

3. LOSS ASSESSMENT

3.1 Introduction

The spot-checking approach adopted in the pilot study (Dargie 1992) was not employed due to major reservations on its accuracy (see section 2.4). The size of lowland wet grassland blocks varies enormously from the lower limit of 10 ha required of this project to the largest (SW134) of 23,542 ha in Somerset. Even more important, size variation has a frequency distribution which reduces as a logarithmic function of block size (Figure 3.1). A random selection of blocks for spot-checking would therefore be biased towards smaller cases and stratification to include representative numbers of larger blocks would then find it impossible to complete in the time available since access permission would be required from many owners and a mapping of each block would be needed for comparison with the block details derived from Phase 1 survey data.

An alternative selective approach was adopted using three counties (Staffordshire, Humberside, Cumbria) which had recent air photo cover (1989 or later) and Phase 1 results from surveys at least ten years earlier. Results were also compared with habitat change statistics in other studies.

3.2 Air Photo Studies

3.2.1 Staffordshire

Air photos (1:10,000 colour, various dates 1991 and 1992) for all of Staffordshire were interpreted at English Nature offices, Attingham Park, Shropshire. All areas with lowland wet grassland terrain were examined for grassland and, if present, boundaries were marked on tracing paper overlying 1:25,000 maps with field boundary and ditch information. Grid intersections were also marked. These maps were then reduced to 1:50,000 and laid over the grassland maps derived from the 1979 Staffordshire Phase 1-type survey. The latter did not include semi-improved or improved grassland and therefore large tracts of these grassland types were identified. Change statistics were measured using Romer dot grids and results are summarized in Table 3.1.

The blocks of unimproved grassland identified from 1979 data (total area 739 ha) showed a loss in area of 137 ha (18.5% of 1979 extent), an annual rate of loss 1979-92 of 1.4%. The major losses to 1979 blocks were caused by conversion to arable land and sand/gravel extraction, in approximately equal proportions.

The ratio of 1992 total grassland (2774 ha) to 1992 unimproved grassland (602 ha) is 4.6:1, a multiplier which can be used to obtain a total grassland area 'guesstimate' for other counties with no data on unimproved or semi-improved grassland. Given the extent of new grassland identified in Staffordshire, the information from air photos was added to outline maps and new blocks were listed in Annex 1, together with area changes to existing blocks.

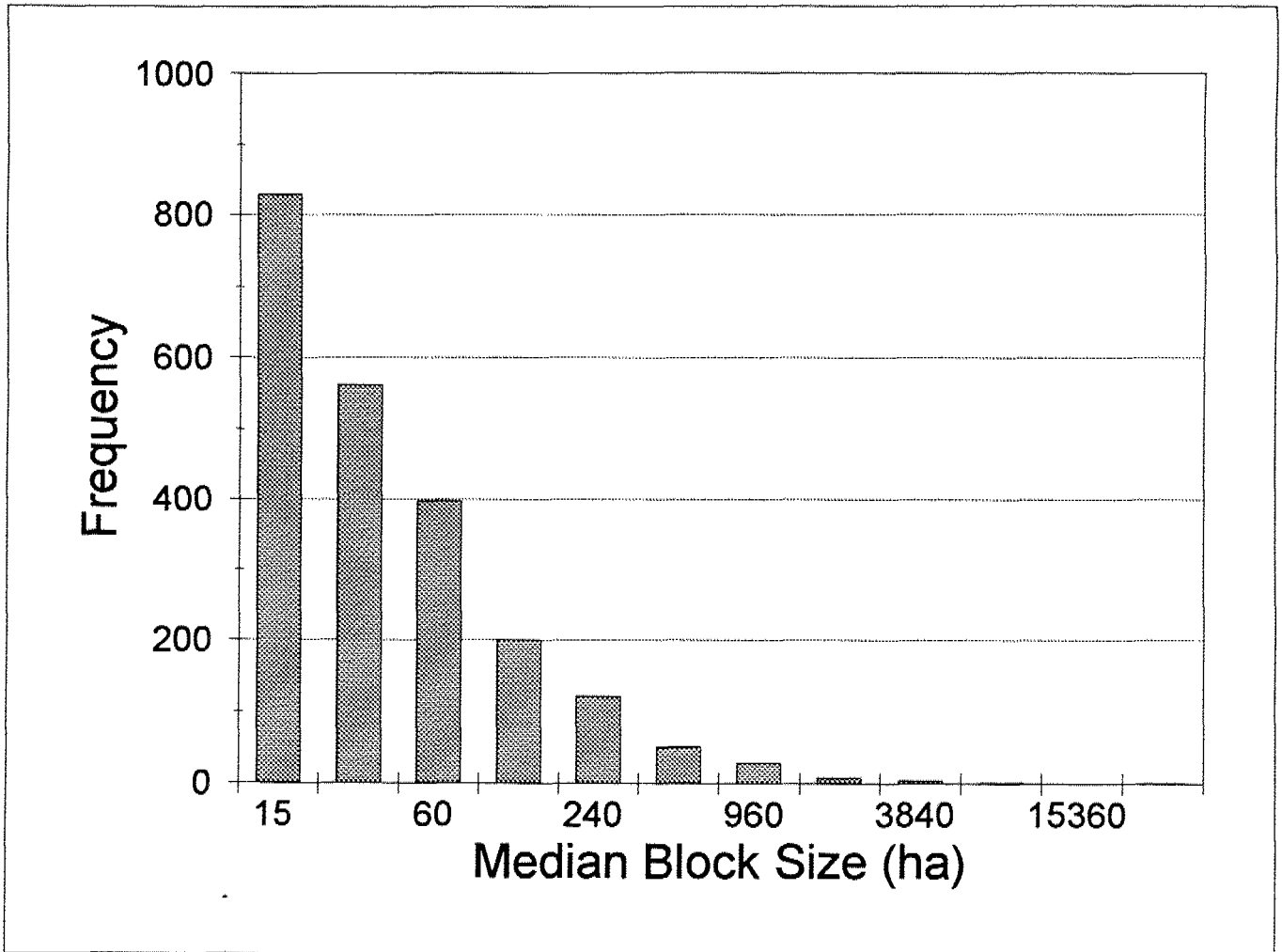


Figure 3.1 Frequency distribution of block size for lowland wet grassland in all regions .
Data source: Annex 1 - revised data for Staffordshire excluded.

Table 3.1 Changes in lowland wet grassland blocks in Staffordshire between 1979 data (unimproved grassland only) and grassland mapped from 1991/92 air photos (all grassland types).

Blocks entirely lost since 1979	Blocks partly lost or assimilated into other blocks	Blocks expanding in size since 1979	New blocks discovered
WM79 (40ha) WM94 (19ha) Loss = 59 ha	WM52 (-10ha) WM80 (-68ha) Loss = 78 ha	WM27 (+96ha) WM28 (+41ha) WM53 (+296ha) WM54 (+286 ha) WM55 (+236 ha) WM80 (+44 ha) WM95 (+140 ha) WM96 (+138 ha) Expansion = 1277 ha	WM189 - WM207 (see outline maps and Annex 1 for details) New area = 895 ha

3.2.2 Humberside

Air photos (1:10,000 colour, May and August 1989) for a sample of Humberside 10 km squares and the lower Derwent valley were interpreted at Humberside County Council offices, Beverley. Nine 10km squares on OS 1:50,000 sheet 107 (TA03/04/05/12/13/14/22/23/32) were selected to give a large number of grassland blocks (55, out of a Humberside total of 131) for measuring loss. Grassland identified in these squares was marked on tracing paper at 1:25,000 scale and later reduced for comparison with outline maps, in the same manner as for Staffordshire (see section 3.2.1).

Of 55 1978 blocks, 3 showed no change, 26 had been entirely lost, 22 showed a net decrease in area and 4 a net increase in size. A total of 17 new grassland blocks was found in the study area. The total 1978 area was 2957 ha, with 1978-89 losses of 2166 ha and 735 ha as gains. Net loss was therefore 1431 ha, 48.4% of the 1978 area (an annual rate of 4.4% loss from the 1978 baseline). It was clear from this study that much scattered lowland wet grassland is part of a temporary ley - arable rotation in Humberside, though the long-term trend is towards a substantial reduction in grassland.

An additional study was also made of the western boundary of north Humberside along the course of the lower River Derwent. Mapping of this grassland from Humberside and North Yorkshire results was considered poor (Tim Dixon, English Nature York, personal communication) and this view was confirmed when a map of grassland on air photos was laid over the 1:50,000 outline map. New grassland in seven sectors totalled 741 ha. Reedswamp (*Phragmites australis*) at Wheldrake Ings had been mapped incorrectly as grassland, requiring 71 ha to be excluded from the map. Fifteen blocks were identified as lost since the Humberside and North Yorkshire surveys, totalling 261 ha. Grassland in this sector therefore requires increasing from its measured 1040 ha to a new total of 1449 ha. A revised map of the lower Derwent grasslands is given in section 4.3.

3.2.3 Cumbria

Air photos (1:25,000, various dates 1992) for areas of Cumbria outside the Lake District National Park were interpreted at English Nature offices, Blackwell, Cumbria. Cover was not available for most blocks lying within the national park but most outside the boundary were examined. Procedures followed those for Staffordshire and Humberside except that 1:10,000 maps were often needed for plotting results since 1:25,000 maps were not in all cases available.

Results were treated as two areas. North Cumbria blocks on OS 1:50,000 sheets 85 and 86 (29 blocks) had only 7 blocks (NW8,9,17,18,24,25,27) showing change (380 ha loss, 161 ha gain, net loss 219 ha). Total block area in 1978/80 was 8659 ha, giving a 2.5% loss over the study period (0.2% loss per year). South Cumbria blocks on OS sheets 96 and 97 (29 blocks, lack of cover for the national park excluded NW59-64,76-79,81,82) had only 4 blocks (NW67,78,87,99) showing change, a 141 ha loss of grassland. Total block area (all 29 blocks) in 1978/80 was 5429 ha, giving a 2.6% loss over the study period (0.2% loss per year). Results for North and South Cumbria are thus very similar. Most loss was to arable land, suggesting a small proportion of Cumbrian lowland wet grassland is part of an arable - temporary ley rotation. Small losses were also due to caravan site expansion and scrub development on grassland developed on peat.

3.3 Review of other habitat loss studies

3.3.1 Coastal grazing marsh

Several studies have calculated rates of loss and these are reviewed by Thornton & Kite (1990). In five areas of SE England these are shown to vary from 0.7% to 2.0% per year over a study period of 1930/39 to 1980/82 (Table 3.2).

Table 3.2 Annual rates of coastal grazing marsh loss in SE England

	Annual rate of loss (1930/39 - 1980/82)	Source
Broadland	0.7%	Friends of the Earth 1985
East Essex	2.0%	Williams & Hall 1987
North Kent	1.0%	Williams <i>et al.</i> 1983
Romney Marsh	1.3%	Sheail & Mountford 1984
Thames Estuary	1.2%	Thornton & Kite 1990

3.3.2 Other wet grassland

There are very few additional studies of other types of lowland wet grassland, probably reflecting poor baseline information for use in calculating loss. Shropshire Wildlife Trust (1992) resurveyed wet grassland sites recorded in 1979 Phase1-type survey. Losses by 1992 were 29% of 1979 extent, an annual rate of 2.1% loss. Quality deterioration was also observed in other sites still under grassland cover. There are other studies featuring change statistics for unimproved neutral grassland but these naturally cover a wider range of habitats than lowland wet grasslands and rates of loss are probably less relevant. Even so, a decline of 60% in unimproved neutral grassland in Dorset (Porley & Ulf-Hansen 1991) between 1983 and 1988 is notable for a 12% annual rate of loss, some of which probably includes lowland wet grassland. Culm grassland in Devon (English Nature 1992) declined by 48% between 1984 and 1989/90, an 8% annual rate of loss, though little of this is likely to have been lowland wet grassland. This range of rates of loss falls within those observed for all lowland grasslands within England (Jefferson & Robertson in prep.).

3.4 Overview of loss rates

The number of published studies citing loss rates is small and there are only three additional county-scale results presented here using air photo analysis. The range in rate of loss is considerable, from 0.2% per year in Cumbria to 4.6% in Humberside. Most studies range between 1% and 2%. There is probably an underlying geographical trend in rates, with traditional western grazing areas having very low rates of loss (e.g. Cumbria) and eastern arable areas with high rates of conversion to tillage (e.g. Humberside). Intermediate rates might reflect the impact of further losses due to housing and industrial development, sand/gravel extraction in river valleys, landfill etc. superimposed on a moderate trend of loss to arable land.

Loss rates are important because they point to a significant error in most data sources as they age. In this study loss rates are used to adjust survey totals for likely reductions in area since survey completion. Without a larger number of loss rate studies such an approach can only be considered a form of 'guesstimate' to obtain an approximation of county and national areas in 1992. Counties and metropolitan areas without loss data are adjusted by subjectively applying a 0.5%, 1.5% or 4% rate of loss depending on their location and evidence of development pressures (see section 4.1). One possible important flaw in this approach is that it overlooks circumstances leading to a reduction or elimination of loss (e.g. creation of Environmentally Sensitive Areas leading to re-establishment of grassland, as in Suffolk and Norfolk; Countryside Stewardship Scheme) but in general such cases are rare for the bulk of lowland wet grassland.

4. REGIONAL RESULTS FOR LOWLAND WET GRASSLAND

4.1 Introduction

Measured areas of lowland wet grassland are listed in full by block in Annex 1. These data are aggregated here (Table 4.1) by county/metropolitan area and by soil type (marine alluvium, river alluvium, peat, other soils, mixed soils). Adjustments to area data are also made to reflect underestimation of grassland area in measured results and losses of grassland since the date of data sources used in abstraction, bringing all areas to a common 1992 baseline for this study. It is stressed that most of these adjustments are based on 'guesstimates' of rates of change and degree of area underestimation (see sections 3.2, 3.3 and 3.4) - adjusted areas are therefore likely to be only approximations of extent in 1992. Adjusted results are given in Table 4.2. Information is presented on a regional basis, covering data sources, distribution of lowland wet grassland, soil relationships, data evaluation and data adjustments. Full details of most Phase 1-type sources are not given here since these are covered in depth by Wyatt (1991a-i). Important points on grassland information quality are made, however, together with comment on surveys completed since the review by Wyatt in 1991.

4.2 North-West Region

4.2.1 Data sources

The following sources were used for data abstraction:

Cumbria 1983-87 Phase 1 survey, plus 1992 1:25,000 colour air photos of selected areas

Lancashire 1988-1991 Phase 1 survey

Merseyside Phase 1 surveys of Wirral MD (1987-88), Liverpool MD (1987-88), Sefton MD (1989), St Helens and Knowsley MDs (1981)

Greater Manchester Phase 1 surveys of Wigan MD (1987-87), Bolton MD (1989), Salford MD (1989), Oldham MD (1990-91), Manchester MD (1991-92), Trafford MD (1991-92), Bury MD (1990-91), Stockport MD (1990-91), Rochdale MD (1988). (Only Tameside MD has not been surveyed and no consultation was possible. There is probably very little lowland wet grassland >10 ha in size in this area.)

West Yorkshire Phase 1 survey 1976-79

South Yorkshire Phase 1 survey 1980-81

4.2.2 Distribution and soil relationships

There is a widespread distribution of lowland wet grassland in the region, but with major concentrations restricted to north Cumbria, south Cumbria, west Lancashire and South Yorkshire (Figure 4.1). The west coast concentrations are related mainly to Flandrian marine alluvium, together with the margins of peat bodies established on top of the marine deposits. These grade inland into river alluvium for some large blocks, giving extensive areas on mixed soils. The South Yorkshire grassland is mainly developed on glaciolacustrine material (recorded as Other soil) which also extends in quantity into North Yorkshire and Humberside. River alluvium supports large extents in the Ribble valley but elsewhere grassland is restricted

Table 4.1 Measured areas of lowland wet grassland in counties and metropolitan areas of England. Areas in hectares. * - Staffordshire Phase 1 data in brackets, other data from air photo analysis. ** - no data for Lincolnshire.

	MARINE	RIVER	PEAT	OTHER	MIXED	TOTALS	REGION TOTAL
KENT	10622	589	-	-	-	11211	
SURREY	-	50	-	-	-	50	
GREATER LONDON	690	-	-	-	-	690	
WEST SUSSEX	1840	1363	-	565	511	4279	
EAST SUSSEX	3874	710	-	-	3136	7720	
SOUTH-EAST REGION TOTALS	17026	2712	0	565	3647		23950
CORNWALL	-	374	-	107	-	481	
DEVON	905	3800	-	386	818	5909	
SOMERSET	1852	2360	-	189	36874	41275	
AVON	2957	228	-	100	7837	11122	
DORSET	94	3121	-	368	1129	4712	
SOUTH-WEST REGION TOTALS	5808	9883	0	1150	46658		63499
CUMBRIA	9504	3298	688	1861	5349	20700	
LANCASHIRE	2861	2321	458	641	4739	11020	
MERSEYSIDE	-	8	-	492	-	500	
GREATER MANCHESTER	-	324	-	-	-	324	
WEST YORKSHIRE	-	204	-	-	-	204	
SOUTH YORKSHIRE	-	2120	147	1505	10	3782	
NORTH-WEST REGION TOTALS	12365	8275	1293	4499	10098		36530
HAMPSHIRE	811	2454	14	183	2183	5645	
WILTSHIRE	-	2157	-	368	-	2525	
BERKSHIRE	-	1068	-	10	-	1078	
OXFORDSHIRE	-	4522	-	407	-	4929	
BUCKINGHAMSHIRE	-	631	-	66	-	697	
SOUTH REGION TOTALS	811	10832	14	1034	2183		14874
HUMBERSIDE	2798	307	-	1206	524	4835	
NORTH YORKSHIRE	-	2895	926	1868	406	6095	
CLEVELAND	550	42	-	46	-	638	
DURHAM	-	-	-	-	-	0	
TYNE AND WEAR	-	-	-	170	-	170	
NORTHUMBERLAND	-	197	-	38	-	235	
NORTH-EAST REGION TOTALS	3348	3441	926	3328	930		11973
ESSEX	4184	558	-	681	1465	6888	
SUFFOLK	1122	216	32	344	5244	6958	
NORFOLK	6032	-	540	31	6151	12754	
HERTFORDSHIRE	-	131	-	249	166	546	
BEDFORDSHIRE	-	649	-	-	443	1092	
NORTHAMPTONSHIRE	-	1694	-	119	1937	3750	
LEICESTERSHIRE	-	475	-	13	1457	1945	
NOTTINGHAMSHIRE	-	1660	87	464	662	2873	
CAMBRIDGESHIRE	197	590	250	1366	5086	7489	
LINCOLNSHIRE**							
EAST REGION TOTALS	11535	5973	909	3267	22611		44295
CHESHIRE	469	814	37	180	780	2280	
DERBYSHIRE/PDNP	-	2307	-	116	719	3142	
STAFFORDSHIRE*	-	2557 (522)	-	40 (40)	177 (177)	2774 (739)	
GLOUCESTERSHIRE	408	2809	-	495	6538	10250	
HEREFORD AND WORCESTER	-	1079	-	66	37	1182	
SHROPSHIRE	-	640	-	14	-	654	
WARWICKSHIRE	-	482	-	454	375	1311	
WEST MIDLANDS	-	140	-	62	-	202	
WEST MIDLAND REGION TOTALS	877	10828	37	1427	8626		21795
NATIONAL TOTALS	51770	51944	3179	15270	94753		216916

Table 4.2 Lowland wet grassland area in counties and metropolitan areas of England adjusted to 1992 'guesstimate' of extent. Areas in hectares.

	UNADJUSTED TOTALS	ESTIMATED PROPORTION LOST BY 1992	ESTIMATED AREA LOST BY 1992	ADDITIONAL AREA DUE TO UNDER-ESTIMATE	ADJUSTED 1992 AREA GUESS-TIMATE
KENT	11211	1.5%	176	500	11535
SURREY	50	1.0%	1	-	49
GREATER LONDON	690	3.5%	24	-	666
WEST SUSSEX	4279	5.5%	235	-	4044
EAST SUSSEX	7720	4.5%	347	-	7373
SOUTH-EAST REGION TOTAL	23950		783	500	23667
CORNWALL	481	4%	19	-	462
DEVON	5909	4%	236	-	5673
SOMERSET	41275	15%	6191	-	35084
AVON	11122	6%	667	-	10455
DORSET	4712	13.5%	636	-	4076
SOUTH-WEST REGION TOTAL	63499		7749	-	55750
CUMBRIA	20700	1.4%	290	-	20410
LANCASHIRE	11020	1.0%	110	-	10910
MERSEYSIDE	500	2.0%	10	-	490
GREATER MANCHESTER	324	1.0%	3	-	321
WEST YORKSHIRE	204	7.0%	14	-	190
SOUTH YORKSHIRE	3782	44.0%	1664	-	2118
NORTH-WEST REGION TOTAL	36530		2091	-	34439
HAMPSHIRE	5645	-	-	-	5645
WILTSHIRE	2525	-	-	1836	4361
BERKSHIRE	1078	9%	446	3881	4513
OXFORDSHIRE	4929	13.5%	665	-	4264
BUCKINGHAMSHIRE	697	9%	289	2509	2917
SOUTH REGION TOTAL	14874		1400	8226	21700
HUMBERSIDE	4835	52%	2514	204	2525
NORTH YORKSHIRE	6095	6%	366	905	6634
CLEVELAND	638	7.5%	48	-	590
DURHAM	0	-	-	-	0
TYNE AND WEAR	170	-	-	-	170
NORTHUMBERLAND	235	-	-	60	295
NORTH-EAST REGION TOTAL	11973		2928	1169	10214
ESSEX	6888	3%	207	-	6681
SUFFOLK	6958	12%	835	-	6123
NORFOLK	12754	4.5%	574	500	12680
HERTFORDSHIRE	546	10.5%	141	800	1205
BEDFORDSHIRE	1092	7.5%	82	-	1010
NORTHAMPTONSHIRE	3750	19.5%	731	-	3019
LEICESTERSHIRE	1945	1.5%	29	-	1926
NOTTINGHAMSHIRE	2873	6%	172	-	2701
CAMBRIDGESHIRE	7489	16%	1198	-	6291
LINCOLNSHIRE	-	-	-	7500	7500
EAST REGION TOTAL	44295		3979	8800	49136
CHESHIRE	2280	12%	274	-	2006
DERBYSHIRE/PDNP	3142	13.5%	424	-	2718
STAFFORDSHIRE	2774	0%	-	-	2774
GLOUCESTERSHIRE	10250	22.5%	2306	-	7944
HEREFORD AND WORCESTER	1182	22.5%	1223	4255	4214
SHROPSHIRE	654	19.5%	587	2354	2421
WARWICKSHIRE	1311	15%	393	1311	2229
WEST MIDLANDS	202	2%	4	-	198
WEST MIDLAND REGION TOTAL	21795		5211	7920	24504
NATIONAL TOTAL	216916				219410

on this material, often due to urban development in Merseyside, Greater Manchester and West Yorkshire. Many fragmented patches <10 ha in size were found in these areas but were not mapped. Some grassland in Cumbria rises to high altitude (to 190 m in Martindale) and large areas are found on flat terrain around the margins of some lakes (especially between Derwent Water and Bassenthwaite. The inter-county soil types are compared in Figure 4.2. Cumbria contains more grassland than all other parts of North-West Region, predominantly on marine alluvium. Lancashire also has a large extent, followed by moderate areas in South Yorkshire. Steeper terrain and urban/industrial development in Merseyside, Greater Manchester and West Yorkshire greatly restrict such grassland and rather small totals are found.

4.2.3 Data evaluation and adjustment

All of North-West Region apart from Tameside MD (Greater Manchester) has been mapped by Phase 1 surveys. The quality of these is in general good and the only important data adjustment is that for losses which have occurred since individual surveys were completed. The following subjective adjustments were made to results, apart from Cumbria where the loss rate obtained from air photo analysis is applied (see section 3.2.3):

	Median Survey Date	Annual Loss Rate	Estimated Total Loss
Cumbria	1985	0.2%	1.4%
Lancashire	1990	0.5%	1.0%
Merseyside	1988	0.5%	2.0%
Greater Manchester	1990	0.5%	1.0%
West Yorkshire	1978	0.5%	7.0%
South Yorkshire	1981	4.0%	44.0%

It is assumed that grassland extent in South Yorkshire has declined at a steep rate similar to that of Humberside, accounting for the very large overall estimated proportion over an eleven year timespan.

4.3 North-East Region

4.3.1 Data sources

The following sources were used for data abstraction:

Northumberland and Tyne & Wear 1992 1:10,000 air photos

Durham - no consultation, map evidence suggesting no lowland wet grassland

Cleveland 1987 Phase 1 survey

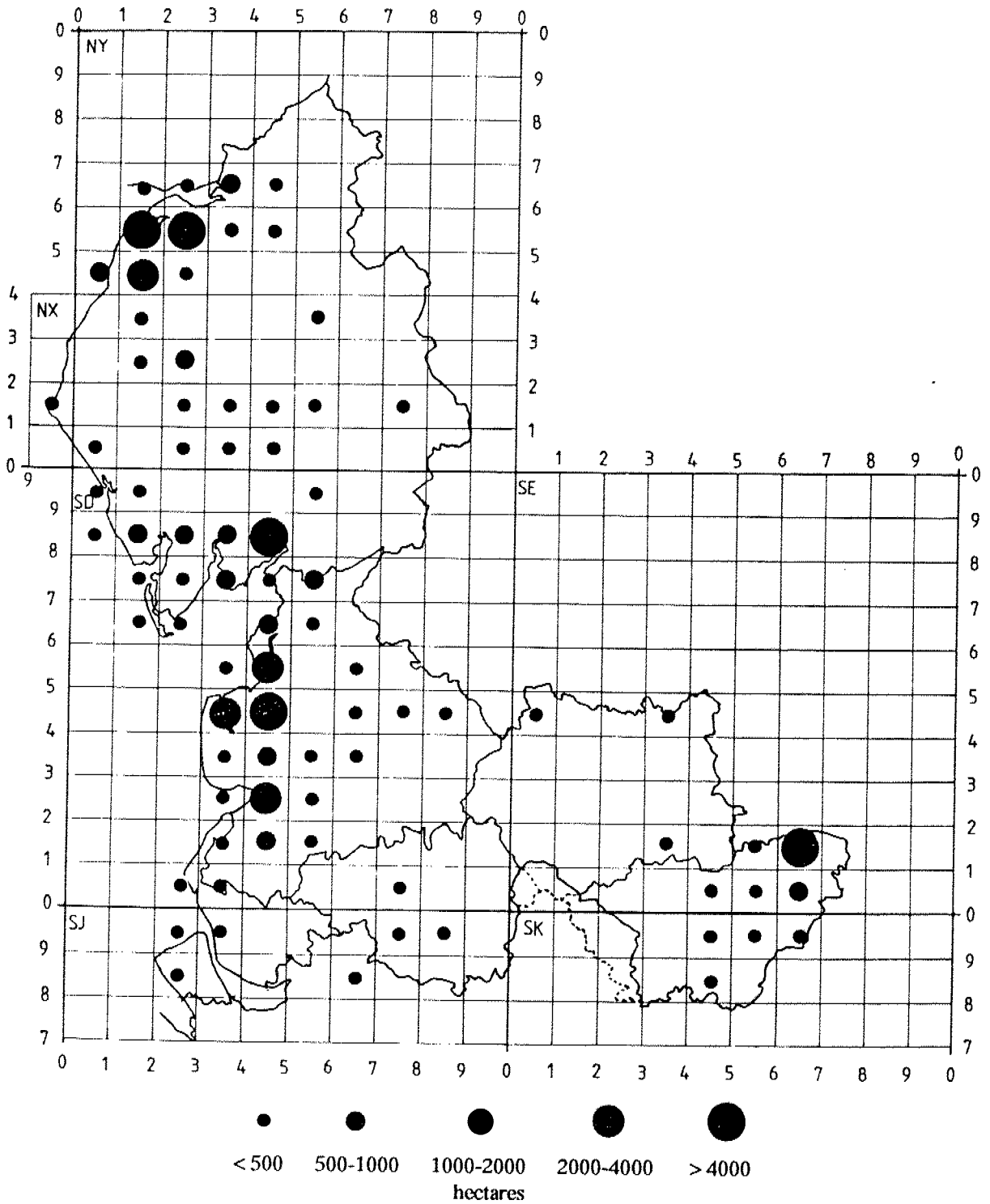
North Yorkshire Phase 1 surveys of Ryedale District (1988-1990), Scarborough

District (1986-87), Hambleton District (1987), Selby District (1986-88), part

Richmondshire District (1989 - present), part Harrogate District

(1991 - present) - the latter two districts have on-going surveys and western sectors have not been completed. Lowland wet grassland on upper parts of the Ure, Swale and Wharfe have thus not been mapped. York Green Spaces study used to locate grassland within the city boundaries.

Humberside 1978/79 Land Use Survey and N. Humberside Neutral Grassland Survey (the 1978/79 survey includes air photos of even earlier age making it impossible to age the survey date of individual blocks - the survey is regarded as poor in quality).



Grid lines are spaced at 10 km intervals

Figure 4.1 Distribution of lowland wet grassland in 10 km squares of North-West Region

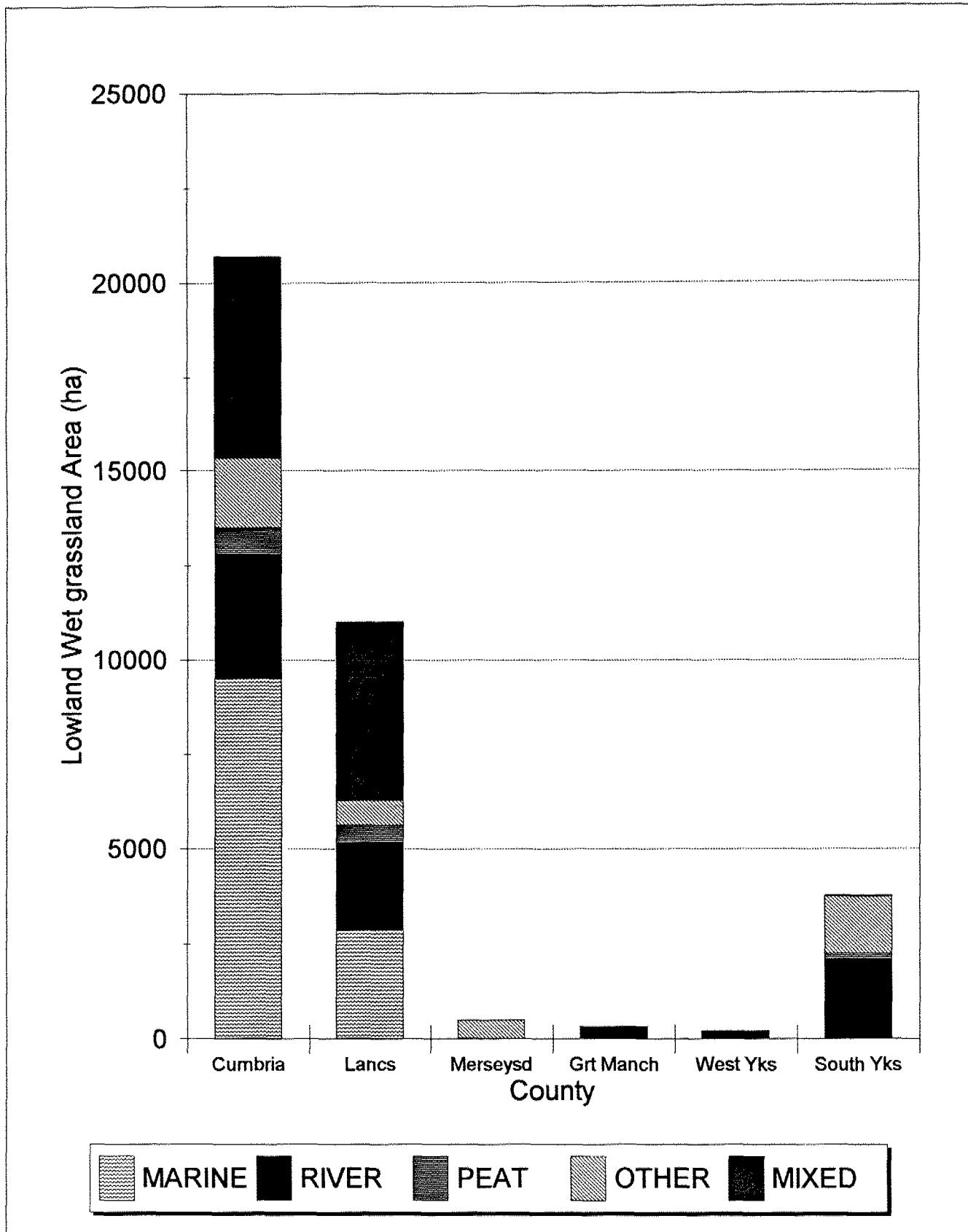


Figure 4.2 Soil parent material of lowland wet grassland in counties and metropolitan areas of North-West Region. Source: Table 4.1 and Annex 1.

4.3.2 Distribution and soil relationships

Lowland wet grassland is rare in northern sectors of North-East Region (Figure 4.3). It is restricted to small coastal locations and one poorly-drained sector of Tyne & Wear on higher ground. Patches are present in the Tees Estuary in Cleveland on marine alluvium. The major concentrations are in the Vale of Pickering, Vale of York, Holderness, though no area has very large extents. Map evidence suggested there was no suitable grassland habitat in Durham and sources for this area were not consulted. Counties are compared in terms of soil parent material in Figure 4.4. The dominance of North Yorkshire and Humberside is very clear. River, peat (notably in the Vale of Pickering) and glaciolacustrine/glaciofluvial materials (recorded as other soil) are all important parent materials in North Yorkshire. Marine sediments are dominant in Humberside derived from Humber Estuary sediments, together with glaciolacustrine/glaciofluvial materials. Air photo studies (section 3.2.2) suggest that half of the mapped Humberside grassland has now been lost, notably from large blocks in the upper sectors of the Hull valley and eastern Holderness. Data sources for the River Derwent produced an inadequate map and 1989 air photos were used to update this very important area of lowland wet grassland (Figure 4.5).

4.3.3 Data evaluation and adjustment

Air photo cover was not available for a small proportion of potential lowland wet grassland in Northumberland and mapped extent probably underestimates the county total by 20%. Cleveland data are probably good quality and only need adjustment for loss since survey. North Yorkshire has an unfinished Phase 1 survey in progress and western areas are not yet mapped - a possible 700 ha ('guesstimate') of lowland wet grassland might be found in the Ure, Swale and Wharfe valleys. Poor mapping of the lower River Derwent requires additional grassland recorded from 1989 air photos to be divided between North Yorkshire and Humberside totals (see 3.2.2). Other North Yorkshire data need a small adjustment for recent losses but this factor is much more important in Humberside where data sources are older and rates of loss are probably large. The following subjective adjustments are therefore applied to mapped results:

	Median Survey Date	Annual Loss Rate	Estimated Total Loss	Underestimated Area (ha)
Northumberland	1992	-	-	60
Tyne & Wear	1992	-	-	-
Cleveland	1987	1.5%	7.5%	-
North Yorkshire	1988	1.5%	6%	700 + 205 (Derwent)
Humberside	1979	4.0%	52%	204 (Derwent)

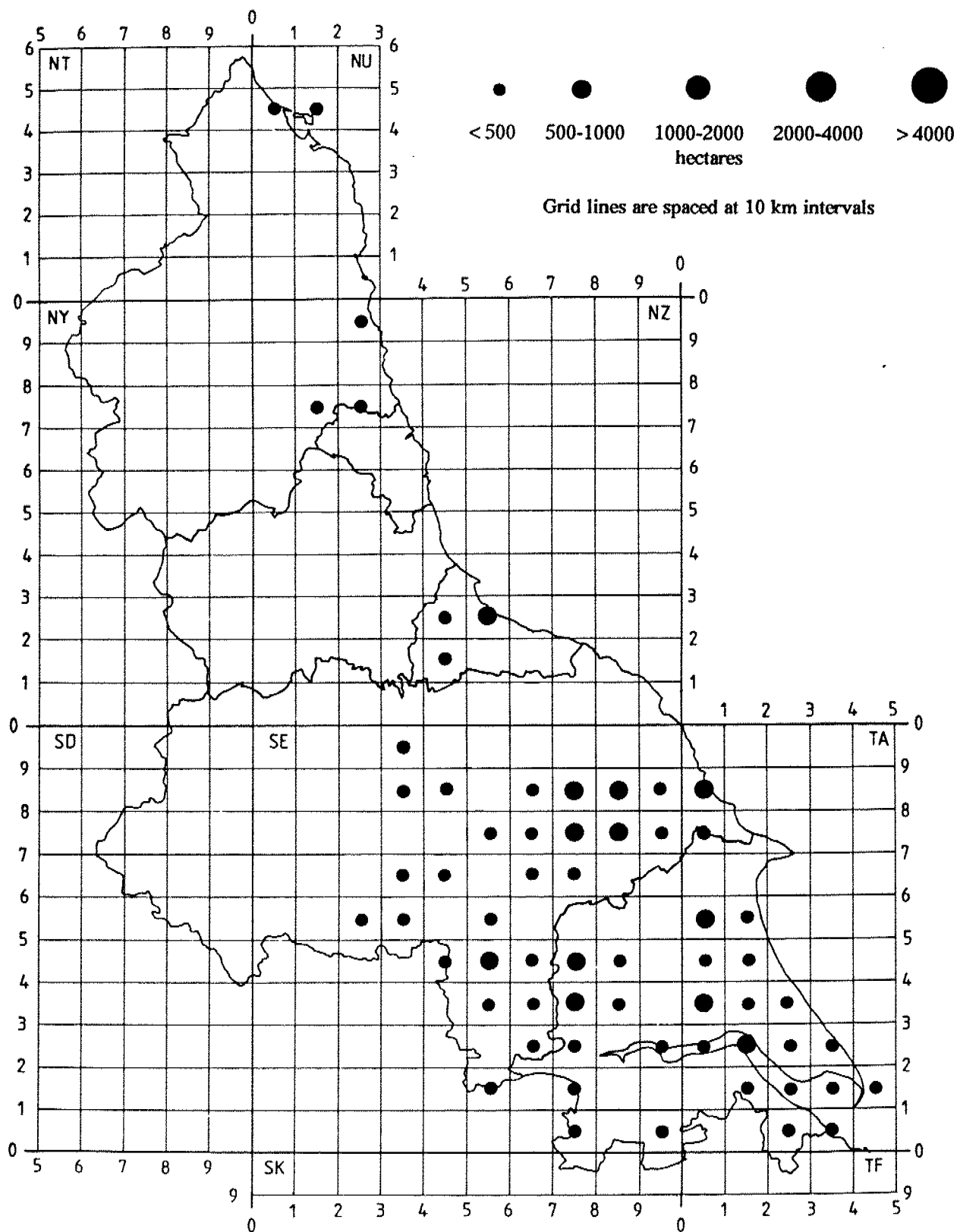


Figure 4.3 Distribution of lowland wet grassland in 10 km squares of North-East Region

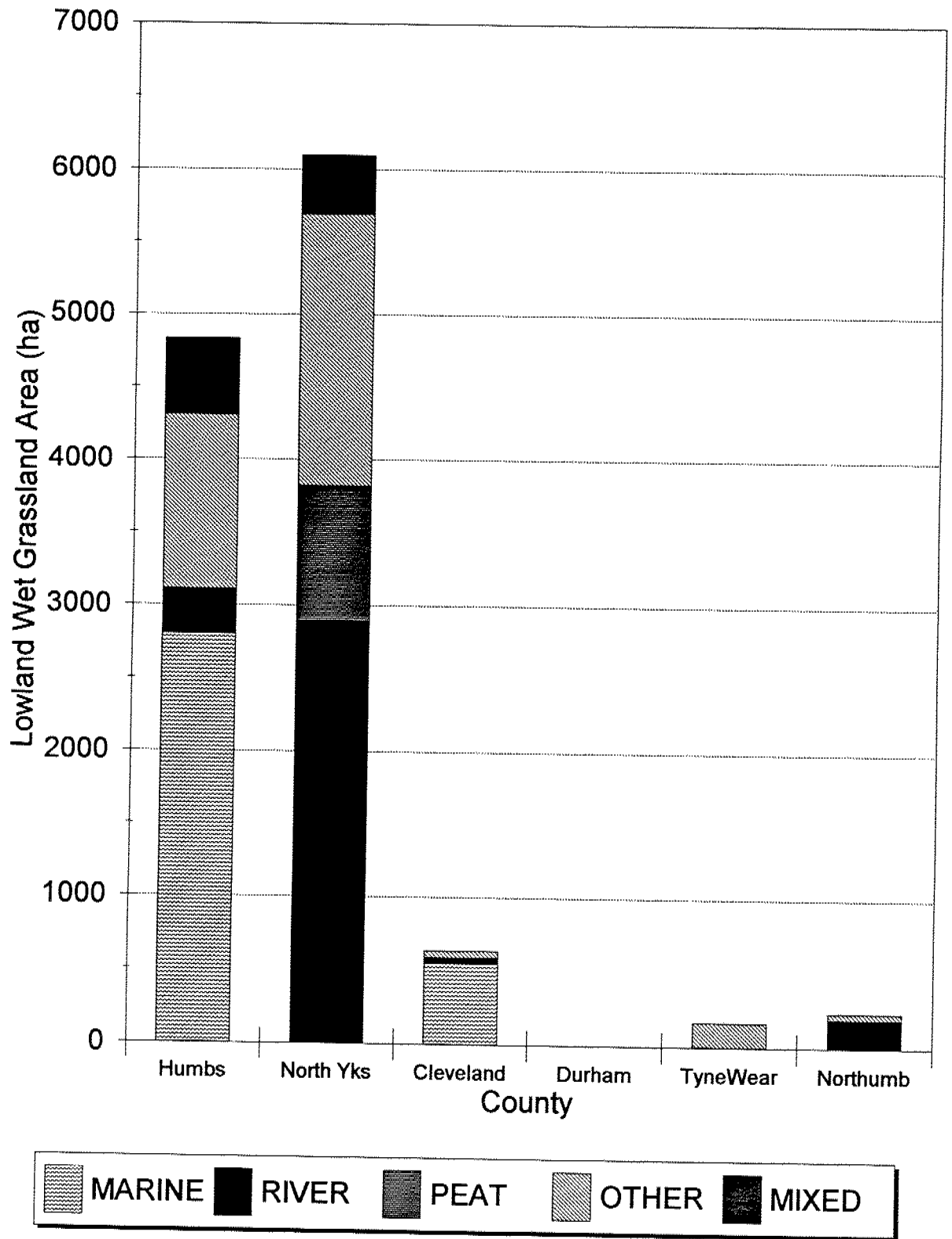


Figure 4.4 Soil parent material of lowland wet grassland in counties of North-East Region. Source: Table 4.1 and Annex 1.

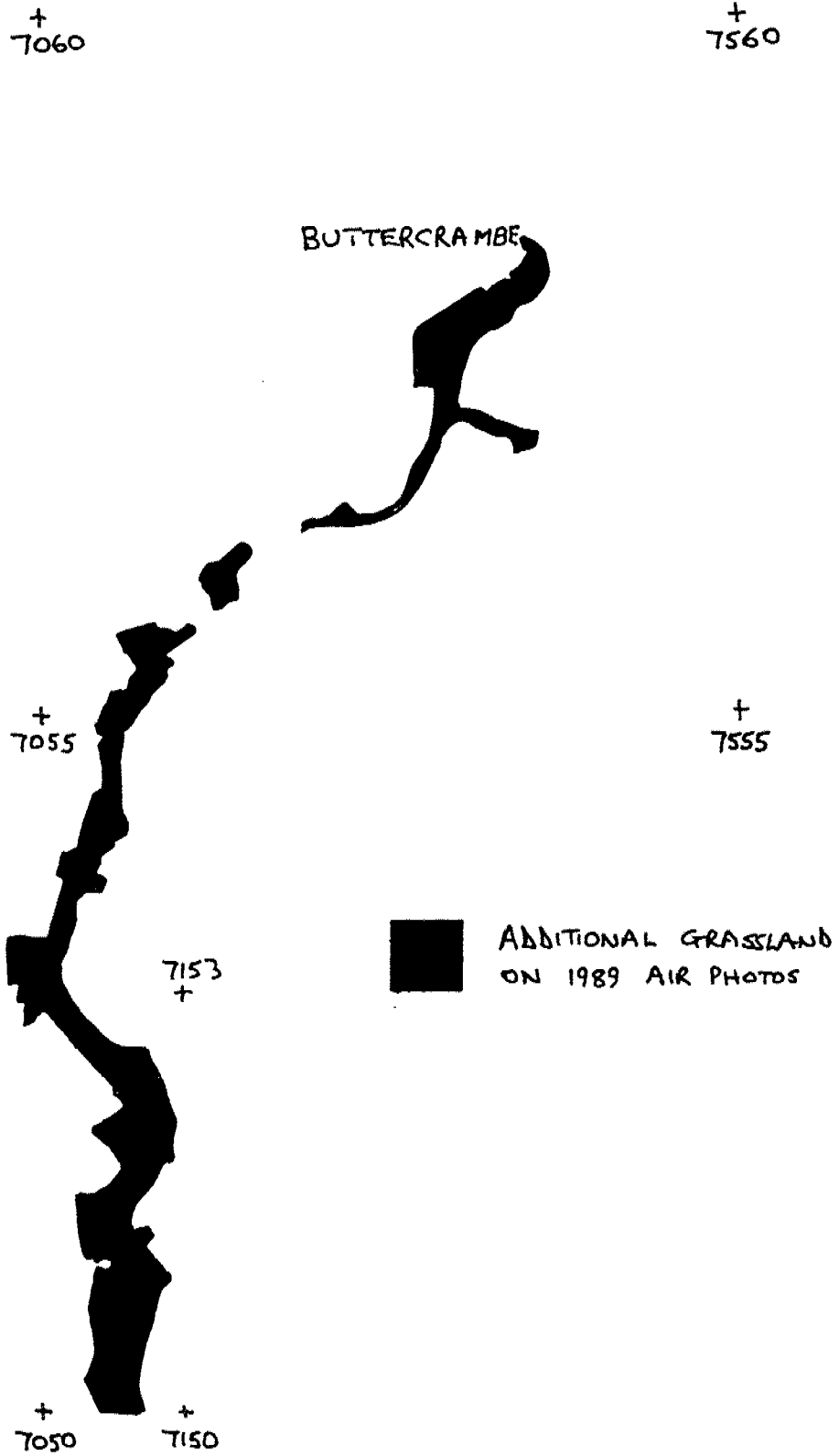


Figure 4.5 Distribution of lowland wet grassland on the lower River Derwent (North Yorkshire and Humberside) in 1989 (scale 1:50,000). Source: 1989 1:10,000 colour air photos of Humberside County Council.

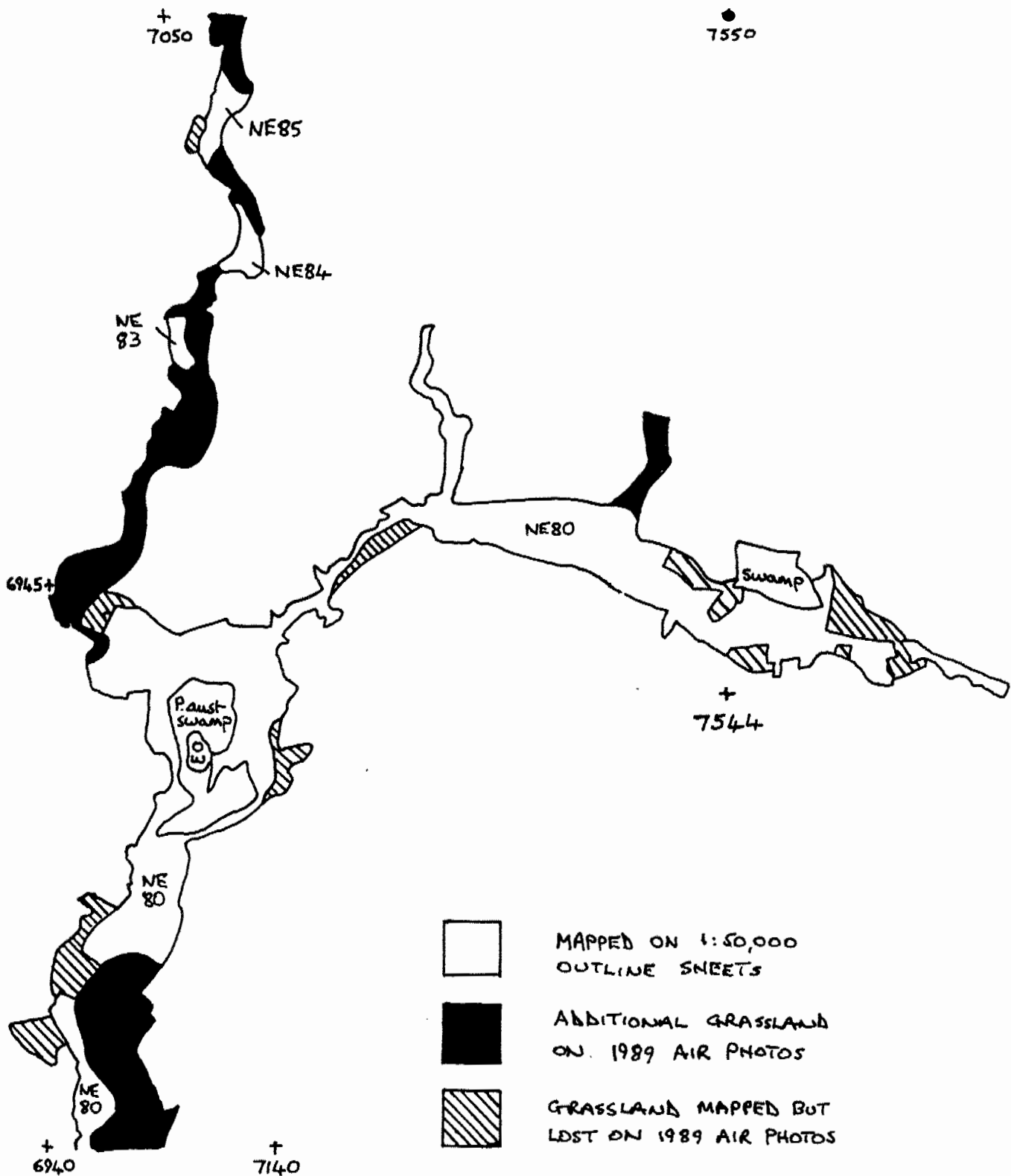


Figure 4.5 Distribution of lowland wet grassland on the lower River Derwent (North Yorkshire and Humberside) in 1989 (scale 1:50,000). Source: 1989 1:10,000 colour air photos of Humberside County Council.

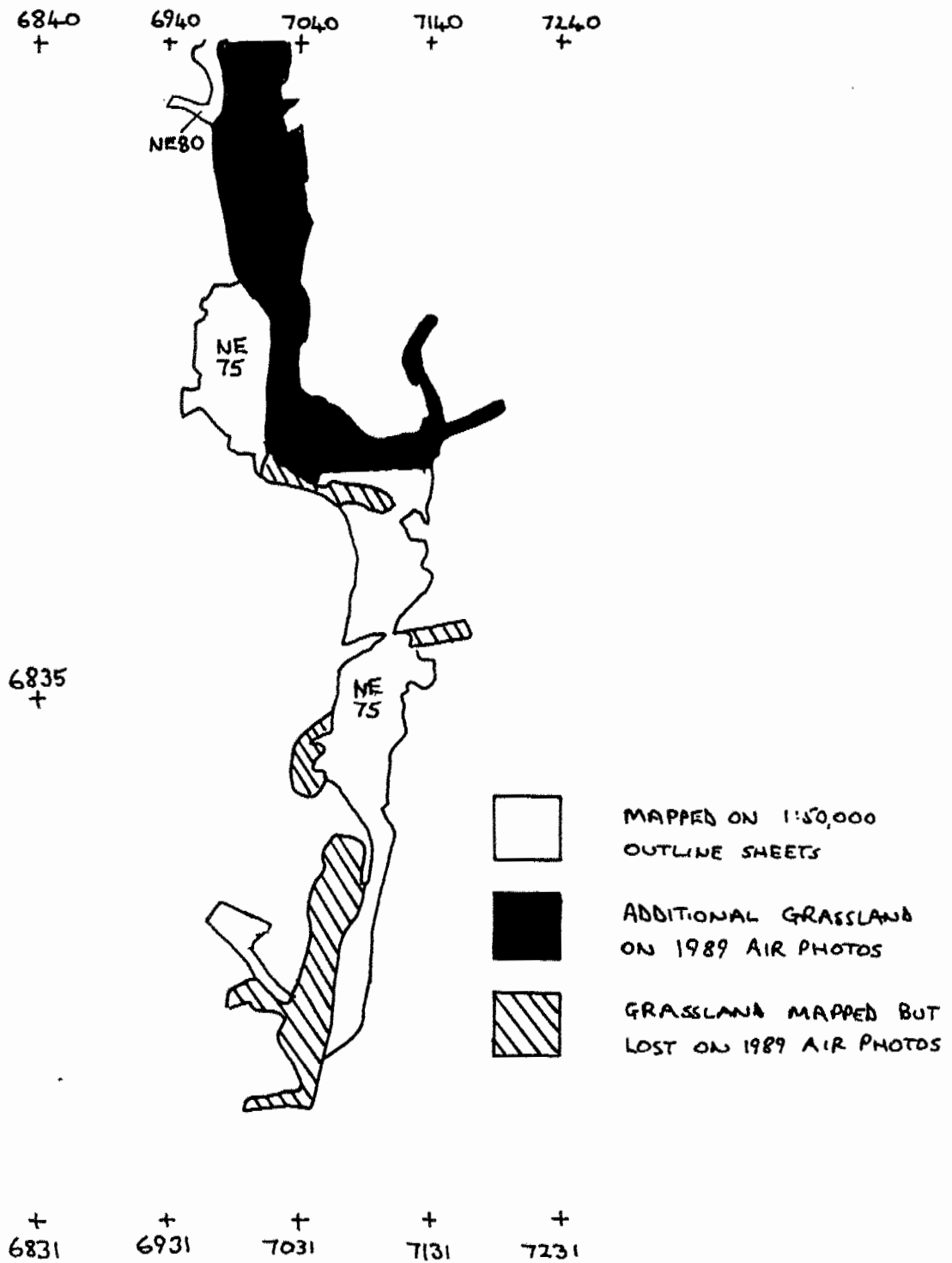


Figure 4.5 Distribution of lowland wet grassland on the lower River Derwent (North Yorkshire and Humberside) in 1989 (scale 1:50,000). Source: 1989 1:10,000 colour air photos of Humberside County Council.