


Urban Natural Habitat Quality Index and Resilience Threshold

Oxford Sabbatical Study

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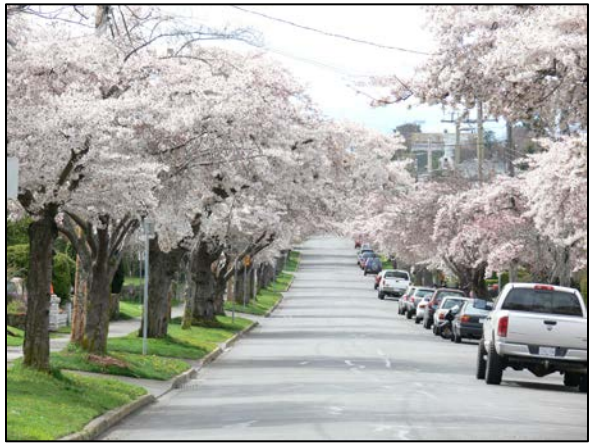
Definition of “Urban”

- The European landscape convention recognizes two major classes of landscape, natural and anthropic, the latter being urban (European Council 2000).
- Urban Habitat Quality Index evaluates natural areas versus built areas



Urban Built

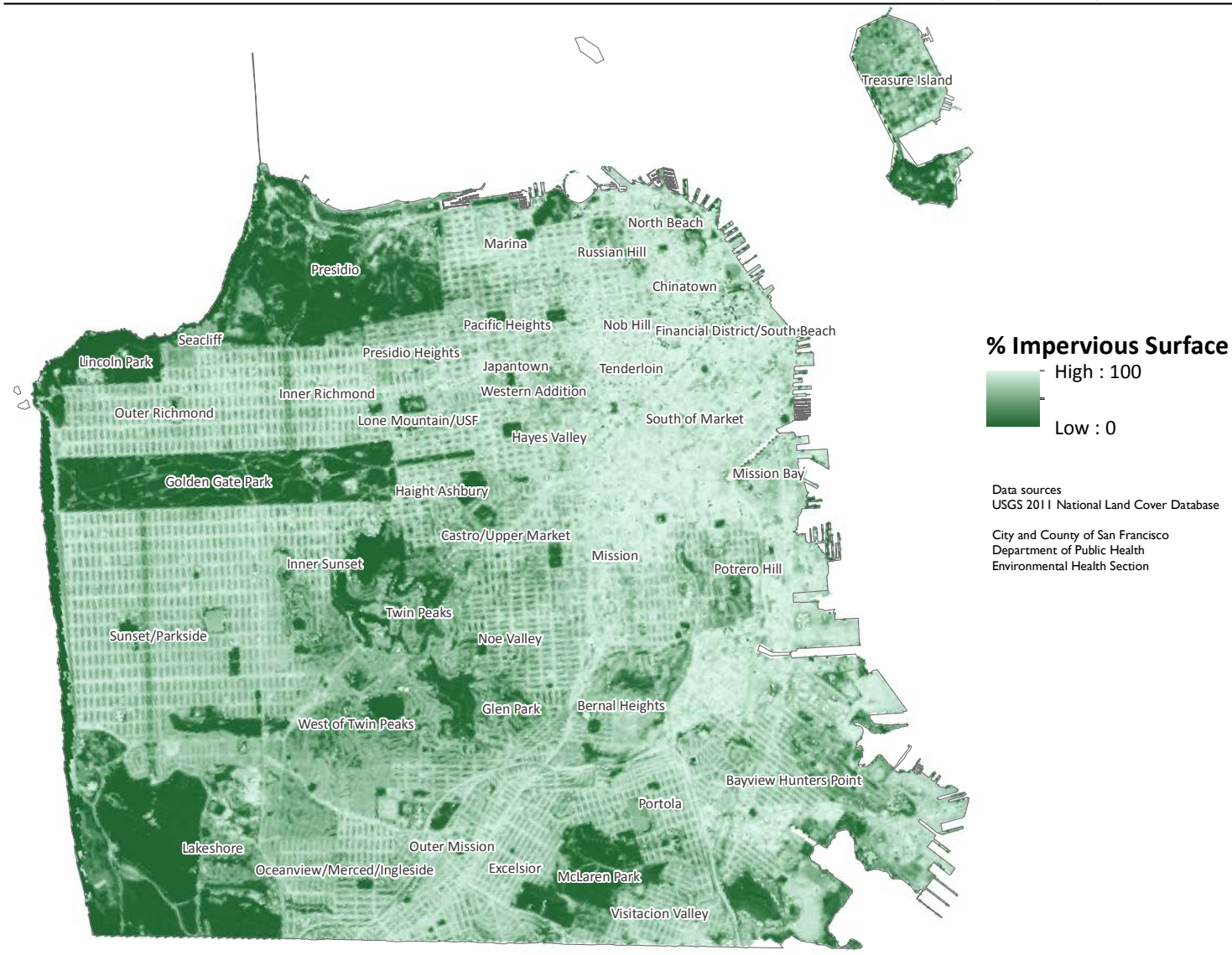
Urban Natural


Urban Matrix in built areas –
Metric: Impervious Surface

San Francisco Indicator Project

Impervious Surfaces (2011)

City and County of San Francisco Department of Public Health: Environmental Health Branch



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http://www.sfindicatorproject.org/

Relative Biodiversity in Metro Vancouver – similar to impervious surface map

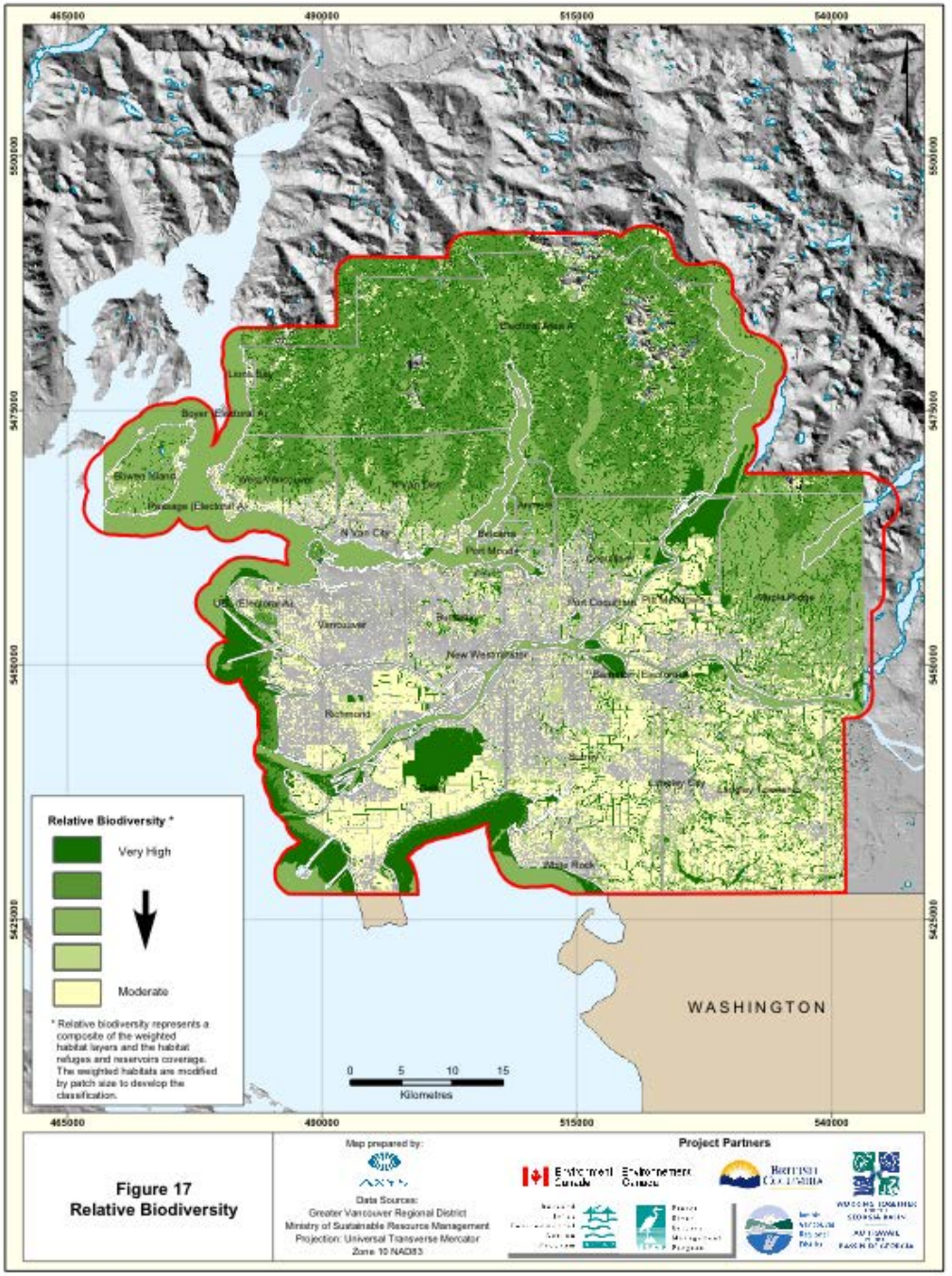


Figure 17
Relative Biodiversity


Urban Natural Areas –
Habitat Quality Index
Byrne Creek Ravine,
Burnaby

Relationship of percent impervious surface to stream health

Bauer and Loeffelholtz (2004)

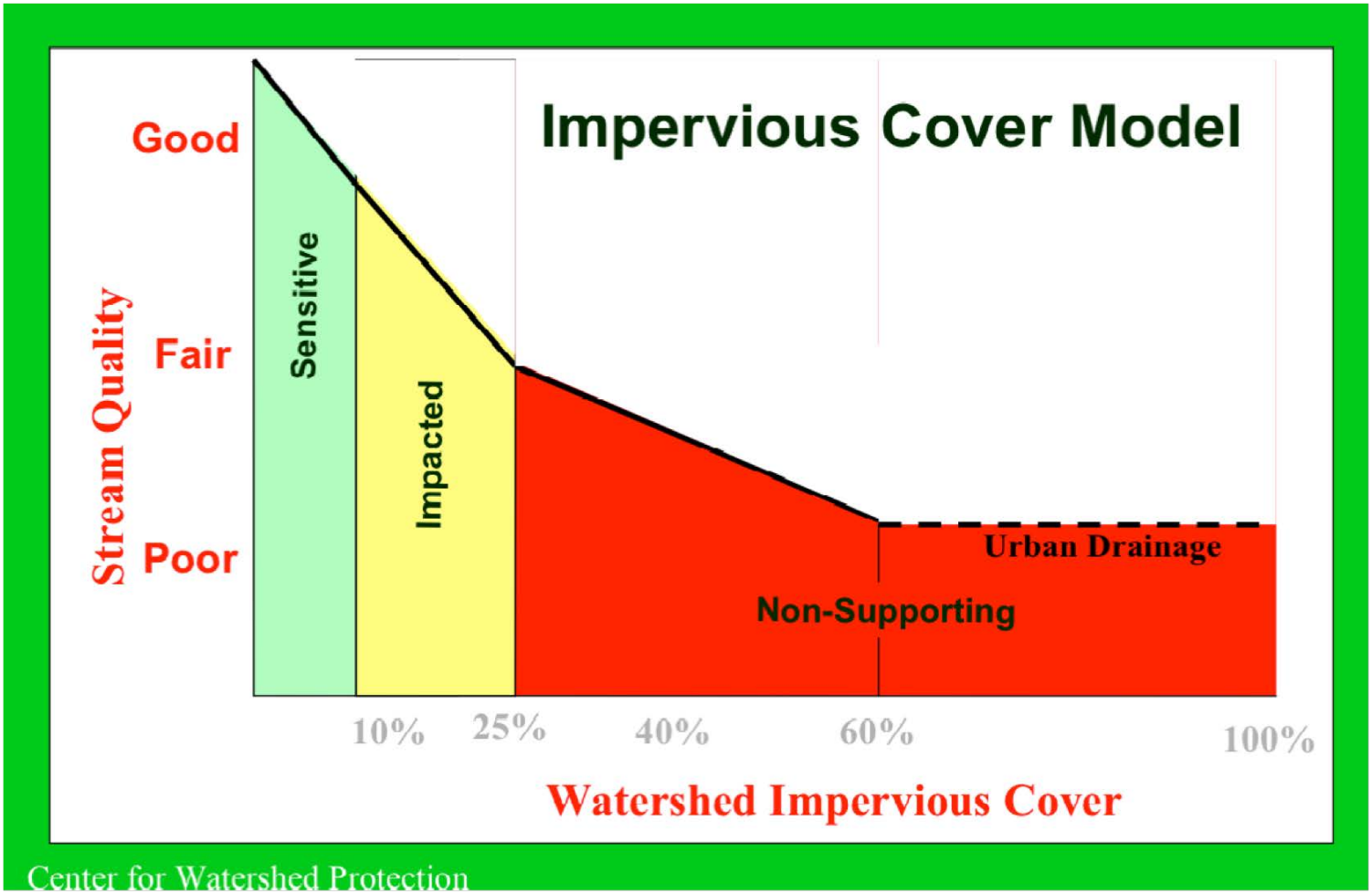


Figure 1. Model of impact of impervious surface on stream quality.

Threshold – Ecological Memory

(Sun et al. 2014)

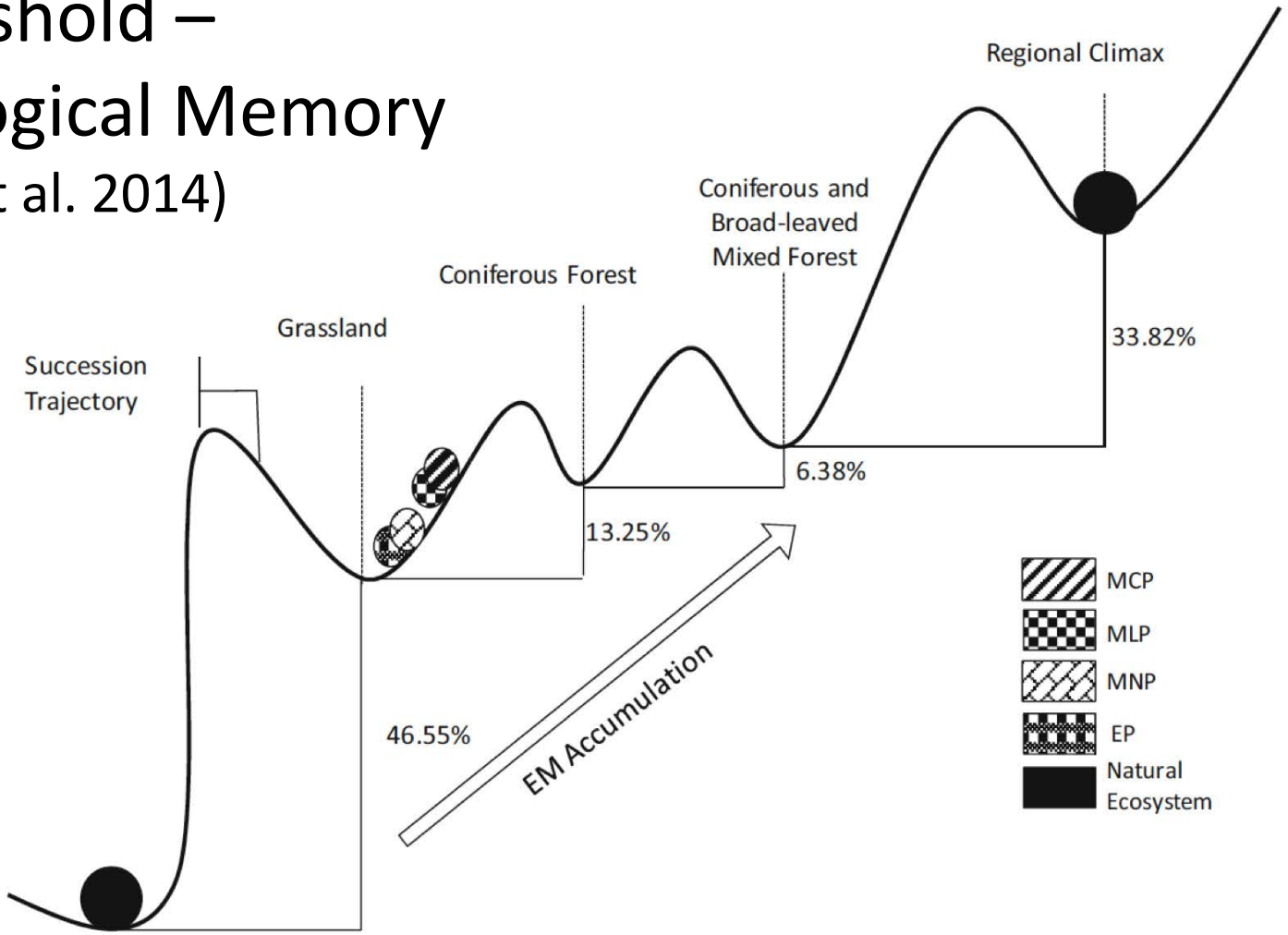


Fig. 7 The positions of the four plantations in the natural EM succession trajectory. The natural succession trajectory of EM was established in our previous study (Sun et al. 2013). EM accumulates nonlinearly during secondary succession. The valleys labeled with initial state, grassland, coniferous forest, coniferous, broad-leaved mixed forest, and regional climax forest represent successional stages of the subtropical forest. The positions of the balls in the valleys represent the restoration status and developing trend of the ecosystem. *BF* broad-leaved forest, *EP* eucalyptus plantation, *MLP* mixed legume plantation, *MBP* mixed broad-leaved species plantation, *MCP* mixed coniferous plantation

Other Qualitative Indices

Proper Functioning Condition

US Department of Interior

Lentic Standard Checklist

Name of Riparian-Wetland Area:_____

Date:_____ Area/Segment ID: _____ Acres:_____

ID Team Observers: _____

Yes	No	N/A	HYDROLOGY
			1) Riparian-wetland area is saturated at or near the surface or inundated in "relatively frequent" events
			2) Fluctuation of water levels is not excessive
			3) Riparian-wetland area is enlarging or has achieved potential extent
			4) Upland watershed is not contributing to riparian-wetland degradation
			5) Water quality is sufficient to support riparian-wetland plants
			6) Natural surface or subsurface flow patterns are not altered by disturbance (i.e., hoof action, dams, dikes, trails, roads, rills, gullies, drilling activities)
			7) Structure accommodates safe passage of flows (e.g., no headcut affecting dam or spillway)

Yes	No	N/A	VEGETATION
			8) There is diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery)
			9) There is diverse composition of riparian-wetland vegetation (for maintenance/recovery)
			10) Species present indicate maintenance of riparian-wetland soil moisture characteristics
			11) Vegetation is comprised of those plants or plant communities that have root masses capable of withstanding wind events, wave flow events, or overland flows (e.g., storm events, snowmelt)
			12) Riparian-wetland plants exhibit high vigor
			13) Adequate riparian-wetland vegetative cover is present to protect shoreline/soil surface and dissipate energy during high wind and wave events or overland flows
			14) Frost or abnormal hydrologic heaving is not present
			15) Favorable microsite condition (i.e., woody material, water temperature, etc.) is maintained by adjacent site characteristics

Yes	No	N/A	EROSION/DEPOSITION
			16) Accumulation of chemicals affecting plant productivity/composition is not apparent
			17) Saturation of soils (i.e., ponding, flooding frequency, and duration) is sufficient to compose and maintain hydric soils
			18) Underlying geologic structure/soil material/permafrost is capable of restricting water percolation
			19) Riparian-wetland is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition)
			20) Islands and shoreline characteristics (i.e., rocks, coarse and/or large woody material) are adequate to dissipate wind and wave event energies

(Revised 1999)

Threshold Study Sites – U Vic: Urban – Mid (Transition) - Natural

Urban

Mid

Natural

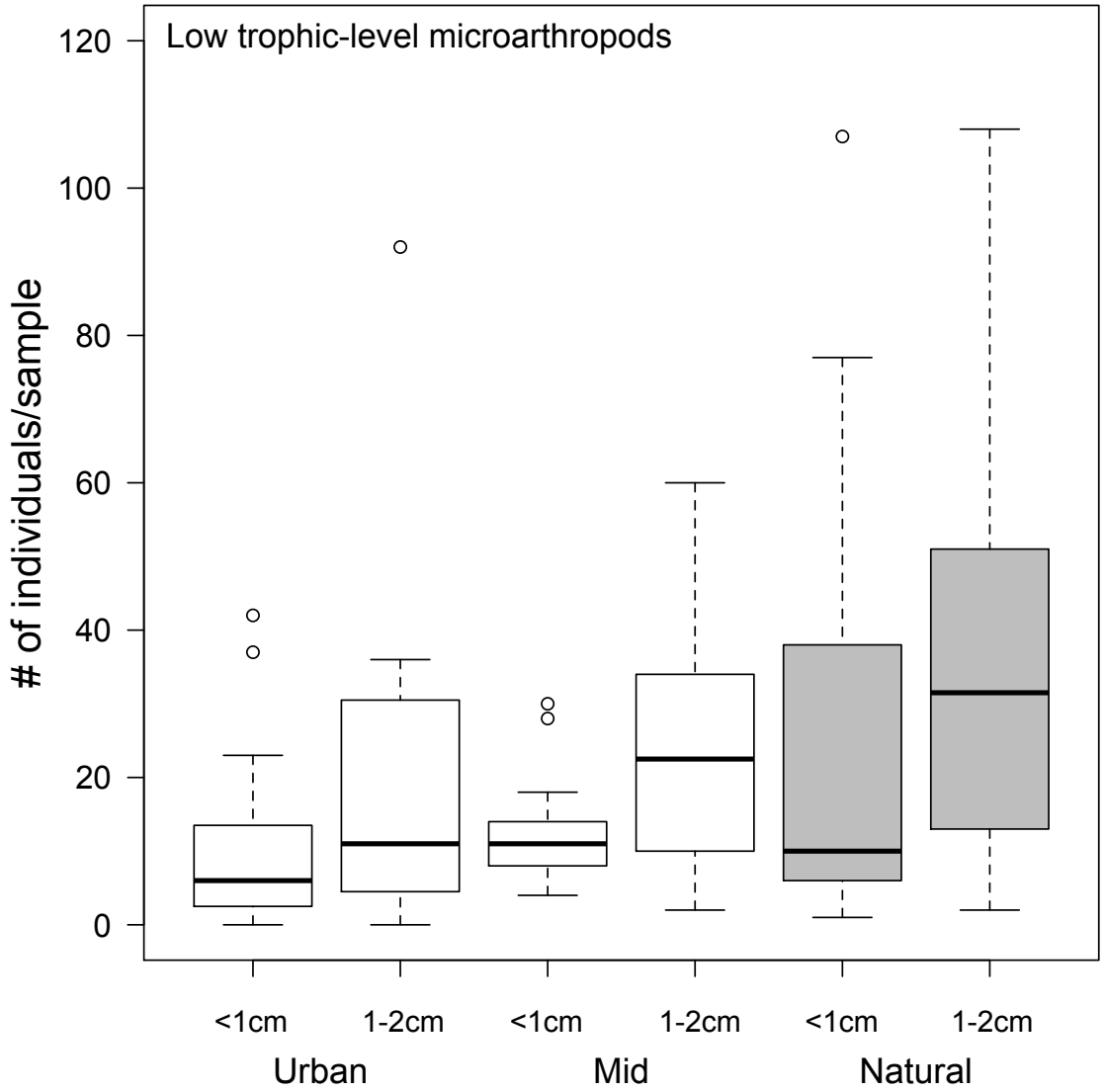
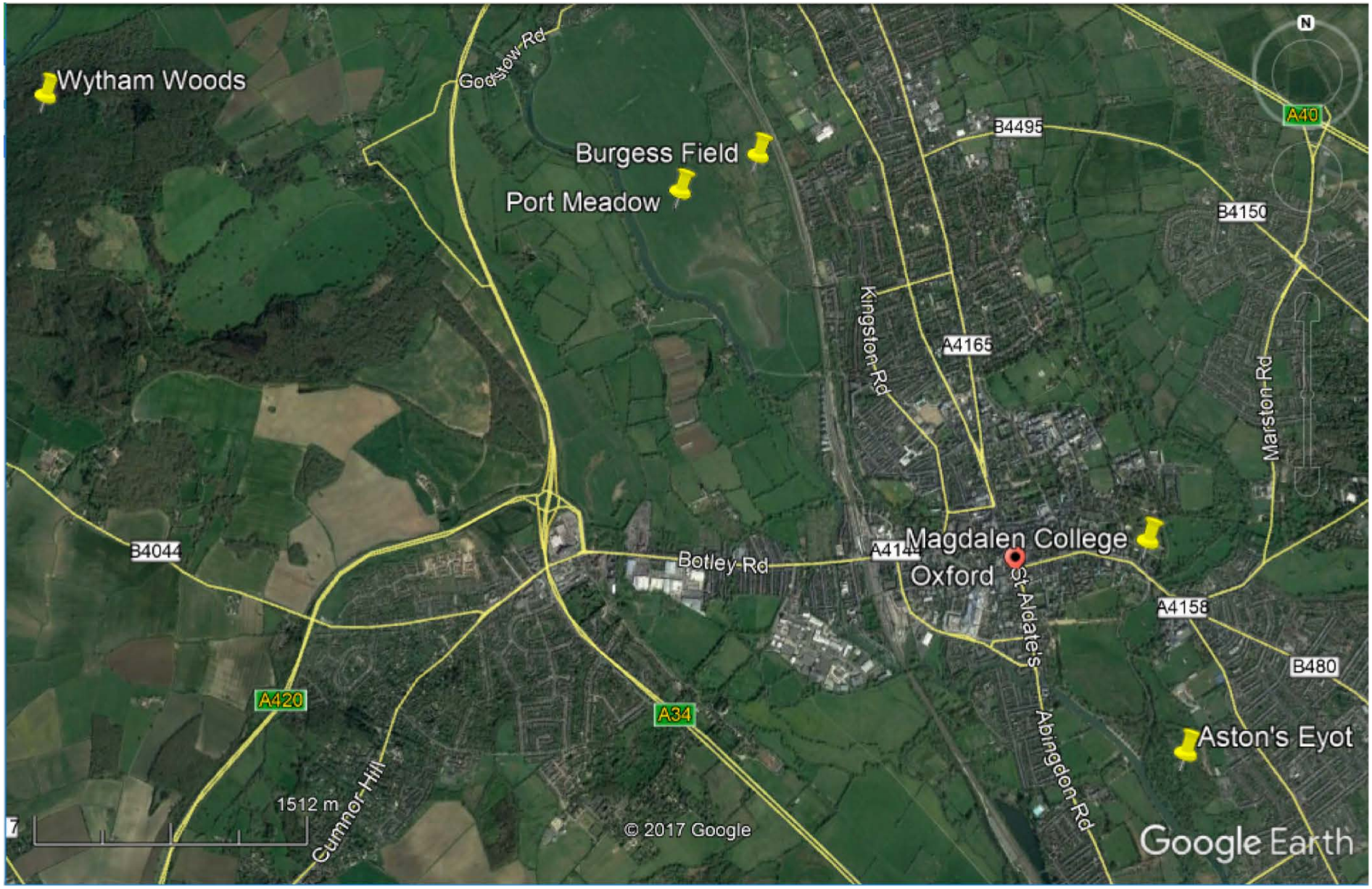


Fig. 4 Low trophic-level soil microarthropod abundance from two soil depths (<1cm, 1-2cm) at urban, mid and natural habitats on the University of Victoria campus, British Columbia. Gray shading indicates a significant difference ($p < 0.05$) between urban sites and mid-urban sites or urban sites and natural sites. Open circles are outliers.

Oxford Study Sites

1. Aston's Eyot
2. Magdalen College
3. Port Meadow
4. Burgess Field
5. Wytham Wood

Site Overview



European Ash Forest Plantation

Aston’s Eyot

Ornamental

Anthony Fisher at Badger Sett - badgers arrived 8 years ago

Browse Line from Muntjacs

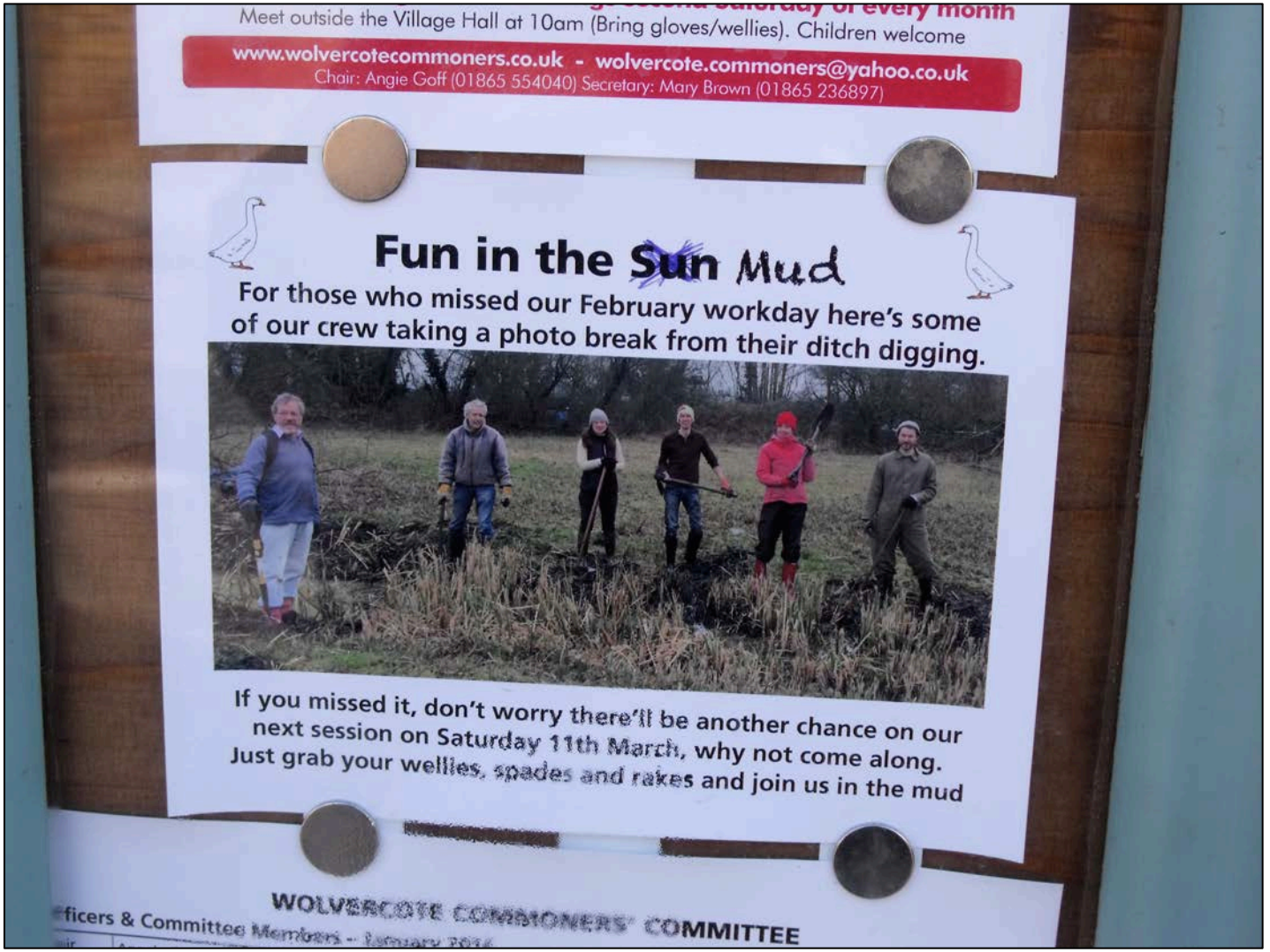
Pollarded Crack Willows (120 yrs) Along Thames

Water voles eaten by mink (liberated from farms) gone since 1996

Port Meadow

Transitional

Stewardship



Untilled Since 1200

Microbial Signatures of Ancient Habitats

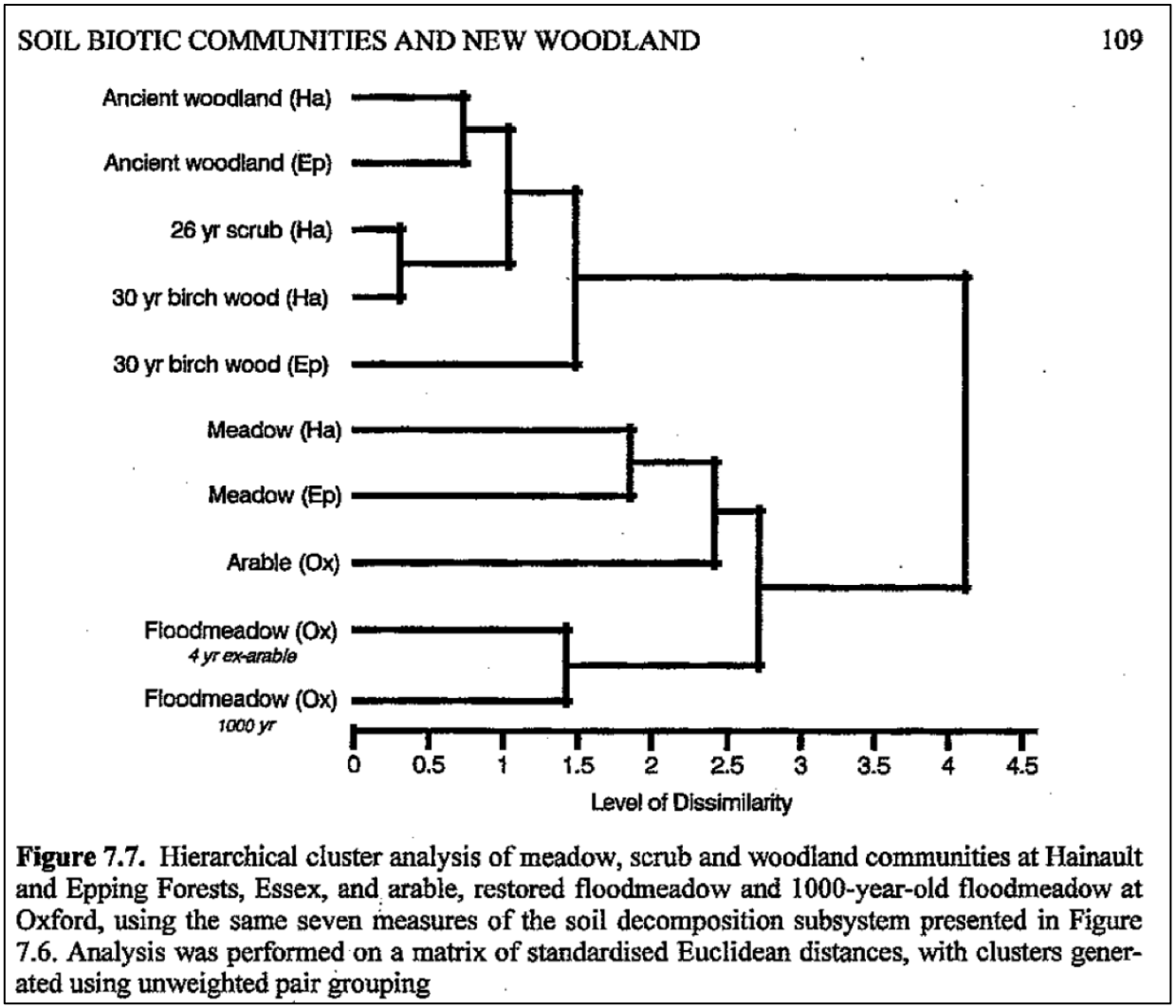


Figure 7.7. Hierarchical cluster analysis of meadow, scrub and woodland communities at Hainault and Epping Forests, Essex, and arable, restored floodmeadow and 1000-year-old floodmeadow at Oxford, using the same seven measures of the soil decomposition subsystem presented in Figure 7.6. Analysis was performed on a matrix of standardised Euclidean distances, with clusters generated using unweighted pair grouping

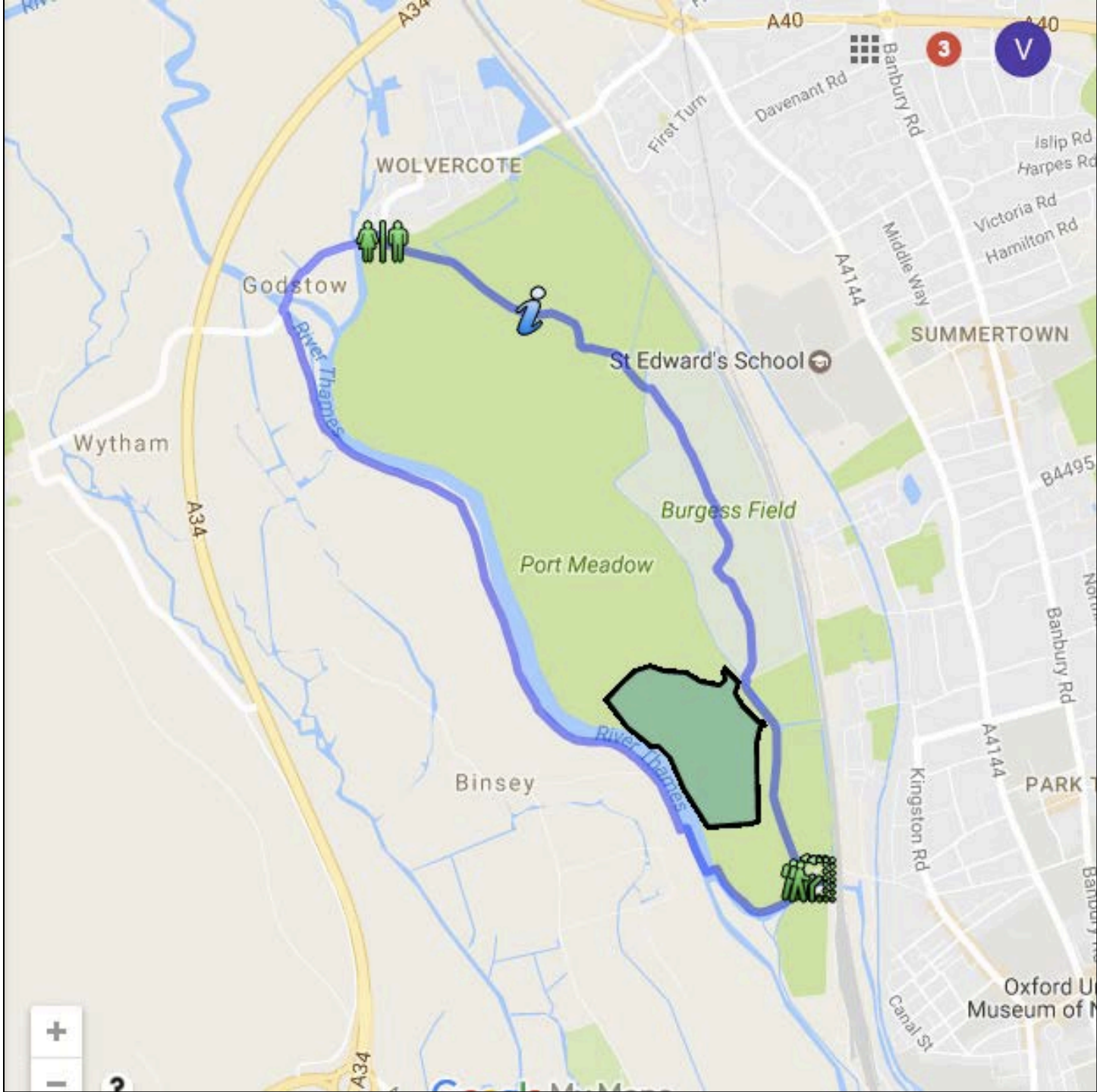
Harris and Hill 1996

Graylag Geese

Flooded Lower End of Meadow

Port Meadow with Burgess Nature Park

Ornamental



Sign to Nature Park

Ditch by Nature Park

Grass Hummocks in Nature Park

Magdalen College

Transitional

Cloisters

Collared Dove, Wood Pigeon

Fallow Deer

Herd 300 years old

Wytham Woods

Oxford University Research Forest

Ancient Woodland Ecosystem

Functional

Woodlands at Back of Parish

90% Natural Regeneration is European Ash

Ditch and Bank to Keep Cattle from Wood

Hundreds of years old - Need trees for materials

Evidence of Permaculture – Zone 5

Metrics for Urban Natural Habitat Quality Index

General Categories of Metrics and # of Variables

Indicator species (3)

Primary productivity (1)

Spatial Structure (6)

Disturbance (4)

Stewardship (1)

Indicator Species:
Large Mammalian Herbivores - Deer

Score Description

0 - none

1 - a few

2 - several

3 - common

4 - abundant

5 - hyperabundant

Indicator Species:
Large Predator – European badger

Score Description

0 - none

1 - individual

2 - population new to area

3 - present <5 years

4 - established

5 - large setts

Nigel Fisher – Conservator Wytham Woods

Primary Productivity: Visible Biomass

Score Description

0 - very little

1 - grazed grass

2 - lush field

3 - field with shrubs

4 - immature forest

5 - mature forest stand

Spatial Structure:
Patch Size (ha)

Score Description

0 - <10

1 - 10-20

2 - 20-100

3 - 100-300

4 - 300-500

5 - 500-600

Spatial Structure: Connectivity

Score Description

0 - no connections

1 - street trees

2 - boulevards

3 - pocket park stepping stones

4 - riparian connection

5 -contiguous with adjacent habitat

Disturbance: Buffering

Score Description

0 - none

1 - adjacent to development

2 - development within 100 m

3 - development within 200 m

4 - development within 300 m

5 - no nearby development

Disturbance:
Invasive Species

0 - mostly invasive

1 – large patches of invasive species

2 - invasive species common but don’t form patches

3 – small patches of invasive species

4 – few invasive species

5 – none

Ecological Restoration: Stewardship

Score Description

0 - none

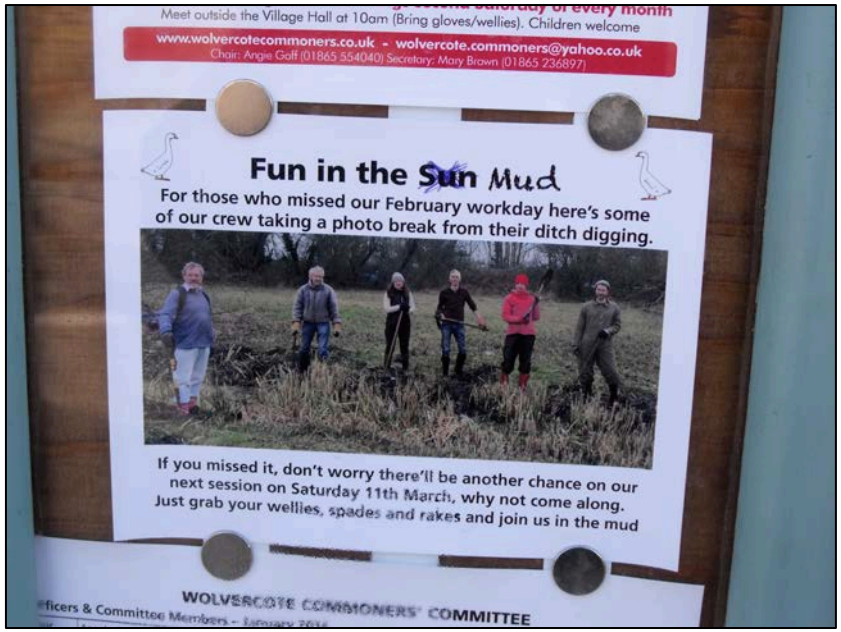
1 - volunteers with few resources

2 - volunteers with good resources

3 - volunteers with established programs

4 - paid maintenance staff

5 - paid staff and development programs



Comparison of Oxford Study Sites

Habitat Quality Scores

Scale
0 – none 5 - excellent

Habitat/ Indicator	Aston's Eyot 12 ha	Port Meadow 120 ha	Magdalen College 40.5 ha	Burgess Park 8.5 ha	Wytham Woods 600 ha
1. Deer	2	0	4	2	5
2. Waterfowl	3	5	4	3	4
3. Badger	4	0	0	0	4
4. Biomass	2	2	3	2	5
5. Patch Size	1	3	2	0	5
6. Connectivity	4	5	4	5	5
7. Habitat Diversity	3	4	5	3	5
8. River	5	2	5	2	3
9. Ponds and Marshes	0	5	2	0	1
10. Woodlands >5 ha	0	5	5	1	5
11. Buffers	2	2	3	3	4
12. Invasive Species	2	4	4	3	5
13. Intensity of use	0	0	2	1	5
14. Age >60 years	0	5	5	0	5
15. Stewardship	2	3	4	2	5
Urban Habitat Quality Index = Total / 75	**30**	**47**	**52**	**29**	**68**
Index as a Percent of Total Perfect Score of 75	**40**	**63**	**69**	**39**	**91**
Habitat Type	**Ornamental**	**Transitional**	**Transitional**	**Ornamental**	**Functional**

Overall Habitat Quality of Oxford Sites (%)

Habitat/ Indicator	Aston's Eyot 12 ha	Port Meadow 120 ha	Magdalen College 40.5 ha	Burgess Park 8.5 ha	Wytham Woods 600 ha
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