Embedding Citizen Science Within Landscape-Scale Nature- Based Recovery; A Study of Hedgerow Species Communities Across Three Management Blocks

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Summary

A comparative baseline study of hedgerow biodiversity was undertaken across three agricultural blocks; grassland restoration, agroforestry, and regenerative agriculture, at the 'Sapperton Wilder' ecological restoration project in Gloucestershire, U.K. Approximately 100 hedgerow transects (~3 km) were surveyed by citizen scientists and professional recorders between May and October 2023, assessing woody plants, flowering plants, and invertebrates.

Flowering species richness was highest in the regenerative block, while invertebrate diversity was greatest in the agroforestry block, likely due to adjacent woodland buffers.

Significant differences in species richness were detected between blocks and over time (P < 0.01). Citizen scientists recorded comparable or slightly higher species richness than professionals for some taxa, demonstrating their value for large-scale monitoring. These findings provide a baseline for future biodiversity monitoring and inform land management decisions supporting biodiversity net gain and ecological restoration.

Method

A total of 39 citizen scientists were recruited, mostly from the local area, through events, newsletters, local magazines, and word of mouth. Baseline ecological data were collected across three land management blocks: Grassland Restoration, Regenerative Agriculture, and Agroforestry. Hedgerows were the focus, given their ecological importance. Data contributed to local and national conservation efforts. Hedgerows in each block were mapped and divided into 30m sections; each assigned a number. Species richness and diversity were compared across the three blocks. Surveys recorded woody plants, flowering plants, and invertebrates, balancing detail, reliability, and time demands. Three main methods were used:

- **Woody plants**: percentage cover method
- **Flowering plants**: DAFOR scale
- **Other species & invertebrates**: abundance counts
- Citizen scientists received standardised instructions and identification resources (keys, apps, guidebooks).

Sampling Strategy Hedgerow sections were allocated using a randomised "ticketing system" to ensure even coverage across the site. Sections were prioritised (high, mid, low) to ensure representative sampling. At least 25 high-priority sections per block were surveyed as a minimum. Six monthly field events (May–Oct 2023) were held, each lasting 4–5 hours, with volunteers surveying 1–2 sections each. Surveys covered all three blocks evenly each month to account for seasonal variation. Ad-hoc surveys were allowed for unsupervised volunteers to fill gaps. Each 30m section was clearly marked and surveyed using standardised forms. Volunteers recorded flora and fauna using provided keys and scored according to guidance. Professionals followed up within a week.

Results

A total of 138 species were recorded across all blocks. The Regenerative Agriculture block had the highest overall species richness (91 species), followed by Grassland Restoration (78) and Agroforestry (65).
Woody species: The northern block (grassland restoration) had the highest richness (17 species), including 3 unique species, while Regenerative Agriculture and Agroforestry recorded 14 and 15 woody species, respectively.
Flowering species: Both Grassland Restoration and Regenerative Agriculture blocks had 51 species each, with Agroforestry at 40. Flowering plants contributed the highest overall richness and the most unique species per block.
Bumblebees: All blocks recorded 5 species, with one unique to Agroforestry.
Butterflies: Agroforestry and Regenerative Agriculture recorded 8 species each, Grassland Restoration 7, with unique species noted in each block. Agroforestry, possibly due to adjacent woodland scrub.

Statistical analysis (GLMs) showed significant differences in species richness between blocks and over time, underscoring the influence of recent land use and seasonal effects.

Key Findings and Conclusions

Highest flowering and overall species richness in the **Regenerative Agriculture** block.

Highest invertebrate richness and diversity in the **Agroforestry** block.

Highest butterfly richness in the **Regenerative Agriculture** block.

Recent land use, habitat differences, farming regimes, and pesticide use likely influenced species richness. The site shows strong potential to support biodiversity and connectivity while maintaining food production through regenerative practices. The high flowering species richness in the Regenerative Agriculture block may reflect historical wildflower margins. Invertebrate richness and diversity were greatest in the Agroforestry block, possibly due to adjacent woodland scrub. Statistical analysis showed significant differences in species richness between blocks and over time, underscoring the influence of recent land use and seasonal effects.