The evolution of the Holocene wetland landscape of the Humberhead Levels from a fossil insect perspective.

Nicola Jane Whitehouse

Volume 2 of 2

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Plate 8.1 NOT DIGITISED BY REQUEST OF THE UNIVERSITY

CONTAINS PULLOUTS

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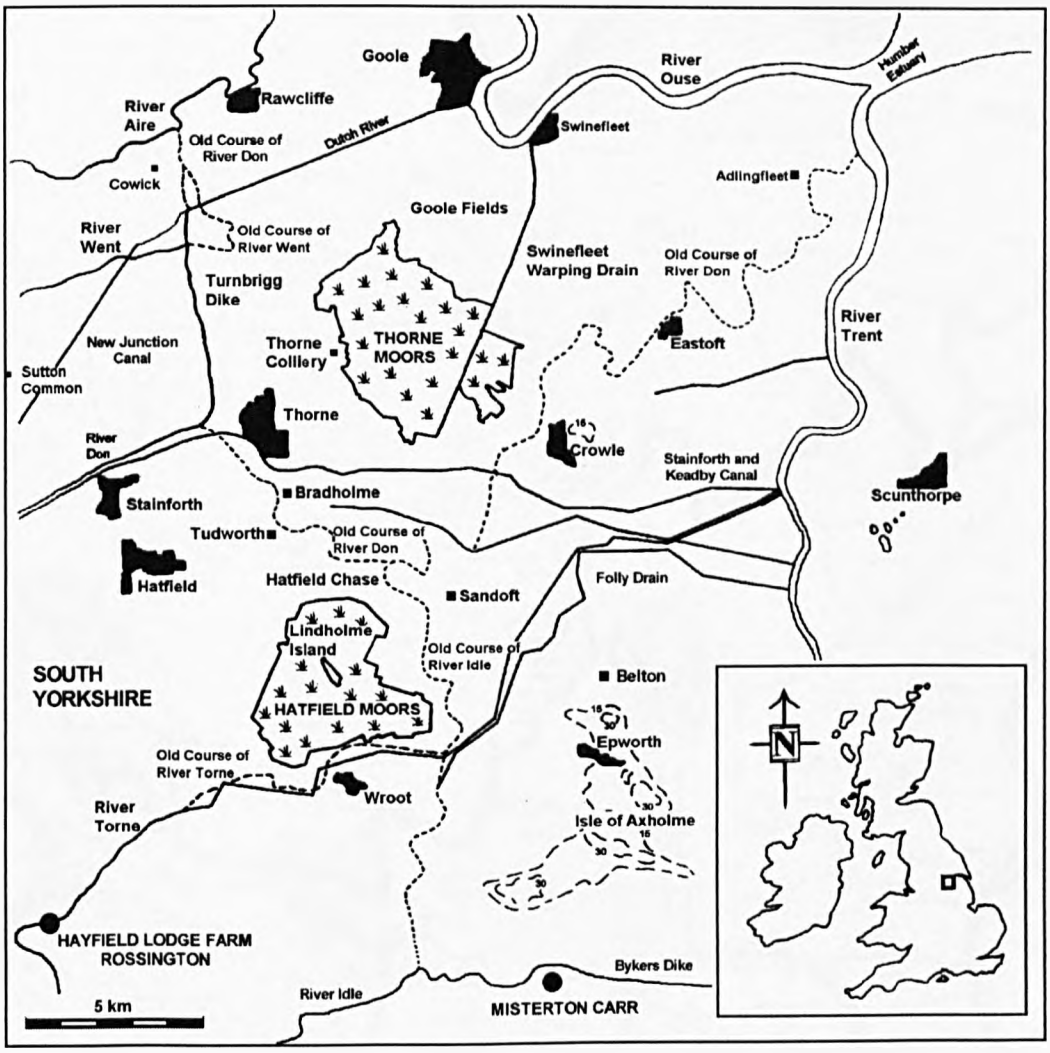
Figure 1.1; Location map of the Humberhead Levels, with study sites
(amended from an original map by P.I.Buckland)



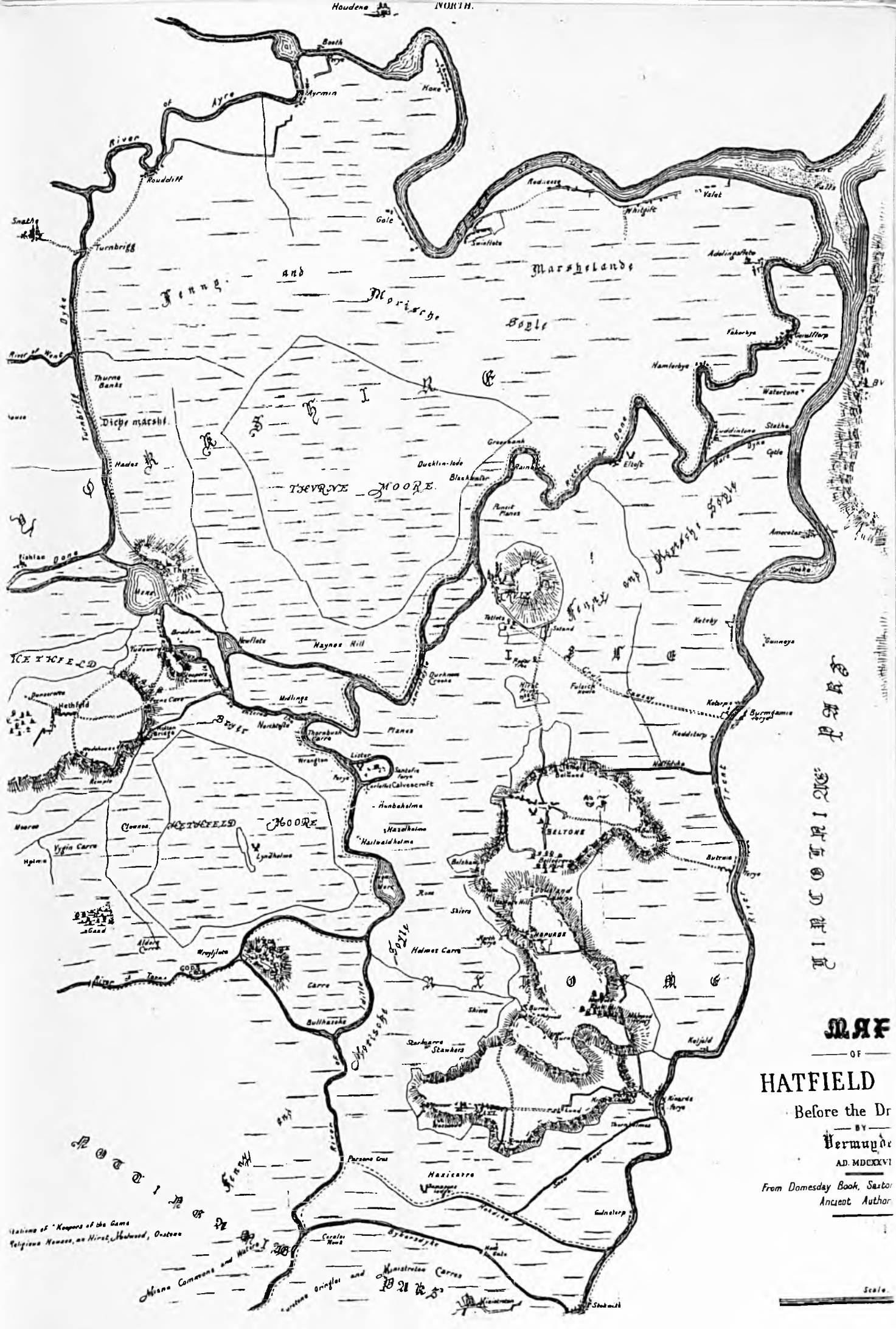


Figure 1.2; Traditional Map of 1626 showing the Humberhead Levels prior to drainage.

Figure 1.3; Geology Map for the Humberhead Levels.

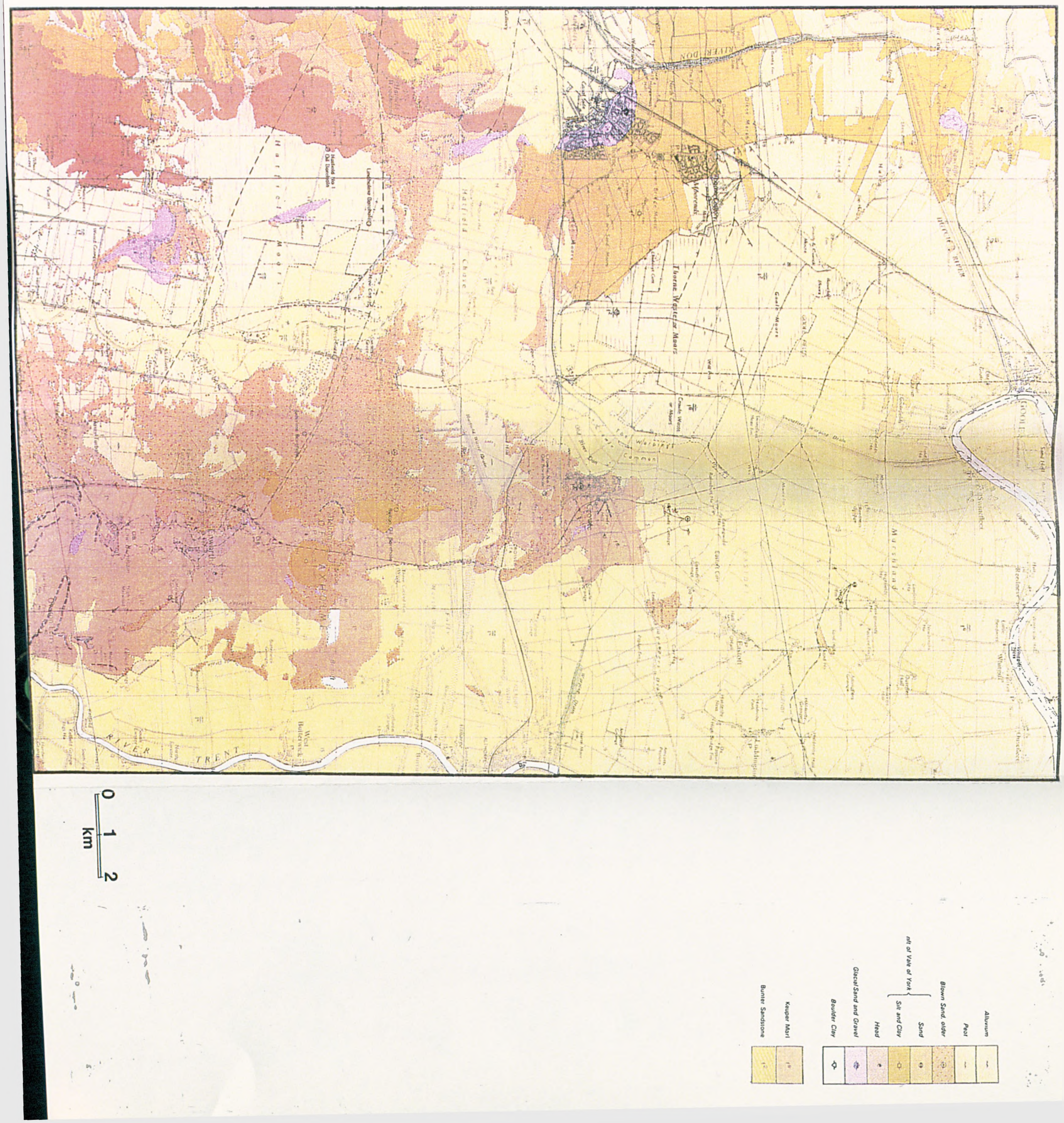


Figure 2.1; Summary of main vegetational changes in the Humberhead Levels. After Dinnin (1997b), using data from Smith (1985) and Mather (1991). Dates for *Tilia* and *Ulmus* declines and *Alnus* rise at Hayfield Lodge Farm correlated from Turner (1962, in Mather, 1991), Baillie (1992) and Brayshay and Dinnin (*in press*).

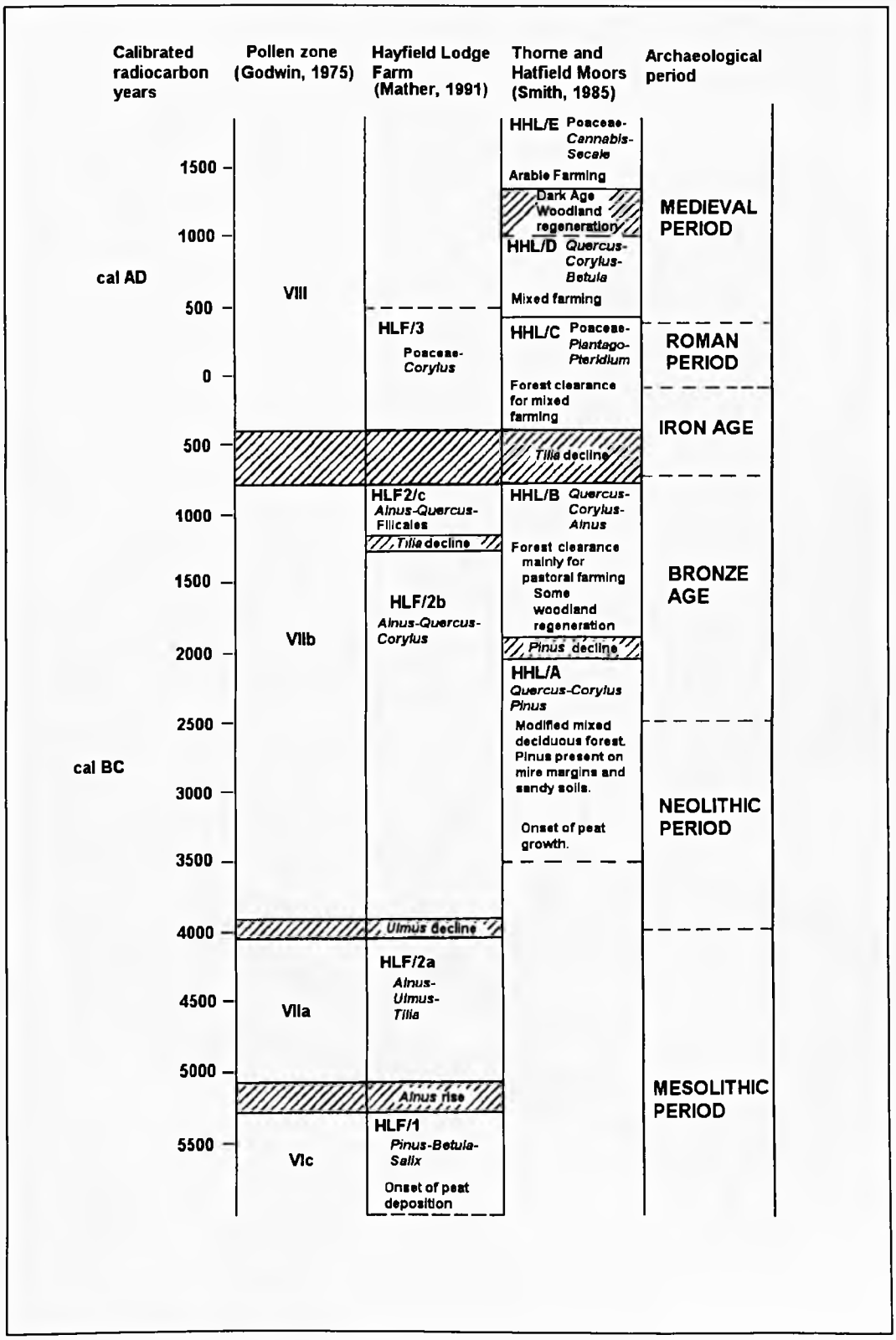


Figure 4.1; Field survey results, Hatfield Moors.

Figure 4.2; Hatfield Moors: sampling sites and boring transects.

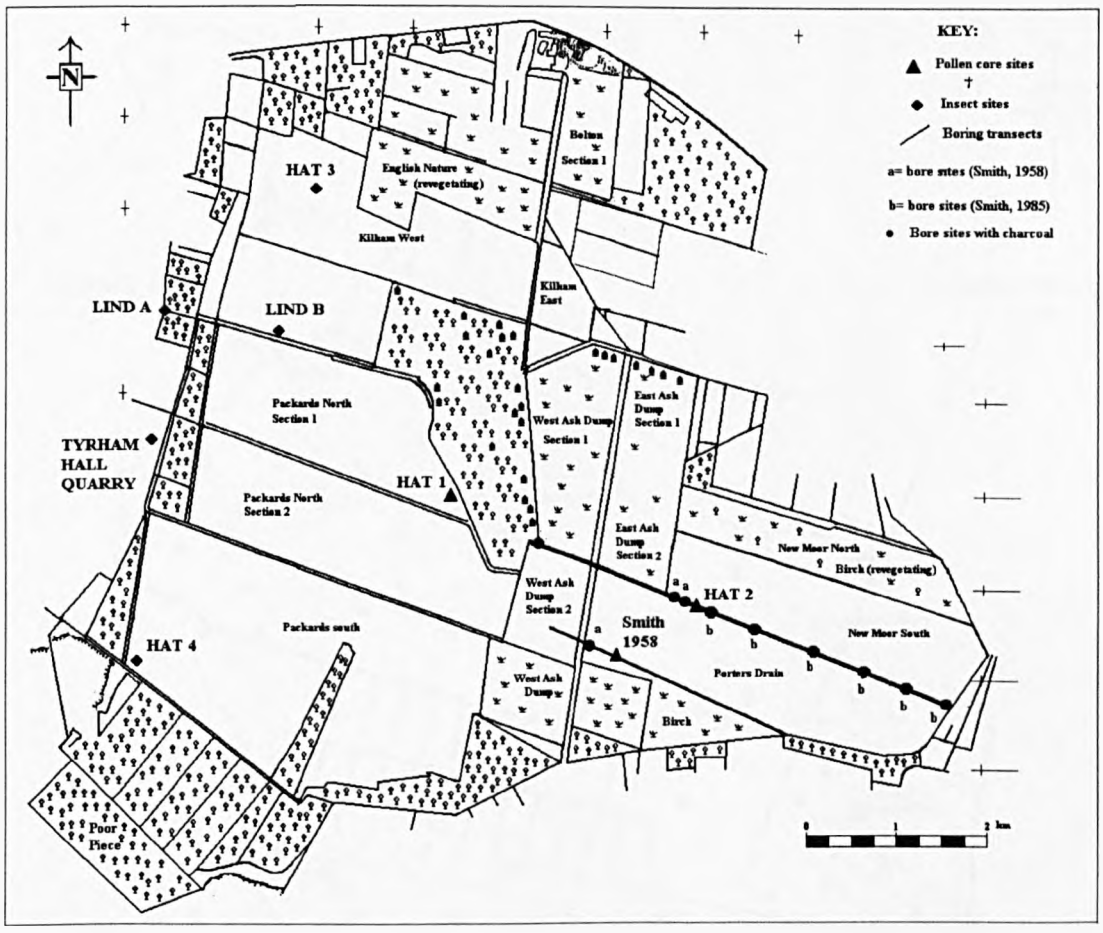


Figure 4.3. Thorne Moors. Palaeoecological sites

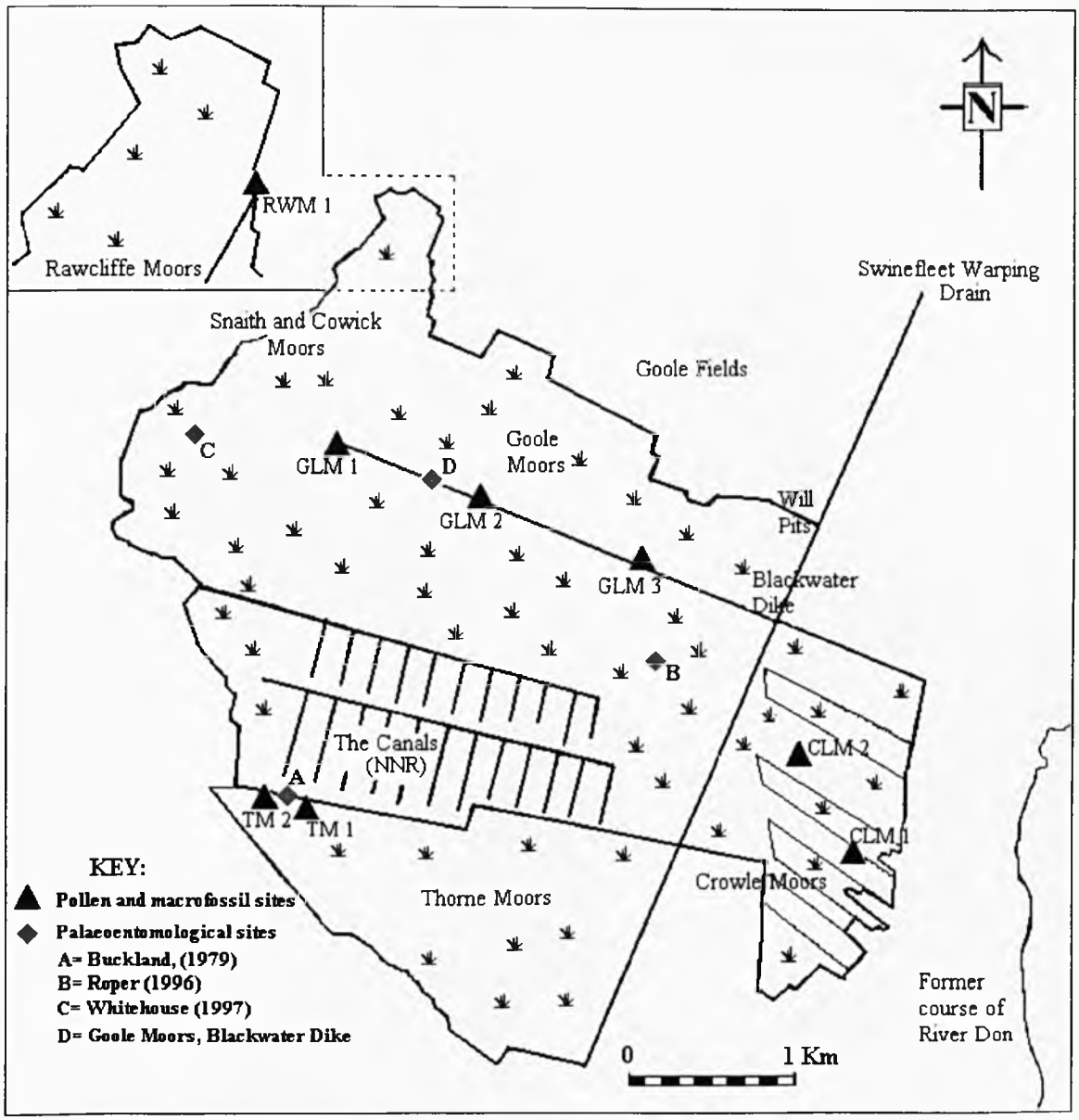


Figure 4.4 Location of site at Hayfield Lodge Farm, Rossington.

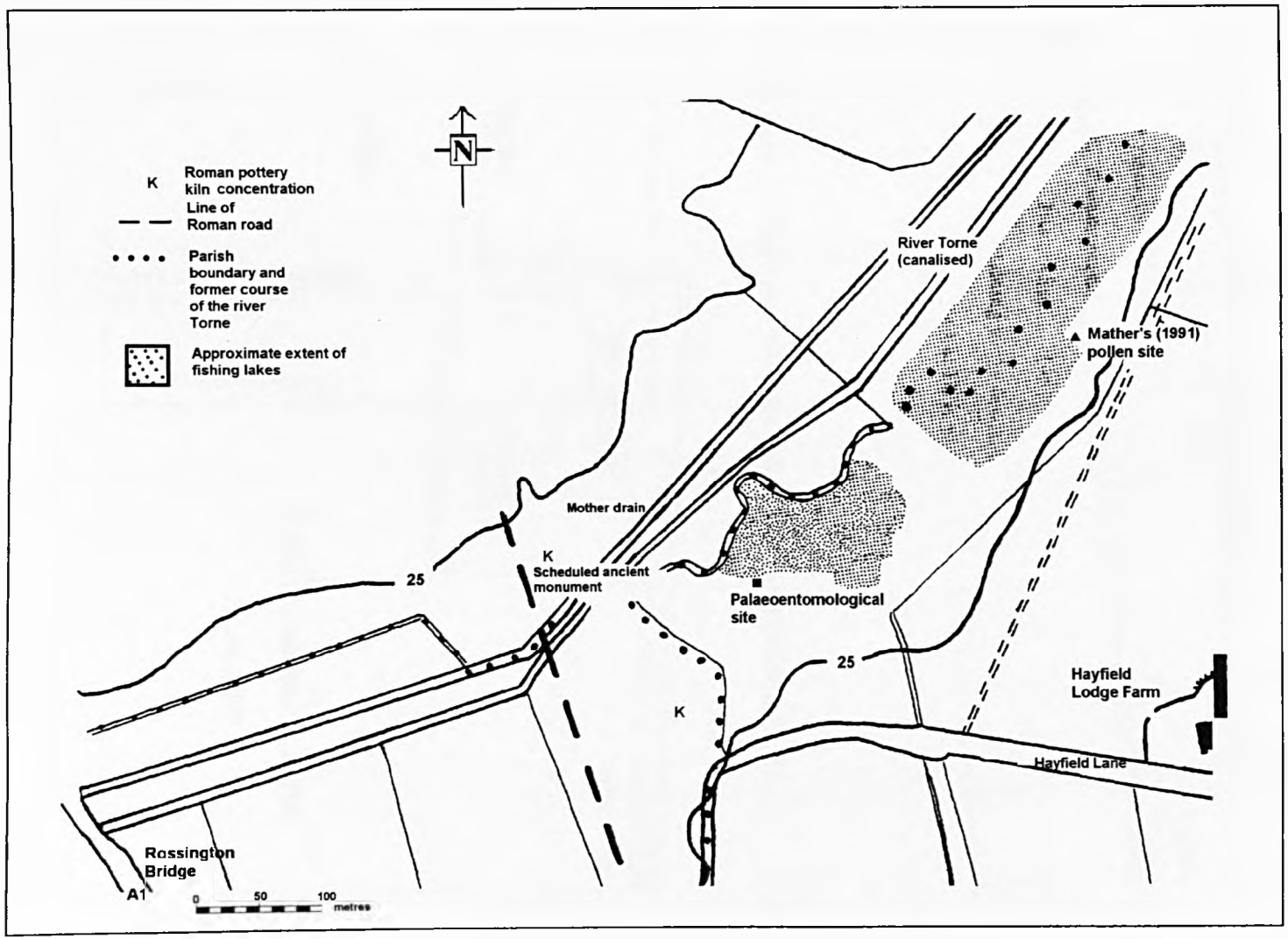


Figure 4.5a; Location map of Misterton Carr site, after an original by Buckland and Dolby (1973). N.B. There was no scale on the original, except stating "Scale 4": 1 mile. This is however, meaningless, without knowing the original size of the map.

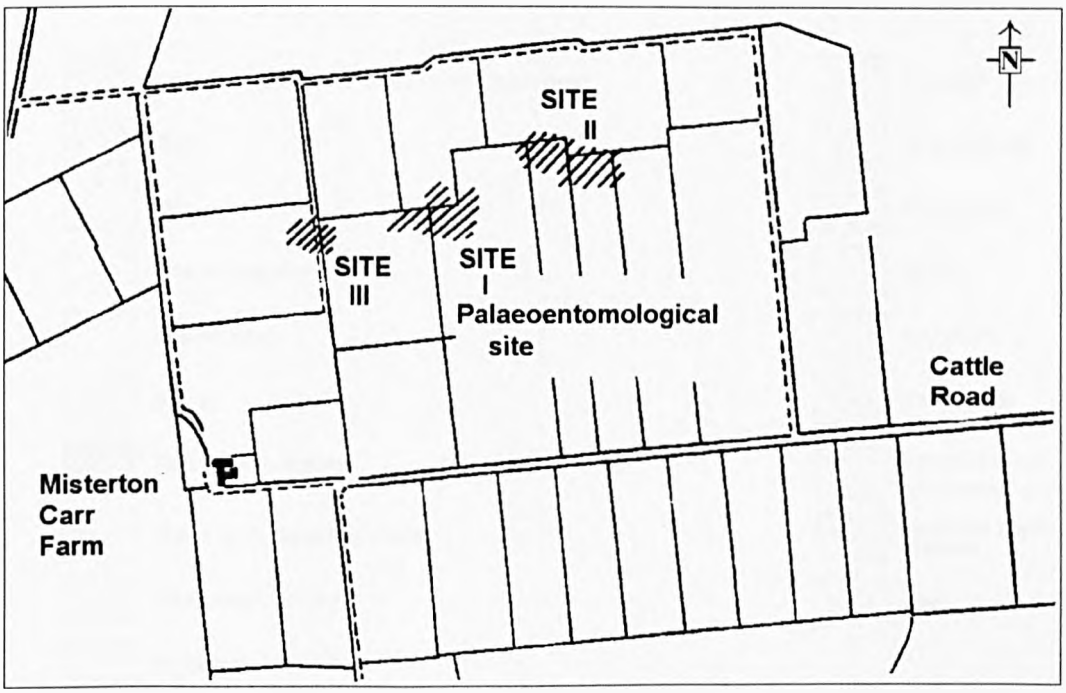
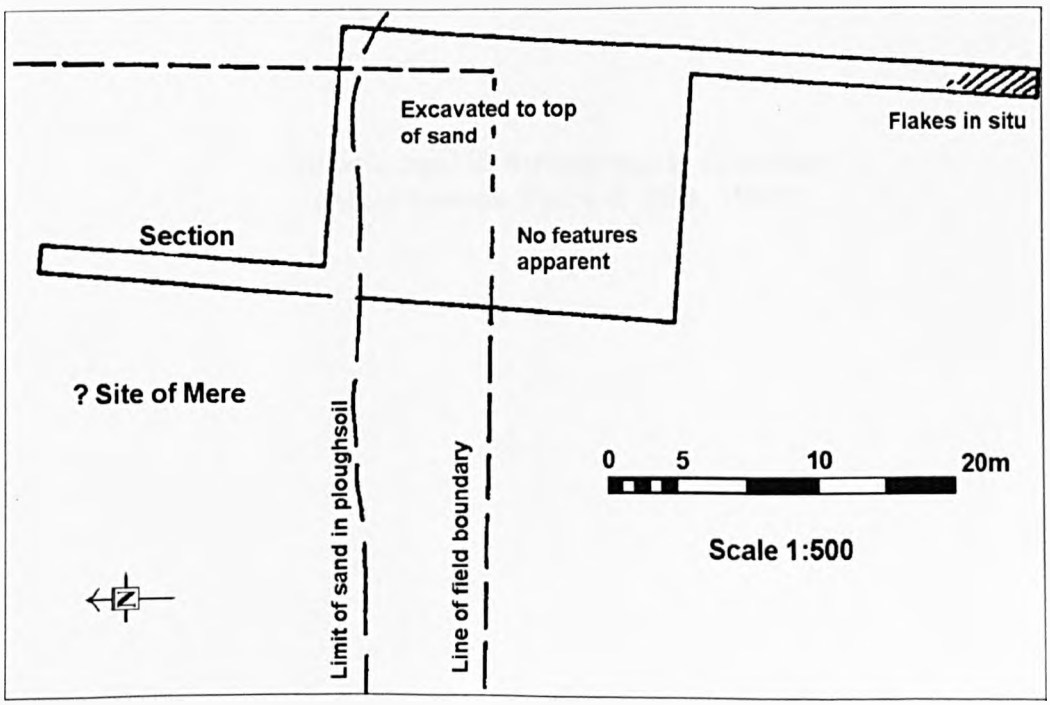
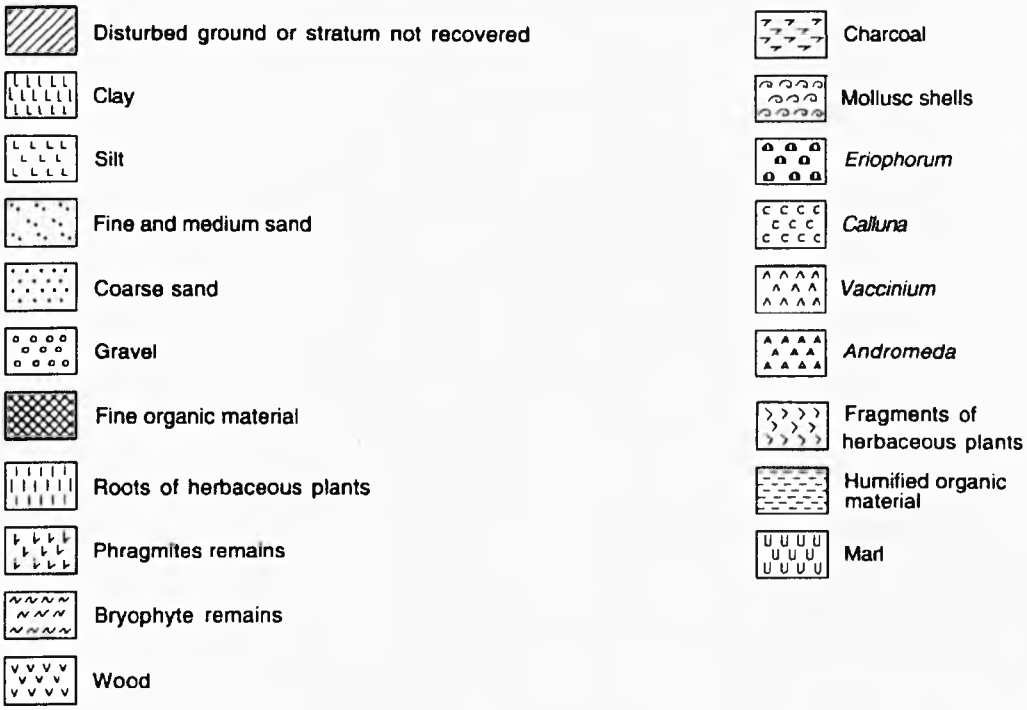


Figure 4.5b; Plan of Misterton site (after Buckland and Dolby, 1973).





Symbols used in Stratigraphic drawings
(After Van de Noort & Ellis, 1997)

Figure 4.6; Stratigraphic section of site at Hatfield 3 (HAT 3), Hatfield Moors.

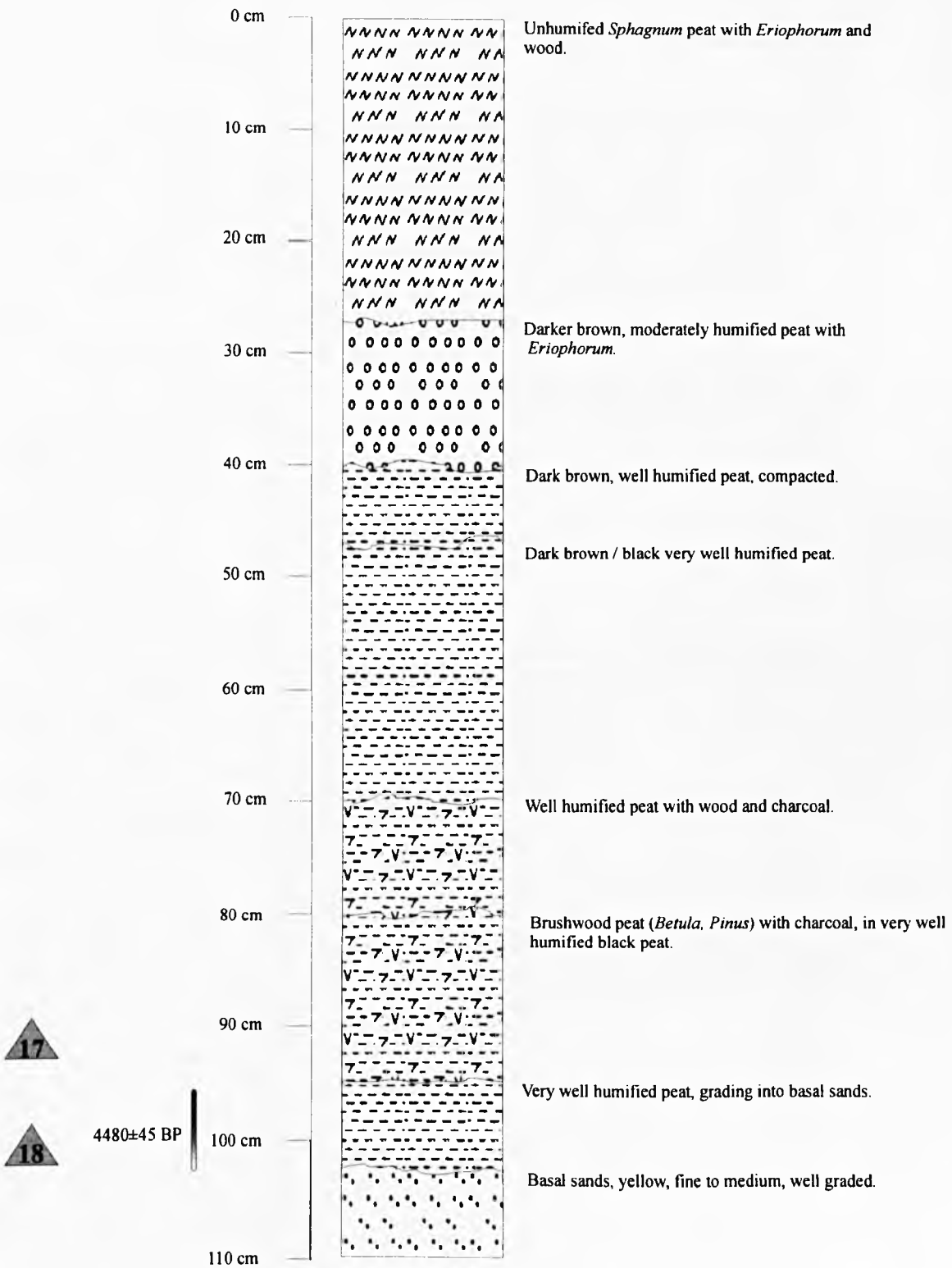


Figure 4.7; Stratigraphic section of site at Hatfield 4 (HAT 4), Hatfield Moors.

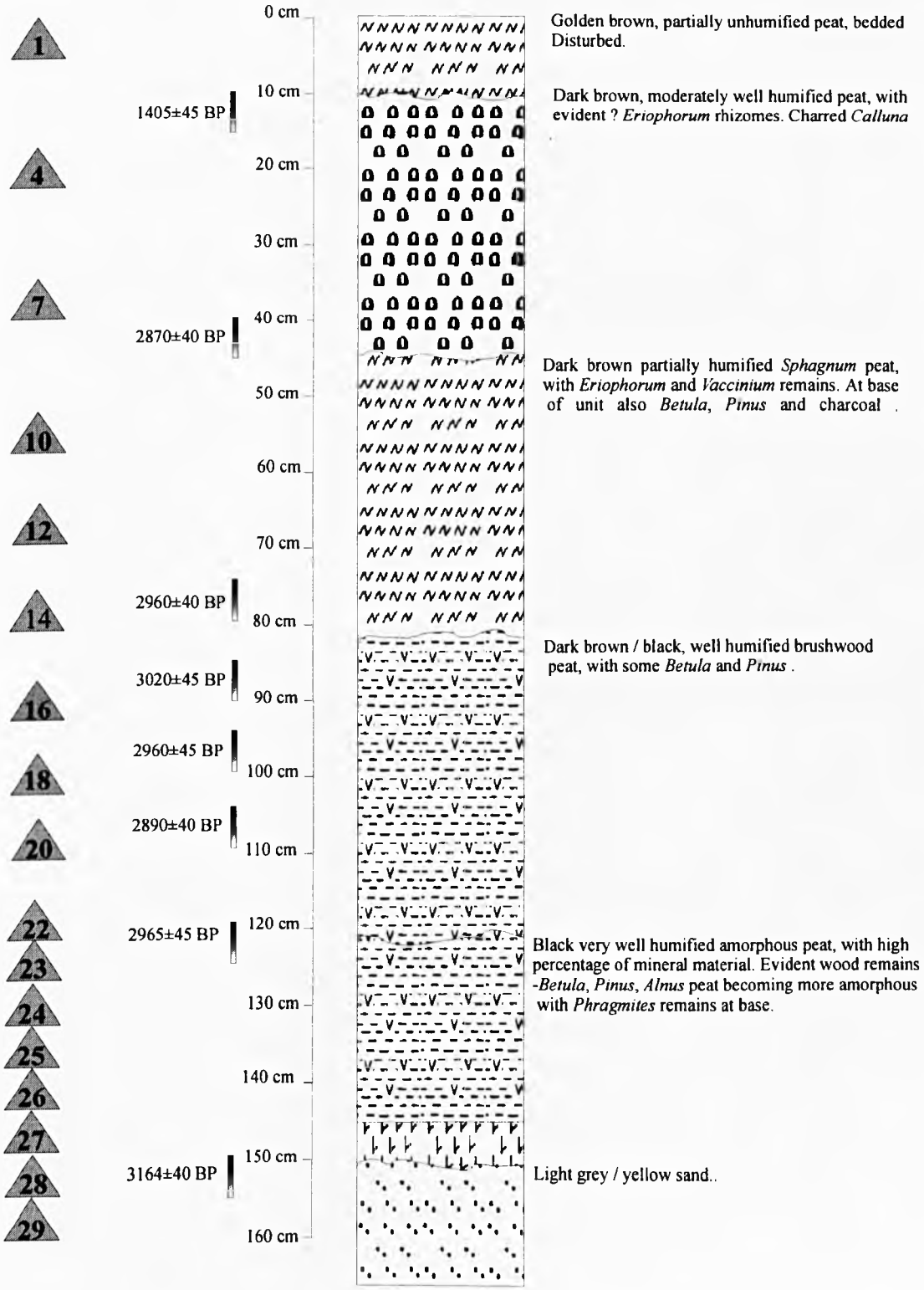


Figure 4.8; Stratigraphic section of site at Lindholme A, Lindholme bank Road, Hatfield Moors.

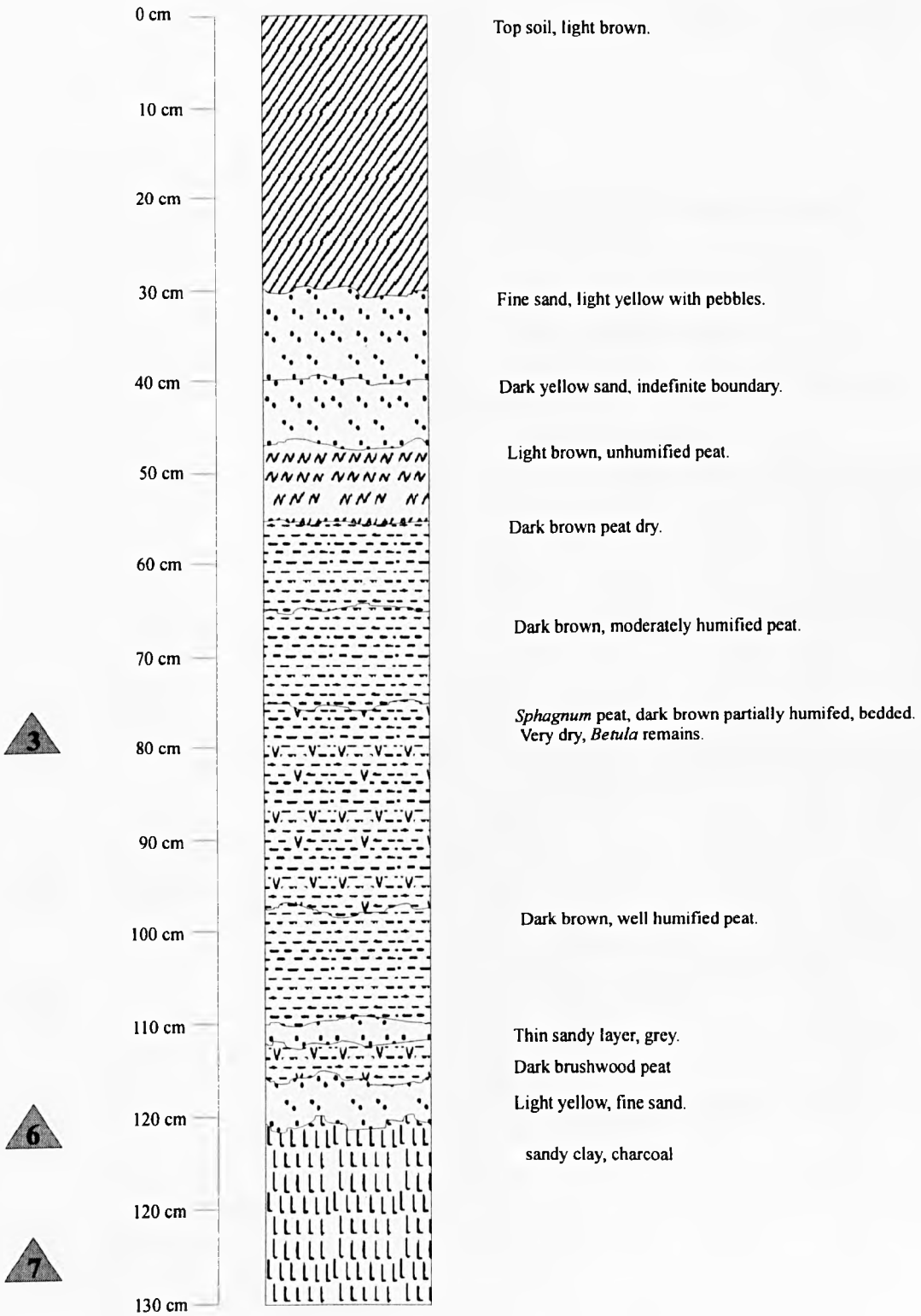


Figure 4.9; Stratigraphic section of site at Lindholme B, Lindholme bank Road, Hatfield Moors.

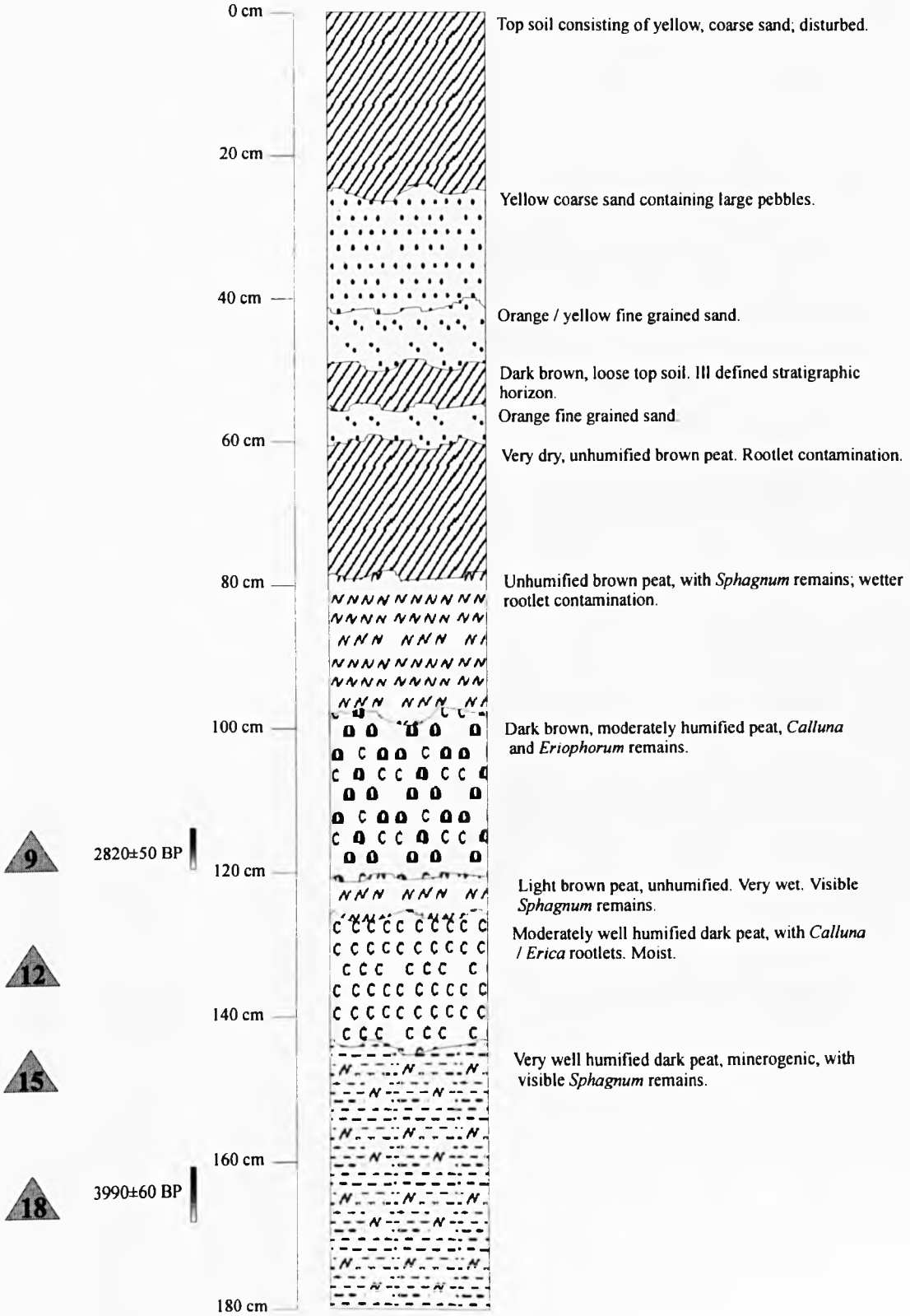


Figure 4.10; Stratigraphic section of site at Blackwater Dike, Goole Moors (Thorne Moors).

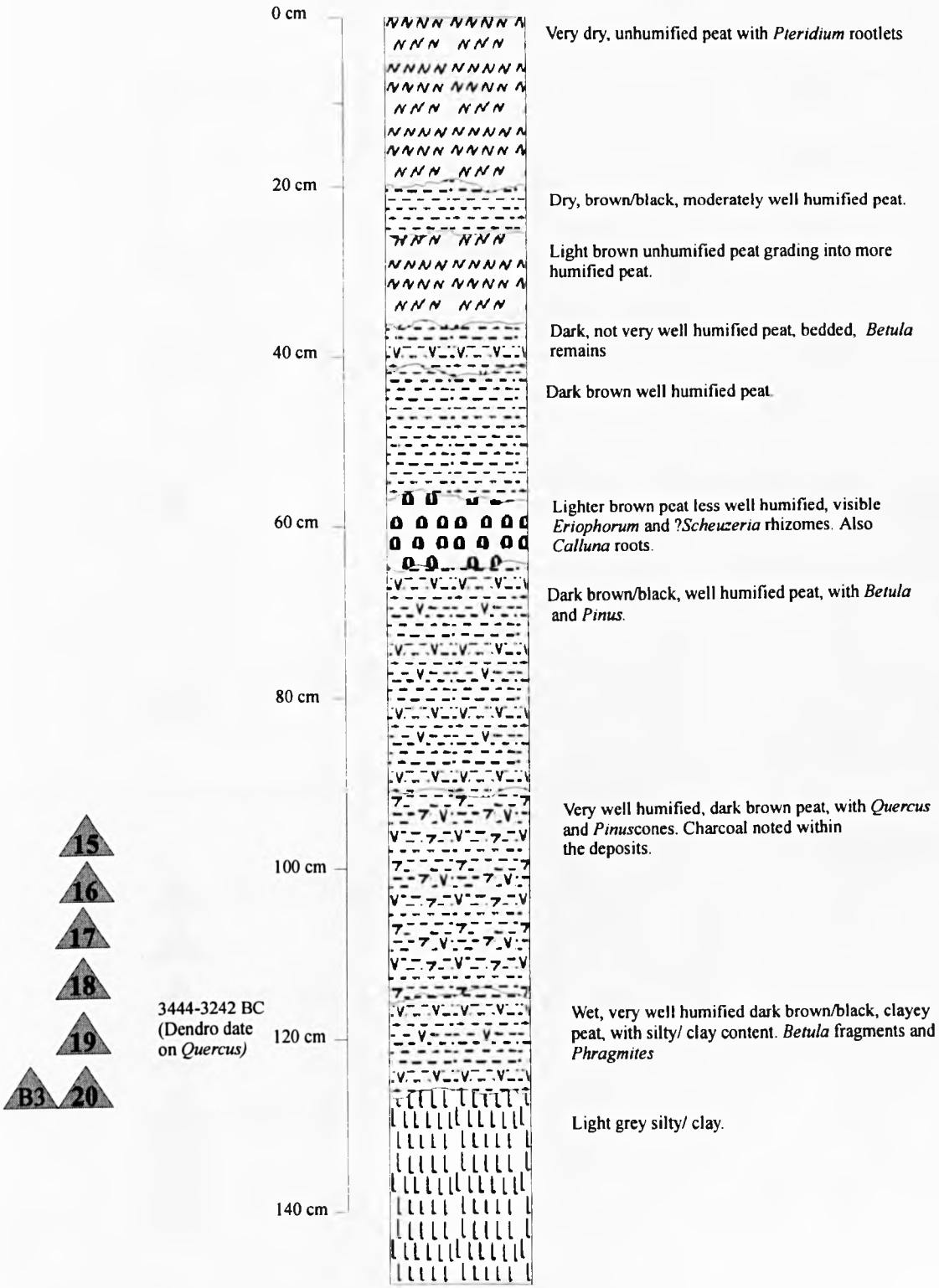


Figure 4.11; Stratigraphic section of site at Hayfield Lodge Farm, Rossington.

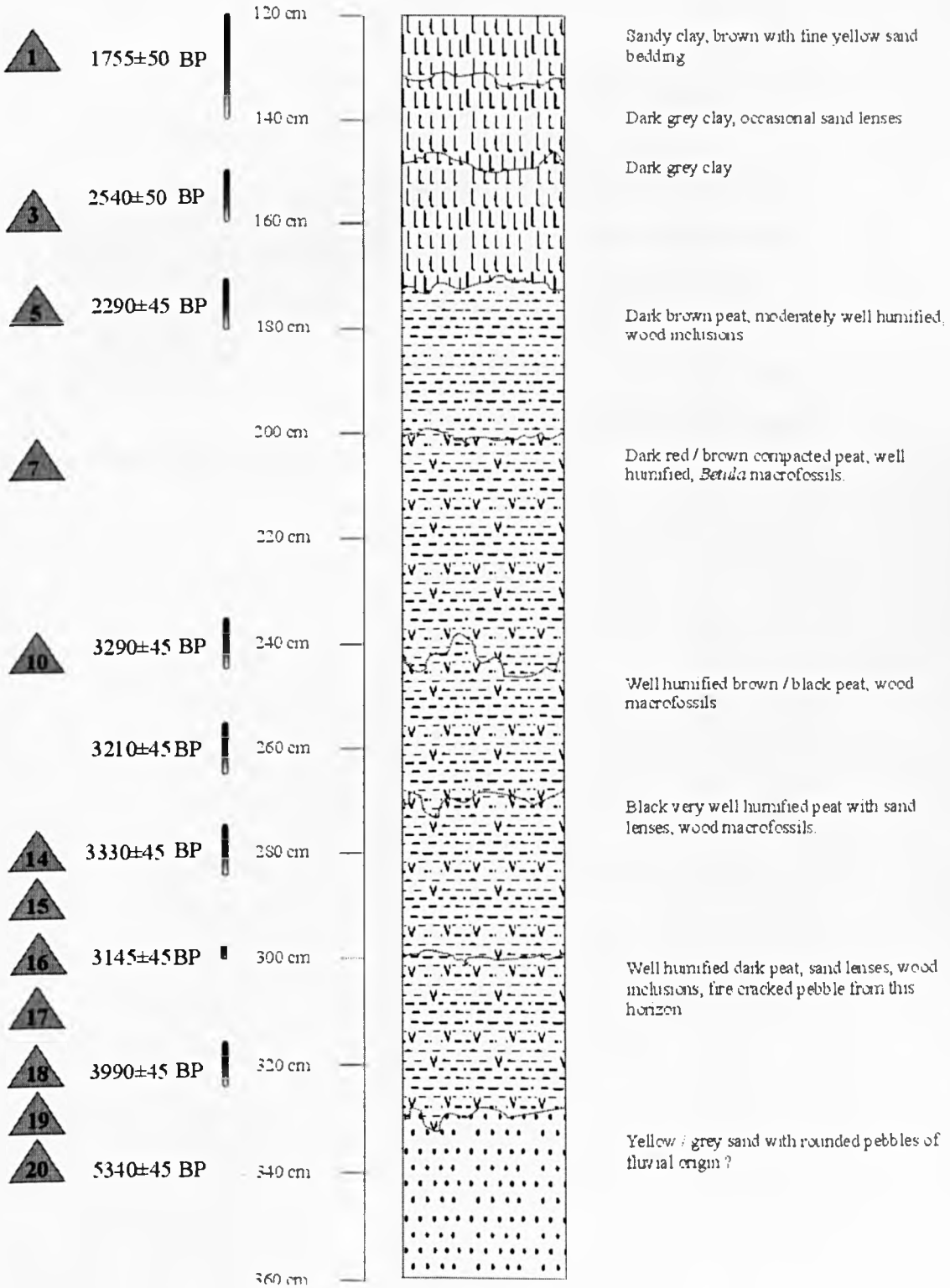


Figure 4.12; Stratigraphic sketch of section at Misterton carr
(redrawn from Buckland and Dolby, 1973).

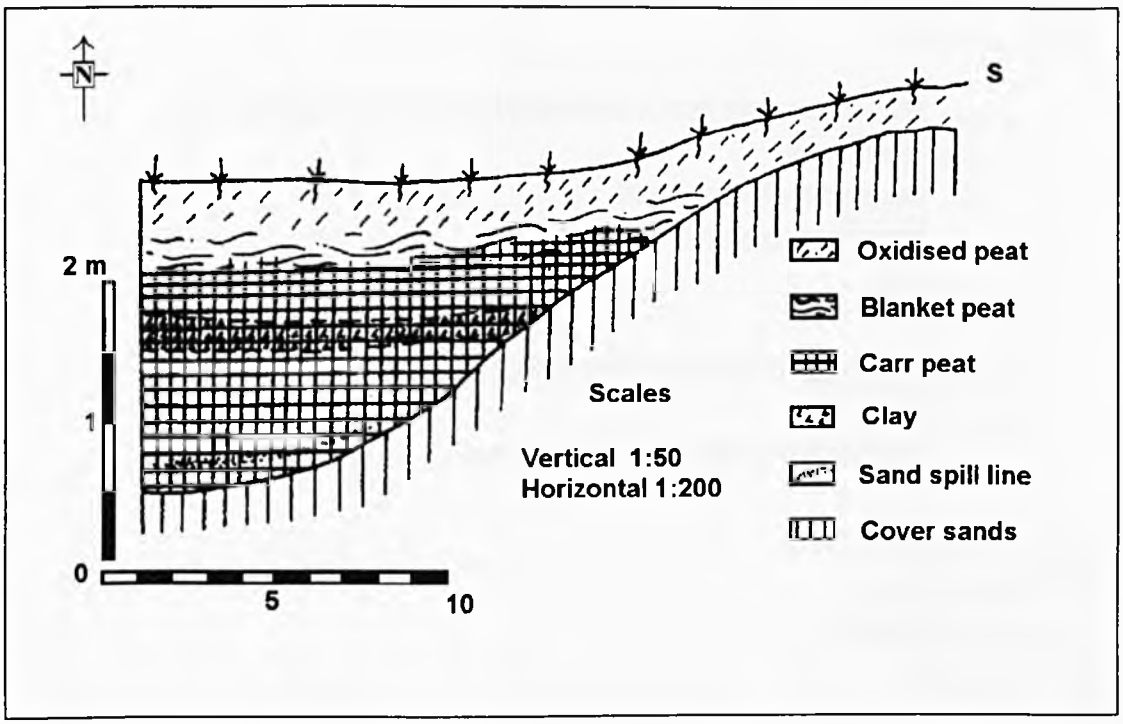


Figure 6.1; HAT 3, Assemblage categories

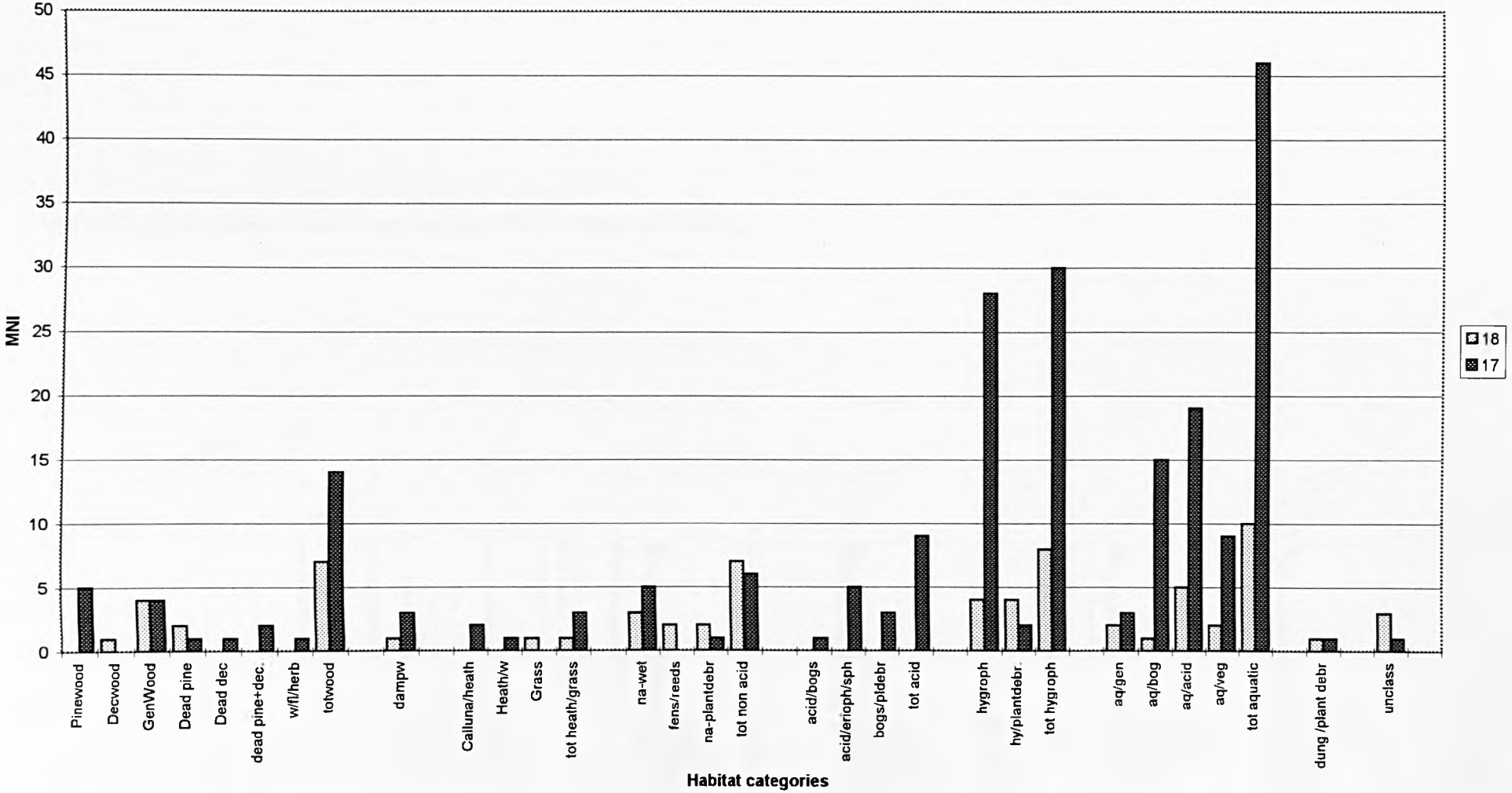


Figure 6.2; Insect macrofossil diagram for HAT 4, Hatfield Moors.

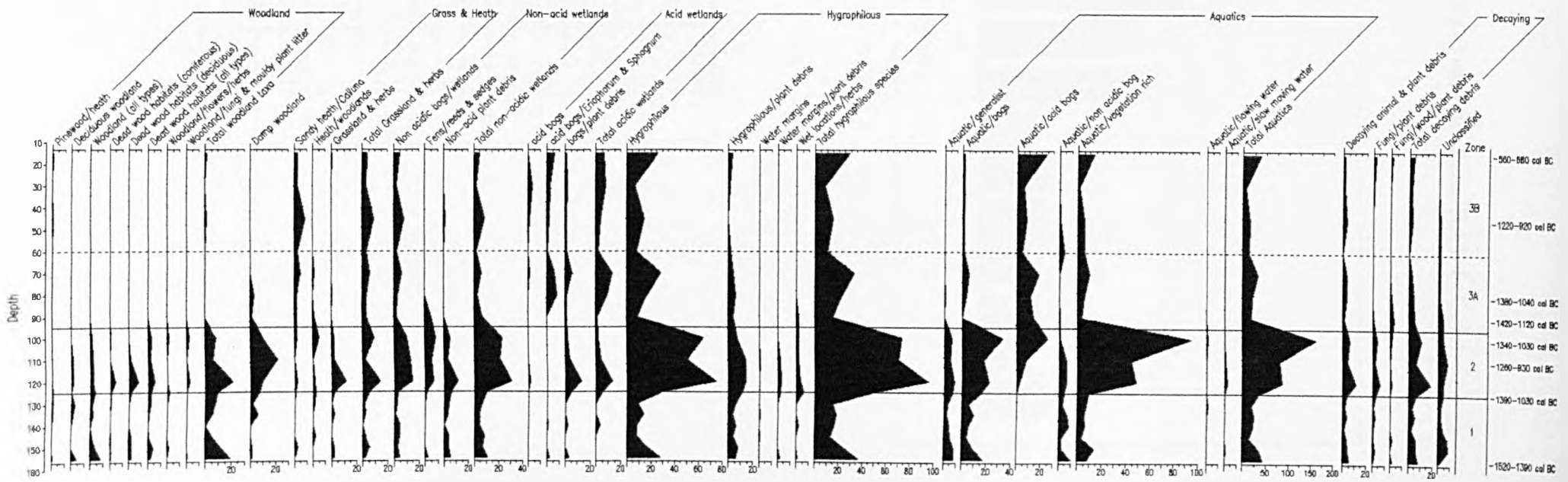
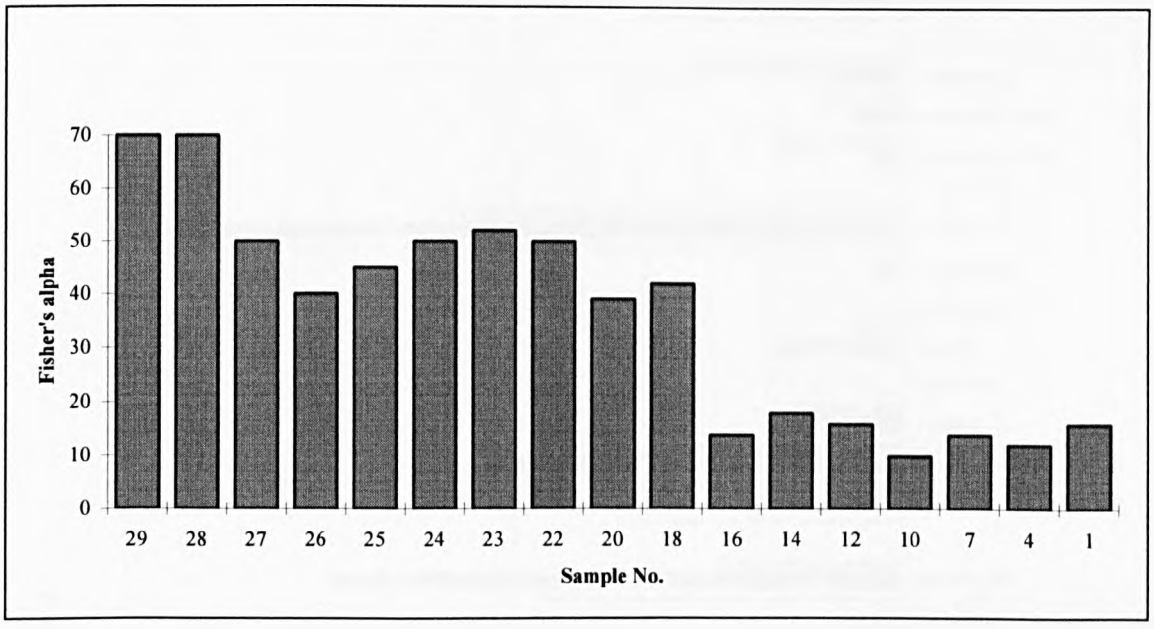


Figure 6.3; Measure of the species diversity of samples from HAT 4



Sample	No. of individuals	No. of Species	Fisher's α
HAT2-29	127	69	70
HAT2-28	98	61	70
HAT2-27	55	38	50
HAT2-26	51	33	40
HAT2-25	66	40	45
HAT2-24	53	37	50
HAT2-23	129	64	52
HAT2-22	294	100	50
HAT2-20	217	71	39
HAT2-18	300	90	42
HAT2-16	54	22	14
HAT2-14	66	29	18
HAT2-12	95	31	16
HAT2-10	32	16	10
HAT2-7	57	23	14
HAT2-4	30	17	12
HAT2-1	88	29	16

Figure 6.4; Habitat categories LIND A

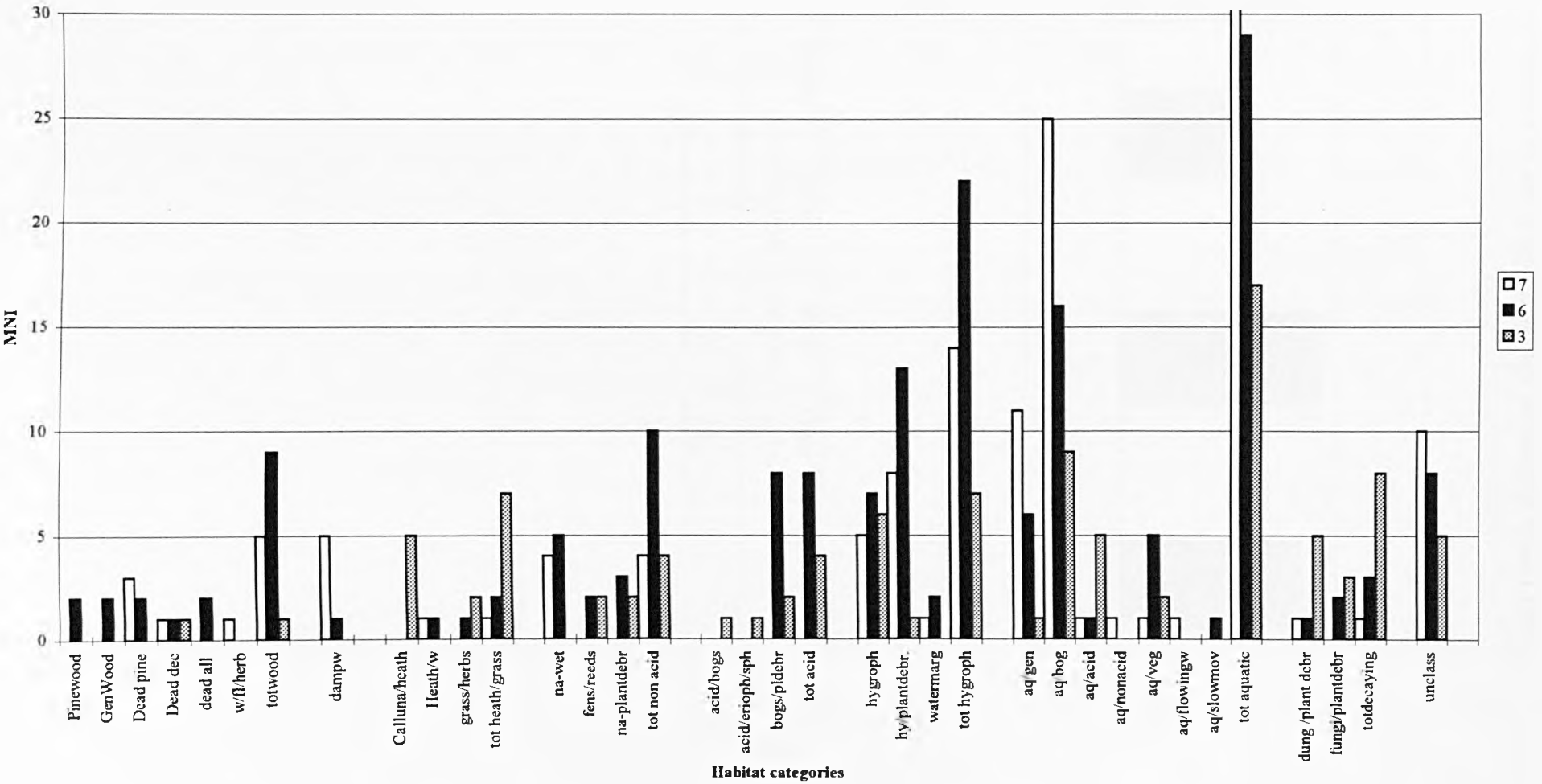
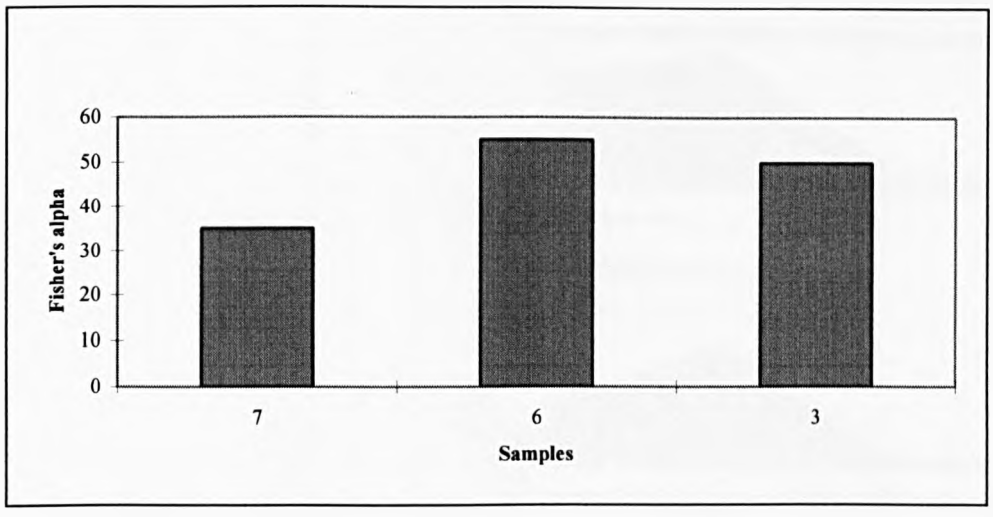


Figure 6. 5; Measure of the species diversity of samples from LIND A



Sample	No. of individuals	No. of Species	Fisher's α
7	80	43	35
6	92	56	55
3	53	37	50

Figure 6.6; Insect macrofossil diagram for LIND B (Lindholme Bank Road), Hatfield Moors.

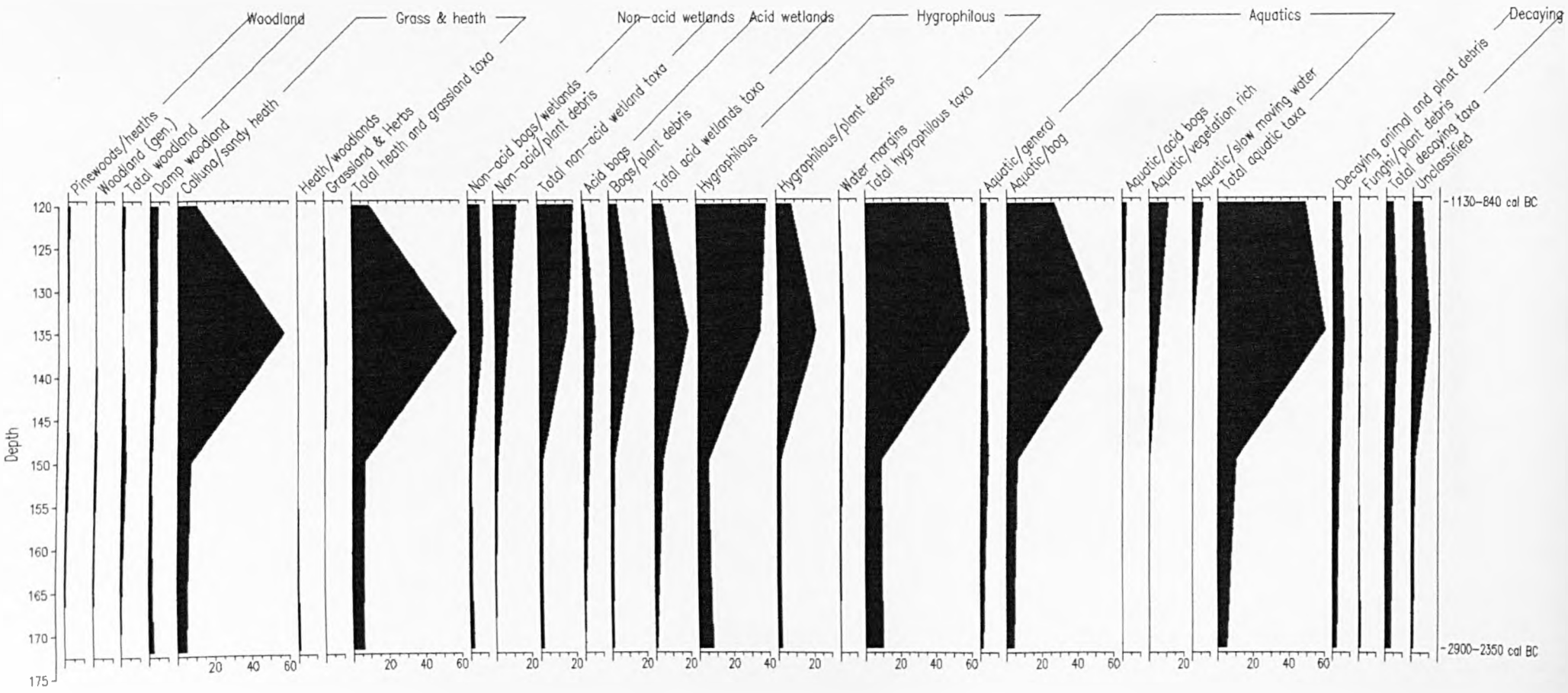
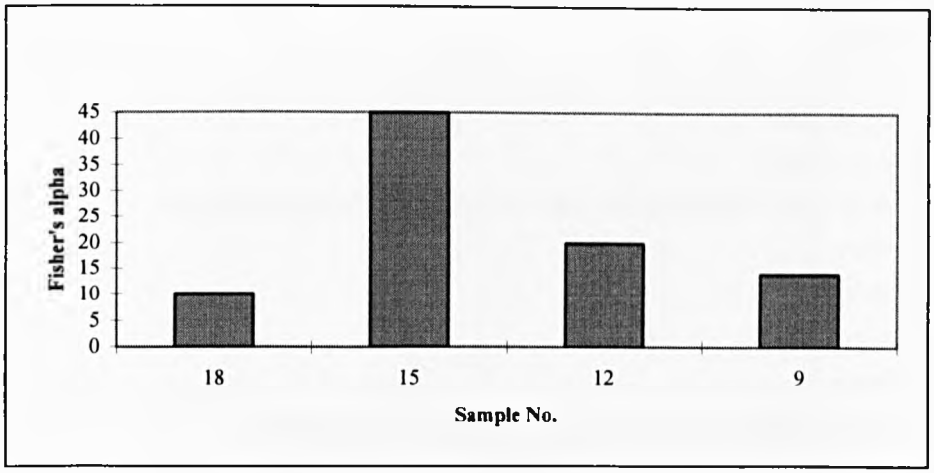


Figure 6.7; Measure of species diversity of samples from LIND B



Sample	No. of individuals	No. of Species	Fisher's α
18	30	14	10
15	42	29	45
12	229	50	20
9	145	33	14

Figure 6.8; Habitat categories Tyrham Hall Quarry *Quercus* sample.

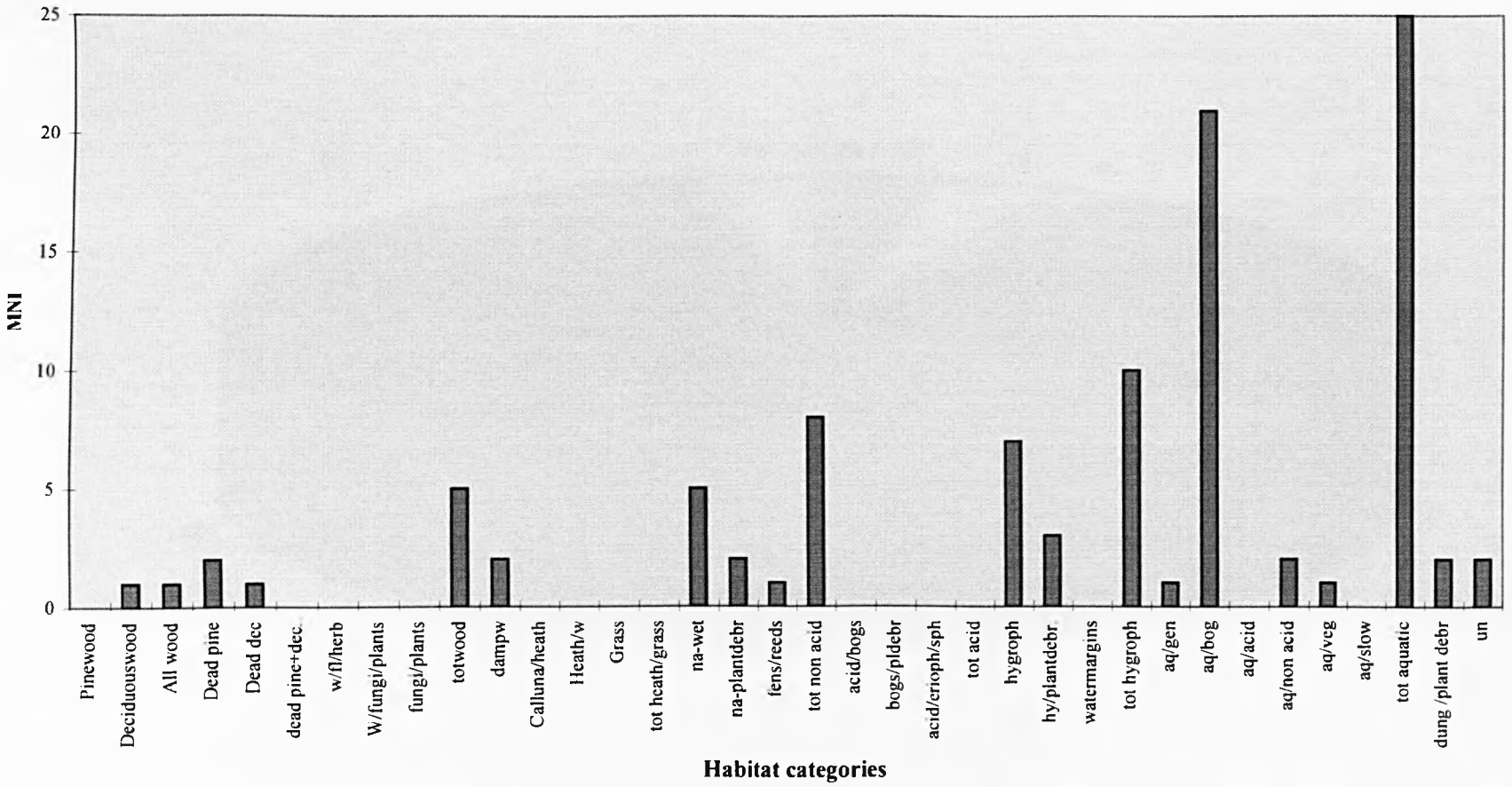


Figure 6.9; Tyrham Hall Quarry, *Quercus* sample. Proportions of Wood and Total habitat categories.

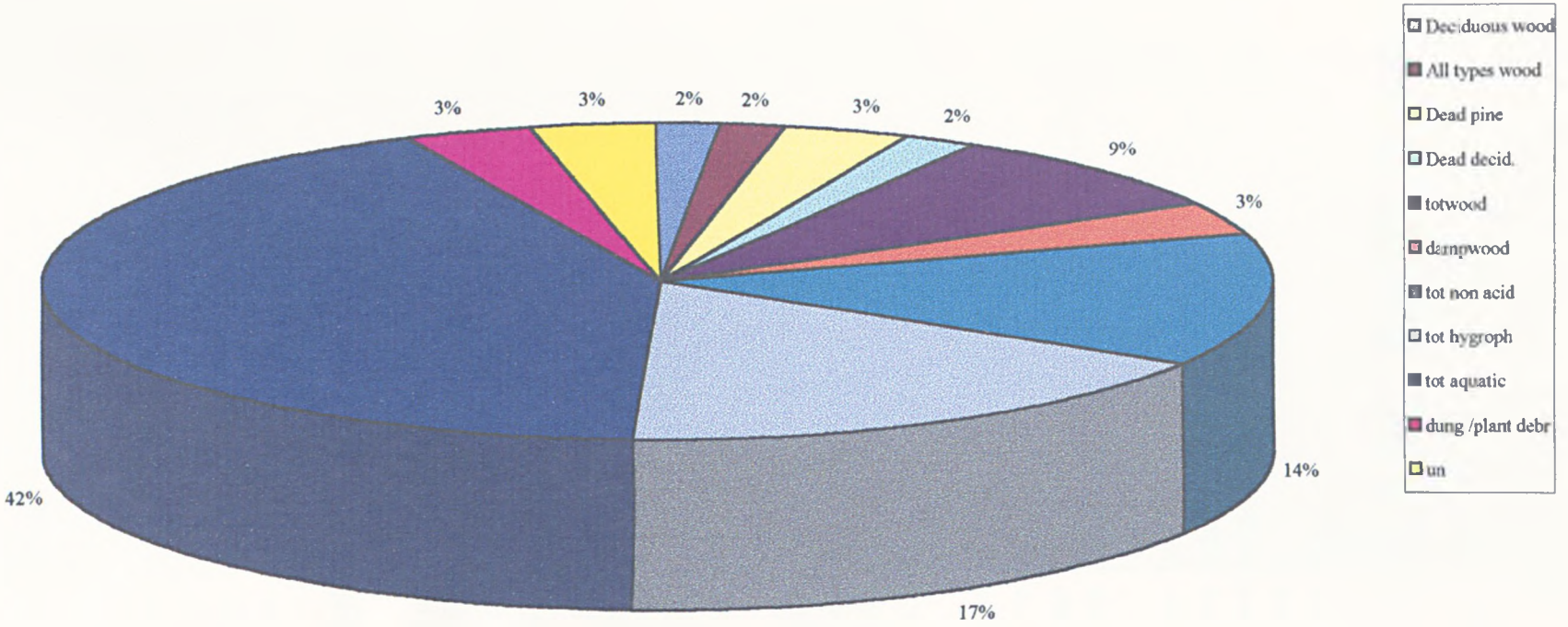


Figure 6.10; Tyrham Hall Quarry, *Pinus* 1, habitat categories.

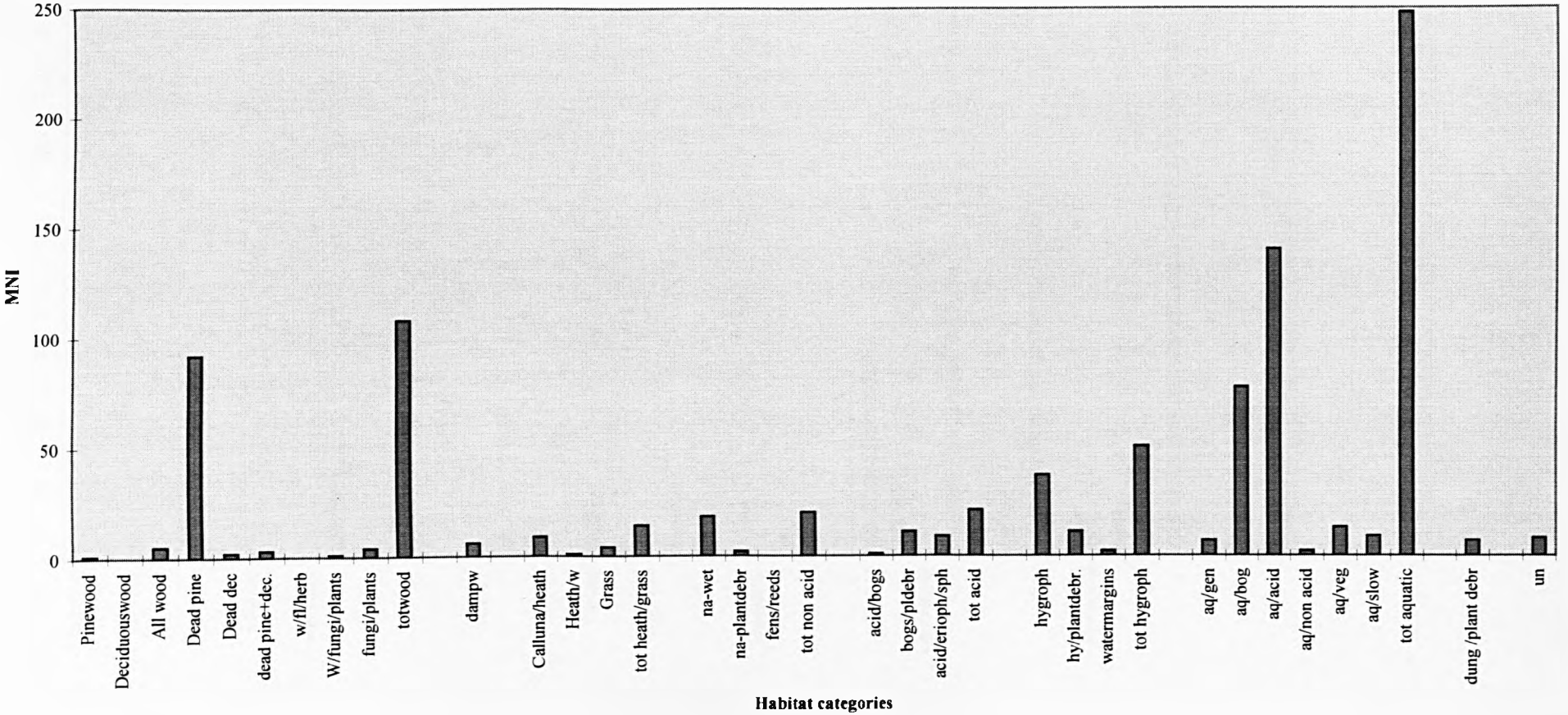


Figure 6.11; Tyrham Hall Quarry, *Pinus* 2A, habitat categories.

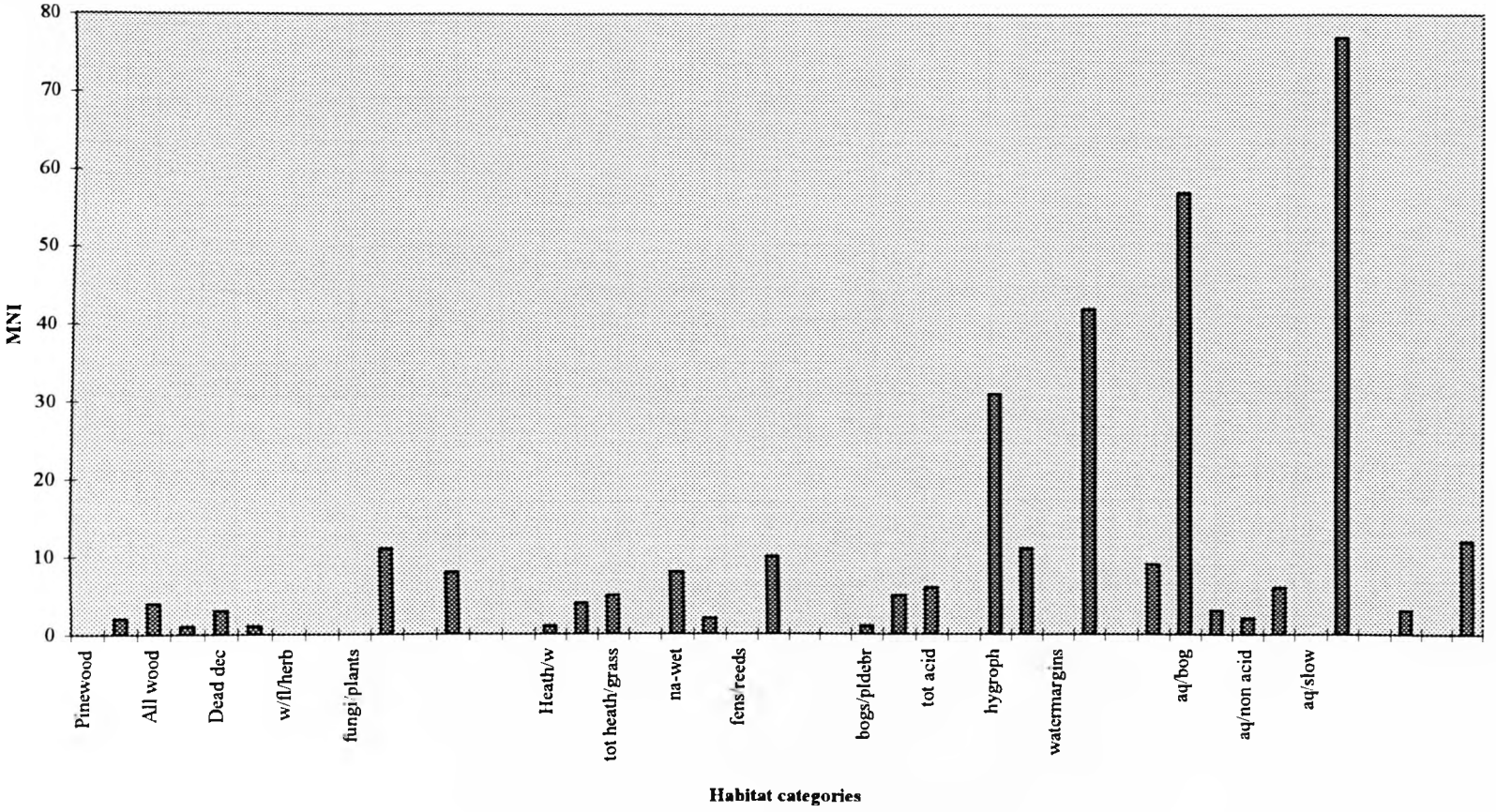


Figure 6.12; Tyrham Hall Quarry, *Pinus* 2B, habitat categories.

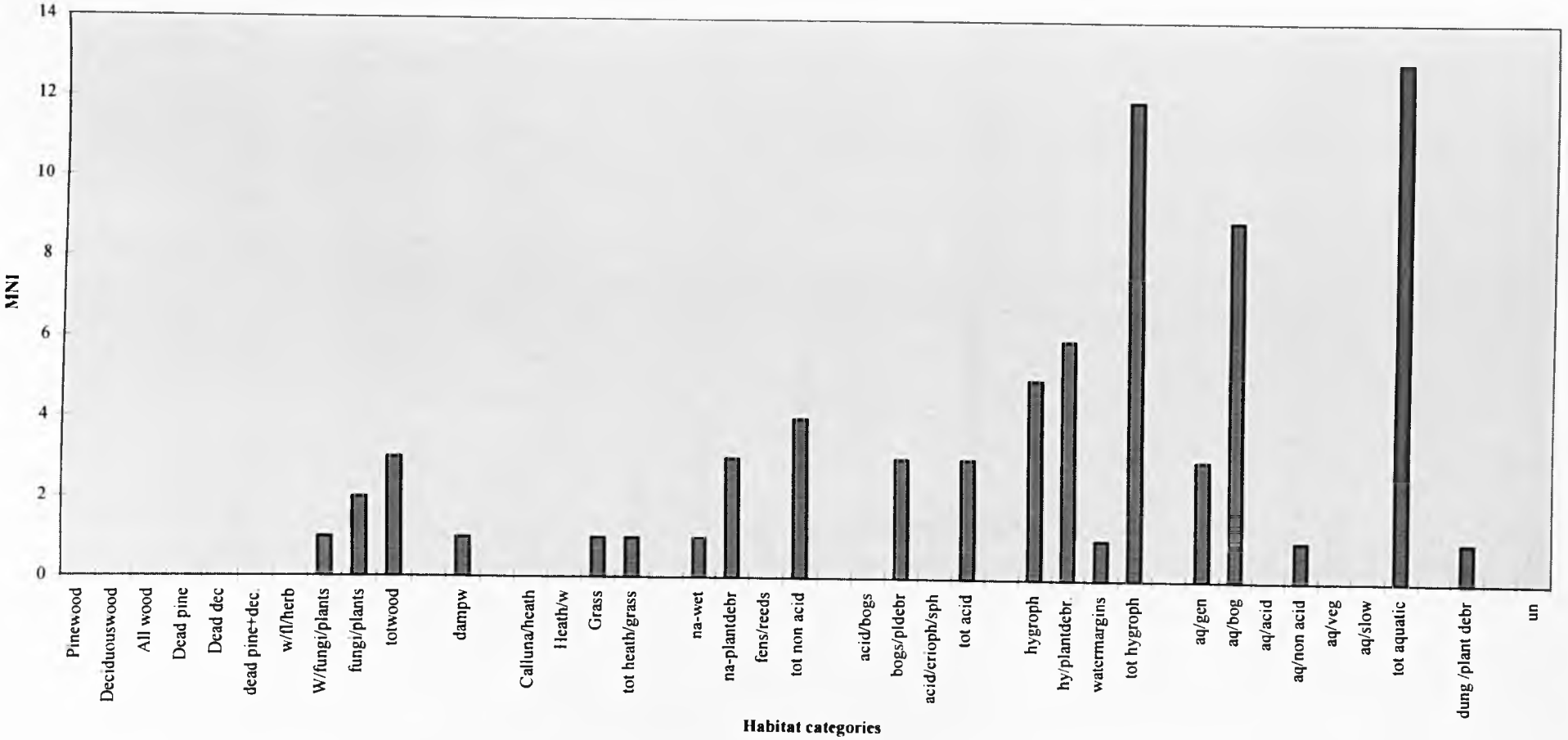


Figure 6.13. Tyrham Hall Quarry, *Pinus* 3, habitat categories.

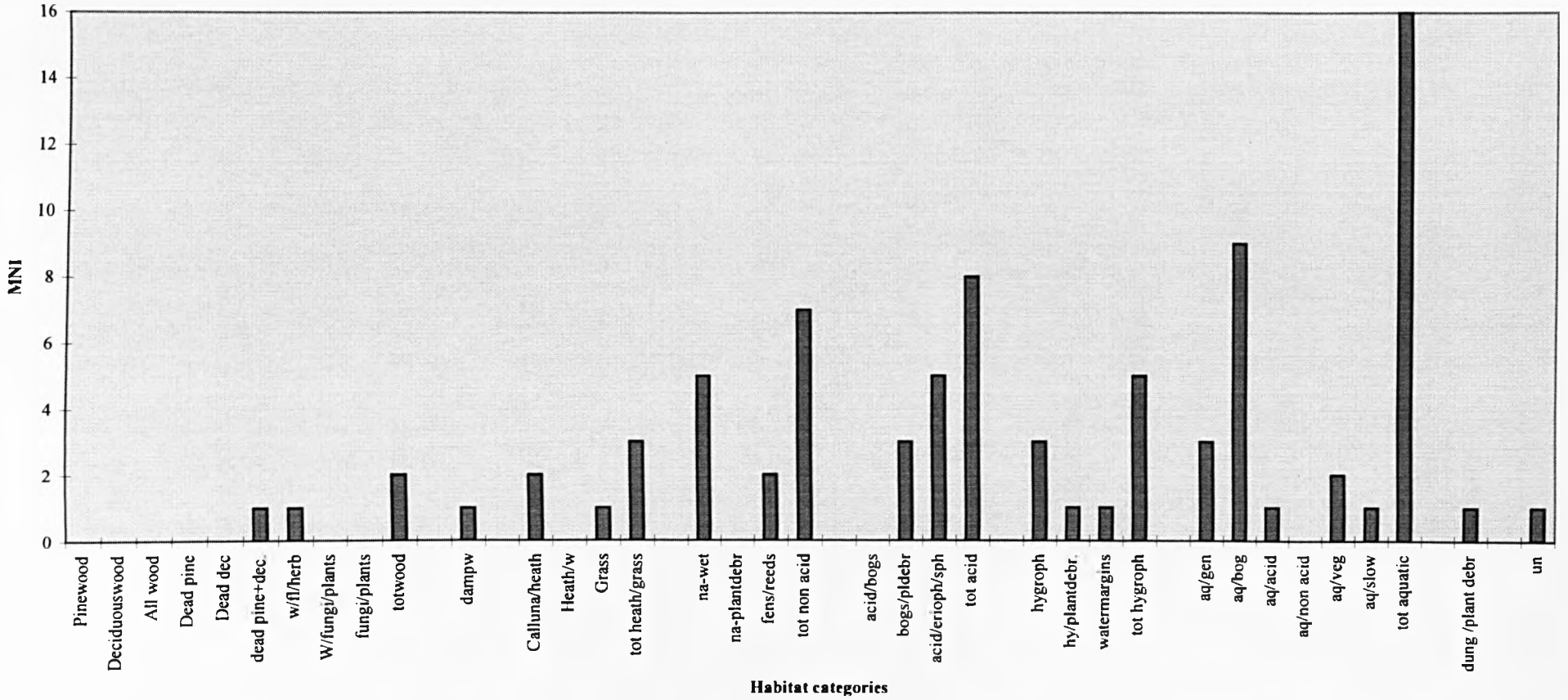


Figure 6.14; Tyrham Hall Quarry, *Pinus* K, habitat categories.

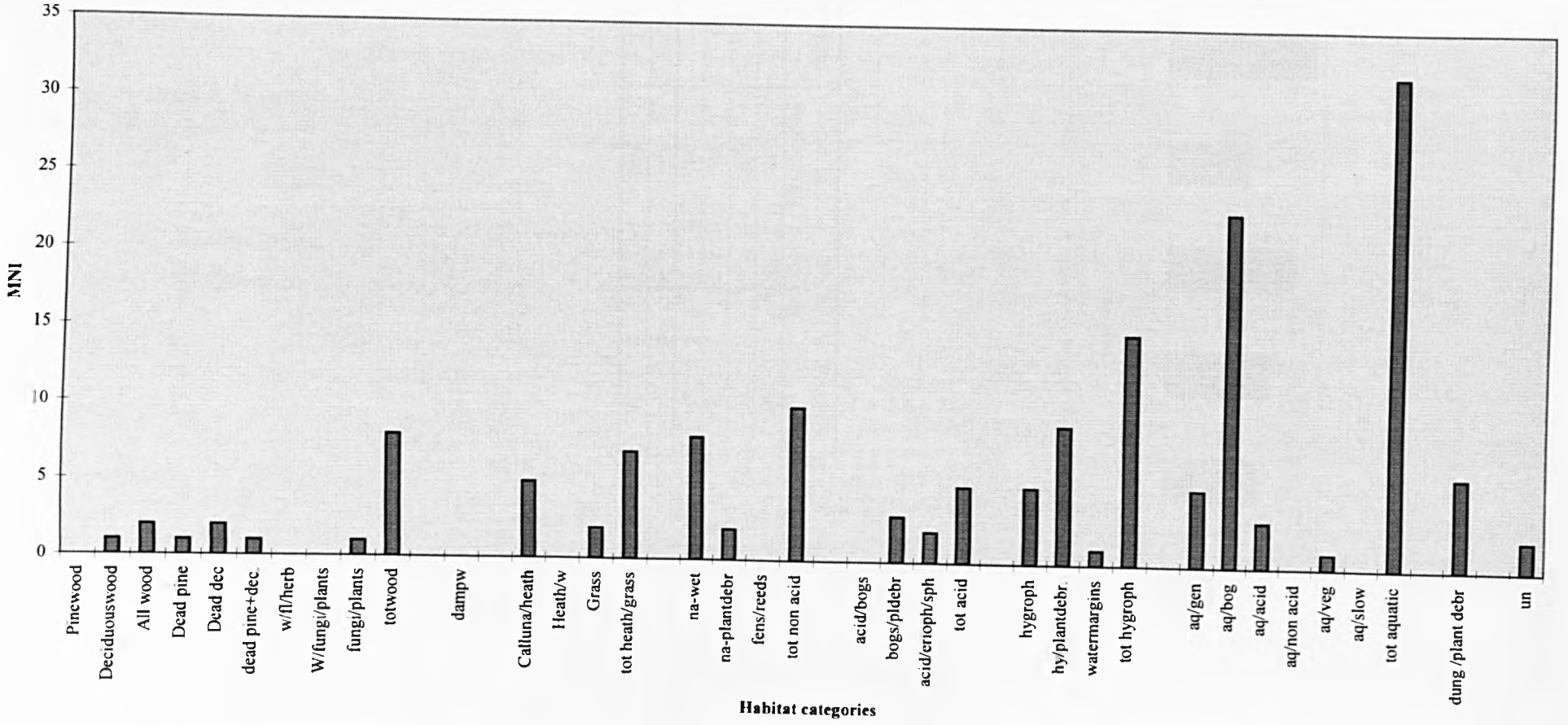
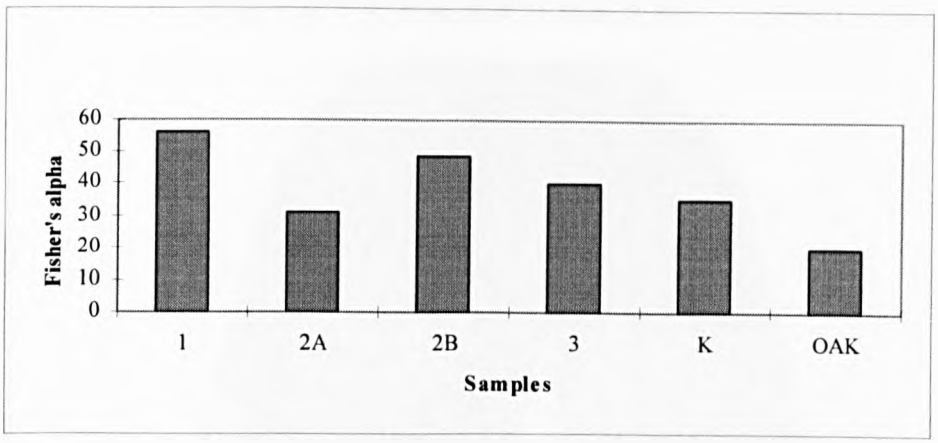
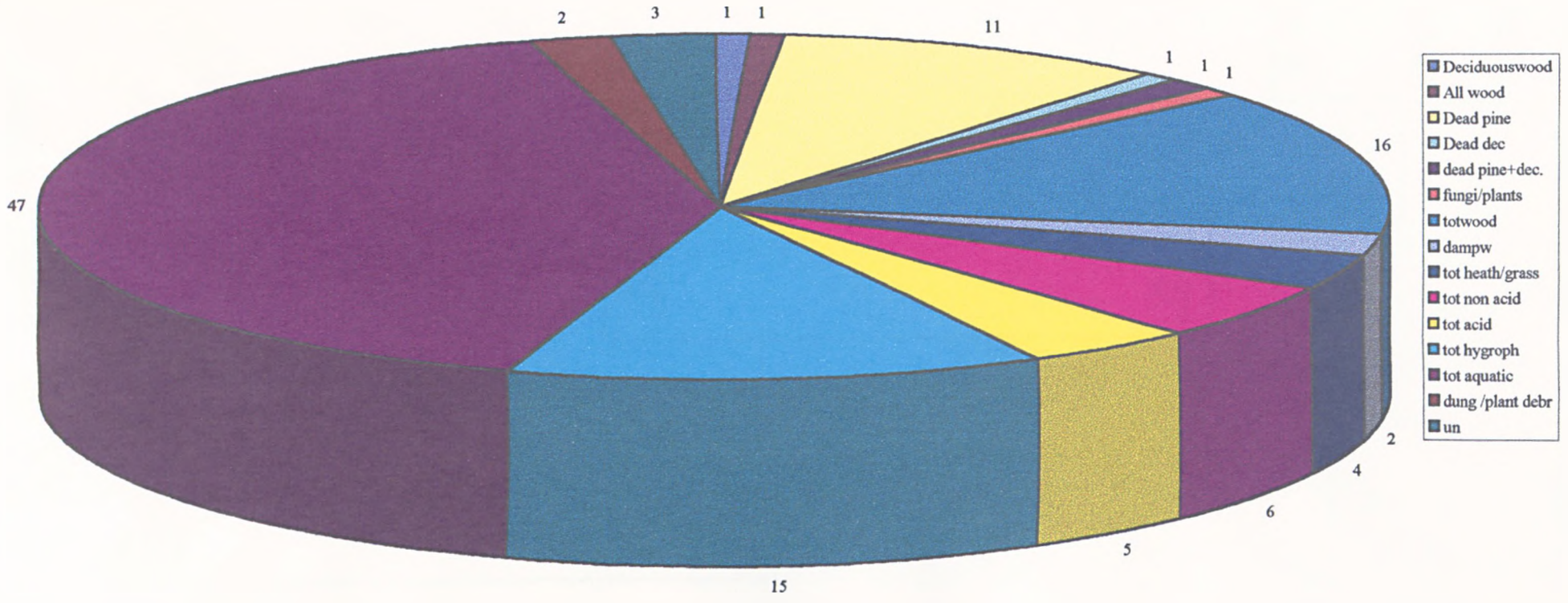


Figure 6. 15; Measure of species diversity of samples from TYRHAM



Sample	No. of individuals	No. of Species	Fisher's α
1	482	102	56
2A	174	64	31
2B	38	26	49
3	44	28	40
K	85	44	35
OAK	54	27	20

Figure 6.16; Tyrham Hall Quarry, *Pinus* samples. Proportions of Wood and Total categories.



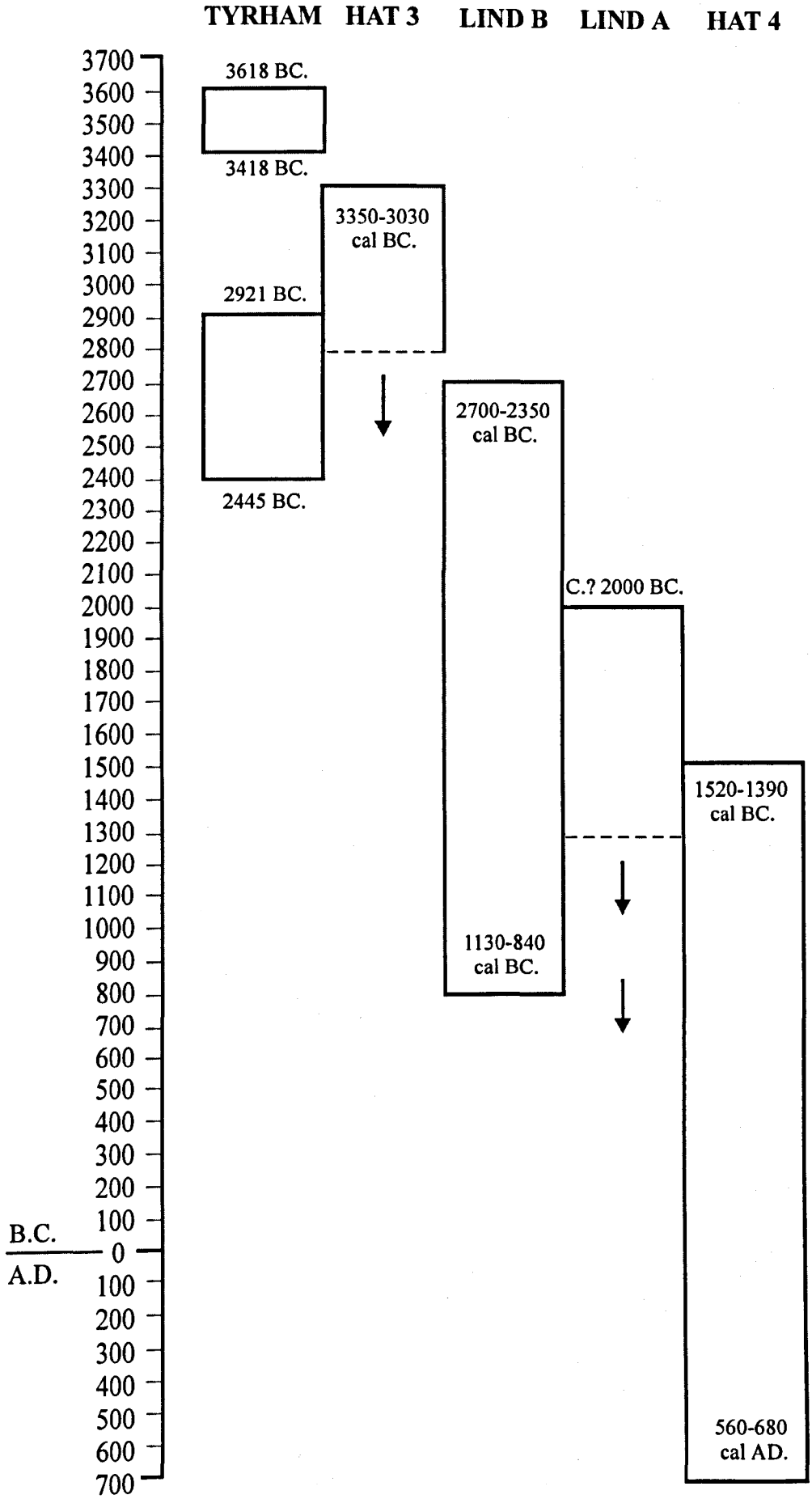


Figure 7.1. Chronology of samples

Figure 7.2a Smith (1985) pollen diagram for HAT 1

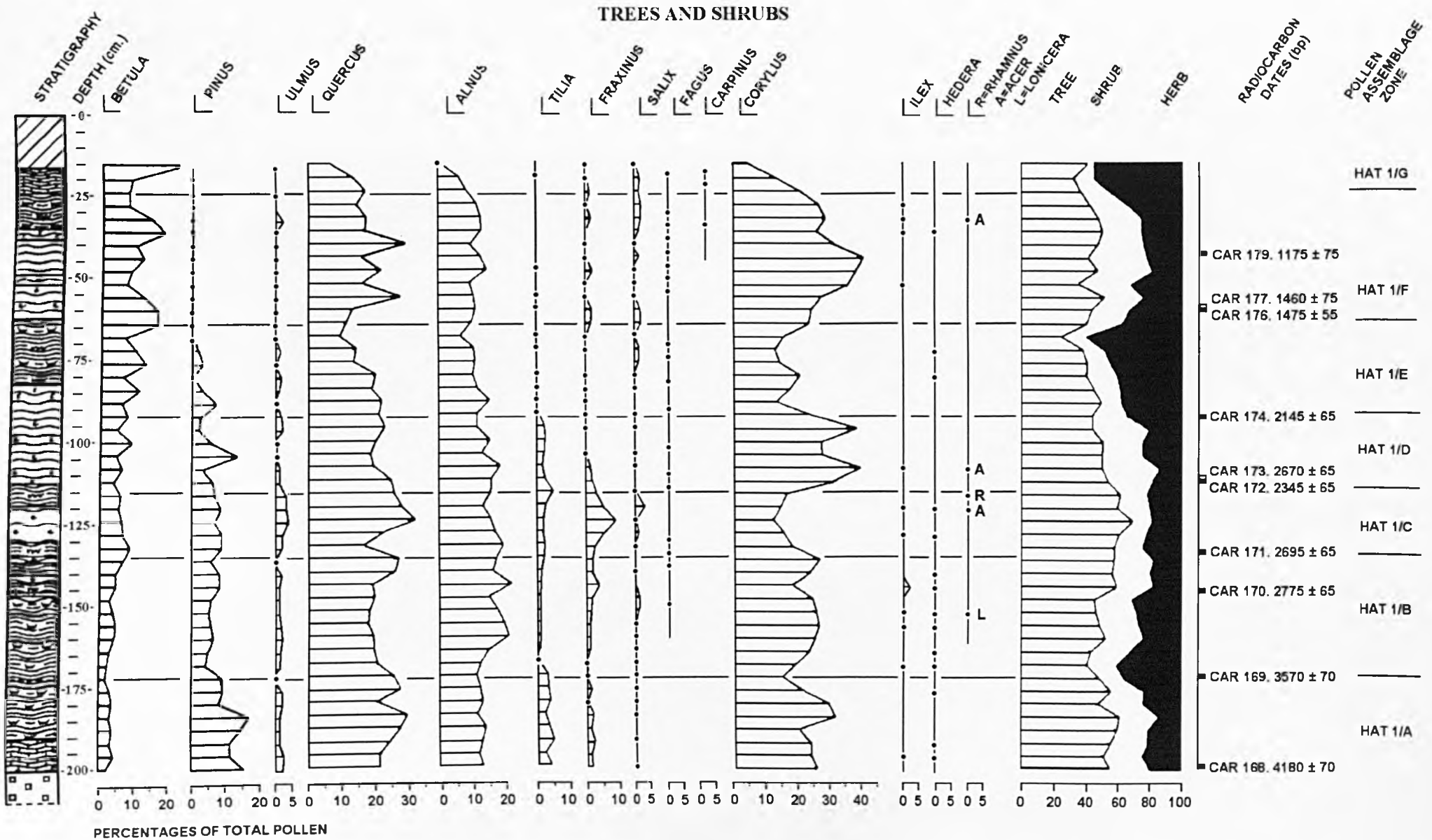


Figure 7.2b Smith (1985) pollen diagram for HAT 1

HERBS, AQUATICS AND CRYPTOGAMS

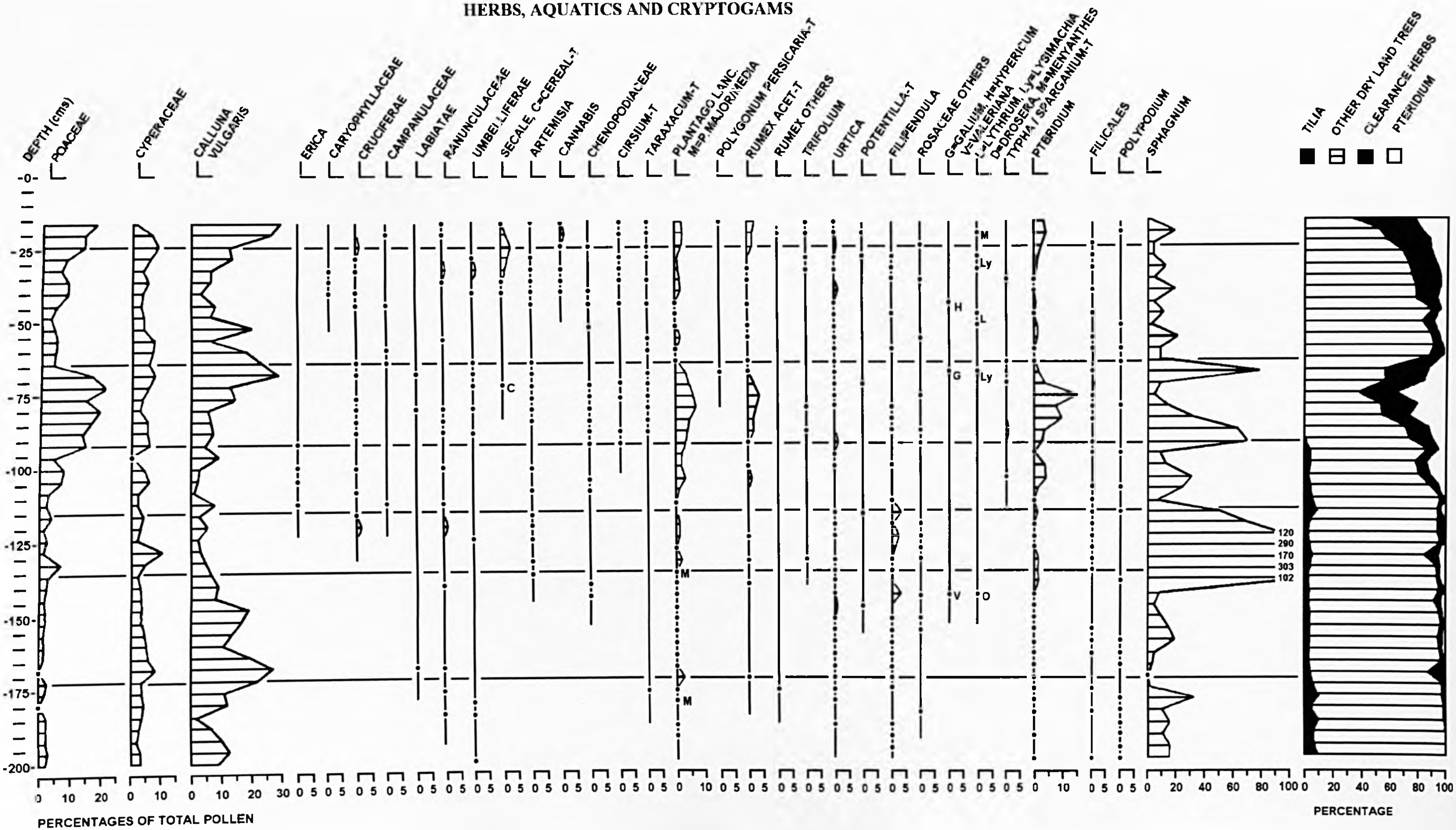


Figure 7.3a Smith (1985) pollen diagram for HAT 2

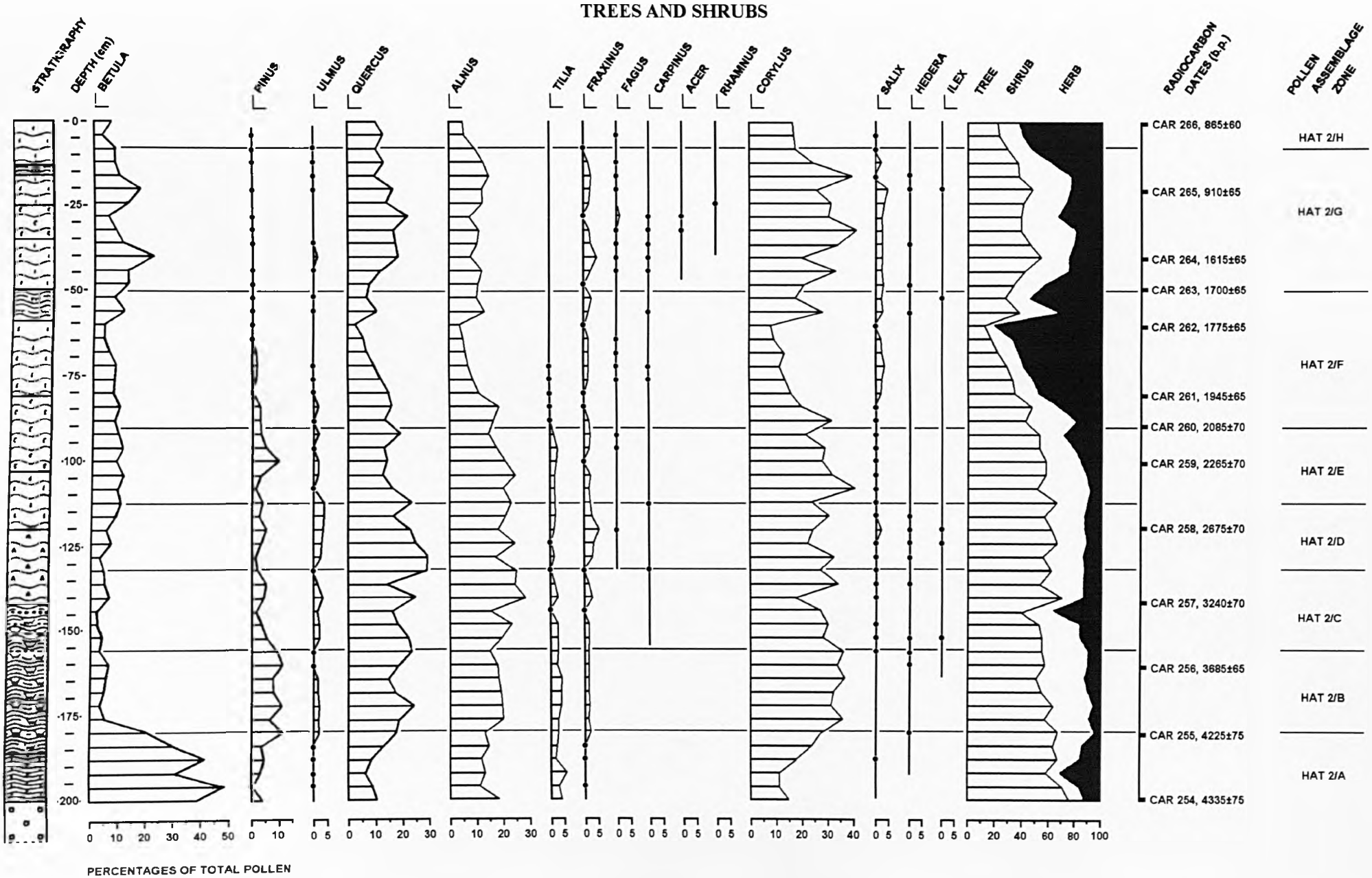


Figure 7.3b Smith (1985) pollen diagram for HAT 2 HERBS, AQUATICS AND CRYPTOGAMS

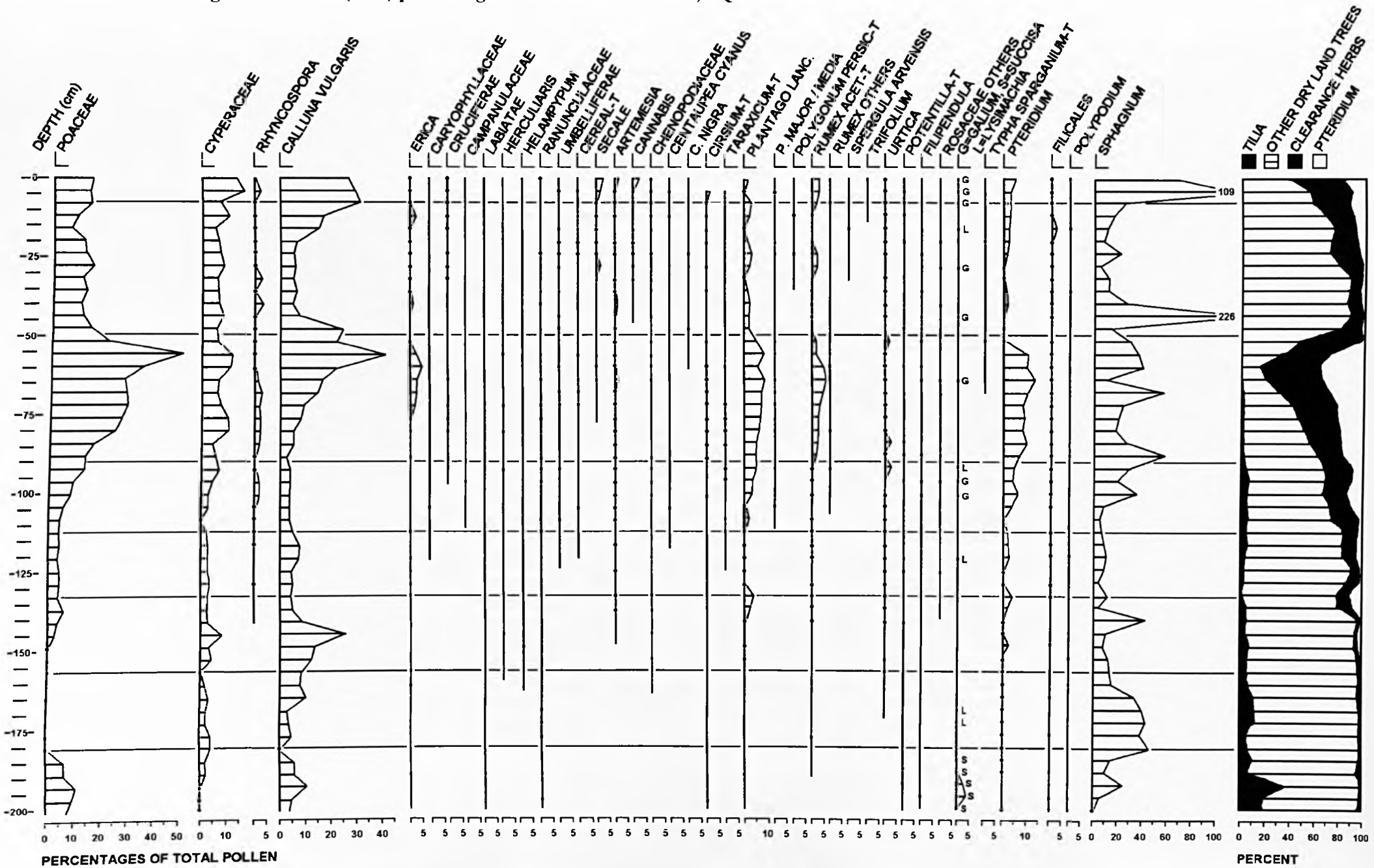


Figure 7.4; Copy of O.S. map of 1853 for Hatfield Moors

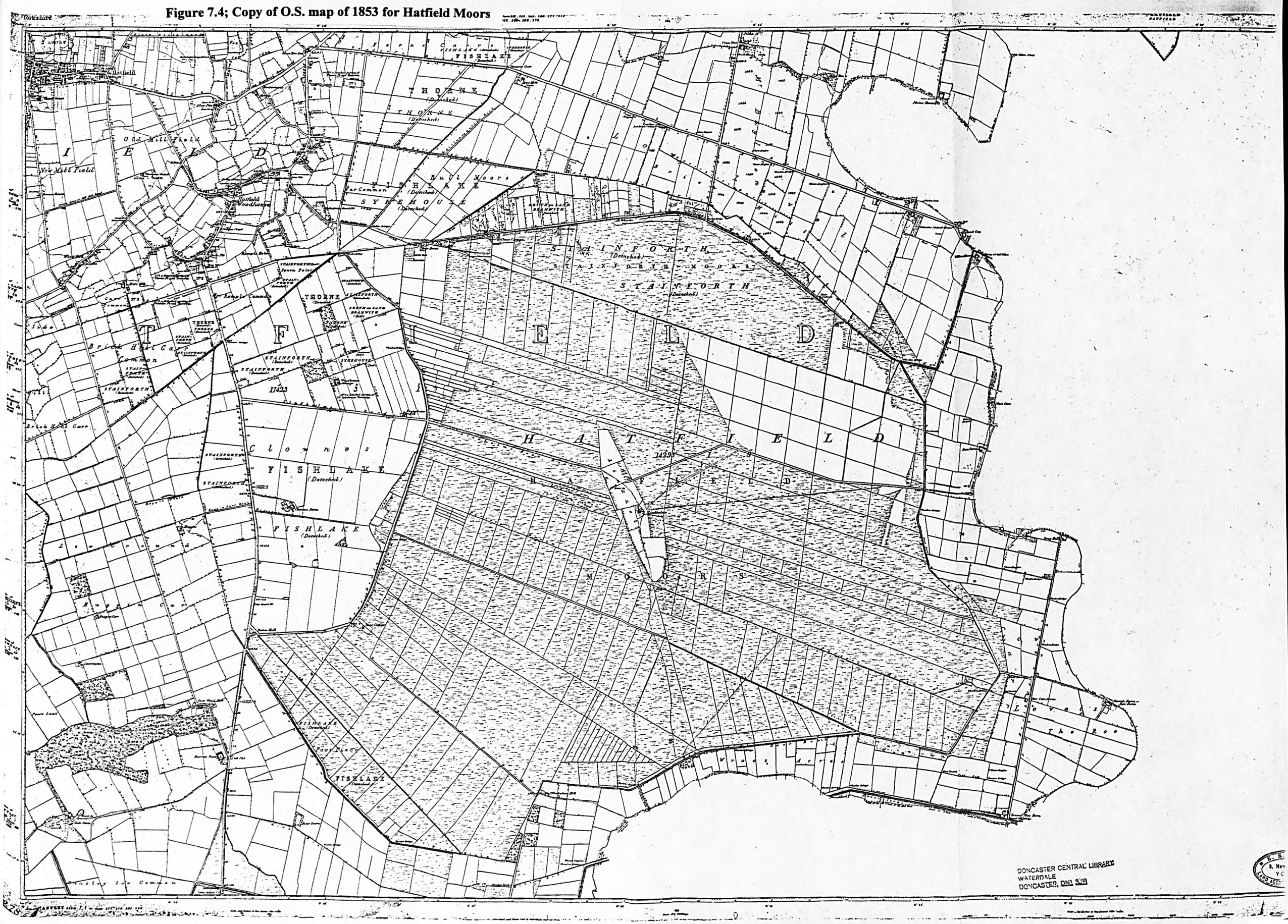


Figure 7.5. Basal peat initiation dates for Hatfield Moors

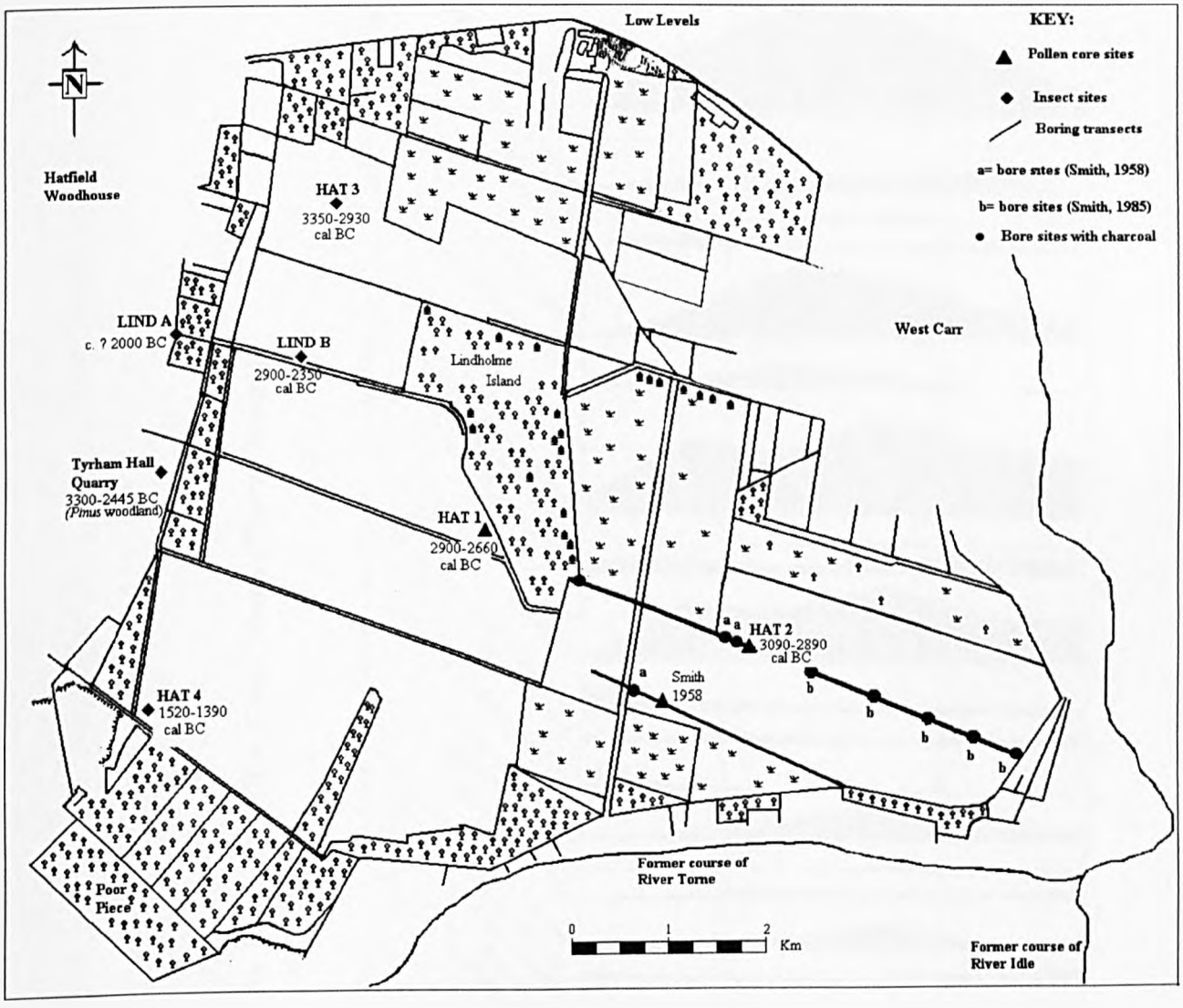


Figure 8.1; Insect macrofossil diagram for Blackwater Dike, Goole Moors (Thorne Moors)

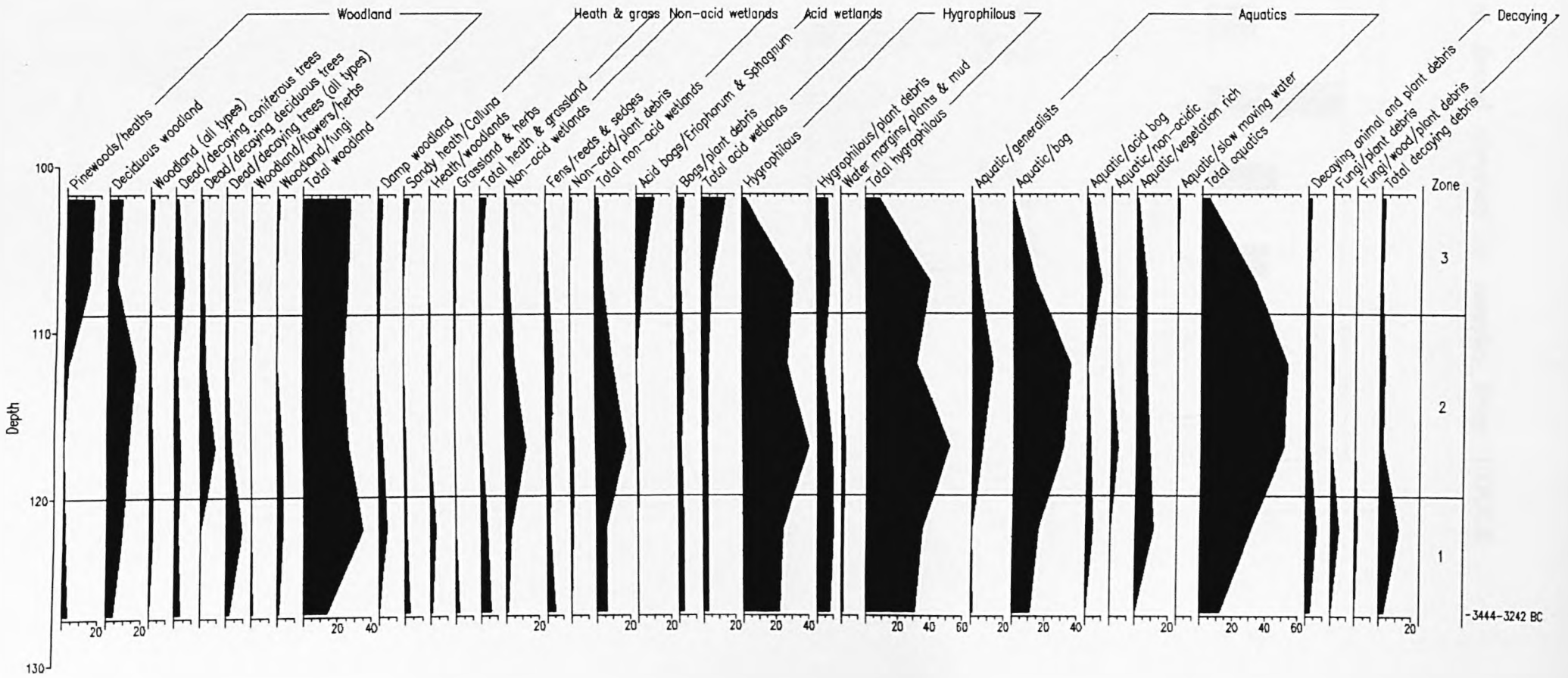
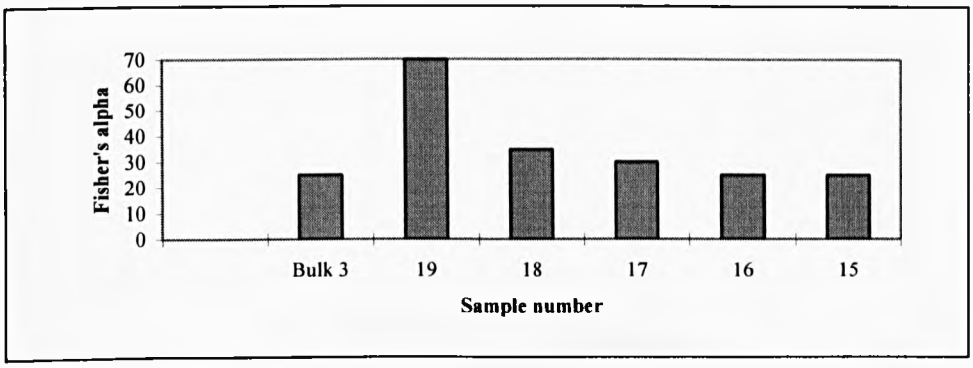
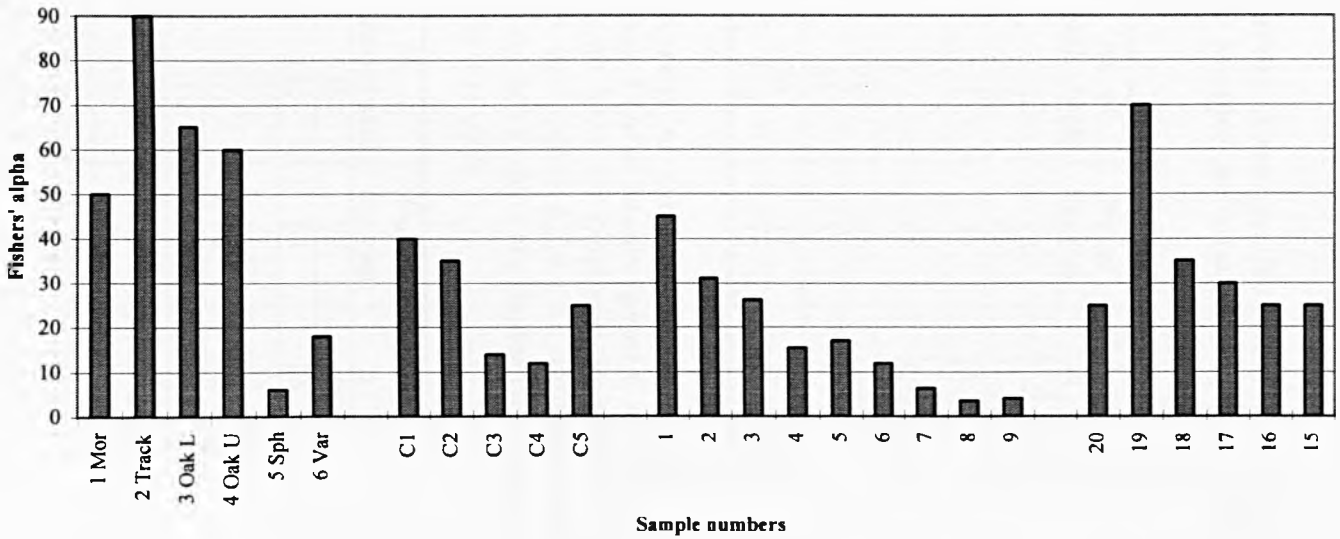


Figure 8.2; Measure of faunal diversity of samples from GOOLE (Blackwater Dike)



Sample	No. of individuals	No. of Species	Fisher's α
20	65	36	25
19	136	72	70
18	158	59	35
17	131	49	30
16	115	43	25
15	68	33	25

Figure 8.3; Faunal diversity calculated for all palaeoentomological samples from Thorne Moors (points A-D, Figure 4.3) (Data below)



Measure of faunal diversity of samples calculated for Buckland's (1979) samples from Thorne Moors (point A on Figure 4.3). Samples are not arranged chronologically:

Sample	No. of individuals	No. of Species	Fisher's α
1 Mor	42	30	50
2 Track	825	205	90
3 Oak L	763	163	65
4 Oak U	274	104	60
5 Sph	588	29	6
6 Var	49	24	18

N.B. Species numbers have been estimated.

Measure of faunal diversity of samples from Roper (1993, 1996), (point B on Figure 4.3). The samples are arranged stratigraphically, sample 1 denoting the deepest:

Sample	No. of individuals	No. of Species	Fisher's α
1	101	53	45.0
2	220	65	31.1
3	131	47	26.3
4	93	30	15.4
5	62	27	17.0
6	94	26	11.9
7	87	17	6.3
8	76	11	3.5
9	100	13	4.0

Measure of faunal diversity of samples calculated for Whitehouse's (1993, 1997) samples from Thorne Moors (point C on Figure 4.3).
N.B. Samples C1-C5 came from the same sampling location, but are not arranged chronologically. See section 8.2.4.4 for additional details. Samples B1-B3 came from *Pinus* rot holes; diversity figures have not been calculated because of the low figures involved.

Sample	No. of individuals	No. of Species	Fisher's α
C1	343	91	40
C2	182	65	35
C3	46	21	14
C4	77	26	12
C5	91	40	25
B1	2	2	-
B2	13	11	-
B3	18	3	-

Figure 8.4a; Pollen diagram GLM 1 (Smith, 1985): Trees and shrubs.

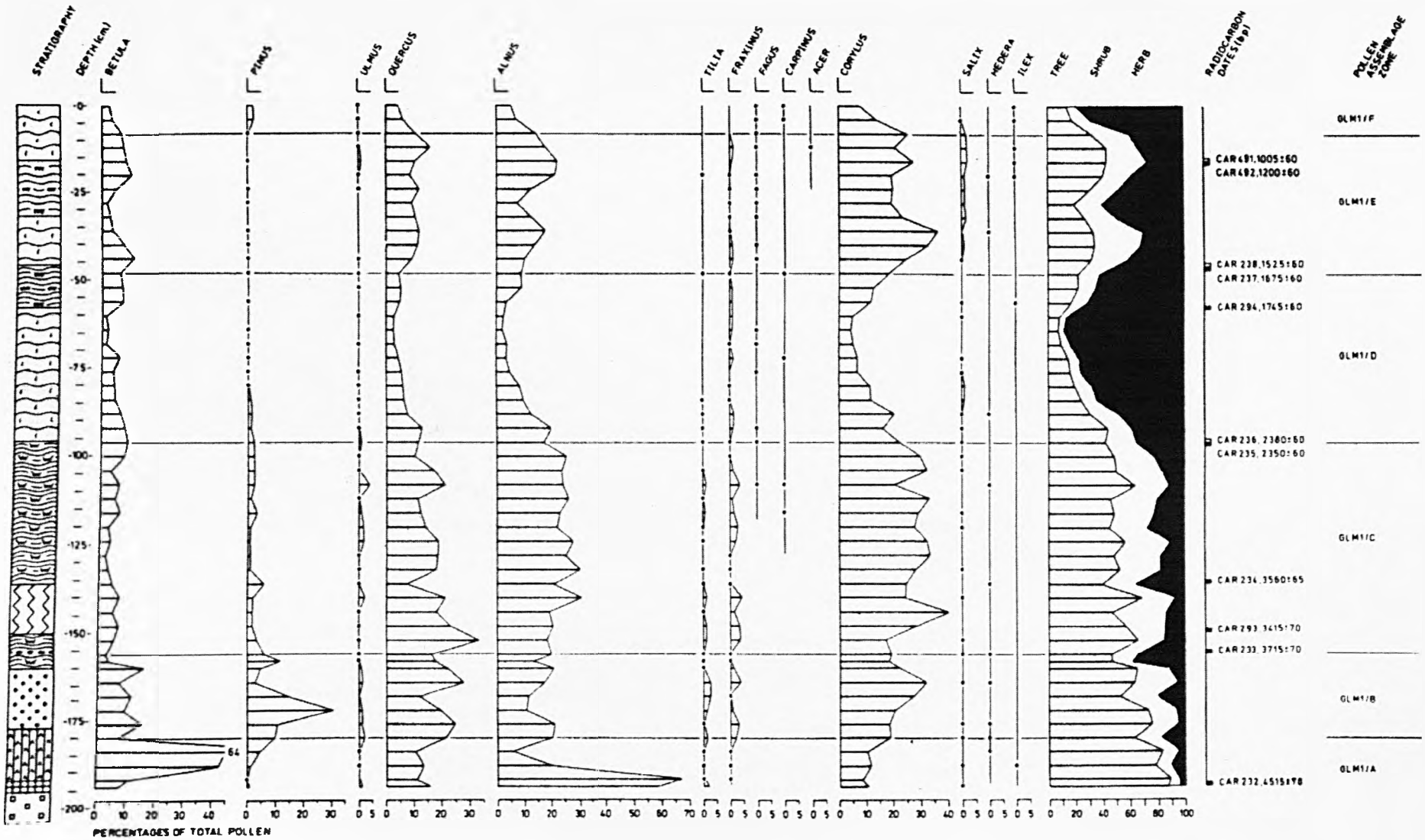


Figure 8.4b; Pollen diagram GLM 1 (Smith, 1985): Herbs, Aquatics, Cryptogams

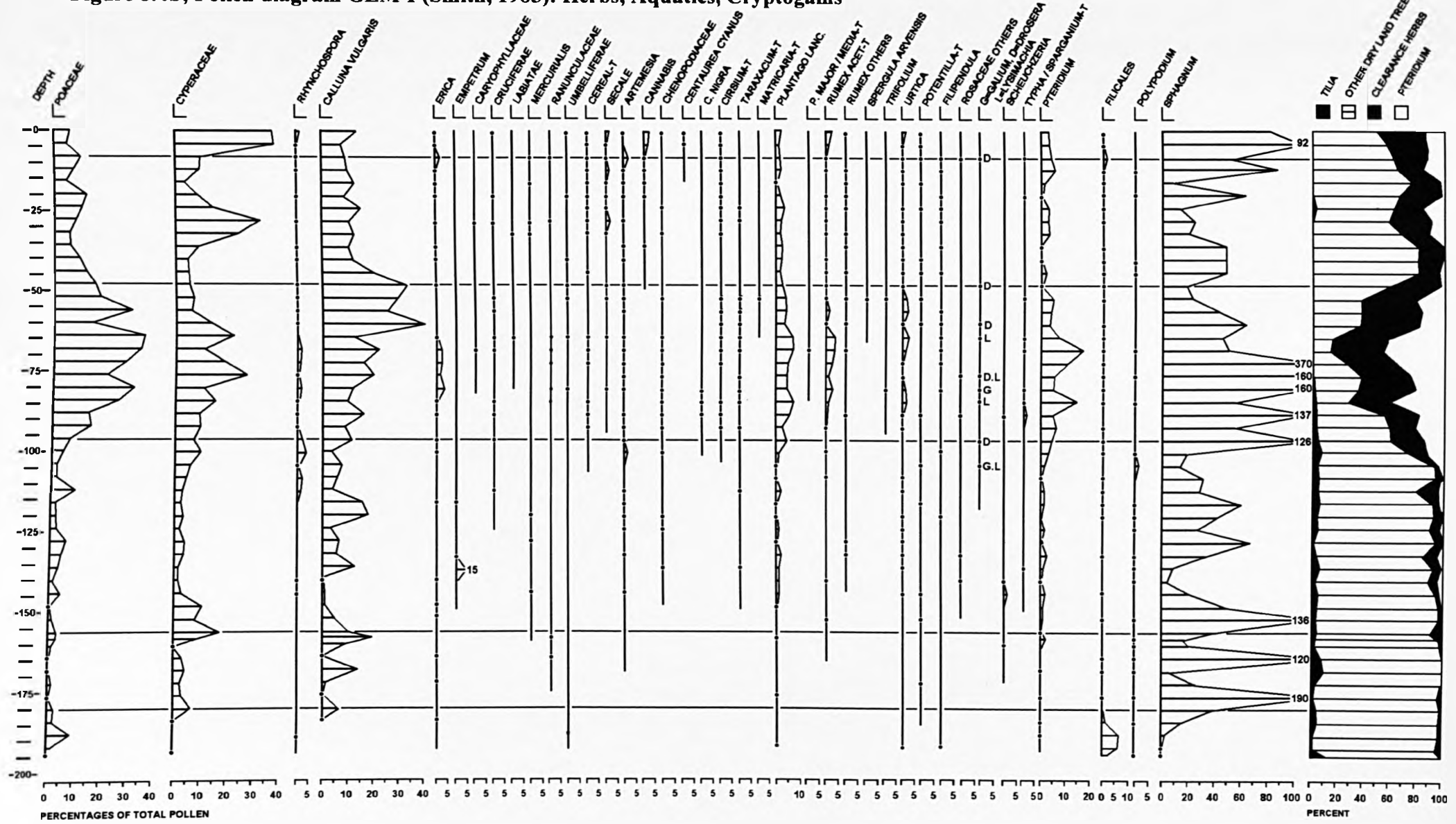


Figure 8.5 Coniferous- and deciduous-wood taxa at Blackwater Dike, Goole Moors (including dead-wood taxa).

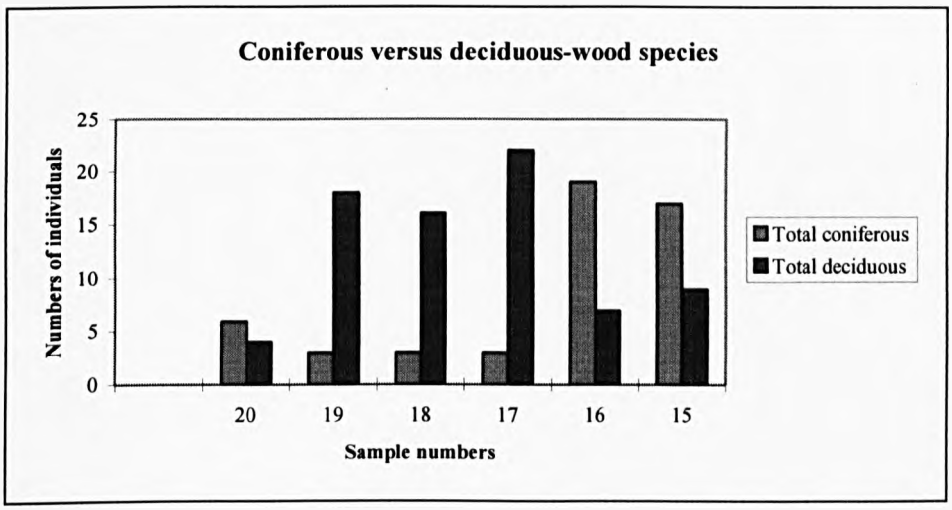
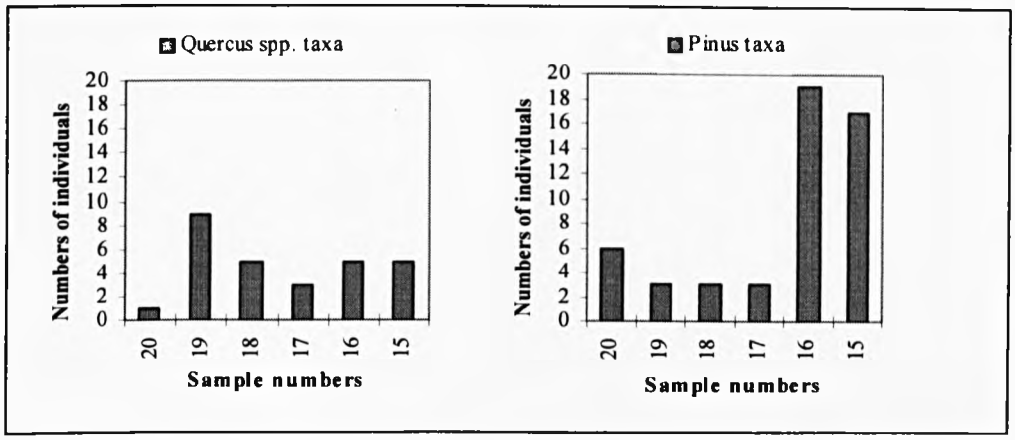
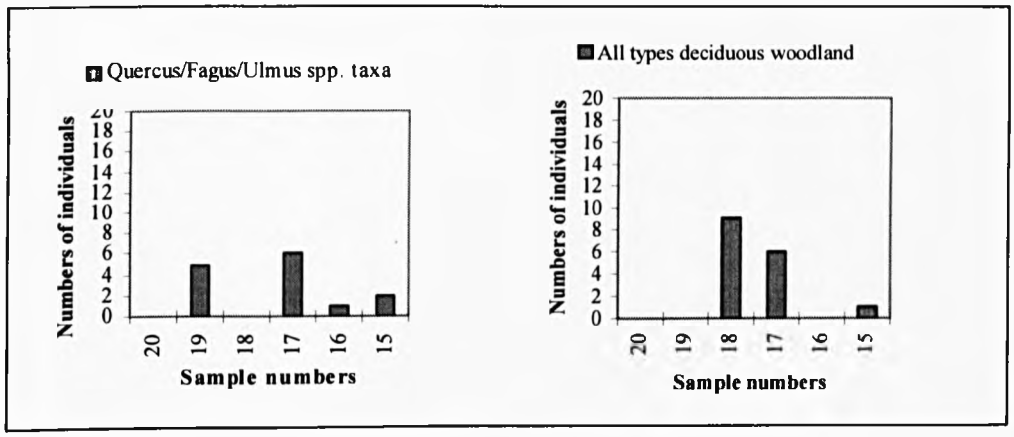


Figure 8.6 Tree taxa represented by fossil Coleoptera from Blackwater Dike, Goole Moors.





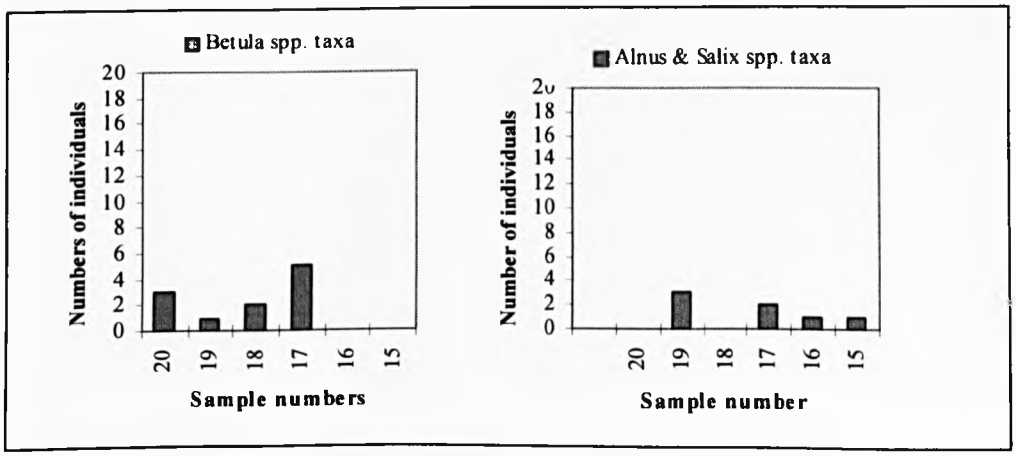
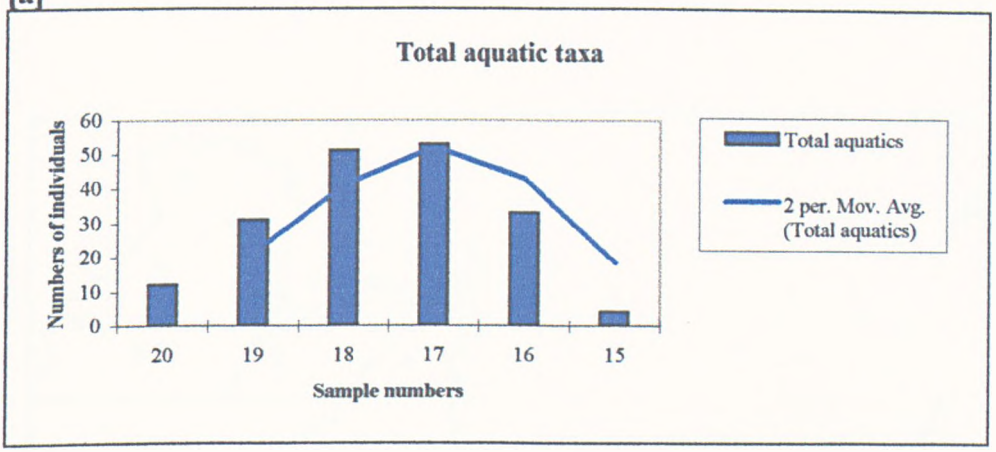
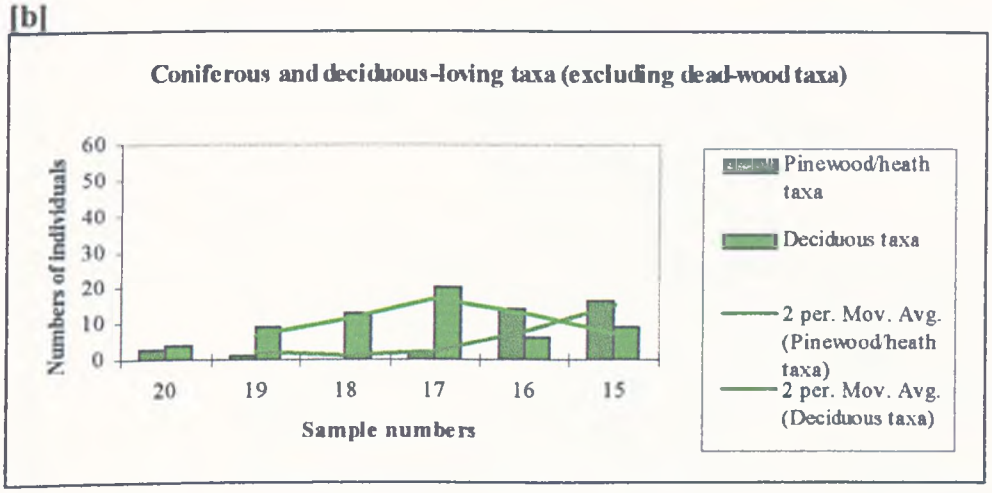


Figure 8.7 Graphs showing trends across the samples amongst aquatic species, deciduous and coniferous-loving taxa (excluding dead wood species) and acid and non-acid loving taxa.

[a]



[b]



[c]

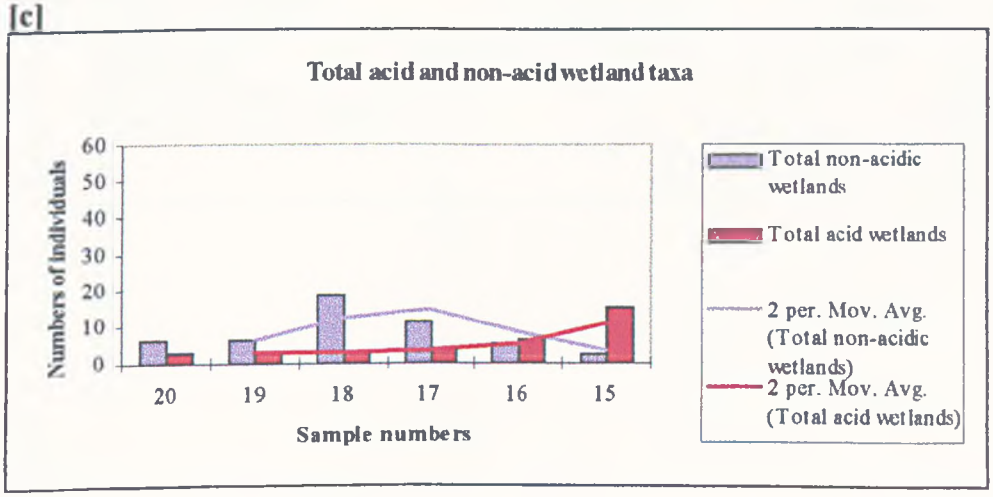


Figure 8.8. Basal peat initiation dates for Thorne Moors.

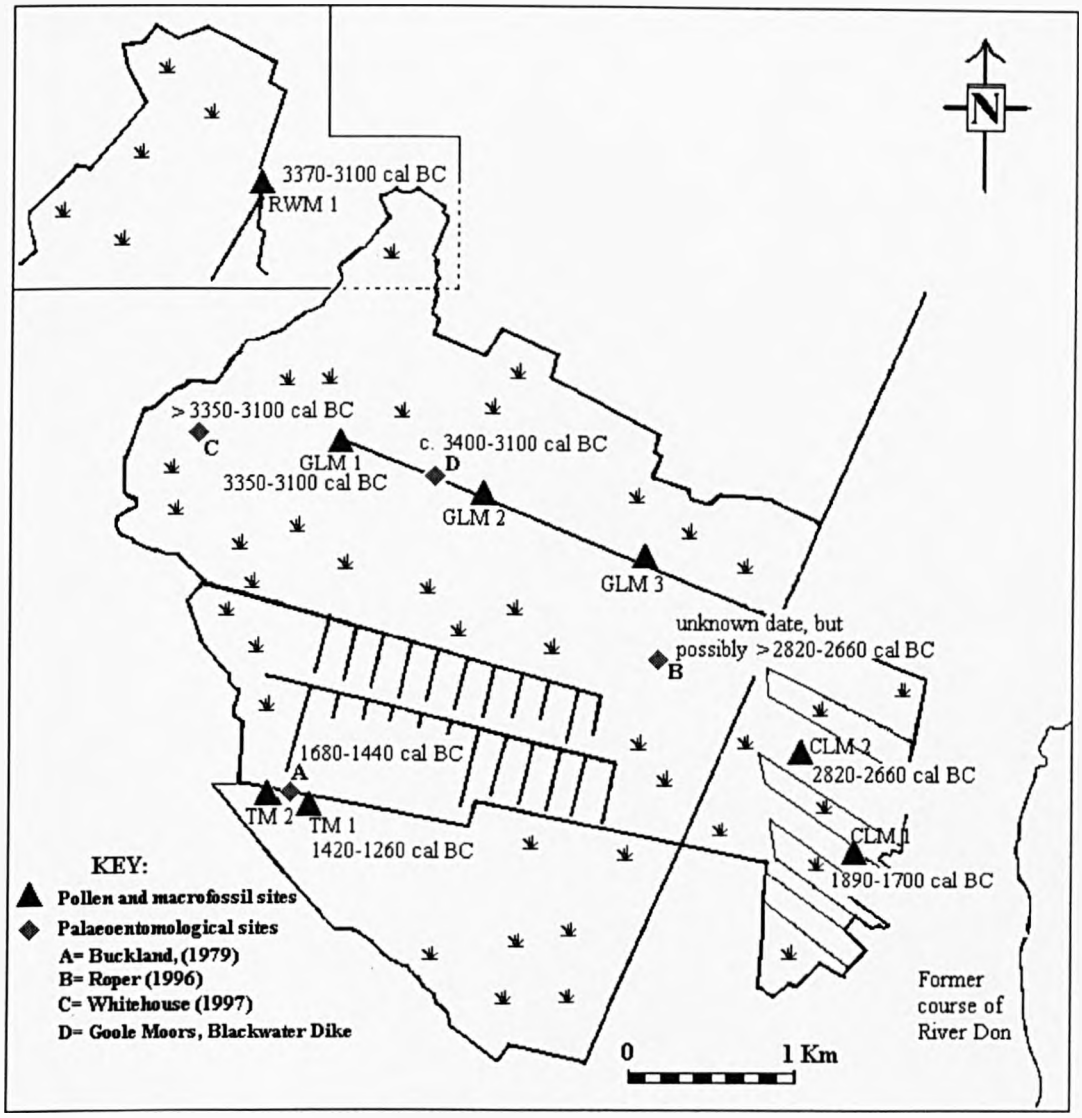


Figure 8.9; Distribution of *Quercus* and burnt trees across Thorne Moors (after Whitehouse, 1997a).

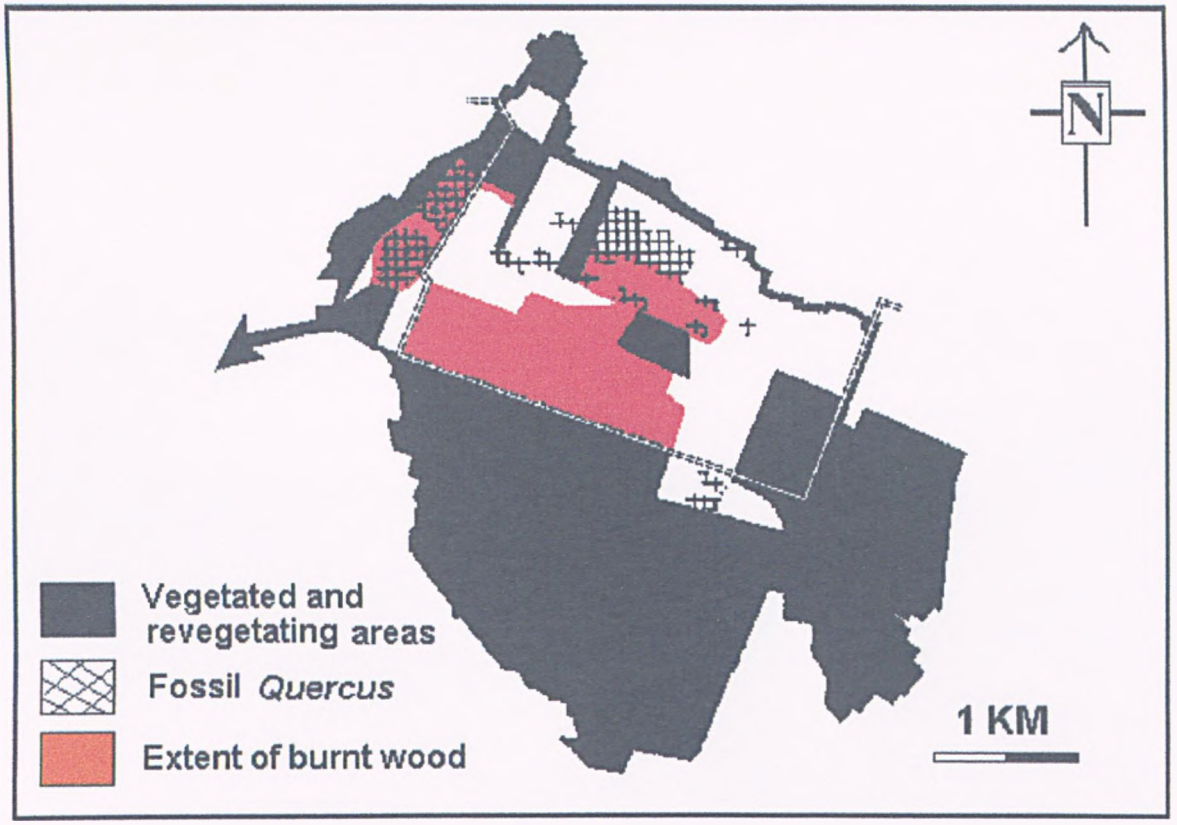


Figure 9.1; CA plot of samples from Thorne and Hatfield Moors. Quadrants are lettered A-D (N.B. Not all samples are displayed in this plot; to display all points quadrants have to be enlarged, as following figures show)

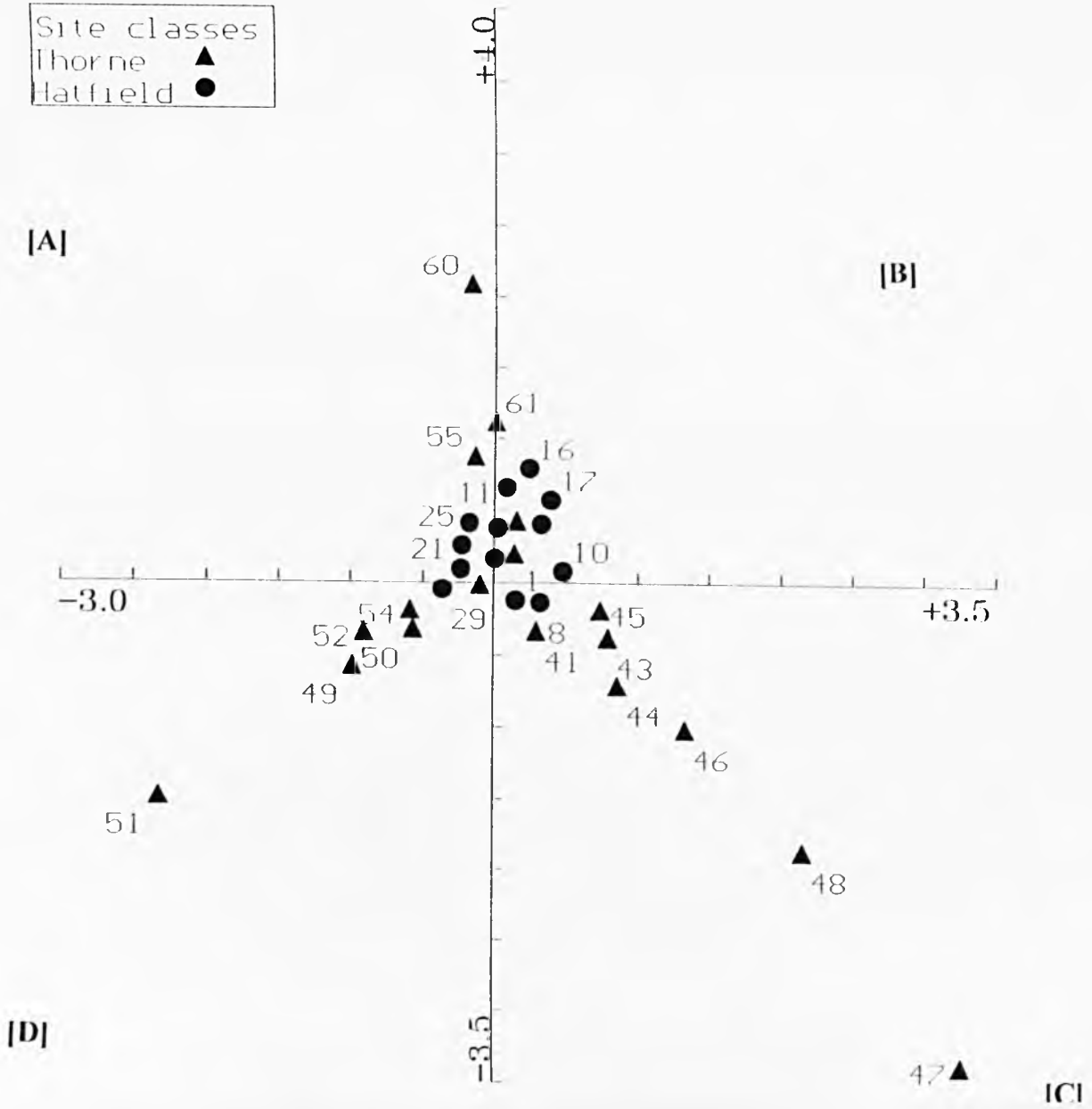


Figure 9.2; Enlarged CA plot of samples from Thorne and Hatfield Moors.

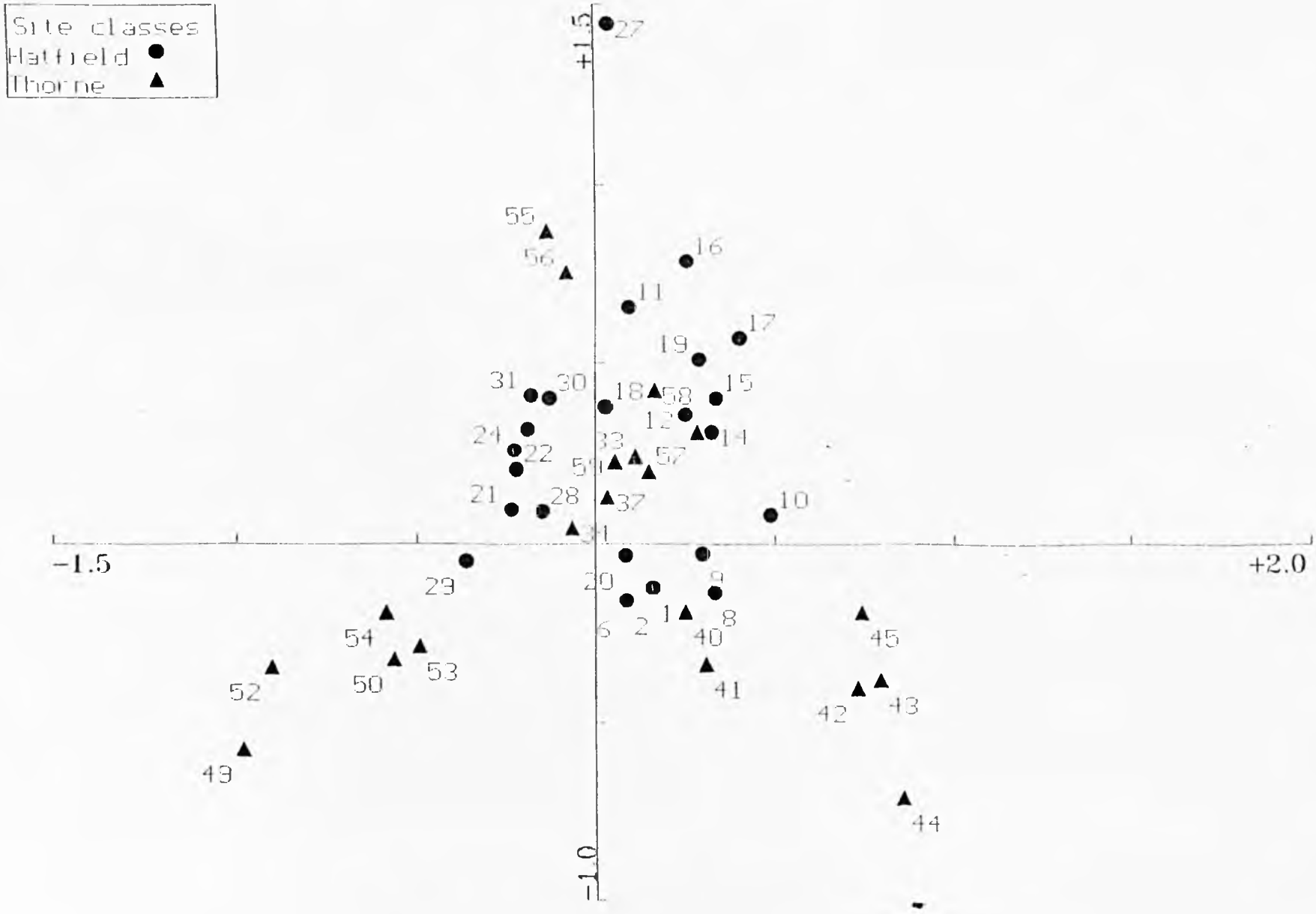


Figure 9.3; Sample plot, quadrant C highlighting Goole 1 (Thorne Moors) samples (Roper, 1993, 1996).

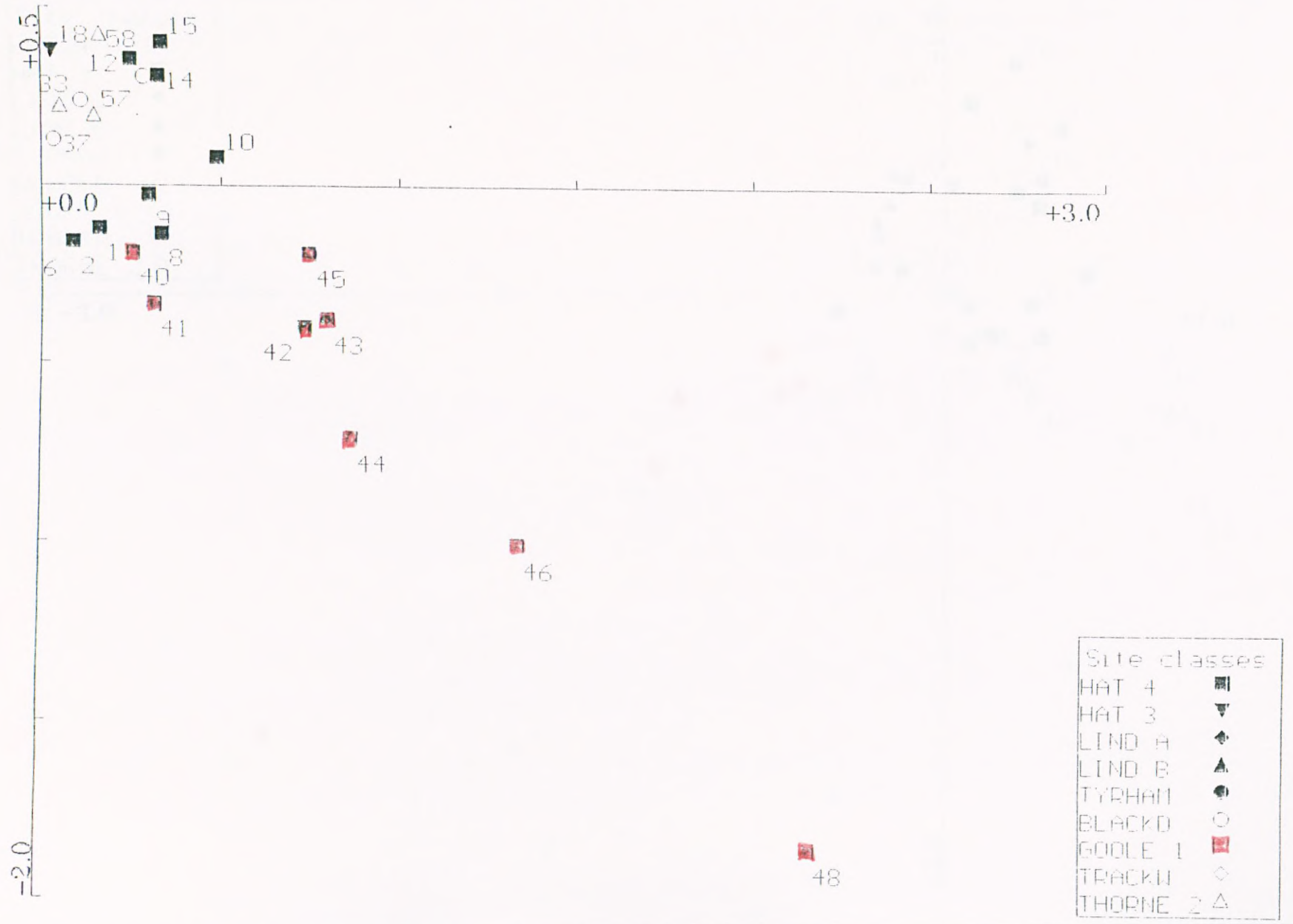


Figure 9.4; Sample plot, quadrant D highlighting Trackway (Thorne Moors) samples (Buckland, 1979).

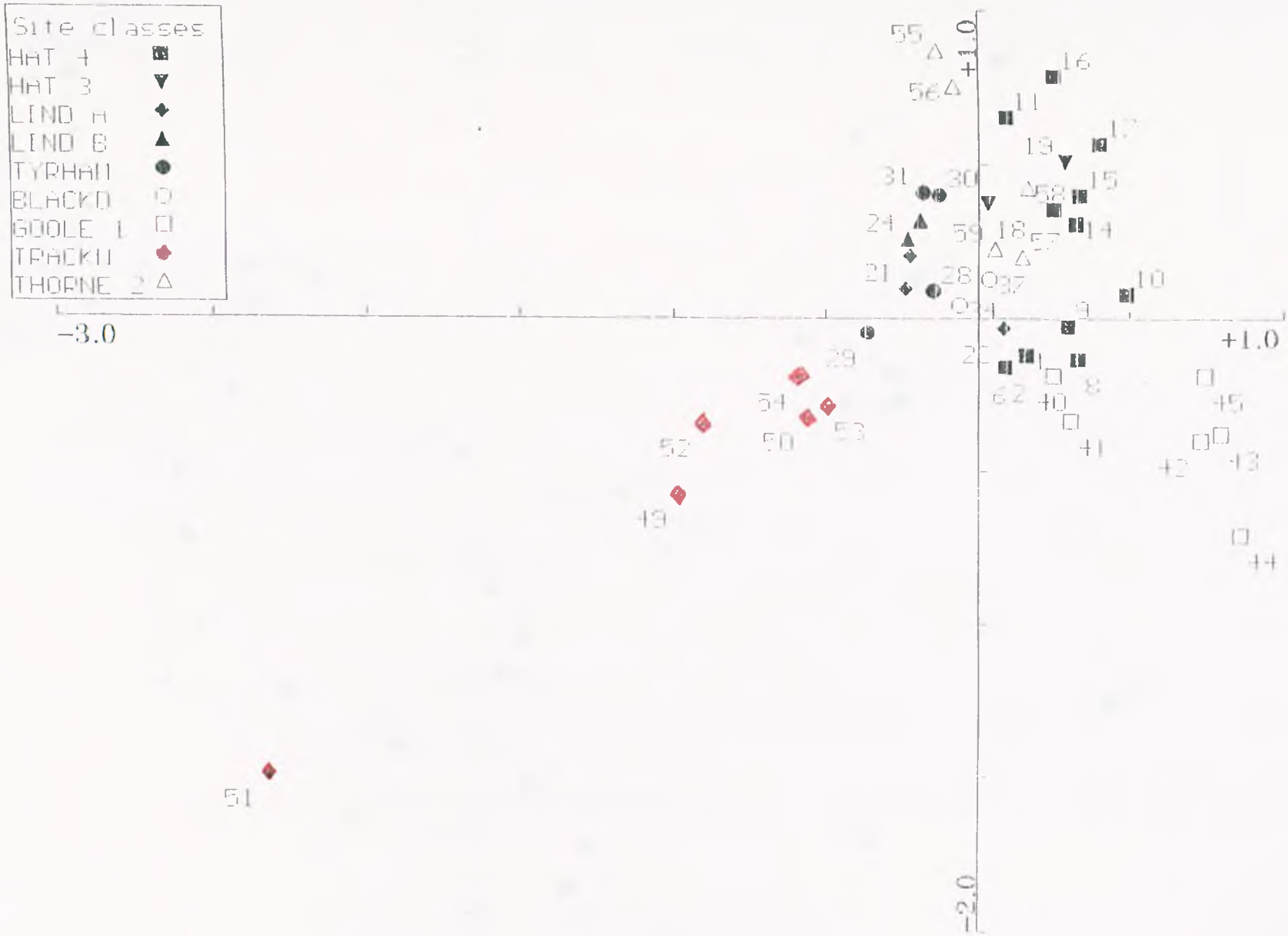


Figure 9.5; Sample plot, quadrants A & B highlighting Blackwater Dike (Thorne Moors) samples (chapter 8).

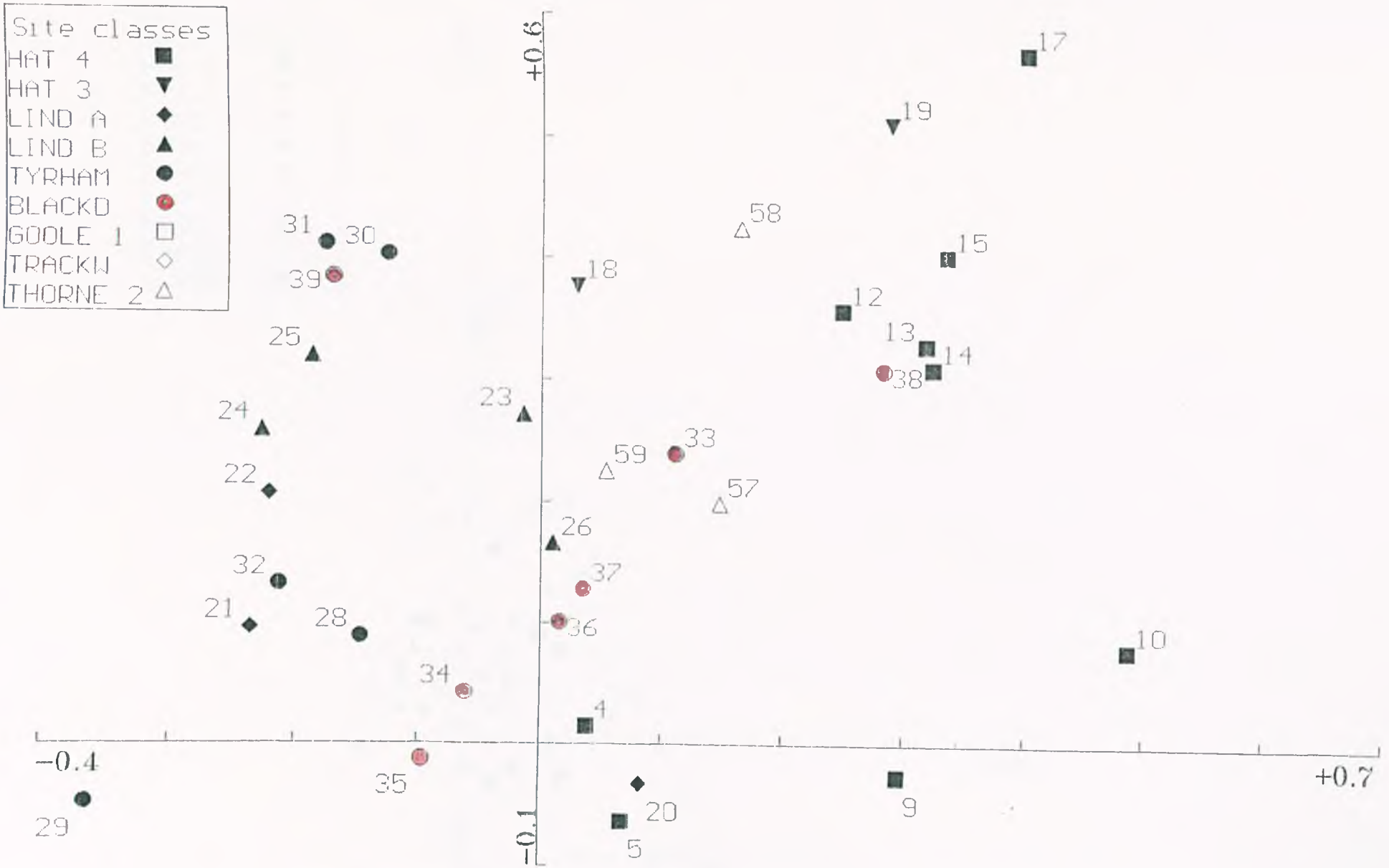


Figure 9.6: Sample plot, Thorne 2 samples (Whitehouse, 1993, 1997).

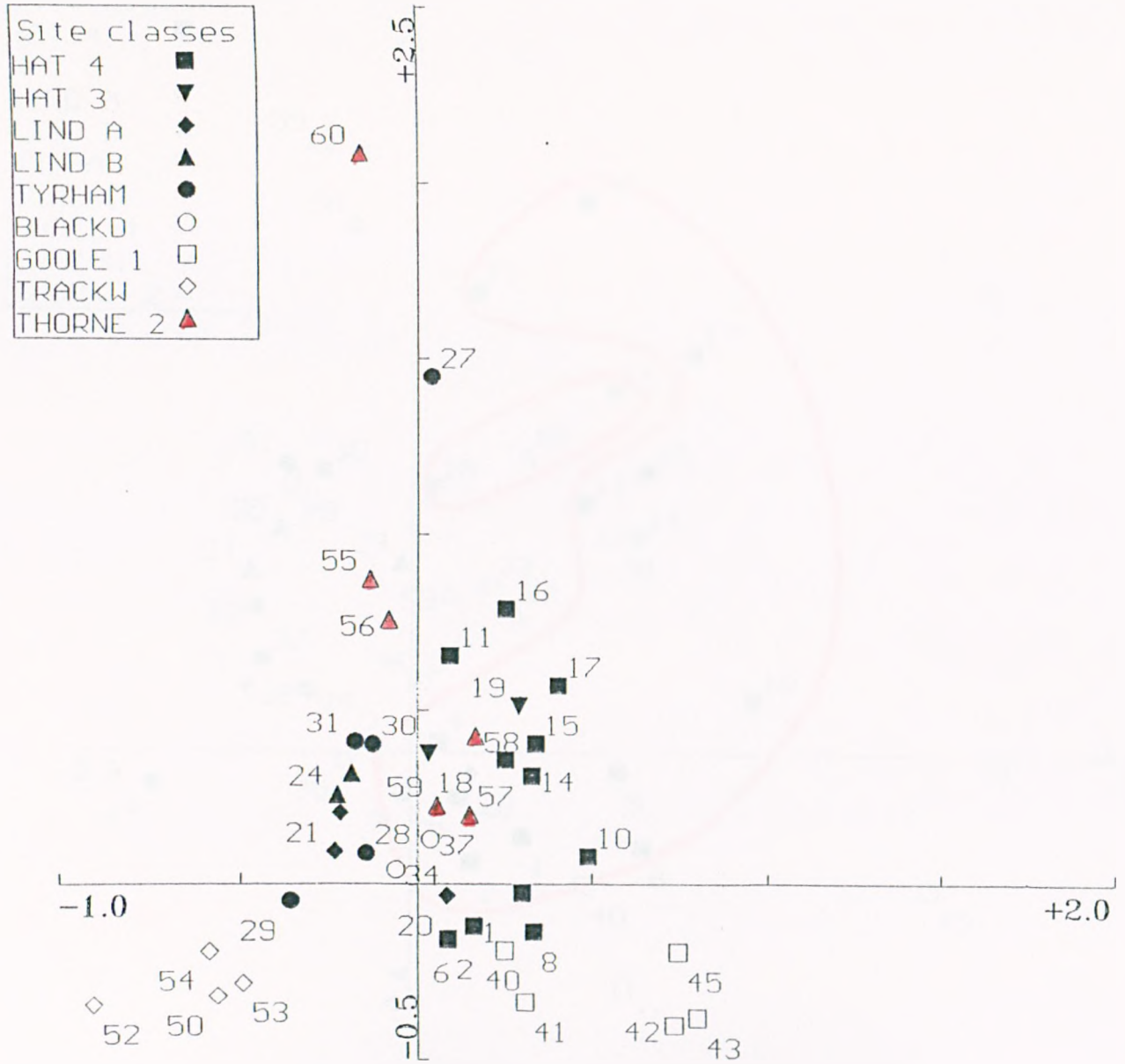


Figure 9.7; Sample plot, HAT 3 and HAT 4 samples (Hatfield Moors), Chapter 6.

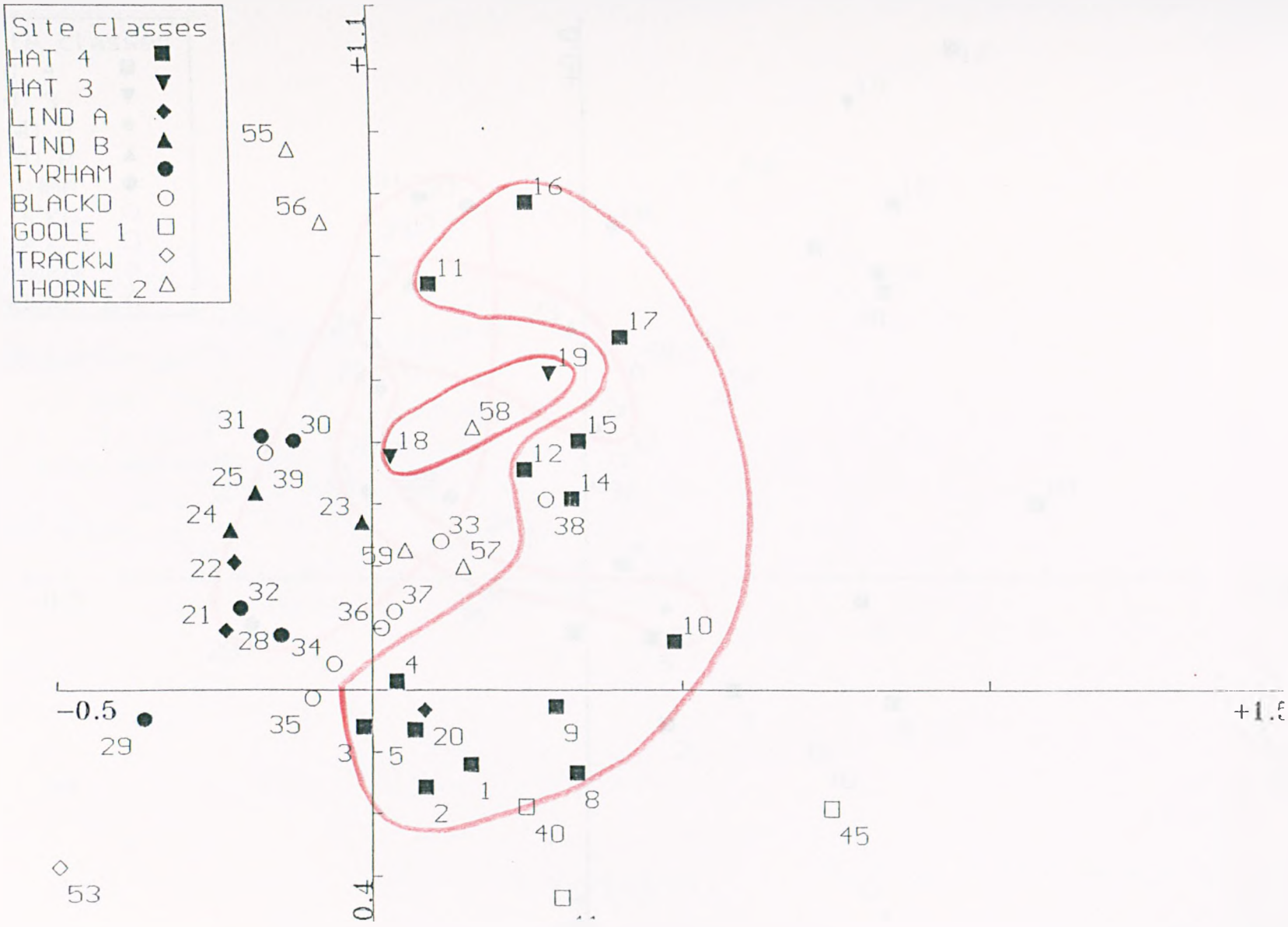
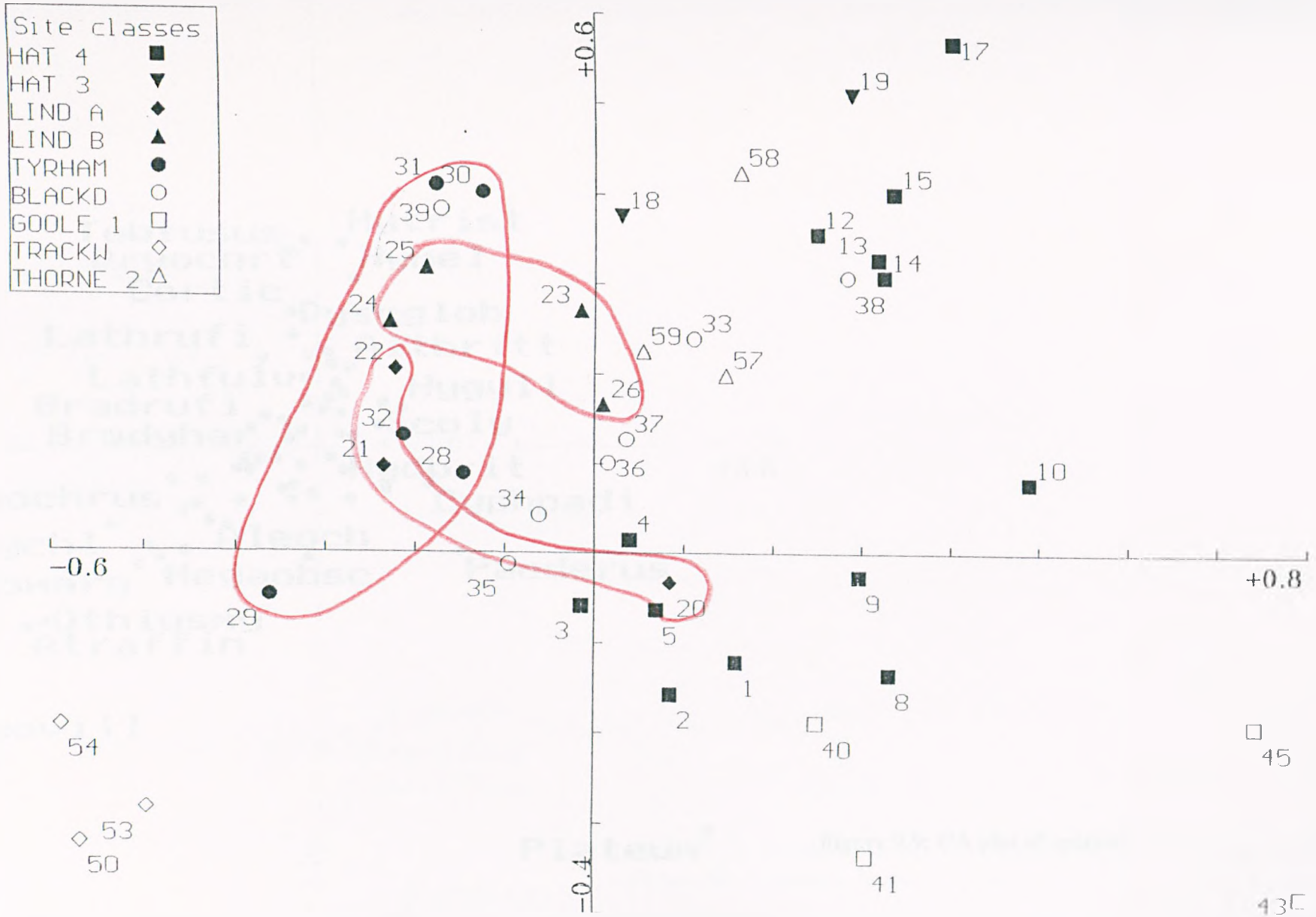


Figure 9.8: Sample plot, LIND A, B and TYRHAM samples (Hatfield Moors), Chapter 6.



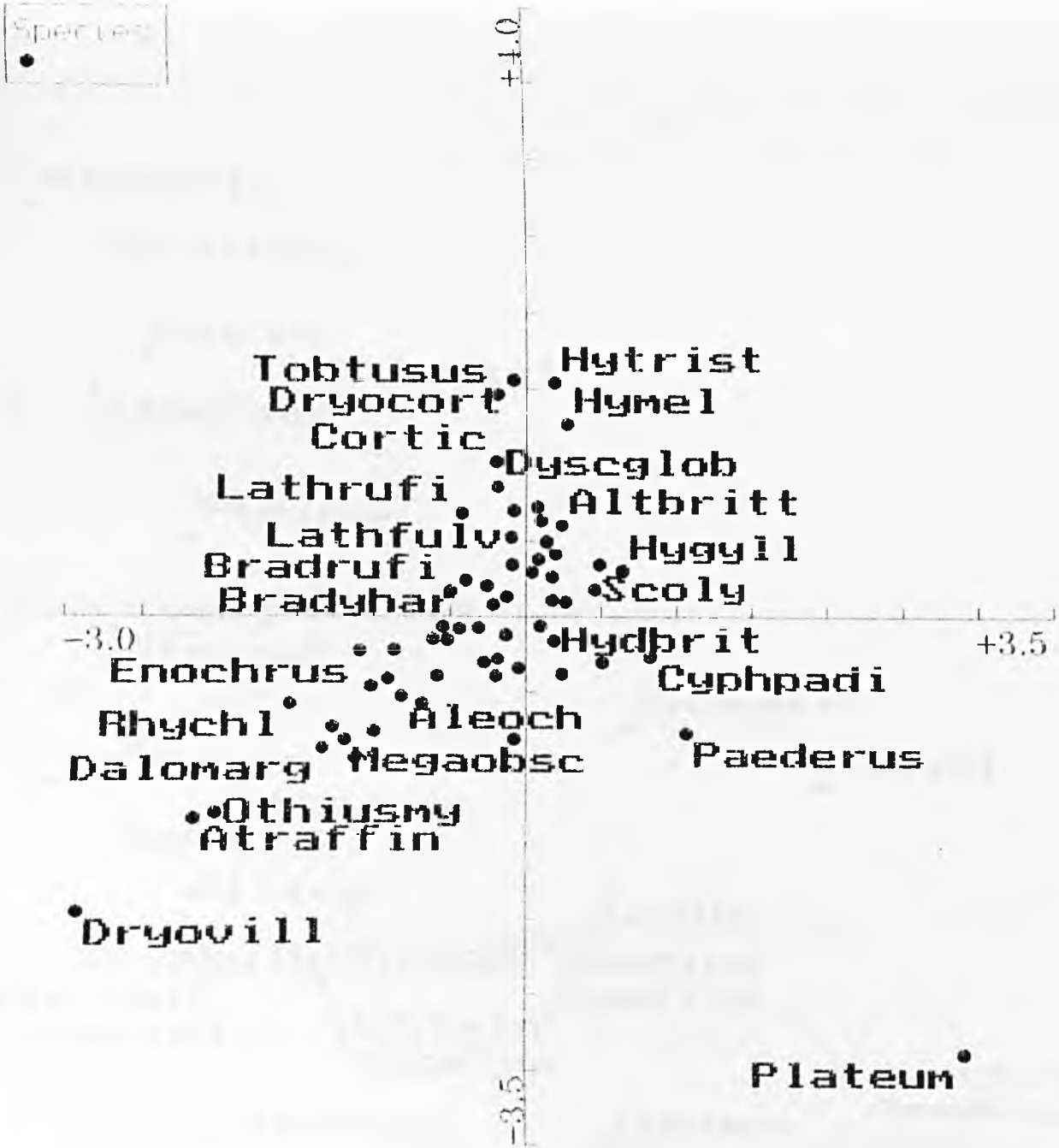


Figure 9.9; CA plot of species.

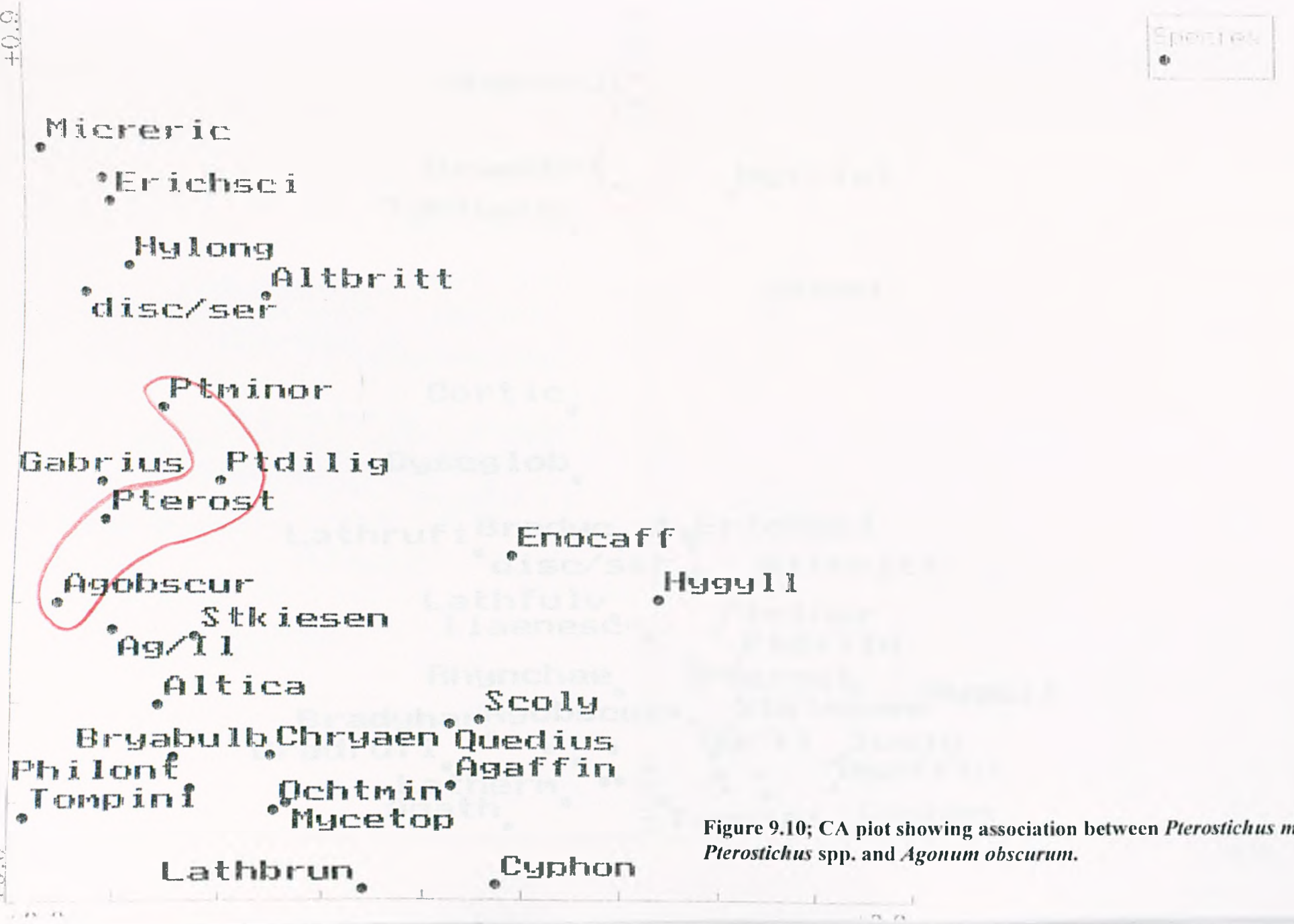
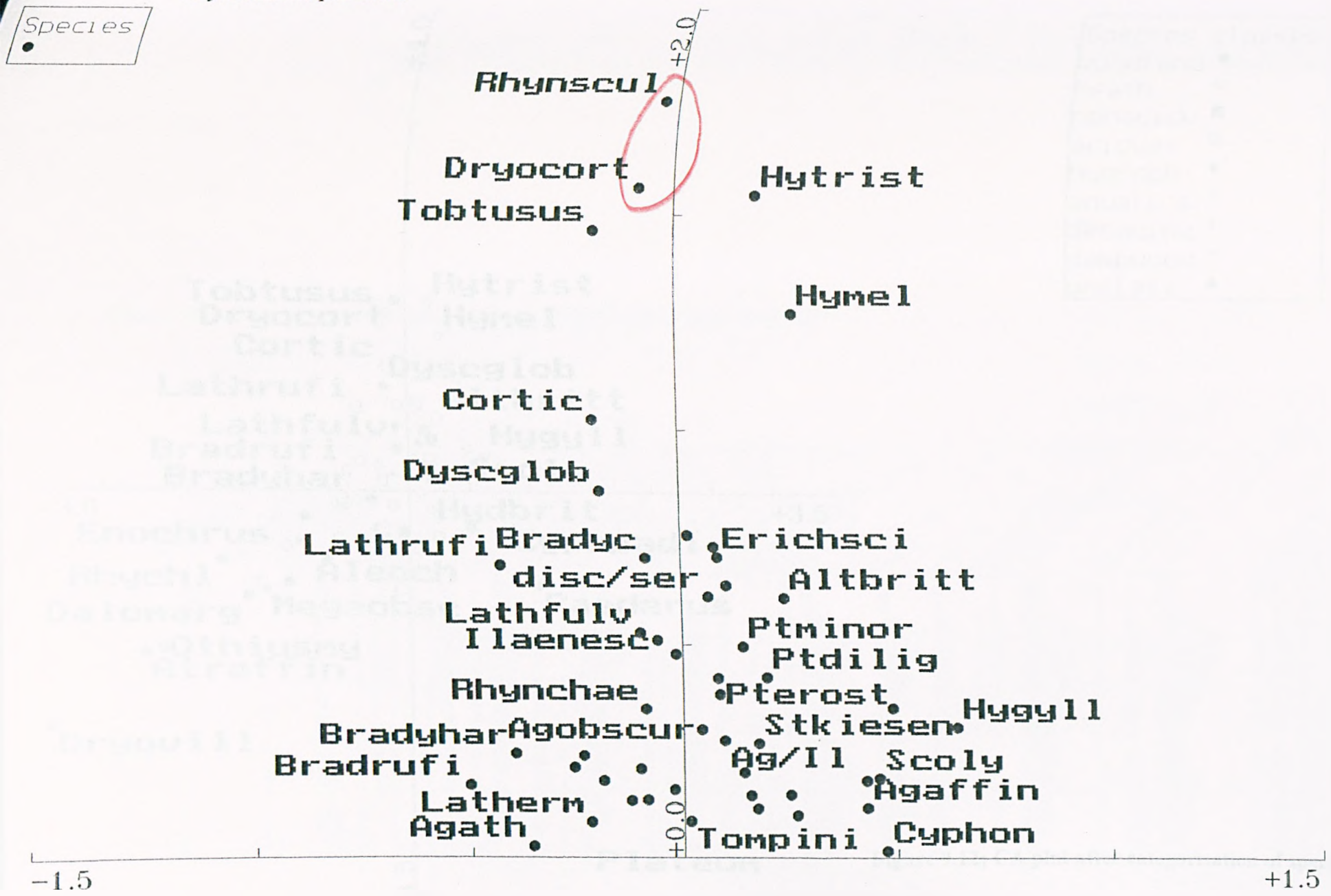


Figure 9.10; CA plot showing association between *Pterostichus minor*, *P. diligens*, *Pterostichus* spp. and *Agonum obscurum*.

Figure 9.11; CA plot showing association between Dryophthorus corticalis and Rhyncolus sculpturatus.



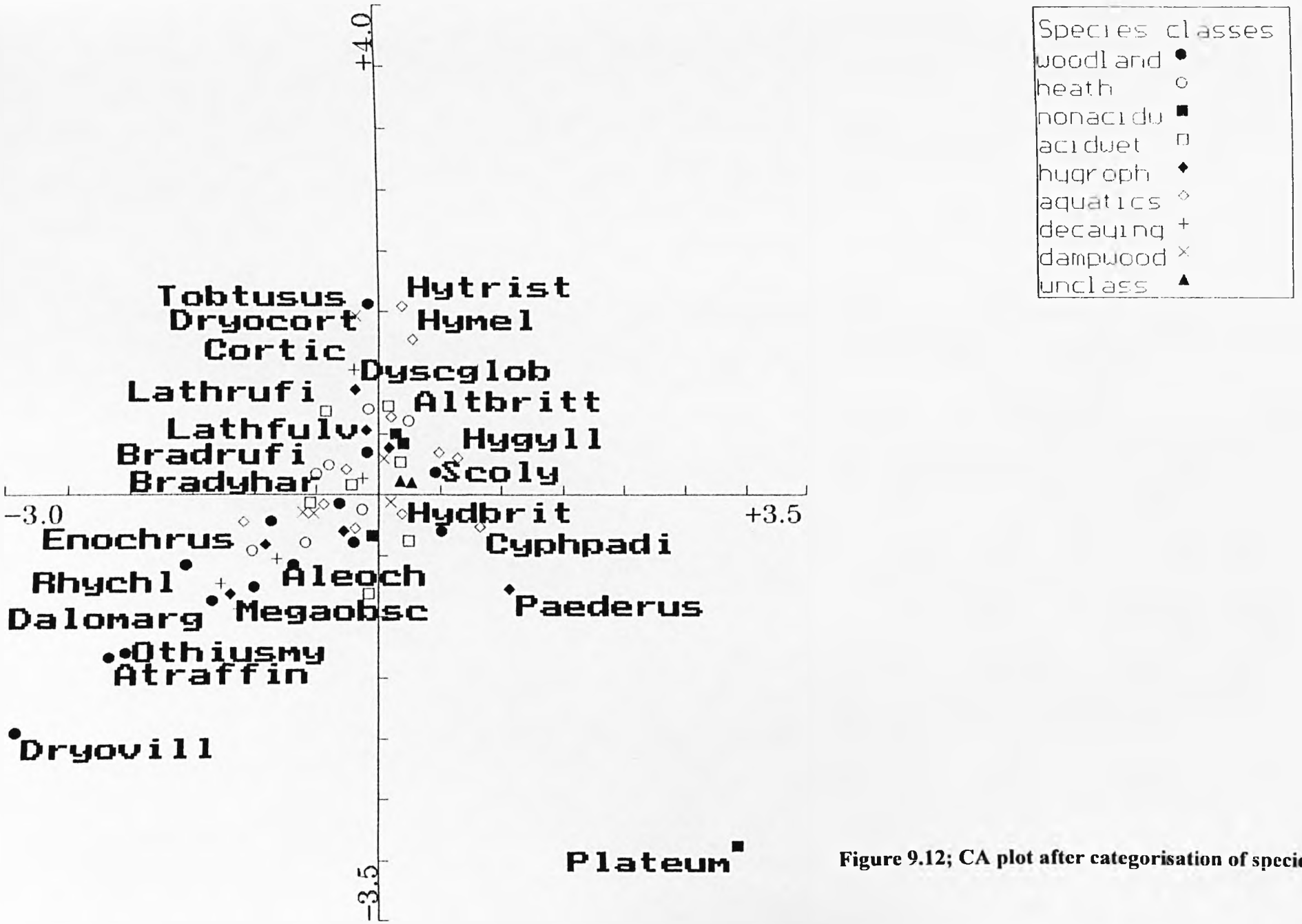


Figure 9.12; CA plot after categorisation of species.

Figure 10.1; Insect macrofossil diagram for Hayfield Lodge Farm, Rossington

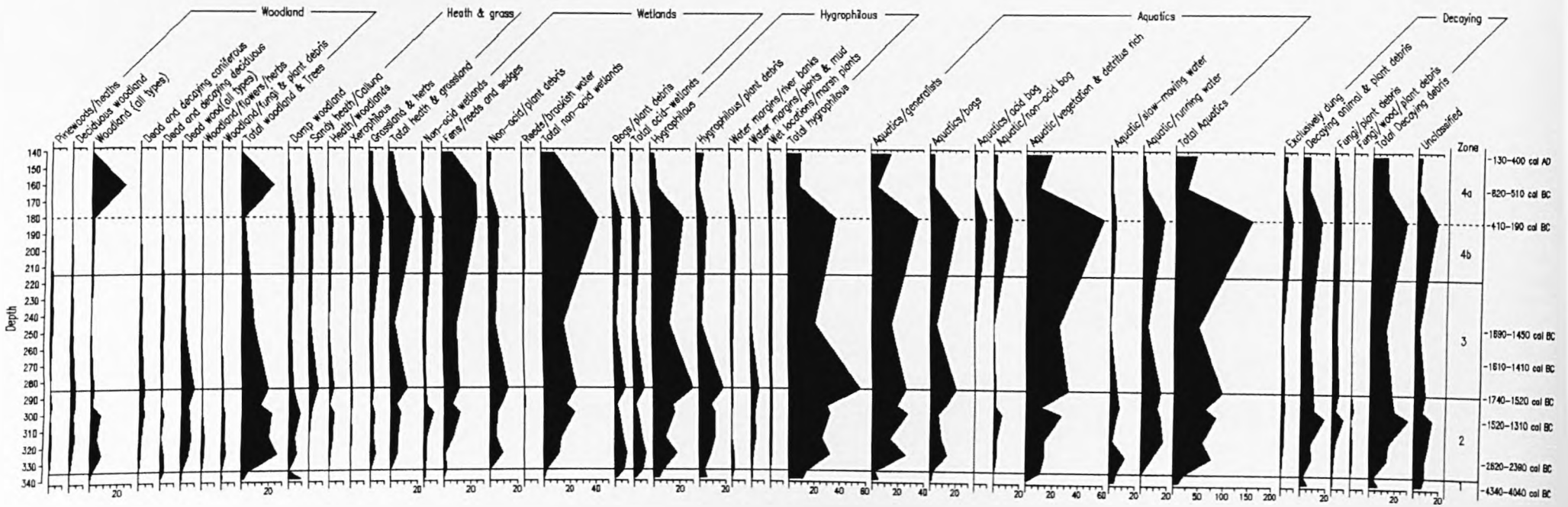
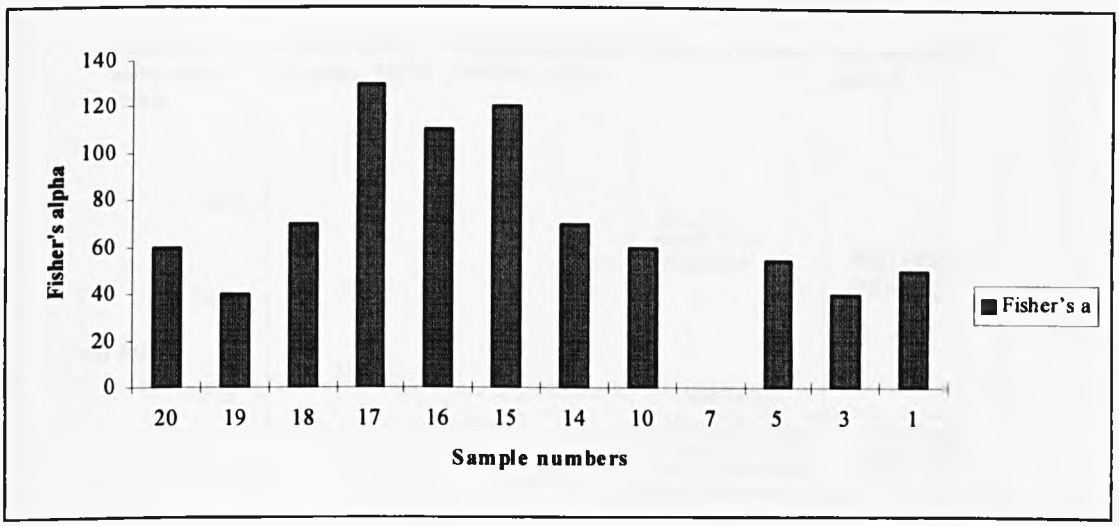


Figure 10.2; Diversity indices for Hayfield Lodge farm, Rossington.



Sample	No. of individuals	No. of Species	Fisher's α
20	41	32	60
19	61	38	40
18	186	91	70
17	157	98	130
16	225	120	110
15	158	93	120
14	246	104	70
10	117	62	60
7	4	4	-
5	309	122	55
3	83	45	40
1	83	52	50

Figure 10.3; Diagram showing main changes indicated by fossil insect data and correlation with Mather's (1991) pollen diagram.

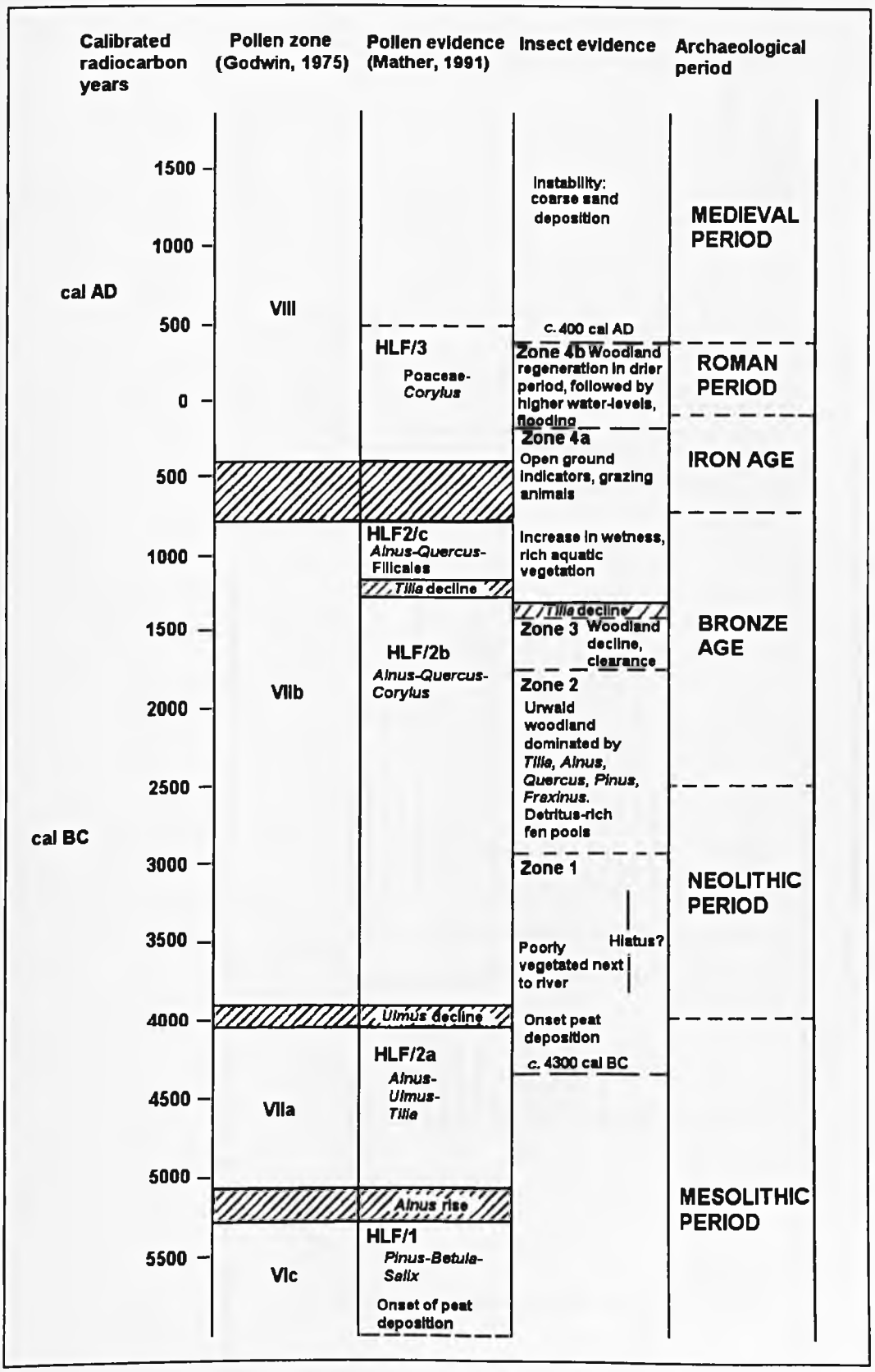


Figure 10.4a; Mather (1991) relative pollen diagram for Hayfield Lodge Farm, Rossington (trees and shrubs)

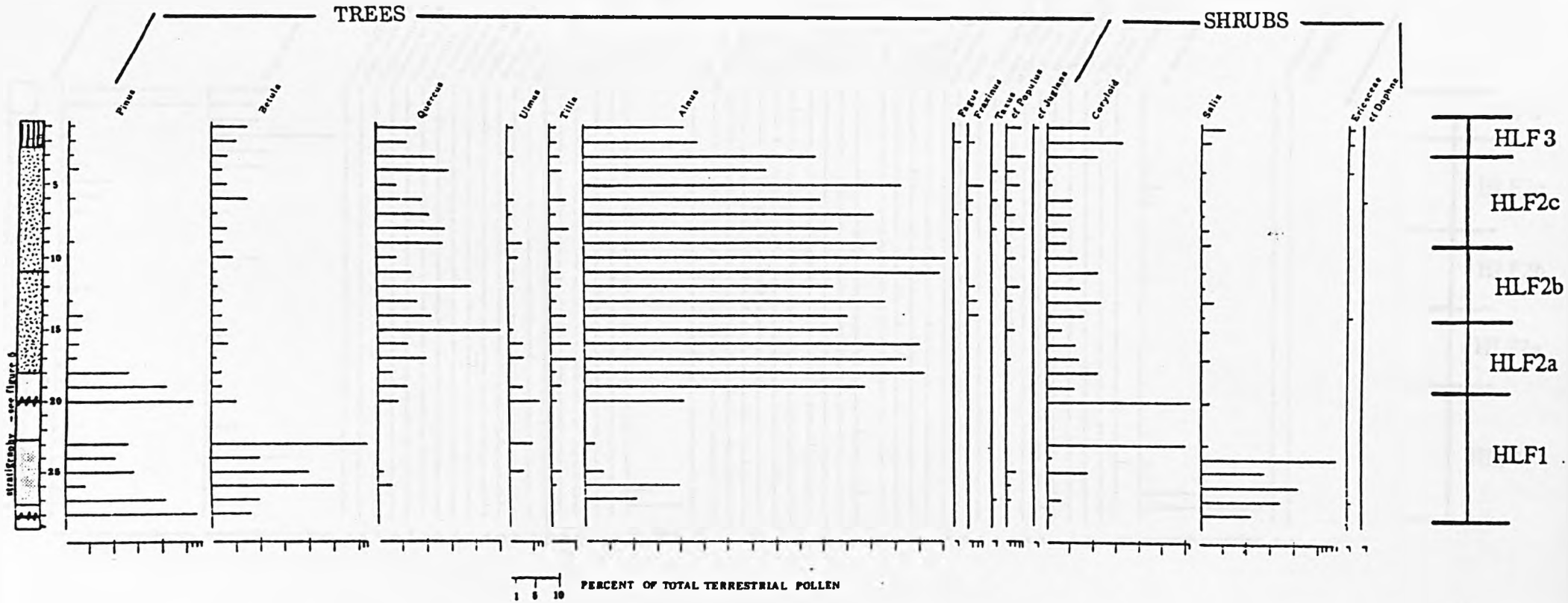


Figure 10.4b; Mather (1991) relative pollen diagram for Hayfield Lodge Farm, Rossington (herbs)

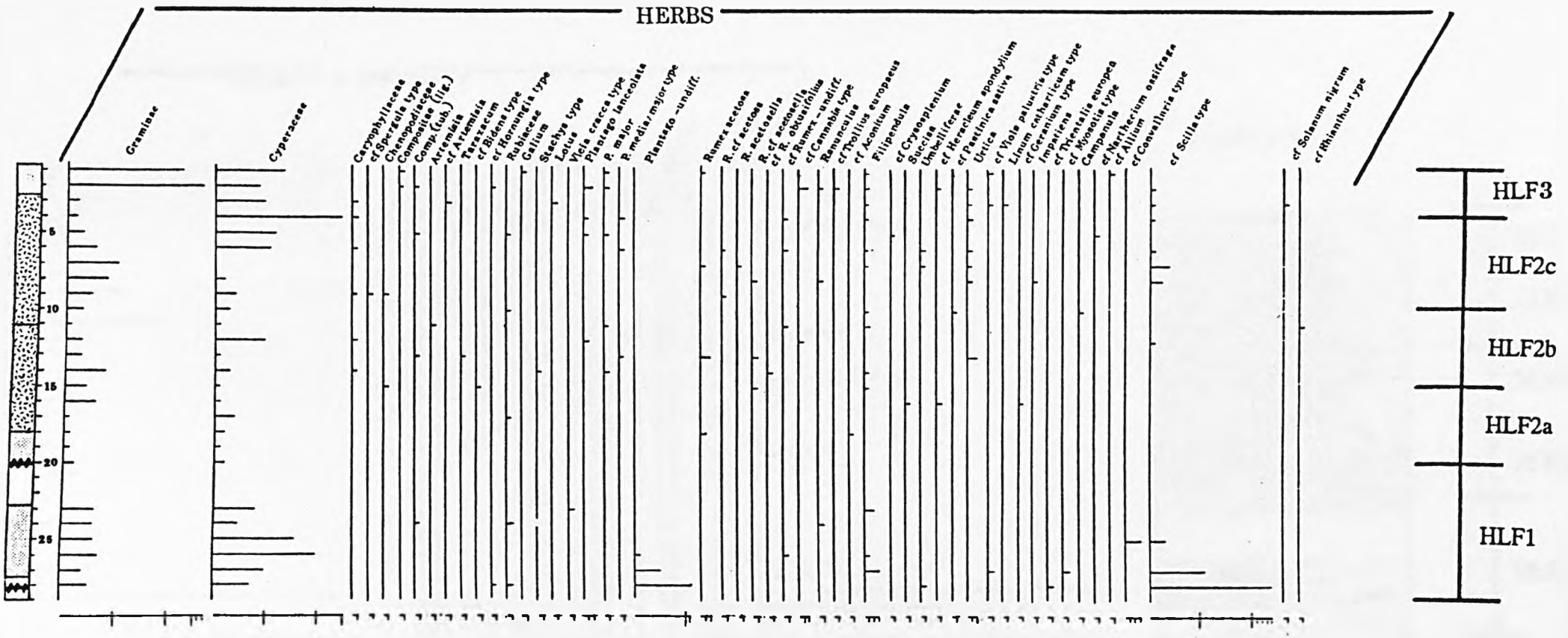


Figure 10.4c; Mather (1991) relative pollen diagram for Hayfield Lodge Farm, Rossington (spores and aquatics)

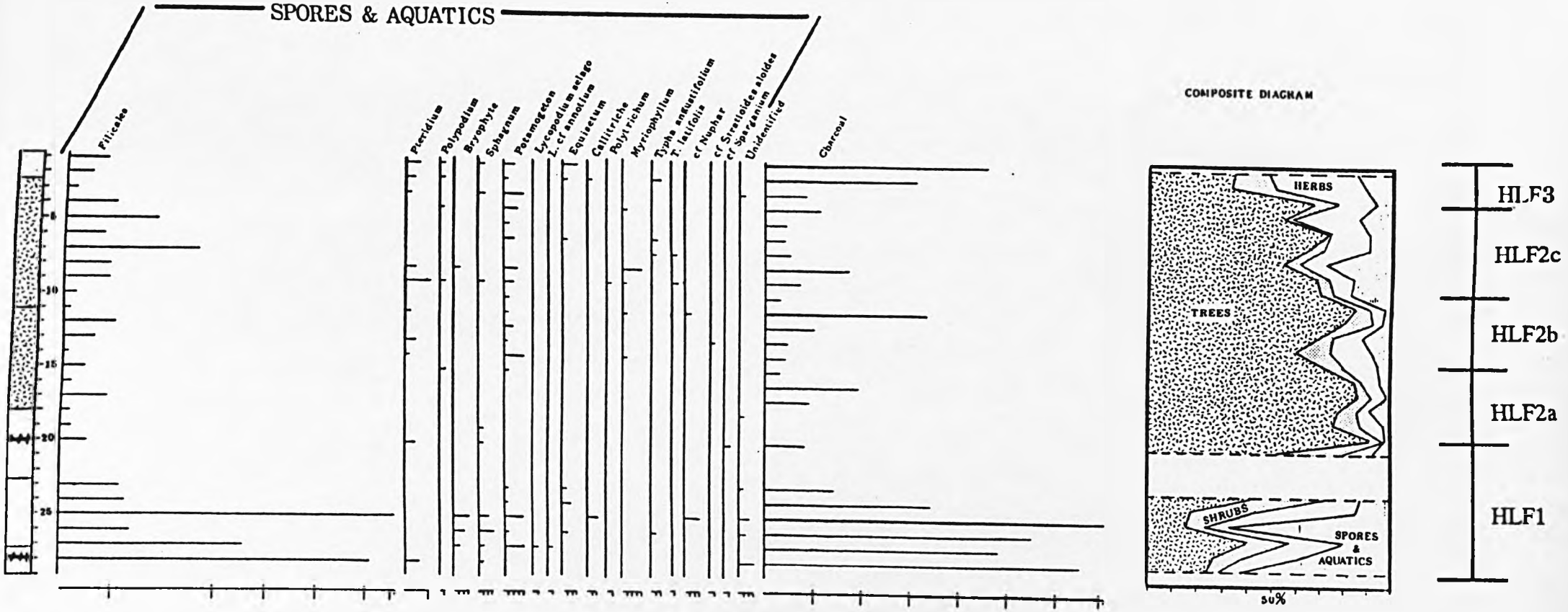


Figure 11.1; Klinger's (1996) Bog Climax Theory, where peat formation occurs as a result of both terrestrialisation and paludification.

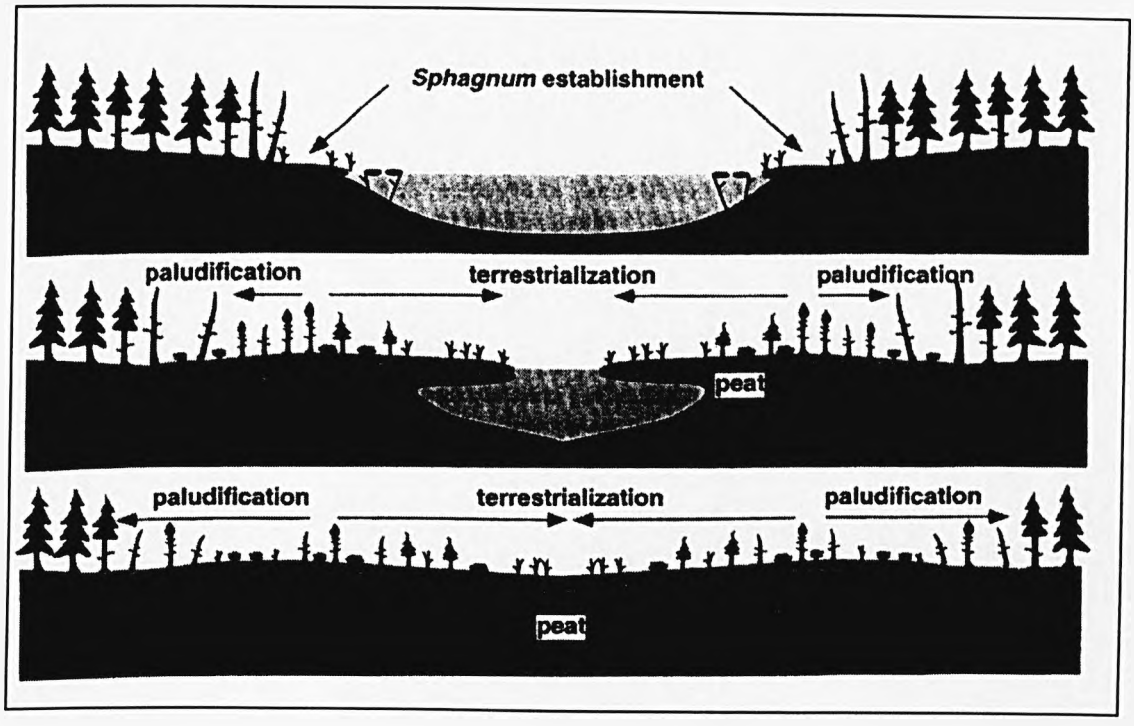


Figure 11.2; Flow diagram indicating the development of the landscape of the Humberhead Levels, after Buckland and Sadler (1985).

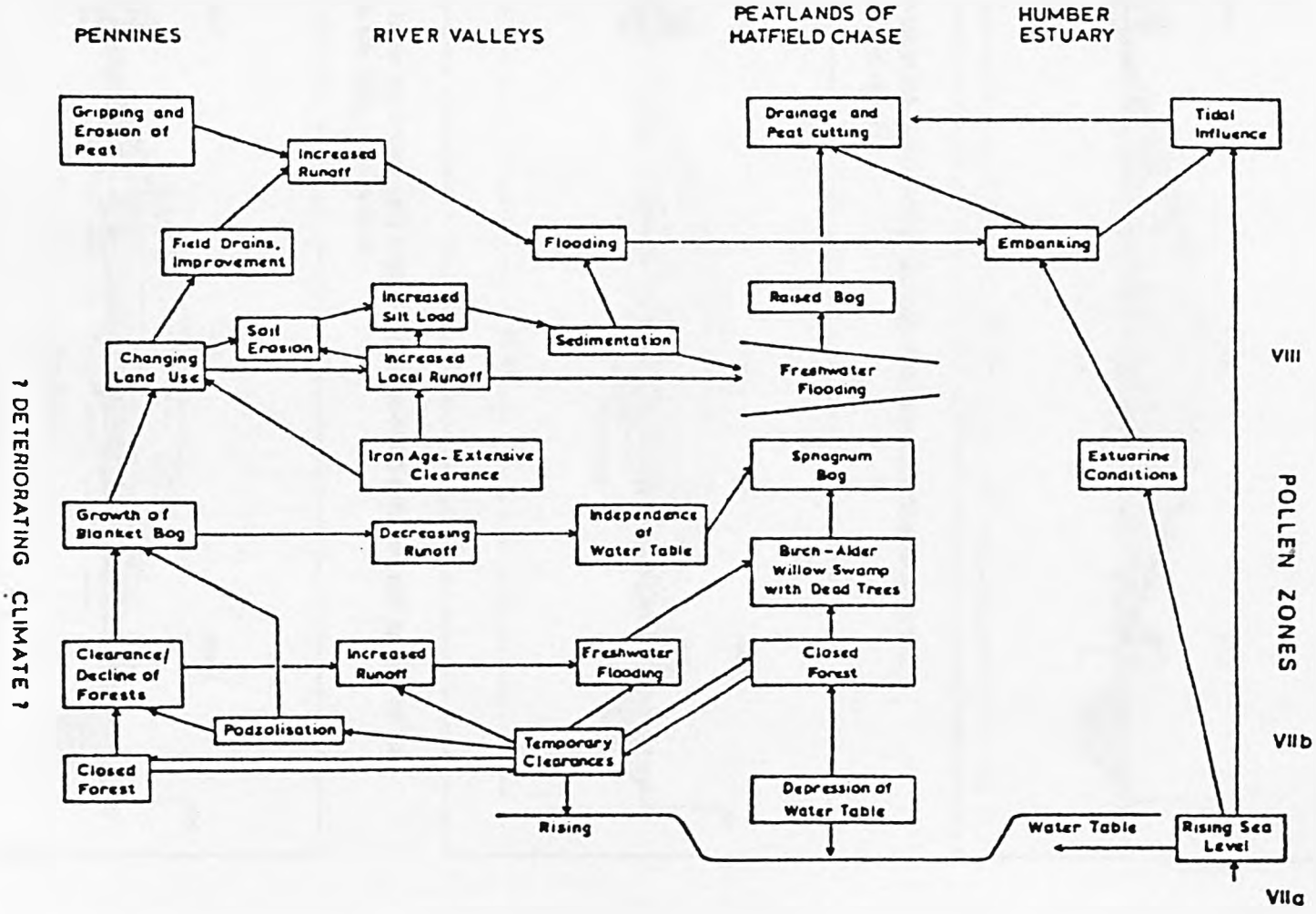
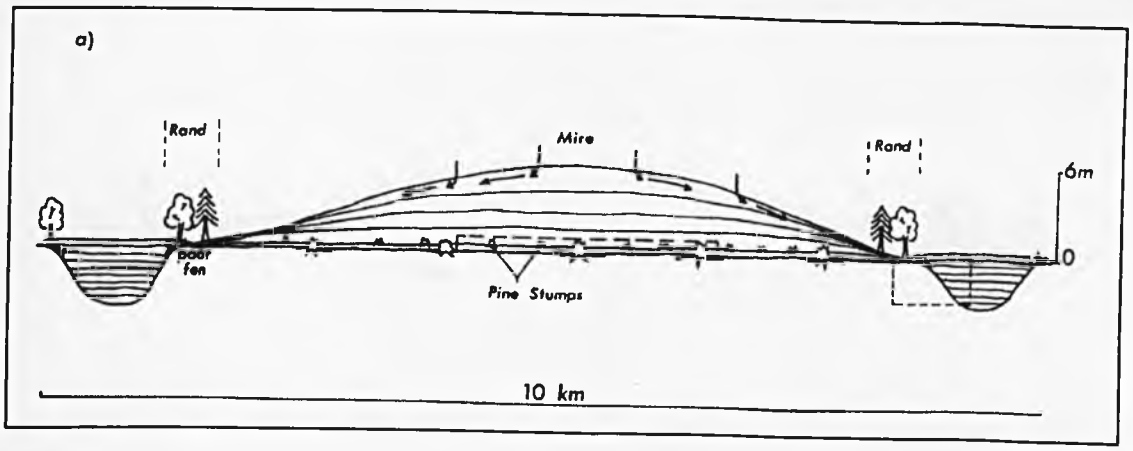
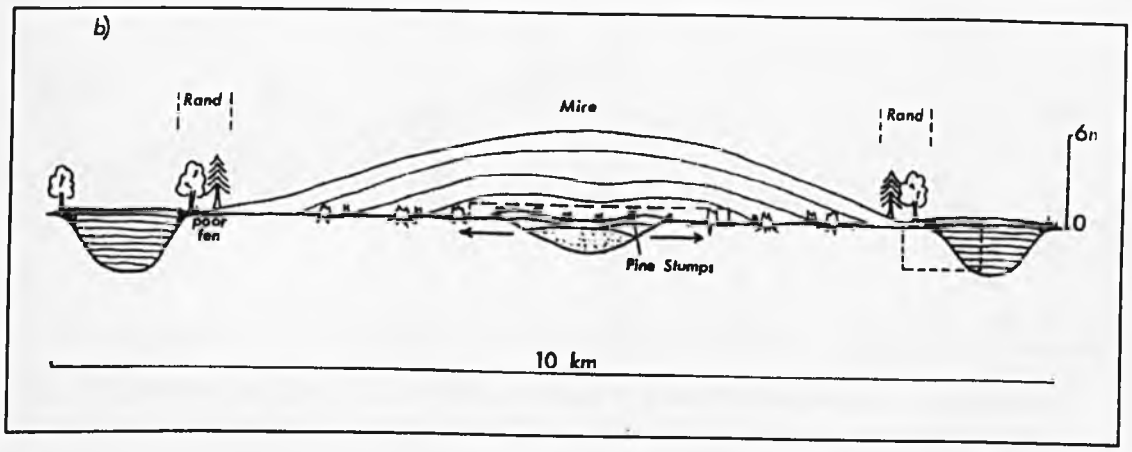


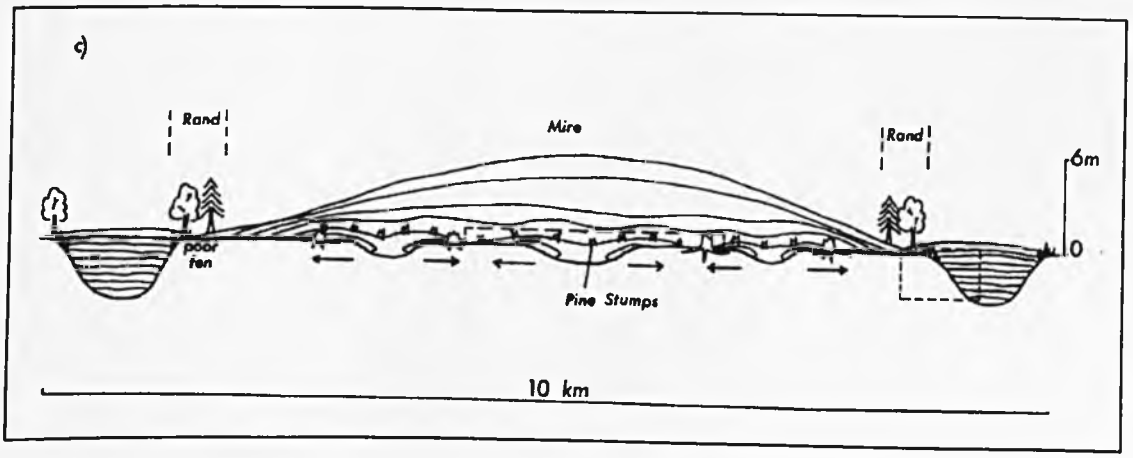
Figure 11.3; Models of mire initiation proposed by Buckland and Smith (*in press*) (drawings by P.C.Buckland)



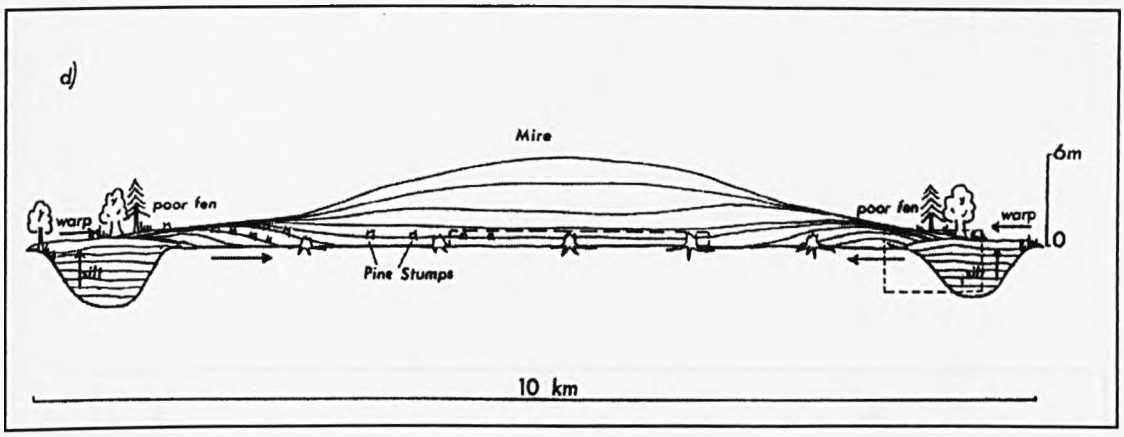
a. Rising water-table leads to widespread paludification, leading to poor fen, acidification and raised mire.

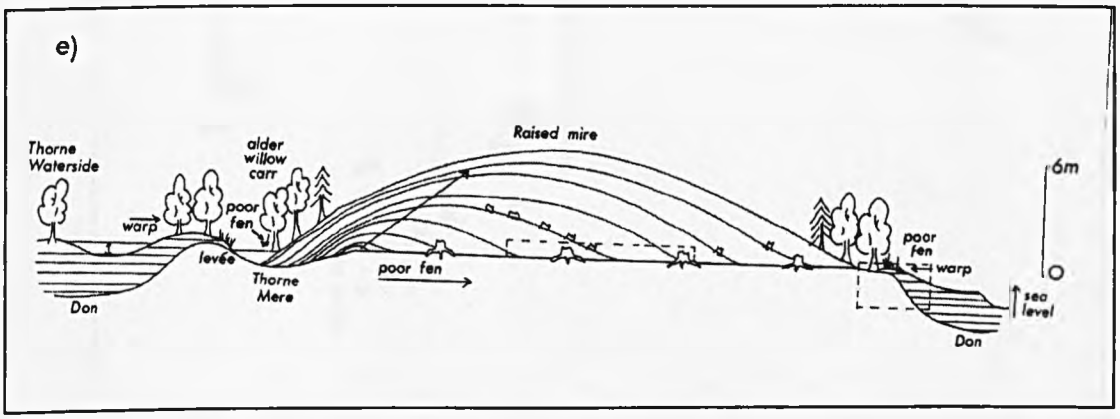


b. Infilling of a basin by limnic sediments leads to terrestrialisation and growth of fen, to poor fen from the margins of a lake.



c. A poly version of (b), with several small ponds rather than lakes forming on the forest floor. The developing poor fen communities lead to raised mires and eventually coalesce into larger raised mire.





d & e. Progressive infilling of river channels leads to paludification from the margins of a river or mere, progressing inwards towards its "core" (d) or laterally until confined by slope or a more active nutrient-rich environment (e).

Figure 11.4; The distribution of "Wells" on Thorne Moors in the mid 19th century (reproduced from 1953 O.S. Map and published by Limbert [1987])

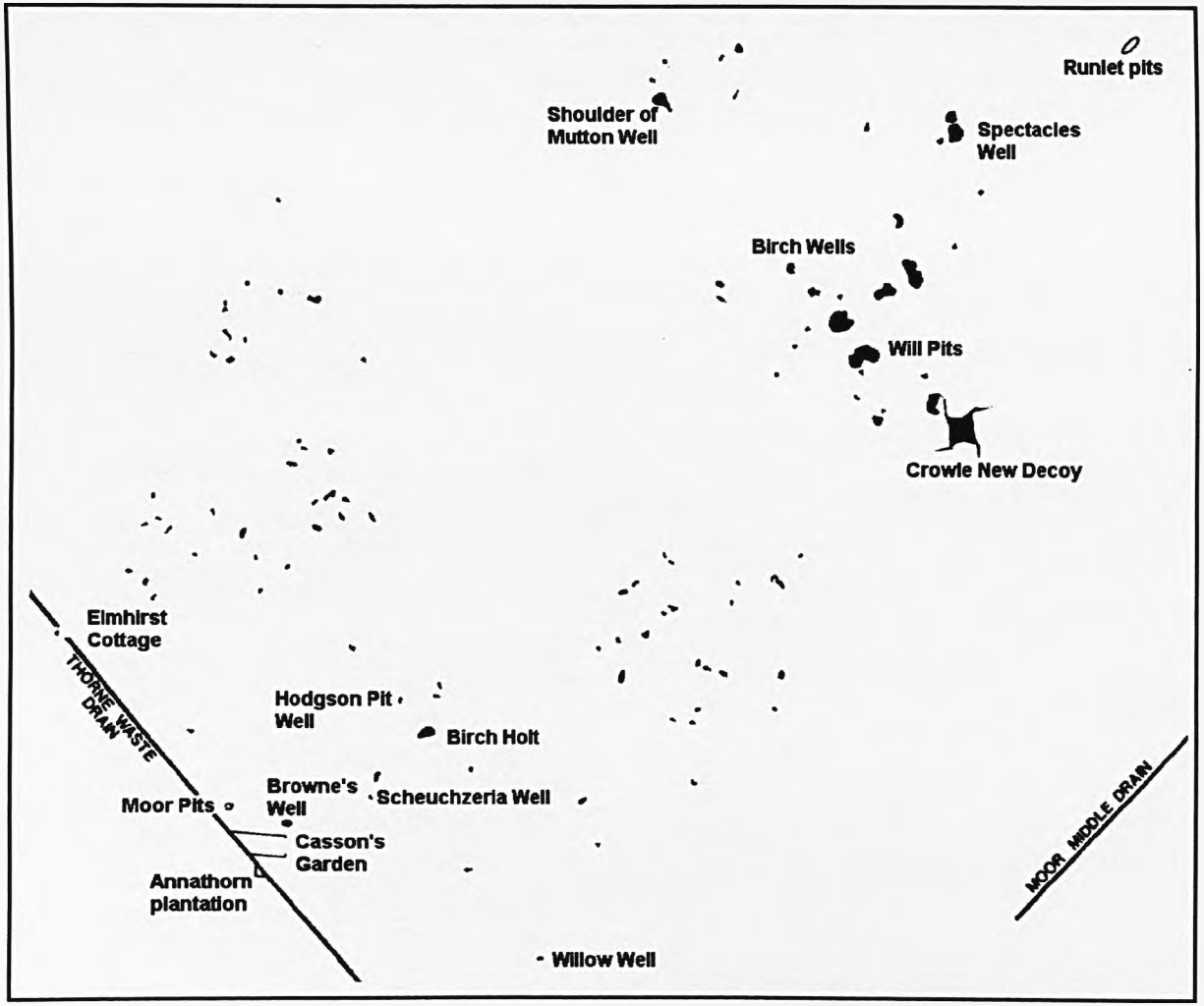


Figure 12.1; Modern distribution of *Buprestis rustica* L.
Latest fossil date: *c.* 2921-1489 BC

Figure 12.2; Modern distribution of *Isorhipis melasoides* (Cast.)
Latest fossil date: *c.* 1390-1060 cal BC

Figure 12.3; Modern distribution of *Tenebrioides fuscus* (Goeze)
Latest fossil date: *c.* 1320-1030 cal BC

Figure 12.4; Modern distribution of *Cryptolestes corticinus* Er.
Latest fossil date: *c.* 2000 cal BC

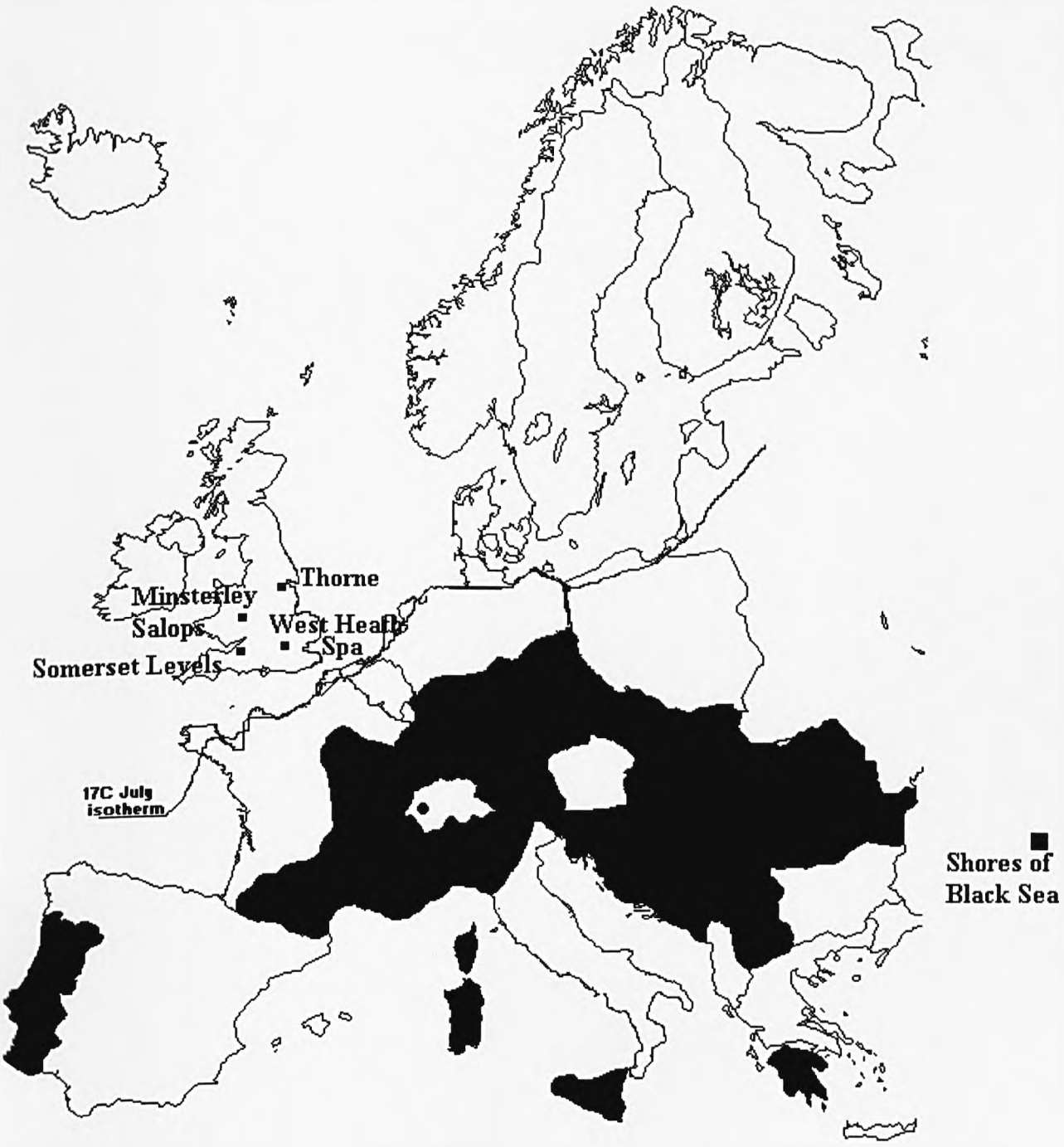


Figure 12.5; Modern distribution of *Pycnomerus tenebrans* Ol.
Latest fossil date: *c.* 3444-2921 cal BC

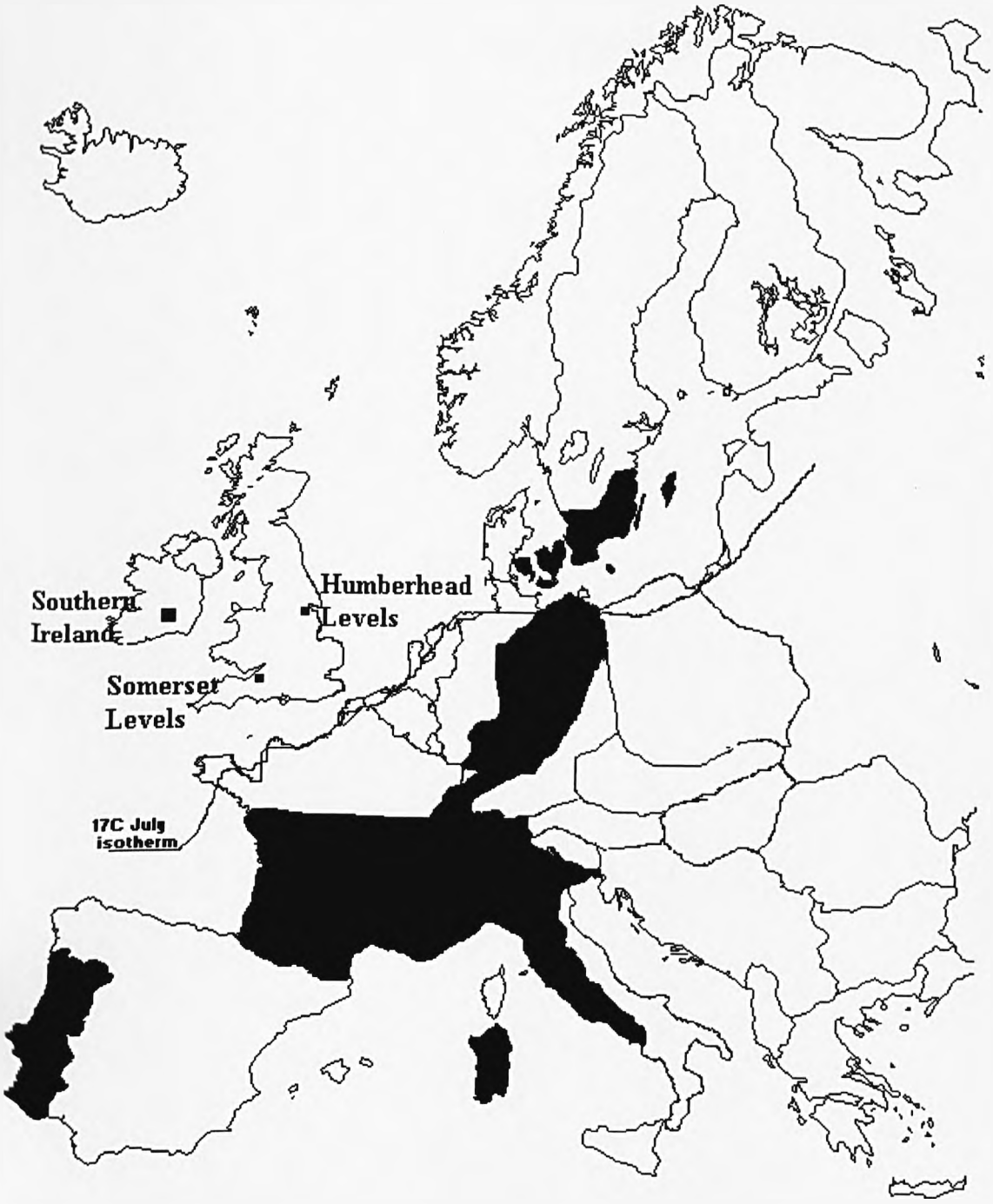


Figure 12.6; Modern distribution of *Prostomis mandibularis* (F.)
Latest fossil date: *c.* 1390-1060 cal BC

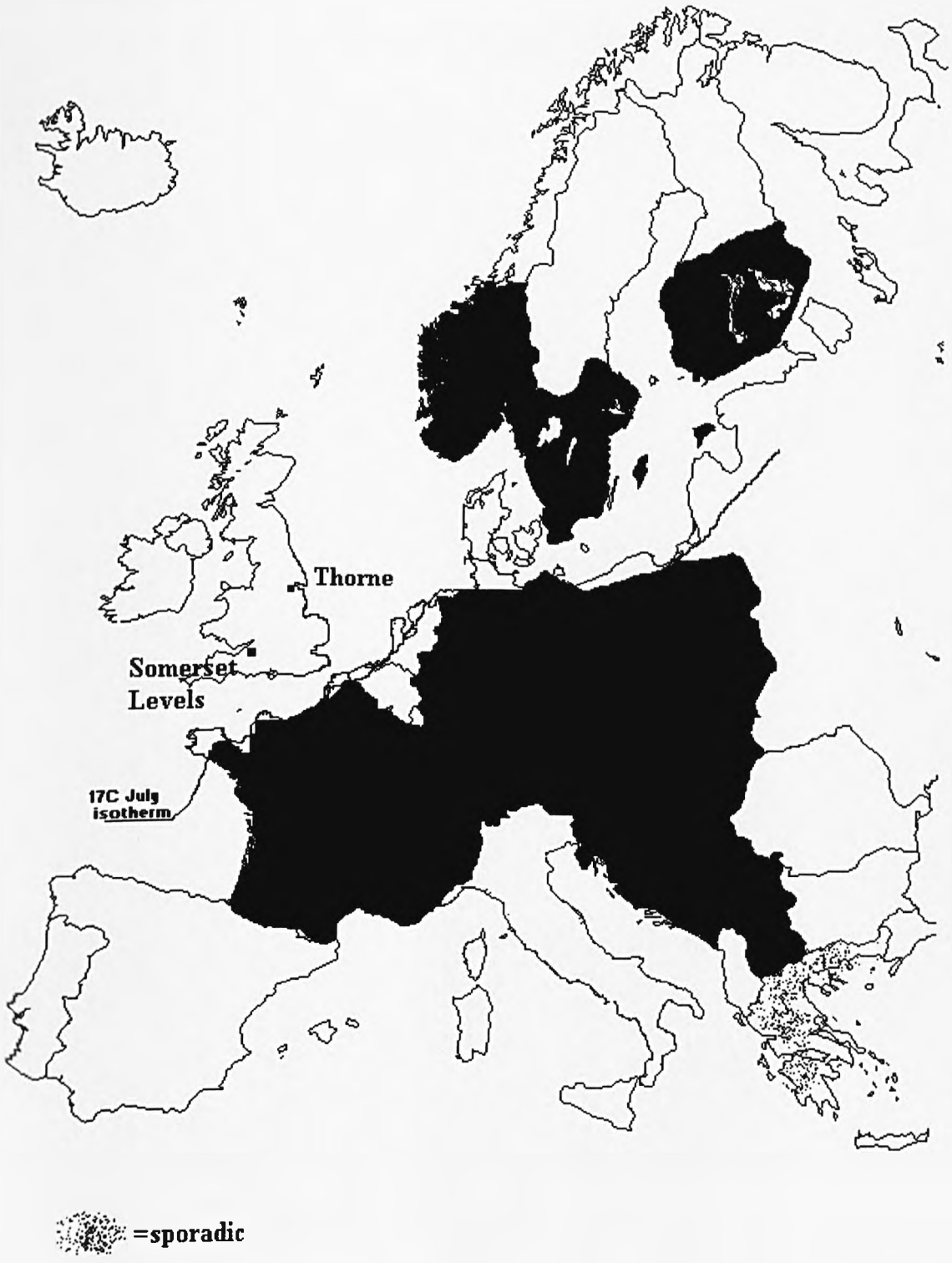


Figure 12.7; Modern distribution of *Bothrideres contractus* (F.)
Latest fossil date: *c.* 3444-2445 BC

Figure 12.8; Modern distribution of *Mycetina cruciata* (Schall.)
Latest fossil date: *c.* 1390-1060 cal BC
N.B. the distribution of this species is mainly restricted to mountainous areas.

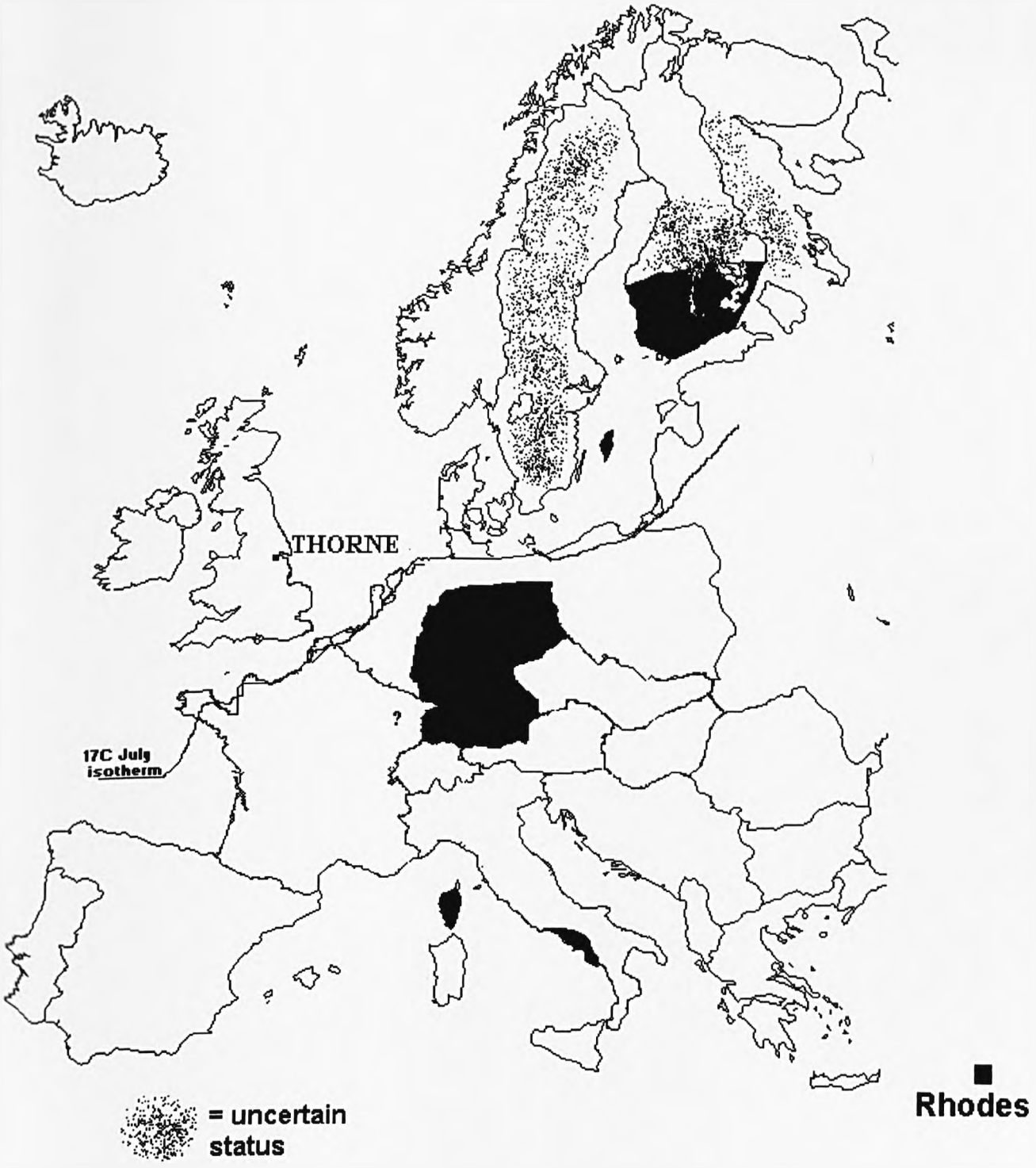


Figure 12.9; Modern distribution of *Stagetus borealis* Israelsson
Latest fossil date: *c.* >3350-3100 cal BC

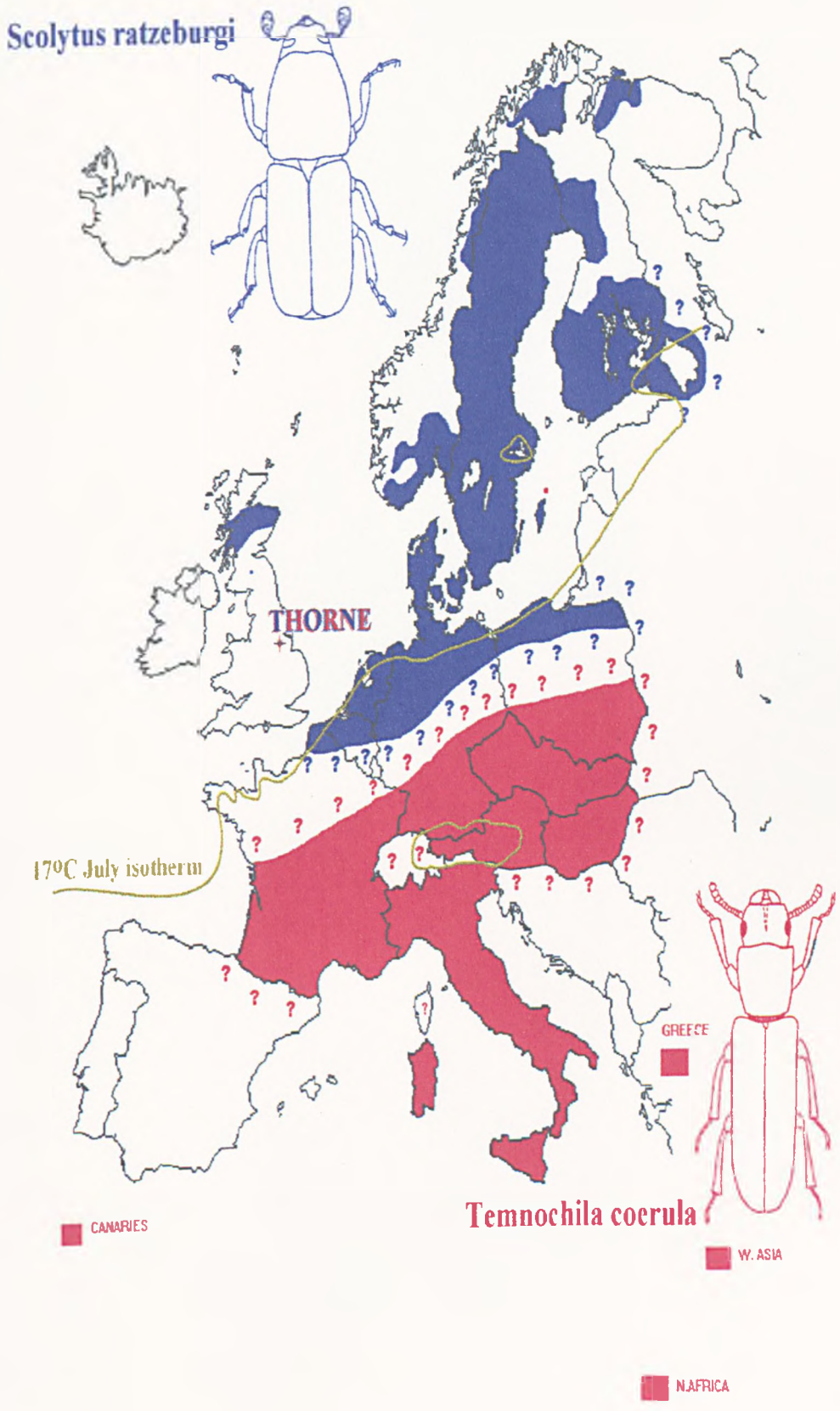
Figure 12.10; Modern distribution of *Rhyncolus elongatus* Gyll.
Latest fossil date: 2921-2445 BC

Figure 12.11; Modern distribution of *Rhyncolus sculpturatus* Waltl *(=nitidipennis* Thoms.*)*

Latest fossil date: 2921-2445 BC

Figure 12.12; Modern distribution of *Rhyncolus punctulatus* Bohe.
Latest fossil date: > 1520-1310 cal BC.

Figure 12.13; Modern distribution of *Scolytus ratzeburgi* and *Temnochila coerulea*



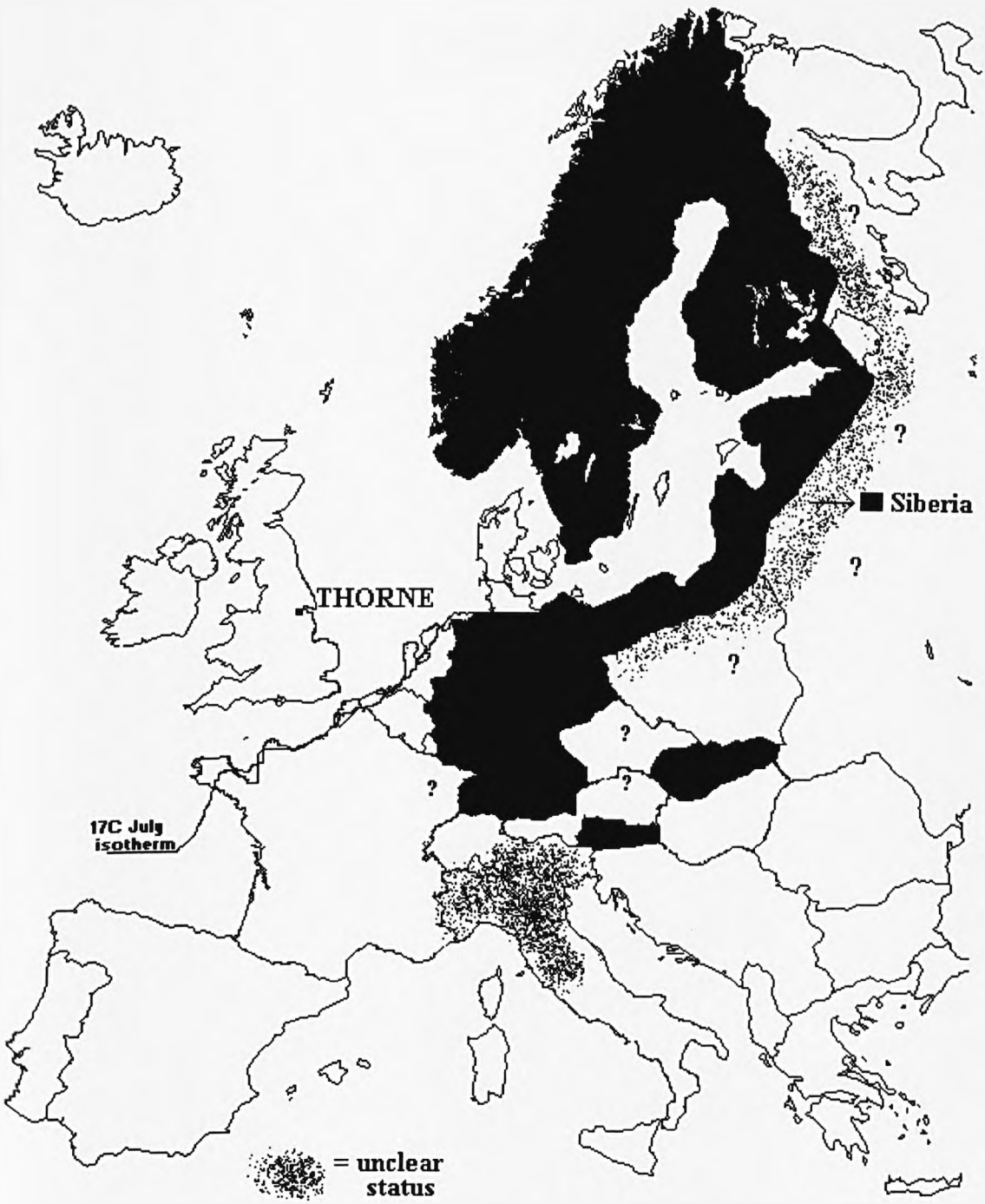


Figure 12.14; Modern distribution of *Pissodes gyllenhali* (Sahl.).
Latest fossil date: > 3350-3100 cal BC.

TABLES

Table 5.1; Preservation Index for Coleoptera.

0. Blank	No insect remains present in the sample
1. Very poor	Only the most robust, highly sclerotised taxa (i.e. Ground beetles and Weevils) present, these eroded and testaceous. Identification can be expected only to genus level.
2. Poor.	Testaceous, even amongst more robust groups, and the more weakly sclerotised taxa eroded. Some identification to species level may be expected.
3. Moderate.	Poorly sclerotised groups are testaceous and there will be some erosion of chitin but identification to species level is usually possible. Setae may be evident upon pubescent species.
4. Good.	Well-sclerotised with little evidence of erosion, but large or brittle elytra still fragmented. Setae preserved on pubescent species. A range of Diptera preserved, including wings.
5. Excellent.	Complete, well-sclerotised remains often with some parts still articulated. Complete elytra may be expected even in larger specimens. Good preservation of colouring and setae.

Table 5.2; Habitat categories

Woodland/trees

1. Pinewoods/heaths	This includes those species which are associated with pinewood and heaths, such as *Dromius augustatus* and Scolytidae such as *Tomicus piniperda, Hylastes opacus.* It does not include any dead wood feeders.
2. Deciduous woodland	Includes those woodland species associated with broad-leaved woodland. Generally associated with live parts of trees, rather than dead wood and includes leaf miners such as members of the genus *Rhynchaenus.*
3. Woodlands (all types)	This includes species which live in all types of trees and whose preference is more wide-ranging.
4. Dead and decaying tree habitats (coniferous).	Includes specialists which feed on rotting, mouldy bark, particularly characteristic of late successional habitats, exclusively associated with coniferous trees (e.g. *Ostoma ferrugineum*; *Rhyncolus ater*).
5. Dead and decaying tree habitats (deciduous).	As above (4), but associated exclusively with deciduous trees (e.g. *Cerylon ferrugineus*; *Dryophthorus corticalis*)
6. Dead and decaying tree habitats (all types).	Includes species whose preferences are more wide-ranging than those above, including both coniferous as well as deciduous trees (e.g. *Rhyncolus punctulatus*).
7. Woodland/flowers/herbs	Species which typically live in open areas of woodlands or at woodland margins and which often feed upon flowers and herbs (e.g. *Dascillus cervinus*; *Xylocleptes bispinus*).
8. Woodland/fungi & mouldy plant debris	Includes those species which are often associated with bracket fungi on wood, such as *Polyporus* spp., but which can also be found in plant litter/moss (e.g. *Aspidophorus orbiculatus*).

Damp woodland

9. Damp woodland (e.g. *Alnus* carr)	Species which commonly live in humus-rich, damp deciduous woodland, often in places such as *Alnus* and *Salix* carr (e.g. *Chrysomela aenea, Nebria brevicollis, Carabus granularis*).

Heath and grassland

10. Sandy heath/*Calluna*	Species associated with sandy substrates and heathland/moorland, often feeding on *Calluna vulgaris* (e.g. *Bradycellus ruficollis*; *Micrelus ericae*). This category overlaps with cat.1.
11. Heath/woodlands	Species which are found in both heath and woodland, but excludes coniferous species, which are included within pinewoods/heaths. It includes species such as *Rhamphus pulicarius*.
12. Xerophilous	Species which prefer dry places, such as dry heath, sandy or gravelly areas, sandy shores and dunes. Includes species that could not be accommodated within the two previous categories.
13. Grassland, herbs & flowers	Species which live in grassland and herbs, in open situations, such as members of the genera *Apion, Sitona*, some Chrysomelidae and Nitidulidae.

Non-acid wetlands

14. Non acidic bogs/wetlands	Fairly eurytopic species found in a variety of wet biotopes, including peatlands and fens, but not considered obligate oligotrophic taxa (e.g. *Agonum fuliginosum*, *Pterostichus diligens*; *Trechus rivularis*).
15. Fens/reeds and sedges	Includes those species which are typically found in fens or more nutrient rich wetlands on emergent vegetation (e.g. members of the genus *Donacia, Plateumaris sericea*).
16. Non-acid/plant debris	Includes those species which are less tolerant of very oligotrophic conditions (e.g. *Olophrum piceum*).
17. Reeds/brackish water	Includes species which live on reeds in brackish water (e.g. *Plateumaris braccata*).

Acid wetlands

18. Acid bogs	Includes those species particularly associated with peat bogs and *Sphagnum* habitats, which are obligate oligotrophic taxa (e.g. *Bembidion humerale*; *Agonum ericeti*).
19. Acid bogs / *Eriophorum* & *Sphagnum*	Includes those species which are typically associated with acid loving vegetation (e.g. *Plateumaris discolor*).
20. Bogs/plant debris	Includes those species which are found in all types of bogs, but which are more acid tolerant than category 16 (e.g. *Acidota crenata*).

Hygrophilous

21. Hygrophilous	Includes many of those more "generalist" species, which are wet-loving but which live in a variety of habitats (e.g. *Dyschirius globosus*; *Bembidion* spp.; *Pterostichus* spp.).
22. Hygrophilous/plant debris	Includes species which are wet loving which live amongst plant debris, for instance *Trechus rubens, Stenus* spp. and *Lathrobium* spp.
23. Water margins/river banks	This category includes those species which live in the littoral zone and includes those species which live on river banks (e.g. *Elaphrus cupreus*; *Bembidion schueppeli*).
24. Water margins/plants & mud	Includes species which reside in the littoral zone of pools/streams/rivers. Many species live in detritus and flood debris, as well as burrow in mud and algae detritus (e.g. *Bledius* spp.; *Bembidion guttula*).
25. Wet locations/ herbs & marsh plants	Includes species which live in wet locations on marshy plants.

Aquatics

26. Aquatic/generalists	Aquatics (species which spend most of their adult life under water) which are found in many different types of water (e.g. *Agabus bipustulatus*; *Ilybius fuliginosus*; *Colymbetes fuscus*).

27. Aquatics/bogs	Aquatics which are found on all types of bogs, including those tolerant of a range of acidic conditions (e.g. *Hydroporus* spp.; *Hydroporus scalesianus*).
28. Aquatic/acid bog	Aquatics which are associated only with typically acid conditions (e.g. *Hydroporus gyllenhali*; *Hydroporus tristis*).
29. Aquatic/non acidic bog	Aquatics found in fen and other non-acidic conditions (e.g. *Hydraena testacea*; *Limnebius aluta*) and which are not tolerant of acidic conditions.
30. Aquatic/vegetation & detritus rich	Aquatic species which enjoy living in habitats with plenty of vegetation and detritus (e.g. *Ochthebius minimus*; *Anacaena globosus*) as well as those living in vegetation rich standing and slow moving waters.
31. Aquatic/stagnant & sometimes brackish water	Species which live in stagnant water, sometimes also brackish, such as *Noterus clavicornis* and *Haliplus confinis*.
32. Aquatic/slow moving water	Aquatic species which are associated with very slow moving water (e.g. *Ochthebius bicolon*; *Graptodytes pictus*).
33. Aquatic/running water	Aquatic species which are associated with running water (e.g. *Limnebius truncatellus*; *Gyrinus aeratus*), often clear.

Decaying debris

34. Exclusively dung	Species which are associated exclusively with dung (e.g. many members of the genus *Aphodius*). N.B. this category was only utilised in the analysis of the floodplain sequences.
35. Decaying animal and plant debris	Includes those species found commonly in dung and other animal debris (e.g. carrion) as well as in other rotting organic material. (e. g. *Cercyon* spp.; *Platydracus fulvipes*; *Aphodius* spp). Fouler than the next category.
36. Fungi/plant debris	Includes species which live in mouldy and rotting plant debris, such as some members of the Lathridiidae & Cryptophagidae families.
37. Fungi/wood/plant debris	Includes those species which live under mouldy fungoid wood as well as plant debris (e.g. *Dienerella separanda*).

Fire species

38. Fire indicators	Species which are noted in the literature as being attracted to fire (pyrophilous). N.B. This category is additional to any of those above and all species in this category belong to one of the main habitat categories.

Unclassified

UN Unclassified	This includes individuals whose identifications which were not close enough to enable them to be categorised .

Table 5.3; Radiocarbon Dates from the Humberhead Levels

Site	Date (BP)	Lab. No.	Depth	Comments	Calibrated date
Crowle Moors					
Site CML1	3475 ± 65	CAR-208	2.3m	Base of peat	1890-1700 BC
	3540 ± 70	CAR-209	2.2m		1980-1770 BC
	3230 ± 75	CAR-210	2.18m		1610-1430 BC
	3025 ± 65	CAR-211	1.92m		1410-1210 BC
	2405 ± 70	CAR-212	1.55m		550- 390 BC (0.68)
					760- 680 BC (0.29)
	2185 ± 65	CAR-213	1.17m		370- 180 BC
	2225 ± 70	CAR-214	1.12m		320- 200 BC (0.75)
					390- 340 BC (0.25)
	2175 ± 60	CAR-215	1.05m		370- 280 BC (0.5)
					260- 170 BC (0.5)
	1445 ± 60	CAR-216	0.84m		555-655 AD
	930 ± 55	CAR-217	0.48m		1030-1160 AD
	725 ± 60	CAR-218	0.32m		1220-1300 AD (0.91)
					1360-1380 AD (0.09)
	360 ± 55	CAR-219	0.15m		1460-1530 AD (0.52)
					1560-1630 AD (0.48)
	225 ± 55	CAR-220	0.15m		1730-1810 AD (0.51)
					1630-1690 AD (0.36)
					530-1550 AD (0.08)
Site CML2	4230 ± 70	CAR-309	4.0m	Base of peat "Crowle Depression"	2820-2660 BC (0.61)
					2920-2860 BC (0.39)
	3620 ± 75	CAR-311	3.0m		2050-1890 BC (0.76)
					2130-2070 BC (0.24)
	1825 ± 60	CAR-310	1.3m		110-250 AD
	1480 ± 65	CAR-312	0.65m		530-650 AD (0.93)
					460-480 AD (0.07)
	3545 ± 70	CAR-313		Burnt pine	1980-1870 BC (0.59)
					1850-1770 BC (0.34)
					2030-2000 BC (0.08)
	3620 ± 60	CAR-247	2.9-3.0m	Charcoal horizon	2040-1910 BC (0.79)
					2130-2080 BC (0.21)
Goole Moors					
Site GLM1	4515 ± 70	CAR-232	1.95m	Base of peat	3350-3100 BC
	3715 ± 70	CAR-233	1.55m	Charcoal horizon	2210-2030 BC (0.87)
					2280-2030 BC (0.13)
	3415 ± 70	CAR-293	1.5m		530-380 BC
	3560 ± 65	CAR-234	1.35m		2030-1870 BC (0.82)
					1840-1780 BC (0.18)
	2350 ± 60	CAR-235	0.96m		530-720 BC (0.89)
					750-380 BC (0.11)
	2380 ± 60	CAR-236	0.96m		530-390 BC (0.81)
					760-710 BC (0.19)
	1745 ± 60	CAR-294	0.58m		220-380 AD
	1675 ± 60	CAR-237	0.48m		320-430 AD(0.76)
					250-300 AD(0.24)
	1525 ± 60	CAR-238	0.48m		450-600 AD
	1200 ± 60	CAR-492	0.15m		760-900 AD (0.91)
					720-740 AD(0.09)

	1005 ± 60	CAR-491	0.15m		AD 960-1050 (0.73) AD 1080-1120 (0.18) AD 1140-1160 (0.08)
Site GLM3	770 ± 55 725 ± 55	CAR-299 CAR-300	0.25m 0.25m		AD 1210-1280 AD 1220-1380
Site GLM2	1730 ± 60 1675 ± 60 860 ±55 825 ± 60	CAR-295 CAR-296 CAR-297 CAR-298	0.72m 0.72m 0.23m 0.23m		AD 240-390 AD 320-430 (0.76) AD 250-300 (0.24) AD 1120-1240 (0.77) AD 1040-1090 (0.23) AD 1160-1270
Rawcliffe Moors					
Site RWM1	4545 ± 75 4255 ± 70 3975 ± 75 2825 ± 75 2525 ± 60 1725 ± 60 1665 ± 70 1350 ± 55 1235 ± 60 1295 ± 60 555 ± 60 675 ± 60	CAR-221 CAR-301 CAR-222 CAR-223 CAR-302 CAR-224 CAR-225 CAR-303 CAR-490 CAR-489 CAR-226 CAR-227	2.12m 2.0m 1.76m 1.3m 1.18m 0.92m 0.92m 0.72m 0.46m 0.46m 0.25m 0.25m	Base of peat	3370-3100 BC 2930-2860 BC (0.46) 2810-2750 BC (0.27) 2730-2650 BC (0.16) 3030-2990 BC (0.11) 2610-2450 BC (0.85) 2430-2360 BC (0.12) 2850-2830 BC (0.02) 1120-900 BC 700-540 BC (0.76) 800-750 BC (0.24) 240-390 AD 250-440 AD 630-720 AD(0.88) 740-760 AD(0.12) 690-860 AD 660-780 AD 1300-1360 AD(0.52) 1380-1430 AD(0.48) 1270-1320 AD(0.56) 1350-1390 AD(0.44)
Thorne Moors					
Site TM1	3060 ± 65 2900 ± 65 2415 ± 65 2095 ± 45 2335 ± 40 2310 ± 45	CAR-180 CAR-182 CAR-187 CAR-188 CAR-189 CAR-190	0.9m 0.75m 0.4m 0.27m 0.2m 0.2m	Base of peat	1420-1260 BC 1220-1000 BC 550-400 BC (0.67) 760-680 BC (0.30) 660-640 BC (0.03) 200-50 BC 510-370 BC 410-360 BC (0.77) 290-250 BC (0.23)
Turner's site	2942 ± 115 3170 ± 115 2329 ± 110	Q-482 Q-481 Q-479	0.95m 0.95m 0.83m	Turner (1962) Turner (1962) Turner (1962)	1320-1010 BC 1750-1000 BC 550-200 BC (0.84) 800-650 BC (0.16)
Trackway Site	3260 ± 100 3080 ± 90 2980 ± 110	BIRM-335 BIRM-336 BIRM-337	1.1m 1.0m 0.95m	Buckland (1979) Base of peat Buckland (1979) Buckland (1979)	1680- 1440 BC 1450-1220 BC 1390-1060 BC

Hatfield Moors					
HAT 1	4180 ± 70	CAR-168	2.0m	Base of peat	2820-2660 BC (0.77) 2900-2860 BC (0.17) 2640-2620 BC (0.06)
	3570 ± 70	CAR-169	1.72m	Charcoal layer	2040-1870 BC (0.85) 1840-1780 BC (0.15)
	2775 ± 65	CAR-170	1.48m		1000-840 BC
	2695 ± 65	CAR-171	1.35m		905- 810 BC
	2345 ± 65	CAR-172	1.12m		530-370 BC (0.86) 760-710 BC (0.14)
	2470 ± 65	CAR-173	1.12m		770-520 BC
	2145 ± 65	CAR-174	0.92m		250-100 BC (0.71) 360-300 BC (0.29)
	1475 ± 55	CAR-176	0.6m		540-650 AD
	1460 ± 75	CAR-177	0.6m		530-660 AD
	1175 ± 75	CAR-179	0.44m		770-960 AD
HAT 2	4335 ± 75	CAR-254	2.0m	Base of peat	3040-2890 BC 3090-3060 BC
	4255 ± 75	CAR-255	1.8m		2810-2660 BC (0.46) 2930-2860 BC (0.43) 3030-2990 BC (0.12)
	3685 ± 65	CAR-256	1.6m	4 cm below Charcoal	2200-1970 BC
	3240 ± 70	CAR-257	1.4m		1610-1440 BC
	2675 ± 70	CAR-258	1.2m		910-800 BC
	2265 ± 70	CAR-259	1.0m		320-200 BC (0.65) 400-350 BC (0.35)
	2085 ± 70	CAR-260	0.9m		200-1 BC
	1945 ± 65	CAR-261	0.8m		30 BC-120 AD
	1775 ± 65	CAR-262	0.6m		140-340 AD
	1700 ± 65	CAR-263	0.5m		250-410 AD
	1616 ± 65	CAR-264	0.4m		380-540 AD
	910 ± 65	CAR-265	0.2m		1030-1180 AD
	865 ± 60	CAR-266	0m		1120-1230 AD (0.73) 1040-1090 AD (0.27)
HAT 3 (Kilham West)	4480 ± 45	SRR-6119	0.95-1.03 m	Base of peat	3350-3030 BC (0.96) 2980-2930 BC (0.04)
HAT 4 (Packards south)	3164 ± 40	SRR-6127	1.50-1.55 m	Base of peat	1520-1390 BC
	2965 ± 45	SRR-6126	1.20-1.25 m		1320-1030 BC (0.95) 1390-1340 BC (0.05)
	2890 ± 40	SRR-6125	1.05-1.1 m		1260-980 BC (0.98) 960-930 BC (0.02)
	2960 ± 45	SRR-6124	0.95-1.0 m		1320-1030 BC (0.96) 1380-1340 BC (0.04)
	3020 ± 45	SRR-6123	0.85-0.9 m		1420-1120 BC
	2960 ± 40	SRR-6122	0.75-0.80 m		1320-1040 BC (0.97) 1380-1340 BC (0.03)
	2870 ± 40	SRR-6121	0.40-0.45 m		1220-920 BC
	1405 ± 45	SRR-6120	0.10-0.15 m	Top of peat	560-680 AD
LIND B	3990 ± 60	BETA-91800	1.60-1.72 m	60 cms. from base	2700-2350 BC(0.92) 2900-2800 BC (0.08)
	2820 ± 50	BETA-91799	1.15-1.20 m		1130-840 BC

Thorne Waterside					
River Don	4230 ± 100	BIRM-358		?Base of channel	2820-2660 BC (0.61) 2930-2850 BC (0.30) 2640-2620 BC (0.06) 3020-3000 BC (0.04)
Misterton Carr					
River Idle	4330 ± 120	BIRM-359		?Base of channel	3300-2700 BC
Rossington					
River Torne	5340 ± 45 3990 ± 45 3145 ± 45 3330 ± 45 3210 ± 45 3290 ± 45 2290 ± 45 2540 ± 50 1755 ± 50	SRR-6136 SRR-6135 SRR-6134 SRR-6133 SRR-6132 SRR-6131 SRR-6130 SRR-6129 SRR-6128	3.40 m 3.25-3.15 m 3.00-2.95 m 2.85-2.75 m 2.65-2.55 m 2.45-2.35 m 1.80-1.70 m 1.60-1.50 m 1.20-1.40m	Base of channel Charcoal layer Top of peat Alluvium Top of organic deposits (alluvium)	4340-4040 BC 2620-2450 BC (0.91) 2860-2820 BC (0.04) 2660-2640 BC (0.02) 2430-2390 BC (0.03) 1520-1370 BC (0.91) 1350-1310 BC (0.09) 1740-1520 BC 1610-1410 BC 1690-1450 BC 410-190 BC 820-510 BC 130-400 AD
Sutton Common					
Large enclosure	2370 ± 50 2360 ± 50	GU-5524 GU-5525	palisade	Parker Pearson & Sydes (1997) *idem*	530- 390 BC (0.94) 750- 730 BC (0.06) 520- 390 BC (0.99) 750- 740 BC (0.01)
Small enclosure	2240 ± 90 2260 ± 70 2340 ± 70	HAR-8916 HAR-8915 HAR-8917		*idem* *idem* *idem*	400- 200 BC 320- 200 BC (0.67) 400- 350 BC (0.33) 530- 360 BC (0.82) 750- 710 BC (0.14) 280- 260 BC (0.04)
Scaftworth					
Roman road	1690 ± 40	(unknown ref.)	timber from road bed	Kennedy, unpubl.	260- 290 AD (0.23) 330- 410 AD (0.77)
Lateglacial Sites					
Cawood	10469 ± 60	SRR-870	Cover Sands	Jones & Gaunt (1976)	
West Moor Armthorpe	11100 ± 200	N-810		Gaunt *et al.* (1971)	
Messingham	10280 ± 120 10550 ± 250	BIRM-349 BIRM-707	Cover Sands Cover Sands	Buckland (1982) Buckland (1982)	
Late Devensian					
Brantingham	21835± 1660	St 3903	Pre-Lake Humber	Gaunt (1974)	

Data from Smith (1985), unless otherwise indicated. New dates obtained for this research are coded SRR-** or Beta **. This table was originally devised by P.C. Buckland (in Smith, *in press*), to whom due acknowledgement is made, with additions by the author.

Note: Depths for sites on Thorne and Hatfield Moors are below the cutting surface at the time of sampling in the late 1970's, before large scale milling of peat, except recent dates, which reflect depths recorded in 1995.

Table 6.1; Radiocarbon dates from Hatfield Moors (data as per Table 5.3).

Hatfield Moors					
HAT 1	4180 ± 70	CAR-168	2.0m	Base of peat	2820-2660 BC (0.77) 2900-2860 BC (0.17) 2640-2620 BC (0.06)
	3570 ± 70	CAR-169	1.72m	Charcoal layer	2040-1870 BC (0.85) 1840-1780 BC (0.15)
	2775 ± 65	CAR-170	1.48m		1000- 840 BC
	2695 ± 65	CAR-171	1.35m		905- 810 BC
	2345 ± 65	CAR-172	1.12m		530-370 BC (0.86) 760-710 BC (0.14)
	2470 ± 65	CAR-173	1.12m		770-520 BC
	2145 ± 65	CAR-174	0.92m		250-100 BC (0.71) 360-300 BC (0.29)
	1475 ± 55	CAR-176	0.6m		540- 650 AD
	1460 ± 75	CAR-177	0.6m		530- 660 AD
	1175 ± 75	CAR-179	0.44m		770- 960 AD
HAT 2	4335 ± 75	CAR-254	2.0m	Base of peat	3040-2890 BC 3090-3060 BC
	4255 ± 75	CAR-255	1.8m		2810-2660 BC (0.46) 2930-2860 BC (0.43) 3030-2990 BC (0.12)
	3685 ± 65	CAR-256	1.6m	4 cm below Charcoal	2200- 1970 BC
	3240 ± 70	CAR-257	1.4m		1610-1440 BC
	2675 ± 70	CAR-258	1.2m		910-800 BC
	2265 ± 70	CAR-259	1.0m		320-200 BC (0.65) 400-350 BC (0.35)
	2085 ± 70	CAR-260	0.9m		200-1 BC
	1945 ± 65	CAR-261	0.8m		30 BC-120 AD
	1775 ± 65	CAR-262	0.6m		140-340 AD
	1700 ± 65	CAR-263	0.5m		250-410 AD
	1616 ± 65	CAR-264	0.4m		380-540 AD
	910 ± 65	CAR-265	0.2m		1030-1180 AD
	865 ± 60	CAR-266	0m		1120-1230 AD (0.73) 1040-1090 AD (0.27)
HAT 3 (Kilham West)	4480 ± 45	SRR-6119	0.95-1.03 m	Base of peat	3350-3030 BC (0.96) 2980-2930 BC (0.04)
HAT 4 (Packards south)	3164 ± 40	SRR-6127	1.50-1.55 m	Base of peat	1520-1390 BC
	2965 ± 45	SRR-6126	1.20-1.25 m		1320-1030 BC (0.95) 1390-1340 BC (0.05)
	2890 ± 40	SRR-6125	1.05-1.1 m		1260-980 BC (0.98) 960-930 BC (0.02)
	2960 ± 45	SRR-6124	0.95-1.0 m		1320-1030 BC (0.96) 1380-1340 BC (0.04)
	3020 ± 45	SRR-6123	0.85-0.9 m		1420-1120 BC
	2960 ± 40	SRR-6122	0.75-0.80 m		1320-1040 BC (0.97) 1380-1340 BC (0.03)
	2870 ± 40	SRR-6121	0.40-0.45 m		1220-920 BC
	1405 ± 45	SRR-6120	0.10-0.15 m	Top of peat	560-680 AD
LIND B	3990 ± 60	Beta-91800	1.6-1.72 m	60 cms. from base	2900-2350 BC
	2820 ± 50	Beta-91799	1.15-1.2 m		1130-840 BC

Table 6.2: Coleoptera list from HAT 3, Hatfield Moors (* denotes non-British species).

Coleoptera	**18**	**17**
	Base	**85-95**
Carabidae		
Bradycellus sp.		1
Pterostichus diligens (Strm.)	1	4
P. nigrita (Payk.) / *rhaeticus* Heer		1
P. ? minor (Gyll.)	1	
Agonum fuliginosum (Panz.)	1	
A. obscurum (Hbst.)	1	2
Dromius sp.		1
Dytiscidae		
Hydroporus scalesianus Steph.	1	
H. gyllenhali Schdte.		4
H. tristis (Payk.)	2	8
H. melanarius Strm.	2	7
Hydroporus spp.		15
Agabus bipustulatus (L.)		1
A. affinis (Payk.)	1	
Agabus spp.		2
Agabus/Ilybius sp.	1	
Hydrophilidae		
Cercyon convexiusculus Steph	1	
Megasternum obscurum (Marsh.)	1	
Anacaena sp.	1	
Staphylinidae		
Olophrum piceum (Gyll.)		1
O. fuscum (Grav.)	1	
Lesteva sp.		1
Stenus kiesenwetteri Rosen.		1
Stenus sp.	1	1
Lathrobium rufipenne Gyll.		1
L. longulum Grav.	1	
Lathrobium sp.	1	
Ochthephilum fracticorne (Payk.)		1
Philonthus sp.	1	
Aleocharinae gen. et sp. indet.		1

	18	17
Pselaphidae		
Bryaxis sp.	1	1
Cantharidae		
Cantharis sp.		1
Rhagonycha testacea (L.)		1
Elateridae		
Dalopius marginatus (L.)		1
Pseudathous ? hirtus (Hbst.)		1
Elateridae gen et sp. indet.	1	
Scirtidae		
Microcara testacea (L.)		1
Cyphon padi (L.)	2	9
Cyphon spp.	3	27
Cucujidae		
* *Prostomis mandibularis* (F.)		1
Coccinellidae		
Rhyzobius litura (F.)	1	
Anobiidae		
Grynobius planus (F.)		1
Scarabaeidae		
Aphodius sp.	1	
Scarabaeidae gen. et sp. indet.		

Chrysomelidae	**18**	**17**
Plateumaris discolor (Panz.)		5
Plateumaris sericea (L.)	1	
Altica ericeti/britteni Sharp		1
Scolytidae		
Hylastes ater (F.)	1	
Hylesinus crenatus (F.)	1	
Scolytidae gen. et sp. indet.	1	
Curculionidae		
* *Rhyncolus elongatus* Gyll.		1
* *R. sculpturatus* Walt.	1	
Limnobaris dolorosa (Goez.)	1	
Micrelus ericae (Gyll.)		1
Magdalis carbonaria (L.)		1
Brachonyx pineti (Payk.)		5
Rhynchaenus spp.	3	2
Curculionidae gen. et sp. indet.	1	
Coleoptera total individuals	**38**	**112**
Coleoptera total species	**32**	**40**
Formicidae indet.	1	9
Diptera indet.		1

Table 6.3; Coleoptera list from Hatfield 4 (HAT 4) (* denotes non-British species)

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
	150-155	145-150	140-145	135-140	130-135	125-130	120-125	115-120	105-110	95-100	85-90	75-80	65-70	55-60	40-45	25-30	10-15
Carabidae																	
Elaphrus ? uliginosus F.			1														
Dyschirius globosus (Hbst.)						1											
Bembidion doris (Panz.)							1										
Bembidion sp.		1		1						1							
Bradycellus ruficollis (Steph.)								1				1	2				
B. harpalinus (Serv.)														1			2
Bradycellus sp.											1						
Pterostichus diligens (Strm.)			1		1		1	7	4	4	2	3	5	2	5	2	2
P. nigrita (Payk.) / rhaeticus Heer		1		2					3	2					2		2
P. minor (Gyll.)		1	1	2			2	2	2	2							
P. ? minor (Gyll.)	1		1			1											
Pterostichus spp.							1			2							
Agonum ericeti (Panz.)															1		
A. fuliginosum (Panz.)	2	1				1		5	5	1							1
A. obscurum (Hbst.)									2	2							
Amara similata (Gyll.)								1									
Cymindis vaporariorum (L.)															1		
Dromius agilis (F.)							1										
D. angustus Brul.	1					1											
D. meridionalis Dej.								1									
Dromius sp.								1									
Carabidae gen. et sp. indet.	1								1								
Haliplidae																	
Haliplus sp.									1	1							

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Dytiscidae																	
Hygrotus decoratus (Gyll.)						1			1	3							
Hydroporus scalesianus Steph.				1				1	1				3	5	6	1	5
H. umbrosus (Gyll.)														3			
H. tristis (Payk.)									6	4	7	3	4		2	3	10
H. striola (Gyll.) group							1										
H. ? obscurus Strm.											2	3	7				3
H. melanarius Strm.									1	19	7	3	2	2	3		9
H ? neglectus Schaum.													1				
Hydroporus spp.	3	2	2	4	4	2	6	7	10	25		3	4	1	1	1	
Graptodytes granularis (L.)								4		2							
Copelatus haemorrhoidalis (F.)											1						
Agabus bipustulatus (L.)	1		1														
A. affinis (Payk.)								1		1							
Agabus spp.					1				1	4							
Ilybius fuliginosus (F.)					1							1					
I. subaeneus Er.			1														
I. ? quadriguttatus (Lac)											1						
Ilybius spp.		1				1		1	2	1							
Agabus/Ilybius spp.	1						1										
Colymbetes fuscus (L.)	1																
Graphoderus sp.							1										
Acilius canaliculatus (Nic.)					1												
Gyrinidae																	
Gyrinus aeratus Steph.										1							
Gyrinus sp.								1									

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Hydraenidae																	
Hydraena britteni Joy					5	1	8	7									
Hydraena ? britteni Joy		6															1
Hydraena britteni Joy / *riparia* Kug.	11	1	3						1								
H. testacea Curt.	1	1		4	5	2	3	2	1								
Hydraena spp.								1									
Ochthebius bicolon Germ.		1							1								
O. minimus (F.)		4			4				1								
O. ? minimus (F.)	3			4											1	1	
Ochthebius spp.			2	1			2										
Limnebius ? truncatellus (Thun.)						1											
L. papposus Muls.								2									
L. aluta Bed.	3		1		1	1		4	1	1					1		
Limnebius spp.		2															
Hydrophilidae																	
Hydrochus elongatus (Schall.)	3	1		1			1										
H.? ignicollis Mots.				1													
H. ignicollis Mots./ *carinatus* Germ.			1														
H. ? carinatus Germ.				1													
H. brevis (Hbst.)						1		2	5	2							
H. nitidicollis Muls.	1																
H. augustatus Germ.				1													
Hydrochus sp.							1	1									
Helophorus ? aquaticus (L.) auct.		1															
H. brevipalpis group													2				

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
H.laticollis Thom./ *stringifrons* Thom.	2																
Helophorus spp.			2	1													
? *Coelostoma orbiculare* (F.)							1										
Cercyon convexiusculus Steph	5	4	4		2	4	5	7	3	1							
C. sternalis Sharp										2							
Cercyon spp.			2														
Megasternum obscurum (Marsh.)	2	1		1		1	3		5	1			1				
Hydrobius fuscipes (L.)	1	1	1	2		2	2	2	1								
Anacaena globulus (Payk.)	3	3	2	2	1	2	9	8	8	4							
A. limbata (F.)	2																
Anacaena spp.	2																
Enochrus affinis (Thun.)								1				3	4	1	2	2	
E. coarctatus (Gred.)	2								4								
Hydrophilous piceus (L.)					1												
Hydrophilidae gen et sp. indet.	1	3						2									
Silphidae																	
Silpha atrata L.							1		1								
Silpha ? atrata L.		1	1														
Silpha sp.								1									
Leiodidae																	
Agathidium spp.	1									1	3	1					
Leiodidae gen. et sp. indet.			1														

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Scydmaenidae																	
Stenichnus collaris (Mull.)						1	1	1									
Stenichnus sp.		1															
Euconnus hirticollis (Ill.)					1												
Scydmaenus ? tarsatus Mull.										1							
Scydmaenidae gen. et sp. indet.										1							
Ptillidae																	
Ptenidium sp.				1	1		2	2		1							
Acrotrichis sp.								4									
Staphylinidae																	
Megarthrus / Proteinus sp.	1																
Proteinus ovalis Steph.																	1
Proteinus ? brachypterus (F.)								1									
Eusphalerum sp.				1													
Dropephylla grandiloqua (Luze)	1																
Olophrum piceum (Gyll.)							1	2		2					1		
O. fuscum (Grav.)					1			2									
Acidota crenata (F.)				1					1		1			1			
Lesteva heeri Fauv.	1						2	7		2			1				
Lesteva sp.								1									
Omalium sp.			1							1							
Omaliinae gen. et sp. indet.			1														
Carpelimus ? corticinus (Grav.)							1										
Carpelimus sp.	1			1								1					

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Anotylus rugosus (F.)	1																
Oxytelus fulvipes Er.							1	3									
Platystethus sp.					1												
Stenus biguttatus (L.)									2								
S. ? comma LeC.		1															
Stenus guttula Mull.									1								
Stenus spp.	3	5	2	5	2	4	4	7	5	4	1	2		1		1	1
Paederus fuscipes Curt.								2									
Lathrobium rufipenne Gyll.													2				1
L. terminatum Grav.													3				
L. geminum Kr.		1			1												
L. fulvipenne (Grav.)	1		1				2		2				1				1
L. brunnipes (F.)			1			1		7		2							1
L. longulum Grav.							2										
L. dilutum Er.				1													
L. ? dilutum Er.		2															
Lathrobium spp.		1			2		2	3	2	3		1				1	
Xantholinus longiventris Heer													1				
Othius punctulatus (Goez.)	1																
O. angustus Steph.																1	
Erichsonius cinerescens (Grav.)									1						1	2	
Erichsonius sp.																	1
Philonthus spp.		1							1				1				
Philonthus/ Quedius spp.		1	1		1	1		2	1					1			
Gabrius sp.	1			1			1	1									
Platydracus fulvipes (Scop.)										1							
Quedius sp.		1										1					
Habrocerus capillaricornis Grav								1									
Mycetoporus splendidus Grav.									1								
Mycetoporus spp.	2																

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Lordithon sp.								1		1							
Sepedophilus immaculatus (Steph.) / *lusitanicus* Hamm.			1														
Aleocharinae gen. et sp. indet.	2	3	1		2	1	2	4	3	3	1	3	2		1		1
Pselaphidae																	
Bibloporus sp.																	1
Bythinus burrelli (Denny)	1																
Bryaxis ? puncticollis (Denny)									1								
B. curtisi (Leach)							1										
B. bulbifer (Reich.)	1			1			1	4	1								
Bryaxis spp.		1						2		4	4	2	1				
Reichenbachia juncorum (Leach)	1																
Trissemus impressus (Panz.)	1																
Pselaphus heisei (Hbst.)												1					
Pselaphidae gen. et sp. indet.							1										
Cantharidae																	
Cantharis sp.		2															
Rhagonycha sp.							1			1							
Cantharidae gen. et sp. indet.										1							
Melyridae																	
Aplocnemus impressus (Marsh.)						1	1										

Elateridae	**29**	**28**	**27**	**26**	**25**	**24**	**23**	**22**	**20**	**18**	**16**	**14**	**12**	**10**	**7**	**4**	**1**
Ampedus balteatus (L.)								2									
Ampedus sp.	1																
Dalopius marginatus (L.)								1	1								
Agriotes acuminatus (Steph.)		1															
Denticollis linearis (L.)		1				1		3	1								
Athous haemorrhoidalis (F.)		2															
Hypnoidus riparius (F.)		1			2												
Elateridae gen et sp. indet.	1	1					1										
Eucnemidae																	
Melasis buprestoides (L.)							1	3									
Melasis buprestoides (L.) /			1														
* *Isorhipis melasoides* (Cast.)																	
Scirtidae																	
Microcara testacea (L.)		1			5		5	7	13	6		2					
Cyphon padi (L.)		6				4		39	37	87	2	5	8	4	3		12
Cyphon spp.	25	13	9	7	10	7	28	68	50	56	10	16	28	7	14	4	23
Ostomidae																	
* *Tenebrioides fuscus* Goeze										1							
Ostoma ferrugineum (L.)	1	1	1					2									
Cryptophagidae																	
Atomaria spp.						1	1	1									

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Phalacridae																	
Phalacrus caricis Strm.	1			1			3	3	1								
Phalacrus spp.				1			2			1							
Lathridiidae																	
Stephostethus angusticollis (Gyll)								1									
Lathridius spp.		1														1	
Corticaria ? punctulata Marsh.										1							
Corticaria spp.								1		1							
Cortinicara gibbosa (Hbst.)										1							
Lathridiidae gen. et sp. indet.									1								1
Colydiidae																	
Synchita humeralis (F.)		1															
Cerylon ferrugineum Steph.		1	1														
Endomychidae																	
Endomychus coccineus (L.)	1				1												
Coccinellidae																	
Chilocorus bipustulatus (L.)							1				1	1					
Lycidae																	
Lyctus sp.								1									

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Anobiidae																	
Grynobius planus (F.)		1	1				1			1							
Dorcatoma chrysomelina Strm.								1									
Ptinidae																	
Ptinus fur (L.)								1									
Ptinus ? clavipes Panz.	1		1														
Ptinus sp.		1			1					1							
Ptinidae gen. et sp. indet.	1																
Pythidae																	
? *Rhinosimus planirostris* (F.)			2														
Modellidae																	
Anaspis sp.							1										
Serropalpidae																	
Orchesia micans (Panz.)								1		1							
Abdera ? flexuosa (Payk.)									1								
Abdera sp.		1								1							
Serropalpidae gen. et sp. indet.		1				1			1								
Tenebrionidae																	
Corticeus sp.						1											

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Tenebrionidae/Salpingidae											1						
gen. et sp. indet.																	
Scarabaeidae																	
Aphodius contaminatus (Hbst.)		1													2	1	
A. sphacelatus (Panz.)						1											
A. ater (Deg.)								1									
Aphodius spp.	1		1	1	1		1		1	1							
Scarabaeidae gen. et sp. indet.								1									
Cerambycidae																	
Grammoptera ? ruficornis (F.)							1										
Leptura scutellata F.								1		1							
Leiopus nebulosus (L.)								1	1	1							
Cerambycidae gen. et sp. indet.								1									
Chrysomelidae																	
Donacia impressa Payk.	1																
D. marginata Hoppe								2									
D. vulgaris Zsch.									1								
Plateumaris discolor (Panz.)												3	6		2	3	5
Plateumaris ? discolor (Panz.)	1											5		1			
Plateumaris discolor (Panz.)/							1		2	8							
sericea (L.)																	
Plateumaris sericea (L.)								2	2		5						
Plateumaris sp.	1																
Donaciinae gen. et sp. indet.			1										1				

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Prasocuris phellandrii (L.)							1										
Chrysomela aenea L.	1								3	1	1	1					
Phratora vulgatissima (L.)									2								
Galerucella ? calmariensis (L.)									1								
Lochmaea suturalis (Thom.)										1			1				
Phyllotreta spp.																	1
Altica lythri Aube										1	2						
Altica ? ericeti (Allard)															7		
Altica britteni Sharp								1					1			3	
Halticinae gen. et sp. indet.																	1
Derocrepis rufipes (L.)								8									
Chaetocnema concinna (Marsh.)								1									
Psylliodes ? dulcamarae (Koch)					1												
Psylliodes spp.							2			1							
Chrysomelidae gen. et sp. indet.	1																
Scolytidae																	
Scolytus ratzeburgi Jans.										1							
Hylastes opacus (Er.)																	1
Tomicus piniperda (L.)					1		1										
Hylesinus crenatus (F.)					1	2											
H. oleiperda (F.)	2																
Hylesinus/Leperisinus A						1	1										
Leperisinus ? varius (F.)	1																
Xylocleptes bispinus (Duft.)		1								1							
Dryocoetinus villosus (F.)								1									
D. alni (Georg)								1									
Ernoporus ? fagi (F.)	2																
Pityophthorus / Pityogenes sp.	1																

	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1
Xyleborus saxeseni (Ratz.)	1																
Xyleborus sp.	1																
Scolytidae gen. et sp. indet.										1							
Curculionidae																	
Apion spp.	2	1			1				1								
Phyllobius sp.						1											
Sitona lineatus (L.) /. *cylindricollis* Fahr												1					
Sitona spp.								1	1	1							
* *Rhyncolus punctatulus* (Bohe.)		1															
R. ater (L.)										1							
Bagous sp.								1									
Dorytomus sp.								1									
Limnobaris dolorosa (Goez.)								2									
Micrelus ericae (Gyll.)		1											2	2	1	3	1
Ceutorhynchus geographicus (Goez.)										1							
Ceutorhynchus sp.		1															
Rhynchaenus quercus (L.)	3																
R. ? fagi (L.)									1								
R. rusci (Hbst.)							1			3	1						
Rhynchaenus spp.	1				2				1								
Rhamphus pulicarius (Hbst.)						1		1		1			1				
Curculionidae gen. et sp. indet.	2				1			2		2							
Coleoptera Gen. et Sp. indet.		1				1											
Coleoptera Total individuals	**127**	**98**	**55**	**51**	**66**	**54**	**130**	**294**	**217**	**300**	**54**	**66**	**95**	**32**	**57**	**30**	**88**
Coleoptera Total species	**69**	**61**	**38**	**33**	**40**	**37**	**64**	**100**	**71**	**90**	**22**	**29**	**31**	**16**	**23**	**17**	**29**
Formicidae indet.				1					4	15	7	42	60	21	35	3	38
Diptera indet.							1		1	2	3	1	1	1	4	1	1

Table 6.4; Coleoptera list from Lindholme A, Hatfield Moors (* denotes non-British species).

Coleoptera	**7**	**6**	**3**
	110-120	**100-110**	**70-80**
Carabidae			
Elaphrus cupreus Duft.	1		
Dyschirius globosus (Hbst.)	1	1	2
Bembidion doris (Panz.)			1
Bembidion sp.			1
Bradycellus ruficollis (Steph.)			3
B. sharpi Joy	1		
Bradycellus sp.			1
Pterostichus diligens (Strm.)	3	2	
P. nigrita (Payk.)		1	
P. minor (Gyll.)	1	1	
P. ? minor (Gyll.)		1	
P. melanarius (Ill.)		1	
Pterostichus spp.		2	
Agonum obscurum (Hbst.)	2	1	
Carabidae Gen. et Sp. indet.	5	3	1
Dytiscidae			
Hydroporus scalesianus Steph.	1	1	2
Hydroporus spp.	23	15	7
Agabus bipustulatus (L.)	1	2	
A. unguicularis Thoms.	1		
Agabus spp.	2	1	
Ilybius aenescens Thom.	1	1	
Colymbetes fuscus (L.)	1	1	
Hydraenidae			
Ochthebius spp.	3		
Hydrophilidae			
Helophorus ? brevipalpis group			2
Coelostoma orbiculare (F.)		1	
Cercyon convexiusculus (Steph.)		1	1
Cercyon sp.			1
Megasternum obscurum (Marsh.)		1	
Paracymus scutellaris (Rosen.)			4
Hydrobius fuscipes (L.)		1	
Anacaena globulus (Payk.)	1	5	
Anacaena sp.		1	
Enochrus affinis (Thun.)			1
Enochrus/Helochares spp.	3		

	7	6	3
Hydrophilidae gen. et sp. indet.			1
Silphidae			
Silphidae Gen. et sp. indet.		1	
Scydmaenidae			
Stenichnus collaris (Mull.)		1	
Euconnus sp.			1
Staphylinidae			
Olophrum fuscum (Grav.)		1	1
O. piceum (Gyll.)		1	
Lesteva punctata Er.		1	
L. longoelytrata Goez.			1
Anotylus sp.			2
Stenus ? *bimaculatus* Gyll.	1		
Stenus spp.	5	3	
Lathrobium fulvipenne (Grav.)		2	
L. brunnipes (F.)	1	2	
L. ? *impressum* Heer	1		
L. longulum Grav.		4	
L. ? *longulum* Grav.		1	
Lathrobium spp.		2	2
Quedius sp.		1	1
Aleocharinae gen. et sp. indet.	1		
Staphylinidae gen. et sp. indet.	3		
Pselaphidae			
Bryaxis curtisi (Leach)	1		
B. bulbifer (Reich.)		7	
Bryaxis sp.	1		
Tychus niger (Payk.)	1		
Trissemus impressa (Panz.)		1	
Dascillidae			
Dascillus cervinus (L.)	1		
Scirtidae			
Cyphon spp.	4	1	1
Cucujidae			
Pediacus dermestoides (F.)		1	
* *Cryptolestes corticinus* Er.		1	

	7	6	3
Cryptophagidae			
Atomaria sp.		2	
Lathridiidae			
Enicmus transversus (Ol.)			1
Corticariinae gen. et sp. indet.			2
Colydiidae			
Cerylon histeroides (F.)		2	
C. ferrugineum Steph.	1		
Tenebrionidae			
Corticeus fraxini (Kug.)	1		
Scarabaeidae			
Aphodius contaminatus (Hbst.)			1
Aphodius sp.			1
Chrysomelidae			
Plateumaris discolor (Panz.)			1
P. sericea (L.)/*discolor* (Panz.)		2	2
Plateumaris sp.	3		
Lochmaea suturalis (Thom.)			1
Altica britteni Sharp.			1
Altica sp.			1
Chaetocnema concinna (Marsh.)			1
C. hortensis (Fourc.)		1	
Scolytidae			
Scolytus ratzeburgi Jans.			1
Hylastes opacus (Er.)		1	
Tomicus piniperda (L.)		1	
? *Pityophthorus lichtensteini* (Ratz.)	1		
Ipinae gen. et sp. indet.		1	
Curculionidae			
Rhynchites sp.		1	
Strophosoma fulvicorne Walt./*capitatum* (Deg.)	1		
S. ? capitatum (Deg.)		1	
Phyllobius sp.		1	

	7	6	3
Rhycolus ater (L.)	1	1	
Curculionidae indet.	1	1	1
Coleoptera gen. et sp. indet.		2	2
Total Coleoptera individuals	**80**	**92**	**53**
Total Coleoptera species	**43**	**56**	**37**
Formicidae gen. et sp. indet.		1	24

Table 6.5; Coleoptera list for Lindholme B (LIND B), Hatfield Moors.

Coleoptera	18	15	12	9
	160-172	145-150	130-135	115-120
Carabidae				
Notiophilus biguttatus (F.)	1			
Dyschirius globosus (Hbst.)		1	11	
Bembidion ? humerale Strm.		1		
Bembidion sp.			1	
Bradycellus ruficollis (Steph.)		1	34	5
Bradycellus harpalinus (Serv.)			5	
Bradycellus sp.			3	
Pterostichus diligens (Strm.)	2	1	7	6
Pterostichus angustatus (Duft.)		1		
Olisthopus rotundatus (Payk.)		1	7	
Agonum cf. *sexpunctatum* (L.)		2		
Amara sp.			1	
Cymindis vaporariorum (L.)				1
Dromius linearis (Ol.)			1	
Dromius sp.		1		
Carabidae gen. et sp. indet.	1	1	2	1
Dytiscidae				
Hydroporus pubescens (Gyll.)			14	
H. longulus Muls.				6
Hydroporus spp.	4	6	39	27
Agabus bipustulatus (L.)			1	1
Ilybius ? subaeneus Er.			2	
I. aenescens Thom.				1
I. ? aenescens Thom.				1
Dytiscidae gen. et sp. indet.		2		
Gyrinidae				
Gyrinus sp.		1		1
Hydraenidae				
Octhebius sp.				2
Hydrophilidae				
Cercyon haemorrhoidalis (F.)			1	
Anacaena globulus (Payk.)				9

	18	15	12	9
Laccobius sp.			1	
Enochrus sp.	1	1		1
Scydmaenidae				
Stenichnus cf. *collaris* (Mull.)	1			
Staphylinidae				
Olophrum piceum (Gyll.)		1	1	13
O. fuscum (Grav.)			6	
Olophrum sp.				1
Acidota crenata (F.)	1	1		
Lesteva sp.			3	
Omalium ? rivulare (Payk.)			1	
Omalium sp.			1	
Stenus spp.	2		10	7
Euaesthetus ruficapillus Bois.			8	2
E. laeviusculus Mann.			1	
Lithocharis sp.			3	
Scopaeus sp.			2	
Lathrobium ? augustatum Bois.		1		
L. fulvipenne (Grav.)		2	4	
L. longulum Grav.			3	
Lathrobium sp.		1	3	
Philonthus nigrita Grav.				2
Philonthus spp.		1	1	2
Platydracus fulvipes (Scop.)				1
Quedius sp.			1	
Aleocharinae gen. et sp. indet.	2	3	3	2
Staphylinidae gen. et sp. indet.			2	
Pselaphidae				
Bibloplectus ambiguus (Reich.)			1	
Bryaxis curtisi (Leach.)				3
B. ? curtisi (Leach.)		1		
Bryaxis spp.	1		3	
Tychus ? niger (Payk.)				1
Pselaphus heisei (Hbst.)		1	1	1
Cantharidae				

	18	15	12	9
Cantharis sp.			1	2
Scirtidae				
Cyphon padi (L.)			3	
Cyphon spp.	8	4	20	39
Lathridiidae				
Corticaria sp.	1		1	
Scarabaeidae				
Aphodius sp.				1
Scarabaeidae gen. indet.		1	1	
Chrysomelidae				
Plateumaris discolor (Panz.)/*sericea* (L.)				1
Donacia/*Plateumaris* sp.			1	
Altica ericeti/*britteni*			6	
A. ? britteni Sharp				1
Curculionidae				
Apion sp.			1	
Micrelus ericae (Gyll.)	5	5	7	5
Coleoptera gen. et sp. indet.			1	
Total Coleoptera individuals	**30**	**42**	**230**	**146**
Total Coleoptera species	**16**	**30**	**58**	**39**

Table 6.6; Coleoptera list from Tyrham Hall Quarry, Hatfield Moors.
(* denotes non-British species).

Coleoptera	1	2A	2B	3	K	Oak
Carabidae						
Dyschirius globosus (Hbst.)	9	1		1	2	
Trechus obtusus Er.	1			1		
T. rubens (F.)		1				
Bembidion quadrimaculatum (L.) /*quadripustulatum* F.				1		
Bembidion sp.		1			1	
Bradycellus ruficollis (Steph.)	1					
B. verbasci (Duft.)	1					
B. harpalinus (Serv.)	1					
Bradycellus sp.	1					
Pterostichus strenuus (Panz.)	1					
P. diligens (Strm.)	8	3	1	4	4	2
P. nigrita (Payk.) / *rhaeticus* Heer	1			1	1	
P. ? nigrita (Payk.) / *rhaeticus* Heer					1	3
P. minor (Gyll.)	4	3			2	
P. ? minor (Gyll.)	2					
Pterostichus spp.	2		1			1
Agonum fuliginosum (Panz.)	2	1				
A.obscurum (Hbst.)	2					2
Agonum sp.	1					
Dromius quadrinotatus Zenk.	1					
Carabidae gen. et sp. indet.	1	3				
Dytiscidae						
Hygrotus decoratus (Gyll.)	1					
Hydroporus scalesianus Steph.		5				
H. gyllenhali Schdte.	3					
H. ? umbrosus (Gyll.)	1					
H. tristis (Payk.)	83					
H. pubescens (Gyll.)	13					
H. melanarius (Duft.)	52					
Hydroporus spp.	59	52	9	9	23	20
Agabus chalconatus (Panz.)	4					
A. ? guttatus (Payk.)	8			1		
A. melanarius Aube	1					
A. bipustulatus (L.)	2	1	1			1
A. ? unguicularis Thoms.		2				2
Agabus spp.	4	2	1	2	2	

	1	2A	2B	3	K	Oak
Ilybius aenescens Thom.	2	3				
I.guttiger (Gyll.)						1
Agabus / Ilybius sp.					1	
Graphoderus ? bilineatus (Deg.)	1					
Hydrophilidae						
Ochthebius ? minimus (F.)	2			2	1	
Ochthebius spp.		3				
Limnebius aluta Bed.			1			
Cercyon ? convexiusculus Steph.			1			
Cercyon sp.		1			3	
Megasternum obscurum (Marsh.)			2		2	
cf. *Paracymus scutellaris* (Rosen.)				1	3	
Hydrobius fuscipes (L.)		1		1		
Anacaena globulus (Payk.)	3	6				1
Anacaena sp.					2	
Laccobius sp.		1				
Helochares/Ernochrus sp.			1			
Ernochrus sp.	1					
Hydrophilidae gen. et sp. indet.		1				
Silphidae						
Silpha ? tristis Ill.		1				
Silpha sp.		1				
Scydmaenidae						
Neuraphes ? elongatulus (Mull.)	2					
Scydmaenidae gen. et sp. indet.		1				
Clambidae						
Clambus sp.		1	1			
Ptiliidae						
Acrotrichis sp.	1					
Staphylinidae						
Megathrus/Proteinus sp.	1				1	
Olophrum piceum (Gyll.)	2	2	2		1	
O. fuscum (Grav.)					1	2

	1	2A	2B	3	K	Oak
Eucnecosum brachypterum (Grav.)	2					
Acidota crenata (F.)			2			
Lesteva punctata Er.					1	
L. ? punctata Er.			1			
Bledius sp.	2			1		
Carpelimus sp.	1	1				
Anotylus sp.	1					
Stenus comma LeC.	1					
Stenus spp.	7	5	2	1	4	2
Scopaeus sulcicollis (Steph.) /*gracilis* (Sperk.)	1					
Lathrobium rufipenne Gyll.	5			1	2	
L. terminatum Grav.			1	1		
L. fulvipenne (Grav.)			1		2	
L. brunnipes (F.)	1	3				
Lathrobium spp.	5	8	1	1	1	3
Xantholinus linearis (Ol.)					1	
X. longiventris Heer	1				2	
Philonthus spp.		2				
Gabrius sp.		1				
Staphylinus brunnipes F.					1	
Staphylinus sp.	1					
Quedius sp.	3					
Mycetoporus sp.					1	1
Aleocharinae gen.et sp. indet.	2	1	1	1		2
Staphylinidae gen. et sp. indet.		2				
Pselaphidae						
Bryaxis bulbifer (Reich.)	2			1	1	
B. curtisi (Leach)		8	1			
Bryaxis sp.	2					
Brachygluta fossulata (Reich.)		1				1
Pselaphus heisei (Hbst.)		1				
Pselaphidae gen. et sp. indet.	1					
Elateridae						
Ampedus ? rufipennis Steph.	1					
Ampedus sp.					1	
Agriotes sputator (L.)	1					
Hypnoides riparius (F.)	1					
Elateridae gen. et sp. indet.	2					
Scirtidae						
Microcara testacea (L.)	2					
Cypon padi (L.)	8					
Cyphon spp.	16	20	3	1	1	3

Byrridae	**1**	**2A**	**2B**	**3**	**K**	**Oak**
? *Curimposis nigrita* (Palm.)	1					
Ostomidae						
Ostoma ferrugineum (L.)	1					
Rhizophagidae						
Rhizophagus ferrugineus (Payk.)					1	
Cucujidae						
**Prostomis mandibularis* (F.)		1				
Lathiididae						
Lathridius minutus (L.) / *pseudominutus* Strand.	1					
L. ? anthracinus Mann.	2					
Cortinicara gibbosa (Hbst.)	1		1			
Corticarina sp.	1					
Corticariinae indet.	1		1			
Lathridiidae gen. et sp. indet.			1		1	
Colydiidae						
Bitoma crenata (F.)						1
Cerylon histeroides (F.)				1		
Colydiidae ? gen. et sp. indet.		1				
Anobidae						
Grynobius planus (F.)	1					
Ptinidae						
Ptinus ? *clavipes* Panz.	1					
Scarabaeidae						
Aphodius sphacelatus (Panz.)	1					

Chrysomelidae	**1**	**2A**	**2B**	**3**	**K**	**Oak**
Plateumaris sericea (L.)				2		
Plateumaris ? sericea (L.)						1
P. discolor (Panz.)	5					
P. discolor (Panz.) / *sericea* (L.)	4	5		5	2	
Donaciinae indet.	1	1				
Chaetocnema concinna (Marsh.)					1	
C. hortensis (Fourc.)					1	
Chrysomelidae Gen. et Sp. indet.				1		
Scolytidae						
Leperisinus varius (F.)					1	
Dryocoetinus villosus (F.)		2				
Pityophthorus lichtensteini (Rantz.)		1				
Pityophthorus/Pityogenes sp.	1					
Xyleborus saxeseni (Ratz.)	1	1				
Ipinidae gen. et sp. indet.	1					
Scolytidae gen. et sp. indet.	2				1	
Curculionidae						
Apion spp.	1	4				
Phyllobius sp.		1				
Sitona sp.			1			
Dryophthorus corticalis (Payk.)	21				2	
**Rhyncolus elongatus* (Gyll.)	31				1	
R. ater (L.)	10					1
R. cf. *ater* (L.)						1
**R. punctulatus* Bohe.	1					
**R. sculpturatus* Walt.	29					
Phloeophagus lignarius (Marsh.)	1					
Cossinine gen. et sp. indet.	1					
Acalles roboris Curt.		1				
A. ptinoides (Marsh.)	1					
Micrelus ericae (Gyll.)	6			1	4	
Ceutorhynchus sp.	1					
Ceutorhynchus pallidactylus Marsh.				1		
Anthonomus ? rubi (Hbst.)				1		
Rhynchaenus quercus (L.)		1				1
R. ? rusci (Hbst.)		1				
Rhynchaenus spp.		3				1
Curculionidae gen. et sp. indet.		1				1
Coleoptera gen. et sp. indet.					1	
Total Coleoptera individuals	**482**	**174**	**38**	**44**	**85**	**54**
Total Coleoptera species	**102**	**64**	**26**	**28**	**44**	**27**
Formicidae indet.	24	5	1	5	11	0

Table 6.7. Tabulation of Jaccard's coefficient of similarity results (0 is the greatest dissimilarity, 1 is the closest similarity).

Site	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat2	Hat1	Hat1	LinA	LndA	LinA	LinB	LinB	LinB	LinB	Tyh	Tyh	Tyh	Tyh	Tyh	Tyh
Sample	29	28	27	26	25	24	23	22	20	18	16	14	12	10	7	4	1	18	17	7	6	3	18	15	12	9	1	2A	2B	3	K	Oak
No.Sp	69	61	38	33	40	37	64	100	71	90	22	29	31	16	23	17	29	32	40	43	56	37	16	30	58	39	102	64	26	28	44	27
Hat2	29	0.14	0.16	0.16	0.14	0.14	0.16	0.11	0.18	0.1	0.06	0.09	0.06	0.05	0.07	0.06	0.07	0.13	0.06	0.1	0.15	0.07	0.06	0.05	0.07	0.08	0.13	0.15	0.1	0.09	0.13	0.12
Hat2	28		0.16	0.13	0.17	0.2	0.14	0.13	0.22	0.15	0.06	0.11	0.1	0.08	0.09	0.1	0.1	0.12	0.12	0.08	0.11	0.1	0.08	0.07	0.12	0.09	0.15	0.12	0.09	0.1	0.11	0.07
Hat2	27			0.15	0.15	0.17	0.15	0.1	0.15	0.11	0.07	0.08	0.1	0.1	0.07	0.08	0.1	0.09	0.1	0.14	0.15	0.07	0.1	0.08	0.12	0.13	0.1	0.15	0.16	0.1	0.09	0.12
Hat2	26				0.11	0.11	0.18	0.1	0.16	0.09	0.06	0.07	0.07	0.11	0.1	0.11	0.07	0.08	0.06	0.1	0.13	0.08	0.09	0.05	0.03	0.09	0.07	0.13	0.09	0.13	0.13	0.07
Hat2	25					0.29	0.32	0.39	0.39	0.38	0.1	0.2	0.1	0.13	0.15	0.15	0.1	0.24	0.21	0.22	0.24	0.18	0.13	0.13	0.2	0.17	0.23	0.24	0.23	0.17	0.15	0.25
Hat2	24						0.13	0.16	0.19	0.13	0.07	0.08	0.08	0.1	0.09	0.06	0.1	0.13	0.07	0.1	0.18	0.07	0.1	0.06	0.08	0.07	0.09	0.1	0.13	0.1	0.08	0.08
Hat2	23							0.17	0.16	0.17	0.08	0.09	0.08	0.05	0.06	0.07	0.06	0.12	0.08	0.09	0.2	0.07	0.08	0.09	0.08	0.12	0.11	0.12	0.14	0.11	0.13	0.1
Hat2	22								0.18	0.19	0.06	0.09	0.1	0.07	0.08	0.07	0.07	0.12	0.09	0.08	0.11	0.1	0.07	0.08	0.1	0.07	0.1	0.11	0.09	0.08	0.07	0.08
Hat2	20									0.2	0.13	0.12	0.12	0.1	0.13	0.1	0.12	0.18	0.13	0.11	0.15	0.08	0.09	0.1	0.08	0.1	0.14	0.14	0.17	0.14	0.13	0.1
Hat2	18										0.12	0.11	0.1	0.06	0.09	0.06	0.09	0.15	0.12	0.11	0.14	0.09	0.07	0.05	0.08	0.08	0.16	0.12	0.14	0.08	0.12	0.1
Hat2	16											0.31	0.18	0.19	0.15	0.11	0.19	0.17	0.17	0.08	0.04	0.04	0.19	0.08	0.1	0.07	0.08	0.06	0.12	0.11	0.05	0.09
Hat2	14												0.25	0.22	0.21	0.21	0.18	0.15	0.19	0.09	0.08	0.12	0.15	0.13	0.14	0.11	0.13	0.09	0.12	0.12	0.07	0.12
Hat2	12													0.21	0.26	0.23	0.25	0.17	0.2	0.09	0.07	0.15	0.15	0.15	0.14	0.13	0.12	0.08	0.14	0.13	0.12	0.07
Hat2	10														0.26	0.27	0.22	0.14	0.14	0.09	0.07	0.08	0.23	0.12	0.1	0.1	0.08	0.07	0.14	0.13	0.09	0.1
Hat2	7															0.38	0.24	0.12	0.21	0.08	0.08	0.11	0.15	0.13	0.09	0.13	0.11	0.07	0.14	0.16	0.12	0.09
Hat2	4																0.18	0.14	0.16	0.09	0.09	0.17	0.18	0.12	0.09	0.12	0.08	0.08	0.13	0.18	0.13	0.13
Hat2	1																	0.15	0.19	0.09	0.1	0.05	0.13	0.09	0.1	0.08	0.12	0.08	0.12	0.14	0.12	0.08
Hat1	18																		0.14	0.12	0.17	0.11	0.09	0.07	0.11	0.08	0.12	0.1	0.12	0.09	0.13	0.16
Hat1	17																			0.12	0.1	0.07	0.14	0.11	0.15	0.14	0.18	0.11	0.14	0.15	0.14	0.14
LinA	7																				0.22	0.1	0.13	0.11	0.12	0.17	0.12	0.22	0.15	0.13	0.1	0.21
LndA	6																					0.15	0.09	0.1	0.14	0.12	0.17	0.19	0.19	0.17	0.23	0.17
LinA	3																						0.06	0.1	0.12	0.1	0.09	0.12	0.09	0.1	0.16	0.08
LinB	18																							0.21	0.14	0.17	0.08	0.08	0.17	0.16	0.09	0.13
LinB	15																								0.21	0.23	0.09	0.13	0.19	0.14	0.12	0.1
LinB	12																									0.17	0.15	0.15	0.12	0.1	0.12	0.1
LinB	9																										0.11	0.17	0.14	0.12	0.09	0.12
Tyh	1																											0.14	0.1	0.14	0.16	0.09
Tyh	2A																												0.14	0.12	0.13	0.17
Tyh	2B																													0.17	0.19	0.18
Tyh	3																														0.24	0.12
Tyh	K																															0.13
Tyh	Oak																															

Table 6.8. Total fossil Coleopterous list for Hatfield Moors, showing RDB status of species and their habitat categories.

Species	Habitat category	RDB status	New Fossil record?
Carabidae			
Notiophilous biguttatus (F.)	11		
Elaphrus cupreus Duft.	23		
Elaphrus uliginosus F.	23	NB	
Dyschirius globosus (Hbst.)	21		
Trechus rubens (F.)	22	NB	
T. obtusus Er.	9		
Bembidion humerale Strm.	18	RDB1	
B. quadrimaculatum/quadripustulatum	10		
Bembidion doris (Panz.)	20		
Bembidion sp.	21		
Bradycellus ruficollis (Steph.)	10		
Bradycellus sharpi Joy	9		
B. verbasci (Duft.)	21		
B. harpalinus (Serv.)	10		
Bradycellus spp.	10		
Pterostichus strenuus (Panz.)	9		
Pterostichus diligens (Strm.)	14		
P. nigrita (Payk.) / *rhaeticus*	14		
P. minor (Gyll.)	14		
P. melanarius (Ill.)	21		
P. angustatus (Duft.)	1 & 38	NB	YES (>2700-2350 cal BC)
Pterostichus spp.	21		
Olisthopus rotundatus (Payk.)	10		
Agonum sexpunctatum (L.)	18		
Agonum ericeti (Panz.)	18		
A. fuliginosum (Panz.)	14		
A. obscurum (Hbst.)	9		
Agonum spp.	21		
Amara similata (Gyll.)	10		YES
Amara sp.	UN		
Cymindis vaporariorum (L.)	1	NB	
Dromius linearis (Ol.)	10		
Dromius agilis (F.)	3		YES
D. angustus Brul.	1 & 38		YES
D. meridionalis Dej.	2		
D. quadrinotatus Zenk.	1 & 38		
Dromius sp.	3		
Haliplidae			
Haliplus sp.	26		
Dytiscidae			
Hygrotus decoratus (Gyll.)	27	NB	
Hydroporus scalesianus Steph.	27	RDB2	
H. gyllenhali Schdte.	28		
H. umbrosus (Gyll.)	29		

H. tristis (Payk.)	28		
H. striola (Gyll.) group	27		
H. ? obscurus Strm.	28		
H. pubescens (Gyll.)	27		YES
H. melanarius Strm.	28		
H ? neglectus Schaum.	27	NB	
H. longulus Muls.	32	NB	
Hydroporus spp.	27		
Graptodytes granularis (L.)	27	NB	
Copelatus haemorrhoidalis (F.)	30		
Agabus chalchonatus (Panz.)	27	NB	
A. ? guttatus (Payk.)	32		
A. melanarius Aube	32	NB	
Agabus bipustulatus (L.)	26		
Agabus unguicularis Thoms.	29	NB	
A. affinis (Payk.)	28		
Agabus spp.	26		
Ilybius fuliginosus (F.)	26		
I. subaeneus Er.	30	NB	
I. aenescens Thom.	28	NB	
I. ? quadriguttatus (Lac)	29		
I. guttiger (Gyll.)	27	NB	
Ilybius sp.	26		
Colymbetes fuscus (L.)	26		
Graphoderus ? bilineatus (Deg.)	29	RDB1	YES
Graphoderus sp.	26		
Acilius canaliculatus (Nic.)	27	RDB2	
Gyrinidae			
Gyrinus aeratus Steph.	33		
Gyrinus sp.	26		
Hydraenidae			
Hydraena britteni Joy	27		
H. testacea Curt.	29		
Hydraena sp.	26		
Ochthebius bicolon Germ.	32	NB	
O. minimus (F.)	30		
Ochthebius spp.	26		
Limnebius truncatellus (Thun.)	33		
L. papposus Muls.	32	NB	
L. aluta Bed.	29	RDB 3	
Limnebius sp.	26		
Hydrophilidae			
Hydrochus elongatus (Schall.)	29		
H.? ignicollis Mots.	29	RDB 2	YES
H. ignicollis Mots./ *carinatus* Germ.	29		
H. ? carinatus Germ.	29	RDB 3	
H. brevis (Hbst.)	27	RDB 3	
H. nitidicollis Muls.	26	NA	YES
H. augustatus	29	NB	
Hydrochus sp.	26		
Helophorus ? aquaticus (L.) auct.	26		
H. brevipalpis group	30		
H.laticollis Thom./ *stringifrons* Thom.	27	RDB2/	

		NB	
Helophorus sp.	26		
Coelostoma orbiculare (F.)	20		
Cercyon haemorrhoidalis (F.)	35		
Cercyon convexiusculus Steph	16	NB	
C. sternalis Sharp	16	NB	
Cercyon spp.	35		
Megasternum obscurum (Marsh.)	22		
Paracymus scutellaris (Rosen.)	28	NB	YES
Hydrobius fuscipes (L.)	26		
Anacaena globulus (Payk.)	30		
A. limbata (F.)	30		
Anacaena spp.	26		
Laccobius sp.	26		
Enochrus affinis (Thun.)	28	NB	
E. coarctatus (Gred.)	29		
Enochrus sp.	26		
Enochrus/Helochares spp.	26		
Hydrophilus piceus(L.)	29	RDB3	
Silphidae			
Silpha ? tristis Ill.	35		
Silpha atrata L.	03		
Silpha sp.	UN		
Leiodidae			
Agathidium sp.	37		
Scydmaenidae			
Neuraphes ? elongatulus (Mull.)	09		
Stenichnus collaris (Mull.)	09		
Stenichnus sp.	UN		
Euconnus hirticollis (Ill.)	09		YES
Euconnus sp.	22		
Scydmaenus ? tarsatus Mull.	35		
Clambidae			
Clambus sp.	22		
Ptillidae			
Ptenidium sp.	36		
Acrotrichis sp.	35		
Staphylinidae			
Megarthrus / Proteinus sp.	35		
Proteinus ovalis Steph.	36		
Proteinus ? brachypterus (F.)	36		
Eusphalerum sp.	UN		
Dropephylla grandiloqua (Luze)	06		YES
Olophrum piceum (Gyll.)	16		
O. fuscum (Grav.)	16		
Olophrum spp.	22		
Eucnecosum brachypterum (Grav.)	20		
Acidota crenata (F.)	20		

Lesteva heeri Fauv.	20		
Lesteva punctata Er.	24		
L. longoelytrata Goez.	20		
Lesteva spp.	21		
Omalium ? rivulare (Payk.)	35		
Omalium sp.	UN		
Omaliinae gen. et sp. indet.	UN		
Carpelimus ? corticinus (Grav.)	24		
Carpelimus spp.	21		
Anotylus rugosus (F.)	35		
Anotylus spp.	35		
Oxytelus fulvipes Er.	24		
Platystethus sp.	23		
Bledius sp.	24		
Stenus biguttatus (L.)	24		
S. comma LeC.	22		
Stenus guttula Mull.	23		
Stenus ? bimaculatus Gyll.	24		
Stenus kiesenwetteri Rosen.	20	RDB2	
Stenus spp.	22		
Euaesthetus ruficapillus Bois.	20		
E. laeviusculus Mann.	20		
Paederus fuscipes Curt.	20		
Lithocaris sp.	22		
Scopaeus sulcicollis (Steph.)/*gracilis* (Sperk.)	21		
Scopaeus sp.	23		
Lathrobium ? augustatum Bois.	23	NB	YES
Lathrobium rufipenne Gyll.	20	RDB2	
L. terminatum Grav.	20		
L. geminum Kr.	22		
L. fulvipenne (Grav.)	22		
L. brunnipes (F.)	22		
L. ? impressum Heer	22		
L. longulum Grav.	22		
L. dilutum Er.	10	RDB3	YES
Lathrobium spp.	21		
Ochthephilum fracticorne (Payk.)	20		
Xantholinus linearis (Ol.)	10		
Xantholinus longiventris Heer	35		
Othius punctulatus (Goez.)	08		
O. angustus Steph.	21		
Erichsonius cinerescens (Grav.)	20		
Erichsonius sp.	21		
Philonthus nigrita Grav.	20		
Philonthus spp.	UN		
Philonthus/ Quedius spp.	UN		
Gabrius sp.	UN		
Platydracus fulvipes (Scop.)	35		
Staphylinus brunnipes F.	22		
Staphylinus sp.	UN		
Quedius sp.	UN		
Habrocerus capillaricornis Grav	36		
Mycetoporus splendidus	20		
Mycetoporus sp.	UN		
Lordithon sp.	36		
Sepedophilus immaculatus (Steph.) / *lusitanicus* Hamm.	36		
Aleocharinae gen. et sp. indet.	35		
Staphylinidae gen. et sp. indet.	UN		

Pselaphidae			
Bibloporus sp.	37		
Bibloplectus ambiguus (Reich.)	22		
Bythinus burrelli (Denny)	20		YES
Bryaxis ? puncticollis (Denny)	09		
B. curtisi (Leach)	09		
B. bulbifer (Reich.)	20		
Bryaxis spp.	22		
Tychus niger (Payk.)	09		
Brachygluta fossulata (Reich.)	22		
Reichenbachia juncorum (Leach)	24		
Trissemus impressa (Panz.)	24		
Pselaphus heisei (Hbst.)	20		
Pselaphidae gen. et sp. indet.	UN		
Cantharidae			
Cantharis spp.	UN		
Rhagonycha testacea (L.)	11		
Rhagonycha sp.	11		
Cantharidae gen. et sp. indet.	UN		
Melyridae			
Aplocnemus impressus (Marsh.)	04	NB	
Elateridae			
Ampedus ? rufipennis Steph.	05	RDB2	YES
Ampedus balteatus (L.)	04		
Ampedus sp.	03		
Dalopius marginatus (L.)	06		
Agriotes acuminatus (Steph.)	03		
A. sputator (L.)	13		
Denticollis linearis (L.)	06		
Pseudathous ? hirtus (Hbst.)	07		
Athous haemorrhoidalis (F.)	03		
Hypnoides riparius (F.)	21		
Elateridae gen et sp. indet.	UN		
Eucnemidae			
Melasis buprestoides (L.)	05	NB	
Melasis buprestoides (L.) / *Isorhipis melasoides* (Cast.)	05	NB/ Non-British	
Dascillidae			
Dascillus cervinus (L.)	07		
Scirtidae			
Microcara testacea (L.)	09		
Cyphon padi (L.)	30		
Cyphon spp.	21		
Byrridae			

Curimopsis nigrita (Palm.)	18	RDB1	
Ostomidae			
Tenebrioides fuscus Goeze	05	Non-British	YES (> 1320-1030 cal BC and < 1000 cal BC)
Ostoma ferrugineum (L.)	04	RDB1	YES
Rhizophagidae			
Rhizophagus ferrugineus (Payk.)	06		
Cucujidae			
Pediacus dermestoides (F.)	05		
Cryptolestes corticinus Er.	04	Non-British (> 2000 cal BC)	
Prostomis mandibularis (F.)	05	Non-British (> 3350-3030 cal BC)	
Cryptophagidae			
Atomaria sp.	36		
Phalacridae			
Phalacrus caricis Strm.	25		
Phalacrus sp.	25		
Lathridiidae			
Stephostethus angusticollis (Gyll)	08		
Lathridius minutus (L.)/pseudominutus Strand.	36		
L. ? anthracinus Mann.	36		
Lathridius sp.	36		
Enicmus transversus (Ol.)	36		
Corticaria punctulata Marsh.	36		
Corticaria sp.	36		
Cortinicara gibbosa (Hbst.)	36		
Corticarina sp.	36		
Coticariinae gen. et sp. indet.	36		
Lathridiidae gen. et sp. indet.	36		
Colydiidae			
Synchita humeralis (F.)	05 & 38	NB	
Bitoma crenata (F.)	05 & 38		
Cerylon histeroides (F.)	06		

Cerylon ferrugineum Steph.	05		
Colydiidae gen. et sp. indet.	06		
Endomychidae			
Endomychus coccineus (L.)	06		YES
Coccinellidae			
Rhyzobius litura (F.)	13		
Chilocorus bipustulatus (L.)	10		
Anobiidae			
Grynobius planus (F.)	06		
Dorcatoma chrysomelina Strm.	05		
Ptinidae			
Ptinus fur (L.)	37		
Ptinus ? clavipes Panz.	37		
Ptinus sp.	36		
Ptinidae gen. et sp. indet.	36		
Pythidae			
? *Rhinosimus planirostris* (F.)	11		
Modellidae			
Anaspis sp.	06		
Serropalpidae			
Orchesia micans (Panz.)	08	NB	
Abdera ? flexuosa (Payk.)	09	NB	YES
Abdera sp.	06		
Serropalpidae gen. et sp. indet.	UN		
Tenebrionidae			
Corticeus sp.	06		
Tenebrionidae/Salpingidae gen. et sp. indet.	UN		
Scarabaeidae			
Aphodius contaminatus (Hbst.)	35		
A. sphacelatus (Panz.)	35		
A. ater (Deg.)	35		
Aphodius spp.	35		
Scarabaeidae gen. et sp. indet.	35		
Cerambycidae			
Grammoptera ruficornis (F.)	02		
Leptura scutellata F.	06	NA	
Leiopus nebulosus (L.)	05		

Cerambycidae ge. et sp. indet.	UN		
Chrysomelidae			
Donacia impressa Payk.	15	NA	
D. marginata Hoppe	15		
D. vulgaris Zsch.	15		
Plateumaris discolor (Panz.)	19		
Plateumaris sericea (L.)	15		
Plateumaris spp.	14		
Prasocuris phellandrii (L.)	25		
Chrysomela aenea L.	09		
Phratora vulgatissima (L.)	09		
Galerucella ? calmariensis (L.)	25		
Lochmaea suturalis (Thom.)	10		
Phyllotreta sp.	13		
Altica lythri Aube	25		
Altica ? ericeti (Allard)	10	NB	YES
Altica ericeti/britteni	10		
Altica britteni Sharp	18		
Altica sp.	13		
Halticinae gen. et sp. indet.	13		
Derocrepis rufipes (L.)	13		
Chaetocnema concinna (Marsh.)	13		
C. hortensis (Fourc.)	13		
Psylliodes dulcamarae (Koch)	13		
Psylliodes sp.	13		
Chrysomelidae gen. et sp. indet.	UN		
Scolytidae			
Scolytus ratzeburgi Jans.	05 & 38	NB	
Hylastes ater (F.)	04		
Hylastes opacus (Er.)	14		
Tomicus piniperda (L.)	14		
Hylesinus crenatus (F.)	02		
H. oleiperda (F.)	03		
Hylesinus/Leperisinus A	03		
Leperisinus ? varius (F.)	02		
Xylocleptes bispinus (Duft.)	07		
Dryocoetinus villosus (F.)	05 & 38		
D. alni (Georg)	05	NA	
Ernoporus ? fagi (F.)	05	NA	YES
Pityophthorus lichtensteini (Ratz.)	04	RDB2	
Pityophthorus / Pityogenes sp.	03		
Xyleborus saxeseni (Ratz.)	03		
Xyleborus sp.	03		
Ipinidae gen. et sp. indet.	03		
Scolytidae ge. et sp. indet.	03		
Curculionidae			
Apion spp.	13		
Rhynchites sp.	03		
Phyllobius sp.	UN		
Strophosoma ? capitatum (Deg.)	11		
S. capitatum (Deg.) / *curvipes* Thom.	11		
Sitona lineatus/cylindricollis Fahr.	13		
Sitona sp.	13		
Dryophthorus corticalis (Payk.)	06	RDB1	

Rhyncolus elongatus Gyll.	04	Non-British (2921-2445 BC*)
R. ater (L.)	04	
Rhyncolus punctatulus (Bohe.)	06	Non-British (2921-2445 BC*)
Rhyncolus sculpturatus Walt.	04	Non-British (2921-2445 BC*)
Phloeophagus lignarius (Marsh.)	05	
Bagous sp.	21	
Dorytomus sp.	09	
Magdalis carbonaria (L.)	11	NB
Brachonyx pineti (Payk.)	01	
Anthonomus ? rubi (Hbst.)	07	
Acalles roboris Curt.	02	NB
A. ptinoides (Marsh.)	11	NB
Limnobaris dolorosa (Goez.)	15	
Micrelus ericae (Gyll.)	10	
Ceutorhynchus geographicus (Goez.)	10	
Ceutorhynchus pallidactylus Marsh.	13	
Ceutorhynchus sp.	13	
Rhynchaenus quercus (L.)	02	
R. ? fagi (L.)	02	
R. rusci (Hbst.)	11	
Rhynchaenus spp.	03	
Rhamphus pulicarius (Hbst.)	11	
Curculionidae gen. et sp. indet.	UN	

* = dendrochronological date.

Table 7.1; Chronology of palaeoentomological samples from Hatfield Moors (dates expressed as BC). All dates are calibrated, except dendrochronological dates, which are prefixed by an asterix *. Uncalibrated radiocarbon dates are included in brackets. Broad-span dates are assessed upon the longest range possible. The term "phase" is used not to denote vegetational phases, but rather to allow groups of sites/samples to be placed together.

Period	Phase	Site/samples	Dominant vegetation as indicated by insects.	Trophic stage
***3618 to 3418 BC**	**1**	Tyrham *Quercus* woodland	Damp *Quercus* dominated woodland.	? Rheotrophic
***c.* 3,300-2445 BC**	**2**			
*2921 to 2445 BC	2	Tyrham *Pinus* woodland	*Pinus/Calluna* heath, with *Quercus*, *Fraxinus*, *Betula*, *Fagus* and *Alnus*	Mesotrophic, grading into ombrotrophic.
c. 3350-2930 cal BC (4480 ± 45 B.P.) and later.	2	Base of HAT 3 *Pinus* woodland.	*Pinus/Calluna* heath with *Quercus*, *Fraxinus*, *Fagus* and *Alnus*.	Mesotrophic, grading into ombrotrophic.
c. 2900-2350 cal BC (3990 ± 60 BP) and later	2	60 cm. from base of LIND B.	Wet *Calluna* heath.	Largely ombrotrophic.
***c.* ? cal 2,000 BC**	**3**			
c. ? 2,000 BC and later (or 3,500 BP)		Base of LIND A. Rough date obtained on stratigraphic grounds. Top of sequence unknown.	Wet *Pinus* heath, turning into *Calluna* heath.	Mesotrophic
***c.* 1520-1390 cal BC to *c.* 1,300 BC**	**4**			
1520-1390 cal BC (3165 ± 40 BP)		Base of HAT 4 (insect assemblage zone 1). End of zone dated upon beginning of next zone.	*Pinus* woodland with *Quercus*, *Fagus*, *Fraxinus* and *Alnus* carr communities	Rheotrophic
***c.* 1,300 to 1,000 cal BC**	**5**			
1390-1030 cal BC to 1320-930 cal BC (2965 ± 45 BP and 2960 ± 45 BP)		HAT 4 Insect assemblage zone 2. Centred around ? possible recurrence horizon (Smith's [1985] HHL V).	*Pinus* heath, becoming increasingly waterlogged, with fen and ombrotrophic indicating taxa.	Mesotrophic.
***c.* 1,000 cal BC to 700 AD**	**6**			
1130-840 cal BC (2820 ± 50 BP)		Top of LIND B sequence.	Ombrotrophic mire with wet heath elements.	Ombrotrophic.
1420-1120 cal BC to 560-680 cal BC (3020 ± 45 BP and 1405 ± 45 BP).		HAT 4 insect assemblage zone 3, dates from top and bottom of zone.	Ombrotrophic mire with wet heath elements	Ombrotrophic.

Table 8.1; Coleoptera list from Blackwater Dike, Goole Moors

(* denotes non-British species).

	Bulk 3	20	19	18	17	16	15
	Base	122-127	122-117	117-112	112-107	107-102	102-97
Carabidae							
Bembidion unicolor Chaud./ *guttula* (F.)				1			
Bradycellus ruficollis (Steph.)				1			
Bradycellus sp.			1				
Pterostichus diligens (Strm.)	1		1	6	3	2	1
P.nigrita(Payk.)/*rhaeticus* Heer			1	1	2	1	
P. minor (Gyll.)			1	1			
Agonum fuliginosum (Panz.)				5	1		
A.obscurum (Hbst.)			2	2			1
Carabidae gen. et sp. indet.			2	1			
Dytiscidae							
Hydroporus scalesianus Steph.						1	
H. tristis (Payk.)						5	
H. melanarius Strm.			2			3	
Hydroporus spp.	6	5	16	29	35	13	
Agabus ? chalconatus (Panz.)				2			
A. melanarius Aube							1
A. bipustulatus (L.)				2	3		
A. affinis (Payk.)			2				
Agabus spp.				1	3		1
Ilybius aenescens Er.				2			
Agabus/Ilybius spp.	1					3	
Rhantus sp.						1	
Colymbetes fuscus (L.)				2	1		
Acilius ? sulcatus (L.)				1			
Hydraenidae							
Ochthebius minimus (F.)				1	4	1	1
Limnebius aluta Bed.				4			
Hydrophilidae							
Coelostoma orbiculare (F.)				1	1		
Cercyon sp.			1				
Hydrobius fuscipes (L.)					2		
Anacaena globulus (Payk.)			2	7	2		
Enochrus affinis (Thun.)						1	1

	Bulk 3	20	19	18	17	16	15
Hydrophilidae gen. et sp. indet.					3		
Scydmaenidae							
Stenichnus collaris (Müll.)			1				
Stenichnus sp.				1			
Ptillidae							
Ptenidium sp.			1				
Acrotrichis sp.							1
Staphylinidae							
Proteinus ? macropterus (Grav.)			1				
Olophrum piceum (Gyll.)				1			1
O. fuscum (Grav.)			1	1			
Acidota crenata (F.)				1			1
Lesteva punctata Er.	1			2			
L. heeri Fauv.						2	2
Lesteva sp.			1				
Stenus kiesenwetteri Rosen.			2				1
Stenus spp.	5	1	3	6	2	6	6
Rugilus sp.						1	
Lathrobium terminatum Grav.	1				1		
L. brunnipes (F.)	2			2	1	1	
L. longulum Grav.			2		1		
Lathrobium spp.	1	1	7	2		2	2
Ochthephilum fracticorne (Payk.)	1						
Gyrohypnus sp.	1						
Xantholinus linearis (Ol.)							3
Atrecus affinis (Payk.)				1			
Othius punctulatus (Goez.)			2				
O. myrmecophilus Kies.	1			2			
Othius sp.			1	1			
Philonthus spp.	2				1		
Staphylinus sp.				1			
Quedius sp.					1		
Aleocharinae gen. et sp. indet.	1	1	4	2	1	1	1
Staphylinidae gen. et sp. indet.							1
Pselaphidae							
Bryaxis bulbifer (Reich.)	1				2		
Bryaxis spp.			4			1	1
Reichenbachia juncorum (Leach)			1				
Pselaphus heisei (Hbst.)			1				

	Bulk 3	20	19	18	17	16	15
Cantharidae							
Cantharis sp.						1	
Rhagonycha sp.					1		
Melyridae							
Aplocnemus nigricornis (F.)						1	
Elateridae							
Ampedus sp.				1			
Dalopius marginatus (L.)			1				
Athous haemorrhoidalis (F.)			1				1
Scirtidae							
Microcara testacea (L.)			1				
Cyphon padi (L.)			9			5	
Cyphon spp.	16	3	16	36	26	28	
Scirtes ? hemisphericus (L.)					1		
Scirtidae gen. et sp. indet.				1			
Dryopidae							
Dryops sp.	1						
Rhizophagidae							
Rhizophagus ferrugineus (Payk.)			1				
R. ? parallelocollis Gyll	1						
R. dispar (Payk.)			2				
Cucujidae							
Psammoecus bipunctatus (F.)						2	
Pediacus dermestoides (F.)			1				
**Cryptolestes corticinus* Er.	1						
Cucujidae gen. et sp. indet.							1
Lathridiidae							
Stephostethus augusticollis (Gyll.)			1				
Enicmus transversus (Ol.)					1		
Dienerella separanda (Reitt.)			1				
Corticaria sp.			2				

	Bulk 3	20	19	18	17	16	15
Colydiidae							
**Pycnomerus tenebrans* Ol.			1				
Colydium elongatum (F.)				1	1		
Teredus cylindricus (Ol.)			2				
**Bothrideres contractus* (F.)					1		
Cerylon histeroides (F.)			2				
Endomychidae							
**Mycetina cruciata* (Schall.)			1	1			
Endomychus coccineus (L.)			1				
Coccinellidae							
Calvia 14-guttata (L.)					1		
Aspidiphoridae							
Aspidiphorus orbiculatus (Gyll.)				1			
Anobidae							
Grynobius planus (F.)	1		1				
Anobium ? punctatum (Deg.)				1			
Dorcatoma chrysomelina Strm.			1	1			
Ptinidae							
Ptinus sp.			1				
Aderidae							
Aderus oculatus (Panz.)			1				
Serropalpidae							
Orchesia minor							1
Abdera 4-fasciata (Curt.)				1			
Serropalpidae gen. et sp. indet.						1	
Tenebrionidae							
? Cylindrinotus laevioctostriatus Go	1						
Scarabaeidae							
Aphodius sp.			1		1		

	Bulk 3	20	19	18	17	16	15
Cerambycidae							
Grammoptera sp.			1				
Pogonocherus hispidulus (Pill.)							1
Oberea oculata (L.)					1		
Cerambycidae gen. et sp. indet.			2		1		
Chrysomelidae							
Plateumaris discolor (Panz.)				1		4	11
P. sericea (L.)	4		2		4		
P. discolor (Panz.)/*sericea* (L.)	1			3	1		
Chrysomela aenea L.						1	
Scolytidae							
Scolytus scolytus (F.)			1				1
S. ratzeburgi Jans.				1	1		
Tomicus piniperda (L.)	1				1		
Xylocleptes bispinus (Duft.)						1	
Dryocoetinus villosus (F.)						1	
D. alni (Georg.)			3				
Pityophthorus pubescens (Marsh.)			1				
P. ? pubescens (Marsh.)						4	4
P. lichtensteini (Ratz)	2				1		
Pityogenes quadridens (Hartig.)						4	
Xyleborus ? saxeseni (Ratz.)					1		
X. ? dryophagus (Ratz.)							1
Scolytidae gen. et sp. indet.				1			
Curculionidae							
Apion sp.						1	1
Phyllobius sp.			1	1	1		
Dryophthorus corticalis (Payk.)						1	
**Rhyncolus elongatus Gyll.*							1
R. ater (L.)			2	1	1		
**R. sculpturatus*	2			1			
Anthonomus ? rubi (Hbst.)	1						
Brachonyx pineti (Payk.)						10	12
Acalles roboris Curt.							
A. ptinoides (Marsh.)			3				
Micrelus ericae (Gyll.)	3						
Gymnetron spp.	2						
Rhynchaenus foliorum Mull.							1
R. quercus (L.)		1	7	3	3	5	5
R. fagi (L.) type					6		
R. rusci (Hbst.)			1		4		

	Bulk 3	20	19	18	17	16	15
Rhynchaenus spp.				8	2		1
Rhamphus pulicarius (Hbst.)	3			1			
Curculionidae gen. et sp. indet.	1						
Coleoptera gen. et sp. indet.			1				
Total Coleoptera individuals	**65**	**12**	**136**	**158**	**131**	**115**	**68**
Total Coleoptera species	**36**	**8**	**72**	**59**	**49**	**43**	**33**
Lygaeidae							
Drymus sp.			1	1			
Formicidae gen et sp. indet.	1		2	2	51	25	21
Diptera gen. et sp. indet.					1	3	

Addendum to species list from Thorne Moors identified by Whitehouse (1993):

One individual of Species "A" (sample C1) has now been identified as *Steghetus borealis* Israelsson

Table 8.2; Coleopterous list from Blackwater Dike (Goole Moors), showing RDB species status and habitat categories.

Species	Habitat category	RDB status	New Fossil record, including date
Carabidae			
Bembidion unicolor Chaud./ *guttula* (F.)	21		
Bradycellus ruficollis (Steph.)	10		
Bradycellus sp.	10		
Pterostichus diligens (Strm.)	14		
Pterostichus nigrita(Payk.)/*rhaeticus* Heer	14		
Pterostichus minor (Gyll.)	14		
Agonum fuliginosum (Panz.)	14		
Agonum obscurum (Hbst.)	09		
Carabidae gen. et sp. indet.	UN		
Dytiscidae			
Hydroporus scalesianus Steph.	27	RDB2	
Hydroporus tristis (Payk.)	28		
Hydroporus melanarius Strm.	28		
Hydroporus spp.	27		
Agabus ? chalconatus (Panz.)	27	NB	
Agabus melanarius Aube	32	NB	
Agabus bipustulatus (L.)	26		
Agabus affinis (Payk.)	28		
Agabus spp.	26		
Ilybius aenescens Er.	28	NB	
Agabus/Ilybius spp.	26		
Rhantus sp.	26		
Colymbetes fuscus (L.)	26		
Acilius ? sulcatus (L.)			
Hydraenidae			
Ochthebius minimus (F.)	30		
Limnebius aluta Bed.	29	RDB3	
Hydrophilidae			
Coelostoma orbiculare (F.)	20		
Cercyon sp.	35		
Hydrobius fuscipes (L.)	26		
Anacaena globulus (Payk.)	30		
Enochrus affinis (Thun.)	28	NB	
Hydrophilidae gen. et sp. indet.	26		
Scydmaenidae			

Stenichnus collaris (Müll.)	09		
Stenichnus sp.	UN		
Ptillidae			
Ptenidium sp.	36		
Acrotrichis sp.	35		
Staphylinidae			
Proteinus ? *macropterus* (Grav.)	36		>3444-3242 BC
Olophrum piceum (Gyll.)	16		
Olophrum fuscum (Grav.)	16		
Acidota crenata (F.)	20		
Lesteva punctata Er.	24		
Lesteva heeri Fauv.	20		
Lesteva sp.	21		
Stenus kiesenwetteri Rosen.	20	RDB2	
Stenus spp.	22		
Rugilus sp.	21		
Lathrobium terminatum Grav.	20		
Lathrobium brunnipes (F.)	22		
Lathrobium longulum Grav.	22		
Lathrobium spp.	21		
Ochthephilum fracticorne (Payk.)	20		
Gyrohypnus sp.	35		
Xantholinus linearis (Ol.)	10		
Atrecus affinis (Payk.)	04		
Othius punctulatus (Goez.)	08		
Othius myrmecophilus Kies.	08		
Othius sp.	22		
Philonthus spp.	UN		
Staphylinus sp.	UN		
Quedius sp.	UN		
Aleocharinae gen. et sp. indet.	35		
Staphylinidae gen. et sp. indet.	UN		
Pselaphidae			
Bryaxis bulbifer (Reich.)	20		
Bryaxis spp.	22		
Reichenbachia juncorum (Leach)	24		
Pselaphus heisei (Hbst.)	20		
Cantharidae			
Cantharis sp.	UN		
Rhagonycha sp.	11		
Melyridae			

Aplocnemus nigricornis (F.)	04	NA	
Elateridae			
Ampedus sp.	03		
Dalopius marginatus (L.)	06		
Athous haemorrhoidalis (F.)	03		
Scirtidae			
Microcara testacea (L.)	09		
Cyphon padi (L.)	30		
Cyphon spp.	21		
Scirtes ? hemisphericus (L.)	21		
Scirtidae gen. et sp. indet.	21		
Dryopidae			
Dryops sp.	21		
Rhizophagidae			
Rhizophagus ferrugineus (Payk.)	06		
Rhizophagus ? parallelocollis Gyll	06		
Rhizophagus dispar (Payk.)	06		
Cucujidae			
Psammoecus bipunctatus (F.)	15		
Pediacus dermestoides (F.)	05		
Cryptolestes corticinus Er.	04	Non-British (>3444-3242 BC)	
Cucujidae gen. et sp. indet.	UN		
Lathridiidae			
Stephostethus augusticollis (Gyll.)	08		Early record
Enicmus transversus (Ol.)	36		
Dienerella separanda (Reitt.)	37		
Corticaria sp.	36		
Colydiidae			
Pycnomerus tenebrans Ol.	05	Non-British (>3444-3242 BC)	
Colydium elongatum (F.)	06	RDB3	
Teredus cylindricus (Ol.)	05	RDB1	
Bothrideres contractus (F.)	05	Non-British	

		(>3444-3242 BC)	
Cerylon histeroides (F.)	06		
Endomychidae			
Mycetina cruciata (Schall.)	06	Non-British (>3444-3242 BC)	
Endomychus coccineus (L.)	06		YES (>3444-3242 BC)
Coccinellidae			
Calvia 14-guttata (L.)	02		YES (>3444-3242 BC)
Aspidiphoridae			
Aspidiphorus orbiculatus (Gyll.)	08		
Anobidae			
Grynobius planus (F.)	06		
Anobium ? punctatum (Deg.)	06		
Dorcatoma chrysomelina Strm.	05		
Ptinidae			
Ptinus sp.	36		
Aderidae			
Aderus oculatus (Panz.)	05	NB	YES (>3444-3242 BC)
Serropalpidae			
Orchesia minor	08		YES (>3444-3242 BC)
Abdera 4-fasciata (Curt.)	05	NA	YES (>3444-3242 BC)
Serropalpidae gen. et sp. indet.	UN		
Tenebrionidae			
? Cylindrinotus laevioctostriatus Go	11		YES

			(>3444-3242 BC)
Scarabaeidae			
Aphodius sp.	35		
Cerambycidae			
Grammoptera sp.	03		
Pogonocherus hispidulus (Pill.)	03		
Oberea oculata (L.)	02	RDB1	YES (>3444-3242 BC)
Cerambycidae gen. et sp. indet.	UN		
Chrysomelidae			
Plateumaris discolor (Panz.)	19		
Plateumaris sericea (L.)	15		
Plateumaris discolor (Panz.)/*sericea* (L.)	15		
Chrysomela aenea L.	09		
Scolytidae			
Scolytus scolytus (F.)	02		
Scolytus ratzeburgi Jans.	05 & 38	NB	
Tomicus piniperda (L.)	01		
Xylocleptes bispinus (Duft.)	07		
Dryocoetinus villosus (F.)	05 & 38		
Dryocoetinus alni (Georg.)	05	NA	
Pityophthorus pubescens (Marsh.)	01		YES (>3444-3242 BC)
P. lichtensteini (Ratz)	01	RDB2	
Pityogenes quadridens (Hartig.)	04	NA	
Xyleborus ? saxeseni (Ratz.)	03		
X. ? dryophagus (Ratz.)	02	NB	
Scolytidae gen. et sp. indet.	03		
Curculionidae			
Apion sp.	13		
Phyllobius sp.	UN		
Dryophthorus corticalis (Payk.)	06	RDB1	
Rhyncolus elongatus Gyll.	04	Non-British (>3444-3242 BC)	
Rhyncolus ater (L.)	04		
Rhyncolus sculpturatus	04	Non-British (>3444-	

		3242 BC)
Anthonomus ? rubi (Hbst.)	07	
Brachonyx pineti (Payk.)	01	
Acalles roboris Curt.	02	NB
Acalles ptinoides (Marsh.)	11	NB
Micrelus ericae (Gyll.)	10	
Gymnetron spp.	13	
Rhynchaenus foliorum Mull.	09	NA
Rhynchaenus quercus (L.)	02	
Rhynchaenus fagi (L.) type	02	
Rhynchaenus rusci (Hbst.)	02	
Rhynchaenus spp.	02	
Rhamphus pulicarius (Hbst.)	02	
Curculionidae gen. et sp. indet.	UN	

Table 9.1; List of sites used in the CA analysis, together with sources of data and CANOCO site codes used in scatter plots. All sites have been previously identified within the text of appropriate chapters.

Site	Sample No	CANOCO site code	Reference to site
Hat 4	29	1	HAT 4 (Hatfield), Chapter 6
Hat 4	28	2	
Hat 4	27	3	
Hat 4	26	4	
Hat 4	25	5	
Hat 4	24	6	
Hat 4	23	7	
Hat 4	22	8	
Hat 4	20	9	
Hat 4	18	10	
Hat 4	16	11	
Hat 4	14	12	
Hat 4	12	13	
Hat 4	10	14	
Hat 4	7	15	
Hat 4	4	16	
Hat 4	1	17	
Hat 3	18	18	HAT 3 (Hatfield), Chapter 6
Hat 3	17	19	
Lind A	7	20	Lindholme A (Hatfield), Chapter 6
Lind A	6	21	
Lind A	3	22	
Lind B	18	23	Lindholme B (Hatfield), Chapter 6
Lind B	15	24	
Lind B	12	25	
Lind B	9	26	
Tyham	1	27	Tyham Hall Quarry (Hatfield), Chapter 6
Tyham	2A	28	
Tyham	2B	29	
Tyham	3	30	
Tyham	K	31	
Tyham	Oak	32	
BlackD	Bulk 3	33	Blackwater Dike (Thorne Moors), Chapter 8
BlackD	20	34	
BlackD	19	35	
BlackD	18	36	
BlackD	17	37	
BlackD	16	38	
BlackD	15	39	
Goole 1	1	40	Goole Moors 1 (Thorne Moors), (Roper, 1993, 1996)
Goole 1	2	41	
Goole 1	3	42	
Goole 1	4	43	

Goole 1	5	44	
Goole 1	6	45	
Goole 1	7	46	
Goole 1	8	47	
Goole 1	9	48	
Trackw	1 Mor	49	Trackway site (Thorne Moors), (Buckland, 1979).
Trackw	2 Trk	50	
Trackw	3 Oak	51	
Trackw	4 Oak	52	
Trackw	5 Sph	53	
Trackw	6 var.	54	
Thorne 2	C1	55	Thorne 2 (Thorne Moors), (Whitehouse, 1993, 1997a).
Thorne 2	C2	56	
Thorne 2	C3	57	
Thorne 2	C4	58	
Thorne 2	C5	59	
Thorne 2	B1	60	
Thorne 2	B2	61	
Thorne 2	B3	62	

Table 9.2; List of species included in CANOCO analysis, including abbreviated names which appear in plots (N.B. Species are not in taxonomic order. Their order is determined by the number of samples each species occurred in, sorted in numerical order).

Species	Abbreviated name
Bradycellus spp.	Bradyc
Ilybius aenescens Thom.	Ilaenesc
Ilybius spp.	Ilybius
Agabus/Ilybius sp.	Ag/Il
Colymbetes fuscus (L.)	Colfusc
Enochrus spp.	Enochrus
Agathidium sp.	Agath
Xantholinus linearis (Ol.)	Xanlin
Atrecus affinis (Payk.)	Atraffin
Othius myrmecophilous Kies.	Othiusmy
Erichsonius cinerescens (Grav.)	Erichscin
Mycetoporus sp.	Mycetop
Atomaria spp.	Atomaria
Phalacrus caricis Strm.	Phalcar
Cerylon histeroides (F.)	Ceryhist
Dryocoetinus villosus (F.)	Dryovill
Ceutorhynchus spp.	Ceutorhy
Trechus obtusus Er./ *4-striatus*	Tobtusus
Bradycellus harpalinus (Serv.)	Bradyhar
Hydroporus longulus Muls.	Hylong
Agabus affinis (Payk.)	Agaffin
Helophorus spp.	Heloph
Silpha atrata L.	Silphatr
Stenus kiesenwetteri Rosen.	Stkiesen.
Paederus spp.	Paederus
Gabrius spp.	Gabrius
Bryaxis curtisi (Leach)	Brycurt
Pselaphus heisei (Hbst.)	Pselheis
Denticollis linearis (L.)	Dentlin
Melasis buprestoides (L.)	Melasis
Chrysomela aenea L.	Chryaen
Altica britteni Sharp	Altbritt
Altica sp.	Altica
Phyllobius sp.	Phyllob
Dryophthorus corticalis (Payk.)	Dryocort
Hydroporus gyllenhali Schdte.	Hygyll
Hydraena testacea Curt.	Hydrtest
Stenichnus collaris (Mull.)	Stencoll
Lathrobium rufipenne Gyll.	Lathrufi.
Lathrobium longulum Grav.	Lathlong
Ochthephilum fracticorne (Payk.)	Ochfract
Dalopius marginatus (L.)	Dalomarg
Scolytus ratzeburgi Jans.	Scolratz
Tomicus piniperda (L.)	Tompini

Rhyncolus sculpturatus Walt.	Rhynscul
Lathridiidae indet.	Lathrid
Bembidion spp.	Bembid
Cercyon spp.	Cercyon
Lathrobium terminatum Grav.	Latherm
Rhamphus pulicarius (Hbst.)	Rhpulic
Pterostichus spp.	Pterost
Hydraena britteni Joy	Hydbrit
Ochthebius spp.	Ochtheb
Limnebius aluta Bed.	Limaluta
Coelostoma orbiculare (F.)	Coelorbi
Enochrus affinis (Thun.)	Enocaff
Olophrum fuscum (Grav.)	Olofusc
Corticaria spp.	Cortic
Rhyncolus elongatus Gyll.	Rhynelon
Dyschirius globosus (Hbst.)	Dyscglob
Philonthus/ Quedius spp.	Phil/ Qu
Grynobius planus (F.)	Gryplan
Scolytidae gen. et sp. indet.	Scoly
Quedius spp.	Quedius
Microcara testacea (L.)	Micrtest
Plateumaris spp.	Plateum
Rhynchaenus rusci (Hbst.)	Rhyrusci
Bradycellus ruficollis (Steph.)	Bradrufi
Pterostichus minor (Gyll.)	Ptminor
Hydroporus tristis (Payk.)	Hytrist
Hydroporus melanarius Strm.	Hymel
Acidota crenata (F.)	Acrenata
Lathrobium fulvipenne (Grav.)	Lathfulv
Rhynchaenus quercus (L.)	Rhyquerc
Agonum obscurum (Hbst.)	Agobscur
Hydroporus scalesianus Steph.	Hyscales
Lesteva heeri Fauv.	Lestheer
Apion spp.	Apion
Rhyncolus chloropus (L.)	Rhychl
Cercyon convexiusculus Steph	Cercconv
Megasternum obscurum (Marsh.)	Megaobsc
Lathrboum brunnipes (F.)	Lathbrun
Philonthus spp.	Philont
Bryaxis bulbifer (Reich.)	Bryabulb
Aphodius spp.	Aphodius
Rhynchaenus spp.	Rhynchae.
Ochthebius minimus (F.)	Ochtmin
Hydrobius fuscipes (L.)	Hydfusc
Plateumaris discolor (Panz.)/ *sericea* (L.)	disc/ser
Plateumaris sericea (L.)	PlatSer
Agabus bipustulatus (L.)	Agbip
Micrelus ericae (Gyll.)	Micreric
Bryaxis spp.	Bryaxis

Plateumaris discolor (Panz.)	Platdisc
Agabus spp.	Agabus
Agonum fuliginosum (Panz.)	Agonfuli
Anacaena globulus (Payk.)	Anacglob
Cyphon padi (L.)	Cyphpadi
Olophrum piceum (Gyll.)	Olopic
Pterostichus nigrita (Payk.) / *rhaeticus*	Ptnigrit
Lathrobium spp.	Lathrob
Pterostichus diligens (Strm.)	Ptdilig
Aleocharinae gen. et sp. indet.	Aleoch.
Stenus spp.	Stenus
Cyphon spp.	Cyphon
Hydroporus spp.	Hydrop

Table 10.1; Coleoptera list from Hayfield Lodge Farm, Rossington (* denotes non-British species)

	20	19	18	17	16	15	14	10	7	5	3	1
	340-335	335-325	325-315	315-305	300-295	295-285	285-275	245-235	215-205	180-170	160-150	140-120
Carabidae												
Carabus granulatus L.					1							
Carabus sp.				1	1							
Nebria brevicollis (F.)				1								
Elaphrus uliginosus F.			1									
E. cupreus Duft.							1			1		
Loricera pilicornis (F.)						1				1		
Dyschirius globosus (Hbst.)			4		2	1	3	1		1		
Trechus rivularis (Gyll.)				1	1			1		1		
T. rubens (F.)	1			1								
Trechus sp.			2									
Bembidion schueppeli Dej.		1										
B. doris (Panz.)	1											
B. guttula (F.)				2		1						
Bembidion sp.			1		1	2	3			2	2	
Patrobus assimilis Chaud.	1											
P. atrorufus (Strom.)				1								
Trichocellus sp.										1		
Pterostichus diligens (Strm.)					1			1		1		
P. nigrita (Payk.)/*rhaeticus* Heer		1	1		3	1				3		
P. minor (Gyll.)			1	1	1	1	1		1	3		1
P. melanarius (Ill.)				1								
Pterostichus sp.	1				1	1	2	2				
Synuchus nivalis (Panz.)				1								
Agonum versutum Strm.										1		

	20	19	18	17	16	15	14	10	7	5	3	1
A. fuliginosum (Panz.)					1							
A. thoreyi Dej.								1		2		
Agonum sp.		1					1				2	
Amara sp.										1		
Dromius linearis Ol.							1					
D. quadrimaculatus (L.)			1									
Carabidae gen. et sp. indet.	1	1	2	1	2			1				
Haliplidae												
Haliplus confinis Steph.										1		
Haliplus sp.						1						1
Dytiscidae												
Hyphydrus ovatus										1		
Hygrotus inaequalis (F.)										9		
Hydroporus scalesianus Steph.										1		
H. palustris (L.)										1	1	
Hydroporus spp.	1	2	2	3	6	4	5	3		12	1	3
Graptodytes pictus (F.)												1
Oreodytes ? septentrionalis Sahl.										1		
Noterus clavicornis Deg.										2	1	
Agabus bipustulatus (L.)			1	1	1	3	2			2		
Agabus spp.					5					3	1	1
Ilybius sp.	1	1					4	3		2		
Agabus/Ilybius spp.			2	3		4	1					
Rhantus exsoletus (Forst.)												1

	20	19	18	17	16	15	14	10	7	5	3	1
Rhantus spp.										2		
Colymbetes fuscus (L.)	1	1	1	1	1	1	1					
Acilius sulcatus (L.)			1									
A. canaliculatus (Nic.)												
Acilius spp.					1							
Dytiscus semisulcatus Müll.					1			1				
Dytiscus sp.			3	1		1	1			1		
Dytiscidae gen. et sp. indet.							1			2		
Gyrinidae												
Aulonogyrus striatus (F.)							1					
Gyrinus aeratus Steph.				1	1	1	3				1	
G. aeratus Steph. / *substriatus* Steph.										1		
G. ? natator (L.)											3	
Gyrinus spp.			3		1		2	1		2		
Orectochilus villosus (Müll.)			1		2	1	1					
Hydraenidae												
Hydraena britteni Joy			11	6		8	15	2				
Hydraena riparia Kug.	4	5	1		5					2	1	
H. britteni Joy /*riparia* Kug.			4		11	4		7				
H. ? nigrita Germ.										1		
H. pulchella Germ.			4	1	1		1					
H. testacea Curt.			1	1	2							
H. gracilis Germ.					1							
Hydraena sp.	1		1				2					
Ochthebius bicolon Germ.				2		5	4					

	20	19	18	17	16	15	14	10	7	5	3	1
O. minimus (F.)		10		10	25	9	9	24		36	7	17
O. cf. *minimus* (F.)			13				20					
Ochthebius sp.	2		4	3		1				7		
Limnebius truncatellus (Thun.)				14	4	2	9					
L. papposus Muls.			11			2						
L. truncatellus (Thun.)/*papposus* Muls.								3		14	2	
L. nitidus (Marsh.)					3							
L. aluta Bed.										7	1	2
Limnebius spp.					1	1	6					1
Hydrophilidae												
Hydrochus elongatus (Schall.)										3		
Hydrochus sp.			1	2	2			1				
Helophorus brevipalpis Bed.										10		
H. minutus F.											1	1
Helophorus spp.			1				1	2		4	2	6
Coelostoma orbiculare (F.)										4		
Cercyon atomarius (F.)												2
C. convexiusculus Steph			3	1	3	5	7		1	4	1	2
C. sternalis Sharp				1						2		
Cercyon spp.	1		1		1			1		1		
Megasternum obscurum (Marsh.)	1	1	3	2	4	3	7			2		2
Cryptopleurum minutum (F.)					1					1		
Hydrobius fuscipes (L.)		1	2	2	2	2	1	1		5	1	1
Anacaena globulus (Payk.)		1	1	4		2	3					

	20	19	18	17	16	15	14	10	7	5	3	1
Anacaena spp.							1			3	1	
Laccobius spp.			1	1	1	1	1			2		2
Helochares obscurus (Müll.)										2		
H. punctatus Sharp.										2		
Helochares spp.										3		1
Enochrus affinis (Thun.)										8		1
Enochrus sp.												2
Cymbiodyta marginella (F.)										2		
Chaetarthria seminulum (Hbst.)										1		
Hydrochara caraboides (L.)			1	1	1	1	1			1		
Hydrophilidae gen. et sp. indet.			1		2		2					1
Histeridae												
Onthophilus striatus (Forst.)				1			1					
Silphidae												
Silpha ? obscura L.							1					
Silpha atrata L.			1									
Silphidae gen. et sp. indet.					1							
Leiodidae												
Agathidium varians Beck / *rotundatum* Gyll.			1	1								
Agathidium spp.			1				1					

	20	19	18	17	16	15	14	10	7	5	3	1
Schymenidae												
Stenichnus collaris (Müll.)	1		4		1	1	1					
Ptlilidae												
Ptenidium sp.					2		2	3			1	
Acrotrichis sp.				2	2		1			1		
Staphylinidae												
Megarthrus/ Proteinus sp.						3						
Proteinus brachypterus (F.)/ *macropterus* (Grav.)	1											
Proteinus sp.					1		1	1				
Eusphalerum minutum (F.)				1	1							
Eusphalerum sp.												
Phyllodrepa spp.						1						
Dropephylla ioptera (Steph.)			1									
Omalium rivulare (Payk.)						1						
Omalium sp.			1		2							1
Phyllodrepoidea crenata (Grav.)	1	1										
Anthobium atrocephalum (Gyll.)	1											
Anthobium sp.	1											
Olophrum piceum (Gyll.)				1	1	1	1					
O. fuscum (Grav.)			6	1	1	2	5	4		1		
Olophrum sp.		1		1		1						
Eucnecosum brachypterum (Grav.)		1	1									
Lesteva punctata Er.					2	2						
L. heeri Fauv.	1	3	5	2	3	1	7	2	2	1		

	20	19	18	17	16	15	14	10	7	5	3	1
L. longoelytrata							1					
Lesteva_spp.		1		1	1		2					
Omaliinae indet.	2	2		3	2							
Carpelimus rivularis (Mots.)	1											
Carpelimus spp.		1	1		1	2	2	4		1		1
Anotylus insecatus (Grav.)							2					
A. rugosus (F.)			3	2	3	4	3	1		2	1	1
Oxytelus fulvipes Er.			1									
O. laqueatus (Marsh.)	2											
Platystethus capito Heer										1		
Platystethus sp.					1							
Bledius sp.			1	1			2	1				
Stenus biguttatus (L.)						1	4					
S. bimaculatus Gyll.				1								
Stenus spp.	1	1	2	5	6	3	6	3		5	2	4
Rugilus orbiculatus (Payk.)				1								
Dianous coerulescens							2					
Medon sp.										1		
Lathrobium angusticolle Bois.		1										
L. fulvipenne (Grav.)				2								
L. brunnipes (F.)			1			2						
L. impressum Heer	1	1		1								
L. longulum Grav.			1		1							
Lathrobium spp.			2	2	2		8	2		2		1
Gyrohypnus angustatus Steph.					1							
Xantholinus linearis Ol.											3	
Xantholinus sp.											1	
Atrecus affinis (Payk.)					1	1						

	20	19	18	17	16	15	14	10	7	5	3	1
Othius punctulatus (Goez.)	1											
Othius sp.		1	1			1		1				1
Erichsonius cinerescens (Grav.)				1						1		
Philonthus ? nigrita (Grav.)			1									1
Philonthus sp.	1			1	1	1						
Gabrius sp.							1		1	3		2
Quedius sp.		1	1	1						1		
Philonthus/ Quedius spp.						1	1	1		1		
Mycetoporus sp.												1
Sepedophilus sp.				1		1	1					
Tachinus sp.					1							
Aleocharinae gen. et sp. indet.	3	2	4	3	8	3	3	4		9	5	2
Staphylinidae gen. et sp. indet.		2										
Pselaphidae												
Batrisodes venustus (Reich.)		1										
Bryaxis puncticollis (Denny)					1							
B. curtisi (Leach)					1							
B. bulbifer (Reich.)		3	2	3								
Bryaxis sp.	1						1					
Tychus niger (Payk.)					1							
Cantharidae												
Cantharis spp.				1			1			1		
Rhagonycha sp.				2								
Cantharis/Rhagonycha sp.						1						

	20	19	18	17	16	15	14	10	7	5	3	1
Cantharidae gen. et sp. indet.							1					
Melyridae												
Aplocnemus impressus (Marsh.)				1	1							
A. nigricornis (F.)				1								
Dasytes ? niger (L.)						1		1				
Melyridae gen. et sp. indet.					1							
Elateridae												
Ampedus sp.		1				1						
Dalopius marginatus (L.)				1		1						
Melanotus erythropus (Gmel.)								1				
Denticollis linearis (L.)			2			1	2	1				
Athous sp.										1		
Hypnoides riparius (F.)		1	1		1	1						
Elateridae gen. et sp. indet.			1	1			1	1				
Eucnemidae												
Melasis buprestoides (L.)			1									
Scirtidae												
Microcara testacea (L.)											1	
Cyphon spp.	3					6	2					
Scirtidae gen. et sp. indet.		3	3	3	5	1	4	3		9		1

	20	19	18	17	16	15	14	10	7	5	3	1
Dryopidae												
Dryops spp.			4	2	2	1	3	1		7	1	
Oulimnius tuberculatus (Müll.)			1			1						
O. ? rivularis (Rosen.)								1				
Oulimnius spp.					1	1						
Limnius volckmari (Panz.)			1		2	4						1
Riolus ? subviolaceus (Müll.)			1	1	1	2						
Elmidae gen. et sp. indet.					1							
Byrridae												
Simplocaria semistriata (F.)			2		1							
Byrrhus pilula (L.)										1		
Byrrhus sp.						1						
Ostomidae												
Ostoma ferrugineum (L.)						1						
Nitidulidae												
Meligethes spp.										1		
Epuraea spp.			1	1								
Nitidulidae gen. et sp. indet.					1					1		
Rhizophagidae												
Rhizophagus depressus (F.)							1					

	20	19	18	17	16	15	14	10	7	5	3	1
R. dispar (Payk.)				1	1							
R. bipustulatus (F.)								1				
Rhizophagus sp.			1									
Cucujidae												
Monotoma longicollis Gyll.					1							
Psammoecus bipunctatus (F.)								1				
Cryptophagidae												
Cryptophagus spp.					1							
Atomaria spp.			1		2			1		1	1	1
Phalacridae												
Phalacrus caricis Strm.				1	3							
Phalacrus spp.							1					1
Lathridiidae												
Stephostethus augusticollis (Gyll.)							1					
Enicmus brevicornis (Mann.)					1							
E. transversus (Ol.)					2							
Corticaria spp.					1	1	1			4		
Lathridiidae gen. et sp. indet.						1					2	
Mycetophagidae												

	20	19	18	17	16	15	14	10	7	5	3	1
Mycetophagus sp.		1										1
Colydiidae												
Colydium elongatum (F.)					1							
Cerylon histeroides (F.)				1			1					
C. ferrugineum Steph.							1					
Coccinellidae												
Coccidula scutellata (Hbst.)										2		
Rhyzobius litura (F.)												2
Chilocorus bipustulatus (L.)					1	1						
Anisosticta novemdecimpunctata L.										1	2	2
Coccinellidae gen. et sp. indet.		1								1		
Aspidiphoridae												
Aspidiphorus orbiculatus (Gyll.)						1						
Cisidae												
Cis sp.			1	1	1							
Anobiidae												
Grynobius planus (F.)			1	1	2	1	5	1				
Ptilinus pectinicornis (L.)			1		1							

	20	19	18	17	16	15	14	10	7	5	3	1
Ptinidae												
Ptinus fur (L.)				1		2						
P. ? pusillus Strm.			1									
Ptinus spp.				1							1	
Pythidae												
Rhinosimus planirostris (F.)							1					
Mordellidae												
Anaspis sp.			1	2		1						
Serropalpidae												
Abdera sp.			1		1							
Scarabaeidae												
Geotrupes stercorarius (L.)					1	1						
Geotrupes sp.				1		1	2					
Aphodius fossor (L.)										1		
A. contaminatus (Hbst.)												1
A. sphacelatus (Panz.)										2		
A. prodromus (Brahm)								1		4		
A. consputus Creutz.												1
A. granarius (L.)										1		
Aphodius spp.			1	1	1	1					1	

	20	19	18	17	16	15	14	10	7	5	3	1
Heptaulacus testudinarius (F.)												1
Melolontha melolontha (L.)			1									
Melalontha sp.			1									
Anomala dubia (Scop.)							1			1		
Phyllopertha horticola (L.)										1		
Cerambycidae												
Grammoptera sp.				1								
Strangalia sp.			1									
Acanthocinus aedilis (L.)			1									
Cerambycidae gen. et sp. indet.										1		
Chrysomelidae												
Donacia clavipes F.											1	
D. crassipes F.										2		
D. versicolorea (Brahm)							1			1		
D. aquatica (L.)							2	1				1
D. impressa Payk.				1		1						
D. marginata Hoppe											4	
D. bicolora Zsch.					1							
D. obscura Gyll.										5		
D. vulgaris Zsch.						1						
D. simplex F.				2			1	1		3	2	1
D. cinerea Hbst.											1	
Donacia spp.							1	1		1	1	
Plateumaris sericea (L.)						2	1	4		5	3	
P. discolor (Panz.)/*sericea* (L.)				2	3						11	1

	20	19	18	17	16	15	14	10	7	5	3	1
P. braccata (Scop.)						1				2	1	
P. affinis (Kunze)		1		1	3	1	1	1		2	1	
Plateumaris spp.			1		1					1		
Donaciinae gen. et sp. indet.		1				1	3					
Phaedon ? timidulus (Germ.)							1			2		
Phaedon sp.					1							
Prasocuris phellandrii (L.)			1			1	1	2		2	3	1
Chrysomela aenea L.			2	2	1	4	2	1				
Agelastica alni (L.)					2			1				
Lochmaea suturalis (Thom.)						1		1		2		
Phyllotreta sp.					1							
Chaetocnema concinna (Marsh.)			1	1				1		1		
Chrysomelidae gen. et sp. indet.	1		3	1	2	1	2					
Scolytidae												
Scolytus rugulosus (Müll.)					1							
S. mali (Bech.)				1								
Hylastes opacus (Er.)						1		1				
Tomicus piniperda (L.)				1				1				
Hylesinus crenatus (F.)			1									
H. oleiperda (F.)				1								
Hylesinus sp.							1					
Hylesini gen. et sp. indet.				1								
Leperisinus varius (F.)				2								
Hylastinus obscurus (Marsh.)			1									
Xylocleptes bispinus (Duft.)			1	1								
Ernoporus caucasicus Lind.		2	1		1			1				
Pityogenes sp.								1				

	20	19	18	17	16	15	14	10	7	5	3	1
Xyleborus saxeseni (Ratz.)			1									
Xyloterus ? *lineatus* (Ol.)					1							
Scolytidae gen. et sp. indet.			1		1							
Curculionidae												
Rhinchitinae gen. et sp. indet.							1					
Apion spp.					1		2			1	2	1
Phyllobius sp.		1					1			1		
Strophosoma melanogrammum (Forst.)					1							
Strophosoma sp.							4					
Sitona spp.				1						1		
Cossonus linearis (F.)			1									
Rhyncolus ater (L.)							3					
* *R. punctulatus* Bohe.					1							
Cossininae gen. et sp. indet.							1			1		
Tanysphyrus lemnae (Payk.)								1				
Dorytomus sp.										2		
Acalles roboris Curt.						1						
A. ptinoides (Marsh.)			1				1					
Limnobaris t-album (L.)										1		
L. dolorosa (Goez.)					1					1		1
Eubrychius velutus (Beck)										1		1
Rhinoncus bruchoides Hbst.										2		
Micrelus ericae (Gyll.)							1			1	1	
Ceutorhynchus contractus (Marsh.)										1		
Ceutorhynchus sp.			2			1		1			1	
Ceutorhynchidae gen et sp. indet.										2		
Rhynchaenus quercus (L.)					1	2	2					

	20	19	18	17	16	15	14	10	7	5	3	1
R. rusci (Hbst.)					3							
Rhynchaenus spp.			2	1	5					1		
Rhamphus pulicarius (Hbst.)										1		
Curculionidae indet.	1		1	1		1				4		
Coleoptera indet.					2							
Coleoptera Total individuals	**41**	**61**	**186**	**157**	**225**	**158**	**246**	**117**	**4**	**309**	**83**	**83**
Coleoptera Total species	**32**	**38**	**91**	**98**	**120**	**93**	**104**	**62**	**4**	**122**	**45**	**52**
Diptera indet.	1		4	3	1	11	5	2		10	3	2
Formicidae indet.				1		1						

Table 10.2; Coleopterous list from Hayfield Lodge Farm, Rossington, showing RDB species status and habitat categories.

Species	Habitat category	RDB status	New Fossil record?	Early record? (including new date)
Carabidae				
Carabus granulatus L.	9			
Carabus sp.	UN			
Nebria brevicollis (F.)	9			
Elaphrus uliginosus F.	23	NB		
E. cupreus Duft.	23			
Loricera pilicornis (F.)	9			
Dyschirius globosus (Hbst.)	21			
Trechus rivularis (Gyll.)	14	RDB 3		
T. rubens (F.)	22	NB		
Trechus sp.	21			
Bembidion schueppeli Dej.	23	NA		
B. doris (Panz.)	20			
B. guttula (F.)	24			
Bembidion sp.	21			
Patrobus assimilis Chaud.	14			
P. atrorufus (Strom.)	9			
Trichocellus sp.	21			
Pterostichus diligens (Strm.)	14			
P. nigrita (Payk.)/*rhaeticus* Heer	14			
P. minor (Gyll.)	14			
P. melanarius (Ill.)	21			
Pterostichus sp.	21			
Synuchus nivalis (Panz.)	12			Yes, (3145 ± 45, 1520-1310 cal BC), prev. Roman
Agonum versutum Strm.	23	NB		
A. fuliginosum (Panz.)	14			
A. thoreyi Dej.	23			
Agonum sp.	21			
Amara sp.	UN			
Dromius linearis Ol.	10			
D. quadrimaculatus (L.)	1			
Carabidae gen. et sp. indet.	UN			
Haliplidae				
Haliplus confinis Steph.	9		Yes, for Britain (3145 ± 45 BP, 1520-1310 cal BC)	
Haliplus sp.	26			
Dytiscidae				
Hyphydrus ovatus	30			

Hygrotus inaequalis (F.)	30		
Hydroporus scalesianus Steph.	27	RDB 2	
H. palustris (L.)	30		
Hydroporus spp.	27		
Graptodytes pictus (F.)	32		
Oreodytes ? septentrionalis Sahl.	33		
Noterus clavicornis	30		
Agabus bipustulatus (L.)	26		
Agabus spp.	26		
Ilybius sp.	26		
Agabus/Ilybius spp.	26		
Rhantus exsoletus (Forst.)	30		
Rhantus spp.	26		
Colymbetes fuscus (L.)	26		
Acilius sulcatus (L.)	26		
A. canaliculatus (Nic.)	27	RDB 2	
Acilius spp.	30		
Dytiscus semisulcatus Müll.	30		
Dytiscus sp.	26		
Dytiscidae gen. et sp. indet.	26		
Gyrinidae			
Aulonogyrus striatus (F.)	32		Yes (3990 ± 45 BP, 2860-2390 cal BC)
Gyrinus aeratus Steph.	33		
G. aeratus Steph. / *substriatus* Steph.	32		
G. ? natator (L.)	27	RDB 1	
Gyrinus spp.	26		
Orectochilus villosus (Müll.)	33		
Hydraenidae			
Hydraena britteni Joy	27		
H. riparia Kug.	32		
H. britteni/riparia	26		
H. ? nigrita Germ.	33	NB	
H. pulchella Germ.	33		
H. testacea Curt.	29		
H. gracilis Germ.	33		
Hydraena sp.	26		
Ochthebius bicolon Germ.	32	NB	
O. minimus (F.)	30		
O. cf. minimus (F.)	30		
Ochthebius sp.	26		
Limnebius truncatellus (Thun.)	33		
L. papposus Muls.	32	NB	
L. truncatellus (Thun.)/*papposus* Muls.	33		
L. nitidus (Marsh.)	29	NB	
L. aluta Bed.	29	RDB 3	
Limnebius spp.	26		
Hydrophilidae			

Hydrochus elongatus (Schall.)	29		
Hydrochus sp.	26		
Helophorus brevipalpis Bed.	30		
H. minutus F.	30		
Helophorus spp.	26		
Coelostoma orbiculare (F.)	20		
Cercyon atomarius (F.)	35		
C. convexiusculus Steph	16	NB	
C. sternalis Sharp	16	NB	
Cercyon spp.	35		
Megasternum obscurum (Marsh.)	22		
Cryptopleurum minutum (F.)	35		
Hydrobius fuscipes (L.)	26		
Anacaena globulus (Payk.)	30		
Anacaena spp.	26		
Laccobius spp.	26		
Helochares obscurus (Müll.)	29	RDB 3	
H. punctatus Sharp.	27	NB	Yes (2290 ± 45, 410-190 cal BC). Prev. Roman
Helochares spp.	27		
Enochrus affinis (Thun.)	28	NB	
Enochrus sp.	26		
Cymbiodyta marginella (F.)	27		
Chaetarthria seminulum (Hbst.)	27	NB	
Hydrochara caraboides (L.)	29	RDB 1	
Hydrophilidae gen. et sp. indet.	26		
Histeridae			
Onthophilus striatus (Forst.)	35		
Silphidae			
Silpha ? obscura L.	35		
Silpha atrata L.	3		
Silphidae gen. et sp. indet.	UN		
Leiodidae			
Agathidium varians Beck / *rotundatum* Gyll.	8		
Agathidium spp.	36		
Schymenidae			
Stenichnus collaris (Müll.)	9		
Ptilidae			
Ptenidium sp.	36		
Acrotrichis sp.	35		

Staphylinidae

Megarthrus/ Proteinus sp.	35		
Proteinus brachypterus (F.)/ *macropterus* (Grav.)	36		
Proteinus sp.	35		
Eusphalerum minutum (F.)	25		
Eusphalerum sp.	UN		
Phyllodrepa spp.	UN		
Dropephylla ioptera (Steph.)	8		
Omalium rivulare (Payk.)	35		
Omalium sp.	35		
Phyllodrepoidea crenata (Grav.)	6		
Anthobium atrocephalum (Gyll.)	9		
Anthobium sp.	22		
Olophrum piceum (Gyll.)	16		
O. fuscum (Grav.)	16		
Olophrum_sp.	22		
Eucnecosum brachypterum (Grav.)	20		
Lesteva punctata Er.	24		
L. heeri Fauv.	20		
L. longoelytrata	20		
Lesteva sp.	21		
Omaliinae indet.	UN		
Carpelimus rivularis (Mots.)	24		
Carpelimus sp.	21		
Anotylus insectus (Grav.)	22	Notable	
A. rugosus (F.)	35	NA	
Oxytelus fulvipes Er.	24		
Oxytelus laqueatus (Marsh.)	35		
Platysthetus capito Heer	12		
Platysthetus sp.	24		
Bledius sp.	24		
Stenus biguttatus (L.)	24		
S. bimaculatus Gyll.	24		
Stenus spp.	22		
Rugilus orbiculatus (Payk.)	36		
Dianous coerulescens	22		
Medon sp.	21		
Lathrobium angusticolle Bois.	24	NB	Yes (5340 ± 45 BP, 4340-4040 cal BC)
L. fulvipenne (Grav.)	22		
L. brunnipes (F.)	22		
L. impressum Heer	22		
L. longulum Grav.	22		
Lathrobium spp.	21		
Gyrohypnus angustatus Steph.	35		
Xantholinus linearis Ol.	10		
Xantholinus sp.	UN		
Atrecus affinis (Payk.)	4		
Othius punctulatus (Goez.)	8		
Othius sp.	23		
Erichsonius cinerescens (Grav.)	20		

Philonthus ? nigrita (Grav.)	20	
Philonthus sp.	UN	
Gabrius sp.	UN	
Quedius sp.	UN	
Philonthus/ Quedius spp.	UN	
Mycetoporus sp.	UN	
Sepedophilus sp.	36	
Tachinus sp.	UN	
Aleocharinae gen.et sp. indet.	35	
Staphylinidae gen. et sp. indet.	UN	
Pselaphidae		
Batrisodes venustus (Reich.)	5	NA
Bryaxis puncticollis (Denny)	9	
B. curtisi (Leach)	9	
B. bulbifer (Reich.)	20	
Bryaxis sp.	22	
Tychus niger (Payk.)	9	
Cantharidae		
Cantharis spp.	UN	
Rhagonycha sp.	11	
Cantharis/Rhagonycha sp.	UN	
Cantharidae gen. et sp. indet.	UN	
Melyridae		
Aplocnemus impressus (Marsh.)	4	NB
A. nigricornis (F.)	6	NA
Dasytes ? niger (L.)	6	NA
Melyridae gen. et sp. indet.	UN	
Elateridae		
Ampedus sp.	3	
Dalopius marginatus (L.)	6	
Melanotus erythropus (Gmel.)	5	
Denticollis linearis (L.)	6	
Athous sp.	UN	
Hypnoides riparius (F.)	21	
Elateridae gen. et sp. indet.	UN	
Eucnemidae		
Melasis buprestoides (L.)	5	NB
Scirtidae		
Microcara testacea (L.)	9	
Cyphon spp.	21	
Scirtidae gen. et sp. indet.	21	

Dryopidae			
Dryops spp.	21		
Oulimnius tuberculatus (Müll.)	33		
O. ? rivularis (Rosen.)	33	NA	Yes, (3290 ± 45 BP, 1690-1450 cal BC)
Oulimnius spp.	33		
Limnius volckmari (Panz.)	33		
Riolus ? subviolaceus (Müll.)	33	NB	
Elmidae gen. et sp. indet.	33		
Byrridae			
Simplocaria semistriata (F.)	22		
Byrrhus pilula (L.)	12		
Byrrhus sp.	12		
Ostomidae			
Ostoma ferrugineum (L.)	4	RDB 1	
Nitidulidae			
Meligethes spp.	13		
Epuraea spp.	7		
Nitidulidae gen. et sp. indet.	UN		
Rhizophagidae			
Rhizophagus depressus (F.)	3		
R. dispar (Payk.)	6		
R. bipustulatus (F.)	2		
Rhizophagus sp.	3		
Cucujidae			
Monotoma longicollis Gyll.	36		Yes, (3145 ± 45 BP, 1520-1310 cal BC), prev. record Roman
Psammoecus bipunctatus (F.)	15		
Cryptophagidae			
Cryptophagus spp.	36		
Atomaria spp.	36		
Phalacridae			
Phalacrus caricis Strm.	15		
Phalacrus spp.	15		
Lathridiidae			

Stephostethus augusticollis (Gyll.)	8			Yes (3330 ± 45 BP, 1740-1520 cal BC), prev. record IA
Enicmus brevicornis (Mann.)	8	Notable	Yes, to Britain (3145 ± 45 BP, 1520-1310)	
E. transversus (Ol.)	36			
Corticaria spp.	36			
Lathridiidae gen. et sp. indet.	36			
Mycetophagidae				
Mycetophagus sp.	36			
Colydiidae				
Colydium elongatum (F.)	6	RDB 3		
Cerylon histeroides (F.)	6			
C. ferrugineum Steph.	5			
Coccinellidae				
Coccidula scutellata (Hbst.)	15			
Rhyzobius litura (F.)	13			
Chilocorus bipustulatus (L.)	10			
Anisosticta novemdecimpunctata L	15			
Coccinellidae gen. et sp. indet.	UN			
Aspidiphoridae				
Aspidiphorus orbiculatus (Gyll.)	8			
Cisidae				
Cis sp.	8			
Anobiidae				
Grynobius planus (F.)	6			
Ptilinus pectinicornis (L.)	5			
Ptinidae				
Ptinus fur (L.)	37			
P. ? pusillus Strm.	37		Yes (3990 ± 45 BP, 2860-2390 cal BC)	
Ptinus spp.	36			
Pythidae				

Rhinosimus planirostris (F.)	11		
Mordellidae			
Anaspis sp.	6		
Serropalpidae			
Abdera sp.	6		
Scarabaeidae			
Geotrupes stercorarius (L.)	34		
Geotrupes sp.	34		
Aphodius fossor (L.)	34		
A. contaminatus (Hbst.)	34		
A. sphacelatus (Panz.)	34		
A. prodromus (Brahm)	34		
A. consputus Creutz.	34		
A. granarius (L.)	35		
Aphodius spp.	34		
Heptaulacus testudinarius (F.)	34	RDB 2	
Melolontha melolontha (L.)	3		
Melalontha sp.	3		
Anomala dubia (Scop.)	12		
Phyllopertha horticola (L.)	13		
Cerambycidae			
Grammoptera sp.	3		
Strangalia sp.	2		
Acanthocinus aedilis (L.)	4	NB	Yes, to Britain (3990 ± 45 BP, 2860-2390)
Cerambycidae gen. et sp. indet.	UN		
Chrysomelidae			
Donacia clavipes F.	15	NB	
D. crassipes F.	15	NB	
D. versicolorea (Brahm)	15		
D. aquatica (L.)	15	RDB 3	
D. impressa Payk.	15	NA	
D. marginata Hoppe	15		
D. bicolora Zsch.	15	RDB 2	
D. obscura Gyll.	15	NA	
D. vulgaris Zsch.	15		
D. simplex F.	15		
D. cinerea Hbst.	15	NB	
Donacia spp.	15		
Plateumaris sericea (L.)	15		
P. discolor (Panz.)/*sericea* (L.)	15		

P. braccata (Scop.)	17	NA	
P. affinis (Kunze)	15	NB	
Plateumaris spp.	15		
Donaciinae gen. et sp. indet.	15		
Phaedon ? timidulus	11		
Phaedon sp.	13		
Prasocuris phellandrii (L.)	25		
Chrysomela aenea L.	9		
Agelastica alni (L.)	9	RDB 1	
Lochmaea suturalis (Thom.)	10		
Phyllotreta sp.	13		
Chaetocnema concinna (Marsh.)	13		
Chrysomelidae indet.	UN		
Scolytidae			
Scolytus rugulosus (Müll.)	2		
S. mali (Bech.)	2	NB	
Hylastes opacus (Er.)	1		
Tomicus piniperda (L.)	1		
Hylesinus crenatus (F.)	2		
H. oleiperda (F.)	3		
Hylesinus sp.	3		
Hylesini gen et sp. indet.	3		
Leperisinus varius (F.)	2		
Hylastinus obscurus (Marsh.)	13		
Xylocleptes bispinus (Duft.)	7		
Ernoporus caucasicus Lind.	5	RDB 1	
Pityogenes sp.	4		
Xyleborus saxeseni (Ratz.)	3		
Xyloterus ? lineatus (Ol.)	4		Yes, to Britain (3145 ± 45 BP, 1520-1310)
Scolytidae gen. et sp. indet.	3		
Curculionidae			
Rhinchitinae gen. et sp. indet.	2		
Apion spp.	13		
Phyllobius sp.	UN		
Strophosoma melanogrammum (Forst.)	3		
Strophosoma sp.	10		
Sitona spp.	13		
Cossonus linearis (F.)	6	NA	
Rhyncolus ater (L.)	4		
R. punctulatus Bohe.	6	Non-British species (1520-1310 cal BC)	
Cossiniae gen. et sp. indet.	6		
Tanysphyrus lemnae (Payk.)	15		

Dorytomus sp.	9	
Acalles roboris Curt.	2	NB
A. ptinoides (Marsh.)	11	NB
Limnobaris t-album (L.)	15	
L. dolorosa (Goez.)	15	
Eubrychius velutus (Beck)	15	NB
Rhinoncus bruchoides Hbst.	13	
Micrelus ericae (Gyll.)	10	
Ceutorhynchus contractus (Marsh.)	13	
Ceutorhynchus sp.	13	
Ceutorhynchidae gen et sp. indet.	13	
Rhynchaenus quercus (L.)	2	
R. rusci (Hbst.)	11	
Rhynchaenus spp.	3	
Rhamphus pulicarius (Hbst.)	11	
Curculionidae indet.	UN	
Coleoptera indet.	UN	

N.B. All dates have been previously displayed in Table 5.3 and are duplicated within Chapter 10. Radiocarbon serial numbers are included in those tables, but not here because of space restrictions.

Table 10.3. Coleoptera list from Misterton Carr (MISS) (* denotes non-British species).

"X" denotes presence of species in sample

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
	195-200	190-195	185-190	180-185	175-180	160-165	145-150	135-140	110-115	115-120	100-105	85-90	80-85	75-80	65-70	20-25
Carabidae																
Notiophilus biguttatus (F.)																x
Loricera pilicornis (F.)	1	1		1												
Clivina sp.																x
Trechus sp.	1															
Bembidion guttula (F.)	2	3														
Patrobus atrorufus (Strom.)	3			1					2							
Pterostichus diligens (Strm.)							x									
Pterostichus nigrita (Payk.)	1															
Dytiscidae																
Hydroporus sp.		1		1												
Hydrophilidae																
Hydraena testacea Curt.	1	5		1	7											

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
Hydraeana spp.			8	10		x		x		x	x	x	x	x	x	x
Ochthebius sp.	1										x	x	x	x	x	
Limnebius truncatellus (Thun.)	7	5		2				x	23							
Limnebius sp.										x	x	x	x	x	x	
Cercyon spp.	2	1														
Megasternum obscurum (Marsh.)		2		1												
Anacaena globulus (Payk.)	3	3														
Laccobius sp.	1	4														
Silphidae																
Silpha atrata L.									1							
Silpha sp.		1														
Leiodidae																
Agathidium confusum Bris.	1															
Ptinidae																
Ptenidium sp.				3												

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
Acrotrichis sp.	5			2												
Staphylinidae																
Micropeplus tesserula Curt.		1														
Micropeplus staphylinoides Marsh	2		1													
Acidota cruentata (Mann.)	1														x	
Lesteva punctata Er.	5	5	2	3					5							
Carpelimus sp.		1	2													
Oxytelus fulvipes Er.	4															
Stenus spp.	5	4	2	2	1				3		x			x	x	
Lathrobium terminatum Grav.		3														
Lathrobium spp.	4	2		1			x		2							
Xantholinus linearis (Ol.)/ *longiventris* Heer	1	1														
Quedius sp.	2	3							1							
Aleocharinae gen. et sp. indet.	3			1												
Pselaphidae																
Amauronyx maerkeli (Aube)					1											

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
Bryaxis sp.	1			2	1											
Brachygluta sp.				1												
Melyridae																
Aplocnemus sp.										x						
Dasytes sp.										x						
Dasytes sp.										x						
Elateridae																
Ampedus sp.									1							
Selatosomus bipustulatus (L.)				2												
Dalopius marginatus (L.)									3							
Melanotus erythropus (Gmel.)									1							
Denticollis linearis (L.)				1												
Athous haemorrhoidalis (F.)	1															
Eunemidae																
Melasis buprestoides (L.)			1													

	37	36	35	34	33	30	27	25	20	21	18	15	14	13	11	2
Isorhipis melasoides (Cast.)	1						x				x			x		
Scirtidae																
Scirtidae gen et sp. indet.	2	1	1	1	1				1							
Dryopidae																
Dryops sp.		1					x		2				x		x	
Esolus parallelepipedus Mül					1											
Oulimnius troglodytes (Gyll.)		1														
Limnius volckmari (Panz.)							x									
Cucujidae																
Pediacus dermestoides (F.)														x		
Cryptophagidae																
Cryptophagus sp.														x		

Colydiidae	**37**	**36**	**35**	**34**	**33**	**30**	**27**	**25**	**21**	**20**	**18**	**15**	**14**	**13**	**11**	**2**
Cerylon fagi Bris.														x		
Lyctidae																
Lyctus sp.														x		
Anodiidae																
Grynobius planus (F.)	1	1							1				x	x		
Ptilinus pectinicornis (L.)														x		
Anobium sp.										x				x		
Ochina ptinoides (Marsh.)	1															
Ptinidae																
Ptinus palliatus Perr.									1							
Scarabaeidae																
Geotrupes sp.	1	1		1			x		1							

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
Aphodius sp.	1								1					x		
Serica brunnea (L.)	1	1							1					x		
?Phyllopertha horticola (L.)																x
Lucanidae																
Sinodendron cylindricum (L.)									1		x			x	x	
Cerambycidae																
Grammoptera ruficornis (F.)	1			1												
Leiopus nebulosus (L.)															x	
Chrysomelidae																
Prasocuris phellandrii (L.)	1		1	2							x	x	x			
Chrysomela aenea L.	1	1							2	x		x		x		
Scolytidae																
Scolytus sp.													x	x		

	37	36	35	34	33	30	27	25	21	20	18	15	14	13	11	2
Hylesinus crenatus (F.)									1			x				
Hylesinus sp.	1											x				
Leperisinus varius (F.)	1															
Drycoetinus sp.											x				x	
Ernoporus caucasicus Lind.	1							x		x	x	x	x	x		
Curculionidae																
Phyllobius pomaceus Gyll./ calcaratus (F.)				1												
Magdalis sp.												x				
Strophosoma sp.			1			x								x		
Acalles sp.										x				x		
Rhynchaenus quercus (L.)	1															
Curculio sp.				1												
Total individuals	**73**	**53**	**19**	**42**	**12**	**?**	**?**	**?**	**54**	**?**	**?**	**?**	**?**	**?**	**?**	**?**
Total species	**39**	**25**	**9**	**23**	**6**	**2**	**6**	**3**	**20**	**8**	**9**	**9**	**8**	**20**	**9**	**4**

Table 12.1; Known pre-Linnean Coleoptera extirpations

Species	Most recent fossil record	Earliest fossil record
Chlaenius sulcicollis (Payk.)	4040-3820 cal BC	√
Oodes gracilis Vil.	4040-3820 cal BC	√
Gyrinus colymbus Er.	1300 cal AD	√
Rhysodes sulcatus (F.)#	1390-1060 cal BC	3970-3530 cal BC
Micropeplus caelatus Er.	4th century AD	Early Holocene
Batrisus formicarius Aube.#	> 3360-2920 cal BC	√
Buprestis rustica L.#	2921-1489 BC *	√
Porthmidius austriacus (Schrk.) #	Neolithic	√
Isorhipis melasoides (Cast.) #	1390-1060 cal BC	√
Dermestes laniarius Ill.	1610-1300 cal BC	√
Zimioma grossum (L.) #	1390-1060 cal BC	> 4350-4170 cal BC
Temnochila coerula Westw. #	> 3350-3100 cal BC	√
Tenebrioides fuscus Goeze #	> 1320-1030 cal BC	√
Cryptolestes ? corticinus Er. #	> 2000 cal BC	> 3350-3100 cal BC
Airaphilus elongatus (Gyll.)	4th century AD	5000-4000 cal BC
Prostomis mandibularis (F.) #	1390-1060 cal BC	4030-3820 cal BC
Leucohimatium sp.	9420 ± 200 BP	√
Pycnomerus terebrans (Ol.) #	3444-2921 BC *	4030-3820 cal BC
Dromaeolus barnabita (Villa)#	> 4300-4100 to < 1900-1750	c.8240-6290 BP
Bothrideres contractus F.#	3444-2445 BC *	4030-3820 cal BC
Mycetina cruciata (Schall.#)	1390-1060 cal BC	3444-2445 BC*
Rhopalodontus bauderi Ab#.	1390-1060 cal BC	√
Anthicus gracilis (Panz.)	415-380 cal BC	4030-3820 cal BC
Stagetus borealis Israelsson #	> 3350-3100 cal BC	√
Onthophagus fracticornis Preyss.	2nd century AD	Early Holocene
Aphodius quadriguttatus (Hbst.)	1610-1300 cal AD	√
Caenoscelis subdeplanata Bris. #	late Iron Age	> 2820-2660 cal BC
Platycerus caraboides (L.) #	mid Holocene	√
Cerambyx cerdo L. #	2500-1750 cal BC	Mid-Holocene
Hesperophanes fasciculatus (Fald.)#	2nd century AD ♦	√
Cathormiocerus validiscapus Roug.	8,320 +/- 100 BP	√
Cyphocleonus trisulcatus (hbst.)	9420 +/- 200 BP	√
Rhyncolus elongatus Gyll. #	2921-2445 BC*	Mid-Holocene
Rhyncolus sculpturatus `Walt #.	2921-2445 BC*	> 3350-3100 cal BC
Rhyncolus punctulatus Boh. #	1520-1310 cal BC	> 3350-3100 cal BC
Rhyncolus strangulatus Perr. #	Mid-Holocene	Mid-Holocene
Pissodes gyllenhali (Gyll.) #	> 3350-3100 cal BC	√
Acalles sp.	1390-1060 cal BC	√

This is an updated version of a table which was originally published by Buckland and Dinnin (1993), with substantial modifications. Data from Buckland (1979); Girling (1980, 1982b, 1984, 1985, 1989), Dinnin (1997e); Duffy (1968); Harding and Plant (1978); Osborne (1972; 1974b; 1995). Robinson (1991) Roper (1993; 1996); Wagner (1997); Whitehead, (1989); Whitehouse (1993; 1997) & chapters 6, 8 and 10.

♦ Probably imported in furniture during the Roman period.

√= same as

All dates have been calibrated, where possible, except those beyond *c.*7000 BP, which could not be calibrated. * denotes dendrochronological dates.

The symbol # denotes the saproxylic species. This list does not include recent extinctions.

Table 12.2; List of extirpated species recovered from the deposits investigated in the Humberhead Levels (TM= Thorne Moors; HM= Hatfield Moors; ROS= Rossington; MISS= Misterton). # = *Pinus*-loving species

Species	TM	HM	ROS	MISS	Reference	Other records
#Pterostichus augustatus * (N.B. unclear status with regard to its "extinction"		✓			Chapter 6	
Rhysodes sulcatus	✓				Buckland (1979)	Shustoke, Warks (Kelly & Osborne, 1965). Somerset (Girling ,1980). North Sea Floor, E. Anglia (Blair, 1935).
#Buprestis rustica ★	✓				Skidmore *	
Isorhipis melasoides	✓	?	✓		Buckland (1979); Chapter 6.	West Heath Spa, Herts (Girling, 1989). Somerset (Girling, 1980). Misterton Carr, Notts. (Osborne, 1978) & Chapter 10.
Zimioma grossum	✓				Buckland (1979)	Runnymede, Surrey (Robinson, 1991).
#Temnochila coerula	✓				Whitehouse (1993) & Roper (1993)	
Tenebrioides ? fuscus		✓			Chapter 6	
#Cryptolestes corticinus	✓	✓			Whitehouse (1993);Chapter 6 & 8	
Pycnomerus tenebrans	✓				Chapter 8	West Heath Spa, Herts (Girling, 1989). Minsterley, Salops (Osborne, 1972). Stileway, Somerset (Girling, 1985).
Prostomis mandibularis	✓	✓			Buckland (1979); Chapter 6	Sweet Track, Somerset (Girling, 1984). S. Ireland (Reilly, *pers. comm.*)
Bothrideres contractus	✓				Chapter 8	Stileway, Somerset (Girling, 1985).
Mycetina cruciata	✓				Buckland (1979); Chapter 8	
Rhopalodontus bauderi	✓				Buckland (1979)	
# Stagetus borealis ✦	✓				Chapter 8	
Caenoscelis subdeplanata †	✓				Roper (1993)	
Acalles sp.	✓				Buckland (1979)	
#Rhyncolus elongatus	✓	✓			Whitehouse (1993); Roper (1993) Chapters 6 & 8.	Worldsend, Salops. (Osborne, 1972).
#R. punctulatus	✓	✓		✓	Whitehouse (1993); Chapter 6	Stileway, Somerset (Girling, 1985); Hayfield Lodge Farm (chapter 10)
#R. sculpturatus	✓	✓			Whitehouse (1993); Chapter 6 & 8	
#Pissodes gyllenhali	✓				Whitehouse (1993)	

* Species is on the current British list but is commonly believed to be an introduction earlier this century. Since this ground beetle is unlikely to have been overlooked during collecting, it is likely that it became extinct until its re-introduction.

★ Peter Skidmore recovered *B.rustica* from a pupal chamber in a pine whilst fieldwalking.

† This species was added to British list by Johnson (1966). Became extinct before its "re-introduction"?

✦ Originally identified as "Species A" by Whitehouse (1993).

PLATES

Plate 1.1; Inclesmoor Map (*c.* 1410), after Beresford (1986).

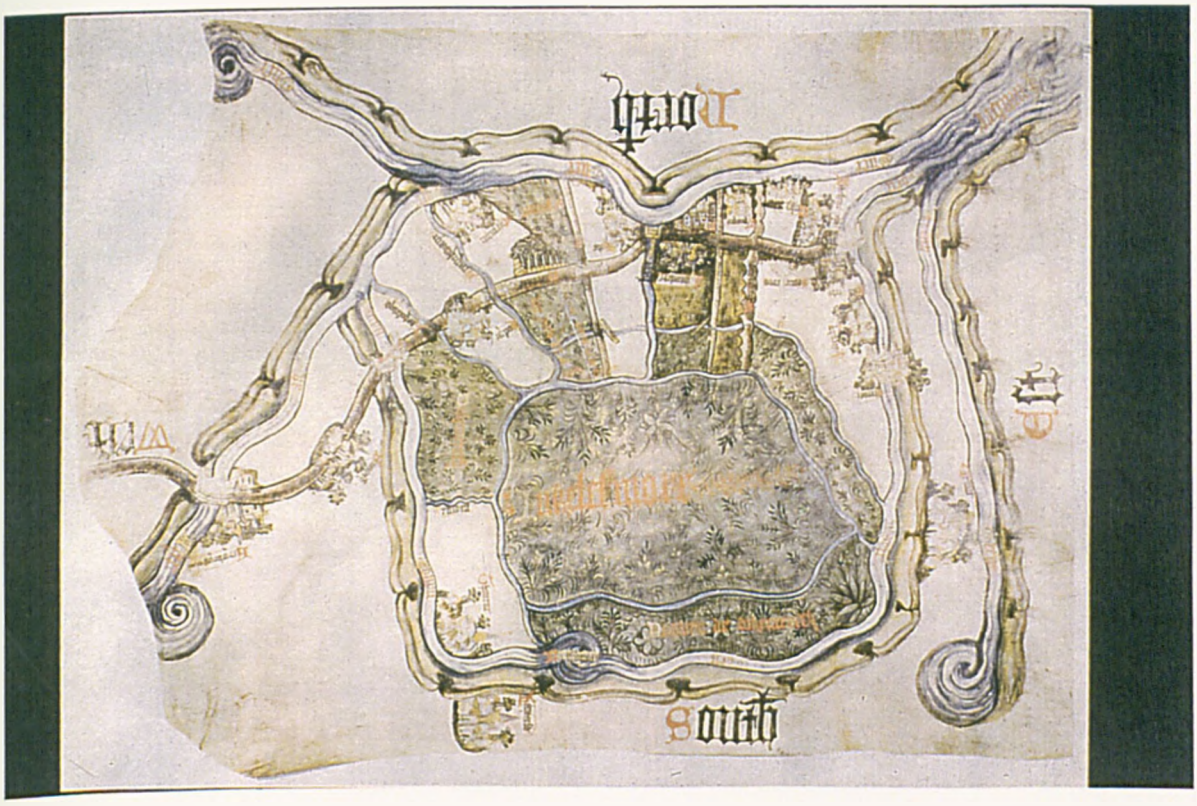


Plate 2.1; Wet heath, Skipwith Common, Vale of York.

Plate 4.1a; Morainic ridge of Lindholme exposed beneath wind-blown sands at Kilham West.

Plate 4.1b; Kilham West: podzol.

Plate 4.2 a, b; Fossil *Pinus* woodland at Tyrham Hall Quarry

Plate 4.3a; Tyrham Hall Quarry. *Pinus* with insect flight holes, probably caused by members of the genus *Rhagium* (Col. Cerambycidae).

Plate 4.3b; Fossil forest at Kilham West.

Plate 4.4a, b; Charring under fossil *Pinus* at Kilham West.

Plate 4.7; Site of HAT 3 (Kilham West).

Plate 4.5a; Localised burning on a *Pinus* (Kilham West).

Plate 4.5b; "Ripped" detail of a *Pinus* stump (Kilham West).

Plate 4.6a, b; Recently burnt *Pinus* on raised mire in Ireland (Clara Bog).

N.B. Plate 4.7 is bound after Plate 4.4a,b

Plate 4.8a; Detail: rot hole sampled at Tyrham Hall Quarry (sample 2).

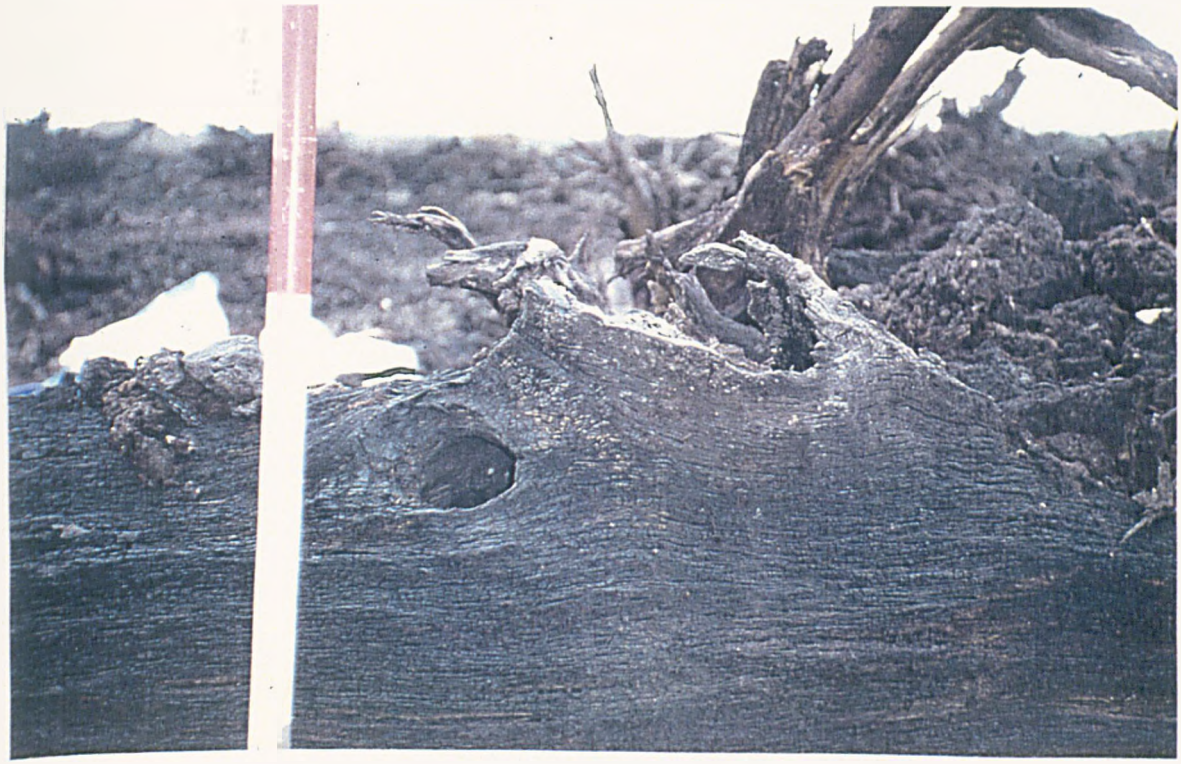


Plate 4.8,b; Location of site at Blackwater Dike, Goole Moors.

Plate 4.9a; Hayfield Lodge Farm, Rossington. Fen peats exposed adjacent to the River Torne.

Plate 4.9,b; Exposure sampled at Hayfield Lodge Farm, Rossington.

Plate 4.10; Hayfield Lodge Farm, Rossington: stratigraphy.

Plate 11.1a,b; *Pinus sylvestris* growing on the surface of mires in Sweden
(photo: P.C. Buckland)

Plate 11.2; Fossil *Pinus sylvestris* from Lindow bog, Cheshire.
(photo: P.C. Buckland)

APPENDICES

APPENDIX A

Classification of Rare and Scarce Coleoptera

As an aid to conservation, The Nature Conservancy Council (NCC) published in 1987 "British Red Data Books: 2, Insects" (Shirt 1987). This is a comprehensive statement on the status of most threatened insects in Great Britain, the main purpose of which is to draw attention to those species which insects whose continued survival is threatened, including those which have stable populations but occur in only a few sites. The Book contains three major categories based upon degrees of threat (RDB classifications). These categories were added to in the various reviews (e.g. Hyman, 1992, 1994) carried out by the JNCC.

Definitions

Categories 1: **Endangered (RDB1)**

Species in danger of extinction and whose survival is unlikely if the causal factors continue operating.

Category 2: **Vulnerable (RDB2)**

Species believed likely to move into the Endangered category in the near future if causal factors continue operating.

Category 3: **Rare (RDB3)**

Species with small populations that are not at present Endangered or Vulnerable, but are at risk.

Nationally Scarce

Notable A species (**NA**) are known to occur in 100 or fewer of the 3,600 ten-km squares of the Ordinance Survey National Grid in Britain; whereas Notable B species (**NB**) occur in 1000 squares.

APPENDIX B

Fieldwalking results, Hatfield Moors.

Kilham West

The western section of this area represents one of the largest of the buried forest on Hatfield Moors. Each ditch, along the whole length of the field, was surrounded by tree macrofossils and represents a high concentration of material, probably comparable with the material from Tyrham Hall Quarry. About 85-90 % of the trees are *Pinus*, the rest being *Betula*. The trees appeared to be rooted into the underlying sands and were of a considerable size. Some of the trees were clearly charred. There seemed to have been a lot of erosion of some of the surfaces, where charred material may have dropped away.

Many of the trees did not retain their bark, suggesting they had been exposed to the elements rather longer. Material from Tyrham and Thorne Moors (Goole), for example, had many trees with bark still intact. The colour of the wood was silver/white, suggesting they had been exposed to the elements for some time: many of these trees are golden when they first come out of the peat. Having discussed the area with peat workers, it appears the trees were exposed within the last year (1995). Roots of the trees were solid and sizeable, but had a good lateral root development, suggesting the trees were growing with roots spreading. Many of the trees were stumps *in situ*, rather than trunks, although there were also some very long trunks visible. There were signs of burning on many macrofossils throughout the area. Some of this was quite unusual, with charring under the roots, indicating localised burning, when trees had already fallen on their sides, either on the floor of the developing mire, or when they had been buried within the peat body. In any case, rotting wood material and peat would have made the location prone to fires. In addition to all the *Pinus* and *Betula* observed, a single *Quercus* macrofossil was identified by Gretel Boswijk, who was accompanying the author on this occasion. This was the first time *Quercus* remains have been noted on Hatfield Moors. The oak had 50 or more growth rings. It is perhaps pertinent that the location of the tree was on the present margins of the present Moors. The trees were rooted into the sand substrate and overlain by peat.

To the east of this area, the peat appeared shallower, particularly towards the direction of Lindholme island, with sand dunes protruding through the peat. Within this area an iron pan was also visible within many sections. Above the iron pan is generally a thin layer of sand (circa 5 cm.) with rootlets. Into both these deposits are rooted the remains of *Pinus sylvestris*. Directly above the sand appears to be *Sphagnum* peat, suggesting that this area

of the Moor did not go though a fen phase of bog development. Most of the tree macrofossils in this area appear to follow the distribution of the sand dunes protruding through the peat. In some of the large drainage ditches running west-east there are also deposits showing rounded pebbles and other material beneath the iron pan. It seems likely that this material marks part of the moraine represented by Lindholme island, but deposits were too shallow to impede first wind-blown sand and then peat to develop above them.

Kilham East

Fairly deep peat, *c.* 1.5-2 metres in places in the boundary ditch. The milling ditches did not reach the underlying sands, but showed the well-humified layer, suggesting the basal sands were only about 50 cms beneath the exposed sections. Sand dunes were evident in localised places. Along the side of the dike tree remains were evident about 1.20-1.30 cms from the basal sands, possibly *Pinus* or *Betula*, suggesting these trees had colonised the mire during a period of drying-out. There are also tree remains within the lower levels of the exposed peat, suggesting that at least two phases of drying had occurred in this area. Towards the southern section of Kilham East sand dunes were protruding through the peat. A section against one of these sand dunes was cleaned, showing a succession of pale sand, followed by a darker sand, with dark sand lenses, immediately above which was black, well-humified peat of about 4-5 cms. thickness, followed by less well-humified brown and then brown, largely unhumified peat. Of interest in this area was the presence of evident recurrence horizons, which appeared to follow the contours of hollows and hummocks.

Belton section 1

This is an area of abandoned cuttings which is vegetated. Visibility of this area was so poor that it was not fieldwalked.

Packards North, section 2

Ditches in this field were between 1-1.5 metres in depth, although in places as shallow as 0.50 cm Many charred trees were observed in this area. The charring observed seems superficial and patchy, although this may be related to the variable survival of charred wood on exposed macrofossils. It was not clear how long the material had been exposed to the elements, possibly one or two summers. Some of the trees indicated that they had been growing on the surface of the developing bog, possibly indicating the colonisation

of the mire surface during drier periods. This was suggested by the fact that the roots were rooted into the peat.

In the middle section of the field there were sand dunes, upon which was a concentration of *Pinus* stumps, twigs, branches and trunks, indicating that the pines had been growing on the surface of the sand dunes. In this area there was only circa 30-40 cms. of peat above the basal sands, whereas in other areas of the field peat depth was much greater, suggesting peat developing on the sand dunes was more recent compared with those areas where the sand dunes were not as elevated or within the "hollows" of the dunes. The pines are generally small, as if stressed and not as large as the ones observed in the area around Tyrham Hall Quarry.

Looking at the peat section, at the base there is the wind-blown sand, which appears to show signs of root activity. Immediately above this was recorded a very fine layer (1 cm.) of dry, well humified peaty/soil, possibly representing a "forest" soil. Above this are 2-3 cms. of *Sphagnum* peat with *Scheuzeria* rhizomes, grading into *Scheuzeria* peat. This suggests that in this area of Hatfield Moors there was no fen episode, with a transition from forest into *Sphagnum* peat. Within the underlying sands are also the remains of glacially smoothed pebbles, probably deposited when the moraine of Lindholme island was formed. These gravels become more evident the closer to Lindholme island, and the sand and gravel deposits protrude markedly in this area, with a corresponding increase in the number of trees growing on these areas. The pines show signs of charring in this area.

Packards South

The area covered by this field still contains a relatively good peat depth. In the western corner peat workers suggested there was up to 3.5 metres in depth of peat. Unfortunately, peat depths close to the terminal ditch were no-where that close. This is the area where the HAT 4 site was sampled from, but the greatest depth recoverable was about 1.5 metres of peat. Not many tree macrofossils were recorded from this field. It seems likely this is because the depth of peat remaining on the field was sufficiently deep that the basal trees were not exposed at this location. Indeed, when sampling was carried out at the HAT 4 site the section revealed the basal deposits contained the remains of both *Pinus* and *Betula*. In addition, there were no dunes protruding through the peat, upon which trees would have been able to grow. It seems likely therefore that in this area the basal sands do not form dune fields and so the palaeoforest is preserved only in the basal deposits in this area.

West Ash Dump section 1

This area was not fieldwalked as it was one of the few areas which have been returned to nature conservation and were regenerating with young *Betula* and some *Calluna*. The area was also surrounded by large ditches which at the time of visiting this area where full of water, so it was not possible to get onto the area. There were stockpiles of *Pinus sylvestris* which were piled alongside the surrounding ditch suggesting many of the tress had come from the ditch, although some many have also come off the former milling field. Given the proximity of this area to the moraine of Lindholme island, it is not surprising that there should have been a sizeable number of tree macrofossils, particularly as the morainic ridge of the Island extends into this area, making this an ideal area where *Pinus* would have lived.

West Ash Dump section 2

The southern-most part of this field was re-vegetating, so was not walked.

East Ash Dump, sections 1 & 2

East Ash Dump, section 1 contained old style, wide baulks, some 1-1.5 metres high and the area was re-vegetating with *Calluna*, Betula and a few young *Pinus*, presumably re-colonising from Lindholme island. This area presented a good sampling opportunity, but time constraints upon the project prohibited taking any further samples. However, if the area has not been stripped for milling it should present a good opportunity for sampling.

Section 2 had been completely worked out, but showed the presence of in *situ Pinus* stumps at the base of the peat, which had clearly been growing in the underlying sand. Of interest was the "ripped" nature of the stumps, with jagged edges protruding. This was a feature of many of the *Pinus* stumps observed across the Moors, suggesting that the bases of the pines had becomes disconnected from their trunks by a deterioration and rotting of the pine trunks.

New Moor North

This area was re-vegetating with *Betula* and *Calluna* and had clearly been cut for peat using the old style "block cutting" technique, but due to the vegetation on site could not be fieldwalked. On a subsequent trip several years later it was noted that the area had been cleared for peat milling.

New Moor South

This area had been cleared of vegetation for milling recently, but unfortunately contained no drains (except periphery ones) which could be walked.

Porters Drain

This large drain running west-east of the eastern side of Hatfield Moors forms a major boundary in this part of the Moor. It a major and deep (*c.* 3 metres deep) ditch, with a good peat succession. Unfortunately, the ditch contained too much water to sample safely. Tree remains which had come out of the drain were evident beside the drain and tree macrofossils were evident in the exposed sections. The area to the south of the drain had only been recently cleared of vegetation prior to milling and contained no drains, so it was not fieldwalked. In a subsequent visit several years later ditches had been installed, but it was not fieldwalked.

Lindholme Island

The island was not systematically fieldwalked, none of the fields were under cultivation at the time of the field work. However, the area was walked by the Humber Wetlands Team. In addition, the author walked around the area covered by the Island and made several records. A quarry close to Lindholme provided the opportunity to photograph an exposed stratigraphic section through the moraine. The section was about 2.5 metres deep, showing the top soil grading into aeolian sands. Beneath this unit was a matrix of rounded pebbles grading into heavier rounded pebbles, mostly of sandstone. The pebbles vary in size and are mixed. This material represents material which was deposited at the end of the Devensian, when the ice sheet surged into the area, creating the moraine which is now Lindholme Island.

Apart from a central area which is dominated by grassland, the island is composed of mixed woodland, with some mature *Quercus*, relatively young *Betula* woodland and *Pinus sylvestris* in areas, generally in isolated stands. *Calluna* and *Pteridium* form the understorey. Towards the margin of the island, there are deeper deposits of peat and the growth of *Sphagnum*. Indeed, the northern part of Lindholme has an active catotelm (Howes, *pers. comm.*). A drainage ditch surrounds Lindholme island, which most of the time contains water. One section was observed, which was dry, with a depth of about 1.75 cms. of peat. From base to the top, the stratigraphy showed sand at the base, followed by sandy peat, followed by a layer containing *Pinus sylvestris*. Above this layer was well-humified peat, followed by layers of unhumified and humified peat.

Unfortunately, the stratigraphy was not measured on this occasion, but these observations are included here as a record.

On the northern-western side of the island were the remains of pine macrofossils which had evidently come from the drainage ditch which surrounds the island; the size of the macrofossils was small, displaying stunted and contorted root systems, suggesting the trees had died at a young age and were living in stressful conditions; the wide rooting system of the roots suggests this was probably related to increasing water table in the area. None of the macrofossil displayed any signs of charring.

Tyrham Hall Quarry

An area which was being worked for peat was investigated, approximately about 300m wide by 400 m in length. The area from which samples were removed contained a large quantity of tree macrofossils, mainly *Pinus sylvestris*, some *Betula*, and some scattered *Quercus* trunks. The peat was still in a reasonably wet state, so much of the material was in excellent condition. The area was walked, and some observations regarding the state of the trees was noted. Some of the trees had very wide root stumps, with quite substantial sized roots. In one example, the width of the roots, from one end to the other, was about 2.5m across, with the main part of the trunk probably about 55cm. in diameter. In some cases, the pines had been clearly rooted into the underlying aeolian sands, which was still adhered to the root formation, together with part of the iron pan which is visible across certain areas of Hatfield moors, most notably on its north-western side. There were a substantial number of tall, substantial straight-growing trees, and many appeared to have been growing in good conditions, an impression which is corroborated by the dendrochronological data carried out by Gretel Boswijk (1998). The density of trees in the area was so large that there appeared to be several generations of trees here (i.e. several hundred years), an impression which again is corroborated by the dendrochronological data.

Another pine tree trunk was very straight in growth, about 7.5 metres long, and was riddled with insect flight holes. These flight holes in some cases were very large, indicating that the pine had been quite badly attacked by insect activity in the past; the state of the holes indicated that the insect attack had not occurred recently, and most likely the tree had been attacked at some stage before being submerged by the acidic conditions of the mire at Hatfield Moors. Some of the exit/entry holes were about 3.5 cms. in diameter, with others varying between 3 & 2 cm. in diameter, possibly created by members of the Cerambycid family, such as the genus *Rhaghium*. There was also some

oak growing on the site, which appeared to have been growing together with the pine trees, but appear to have been much smaller in size in comparison with ones recorded from Thorne Moors. To provide some measure of the density of the tree macrofossil remains, an area roughly measuring about 26m E-W by 18m N-S contained thirty tree. Another area examined, roughly 100m X 100m contained about 52 stumps, many of which were large in size.

Many of the trees had visible signs of charring, with charcoal sealed beneath the peat, on the surface of the wood. One large pine was examined which was charred along one side, but its other side still retained its bark, uncharred. This circumstantial evidence would suggests that the tree was probably burnt after death, when it was lying on its side; it seems unlikely that it had been burnt whilst it was still alive and standing. It should be noted that charring on many of these trees is often difficult to identify, as the friability of the charcoal causes it to drop away from the tree macrofossils when exposed by the digging machines. All of the samples which were subsequently processed contained large fragments of charcoal.

APPENDIX C

Sample and processing details

SAMPLE DETAILS: HATFIELD 2, (HAT 4), south Hatfield Moors.

Processing Details

Sample No.	**29**	**28**	**27**	**26**	**25**
Context	150-155 cms.	145-155 cms.	140-145 cms.	135-140 cms.	130-135 cms.
Soil description	Very well humified, amorphous, dark brown/black peat, some *Phragmites* and wood remains.	Black, well humified brushwood peat, including many wood fragments of *Pinus* and *Betula.*	Dark brown/black, moderate to well humified brushwood peat, with *Pinus*, *Betula* and ? *Quercus* frags.	Well humified *Sphagnum* peat, with wood remains, *Pinus*, *Betula* and ? *Quercus.*	Dark black/brown, well humified brushwood peat, with evident *Betula* remains.
Sample volume	6 litres	6 litres	7 litres	7 litres	7 litres
Volume processed	3 litres	3 litres	3 litres	3 litres	3 litres
Volume of flot	30 ml.	17 ml.	18 ml.	15 ml.	20 ml.

Sample No.	**24**	**23**	**22**	**20**	**18**
Context	125-130 cms.	120-125 cms.	115-120 cms.	105-110 cms.	95-100 cms.
Soil description	Dark black/brown moderately well humified birchwood peat. Evident *Betula* remains.	Dark brown, moderately well humified birchwood peat, with evident *Sphagnum* remains and *Betula* and *Alnus* wood frags.	Dark, well humified peat, with some *Betula* remains.	Dark, well humified brushwood peat, Many wood fragments, particularly *Betula.*	Dark, well humified brushwood peat. Many wood fragments, particularly *Betula.*
Sample volume	5 litres	5 litres	6 litres	4 litres	3 litres
Volume processed	3 litres	3 litres	3 litres	3 litres	3 litres
Volume of flot	20 ml.	17 ml.	100 ml.	25 ml.	50 ml.

Sample No.	16	14	12	10	7
Context	85-90 cms.	75-80 cms.	65-70 cms.	55-60 cms.	40-45 cms.
Soil description	Dark black/brown, well humified, brushwood peat, with *Betula* and *Pinus* frags.	Dark brown, moderately well humified peat with evident *Sphagnum* remains and other mire plants. Also *Betula* and *Pinus* fragments.	Dark brown, moderately to not well humified peat, evident plant remains, such as *Vaccinium* spp. and *Scheuzeria.*	Dark brown, partially humified peat, with evident plant remains such as *Eriophorum*, *Vaccinium*, somewhat bedded.	Dark brown/black well humified *Sphagnum* peat, slightly bedded.
Sample volume	6 litres	4 litres	4 litres	5 litres	4 litres
Volume processed	3 litres	3 litres	3 litres	3 litres	3 litres
Volume of flot	200 ml.	800 ml.	300 ml.	100 ml.	175 ml.

Sample No.	4	1
Context	25-30 cms.	10-15 cms.
Soil description	Dark brown, moderately well humified *Sphagnum* peat.	Golden brown, poorly to moderately humified *Sphagnum* peat, with evident *Sphagnum* remains, bedding evident.
Sample volume	7 litres	6 litres
Volume processed	3 litres	3 litres
Volume of flot	950 ml.	360 ml.

Sample contents: ABUNDANCE OF FLORA AND FAUNA, HAT 4

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	29	28	27	26	25	24	23	22	20
Coleoptera	O	O	O	O	F	O	F	F	F
Diptera (Gen.)	R	O	R	R	R	R	F	R	R
Chironomidae (Diptera)	No	O	R	R	R	R	R	No	R
Formicidae	O	O	O	R	R	No	O	R	O
Acarina	R	O	O	O	R	R	O	F	F
Seeds	O	F	O	R	R	R	O	No	O
Wood	O	O	F	R	R	O	R	No	O
Other plant	F	A	F	F	F	D	O	D	D
Charcoal	No	No	No	No	No	No	No	No	No
Preservation index	2/3	2/3	3	3	3	2	4	4	4

Sample Numbers →	18	16	14	12	10	7	4	1
Coleoptera	F	R	R	F	O	O	O	O
Diptera (Gen.)	F	O	R	R	R	O	R	R
Chironomidae (Diptera)	F	R	No	O	R	R	R	O
Formicidae	F	O	R	F	F	F	R	R
Acarina	F	O	O	R	F	O	R	F
Seeds	O	O	O	F	F	O	O	O
Wood	D	No	No	No	R	No	No	No
Other plant	O	D	D	D	D	D	D	D
Charcoal	No	No	Yes/O	No	Yes/O	Yes	Yes/F	Yes/O
Preservation Index	3/4	4	4	4	4	4	4	4

Charcoal: sample 7, 4, 1 - Calluna charcoal.

SAMPLE DETAILS: HATFIELD 1, (HAT 3), north Hatfield Moors.

Sample No.	18	17
Context	95-103 cms (Base)	85-95 cms.
Soil description	dark brown peat with evident charcoal (check this descr against C14)	very well humified, black amorphous, peat with some *Pinus* and *Betula* macros; *Sphagnum* remains.
Sample volume	3 litres	3.5 litres
Volume processed	1 litre	3.5 litres
Volume of flot	20ml.	1.1 litres

Sample contents: ABUNDANCE OF FLORA AND FAUNA, HAT 3

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	18	17
Coleoptera	O	O
Diptera (Gen.)	None	R
Chironomidae (Diptera)	O	R
Formicidae	R	R
Acarina	O	R
Seeds	R	O
Wood	None	R
Other plant	D	D
Charcoal	O	A
Preservation index	2	3

N.B. Sample 18 - large charcoal fragments, including charred pine cone fragments. Sample 17 - large charcoal fragments (probably from wood), the size and abundance of which suggests *in situ* fire.

SAMPLE DETAILS: LINDHOLME A, (LIND A), Lindholme Bank Road, Hatfield Moors.

Sample No.	**7**	**6**	**3**
Context	110-120 cms.	100-110 cms.	70-80 cms.
Soil description	Partially humified, very dry peat, with *Betula* macrofossils.	Very dry, partially humified peat. Wood and rootlets.	Very dry, bedded *Sphagnum* peat, poorly humified.
Sample volume	10 litres	8 litres	6 litres
Volume processed	5 litres	5 litres	3 litres *
Volume of flot	50 ml.	50 ml.	75 ml.

* only 3 litres taken for this sample, as the material was so dried up: to take a larger sample would have taken up more processing time which would not repay in a well-preserved assemblage.

Sample contents: ABUNDANCE OF FLORA AND FAUNA, LIND A

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	**7**	**6**	**3**
Coleoptera	O	O	R
Diptera (Gen.)	O	O	R
Chironomidae (Diptera)	O	O	R
Formicidae	O	O	O
Acarina	O	O	O
Seeds	None	F	R
Wood	F	F	None
Other plant	A	A	D
Charcoal	F	F	None
Preservation index	2	3	4

sample 7 - charred wood
sample 6 - charred Calluna

Sample details: **LINDHOLME B (LIND B),** Lindholme Bank Road, Hatfield Moors.

Sample No.	18	15	12	9
Context number	160-172 cms.	145-150 cms.	130-135 cms.	115-120 cms.
Soil description	Dark black, well humified peat, some silt/clay element.	Dark black, well humified peat, some silty/clay element.	Unhumified peat, numerous un-degraded *Sphagnum* inclusions.	Moderately humified peat, *Calluna* inclusions.
Sample volume	10 litres	10 litres	12 litres	8 litres
Volume processed	5 litres	5 litres	5 litres	5 litres
Volume of flot	150 ml.	300 ml.	3150 ml.	3150 ml.

Sample contents: ABUNDANCE OF FLORA AND FAUNA, LIND B.

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	18	15	12	9
Coleoptera	R	O	F	F
Diptera (Gen.)	R	R	R	O
Chironomidae (Diptera)	R	R	R	R
Formicidae	R	O	A	A
Acarina	R	O	O	O
Seeds	O	R	R	O
Wood	None	None	None	None
Other plant	D	D	D	D
Charcoal	F	O	None	None
Preservation index	3	4	4	4

Sample 18, 15 burnt plant material

SAMPLE details: Tyrham Hall Quarry, (TYRHAM), Hatfield Moors.

Processing details

Sample No.	1	2A	2B	3	K	Oak
Context	*Pinus* rot hole	*Pinus* rot hole	*Pinus* branch hole.	*Pinus* rot hole	*Pinus* rot hole	*Quercus* rot hole.
Soil description	Black, well humified peat, wood inclusions.	Very dark, well humified peat with frass material.	Very well humified black peat, with frass material.	Dry, frass material; dry wood	Very dry, frass material with well humified black peat.	Very dry *Quercus* frass and dried peat.
Sample volume	3 litres	3 litres	1 litre	4 litres	3 litres	7 litres
Volume processed	3 litres	3 litres	1 litre	4 litres	3 litres	3 litres
Volume of flot	115 ml.	25 ml.	10 ml.	60 ml.	235 ml.	35 ml.

Sample contents: ABUNDANCE OF FLORA AND FAUNA, TYRHAM.

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	1	2A	2B	3	K	Oak
Coleoptera	D	A	F	F	O	O
Diptera (Gen.)	R	F	O	R	R	O
Chironomidae (Diptera)	None	F	F	R	R	O
Formicidae	F	F	O	R	R	O
Acarina	O	O	R	R	R	O
Seeds	F	F	None	O	R	O
Wood	A	O	None	F	R	A
Other plant	F	A	R	D	D	F
Charcoal	A	None	None	A	A	A
Preservation index	4/5	4	3	3/4	4	4

Sample 1 - charred *Calluna* seeds. Large pieces of charcoal = in situ fire.
Sample 3, K - lots charcoal.
Oak - lots of charcoal

SAMPLE details: Blackwater Dike, Goole Moors, Thorne Moors (Goole *Quercus/Pine* sequence)

Processing details

Sample No.	Bulk 3	20	19	18	17
Context	Bulk sample from base of section	122-127 cm	117-122 cm.	112-117 cm.	107-112 cm.
Soil description	Black, very well humified peat, with clay element.	Black, very well humified peat, with clay element.	Dark black, well humified peat. Some wood macrofossils, also *Phragmites*.	Very well humified, black peat with wood, including *Quercus* and *Betula*. Also *Phragmites*.	Dark brown, well humified peat with *Betula* and *Pinus* remains.
Sample volume	7 litres	3 litres	5 litres	6 litres	5 litres
Volume processed	1 litre	3 litres	3 litres	3 litres	3 litres
Volume of flot	50 ml.	10ml.	150 ml.	175 ml.	75 ml.

Sample No.	16	15
Context	102-107 cm	97-102 cm
Soil description	Well humified, black brushwood peat, with *Betula* macros and *Pinus* cones.	Very well humified, dark brown peat with *Betula* macros and *Sphagnum* remains.
Sample volume	5 litres	4 litres
Volume processed	3 litres	3 litres
Volume of flot	190 ml.	380 ml.

Sample contents: ABUNDANCE OF FLORA AND FAUNA, Blackwater Dike, Goole Moors, (Goole *Quercus/Pine* sequence)

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	Bulk 3	20	19	18	17	16	15
Coleoptera	F	O	F	A	F	A	F
Diptera (Gen.)	O	None	O	O	A	O	O
Chironomidae (Diptera)	R	None	O	O	F	F	F
Formicidae	O	None	R	O	F	F	O
Acarina	O	O	R	O	F	O	O
Seeds	O	F	O	F	F	O	O
Wood	O	F	None	R	F	R	R
Other plant	D	A	D	D	A	D	D
Charcoal	None	None	None	O	O	None	None
Preservation index	4	2/3	4	4	4	4	4

SAMPLE details: Hayfield Lodge Farm, Rossington (ROS)

Sample No.	20	19	18	17	16
Context	335-340 cm	325-335 cm	315-325 cm	305-315 cm	295-305 cm
Soil description	Deposit consisting largely of sandy gravel with riverine pebbles. Some clay.	Sandy soil, with some clay, including riverine pebbles and wood fragments.	Well humified, dark grey peat, including sand and riverine pebbles. Wood fragments, some noticeably charred. *Corylus* seeds.	Very well-humified, dark grey fen peat. Some *Betula* fragments. Some fine grey sand. Fire-cracked pebble (sandstone) was recovered during processing.	Very well humified, almost structure-less fen peat, including *Phragmites*. Some fine-grained sand bedded within deposit.
Sample volume	3 litres	5 litres	5 litres	6 litres	6 litres
Volume processed	3 litres	5 litres	3 litres	3 litres	3 litres
Volume of flot	25 ml	25 ml	40 ml	80 ml	40 ml

Sample No.	15	14	13	12	10
Context	285-295 cm	275-285 cm	265-275 cm	255-265 cm	235-245 cm
Soil description	Very well humified peat with fine yellow sand bands. *Corylus* nuts and *Betula* fragments. *Alnus* seeds.	Very well humified, dark black, sandy peat. Wood incorporated, ?*Pinus*, ?*Alnus* and *Corylus* nuts. Abundant charcoal.	Sandy, very well humified black fen peat incorporating wood. Some charcoal.	Very well humified fen peat, dark brown, with some sand (?flooding episodes)	Very well humified black/brown peat.
Sample volume	7 litres	7 litres	8 litres	7 litres	6 litres
Volume processed	3 litres	3 litres	3 litres	3 litres	3 litres
Volume of flot	55 ml	55 ml	35 ml	65 ml	17 ml

Sample No.	9	7	5	3	1
Context	225-235 cm	205-215 cm	170-180 cm	150-160 cm	120-140 cm
Soil description	Dark black, well humified peat with *Betula* remains. Dryish.	Dark brown, well-humified compacted peat, incorporating wood and plant remains. Small amounts of clay.	Well-humified and compacted dark brown/black peat, incorporating wood and plant remains. Some clay.	Dark grey clay, probably alluvium, incorporating *Phragmites* remains.	Light, olive brown sandy deposit, with some dark grey silty clay (?alluvium).
Sample volume	10 litres	10 litres	13 litres	8 litres	12 litres
Volume processed	3 litres	5 litres	5 litres	3 litres	8 litres
Volume of flot	55 ml	100 ml	300 ml	30 ml	10 ml

Sample contents: ABUNDANCE OF FLORA AND FAUNA, Hayfield Lodge Farm, Rossington (ROS)

D = Dominant; A = Abundant; F = Frequent; O = Occasional, R = Rare

Sample Numbers →	20	19	18	17	16	15	14	13	12	10	9	7	5	3	1
Coleoptera	O	O	A	A	A	F	A	A	A	F	F	O	F	F	F
Diptera (Gen.)	R	R	R	O	O	O	A	F	F	O	O	O	O	O	O
Chironomidae (Diptera)	R	O	F	A	O	O	F	F	A	F	A	O	F	F	F
Formicidae	R	R	R	R	R	R	R	O	O	O	O	No	No	R	R
Acarina	R	O	O	A	F	F	A	F	A	F	F	O	No	R	O
Seeds	O	R	O	O	A	F	A	F	F	F	O	R	O	O	O
Wood	A	F	No	No	R	F	O	F	No	No	No	No	No	No	No
Other plant	A	A	O	F	O	R	O	O	O	D	A	D	A	F	F
Charcoal	No	No	Yes	No	No	No	Yes	Yes	No	No	No	No	No	No	O
Preservation index	2/3	2/3	4	4	4	4	4	4	4	3	3	1	4	3	3/4

APPENDIX D

Identification problems

General identification problems

Identification of the aquatic genus *Hydroporus* to species is notoriously difficult. In some cases, successful identification was carried out to species level. However, this was not always possible, although it was clear that different taxa were present in the assemblage. In such cases, a note was made as to how many species were represented. In addition, as the expertise of the researchers' identification skills increased identification of this taxon was made to species level more frequently. Much time was invested in attempting to successfully identify this genus, since it can yield interesting information regarding water quality, acidity and a range of other factors. It was noted that whereas micro-sculpture is a useful attribute to aid identification, the shape of the angle of the shoulder on the underside of the elytra is a good diagnostic feature for speciation. This is an attribute which is not picked out in any keys, but proved a useful way of separating out taxa and identifying different species.

Cyphon is another genus which is difficult to identify. These beetles have very fragile elytra which can often get torn during processing. It was decided from the outset to record these fragments to genus, except for one species, *Cyphon padi*, which has a distinctive macula on the elytra. Other genera which were not pursued to species level were individuals of the genus *Stenus* (except those species with a distinctive orange macula) and the mould feeders *Corticaria*.

The hydrophilid, *Hydreana britteni/riparia* was a common fragment within many of the samples. The diagnostic sclerite for the successful identification of this species is its thorax (Jäch, 1988). In many cases, only elytra survived and attempting to separate the two species on this body part was problematic. Where possible, separation of the two species was attempted. Where this was not possible, the sclerites were recorded as *Hydreana britteni/riparia*. Another pair of species difficult to separate were the reed beetles *Plateumaris sericea/discolor*. Separation of these two species upon elytra is virtually impossible, although they can be separated on thorax and occasionally, on heads. Separation of these two taxa is quite important, as the former is an indicator of non-acidic mire conditions (fen) and the latter of acid wetlands (ombrotrophic mire). Where separation was not possible, individuals were recorded as *P. sericea/discolor*. The ground beetle *Pterostichus nigrita/rhaeticus* was identified to this species category, as both species are easily confused and are only safely separated on genitalia (Luff, 1990).

Specific identification problems relating to particular assemblages.

Hatfield 1

Few identification problems were encountered. Sample 18 contained more poorly preserved material compared with 17, originating from the black, very amorphous basal peat which is common across many areas of Hatfield Moors. A greater proportion of taxa could only be identified to genus rather than species, although the majority of fossils were identified to species. Additional time was spent in the identification of the non-British species, such as *Rhyncolus sculpturatus*, identified on the basis of its elytra, through the use of a new key to this genus devised by the author (Appendix D). Identification was also confirmed by comparison with a named specimen at Manchester Museum. *Rhyncolus elongatus* was identified in the same way. *Prostomis mandibularis* was another non-British species recovered and identified on the basis of its thorax and named characteristics within Porta (1929) and comparison with a named specimen at Manchester Museum.

Hatfield 2

Beyond the identification problems already discussed in section 5.4, several other taxa were problematic. The extinct *Tenebrioides fuscus* was identified on the basis of the elytra recovered and named morphological characteristics in Vogt (1967a). However, it could not be compared with a named specimen, although a special trip to the Coleoptera collection at the British Museum was undertaken. There are apparently no known specimens of *Tenebrioides fuscus* in England.

The other extirpated taxon recovered was a single *Rhyncolus punctulatus* identified on its elytra, on the basis of a new key (Appendix D). Confirmation was made by comparison with a named specimen at Manchester Museum. A number of individuals of *Ostoma ferruginum* were also recovered from this sequence. Initially these fossils were thought to be *Zimioma grossum*, a closely allied non-British species. However, on closer inspection it was found that the fossils were *Ostoma*, based upon the setiferous punctures upon the "ribs" of the elytra, which *Z. grossum* does not have. Comparison was also made with a named specimen at Manchester Museum. A thorax of the Colydiid *Synchita humeralis* could not be matched against material at Doncaster Museum, but was identified by Colin Johnson (Manchester). The separation of *Melasis buprestoides* and *Isorhipis melasoides* was occasionally problematic, as the diagnostic feature used to separate these two species is the elytral apex, which was not always available (e.g. sample 27).

Members of the family Scolytidae were identified through use of keys and the reference collection at Manchester Museum.. Several specimens proved to be problematic to identify and were eventually assigned to the genus *Hylesinus/Leperisinus* A. The fossils are reproduced in Figure 6.6. Part of the problem identifying these fossils related to the presence of small "spines" on the top part of the elytra, near the central suture. Since recent specimens are still covered with setae it is difficult to see any spines, although they should still show through. However, none of the reference material satisfactorily matched the fossil material. Keys were also utilised to identify the fossil, but none of the descriptions appeared to match the fossil. The fossils seem to be closely related to the genera *Hylesinus* and *Leperisinus*.

Lindholme A

Few identification problems were encountered. The non-British fossil *Chryptolestes corticinus* was identified on the basis of its elytra. This was carried out through the use of taxonomic keys in Freude, Harde & Lohse (1967) and Porta (1929) as well as comparison with a named specimen at Manchester Museum and confirmed by Colin Johnson. All members of the Scolytidae were taken to Manchester Museum for identification.

Lindholme B

The standard of preservation in these samples was generally good, allowing identification to species in the majority of cases. All samples scored 4 (Good) on the Preservation Index for Coleoptera remains. There were no significant identification problems. One of the most important species recovered was the ground *Bembidion*? *humerale*. Unfortunately, its elytral apex was missing, a diagnostic element for this species. This species has a macula on the shoulder, but not the apex; other species of *Bembidion* with shoulder markings have corresponding markings on the elytral apex. The identification of the sub-fossil was based upon the shape of the macula and of the shoulder, which closely matched modern specimens of this species. These characters were also checked against other species in the genus, but the closest identification was clearly *B. humerale*. In the absence of the apex, the identification remains tentative.

Pterostichus augustata was identified on the basis of a pronotum and confirmed by a Carabidae specialist, Brian Eversham. There were two other species this specimen could have been confused with, *P. oblongopunctatus* and *P. adstrictus*, but extensive comparison with specimens of all species confirms the identification. This was on the

basis of the relatively small and narrow thorax; it was heavily punctate at the base; strongly sinuated at the sides; the base was strongly oblique and the margin was moderately wide throughout. Since this species is regarded as an introduction early this century, the identification of this specimen had to be secure, given the biogeographic implications of its presence.

Tyrham Hall Quarry

Most of the material from these contexts were in excellent condition. In particular material from sample 1 contained material in a superb state of preservation, with many individuals virtually still intact. This facilitated the process of identification. All members of the Scolytidae were taken to Manchester Museum for identification. The non-British fossils recovered (members of the genus *Rhyncolus* and *Prostomis mandibularis*) were identified on the basis of European keys and compared against a named specimen at Manchester Museum. The key devised by the author (Appendix D) was also used to identify the *Rhyncolus* species.

Goole Moors (Thorne Moors), *Quercus/Pinus* sequence

The only specimen which created any problems was from sample 19, Pycnomerus tenebrans, as only the apex of the elytra was available for identification. The specimen was taken to the British Museum and compared with a range of species of this genus. However, this species is extremely distinctive and has upstanding striae, curved, with punctures on the striae. It is very different from the British species, *P. fuliginosus*, which is dull, with different striae and much bigger punctures on the striae.

Hayfield Lodge Farm, Rossington

The extensive range of Scolytids recovered from this succession were all taken to Manchester Museum for identification. The non-British *Rhyncolus punctulatus* was identified at Manchester through comparison with a named specimen and key characteristics.

A head of *Agelastica alni* was identified by P. Skidmore for the author. The fossil was also taken to Manchester Museum for comparison with a range of specimens, since the Doncaster collection contained just one specimen of this rare species. The range of reed beetles of the genus *Donacia* proved a challenge to identify. This was done through patient comparative work of modern specimens. However, the information gained from these aquatic vegetation beetles was worth the time expended during identification.

Table 9.1; List of sites used in the CA analysis, together with sources of data and CANOCO site codes used in scatter plots. All sites have been previously identified within the text of appropriate chapters.

Site	Sample No	CANOCO site code	Reference to site
Hat 4	29	1	HAT 4 (Hatfield), Chapter 6
Hat 4	28	2	
Hat 4	27	3	
Hat 4	26	4	
Hat 4	25	5	
Hat 4	24	6	
Hat 4	23	7	
Hat 4	22	8	
Hat 4	20	9	
Hat 4	18	10	
Hat 4	16	11	
Hat 4	14	12	
Hat 4	12	13	
Hat 4	10	14	
Hat 4	7	15	
Hat 4	4	16	
Hat 4	1	17	
Hat 3	18	18	HAT 3 (Hatfield), Chapter 6
Hat 3	17	19	
Lind A	7	20	Lindholme A (Hatfield), Chapter 6
Lind A	6	21	
Lind A	3	22	
Lind B	18	23	Lindholme B (Hatfield), Chapter 6
Lind B	15	24	
Lind B	12	25	
Lind B	9	26	
Tyham	1	27	Tyham Hall Quarry (Hatfield), Chapter 6
Tyham	2A	28	
Tyham	2B	29	
Tyham	3	30	
Tyham	K	31	
Tyham	Oak	32	
BlackD	Bulk 3	33	Blackwater Dike (Thorne Moors), Chapter 8
BlackD	20	34	
BlackD	19	35	
BlackD	18	36	
BlackD	17	37	
BlackD	16	38	
BlackD	15	39	
Goole 1	1	40	Goole Moors 1 (Thorne Moors), (Roper, 1993, 1996)
Goole 1	2	41	
Goole 1	3	42	
Goole 1	4	43	

Goole 1	5	44	
Goole 1	6	45	
Goole 1	7	46	
Goole 1	8	47	
Goole 1	9	48	
Trackw	1 Mor	49	Trackway site (Thorne Moors), (Buckland, 1979).
Trackw	2 Trk	50	
Trackw	3 Oak	51	
Trackw	4 Oak	52	
Trackw	5 Sph	53	
Trackw	6 var.	54	
Thorne 2	C1	55	Thorne 2 (Thorne Moors), (Whitehouse, 1993, 1997a).
Thorne 2	C2	56	
Thorne 2	C3	57	
Thorne 2	C4	58	
Thorne 2	C5	59	
Thorne 2	B1	60	
Thorne 2	B2	61	
Thorne 2	B3	62	

Table 9.2; List of species included in CANOCO analysis, including abbreviated names which appear in plots (N.B. Species are not in taxonomic order. Their order is determined by the number of samples each species occurred in, sorted in numerical order).

Species	Abbreviated name
Bradycellus spp.	Bradyc
Ilybius aenescens Thom.	Ilaenesc
Ilybius spp.	Ilybius
Agabus/Ilybius sp.	Ag/Il
Colymbetes fuscus (L.)	Colfusc
Enochrus spp.	Enochrus
Agathidium sp.	Agath
Xantholinus linearis (Ol.)	Xanlin
Atrecus affinis (Payk.)	Atraffin
Othius myrmecophilous Kies.	Othiusmy
Erichsonius cinerescens (Grav.)	Erichscin
Mycetoporus sp.	Mycetop
Atomaria spp.	Atomaria
Phalacrus caricis Strm.	Phalcar
Cerylon histeroides (F.)	Ceryhist
Dryocoetinus villosus (F.)	Dryovill
Ceutorhynchus spp.	Ceutorhy
Trechus obtusus Er./ *4-striatus*	Tobtusus
Bradycellus harpalinus (Serv.)	Bradyhar
Hydroporus longulus Muls.	Hylong
Agabus affinis (Payk.)	Agaffin
Helophorus spp.	Heloph
Silpha atrata L.	Silphatr
Stenus kiesenwetteri Rosen.	Stkiesen.
Paederus spp.	Paederus
Gabrius spp.	Gabrius
Bryaxis curtisi (Leach)	Brycurt
Pselaphus heisei (Hbst.)	Pselheis
Denticollis linearis (L.)	Dentlin
Melasis buprestoides (L.)	Melasis
Chrysomela aenea L.	Chryaen
Altica britteni Sharp	Altbritt
Altica sp.	Altica
Phyllobius sp.	Phyllob
Dryophthorus corticalis (Payk.)	Dryocort
Hydroporus gyllenhali Schdte.	Hygyll
Hydraena testacea Curt.	Hydrtest
Stenichnus collaris (Mull.)	Stencoll
Lathrobium rufipenne Gyll.	Lathrufi.
Lathrobium longulum Grav.	Lathlong
Ochthephilum fracticorne (Payk.)	Ochfract
Dalopius marginatus (L.)	Dalomarg
Scolytus ratzeburgi Jans.	Scolratz
Tomicus piniperda (L.)	Tompini

Rhyncolus sculpturatus Walt.	Rhynscul
Lathridiidae indet.	Lathrid
Bembidion spp.	Bembid
Cercyon spp.	Cercyon
Lathrobium terminatum Grav.	Latherm
Rhamphus pulicarius (Hbst.)	Rhpulic
Pterostichus spp.	Pterost
Hydraena britteni Joy	Hydbrit
Ochthebius spp.	Ochtheb
Limnebius aluta Bed.	Limaluta
Coelostoma orbiculare (F.)	Coelorbi
Enochrus affinis (Thun.)	Enocaff
Olophrum fuscum (Grav.)	Olofusc
Corticaria spp.	Cortic
Rhyncolus elongatus Gyll.	Rhynelon
Dyschirius globosus (Hbst.)	Dyscglob
Philonthus/ Quedius spp.	Phil/ Qu
Grynobius planus (F.)	Gryplan
Scolytidae gen. et sp. indet.	Scoly
Quedius spp.	Quedius
Microcara testacea (L.)	Micrtest
Plateumaris spp.	Plateum
Rhynchaenus rusci (Hbst.)	Rhyrusci
Bradycellus ruficollis (Steph.)	Bradrufi
Pterostichus minor (Gyll.)	Ptminor
Hydroporus tristis (Payk.)	Hytrist
Hydroporus melanarius Strm.	Hymel
Acidota crenata (F.)	Acrenata
Lathrobium fulvipenne (Grav.)	Lathfulv
Rhynchaenus quercus (L.)	Rhyquerc
Agonum obscurum (Hbst.)	Agobscur
Hydroporus scalesianus Steph.	Hyscales
Lesteva heeri Fauv.	Lestheer
Apion spp.	Apion
Rhyncolus chloropus (L.)	Rhychl
Cercyon convexiusculus Steph	Cercconv
Megasternum obscurum (Marsh.)	Megaobsc
Lathrboum brunnipes (F.)	Lathbrun
Philonthus spp.	Philont
Bryaxis bulbifer (Reich.)	Bryabulb
Aphodius spp.	Aphodius
Rhynchaenus spp.	Rhynchae.
Ochthebius minimus (F.)	Ochtmin
Hydrobius fuscipes (L.)	Hydfusc
Plateumaris discolor (Panz.)/ *sericea* (L.)	disc/ser
Plateumaris sericea (L.)	PlatSer
Agabus bipustulatus (L.)	Agbip
Micrelus ericae (Gyll.)	Micreric
Bryaxis spp.	Bryaxis

Plateumaris discolor (Panz.)	Platdisc
Agabus spp.	Agabus
Agonum fuliginosum (Panz.)	Agonfuli
Anacaena globulus (Payk.)	Anacglob
Cyphon padi (L.)	Cyphpadi
Olophrum piceum (Gyll.)	Olopic
Pterostichus nigrita (Payk.) / *rhaeticus*	Ptnigrit
Lathrobium spp.	Lathrob
Pterostichus diligens (Strm.)	Ptdilig
Aleocharinae gen. et sp. indet.	Aleoch.
Stenus spp.	Stenus
Cyphon spp.	Cyphon
Hydroporus spp.	Hydrop