AGILE Nature Recovery and NbS Opportunity Maps: Shropshire, Telford and Wrekin - Technical Report

Nature Recovery Shropshire and Telford & Wrekin

Shropshire and Telford & Wrekin Local Nature Recovery Strategy.
Consultation draft, July 2025

Appendix 6: Mapping methodology

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Contents

1 Introduction

This document describes the Agile nature recovery opportunity maps for Shropshire and Telford & Wrekin, which were created as part of a research partnership between Shropshire Council and the Leverhulme Centre for Nature Recovery at the University of Oxford. The aim of this partnership was to explore how the maps could be used in practice to support the development of Local Nature Recovery Strategies. As part of this partnership we are keen to receive feedback on the usefulness of the maps and suggestions for improvements.

The system for generating these maps has been developed over many years of research, most recently as part of the Agile Initiative at the Oxford Martin School, and further development of the maps is now being taken forward by the Leverhulme Centre for Nature Recovery at the University of Oxford.

1.1 What is the Agile Initiative?

The Agile Initiative is a five-year programme (2022-2027) based at the Oxford Martin School which aims to respond to specific social and environmental policy questions with fast-paced solution-focused 'Sprints' that deliver demand-led new research. The NbS sprint worked with policymakers and practitioners to help provide tools and guidance for tackling the challenges around scaling-up high-quality nature-based solutions in the UK. This included mapping NbS and nature recovery opportunities, as well as guidance on governance, funding and monitoring NbS, with a map of case study examples. See our NbS knowledge hub for all the outputs.

1.2 What are the Agile opportunity maps?

The maps can be created for any area in England, using our open-source software, and we are also working on adapting the system for use in the other UK nations. They show areas which are potentially suitable for specific types of nature recovery and Nature-based Solution (NbS) opportunities, such as restoring woodlands, grasslands, wetlands, heathland and peatland, based on a series of simple rules. They are intended to encourage the siting of interventions in the most suitable locations to maximise benefits and minimise trade-offs.

The Agile opportunity maps are intended as a **decision-support tool** as part of a process of participatory engagement with stakeholders (see our Recipe for Engagement), and should always be used in conjunction with **ground-truthing** and **consultation with local experts** (see our Ground-truthing Guide).

The maps provide the following information:

- Habitat, based on information from OS Mastermap, Natural England's Priority Habitat Inventory (PHI), CROME crop map of England and OS Greenspace data.
- Agricultural land classification, Designations and Public accessibility (ALC)
- Scores from 0 to 10 for 18 ecosystem services, and a similar score for biodiversity
- Estimates of carbon stored and sequestered per hectare (which can be used to estimate totals for the area)
- Opportunities for nature recovery and nature-based solutions: woodland & scrub, grassland, heathland and wetland creation or restoration; peatland restoration; agroforestry opportunities (silvoarable or silvopasture), community orchards, erosion prevention and natural flood management.

The maps can be used for several purposes (Figure 1). They can provide a baseline habitat map (1), then following the addition of extra data (2) they can identify areas that are currently delivering high levels of ecosystem services (3) and identify opportunities for enhancements (4). For this

project, we also developed a new system for creating a priority network of opportunities to form the LNRS Local Habitat Map. Known in Shropshire and Telford & Wrekin LNRS as Zone 2 Opportunity map. Finally, the ecosystem service scores can be exported to a spreadsheet, and this can then be used to assess the outcome of different interventions in terms of changes to ecosystem service scores, and hence benefits for people (5). This last step is not automated and would require additional work.

The key features of the maps are:

1. Complete, detailed coverage with no gaps or overlaps – allows full habitat inventory and assessment of 'white space' options in areas in-between designated areas, including urban areas.
2. Matches OS Mastermap boundaries but also includes smaller habitat patches
3. Includes constraint and opportunity layers (ALC, designations, public access, flood zone, slope, soil type, peat status) all in one layer for rapid assessments

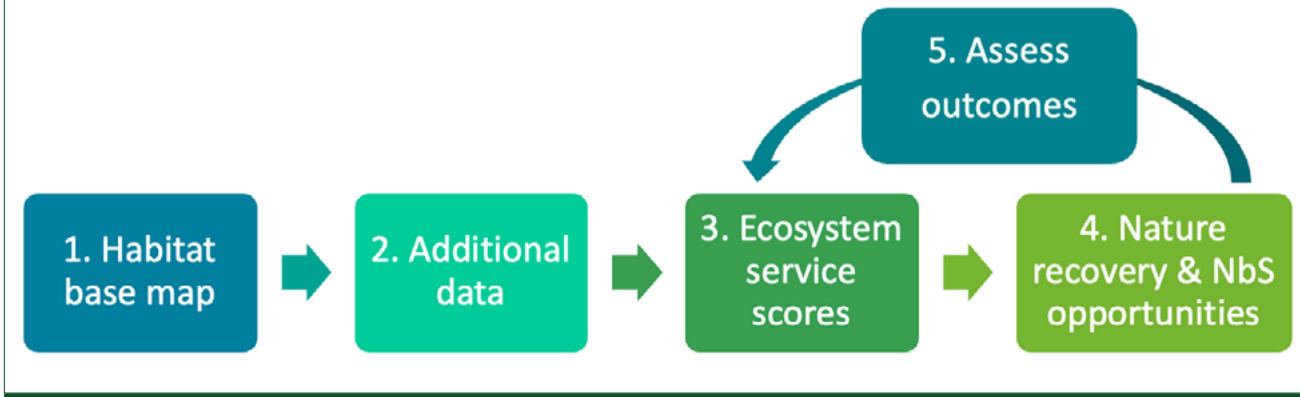

Figure 1. The Agile Opportunity Maps can be used to produce a baseline habitat map, assess baseline ecosystem service delivery, identify opportunities (including creation of a priority network map), and assess the benefits or trade-offs of proposed interventions.

4. Shows opportunities for nature recovery (woodland & scrub, grassland, heathland, wetland, ponds, wood pasture, community orchards, agroforestry) and nature-based solutions (flood and erosion protection)
5. Create a network of priority opportunities
6. Open-source code can be used to generate the maps anywhere in England
7. Maps can be updated easily:
   - Download zip files from the LNRS data viewer and elsewhere to a specified directory
   - Run the python code (takes 3-4 days for a typical county)
8. Flexible – we can respond to user requests for changes and new features.

2 Licensing requirements

The software to generate the maps is freely available, and most of the datasets incorporated into the maps are open access. However, there are some license requirements.

- **OS Mastermap.** The base layer for the maps is OS Mastermap (OSMM). This is free for public sector organisations and academics. Other users can also apply for licenses for non-commercial use under specific conditions. The GIS files for the maps may not be shared with other users unless they have a license to use OS Mastermap – this could be a contractor's license granted by the Council.
- **Soil data.** Standard versions of the opportunity maps use freely available national soil data but the Council purchased National Soil Map data with a license from Cranfield University. Those license conditions need to be followed when sharing the maps with others (this can be via providing a sub-license). The soil data is only used to i) identify the highest priority soil erosion prevention opportunities, and ii) identify potential opportunities to restore acid, calcareous and neutral grassland.
- **Hedgerow data.** The Council purchased hedgerow data from UK CEH. This is only used for creating the priority network maps, where existing tall or wide hedgerows form one element of the network and in some versions of the map field boundaries with no hedgerows (or low / narrow hedgerows) form a potential opportunity. Sharing images is allowed. Sharing derived data is only allowed if the Derived Data does not contain substantial amounts of the Licensed Data and cannot act as a direct substitute for the Licensed Data or be used to create a direct substitute for the Licensed Data. However, the data can be shared with 'co-deliverers', defined as: "a person who is supplied by the Licensee with the Licensed Data for purposes all of which support the achievement of the Licensee's statutory functions, where no revenue or credit is received in relation to any supply of the Licensed Data that exceeds the marginal costs of supply (unless it is a statutory charge)/ where that person supplied with Licensed Data uses it only for non-commercial purposes."
- **ArcGIS.** The data is supplied as ArcGIS File Geodatabase datasets. Individual opportunity layers can also be provided as shapefiles that can be used by other GIS packages such as QGIS, but attribute names will be truncated to 10 characters. Unfortunately, the symbologies that we provide to display the maps in the correct colours cannot be exported from ArcGIS to other formats.

The incorporation of licensed datasets into the Agile maps is summarised below.

The base habitat map, ecosystem service maps and carbon maps: use OSMM but no other licensed datasets.

The opportunity maps:

- use OSMM, but individual opportunity layers can be exported in a way that removes the OSMM boundaries.
- use soil data for calcareous / acid / neutral grassland opportunities and to split the erosion prevention opportunities (on slopes over 7 degrees) into high and low priorities, based on the soil erodibility
- do not use hedgerow data.

The priority network itself:

- does not use soil data (because we do not split out the erosion opportunities into high and low). However, when the individual opportunities within the network are mapped, these do use soil data as outlined above.
- uses hedgerow data (only for the hedgerow opportunities)
- uses OSMM for the field boundaries, which are incorporated in:
  - the hedgerow opportunities
  - the Countryside Stewardship polygons (as these have been trimmed those down to OSMM fields, though entire holdings could be used instead if necessary)
  - priority habitats (though could use original PHI data instead of the tidier version that matches OSMM boundaries)
  - the Historic Landscape Character (HLC) polygons, as these were made to fit the OSMM boundaries (though we could go back to using the original HLC polygons if necessary)
  - the canals
  - peat opportunities.

2.1 Attribution

Please always display this copyright statement prominently with any output maps, whether presented online, in reports or papers, in presentations, or printed.

Created using Agile Opportunity Maps software from the Oxford Martin School. This map incorporates OS data (© Crown Copyright and database rights 2025 Ordnance Survey AC0000851941) and Open Government License data.

For maps that include National Soil Map data (i.e. any maps that include calcareous grassland opportunities and erosion opportunities) please add this attribution statement:

Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2025].

For maps that include the UK CEH hedgerow data please add:

Some features of this map are based on digital spatial data licensed from the UK Centre for Ecology & Hydrology, © UKCEH. 'Contains Ordnance Survey data © Crown Copyright 2007, Licence number 100017572.'

3 Map creation methodology

3.1 Stage 1: The habitat baseline map

The habitat baseline incorporates the following datasets.

- **Ordnance Survey Mastermap (OSMM) Topography Layer**. This is a highly detailed vector map, i.e. it contains polygons mapping the shape of fields, buildings, etc., rather than a raster map comprised of pixels. Hence the resolution is extremely precise - it shows individual buildings, roads, verges, gardens, waterbodies and field boundaries (Figure 2). It also includes a certain amount of useful habitat information, e.g. coniferous, broadleaved and mixed woodlands, scattered trees, scrub, rough grassland, heath, marsh, rock and boulders. It is regularly updated by OS.
- **Habitat data:** Natural England's Priority Habitat Inventory (PHI), Wood Pasture and Parkland and Open Mosaic Habitats on Previously Developed Land. These are freely available national datasets, but users should be aware that much of this data is from around 2010. The maps should therefore always be used in conjunction with local knowledge and ground-truthing.

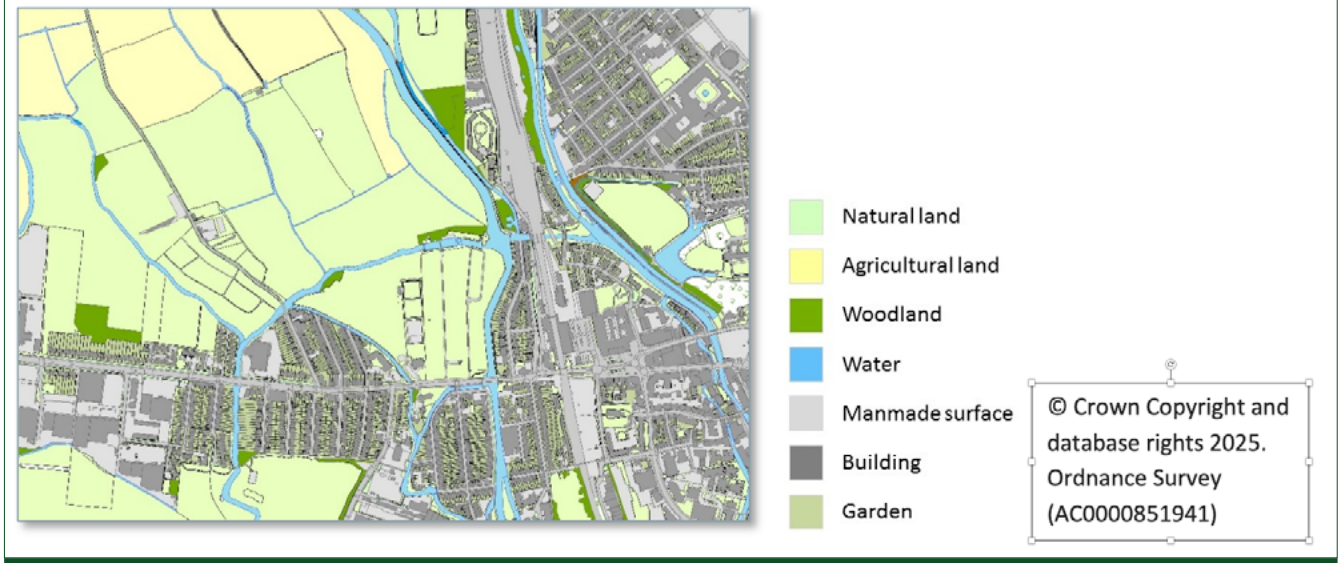

Figure 2. An extract from Ordnance Survey Mastermap (for Oxford), which has accurate mapping of buildings, gardens, roads, field boundaries etc plus some information on habitats

- **The Rural Payment Agency's Crop Map of England** (CROME) is used to determine whether agricultural land is arable or improved pasture. This version uses CROME from 2022, the most recently available version at the time the maps were created (Autumn 2024).
- **OS Greenspace Data** is used to identify greenspace (allotments, playing fields, playgrounds, golf courses, cemeteries and churchyards and amenity grassland). We use both OS Open Greenspace, which covers all areas, urban and rural, and OSMM Greenspace, which only covers larger urban areas (not villages) but contains more detail (e.g. it identifies amenity grassland) (Figure 3).

All the datasets are merged into a single layer. One challenge when merging these datasets is that often the boundaries do not exactly match OS Mastermap boundaries. Therefore a straightforward intersect operation, when performed at county scale, creates millions of tiny extra polygons ('slivers') along the main polygon edges, where the boundaries overlap slightly, which makes the dataset unmanageable. The Agile software overcomes this challenge using a novel process (designed by Martin Besnier, a visiting researcher from the Université Paris Sud) that can merge 'messy' non-matching boundaries while staying faithful to the OSMM base map (Figure 4). The final habitat base map therefore has complete and detailed coverage of the area with no overlaps or gaps (Figure 5).

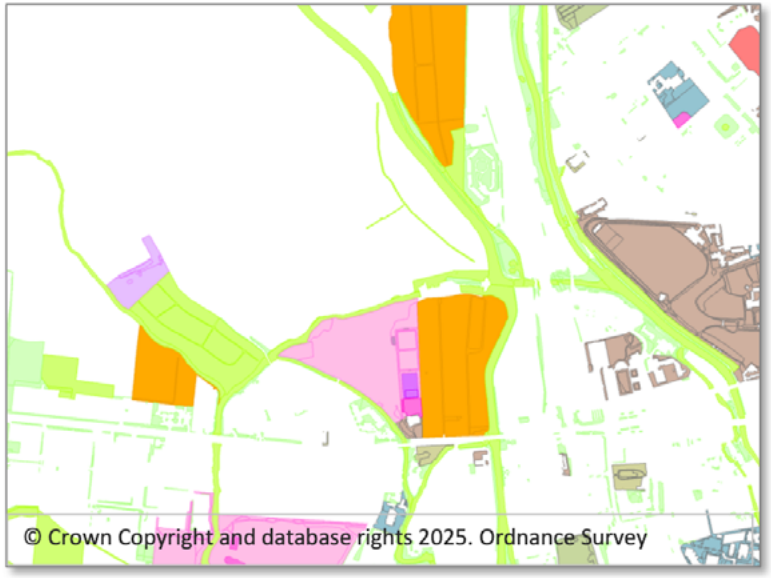

Figure 3. Extract from Ordnance Survey Green Space maps (for Oxford)

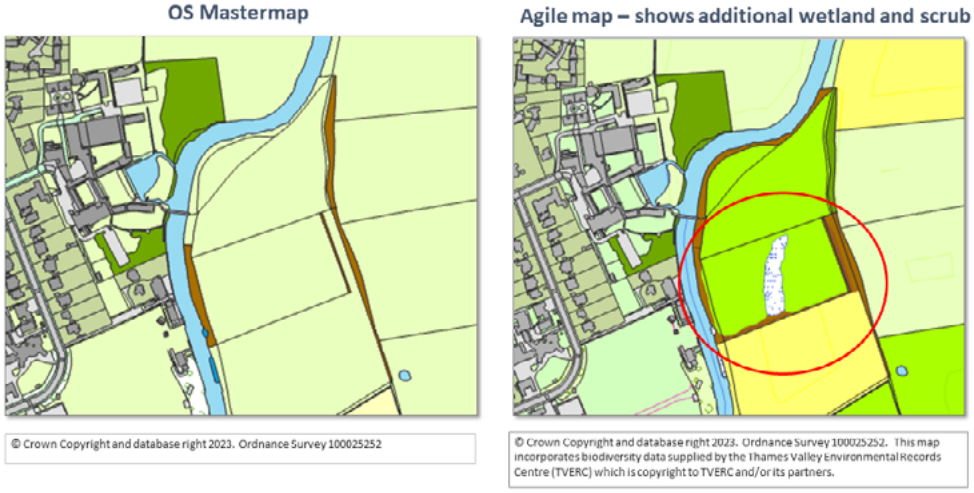

Figure 4. Agile map generation software merges messy datasets with non-matching boundaries, staying faithful to the original OS Mastermap boundaries but merging in new habitat patches where needed.

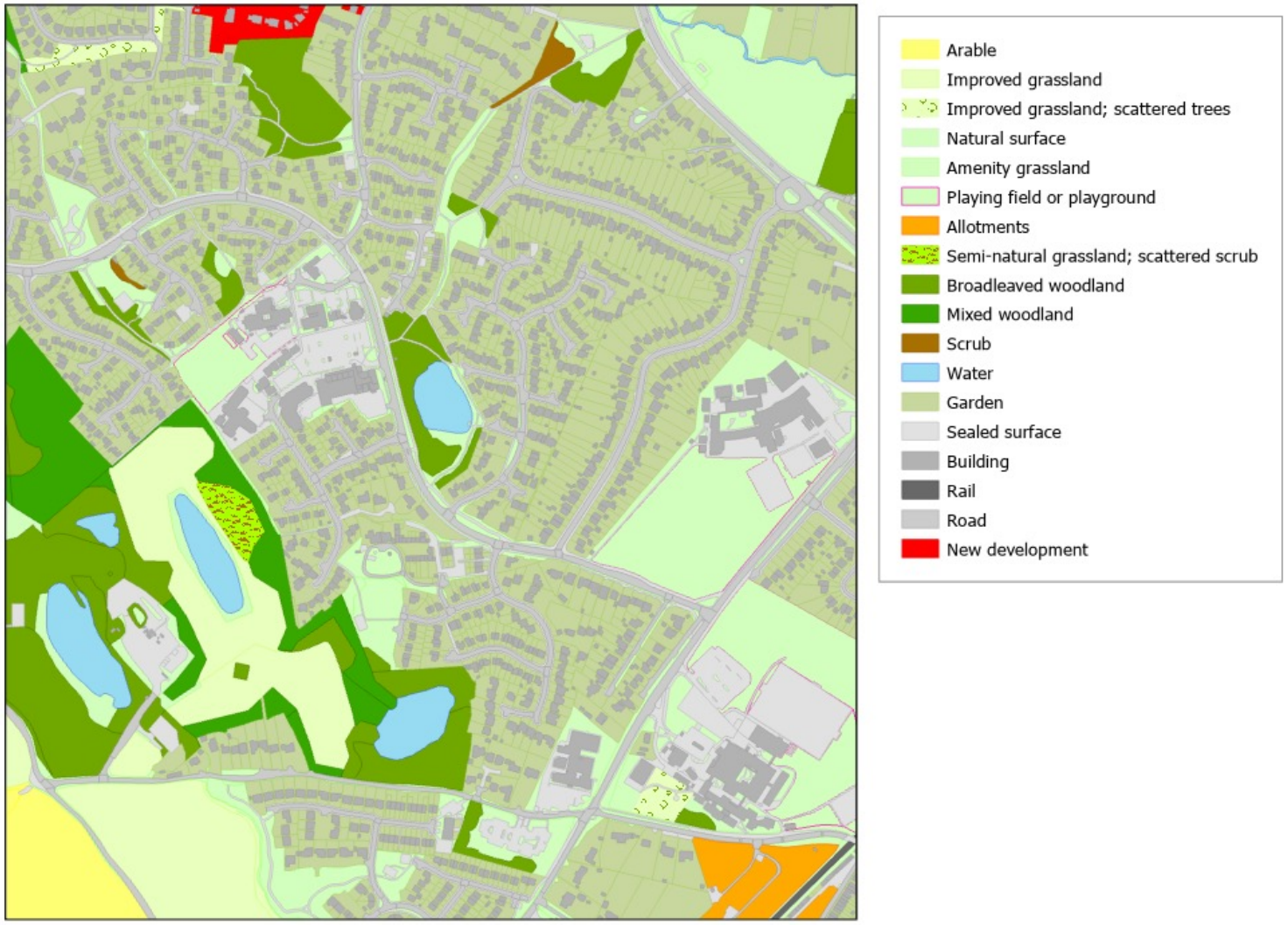

Figure 5. Extract from the Agile habitat baseline map for Shropshire showing complete and detailed coverage including greenspace

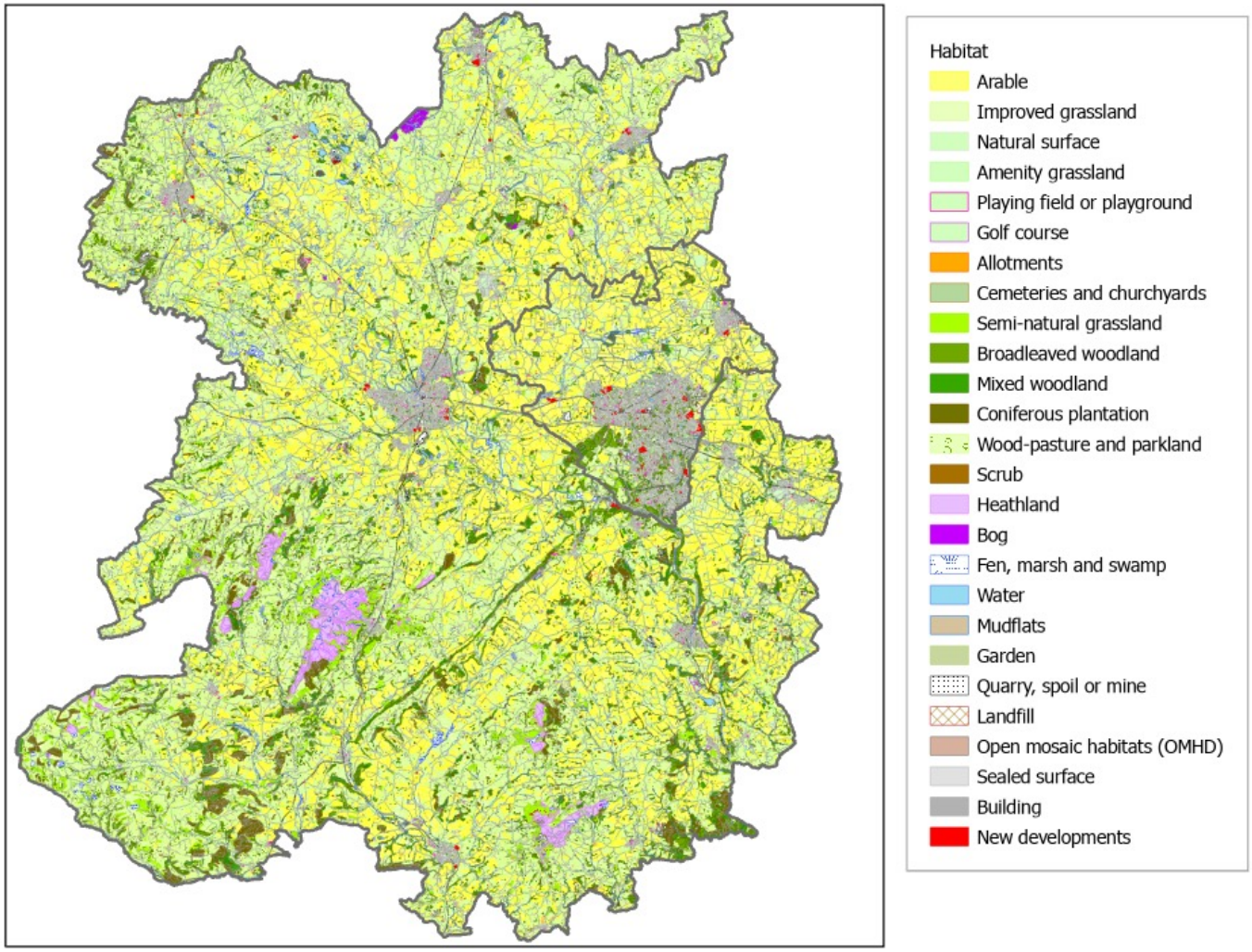

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Figure 6. The Agile habitat map for Shropshire, Telford and Wrekin

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3.2 Stage 2: Adding extra data to inform ecosystem service scores and nature recovery opportunities

In order to inform the ecosystem service scores and also the constraints for the opportunity mapping, the following additional datasets are then merged in to the habitat base map.

- Agricultural Land Class: used to assess the capability of the land to produce food and to inform selection of nature recovery and NbS opportunities that minimise trade-offs with food production (see Stage 3).
- Nature and cultural designations. We aim to incorporate all the relevant designations, e.g. National Nature Reserves, Local Nature Reserves, SSSIs, Scheduled Ancient Monuments, National Trust Land, Green Belt, National Landscapes (formerly AONBs), etc. Currently we use a standard list of around 20 designations, all freely available. Users can add local datasets, e.g. Local Wildlife Sites.
- Public accessibility information is incorporated in order to assess the capability of the land to provide opportunities for nature-based recreation. This is based on Countryside and Rights of Way open access land, assumptions about the accessibility of certain types of greenspace, plus 50 m buffers around public footpaths. There is also an option to incorporate additional footpath and open space accessibility data from Open Street Map: this was not done for Shropshire.

3.3 Stage 3: Estimating ecosystem service scores

We map the potential for each habitat to deliver benefits for people. This is done using a table of scores (from 0 to 10) that reflect the capability of each habitat to deliver each of 18 ecosystem services (Figure 7, Table 1). The matrix of scores is provided as a spreadsheet, for reference. The scores for some services are adjusted using multipliers to reflect Agricultural Land Class (for food production), designations (for cultural ecosystem services), and public accessibility (for recreation).

We can export a summary of the average scores per hectare for the area, and the area of high-scoring habitats. This information can also be used to explore the possible outcome of future interventions on ecosystem service delivery.

This section first describes the scores, then the multipliers, then presents important caveats to use when interpreting the ecosystem service maps.

Scores

The scores have been developed over several years of research and testing, drawing on the following sources (a publication describing the rationale underpinning the scores is in preparation):

- A literature review of 780 papers.[1]
  A comparison exercise with similar scoring systems and other evidence sources, as part of the development of Natural England's Environmental Benefits from Nature tool (EBNT), which can be used alongside the Biodiversity Metric for assessing the ecosystem service outcomes of land-use change.
- A series of expert review consultations as part of the EBNT project.

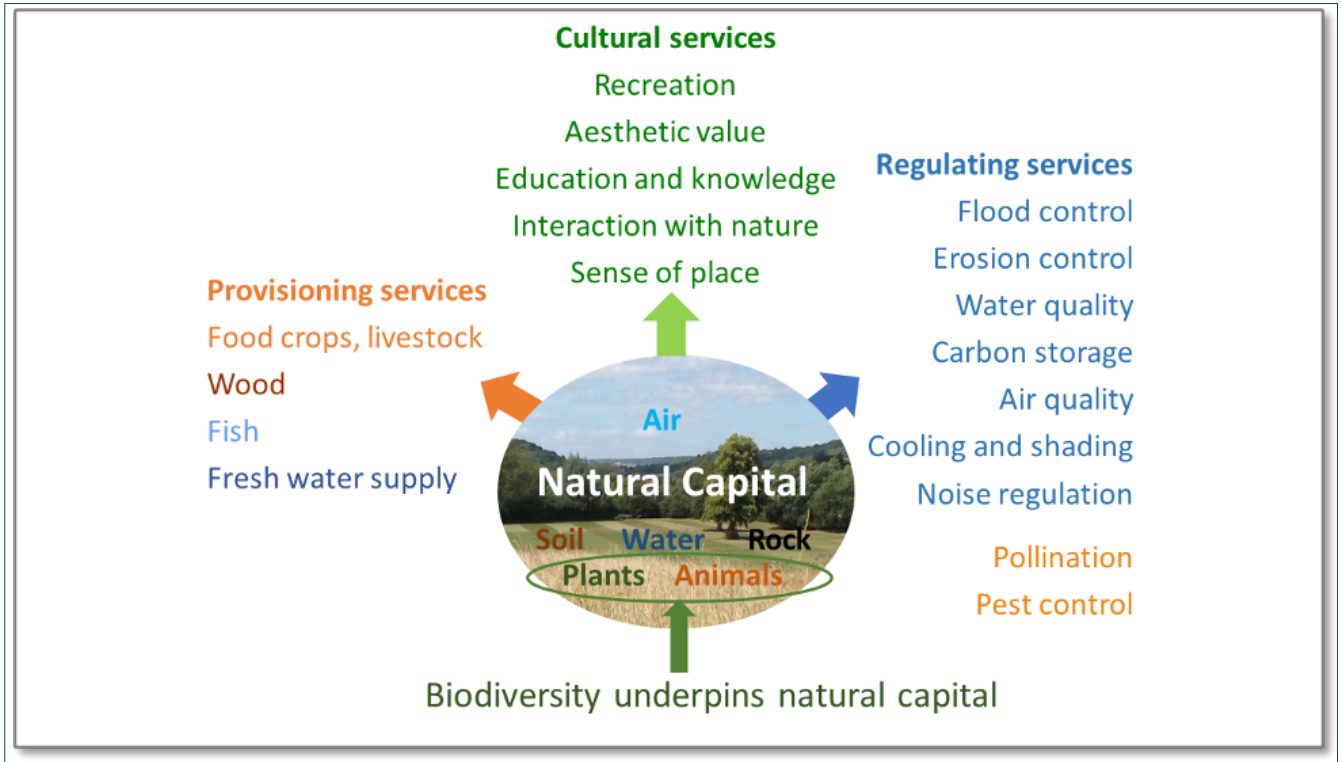

Figure 6. The Agile habitat map for Shropshire, Telford and Wrekin

Table 1. Definitions of each of the 18 ecosystem services

Provisioning	Food production	Arable crops, horticulture, livestock, orchards, allotments, urban food, wild food (e.g. gathering berries or mushrooms).
	Wood production	Timber, wood production for paper, woody biofuel crops, coppice wood or wood waste used for biofuel.
	Fish production	Aquaculture, commercial fishing, recreational fishing (recreational fishing is also a cultural service, but the habitat conditions match those for fish production).
	Water supply	Impact of soil and vegetation on rainwater runoff and infiltration, and thus on groundwater recharge or surface water flow.

Regulating	Flood protection	Reduction of surface runoff, peak flow, flood extent and flood depth through canopy interception, evapotranspiration, soil infiltration and physical slowing of water flow.
	Erosion protection	The ability of vegetation to stabilise soil against erosion and mass wastage by protecting the soil from the erosive power of rainfall and overland flow, trapping sediment, and binding soil particles together with roots.
	Water quality regulation	Direct uptake of pollutants by terrestrial or aquatic vegetation; interception of overland flow and trapping / filtration of pollutants and sediment by vegetation before it reaches watercourses; breakdown of pollutants into harmless forms e.g. by denitrifying bacteria that convert nitrates into nitrogen gas. Also infiltration into the ground, allowing pollutants to be filtered out by the soil and preventing pollution of watercourses – though pollutants could enter groundwater supplies.
	Carbon storage	Carbon stored in vegetation and soil. In the context of land use change (with complete loss of habitats and often major soil disturbance), this is more relevant than carbon sequestered annually. The 'time to reach target condition' reflects the time taken for a new habitat to reach a typical carbon sequestration rate for a mature habitat.
	Air quality regulation	Removal of air pollutants by deposition, absorption and/or breakdown by vegetation. Fine particles (PM2.5) are the most damaging type of pollution, but vegetation can also remove ozone and nitrogen oxides (by absorption into pores).
	Cooling and shading	Shade, shelter and cooling effect of vegetation and water, especially urban trees close to buildings, green roofs and green walls, which can reduce heating and cooling costs, or trees in urban parks which can provide shade on hot days.
	Noise reduction	Attenuation of noise by vegetation.
	Pollination	Pollination of crops (and wild plants, supporting other ES) by wild insects (mainly bees and hoverflies). Excludes pollination by managed honeybees.
	Pest control	Predation of crop or tree pests by invertebrates (e.g. beetles, spiders, wasps), birds and bats.

Cultural	Recreation and leisure	Provision of green and blue spaces that can be used for any leisure activity, e.g. walking, cycling, running, picnicking, camping, boating, playing or just relaxing.
	Aesthetic value	Provision of attractive views, beautiful surroundings, and pleasing, calming or inspiring sights, sounds and smells of nature.
	Education and knowledge	Opportunities for formal education (e.g. school trips), scientific research, local knowledge and informal learning (e.g. from information boards or experiences).
	Interaction with nature	Provision of opportunities for formal or informal nature-related activities, e.g. bird watching, botany, random encounters with wildlife, or feeling 'connected to nature'. There is some overlap with biodiversity, but access by people can have negative impacts on some wildlife habitats. Excludes recreational fishing; hunting / shooting (not covered); the intrinsic value of nature (covered by the biodiversity metric); existence value (from just knowing that nature exists).
	Sense of place	The aspects of a place that make it special and distinctive – this could include locally characteristic species, habitats, landscapes or features; places related to historic and cultural events, or places important to people for spiritual or emotional reasons.

Woodland habitats tend to have high scores for the regulating and cultural services, because trees are highly effective for storing carbon, intercepting rainwater and stabilising soil as well as being attractive locations for recreation. Semi-natural grasslands also score highly for cultural services but less for services such as carbon storage and flood protection. Farmland has a maximum score of 10 for food production, but tends to have low scores for most of the other services (with the exception of water provision via groundwater recharge). However certain elements of farmed landscapes (hedges, field margins, woodlands, paths) do have higher scores for regulating and/or cultural services. The matrix also includes scores for watercourses, wetlands and urban green infrastructure.

3.3.1 Multipliers

The scores for some services are adjusted using multipliers, as follows.

1. Agricultural Land Class (ALC): a multiplier based on ALC is applied to the Food production score, to reflect the fact that high grade land produces higher yields and is also more versatile (i.e. it can produce a range of crops, including horticulture). The multiplier ranges from 2.4 (Grade 1) down to 0.5 (Grade 5). After applying the multiplier, scores are re-normalised to the scale of 0-10. Grade 1 agricultural land (arable and improved grassland) thus scores 10, Grade 2 scores 7.6, Grade 3 scores 4.9, Grade 4 scores 3.5 and Grade 5 scores 2.1. The multipliers are roughly based on expected differences in productivity (in tonnes per hectare) between the different land classes, and a further arbitrary uplift to reflect the versatility of Grade 1 and 2 land.
2. Public accessibility is used to adjust the scores for recreation. For paths, the ecosystem service of recreation is delivered not from the path itself (which could be a sealed surface which scores zero) but from the way in which the path enables the user to experience a green space setting. We therefore assume that the service of recreation in green space is delivered by the area within a 50m buffer zone on each side of the path. Habitats within this 50m buffer receive a 'public access' multiplier of 0.75, reflecting that although they are not actually accessible to the path user, they contribute to the experience of recreation in green space. The accessibility multiplier is not currently applied for the services of education, aesthetic value or interaction with nature, where the application of the multiplier is less straightforward (e.g. some areas could be available for educational trips but not publicly accessible). The accessibility multiplier is arbitrary and is:

- 1 for open access
- 0.9 for schools, which are accessible only to pupils and only during school hours but are nevertheless very important for recreation
- 0.75 for the zone 50m each side of paths (see above)
- 0.75 for semi-restricted access (areas restricted to clubs or members, e.g. allotments, bowling greens, but where access is not expensive or exclusive)
- 0.5 for restricted access (e.g. golf courses, where membership is expensive)
- 0.25 for private gardens (very useful to owners but not anyone else).

3. Nature and cultural designations.

- There is an arbitrary multiplier of 1.1 for the service of aesthetic value for areas within AONBs.
- There is an arbitrary multiplier based on the number of nature and/or cultural designations for each site for the services of education (nature and certain cultural designations), interaction with nature (nature designations only) and sense of place (nature or cultural designations). The multiplier is 1.1 for one designation, 1.15 for two and 1.2 for three or more.

3.3.2 Ecosystem service maps

With scores for 18 different ecosystem services, it can be difficult to get an overview of where the land delivers benefits to people. Adding scores for different services together is best avoided, because this is not comparing like with like. The scores are simply rankings of the capacity of different habitats to deliver each service on a scale of 0 to 10. A score of 10 for recreation means that we think that land parcel delivers the maximum possible level of service for recreation (in terms of habitat type and accessibility), but that does not make it equivalent to a score of 10 for carbon storage or food production because the scores are not in common physical or monetary units. However, to help identify the important natural assets in the area, we show the maximum score out of all the regulating and cultural services. Polygons with high maximum scores are known to have a high value for delivering at least one regulating or cultural service. This is intended to be displayed together with a separate overlying layer showing high-scoring areas for food production (i.e. Grade 1 and 2 arable and improved grassland). Areas with high scores for food production have low scores for most of the regulating and cultural services. Following feedback from users, we display these areas in a different colour (orange) to distinguish them from the areas with high scores for other services (green) (Figure 8).

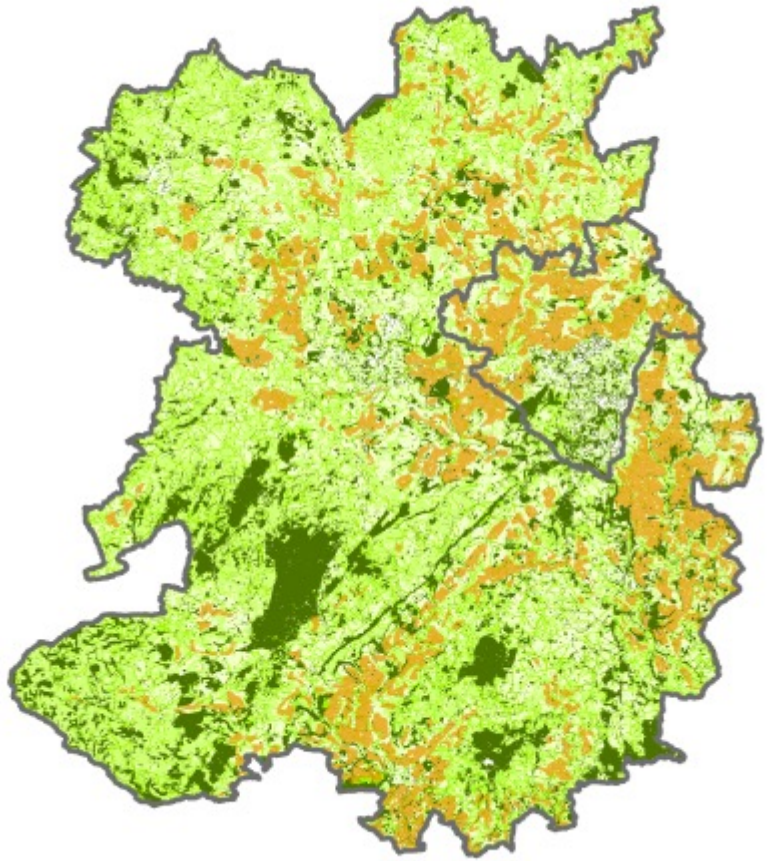

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Figure 8: Maximum score for cultural and regulating services (green) or food provision (orange)

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3.3.3 Caveats for the ecosystem service maps

Please be aware of the following caveats when interpreting the ecosystem service scores.

- As the scores are based on habitat type, all habitats of the same type will have the same score, unless one of the multipliers has been applied.
- The scores reflect only potential supply of services, not demand or actual flow of services.
- Scores for most of the ecosystem services are indicative rankings of different habitats based on best available evidence. The exceptions are carbon storage and air quality regulation, where the scores are directly proportional to biophysical evidence (carbon stored in soils and vegetation[2], and estimates of the health benefits of air pollution removal by vegetation in the UK Natural Capital Accounts[3]). Scores for cultural services such as aesthetic value are subjective, as they are dependent on personal views. However, the scores are about as robust as this type of scoring system can be.
- The service of fish provision is delivered by rivers and lakes. These score 10, but the scores should be adjusted according to the ecological quality of the waterbody. This can be done using the Water Framework Directive status provided by the Environment Agency, but this is not currently automatically integrated into the maps.
- Hedgerows and individual trees are also very important for delivering ecosystem services. Where available, maps of these landscape features can be displayed as an extra layer on top of the habitat-based maps.
- Note that although these maximum scores are a useful way of synthesising the scores from multiple services, they do not reflect the multi-functionality of habitats. Thus a habitat with a high score for just one service will appear in the same shade of green as a habitat that delivers high levels of multiple services. We are interested in feedback on different methods of displaying the results.

3.3.4 Carbon storage and sequestration maps

- To complement the scores, we provide estimates of carbon storage in tonnes per hectare (Figure 9) and carbon sequestration in tonnes per hectare per year (Figure 10), based on literature evidence from Natural England[4], and other sources.[2]

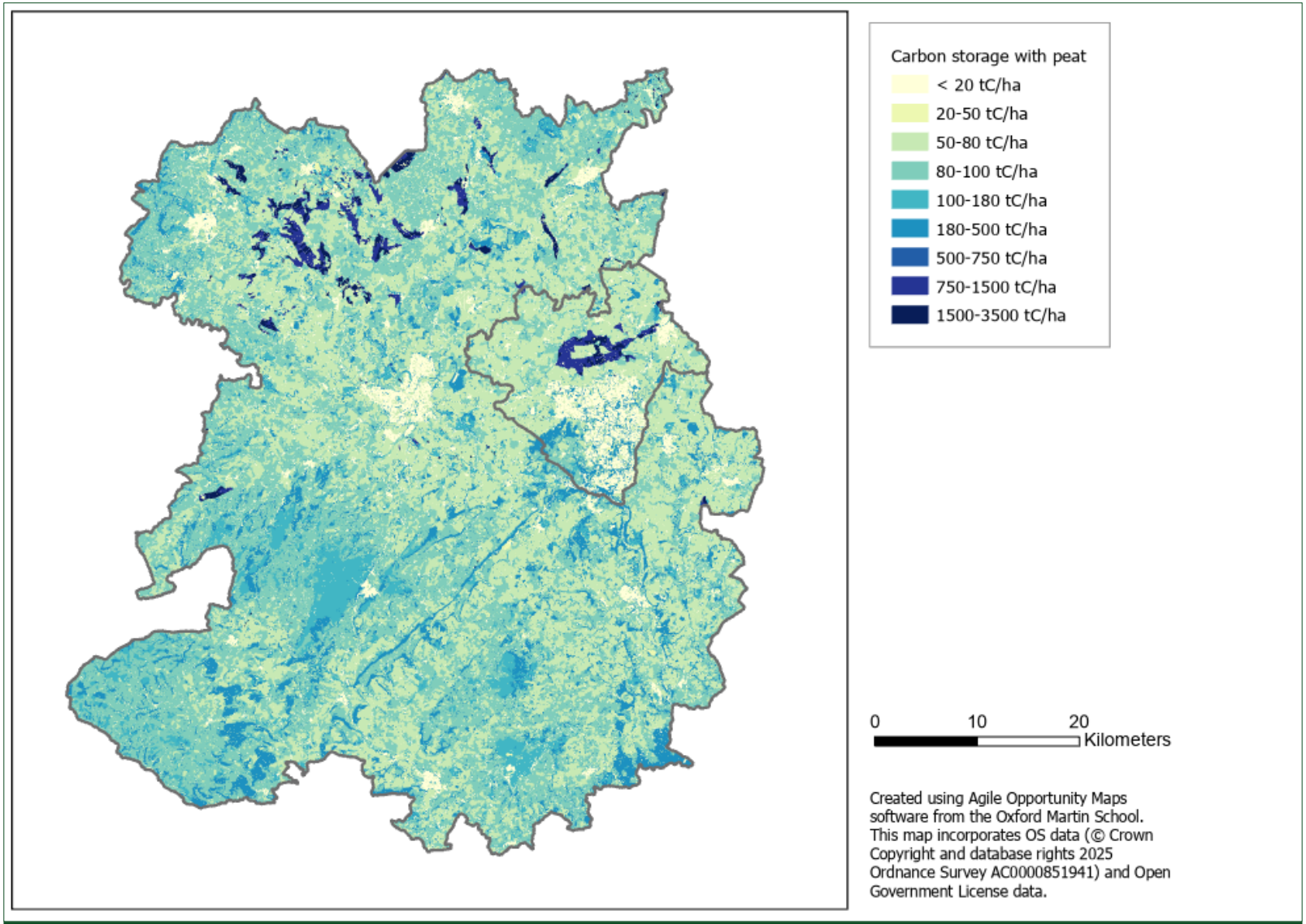

Figure 9. Carbon storage map of Shropshire, Telford and Wrekin

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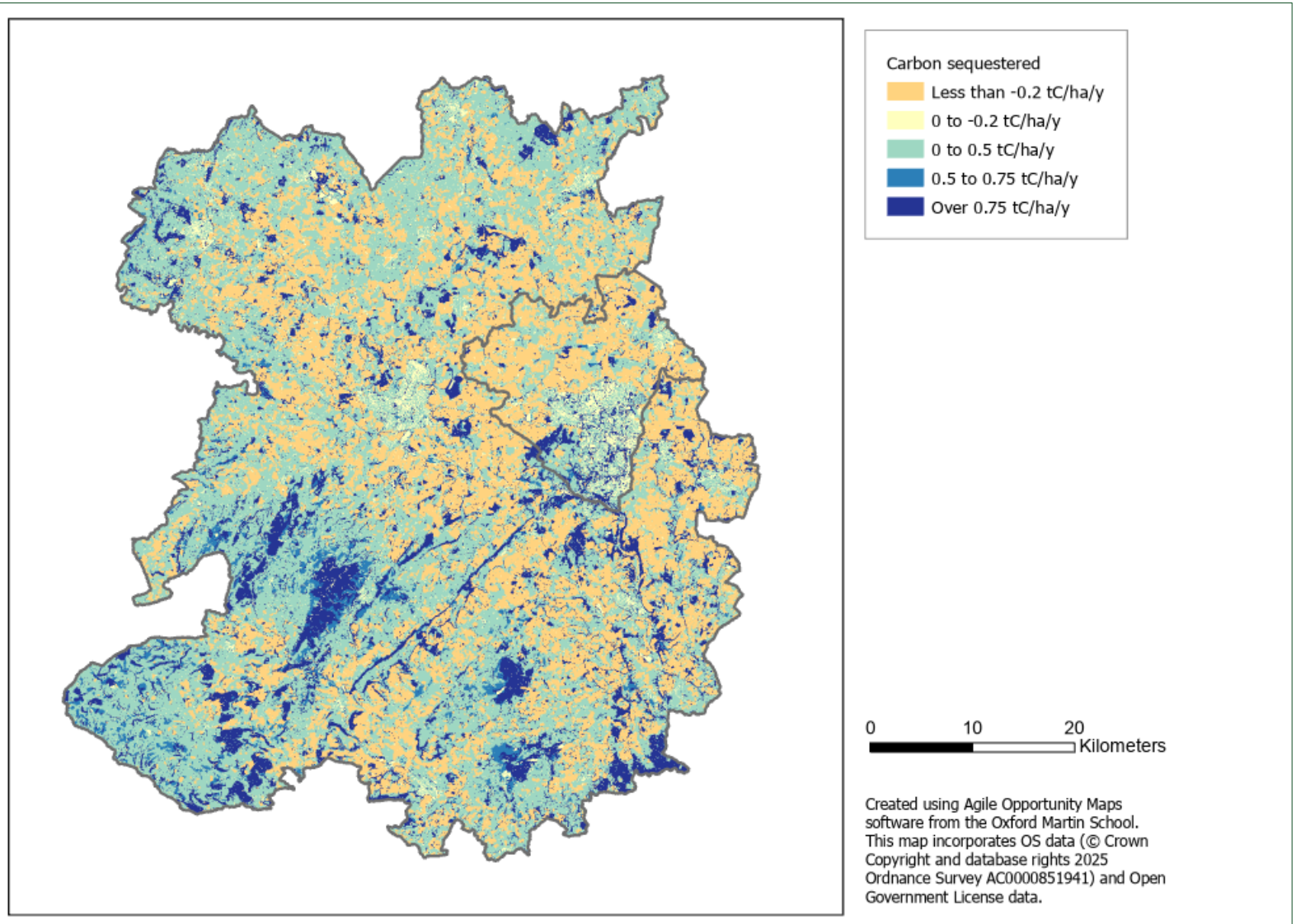

Figure 10. Carbon sequestration map of Shropshire and Telford & Wrekin

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3.4 Stage 4: Identifying nature recovery and NbS opportunities

Opportunities for nature recovery and NbS have been identified using the constraints shown in Table 2. The general ecological rules used to identify opportunities were initially developed in partnership with the Oxfordshire Treescapes Project, and have been expanded to include a wider range of habitats, as described below.

1. Target low-biodiversity habitats (arable land, improved grassland, poor quality semi-improved grassland, felled woodland, bracken), thus avoiding conversion of semi-natural habitats to other habitats. The exception is degraded deep peat, which is prioritised for restoration regardless of habitat type (except for manmade surfaces or gardens) unless the Natural England peat status dataset records the presence of valuable semi-natural habitats or native woodland. Note that some areas mapped as 'Wood-pasture and parkland' are actually mainly improved grassland, possibly with a few trees – this is a known issue due to the Natural England dataset mapping entire parkland areas regardless of detailed habitat type within the estate boundaries. We therefore allow semi-natural grassland restoration on areas of 'Wood-pasture and parkland' which the CROME crop map identifies as improved grassland.

2. Avoid the conversion of high-grade farmland (ALC grade 1 or 2) to other habitats. The exceptions are for peatland and wetland, where food production produces high carbon and biodiversity impacts and so restoration takes priority, and for agroforestry or restoration of improved grassland to semi-natural grassland, where food production can still continue. This rule is intended to minimise displacement of food production and associated impacts to other regions, as high-grade land can produce twice as much food as low-grade land. However, it does have complex implications and trade-offs that we intend to discuss further with stakeholders, especially for restoration of chalk grassland which is largely confined to Grade 2 land in certain regions, and for production of horticulture on fen peat, which has implications for food security and local economies.

3. Avoid conversion of peat to other habitats except for degraded shallow peat or peaty pockets, which might be suitable for restoration to wetland, heathland or semi-natural grassland (or mosaics) if it cannot be restored to peat bog. Tree planting is a particular risk on peat (even on shallow peat), because it results in loss of soil carbon that can outweigh the carbon sequestered by the trees.[5]

4. Wetland and pond creation opportunities are currently restricted to the flood zone (1 in 100 year risk of flooding; Environment Agency flood zone 2). We are also working on a method of identifying non-flood zone sites for wetland creation using the Topographic Wetness Index.

5. Woodland, grassland, heathland and wetland opportunities are zoned depending on distance from core habitat patches (200m, 500m, 1km, or over 1km but within the Natural England Nature recovery network for that habitat). This is based on the approach pioneered by Gloucestershire Wildlife Trust for the Gloucestershire Local Nature Partnership nature recovery network maps. The core patches are above a size limit: 1000 m^2 for woodland, 500 m^2 for grassland and heathland, and 100 m^2 for wetland. For woodland, grassland and wetland they are restricted to areas identified as priority habitat (excluding areas identified only as 'floodplain grazing

marsh' in the Priority Habitat Inventory, which can include improved grassland on the floodplain). A fifth zone identifies areas outside these networks where there are no constraints on habitat creation; these areas can be suitable for creation of stepping stone habitats in network gaps. The maps include entire fields in each zone, even if only part of the field is within the distance limit; the rationale is that most interventions will target a whole field. However, this could be changed in response to user feedback.

6. We map separate networks for calcareous, neutral, or lowland acid grassland, with calcareous grassland restricted to calcareous soils, and lowland acid grassland restricted to the Natural England lowland acid grassland recovery network (as the soil type is difficult to predict). We use the freely available British Geological Survey Soil Parent Material Model at 1km resolution to identify calcareous soils, though there is also a facility to use Soilscapes or the National Soil Map for a more accurate result if a license has been purchased from Cranfield University. We also map a 'combined grassland network' that includes all these types as well as less specific core grassland areas such as 'good quality semi-improved grassland'.

7. Agroforestry is considered to be suitable even for high grade farmland, as evidence suggests it can make food production more resilient (there might be a small yield loss in the short term for silvoarable, but evidence suggests no loss or even a gain for silvopasture due to increased animal welfare). However, we avoid suggesting conversion of existing pasture to silvoarable, as that would involve loss of stored soil carbon and biodiversity. We also do not suggest conversion of high-grade arable land to silvopasture, on the grounds that it is more appropriate to continue plant-based food production on high grade land. An exception could be if the area is at high risk of erosion (though this is not yet implemented).

8. Community orchards follow the same rules as woodland opportunities but are also restricted to within 500m of urban areas (identified using Ordnance Survey Zoomstack urban areas).

9. Erosion prevention opportunities are identified on steep slopes (over 7 degrees), with a higher priority if the area also has highly erodible soils. Note that freely available soil erodibility datasets have low accuracy, so the slope is the main indicator. The default option is the British Geological Survey Soil Parent Material Model dataset at 1km^2 resolution, but Shropshire Council purchased the National Soil Map from Cranfield University, which can give a much better indication of erodibility.

10. Natural flood management using woodland is targeted using the Wider Catchment Woodland dataset from the Environment Agency. This indicates areas where soils have restricted drainage, where woodland creation can help to improve soil infiltration and thus reduce flooding.

Table 2. Constraints used to identify opportunities for nature recovery and NbS

	Arable	Improved grassland	Amenity grassland	Poor semi-improved grassland	Bracken	Felled woodland	Semi-natural habitats	Deep Peat	Shallow peat and peaty pockets	Verges	ALC 1 or 2	Flood zone
Woodland	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**n**	**n**	**n**	**n**	**y**
Grassland	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**n**	**y**	**y**	**If improved grass**	**y**
Heathland	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**n**	**y**	**n**	**n**	**y**
Wetland	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**n**	**y**	**n**	**if peat**	**essential**
Peatland	**y**	**y**	**y**	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**y**	**y**
Silvoarable	**y**	**n**	**n**	**n**	**n**	**n**	**n**	**n**	**n**	**n**	**y**	**y**
Silvopasture	**unless ALC 1 or 2**	**y**	**n**	**n**	**n**	**n**	**n**	**n**	**n**	**n**	**y**	**y**
Community orchard	**y**	**y**	**y**	**y**	**y**	**y**	**n**	**n**	**n**	**n**	**n**	**y**

An example of an opportunity map for restoring calcareous grassland is shown in Figure 11. We map zones according to the distance from core habitat in shades of blue. The 'extension zone' in pale blue is areas that are not within 1km of core habitat patches but which are located within Natural England's habitat network (shown as a blue hatching overlay). This provides links between habitat patches that are close together. The cream colour is areas that are not in a network but for which there are no constraints. These could be opportunities to create stepping stones. For designated areas, restoration may or may not be appropriate and additional consultation is necessary with the relevant site managers and local ecological experts. We therefore map designated areas in shades of purple rather than shades of blue, to distinguish them.

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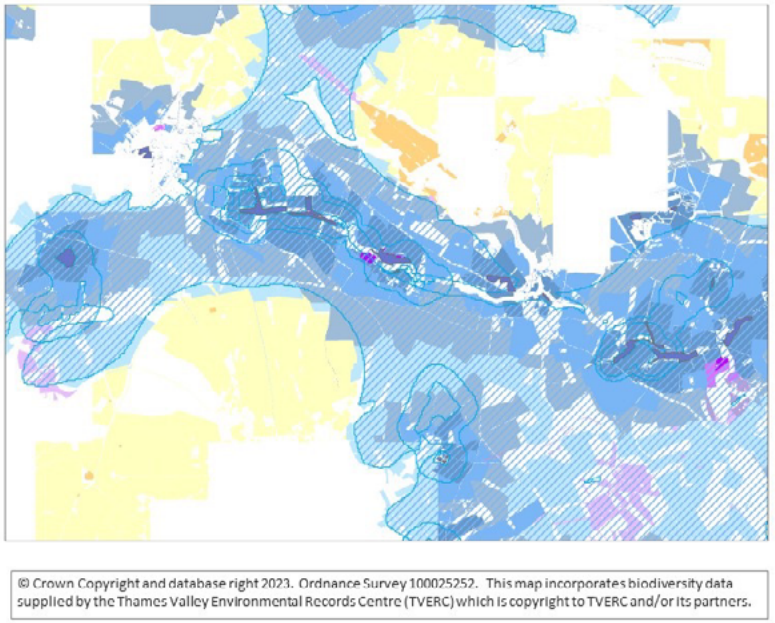


Figure 11. Example of part of a calcareous grassland opportunity network, with designated sites distinguished by using purple shades

These network maps tend to identify more opportunities for habitats that are more common, such as woodland. To address this, we created a more refined woodland network map that was more restricted in extent and prioritised connecting existing woodland patches. This was done using a buffer / reverse buffer approach, similar to the method Natural England used to create their maps.

3.4.1 Prioritising The Opportunities

Our priority maps indicate which might be the highest priority opportunities in a given location. These rules are still developing and we are seeking to refine them as feedback emerges. It is important to emphasise again that detailed ground-truthing and consultation with stakeholders and local experts is essential before any interventions are implemented on the ground: the Agile maps should only be used to indicate which options might be best suited to certain locations. See the Ground Truthing Guidance for more details.

Peat restoration is always prioritised on deep peat, due to the urgent need to cut the exceptionally high level of emissions from degraded peat. **Wetlands** are currently prioritised on floodplains, although we emphasise here that these should be part of a mosaic of **floodplain meadows, ponds,** and small patches of **wet woodland**. More detailed 'Stage zero' modelling of floodplain restoration potential (i.e. modelling the potential to restore the floodplain to its original state prior to human intervention), using higher resolution height data (1m or 2m rather than the 5m LIDAR used here) can identify which parts of the floodplain are slightly higher or lower.[6] This can then be used to target wetland creation in the lower areas, wet woodland on the slightly drier areas, and meadows in the areas in-between (as floodplain meadows do not benefit from prolonged inundation).

For woodland, grassland and heathland, the habitat closest to a patch of the same habitat is prioritised. However, this approach has drawbacks as it ignores opportunities to create 'stepping stones' in areas currently deprived of existing habitat.

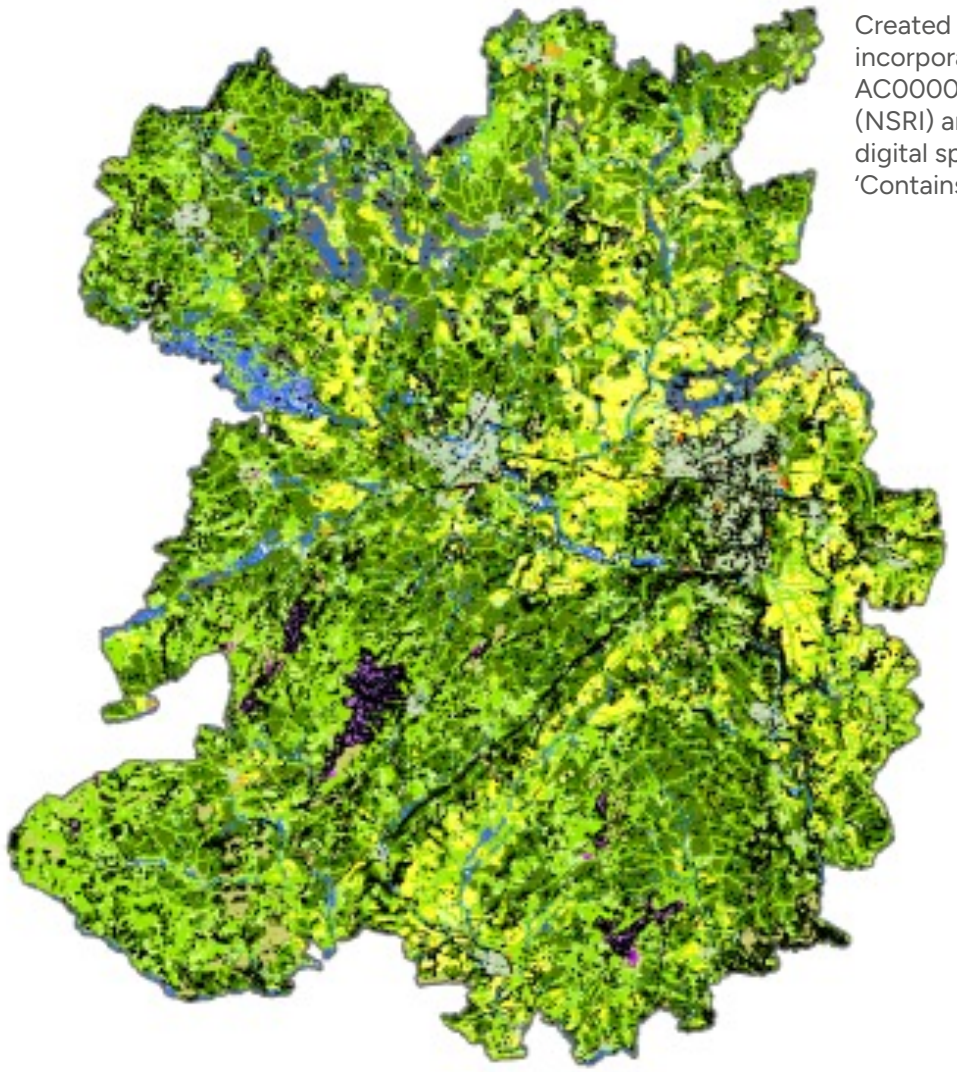
For many areas, two or more options are equally suitable and we record a list of all

the equally suitable options. We always note opportunities for agroforesty or community orchards, though these occur further down the list than the opportunities for semi-natural habitat restoration.

Following the approach pioneered by the Gloucestershire Local Nature Partnership, for areas where more than one habitat is equally suitable, we suggest that one option is to aim to create mosaic or intermediate habitats that could be used by species from each habitat as a corridor between patches of their core habitat. For example, where grassland and woodland are equally suitable, options could include wood-pasture and parkland with scattered trees, scrub, silvopasture or orchards. This is reflected on the map by showing the symbol for grassland with scattered trees. For areas where heathland and woodland and/or agroforestry are equally suitable, the map shows the symbol for heathland with scattered trees.

Often three, four or even five options might all be suitable. We do not attempt to show all these via the map symbology, but clicking on a polygon will reveal the full list of priority options. However, in some cases it might be more appropriate to prioritise a specific habitat that is particularly at risk, or supports rare and threatened species, rather than simply the one that is closest to existing core habitat patches. For example, in some areas, semi-natural grassland and lowland heathland are more scarce than native woodland.

The priority opportunities map for Shropshire and Telford & Wrekin is shown in Figure 12. The map includes areas of existing habitats (with dark outlines), existing other land use such as built-up areas (shades of pale grey and green) and the nature recovery opportunities. Although the map covers the whole county, this does not imply that all the opportunity areas should be targeted for intervention, as that would leave no space for food production! It simply suggests the highest priority opportunities in any one area. The aim is that this map can be used to support a process of participatory stakeholder engagement, to take account of local priorities and the need for nature-based solutions to tackle local problems.



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- Grass
- Natural regeneration
- Wood
- Grass-tree-scrub mosaic
- Grass-scrub mosaic
- Heath
- Grass, Heath
- Heath, Wood
- Peat
- Wetland
- Wetland, Grass
- Wetland, Heath
- Silvopasture
- Silvoarable
- Orchard
- Hedgerow / field margin opportunity
- Undecided
- Water

- Existing habitat: Bog
- Existing habitat: Heathland
- Existing habitat: Heath/grass mosaic
- Existing habitat: Semi-natural grassland
- Existing habitat: Broadleaved woodland
- Existing habitat: Mixed woodland
- Existing habitat: Wood-pasture and parkland
- Existing habitat: Scattered trees
- Existing habitat: Orchards
- Existing habitat: Scrub
- Existing habitat: Open mosaic habitats (OMHD)
- Existing habitat: Fen, marsh and swamp
- Existing habitat: Rock, scree and boulders
- Existing habitat: Mudflats
- Existing habitat: Sand or shingle
- Existing habitat: hedgerow

- Existing land use: Coniferous plantation
- Existing land use: Building
- Existing land use: Sealed surface
- Existing land use: Landfill
- Existing land use: Quarry, spoil or mine
- Existing land use: Garden
- Existing land use: Allotments
- Existing land use: Playing field or playground
- Existing land use: Cemeteries and churchyards
- Existing land use: Golf course
- Existing land use: Fountain
- Existing land use: Swimming pool
- Existing land use: Unknown

Figure 12. Nature recovery opportunities map for Shropshire and Telford & Wrekin

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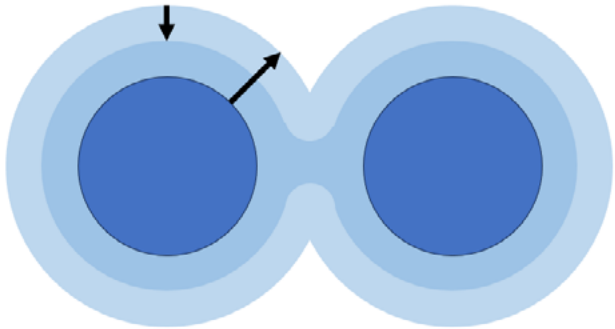
3.5 Stage 4a: Creating LNRS networks

For this research partnership we worked together to create a system for generating an LNRS priority map (known in Shropshire as the Zone 2 Opportunity network) by combining multiple priority areas such as nature reserves and priority habitats into a reasonably well-connected network. This was done partly by using linear features such as river valleys and greenways as connecting features, and partly using a system of buffering that helped to link the priority features together. We developed new software to automate this system, which will be released for wider use following further testing and refinement.

The buffering system was inspired by the method used by Natural England to create their National Habitat Networks (see blue hatching on Figure 11). To mimic this, we applied positive buffers to certain priority network elements (such as important designated sites) followed by reverse (negative) buffers. This has the effect of 'gluing together' any sites which are closer than the positive buffer distance, but removing any parts of the buffer that do not form a link between nearby sites (see schematic in Figure 13, top). It therefore helps to create a more connected network without using up too much land in the buffer zones. The reverse buffer step tends to create characteristic rounded edges and sometimes 'holes' in the network (Figure 13, bottom). This happens when the initial buffer leaves a small gap and the reverse buffer then expands the gap to a rounded hole. These gaps could be filled in, but this was not done because it would make the network too big (in terms of the % of the county covered).



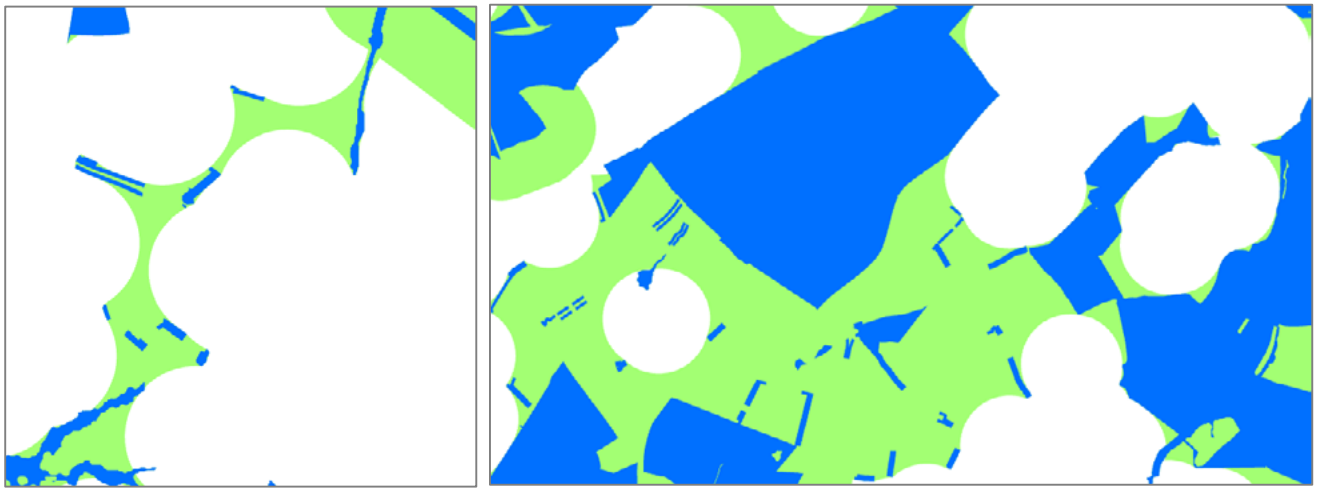


Figure 13.
Top: Schematic diagram of reverse buffer process. Using a positive buffer (outer pale blue zone, long arrow) followed by a smaller negative buffer (short arrow) to link nearby sites (dark blue circles) into a connected network (the middle blue zone shows the final buffer zone).

Bottom: Extracts from the map, showing how the buffer (green) links together the network components (blue) while the reverse buffer process also creates characteristic concave rounded edges and sometimes holes.

Following a period of co-design during which different combinations of network elements, buffer distances and constraints were trialled, the final list of elements included with the total area of each component and the buffer distances applied is shown in Table 3.

Constraints were excluded from this priority network:

- High grade agricultural land (Grade 1 and 2) unless:
  - It is (or has recently been) under a Countryside Stewardship, Higher Level Environmental Stewardship or Organic scheme
  - It is on peat soil (in which case it will be prioritised for peatland restoration)
  - It is on a slope over 7 degrees (in which case it will be prioritised as an erosion reduction opportunity)
  - It is on the floodplain (this was requested by local stakeholders who felt there were valuable nature recovery opportunities on high grade floodplain land)
- Sealed surfaces, buildings, roads, rail, gardens, allotments, development sites, and active quarries or landfill sites

Water has not been removed as it has existing biodiversity value and can also be restored. Neither have coniferous plantations, golf courses or playing fields.

Table 3: Priority network component areas (after constraints have been removed), percentages of the total network area and county area, buffer distances applied, and buffer link extensions (polygons closer together than this will be joined with a link).

Priority network component	ha	% of network	% of county	Unique % of county[1]	Buffer	Buffer link extension
SAC	926	0%	0.3%	0.0%	200	600
Ramsar	561	0%	0.2%	0.0%	200	600
NNR	1,421	1%	0.4%	0.0%	200	600
LNR	866	0%	0.2%	0.0%	100	400
SSSI	7,325	4%	2.1%	0.0%	200	0
Ancient woodland	9,100	5%	2.6%	0.0%	200	600
National Trust	2,985	2%	0.9%	0.0%	0	0
Historic park or garden	3,812	2%	1.1%	0.0%	0	0
Scheduled monument	113	0%	0.0%	0.0%	0	0
LWS	17,992	10%	5.2%	0.4%	100	400
Local geological site	2,045	1%	0.6%	0.0%	0	0
Priority habitats	35,001	19%	10.0%	1.5%	0	0
Ancient trees	15	0%	0.0%	0.0%	5	40
HLC_targets	47,731	25%	13.7%	1.2%	0	0
Habitat bank	45	0%	0.0%	0.0%	0	0
Flood zone2	19,557	10%	5.6%	1.0%	0	0
OS open rivers	7,992	4%	2.3%	0.1%	20	0

Table continued on next page

Notes for Table 3

1. Unique % of county is the percentage of Shropshire and Telford & Wrekin that is only covered by that component of the network, with no overlapping components.
2. The SSSI buffer is included as a separate row, not within the other buffers. 'Other buffers' is the sum of the areas of all the individual buffers (except for the SSSI buffer) that don't overlap with any individual network components.
3. 'Overall network buffer' is a final 100m buffer and reverse buffer that was applied to most of the network, to help improve connectivity. To keep the network within the target size, the following components were excluded from this step: Ffridd, Woodland priority network, Non-priority woodland and RoFSW.

The final network map occupies 54% of the county, of which 8% is existing Areas of Particular Importance for Biodiversity (APIBs), and 14% is existing APIBs plus existing priority habitats. Figure 14 shows the network, identifying the existing APIBs and priority habitats that need to be protected, nature recovery opportunity areas, high grade farmland where there could be agroecology options, and areas where opportunities may be constrained by the existing land use (e.g. coniferous plantations, golf courses, playing fields). Figure 15 also shows the network, this time identifying the individual network components (where components overlap, only one is shown). The final dataset was intersected with waterbody catchments, for information only.

Table 3 continued

Priority network component	ha	% of network	% of county	Unique % of county[1]	Buffer	Buffer link extension
Surface water flood risk	14,997	8%	4.3%	1.1%	0	0
Canals	200	0%	0.1%	0.0%	10	0
Wide hedges over 2 m tall	873	0%	0.3%	0.2%	0	0
Field margin / hedgerow opportunities	11,790	6%	3.4%	0.1%	0	0
National Trails	160	0%	0.0%	0.0%	20	0
Sustrans Greenways	55	0%	0.0%	0.0%	10	0
Peat opportunity	16,630	9%	4.8%	1.3%	100	0
Erosion opportunity	12,588	7%	3.6%	1.3%	0	0
Countryside Stewardship	39,425	21%	11.3%	5.3%	0	0
ES HLS or organic stewardship	682	0%	0.2%	0.1%	0	0
Cemeteries and churchyards	164	0%	0.0%	0.0%	0	0
Fridd opportunities	24,726	13%	7.1%	1.0%	0	0
Woodland priority network	29,119	15%	8.4%	0.2%	0	0
Non-priority broadleaved & mixed woodland	10,101	5%	2.9%	1.1%	0	0
SSSI 200m buffer[2]	9,376	5%	2.7%	0.4%	200	0
Other buffers[2]	12,174	6%	3.5%	3.5%	Various2	Various2
Overall network buffer[3]	22,015	12%	6.3%	6.2%	0	200
Whole network (without overlaps)	188,679	100%	54%	NA	NA	NA

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3.5.1 Notes on specific network elements

Countryside Stewardship (CS), Environmental Stewardship Higher Level Stewardship (HLS) and Organic farms. This uses government datasets to identify all areas under HLS or organic farming, plus fields where specific CS options have been applied (see Table 4) chosen to represent 'permanent' nature recovery actions (hedges, woodland, priority habitat restoration). This is intended to recognise areas where landowners / managers have already been taking action for nature and also be indicative of a willingness to do more. The areas covered were trimmed to exact field boundaries (rather than entire landholdings) by selecting the OS Mastermap field polygons that included the option points, using a spatial join.

Historic Landscape Character (HLC) targets. The HLC dataset was provided by Shropshire Council and aims to indicate past land use. It was used to identify areas where it might be relatively easy to restore areas back to a recent habitat. Specific types of HLC were selected as follows.

HLC_name IN ('Broadleaved ancient woodland', 'Broadleaved woodland with sinuous boundaries', 'Disused lead/ copper mine', 'Disused stone quarry', 'Drained wetlands', 'Heathland', 'Large assarts with sinuous boundaries', 'Late clearance/ assarts', 'Miscellaneous floodplain fields', 'Mixed ancient woodland', 'Moorland', 'Moss/ raised bog', 'Other commons', 'Parks and gardens', 'Pre-1880s orchard', 'Post-1880s orchard', 'Replanted ancient woodland', 'Small assarts', 'Unimproved enclosed hill pasture', 'Unimproved open hill pasture').

Table 4. Countryside stewardship options selected for inclusion in the priority network

Countryside Stewardship options included
BE3 - Management of hedgerows
BE4 - Management of traditional orchards
BE5 - Creation of traditional orchards
BN11 - Planting new hedges
BN5 - Hedgerow laying
BN6 - Hedgerow Coppicing
BN7 - Hedgerow Gapping
FM2 - Major preparatory work for Priority Habitats (creation and restoration) and Priority Species
GS10 - Management of wet grassland for wintering waders and wildfowl
GS13 - Management of grassland for target features
GS14 - Creation of grassland for target features
GS2 - Permanent grassland with very low inputs (outside SDAs)
GS5 - Permanent grassland with very low inputs in SDA
GS6 - Management of species-rich grassland
GS7 - Restoration towards species-rich grassland
GS8 - Creation of species-rich grassland
GS9 - Management of wet grassland for breeding waders
HS2 - Take historic and archaeological features currently on cultivated land out of cultivation.
LH1 - Management of lowland heathland
LH2 - Restoration of forestry and woodland to lowland heathland
LH3 - Creation of heathland from arable or improved grassland
PA3 - Woodland Management plan/per ha

Countryside Stewardship options included
SW7 - Arable reversion to grassland with low fertiliser inputs
TE1 - Planting Standard Hedgerow Tree
TE10 - Coppicing Bank-side Trees
TE2 - Planting Standard Parkland Tree
TE3 - Planting Fruit Trees
TE4A - Woodland Tree Planting - Biodiversity
TE4B - Woodland Tree Planting - Improving water quality or reducing flood risk
TE4C - Woodland Tree Planting - Restock after a tree health issue
TE4D - Woodland Tree Planting - Hedges and clumps
UP1 - Enclosed rough grazing
UP2 - Management of rough grazing for birds
UP3 - Management of Moorland
WD1 - Woodland creation - maintenance payments
WD10 - Management of upland wood pasture and parkland
WD11 - Restoration of upland wood pasture and parkland
WD12 - Creation of upland wood pasture
WD2 - Woodland improvement
WD4 - Management of wood pasture and parkland
WD5 - Restoration of wood pasture and parkland
WD6 - Creation of wood pasture
WD7 - Management of successional areas and scrub
WD9 - Livestock exclusion supplement - scrub and successional areas
WN2 - Creation of scrapes and gutters
WN5A - Pond Management - creation (first 100 sq m)

Countryside Stewardship options included
WN5B - Pond Management - restoration - first 100 sq m
WN6A - Pond Management - creation - (areas more than 100 sq m)
WN6B - Pond Management - restoration - (areas more than 100 sq m)
WT1 - Buffering in field ponds and ditches in improved grassland
WT10 - Management of lowland raised bog
WT5 - Management of ponds of High Wildlife value (more than 100 sq m)
WT8 - Management of fen
WT9 - Creation of fen

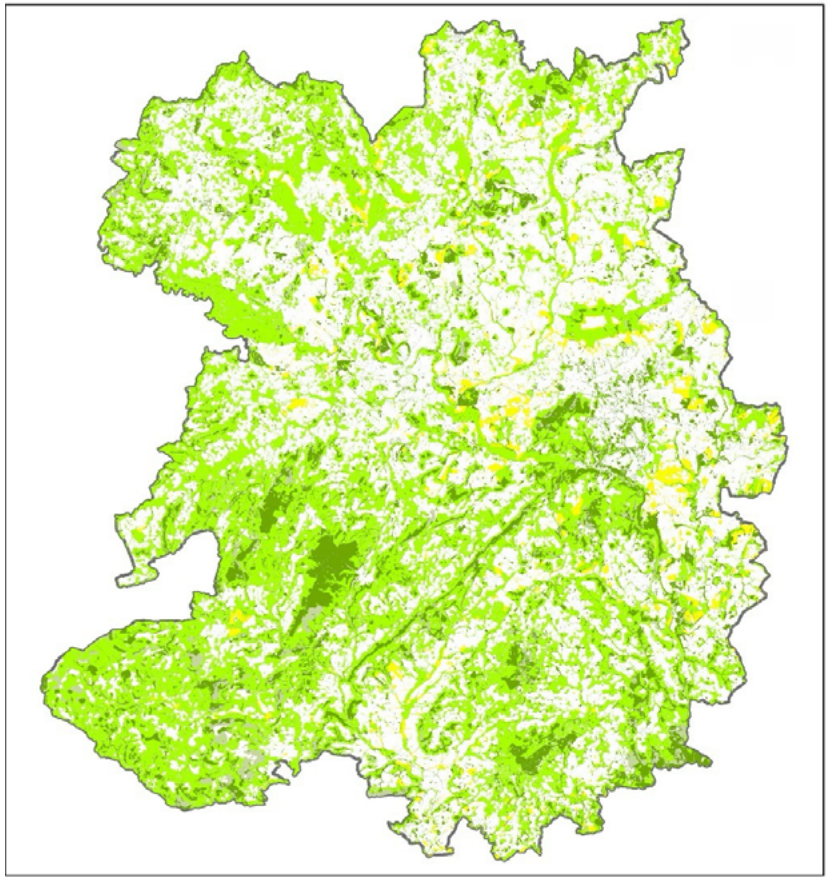

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Figure 14. Priority network map showing overall type of components

Upper catchments in severely disadvantaged areas. This aimed to identify opportunities for nature-based solutions to address flood and erosion risk in priority upland headwaters, e.g. by moorland restoration. It was created as follows.

- Calculate stream order (Agile map code hydrology_prep.py, section calc_wetness)
- With the stream network, convert vertices to points, setting point type = start vertex, to generate stream nodes to use as pour points.
- Run the ArcGIS Watershed function, using flow direction and stream start points.
- Convert the watershed raster to polygons
- Join watersheds to stream start points using their ids, and export to new dataset, to incorporate stream order data.
- To identify priority headwaters: intersect stream order 1 catchments with severely disadvantaged areas.

We also attempted to identify natural flood management opportunities on the lower slopes of upper catchment river valleys, which could have also been intersected with soils with impeded drainage. However, it was decided not to include these opportunities because it was difficult to clearly identify the appropriate catchment stream order to use (e.g. 2 or 3).

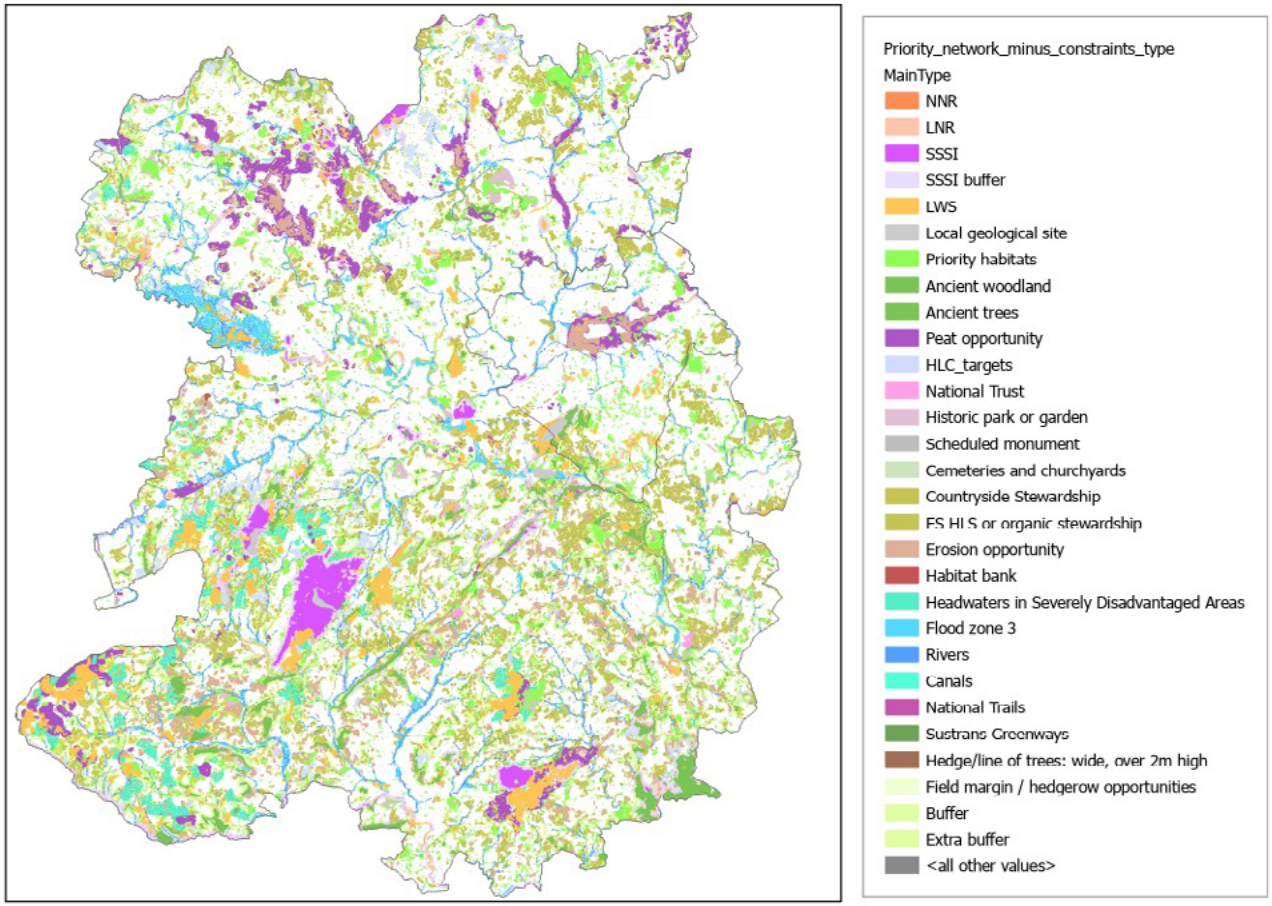

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Figure 15. Priority network map showing individual network components

Fridd. A map of opportunities to restore fridd (a characteristic scrubby habitat found on steep slopes) was created by Shropshire Council following a methodology developed by National Trust by identifying slopes over 12 degrees within a fixed altitude range. It was smoothed and cleaned as follows:

1. Converted to single part and deleted polygons under 1000m^2
2. Buffered by 100m then reverse buffered by -100m.
3. Constraints erased (manmade and water).

Woodland priority opportunity network. Instead of using the standard woodland opportunity layer created by the Agile maps (see Section 3.4), we created a smaller but more connected woodland opportunity network, to reduce the bias towards woodland creation caused by an extensive distribution of small woodland patches in the landscape. This was done by:

1. Buffering and reverse buffering all broadleaved and mixed woodland (priority and non-priority) and wide hedges over 2m high by 50m

2. Merging this with another layer created by

   a. buffering and reverse buffering all broadleaved and mixed woodland (but not tall wide hedges) by 200m, and

   b. deleting isolated polygons under 3 ha.

3. 3. Intersecting this layer with woodland targets, i.e. simple_legend in (arable, improved grassland, natural surface, amenity grassland) and not grade 1 or 2.

4. The whole layer was too big to include in the network but we included it as an extra opportunity where it intersected with the existing network.

Risk of flooding from surface water (RoFSW). This dataset was added to help identify further wetland creation opportunities beyond the floodplain. It is an Environment Agency dataset and was processed as follows:

1. The medium risk component (1 in 100 year risk) and the low-risk component (1 in 1000 year risk) were each clipped to the Shropshire, Telford and Wrekin boundary (We decided not to separate out the high-risk component from the medium risk component (which includes the high risk areas) because the opportunities will be similar for both high and medium risk, i.e. the wetter areas, but different for low-risk (the drier areas).

2. Both datasets were buffered by 5 m (dissolving), converted to single part, polygons over a certain size selected ($100m^2$ for medium risk, $1000m^2$ for low risk) and then reverse buffered by -5m to smooth the edges, not dissolving (as this should not be needed when we are shrinking polygons).

3. Constraints were erased from each dataset: i) water (Simple_hab = 'Water') and ii) man-made features (buildings, sealed surfaces, gardens, unknown, landfill). Quarries and spoil were not excluded because some nature sites are incorrectly mapped as active quarries rather than disused. Allotments were not excluded because if parts of them flood there could be local opportunities. The floodplain (Flood zone 2/3) was not erased, because the intention is that this dataset can be used for more precise targeting of floodplain opportunities. For example, wetlands could be targeted in the areas with high-medium RoFSW, and the drier low-risk areas could be used for floodplain meadows, wet woodlands, or cleanwater ponds (to avoid contamination from polluted rivers).

4. Both datasets were converted to single part. Features over 100 m^2 were extracted from the high-medium risk dataset and features over 1000 m^2 were extracted from the low-risk dataset.

5. The datasets were each modified by adding a 10 character text attribute RoFSW identifying the dataset, which was populated with either '1 in 100' or '1 in 1000'.

6. The high-med risk dataset was used to erase the low- risk dataset then the two were merged

7. The erase operation will have created more small polygons in the low-risk dataset, so convert to single part, select all polygons under $100m^2$ and eliminate.

8. Check for any isolated polygons under $1000m^2$ by dissolving the dataset, converting to single part, and selecting only polygons over $1000m^2$. The select polygons from the undissolved dataset that intersect with the selected dissolved polygons and export to create the final dataset.

9. We are less interested in linear features but want decent sized blobs. So we rejected polygons with a ratio of perimeter to area of over 0.2.

10. Grade 2 land intersecting RoFSW was not excluded from the network, as it was felt that land at risk of flooding would be less valuable for food production.

3.6 Stage 5: Assessing the benefits (optional further work)

Further manual analysis could be carried out to assess the outcomes of different interventions. This can be achieved by using the Agile maps analysis spreadsheet containing the habitat inventory and a summary of the baseline ecosystem service scores from the maps.

1. Make a copy of the baseline habitat sheet to reflect the post-intervention habitats, and change the areas of different habitats to reflect your planned interventions.
2. Using the Agile ecosystem service scoring matrix, calculate the new ecosystem service scores resulting from the planned changes and apply any relevant multipliers as described in this document.

It could also be possible to apply Natural England's Environmental Benefits from Nature Tool for this assessment, although only a few of the 40 condition multipliers can usually be applied when using the EBNT at county scale.

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https://www.agile-initiative.ox.ac.uk/

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6. E.g. see the Stage Zero modelling of potential floodplain reconnection in the Evenlode Catchment by Atkins Réalis.

Appendix 1: Data sources used

All downloaded in late 2024 or early 2025 unless otherwise noted

Type	Details and link
Local Authority boundaries	Created from boundaries for Shropshire and Telford & Wrekin, with Shropshire split into North and South Shropshire along the boundary of the National Character Areas.
Ordnance Survey Mastermap	From August 2024. Provided by Richard Hammerton (Shropshire County Council)
Priority Habitat data	Natural England
CROME	CROME Crop map of England 2022 (provided by Defra as a Large Data Download)
OSMM Greenspace	OSMM GreenSpace
OS Open Greenspace	Downloaded from OS website: OS Open Greenspace
Agricultural Land Class (ALC)	England: Provisional Agricultural Land Classification (ALC)
National Nature Reserves	Natural England Open Data National Nature Reserves
Local Nature Reserves	Natural England Open Data Local Nature Reserves
Sites of Special Scientific Interest	England: Natural England Sites of Special Scientific Interest
Special Areas of Conservation (SACs)	England: JNCC Special Areas of Conservation
Special Protection Areas (SPAs)	England: Special Protection Areas (England)
Potential Special Protection Areas (SPAs)	Natural England Potential Special Protection Areas (England)
Ramsar sites	England: Ramsar sites
Proposed Ramsar sites	Natural England Proposed Ramsar Site
Ancient Woodland	Natural England Open Data Ancient Woodland
AONBs	Defra Data Services Platform Areas of Outstanding Natural Beauty
National Parks	Defra Data Services Platform National Parks
Country Parks	Defra Data Services Platform Country Parks
Heritage Coasts	Defra Data Services Platform Heritage coasts

Type	Details and link
Green Belt	Ministry of Housing, Communities and Local Government English Local Authority Green Belt Boundaries 2022-2023
Millennium Greens	Defra Data Services Platform Millennium Greens
Doorstep Greens	Natural England Open Data Doorstep Greens
National Trust Open Access Land	National Trust Open Data National Trust Land - Always Open
National Trust Restricted Access Land	National Trust Open Data National Trust Land - Limited Access
Important Bird Areas (IBAs)	RSPB Open Data IBAs UK
RSPB reserves	RSPB Open Data RSPB Reserves
Scheduled Ancient Monuments	Historic England Scheduled Monuments (part of National Heritage List for England)
Historic Parks and Gardens	Historic England Registered Parks and Gardens (part of National Heritage List for England)
World Heritage Sites	Historic England World Heritage Sites (part of National Heritage List for England)
Conservation Areas	Historic England Conservation Areas
Local Wildlife Sites	Provided by Richard Hammerton, Shropshire County Council
CROW open access land	Natural England CRoW Act 2000 – Open Access Mapping Areas
Public Rights of Way (PROW)	https://next.shropshire.gov.uk/outdoor-partnerships/countryside-access-and-public-rights-of-way/the-definitive-map/ https://www.telford.gov.uk/info/20467/public_rights_of_way/946/definitive_map
Sustrans cycle routes	National Cycle Network
National Trails	
Catchment boundaries	WFD Surface Water Operational Catchments Cycle 2
Wetland opportunities	Environment Agency Flood Map for Planning (Rivers and Sea) - Flood Zone 2 and Flood Map for Planning (Rivers and Sea) - Flood Zone 3

Type	Details and link
Slope	OS terrain 5 detailed digital terrain model (DTM) of Great Britain. Height points (not contours) as ASC file(s).
Soil erodibility and soil type (acid, neutral, calcareous)	National Soil Map. Soils Data © Cranfield University (NSRI) and for the Controller of HMSO [2025].
Peat restoration opportunities	England Peat Status Greenhouse Gas and Carbon storage
Woodland for flood prevention opportunities	Environment Agency WWNP Wider Catchment Woodland Potential
Urban areas (for Community Orchards)	OS Open Zoomstack
Habitat networks	Natural England Habitat Networks (Individual)
Woodland Trust Ancient Tree Inventory	Woodland Trust Ancient Tree Inventory
OS Open Rivers	OS Open Rivers
Historic Landscape Character	Shropshire Council
UKCEH Land Cover Plus: Hedgerows 2016-2021 (England)	Broughton, R.K.; Burkmar, R.; McCracken, M.; Mitschunas, N.; Norton, L.R.; Pallett, D.W.; Patton, J.; Redhead, J.W.; Staley, J.T.; Wood, C.M.; Pywell, R.F. (2024). UKCEH Land Cover Plus: Hedgerows 2016-2021 (England). NERC EDS Environmental Information Data Centre. https://doi.org/10.5285/d90a3733-2949-4dfa-8ac2-a88aef8699be © UKCEH. Contains Ordnance Survey data © Crown Copyright 2007, Licence number 100017572. Copyright statement to be placed on any images that include the hedgerow data: Some features of this map are based on digital spatial data licensed from the UK Centre for Ecology & Hydrology, © UKCEH. 'Contains Ordnance Survey data © Crown Copyright 2007, Licence number 100017572.'
Risk of Flooding from Surface Water (RoFSW)	https://www.gov.uk/government/publications/flood-risk-maps-for-surface-water-how-to-use-the-map/risk-of-flooding-from-surface-water-understanding-and-using-the-map
Fridd Opportunities	Shropshire Council (slopes over 12% in a certain altitude range)