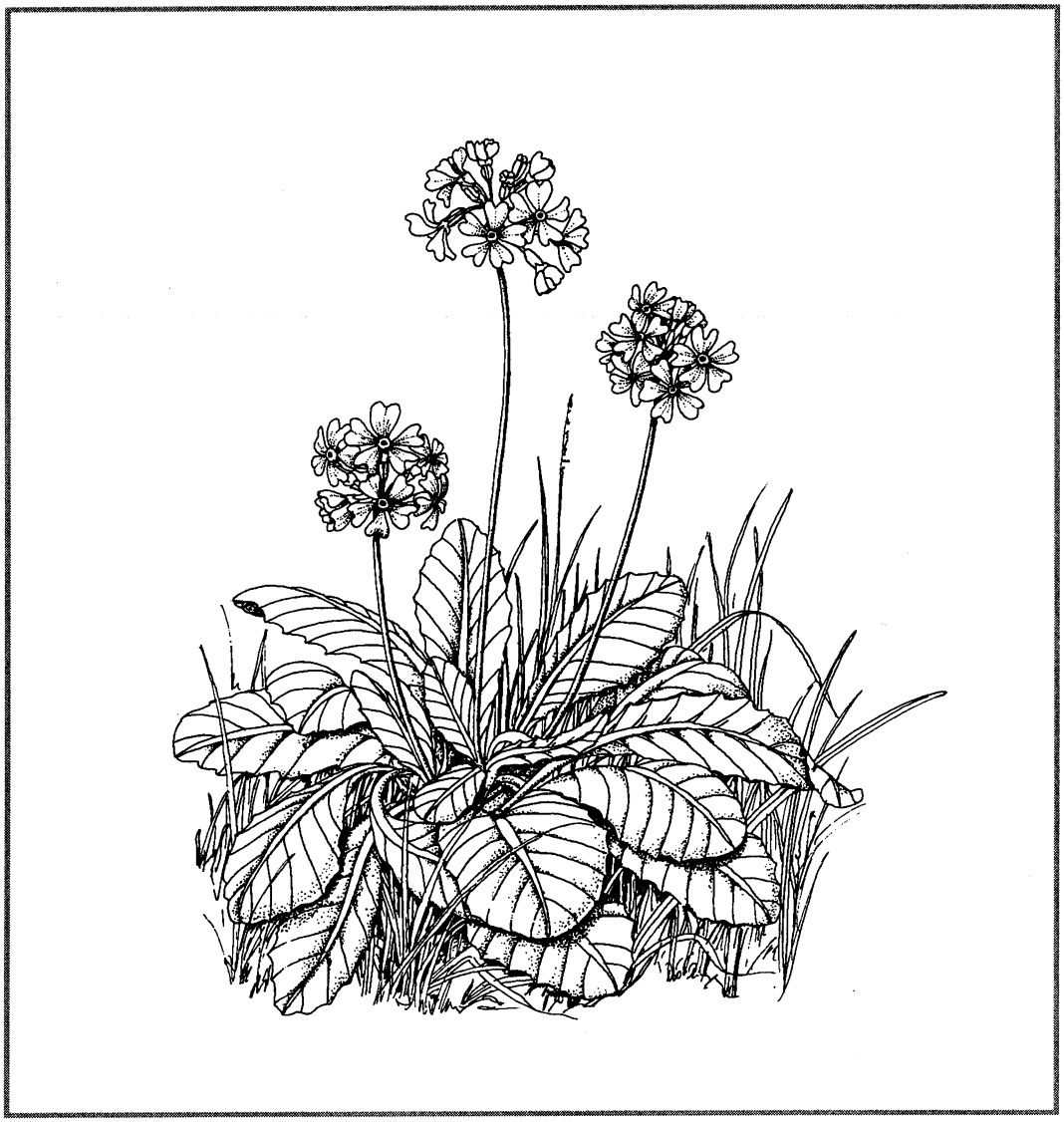
ENGLISH NATURE

Resource survey of base-rich upland seepages

Volume one

No. 427 - English Nature Research Reports



working today
for nature tomorrow

English Nature Research Reports

Number 427

Resource survey of base-rich upland seepages

Volume 1

Caroline Hallam
Scientific Data Services

English Nature Project Officer: Martin Drake

ISSN 0967-876X

Contents

Summary

This contract set out to collate data on the location of base-rich upland seepages throughout the Cumbria Fells and Dales, the North Pennines, the Forest of Bowland, the Yorkshire Dales and the North York Moors Natural Areas. This information has been brought together into a database and on 1:25,000 maps. This allows the extent and distribution of the resource to be assessed, as a basis for the further survey and protection of rare species.

This information has largely come from English Nature offices in the form of SSSI habitat maps, Phase 2 and NVC surveys and Phase 1 maps and target notes. Other organisations, including National Parks, County Councils and Wildlife Trusts, have also been consulted. However there has not been time to complete the search of all data sources within this contract. The report details the sources which have been utilised and those yet to be examined.

The database of sites collated for this contract includes 318 sites with a total of 801 upland base-rich seepages whose locations have been identified. This includes 60 SSSIs with 377 seepages and a further 258 non-SSSI sites with 424 seepages.

Although incomplete, the dataset clearly shows the importance for upland base-rich seepages of both the Yorkshire Dales and the Cumbria Fells and Dales Natural Areas, as well as a few large SSSIs in the North Pennines.

1. Contract objective and background

Upland calcareous seepages are known to be important for both plants and animals, providing a habitat for listed species of bryophytes and invertebrates. The objective of this contract is to collate information on the extent and location of the resource in order to facilitate research on the distribution and appropriate management of selected species.

The botanical importance of base-rich seepages has meant that they have generally been identified in Phase 1 surveys, and have been targeted in some areas for Phase 2 or NVC survey. This contract aims to identify sources of existing information on the location of base-rich seepages, and to bring this information together into a useful form, to allow assessment of the extent of the resource, and to help prioritise areas for survey and management.

For this contract the area of search has been the following Natural Areas : Cumbria Fells and Dales, North Pennines, Forest of Bowland, Yorkshire Dales and North York Moors. Upland has been defined as land above 250m, although some areas at a lower altitude but within an upland landscape have also been included.

Within these areas, SSSIs have been a high priority, followed by secondary sites covered by Phase 2 surveys, with the wider countryside a lower priority.

It was not an objective of this contract to predict areas where base-rich seepages were likely to occur – only sites with precise locations have been included.

2. Methodology

2.1 Data Collection

Data for Cumbria Fells and Dales, the Cumbria part of the North Pennines, the Forest of Bowland and the Yorkshire Dales was collated by Caroline Hallam. Data for the North York Moors and the Durham part of the North Pennines was collated by Trina Barrett.

Since priority has been given to SSSIs in the Contract Objectives, the search for information has begun for each Natural Area at English Nature offices. In most cases there has not been time to go beyond this to look at information held by other bodies, although some have been contacted to see what information is available. Comments on the data held by different organisations are given in the discussion of each natural area in the Results section.

A search was made of the ENSIS database for all SSSIs for which upland base-rich seepages were included as criteria for notification. The local EN officers in each area were asked to add to this list from their own knowledge. The site files (legal and scientific) for these SSSIs were then searched for habitat maps and survey information. All SSSIs have a habitat map of some type; in some cases this was only at Phase 1 level, in others there were detailed Phase 2 maps with descriptive notes, or even detailed NVC maps. In some cases only a map was available and no descriptive information could be found. General comments are made on the information available in the discussion of each natural area in the Results section.

Local EN officers were asked about the availability of Phase 2 survey data for non-SSSI sites likely to include upland base-rich seepages and any such leads were followed up. The availability of such data is discussed under each natural area in the results section.

Phase 1 maps and target notes were examined to ascertain the level of information given. In some counties base-rich seepages were identified as such, in others they were not. The type of information available is discussed in the results section for each area.

The decision as to what to include as a 'base-rich seepage' was left as far as possible to the original surveyors. Most habitat maps available for SSSIs distinguish between base-rich and base-poor flushes. The same is true for NVC maps and most Phase 2 maps. The extent to which base-rich flushes have been specifically distinguished in Phase 1 mapping is variable, and is discussed for each natural area in the Results section. For areas where flush types were not distinguished, a decision had to be made based on the target notes or any other descriptive material available. It was agreed, in discussion with the project officer, that sites which were doubtful, or for which there was insufficient information, would be left out, and only those which had a good probability of being base-rich would be included. There is no generally accepted list of 'species-indicators' which can be used to make this assessment. It was therefore agreed to follow the guidance given by the NVC key to the main base-rich seepage communities ie. M10, M11, M12, M37, M38, as given below.

Extract from *British Plant Communities Volume 2 – Mires and Heaths*
Edited by J.S.Rodwell (1991, Cambridge University Press)

Key to Mires page 38

M10,M11,M12
Various mixtures of small sedges usually an important element in swards with frequent records for at least some of Carex panicea, C. demissa, C. nigra, C.pulicaris, C.echinata, and C. saxatilis. Pinguicula vulgaris and Selaginella common among an often very rich associated flora; bryophyte carpet also frequently extensive and diverse with at least some of Campylium stellatum, D. revolvens, A. pinguis, Scorpidium, Bryum pseudotriquetum and Blindia acuta common.

M10 Carex dioica - Pinguicula vulgaris mire : Saxifraga aizoides only occasional and J. triglumis and Thalitricum alpinum rare but Carex lepidocarpa, C. hostiana, C. nigra and Molinia common; Blindia acuta only locally present.

M11 Carex demissa – Saxifraga azoides mire : Saxifraga aizoides constant and quite often abundant with frequent C. demissa, but only occasional C. lepidocarpa, C.hostiana, C.nigra and Molinia, and frequent Juncus triglumis and Thalitricum alpinum; Blindia acuta constant.

M12 Carex saxatilis mire : C. saxatilis constant and usually dominant with C. bigelowii frequent especially in grassier flush surrounds; Caltha and Viola palustris common among scattered vascular associates; Hylocomium splendens and Scapania undulata often found in patchy bryophyte carpet.

Page 43

M37,M38
Spring heads, rills or flushes with Philonitis fontana, Chrysosplenium oppositifolium and Deschampsia cespitosa occasional to frequent, dominated by Cratoneuron commutatum or C. filicinum, often with some Bryum pseudotriquetum and Aneura pinguis; Carex panicea and C. dioica occasional to frequent.

2.2 Data presentation

For each base-rich seepage identified, whether SSSI or from Phase 1 or 2 survey data, the location of the seepage was transferred to a 1:25,000 map. Small sites are represented as dots, larger sites as areas. For some sites where large scale maps are available (1:10,000 and larger) this inevitably means that detail is lost, but a cross-reference is given in the spreadsheet to the type and scale of habitat map from which the information was derived. The maps are presented as quarter 10 km squares at 1:25,000.

Each site has been entered into the spreadsheet with a unique code, based on the county, quarter 10 km square grid reference, and site name. This follows the convention used in the Grassland Inventory, but with the addition of SW, SE, NE, or NW to indicate which quarter of the 10 km square the site falls in, and hence which map it appears on. Using the site code it is easy to cross-refer between the spreadsheet and the maps.

The definition of a 'site' has largely followed that used by the original surveyors. For instance, where a surveyor has mapped a large area as a cluster of seepages this has been entered as one site, but where in other cases an area has been subdivided into units with separate descriptions, each 'sub-unit' has been taken to be a site and has been given a separate entry in the spreadsheet and hence a unique site code. This reflects the fact that there is more information for some important sites which have been surveyed in more detail. Some Phase 1 and NVC maps indicate areas as mosaics of different vegetation types. Where base-rich seepage communities form a significant component of these mosaics, these areas have been included and information has been given in the 'comments' field to indicate the type of mosaic. Where base-rich seepages form only a minor component of a large area they have not been included in the spreadsheet, on the basis that their precise location is not known.

Each site has been given a 6-figure grid reference (ie. to the 100m square). Where sites cover more than one 100m square, a string of grid references are given to indicate each 100m square included in the site. Although this makes the spreadsheet rather bulky, it has the advantage over a centroid reference, that these grid references can be plotted to give a more accurate picture of the distribution of the resource.

An approximate size is given for each site in the spreadsheet. Only rarely has size been indicated by surveyors so these figures are mostly based on an estimate of the size of the area mapped. Sites which have been mapped as dots are described as 'Small' – this can be taken as generally 0.2 ha or less. It is likely that many sizes given will be over-estimates since surveyors tend to exaggerate the size of small features such as seepages when mapping. Many areas also represent mosaics or clusters of seepages amongst other vegetation, so the sizes given do not represent just the area of seepage.

A field has been included in the spreadsheet to indicate NVC community. This is only given where the community has been identified by surveyors in the field. No attempt has been made by the contractors to attribute NVC post-survey.

The assessment of quality has been particularly difficult, as there is not consistent information on which to base a decision. For some sites there is no descriptive information, others have just a brief description of vegetation type, with sometimes dominant or notable species; in some cases the surveyors themselves have made an assessment of quality, but this is rare. Sedges and bryophytes are particularly important in assessing the quality of base-rich flushes, but the identification of sedges is variable and bryophytes are frequently ignored. In some cases, information is given which relates to the site as a whole but which cannot be attributed to individual seepage areas within it, so for example, it may be known that an SSSI is considered of top quality, but not whether all the individual seepage areas are of equal value. There is also the difficulty that some communities are naturally richer in species than others, so attributing quality based on the presence of particular species will tend to favour one community over another rather than just indicating quality. A simple system has been adopted, in order to avoid a post-hoc arbitrary attribution of quality

category. Sites which have been notified as SSSIs because of the quality of their base-rich seepages (alone, or among other features) have been described in the spreadsheet as **'Top'** quality sites. Those sites which have been noted as 'good', 'superb', 'outstanding' etc., by the original surveyors have been described as **'Good'**. All other sites have been given a quality category of **'?'**, indicating that either their quality is unknown or that the information available does not indicate high quality. However there is additional information in the comments field upon which users may wish to base their own assessment of quality.

The comments field on the spreadsheet provides a précis of the information given in the target notes concerning the type of flush community, including dominant and notable species, the nature of surrounding vegetation, and the topographical situation. There is also occasionally information relating to management. In particular a search on the comments field may be used to identify 'springs' and associated bryophyte-dominated communities.

The source or sources of information for the location and description of sites is given in the spreadsheet. General comments on the storage, accessibility and quality of these sources are given for each natural area in the Results section. The spreadsheet identifies for each site, the type of survey (Phase 1, Phase 2, NVC survey or SSSI habitat map), along with the date and scale of mapping. The presence of target notes or other descriptive information is indicated by the comments field.

A spreadsheet and set of maps has been produced for each Natural Area. There is some difficulty where there is a lack of co-incidence between counties and national park boundaries. SSSIs which straddle county boundaries have not been duplicated but have been allocated to Natural Areas based on the local EN office which takes responsibility for them. For example, Coombe Scar SSSI occurs in Cumbria and in the Yorkshire Dales National Park, and was notified by the Leyburn office of English Nature, so it is included in the Yorkshire Dales database. The Leck Beck Head SSSI which straddles the Cumbria/Lancashire border and two natural areas has been included in the Cumbria Fells and Dales Natural Area.

The entire dataset has been mapped using GIS (Fig. 1) and at a larger scale for each natural area (Figs. 2-5).

3. Results

The results section discusses for each natural area the data available on the location of upland base-rich seepages, its accessibility and quality. Progress made in searching the various sources is reported, and potential for further work is discussed. An overall description of the resource in each Natural Area is given in Section 4.

3.1 Yorkshire Dales

Information located for SSSIs

Local EN staff at the Leyburn office added to list of SSSIs with base-rich flushes produced from ENSIS. Habitat maps for these SSSIs were located in the Site Legal and Scientific files. Almost all had habitat maps which identified the locations of base-rich flushes, although they varied considerably in age, scale and detail; some maps were only at a Phase 1 level of habitat classification. Most sites also had some descriptive information although frequently it was a general description of flushes for the site as a whole with no description of individual areas. For some sites no descriptive information could be located.

Information located for Non-SSSIs

No Phase 2 surveys of upland seepages have been carried out in the Yorkshire Dales. There is an unpublished English Nature report which identifies flush sites which are considered to be a priority for survey and consideration for notification: *Fens and Bogs – A Strategy for the Yorkshire Dales* Paul Evans 1996.

A detailed and comprehensive Phase 1 survey was carried out for the Yorkshire Dales National Park (excluding SSSIs). Further surveys followed for areas outside the National Park. These surveys are summarised in a report collated by Jean Johnson, *Yorkshire Dales Area of Search Habitat Resource* (1992). From these surveys it was estimated that 234 ha of base-rich flush occurred within the National Park (in addition to that in SSSIs) with a further 18 ha in Craven and 2 ha in Richmondshire (including SSSIs).

Phase 1 data takes the form of large coloured maps at 1:10,000 held at both EN Leyburn offices and the National Park offices at Grassington. The extensive target notes are held on index cards at EN Leyburn and as a typed version at the National Park offices. These target notes include one or more habitat categories, a description of vegetation with dominant and notable species (excluding bryophytes) and sometimes notes on the topographical situation. They are not computerised so it is not possible to automate a search through them, however they have largely been allocated to habitat categories which include base-rich flushes. Larger areas of flush have been mapped and can be identified on the maps by their colour coding, however there are many more flushes which have not been mapped but which have been given a grid reference and target note. Surprisingly there are not target notes for all the larger flushes which are mapped so it is necessary to search both maps and target notes to be sure of complete coverage. There are some areas where base-rich flushes are noted as a minor component of a large area – these have not been included in the database since there is no information on their exact location. The surveyors allocation of vegetation to a base-rich flush in the field has been accepted; from the species information given with the target notes the 'base-rich flush' category does appear to have been used consistently. Surveyors also distinguished 'bryophyte-dominated springs' as a category – these have been included in

the database where precise locations are given; they can be identified by a search on the comments field. A précis of the relevant descriptive and species information from the target notes have been given in the comments field on the spreadsheet.

Information provided in the spreadsheet and maps

Priority has been given to the SSSIs which include base-rich flushes; 25 have been included in the database (listed below) with 97 flush locations between them (the clustering and division of flushes is fairly arbitrary, but gives some indication of flush prevalence).

Ashes Pasture & Meadows SSSI	1
Attermire SSSI	2
Austwick & Lawkland Mosses SSSI	2
Birkwith Caves & Fell SSSI	5
Conistone Old Pasture SSSI	3
Coombe Scar SSSI	3
Deepdale Meadows SSSI	1
Ingleborough SSSI	17
Kilnsey Flush SSSI	1
Lovely Seat - Stainton Moor SSSI	1
Low Gill Moor Wetlands SSSI	1
Malham Arncliffe SSSI	9
Mallerstang & Swaledale Head SSSI	4
Marsett Rigg SSSI	2
Newby Moor SSSI	11
Oughtershaw & Beckermonds SSSI	6
Oxenber & Wharfe Woods SSSI	1
Pan Beck Fen SSSI	1
Pen-y-ghent Gill SSSI	4
River Wharfe SSSI	1
Salt Lake Quarry SSSI	1
Scoska Wood SSSI	7
Seato Pastures SSSI	1
Thornton & Twistleton Glens SSSI	2
Upper Wharfedale SSSI	10

The information for Mallerstang and Swalehead SSSI is for the part of the site which falls in Cumbria, and came from the EN Cumbria Team. Part of the Coombe Scar SSSI also occurs in Cumbria, but information for it is largely held at the EN Leyburn office.

The Phase 1 maps and target notes have been searched for most of the 10 km squares which include SSSIs with base-rich flushes. It was not possible to cover the Phase 1 for the whole of the Yorkshire Dales Natural Area within the time available for this contract. The table below shows the 39 quarter 10 km squares included in the database, and indicates which of these have not been searched for Phase 1 data. 'Phase 1 not checked' is printed on the relevant maps.

Quarter 10 km squares included in the database	Checked for phase 1
NY80 NW	no phase 1
SD68 NE	no phase 1
SD76 NE, NW & SW	
SD77 NE, NW, SE & SW	no phase 1
SD78 NE, SE & SW	
SD85 NE & NW	
SD86 NE, NW & SE	
SD86SW	no phase 1
SD87 NE, NW, SE & SW	
SD88 NE, NW, SE & SW	
SD96 NE, NW, SE & SW	
SD97NE, NW & SW	
SD97SE	no phase 1
SD98 NE, NW, SE & SW	
SE09SW (no map provided)	no phase 1

The search of Phase 1 data has concentrated on the western and southern areas of the Yorkshire Dales; there are still considerable areas to the east and north which have not yet been searched, and which would undoubtedly identify more flushes. For instance, a quick scan of maps for SE07NW and SE09SW revealed seven mapped flushes; examination of target notes would probably reveal more.

3.2 Cumbria Fells and Dales

Information located for SSSIs

The EN Cumbria Team made available a comprehensive list of SSSIs in Cumbria which are considered important for their base-rich flushes (amongst other features). Some were discarded because they fell outside the Natural Area and altitude range. Habitat maps are held in the Site Legal Files, with additional descriptive information frequently available in the Site Scientific Files. Almost all had habitat maps which identified the location of base-rich flushes. They varied considerably in age, scale and detail. More detailed information was provided for SSSIs in the Cumbria Mires Survey (1987, Henry Adams), and for others in the Cumbria Grassland Flushes Survey (1989, Ian Slater). These surveys provide detailed large-scale maps showing NVC communities with some quadrat data, description of communities, and in some cases evaluation of quality.

Information located for Phase 2 and NVC surveys

The Cumbria Grassland Flushes Survey (1989-90) provides detailed NVC maps and considerable descriptive information. It includes both SSSIs and non-SSSI sites. Data for the non-SSSI sites in the database have come from this source. Information for the Mallerstang and Swaledale Head SSSI is included in the Yorkshire Dales Natural Area because most of the site falls in Yorkshire.

The Cumbria Mires Survey was undertaken by Henry Adams (1987-91) and reported by Wanda Fojt (*The Cumbria Mire Survey* English Nature Research Reports No. 81, 1994). This involved a collation of Phase 1 data for valley and basin mires in a considerable part of

the southern and central Lake District. It is not always possible from this collation to distinguish the base-rich flushes, so although providing a useful cross-check, it is still necessary to examine the Phase 1 target notes.

A sub-sample of sites identified from the collation exercise were mapped using NVC, thirty of which included M10 base-rich flush communities. There has not been time within this contract to examine this data, except where it has occurred in relation to a site included because it is a SSSI or in the Cumbria Grassland Flushes Survey. However it would clearly be worthwhile to examine this data further.

Information available from Phase 1 survey

Phase 1 survey data takes the form of large coloured maps at 1:10,000 and typed target notes. The maps have been put on to microfiche, but the equipment available is of poor quality and does not readily allow the necessary distinction between colours. The maps and target notes have recently been scanned as images. The map images became available mid-February, however their operation in Map-Info is very slow and the lack of any search facility or labelling of grid lines mean that using them for searching large areas is not cost-effective. The original maps are not due to be returned before the end of February 2000, so were not available for this contract.

Target notes have been examined for two small areas. They do not categorise flushes into base-rich and base-poor, although they do provide descriptive information which could be used to make such a distinction in a reasonable number of cases. The target notes frequently refer to other survey information (eg. Cumbria Meadows Survey), therefore a thorough search would involve looking at these sources as well. Careful examination of the target notes in conjunction with the original Phase 1 maps is likely to identify a number of additional sites for base-rich flushes which could be added to the database provided by the current contract.

Information provided in the spreadsheet and maps

Priority has been given to the SSSIs containing base-rich flushes – 22 have been included in the database (listed below) with 94 flush locations between them (although it should be remembered that the clustering and division of flushes is fairly arbitrary, this does give some indication of flush prevalence).

SSSIs with base-rich flushes	No.
Armboth Fells SSSI	10
Birk Fell SSSI	3
Buttermere Fells SSSI	2
Cautley Thwaite Meadow & Pastures SSSI	2
Crosby Gill SSSI	2
Crosby Ravensworth SSSI	14
Eycott Hill SSSI	1
Helvelyn & Fairfield : Hogget Gill	1
High Lickbarrow Mires & Pastures SSSI	1
Hollin Hill SSSI	1
Kirkby Moor SSSI	2
Lamonby Verges & Fields SSSI	1

Leck Beck Head SSSI	2
Little Asby Inrakes & Outrakes SSSI	1
Loughrigg Fell Flushes SSSI	1
Ludderburn-Candlestick Mires SSSI	2
Naddle Forest SSSI	2
Orton Pastures SSSI	1
Shap Fells SSSI	2
Subberthwaite, Blawith & Torver Low Commons SSSI	15
Sunbiggin SSSI	14
Troutbeck SSSI	13

Mallerstang & Swaledale Head SSSI and Coombe Scar SSSIs both straddle the boundary between Cumbria and Yorkshire, but have been allocated to the Yorkshire Dales Natural Area.

Having investigated the SSSIs, the next priority was to examine maps from the Cumbria Grassland Flushes Survey for non-SSSI sites – this produced another 12 sites with 22 flush locations.

No more than exploratory work has been done on the Cumbria Mires Survey and the Phase 1 data – these sources would undoubtedly provide information on many additional flush sites.

To summarise, the work done for this contract has concentrated on the high quality sites – either SSSIs or sites recognised as a priority for further survey and hence included in the Cumbria Grassland Flushes Survey. This means that the locations of upland base-rich seepages in sites recognised as of high quality have been included in the database and maps produced for this contract, but there is much more data for less well known areas which has not been searched and reported.

Maps are provided for following 39 quarter 10 km squares with flush locations marked on for the SSSI and Cumbria Grassland Flush Survey sites included in the database:

NY21 NE, NW & SW	NY60 NE & NW
NY22 SE	NY61 SE & SW
NY30 NE & SE	NY70 NW, SE & SW
NY31 NW, SE & SW	SD28 NE & SE
NY32 NE	SD29 NW, SE & SW
NY33 NE	SD39 SE
NY40 NW & SW	SD49 SW
NY41 NW & SE	SD67 NE
NY49 NW	SD68 SE
NY50 NE	SD69 NE & SE
NY51 SE & SW	SD79 NE & NW

3.3 North Pennines

Information located for Cumbria

The EN Cumbria Team made available a comprehensive list of SSSIs in Cumbria which are considered important for their base-rich flushes (amongst other features). Habitat maps are held in the Site Legal Files, with additional descriptive information frequently available in the Site Scientific Files. The two major SSSIs in this area, Moorhouse and Cross Fell SSSI and Appleby Fells SSSI have both been the subject of recent NVC surveys, providing detailed NVC maps. (R.Jerram 1997, 1999). The other SSSIs are Helbeck Wood SSSI which has a NVC map from the Cumbria Grassland Flush Survey and Argyll Woods & Pastures SSSI for which there is an older habitat map.

There was no further material for the North Pennines area in the Cumbria Grassland Flush Survey except a survey of part of the Mallerstang and Swaledale Head SSSI which is mostly in North Yorkshire and is reported under the Yorkshire Dales Natural Area.

No other sources were searched for the Cumbria part of the North Pennines. Phase 1 is available (see discussion under section 3.2 on the Cumbria Fells and Dales), but there was insufficient time within the contract to examine it.

Information located for Durham

Upper Teesdale SSSI covers a large area important for base-rich flushes. Only parts of the site have been mapped using NVC; none of these showed base-rich flushes. Information for the SSSI came from a Phase 1 habitat map (1988, 1:25,000) with no target notes, and from a meadows survey – *'The Teesdale Meadows - a preliminary conspectus'* (1987), located in the SSSI Statutory Documents file at EN Stocksfield. The latter included 1:10,000 maps with short species lists.

Four additional SSSIs were found which included base-rich flushes meeting the criteria. Only phase 1 maps, target notes and SSSI descriptions were available for these sites. They include Far High House Meadows SSSI, Middleton Quarry SSSI, Hisehope Burn Valley SSSI and Sleightholme Beck Gorge SSSI. The latter is a geological SSSI, with only a phase 1 map, so it was not possible to tell how good the flushes are.

A phase 1 survey of Durham has been carried out over several years and at various levels of detail. The colour 1:10,000 maps are held by the EN office at Stocksfield. There is no summary report although some statistics are given in the Durham Wildlife Audit (1995). All the phase 1 maps and target notes for Durham which include land over 250m have been checked for base-rich flushes. This identified a further 10 sites.

Information on second tier County Wildlife Sites is held by both the Durham Wildlife Trust and English Nature at Stocksfield. A search of these sites produced no additional flushes which met the criteria.

Northumberland – there was no land in the Northumberland part of the Natural Area over 250m.

The following quarter 10 km squares are included in the database for the North Pennines Natural Area :

CUMBRIA

NY63 NE, NW & SE
NY64 SE & SW
NY71 NE
NY72 NE, NW, SE & SW
NY73 NE, NW, SE & SW
NY74 SW
NY81 NW, SE & SW
NY83 NW

DURHAM

NY82 NE & NW
NY83 NW, SE & SW
NY91 SE
NY92 NE, NW, SE & SW
NY93 NE
NY94 NE & NW
NY95 SE
NZ00 NW
NZ02 SW
NZ04 NW
NZ05 SW

There are 19 for Cumbria and 18 for Durham with only one map which includes sites from both Cumbria and Durham – this is NY83NW.

3.4 North York Moors

Most of the upland area of the North York Moors has been included in one very large SSSI. The information for this came from the Phase 1 habitat map and target notes produced for the North York Moors National Park (1987, 1:10000) which is held at the EN offices in York. The only other SSSI with base-rich flushes which qualified was Stonymoor Sike SSSI.

There are seven further SSSIs which include base-rich flushes, but which have not been included because they fall below the 250m altitude used to define upland; they are Biller Howe Dale SSSI, Newtondale SSSI, Fylingdales Moor SSSI, Cawthorn Moor SSSI, Snaper Farm Meadows SSSI, Ashberry and Reins Wood SSSI and Blaiskey Bank Springs SSSI. The latter two are described in an English Nature report by Fojt (date?) *North York Moors National Park Upland Vegetation Survey.*

The Upland Vegetation Survey of the North York Moors (Jerram, 1996) provides a more detailed NVC map covering large areas of moorland within the National Park. These 1:10,000 maps are held at EN offices in York. The target notes tended to amalgamate information for wetland habitats so it was frequently difficult to determine flush type. This survey provided information on two undesignated sites.

The Phase 1 maps and target notes were searched for all the upland areas of the National Park – this resulted in a further 9 sites.

The North York Moors National Park offices at Helmsley hold information on second tier sites, but there was insufficient time to consult this data source.

The following 14 quarter 10 km maps are included in the database:

NZ50 SW
NZ61 SE
NZ70 SW
SE49 NE
SE59 NW, SE & SW
SE69 NW & SE
SE79 NE, NW & SW
SE89 NW & SW

3.5 Forest of Bowland

Information located for SSSIs

The Bowland Fells SSSI covers most of the upland area of the Forest of Bowland. There is a Birk and Ratcliffe survey from 1980 covering this area (NCC unpublished report). Vegetation survey maps based on the Birk and Ratcliffe classification of upland vegetation are available at 1:5000. However a search of these maps revealed no basic flushes. Local EN staff knew of only one area which might have base-rich flushes (not identified as such in Birk & Ratcliffe or in Phase 1 survey) and the only reference to this was a file note of a field visit. The description of this flush (possibly equivalent to M6b) was not sufficient to qualify it for inclusion in this dataset (see section on Methodology for criteria).

Leck Beck Head SSSI, which straddles the Cumbria/Lancashire border has been included in the Cumbria Fells and Dales dataset.

Standridge Farm Pasture SSSI and Robert Hall Moor SSSI are the only other SSSIs with base-rich flushes in the Natural Area. Both are examples of enclosed pasture but the latter is at only 100m so can hardly be considered of an upland nature.

Information located for Non-SSSIs

There have been no Phase 2 or NVC surveys targeted at flushes although local EN staff have prepared a list of flush sites considered to be a priority for survey.

A Phase 1 survey of Lancashire was carried out 1988-1992 (reported by Kelly & Harwood 1993). Coloured Phase 1 maps at 1:10000 are held at the EN Wigan office along with typed target notes. A search of the Phase 1 maps and target notes for the upland areas of the Forest of Bowland Natural Area revealed very few sites, although there is a cluster around Stocks Reservoir. Burn Moor which lies on the Lancashire/Yorkshire border has been included in the Yorkshire Dales dataset.

Nick Bruce at Lancashire County Council was very helpful in providing information from their database of Biological Heritage Sites which is computerised and linked to a Geographical Information System. This does not have a habitat category which distinguishes base-rich flushes, however staff were able to pick out sites known to them. In addition to the SSSIs this included two sites within the Forest of Bowland Natural Area (Ireby Fell and Copped Hill Pasture) for which they hold more detailed information.

Information provided in the spreadsheet and maps

Flush locations have been mapped and details recorded in the spreadsheet for two SSSIs : Standridge Farm Pasture SSSI and Robert Hall Moor SSSI. In addition there are two Biological Heritage Sites and seven other sites recorded in Phase 1, giving 14 flush locations in all. However several of these sites are below 250m and only marginal to the upland areas. None of the sites are extensive, the two largest being the SSSIs – however they represent a mosaic of flush with grassland in an enclosed situation.

3.6 Summary

The number of sites and seepages for which data has been collected are summarised below :

Natural Area	No. of SSSIs	No. of flush locations	No. of Non-SSSI sites	No. of flush locations	Total No. of sites	Total No. of locations
Cumbria Fells and Dales	22	94	12	22	34	116
The North Pennines	9	151	10	12	19	163
The North York Moors	2	33	11	12	13	45
The Yorkshire Dales	25	97	218	367	243	464
The Forest of Bowland	2	2	7	11	9	13
Total	**60**	**377**	**258**	**424**	**318**	**801**

The data sources consulted, and those which remain to be examined in each area are summarised below:

	Sources checked			
Natural Area	**SSSIs habtat maps**	**Phase 2 surveys**	**Phase 1 survey**	**2nd tier sites**
Cumbria Fells and Dales	complete	partial	No	No
The North Pennines	complete	complete	Durham - yes Cumbria - no	Durham - yes Cumbria - no
The North York Moors	complete	complete	Yes, above 250m	No
The Yorkshire Dales	complete	complete	partial	No
The Forest of Bowland	complete	complete	complete	Complete

4. Discussion

4.1 Yorkshire Dales

The Yorkshire Dales are probably the key natural area for upland base-rich seepages in Northern England (Figs. 1, 2). Other areas may have a greater diversity of flush types botanically and with respect to geological and topographical situations but the prevalence of calcareous geology means base-enriched flushes are more prevalent and widespread here than elsewhere. The summary report of the Phase 1 survey (NCC, 1989) estimates that basic flushes extend over 234ha of the National Park excluding SSSIs. It is represented in 42 out of the 90 five by five km square maps. This is in addition to the base-rich flushes within SSSIs, and those too small to map. Although widely distributed, extensive flush systems are unusual; most seem to lie in systems of less than half a hectare, widely spread over the upland areas of the National Park. In addition there are some small areas outside the National Park : 18 ha in Craven and 2 ha in Richmondshire (estimates include SSSIs).

The summary report of the Phase 1 survey estimates that most base-rich flushes are found in an area bounded by Wensleydale, Chaple-le-Dale and Malham – corresponding to the main areas of Great Scar Limestone and Yoredale Rocks. Basic flushes also occur in the intensively farmed lower dales to the south and east, and in parts of the south-east and north of the Park around Barden Moor and Swaledale/Arkengarthdale. Some assessment of quality is made in the Phase 1 summary report for flushes in the southern half of the National Park. This identified flushes around Chapel-le-Dale/Ribblesdale and that part of Wharfedale north of Grassington, especially around Kettlewell, as of particularly high importance. Examination of base-rich flushes recorded in Phase 1 for this contract showed that they were particularly prevalent in the 10km square SD88 (around Hawes in Wensleydale).

The Phase 1 report does not consider the SSSIs in the National Park. Of these the Ingleborough SSSI, Upper Wharfedale SSSI and Malham-Arncliffe SSSI are all very important, with the latter especially rich in extensive areas of excellent base-rich flushes.

The following sites all contain areas, of 5 ha or more, mapped as base-rich flush, although it must be remembered that these large areas probably represent mosaics rather than flushes alone :

Ingleborough SSSI
Malham Arncliffe SSSI
Newton Moor
Slades
Low Gill Moor Wetlands SSSI
Oughtershaw & Beckermonds SSSI
Pits Hill (Cranes Field)

4.2 Cumbria Fells and Dales

The Cumbria Fells and Dales Natural Area includes five distinct landscapes. It is composed of the high mountain areas of the central and northern Lake District, the low fells of the South Lakes, the limestone areas of Morecambe Bay and the Orton Fells and the smooth hills of the Howgill Fells.

Springs and flushes, although not extensive, provide some of the most diverse features of otherwise more uniform areas, especially in the uplands. Upland base-rich seepages are a significant feature of the Cumbria Fells and Dales and are widely distributed across the Natural Area. They are particularly associated with areas where the groundwater is influenced by Carboniferous Limestones giving rise to flushes typified by brown mosses and small sedges, with notable herbs such as bird's-eye primrose and grass-of-Parnassus. There is an important group of such sites in the east of the region including Sunbiggin, Crosby Gill and Crosby Ravensworth, Little Asby, and Orton Pastures. Local base-enrichment can also occur on acid substrates producing flushes dominated by purple moor-grass and surrounded by heather; this occurs in south-western Cumbria, for example at Subberthwaite, Blawith & Torver Low Commons SSSI. Other important sites occur in the central and northern parts of the Lake District at Armboth Fells, Helvelyn and Troutbeck.

It is unusual to find extensive areas of flushing; most flushes are small and few extend beyond half a hectare. Sites with more extensive flushes include Sunbiggin SSSI and Armboth Fells SSSI; Crosby Gill SSSI and Crosby Ravensworth SSSI also include some larger areas.

4.3 North Pennines

The North Pennines form a distinct upland landscape bordered by the Eden and Tyne valleys, the Durham lowlands and the Yorkshire Dales. The landscape is characterised by high heather moorlands dissected by river valleys. Limestone underlies large parts of the North Pennines so base-rich flushes are not uncommon. The Natural Area profile for the North Pennines provides a map showing the distribution of base-rich flushes, based on Phase 1 data. This shows the concentration of such flushes in Upper Teesdale, particularly on Cronkley and Widdybank Fells, in Harwood Dale and on the slopes of the Appleby Fells. 181 ha were found in the Phase 1 survey of the Natural Area.

M10 communities are most common in the higher parts of Teesdale where it sometimes forms quite large stands, dominated by small sedges and brown mosses with butterwort, bird's-eye primrose and grass-of-Parnassus, jointed rush and purple moor-grass. M11 communities are similar but more montane; these are found on Widdybank Fell in Upper Teesdale, and are characterised by the presence of yellow mountain saxifrage. Bryophyte-dominated springs also occur, although they are always small so tend not to be mapped; some locations were identified by the Phase 1 target notes.

The North Pennines Natural Area is dominated by a few large upland SSSIs: Moorhouse and Cross Fell SSSI, Upper Teesdale SSSI, Appleby Fells SSSI. All of these are extremely important for base-rich seepages. Moorhouse is overwhelmingly dominated by acid vegetation, but is widely scattered with M10 flushes (mostly M10a) and bryophyte-dominated springs (M38). Appleby includes extensive areas of M10 flushes in mosaics with grassland (U5). Upper Teesdale includes a large number of sites, some in enclosed fields, others on open moorland.

4.4 North York Moors

The North York Moors are dominated by heath and blanket bog, but there are also flushed areas, although these are principally acid flushes. The Phase 1 survey recorded 974 ha of flush but there is no separate figure for base-rich flushes which are likely to be only a small component. Basic flushes are usually small, occurring where base-rich sediments outcrop

amongst acid substrates (Fig. 5. The richer flushes on the North York Moors tend to represent a mixture of species associated with basic and acid flushes, without many of the more distinctive herbs associated with base-enrichment in the Yorkshire Dales and Cumbria. This means that the basic influence may not always be obvious, leading to under-recording, especially in the Phase 1 survey.

The Upland Vegetation Survey of the North York Moors (Jerram, 1996) mapped 8.6 ha of M10 vegetation, where there was some base-enrichment of the water feeding flushes – these were mainly on Lockton and Levisham Moors, Bransdale Moor, Wheeldale Moor, Goathland Moor and Fylingdales Moor, generally on steep valley sides where beds of limestone lie near to the surface.

Only a small part of the North York Moors lies above 250m. There are many more base-rich flushes at lower altitudes.

4.5 Forest of Bowland

It is clear that upland base-rich seepages are of only rare occurrence within the Forest of Bowland Natural Area, and that there is little information about them. It may be that they have to some extent been under-recorded because they are not a prominent feature of the area.

5. Recommendations

5.1 Information on the location and character of base-rich flushes tends to be spread around a number of locations and individuals. The exercise of collating this information has only been partly completed within the time available for this contract. It would clearly be desirable to complete this process. Firstly, for data held by English Nature, the main tasks remaining are to complete the search of Phase 1 data for the Yorkshire Dales, and to search the Phase 1 for Cumbria Fells and Dales and the Cumbria part of the North Pennines. The inclusion of lower ground in the North York Moors would add a significant number of sites. In addition, it would be very worthwhile examining the Cumbria Mires Survey and Cumbria Meadows Survey. Secondly, further investigation should be made of information held by other organisations, eg. for sites owned or managed by the local wildlife trusts and the National Trust.

5.2 Clearly it would be interesting to obtain more detailed information, both botanical and entomological, for many of the sites which have not been surveyed in detail, and to do a detailed analysis of the distribution of communities and species across the North of England. However this falls beyond the remit and resources of this contract.

6. References

ALLINSON, J.M., 1990-91. *Craven (outside Yorkshire Dales National Park) Phase 1 Survey.* English Nature unpublished report.

ALLINSON, J.M., 1989-91. *Richmondshire (outside Yorkshire Dales National Park) Grassland and Phase 1 Survey.* English Nature unpublished report.

CLIFTON, S.J. & HEDLEY, S., 1995. *Durham Wildlife Audit – The distribution, abundance and conservation of wildlife in County Durham.* Produced by English Nature, published by The Environment Department, Durham County Council.

ENGLISH NATURE, 1997. *The North Pennines Natural Area Profile* Unpublished report.

ENGLISH NATURE, 1997. *Cumbria Fells and Dales Natural Area Profile* Unpublished report.

EVANS, P., 1996. *Fens and Bogs – A Strategy for the Yorkshire Dales.* Unpublished report Leyburn office of English Nature.

FOJT, W., 1994. The Cumbria Mire Survey. Peterborough: *English Nature Research Reports*, No. 81

JERRAM, R., CLAYDEN, D. & REES, S., 1996. North York Moors National Park - Upland Vegetation Survey – Summary Report. Peterborough: *English Nature Research Reports*, No. 245.

JERRAM, R., 1997. *Moorhouse and Crossfell SSSI – Survey of NVC Communities.* Unpublished report to English Nature – Cumbria Team.

JERRAM, R., 1999. *Appleby Fells SSSI – Survey of NVC Communities.* Unpublished report to English Nature – Cumbria Team.

JOHNSON, J., 1992. *Yorkshire Dales Area of Search Habitat Resource.* Unpublished report, English Nature.

KELLY, P.G. & HARWOOD, T.R., 1993. *Wildlife Habitats in Lancashire: Report of the Phase 1 Habitat Survey of Lancashire 1988-1992.*

MATHESON, S., PILKINTON, E. & THOMAS, S., 1990. *North York Moors National Park - Final Report of 1987-1990 Habitat Survey.*

NATURE CONSERVANCY COUNCIL, 1989. *Botanical Survey of Yorkshire Dales National Park (North Yorkshire) 1985-1988.* Unpublished report by A.Stewart & A.Drewitt

RODWELL, J.S., ed., 1991. *British Plant Communities Volume 2 – Mires and Heaths.* Cambridge: Cambridge University Press

7. Acknowledgements

The information contained in this database and report was collected by Caroline Hallam (Cumbria, Yorkshire Dales, Bowland), and Trina Barrett (North York Moors and Durham). We would like to acknowledge the very great help provided by local English Nature staff in the Kendal, Wigan, Leyburn, York and Stocksfield offices. In addition we have received advice and information from Phil Taylor (Lake District National Park), Nick Bruce (Lancashire County Council) and staff at the Yorkshire Dales and North York Moors National Parks.

Appendix A

Species abbreviations used in the spreadsheet

Ach pta	*Achillea ptarmica*
Anag ten	*Anagalis tenella*
Aneu pin	*Aneura pinguis*
Briz med	*Briza media*
Bry pse	*Bryum pseudotriquetrum*
Camp ste	*Campylium stellatum*
C. dem	*Carex demissa*
C. dio	*Carex dioica*
C. dis	*Carex disticha*
C. ech	*Carex echinata*
C. fla	*Carex flacca*
C. hos	*Carex hostiana*
C. lep	*Carex lepidocarpa*
C. nig	*Carex nigra*
C. ova	*Carex ovalis*
C. pan	*Carex panicea*
C. pil	*Carex pilulifera*
C. pul	*Carex pulicaris*
Chry opp	*Chyrsosplenium oppositifolium*
Crat com	*Cratoneuron commutatum*
Crep pal	*Crepis paludosa*
Dicr pal	*Dicranella palustris*
Drep flu	*Drepanocladus fluitans*
Drep rev	*Drepanocladus revolvens*
Dros rot	*Drosera rotundifolia*
Eleo qui	*Eleocharis quinqueflora*
Equi pal	*Equisetum palustre*
Erio ang	*Eriophorum angustifolium*
Erio lat	*Eriophorum latifolium*
Erio sp.	*Eriophorum* species
Fis adi	*Fissidens adianthoides*
Hyd vul	*Hydrocotyle vulgaris*
Junc acut	*Juncus acutiflorus*
Junc art	*Juncus articulatus*
Junc bul	*Juncus bulbosus*
Junc con	*Juncus conglomeratus*
Junc eff	*Juncus effusus*
Junc squ	*Juncus squarrosus*
Meny tri	*Menyanthes trifoliata*
Mol cae	*Molinia caerulea*
Mont fon	*Montia fontana*
Myo sto	*Myosotis stolonifera*
Myr gal	*Myrica gale*
Parn pal	*Parnassia palustris*
Ped pal	*Pedicularis palustris*
Phil fon	*Philonitis fontana*
Ping vul	*Pinguicula vulgaris*
Pot pol	*Potomogeton polygonifolius*
Prim far	*Primula farinosa*
Ran fla	*Ranunculus flammula*
Sag nod	*Sagina nodosa*
Sax hyp	*Saxifraga hypnoides*
Sch nig	*Schoenus nigricans*
Sco sco	*Scorpidium scorpioides*
Sel sel	*Selaginella selaginoides*
Succ pra	*Succisa pratensis*
Trig pal	*Triglochin palustris*
Trol eur	*Trollius europaeus*
Val dio	*Valeriana dioica*
Vio pal	*Viola palustris*

Figure 1. Calcareous seepages identified in northern England. Dot indicate each seepage. Grey areas are SSSI.

Figure 2. Calcareous seepages in the Yorkshire Dales and the Forest of Bowland. Each dot centres on a 100 x 100 m square (but is shown slightly larger than this area). Grey areas are SSSI; those containing seepages are named.

Figure 3. Calcareous seepages in the Cumbria Fells and Dales. Each dot centres on a 100 x 100 m square (but is shown slightly larger than this area). Grey areas are SSSI; those containing seepages are named.

Figure 4. Calcareous seepages in the North Pennines. Each dot centres on a 100 x 100 m square (but is shown slightly larger than this area). Grey areas are SSSI; those containing seepages are named.

Figure 5. Calcareous seepages in the North York Moors. Each dot centres on a 100 x 100 m square (but is shown slightly larger than this area). Grey areas are SSSI; those containing seepages are named.