

The Agile Initiative

at the Oxford Martin School

NATURE RECOVERY AND NATURE-BASED SOLUTIONS OPPORTUNITY MAPS





Department for Environment Food & Rural Affairs



CORE THE GREENHOUSE GAS







UK Centre for Ecology & Hydrology



Environmental Change Institute











Agile Initiative Sprint 3: Scaling up high quality NbS in the UK

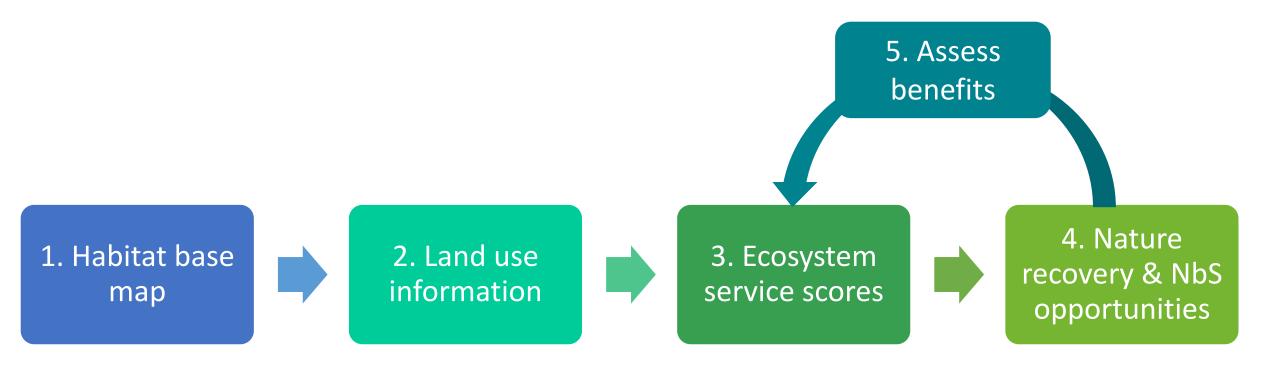


The Agile Initiative research sprint on Scaling up NbS in the UK

https://nbshub.naturebasedsolutionsinitiative.org/

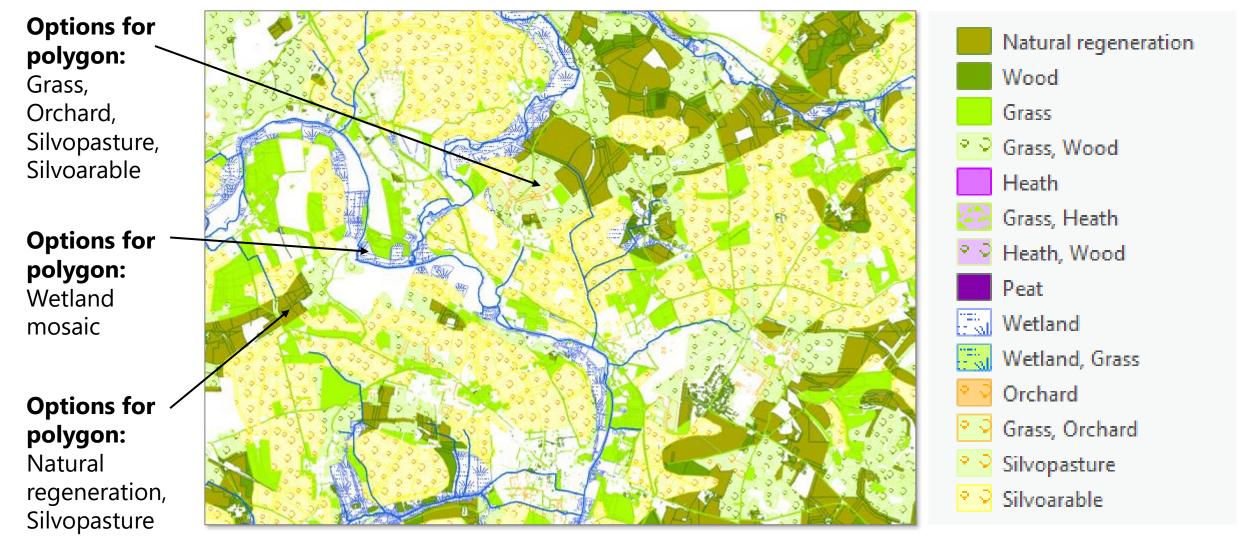
Integration How this Hub supports an integrated approach to scaling up NbS	Governance Effective engagement for successful NbS	Mapping NbS Opportunities Finding suitable NbS for the local context	Monitoring NbS Outcomes Focus on biodiversity and soil metrics
Case Studies	Funding Programmes	Information & Guidance	Policy Briefs & Reports
Inspiring examples of NbS in the UK	UK funding finder tool	A library of useful guidance for practitioners	Agile advice for policy-makers

What are the Agile opportunity maps?



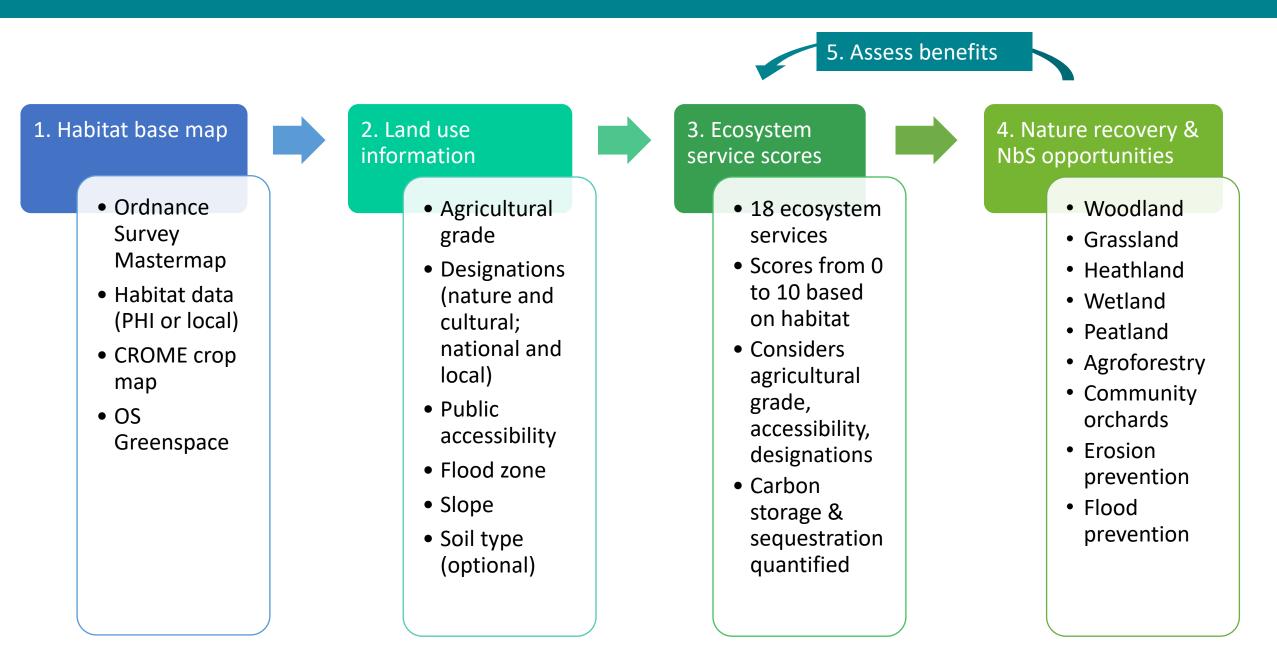
- Maps can be generated anywhere in England using freely available software
 - Suggesting suitable interventions for specific locations
- Intended to be used as part of a participatory process with local stakeholders
 - Ground truthing essential!

Example output: high priority opportunities in each location



Main potential opportunities

How the mapping system works



The Agile opportunity maps integrate many of the LNRS data layers

Image: Home Image: Data Map Image: Data Download LNRS areas Section 107(2) data Section 107(5) data Section 107(6) data Image: Operation of the section of the sec	 Help Other data sources 				
	Other data sources				
Q Search	<u></u>				
Agricultural Land Classification (ALC) Grades - Download Post 1988 Agricultural Land Classification (ALC) Grades - Guidance Guidance	Post 1988				
AIMS Spatial Flood Defences (inc. standardised attributes)	l Land Classification (ALC) Grades - Post 1988.pdf				
	Natural England				
NATURAL	overnment Licence				
Areas of Outstanding Natural Beauty (AONB) Download Lt is how England viewer (ALC). The possiste data	he most detailed and up to date ALC dataset. vever of limited extent compared to the d-wide ALC data also found on this data provisional agricultural land classification, at 1988 agricultural land classification (ALC) a was scanned from original sites surveyed in y the then Ministry of Agriculture Fisheries				

1. Agile habitat maps: complete and detailed coverage

OS Mastermap complete coverage less detail on natural habitats and farmland



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Natural land

Woodland

Water

Building

Garden

Local or national habitat and priority habitat data excludes urban more detail on semi-natural habitats



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CROME Crop Map of England Arable vs improved grassland

1. Agile habitat maps: complete and detailed coverage

OS Open Greenspace OS Mastermap Greenspace



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Allotments Or Community Growing ... Amenity - Residential Or Business Amenity - Transport **Bowling Green** Camping Or Caravan Park Cemetery Golf Course Institutional Grounds Land Use Changing Natural Other Sports Facility Play Space Playing Field Private Garden Public Park Or Garden **Religious Grounds** School Grounds Tennis Court

Agile habitat maps Complete detailed coverage



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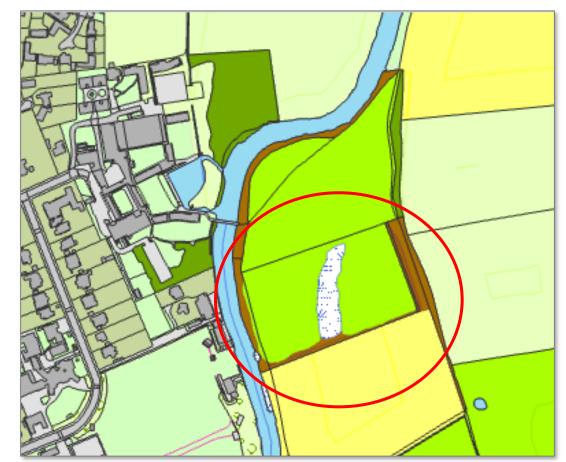
Agile maps match OSMM but include smaller habitat patches

OS Mastermap



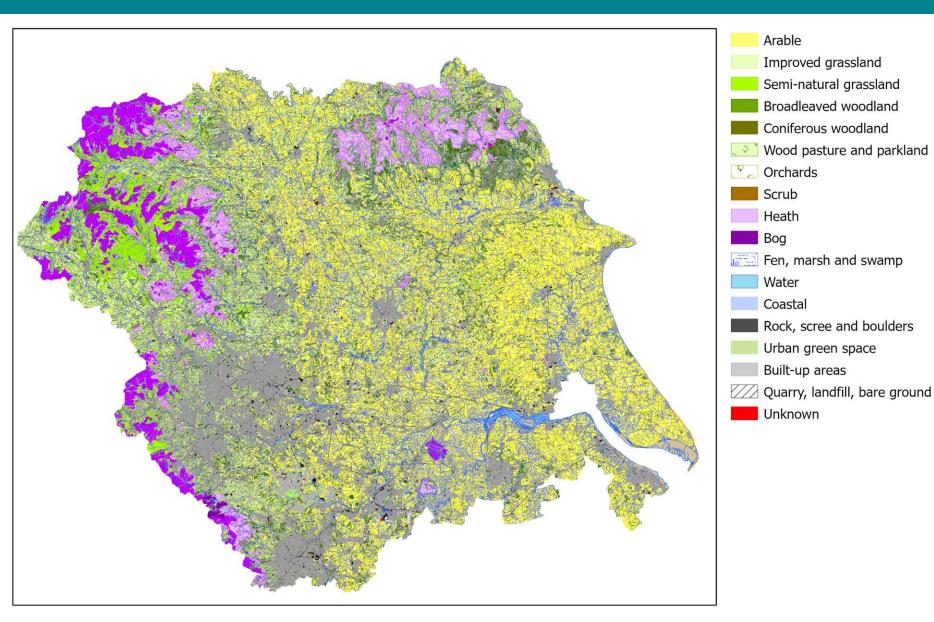
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Agile map – shows additional wetland and scrub



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-> Agile habitat maps can instantly provide a full habitat inventory (whole county or subset such as core areas or opportunity areas)



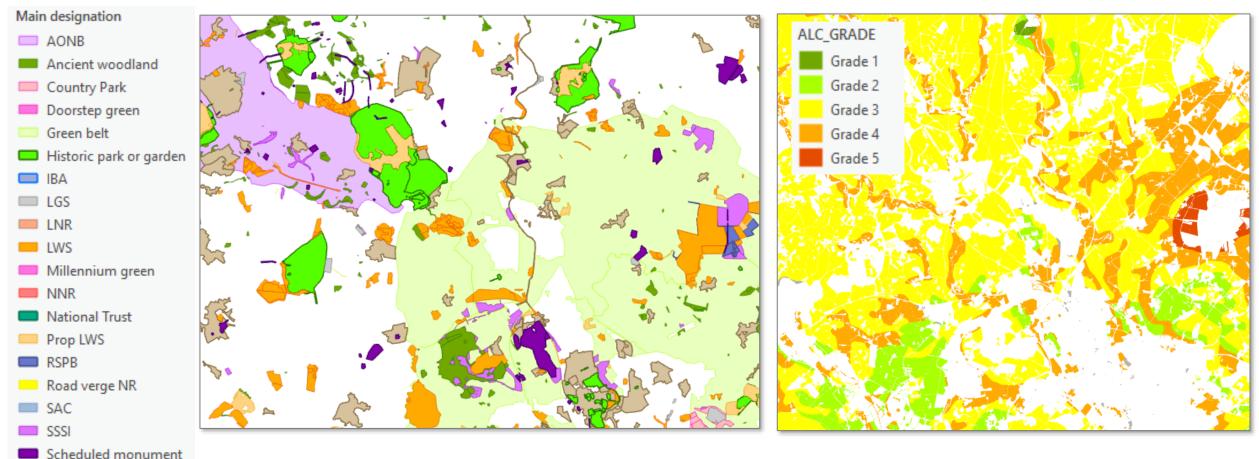
Example of part of a habitat inventory table (first few rows and columns)

Interpreted_habitat	Total	Barnsley	Bradford	Calderdale	Craven	Doncaster	East Riding of Yorkshire
Acid grassland	22,208	101	721	2,286	7,063		
Agricultural land	12,768	597	458	693	541	698	1,144
Allotments, city farm, community garden	1,221	105	79	28	16	118	103
Amenity grassland	6,923	432	683	386	37	431	225
Aqueduct	0		0	0	0	0	0
Arable	630,067	9,166	3,305	3,345	7,036	28,940	180,644
Bog	74,818	1,928	1,198	7,639	19,269	2,191	361
Boulders	620	0	24	10	476	0	10
Bridge	207	7	8	10	8	15	17
Bridge: natural	11	0	0	1	1	1	1
Building	28,048	1,166	2,164	990	482	1,677	2,816
Calaminarian grassland	78				16		
Calcareous grassland	9,437				6,042	6	1,014
Canal	578	8	35	43	38	82	113
Cemeteries and churchyards	1,224	58	104	51	27	68	117
Coastal and floodplain grazing marsh	5						
Coastal lagoons	2						0
Coastal rock	1,043						160
Coastal sand dunes	105						82
Dense scrub	2,109	104	58	38	71	155	225

2. Additional land use data layers are integrated into the habitat map

Designations

Agricultural land class



WHS
 Conservation areas

Also: Public accessibility, Peat status, Flood zone, Slope, Soil type

All integrated into the habitat map as additional attributes

3. Ecosystem services mapped

Cultural services

Recreation

Aesthetic value

Education and knowledge

Interaction with nature

Sense of place

Air

Natural Capital

Water

Soi

Plants

Provisioning services

Food crops, livestock

Wood

Fish

Fresh water supply

Regulating services Flood control **Erosion control** Water quality Carbon storage Air quality Cooling and shading Noise regulation **Pollination**

Pest control

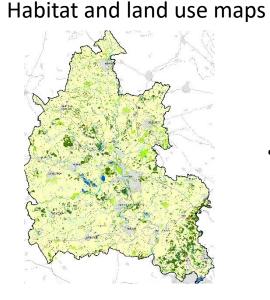
Biodiversity underpins natural capital

Animals

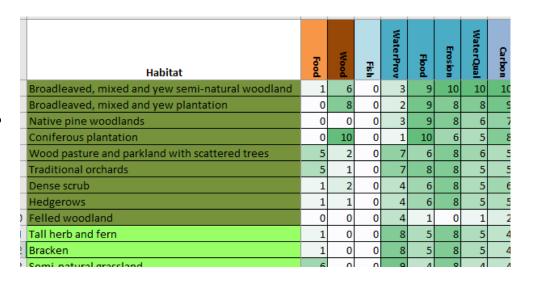
Rock

Ecosystem service scores

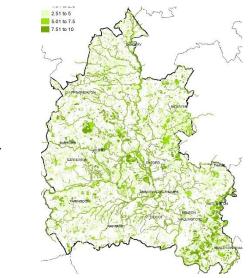
- 1. Scores reflect the potential for each habitat to deliver each of the 18 services
- 2. Apply the scores to the habitat map -> maps for each service
- 3. Multipliers adjust scores: e.g. agricultural land use class (for food provision) and public access (for recreation)

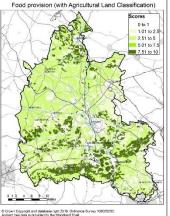


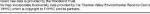
Matrix of scores for each habitat and land-use type

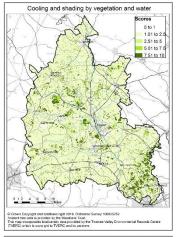


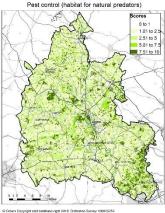
Ecosystem service maps

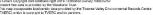


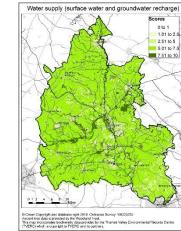




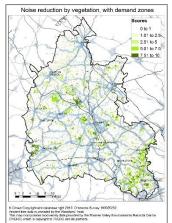


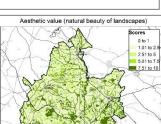






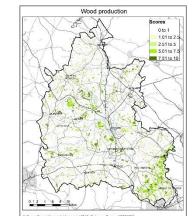




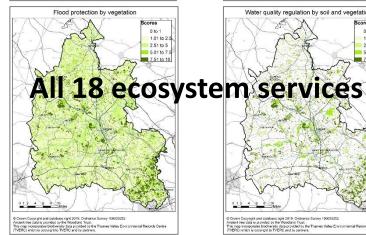




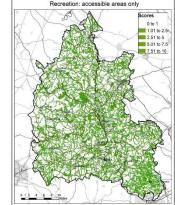
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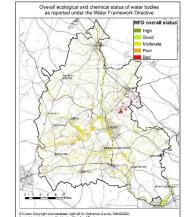
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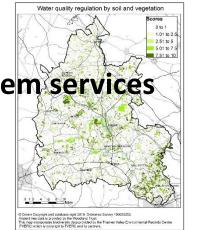


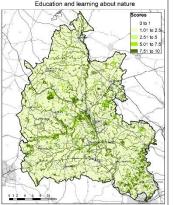


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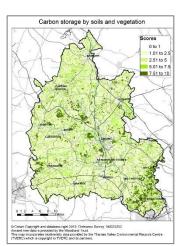


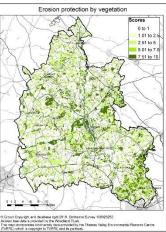
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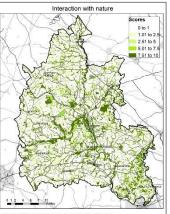




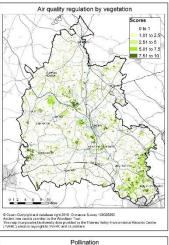
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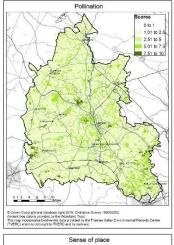


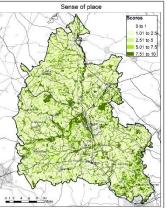




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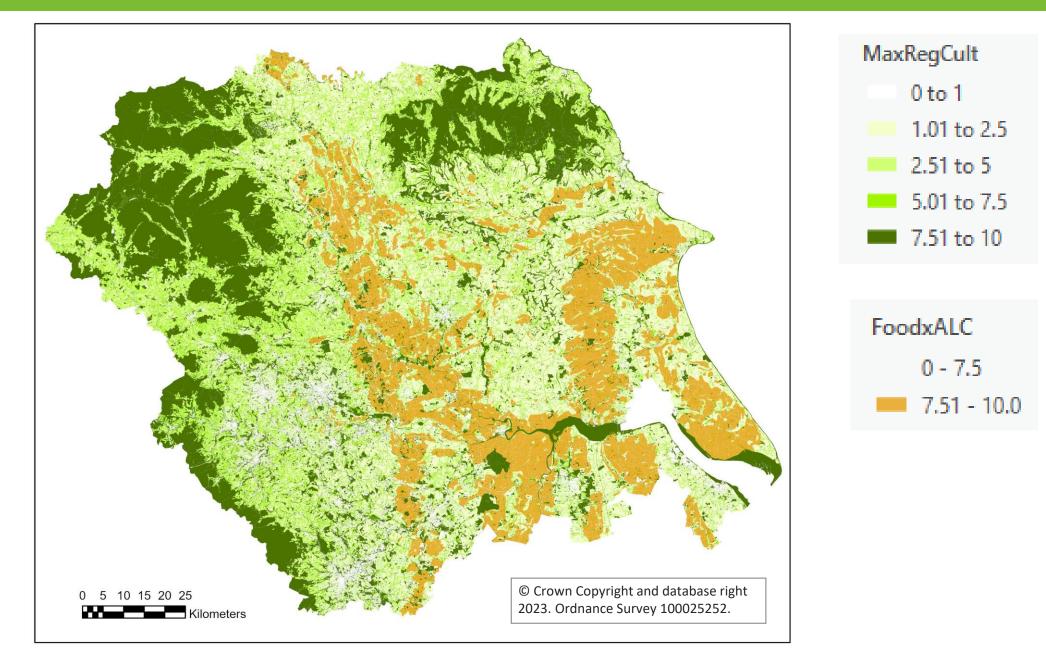




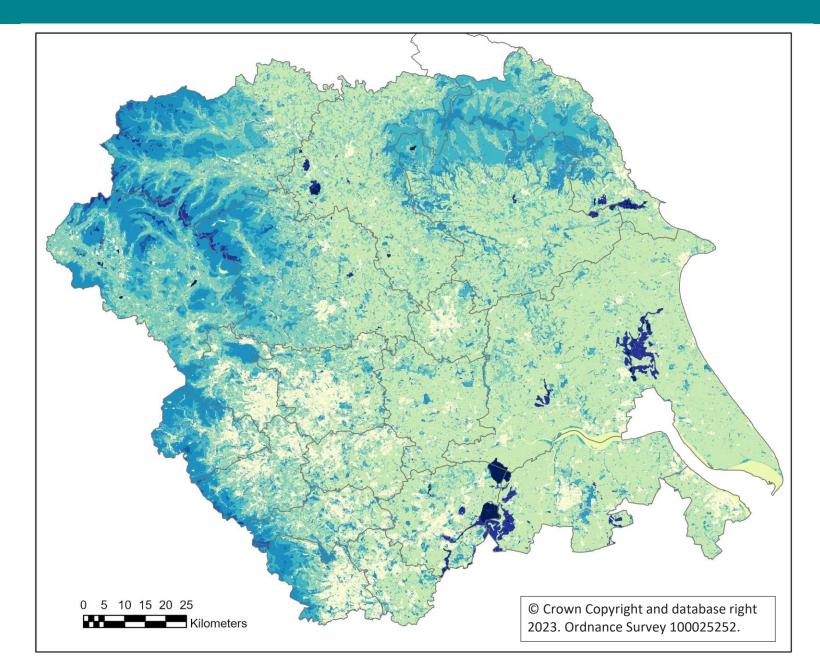


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Maximum score for regulating and cultural services; high score for food



Carbon storage t/ha



Non-peat soils: estimates per habitat from various literature sources e.g. Cantarello et al 2011; Natural England (Gregg et al 2021)

Peat soils: Natural England peat status and GHG emission dataset



4. Mapping opportunities for nature recovery and NbS

Constraints:

High grade farmland

Semi-natural habitats

Peaty soils

Designated areas – may be constraints

Opportunities:

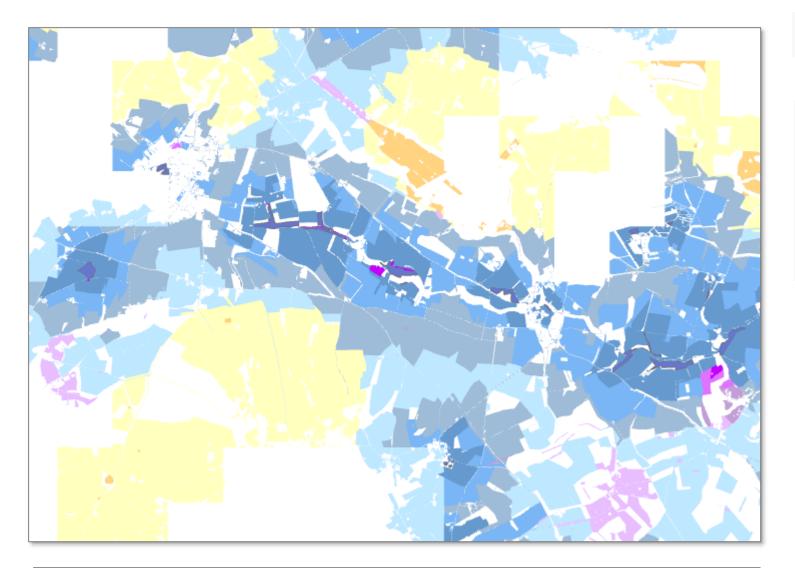
Potential habitat networks:

- Woodland
- Grassland Acid, Neutral, Calcareous
- Heathland
- Wetlands (flood zone; wetness index)
 Peatland restoration
 Agroforestry
 Community orchards (near urban areas)
 Erosion prevention (steep slopes and erodible)
 Natural flood management (upper catchments, poorly drained
- soils)

4. Mapping 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	у	у	у	у	у	У	n	n	n	n	n	у
Grassland	У	У	У	У	У	У	n	n	У	У	lf impr. grass	У
Heathland	у	у	у	у	У	у	n	n	у	n	n	у
Wetland	у	у	У	у	У	у	n	n	У	n	if peat	essential
Peatland	у	у	У	у	у	у	у	У	у	n	у	у
Silvoarable	у	n	n	n	n	n	n	n	n	n	у	у
Silvopasture	unless ALC 1 or 2	У	n	n	n	n	n	n	n	n	У	У
Community orchard	У	У	У	У	У	У	n	n	n	n	n	У

Habitat network approach



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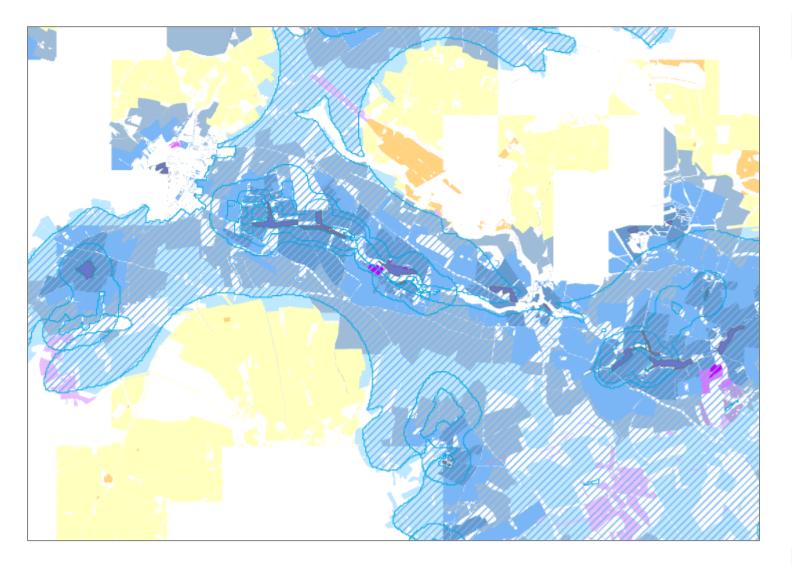
Core calcareous grassland Calcareous grassland network 200m 500m 1000m Extension zone No constraints

Opportunities in designated areas

200m, designated
500m designated
1000m designated
Extension zone, designated
No constraints, designated

Uses BGS Soil Parent Material 1km squares for soil type (free data) but can use Soilscapes or similar if available

Habitat network approach



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Core calcareous grassland Calcareous grassland network 200m 500m 1000m Extension zone No constraints

Opportunities in designated areas

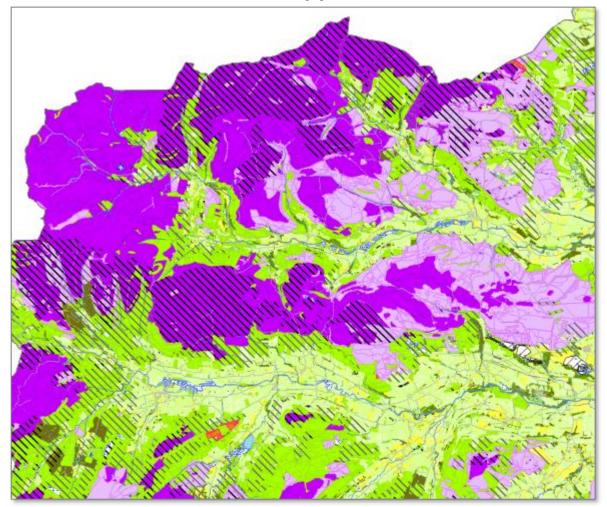
200m, designated
500m designated
1000m designated
Extension zone, designated
No constraints, designated



Natural England lowland calcareous grassland habitat network

Peatland opportunities

Peatland opportunities



1 Deep peat
2 Shallow peat
3 Peaty pockets

Source: Natural England Peat Status and GHG emissions dataset

Identifies peat that is degraded (e.g. drained, burned, overgrazed, etc)

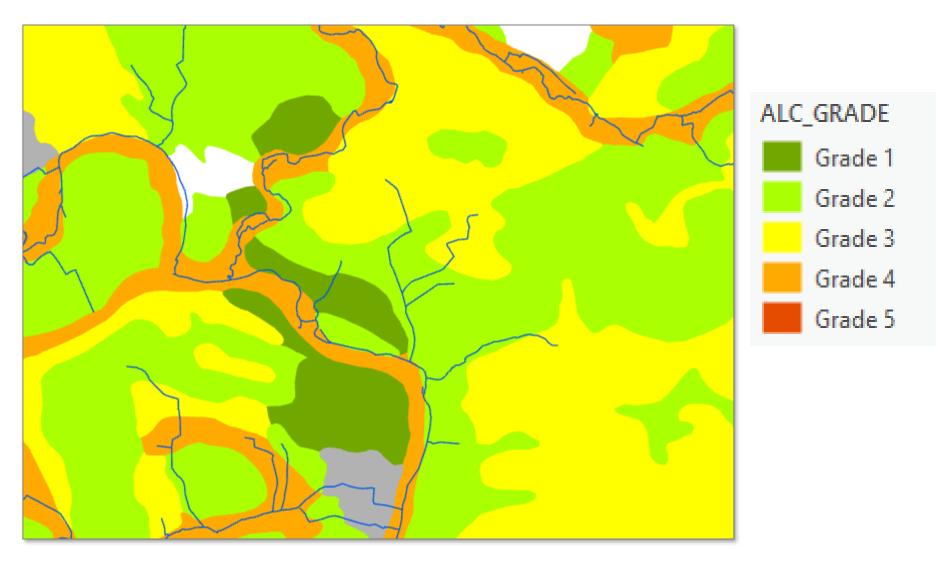
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Example: Habitats



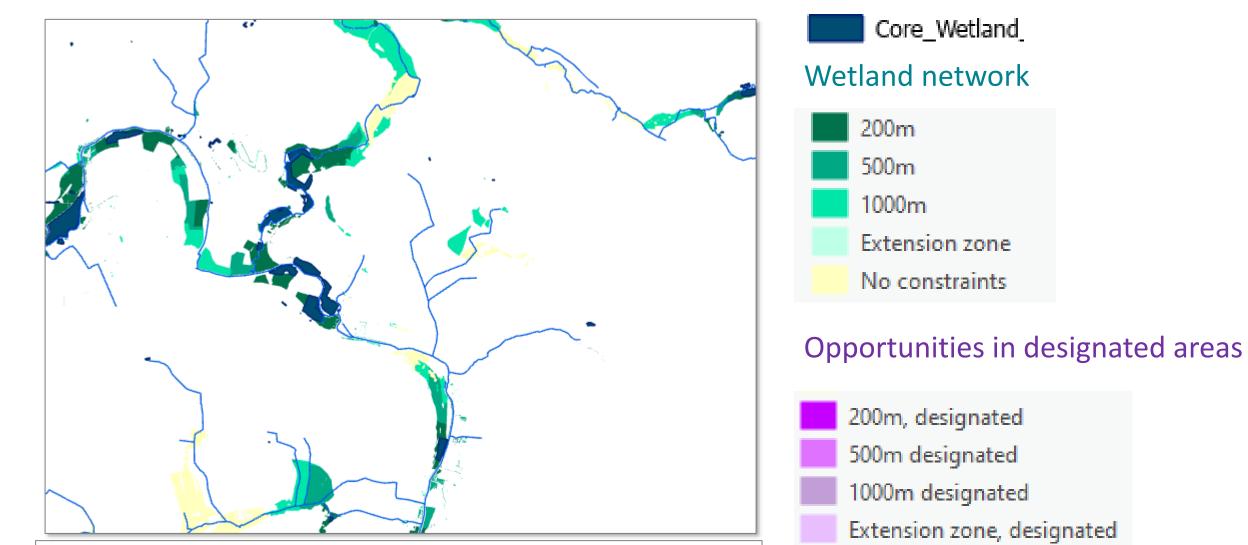
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Agricultural Land Class



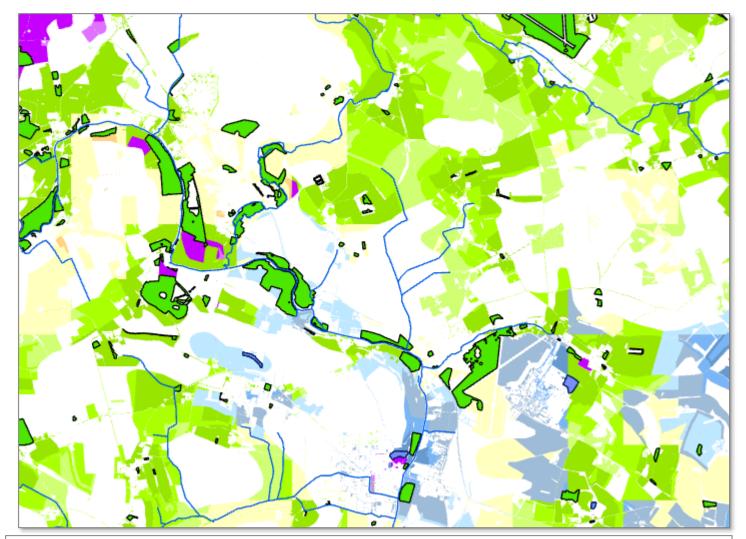
Wetland network (restricted to floodplain)

No constraints, designated

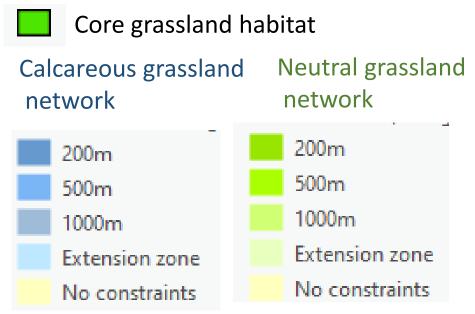


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Grassland network



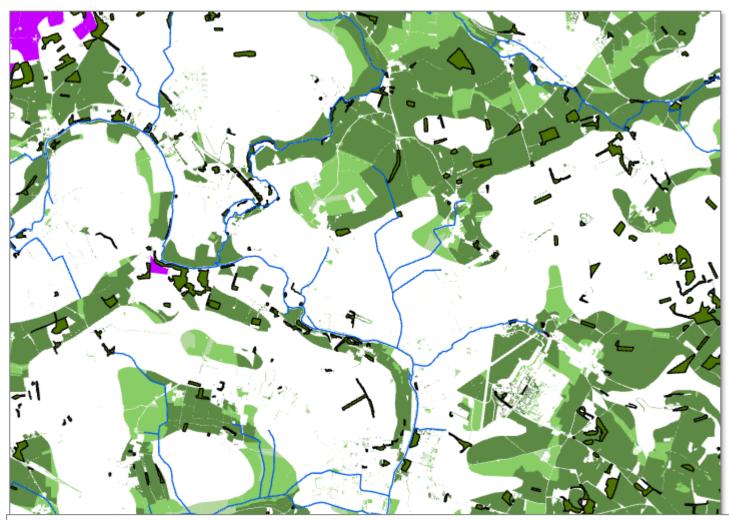
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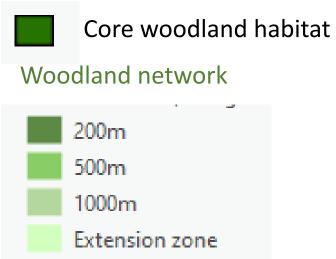
Opportunities in designated areas

200m, designated
500m designated
1000m designated
Extension zone, designated
No constraints, designated

Woodland network



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No constraints

Opportunities in designated areas 200m, designated 500m designated 1000m designated Extension zone, designated No constraints, designated

Community orchards

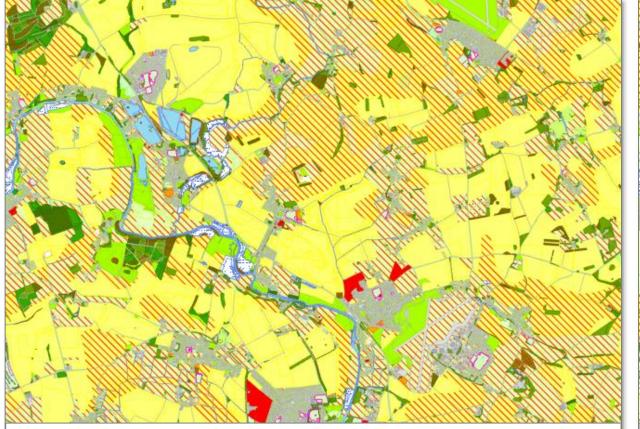


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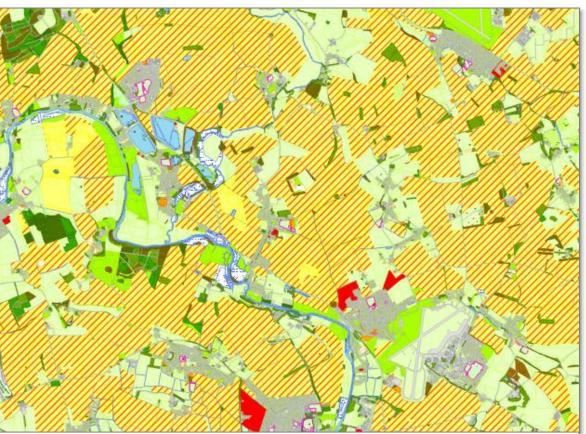
Agroforestry

Silvopasture

Silvoarable



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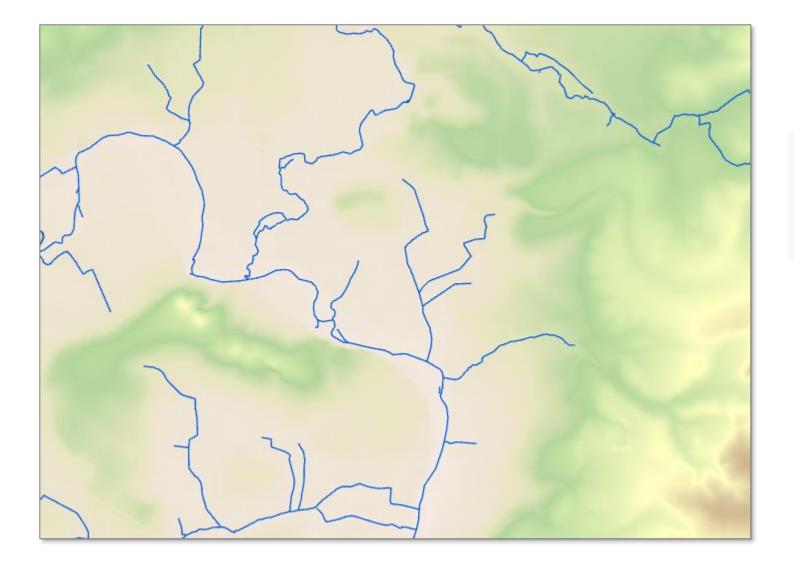


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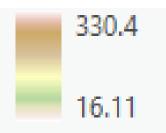
Avoids Grade 1 and 2 arable land

Avoids pasture

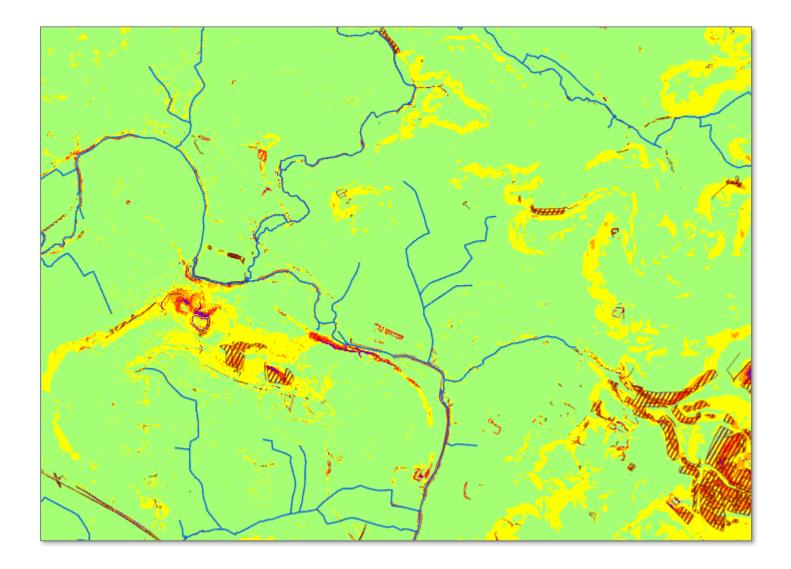
Erosion prevention: 5 m digital terrain model - > steep slopes



Metres above sea level

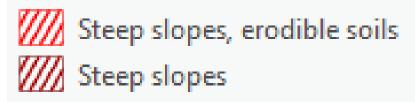


Erosion opportunities on slopes over 7 degrees

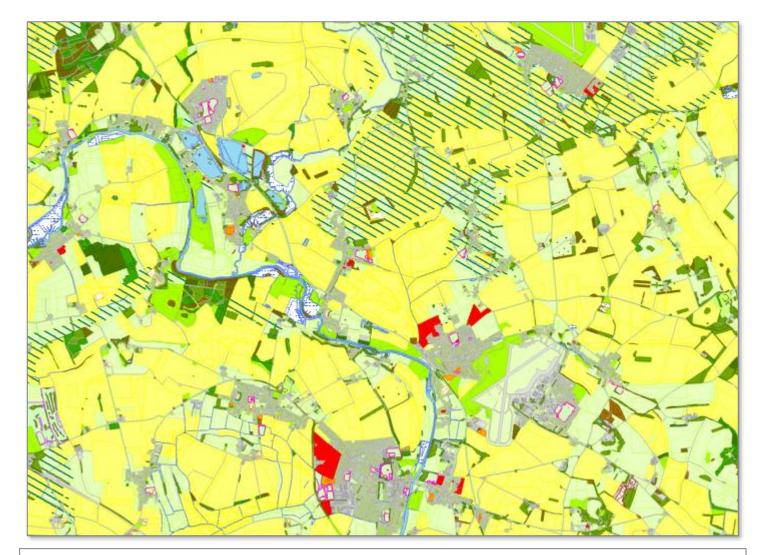




Erosion opportunities



Natural Flood Management opportunities (limited)



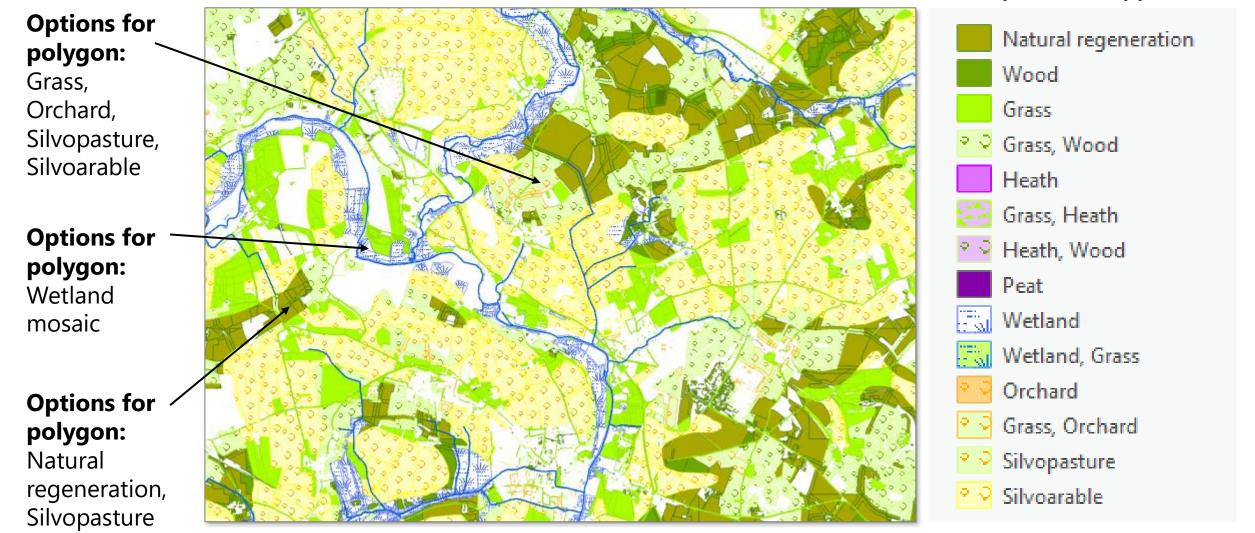
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Opportunities for NFM such as woodland creation to improve infiltration on soils with impeded drainage

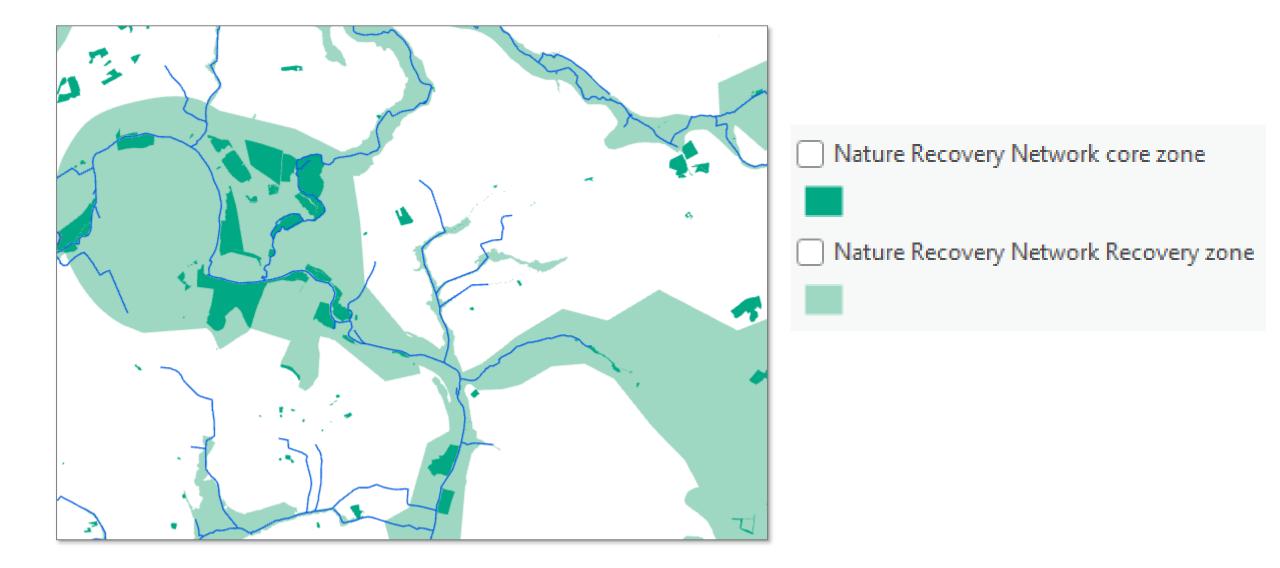
Source: Environment Agency Wider Catchment Woodland

High priority opportunities in each location

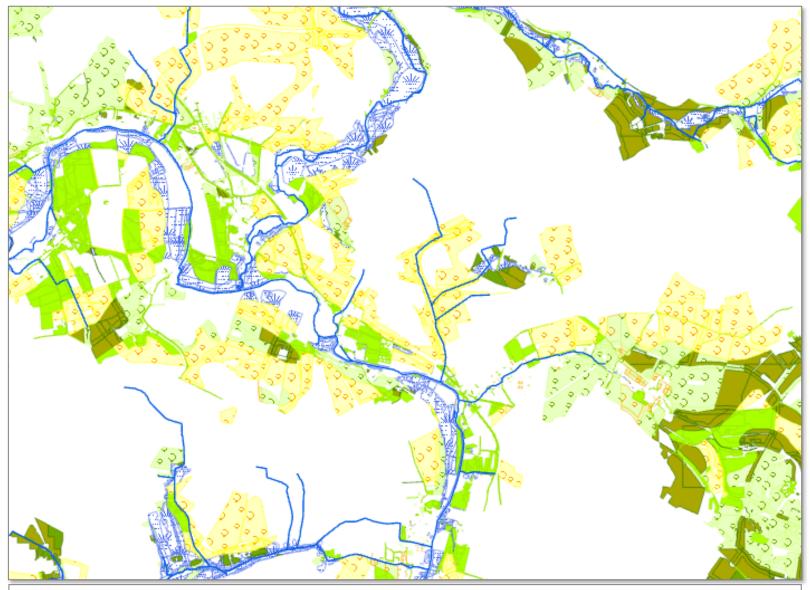


Main potential opportunities

Integrating with existing Nature Recovery Network produced by stakeholders



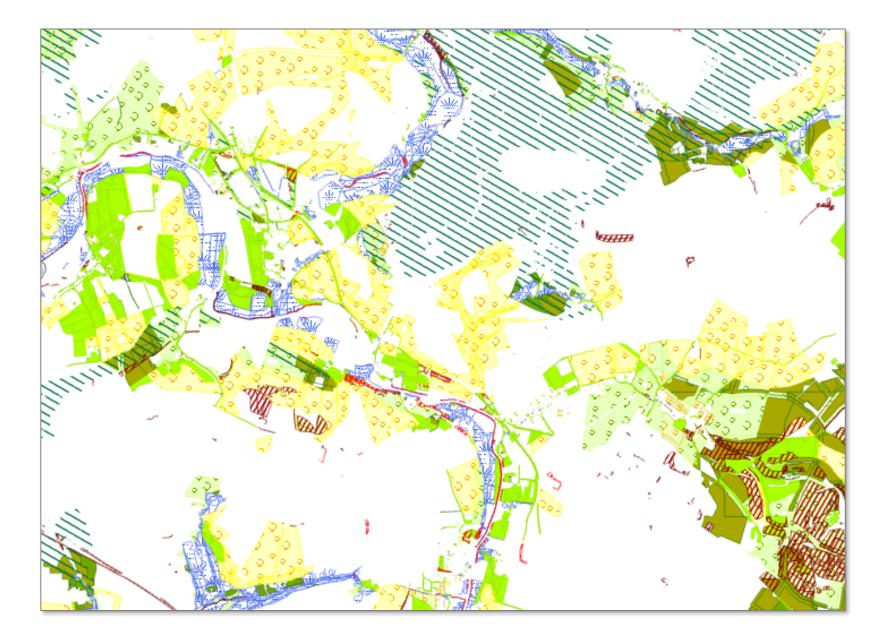
Priorities clipped to existing Nature Recovery Network



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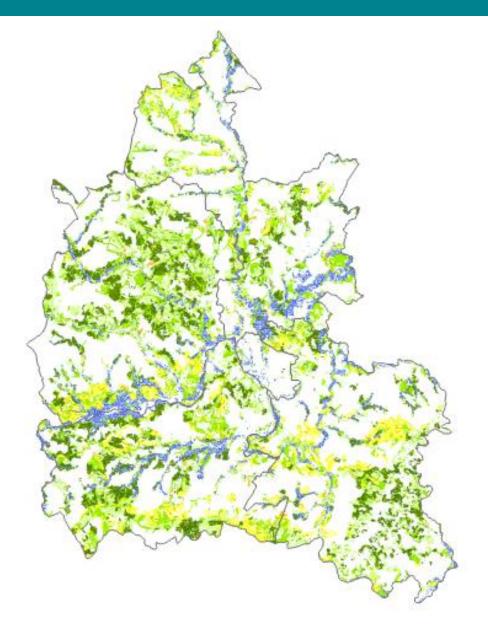


Example: Combined highest priority opportunities



Using with existing nature recovery networks at county scale

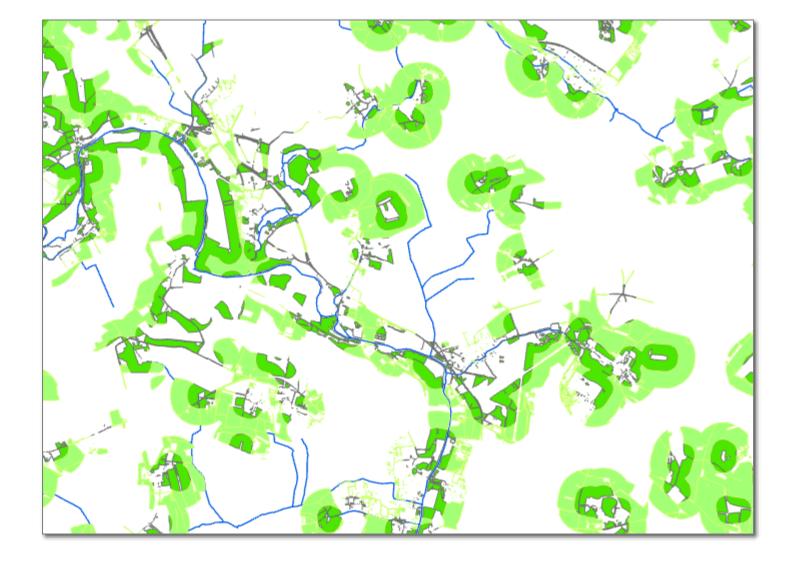




Exporting individual layers: grassland opportunities

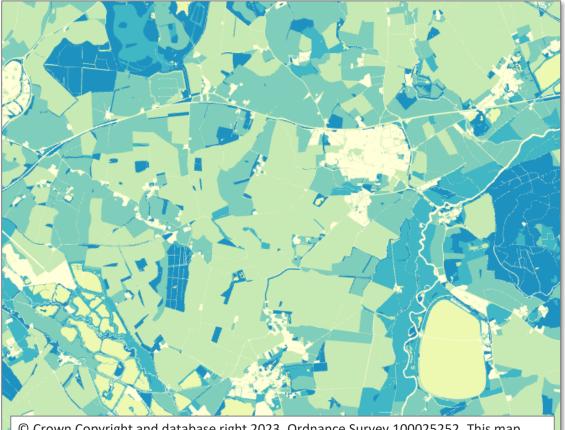
200m zone

500m zone



5. Assessing the benefits from nature recovery and NbS

Baseline carbon stored (tC/ha)



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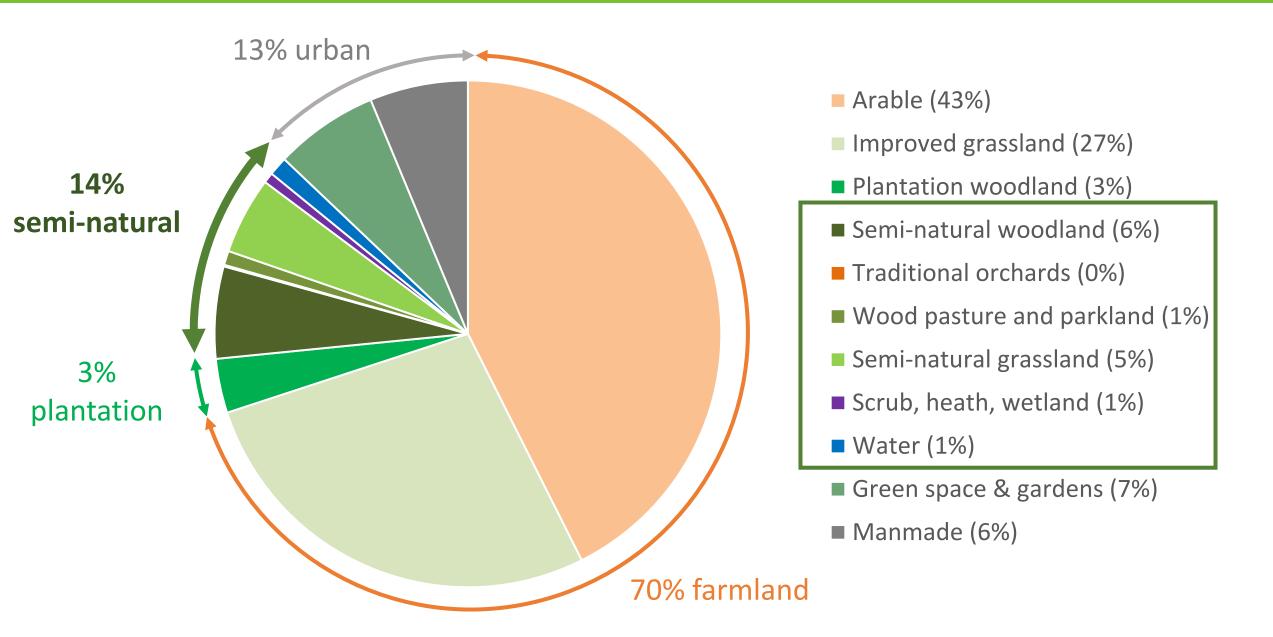
Baseline maximum score for regulating and cultural ecosystem services (scale 0-10)



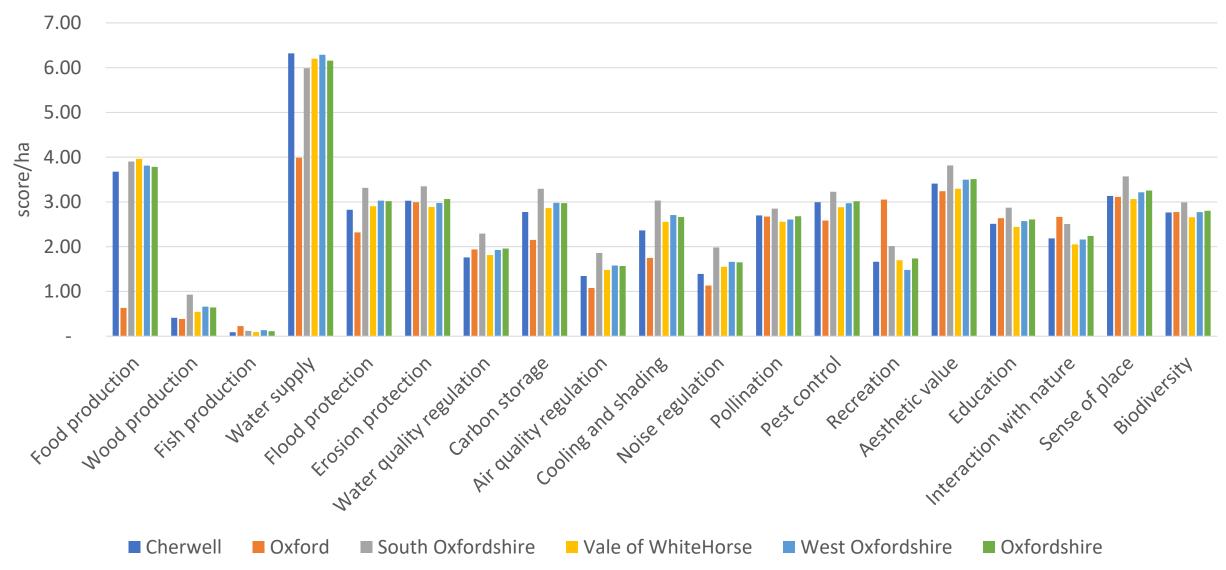
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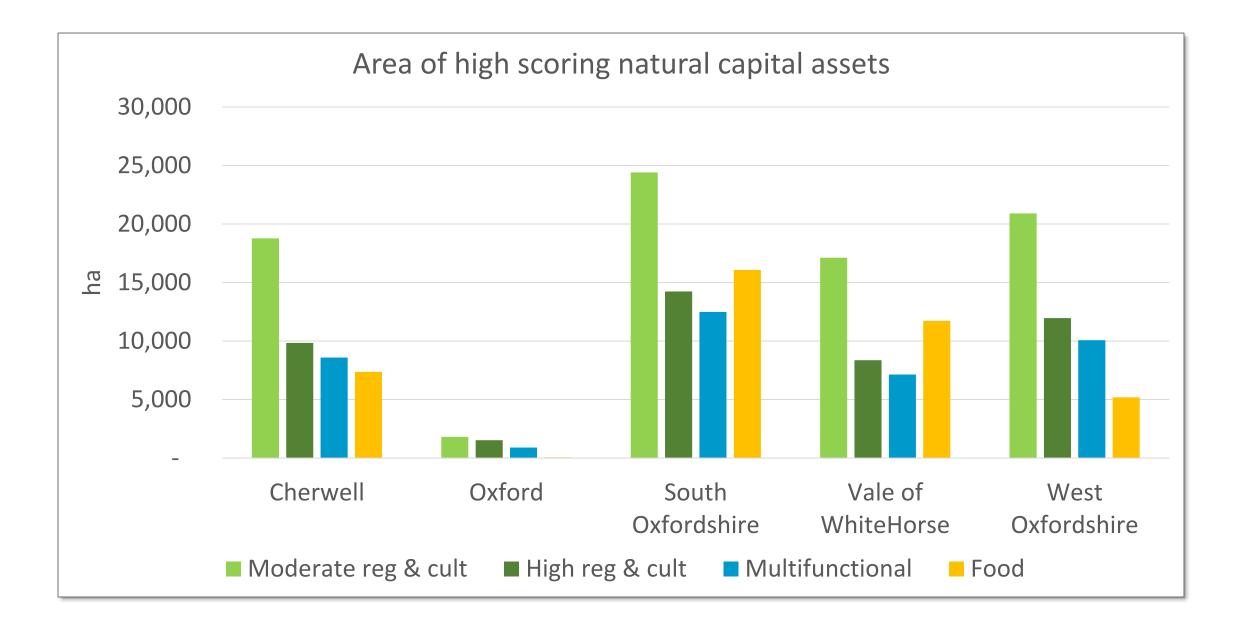
Maps can be used to assess change from baseline for nature recovery options (separate step using spreadsheet; not yet automated)

Baseline inventory

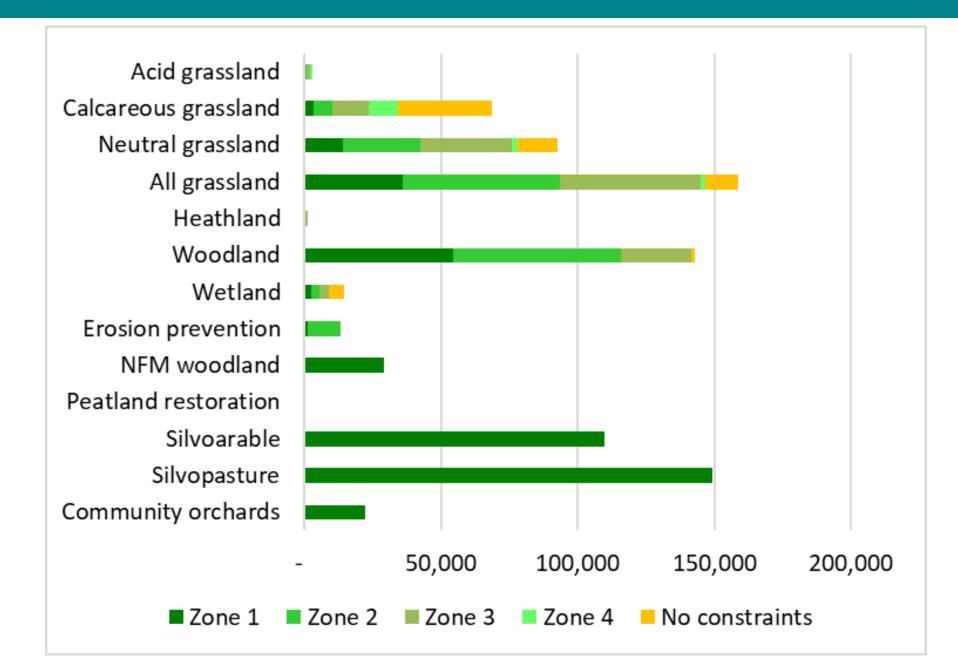


Ecosystem service scores per ha





Opportunity assessment



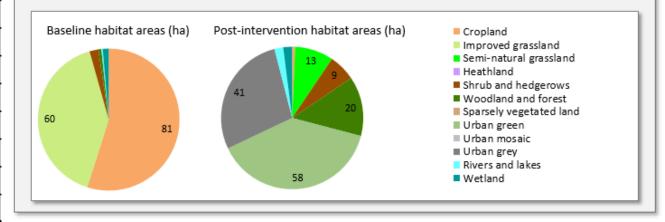
Select area of interest:				
Whole area	1 year	10 year	30 year	Confidence
Food production	→	÷	÷	
Wood production	+	→	7	
Fish production	+	-		
Water supply	2	<u> </u>	2	
Flood regulation	7	2	7	
Erosion protection	+	7	7	
Water quality regulation	7	7	7	
Carbon storage	2	<u> </u>		
Air quality regulation	7	-	7	
Cooling and shading	2	-	7	
Noise reduction	7	7	7	
Pollination	2	7	7	
Pest control	7		7	
Recreation	←	1	1	
Aesthetic value	7	7	7	
Education	7	7	7	
Interaction with nature		7	7	
Sense of place	3	→	7	

Change in average score per hectare

Large decrease (more than -2.5 points out of 10) Decrease (-0.25 to -2.5 points out of 10) Minor change (-0.25 to 0.25 points out of 10) Increase (0.25 to 2.5 points out of 10) Large increase (more than 2.5 points out of 10)



Changes in Natural Capital Assets (total on site and off site)



Using the maps

- Decision-support, not decision-making
- Show areas that <u>could</u> be suitable for different opportunities, avoiding key constraints
- Use as part of a participatory stakeholder engagement process
- Ground truthing and input from local experts is important
- Designated areas may or may not be suitable seek guidance from site managers /ecologists



Examples of how the maps can be used

- LNRS support (testing in Oxfordshire and Yorkshire)
- Farmer Clusters (North-East Cotswolds Farmer Cluster Landscape Recovery Plan)
- Parish and Neighbourhood nature recovery plans
- Natural capital assessments
- Land use planning for large estates and other landowners



Using Agile maps for Local Nature Recovery Strategies

1. Map areas of principal importance for biodiversity	 Map includes designated sites, ancient woodland, lowland fens Can produce complete detailed habitat inventory in those areas
2. Map areas where nature recovery action has been taken	 Areas can be added manually to map polygons Can then determine % of each habitat protected or in recovery
3. Describe the strategy area, its biodiversity and opportunities for recovery	 Produces habitat map and inventory Future pressures – shows habitats in areas for development
 Agree priorities and identify potential measures 	 Engage with local organisations to produce longlist - Agile engagement guidance
5. Map areas that could become of particular importance	 Maps scoring nature recovery and NbS opportunities & benefits Refine and check maps as part of a participatory process

Summary of Agile maps



- 1. Complete, detailed coverage with no gaps or overlaps allows full inventory and 'white space' options
- 2. Match OS Mastermap boundaries but also include smaller habitat patches
- 3. Include constraint and opportunity layers, all in one dataset for rapid assessments
- 4. Show opportunities for nature recovery and nature-based solutions
- 5. Open source code can be used to generate the maps anywhere in England
- 6. 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)
- 7. Flexible can respond to user requests for changes and new features

Agile map creation software: data entry spreadsheet



Script_first_used_in	Agile_parameter	Input_value	Data_type	Status	Where_set	Instructions OI
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SetUp_FileStructure.py	Agile_folder	C:\Agile_maps	String	Essential	Spreadsheet	Enter file path for the top-level Agile ma
SetUp_FileStructure.py	UK_data_folder	C:\Agile_maps\UK_data	String	Optional	Spreadsheet	Central folder to hold national datasets t
SetUp_FileStructure.py	spreadsheet_folder	C:\Agile_maps\Spreadsheets	String	Optional	Spreadsheet	Equivalent to the Spreadsheets folder dc
SetUp_FileStructure.py	repository	C:\Agile_maps\Area1	String	Essential	Spreadsheet	Top level folder to hold the input and ou
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✓ → … Selection	NEY Balruddery Oxfordshire_HL	U Oxfordshire_PHI NECFC Area_1 Defau	I 🕀 🗄	•		

Requirements for using the maps



To use maps created by someone else

- OS Mastermap license
- Ideally, ArcGIS (so you can use the maps ready set up with the correct symbologies)

To create the maps yourself

- OS Mastermap license
- ArcGIS
- Very basic understanding of how to run python code
- Storage space (at least 1 Gb for the final map for a typical county)

Limitations



- 1. Weaknesses in underlying datasets (habitats, farmland, soils)
- 2. Licensing required for ArcGIS, OS Mastermap and possibly LERC data (OK for council and contractors)

Next steps

- 1. Refine network mapping: circuitscape / omniscape
- 2. Automate assessment of benefits
- 3. Integrate National Forest Inventory to identify forest cleared ready for replanting
- 4. Further opportunities air quality regulation, areas deprived of green space
- 5. Wider testing and refinement with feedback from users

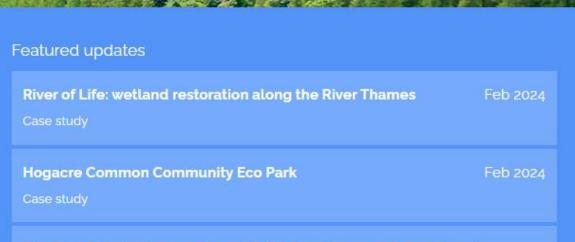
Visit the NbS Knowledge Hub to find out more https://nbshub.naturebasedsolutionsinitiative.org/

Nature-based Solutions Knowledge Hub Home

Home Explore NbS Intiative Agile Initiative

Welcome to the naturebased solutions knowledge hub

An integrated one-stop resource to guide users through the process of governance, designing and funding Nature-based Solutions (NbS), and



The Great North Bog: a partnership for landscape-scale peatland







Fill in the form on the NbS Knowledge Hub mapping page to test the software for your area https://nbshub.naturebasedsolutionsinitiative.org/



Expression of Interest for using the Agile Nature Recovery and Nature-based Solution Opportunity Maps

If you would like to use the Agile maps to explore opportunities for nature recovery and nature-based solutions in your area, please enter your contact details here and we will get back to you. The maps can currently be applied anywhere in England, and we are working on adapting them for the other UK nations, starting with Scotland.

alison.smith@eci.ox.ac.uk Switch accounts

Not shared

* Indicates required question





HOME TEAM PROGRAMME REGISTER INFORMATION GET INVOLVED BURSARIES

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