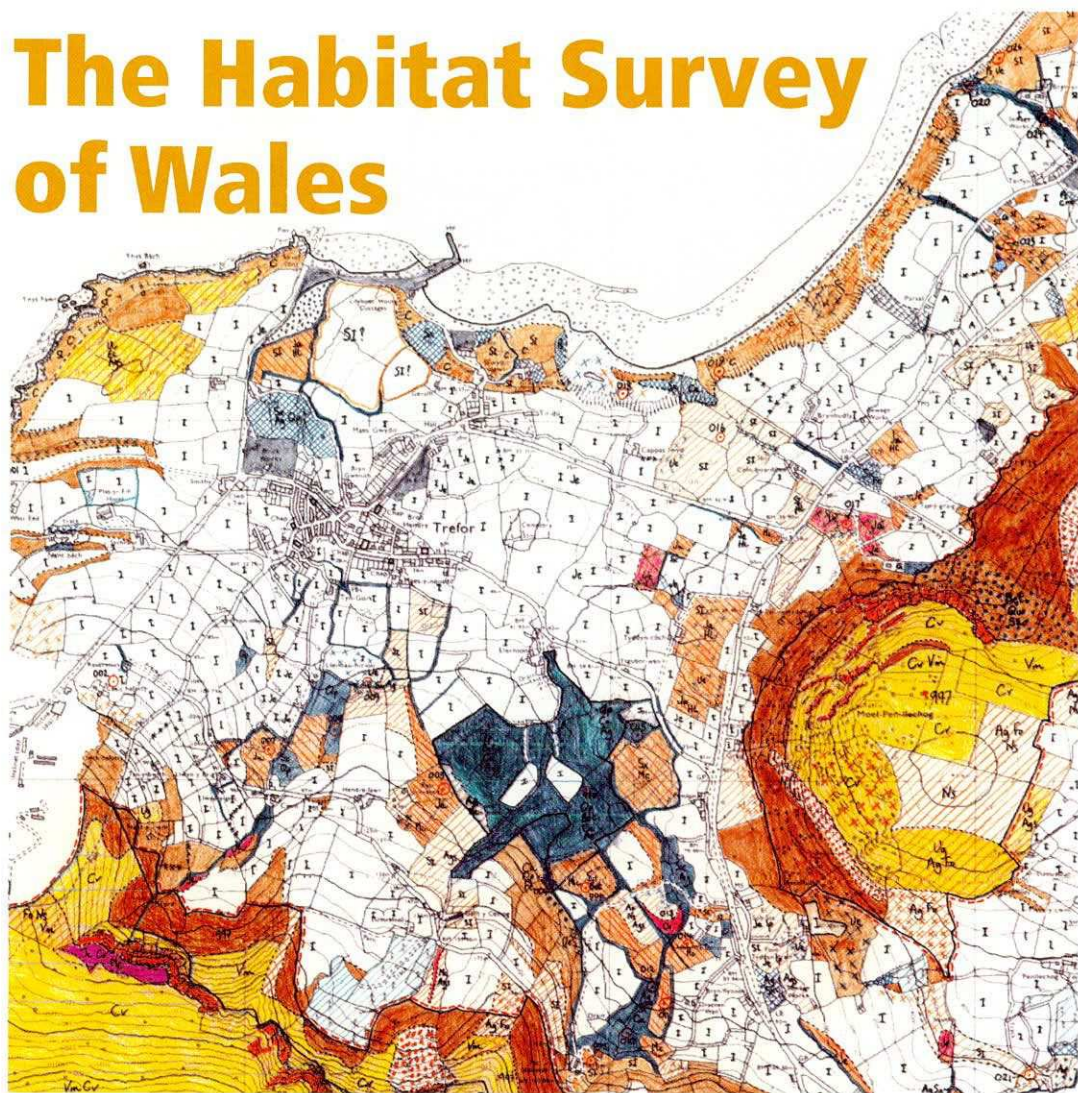


# The Habitat Survey of Wales



**Liz Howe, Tim Blackstock,  
Clare Burrows and Jane Stevens**

**Figure 1** Habitat Survey of Wales master map for area in northern Llyn. Hand-coloured version.

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**T**he fabric of the Welsh countryside, as with the rest of the UK, has had a chequered history moulded by changes in climate, population and industry, but most noticeably in agriculture.

By the early 20th century, the generally wet climate and poorer soils of the west had led to extensive areas of mixed farming, with livestock-rearing, and to a lesser extent arable crops, as the major output from Welsh farms. Intensification of this process over the last 50-60 years, overlaid

with the effects of subsidised production and a remarkable increase in the Welsh sheep flock, has resulted in wholesale 'improvement' of previously little-modified grasslands and other lowland habitats, and increased grazing pressure in the uplands. Arable farming has declined markedly.

The findings of the Grassland Survey of Wales, conducted during the 1930s, were used to exhort farmers to improve their grassland resource by drainage, fertiliser applications and re-seeding (Stapledon 1936). By the 1980s this had been





**The Llyn Peninsula was one of the areas first surveyed in the late 1980s.** David Woodfall/Woodfall Wild Images

substantially achieved in respect of the lowlands, and the then Nature Conservancy Council (NCC) was concerned to find the remaining ancient meadows, limestone and acid grasslands and wet pastures in Wales in order to protect the fragments that remained.

Field work began during 1986 in Brecknock, West Glamorgan and the Llyn Peninsula, where well-known grasslands were visited. The lack of relevant symbols on Ordnance Survey maps for dry semi-natural grasslands hampered a targeted search for previously unknown lowland sites. At about the same time, a ten-year NCC survey of vegetation and habitats in the uplands of Wales was nearing completion (Yeo & Blackstock 2002). The prospect of obtaining full habitat coverage for the whole of Wales was an attractive goal, and our work was greatly extended in scope to cover the entire lowland area of Wales and some remaining higher-altitude areas, beginning in earnest in 1987.

Teams of surveyors were trained in Phase 1 habitat recognition (NCC 1990), and survey techniques refined for Wales were quickly adopted (Howe & Blackstock 1991). Increasing familiarity on the part of the survey teams with the new National Vegetation Classification (Rodwell 1991-2000) helped to select the better sites for more detailed scrutiny at the phytosociological level by a team of Phase 2 surveyors, generating lists of sites for protection as potential Sites of Special Scientific Interest (Yeo *et al.* 1998).

From the field data, hand-coloured 1:10,000

map sheets were produced, showing habitats and dominant species, with target notes pointing to habitat-identification problems, small areas of interesting habitat and other survey data. A subsequent requirement to map Open Access Land under the Countryside and Rights of Way Act 2000 legislation has recently resulted in the Habitat Survey of Wales being digitised. Work progressed county by county and was given added impetus and additional funding when the Countryside Council for Wales was established in 1991, culminating in full-cover data for all habitats by 1997.

The Habitat Survey of Wales (HSW), combining survey findings in the uplands and lowlands, has now been used as a source of information for many projects and policies other than site selection.

### Phase 1 survey methods

The Phase 1 classification of habitats (NCC 1990) has a simple hierarchical structure of approximately 90 different recording units, covering the major land-cover types found in Britain, from woodland and scrub through mires, heaths and grassland to dunes, saltmarsh and open waters. Each major habitat is further subdivided; for example, grasslands can be mapped as acid, neutral, calcareous or marshy, and then further separated into semi-improved and unimproved forms. Surveyors worked with 1:10,000-scale map sheets, making initial observations from vantage points and using aerial photographs at the start of each new map. Field survey was carried out on foot, making extensive use of public rights of way and roads, as well as gaining permission to examine areas not visible, especially where semi-natural habitats were present. The minimum size of mapped habitat patches was 0.1-0.25ha. Habitats were marked on to the maps along with dominant species, and target notes were written to describe features of interest or those patches of habitat too small to map. Surveyors covered 100-300ha per day, depending on the topography, habitat condition and access arrangements.

**Table 1 Summary habitat area data for selected Phase I habitats in Wales**

	Area (ha)*		
	Lowland	Upland	Total
<b>Woodland</b>			
semi-natural broadleaved woodland	80,300	2,300	82,600
planted broadleaved woodland	6,000	110	6,100
planted coniferous woodland	123,900	43,700	167,700
dense scrub	13,300	660	14,000
<b>Grassland</b>			
unimproved acid grassland	19,600	108,100	127,600
semi-improved acid grassland	19,900	5,100	25,100
unimproved neutral grassland#	1,700	<5	1,700
semi-improved neutral grassland	33,100	300	33,400
unimproved calcareous grassland	860	640	1,500
semi-improved calcareous grassland	300	10	310
marshy grassland	35,200	29,200	64,400
improved grassland	1,012,700	14,000	1,026,700
<b>Tall herb and fern</b>			
Bracken	30,100	32,600	62,700
tall ruderal herb	1,000	<5	1,000
<b>Heathland</b>			
dry acid heath	8,800	69,600	78,400
dry basic heath	120	0	120
wet heath	3,600	9,400	13,000
lichen/bryophyte heath	0	130	130
<b>Mire</b>			
blanket bog	500	22,600	23,000
raised bog	990	40	1,000
wet modified bog	2,000	23,600	25,500
dry modified bog	160	8,000	8,100
acid/neutral flush	2,000	12,500	14,600
basic flush	50	90	140
fen	1,900	1,300	3,200
modified fen	770	300	1,100
swamp	1,800	20	1,800
<b>Open water</b>			
marginal and inundation vegetation	70	20	90
standing water	7,400	2,000	9,400
<b>Coastal</b>			
saltmarsh	5,800	0	5,800
vegetated dune	3,700	0	3,700
open dune	2,600	0	2,600
hard cliff	890	0	890
soft cliff	80	0	80
coastal grassland	1,600	0	1,600
coastal heathland	950	0	950
<b>Rock exposures</b>			
cliff	260	1,200	1,500
scree	270	3,300	3,600
other rock	330	3,700	4,000
<b>Miscellaneous</b>			
arable	59,800	220	60,100
amenity grassland	10,400	10	10,400
introduced scrub, ephemerals and bare ground	1,000	310	1,300
quarry, spoil, mine, refuse-tip	5,800	1,700	7,400
urban and other built-up land	146,000	340	146,300
not accessed	8,000	3,000	11,000

**Footnotes** \* Data are given to the nearest 100ha, or to the nearest 10ha if the total is less than 1,000ha. # Cover data for unimproved neutral grassland are derived from recent Phase 2 survey and are therefore a minimum estimate.

Emphasis was placed on producing constant habitat interpretation and mapping resolution throughout Wales; this was ensured by frequent group meetings and training sessions. An analysis of the repeatability of the survey has been carried out (Stevens *et al.* 2004). This revealed an 83% correspondence between initial surveyor and a subsequent assessor in habitat allocation.

Master maps were produced by hand-colouring OS 1:10,000-scale map sheets (Figure 1). The habitat composition of each 1km square was measured and entered into a database.

## Results

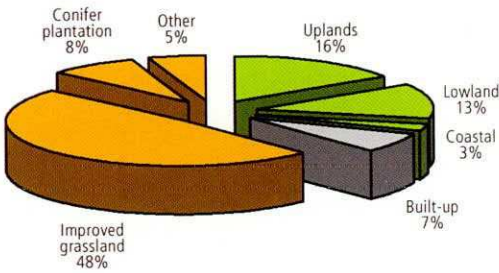
Table 1 presents a summary of habitat-area data for the whole of Wales for the main Phase 1 habitat categories (some minor or more modified types have been omitted or combined for clarity).

The preponderance of improved grassland is striking, covering over 1 million ha, or about 48% of the land surface of Wales. Much of the semi-natural habitat, which covers only 29% of the total area, occurs in the uplands or along the coast (Figure 2). The real value of the dataset, however, becomes clear when a more detailed view is taken.

If we examine the results for lowland wet heathland, it is clear from Figure 3 how scarce and fragmented the habitat is across Wales, remaining mostly in small patches, and particularly associated with west and south Wales. But even in these areas, well known for their heathy vegetation, much has been lost to improved grassland,



# The Habitat Survey of Wales



**Figure 2** Proportion of semi-natural (green) and modified (orange) habitat and built-up land (grey) in Wales. Data for semi-improved acid, neutral and calcareous grassland are included in the semi-natural class.

conifer plantation or scrub.

In contrast, many more areas of good wet grassland have been located in the lowlands than was expected (Figure 4), particularly in the south Wales coalfield, where poorly draining soils with

gradients of base enrichment and low-intensity management by many part-time farmers have resulted in some large areas of high-quality marshy grassland. These grasslands are under threat from light industrial or office development, as well as from agricultural improvement.

The availability of this information on the distribution and relative abundance of habitats makes this dataset a vital tool for conservation purposes in Wales (Jones *et al.* 2003).

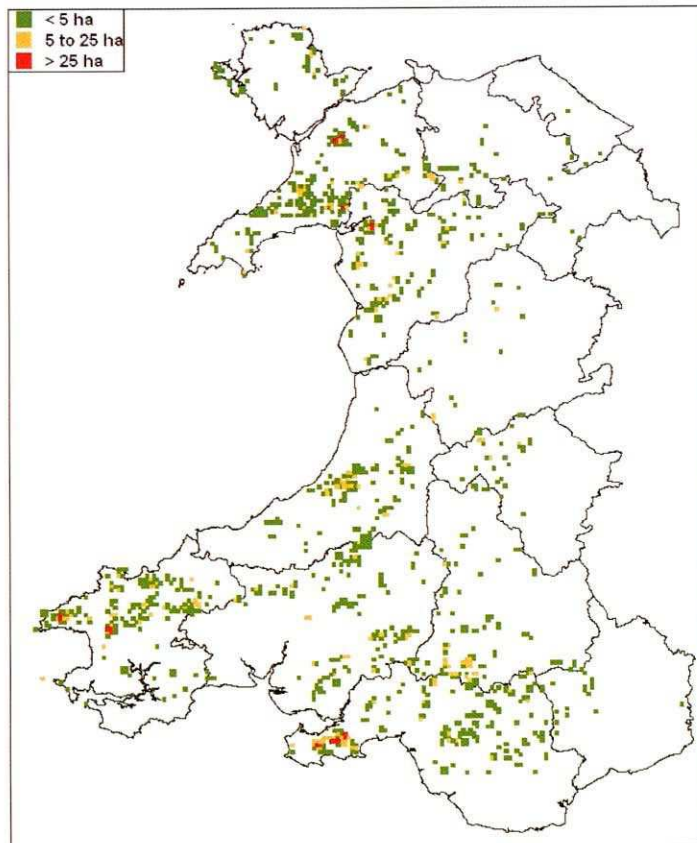
## Uses of HSW maps

### Historical comparisons

Once we had obtained a complete picture of the habitat cover of Wales during the 1980s and 1990s, one obvious question that followed was that of how this information compares with that on past land use. The possibilities for comparison across the whole of the country are few and often obfuscated by the incompatibility of habitat-classification systems used. The 1st Land Utilisation Survey, in the 1930s (Stamp 1962), provided maps at 1:10,560 scale of land-use types, but these do not fit neatly into habitat-cover types, with, for example, most semi-natural land falling into a 'rough grazings' category. Summary data from the Vegetation Survey of Wales, co-ordinated by Taylor (1969, 1980), are expressed as the cover of dominant species and again do not match those of the Phase 1 scheme.

Similarly, habitat-cover data for local landscapes rather than at the site level are very hard to find. However, one remarkable dataset has emerged. A three-year MSc project by John Rees of Bangor University (Rees 1928), in the early 1920s, set out to produce a habitat classification and to map the western half of the Llyn Peninsula. He cycled the lanes, recording floristic samples of semi-natural vegetation, and produced a habitat classification that we

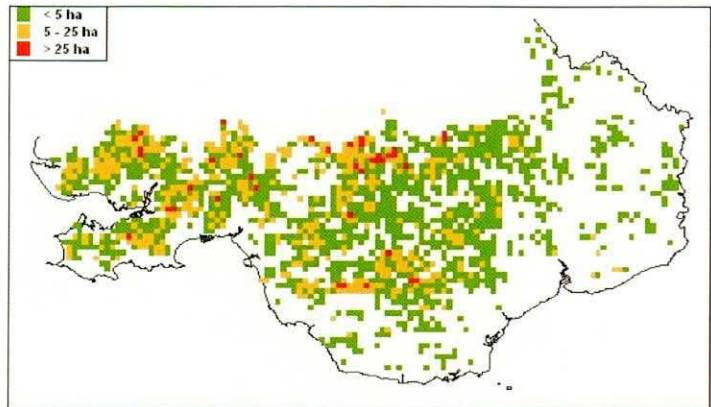
**Figure 3** Distribution of 1km squares with lowland wet heath in Wales. This map is reproduced from Ordnance Survey material with the permission of Ordnance Survey on behalf of the Controller of Her Majesty's Stationery Office © Crown copyright. Unauthorised reproduction infringes Crown copyright and may lead to prosecution or civil proceedings. Countryside Council for Wales, 100018813 (2005).



have translated into Phase 1 types. His hand-coloured maps at 1:10,560 scale are, in themselves, a remarkable archive and, when combined with his 'penny notebook' quadrat records, give a real flavour of the vegetation in Lleyn at the time. Blackstock *et al.* (1995) compared the 1920s data directly with the Phase 1 habitat maps and revealed profound, although partially expected, declines in many habitats, especially lowland wet heath (Figure 5). Some habitats had expanded, e.g. acid grassland, mostly at the expense of heath, and plantation woodland had increased twofold. Not only was total wildlife-habitat cover reduced, but the average patch size of many habitats also suffered a substantial decline (Figure 6). An interesting footnote feature of the Rees dataset was that it revealed many fields planted with Gorse *Ulex europaeus*, which was mostly ground and used for fodder; such gorse fields had disappeared by the late 1990s.

### Planning and landscape

The HSW maps are much used by Countryside Council for Wales and Local Planning Authorities for assessing the potential impacts on wildlife habitats of planning issues, such as the positioning of building developments and the effects of quarrying operations and drainage works. Proposals covered by planning procedures can be considered in the light of both the immediate habitat impact and the effect on the total overall resource in a particular area, or in the whole of Wales. Alternative solutions can be easily tested against habitat loss and damage, and places suitable for different types of mitigation can be located in a



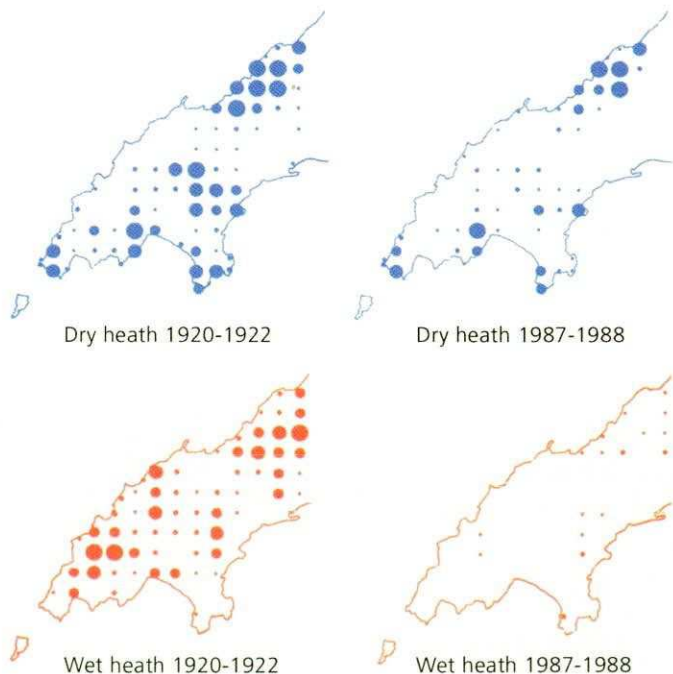
**Figure 4** Distribution of 1km squares with lowland marshy grassland in the old counties of Gwent and Glamorgan, and the Borough of Llanelli, in south Wales.

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sensitive manner. The incorporation and evaluation of biodiversity information into Unitary District Plans and Local Plans is made much easier by the availability of comprehensive habitat data. The 2003 Environmental Impact Assessment

**Figure 5** Changes in distribution and abundance of wet and dry heath in Lleyn. Dot size is proportionate to the amount in each tetrad. Based on Blackstock *et al.* 1995.

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**Figure 6** Comparison of Rees map (left) and digitised HSW map (right). The Rees map (1928 Bangor University) shows areas of wet heath (dark blue/black) and bog (brown) that have been lost completely or transformed into marshy grassland on the HSW map (1987-88). The area of woodland in the centre remains much the same and habitat on higher ground has generally survived. There are signs of pasture improvement and conifer-planting in the ffridd zone.

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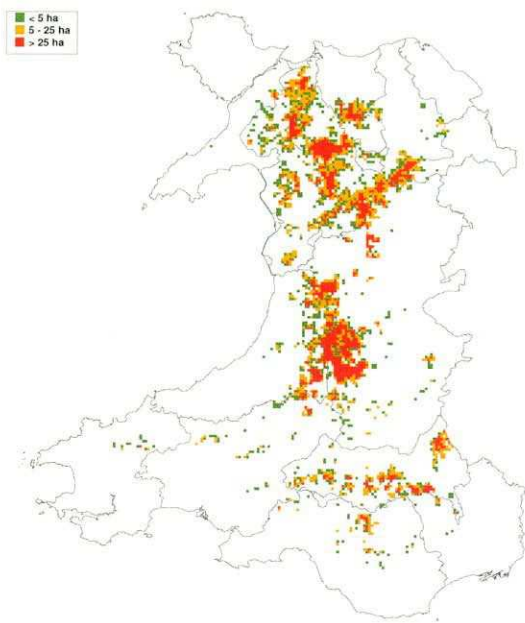
Regulations require assessment of the impact of proposed agricultural intensification projects on semi-natural habitats. Applications are screened by the Welsh Assembly Government against the HSW maps, as well as other criteria, including protected sites and species.

#### Blanket bog in Snowdonia. David Woodfall/Woodfall Wild Images



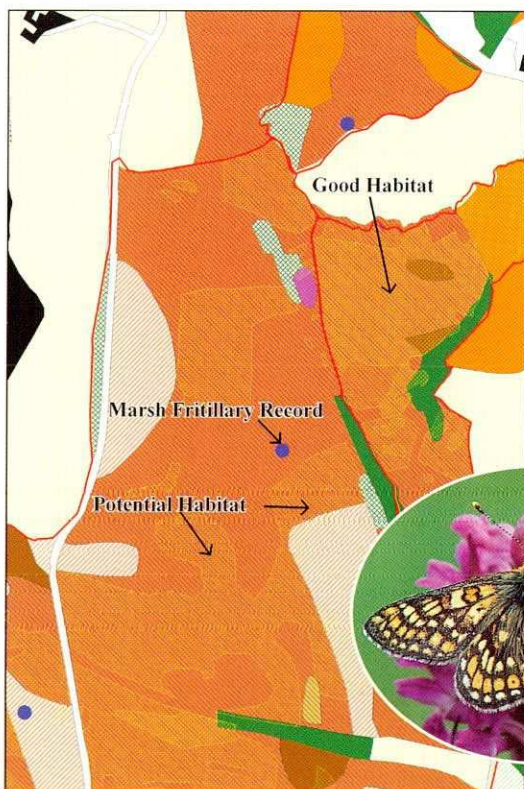
The recent development of *LANDMAP*, a GIS-based system for the storage of various layers that make up the landscape (aspects), has seen the collation and reinterpretation of data on geology, landform, historical associations and visual assessments. *LANDMAP* (Countryside Council for Wales 2001) is being adopted by each local authority across Wales and uses the HSW habitat data extensively for the biodiversity aspect. The ability to consider all the important influences on landscape in a coherent fashion and to take account of the associated management requirements, threats and constraints is an important step forward in local planning in Wales. The habitat classification can be simplified or examined in more detail within *LANDMAP* depending on the scale of the target area,





**Figure 7** Distribution of 1km squares with blanket bog.

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### Species conservation

Examination of species' relationships with habitat type, patch size, distribution and condition is a common feature of conservation studies, especially in response to Species Action Plans (SAPs), and many previous papers in this journal reflect this trend. Autecological work on the Marsh Fritillary *Eurodryas aurinus* has characterised its metapopulation behaviour in the landscape and highlighted the need to provide suitably managed habitat not only of sufficient quantity, but also in

**Figure 8** The baseline HSW map has been overlaid with a later assessment of habitat suitability for Marsh Fritillaries (inset).

This shows the potential habitat area available for this metapopulation of butterflies and can be used to target management advice and funding. (Based on Woodman & Fowles 2002)

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the right places. Research undertaken in Wales has used HSW data to locate areas of potentially suitable wet-pasture habitat for Marsh Fritillaries close to known breeding sites, with the aim of targeting appropriate management regimes to enable small colonies to survive and to expand across the landscape (Woodman & Fowles 2002). Figure 8 shows the Phase 1 habitats on Llantrisant Common, Rhondda-Cynan-Taff. Stands of potentially good Marsh Fritillary habitat and those areas that are currently under appropriate management have been demarcated from the rest of the marshy grassland present. The historical records of Marsh Fritillary butterflies or larval webs do not necessarily coincide with these habitat patches, showing the mobile nature of Marsh Fritillary colonies in the landscape.

### Open-access maps

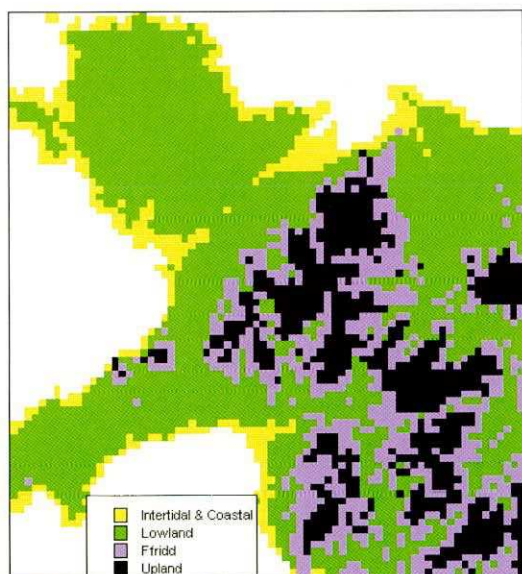
The Countryside and Rights of Way Act 2000 made provision for the right of public access to 'open country', defined as 'predominantly mountain, moor, heath and down', in addition to common land. In Wales, we had the advantage of fully comprehensive vegetation maps from the HSW to locate the habitats contained within this definition. In order to apply the definition in a consistent and rigorous manner, and to produce a set of consultation maps for Wales, it was decided

to digitise the HSW maps. This process has been completed and also allows us to carry out more complex spatial analysis of the dataset. The open-country maps for a particular area can be produced quickly and accurately according to the habitats recorded at the time. These are being checked to take account of subsequent habitat changes and to rationalise open-country boundaries to identifiable features on the ground. Consultation maps are now being produced for examination and comment by landowners and interested parties, and it is expected that open-access maps will be produced for the whole of Wales by May 2005.

### Habitat zonation

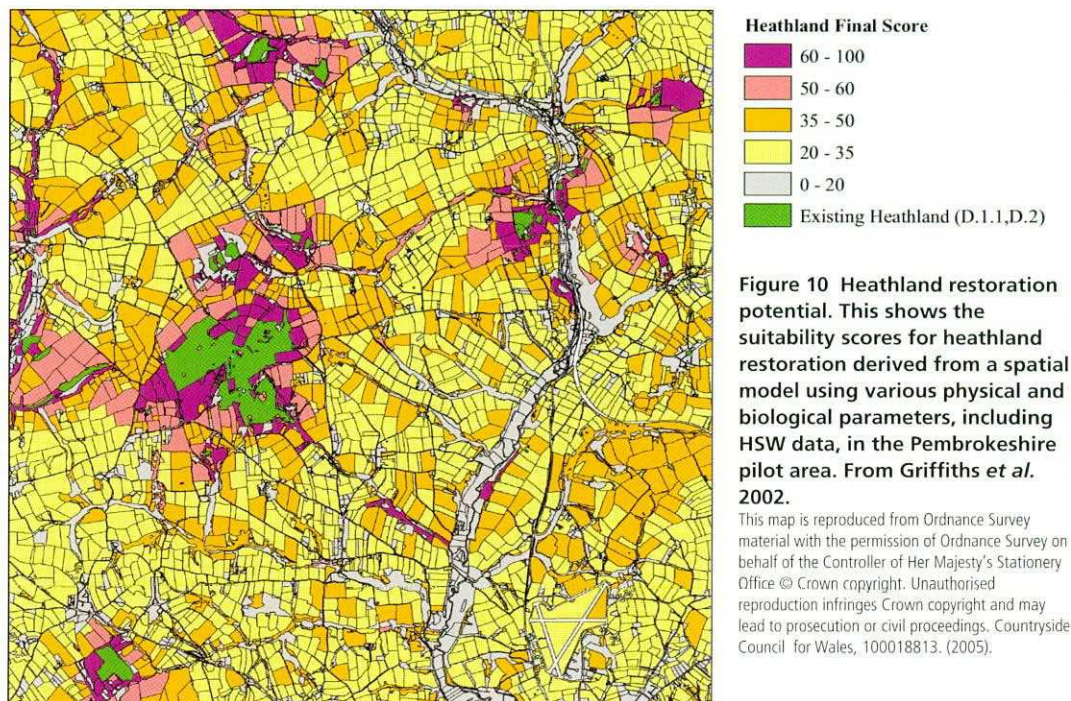
In addition to these very practical uses of the HSW data, we are currently undertaking primary analysis of 1km-square and digital datasets. For example, TWINSPAN classification of part of the 1km-square dataset has been used to produce end groups that show differences between the habitats found in zones running from the coast to the upland moorlands. A case study in north-west Wales is shown in Figure 9. Of particular interest are those squares lying in the 'ffridd' zone. This is the transition between lowland and upland where complex mixtures of heath, grass and mire with some woodland, scrub and Bracken *Pteridium*

**Figure 9** This map represents the TWINSPAN end-groups derived from an analysis of the 1km-square HSW data for north-west Wales. The ffridd zone stands out very clearly. The Merlin (below) is a typical predator of the ffridd zone.



Mike Powles/Natural Image





**Figure 10** Heathland restoration potential. This shows the suitability scores for heathland restoration derived from a spatial model using various physical and biological parameters, including HSW data, in the Pembrokeshire pilot area. From Griffiths *et al.* 2002.

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*aquilinum* support a diverse range of bird species. A number of these are birds of conservation concern, such as Tree Pipit *Anthus trivialis*, Common Redstart *Phoenicurus phoenicurus* and Twite *Carduelis flavirostris*; others are of special ecological significance, such as Meadow Pipit *Anthus pratensis*, a favourite food item of the upland-nesting Merlin *Falco columbarius*. Conservation in this no-man's land has been somewhat neglected as regards special site designations, which have tended to concentrate on the large upland blocks and scattered habitats in the lowlands. We hope that by characterising the types of ffridd found across Wales its conservation profile will be raised. This zone is also particularly suitable for inclusion in agri-environment schemes such as Tir Gofal, where land management can improve its value for wildlife and sustain this unusual mix of habitats, but it is also likely to include sites eligible for special recognition.

### Habitat reconstruction and landscape-scale projects

Continuing on the more experimental side of using HSW data, the digital maps have been used to begin to develop our thinking on the reconstruction and restoration of habitats in Wales. Where is the best place to locate the heathland

patch for which you have obtained Heritage Lottery Funding? Where do we want woodland expansion in preference to grassland restoration?

A project by the University of Reading and Wye College, commissioned by CCW, has initially examined the possibilities of constructing models that use the HSW habitat data alongside physical parameters, including soils, landform and distance to other habitats, such as heathland (Figure 10), in order to produce a possible template for restoration and expansion of several key habitats in two study areas based in Pembrokeshire and Mid Glamorgan (Griffiths *et al.* 2002). The benefits of such a programme could be enormous and a much more extensive outlook to this project is being developed. LBAP groups obtaining funding for habitat work can seek to make the best use of their funds by maximising the possible success of habitat restoration, and avoiding habitat re-creation in inappropriate places.

### Monitoring habitat change

The HSW data provide a base-line 'ground-truth' position against which to measure future habitat change. The development and gradual improvement of satellite and other remote-sensing methods for habitat recognition has been demonstrated by the Land Cover Map (Fuller *et al.* 2002). This





**A mosaic of habitats in the Brecon Beacons National Park.**

David Woodfall/Woodfall Wild Images

seems to offer the most cost-effective solution to carrying out repeat survey of large areas of land in order to provide updates on habitat cover and the impacts of changing countryside policies in the future. This project has provided CCW with invaluable information about the distribution and abundance of semi-natural habitats in Wales. We hope that others will also be able to use it, including other conservation organisations, schools and universities (please see details below), in order to better understand and enjoy our countryside.

## How to obtain a copy of the Habitat Survey of Wales data

CD Rom copies of the HSW digital data are available free of charge to those interested in using the information. Some of the data have already been sent to the National Biodiversity Network (NBN) Wales test site, where it can be viewed ([www.nbn.org.uk](http://www.nbn.org.uk)). Those wishing to obtain a copy of the data should contact J Rothwell ([Jonathan.Rothwell@ccw.gov.uk](mailto:Jonathan.Rothwell@ccw.gov.uk)).

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We thank the many Phase 1 and Upland Surveyors and administrative support staff who worked diligently for NCC and CCW on this project. We are grateful to our colleagues Adrian Fowles, for the Marsh Fritillary data, Jonathan Rothwell, for help with figures, and David Stevens, for comments on the text. We also owe a special debt of gratitude to the many landowners of Wales who freely gave access permission and their time to our surveyors.

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