



Urban Green Infrastructure and Ecosystem Services

AECB Conference

8 June 2019

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Environmental Change Institute





What is green infrastructure?
What benefits does it provide?
How can we plan better GI?



Green infrastructure

‘A network of multi-functional green space, urban and rural, which is capable of delivering a wide range of environmental and quality of life benefits for local communities’

National Planning Policy Framework



Green walls and roofs



Landscaping and Sustainable Drainage (SuDS)



Parks, gardens, allotments, orchards, churchyards...



... playing fields, playgrounds, paths, street trees...

Natural and semi-natural areas...



... and the wider countryside



What is GI?

- Not just grass verges and lollipop trees
- Rural as well as urban
- Wild as well as managed
- Sustainable
- Multifunctional
- (Ideally) connected

Green infrastructure provides ecosystem services

Regulating services

- Flood control
- Erosion control
- Water quality
- Air quality
- Carbon storage
- Cooling and shading
- Noise regulation
- Pollination
- Natural pest control

Cultural services

- Aesthetic value
- Recreation
- Education and knowledge
- Interaction with wildlife
- Sense of place

Provision of:

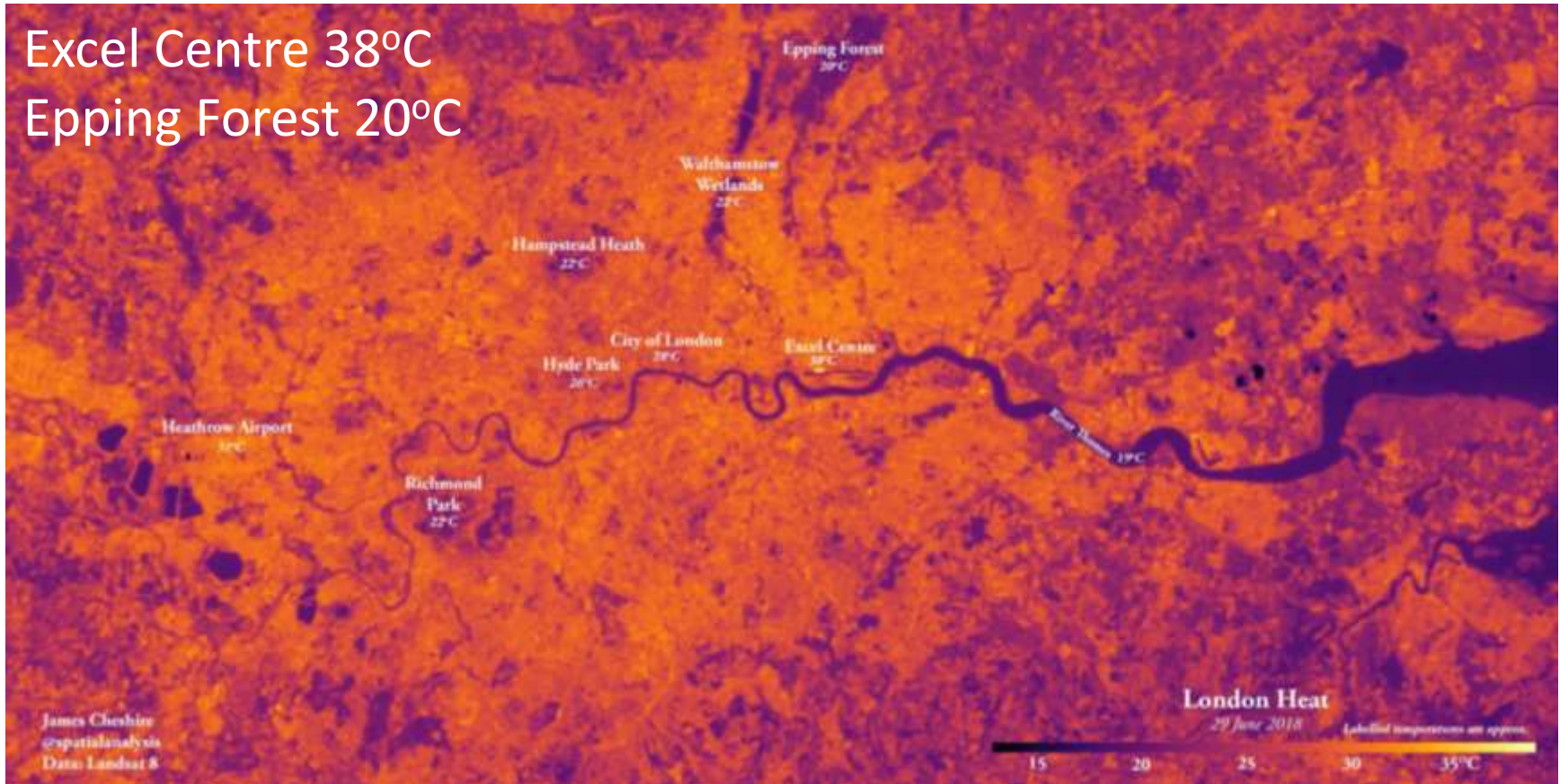
- Food
- Wood
- Fish
- Fresh water



Cooling and shading

Excel Centre 38°C

Epping Forest 20°C



From LANDSAT images, by James Cheshire, UCL (with permission)

Cultural benefits of green infrastructure in Bicester

Street survey * Library drop-in week * Focus group * App

Garth Park is always filled with locals and has a friendly atmosphere. People stop for a chat – there's a sense of community

[Male, 18-24]

Fantastic for wildlife - has been left wild and unmanaged - perfect!

[Male, 65+, Skimmingdish Lane balancing pond]

... the small playgrounds are a lifeline for single mums... [Female, 45-64, Avon Crescent]

136 people
550 responses
64 green spaces

There is a lovely natural view from my house

[Female, 45-64, Blenheim Drive amenity GS]

Gavray meadows is nice and wild-looking

[Female, 45-64]

We do an estate 'playground crawl' - these small spaces are often overlooked but we use them loads! [Female, 25-44]

Participatory mapping: 396 benefits of green space

Local identity

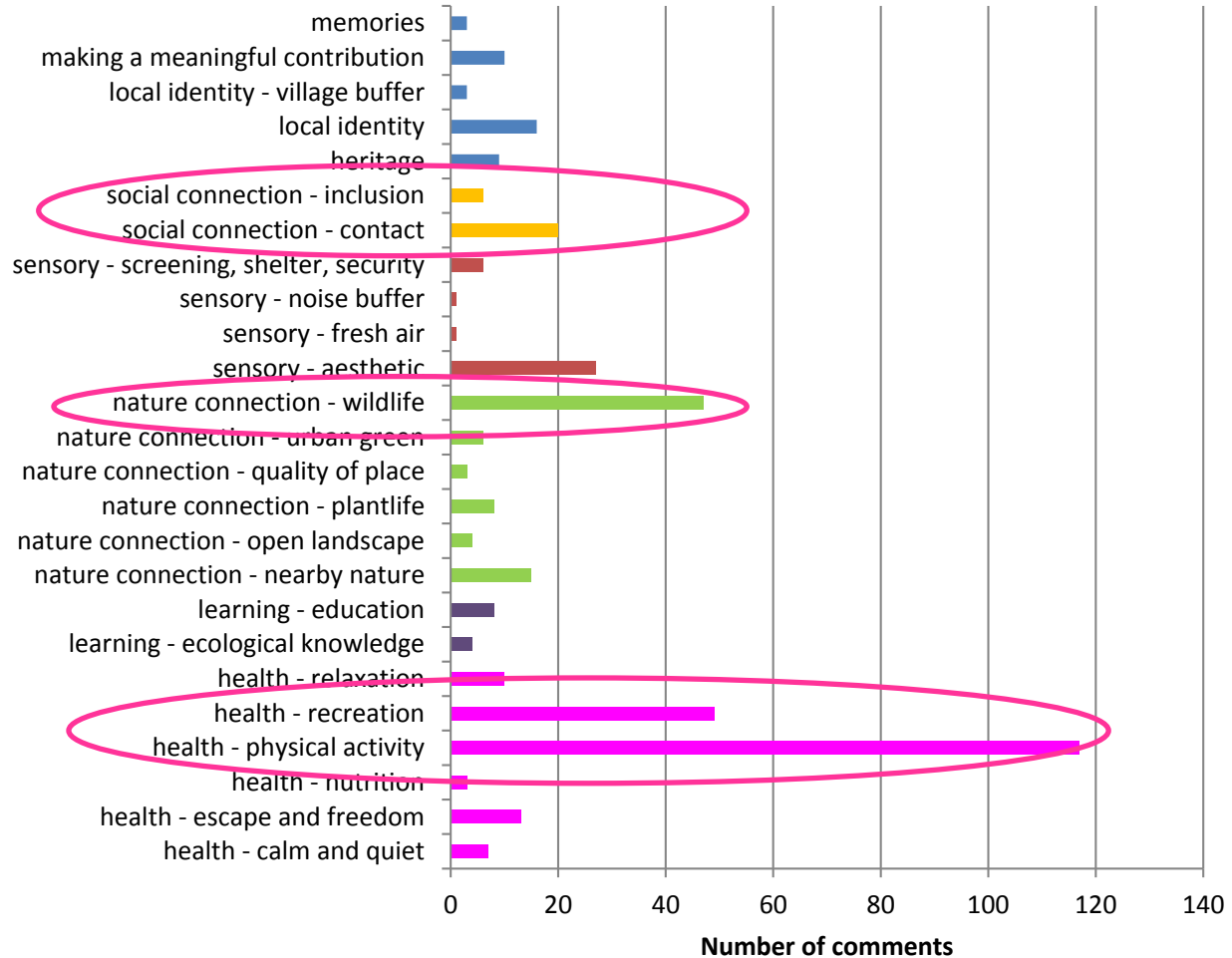
Social connection

Sensory

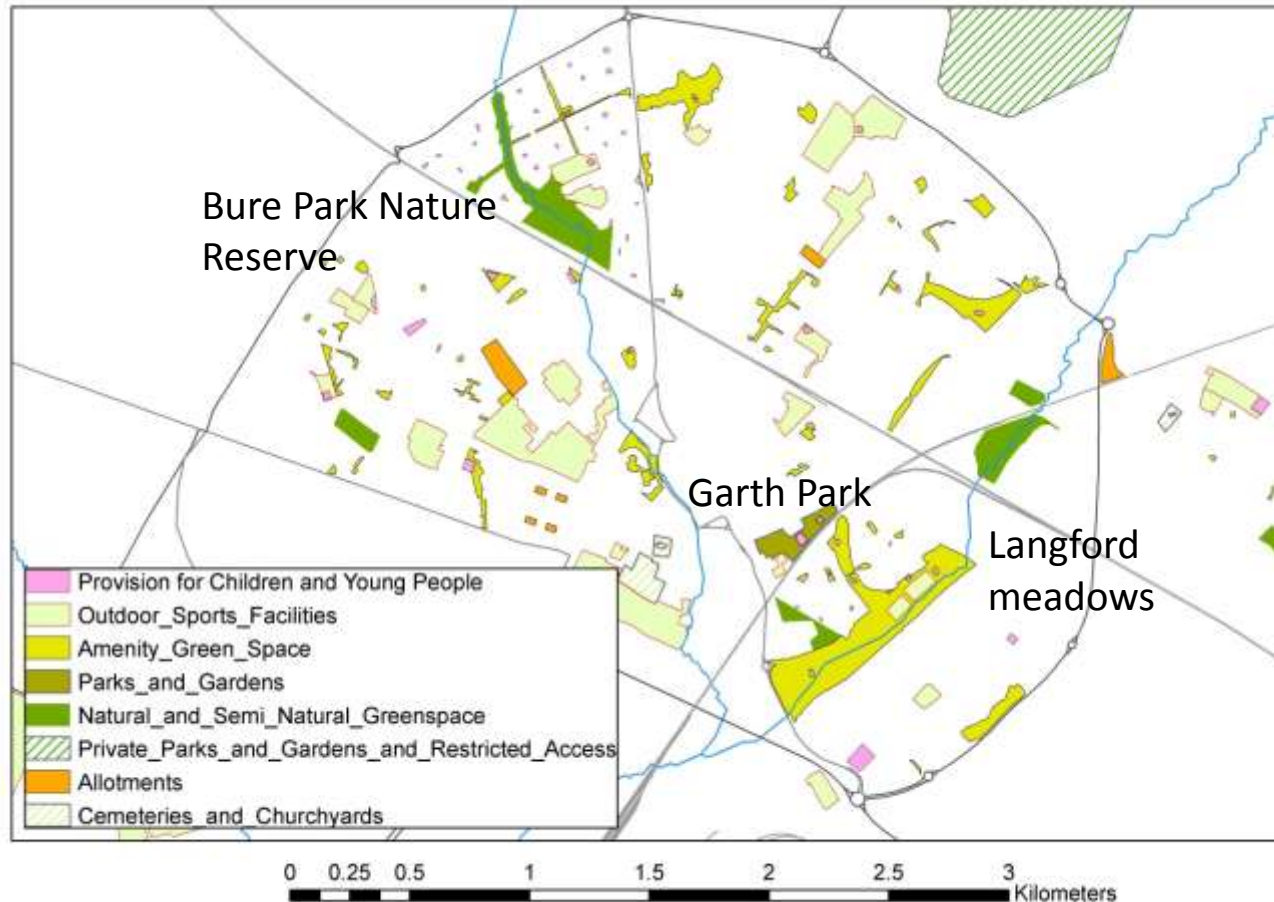
Nature connection

Learning

Health



Planning green Infrastructure in Bicester: Open Spaces



Street trees and grounds

- GRASS
- HARD SURFACE AREA
- HEDGE
- MEADOW AREA
- VERGES
- PERENNIAL BORDER
- PLAY AREA
- SEASONAL BEDDING
- SHRUB BORDER
- WATER
- WILD FLORA AREA
- WOODLAND AREA



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Surrounding countryside – mainly intensive farmland

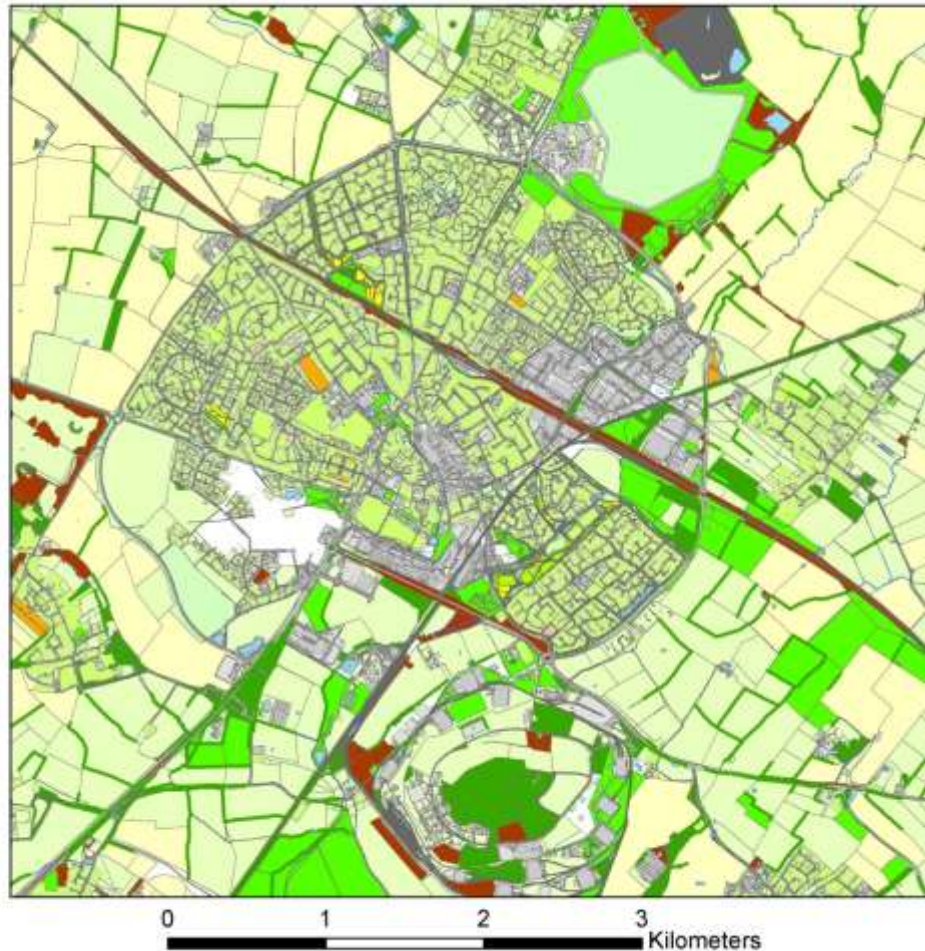


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Green infrastructure in Bicester

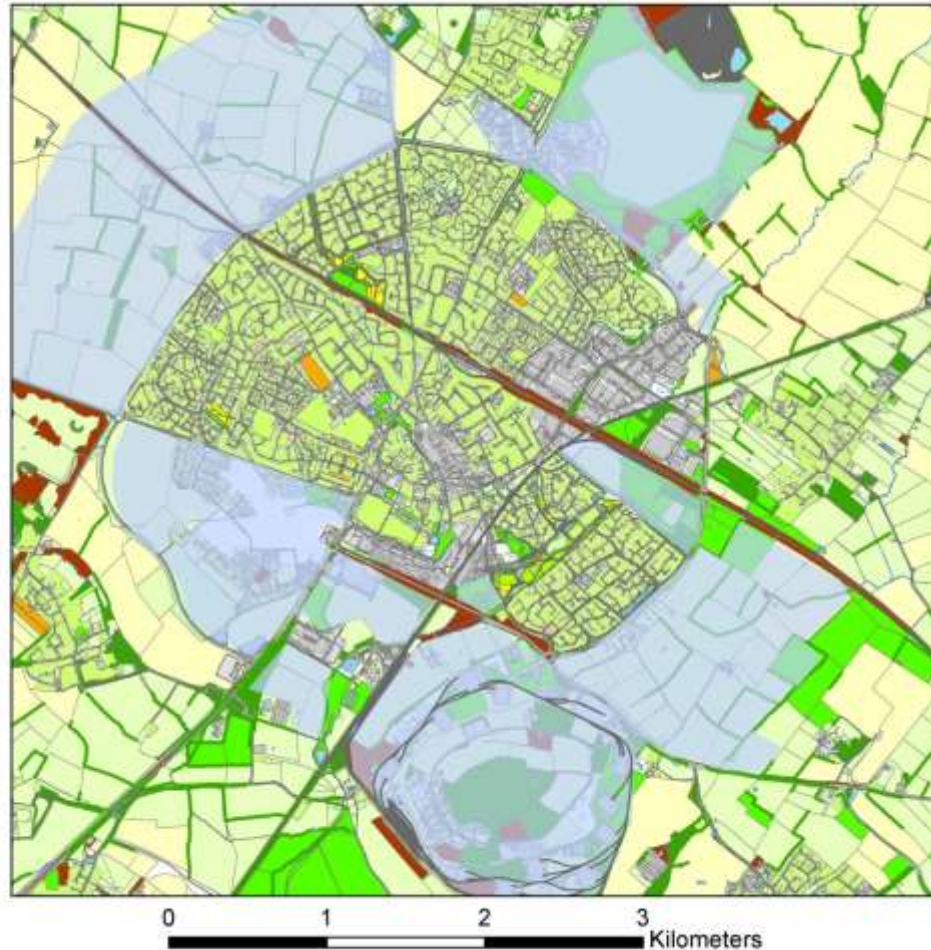
- Amenity grass
- Arable
- Improved grassland
- Woodland
- Shrubland
- Natural grassland
- Fen, marsh or swamp
- Heath
- Hedge
- Allotment
- Orchard
- Parkland with trees
- Building
- Hard surface
- Garden
- Bare ground
- Manmade permeable
- Track
- Play area
- Sports areas
- Urban meadow
- Wildflower area
- Quarry
- Water



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Bicester is expanding...

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Planning green infrastructure

Mapping existing assets

- What assets and networks do we have already?
- What should be protected?

Opportunity mapping

- Where are there gaps in supply?
- Where are the best opportunities for investing?

Site design

- How can we plan good Green Infrastructure?
- Are we achieving a net gain?

Valuation

- What will the benefits be?
- Can we make a business case?

Tools for planning green infrastructure

Mapping existing assets

- Base maps
- Land cover scores
- Participatory maps
- Social media

Opportunity maps

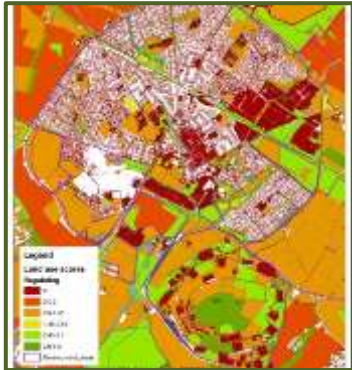
- Scores and rules
- EcoServ-GIS
- ANGSt
- Participatory maps
- Network mapping

Site design

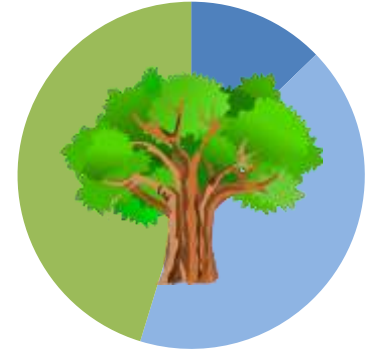
- NCPT
- Eco-metric
- Green factor scores

Valuation

- GI-Val
- BEST
- iTree
- ORVal
- CAVAT



Development Impact Score		
Average Per Hectare		
Component Score	Raw	Adjusted Score
1. Harvested Products	-0.23	-2.54
2. Biodiversity	+0.10	-0.22
3. Aesthetic Values	+1.00	-0.71
4. Recreation	+0.10	+1.46
5. Water Quality Regulation	+0.10	-0.54
6. Flood Risk Regulation	+0.10	-0.42
7. Air Quality Regulation	+1.00	-0.05
8. Local Climate Regulation	+0.10	-0.74
9. Global Climate Regulation	+1.00	-0.11
10. Soil Contamination	+0.10	+0.00
Development Impact Score	+0.10	-3.86



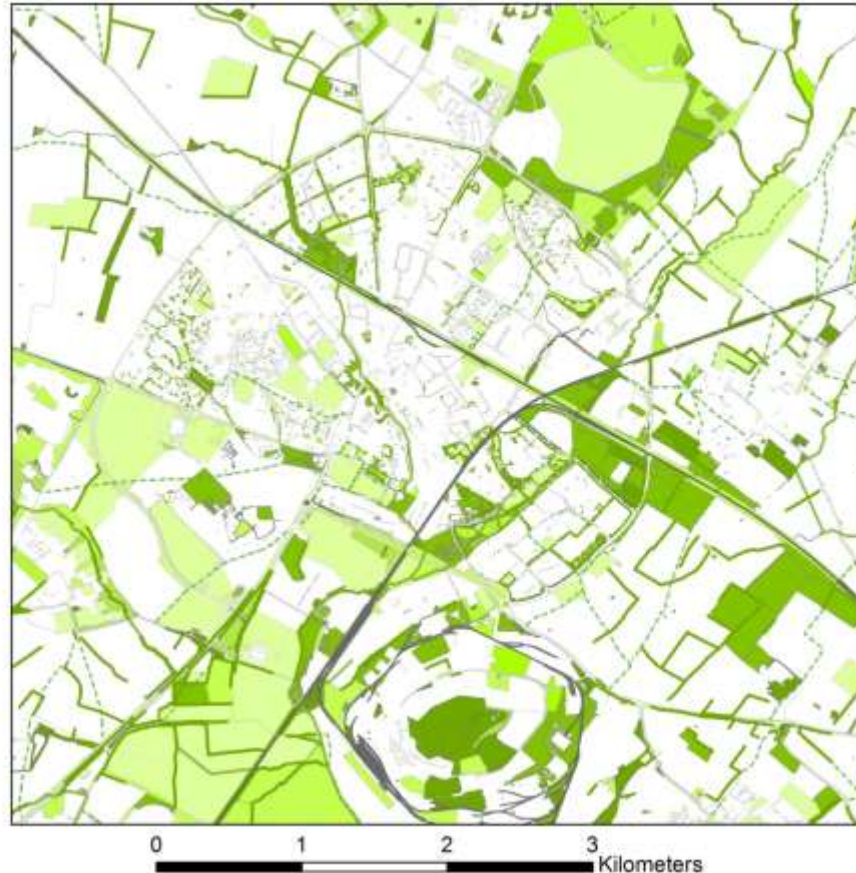
Land-cover score matrix (part of...)

Eco-metric habitat	Food production	Wood production	Fish production	Water supply	Flood regulation	Erosion protection	Water quality regulation	Carbon storage	Air quality regulation	Cooling and shading	Noise reduction	Pollination	Pest control	Recreation	Aesthetic value	Education	Interaction with nature	Sense of place
Broadleaved, mixed and yew semi-natural woodlands	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	10	10	8	7	10
Dense scrub	1	2	0	4	6	8	5	6	7	6	6	7	10	10	8	6	8	6
Hedgerows	1	1	0	4	6	8	5	5	8	6	6	8	10	10	10	8	10	10
Felled woodland	0	0	0	4	1	0	1	2	0	1	0	1	3	10	1	1	1	1
Tall herb and fern	1	0	0	8	5	8	5	4	1	2	1	7	10	10	10	6	8	4
Bracken	1	0	0	8	5	8	5	4	1	2	1	6	8	10	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
<i>Acid grassland</i>	6	0	0	9	4	8	4	4	1	2	1	6	8	10	10	10	10	10
<i>Calcareous grassland</i>	6	0	0	9	4	8	4	3	1	2	1	10	8	10	10	10	10	10
<i>Neutral grassland</i>	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	10	4	2	2	4
Arable fields, horticulture and temporary grassland	10	0	0	7	2	1	1	2	1	2	1	2	2	10	2	2	1	2

Cultural and Regulating Services: average score

Ecosystem service score

- Zero
- Very low
- Low
- Moderate
- High
- Very high



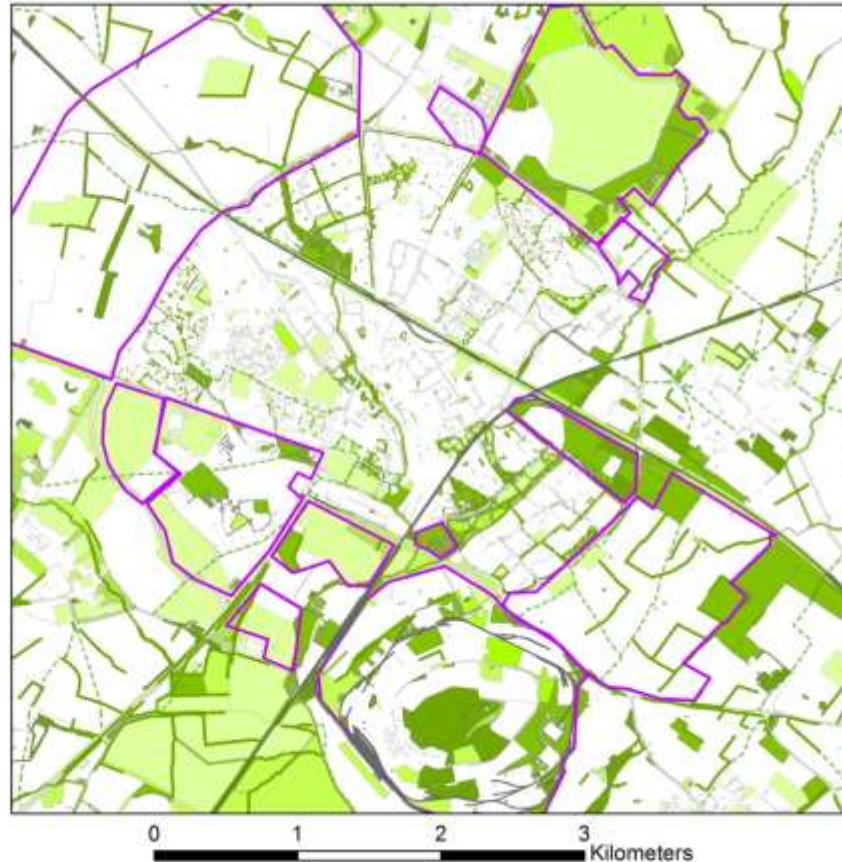
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Cultural and Regulating Services

 Development areas

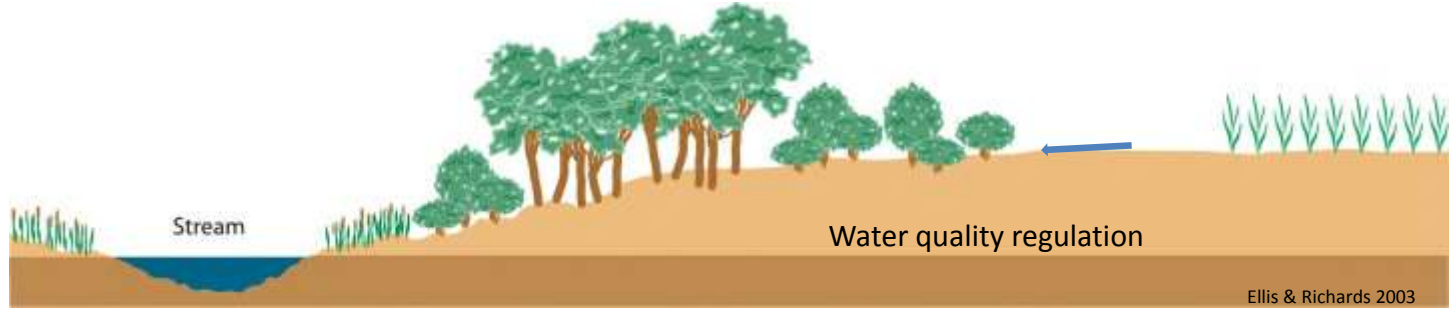
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Locate green infrastructure in the right place to deliver services

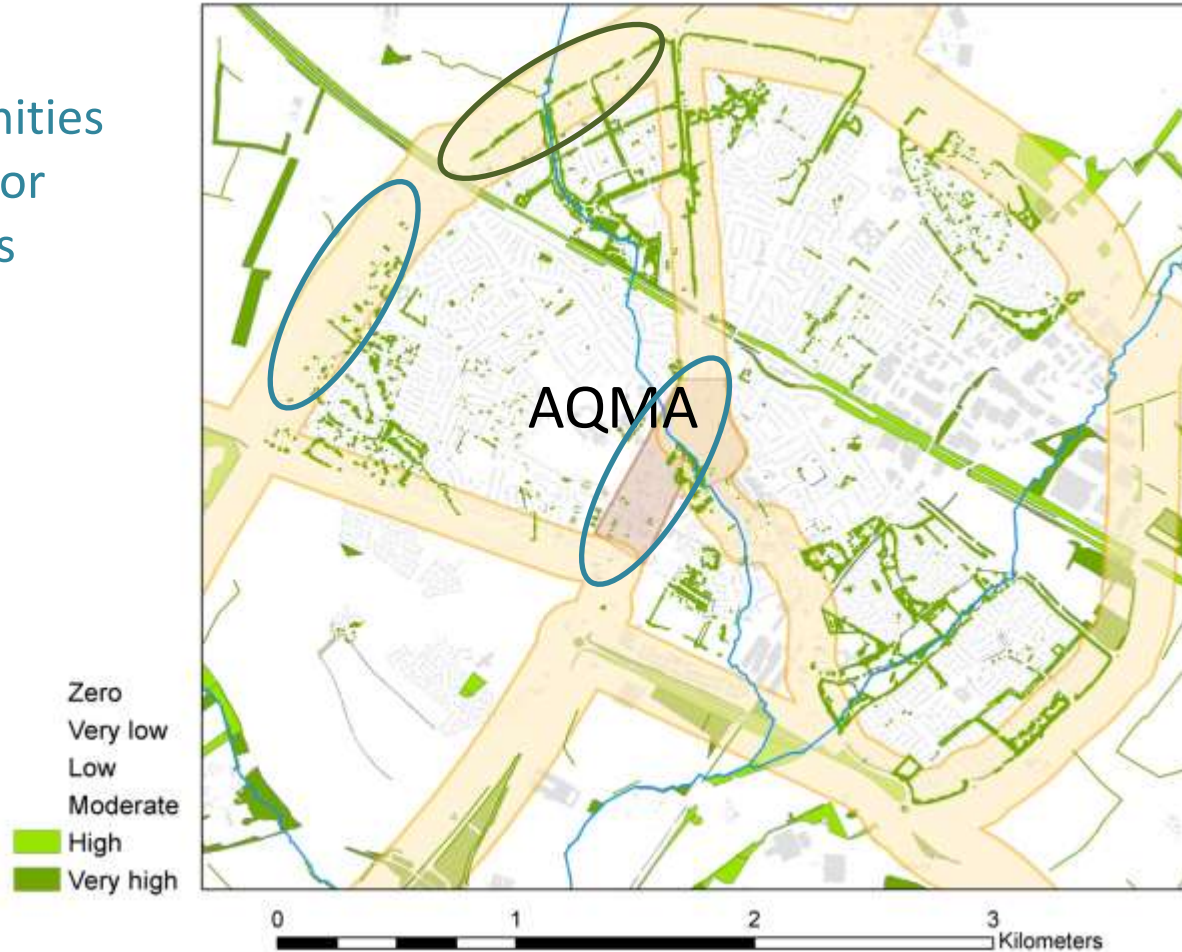


Air quality and noise regulation



Air quality regulation

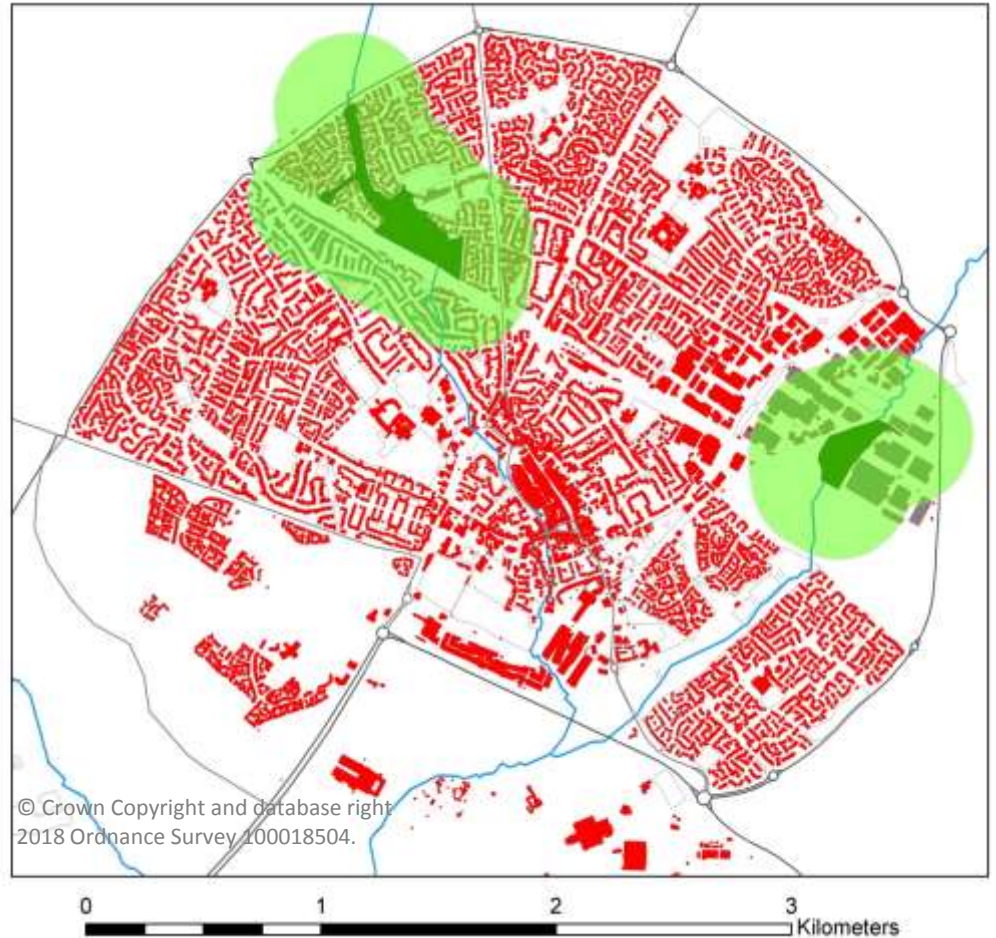
Opportunities
for trees or
hedges as
pollution
barriers?



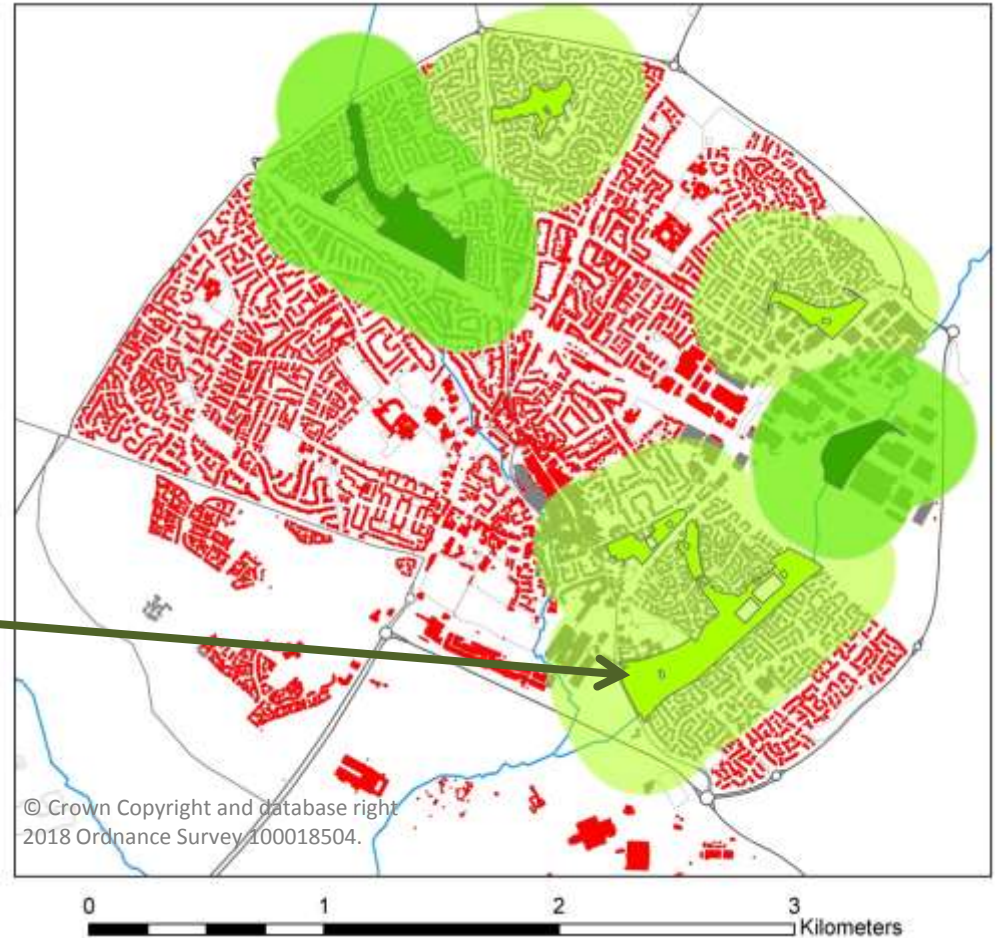
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Accessible Natural Green Space Standards (ANGSt)

Only 13% of buildings are within 300m of a 2ha accessible “natural” green space



A further 32% are within 300m of an “amenity” green space over 2ha



Site design: Guidance


Garden City Standards for the 21st Century
Practical Guides for Creating Successful New Communities

guide 7
planning for green and prosperous places



Garden City Standards for the 21st Century
Practical Guides for Creating Successful New Communities

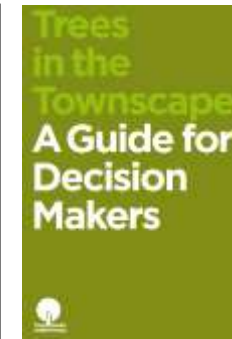
guide 8
creating health-promoting environments



planning for a healthy environment –
good practice guidance for green infrastructure and biodiversity

Town & Country Planning Association
The Wildlife Trusts
July 2012

Trees in the Townscape
A Guide for Decision Makers



Residential Developments and Trees
July 2015



WOODLAND TRUST

The Nine Concepts
Making space for nature and beauty



Public Health England
Protecting and improving the nation's health

Spatial Planning for Health
An evidence resource for planning and designing healthier places



Green Infrastructure Guidance

More fully revised and updated edition

Active Planning Toolkit 2

and creating built environments that encourage sport physical activity

Building with Nature
A new benchmark for the design and maintenance of green infrastructure in housing and commercial developments



Some principles

- Protect and enhance existing assets and networks
- Connect green and blue corridors for wildlife and people
- Engage with local people
- Make spaces biodiverse and multifunctional; optimise position
- Use diverse native species where possible; and large trees
- Correct management is crucial (mowing time, etc)

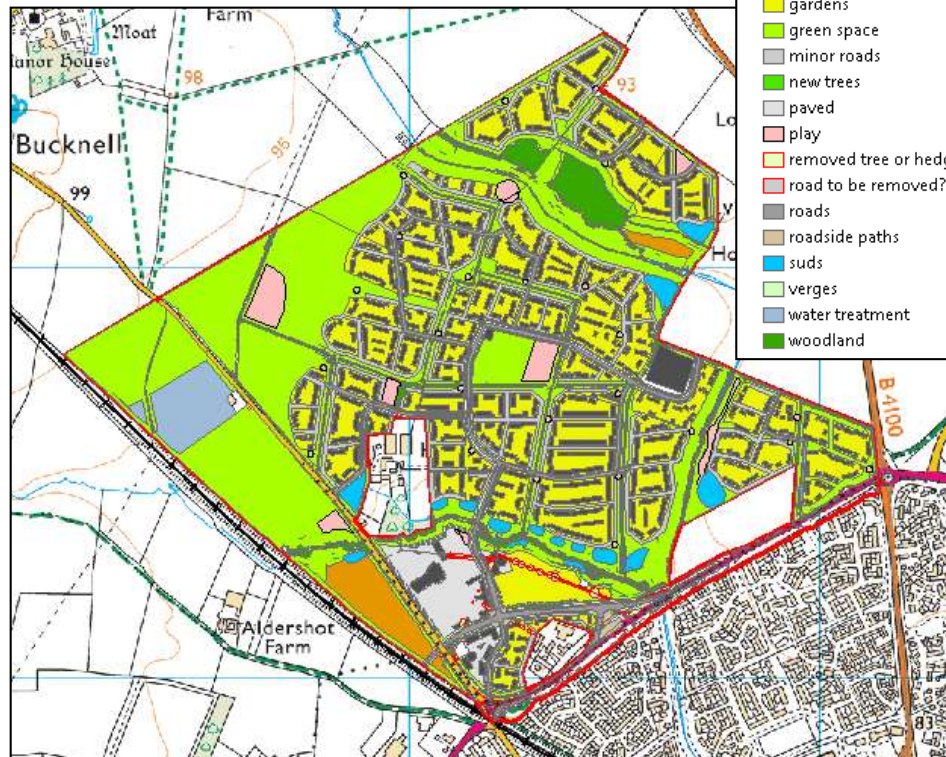


Assessing plans for NW Bicester eco-town

PHASE1HAB

- Amenity grassland
- Broadleaved woodland - plantation
- Broadleaved woodland - semi-natural
- Cultivated/disturbed land - arable
- Hedge
- Improved grassland
- Neutral grassland
- Running water
- Scrub - dense/continuous

- allotment
- buildings
- existing hedge
- existing trees
- existing water
- gardens
- green space
- minor roads
- paved
- play
- removed tree or hedge
- road to be removed?
- roads
- roadside paths
- suds
- verges
- water treatment
- woodland



NW Bicester: designed for net biodiversity gain

Outline Application NW Bicester Planning Application 1

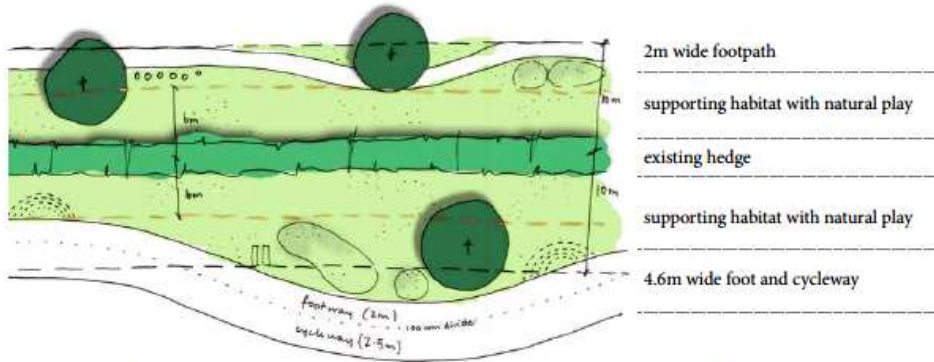
Land to the north of the existing site and 4000 Lodd Lane and 4000 Lodd Lane, comprising Lodd Farm and
Hawkland Farm, Bicester, Oxfordshire

Green Infrastructure and Landscape Strategy

August 2014

north
west
bicester | aadominion

THINKING ABOUT TOMORROW



Example 3: Hedgerow buffer with 4.6m wide foot/cycleway + 2m wide footpath

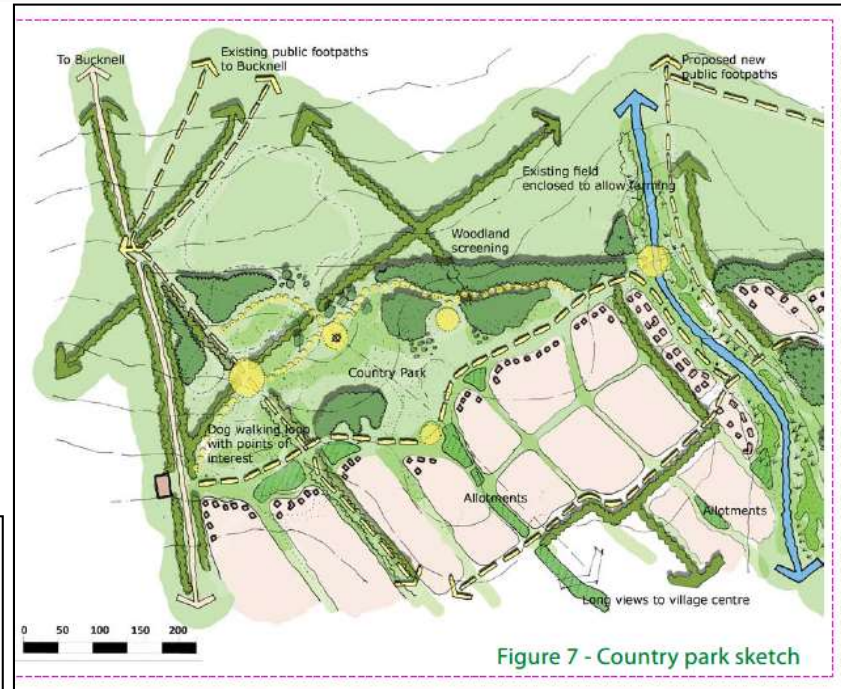
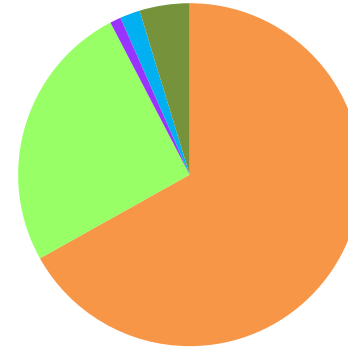


Figure 7 - Country park sketch

Assessing plans for NW Bicester: the eco-metric tool

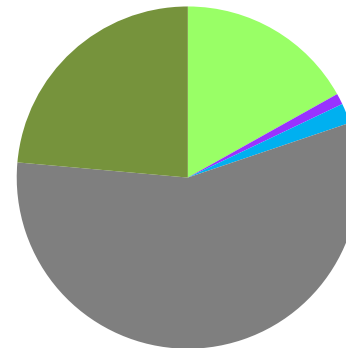
	Before	After	Change
Food production	617	53	↓ -563.9
Wood production	14	57	↑ 42.7
Fish production	7	36	↑ 28.6
Water supply	814	508	↓ -305.2
Flood regulation	297	281	↓ -15.8
Erosion protection	148	267	↑ 118.7
Water quality regulation	73	289	↑ 216.1
Carbon storage	189	139	↓ -50.4
Air quality regulation	147	173	↑ 25.9
Cooling and shading	269	259	→ -10.0
Noise reduction	141	201	↑ 59.6
Pollination	231	376	↑ 145.4
Pest control	355	379	↑ 24.1
Recreation	0	511	↑ 511.1
Aesthetic value	325	457	↑ 131.3
Education	0	280	↑ 280.2
Interaction with nature	0	329	↑ 329.5
Sense of place	325	374	↑ 49.2

Habitat areas before



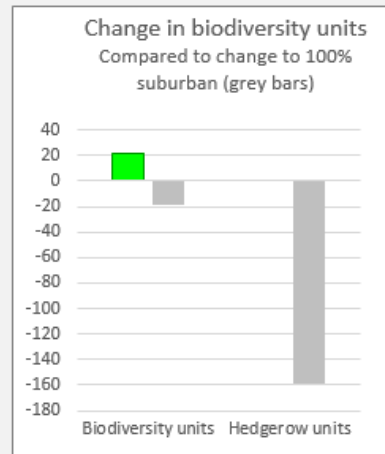
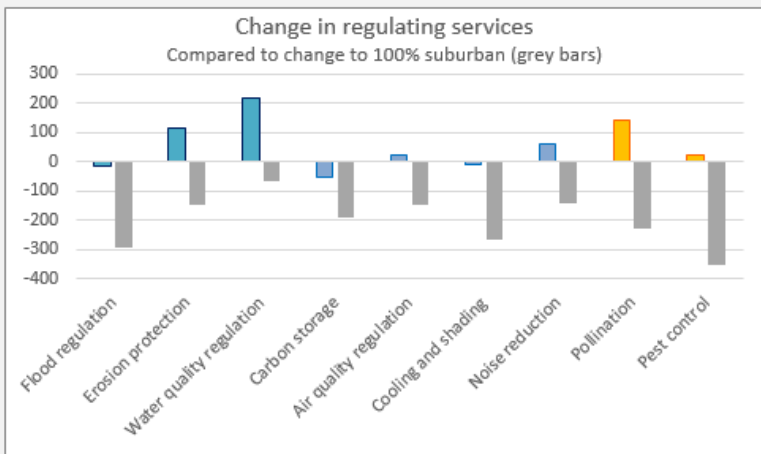
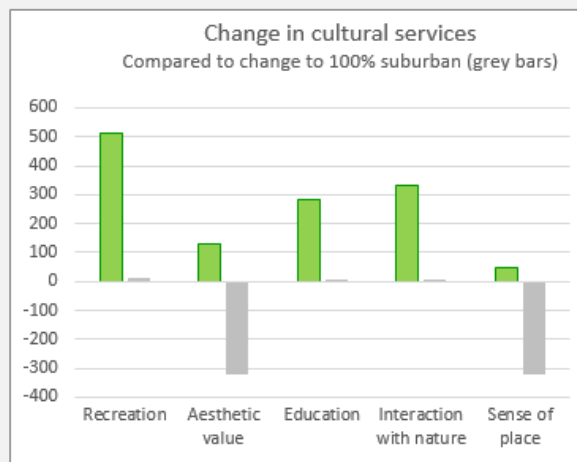
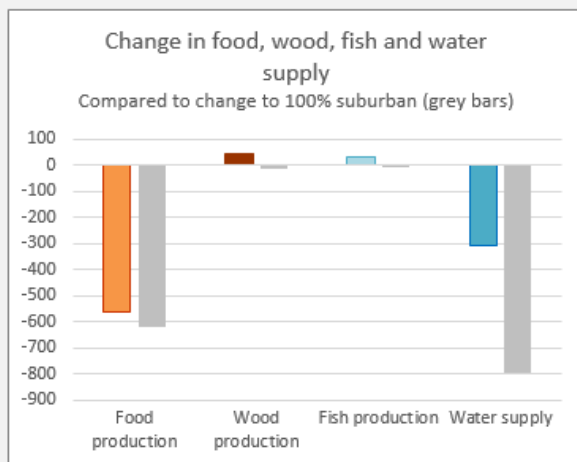
- Cropland
- Grassland
- Heathland and shrub
- Rivers and lakes

Habitat areas after

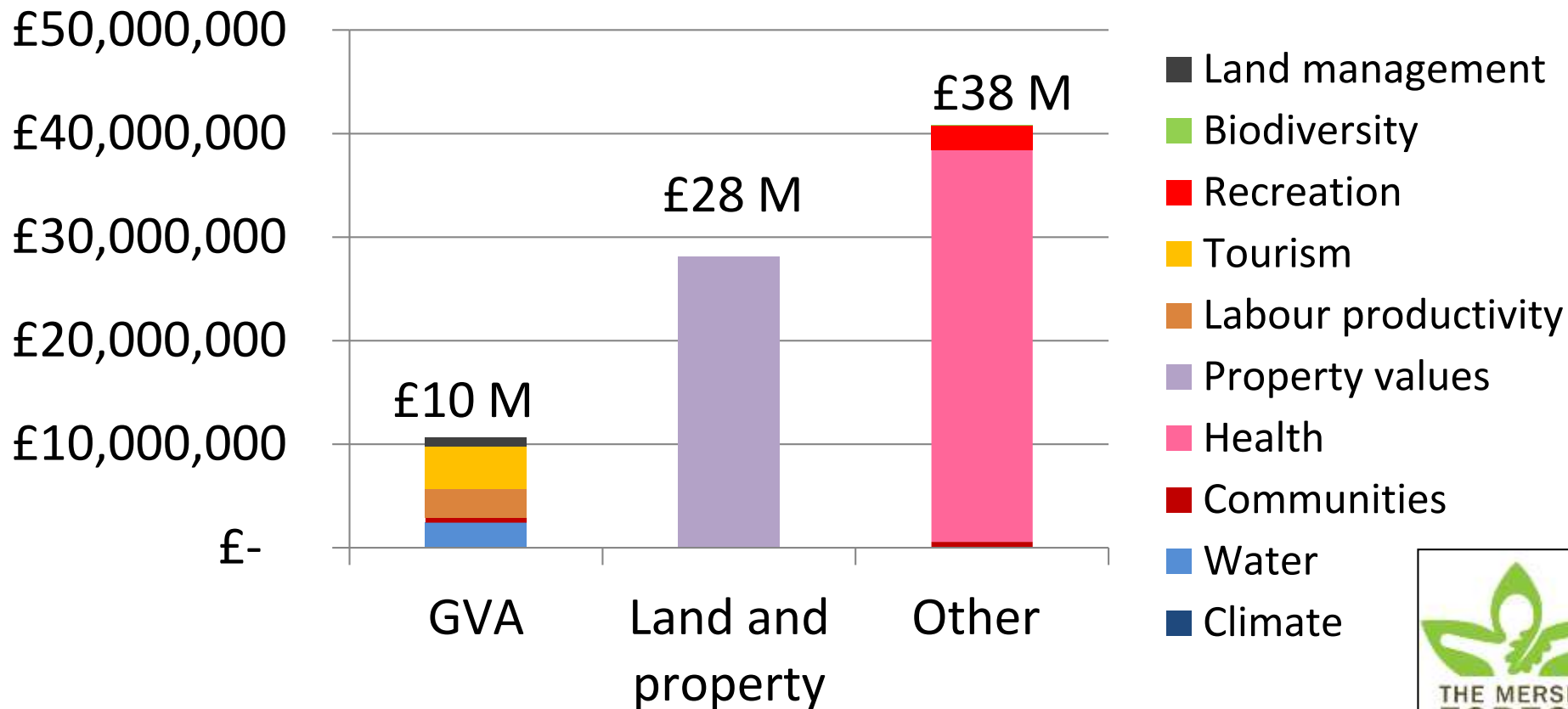


- Sparsely vegetated land
- Urban
- Wetland
- Woodland and forest

Change: masterplan (colour) compared to 'standard suburban mosaic' (grey)



GI-Val: Benefits of NW Bicester masterplan vs base case



Urban Greening Factor for London

Surface Cover Type	Factor
Semi-natural vegetation (e.g. woodland, flower-rich grassland) created on site.	1
Wetland or open water (semi-natural; not chlorinated) created on site.	1
Intensive green roof or vegetation over structure. Substrate minimum settled depth of 150mm	0.8
Standard trees planted in natural soils or in connected tree pits	0.8
Extensive green roof with substrate of minimum settled depth of 80mm that meet GRO Code 2014	0.7
Flower-rich perennial planting – see Centre for Designed Ecology for case-studies.	0.7
Rain gardens and other vegetated sustainable drainage elements – See CIRIA for case-studies.	0.7
Hedges (line of mature shrubs one or two shrubs wide) – see RHS for guidance.	0.6
Standard trees planted in pits with soil volumes less than two thirds of the projected canopy area	0.6
Green wall –modular system or climbers rooted in soil – see NBS Guide to Façade Greening for overview.	0.6
Groundcover planting – see RHS Groundcover Plants for overview.	0.5
Amenity grassland (species-poor, regularly mown lawn).	0.4
Extensive green roof of sedum mat or other lightweight systems that do not meet GRO Code 2014.	0.3
Water features (chlorinated) or unplanted detention basins.	0.2
Permeable paving - see CIRIA for overview.	0.1
Sealed surfaces (e.g. concrete, asphalt, waterproofing, stone).	0

Thank you

