA has allowed planting of over 1.1km of hedgerows at Fillongley Hall which will help to slow flow and absorb rainwater over years to come. It is estimated that around 1 cubic m of water slowed/detained per metre of hedge planted so 1100 cubic m detained in catchment<sup>12</sup>. Installing a rotational grazing plan at Stonehouse is hoped to increase root growth, soil air gaps, and increase water retention within soils. Less compaction and longer grass will also help improve soil profile.



Figure 8.1: N4N26, Reconnecting Fillongley: newly planted hedge

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<sup>12</sup> [Reference pending]



## 9 Visitors' Recreational Value

Across the 16 N4N projects with visitor sites, it is estimated that over 3 million people visit these areas and footpaths per year, equivalent to a total annual recreation value of £11 million.

The aim of this exercise is to understand the monetary value of natural spaces: how much people value natural spaces and how much they are willing to spend on being out in nature. Through knowing the monetary value associated with these activities it becomes more feasible to compare with other priced goods and services, as well as understanding how much should be invested in these natural areas.

However, as these sites are non-market goods (publicly accessible without a price/entrance fee), it is not possible to directly infer how much they value the service. Therefore, techniques such as the travel cost method must be used to reveal the price individuals attach to non-market goods. What people pay to travel to the natural areas represents their willingness to pay for these services and hence to derive the associated monetary value, which we refer to as the recreational value. One such model that deploys this technique is the Outdoor Recreation Valuation (ORVal) model.

### ORVal Model

The ORVal model designed by the Land, Environment, Economics and Policy (LEEP) Institute of Exeter University is freely available online<sup>13</sup> and estimates the number of visits and recreational value of a range of natural sites (e.g., national parks, SSSIs etc.) and footpaths in the UK. It assumes that the recreation value is equal to travel costs. The model is underpinned by a Recreation Demand Model, an econometric model created using data available from the comprehensive Monitor and Engagement along with the Natural Environment (MENE) survey<sup>2</sup>.

It is important to note that, while useful, the recreational value only represents half the story. The impact of the intervention from the N4N programme is told through the narrative of the site, which cannot always be monetised but can/will be monitored by surveying visitors' experiences.

### Methodology

The ORVal model was used to determine the estimated number of visits and welfare values from N4N sites. Those projects that mentioned visitors and community engagement as an outcome of their work through initial consultations held by ERS with project managers are included in this analysis. The methodology used to collect the data is described below:

1. Search associated grid reference and postcode of project in the ORVal model,
2. Select the site in the model corresponding to site images provided by project managers, as well as boundaries from N4N's project online map<sup>3</sup>,
3. Where images have not been provided by projects or the available site on ORVal do not match the image, the next best alternative is selected as a proxy.
4. Proxy sites are one or more smaller sites within the area or footpaths cutting through the site and/or adjacent to site boundaries.

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<sup>13</sup> [ORVal Outdoor Recreation Valuation \(exeter.ac.uk\)](https://www.exeter.ac.uk/leee/orval/)



5. Once areas and paths are selected, the estimated number of visits and welfare value are recorded.

## Results

Table 9.1 below shows the baseline recreational value of each of the 16 projects. Some projects have multiple sites and paths, representing projects covering numerous sites and larger areas. In the case of N4N10, there are three sites: Summer Leys, Nene Wetlands and Titchmarsh; however, the ORVal model has several smaller sites for Nene Wetlands, hence there is an additional site in the analysis. This project also includes several footpaths, capturing adjoining paths next to and between sites.

The different projects have a range of values due to their size and popularity. N4N32 has the smallest recorded estimated visits and welfare values per year, of 16,000 and £50,000 respectively. N4N10 continues to have the largest recorded estimated visits and welfare values per year, 805,000 and £2,640,000 respectively.

Note that several projects (N4N20, 22, 28, 29) do not have any available sites for the Baseline in the ORVal model since they are not currently open for public access. In some cases, footpaths were available and have been included.

Table 9.1: Baseline recreational value of N4N projects

Ref	Number of sites	Number of footpaths	Total estimated visits	Total welfare value (£)
N4N10	4	4	804,747	£2,639,949
N4N15	0	0	193,373	£542,323
N4N16	1	0	42,306	£166,778
N4N17	1	0	57,042	£183,262
N4N18	3	0	217,457	£633,620
N4N20	0	0	-	-
N4N22	0	1	309,562	£1,073,818
N4N26	1	2	60,440	£173,717
N4N28	0	1	49,502	£121,602
N4N29	0	1	182,240	£547,210
N4N30	1	1	22,113	£100,998
N4N31	18	9	722,514	£3,230,622
N4N32	1	0	15,810	£49,826
N4N34	1	0	154,294	£462,019
N4N35	6	3	247,015	£688,736
N4N36	1	0	80,305	£356,119
<b>Total</b>	<b>38</b>	<b>22</b>	<b>3,158,720</b>	<b>£10,970,599</b>

### Baseline recreational value

The post-interventional recreational value depends on the project activities/improvements carried out as part of the N4N programme. Each project has a specific focus when it comes to visitors, but in general all aim to improve the visitor experience in some way.

As mentioned in the previous annual report, a handful of projects have installed more interpretation content to increase visitors' awareness and engagement with the local wildlife. N4N20 has installed bird hides to improve opportunities to view the birds whereas N4N28 and N4N18 are focusing on the engagement and awareness of pollinator species and dormice, respectively.



It should be noted that this intervention is likely to increase the recreational unit value of these sites, based on the assumption that greater awareness and engagement with nature increases the relative enjoyment of natural space. However, since it is not possible to include these factors in the model, any 'post-intervention' recording of the values from ORVal will not include this activity. Nevertheless, it will be possible to increase the overall recreational value if visitor numbers were to increase, as a result of the increased interpretation of the site – hence recording of visitor numbers and annual monitoring of sites by project managers. The expectation is that the post-intervention calculation for these sites the value will increase. Furthermore, recording the stories of visitors who engage with these activities will contribute to the value created and captured.

Some sites lack the infrastructure for visitor access or are unsafe. Projects N4N7, N4N11 and, N4N16 have been working to improve access to sites, while N4N17 have sought to improve the safety of the site for all visitors. Additional access sites points are a feature of the ORVal model and can be included once work has been completed. The expectation is that it will increase recreational value and produce a net additional benefit.

The projects which do not currently have sites in the ORVal model, i.e., N4N20, 22, 28, 29, will be added manually and included in the 'post-intervention' calculation, showing the net additional benefit of the works carried out.

The project annual report returns include three projects which have included data on visitor numbers. N4N17 has had an estimated constant rate of 15,000 visitors per year since April 2019, whilst the completed N4N22 project has doubled their estimated rate from 60,000 visitors in Apr 2019 – Mar 2020 to 120,000 in Apr 2022 – Mar 2023. The only other project to give an estimated visitor count was N4N36 for the year Apr 2022 – Mar 2023, with 12,000 estimated visitors.

Project N4N22 is the first project to officially close and complete their End of Project report. N4N22 Bringing Biodiversity Back to the Broads has had improved visitor benefits, specifically in terms of visitor numbers. It has been reported by project management that increased numbers have been evidenced through till transactions, people counters on the reserve, and an observational survey. Although there has been a clear visitor aspect on the project, an improvement to the visitor experience is yet to be evidenced. This is because the annual visitor survey will need to be completed this summer and in future years, and then be compared to previous years' results to demonstrate an impact.

At present it is estimated that over three million people visit N4N sites every year, bringing an estimated recreational value of nearly £11 million. It is expected that interventions of the N4N programme will bring about a positive increase to both the baseline estimated visits and recreational value. Project activities are also expected to improve the visitor experience, by raising awareness and engagement of natural sites, as well as improving access. Although it is not possible to completely capture these changes in the ORVal model, their value will be recorded through the stories of visitors who engage with the sites.



## 10 Volunteering

The volunteering undertaken for N4N projects during 2022-23 had an equivalent wage value of £24,851.

### Equivalent value

Overall, the number of volunteers engaged across N4N projects during the financial year 2022-23 was 368, across 22 of the projects that have been active this year. In terms of hours, their engagement represents 3099.2 hours, across 340.7 volunteering days (defined as a minimum of 7 hours).

The projects engaging with the greatest number of volunteers were **N4N2, M56-A56 Pollinator Networks** and **N4N32 Bodenham Reedbeds**. Within N4N2, 55 volunteers were carried out plug planting, wildflower seeding, habitat assessments, and plant and invertebrate surveys. N4N32, located at the River Lugg SSSI, involved 32 volunteers carrying out toad patrol by protecting migrating toads during their breeding season.

Other volunteering activities across other projects' included planting and seeding (across 4 projects), surveying (across 6 projects), species monitoring (across 6 projects), and habitat management (across 5 projects).



Figure 10.1 N4N2, M56-A56 Pollinator Networks, plug planting.

The value provided by volunteer hours to TWT, and in turn NH, can be proxied using the “replacement cost approach” as described by the Office for National Statistics.<sup>14</sup> This method applies a market wage to calculate what voluntary work would cost had the work been paid. The market wage can be taken as either the minimum wage, mean wage, median wage, or a market wage for voluntary work.

Taking the lowest of these, replacement wage values, 340.7 volunteer days, involving a 7-hour day, paid at the current National Minimum Wage (for adults over the age of 22) of £10.42 per hour represents a value of £24,851.

### Monetisation of Life Satisfaction Impacts

An HM Treasury Supplementary Guidance<sup>15</sup> document published in July 2021 provides guidance on the valuation of wellbeing, and how benefits can be monetised for publicly funded projects. The suggested approach used for monetising the wellbeing impact associated with volunteering is using the subjective wellbeing valuation approach, which gives a value of £911 per volunteer per year on average<sup>16</sup>. Using this methodology, it can be estimated that N4N created a wellbeing value of £335,000 per annum. This

<sup>14</sup> Foster, R. (2013). ONS. Household Satellite Accounts – Valuing Voluntary Activity in the UK.

<sup>15</sup> HM Treasury (2021) Wellbeing\_guidance\_for\_appraisal\_-\_supplementary\_Green\_Book\_guidance.pdf, page 63.

<sup>16</sup> Lawton, R.N., Gramatki, I., Watt, W. et al. Does Volunteering Make Us Happier, or Are Happier People More Likely to Volunteer? Addressing the Problem of Reverse Causality When Estimating the Wellbeing Impacts of Volunteering. *J Happiness Stud* 22, 599–624 (2021). <https://doi.org/10.1007/s10902-020-00242-8>



is however a gross figure and does not explore the extent to which N4N volunteering is *net additional* or over and above what would have happened anyway.

## Volunteer outcomes survey

In order to assess the outcomes experienced by volunteers themselves, and therefore an added social benefit of the N4N programme, volunteers were surveyed. The survey was launched in 2022-23 and will remain active throughout the delivery of N4N. Survey questions examined motivations for volunteering, types of tasks undertaken, impacts that voluntary roles have had on individuals, as well as how volunteering has affected their nature-connectedness.

### Methodology

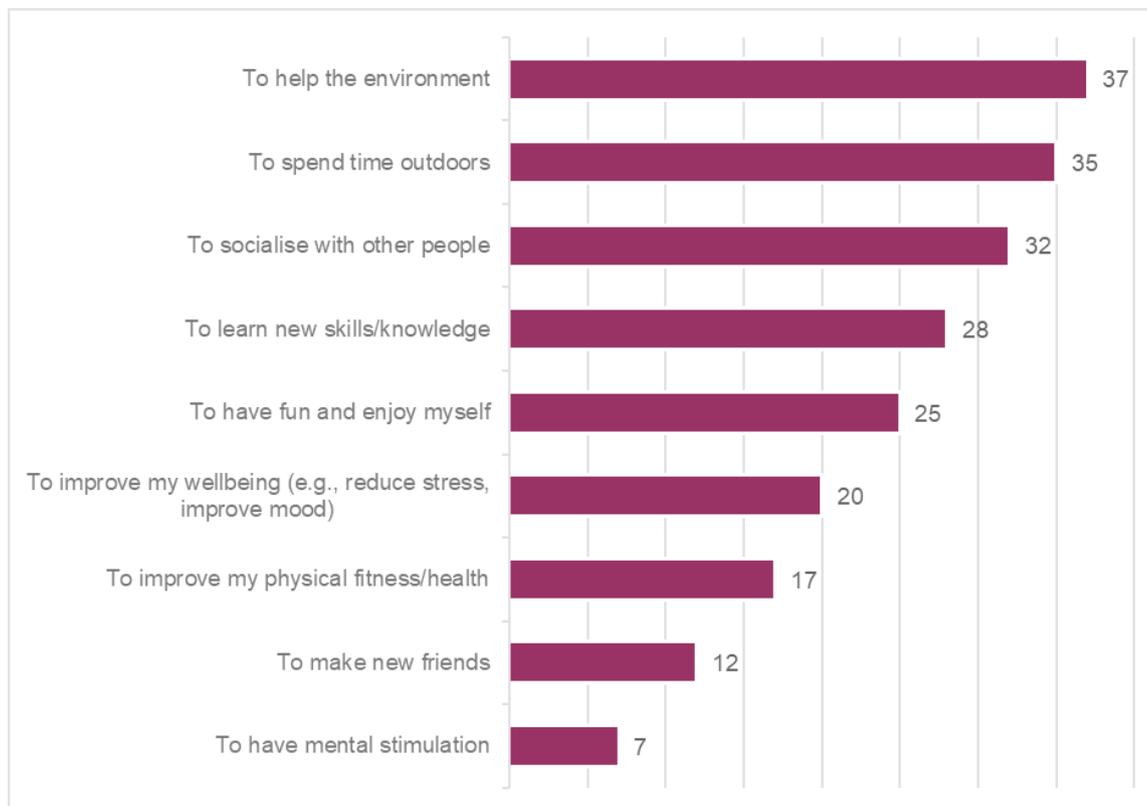
In total, 49 responses to the survey were received before cleansing. Of these, six respondents did not provide consent, five provided consent but no further answers, and one response was removed as it belonged to an employee of NH. This to avoid overlap or double-counting outcomes from initiatives such as Corporate Social Responsibility activities. Hence, the total number of responses after cleansing was 37, with most individual questions therefore receiving a maximum of 37 total responses. Analysis of the survey responses we have received to date is outlined below, with key themes drawn out which portray the value added by N4N projects.

### Survey analysis

Respondents were asked what motivated them to volunteer initially, for which a wide variety of options were presented. Respondents were able to select as many as they felt were applicable. The top 3 motivators, as can be seen in Figure 10.2, were to help the environment (37 respondents), to spend time outdoors (35 respondents), and to socialise with other people (32 respondents). Mental stimulation, and making new friends were less often highlighted as drivers.



Figure 10.2 Motivations for volunteering (n=37)



The majority of respondents (24 individuals) could be considered “long-term” volunteers, defined as having volunteered for a period of between five to 20 years, and indicated on the right-hand side of Figure 10.3 below. The left-hand bars represent those defined – for the purposes of this report – as ‘new’ volunteers (13 individuals). Of the ‘new’ volunteers, the most common response was a volunteering period of “less than 6 months” to date (six individuals), suggesting positive engagement of new volunteers within that time period.

Figure 10.3 Duration of volunteering at respective Wildlife Trust sites. (n=37)

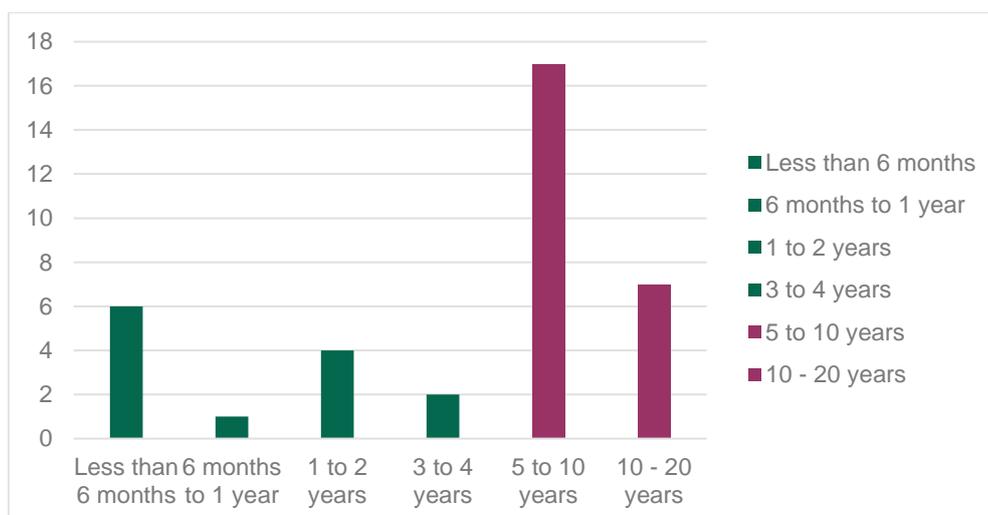
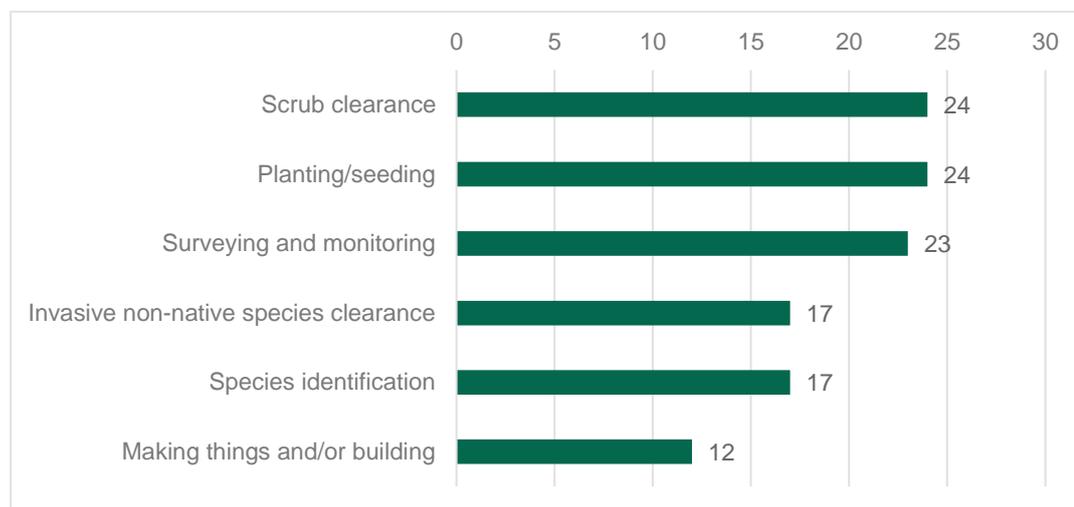


Figure 10.4, below, indicates the range of tasks and activities that survey respondents were most frequently involved in. “Scrub clearance” and “Planting/seeding” were jointly the most common task



types that respondents had participated in as part of their voluntary role. “*Making things and/or building*” was least common, albeit responses were relatively evenly spread between categories. Respondents had typically reported taking part in 3 different types of tasks, showing that volunteers’ roles are varied. These trends also correspond with feedback from projects around the range of tasks.

Figure 10.4 Tasks undertaken as part of voluntary roles. Respondents were asked to select all responses that apply to them. (n=37)



As well as responding to the question above, respondents were given an option to select “*other*” and offer further information on tasks carried out if they wished to do. The themes arising from the 17 qualitative responses were coded to identify common themes. The top three task or activity types arising from the qualitative data were:

- **Fencing** (9 mentions), e.g. repairing boundary fences
- **Hedge-laying** (5 mentions)
- **“Toad Patrol”** (3 mentions)

Other skills mentioned included, for example: dormice monitoring, litter-picking, pond clearance, and dry-stone walling.

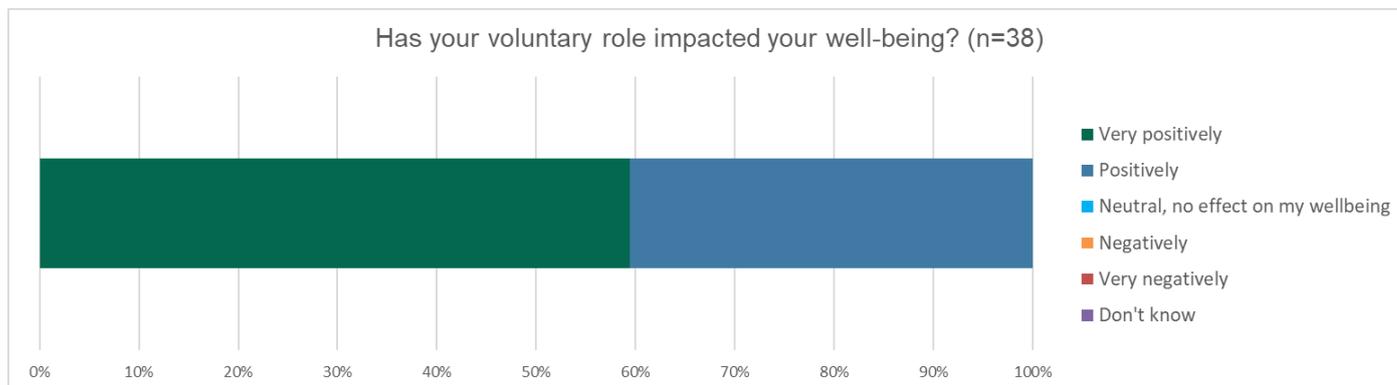
Volunteer wellbeing was another important outcome assessed by the survey. It is well-documented within volunteering literature that voluntary engagement can positively affect mental health<sup>17</sup> and wellbeing. Taking this, in combination with the positive effects of nature connectedness on mental health and wellbeing, N4N volunteers have the potential to benefit from their time spent volunteering.

Survey participants were asked to respond to a rating scale question to estimate the extent to which their voluntary role has impacted upon their wellbeing, where -2 was *very negatively* and +2 was *very positively*. Encouragingly, **all respondents stated that their voluntary role had impacted their wellbeing positively**, with 22 individuals describing the effect as *positive*, and 15 as *very positive*. No respondents reported a neutral nor a negative effect, and there were zero *don't know* responses.

<sup>17</sup> Nichol, B., Wilson, R., Rodrigues, A. et al. Exploring the Effects of Volunteering on the Social, Mental, and Physical Health and Well-being of Volunteers: An Umbrella Review. *Voluntas* (2023). <https://doi.org/10.1007/s11266-023-00573-z>



Figure 10.5 Impact of volunteering on respondents' wellbeing. (n=38)



Alongside the rating scale question, survey respondents were also able to offer further comments, and were asked to report whether and how their voluntary role had contributed to wellbeing. Of the qualitative data collected, further comments were provided by 32 respondents. These comments were analysed by theme, and emerging themes were then quantified in order to understand which were most commonly occurring. The themes provide useful insights into the features of the volunteering experience which respondents felt contributed to improved wellbeing. The five most commonly occurring themes are described below.

- **Being in the outdoors / natural environment** (17 mentions)
- **The opportunity to be with “like-minded” people** (16 mentions)
- **The opportunity to contribute positively to the environment** (12 mentions)
- **Engaging in physical activity / staying active** (7 mentions)
- **The sense of achievement arising from tasks / taking positive action for the environment** (6 mentions)



*I sometimes struggle with anxiety etc, however I find being in the outdoors very free, liberating and it's a place I am most happy. If I could afford to retrain and work in conservation I would, however I can't, and volunteering provides me a good opportunity to experience things within nature that I wouldn't experience otherwise. I feel very lucky to be a part of it and I hope it continues in the future and I have more opportunities to take part.*

Volunteer survey respondent



*The whole experience is beneficial - there is clear job satisfaction, a sense of making a difference and trying to improve the environment for us all.*

Volunteer survey respondent

As well as feeling a sense of achievement, many volunteers reported having gained new skills through volunteering on a N4N project. Of the 36 responses to the question 'Have you learnt new skills as part of your role?', 30 selected 'yes' (83 per cent). Individuals who responded 'yes' were asked to provide further information if they wished. Of the qualitative data supplied, different areas of skills gained by participants were highlighted:



- **Species identification and/or surveying** (21 mentions), e.g. beetle identification, crayfish identification and surveying
- **Safe and effective tool-use** (16 mentions) e.g. chainsaw operation, bone saws, scything
- **Hedge-laying / maintenance** (6 mentions)
- **Planting (3 mentions)** e.g. tree-planting, wildflower meadow sowing
- **Habitat management** (3 mentions) e.g. practical maintenance tasks
- **Construction / building** (2 mentions) e.g. boardwalk construction, gate post erection
- **Use of off-road vehicles** (2 mentions) e.g. quad bikes / 4x4 vehicles



Figure 10.6 N4N2, M56-A56 Pollinator Networks Habitat condition assessment

Other skills mentioned were wide-ranging and included coppicing, first aid, citizen science, and team leading.



*Yes definitely (I have learnt new skills), I have learnt a lot about Dormice, their habitats, food sources, how they like to live etc. I am hoping to take it further in the future and do training as well as work towards my Dormouse handling licence.*

Volunteer survey respondent



*Surveying and monitoring of various species of wildlife helps in understanding how the environment impacts on them.*

Volunteer survey respondent



Respondents were also asked to reflect on how their time spent volunteering had affected their connectedness to nature, by being presented with Figure 10.7 below<sup>18</sup>, and being asked which diagram they felt best represents their connectedness with nature. The number of respondents that selected each of the images below is outlined in Figure 10.8, which demonstrates that image (E) was the most popularly selected image, followed by (G).

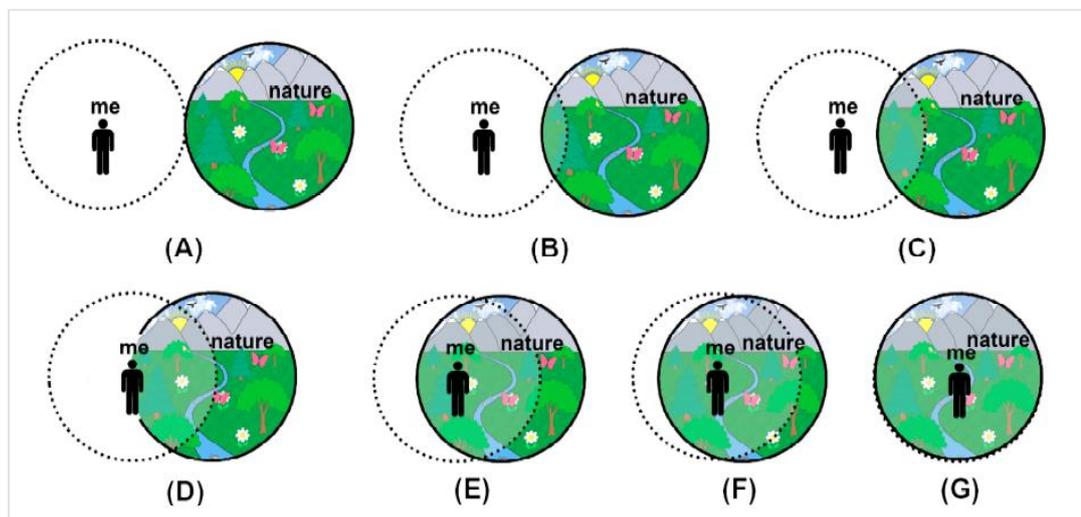


Figure 10.7 Nature connectedness infographic, as presented within N4N volunteer survey.

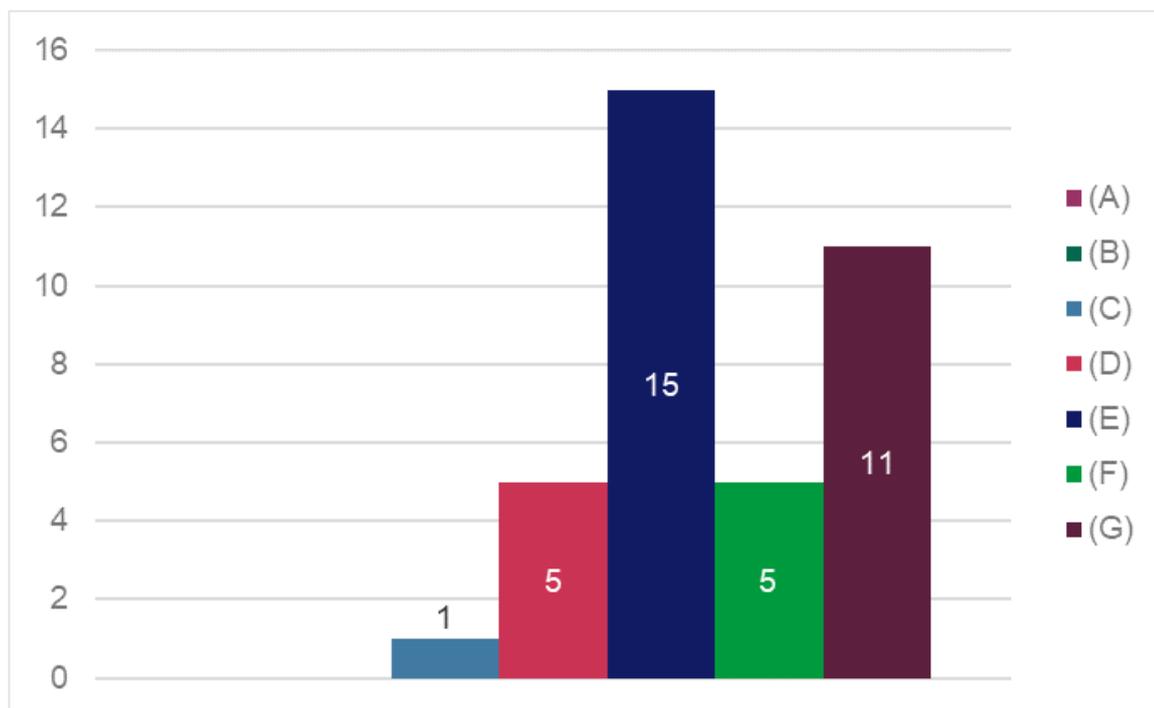


Figure 10.8 Interconnectedness with nature: image selected and number of respondents. (n=37)

<sup>18</sup> Kleespies, M.W.; Braun, T.; Dierkes, P.W.; Wenzel, V. Measuring Connection to Nature—A Illustrated Extension of the Inclusion of Nature in Self Scale. *Sustainability* 2021, 13, 1761. <https://doi.org/10.3390/su13041761>



It is useful to recognise that the volunteer samples are subject to self-selection, i.e. individuals who have better wellbeing<sup>19</sup> and are more connected to nature than the average person, may also be more likely to volunteer (on a biodiversity-related project). Therefore, respondents were asked further questions to ascertain the attribution of effects that volunteers felt with regard to their roles on TWT sites.

Of the 34 responses received to the question ‘please outline whether/how your voluntary role has contributed to [your connectedness with nature]’, 13 respondents noted that the time spent outdoors had been a catalyst for how connected they felt with nature. The physical and mental immersion allowed many volunteers to develop personal relationships with the sites they have been working on, and the work they have been doing.



***It's given me more opportunity to explore things I wouldn't have been able to explore before and it has given me more time to spend outdoors. I am a very outdoorsy person anyway, but opportunities like this are valuable and I hope it continues.***

Volunteer survey respondent



***Feel ownership to not only the reserves in which we work, but the environment in general.***

Volunteer survey respondent

For other volunteers (8 respondents), the sense of reward and achievement that they felt from spending time volunteering greatly improved their connectedness to nature. Several volunteers reported feeling that working in nature reserves placed them in the centre of nature, allowing them to feel the effects of the voluntary work they were doing first-hand.



***I see the effect my countryside conservation activities are having on wildlife sites every week.***

Volunteer survey respondent

Finally, it is noteworthy that many volunteers attributed the positive impacts on their nature connectedness directly to the experiences that they had had whilst volunteering, whether this be through knowledge gains, greater involvement in practical action, or a better understanding of the importance of habitats for biodiversity. Positively, one volunteer even noted that they have been recommending others to volunteer alongside them or undertake similar activities in their own settings.



***Since joining I encourage others to do likewise. I encourage our grandchildren to make their garden more wildlife friendly.***

Volunteer survey respondent

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<sup>19</sup> Ricky N. Lawton, Julian Gramatki, Will Watt and Daniel Fujiwara; Does Volunteering Make Us Happier, or Are Happier People More Likely to Volunteer? Addressing the Problem of Reverse Causality When Estimating the Wellbeing Impacts of Volunteering, Journal of Happiness Studies (2020); <https://doi.org/10.1007/s10902-020-00242-8>



# 11 Summary and conclusions

## Summary

- **Outputs:** Overall, projects are performing comfortably towards their programme plans (targets) with many approaching 50 per cent achieved with two years of the programme remaining. The outputs showcase the wide range and depth of activities taking place. The output areas that have seen particularly notable progress are *ponds improved* and *new ponds* with 70 and 84 per cent of those planned already delivered. The programme has engaged over 350 volunteers during 2022-23, providing a valuable resource to the programme.
- **CO2:** The carbon assessment methodology has been applied to phase 3 projects. Overall, it is estimated that post-intervention habitats included within phase 1 to 3 projects are estimated to sequester 1,222 t CO<sub>2</sub>-eq per year. This is approximately equivalent to 746 people's yearly driving.
- **Species and connectivity:** Overall 2022-23 has been characterised by projects undertaking planning, clearance works and, in some cases, projects moving on to groundworks and planting. Encouragingly, some projects have noted early observations of positive indicator species.
- **Water:** N4N projects are supporting nearly 21km of England's waterways, and objectives have centred around improving water quality, improving ecological conditions, reducing pollutants, and restoring riparian habitats. Progress over the last year has included detailed designs (including floodplain design) and planning, as well as seeking permissions to undertake these. Two projects are awaiting sign off on already-designed plans, with a further two undertaking feasibility studies for planned activity.
- **Flood:** During 2022-23, three projects have undertaken flood risk modelling.
- **Visitor:** Phase 3 projects have been added to recreational value analysis. Across the 16 N4N projects with visitor access, it is estimated that over 3 million people visit these areas and footpaths per year, equivalent to a total annual recreation value of £11 million.
- **Volunteering:** The volunteering undertaken for N4N projects during 2022-23 had an equivalent wage value of £24,851. Volunteer feedback demonstrates the positive impact on wellbeing with all survey respondents indicating either a positive or very positive effect on their wellbeing (n=37).

## Methodological considerations and reflections

Whilst largely successful, the current cycle of annual reporting and analysis has revealed some useful points of reflection for future reporting, which are outlined below:

- With regard to projects utilising the volunteering survey, an aim for 2023-24 will be to expand the range of projects distributing the volunteer survey. This will allow for a fuller analysis of the social impact created by voluntary roles through N4N projects.
- Within impact evaluation it is crucial to assess the level of *additionality* i.e. what would have not/have occurred in the absence of the intervention. While this relates most closely to volunteering, the additionality of other outcomes such as land restoration, increased abundance of species, and visitor experience could be considered more closely moving into the next phase.
- Additionally, a more cohesive approach to the collection of species and connectivity data will be taken. This could include pre-defined categories being offered to projects to select from in terms of types of species, in order to draw out overarching themes present in terms of species being protected, supported, or reintroduced. In addition, exemplar responses and further guidance will be given to projects, in order to ensure that a comparative level of detail and granularity is being reported by individual projects. Pre-defined categories could also be utilised in relation to



connectivity, in order to encourage responses that would similarly facilitate qualitative overarching analysis.

- To date the National Highways tool has been used to assess carbon sequestration. The tool is limited to the assessment of peatland and woodland habitats. National Highways have endorsed the inclusion of other habitats within reporting, should appropriate proxies be sourced and referenced. This can also be explored during 2023-24.
- As projects come to a close, more project visits will be conducted, and case studies written in order to describe the wider outcomes and impacts of projects.
- Finally, the Environmental Benefits in Nature (EBN) tool and its resulting analysis will be assessed in terms of how it can most effectively be used to complement evaluation findings.



## Appendix 1: N4N Projects Overview

Ref	Project Name	Trust	Confirmed funding	Match	Start date	End date
N4N1	Whittle Dene Semi Natural Woodland Restoration	Northumberland	£104,400.00	£8,400.00	01/09/2022	31/05/2025
N4N2	M56-A56 Pollinator Networks	Lancashire	£210,214	£ -	01/01/2022	31/12/2023
N4N3	Red Moss SSSI	Lancashire	£93,634	£ 11,000.00	11/10/2021	31/03/2024
N4N4	Improving the Connectivity and Biodiversity of the Manchester Mosses SAC	Lancashire	£296,917.66	£42,000.00	13/10/2021	31/03/2023
N4N6	Rotherham Rivers 3	Sheffield & Rotherham	£522,095	£201,658.00	06/09/2021	31/05/2025
N4N7	The Lugg Living Landscape	Herefordshire	£338,000	£292,400.00	06/09/2021	31/03/2024
N4N8	M5 Clean Rivers Project	Birmingham & Black Country	£235,000	£ -	02/11/2021	31/03/2024
N4N10	Nene Valley Wetland Restoration Project	BCN	£241,800	£ -	06/09/2021	31/03/2025
N4N11	East Winch Common SSSI	Norfolk	£180,600	£ -	01/10/2021	31/03/2024
N4N13	Wymondham Green Bridge Conversion	Norfolk	£64,800	£ -	30/11/2021	31/03/2025
N4N14	Sillfield Newt Reserve (VAT)	Norfolk	£44,040	£ -	31/12/2021	31/10/2023
N4N15	Blows Down	BCN	£65,950	£6,500.00	06/09/2021	31/03/2025
N4N16	River Lea Habitat Restoration	Herts & Middlesex	£282,030	£ -	06/09/2021	31/03/2025
N4N17	The Woodland Wonders of Moor Copse	BBOWT	£259,832	£ -	06/09/2021	31/03/2025



<b>N4N18</b>	Dormouse Reconnected (VAT)	Somerset	£402,000	£4,000.00	03/01/2022	30/06/2025
<b>N4N19</b>	Langford Lakes Wetland Project	Wiltshire	£318,239	£67,186.00	06/09/2021	31/03/2025
<b>N4N19(b)</b>	Langford Lakes Wetland project extension (Smallbrook Meadows)	Wiltshire	£128,003	£6,500.00	01/11/2021	31/03/2025
<b>N4N20</b>	J10 Chalk Grassland Restoration	Hants and IoW Wildlife Trust	£252,634.00	£175,000.00	06/09/2021	31/03/2024
<b>N4N21</b>	Shap Fells Peatland Restoration	Cumbria Wildlife Trust	£400,000	£ -	01/10/2021	31/03/2024
<b>N4N22</b>	Bringing Biodiversity Back to the Broads	Suffolk Wildlife Trust	£92,262.55	£56,864.00	06/09/2021	01/02/2023
<b>N4N23</b>	South Elmham Hall wildlife pond network	Suffolk Wildlife Trust	£50,000	£ -	30/01/2022	31/03/2024
<b>N4N24</b>	Bamfield-Blythburgh Farm Cluster	Suffolk	£128,000.00	£18,000.00	01/04/2022	31/03/2025
<b>N4N25</b>	Suffolk Wool Towns	Suffolk	£56,400.00	£ -	31/10/2021	31/03/2025
<b>N4N26</b>	Reconnecting Fillongley	Warwickshire Wildlife Trust	£364,831.00	£50,000.00	31/12/2021	31/03/2025
<b>N4N27</b>	Riddy Connectivity Restoration	BCN	£31,300.00	£2,400.00	01/01/2022	31/03/2025
<b>N4N28</b>	Cumbria Wildflower Meadow Restoration	Cumbria	£165,300.00	£ -	01/04/2022	31/03/2025
<b>N4N29</b>	Badley Habitat Mosaic Creation	Suffolk	£88,000.00	£ -		31/03/2025
<b>N4N/42</b>	Creating Species Highways	Devon WT	£76,425.00			31/05/2025
<b>N4N/37</b>	Pevensy Levels - Reeds, Fens, Restoration and Resilience	Sussex WT	£104,280.00		30/09/2022	30/09/2023
<b>N4N/36</b>	Bovey Heathfield SSSI restoration	Devon WT	£43,560.00		01/11/2022	31/07/2023
<b>N4N/31</b>	Coast to Fell	Cumbria WT	£155,268.60		01/11/2022	31/03/2025
<b>N4N/39</b>	West Chisenbury Wetland	Wiltshire WT	£132,650.00		11/11/2022	31/05/2025



<b>N4N/40</b>	West Yorkshire INNS Restoration and Resilience	Yorkshire WT	£178,342.00	11/11/2022	31/05/2025
<b>N4N/41</b>	Natural Highways and Homes	Warwickshire WT	£491,495.00	11/11/2022	31/05/2025
<b>N4N/35</b>	Shropshire Road Networks Nature Retreats	Shropshire WT	£89,276.40	11/11/2022	31/03/2025
<b>N4N/32</b>	Bodenham Reedbeds	Herefordshire WT	£108,000.00	11/11/2022	30/03/2025
<b>N4N/34</b>	Huckerby's Meadow	London Wildlife Trust	£57,026.00	28/02/2023	31/03/2025
<b>N4N/30</b>	Restoring Burns Beck Moss	Cumbria WT	£300,250.00	31/03/2023	31/03/2025



## Appendix 2: Technical note net change in CO<sub>2</sub> emissions

### Emission factors

Emission factors in the model are from Natural England. Table A3.1 shows the different values for each habitat. Negative numbers represent carbon sequestration and positive numbers represent carbon emitted.

Table A3.1: Emission factors

Habitat	tCO <sub>2</sub> -eq per ha per year	
	Carbon emitted	Carbon Sequestered
<b>Woodland and other</b>		
Newly planted native broadleaf woodland		-5.77
Newly planted conifer woodland		-7.5
Scrubland	1.99	
Heathland	0.05	
Grassland	0	
Arable / cultivated land	0.29	
<b>Peatland</b>		
Near Natural Fen (undrained)		-0.93
Near Natural Bog (undrained)		-0.02
Rewetted Bog	3.87	
Rewetted Fen	8.05	
Rewetted Modified (semi-natural) Bog		-0.02
Modified Bog (semi-natural) Heather + Grass dominated - Drained	3.48	
Modified Bog (semi-natural) Heather + Grass dominated - Undrained	2.25	
Eroding Modified Bog (bare peat) - Drained	13.14	
Eroding Modified Bog (bare peat) - Undrained	12.03	
Extracted Domestic (drained)	13.23	
Extracted Industrial (drained)	13.14	
Cropland	32.89	
Intensive Grassland	24.87	
Extensive Grassland (combined bog/fen)	11.02	

### Mapping

Table A3.2 below shows the mapping between the biodiversity units assessment classification and habitats available from NH's model. Woodland habitats that are an 'enhancement' and not included in the model have an N/A in their respective cell.

Table A3.2: Mapping between Biodiversity assessment and NH's model

Biodiversity units assessment		Environment & Wellbeing Fund Appraisal Tool CO <sub>2</sub> model	
Baseline habitat	Post-intervention habitat	Baseline habitat	Post-intervention habitat
Urban - Amenity grassland	Woodland and forest - Other woodland; broadleaved	Arable / cultivated land	Newly planted native broadleaf woodland
Heathland and shrub - Mixed scrub	Woodland and forest - Other woodland; broadleaved	Scrubland	Newly planted native broadleaf woodland



Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Woodland and forest - Other Scot's Pine woodland	Woodland and forest - Other Scot's Pine woodland	N/A	N/A
Wetland - Transition mires and quaking bogs (H7140)	Wetland - Transition mires and quaking bogs (H7140)	Eroding modified bog (drained)	Modified bog (undrained)
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Wetland - Transition mires and quaking bogs (H7140)	Wetland - Transition mires and quaking bogs (H7140)	Eroding modified bog (drained)	Modified bog (undrained)
Heathland and shrub - Mixed scrub	Woodland and forest - Wet woodland	Scrubland	Newly planted native broadleaf woodland
Wetland - Transition mires and quaking bogs (H7140)	Wetland - Transition mires and quaking bogs (H7140)	Eroding modified bog (drained)	Modified bog (undrained)
Wetland - Lowland raised bog	Wetland - Lowland raised bog	Eroding modified bog (undrained)	Modified bog (undrained)
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Grassland - Bracken	Wetland - Lowland raised bog	Intensive Grassland	Rewetted bog
Grassland - Bracken	Wetland - Transition mires and quaking bogs (H7140)	Intensive Grassland	Eroding modified bog (undrained)
Wetland - Depressions on Peat substrates (H7150)	Wetland - Transition mires and quaking bogs (H7140)	Rewetted modified bog	Eroding modified bog (undrained)
Woodland and forest - Wet woodland	Woodland and forest - Wet woodland	N/A	N/A
Woodland and forest - Lowland mixed deciduous woodland	Woodland and forest - Lowland mixed deciduous woodland	N/A	N/A
Woodland and forest - Other woodland; mixed	Woodland and forest - Other woodland; mixed	N/A	N/A
Woodland and forest - Lowland mixed deciduous woodland	Woodland and forest - Lowland mixed deciduous woodland	N/A	N/A
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Woodland and forest - Other woodland; mixed	Woodland and forest - Other woodland; mixed	N/A	N/A
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Woodland and forest - Other woodland; broadleaved	Woodland and forest - Other woodland; broadleaved	N/A	N/A
Wetland - Blanket bog	Wetland - Blanket bog	Eroding modified bog (undrained)	Near Natural Bog (undrained)
Baseline habitat	Proposed habitat	Baseline	Post intervention
Urban - Amenity grassland	Woodland and forest - Other woodland; broadleaved	Arable / cultivated land	Newly planted native broadleaf woodland
Heathland and shrub - Mixed scrub	Woodland and forest - Other woodland; broadleaved	Scrubland	Newly planted native broadleaf woodland

## Transformation and maintenance cost

The transformation and maintenance cost is included in the model to represent the emissions emitted during transformation to the new habitat and additional maintenance required since the intervention (those habitats classified as succession and creation).



The average transformation and maintenance cost used for this calculation was provided by the Royal Society of Wildlife Trusts (RSWT). It represents the average CO<sub>2</sub> emissions emitted per ha in 2019 (on a total landholding of a little over 101,000 ha) for all activities across RSWT, as well as all the individual Wildlife Trusts. The value is 0.6 t CO<sub>2</sub> eq per ha of land managed emitted.

For transformation, this value is then multiplied by the total ha (132) included in the model, divided by the total years of appraisal period (69 years) to get the average yearly value.

For maintenance, the same value is then multiplied by the total ha which are assumed to be under new maintenance. This is then added into every year of the model.