Mapping Natural Capital in Oxfordshire

Alison Smith

Environmental Change Institute

Funded by the Oxford Policy Exchange Network

Housing & Growth Deal adds 100,000 new homes to the 280,000 existing homes by 2031 -> Need a plan

Report on consultation responses for first draft:

"**Many respondents, including statutory consultees, advocated a full understanding and mapping of Oxfordshire's natural capital assets** to underpin the Oxfordshire Plan".

"...to identify opportunities to protect, enhance and invest in the natural environment, including strengthening green infrastructure and ecological networks and buffering natural habitats."

"...development should be steered to the least sensitive areas, but this requires an understanding of the natural capital value of land as opposed to a focus solely on statutory designations."

Existing information

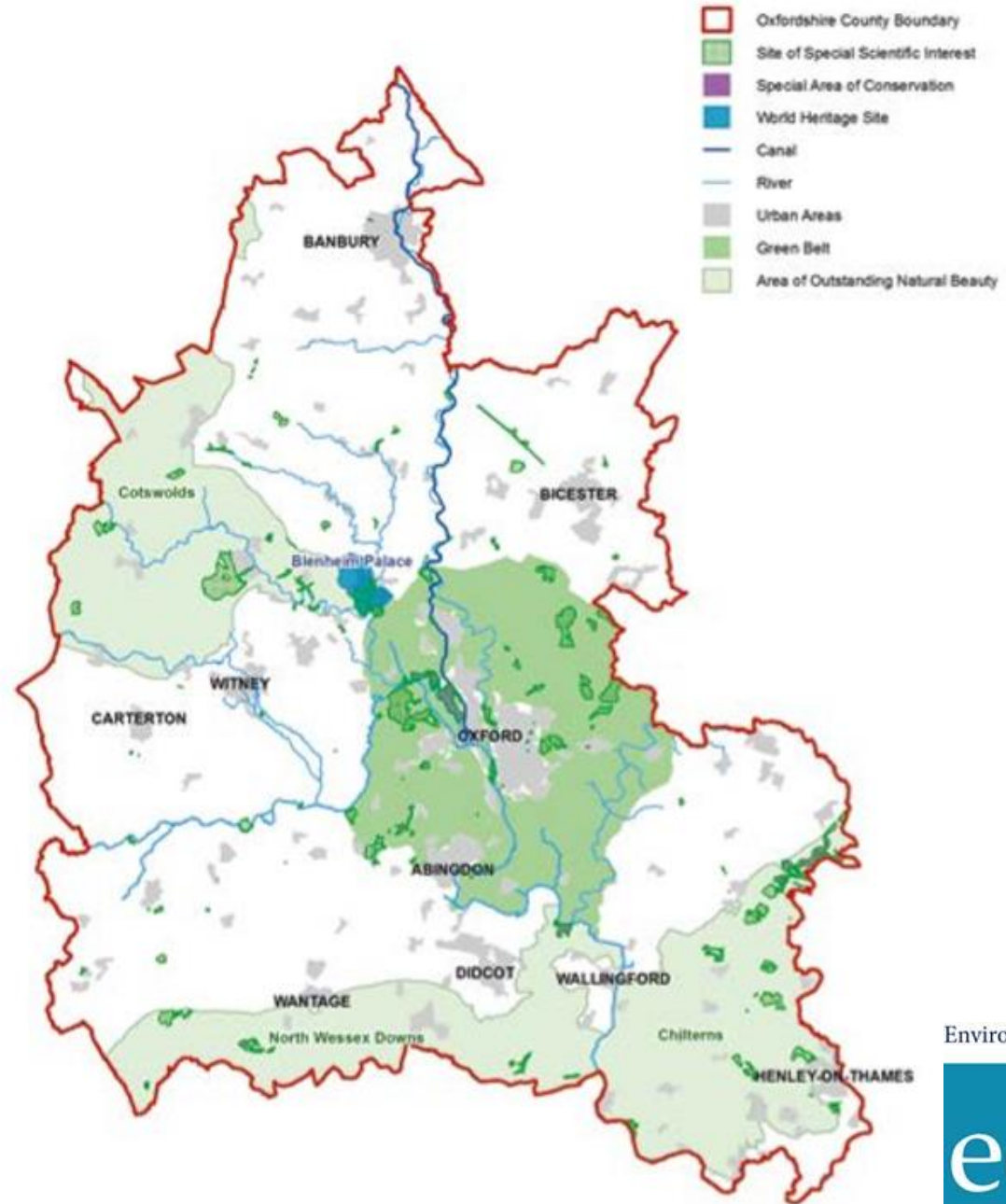**Strategic Environmental and Economic Investment Plan**
Major natural capital assets... limited to designated areas
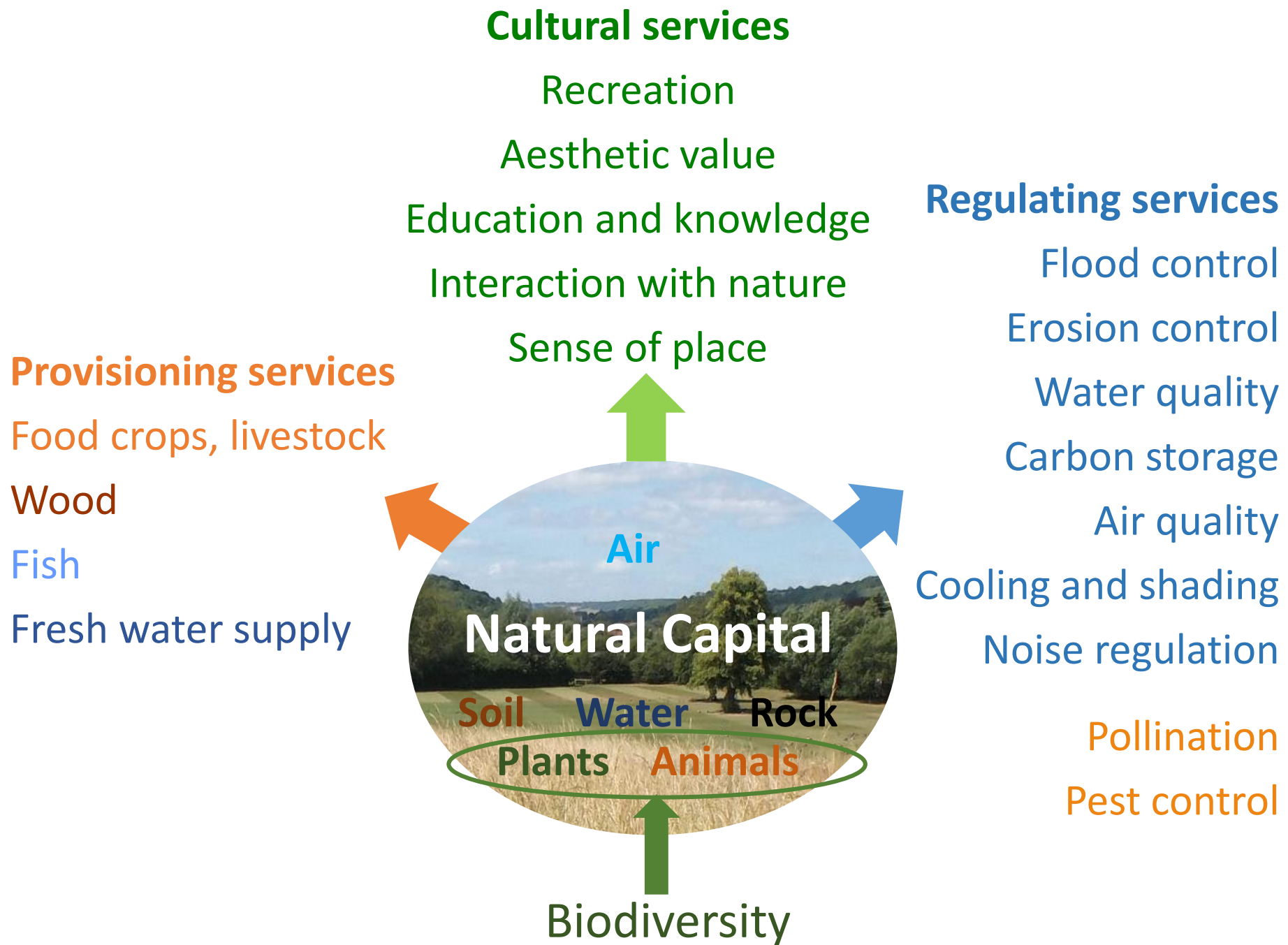
Information gap!

-> Oxford Policy Exchange Network
Funding for researchers to work with non-academics to generate real life impact from university research

Figure 2: Major natural capital assets in Oxfordshire

Cultural services
Recreation
Aesthetic value
Education and knowledge
Interaction with nature
Sense of place

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

Pollination
Pest control

Provisioning services
Food crops, livestock
Wood
Fish
Fresh water supply

Natural Capital

Air

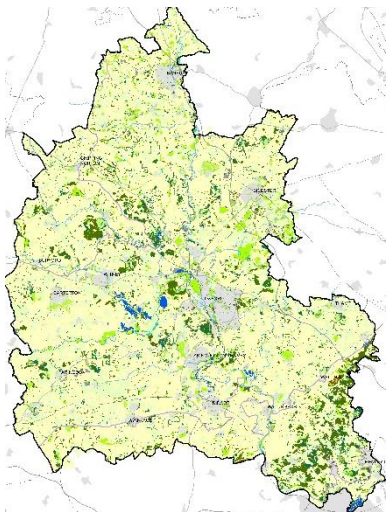Soil Water Rock
Plants Animals

Biodiversity

The land use scoring approach

1. Develop a matrix of scores from 0 to 10 for the ability of each habitat / land use type to deliver each of the 18 services

2. Apply the scores to a habitat and land use map -> maps for each of the 18 services

3. Extra multipliers can be used to reflect habitat condition or location – e.g. agricultural land use class (for food provision) and public access (for recreation)

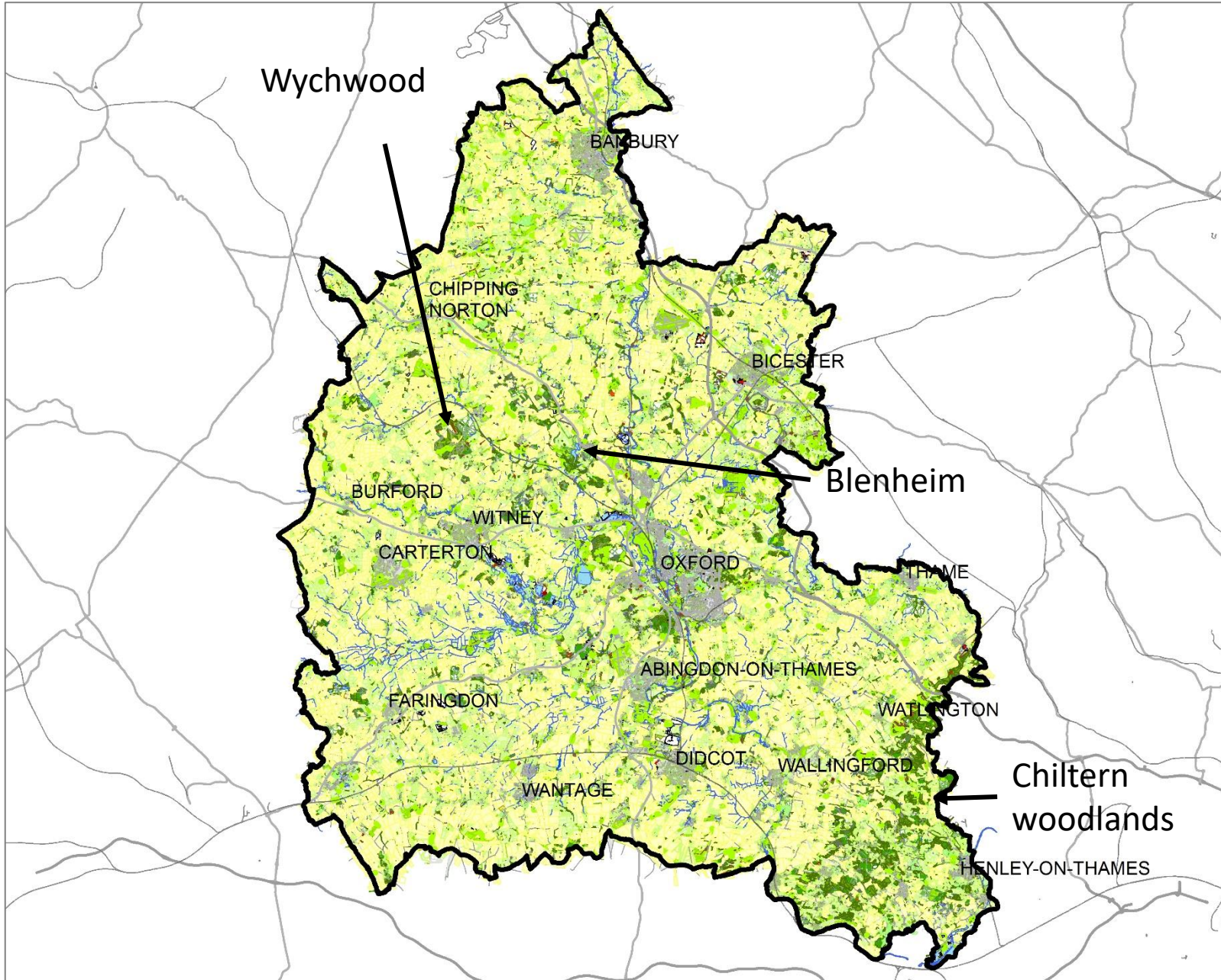Habitat and land use maps   Matrix of scores for each habitat and land-use type   Ecosystem service maps

X

Habitat	Food	Wood	Fish	WaterProv	Flood	Erosion	WaterQual	Carbon
Broadleaved, mixed and yew semi-natural woodland	1	6	0	3	9	10	10	10
Broadleaved, mixed and yew plantation	0	8	0	2	9	8	8	9
Native pine woodlands	0	0	0	3	9	8	6	7
Coniferous plantation	0	10	0	1	10	6	5	8
Wood pasture and parkland with scattered trees	5	2	0	7	6	8	6	5
Traditional orchards	5	1	0	7	8	8	5	5
Dense scrub	1	2	0	4	6	8	5	6
Hedgerows	1	1	0	4	6	8	5	5
Felled woodland	0	0	0	4	1	0	1	2
Tall herb and fern	1	0	0	8	5	8	5	4
Bracken	1	0	0	8	5	8	5	4
Semi-natural grassland	6	0	0	9	4	8	4	4

=

Habitats and land-use in Oxfordshire

Wychwood

Blenheim

Chiltern woodlands

BANBURY
CHIPPING NORTON
BICESTER
BURFORD
WITNEY
CARTERTON
OXFORD
THAME
ABINGDON-ON-THAMES
FARINGDON
WATLINGTON
DIDCOT
WALLINGFORD
WANTAGE
HENLEY-ON-THAMES

Legend:
- Arable
- Broadleaved woodland
- Built-up areas
- Coniferous woodland
- Fen, marsh and swamp
- Heath
- Improved grassland
- Orchards
- Quarry
- Scrub
- Semi-natural grassland
- Urban green space
- Water
- Wood pasture and parkland

Habitats and land-use in Oxfordshire

Urban green space, 3.1%
Manmade, 5.7%
Gardens, 4.0%
Water, 1.2%
Other semi-natural, 2.1%
Semi-natural grassland, 3.9%
Semi-natural woodland, 6.3%
Plantation, 2.8%
Arable, 49%
Improved grassland, 22%
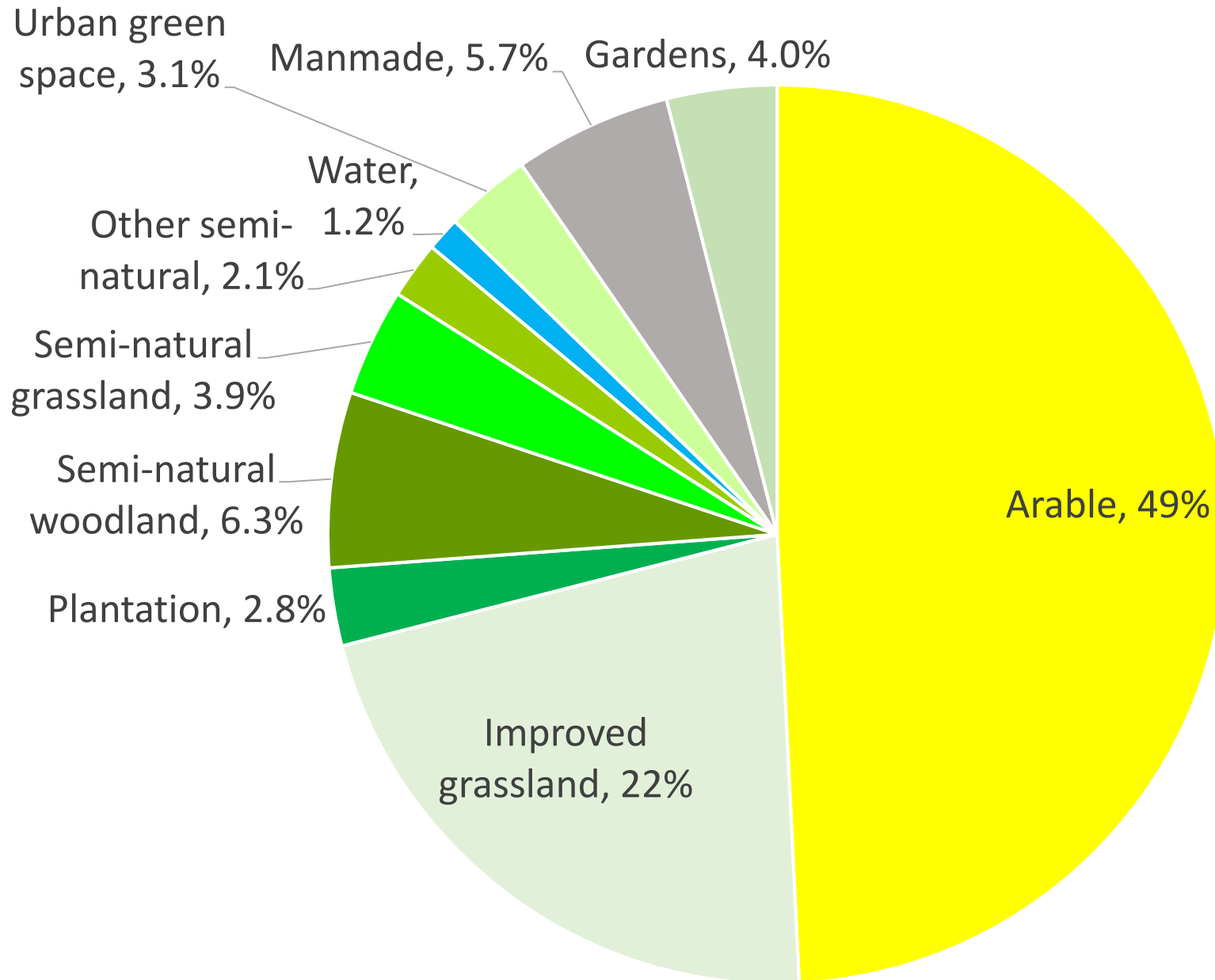
71% intensive farmland
13% urban
3% conifer plantation
13% semi-natural habitats

Plus:
- 9,564 km rural hedgerows
- 7,407 km linear woodland
- At least 2251 ancient trees

- 1698 km rivers

- 164 km National Trails
- 92 km Sustrans off-road
- 4,234 km PROW

Habitat	Food	Wood	Fish	WaterProv	Flood	Erosion	WaterQual	Carbon	AirQuality	Cooling	Noise	Pollination	Pest Control	Recreation	Aesthetic	Education	Nature	SensePlace
Broadleaved, mixed and yew semi-natural woodland	1	6	0	3	9	10	10	10	6	10	8	7	8	10	10	10	10	10
Broadleaved, mixed and yew plantation	0	8	0	2	9	8	8	9	6	10	8	6	6	10	10	6	7	8
Native pine woodlands	0	0	0	3	9	8	6	7	8	10	10	6	8	10	10	10	10	10
Coniferous plantation	0	10	0	1	10	6	5	8	10	10	10	2	6	10	6	6	4	6
Wood pasture and parkland with scattered trees	5	2	0	7	6	8	6	5	3	6	6	7	8	10	10	8	8	10
Traditional orchards	5	1	0	7	8	8	5	5	4	8	6	7	8	8	10	8	7	10
Dense scrub	1	2	0	4	6	8	5	6	7	6	6	7	10	8	8	6	8	6
Hedgerows	1	1	0	4	6	8	5	5	8	6	6	8	10	8	10	8	10	10
Felled woodland	0	0	0	4	1	0	1	2	0	1	0	1	3	5	1	1	1	1
Tall herb and fern	1	0	0	8	5	8	5	4	1	2	1	7	10	8	10	6	8	4
Bracken	1	0	0	8	5	8	5	4	1	2	1	6	8	8	6	4	6	2
Semi-natural grassland	6	0	0	9	4	8	4	4	1	2	1	7	8	10	10	10	10	10
Acid grassland	6	0	0	9	4	8	4	4	1	2	1	6	8	10	10	10	10	10
Calcareous grassland	6	0	0	9	4	8	4	3	1	2	1	10	8	10	10	10	10	10
Neutral grassland	6	0	0	9	4	8	4	4	1	2	1	7	8	10	10	10	10	10
Improved grassland	10	0	0	7	3	4	1	3	1	2	1	2	3	5	4	2	2	4
Arable fields, horticulture and temporary grass	10	0	0	7	2	1	1	2	1	2	1	2	2	5	2	2	1	2
Arable field margins	0	0	0	8	4	6	5	2	1	2	1	6	8	10	8	6	6	4
Woody biofuel crops	0	10	0	3	4	2	1	4	1	2	1	2	4	5	2	2	1	2
Intensive orchards	10	1	0	3	8	6	1	5	4	8	6	6	4	5	8	2	1	2
Bog	1	0	0	10	5	8	7	10	1	4	1	4	3	8	8	8	10	10
Dwarf shrub heath	1	0	0	8	5	8	5	4	1	2	1	10	9	10	10	8	10	10
Inland rock	0	0	0	0	0	0	0	0	0	0	0	0	0	8	10	10	6	10
Freshwater	0	0	10	10	0	0	1	1	0	4	0	1	2	10	10	10	10	10
Standing open water and canals	0	0	10	10	4	0	1	1	0	4	0	1	2	10	10	10	10	10
Running water	0	0	10	10	1	0	1	0	0	4	0	1	2	10	10	10	10	10
Fen, marsh and swamp	1	0	0	10	4	8	7	6	1	4	1	4	3	6	10	10	10	10
Lowland fens	1	0	0	10	4	8	7	6	1	4	1	4	3	6	10	10	10	10
Purple moor grass and rush pastures	4	0	0	9	4	8	7	4	1	2	1	4	6	10	10	8	10	10
Upland flushes, fens and swamps	1	0	0	10	4	8	7	6	1	4	1	4	3	6	10	10	10	10
Aquatic marginal vegetation	0	0	10	10	4	8	7	2	1	4	1	6	8	6	10	10	10	10
Reedbeds	0	0	10	10	4	8	7	4	1	4	1	2	3	6	10	10	10	10

Woodland habitats: high scores for most regulating and cultural services

Grassland habitats: high scores for cultural but lower for regulating

Farmland habitats: max scores for food but lower for other

Freshwater and wetland: high for cultural, water supply, fish; lower for some regulating

Habitat	Food	Wood	Fish	WaterProv	Flood	Erosion	WaterQual	Carbon	AirQuality	Cooling	Noise	Pollination	Pest Control	Recreation	Aesthetic	Education	Nature	SensePlace
Other swamps	1	0	0	10	4	8	7	4	1	4	1	4	3	6	10	8	10	10
Coastal rock	0	0	0	0	1	1	0	0	0	0	0	0	0	10	10	10	8	10
Coastal saltmarsh																0	10	10
Vegetated dunes and s																8	8	10
Beach and bare sand																8	6	10
Other littoral sedimen																8	6	10
Sealed surface and bui																0	0	0
Artificial unvegetated,																0	0	0
Bare ground																0	0	0
Garden																2	2	2
Vegetated garden																4	4	4
Unvegetated garden																0	0	0
Open mosaic habitats																8	6	4
Parks and gardens																6	6	6
Footpath / cycle path -																2	4	6
Green bridge																6	8	8
Amenity grassland	0	0	0	7	3	4	2	3	1	2	1	2	2	10	5	2	2	2
Road island / verge																2	2	2
Natural sports pitch, re																2	2	4
Cemeteries and church																2	4	8
Allotments, city farm,																6	4	10
Intensive green roof																4	2	6
Green wall																4	2	6
Brown roof or extensiv																4	4	6
Tree	0	1	0	1	6	6	2	7	6	8	6	6	8	2	10	8	8	10
Bioswale	0	0	0	5	5	2	2	2	1	4	1	5	4	2	8	4	6	4
Rain garden	0	0	0	10	5	2	7	2	1	4	1	6	6	2	10	6	8	6
Introduced shrub	0	1	0	4	5	6	4	4	4	6	6	6	6	2	8	2	4	4
Flower bed	0	0	0	7	2	2	1	2	1	2	1	6	6	2	10	2	6	4
Suburban/ mosaic of developed/ natural surface	0	0	0	1.5	0.5	1	0.5	0.5	0.2	0.3	0.2	0.5	0.4	0	0.5	0	0.5	0.5

Source of scores (from our other projects):
- Stakeholder workshop in Warwickshire
- Literature review (780 papers)
- Review of similar tools
- Expert workshops
- Peer review

Most scores are indicative rankings, but two (carbon storage and air quality regulation) are proportional to measured values

Coastal habitats: high scores for cultural, low for most regulating

Sealed surfaces: zero

Urban green infrastructure: generally quite high for cultural, medium to low for regulating (trees and shrubs higher)

Carbon storage by soils and vegetation

Flood protection by vegetation
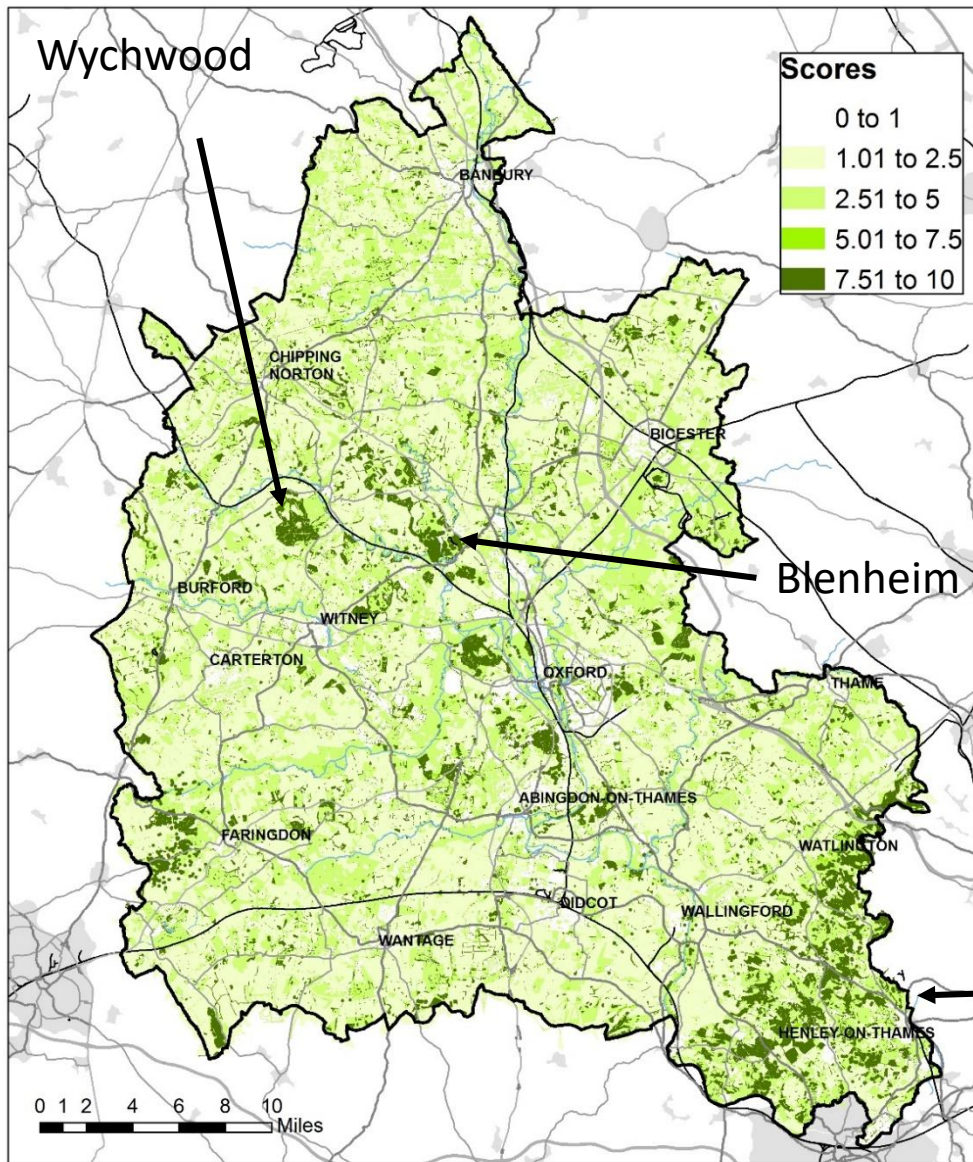
Most of the regulating and cultural services are similar as they are highest for areas of woodland and other semi-natural habitats

Scores
0 to 1
1.01 to 2.5
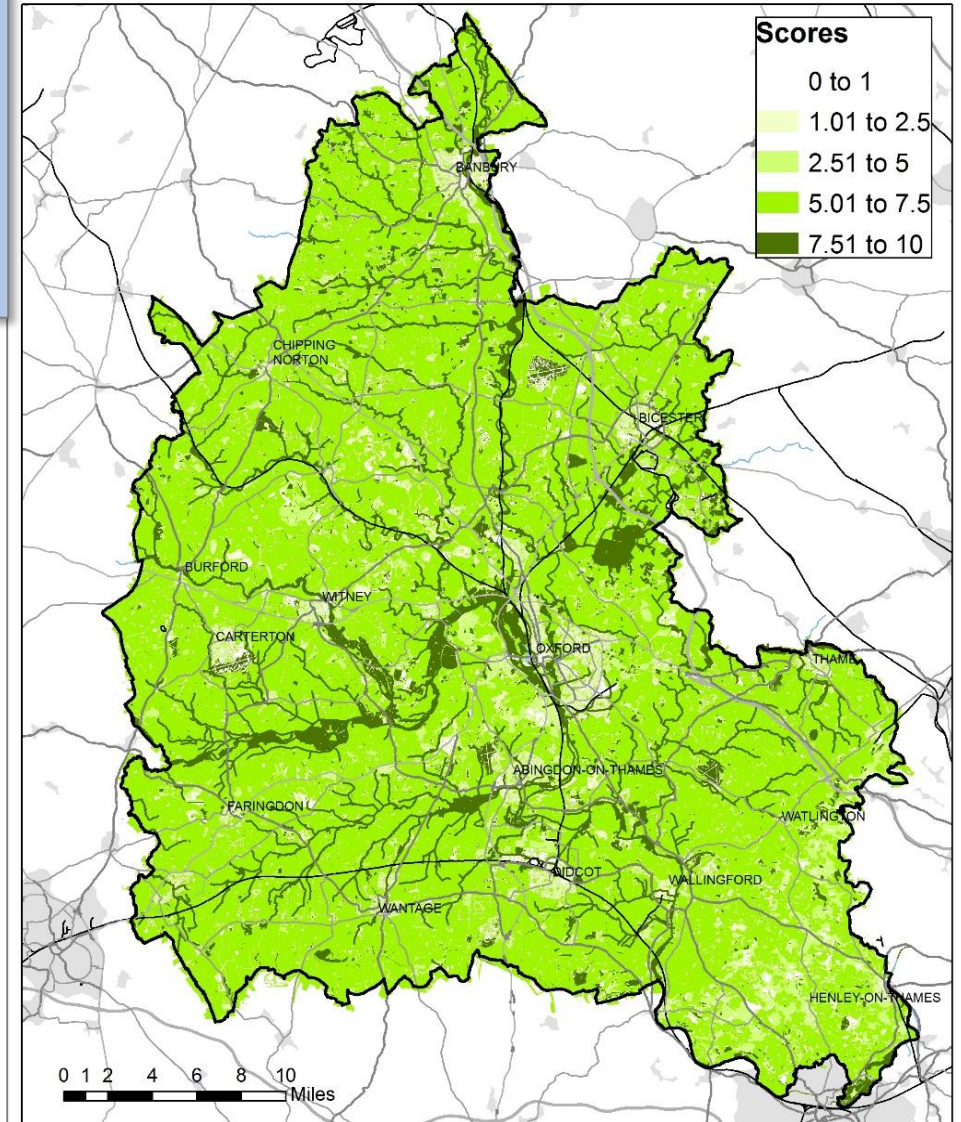2.51 to 5
5.01 to 7.5
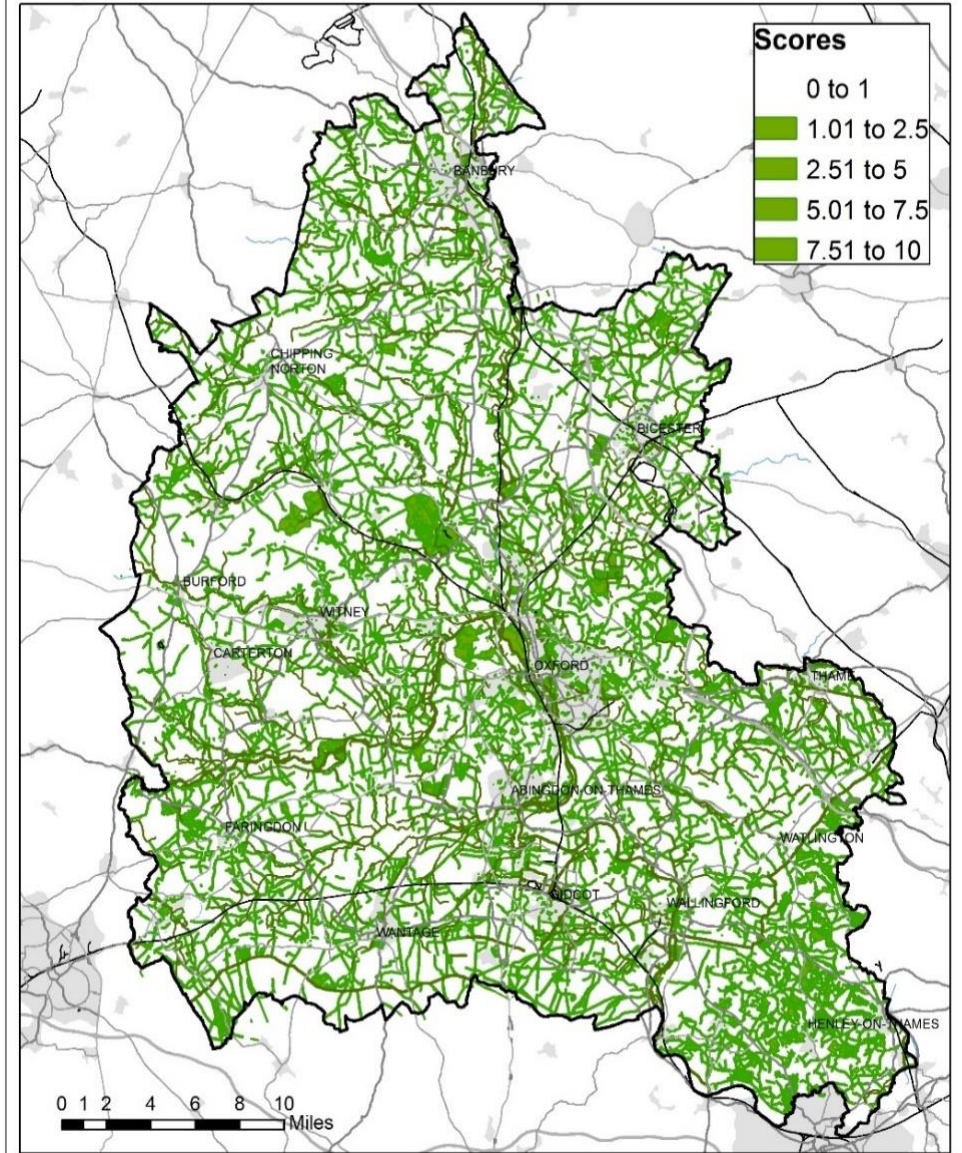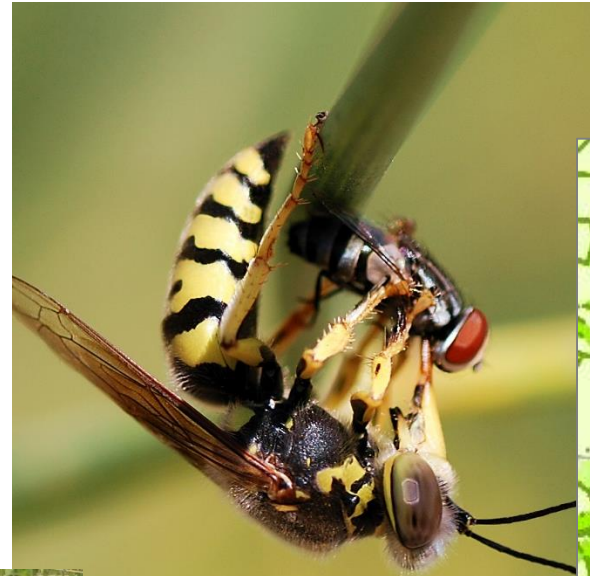7.51 to 10

Wychwood

Blenheim
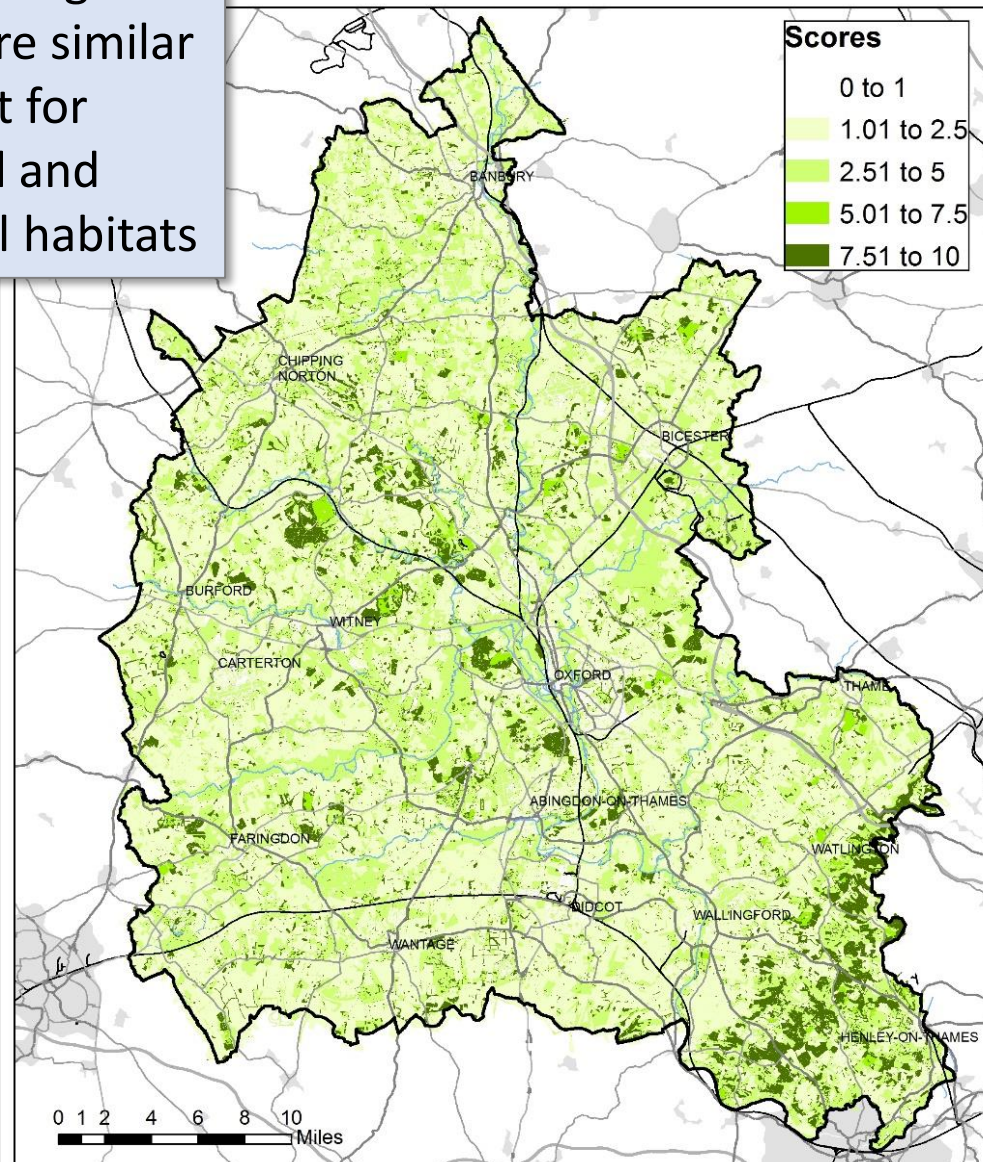
Chiltern woodlands

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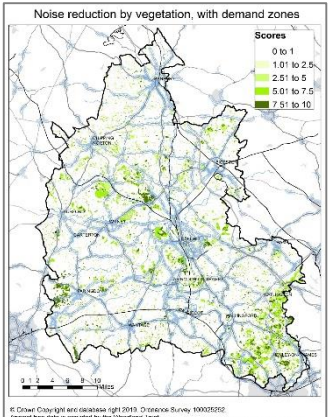
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Food provision
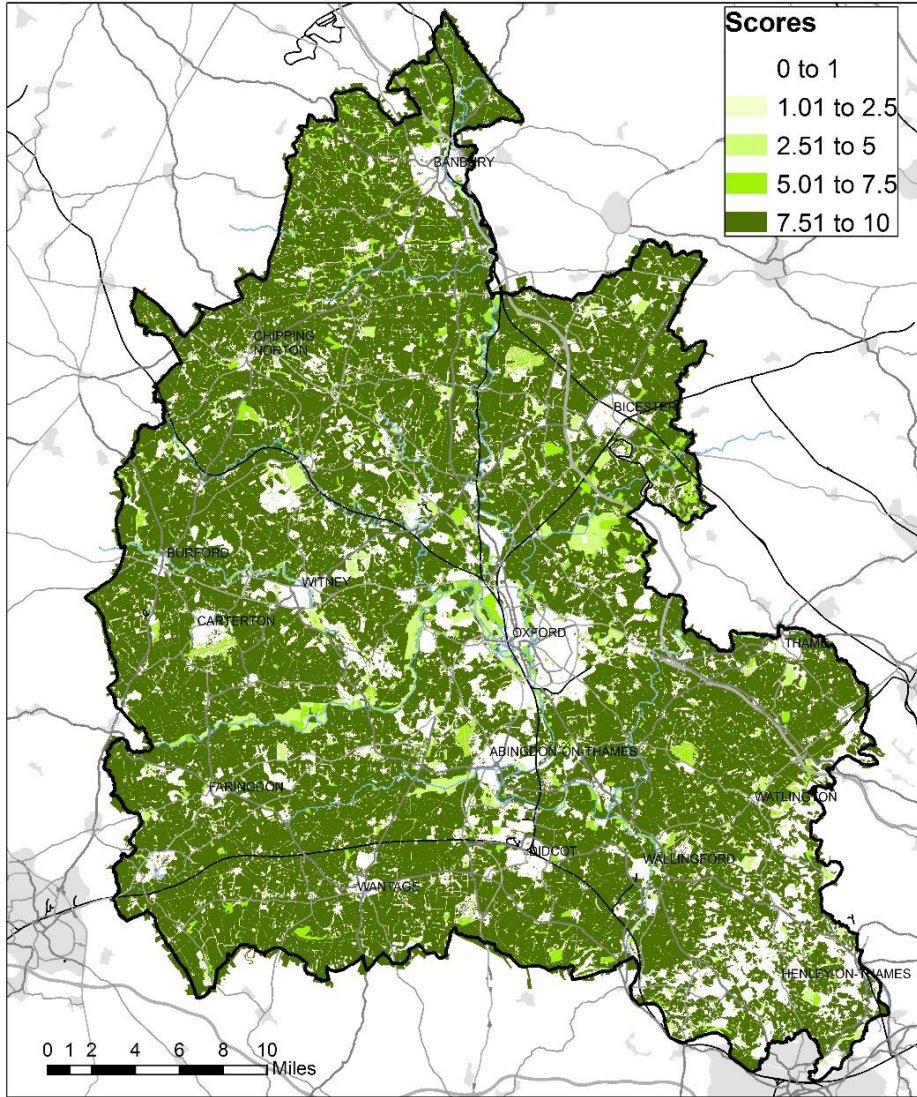
Scores
- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

0 1 2   4   6   8   10 Miles

Agricultural Land Class (accounts for slope, soil, climate, drainage)
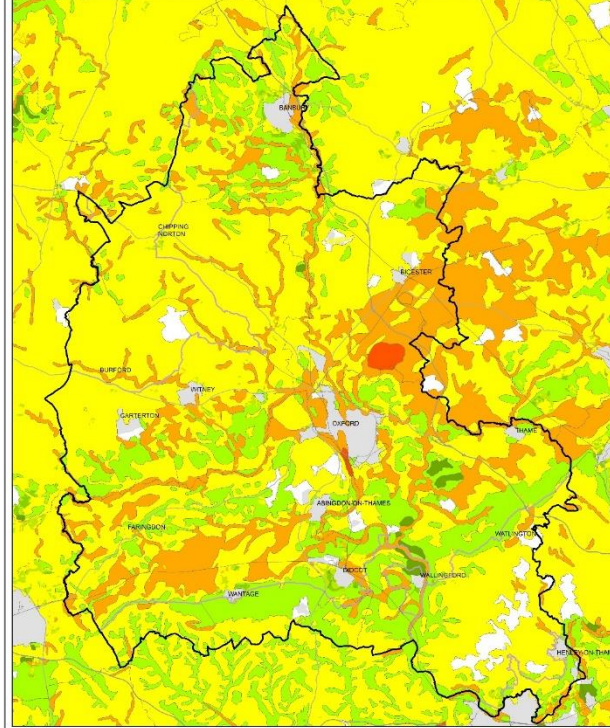
ALC Grades
- Grade 1 (best and most versatile)
- Grade 2
- Grade 3
- Grade 4
- Grade 5 (rough grazing only)

0 1 2   4   6   8   10 Miles

Food provision (with Agricultural Land Classification)
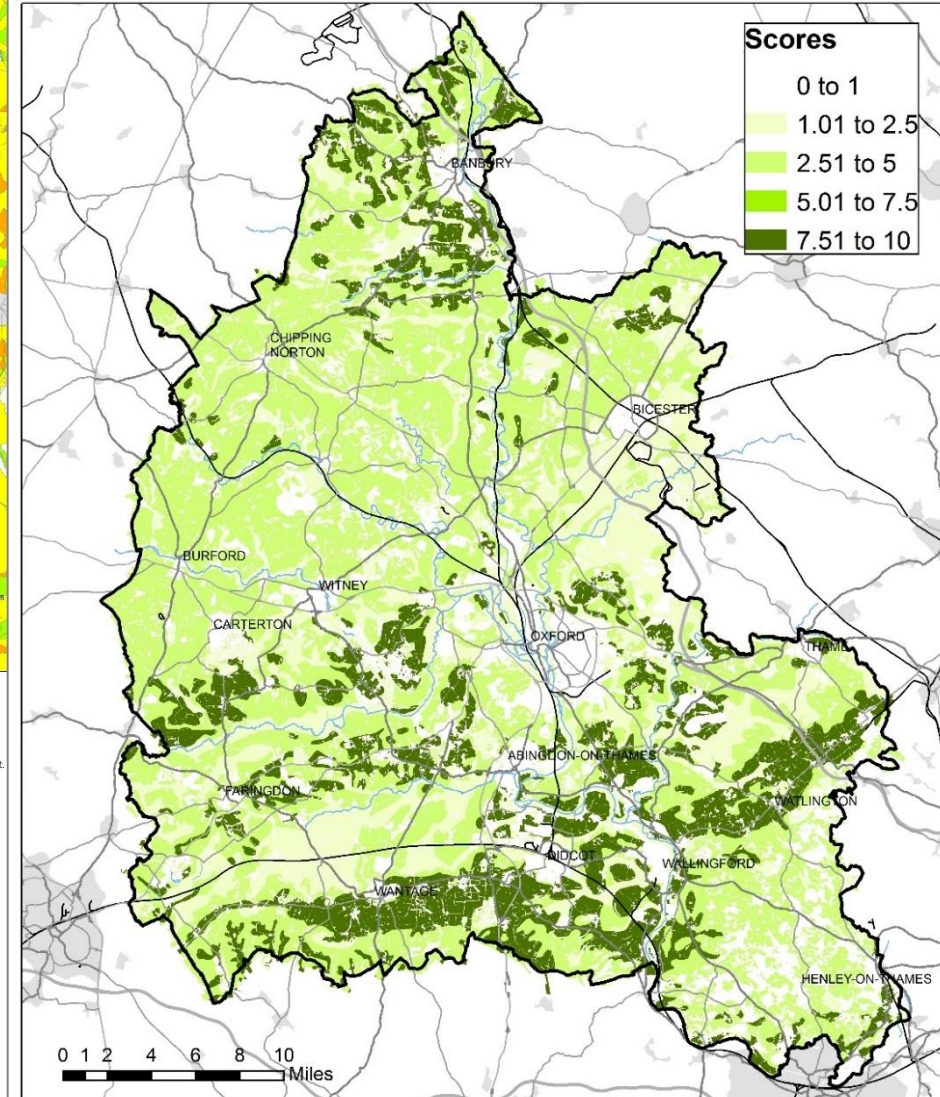
Scores
- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

0 1 2   4   6   8   10 Miles

Coniferous plantations score max

Wood production
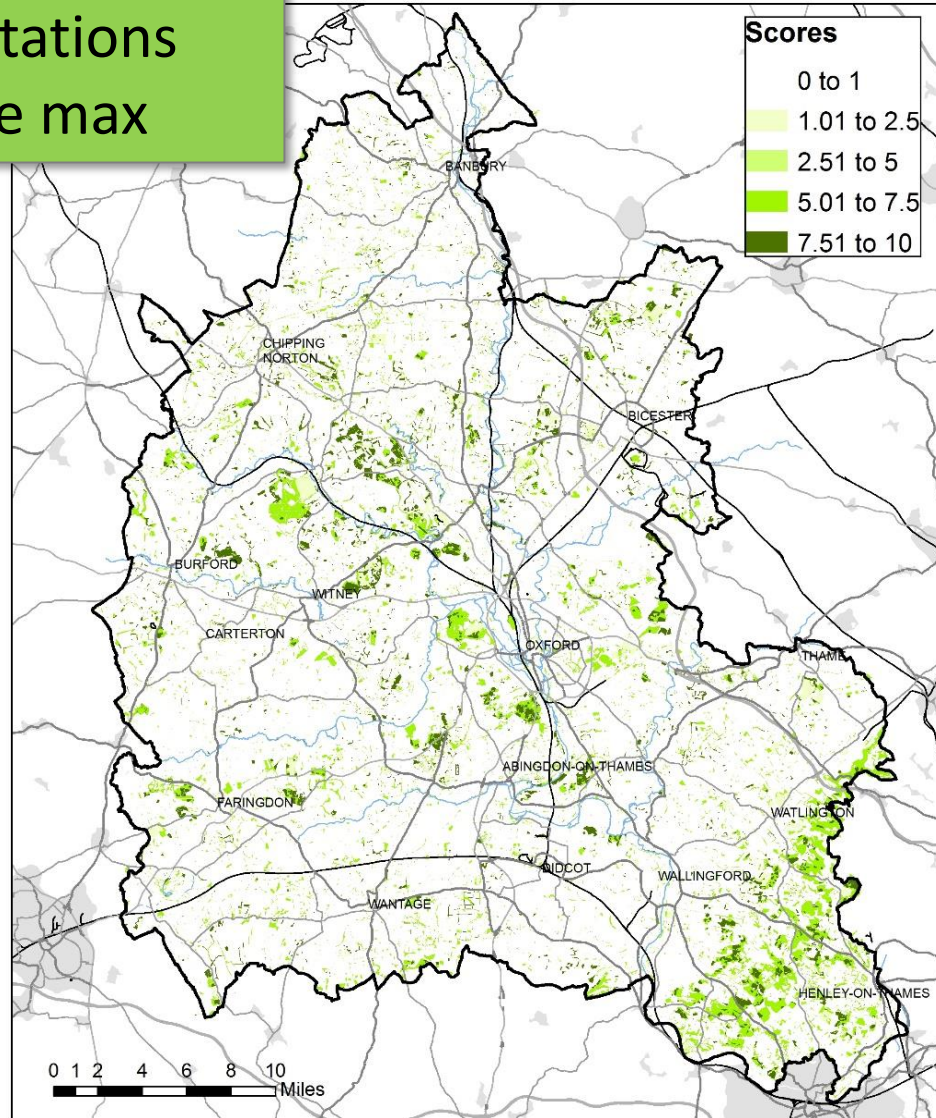
Scores
0 to 1
1.01 to 2.5
2.51 to 5
5.01 to 7.5
7.51 to 10

Any permeable area allows groundwater recharge

Water supply (surface water and groundwater recharge)

Scores
0 to 1
1.01 to 2.5
2.51 to 5
5.01 to 7.5
7.51 to 10

0 1 2 4 6 8 10 Miles

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Aesthetic value (natural beauty of landscapes)

Recreation: accessible areas only
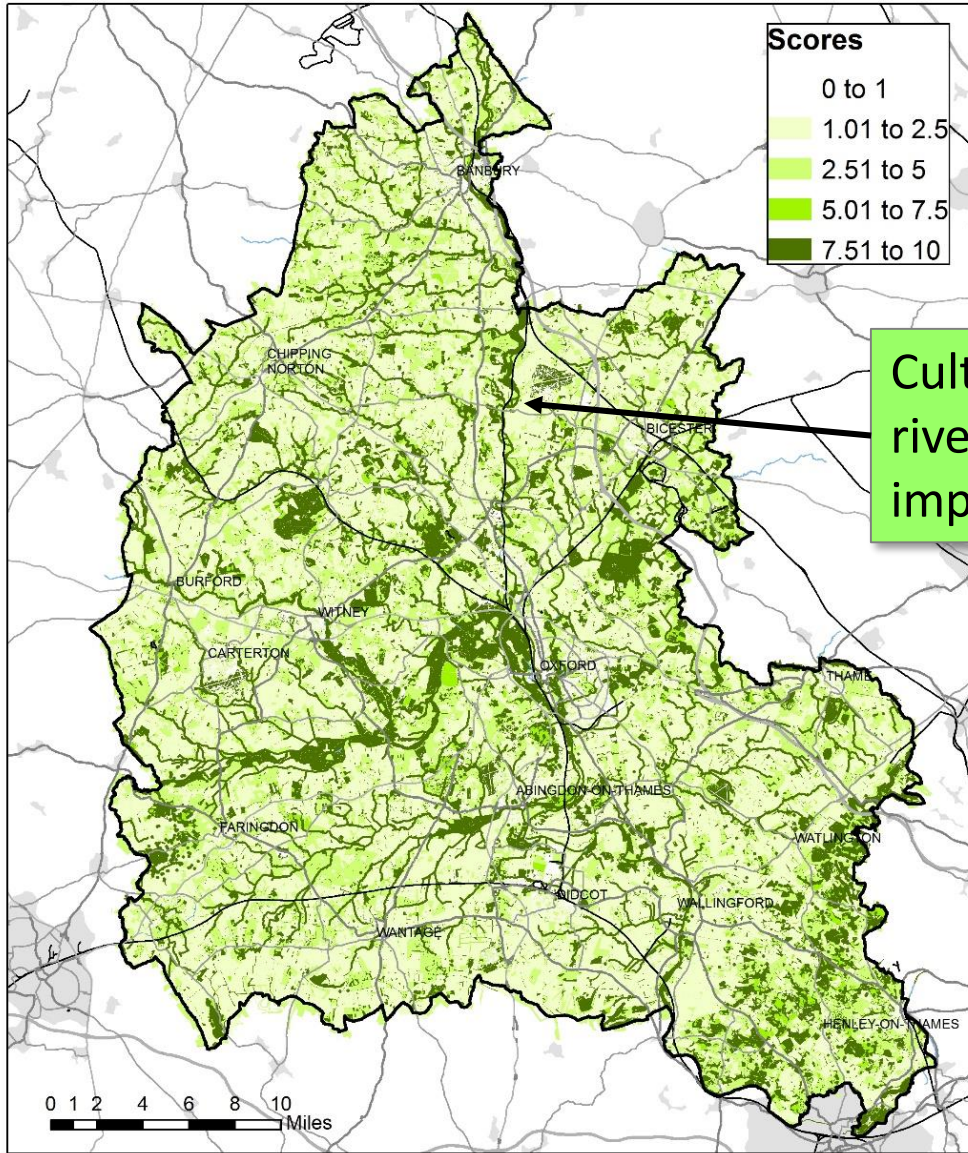
Cultural services: rivers and paths important.

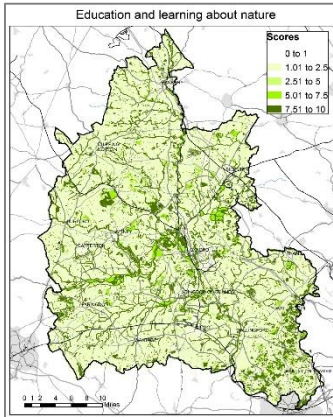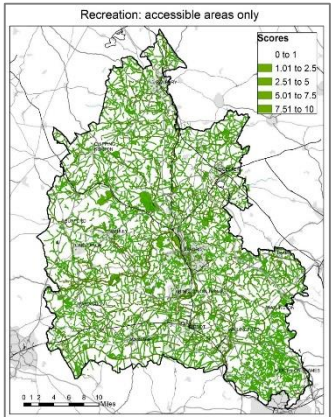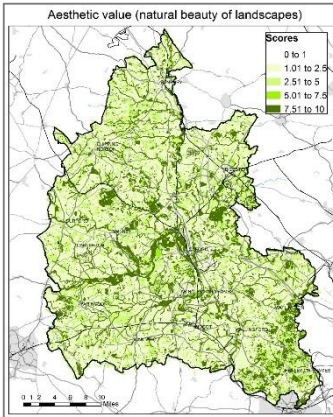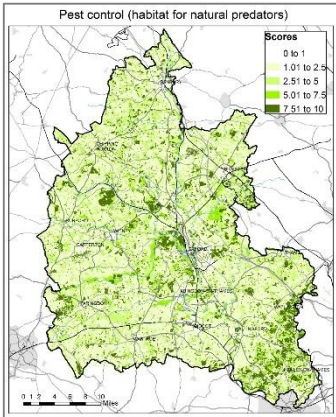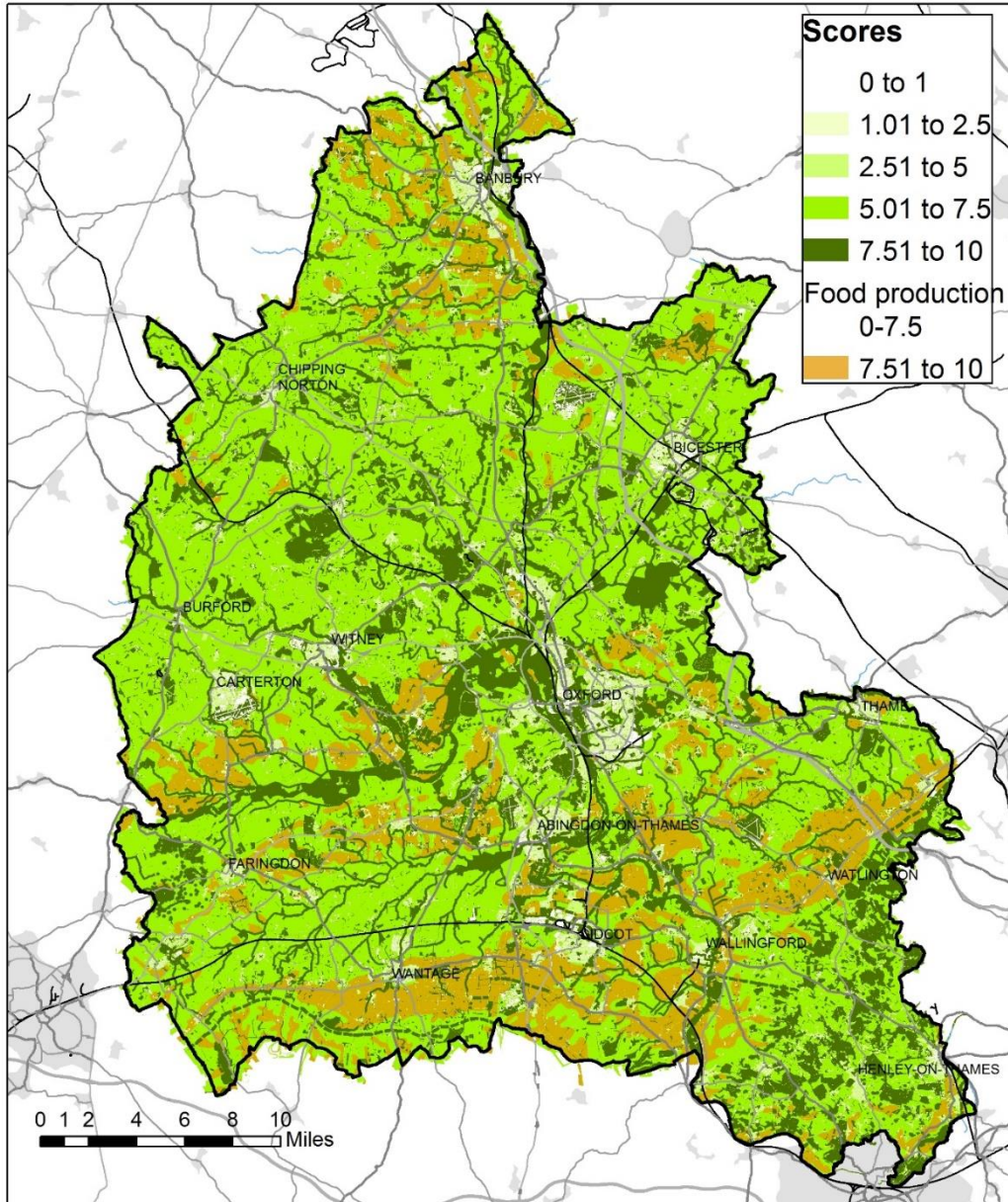# Pollination and natural pest control: importance of hedges

Pollination

Pest control
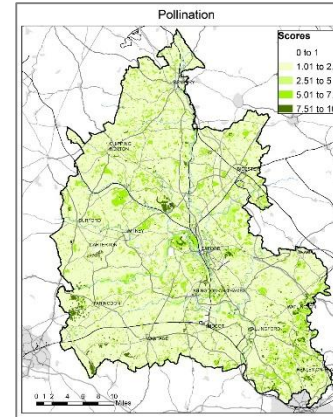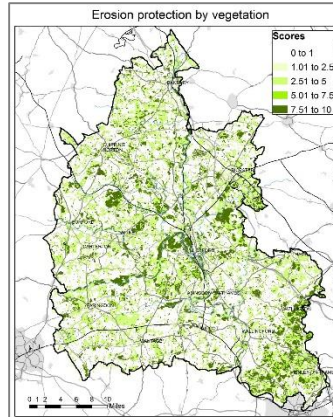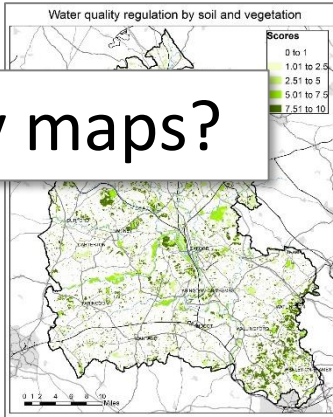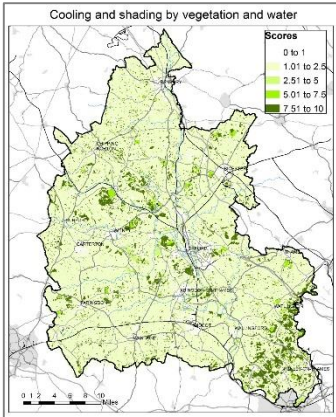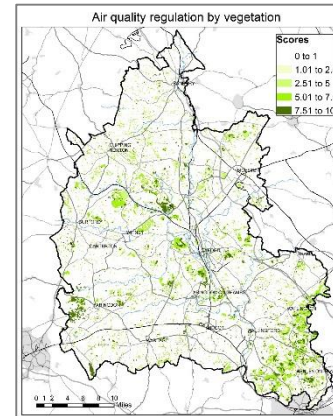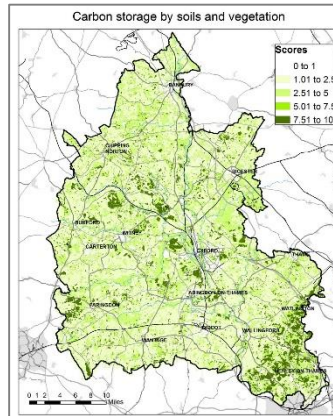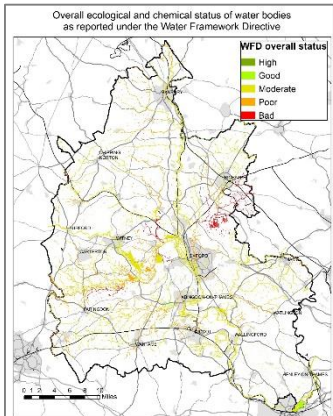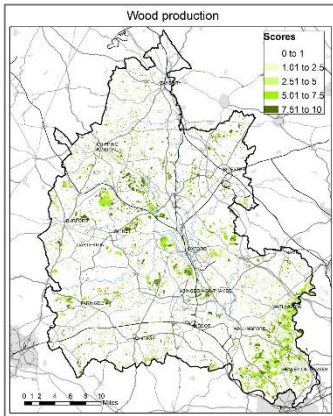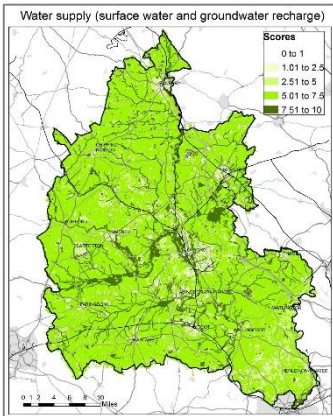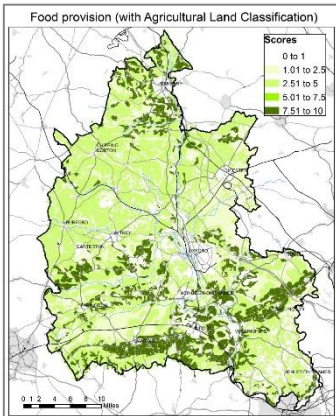
Too many maps?
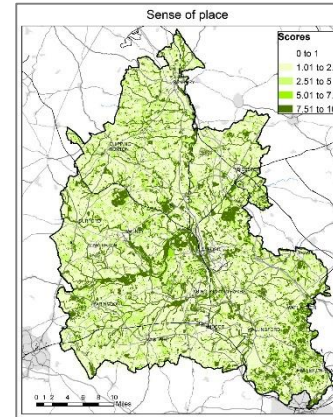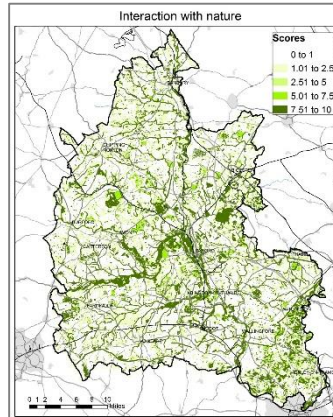
Maximum score for cultural/regulating services and water supply (green) or food provision (orange)

Scores
- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

Food production 0-7.5
- 7.51 to 10

0 1 2 4 6 8 10 Miles

Maximum score for cultural/regulating services(green) or food (orange)

Scores
- 0 to 1
- 1.01 to 2.5
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- 5.01 to 7.5
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Food production 0-7.5
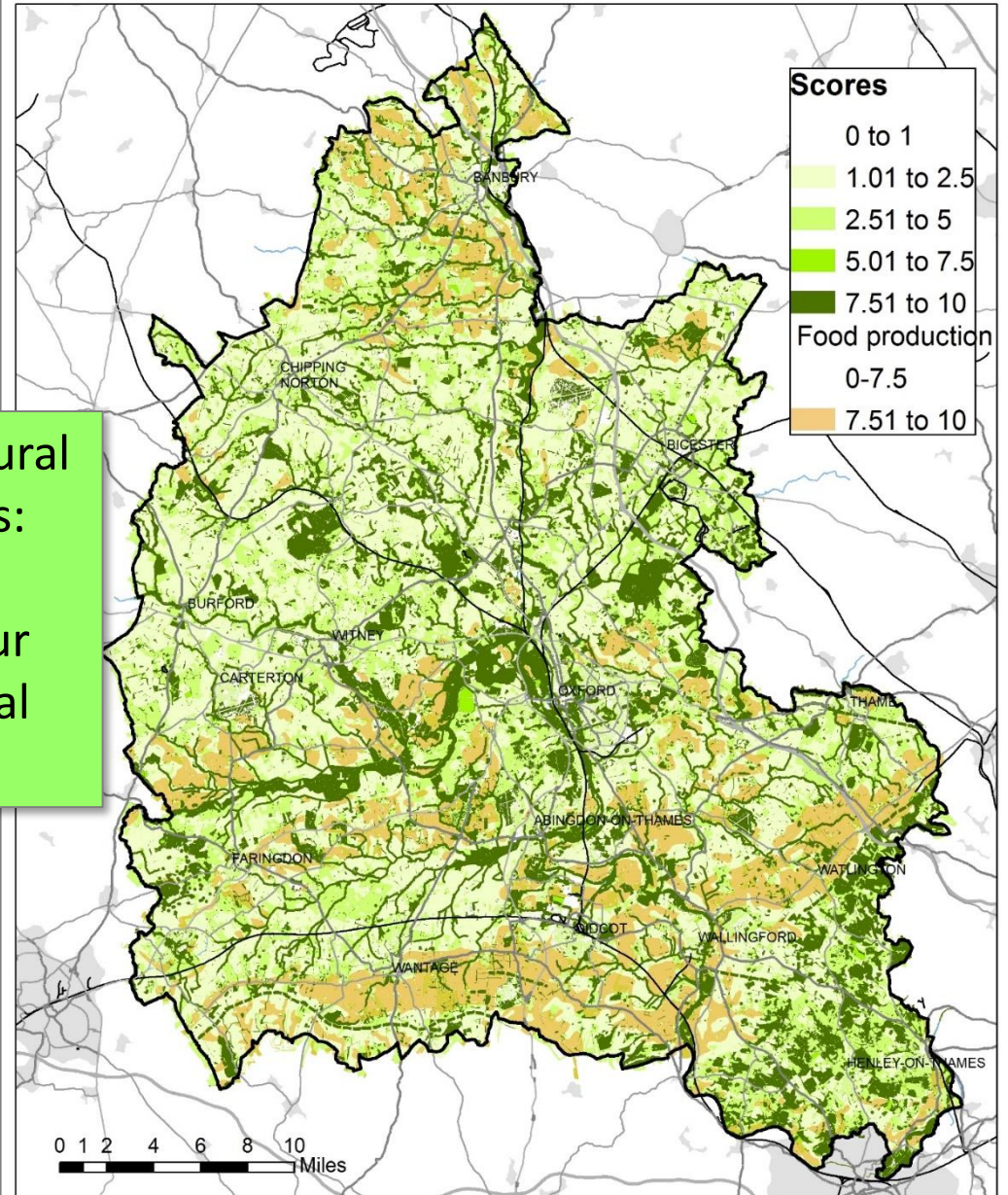- 7.51 to 10

0 1 2 4 6 8 10 Miles
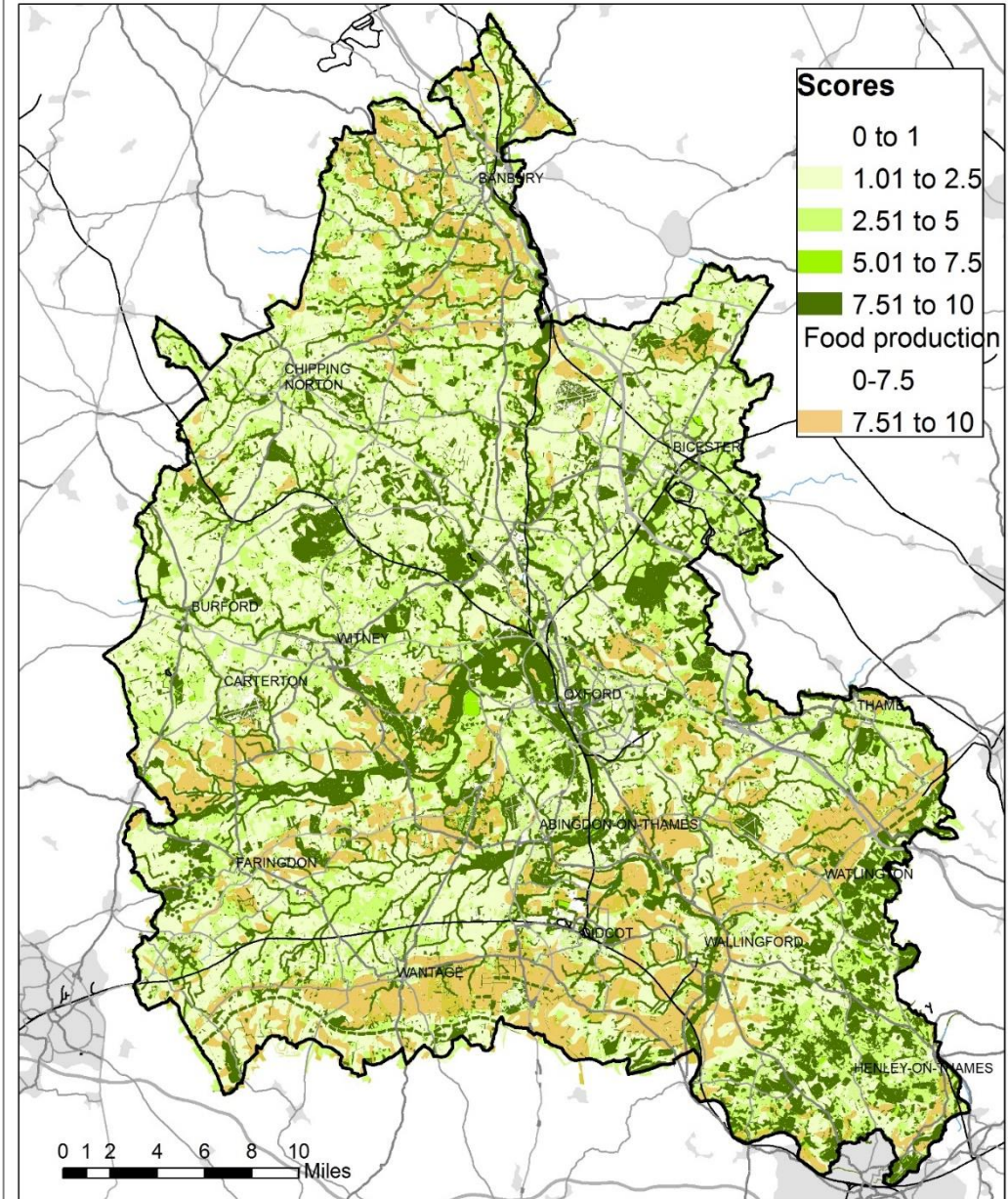
1. **Identifying high value natural capital assets** that should be protected from inappropriate development

2. **Identifying strategic networks of green and blue infrastructure**, which can form part of future nature recovery networks

3. **Identifying low value areas where there may be opportunities to enhance natural capital**, perhaps as part of nature recovery networks.

Figure 2: Major natural capital assets in Oxfordshire

Legend (left map):
- Oxfordshire County Boundary
- Site of Special Scientific Interest
- Special Area of Conservation
- World Heritage Site
- Canal
- River
- Urban Areas
- Green Belt
- Area of Outstanding Natural Beauty

Maximum score for cultural/regulating services(green) or food (orange)

Scores
- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

Food production
- 0-7.5
- 7.51 to 10
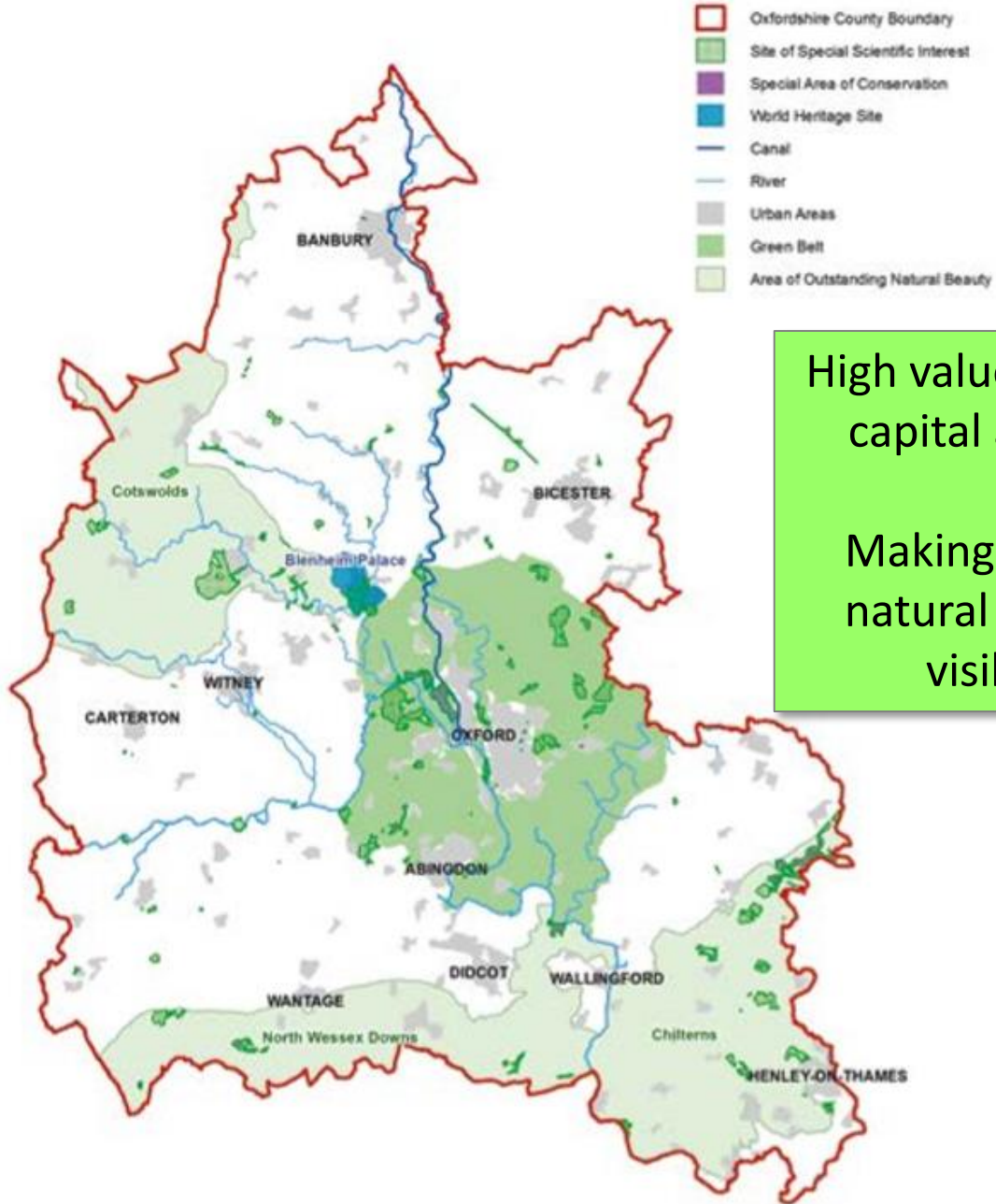
High value natural capital assets:

Making all our natural capital visible

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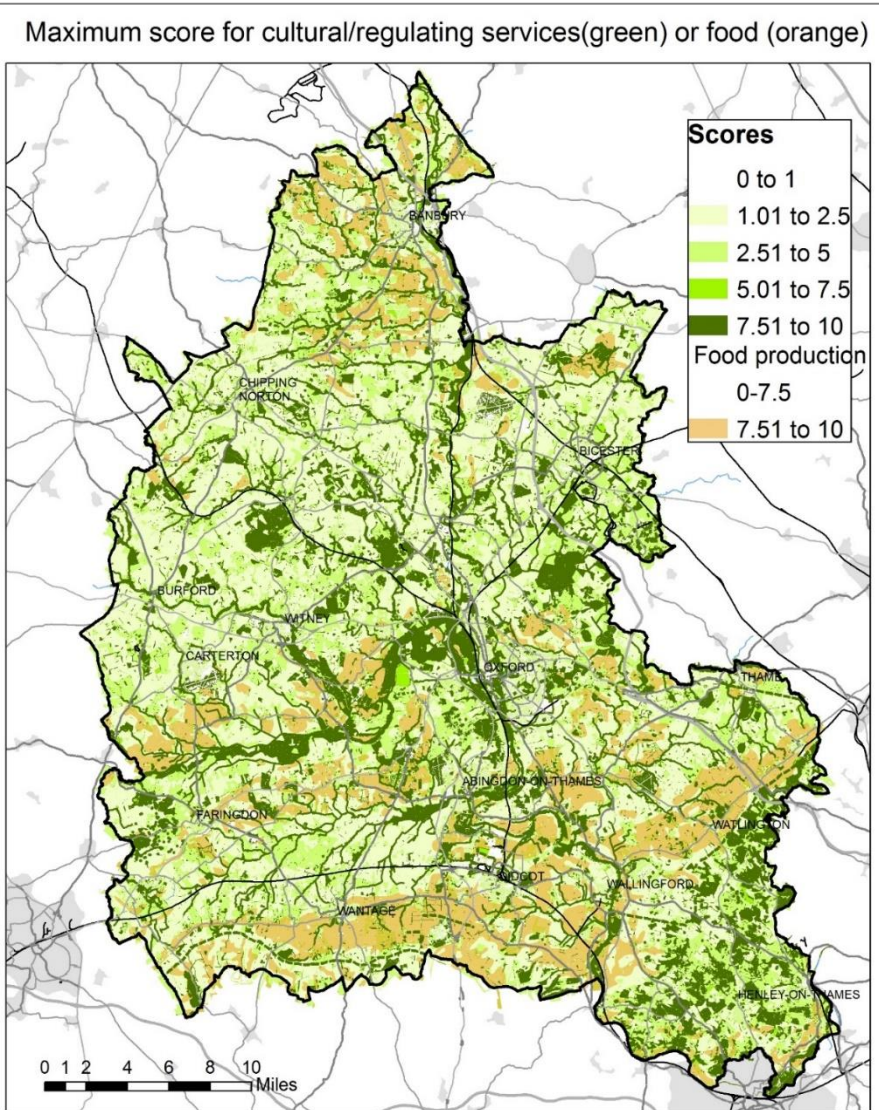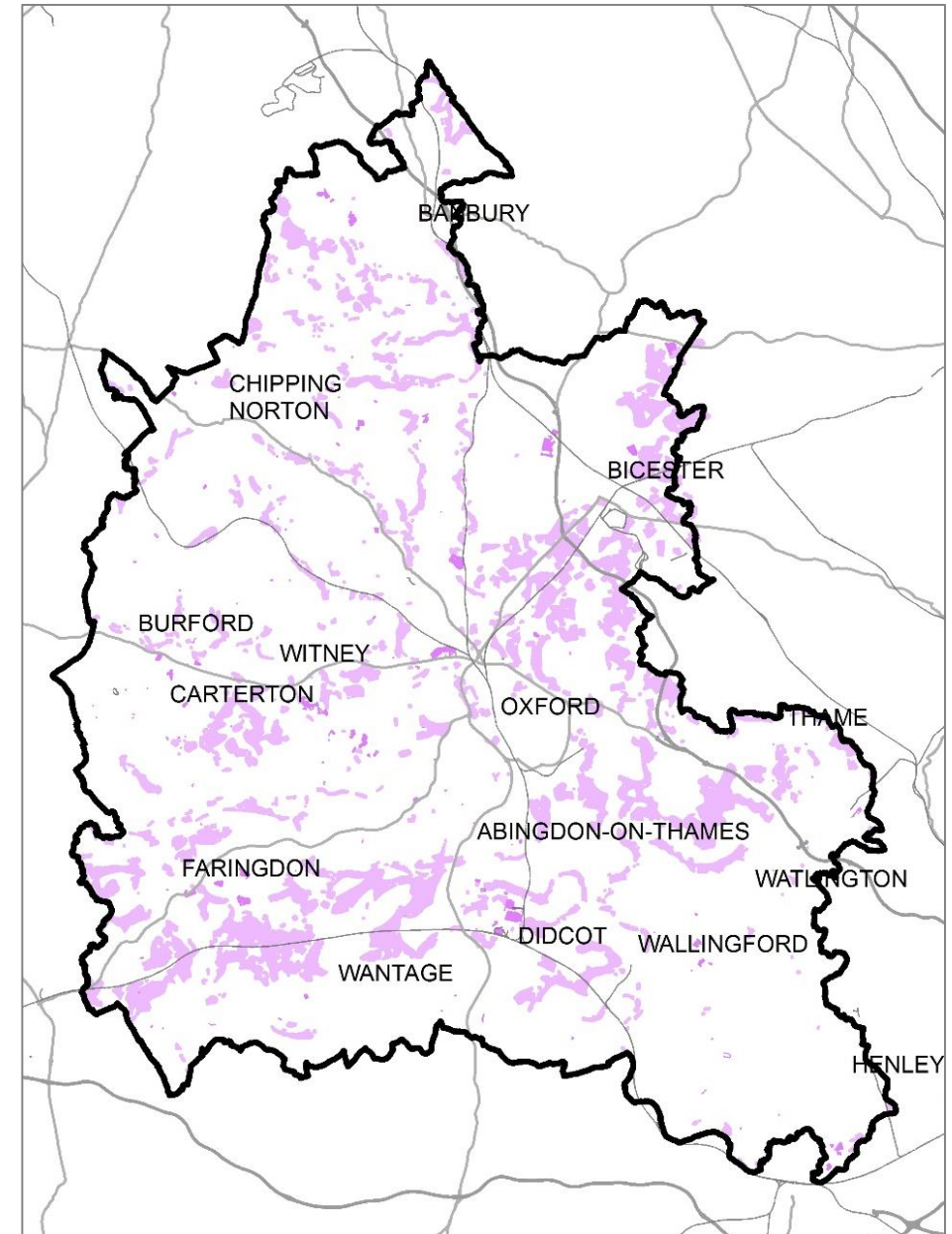Conservation target areas (pink) and Natural England habitat networks (green)

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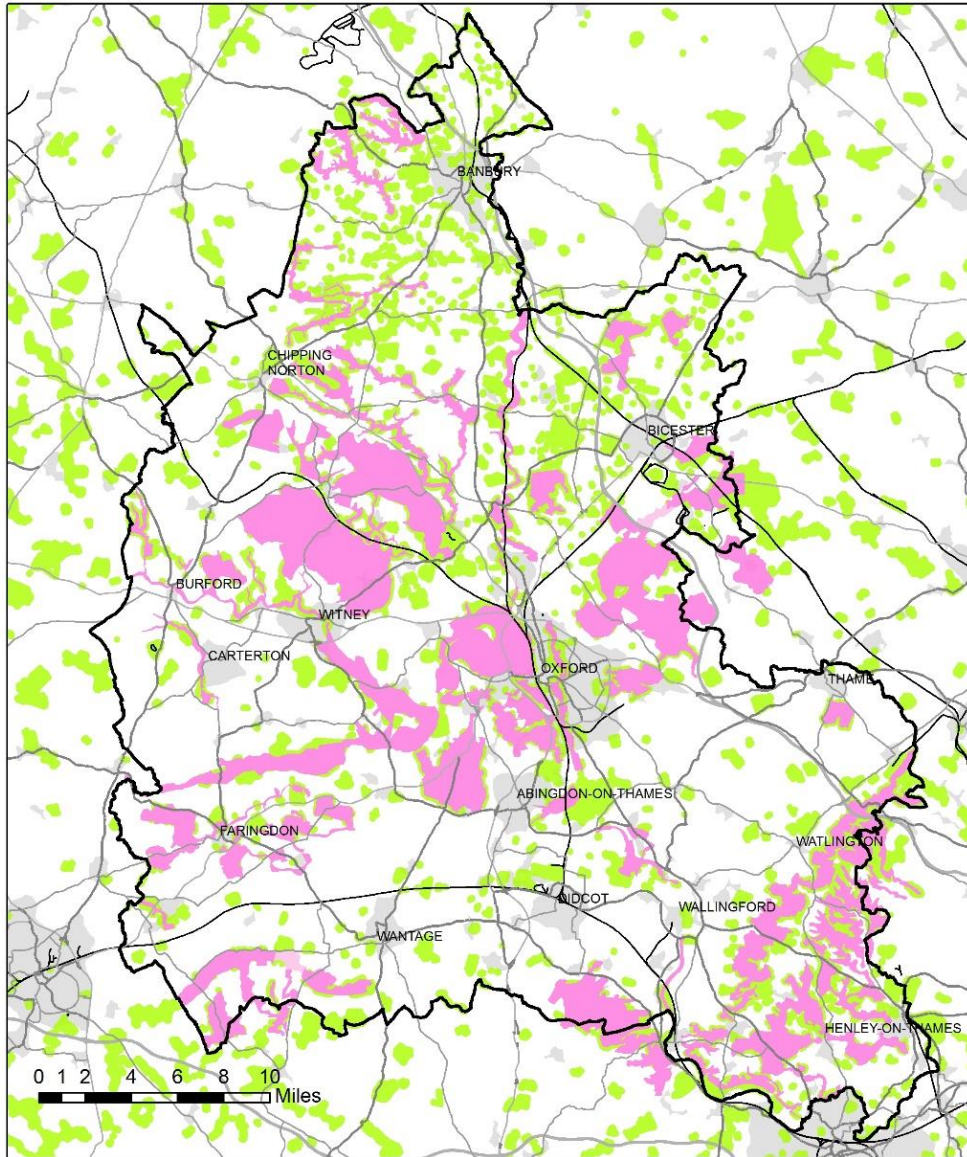
2. Strategic blue-green infrastructure networks
(habitat networks overlaid on high value natural capital map)

3. Areas with low natural capital: opportunities for enhancement

Maximum score for cultural/regulating services(green) or food (orange)

Scores
- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

Food production
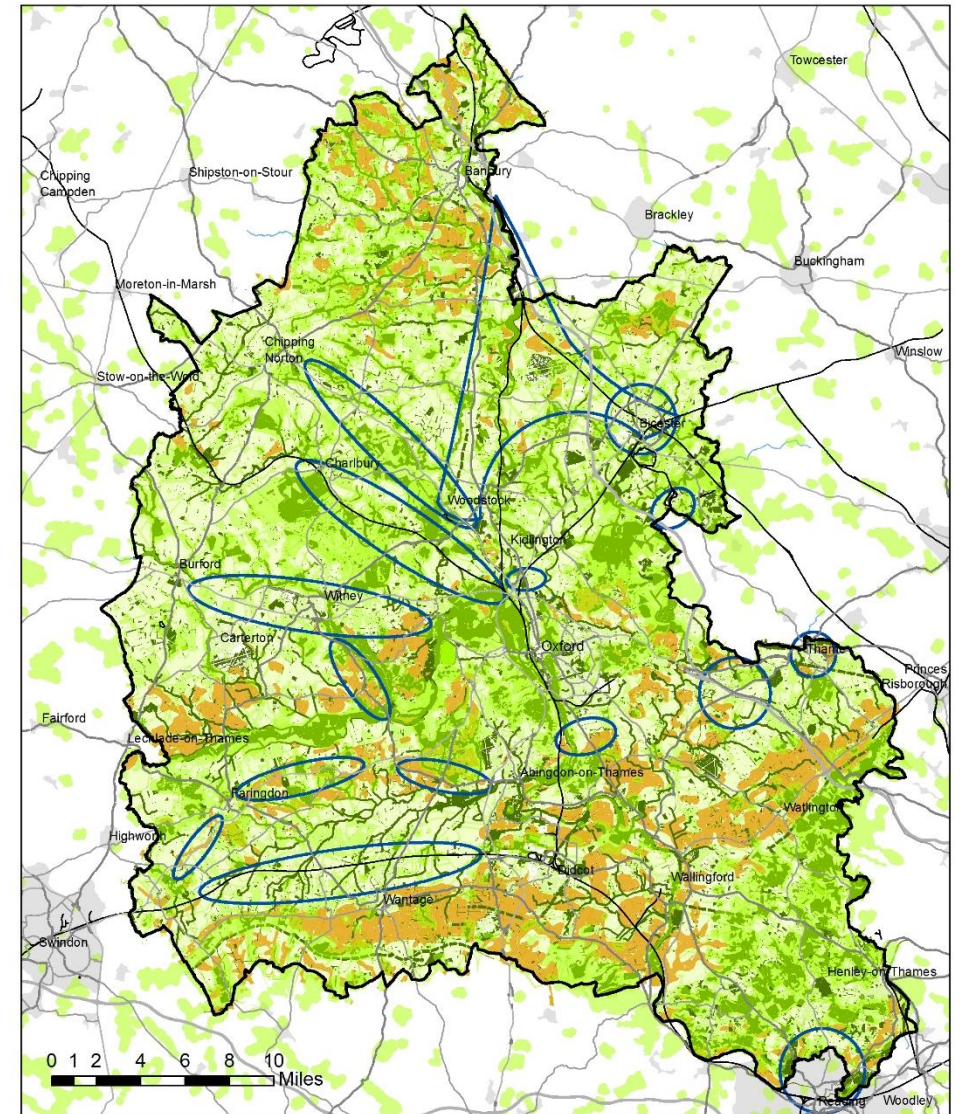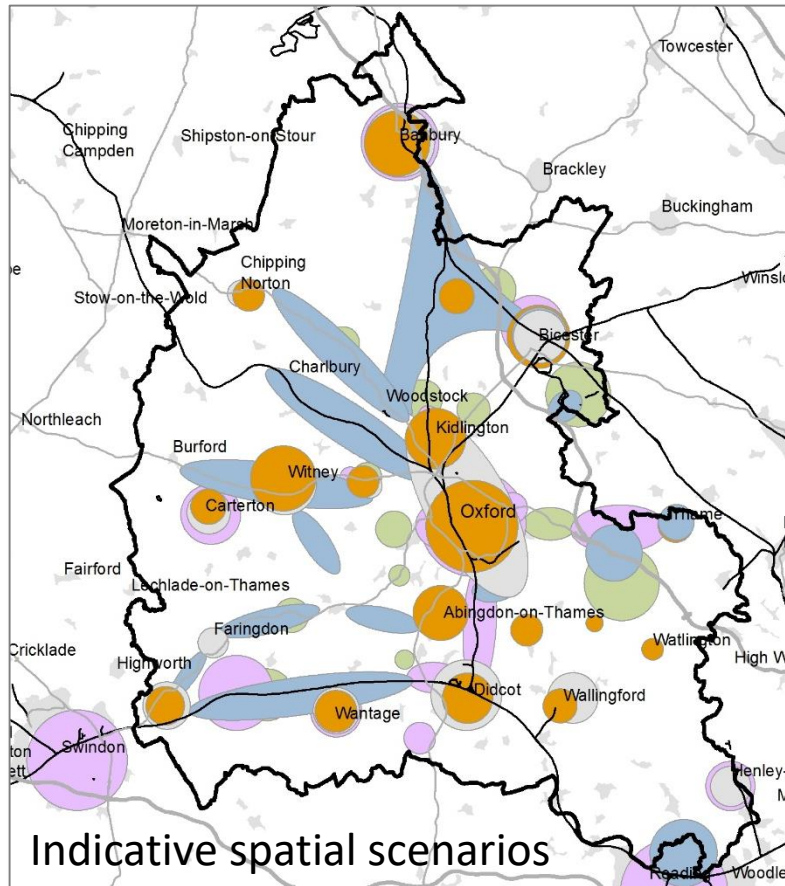- 0-7.5
- 7.51 to 10

0 1 2   4   6   8   10
Miles

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Strategic Influencers on indicative broad spatial scenarios for the Oxfordshire plan
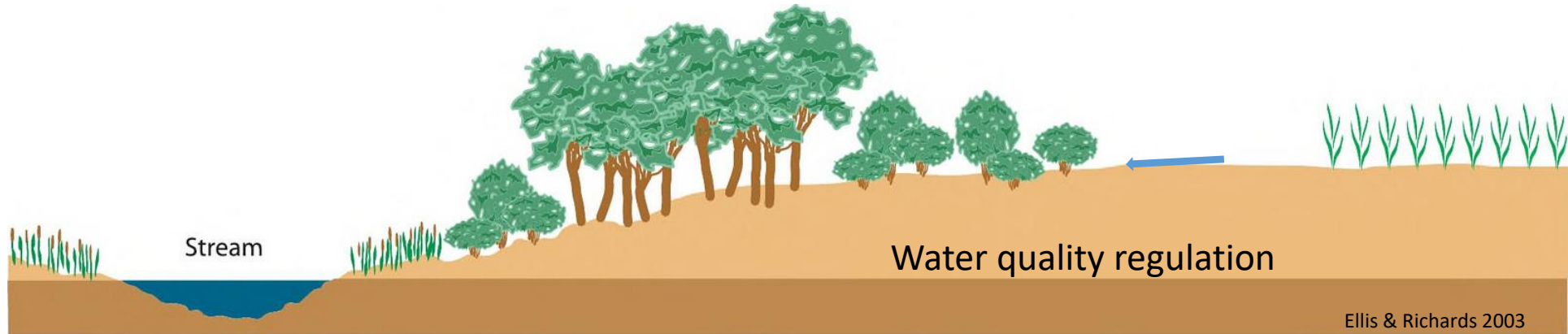

Indicative spatial scenarios

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Next steps

- **Continue to improve method and maps**
  - Improve base map of land cover
  - Refine matrix of scores
  - Consider demand for services, based on needs of local population (present and future)

- **Integrate natural capital with Nature Recovery Networks**

- **Continue to input to assessments for the OP2050 and Ox-Cam Arc**

- **Test and evaluate with stakeholders**

# Habitat location is vital for some services

Stream

Water quality regulation

Ellis & Richards 2003

Flood protection

Air quality and noise regulation

Demand and opportunities for air quality regulation

Areas of high PM2.5 pollution (fine particles)

Areas close to where people live

Air quality regulation by habitats

Ecosystem service scores

- 0 to 1
- 1.01 to 2.5
- 2.51 to 5
- 5.01 to 7.5
- 7.51 to 10

0 1 2 4 6 8 10 Miles

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Developing Local Natural Capital Plans for the Oxford-Cambridge Arc:
Preliminary map of high natural capital areas and Natural England habitat networks

Working with Natural England and the Environment Agency

Also working with Infrastructure team at Oxford

Assessing different methods of mapping natural capital

Aims to provide resources for local stakeholder activities
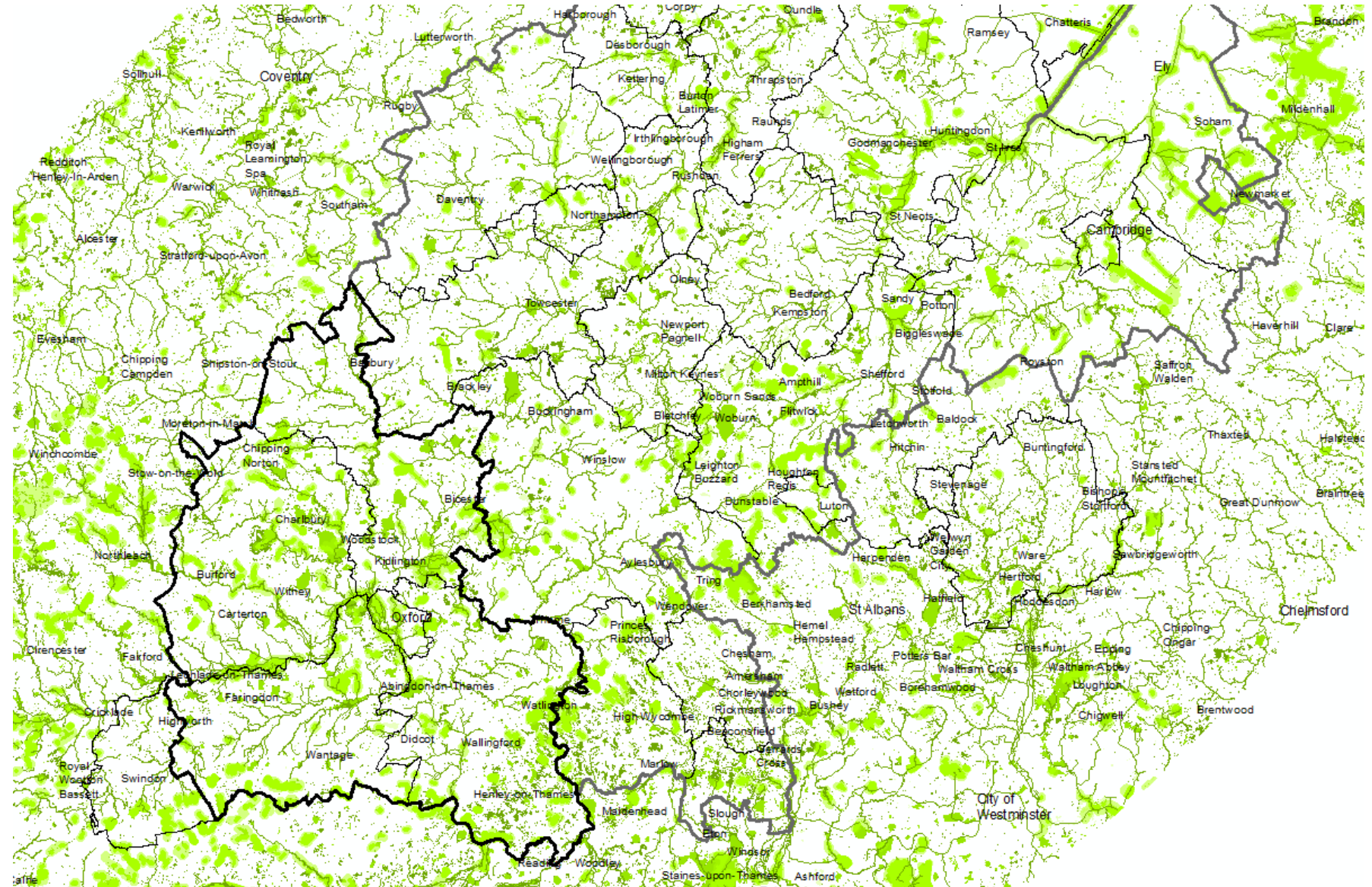
Thank you!

alison.smith@eci.ox.ac.uk

Oxford Policy Exchange Network

Developing natural capital maps: from research to impact