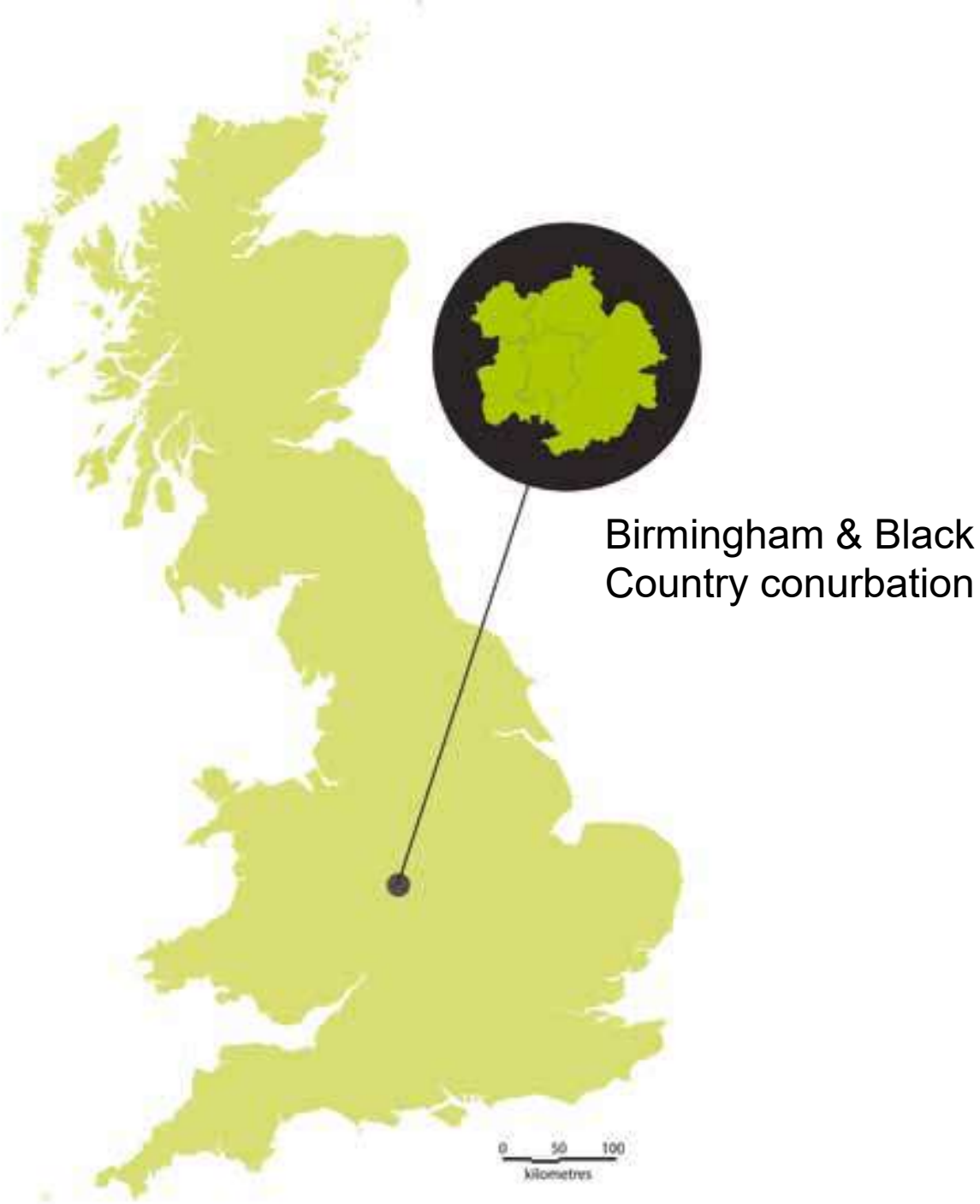
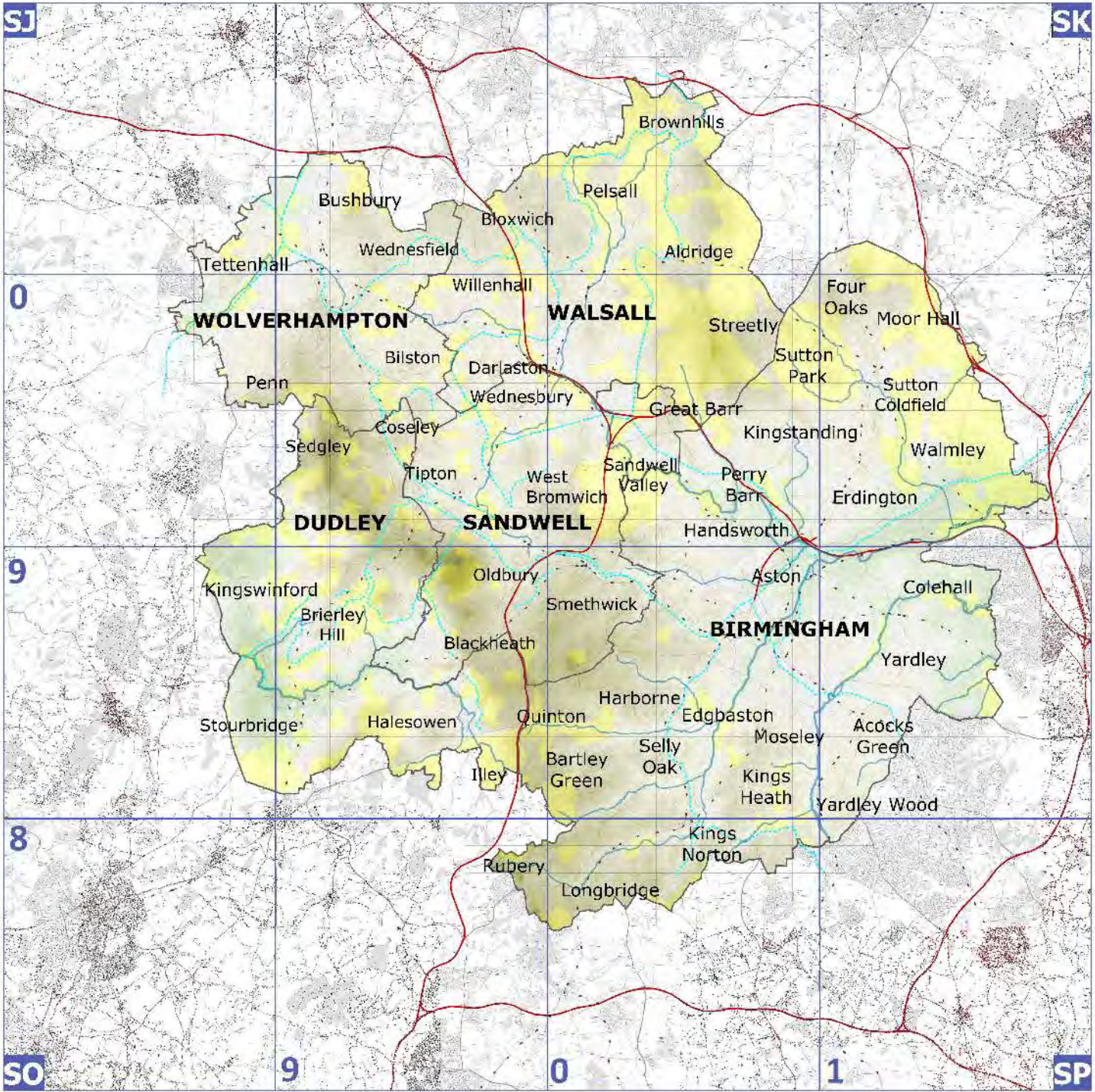
The use of the axiophyte concept to describe ecological networks and botanical change in monad and tetrad data

Ian Trueman

Simple analysis of regional Flora data

- Axiophyte analysis of Birmingham & the Black Country monad data to delimit an ecological network
- Axiophyte analysis of the Shropshire tetrad data to describe botanical change
- Multivariate analysis of monad and tetrad data


Birmingham & Black Country conurbation
0 50 100
kilometres


SJ
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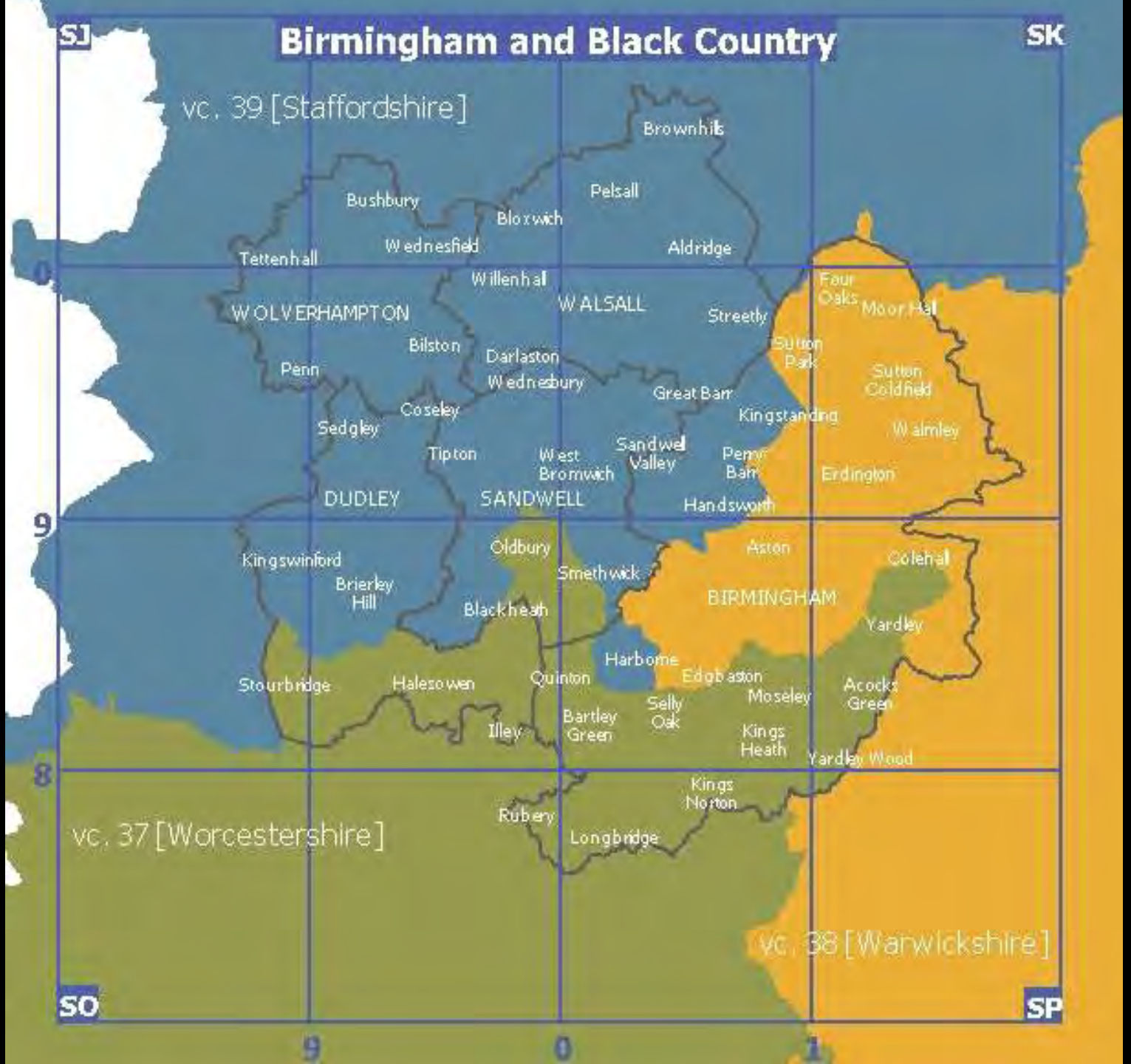
Brownhills
Pelsall
Bushbury
Bloxwich
Wednesfield
Aldridge
Tettenhall
Willenhall
WOLVERHAMPTON
WALSALL
Four Oaks
Moor Hall
Streetly
Bilston
Darlaston
Sutton Park
Penn
Wednesbury
Sutton Coldfield
Great Barr
Coseley
Kingstanding
Sedgley
Walmley
Tipton
Sandwell Valley
Perry Barr
West Bromwich
Erdington
DUDLEY
SANDWELL
Handsworth
Oldbury
Aston
Colehall
Kingswinford
Smethwick
Brierley Hill
BIRMINGHAM
Blackheath
Yardley
Harborne
Edgbaston
Stourbridge
Halesowen
Quinton
Moseley
Acocks Green
Selly Oak
Bartley Green
Illey
Kings Heath
Yardley Wood
Kings Norton
Rubery
Longbridge


Birmingham and Black Country
SJ
SK
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vc. 39 [Staffordshire]
vc. 37 [Worcestershire]
vc. 38 [Warwickshire]
Brownhills
Pelsall
Bushbury
Bloxwich
Wednesfield
Aldridge
Tettenhall
Willenhall
WOLVERHAMPTON
WALSALL
Streetly
Four Oaks
Moor Hall
Bilston
Darlaston
Penn
Wednesbury
Sutton Park
Sutton Coldfield
Great Barr
Coseley
Kingstanding
Walmley
Sedgley
Tipton
West Bromwich
Sandwell Valley
Perry Barr
Erdington
DUDLEY
SANDWELL
Handsworth
Oldbury
Aston
Coleshill
Kingswinford
Smethwick
Brierley Hill
BIRMINGHAM
Blackheath
Yardley
Harborne
Stourbridge
Halesowen
Quinton
Edgbaston
Acocks Green
Moseley
Selly Oak
Bartley Green
Illey
Kings Heath
Yardley Wood
Kings Norton
Rubery
Longbridge
9
8
0
1

Birmingham &
Black Country

EcoRecord

the ecological database
for Birmingham and the Black Country

EcoRecord is the biological record centre for Birmingham and the Black Country (Dudley, Sandwell, Walsall & Wolverhampton).
EcoRecord collects, collates and makes available information about the wildlife, wildlife sites and habitats of Birmingham and the Black Country and currently has over 500,000 species records on its database. Records come from many sources, ranging from professional ecologists, to amateur expert naturalists, to other wildlife enthusiasts. For more information please visit http://www.ecorecord.org.uk or telephone 0121 454 1808.


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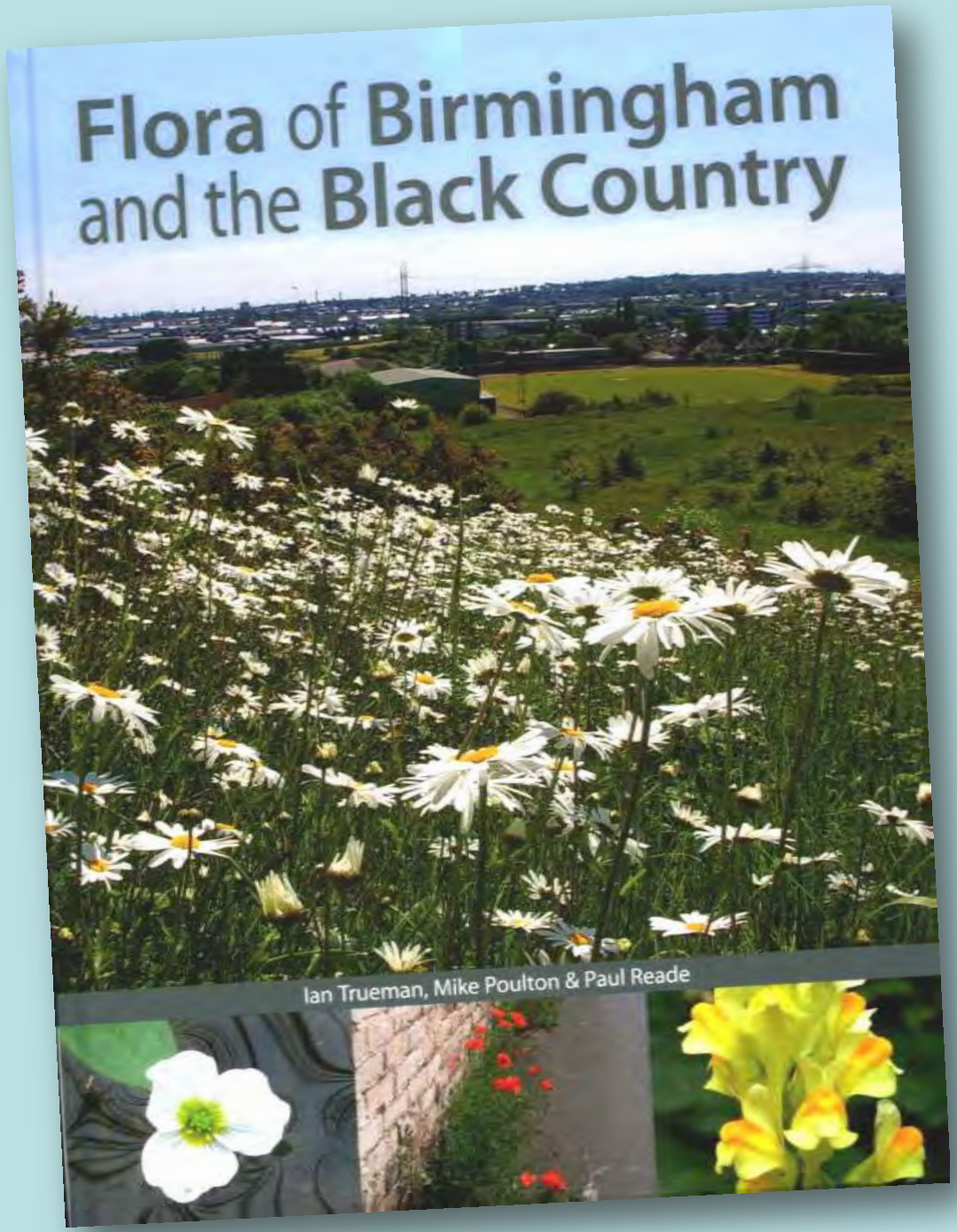
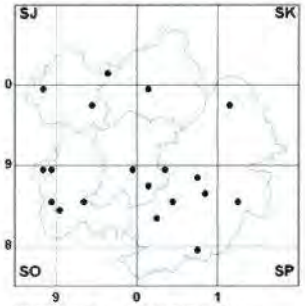

Flora of Birmingham and the Black Country
Ian Trueman, Mike Poulton & Paul Reade

margins of many of the canals, lakes and ponds throughout the conurbation where it frequently forms dense colonies. Also a popular introduction in planting schemes causing confusion as to its true native status in some places. Displays a wide degree of tolerance to water conditions and sometimes forms pure stands in the absence of other marginals, but apparently requires at least an intermediate base and nutrient status. Considerably more frequent than in the 1970s Floras. Ass: *Alisma lanceolatum, Butomus umbellatus, Epilobium hirsutum, Sagittaria sagittifolia, Sparganium erectum, Typha latifolia.*

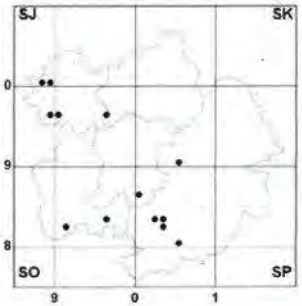
Iris foetidissima L.
Stinking Iris



19. Native. A perennial herb, the few scattered records in isolation suggest this species is no more than an introduction in B&BC. Individual clumps or small patches have been recorded, sometimes but not always in the shade and on moderately fertile and base-rich soil, from municipal parks, waste ground close to gardens, track verges, hedgerows, several canal towpaths, banks of the Rivers Stour and Rea, Ham Dingle. Ass: *Brachypodium sylvaticum, Campanula trachelium, Conium maculatum, Dipsacus fullonum.*

Crocus vernus (L.) Hill
Spring Crocus

13. Neophyte. A cormous perennial herb. The most commonly grown species which includes several showy cultivars such as 'Pickwick', 'Remembrance', 'King of the Whites' and 'Little Dorritt'. Abundantly grown, and planted on many graves and often spreading into surrounding grassland in most of the churchyards throughout the conurbation, where, in early spring it displays showy patches of white, purple and purple-white, bi-coloured flowers. Also regularly discarded into grassy patches and bits of waste ground near houses where

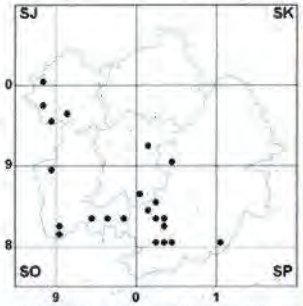


it persists without showing much sign of spread. Undoubtedly under-recorded due to the earliness of flowering and withering of foliage and doubts about whether plantings are deliberate. Many records for *Crocus* sp. belong here but have not been included in the map. S & C Europe.

Crocus chrysanthus (Herb.) Herb.
Golden Crocus

2. Neophyte. Cormous herb. Recorded, rarely, in sites marginal to cultivation. Naturalised in a churchyard, West Bromwich (SP0192, A. Underhill, 1996); plentiful in grassy verge, Woodlands Walk, Penn (SO895959, CBW, 2007). Balkans and Turkey.

Crocus tommasinianus Herb.
Early Crocus



22. Neophyte. A cormous herb, readily spreading by seed from original garden plantings into grassy roadside verges, lawns, garden paths and paving, roadside banks and patches of woodland. Also a rapid coloniser from original plantings in grassy areas between graves in many of the churchyards in B&BC. Likely to be under-recorded due to the earliness of its flowering and withering of foliage later in

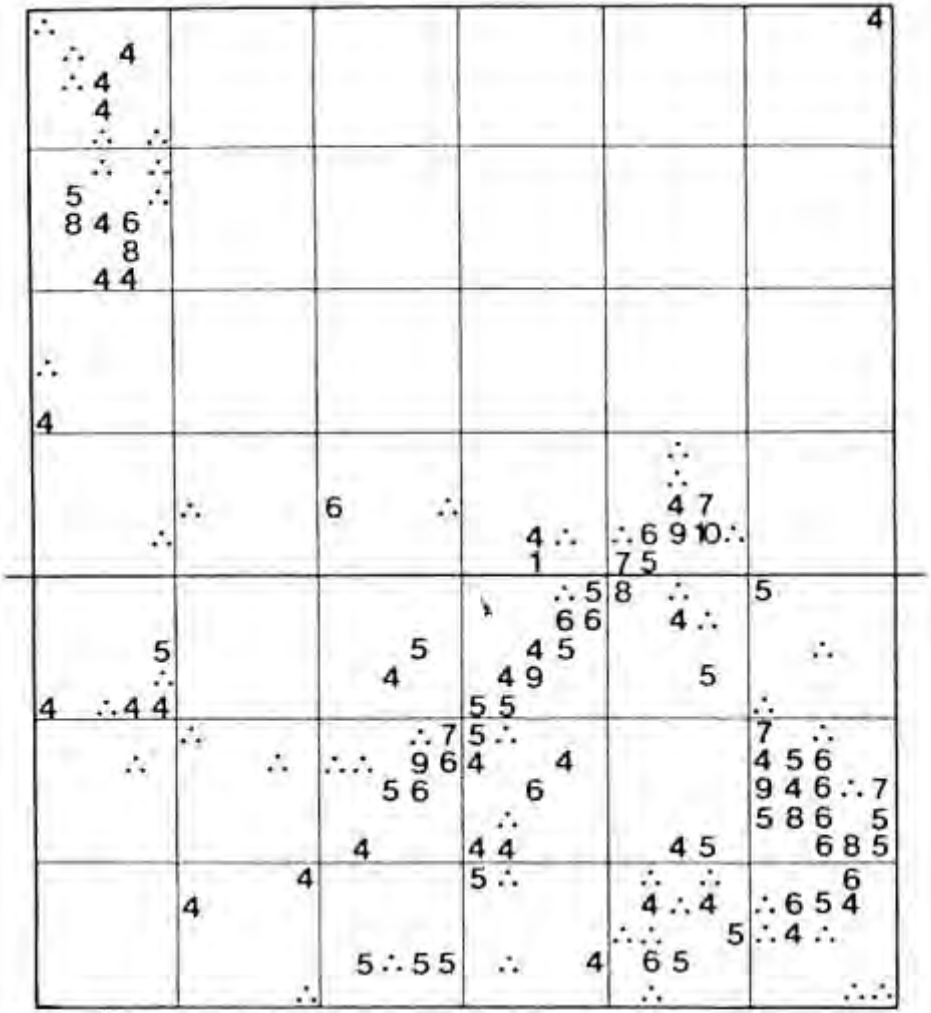
▲ *Ophrys apifera*

▲ *Sisyrinchium montanum*

▲ *Iris foetidissima*

Flora database

- Recording period 1995-2012
- A total of nearly 240,000 records about 1902 taxa
- From an area of circa 625 square kilometres spread over 715 monads
- Database for analysis is 1449 taxa x 715 monads



(b) *Old woodlands on base-rich soils*

Campanula trachelium
Carex strigosa
Epipactis helleborine
E. purpurata
Festuca altissima
Hordelymus europaeus
Lathraea squamaria
Listera ovata
Orchis mascula
Paris quadrifolia
Sorbus torminalis
Tilia cordata
Vicia sylvatica
Viola reichenbachiana

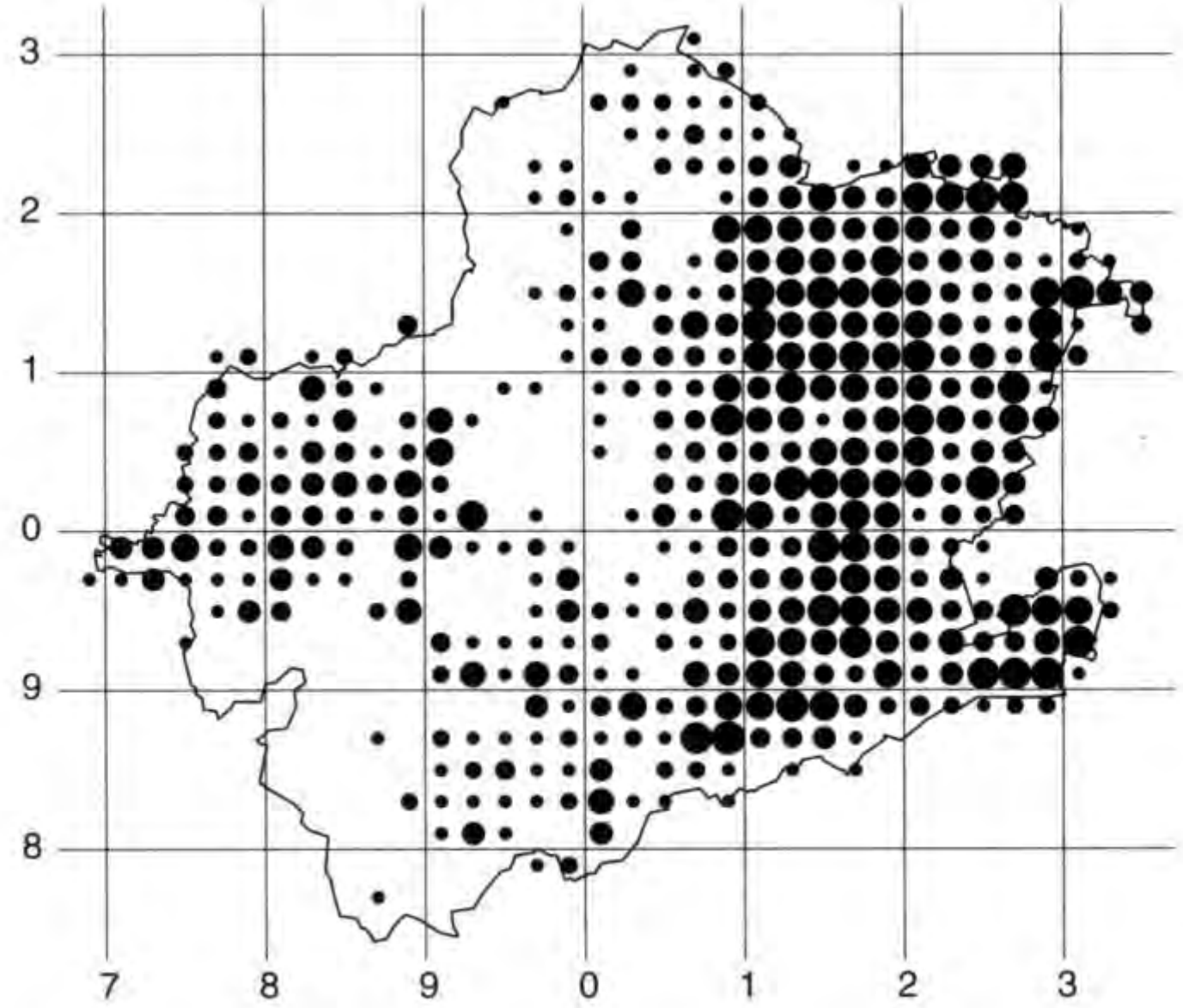


Fig. 11.11 Coincidence map for ancient woodland species.

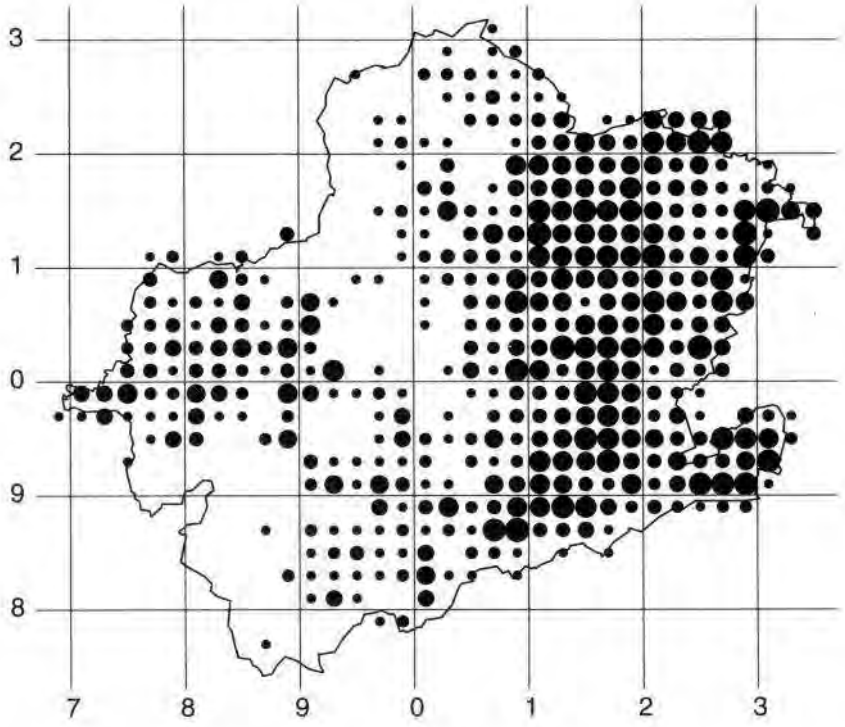


Fig. 11.11 Coincidence map for ancient woodland species.

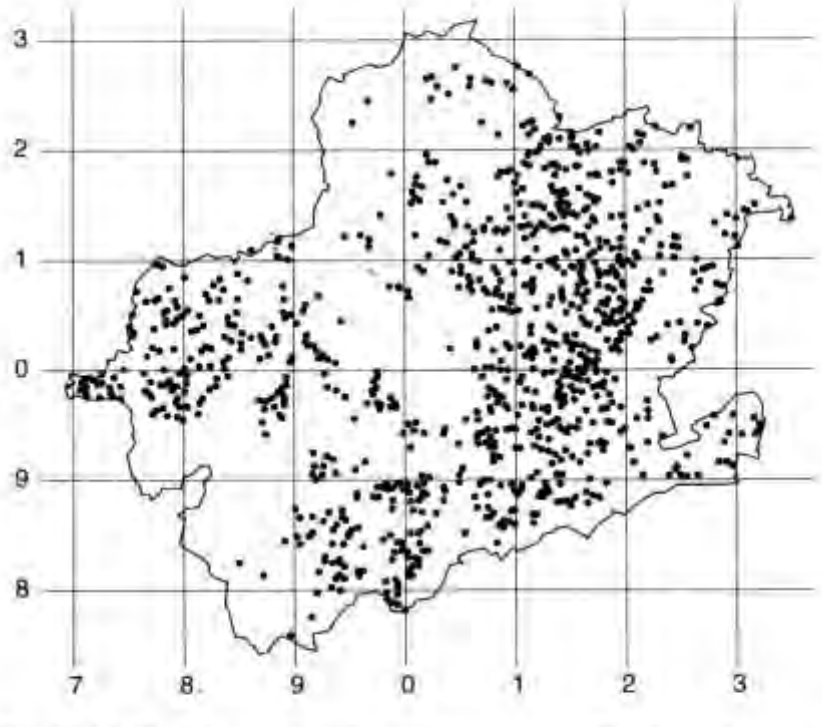
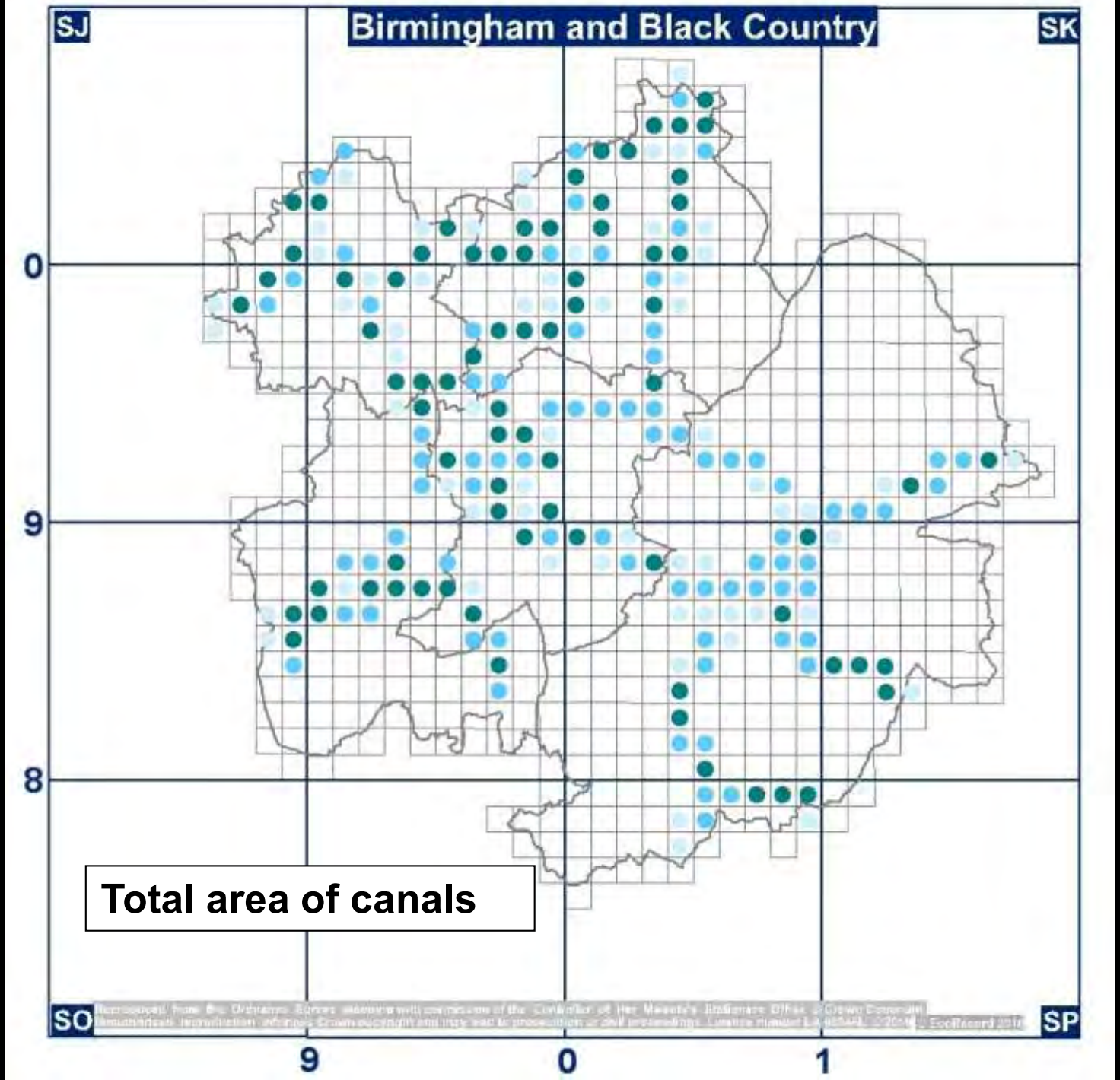
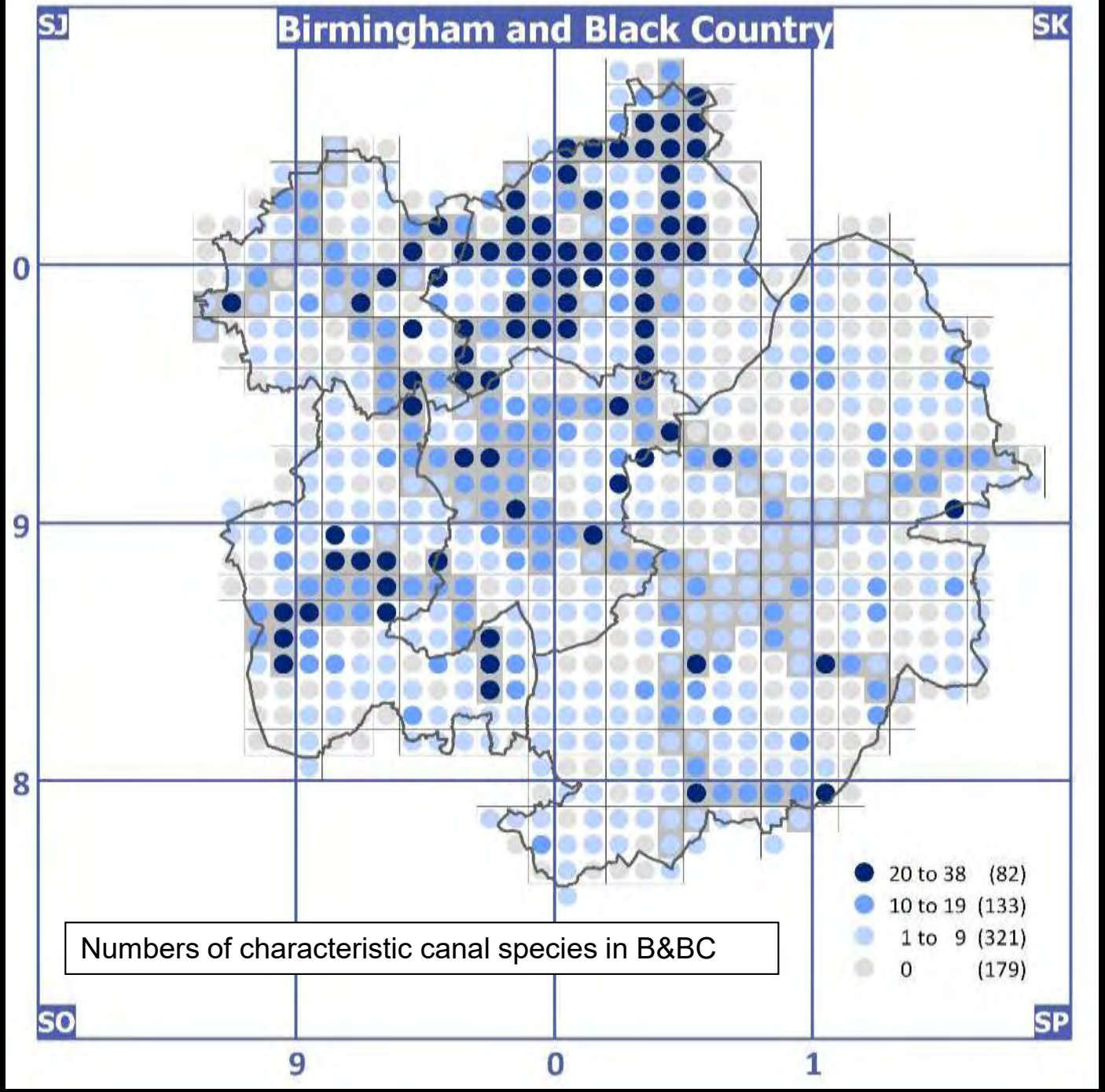


Fig. 11.12 Distribution of ancient woodland sites in Montgomeryshire. Map based on the 100m grid references given in the NCC Inventory of Ancient Woodland in Montgomery (Sothern & Drewett, 1991).

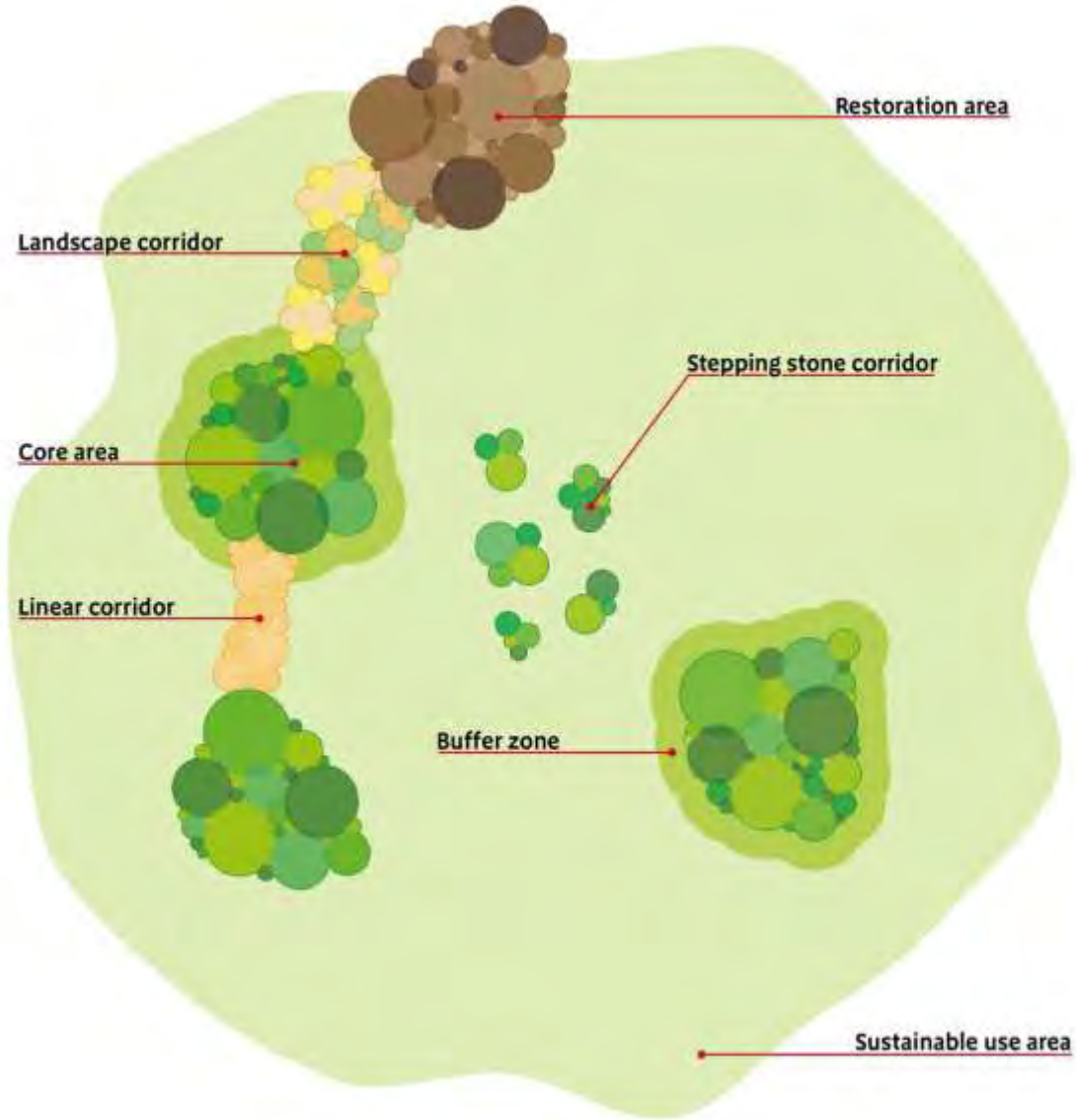

Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Total area of canals


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
20 to 38 (82)
10 to 19 (133)
1 to 9 (321)
0 (179)
Numbers of characteristic canal species in B&BC

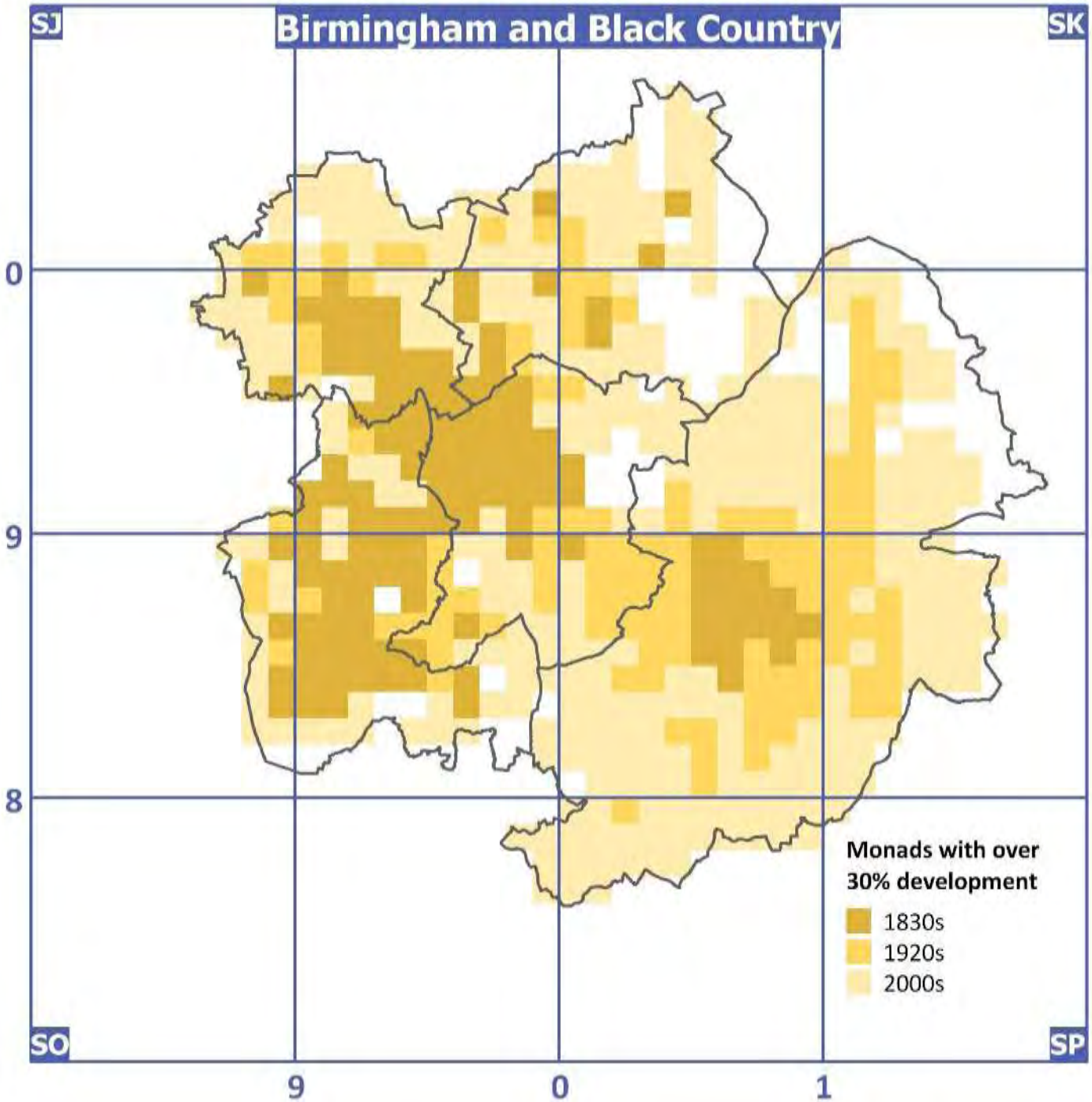
Making Space for Nature:
A review of England's Wildlife Sites and Ecological Network

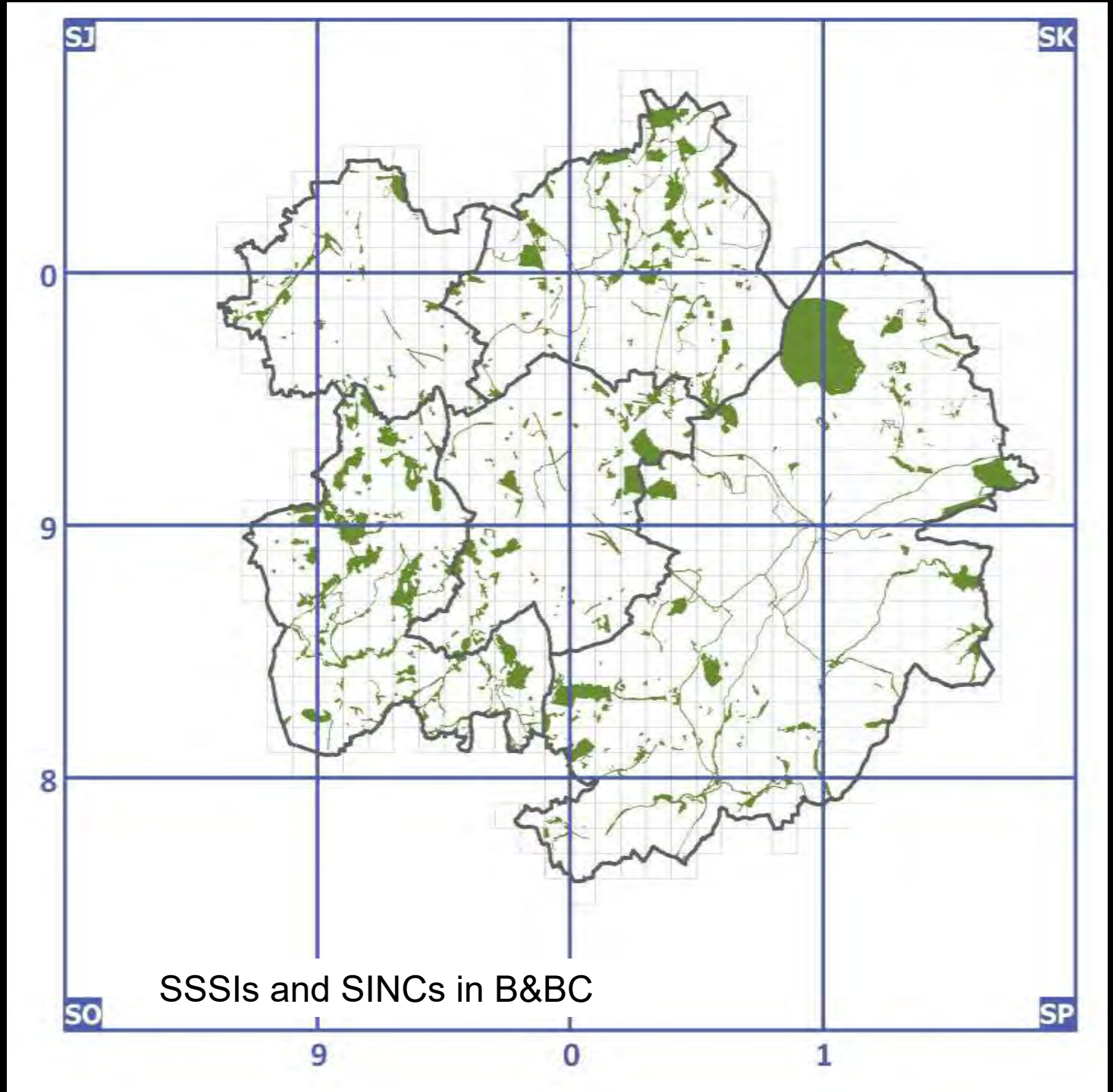
Chaired by Professor Sir John Lawton CBE FRS

Submitted to the Secretary of State, the Department for Environment, Food and Rural Affairs on 16 September 2010

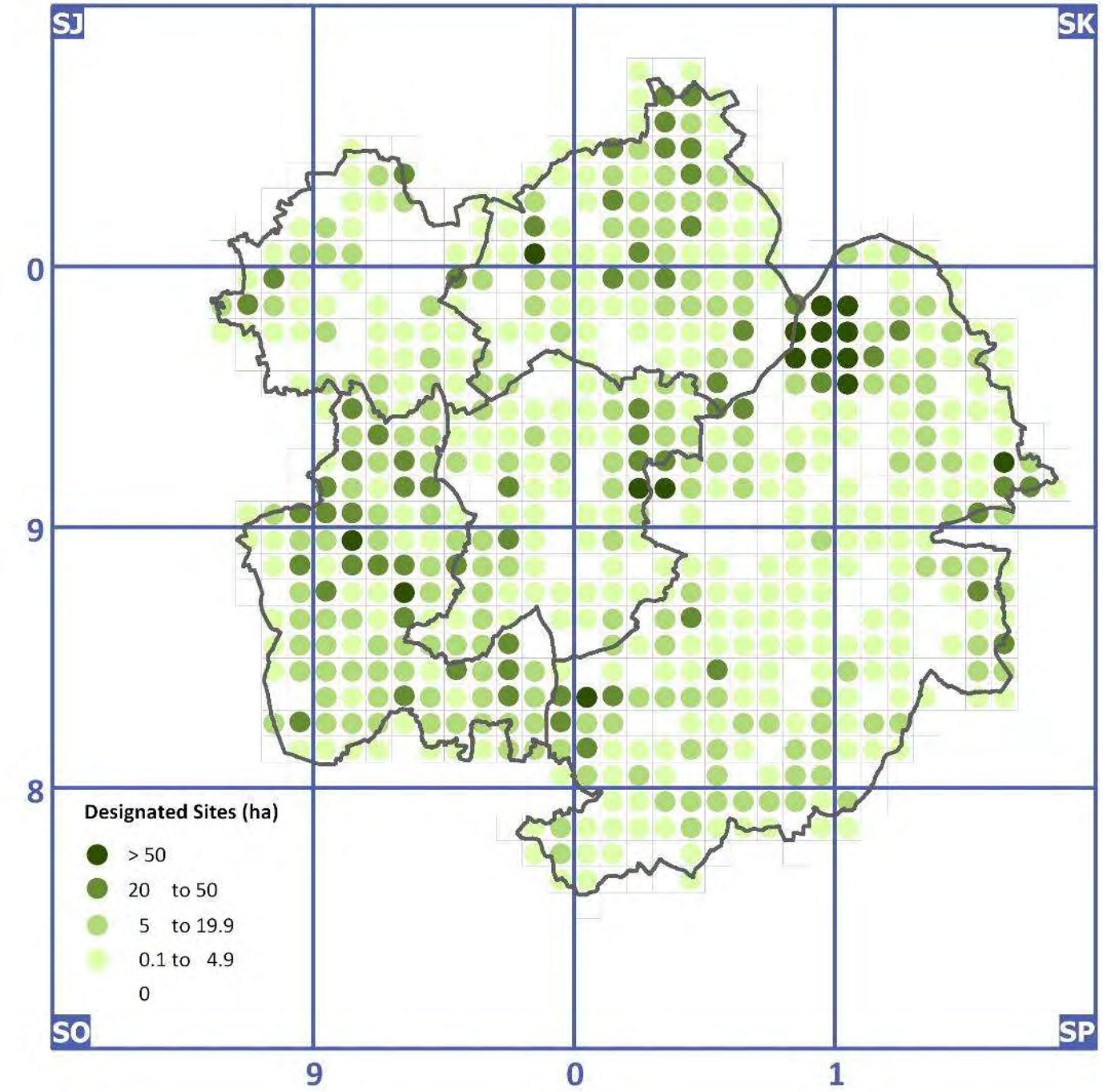


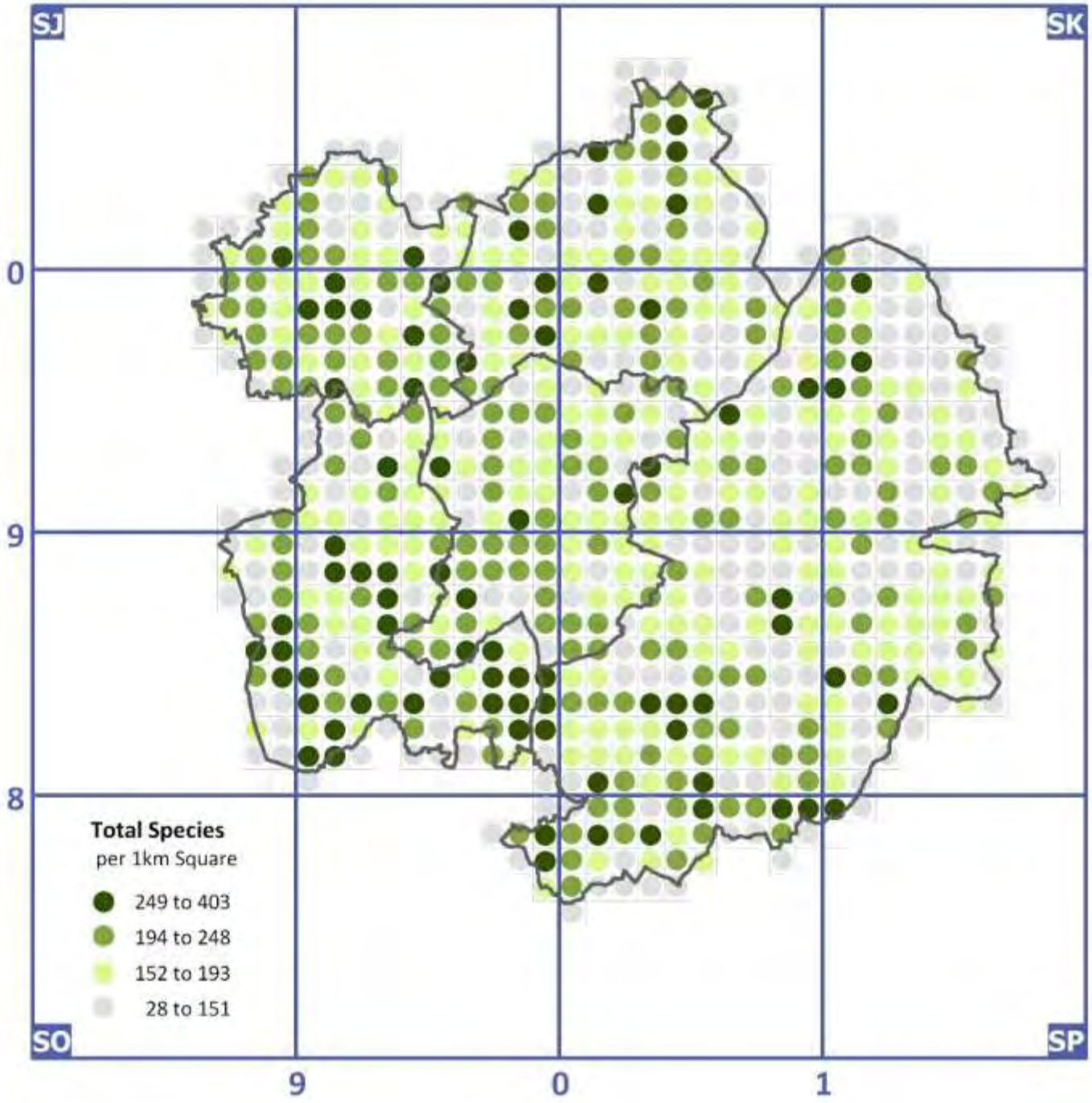
Lawton's schematic "**Ecological Network**" from "Making Space for Nature: a review of England's wildlife sites and ecological network" a report to UK Government (2010) moving away from just conserving existing sites towards consolidation at a landscape scale via habitat restoration and re-creation

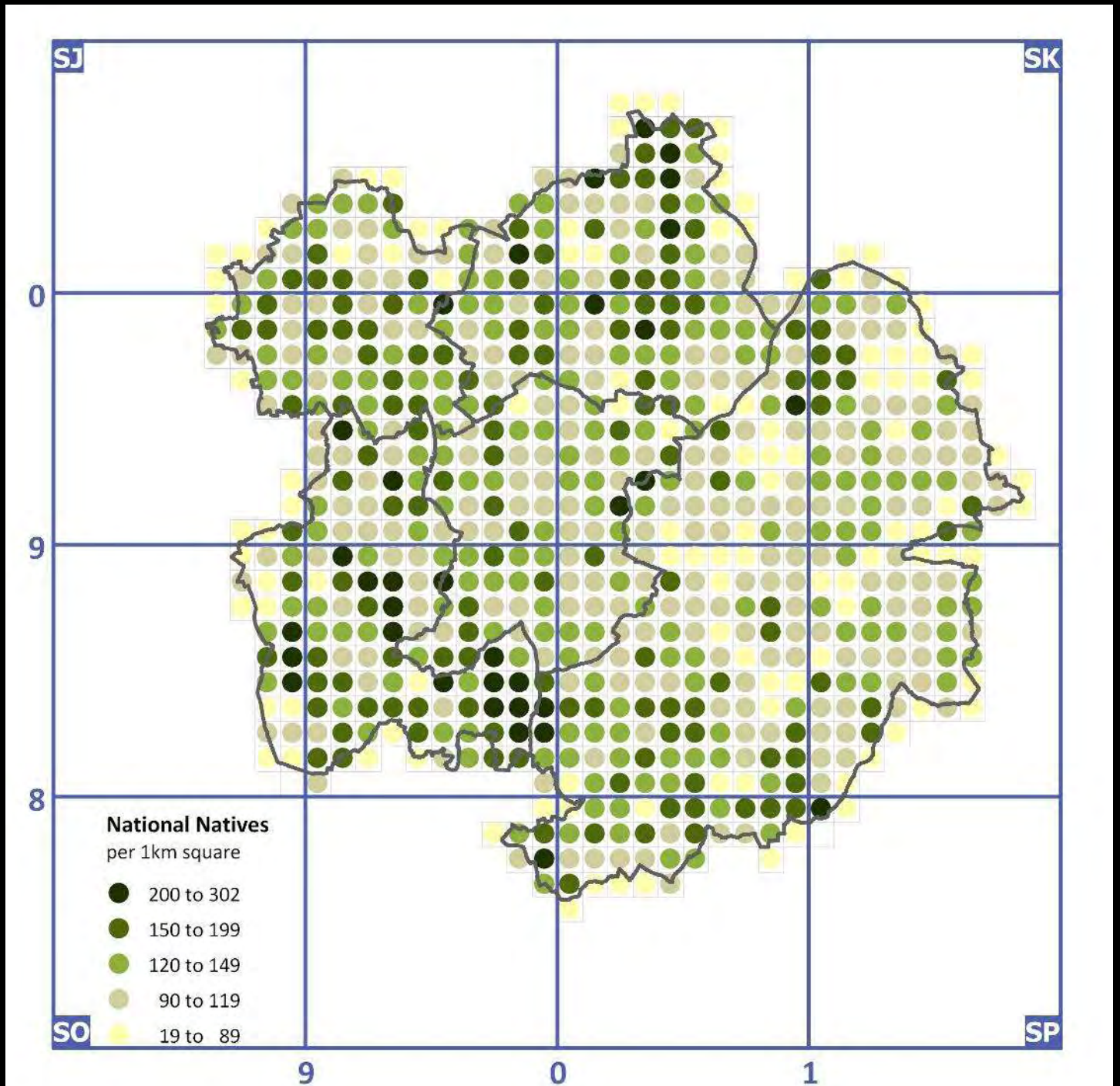

Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Monads with over
30% development
1830s
1920s
2000s



SSSIs and SINCs in B&BC

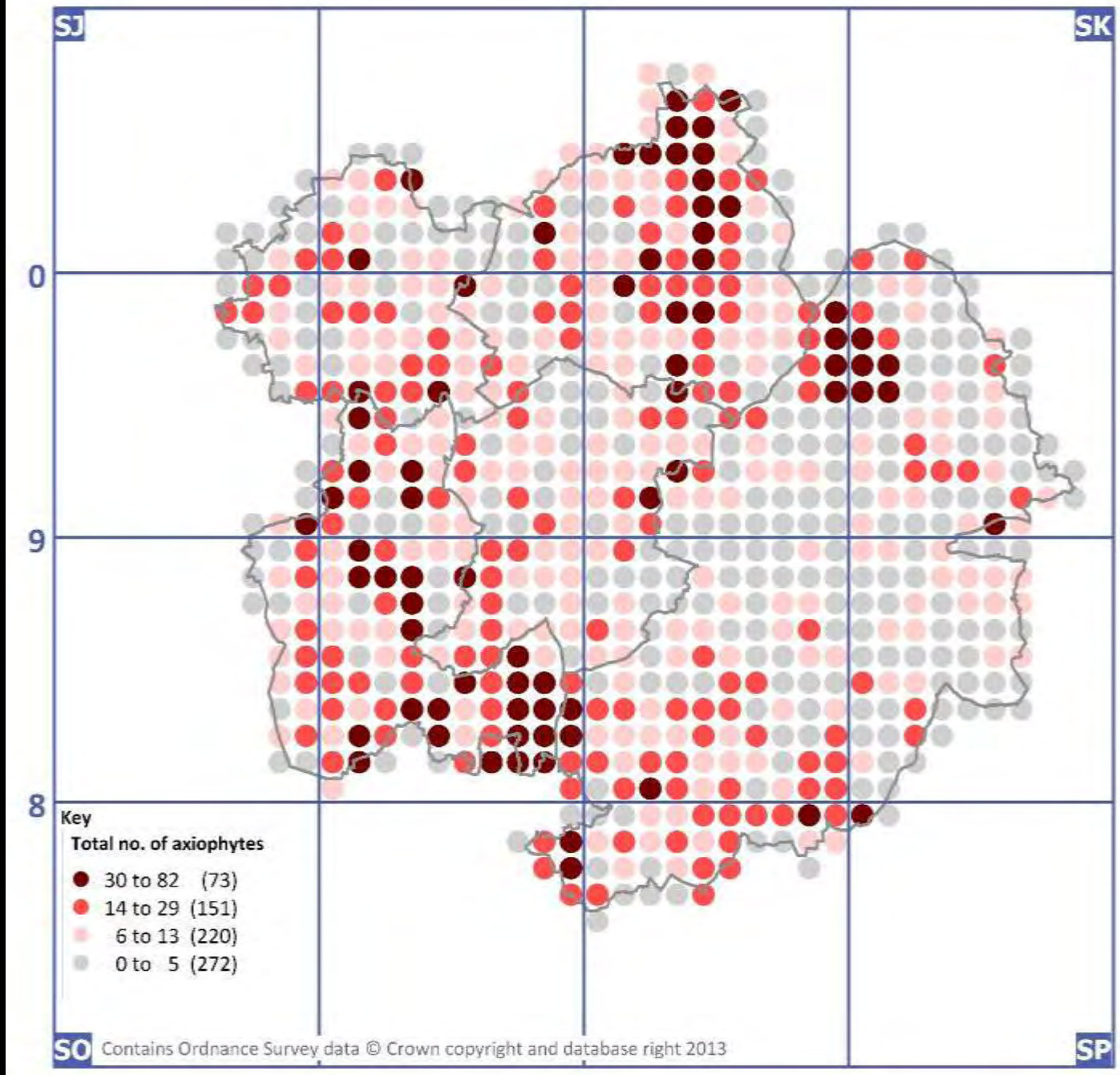

SJ
SK
SO
SP
0
9
8
9
0
1
Designated Sites (ha)
> 50
20 to 50
5 to 19.9
0.1 to 4.9
0


SJ
SK
SO
SP
0
9
8
9
0
1
Total Species
per 1km Square
249 to 403
194 to 248
152 to 193
28 to 151


SJ
SK
SO
SP
0
9
8
9
0
1
National Natives
per 1km square
200 to 302
150 to 199
120 to 149
90 to 119
19 to 89

Axiophytes

- Species 90% restricted to habitats of nature conservation importance
- Species recorded in fewer than 25% of tetrads in a vice-county
- Very rare species should be considered for omission as chance occurrences
- See http://www.bsbi.org.uk/axiophytes


SJ
SK
SO
SP
0
9
8
9
0
1
Key
Total no. of axiophytes
30 to 82 (73)
14 to 29 (151)
6 to 13 (220)
0 to 5 (272)
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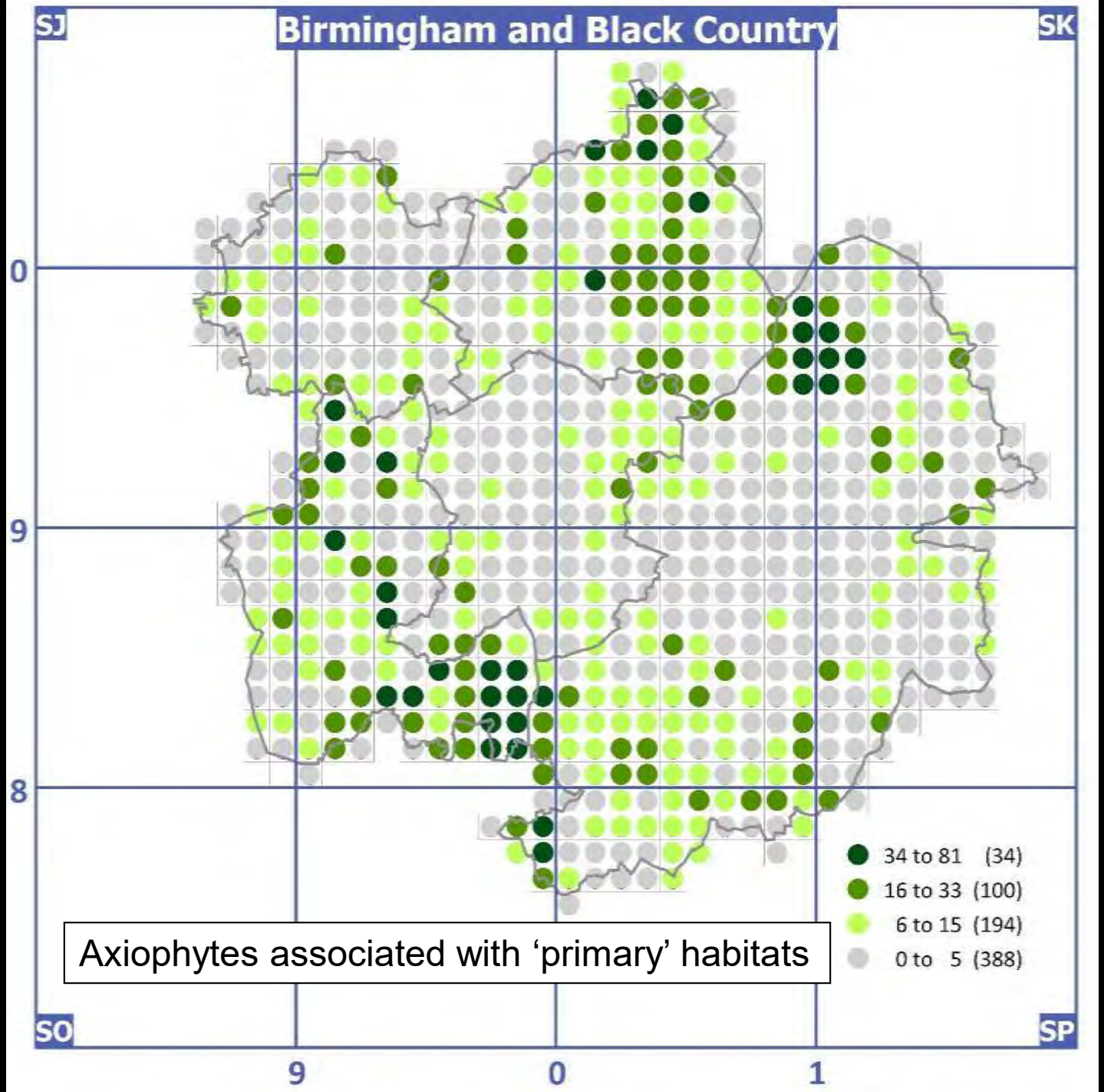
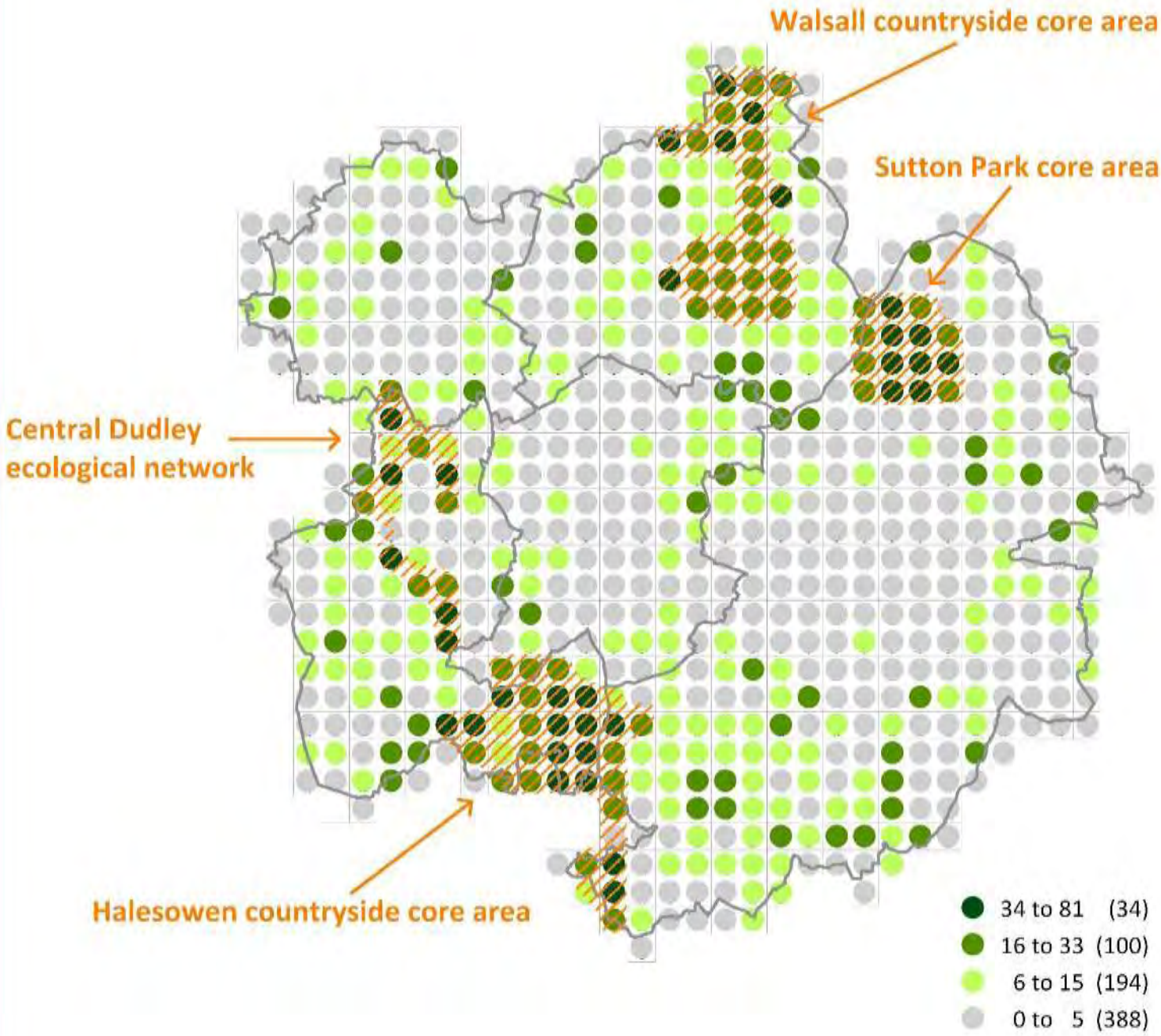
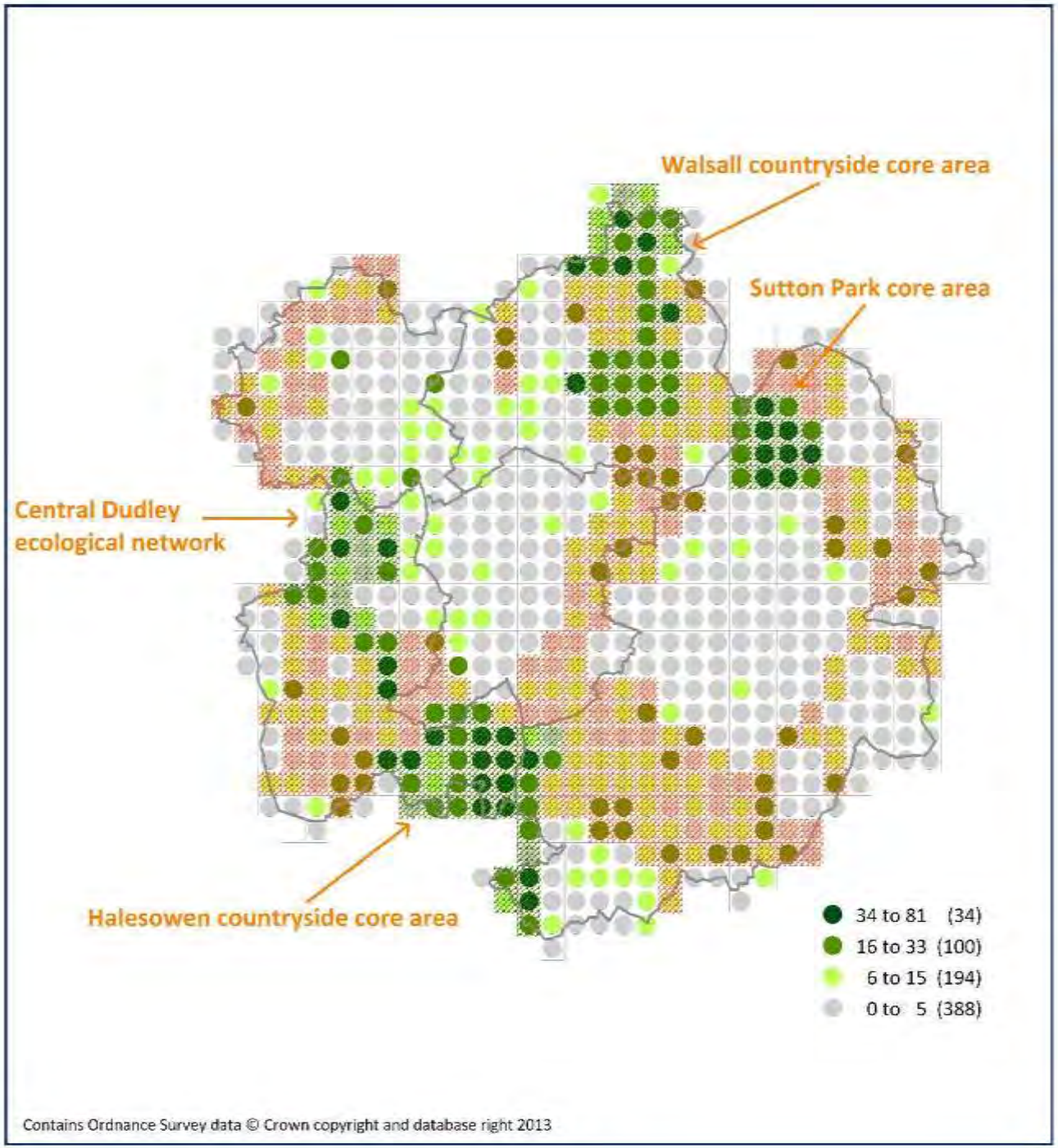
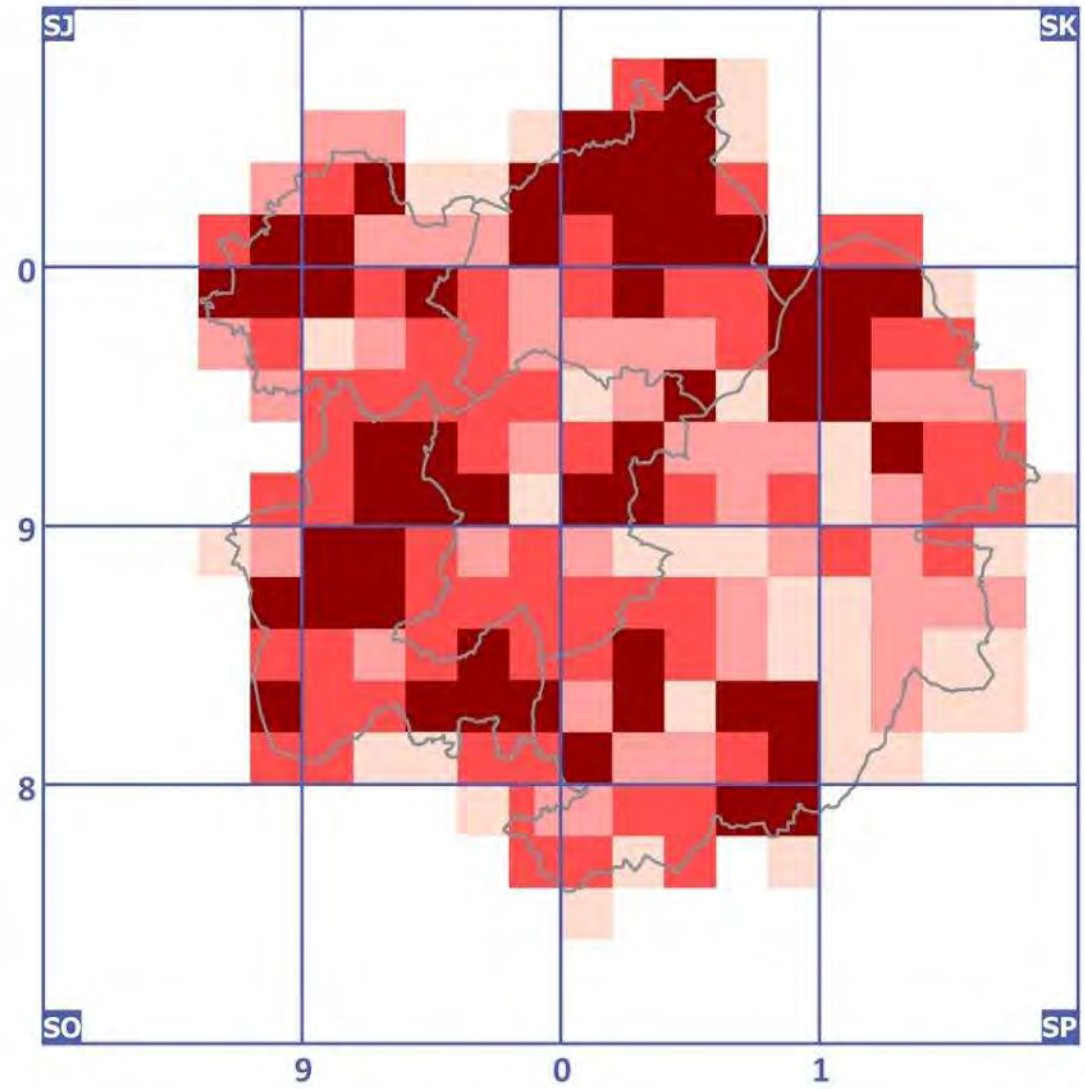

Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
34 to 81 (34)
16 to 33 (100)
6 to 15 (194)
0 to 5 (388)
Axiophytes associated with ‘primary’ habitats


Walsall countryside core area
Sutton Park core area
Central Dudley
ecological network
Halesowen countryside core area
34 to 81 (34)
16 to 33 (100)
6 to 15 (194)
0 to 5 (388)


Walsall countryside core area
Sutton Park core area
Central Dudley ecological network
Halesowen countryside core area
34 to 81 (34)
16 to 33 (100)
6 to 15 (194)
0 to 5 (388)
Contains Ordnance Survey data © Crown copyright and database right 2013



Key:

Number of Breeding Brid Species per Tetrad

- 36 to 66
- 26 to 36
- 17 to 26
- 1 to 17

Drawing title:

NUMBER OF BREEDING BIRDS PER TETRAD

Scale:	Date:
1:250,000 @ A4	21/08/2013

EcoRecord

the ecological database for Birmingham and the Black Country

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To achieve long-term environmental gains for the wildlife and people of Birmingham & the Black Country by delivering targeted, on-the-ground, biodiversity projects at a landscape scale.


Birmingham
& Black
Country
Nature
Improvement
Area

Axiophyte analysis of the Shropshire tetrad data to describe botanical change

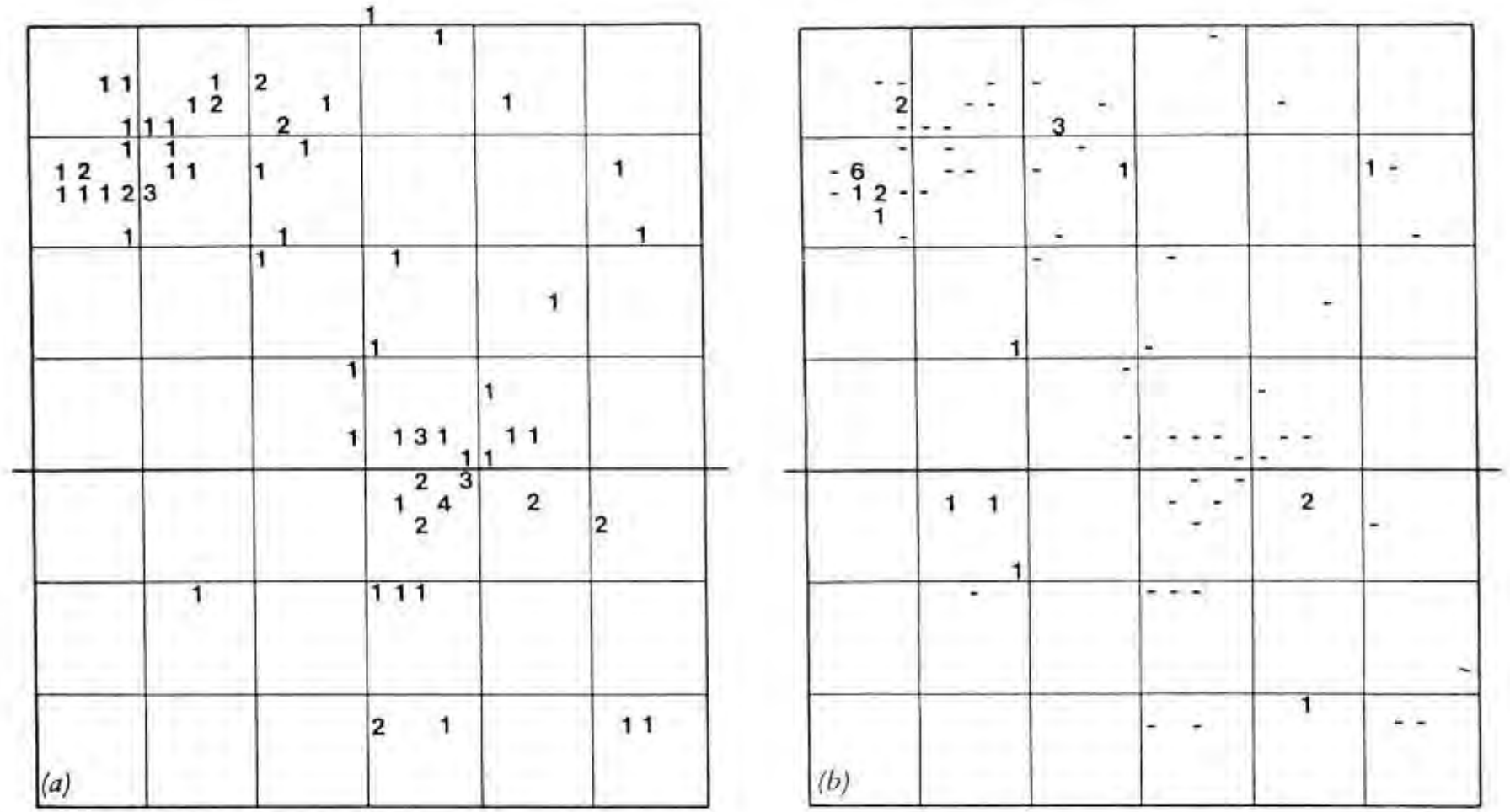
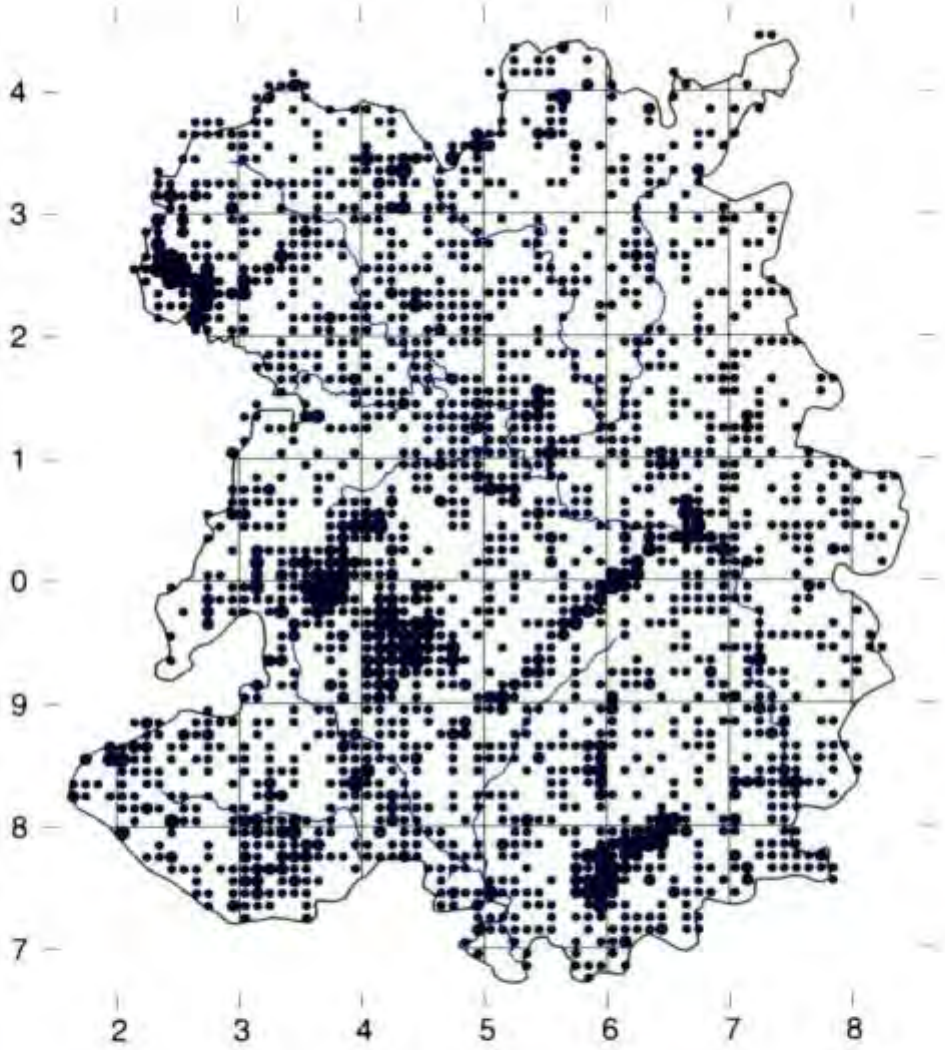
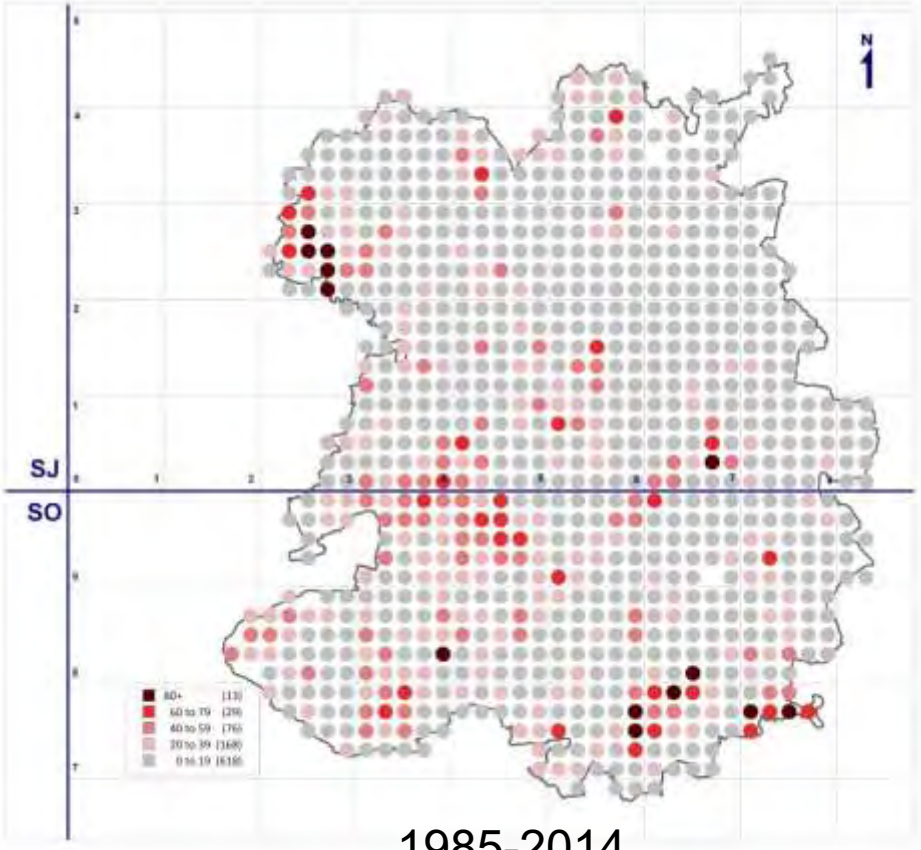


Fig. 9.4 *Coincidence maps (a) pre–1913 and (b) post–1969 for calcareous fens and mires*

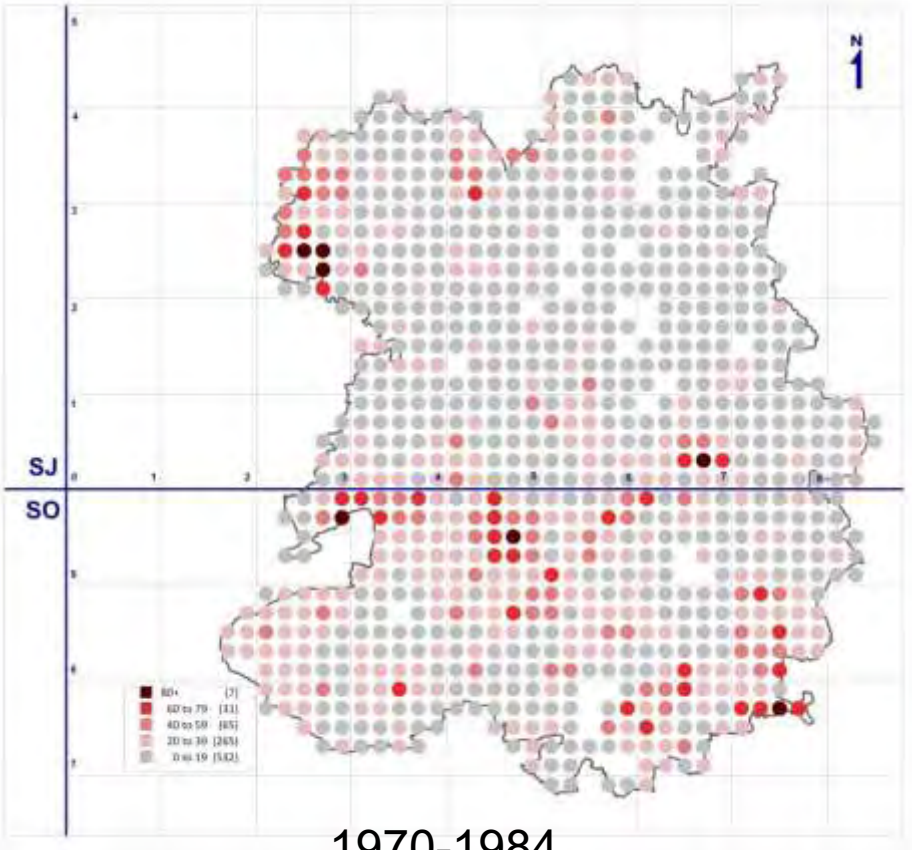
†Blysmus compressus
Carex dioica
Crepis paludosa
Epipactis palustris
Eriophorum latifolium
Parnassia palustris
Samolus valerandi
Trollius europaeus



Coincidence map of axiophytes in Shropshire, with larger dots representing the greatest number of species (up to 95 in a 1 km square) using data from 1985 to 2013.



1985-2014



1970-1984

Range in axiophyte score per tetrad	Survey	
	1970-84	1985-2013
0-19	541	623
20-39	261	165
40-59	61	75
60-79	30	28
80-99	6	9
100+	1	4
Total tetrads	900	904
Average score	19.53	18.17

Range of axiophyte scores per tetrad in the 1970-84 and 1985-2014 surveys
(seven Axiophyte spp. which were A spp in the 1985 Flora omitted)

Multivariate analysis of monad and tetrad data using TWINSPAN

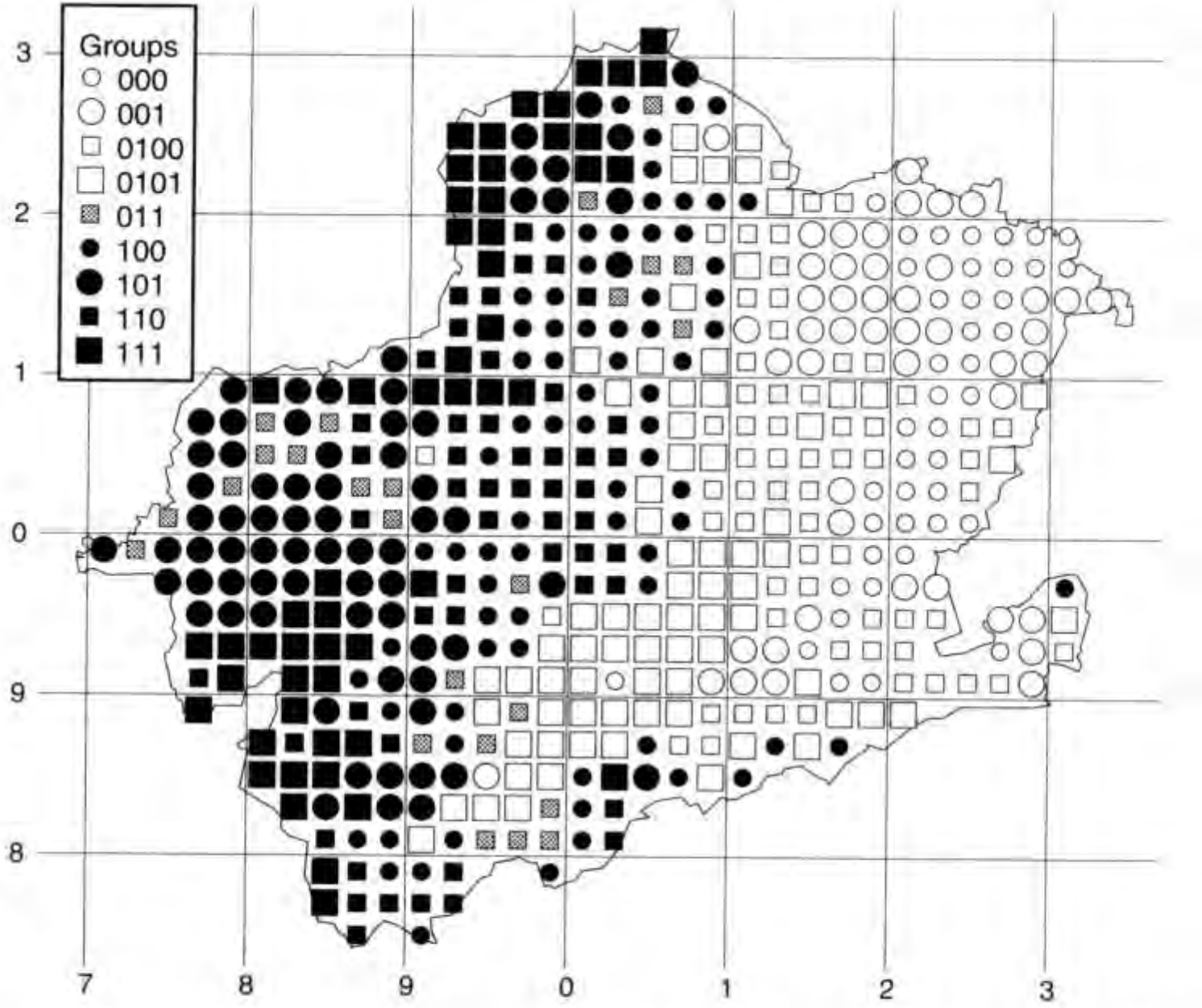


Fig. 11.10 Summary of Geographical Distribution of TWINSPAN classification of tetrads.

Figure 10.3 - Map showing locations of tetrads at the third level of TWINSPAN

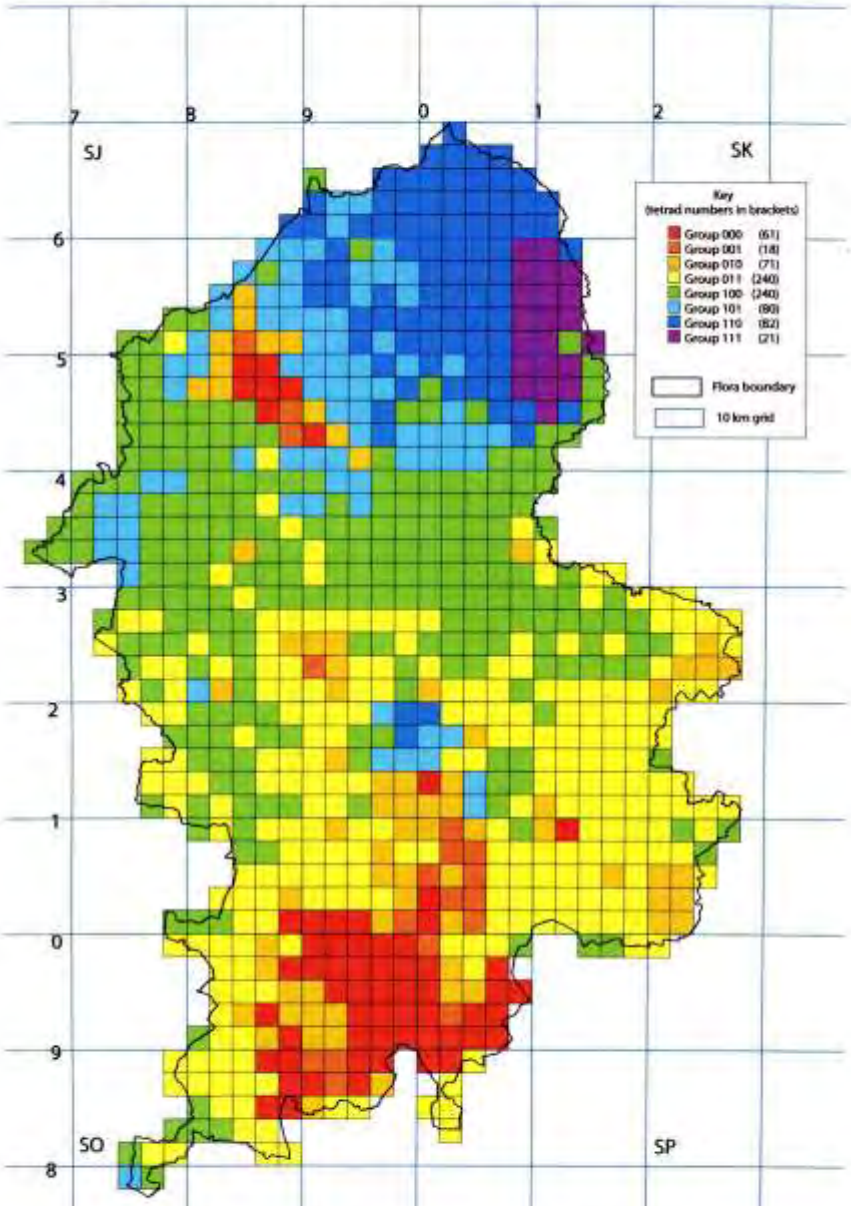
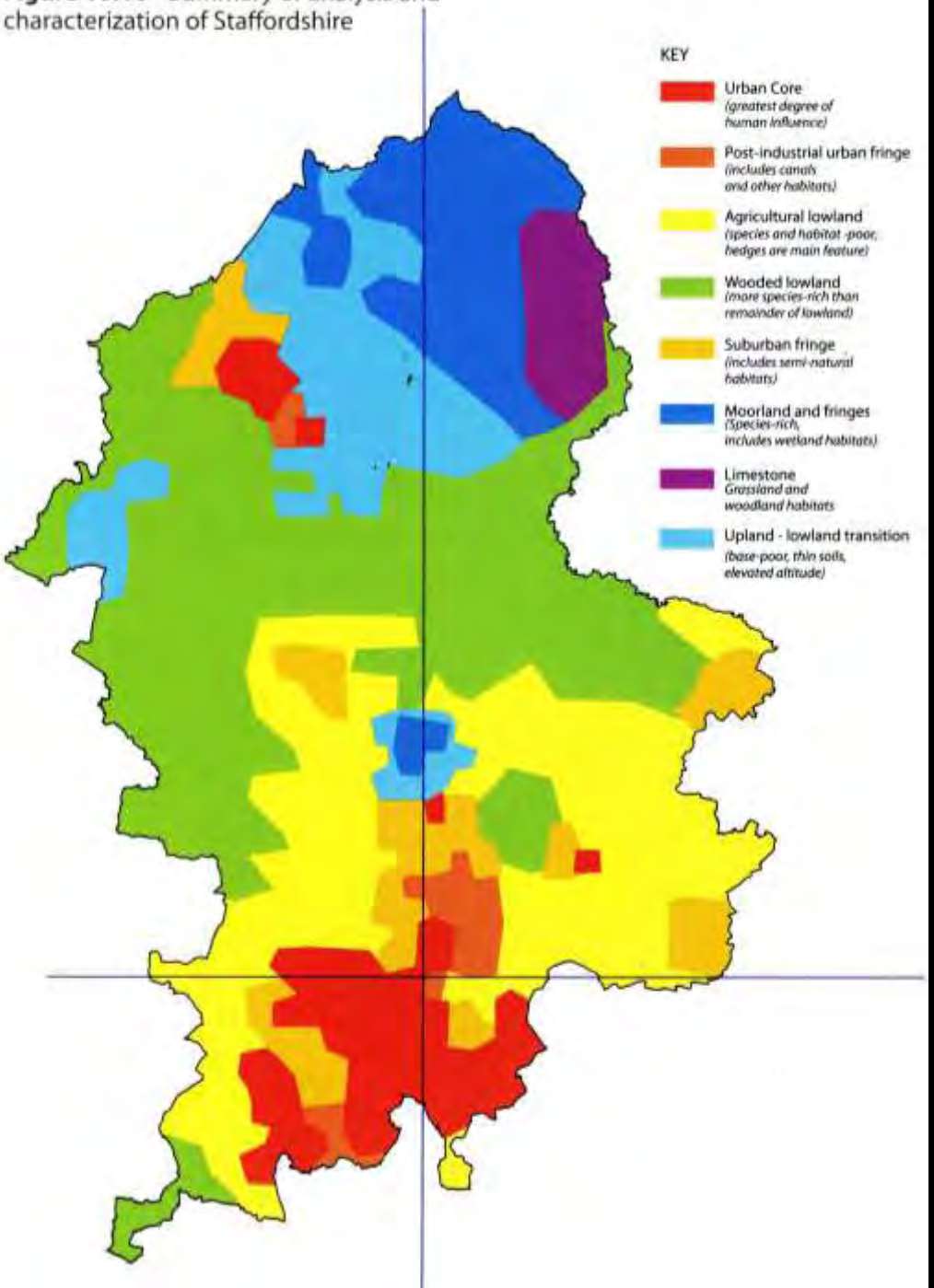


Figure 10.10 - Summary of analysis and characterization of Staffordshire



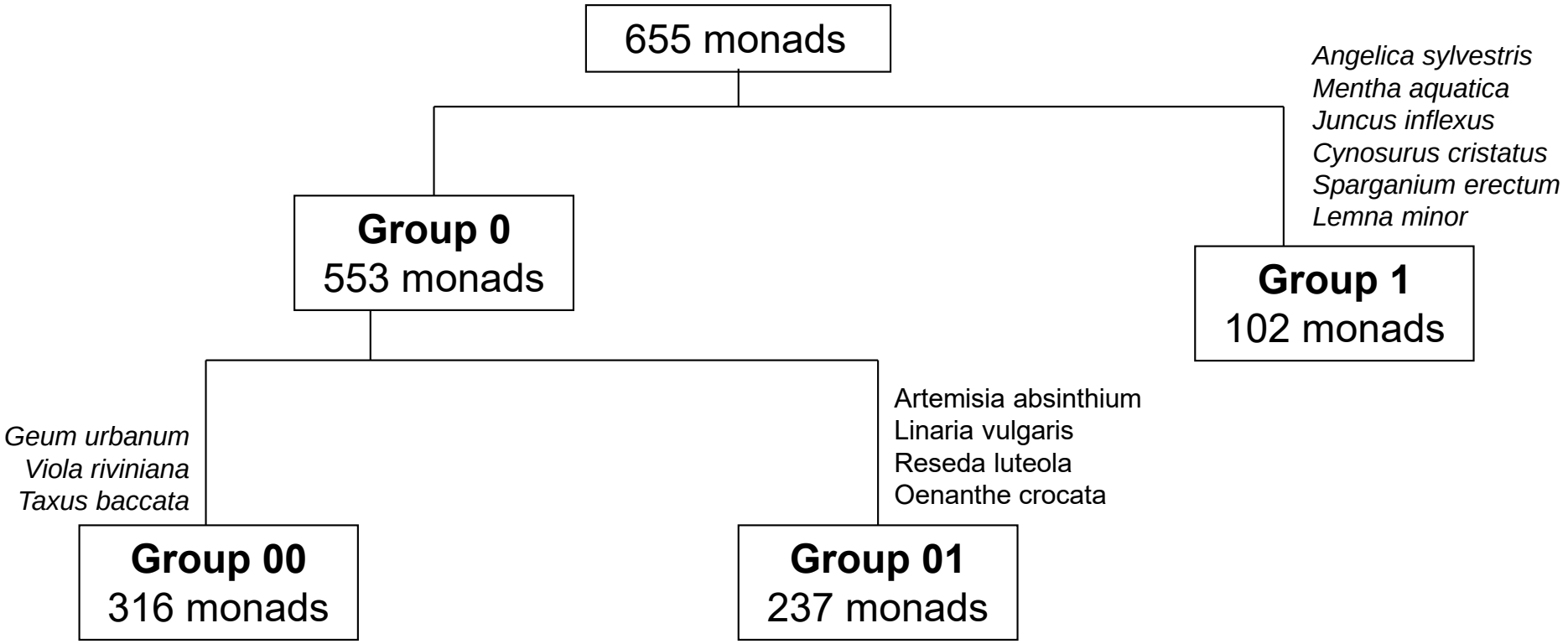
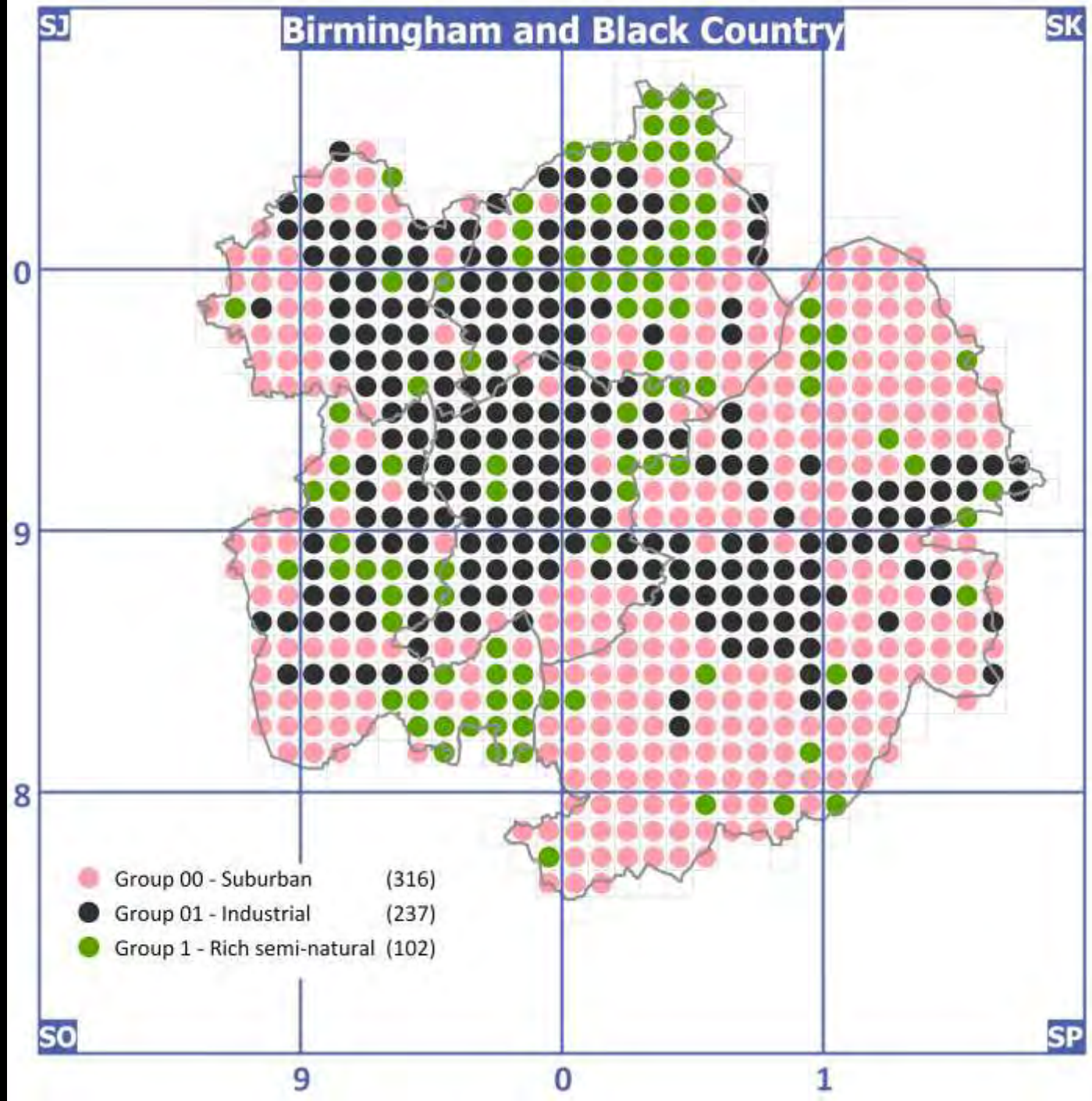
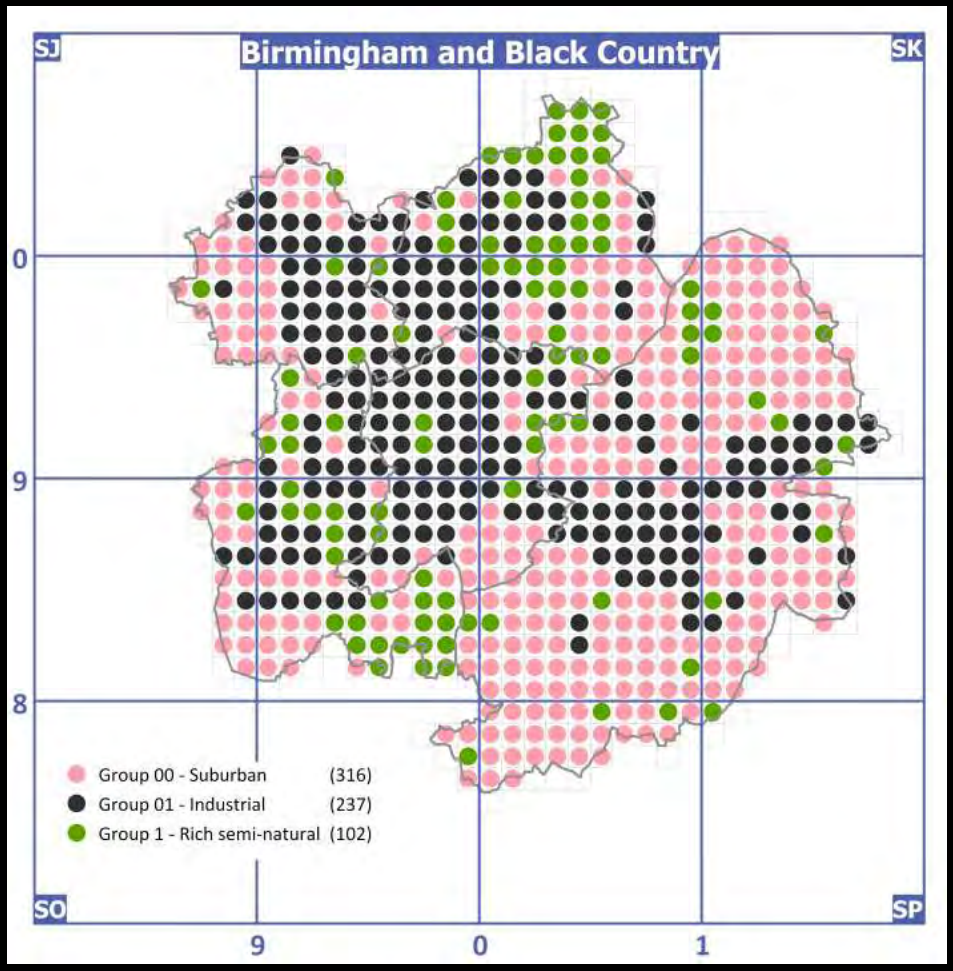
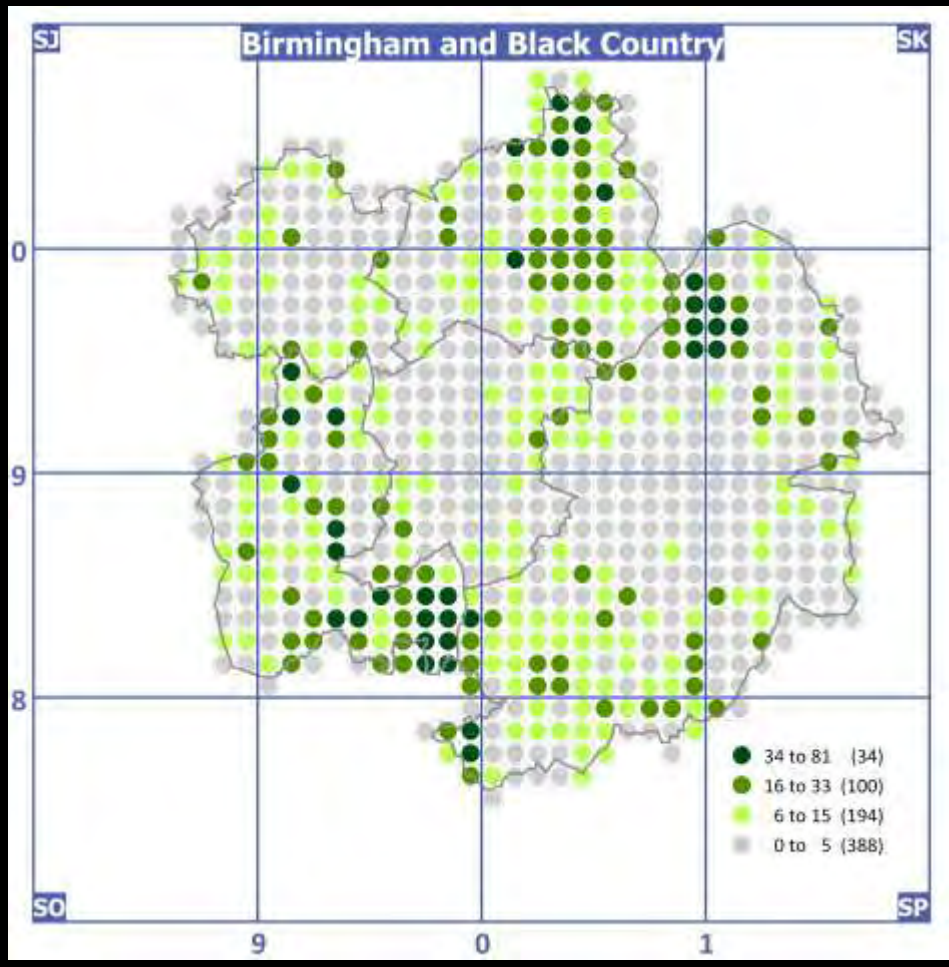


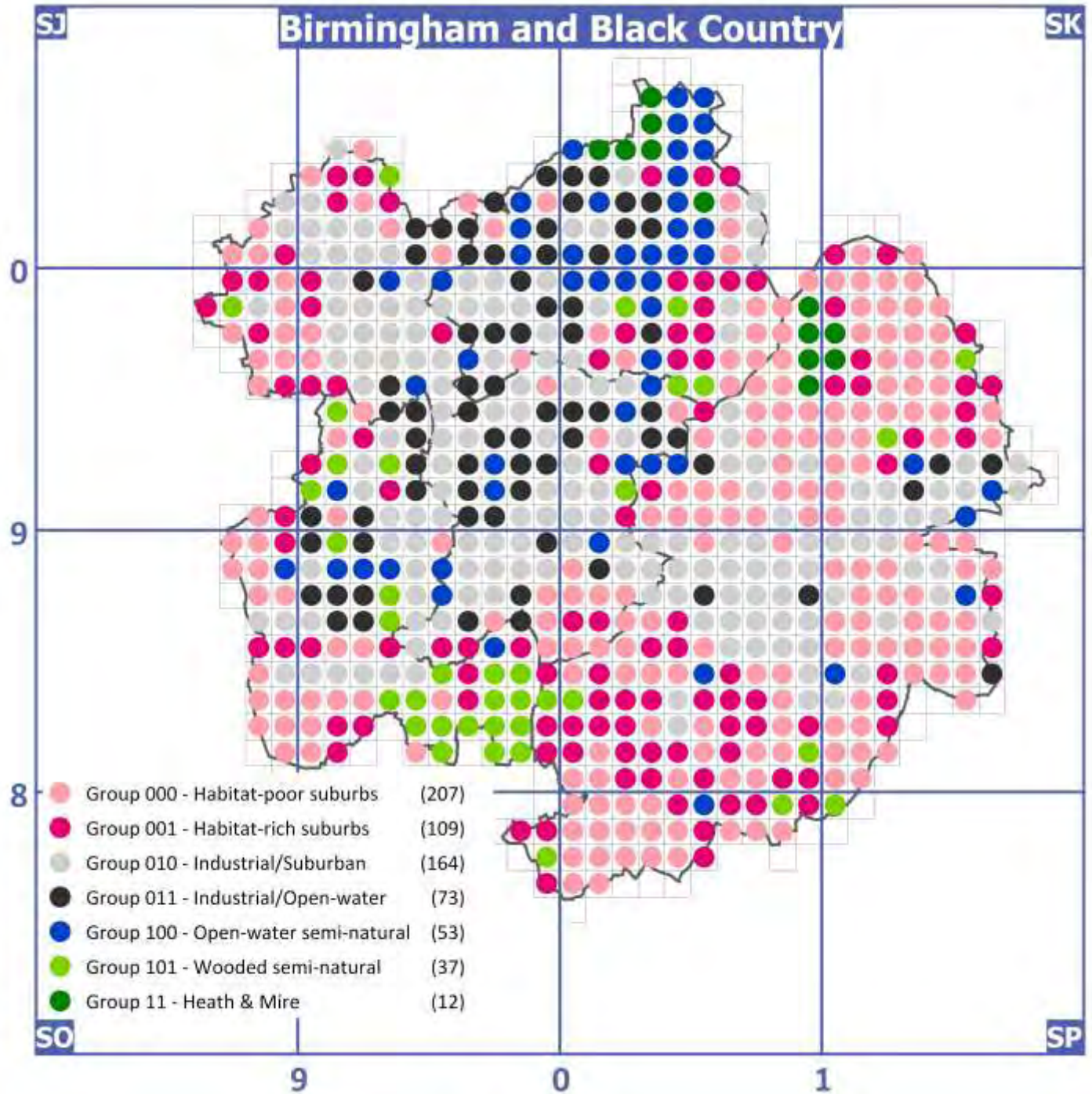
Fig. 4.1.5 ***Dendrogram showing the primary divisions of a TWINSPAN analysis of monads in B&BC (monads with <25% within B&BC omitted)***

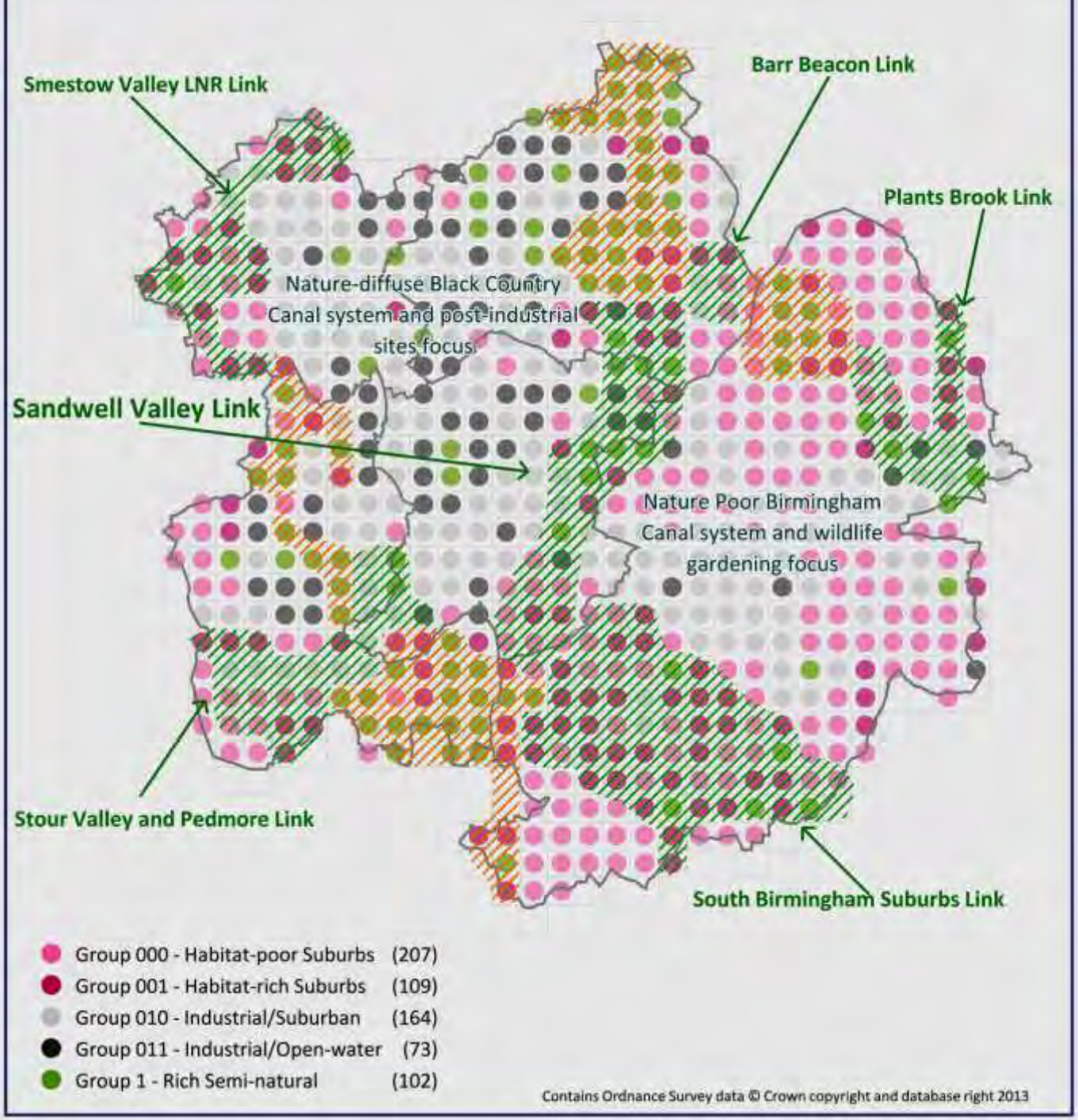
Species shown are indicators for the relevant side of a division


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Group 00 - Suburban (316)
Group 01 - Industrial (237)
Group 1 - Rich semi-natural (102)


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Group 00 - Suburban (316)
Group 01 - Industrial (237)
Group 1 - Rich semi-natural (102)


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
34 to 81 (34)
16 to 33 (100)
6 to 15 (194)
0 to 5 (388)


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Group 000 - Habitat-poor suburbs (207)
Group 001 - Habitat-rich suburbs (109)
Group 010 - Industrial/Suburban (164)
Group 011 - Industrial/Open-water (73)
Group 100 - Open-water semi-natural (53)
Group 101 - Wooded semi-natural (37)
Group 11 - Heath & Mire (12)


Smestow Valley LNR Link
Barr Beacon Link
Plants Brook Link
Nature-diffuse Black Country
Canal system and post-industrial
sites focus
Sandwell Valley Link
Nature Poor Birmingham
Canal system and wildlife
gardening focus
Stour Valley and Pedmore Link
South Birmingham Suburbs Link
Group 000 - Habitat-poor Suburbs (207)
Group 001 - Habitat-rich Suburbs (109)
Group 010 - Industrial/Suburban (164)
Group 011 - Industrial/Open-water (73)
Group 1 - Rich Semi-natural (102)
Contains Ordnance Survey data © Crown copyright and database right 2013

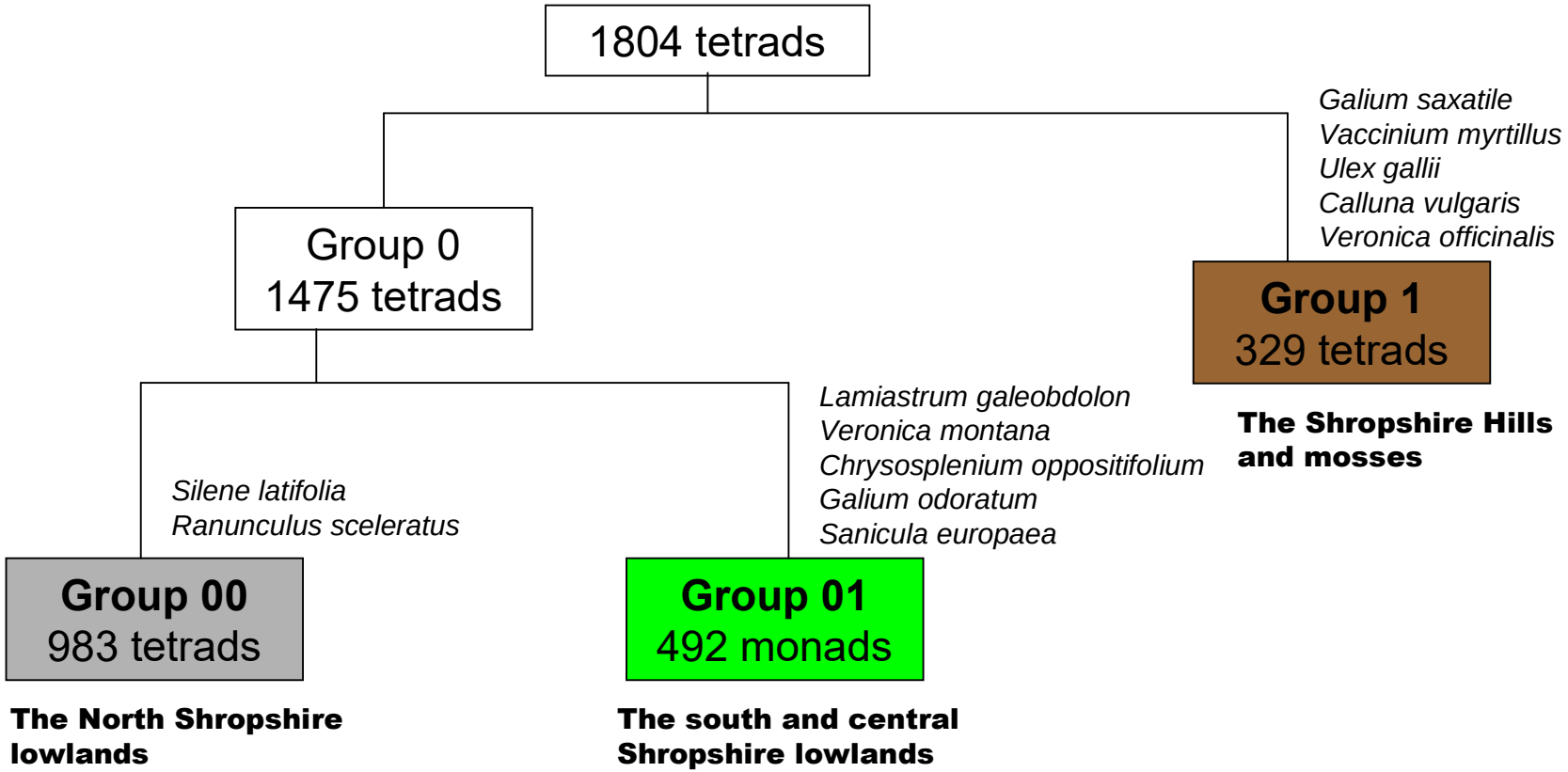
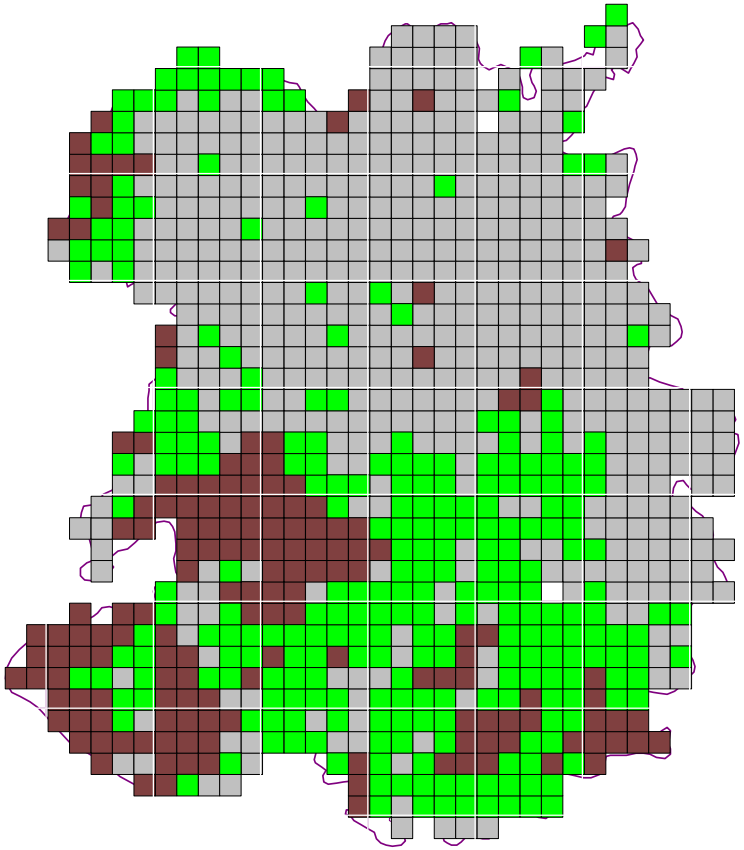
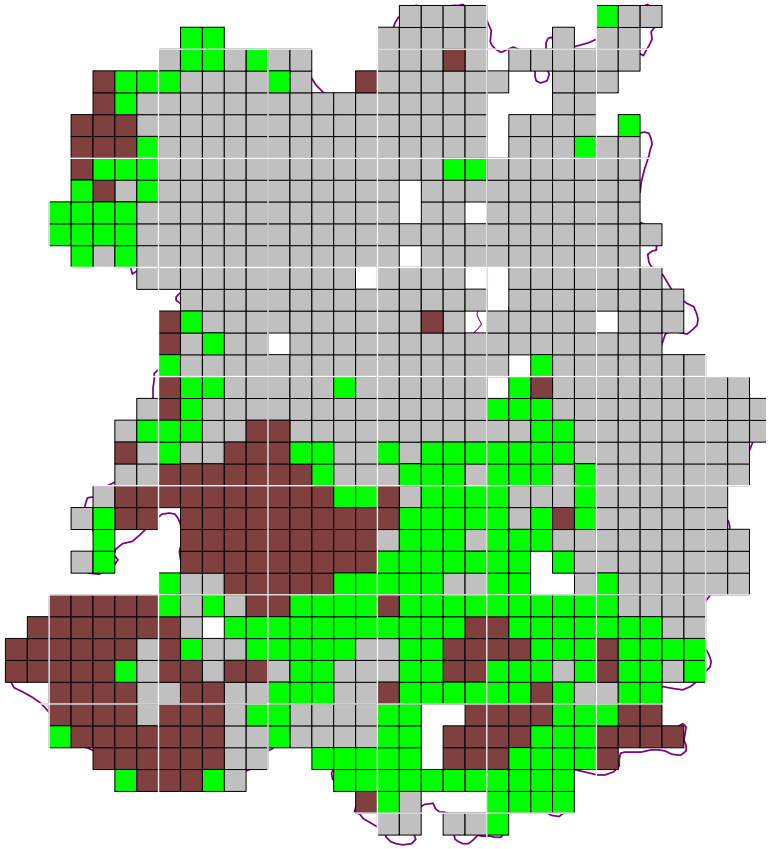


Fig. #2 ***Dendrogram showing the primary divisions of a TWINSPAN analysis of tetrads common to the 1970-84 and 1985-2013 surveys in Shropshire (tetrads with less than 10 non-A species omitted)***

Species shown are indicators for the relevant side of a division. The three end groups are emboldened



Lockton & Whild



Sinker *et al.*

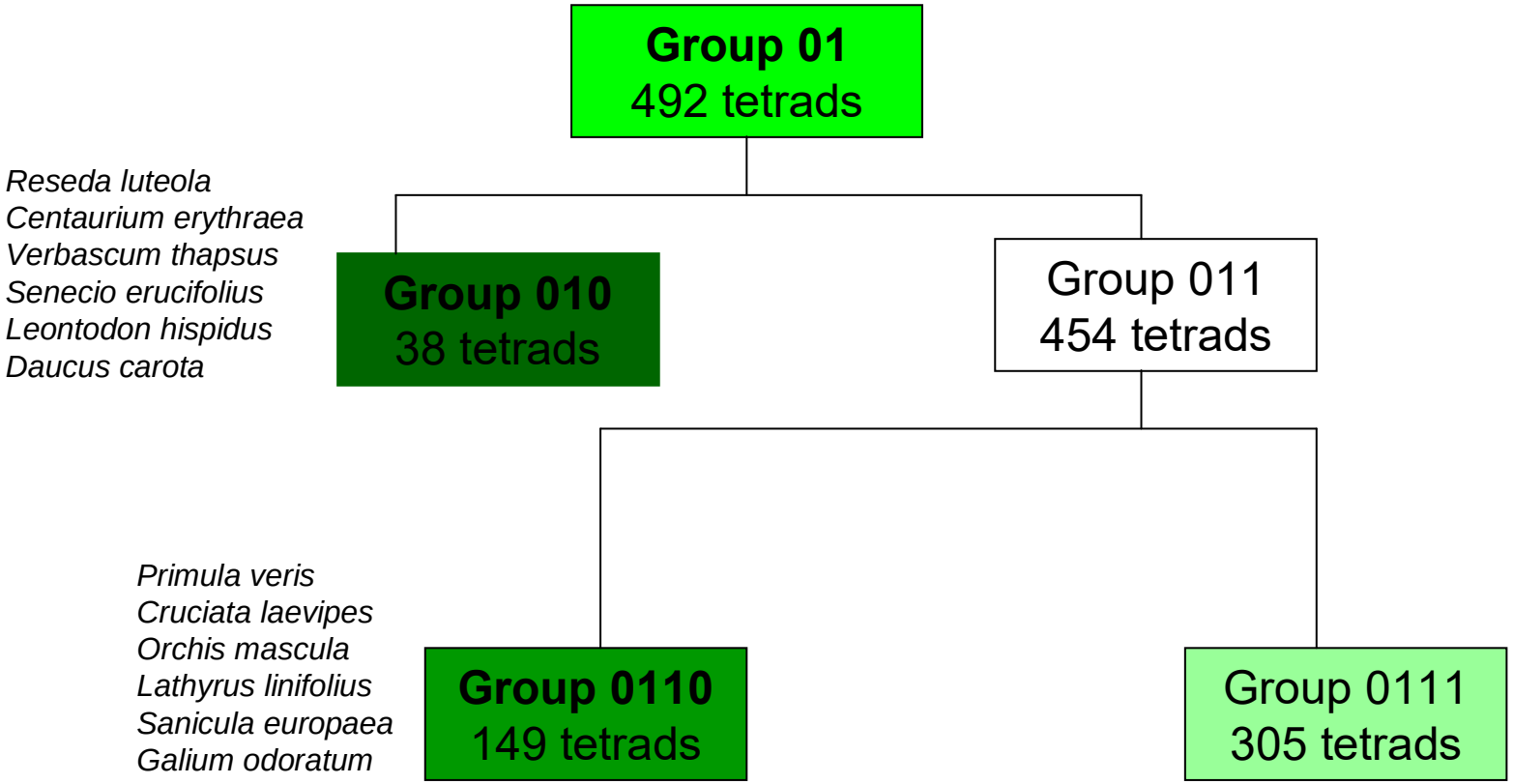
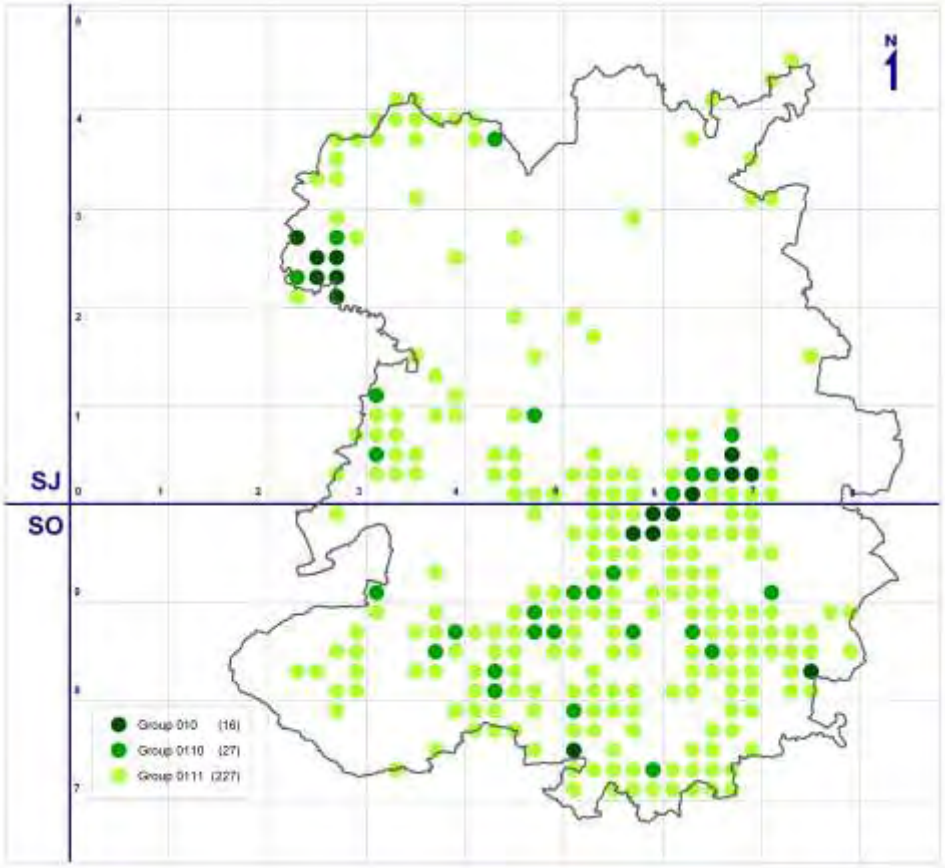
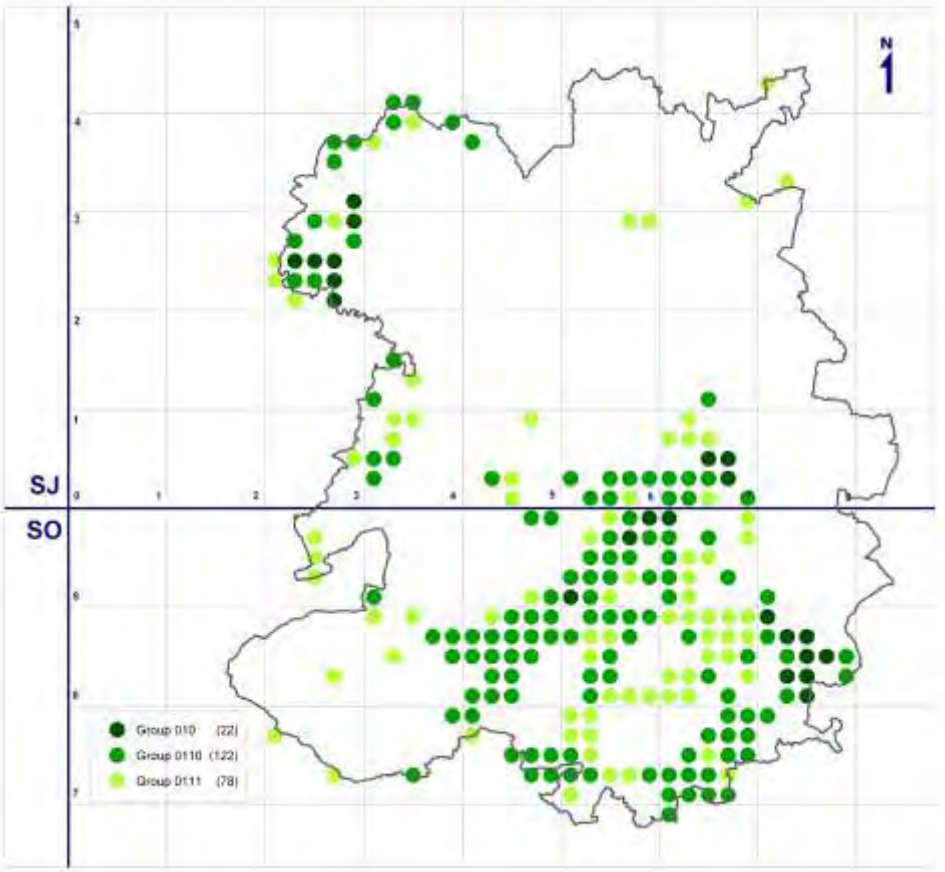


Fig. #6 South and Central Shropshire lowlands. ***Dendrogram showing major divisions of Group 01 in a TWINSPAN analysis of tetrads common to the 1970-84 and 1985-2013 surveys in Shropshire (tetrads with less than 10 non-A species omitted)***

Species shown are indicators for the relevant side of a division. Group 01 and the three end groups are emboldened and coloured

Species	No tetrads 1970-84	No tetrads 1985-2014
Primula veris	375	244
Cruciata laevipes	500	237
Orchis mascula	129	74
Lathyrus linifolius	213	157
Sanicula europaea	269	174
Galium odoratum	266	204





Lockton & Whild

Sinker *et al.*

Charles Sinker, writing in the 1985 Flora p. 141:

- **Wilder lane-sides and banks**:

"The best of them have affinities with open woodland or old grassland, carrying rich communities of herbaceous plants…….These flower-lined lanes, with their sustained splendour from early spring to the end of autumn, are a priceless legacy in the border landscape. We must not lightly let them go."

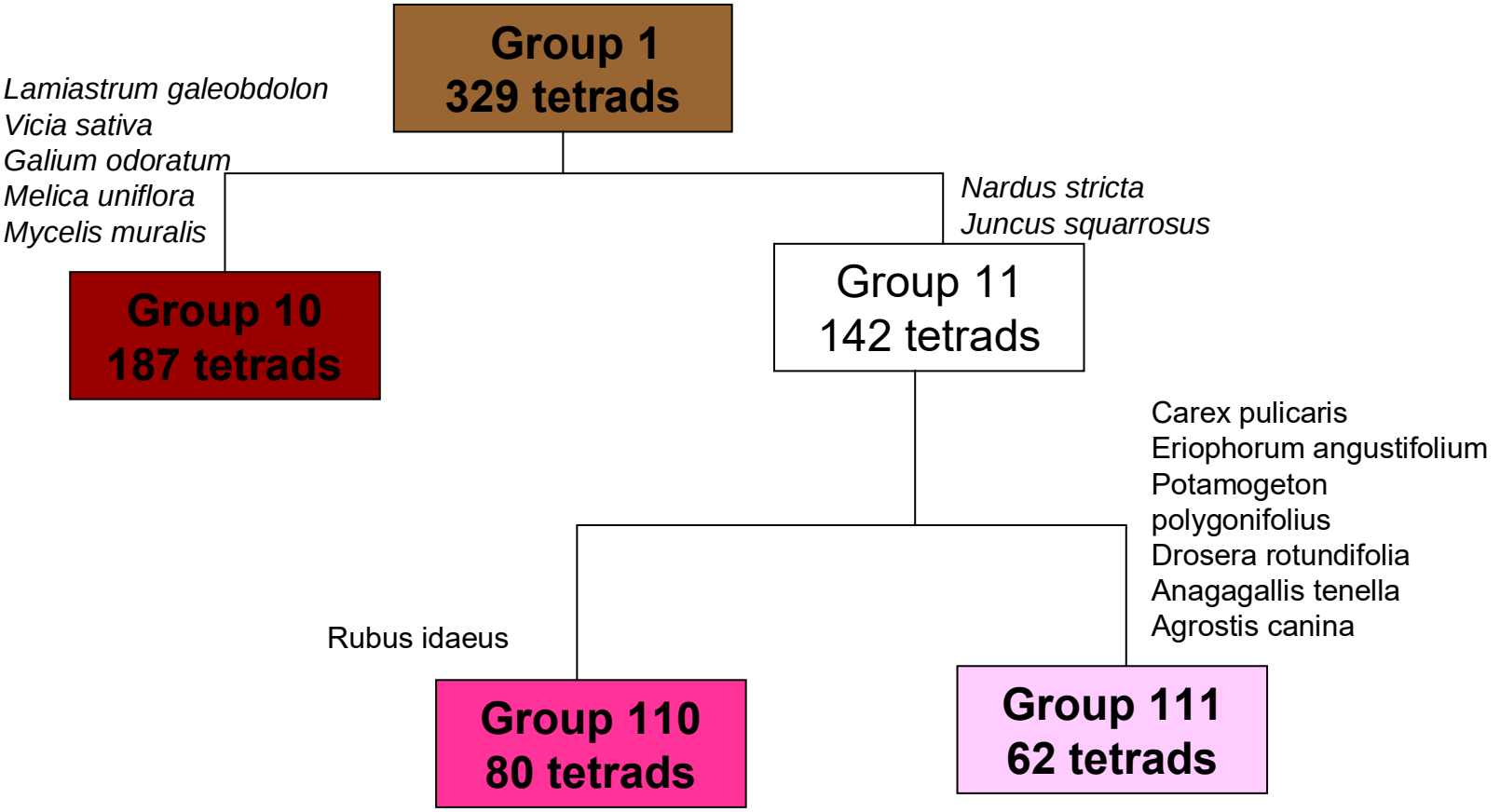
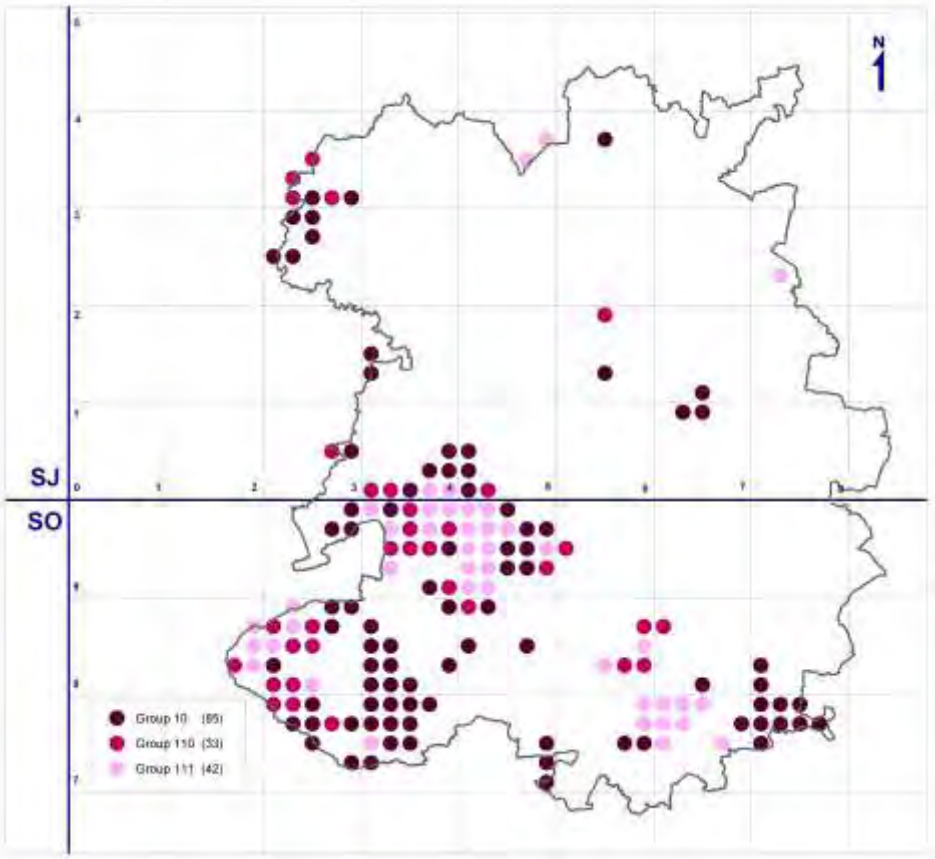
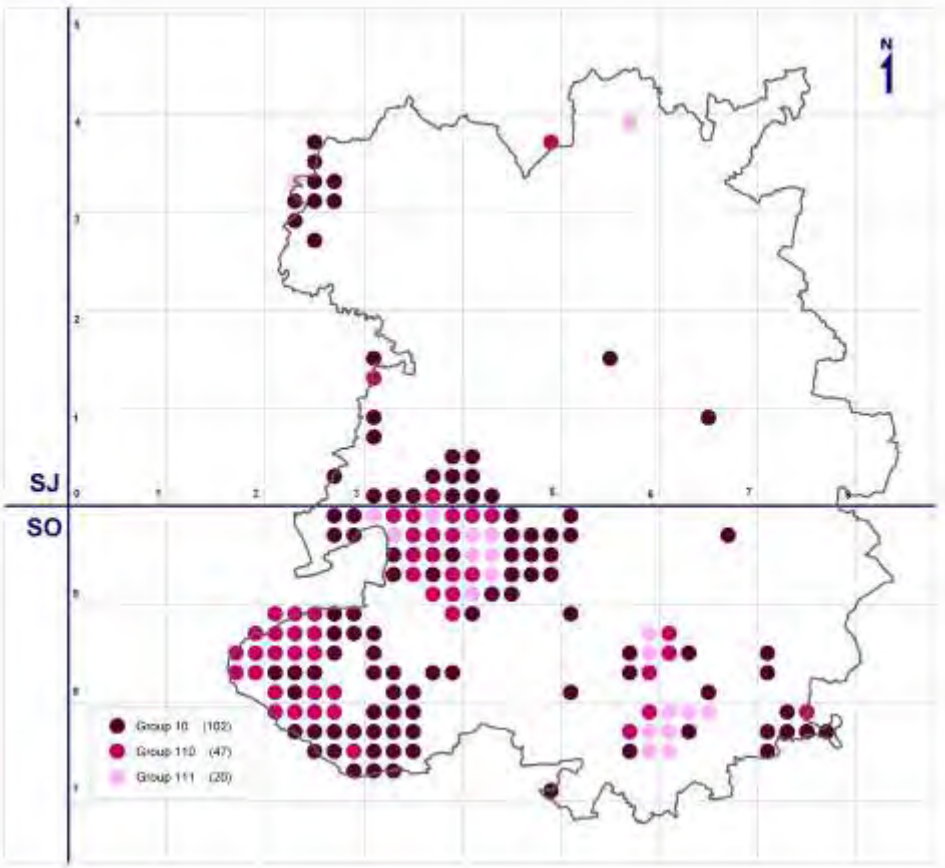


Fig. #4 Shropshire Hills and Mosses. ***Dendrogram showing major divisions of Group 1 in a TWINSPAN analysis of tetrads common to the 1970-84 and 1985-2013 surveys in Shropshire (tetrads with less than 10 non-A species omitted)***

Species shown are indicators for the relevant side of a division. Group 1 and the three end groups are emboldened and coloured



Lockton & Whild



Sinker *et al.*

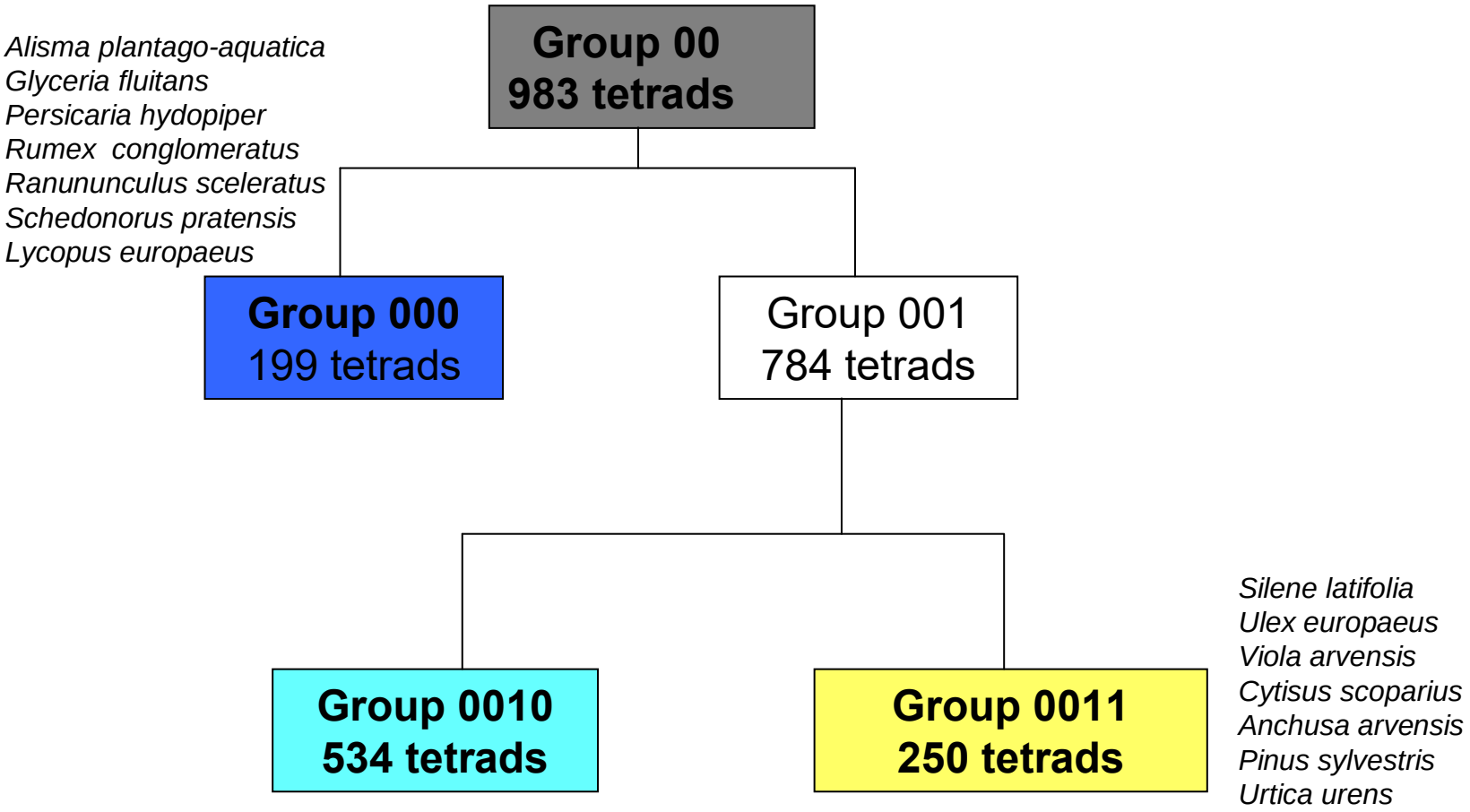
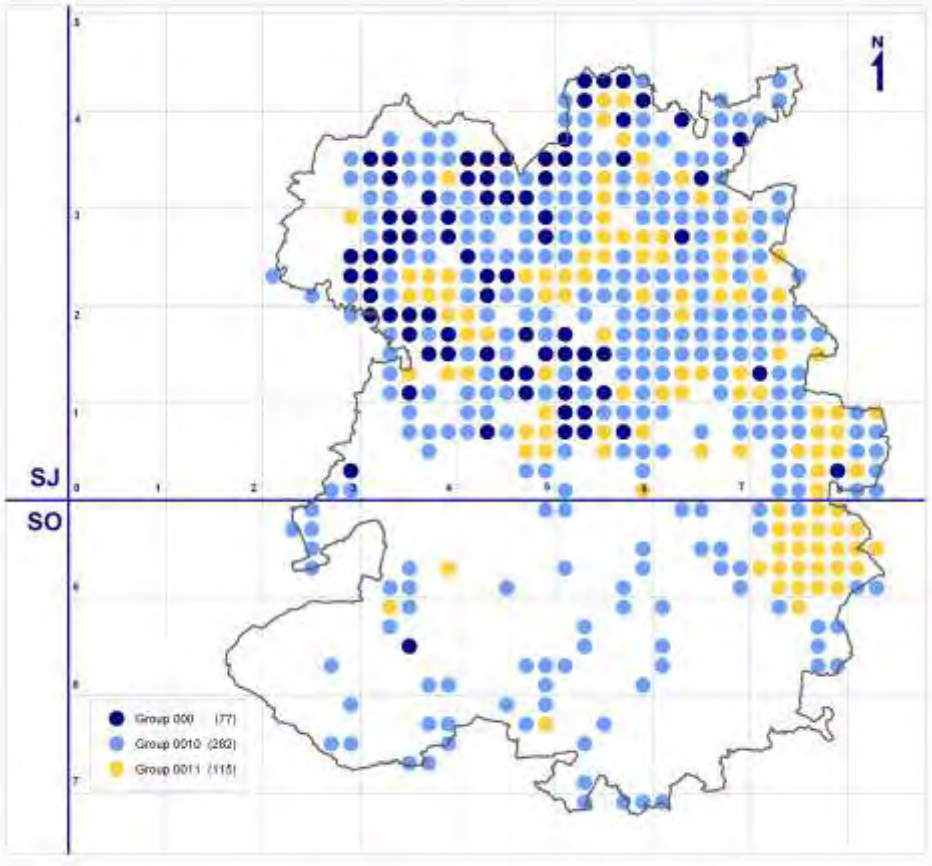
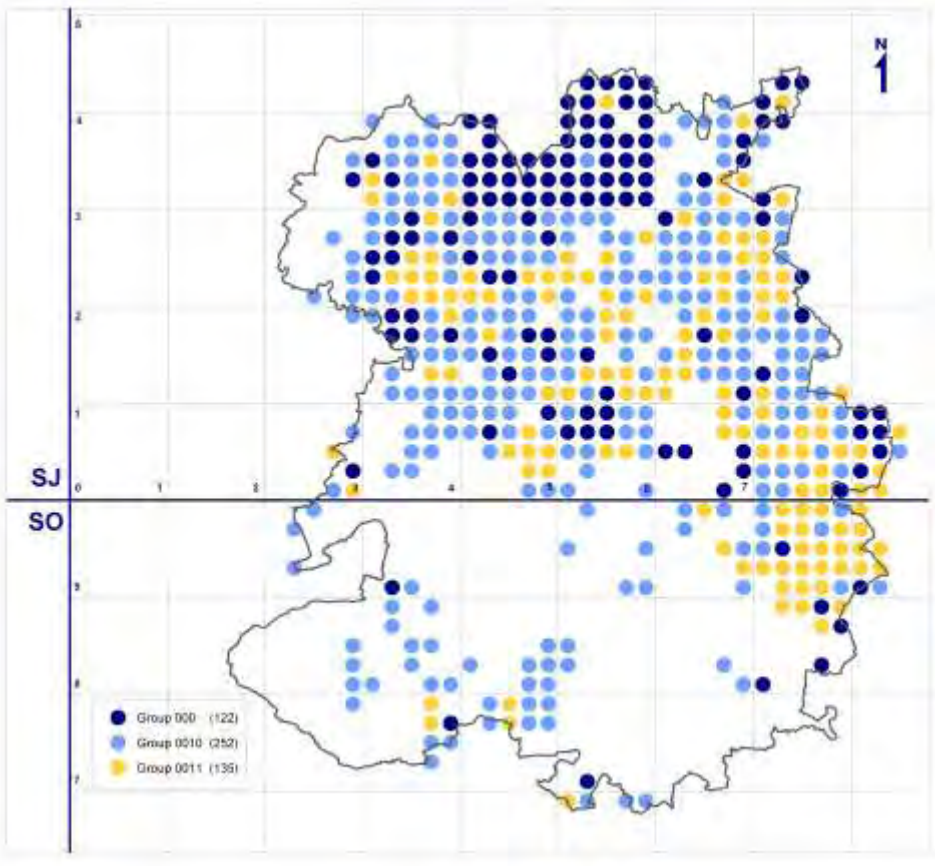


Fig. #8 North Shropshire. ***Dendrogram showing major divisions of Group 00 in a TWINSPAN analysis of tetrads common to the 1970-84 and 1985-2013 surveys in Shropshire (tetrads with less than 10 non-A species omitted)***

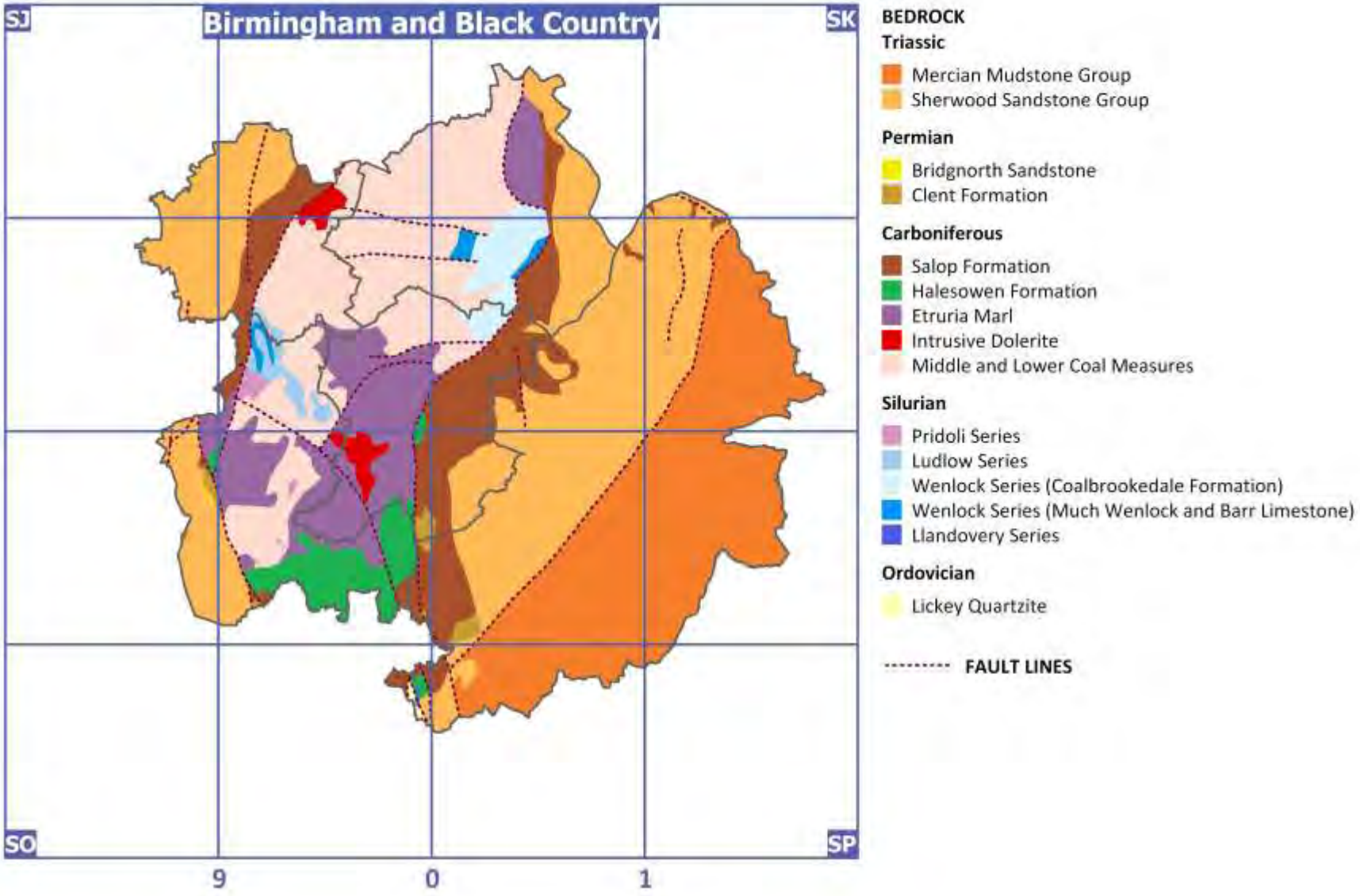
Species shown are indicators for the relevant side of a division. Group 00 and the three end groups are emboldened and coloured

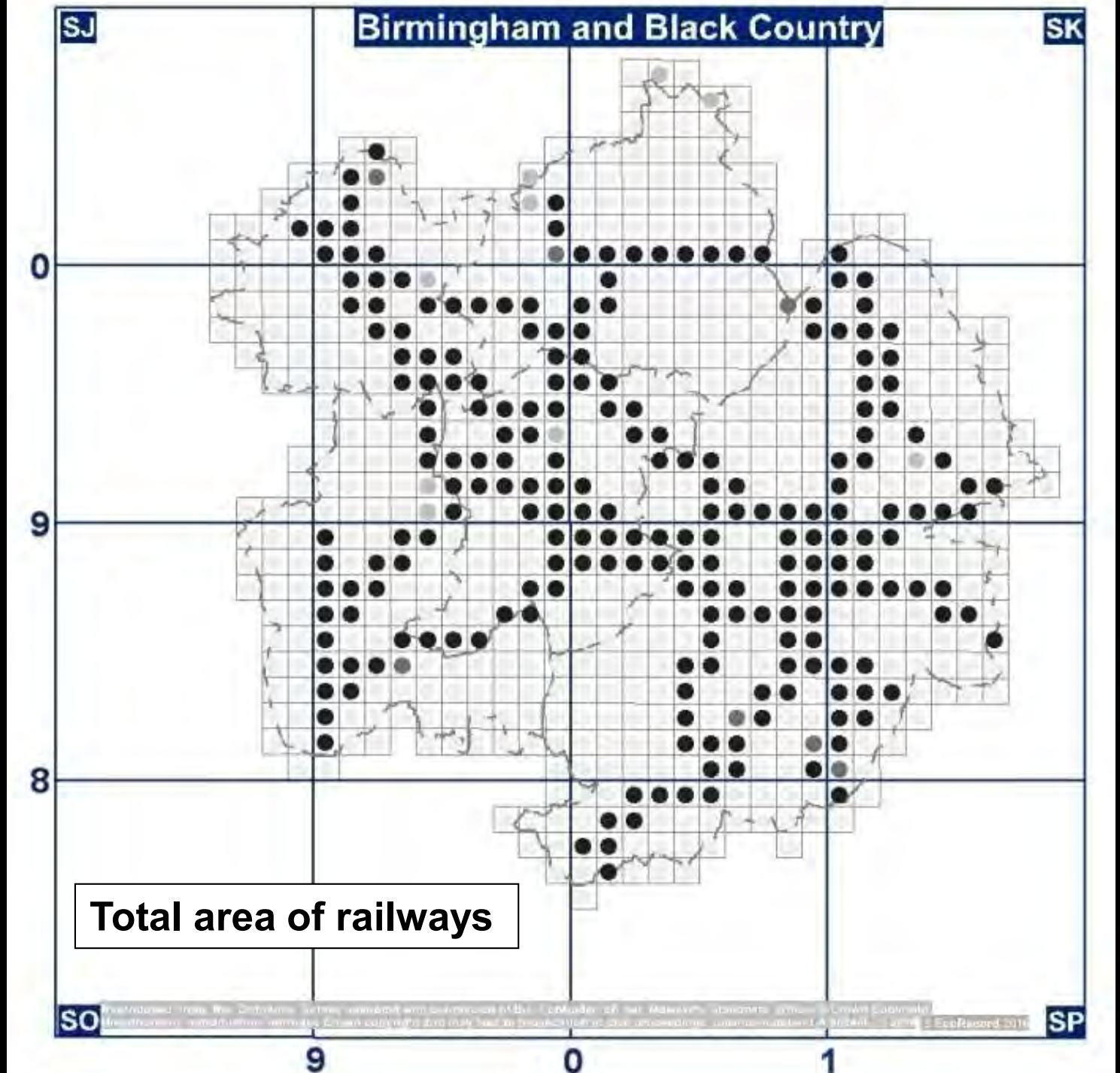


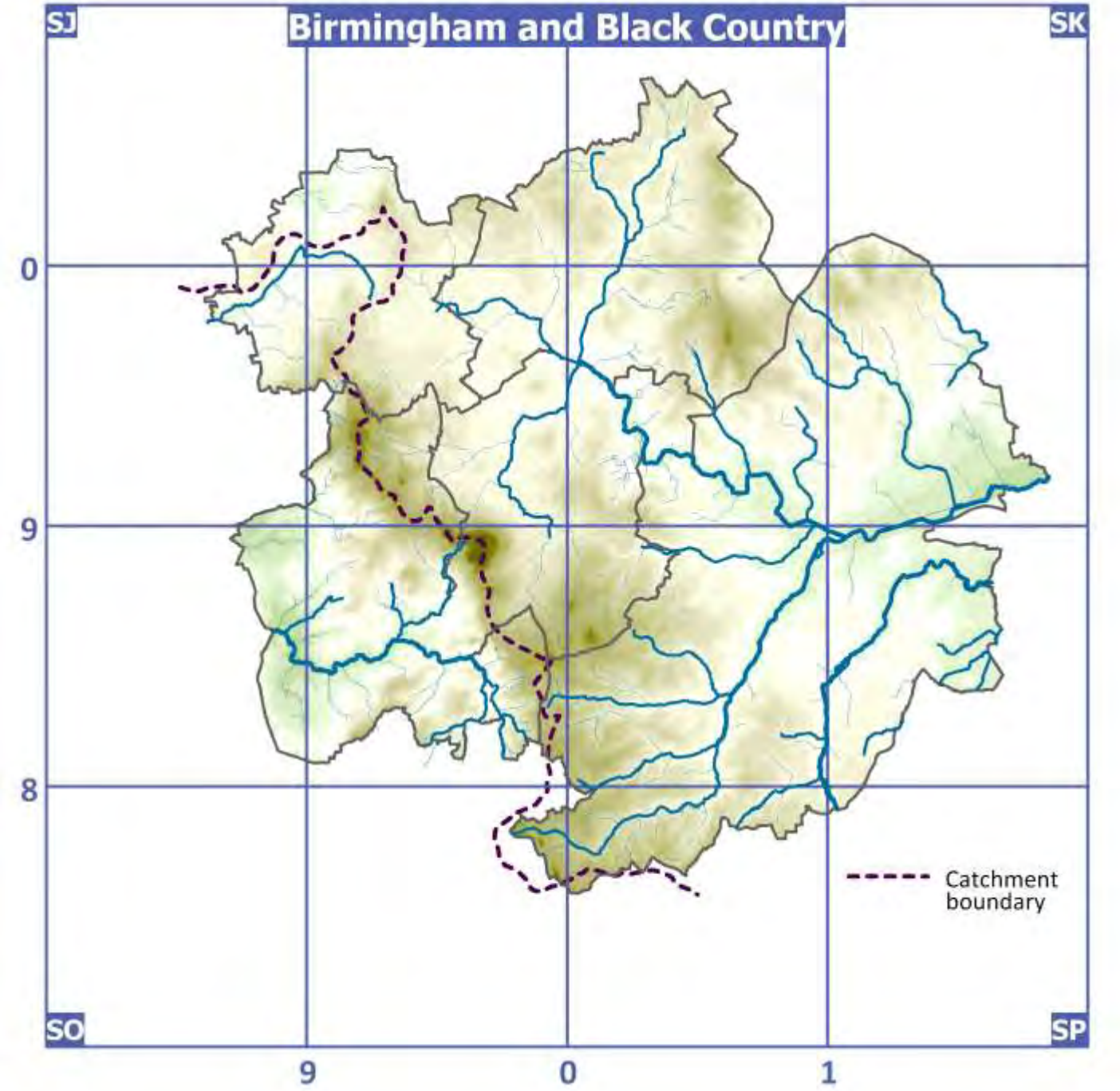
Lockton & Whild



Sinker *et al.*


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
BEDROCK
Triassic
Mercian Mudstone Group
Sherwood Sandstone Group
Permian
Bridgnorth Sandstone
Clent Formation
Carboniferous
Salop Formation
Halesowen Formation
Etruria Marl
Intrusive Dolerite
Middle and Lower Coal Measures
Silurian
Pridoli Series
Ludlow Series
Wenlock Series (Coalbrookedale Formation)
Wenlock Series (Much Wenlock and Barr Limestone)
Llandovery Series
Ordovician
Lickey Quartzite
FAULT LINES


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Total area of railways


Birmingham and Black Country
SJ
SK
SO
SP
0
9
8
9
0
1
Catchment boundary