Fairnley Riparian Corridor

Summary Report

INTERVENTIONS

Creating 3.5ha of riparian buffer will restore natural river processes and allow natural regeneration of riparian vegetation, trees, scrub and priority habitat.

This buffer will create wildlife connectivity to adjacent woodlands (due to be converted to broadleaved woodland in 2024) and the expanding hedgerow network: 10km planted in 2021, which this connects to.

Slowing the water flow will be achieved through longer vegetation increasing roughness and slowing surface runoff. Reducing sediment loading into the watercourse from farm traffic and stock movements will improve habitat and water quality for white clawed crayfish by stock exclusion and improved vegetation cover over time with natural regeneration of trees and shrubs.

Summary of vegetation, soil carbon & winter bird reports can be found below.

Vegetation

Habitat	Average herbaceous plants (%)	Average short grasses (%)	Average medium grasses (%)	Average long grasses (%)	Species diversity (total no. species)
Fairnley Burn	17	0	33	41.5	35

Soil Carbon

Habitat	Average soil organic carbon (%)	Average total carbon (%)	Average organic carbon stock (tonnes per hectare)
Fairnley Burn (upper: 0-15cm)	3.1	3.1	43.6
Fairnley Burn (lower: 15-30cm)	1.7	1.8	27.4

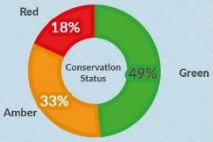
Birds

Total number of

680

birds spotted between

Nov 23 - Feb 24



33 different species spotted with 18% being in 'Red' conservation

Top 3 species of birds by amount spotted between Nov 23 - Feb 24

This is a summary of the winter bird surveys and were conducted over a single site visit per month.

Wansbeck Restoration for Climate Change (WRCC) is one of six pioneering nature projects across England to receive funding from Natural England to trial ways to capture carbon and mitigate the impacts of climate change. This nationwide project, 'Nature Returns', is funded by the Treasury's Shared Outcomes Fund, and co-sponsored by Defra and the Department for Energy Security and Net Zero. The project aims to provide the evidence for how nature-based solutions can tackle the environmental crisis. This project aims to restore mixed habitats, showcasing how land owners, environmental bodies such as the National Trust, and governing bodies such as Natural England, can come together to address climate change, increase biodiversity, reduce greenhouse gas emissions and promote carbon storage, in a way that benefits nature and society.

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INTRODUCTION

Wansbeck Restoration for Climate Change (WRCC) is one of six pioneering nature projects studying how we can best use land across England to address climate change whilst producing food and promoting thriving nature.

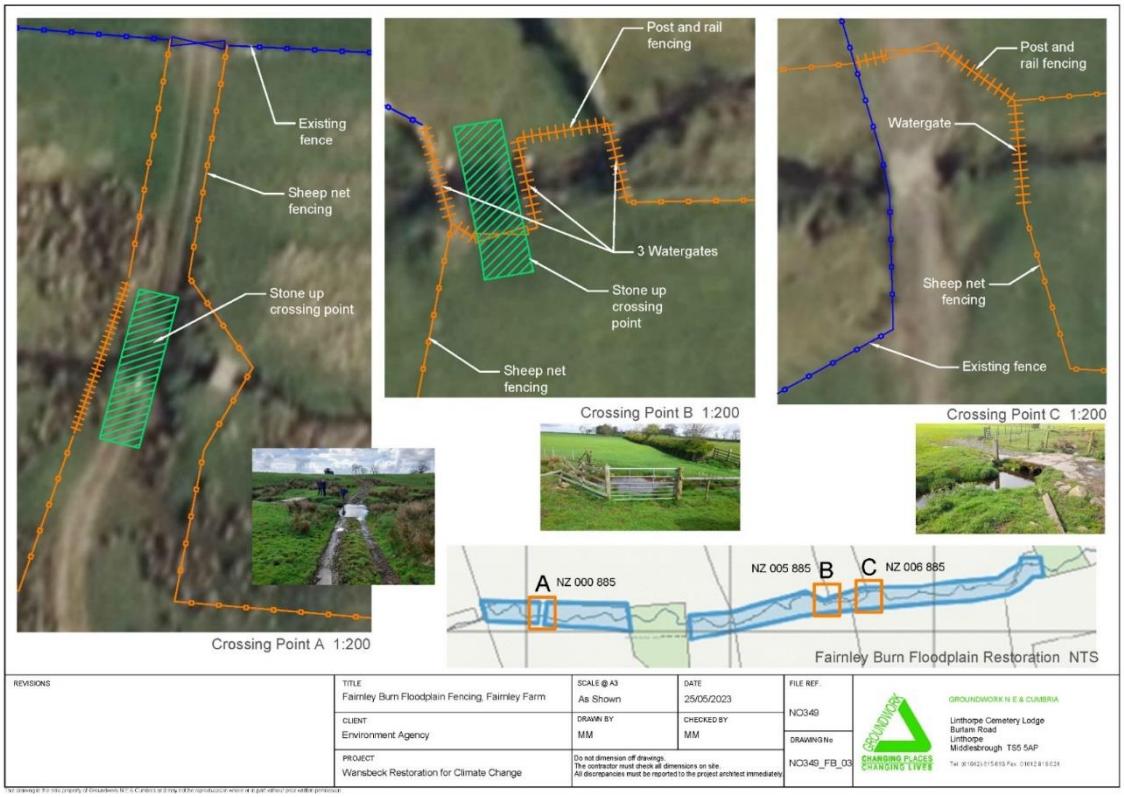
Led by Natural England, 'Nature Returns' is funded by the Treasury's Shared Outcomes Fund, and co-sponsored by the Department for Farming and Rural Affairs (Defra) and Department for Energy Security and Net Zero (DESNZ).

WRCC is providing evidence through its trials as to how a range of nature-based solutions can help tackle the Climate and Biodiversity crises.

The project aims to restore mixed habitats and showcase how landowners, farmers, environmental bodies (such as the National Trust) and governing bodies (such as Natural England) can come together to:

- **address climate change**
- **increase biodiversity**
- **reduce greenhouse gas emissions**
- **promote carbon storage**
- **provide benefits for nature and society**

Site Plan



PROJECT SUMMARY

Stock-proof fencing erected along either side of 1200m of water course has protected a 3.5ha riparian buffer which will restore natural river processes and allow natural regeneration of riparian vegetation, trees, scrub and priority habitat.

This buffer will create wildlife connectivity to adjacent woodlands (due to be converted to broadleaved woodland in 2024) and the expanding hedgerow network: 10km planted in 2021, which this connects to. Slowing the water flow will be achieved through longer vegetation increasing roughness and slowing surface runoff.

Two stream crossings and two watering bays were lined with stone to protect water quality. Reducing sediment loading into the watercourse from farm traffic and stock movements will improve habitat and water quality for white clawed crayfish.

KEY FACTS:

Location: Fairnley Farm, Wallington Estate Grid ref NZ101 840

Outputs: 3.5ha riparian buffer enclosed by new stock fencing; 3 fenced crossing points including 2 stone-lined crossing points and 2 watering bays

Consents: Land Drainage Consent obtained for the crossing works on Fairnley Burn (an Ordinary Watercourse)

Method of hard surfaced crossings:

- Pre-commencement ecological survey identified habitat suitable for priority species including white clawed crayfish.
- Immediately before to works commenced a licenced WCC worker carried out a 'destructive' survey, lifting stones and relocating crayfish downstream of the works.
- Large stones keyed into bed of the beck to form a gravel trap
- Base of entrance and the exit ramp protected with rock armouring using cobble-sized rocks to create as flat a surface as possible and filling any gaps with coarse gravel or hardcore.
- Stockproof fencing including watergates installed

Completed September 2023

Management: controlled grazing by livestock for 2-3 months later summer.

Benefits: Stone-surfaced crossings will reduce sediment input from vehicles and stock. Slowing and filtering the flow of surface runoff by rougher longer vegetation will improve habitat and water quality.

VEGETATION

Throughout the summer and autumn months of 2023 and 2024, Groundwork field staff carried out vegetation surveys at Fairnley Burn to assess baseline conditions prior to, and after implementation of interventions. Through the use of a 2x2m quadrat and a 10x10m quadrat, we took at least 5 samples in every field parcel. Within each quadrat, we measured the percentage cover of vegetative categories and species diversity.

Habitat	Average herbaceous plants (%)	Average short grasses (%)	Average medium grasses (%)	Average long grasses (%)	Species diversity (total no. species)
Fairnley Burn	17	0	33	41.5	35

Results

Table 1. Average values of percentage cover of herbaceous plants, short grasses, medium grasses and long grasses, and the total number of species found within the sampled habitat at Fairnley.

These results are indeed indicative of what we would expect, with riparian habitats exhibiting a greater number of species when compared to drier grassland habitats, due to the higher number of microhabitats available in damper, wetter conditions. The riparian habitat at Fairnley was dominated by long grasses due to the absence of grazing. These species included Perennial Rye, Yorkshire Fog, and Cocksfoot Grass. Herbaceous plants such as Common Sorrell, Water Mint, and Marsh Bedstraw made up 17% of our samples at Fairnley, however the total species diversity of 35 species is largely due to the presence of many wildflowers, such as Marsh Marigold, Bluebell Bellflower and Germander Speedwell which were fantastic to see.

Comparing Vegetation Data with Other Pilot Sites

It is also interesting to note that when considering results from all Nature Returns pilot sites nationwide, our results from Fairnley are consistent with that of other sites, with wetter conditions, such as that of floodplain and riparian corridors, increasing the range of both grasses and herbaceous plants, benefitting ecosystem health and overall biodiversity.

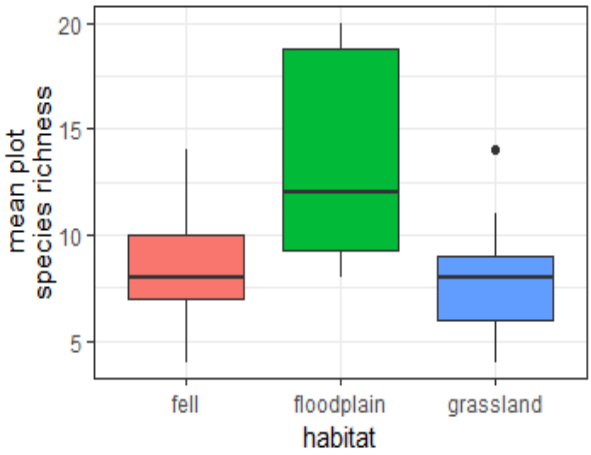


Figure 2. Average species richness of fell, floodplain and grassland habitat, from the six Nature Returns pilot sites across England

SOIL CARBON

Groundwork soil samples were collected in October 2023, with these samples then being sent to a laboratory to understand the amounts of carbon stored in the soil at Fairnley Burn.

Results

Habitat	Average soil organic carbon (%)	Average total carbon (%)	Average organic carbon stock (tonnes per hectare)
Fairnley Burn (upper: 0-15cm)	3.1	3.1	43.6
Fairnley Burn (lower: 15-30cm)	1.7	1.8	27.4

Table 2. Average values of soil organic carbon (%), calculated organic carbon stock (t/ha), and total carbon (%) within cores extracted from the upper layer of soil (0-15cm) and lower level of soil (15-30cm) at Fairnley.

Wetter riparian habitat often exhibits greater amounts of soil carbon than other, drier habitats. This is likely due to the greater diversity of vegetation present, resulting in the breakdown of more organic matter and thus more carbon. Our results from Fairnley Burn support this explanation; our soil carbon results from sites which included either riparian or floodplain habitat tended to demonstrate higher carbon percentages.

These results also demonstrate that the greatest density of carbon is stored within the upper fraction of soil, closest to the surface (0-15cm), with lower fractions exhibiting less carbon. This is due to the majority of organic matter breakdown by microbes occurring within the topsoil. The identical results of average soil organic carbon (%) and average total carbon (%) suggests a high level of readily available carbon for digestion by microbes, suggesting good overall soil health.

Soil Carbon: Terms Explained

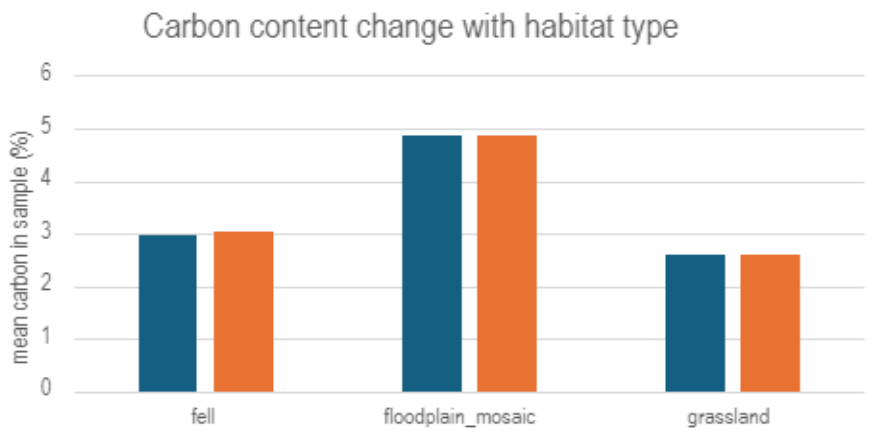
Table 2 presents the lab results as average soil organic carbon (%), average total carbon (%), and average organic carbon stock (t/ha). The key difference between these variables is that organic carbon (%) enters the soil through the decomposition of plant and animal residues, root exudates, and living and dead microorganisms. It therefore includes all the carbon-based compounds that were once found in living organisms and so acts as a relatively available form of carbon that can be absorbed by microbes and respired back into the environment as atmospheric carbon. Organic carbon (%) can thus act as a key indicator of overall soil health.

Average total carbon (%) includes both organic and inorganic carbon, where inorganic carbon refers to the inclusion of carbon compounds that do not contain carbon-hydrogen bonds, such as carbon dioxide and carbonates. Inorganic carbon is largely found in carbonate minerals (soils in Limestone areas) and does not act as a readily available source of carbon for digestion by microbes.

The metric tonnes per hectare (t/ha) is calculated using the following equation: (t/ha) = 10,000 x L x BD x (SOC/100) where:

10,000 m2 in one hectare
L = sample length (m)
BD = bulk density (kg/l)
SOC = soil organic carbon (%)

Comparing Soil Carbon to other Northumberland Pilot Sites



These results (Figure 3) which incorporate all farms from our Northumberland study sites, show that floodplain mosaic habitat stores more soil carbon than other habitats. Fairnley riparian corridor falls within this category. Fell and grassland habitats which consistently have less vegetative diversity present, possess lower levels of carbon in soil.

Figure 3. The change in the carbon content of average total carbon (%) and average organic carbon (%) in soil samples between fell, floodplain mosaic and grassland habitat types across all Northumberland pilot sites.

OTHER SURVEYS

Greenhouse Gas Flux

One of the long-term aims of this project is to monitor a fundamental driver of climate change, the net emission and removal of greenhouse gases by terrestrial ecosystems. We are doing this on our project sites through the use of an EGM machine (Figure 4), which allows us to measure the rates of both soil respiration and plant photosynthesis. This gives us a method of quantifying the biosphere's capacity to sequester (capture) carbon in one particular area, and also allow us to understand how differing land management strategies are affecting these sequestration rates.

Due to the inter-annual variability of gas flux emissions, we are unable to provide immediate findings for this part of the project. However, carrying out these measurements seasonally over a number of years means we will be able to analyse long term carbon sequestration trends, helping us to understand how both habitat type, land use change and climatic effects are impacting the carbon sequestration of these landscapes.

Figure 4. EGM machine (right) pictured with soil respiration chamber (left) used to measure the rates of respiration of soil microbes.

Bird Surveys

Groundwork commissioned Birdwatch North East Ltd to carry out bird surveys on various Northumberland study sites. A total of 62 species were recorded within these sites. Many were birds of conservation concern, sitting on either the red or amber list.

Farm	Date	Total no of species	Breeding	Non-breeding	Red	Amber	Green	Comments
Fairnley	06-07-2023& 04-07-2024	37	19	18	6	14	16	Felled and standing plantations at each end of riparian with tall and short grassland makes a good variety of habitats for grey wagtail, meadow pipits, tree sparrows, swallows, willow warblers. Non breeding – curlew, linnet, lesser redpoll, starlings as a post-breeding aggregation.

CONCLUSIONS

We are very grateful to be able to access these study sites across Northumberland. Access to your land is allowing us to collect valuable data which is not only helping us to assess the effects of Groundwork's interventions, but is also allowing us to understand how nature and various agricultural practices interact. It is clear from these results that:

- Wetter riparian habitats such as Fairnley Burn exhibit a greater number of species when compared to drier grasslands due to the higher number of microhabitats available in damper, wetter conditions
- Fairnley Burn riparian corridor was dominated by long grasses, however the total species diversity is largely due to the presence of many wildflowers
- Wetter riparian habitats such as Fairnley exhibit greater amounts of soil carbon than other, drier habitats, likely due to the greater diversity of vegetation present
- At Fairnley, the greatest density of carbon is stored within the upper fraction of soil, closest to the surface (0-15cm); this is due to the majority of organic matter breakdown by microbes occurring within the topsoil
- Soil at Fairnley Burn riparian corridor demonstrates a high level of readily available carbon for digestion by microbes, suggesting good overall soil health
- Soil carbon should continue to increase in the Fairnley Burn corridor as the number of vegetative and invertebrate diversity continues to increase, which will increase soil fertility and ecosystem health
- The continuation of Greenhouse Gas Flux surveys will provide valuable data to show Fairnley's capacity to sequester carbon, and will provide us with a bigger picture to how differing land use practices are affecting these sequestration rates.