CONTRACT WWB/02/07

NATURAL CAPITAL AUDIT

2: CARMARTHENSHIRE

Collation of summarised information on biodiversity and the wider environment to assist the farming community of this region in diversification of interests. This report is a synthesis of available information on all aspects of natural and cultural heritage.

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by

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TABLE OF CONTENTS

1. IMPORTANT HABITATS WITHIN CARMARTHENSHIRE

Carmarthenshire has a rich variety of habitats. These habitats range from the coastal lowlands of Carmarthen Bay to the more rugged upland areas of the north east of the county. The habitats detailed below are those which have been afforded priority status within the UK Biodiversity Action Plan. Some habitats may not have a priority status on a national level, however, they have been considered important within Carmarthenshire itself. Threats to the various habitats as well as possible opportunities are included.

The section that follows is an inventory of the type, extent and condition of semi-natural habitats that occur across Carmarthenshire. Semi-natural habitats are defined here as a habitat which has been modified to a limited extent by man and those areas of a farm that are non-productive, i.e. areas with no intentional inputs of pesticides or nutrients and remaining effectively undisturbed. These habitats offer important diversification opportunities to farmers based on natural assets because they act as qualifiers for the Tir Gofal agri-environment scheme. Farmers need to know what rare habitats may occur on their land.

The following table and map presents information on the extent and frequency of patches of habitats disaggregated for Carmarthenshire as classified by the Countryside Council for Wales in the Phase 1 dataset. Habitat fragmentation is a major problem for conservation now and the last column presents mean patch size and is indicative of fragmentation. Important and priority habitats are highlighted.

		Code	Area (ha)	%	Count	Mean
WOODLAND AND SCRUB	semi-natural broadleaved woodland	A.1.1.1	13268	5	9166	1.45
	planted broadleaved woodland	A.1.1.2	348	0	299	1.16
	planted coniferous woodland	A.1.2.2	21494	8	1356	15.85
	semi-natural mixed woodland	A.1.3.1	1	0	2	0.60
	planted mixed woodland	A.1.3.2	988	0	287	3.44
	dense scrub	A.2.1	2053	1	3903	0.53
	felled broadleaved woodland	A.4.1	22	0	44	0.51
	felled coniferous woodland	A.4.2	826	0	184	4.49
	felled mixed woodland	A.4.3	0	0	1	0.39
GRASSLAND AND MARSH	unimproved acid grassland	B.1.1	14689	6	597	24.61
	semi-improved acid grassland	B.1.2	2017	1	1064	1.90
	semi-improved neutral grassland	B.2.2	7087	3	5705	1.24
	unimproved calcareous grassland	B.3.1	147	0	18	8.19
	semi-improved calcareous grassland	B.3.2	16	0	12	1.37
	improved grassland	B.4	145259	57	6509	22.32
	marshy grassland	B.5	8009	3	5550	1.44
	marshy grassland Juncus dominated	B.5.1	10	0	4	2.62
	marshy grassland Molinia dominated	B.5.2	2762	1	55	50.22
TALL HERB AND FERN	bracken	C.1.1	4283	2	4105	1.04
	tall ruderal herb	C.3.1	104	0	390	0.27
HEATHLANDS	dry acid heath	D.1.1	3086	1	224	13.78
	wet heath	D.2	1288	1	197	6.54
	dry heath/acid grassland mosaic	D.5	1857	1	151	12.30
	wet heath/acid grassland mosaic	D.6	365	0	41	8.91
MIRE	blanket bog	E.1.6.1	209	0	47	4.44
	raised bog	E.1.6.2	25	0	4	6.27
	wet modified bog	E.1.7	207	0	60	3.45
	dry modified bog	E.1.8	132	0	12	11.03
	acid/neutral flush	E.2.1	721	0	655	1.10
	basic flush	E.2.2	48	0	8	6.05
	fen	E.3	39	0	10	3.90
	valley mire	E.3.1	74	0	21	3.51
	modified valley mire	E.3.1.1	22	0	3	7.45
	basin mire	E.3.2	23	0	12	1.88
	modified basin mire	E.3.2.1	6	0	4	1.44

	flood-plain mire	E.3.3	1	0	1	1.04
SWAMP, INUNDATION						
	swamp	F.1	191	0	306	0.62
	inundation vegetation	F.2.2	5	0	29	0.17
OPEN WATER						
	standing water	G.1	501	0	705	0.71
	running water	G.2	803	0	345	2.33
COASTLAND						
	intertidal mud/sand	H.1.1	5207	2	68	76.58
	intertidal cobbles/shingle	H.1.2	133	0	36	3.68
	intertidal rocks/boulders	H.1.3	1	0	7	0.21
	salt marsh	H.2.6	1244	0	87	14.30
	mud/sand above mhw	H.3.1	216	0	79	2.73
	shingle/gravel above mhw	H.3.2	27	0	17	1.57
	rocks/boulders above mhw	H.4	0	0	1	0.11
	dune slack	H.6.4	147	0	80	1.83
	dune grassland	H.6.5	88	0	27	3.28
	dune scrub	H.6.7	156	0	109	1.43
	open dune	H.6.8	764	0	32	23.89
	hard cliff	H.8.1	16	0	8	1.94
	soft cliff	H.8.2	7	0	5	1.46
	coastal grassland	H.8.4	35	0	4	8.84
ROCK EXPOSURE & WASTE						
	inland cliff	I.1.1	75	0	1	75.47
	acid/neutral inland cliff	I.1.1.1	4	0	7	0.63
	scree	I.1.2	11	0	2	5.29
	acid/neutral scree	I.1.2.1	10	0	9	1.10
	basic scree	I.1.2.2	1	0	2	0.52
	other rock exposure	I.1.4	45	0	15	2.99
	acid/neutral rock	I.1.4.1	31	0	161	0.19
	basic rock	I.1.4.2	0	0	1	0.43
	quarry	I.2.1	232	0	103	2.25
	spoil	I.2.2	442	0	73	6.05
	mine	I.2.3	608	0	25	24.30
	refuse-tip	I.2.4	37	0	29	1.27
MISCELLANEOUS						
	arable	J.1.1	2102	1	607	3.46
	amenity grassland	J.1.2	734	0	445	1.65
	ephemeral/short perennial	J.1.3	144	0	84	1.72
	introduced scrub	J.1.4	1	0	2	0.48
	gardens	J.1.5	339	0	1250	0.27
	caravan site	J.3.4	85	0	57	1.49
	sea-wall	J.3.5	0	0	1	0.23
	buildings	J.3.6	6284	2	10036	0.63
	track (not comprehensively digitised)	J.3.7	324	0	942	0.34
	bare ground	J.4	123	0	338	0.36

	not accessed land	NA	2110	1	1522	1.39
	habitat code illedgible on the original veget	?	42	0	2	20.7 7
TOTAL			254815	100	58360	4.37

Ancient and/ or Species Rich Hedgerows

Ancient hedgerows are defined as those which have been in existence since at least 1845. They are generally considered to predate the Enclosure Acts. Species rich hedgerows are field boundaries composed of five or more native woody shrubs in a 30m sample in the lowlands and four species in the uplands. These hedgerows are frequently situated on banks which are rich in herbaceous plants. Hedgerows can be extremely important habitats for butterflies, moths, small mammals and birds.

Carmarthenshire has a vast network of ancient and species rich hedgerows, largely as a result of past and present agricultural practices. The actual length and number of hedgerows within the county is unknown. Survey suggests that approximately 70% of the hedgerows in Carmarthenshire can be described as ancient or species rich, or both. This is probably one of the highest densities of this habitat within Wales.

The unregulated removal of hedgerows for agricultural purposes is a considerable threat to this habitat as well as the removal for development and road building. The lack of appropriate management is also a factor that contributes to the loss or damage of this habitat.

Ffridd

Ffridd is composed of a mosaic of semi-natural habitats. Bracken (*Pteridium aquilinum*) typically dominates ffridd but the habitat may also include wet and dry heath, acid grassland, marshy grassland, scrub and woodland. Although usually occurring on the area of land between enclosed farmland and the open hill, ffridd can also be found within enclosed fields where these have been abandoned.

Ffridd is an important habitat for a number of different species, most notably the fritillary butterflies. Assemblages of important breeding bird species, such as yellowhammer (*Emberiza citrinella*) and stone chat (*Saxicola torquata*) make use of the ffridd habitat. Large populations of small mammals inhabit ffridd and these in turn provide food for birds of prey.

Within Carmarthenshire, ffridd is located within the north east of the county along the upland fringes.

A number of different factors may affect ffridd. These can include agricultural intensification; scrub encroachment due to under grazing; burning mismanagement and afforestation.

Heathland

Heathland is made up of at least 25% heather. Upland heathland, or moorland, occurs on poorer soils in upland areas (above 300m – shown as a red line on the habitat map). Along with other habitats, heathland often forms a mosaic. These other habitats can include blanket bog, grassland, bracken, scree and woodland. Dry heath is composed of moor heather (*Culluna vulagris*), bell heather (*Erica cinerea*), bilberry (*Vaccinium myrtillus*), crowberry (*Empetrum nigrum*) and western gorse (*Ulex gallii*). Wet heath is dominated by mixtures of heather, cross-leaved heath (*Erica tetralix*), purple moor-grass (*Molinia caerulea*), deer grass (*Scirpus cespitosus*) and carpets of moss. All these species need open conditions to do well.

Lowland heathland occurs on nutrient poor soils below the upper limits of agricultural enclosure and is generally found below 300m. Lowland heathland is often associated with acid or damp grassland. This habitat is characterised by the following plant species: heather; bell heather; cross-leaved heath and western gorse.

Within Carmarthenshire, much of the upland heathland is concentrated on Mynydd Mallaen. Mynydd Llanllwni (north of Brecfa) is also an important area. Lowland heathland is less common in the county and is mostly wet heath that is associated with marshy grassland. Good examples of lowland heathland occur at Cernydd Carmel and Mynydd Llangyndeyrn.

Heathlands are threatened by a number of different factors. These factors include: overgrazing, especially by sheep; inappropriate burning of upland heaths; agricultural improvement; loss to development and afforestation.

Coastal and Floodplain Grazing Marsh

Coastal and floodplain grazing marsh is typically found on low-lying coastal land or along flat river floodplains. This type of habitat is defined as periodically inundated pasture of meadow which is drained by a network of ditches to maintain water levels. Most grazing marshes consist of grassland that is either cut for hay or silage or is managed as pasture. Although stands of semi-natural grassland may occasionally occur, often the land is agriculturally improved.

The associated ditch systems are often of importance for various species of plants, invertebrates and mammals (e.g. water voles). Grazing marshes can also be important breeding wintering sites for birds.

Within Carmarthenshire, the most important coastal grazing marshes occur in the lower Gwendraeth and Pendine areas. These sites are relatively intact and as such retain significant wildlife interest. The Llanelli coast once supported extensive areas of grazing marsh. However, this has now become degraded as a result of urban and industrial

development. Floodplain grazing marsh occurs along the main river valleys with the River Tywi supporting the most extensive area.

This habitat is threatened by a number of different factors. These include agricultural intensification (habitat loss and eutrophication), excessive drainage and development.

Coastal Saltmarshes

Coastal saltmarshes make up the upper, vegetated parts of intertidal mudflats. Saltmarshes require a net accumulation of sediment and shelter from strong wave action. Therefore they are very often found in sheltered estuarine environments. Plants that inhabit saltmarshes typically exhibit a zonation dependant on the level of salt tolerance. Amongst salt marshes, plant species diversity tends to be low. In Wales about 50 saltmarsh species are considered to be rare or scarce.

Saltmarshes provide important roosting sites for waders that are feeding on adjacent mudflats. A variety of bird species use the saltmarshes for breeding sites as well as feeding grounds during the winter. Saltmarshes can support a number of uncommon invertebrates.

Despite coastal saltmarshes being dynamic in nature they often provide an effective means of dissipating wave energy. Therefore they can play a significant role in coastal defences.

Within Carmarthenshire, saltmarsh vegetation covers an area of approximately 1288 ha. A high proportion of this area is on the Tywi, Taf and Gwendraeth estuaries. The remainder occurs on the Carmarthen side of the Burry Inlet.

Coastal saltmarshes are affected by a number of different factors. Heavy grazing can affect the structure and composition of saltmarsh vegetation, very often resulting in a short homogenous sward. Agricultural improvement in the form of eutrophication as a result from fertiliser run-off can lead to algal growth. Other factors affecting saltmarshes include erosion and accretion, land reclamation and the spread of invasive species.

Besides its rare status, saltmarsh can offer farmers another economic opportunity based on a natural habitat asset. ‘Saltmarsh lamb’ has a unique and highly sought after flavour and has been successfully marketed by West Wales farmers and butchers, especially to outlets in France. It offers an added benefit because sheep grazing on saltmarsh need lower dosages of dips and drenches for lower levels of parasites.

Coastal Sand Dunes

Coastal sand dunes develop as a result of a beach plain forming within the intertidal zone. The surface of this beach plain dries out between tides. This dry sand blows landward and is deposited above the high water mark. Here it will be trapped by specialist dune-building grasses before eventually being colonised by more stable plant communities.

Within Carmarthenshire, a significant proportion of the Wales sand dune resource is held with an area of 1153 ha. There are two significant dune systems within the county. These are located at Laugharne- Pendine Burrows and the Pembrey Coast. However, both of these sites are currently suffering from over-stabilisation due to a lack of grazing. This has led to a decline in habitat and species interest.

Factors that may affect sand dunes are as follows: erosion and accretion; grazing; recreation; sea defence and stabilisation affecting the natural dynamics; beach management; invasive species. There are worries that the dredging of sand offshore the Gower may be depleting the source of sand for beaches and dunes along the South Wales coastline.

Coastal Vegetated Shingle

Coastal vegetated shingle structures above the reach of wave action are rare. These habitats support specialised communities of plants and invertebrates. Typically the vegetation of shingle structures consists of pioneer species on the seaward side. These are able to withstand exposure to salt spray and a degree of erosion and burial. Moving further from the shore, more stable vegetation develops. This vegetation may include a range of grassland, lowland heath, moss and lichen communities. Shingle habitats support diverse invertebrate communities with some species being restricted to this habitat.

Carmarthenshire supports two coastal vegetated shingle structures. These are located at Penrhyngwyn to the south of Llanelli and at Morfa Bychan to the west of Pendine. The shingle structure at Penrhyngwyn is the remnant of a once much larger shingle spit. This remnant is of considerable interest for its vegetation and invertebrates. Several uncommon invertebrates have been recorded here. This site is one of only two in Wales that supports the specialist millipede (*Thalassisobates littoralis*). Morfa Bychan supports the presence of the sea stork's bill (*Erodium maritimum*) which is rare within Carmarthenshire.

There are a number of factors that may affect coastal vegetated shingle. These factors may include: sediment supply; natural mobility; exploitation; coastal defences and access and recreation.

Mudflats & Intertidal

Mudflats are sedimentary intertidal habitats which are created by the deposition of silts and clay in low energy environments. Mudflats are generally found in estuaries and are devoid of vegetation. Mudflats normally appear in the natural succession of habitats between subtidal channels and vegetated saltmarsh. Mudflats can play an important part in coastal defence due to the ability of dissipating wave action.

Large numbers of wintering wildfowl and waders use mudflats as feeding and resting areas. These feeding areas are important because the mudflats are characterised by a high organic matter content which in turn supports a high invertebrate biomass.

Within the Taf, Tywi, and Gwendraeth estuaries, as well as the Carmarthen side of the Burry Inlet are the major concentrations of mudflats within Carmarthenshire.

Mudflats can be affected by a number of different factors. These can include: rising sea levels, resulting in complete loss of the habitat; land reclamation; barrage schemes and discharge from agriculture, industry and urban areas resulting in the creation of abiotic areas or algal mats which may lead to a decrease in invertebrate communities.

This is a summary of the extent, frequency and patchiness of the intertidal lifeforms found along the Carmarthenshire coastline (from CCW: Phase 1 Intertidal Biotope Map).

Life Form	Frequency	Area (ha)	%	Mean patch size (ha)
Algal turf	140	10	0.1	0.07
Fucoids	378	49	0.6	0.13
Lichens & algae	205	23	0.3	0.11
Mud	217	487	6.2	2.25
Muddy sandy shore	173	1233	15.8	7.13
Mussel beds	69	113	1.5	1.64
Mussels & Barnacles	135	26	0.3	0.20
No Lifeform	7	28	0.4	4.03
Saltmarsh	168	1288	16.5	7.67
Sand	193	4505	57.7	23.34
Sea grass beds	5	1	0.0	0.22
Shingle, coarse sand, mixed sediments	101	38	0.5	0.37
Short faunal turf; crusts & cushions	4	0	0.0	0.00
Total	1795	7803	100.0	4.35

Roadside Verges

Verges often represent remnants of semi-natural habitats that have become increasingly rare within the agricultural landscape. There can be a large variety of vegetation communities amongst verges. Many verges are species-rich and support large assemblages of plant species. More recently constructed roads may have a more modified flora amongst the verges.

Within Carmarthenshire, there are more than 6000 km of roadside verge. Many of these verges are of significant wildlife interest.

There are a number of factors affecting this habitat. These are inappropriate cutting and use of herbicides and the invasion and spread of exotic species such as Japanese knotweed.

Lowland Meadows

Lowland meadows were once a familiar sight in the countryside. These habitats are typical of traditionally managed farmland and as a result are often rich in wildlife. Lowland meadows can include: livestock- grazed pastures; hay meadows; churchyards and on roadside verges. These habitats can contain a range of species and typically occur on soils that are nutritionally poor and which will not have been heavily fertilised or reseeded.

Within Carmarthenshire there are still good examples of these lowland flower-rich meadows. The south east of the county still holds lowland meadows due to this region having a history of being less intensively farmed as a result of its industrial past.

These habitats are threatened by agricultural intensification, lack of management which results in rank growth and scrub invasion and urban/ industrial development.

Purple-moor Grass and Rush Pasture

Purple moor grass and rush pastures are damp grasslands. This habitat occurs on poorly drained, usually acidic soils throughout the lowlands, as well as the upland fringes. The distribution of this habitat is characterised by areas of high rainfall. Purple moor grass and rush pastures can be teeming with wildlife and can include a number of different flowering plant species such as, whorled caraway (*Carum verticillatum*), meadow thistle (*Cirsium dissectum*), ragged robin (*Lychnis flos-cuculi*), devil's-bit scabious (*Succisa pratensis*) and orchids.

Carmarthenshire is one of the most important areas for rush pastures. Within the coalfield area of the county alone, 20% of the Welsh total for this habitat is found. This is a result of less intensive farming practices and therefore less 'improved' land.

This habitat is threatened by inappropriate or lack of management, agricultural intensification and residential or industrial development.

Fens

Fens are peat- based wetlands. These habitats receive water and nutrients from ground water and rainfall. Fens can be split broadly into two types: topogenous and silogenous. Topogenous fens include basin and floodplain fens where the water movement is vertical. Silogenous fens include valley mires and flushes where the water moves in a more lateral direction. There are also 'poor- fens' and 'rich- fens' depending on their chemical composition. Poor- fens have water moving through it that is derived from base- poor, acidic rocks such as granite or sandstone. These fens can be associated with the lowlands

although they tend to more often occur in the uplands. In contrast, rich- fens are fed by calcareous waters and mainly confined to lowland areas.

Fens support a diverse range of flora and fauna, including dragonflies and other invertebrates, with base- rich fens being especially species- rich.

There are a number of factors that may affect this habitat. These can include: agricultural intensification; eutrophication, particularly from agricultural sources; decline of management leading to scrub invasion and excessive water abstraction from underground aquifers which leads to a lowering of the water table.

Reedbeds

Reedbeds are wetlands that are dominated by the common reed. The water table is at or above ground level for much of the year. Reedbeds provide an important habitat for many birds, including a number of internationally rare species.

Within Carmarthenshire, locally important reedbeds occur around Wichett Pool at Laugharne- Pendine Burrows, at Ffrwd Fen near Pinged and at Llangennech overlooking the Loughor estuary.

There are a number of factors affecting reedbeds. These include: drainage; development and lack of adequate management resulting in scrub encroachment.

For opportunities to establish thatch production see page .

Blanket Bog

Blanket bog is a globally rare habitat. Approximately 10- 15% occurs within Britain and Ireland. Bog mosses (*Sphagnum* species) are a prominent component of blanket bogs, as well as dwarf shrub species such as bilberry (*Vaccinium myrtillus*), crowberry (*Empetrum nigrum*), heather (*Calluna vulgaris*) and cross-leaved heath (*Erica tetralix*). Blanket bogs support a rich variety of invertebrate fauna.

Much of the blanket bog is concentrated within the upland areas of north Carmarthenshire. A large proportion is modified and no longer peat forming. Surveys estimate that the total resource covers an area of 816 ha. This includes 110 ha of intact blanket bog, 644 ha of wet modified bog and 62 ha of dry modified bog.

There are a number of factors affecting blanket bogs. These factors include: agricultural intensification; afforestation, leading to the drying out of the bogs; peat extraction; recreational pressure; development and in some areas it is thought that the commercial collection of mosses is a significant threat.

Lowland Raised Bogs

Lowland raised bogs are a rare component of the Welsh peat resource. This habitat forms in lowland areas on waterlogged ground. Lowland raised bogs are an important habitat as they support a number of specialised species, such as peat forming bog mosses (*Sphagnum spp.*), cross-leaved heath (*Erica tetralix*), heather (*Calluna vulgaris*) and cotton grasses (*Eriophorum angustifolium*). Featuring within a raised bog surface is very often a mosaic of pools, hummocks and *Sphagnum* lawns. A number of uncommon invertebrates are associated with raised bogs.

Carmarthenshire is an important area for this habitat as the county contains three relatively intact sites. A particularly good site can be found at Cors Goch, Llanllwch. Smaller areas of this habitat occur near Carmel and at Beacon Bog, near Carmarthen.

Factors affecting the stability of lowland raised bogs include drainage, peat abstraction, afforestation and scrub encroachment which will lead to the drying out of the bog surface.

Rivers and Streams

Carmarthenshire has an intricate network of rivers and streams. This network ranges from narrow, deeply incised upland streams to the gentler lowland meandering sections of the River Tywi. This network of watercourses acts as a corridor for wildlife movement throughout the county. A diverse range of flora and fauna is supported by the mosaic of habitat features found within a river or system. Rivers can provide wildlife corridors between fragmented habitats in intensively farmed areas.

The main rivers within Carmarthenshire flow from the north-east towards the coastal lowlands in the south-west. The Tywi river starts on the southern edge of the Cambrian Mountains and flows diagonally across Carmarthenshire to the sea south of Carmarthen. The Tywi is recognised as the premier sea trout (*Salmo trutta*) river in England and Wales and thereby provides vital commercial income to the area. Over the last twenty years, the rivers of the coalfield area have made a recovery having spent years suffering from pollution.

The upland streams provide important sites for spawning and nursery areas for salmon and sea trout. In contrast, the coastal flats of Carmarthenshire hold the drainage ditches that are important for a range of wildlife. These man-made ditches are located in areas such as the Laugharne- Pendine area. The ditches south-east of Llanelli are a major stronghold for the water vole and as well as the ditches of the lower Gwendraeth and between Laugharne and Pendine, support an assemblage of floating water plants such as frogbit, pondweeds and various bankside emergents.

A long list of factors may affect rivers and streams. These factors can include: agricultural, industrial, road and urban pollution; acidification which may lead to knock-on effects to the food chain; habitat loss through culverting and infilling; damage to riverbanks from livestock trampling and game fishery management (stocking with non-native stock).

Woodland

About one-seventh of Carmarthenshire is covered by woodland and forest. 70% of the total area is made up of introduced conifers plantations. These plantations cover large areas of upland, some valley sides that once held native woodlands have been changed to plantations and they have also been planted on reclaimed industrial land. The remaining 30% is made up of native woodland. Many of these blocks are the remnants of the native broadleaved woodlands that once covered much of Wales. Tree species amongst these woodlands include, oak (*Quercus spp.*), beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), alder (*Alnus glutinosa*) and birch (*Betula spp.*).

Wet Woodland

Wet woodlands are found in river valleys and at the edges of ponds, lakes and bogs. They occur on poorly drained or seasonally wet soils. Wet woodland can range in size from a scattering of shrubby willow to dense stands of alder. These habitats frequently occur with other drier woodland habitats as well as with open ground habitats.

Whilst many wet woodlands have recently appeared, others have a long history of management. In other cases, open wetlands have developed into wet woodlands through natural succession as a result of active management being abandoned.

Carmarthenshire has a significant amount of wet woodland, although few large areas occur. The areas of wet woodland tend to be found mostly along streams or within larger blocks of woodland.

Wet woodlands are threatened by a number of different factors. These include: clearance or fragmentation due to a change in land use; deterioration due to overgrazing and poaching of the land; non-native species invading and drainage of water drying the woodland out.

Upland Mixed Ashwoods

Upland mixed ashwoods occur in areas of base rich soils. This habitat can support a rich invertebrate fauna and lichen flora and tend to occur on limestone. However, fragments of these woodlands can develop on more acidic poorly drained soils, where there is a flushing of nutrients. Although the name of this habitat implies that it is only found in the uplands, this is not the case as they can occur at lower altitudes.

Carmarthenshire is an important area for upland mixed ashwoods. It is estimated that the county contains between 1500 and 1900 hectares, or 10% of the Wales total. Although this habitat is dispersed throughout Carmarthenshire, the most important areas are located in the south of the county along the narrow strip of carboniferous limestone. Example areas include Carmel and Llandybie.

There are a number of different factors that threaten upland mixed ashwoods. These include: quarrying; overgrazing and the cessation of traditional woodland management practices which leads to the loss of structural diversity within the woodland.

Upland oakwoods

Upland oakwoods occur in areas of high rainfall on base-poor to acidic soils. Despite the name, this habitat is not restricted to the uplands. Within Wales it is the most common woodland type. Upland oakwoods are normally dominated by oak (sessile) (*Quercus petraea*) with downy birch (*Betula pubescens*) and varying amounts of ash (*Fraxinus excelsior*) and sycamore (*Acer pseudoplatanus*). The ground flora varies depending on the amount of grazing and underlying soils. In areas of richer soils bluebell (*Hyacinthoides non-scripta*), bramble (*Rubus fructicosus agg*) and ferns may be found. On more acidic soils, bilberry (*Vaccinium myrtillus*), heathers and mosses will dominate.

Within Carmarthenshire upland oak woodlands cover an area of approximately 6000-7000 hectares. This represents 15- 18% of the total for this habitat in Wales.

This habitat is affected by a number of different factors. These can include: overgrazing which may result in a loss of ground flora and a lack of regeneration; invasion by species such as rhododendron (*Rhododendron ponticum*); unsympathetic woodland management.

Lowland Wood-Pasture and Parkland

Lowland wood-pastures and parklands are the products of historic land management systems. These structures typically consist of large open-grown or high forest trees over a grassland sward. Often the trees are of veteran age. The long term continuity of dead-wood niches in lowland wood pastures and parkland has resulted in localised or rare invertebrates being dependent on this habitat. It is not just the habitat that results in lowland wood pastures and parkland being valued, but also for the historic, cultural and landscape interests.

Carmarthenshire holds one outstanding example of parkland, the Dinefwr Estate near Llandeilo. Due to its assemblages of invertebrates and lichens, it is thought to be of national importance. The smaller parklands of Gelli Aur and Middleton Estate are considered to be of county importance.

A number of different factors cause the loss or decline of lowland wood pasture and parkland. These factors can include: the loss of veteran trees due to old age or neglect; removal of decaying branches or whole trees, often for safety reasons; lack of appropriate new plantings and the loss of specialised dependent species as a result of the lack of continuity of dead- wood habitat.

2. IMPORTANT SPECIES WITHIN CARMARTHENSHIRE

Carmarthenshire has a rich diversity of flora and fauna. Several priority and protected species occur within the county's varied habitats and landscape. These species act as important indicators and reflect the status of the Carmarthenshire countryside; many occur on the Carmarthenshire Local Biodiversity Action Plan (LBAP) (*Appendix 5*). These represent important elements of our biodiversity that need (by law) to be safeguarded. We also mention in this section some species that may offer economic opportunities.

Mammals

Riparian mammals

Water voles (*Arvicola terrestris*) are locally distributed in Carmarthenshire. There are two known large populations, one at Llanelli levels and one at Laugharne/ Pendine marshes. They are also likely to occur around streams in the county's upland regions. Loss of habitat, pollution of waterways and predation by American mink are all thought to be factors effecting the distribution of this species.

Otter's (*Lutra lutra*) are distributed throughout the county and signs of their presence can be identified on most waterways in Carmarthenshire.

Terrestrial mammals

Dormice (*Muscardinus avellanarius*) mainly occur in mature deciduous woodland with a wide variety of tree and shrub species. They may also occur in mature hedgerows, reedbeds, heathland and scrub habitats. Hazel, honeysuckle, bramble and oak are particularly good food sources for these small mammals. In Carmarthenshire dormice can be found south or east of the Tywi with the main population being in the coalfield area. They are also known to occur in the Brechfa and Crychan forests and at a few locations between Llandeilo and Carmarthen. Most other mice, rat and vole species (*Muridae spp*) are common and widespread in Carmarthenshire as are most shrew species (*Soricidae spp*).

The red squirrel *(Sciurus vulgaris)*, fairly widespread in the woodlands of Carmarthenshire in the 1970s and 1980s, are now rare and locally distributed in the county. They are located in the Tywi forest around Llyn Brianne and Bryn Arau Duon, a private woodland, between Pumsaint and Rhandirmwyn. They may occur in Brechfa forest. The red squirrel is Britain's only native squirrel species. They live in all types of woodland habitats from pure broadleaf to pure conifer. The decline of the red squirrel is thought to be due to habitat loss and fragmentation, competition with grey squirrels and disease spread by grey squirrels. Grey squirrels (*Sciurus carolinensis*) are common in Carmarthenshire and widely distributed across the county.

Red squirrel

The distribution of the brown hare (*Lepus europaeus*) in Carmarthenshire is patchy. They are mainly found in the north and east of the county in the less populated, less intensively farmed areas but there are important populations on the coast at Pembrey and Pendine. Rabbits (*Oryctolagus cuniculus*) are common and widespread in Carmarthenshire.

The pine marten (*Martes martes*) is extremely rare in the UK, apart from Scotland. Prime habitats for pine martens seem to be well wooded areas with high densities of voles that are their principal prey. In Carmarthenshire a centre for distribution of pine martens has been identified by the Vincent Wildlife Trust in the vicinities of Golden Grove, Brechfa forest and Crychan forest. Other mustelids, the badger *(Meles meles)*, weasel (*Mustela erminea*), american mink (*Mustela vison*) and polecat (*Mustela putorius*) have a widespread distribution in the county but stoats (Mustela nivalis) are encountered less frequently.

Pine marten

The red fox (*Vulpes vulpes*), hedgehog (*Erinaceus europaeus*) and mole (*Talpa europaea*) are all widely distributed in Carmarthenshire.

There are no known breeding colonies of the greater horseshoe bat *(Rhinolophus ferrumequinum)* in Carmarthenshire. There are summer roosts in the Llansteffan area, around Pumsaint and Carmel woods. The lesser horseshoe bat *(Rhinolophus hipposideros)* is less common in the county, only occurring in the south west in the Llansteffan area. This may be the only breeding site for the lesser horseshoe bat in Carmarthenshire. Both the common pipistrelle *(Pipistrellus pipistrellus)* and soprano pipistrelle (*Pipistrellus pigmaeus)* are widespread throughout Carmarthenshire. Other species of bat recorded in the county are; Brandts's (*Myotis brandtii*), whiskered (*Myotis mystacinus*) long eared (*Plecotus auritus*), noctule (*Nyctalus noctula*), Daubentons (*Myotis daubentonii*) and natterer's (*Myotis nattereri*).

Several deer populations occur in Carmarthenshire, many have escaped from domestic herds and are now breeding successfully in the wild. Fallow deer (*Dama dama*) can be seen in the Llandeilo area, there is a herd of sika deer (*Cervus nippon*) at Pendine burrows, roe deer (*Capreolus cpareolus*) can be seen at Crychan and in the Llandovery area. Chinese munjac deer (*Muntiacus reevesi*) are occasionally seen in the county. Deer hunting offers lucrative economic opportunities for local farmers and often there is a need to control local populations. But a conflict situation exists in forests used for public recreational activities where deer shooting poses a health and safety risk.

Marine mammals

Grey seals (*Halichoerus grypus*) can be seen in Carmarthen Bay and estuaries and in the river Tywi. The harbour porpoise (*Phocoena phocoena*) is the most common cetacean in Carmarthenshire waters. Less common in Carmarthen Bay are the common dolphin (Delphinus delphis) and bottle-nosed dolphin (*Tursiops truncatus*).

Amphibians and Reptiles

The following amphibians occur in Carmarthenshire: the palmate newt (*Triturus helveticus*); smooth newt (*Triturus vulgaris*); common toad (*Bufo bufo*) and common frog (*Rana temporaria*). All can be found in and around most fresh water streams and pools in the county at spring time when they return to breed.

The following reptiles occur in Carmarthenshire: common lizard (*Zootoca vivipara*); slow worm (*Anguis fragilis*); grass snake (*Natrix natrix*) and adder (*Vipera berus*). All are widely distributed throughout the county.

Birds

The barn owl (*Tyto alba*), typically a farmland bird, has declined in numbers in recent decades. Small mammal abundance largely determines barn owl numbers in a region and small mammal numbers is determined by suitable habitat. There is estimated to be less than 50 barn owl pairs in Carmarthenshire distributed throughout the county. Farmers have a long history of encouraging owls by providing access to farm buildings through holes in roofs to make maximum use of their ecological services in rodent control. Artifical nestboxes may be sourced from the Hawk and Owl Trust to encourage these birds. Other owl species in the county include the little owl (*Athene noctua*), long-eared owl (*Asio otus*), short-eared owl (*Asio flammeus*) and tawny owl (*Strix aluco*).

The buzzard (*Buteo buteo*) is probably the most common breeding raptor in Carmarthenshire and occurs throughout the county. The goshawk (*Accipiter gentiles*) is a scarce breeding resident with a more localised distribution. In recent years goshawks have been recorded at Stradey Woods, the Cothi Valley, Rhandirmwyn and Llandovery areas. There are now between 640 and 800 pairs of red kite (*Milvus milvus*) in Wales. Once only found in the county's uplands they are moving south all the time and are now thought to be breeding around Llanelli. The number of breeding pairs in the county continues to increase each year.

Kestrels (*Falco tinnunculus*) are scarce resident breeders in Carmarthenshire with a localised distribution. Occurring in areas of rough pasture and heathland, in recent years they have been sighted around Penclacwydd, Rhandirmwyn and Rhydcymerau. The sparrowhawk (*Accipiter nisus*) is a more common breeding resident, utilising woodlands for breeding and it hunts in open country. Peregrine falcon (*Falco peregrinus*) numbers have increased in Carmarthenshire in recent years and they are found widely distributed along the coast.

Hen harriers (*Circus cyaneus*) are a regular winter visitor, most frequently recorded along the coast, they can also be found in areas in the county dominated by semi-natural vegetation like around Cynghordy and the Usk Reservoir. The marsh harrier (*Circus aeruginosus*) is a scarce visitor and is seen mostly in winter. Marsh harriers are mainly distributed in the south of the county around the wetland sites of Carmarthen Bay.

Ospreys (*Pandion haliaetus*) are found in a variety of freshwater, brackish and marine environments. The most important habitat requirement is the presence of ample supplies of medium-sized fish. Ospreys are scarce spring and autumn passage migrants to Carmarthenshire and are most likely to occur around estuaries, river valleys and reservoirs in the county.

Lapwing

Lapwing (*Vanellus vanellus*) numbers have declined dramatically in the last 20 years with the reduction in mixed farming practices and the increase in more intensive farming methods thought to be the main cause. Large wintering flocks of lapwing are found on the coastal marshes. Breeding birds once widespread in upland areas are now scarce and breeding now seems limited to nature reserves and Coed Bach near Kidwelly. Skylarks (*Alauda arvensis*) are locally distributed in Carmarthenshire, mainly in the south of the county. A resident species they utilise all types of open ground from sea level to uplands for breeding. They are also a passage migrant and winter visitor.

Tree sparrow

The tree sparrow (*Passer montanus*) is associated with hedgerows and small woodlands. Numbers have declined in recent years, this is thought to be due to changes in agricultural practices during this period. Carmarthenshire has one of the most important tree sparrow populations in Wales in the Tywi valley. Other populations occur at Pendine and in the south and east of the county. The yellow hammer (*Emberiza citronella*) is a breeding resident that is declining in numbers. Most frequently seen on dry bracken covered hillsides and arable land it has a patchy distribution and is seen more frequently in the south of the county.

European nightjar (*Camprimulgus europaeus*) is mainly associated with heathland, moorland and recently felled conifer plantations. It is a nocturnal bird that feeds at dusk and dawn, is extremely well camouflaged and is rarely seen during the day. The night jar is a summer visitor to Carmarthenshire and is locally distributed in the south of the county at Pembrey and in Brechfa and Crychan forests in the north east.

The common scoter (*Melanitta nigra*) is a duck that breeds on freshwater but spends most of the rest of the year on the sea. Approximately 25,000 common scoters spend the winter in Carmarthen Bay. The population peaks twice each year, moulting birds in late summer and wintering birds in late winter. The curlew (*Numenius arquata*) is now a rare breeding bird in Carmarthenshire. It is a passage migrant and common winter visitor to estuarine sites. The little ring plover (*Charadrius dubius*) is a breeding summer visitor to riverside

shingle on the Tywi, Cothi and Bran. It appears to be increasing in numbers and range in the county.

Large numbers of winter visiting golden plover (*Pluvialis apricaria*) can be seen around Laugharne and the coast of Carmarthenshire. Breeding in the county has dramatically declined but may still take place in the area of Carmarthenshire inside the Brecon Beacons National Park. Common snipe (*Gallinago gallinago*) are common winter visitors to coastal regions with breeding being locally distributed in the north east of the county. The woodcock (*Scolopax rusticola*) is a common winter visitor and breeds in the woodlands in the north east of the county. The red (*Lagopus lagopus*) and black grouse (*Tetrao tetrix*) are extremely rare in Carmarthenshire, however, breeding may occur in the Brecon Beacon National Park.

Species of auk *(Alcidae),* boobies and gannets *(Sulidae),* cormorants and shags *(Phalacrocoracidae),* gulls *(Laridae),* oystercatchers *(Haematopodidae),* petrels and shearwaters *(Procellariidae)* and Skuas *(Stercorariidae)* can be seen from the Carmarthenshire coastline at various times of the year.

Species from the following bird families occur in and around Carmarthenshire's inland waterways, wetlands, estuaries and mudflats. Bitterns and herons (*Ardeidae*), dippers (*Cinclidae*), divers (*Gaviidae*), grebes (*Podicipedidae*), ibises (*Threskiornithidae*), kingfishers (*Alcedinidae*), sandpipers and allies (Scolopacidae), stilts and avocets (*Recurvirostridae*), swans, ducks and geese (*Anatidae*).

Invertebrates

The marsh fritillary is a butterfly associated with damp tussocky grasslands. They have a widespread distribution throughout south Carmarthenshire and a more localised distribution in the north of the county. There is an important population at Mynydd Mawr near Cross Hands and they are commonly seen at Rhos Cefn Bryn and Caeau Ffos Fach nature reserves.

The Mynydd Mawr Project is a pioneering scheme working to ensure the survival of the marsh fritillary population in Carmarthenshire. It is a partnership between Countryside Council for Wales, Butterfly Conservation and local landowners. By entering into management agreements landowners are paid to lightly graze their land with ponies or cattle.

For more details on this project, visit the Carmarthenshire County Council website or contact:
Deborah Sazer
Mynydd Mawr Marsh Fritillary Officer
Butterfly Conservation Wales
0870 7706153

Carmarthenshire is a stronghold for the brown hairstreak butterfly. The distribution of this species is widespread across the middle of the county practically following the route of the A40. There are no records of the brown hairstreak in the south of the county but they are locally distributed in the North on the Ceredigion border in the Llandysul area and around Cilycwm.

The white letter hairstreak is a small butterfly which lives in the tops of elm trees throughout England and Wales. It breeds on various elm species, including Wych Elm (*Ulmus glabra*), English Elm (*U. procera*), and Small-leaved Elm (*U. minor*). It breeds where elms occur in sheltered hedgerows, mixed scrub, and the edges of woodland rides, and also on large, isolated elms. Under recorded in Carmarthenshire, it has a localised distribution. Recent records show a population in the Llandeilo area, older sightings have occurred in the south of the county with isolated occurrences near Brechfa, Cynwyl Elfed and Carmarthen.

As its name suggests the black bog ant (*Formica candida*) is associated with wet heaths and bogs. Its distribution is extremely localised in the UK. It is known to occur at one site in Carmarthenshire at Cors Goch, Llanllwch, a raised bog west of Carmarthen. Relatively little is known about the ecology and management requirements of this species.

The hornet robberfly (*Asilus crabroniformis*) has been recorded from only six locations in Carmarthenshire, although rare, it is also thought to be under recorded.

Fungi

The distribution of waxcap grassland fungi in Carmarthenshire is unknown. There are vast areas of the county that have not been surveyed by mycologists. Acid grassland habitats in the county are potentially good sites for waxcap fungi. The National Botanic Gardens have a good population and there is also a population at Carreg Cennen.

Plants

Far too many plant species occur in Carmarthenshire to mention here. Below is a brief account of the distribution of protected and LBAP species which occur in the county. Plants that are characteristic of specific habitats are referred to in the habitat section. Reference should be made to the *Carmarthenshire Rare Plant Register* (Pryce, 1999) which lists all rare and scarce plant species and where they are known to be present.

The fen orchid (*Liparis loeselii*) is a small green-flowered orchid of fens and dune systems. In Wales it typically occurs in damp dune hollows. Populations of this species in Carmarthenshire used to occur on the coast in the Laugharne - Pendine and Tywyn Burrows, however, it has not been seen at its last remaining site since 2002.

Dune gentian (*Gentianella uliginosa*) grows amongst short vegetation in dune slacks and other dune habitats. The species occurs locally at Laugharne- Pendine and Tywyn Burrows but numbers vary considerably from year to year.

The pennyroyal (*Mentha pulegium*) is associated with seasonally wet habitats, numbers of this plant have declined markedly in recent decades. It has only been recorded as a native plant in Carmarthenshire in 'goose-grazed pastures' at Brynamman in the 1940s but it occasionally occurs on shingle banks along the River Tywi and has been recorded sporadically on brownfield sites such as restored opencast land at Tumble and a development plateau near Llanelli.

The Deptford pink *(Dianthus armeria)* is a plant that is now nationally and locally rare having declined rapidly in the last 60 years. It is found at two sites in Carmarthenshire, in the Llanelli area.

Small flowered catchfly *(Silene gallica)* has also dramatically declined in recent decades probably due to modern agricultural practices. Traditionally thought of as an arable weed, in Carmarthenshire it is confined to just one site extending to only about $2m^2$ on a dock wall at Burry Port Harbour, where it is extremely vulnerable to unsympathetic management.

Rock sea lavender (*Limonium binernosum* agg.) grows almost exclusively on rocks and sea-cliffs and stone dock walls. It is fairly widespread along the coast of Carmarthenshire in suitable habitat but has been all but exterminated from its former dockland sites in the Llanelli area due to their recent redevelopment.

The black poplar (*Populus nigra*) is a tree associated with lowlands and flood plains. In Carmarthenshire the black poplar is an introduced species with a few mature trees remaining on the 'Llanelli Levels' although additional plantings (eg in Peoples Park, Llanelli) were undertaken in the 1950s. More recent plantings have also been carried out, mainly in the low lying coastal belt between Kidwelly and Bynea and at Pendine.

3. PROTECTED SITES WITHIN CARMARTHENSHIRE

International Designations

Ramsar Sites

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. Ramsar sites were originally intended to protect sites of importance especially as waterfowl habitat. However, the Convention has broadened its scope over the years to cover all aspects of wetland conservation and wise use, recognising wetlands as ecosystems that are extremely important for biodiversity conservation in general and for the well-being of human communities.

The Convention adopts a broad definition of wetland:

"*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres*". Wetlands "*may incorporate riparian and coastal zones adjacent to the wetlands, and islands or bodies of marine water deeper than six metres at low tide lying within the wetlands*".

All Ramsar sites in Wales are also Sites of Special Scientific Interest. This means that they have legal protection as well as management guidelines.

Within Carmarthenshire there is one Ramsar Site, Burry Inlet.

Reasons for designations as a Ramsar Site

Burry Inlet

Burry Inlet fulfilled two criterion to become a Ramsar Site. The first is that it supports a bird assemblage that is of international importance. During a winter peak count (2000), numbers of waterfowl were in the region of 41,655 individuals.

The second criterion that was met was the site having species/ populations occurring at levels of international importance. These species include: common redshank (*Tringa totanus*) representing 0.7% of the national population; northern pintail (*Anas acuta*) with 4.4%; Eurasian oystercatcher (*Haematopus ostralegus*) with 1.4%; red knot (*Calidris canuta*) with 1.2% of the national population.

Biosphere

None within Carmarthenshire

Special Protection Areas

Special Protection Areas (SPAs) are strictly protected sites which have been classified in accordance with the EC Directive on the conservation of wild birds, also known as the Birds Directive which came into force in April 1979. They are classified for rare and vulnerable birds (listed in Annexe 1 of the Birds Directive) and for regularly occurring migratory species. Areas designated are deemed most suitable for these species. These sites automatically become part of the Natura 2000 Network.

Within Carmarthenshire, there are three SPAs. These are:

- Burry Inlet
- Carmarthen Bay (this is an entirely marine SPA)
- Elenydd - Mallean

Reasons for designation as a Special Protection Area

Burry Inlet

During the over-wintering season, this site supports at least 1.5% or, 13,590 individuals, of the Europe and Northern/ Western Africa population of oyster catchers (*Haematopus ostralegus*). Burry Inlet also supports at least 3% or, 1,772 individuals, of the wintering North Western Europe population of pintails (*Anus acuta*). This site qualifies as an SPA due to these two species being migratory species of European importance. A second reason for the site qualifying is that it is a wetland of international importance and regularly supports 20,000 waterfowl. This assemblage is made up of wading species that include curlew (*Numenius arquata*), dunlin (*Calidris alpine*), grey plover (*Pluvialis squatarola*) and ducks that include wigeon (*Anas Penelope*), shelduck (*Tadorna tadorna*) and shoveler (*Anas clypeata*).

Carmarthen Bay

Carmarthen Bay is the only entirely marine SPA that has been designated in British waters. This site was classified for its non-breeding aggregations of common scoters (*Melanitta nigra*).

Elenydd Mallean

During the breeding season, Elenydd Mallean holds at least 9.4% (15 pairs) of the national population of red kite (*Milvus milvus*); 1.3% (15 pairs) of the national population of peregrine (*Falco peregrinus*) and at least 0.5% (7 pairs) of merlin (*Falco columbarius*). This site qualifies as an SPA due to these three species being of European importance and are listed on Annexe 1 of the Birds Directive.

Special Areas of Conservation

Special Areas of Conservation (SACs) are strictly protected sites designated under the EC Habitats Directive. The habitat types within the SACs are considered to be most in need of conservation at a European level. These sites form part of the Natura 2000 Network.

Within Carmarthenshire, there are nine SACs. These are:

- Caeau Mynydd Mawr
- Carmarthen Bay Dunes
- Carmarthen Bay and Estuaries
- Cernydd Carmel
- Cleddau Rivers
- Cwm Doethie- Mynydd Mallean
- River Teifi
- River Twyi
- River Usk

Reasons for designation as a Special Area of Conservation

Caeau Mynydd Mawr

It is thought that due to the extent of suitable habitat contained within more than 30 enclosures at Caeau Mynydd Mawr, this site has the ability to support one of the largest metapopulations in Wales of marsh fritillaries (*Euphydryas aurinia*). They occur over a wide area of traditionally-managed purple moor-grass (*Molinia caerulea*) pastures in south-east Carmarthenshire.

Carmarthen Bay Dunes

Carmarthen Bay Dune sites within the Burry Inlet provide a representative example of mobile dunes in south Wales. There is a very large area of shifting dunes along the coastline. In parts of the system, dunes are actively accreting and there are clear zonations of embryonic dunes, shifting dunes and semi-fixed dunes. Sea spurge (*Euphorbia paralias*) has been recorded within the shifting dunes. There are actively forming spits and well conserved structure and function occur within the Carmarthen Bay Dunes complex. This site includes the largest area of humid dune slack in Wales. Many of these dune slacks are rich in species, including the rare fen orchid (*Liparis loeselii*). This site is one of two sites selected for petalwort (*Petalophyllum ralfsii*) in south Wales. Whiteford Burrows contains the largest known population of the narrow-mouthed whorl snail (*Vertigo angustior*) in the UK. The snail occurs at this site in areas of freshwater seepage at the junction between sand dune and saltmarsh habitat.

Carmarthen Bay and Estuaries

Carmarthen Bay and Estuaries includes the sandbank of Helwich Bank, a linear shallow subtidal sandbank that is unusual in being highly exposed to wave and tidal action. The animal communities found in and on the bank are therefore tolerant of high levels of disturbance. There are also several other smaller sandbanks in relatively shallow water within Carmarthen Bay. These support a range of species (bivalves, amphipods and worms), of which, many spend most of their time wholly or partly buried in the sediment.

Carmarthen Bay and Estuaries provides an example of a large estuarine site. It encompasses the estuaries of the Rivers Loughor, Tâf, Tywi and the Gwendraeth. These estuaries support a range of subtidal and intertidal sediments that grade from the sand at the mouth to mudflats in the upper estuary. This site has a range of undisturbed transitions to coastal habitats.

Extensive areas of interitdal mudflats and sandflats are to be found within the area. These contain bivalves, amphipods and worms. The Lougher Estuary is one of the few places in the UK for the worm *Ophelia bicornis*. The nationally scarce dwarf eelgrass (*Zostera noltei*) is also found within the SAC. The large shallow inlets and bays support large numbers of species, including bivalve molluscs, worms, burrowing urchins, brittlestars and sand-stars.

The Carmarthen Bay and Estuaries area is representative of pioneer glasswort saltmarsh in the south-west of the UK. It also supports other pioneer communities and contributes to a complete sequence of saltmarsh vegetation. Twaite shad (*Alosa fallax*) migrate through the waters of Carmarthen Bay and Estuaries to reach spawning sites in the Afon Tywi. The Taf-Tywi-Gwendraeth estuary is also an important nursery area for juveniles.

Cernydd Carmel

Pant-y-Llyn turlough occupies a small depression on the northern perimeter of the South Wales Coalfield at Cernydd Carmel. This depression represents a glacial channel formed along the Betws Fault where displacement brought Carboniferous limestone into contact with older Devonian rock. The site reflects the characteristic behaviour of turloughs by the basin filling to a depth of about 3m during late autumn, remaining full until the following summer when it empties completely. The basin floor at Cernydd Carmel is covered by bryophytes (mainly *Fontinalis antipyretica* and *Drepanocladus aduncus*) and herbaceous swamp (water horsetail *Equisetum fluviatile* and bladder-sedge *Carex vesicaria*) and is surrounded by willow (*Salix*) carr. The invertebrate fauna is characteristic of seasonal standing water with aquatic beetles (*Coleoptera*) acting as the most diverse group of predators on a microinvertebrate community. Turloughs are restricted to karstic limestone areas and examples within the UK are rare.

Cleddau Rivers

The Cleddau rivers are a predominantly lowland catchment. The substrates consist mainly of sand, gravel and well aerated silt which provide an excellent mosaic of lamprey (*Lampetra spp.*) spawning and nursery habitat. Throughout the catchment there is the presence of ammocoetes. The Cleddau has generally finer substrates present and more widespread shading. This means that the bullhead (*Cottus gobio*) in the Cleddau Rivers are more likely to depend on macrophytes and woody debris for cover and represent a lowland population. Bullhead are very widepsread throughout the catchment. The Cleddau Rivers flow through a largely lowland landscape. These slow-flowing rivers have a diversity of bank-side habitats and good water quality ensures good stocks of otter (*Lutra lutra*) prey species. Since the late 1980s/ early 1990s, the otter population has shown excellent signs of recovery.

Cwm Doethie - Mynydd Mallean

Cwm Doethie - Mynydd Mallaen contains a large area of old sessile oak wood along a series of inter-connected valleys. The site is one of several examples representing this habitat in the core of its Welsh range. Sessile oak (*Quercus petraea*) woodland predominates, with a typical acidic ground flora and rich lower plant component. The site is also notable for its upland heathland and grassland communities, and for its breeding bird assemblages, which includes red kite (*Milvus milvus*).

River Teifi

The Teifi is a water course of plain to montane levels. This habitat type is characterised by the abundance of water-crowfoots (*Ranunculus spp.*) and water starworts (*Callitriche spp.*). The Teifi is mainly mesotrophic but also has obliotrophic sections in the upper reaches and represents an outstanding example of a sub-type 3 river in Western Britain. The river is also noteworthy for an unusally low-gradient sections that flows through Cors Caron, a large area of active raised bog and also an SAC in its own right. The Teifi has a mixture of habitats and substrate types which provide the combination of spawning gravels adjacent to silt beds that are favoured by lampreys (*Lampetra spp.*). A large number of tributaries have been included in the SAC as they are thought to be important to lampreys because the main channel is prone to sever floods that may result in the washout of smaller ammocoetes. The semi-natural channel contains a mixture of substrates abd in-stream features that provide excellent habitat for juvenile lampreys.

Bullheads (*Cottus* gobio) are known to be widespread throughout the system. Water quality is generally good and excellent bullhead habitat is provided by the diversity of semi-natural habitat and the predominance of stony substrates. The Teifi provides both upland and lowland streams and within these types of habitats marked differences can be seen in growth and longevity of bullheads. Throughout much of the catchment otters (*Lutra lutra*) are present and there are sutiable resting and breeding sites along the length of the river. Floating water-plantain (*Luronium natans*) in the Teifi is at the western margins of its range in the UK. The species has been recorded in both the nutrient-poor standing waters of the Teifi pools in the headwaters and the moderately nutrient-rich stretch of the river immediately downstream of Cors Caron.

River Tywi

A large spawning population of twaite shad (*Alosa fallax*) (internationally vulnerable) occurs in the Tywi and it is thought to be self-sustaining. Spawning sites occur throughout the lower reaches of the river between Carmarthen and Llangadog, with most spawning sites occuring downstream of Llandeilo. The Afon Tywi is one of the best rivers in Wales for the otter (*Lutra lutra*). The water quality is generally good and there is an ample supply of food. Along the river bank there are suitable lying-up areas, however there are few known breeding sites on the main river.

River Usk

The Usk is a medium-sized catchment in south Wales, important for its population of sea lamprey (*Petromyzon marinus*). Survey of juveniles and observation of spawning adults indicates that this species is mainly restricted to the lower reaches of the catchment. The site supports a range of Annex II fish species. The Usk in south Wales supports a healthy population of brook lamprey (*Lampetra planeri*) and river lamprey (*Lampetra fluviatilis*) and is considered to provide exceptionally good quality habitat likely to ensure the continued survival of the species in this part of the UK. The River Usk is one of the largest rivers in south Wales and twaite shad (*Alosa fallax*) has long been known to spawn there. The Usk is one of only four sites in the UK where a known breeding population of twaite shad occurs (the Rivers Wye and Tywi are other SAC sites). Water quality and quantity are considered favourable for this species. The main channel is largely unmodified and a variety of aquatic habitats are present, including good quality spawning gravels and deep pools used for cover by adults and fry.

The river Usk is a river famous for its salmon (*Salmo salar*), with a high proportion (30–40%) of multi sea winter fish recorded in the rod catch. In 1999, the Usk had highest estimated egg deposition of any British river south of Cumbria and was one of the few rivers in England and Wales to exceed its spawning target for salmon. The Usk has a mixed catchment with no significant obstructions to salmon migration, good quality spawning gravels and a diversity of habitats providing excellent habitat for salmon parr. The most important tributaries for salmon spawning are included within the site boundary. The Usk represents bullhead (*Cottus gobio*) in the southern part of its range in Wales. It is considered to have exceptionally high-quality habitat with good water quality, abundant cover and a variety of aquatic habitats. Bullhead are widespread throughout the Usk system. The River Usk is an important site for otters (*Lutra lutra*) in Wales. They are believed to be using most parts of the main river, from Newport upstream and in recent years signs of otters have increased. In 1991, an expansion upstream of known otter ranges was recorded on several tributaries, including the Honddu, Senni and Crai. The upper Usk may have acted as a 'refuge' during the decline of the 1950s and had subsequently acted as a 'source' population for recolonisation of south-east Wales.

National Designations

National Trust

Within Carmarthenshire the National Trust has 14 properties. These cover an area of approximately 1188 hectares.

National Park

The role of the National Park Authorities throughout the UK is to conserve and enhance the natural beauty, wildlife and cultural heritage; promote opportunities for the understanding and enjoyment of the special qualities of National Parks by the public and also seek to foster the economic and social well-being of local communities within the National Park.

Within the far eastern section of Carmarthenshire lies Brecon Beacons National Park. This national park also extends into the counties of Powys, Glamorgan and Monmouthshire. Brecon Beacons National Park spans an area of 134,954 hectares and contains some of the most diverse landscapes in Europe.

National Nature Reserves

The definition of a National Nature Reserve (NNR) is, "an area that is among the best examples of a particular habitat and is of national importance". The aim of this designation is: to secure the protection and appropriate management of the particular habitat; provide a resource for scientific research and to play a public role.

NNRs have the highest level of conservation protection under UK legislation and therefore, the sites have to be managed appropriately to maintain its status.

There are three NNRs within Carmarthenshire. These are:

- Allt Rhyd y Groes

- Carmel
- Cors Goch, Llanllwch

The designations of NNRs are based on the SSSI (Sites of Special Scientific Interest) features. Further reasons for notification are due to some of the NNRs having the potential for access, education and research.

Sites of Special Scientific Interest

Sites of Special Scientific Interest (SSSIs) are notified under the Wildlife and Countryside Act 1981. Improved provisions for the protection and management of SSSIs were introduced by the Countryside and Rights of Way Act 2000. SSSIs can be owned by anyone and a site's designation identifies it as an area of preservation and provides a level of protection.

Within Carmarthenshire, there are 95 SSSIs. These are:

- Allt Pen y Coed Stream Section
- Allt y Gaer
- Allt y Wern
- Becaon Bog
- Birdshill Quarry
- Bishops Pond
- Broad Oak and Thornhill Meadows
- Burry Inlet and Lougher Estuary
- Cae Blaen- Dyffryn
- Cae Cilmaenllwyd
- Cae Cwm-Tywyll
- Cae Gwynfryn
- Cae Maes y Ffynnon
- Caeau Afon Gwili
- Caeau Blaen Bydernyn
- Caeau Blaen yr Orfa
- Caeau Blaenau Mawr
- Caeau Capel Hendre
- Caeau Ffos Fach
- Caeau Lotwen
- Caeau Nant Gerenig
- Caeau Nantsais
- Caeau Pant y Bryn
- Caeau Rhyd y Gwiail
- Caeau Tir Mawr
- Carreg Cennan
- Cefn Blaenau
- Cernydd Carmel
- Coed Cochion Quarry
- Coed Gwempa
- Coed Llandyfan
- Coedydd Capel Dyddgen
- Coedydd Tregyb

- Coedydd y Garn
- Cors Farlais
- Cors Goch, Llanllwch
- Corsydd a Rwyth Cilyblaidd
- Crug Farm Quarry
- Crychan Farm Quarry
- Cwar Glas Quarry and Sawdde Gorge
- Cwm Clydach, Cydweli
- Cwm Crymlyn Road Section
- Cwm Doethie - Mynydd Mallean
- Cwm Twrch
- Cwm yr Abbey Stream Section
- Dan Lan y Castell Quarry
- Derwen Fach Meadow
- Dinefwr Estate
- Dolaucothi Gold Mines
- Eastern Cleddau
- Felin Fach Meadows, Cwmgwili
- Ffair Fach Railway Cutting and River Section
- Glan Pibwr Stream Section
- Glan y Glasnant Pastures
- Gwernydd Pembre
- Hafod Wennol Grasslands
- Laugharne Pendine Burrows
- Llanfallteg Track Section
- Llansteffan Cliffs
- Llety Wen
- Llyn Llech Owain
- Llyn Pencarreg
- Machynys Ponds
- Maes y Prior
- Mandinam a Coed Deri
- Marros Pendine Coast
- Meidrim Road Section
- Mylett Road Section
- Mynydd Du
- Mynydd Llangyndeyrn
- Mynydd Ystyfflau-Carn
- Pembrey Coast
- Pen Ty Pastures and Wood
- Pine Lodge Meadow
- Pont y Fenni Quarry and Road Cutting
- Pwll Lagoon
- Rhos Cruglas
- Rhos Dolau-Bran
- Rhos Pwllygawnen
- Rhosydd Castell Du and Plas y Bettws

- River Teifi
- River Tywi
- River Usk (Upper Usk)
- Saundersfoot Telpyn Coast
- Smarts Quarry
- Taf Estuary
- Talar Wen Quarry
- Talley Lakes
- Waun Ddu
- Waun Fawr
- Wernbongam Stream Section and Quarry
- Wharley Point Cliffs
- Whitehill Down
- Ydw Valley and Fron Road Geological Exposures
- Ynys Uchaf

Agri-Environment Schemes

Agri-environment schemes were established in the UK in the late 1980s to encourage farmers to manage their land in a more environmentally friendly way. Within Wales there are a number of different schemes for farmers to join whereby a sustainable approach to farming is promoted as well as protecting and improving the wildlife and the environment.

Single Payment Scheme

The Single Payment Scheme (SPS) came into force on 1st January 2005. The payment is made to farmers for keeping their land in good environmental order. This scheme replaced most of the individual Common Agricultural Policy (CAP) subsidy payments previously made to farmers.

In order for farmers to receive the payment, they must
- Be actively farming and/ or maintaining the land in good agricultural and environmental condition.
- Have land at their disposal for at least ten continuous months of the year.
- Retain and maintain up-to-date farm records.
- Ensure that there are no breaches of the cross compliance and Good Agricultural Environmental Condition requirements.

Tir Gofal

Tir Gofal is the Welsh Assembly Government's flagship agri-environment scheme. This scheme rewards farmers for caring for the environmental, historical and cultural features on their land. It is designed to support the farming community in protecting the rich heritage of rural Wales.

Entry to this scheme is only via an application window process. Once an application has been chosen, the farmer will receive a visit from a Tir Gofal Project Officer. This visit will enable the Project Officer to map all habitats and negotiate voluntary options, habitat enhancement prescriptions and capital works. A threshold points score is required in order to be accepted

into the scheme. This will comprise points for a range of habitats, environmental features and farm characteristics. Further points may be gained through habitat improvement, permissive access and capital works options. Tir Gofal agreements apply to the whole farm and last for ten years with a break clause after five years.

Payments will be made for:
- The whole farm section. This includes the preparation of a whole farm Resource Management Plan.
- Management of existing habitats and environmental features.
- Establishment and management of new habitats and features.
- New permissive access for use by the public.
- One off payments for capital works such as fencing and hedge-laying.

Tir Cynnal

Tir Cynnal was introduced in 2005 and is the new entry level agri-environment scheme run by the Welsh Assembly Government. The scheme gives farmers more opportunities to protect areas and features of environmental importance on their land in return for payment. Tir Cynnal requires a greater level of environmental protection when compared to the Single Payment Scheme, yet is not as demanding as Tir Gofal.

The aims of Tir Cynnal are to:
- Prevent the loss of biodiversity by protecting wildlife habitats.
- Protect important landscape features on farmland.
- Safeguard archaeological and historic sites.
- Protect and improve the quality of water, soil and air.

Organic Farming Scheme

The Organic Farming Scheme offers payments to farmers to aid them in converting to organic farming and maintaining the organic status thereafter. The Scheme seeks to increase the area of land devoted to organic farming in Wales. It will play a valuable role in helping to protect and enhance the rural environment, as well as assisting producers to meet consumer demand for organic produce.
The Organic Farming Scheme is compatible with other agri-environment schemes, such as Tir Gofal. Each field that is entered into the scheme will be eligible for five years of payments. Higher payments will be received for fields that are claimed as in conversion; this is to compensate for the cost of converting to organic.

Local Designations

Wildlife Trust Reserves

Within Carmarthenshire, there are eleven Wildlife Trust reserves. These are:
- Allt Cross-Inn Fach
- Castle Woods
- Coed Wern Ddu
- Cors Goch
- Cors Pum Heol

- Ffrwd Farm Mire
- Nant Melin
- Poor Man's Wood
- Rhos Cefn Bryn
- Talley Lakes
- Y Goyallt

Local Nature Reserves

Local Nature Reserves (LNRs) are designated after consultation between the local authority and CCW under the National Parks and Access to the Countryside Act 1949. LNRs are declared and managed for nature conservation and provide opportunities for research and education, as well as just simply enjoying and having contact with nature.

Within Carmarthenshire, there are four LNRs. These are:
- Ashpits Pond and Pwll Lagoon
- Glan Yr Afon
- North Dock Dunes
- Pembrey Burrows and Saltings

Non-designated Wildlife Sites

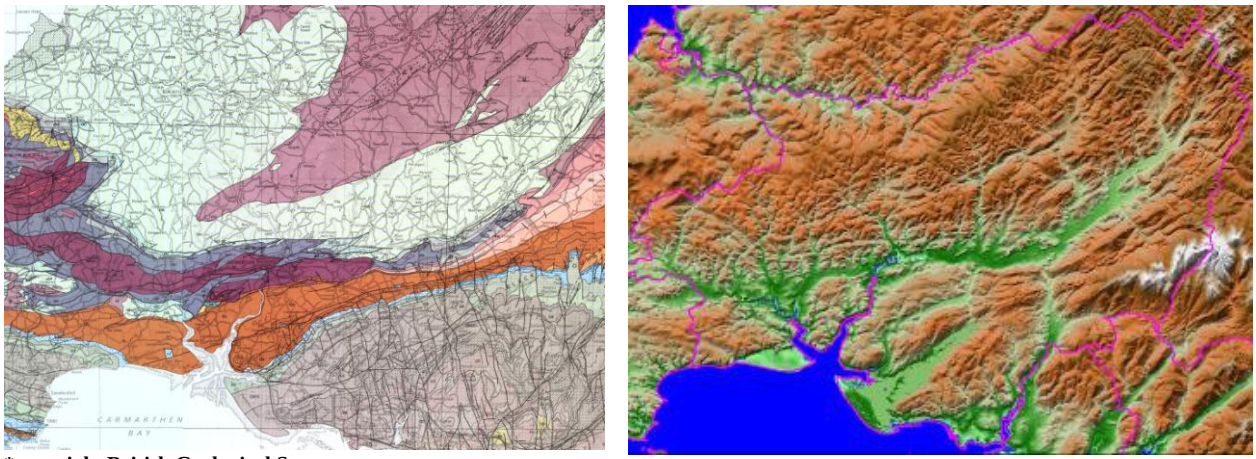
There are non-designated Sites of Interest to Nature Conservation (SINCs) in Carmarthenshire. These are located in Llanelli and the surrounds. An opportunity exists for biodiversity conservation to promote the recognition of such sites.

4. GEOLOGY AND SCENERY WITHIN CARMARTHENSHIRE

This section of the report is contributed by Sid Howells. All photographs and text are the copyright of Sid Howells. This part of the overall report must only be used for the purpose of the Natural Capital Audit.

Introduction

River systems in Carmarthenshire have been superimposed over the rock outcrops shown on the geological map. They have cut down from a level well above the existing uplands and often cross the geological 'grain' of the county (running south-westwards from the east of the county and then curving round to the west - see maps below). Notable exceptions are the River Tywi between Llandovery and Carmarthen, the Cothi River Basin and the Gwendraeth rivers. Elsewhere, river courses often cut through the main landscape divisions in narrow, steep-sided valleys and gorges (the best examples being the Sawdde Gorge – see Area 4 description) or the numerous smaller examples exhibiting the typical steep wooded slopes ('allt'). The drainage pattern has been futher complicated by 'river capture' (when more erosive stream flows cut back in their source area eventually breaking into another river's valley and diverting part of it's flow). During the 'Ice Age', glaciers, ice sheets and meltwater also caused significant modifications.
Despite this complexity the main landscape divisions are still easily identifiable and Carmarthenshire may conveniently be divided into seven distinctive landscape areas as described below.



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Comparison of geological and topographic maps. Some upland areas display gently-curving lineaments, generally corresponding to the more resistant rock types.

Landscape areas within Carmarthenshire

1. Cambrian Uplands

This landscape unit, which is the southwestern part of the Cambrian Mountains, covers the northern half of Carmarthenshire, between the Tywi and the Teifi river valleys and also includes the Cothi River Basin which is entirely enclosed by the uplands. The area consists of a deeply dissected plateaux landscape which has also been bevelled off by the passage of glaciers and ice sheets. The highest ground, along the northern edge of the uplands, forms a gently curving and undulating watershed between the Teifi Valley and the southwards-flowing tributaries of the Taf and Tywi rivers. The underlying Ordovician and Silurian sedimentary rocks (mainly mudstones with slatey-cleavage, together with sandstones, conglomerates and tuffs) have relatively little influence on topography at a broad scale.

Typical scenery of the Cambrian Uplands area. This view of part of Brechfa Forest shows deep valleys and the Teifi River catchment beyond the ridge.

View south-east towards the north-facing slopes of the Cambrian Uplands at Mynydd Llanllwni.

2. The Tywi Valley

The Tywi Valley extends as a natural corridor from Llandovery to Carmarthen, but this landscape area also includes the continuation of the valley between Carmarthen and St Clears, whereas the Tywi River turns south at Carmarthen . This valley was deepened and widened by glacier ice. During the coldest phases of the 'Ice Age', glaciers flowed out of the north facing cwms of the Carmarthen Fans and Black Mountain area. This would have happened on numerous occasions during the ice age, the last glacial maximum having occurred only 18,500 years ago. During these times the whole of the valley, from Llandovery

to St Clears would have been occupied by ice, and on several occasions ice sheets from more northerly and westerly sources would eventually have passed over the top of the glaciated valley. When the ice melted vast torrents of meltwater would have flowed down the valley.

Initially, the valley was still filled with ice, allowing development of meltwater channels at high levels (for example, the excellent examples just west of Carmarthen). Meltwaters from the valley glacier deposited large amounts of gravel in braided channel systems. The familiar meandering channel and flooplains of the present Tywi river represent the most recent phase of landscape development in this lowland corridor.

Twyi valley below Drwslwyn Castle, showing meanders and floodplain. Relatively resistant rocks within a folded and faulted sequence of Ordovician sedimentary rocks (see Area 4 cross section) stand out as knolls.

3. Llanstephan Peninsula

The Llanstephan Peninsula area includes a gently undulating area of higher ground situated between the Taf and Tywi estuaries. The northern limit is defined by the broad valley (part of Area 2) extending from Carmarthen to St Clears. The geology of most of this area is complex.

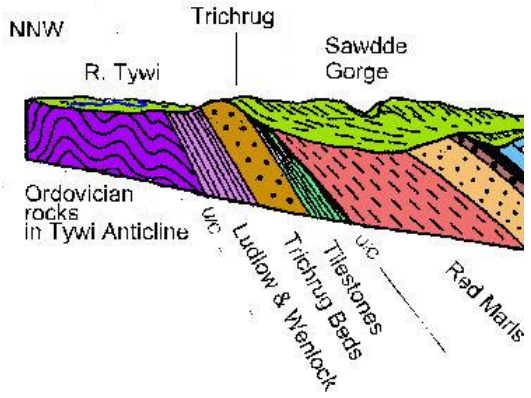
Llanstephan Peninsula – northern boundary (between Carmarthen and St Clears)

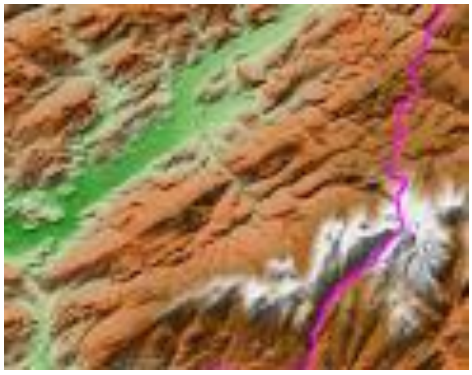
Old Red Sandstone underlies the southern part of the Llanstephan Peninsula, and is exposed in the cliffs facing Carmarthen Bay. Fringing salt marshes constitute part of Area 7.

Llanstephan Peninsula – view east from Taf Estuary to Tywi Estuary. The Llandefaeolog Disturbance (fault zone) runs westwards through this area, and is discernable on the air photo.

4. Ridge and vale scenery bordering the south side of the Tywi Valley

Bordering the south side of the Tywi Valley along its whole length (see map above) are a series of parallel, sometimes sharp-crested ridges, the best example being Trichrug to the south-west of Llandovery. These ridges are developed on more resistant rock outcrops within a steeply- dipping sequence of Silurian rocks as shown below.





Sharp-crested ridge at Trichrug near Trichrug

The Sawdde Gorge cuts through the ridges

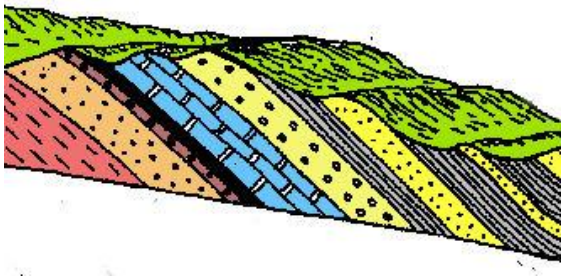
Ridges along the southern border of the Tywi Valley near Paxton's Tower

5. Black Mountain escarpments

The southern part of Carmarthenshire is dominated by text book examples of ridge & vale type scenery, which includes the Black Mountain escarpments and their dip slopes (see cross-section). The Black Mountain forms the highest ground in the county, where land use is generally restricted to rough grazing of moorland, and although the escarpments gradually decrease in height towards the west, they continue to form a distinctive landscape area extending to the coastal plain at Kidwelly.

Sandstones (yellow layers on cross-section) and limestone (blue) form the main escarpments, and where there are shales or mudstones, these have been eroded to form shallow vales. Within any major escarpment smaller ones may be superimposed due to varying hardness of the layers within that rock sequence. In places, the escarpments have been offset by faulting, causing horizontal and/or vertical displacements of the lines of the escarpments. There has been extensive quarrying of limestone along its escarpment, and other rock types have also been exploited as building materials. Silica sand (derived by in-situ weathering and degradation of quartz-rich sandstones) has also been worked in a few places.

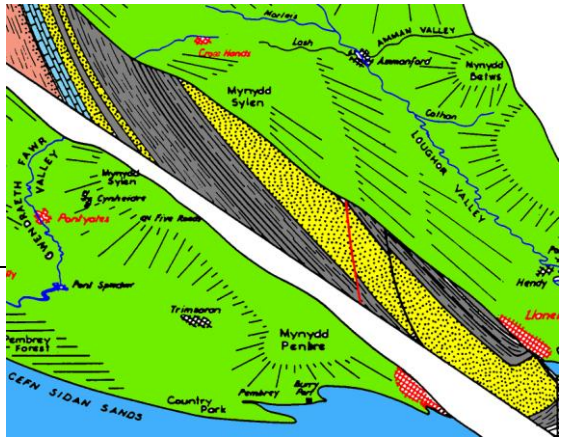
View south-east towards the Black Mountain escarpments. For simplicity, the broad vale in the foreground has been included in this geomorphological area, even though it obviously has very different land use.



Geological influences on topography in the Black Mountain area

6. Mynydd Sylen

This area of higher ground lies between the Gwendraeth Fawr and Loughour Valleys. It is underlain by southwards-dipping rocks of the 'Coal Measures'. The highest ground coincides with the outcrop of harder sandstones (yellow on cut-away diagram).



7. The coastal plain of Carmarthen Bay

This area extends from Pendine to Loughor and includes salt-marsh and sand dune together with drained fens or reclaimed land of the coastal plain. These features have developed on sands and gravels that were deposited by glacial meltwater in the latter part of the 'Ice Age' (between c. 18,000 to 10,000 years ago). At that time, due mainly to the vast amount of water locked up in ice sheets and glaciers, the sea level in the Bristol Channel area was around 40m lower than at present, that is, the whole of Carmarthen Bay was dry land. As the climate improved the sea level rose rapidly, but not before woodland vegetation had developed. The rising sea level caused migration of an almost continuous 'shingle' (cobble/pebble) ridge, similar to the remanant at Marros, across the coastal plains. By around 5,000 years ago the rise in sea level had become almost imperceptible, and since then the 'storm beach' and coastal sands have been depleted by natural attrition (wearing down *in-situ* due to the action of waves). Sand dunes have also formed and human influences have resulted in very significant modifications of the coastal plains.

Coastal plain at Ginst Point (western side of Taf Estuary mouth) showing coastal defences (boulder revetment), sand dunes (with military infrastructure) and reclaimed marshes.

Coastal plain at Cefn Sidan showing sand dunes, saltmarsh and coniferous forestry plantations.

5. THE HISTORIC ENVIRONMENT WITHIN CARMARTHENSHIRE

This section of the report is contributed by Marion Page, of Cambria Archaeology. All photographs and text are the copyright of Cambria Archaeology. This part of the overall report, and the digital HER data that has been supplied with it, must only be used for the purpose of the Natural Capital Audit.

Introduction

Carmarthenshire has an extremely rich historic environment, a valuable part of the county's environmental resource, which includes Carmarthen itself, the oldest town in Wales. The Historic Environment Record for Carmarthenshire contains the information on over 16,000 archaeological sites, over three hundred of which are designated as nationally important Scheduled Ancient Monuments. This resource represents at least twelve thousand years of human activity in the county dating from the earliest human habitation in caves to Second World War features. The record therefore includes a great variety of site 'types' from many diverse and different periods of time. More sites are recorded from some periods than from others with, generally, more sites surviving from later periods. There may be many reasons for this and while the age of a site may be the cause this is not always the case; other factors such as continuing use (or not), construction method and materials will also influence survival. Often the single most important factor influencing the level of survival of an archaeological site is its location. Medieval and later settlement is less common in upland areas, hence the continuing survival of prehistoric features in these areas. However, medieval and post-medieval agricultural activity will have affected the survival of earlier archaeological features in many of these rural areas. Conversely, although many medieval sites would have existed in and around modern settlements, where later development and expansion may have removed *above ground* evidence for the medieval activity, the potential for archaeological features to exist below ground in these locations is extremely high. It is therefore vital to bear in mind that there will be many archaeological sites that have not yet been discovered or brought to the attention of Cambria Archaeology.

The extent of archaeological survival

Information on just over fourteen thousand known sites has been provided in the form of shape files that display the information as point data for GIS. Of these, ten thousand two hundred and seventy-six are recorded as upstanding monuments surviving as buildings, earthworks or other built structures (such as lime kilns/chambered tombs) in reasonable condition that might provide tourism opportunities as part of diversification projects.

Form of monument	Number recorded
Building	5527
Other built structure	1512
Earthwork	3237

Landscapes of Outstanding Historic Interest

The Register of Landscapes of Outstanding Historic Interest recognises that historic landscapes are one of Wales' most valuable cultural assets being a special, often fragile and irreplaceable part of our heritage. These are large areas which retain physical evidence of the past, from the agricultural and ritual landscapes of prehistory to 19th century industrial landscapes. Four of these Registered Landscapes lie fully within Carmarthenshire along with part of one other.

Black Mountain and Mynydd Myddfai

This upland landscape contains a wealth of evidence of past land use ranging from Bronze Age field systems and funerary monuments to post medieval lime kilns and quarries. The two Roman marching camps of y Pigwn and Arosfa Garreg, both Scheduled Ancient Monuments, controlled cross-mountain routes that were the major link between the Usk and Towy valleys until the late eighteenth century. The area also has legendary historic associations with the Lady of Llyn y Fan Fach and the Physicians of Myddfai: the farms mentioned in this legend still exist and are believed to have their origins in the twelfth century.

Carreg Cennen Castle lies within the Black Mountain and Mynydd Myddfai registered landscape

The Towy valley

A landscape rich in prehistoric and later sites including ancient route ways; Iron Age and Roman forts; medieval castles and mottes; post-medieval gentry houses and designed parks and gardens. The Roman fort and town at Carmarthen is designated a Guardianship Ancient Monument. The valley has historic associations with the Picturesque movement and is also an historic artistic Picturesque landscape.

Carn Goch hillfort

Dolaucothi

A landscape containing the Roman fort at Pumsaint and the nearby Dolaucothi Gold Mines, worked since the Roman period and a Scheduled Ancient Monument. This complex comprises surface and underground workings including a system of contour leats 8km in length that brought water to the site from the headwaters of the Cothi. The area also contains the historic settlement of Caio. A ninth century land charter surviving as marginalia in the Llandeilo Gospels suggests that Caio may have been the centre of an early medieval multiple estate.

The complex of mining features at Dolaucothi

The Hudson open field system

Taf and Towy Estuary

This area contains a wealth of evidence of activity from the prehistoric to the recent past and includes the Hugden open field system on the low coastal ridge west of Laugharne. The castles at Kidwelly and Laugharne are Guardianship Ancient Monuments. Coygan Cave, site of some of the earliest known evidence for human activity in the county, was in this region prior to its being quarried away. Evidence for seventeenth century land reclamation survives at Laugharne, Pendine and Pembrey Marshes. Pembrey was the location of an airfield and Royal Ordnance Works during the Second World War. Offshore, in the intertidal zone, several wrecks are visible at low tide.

Preseli

A small part of this registered landscape lies within the county. The area around Glandy Cross and Efailwen contains a dense concentration of Neolithic and Bronze Age funerary and ritual monuments. Excavation has demonstrated the high potential for buried archaeological remains in this area.

Aerial view of Glandy Cross

Landscapes of Special Historic Interest

As well as the areas above, Registered Landscapes in Wales include some that are designated as being of Special Historic Interest. They are generally smaller in area and the difference "is one of degree, and not quality of historic interests."* One of these areas lies fully within Carmarthenshire along with part of one other.

* Register of Landscapes of Special Historic Interest in Wales. Cadw/ICOMOS UK. 2001.

Drefach-Felindre

Drefach and Felindre
Located partly in north Carmarthenshire and partly in Ceredigion this region was, in the late nineteenth/ early twentieth century, the centre of the Welsh woollen industry. At its height there were fifty-two woollen mills, factories or businesses operating in the area and a range of buildings, including worker housing, survive. The industrial heritage is of particular interest because, despite the rise of mechanisation and factory-scale production, the area remained closely tied to its agrarian economic roots.

Lower Teifi Valley
A small part of this area lies within Carmarthenshire. The area, which is around the village of Cenarth, is mentioned for the traditional salmon fishing trade, which involved the use of coracles.

The Teifi at Cenarth

An overview of the archaeological resource

Prehistoric Carmarthenshire (c. 225,000 BC – AD43)

The earliest evidence for human activity in Carmarthenshire dates to the Palaeolithic (Old Stone Age - c.225,000 – 10,000 BC) and consists of flint and bone implements and animal bones, some of which are from animals such as cave lion that are now extinct. Of particular note is the occupation site at the now quarried away Coygan Cave in Llanddowror parish.

The Mesolithic (Middle Stone Age - 10,000 – 4,400BC) period is also represented and again comprises individual flint tools and larger collections, most notably that from Nantgaredig where the nature of more than four hundred artefacts recovered suggests that it was a site where tools were manufactured and repaired.

The majority of prehistoric archaeological sites and monuments surviving in Carmarthenshire are Neolithic (New Stone Age - 4,400 – 2,300 BC) and Bronze Age (2,300 – 700 BC) funerary and ritual monuments, in the form of chambered tombs such as Gwal-y-Filiast, standing stones and burial mounds (barrows) such as those on Mynydd Llangyndeyrn. In the

west of the county the Glandy Cross monument complex, a ritual centre during the Neolithic and Bronze Age, is an area of outstanding archaeological importance and a number of monuments remain here.

Evidence of Iron Age (700 BC – AD43) occupation is principally in the form of hillforts, such as Carn Goch, and defended enclosures. Numerous instances of the latter survive throughout the county, such as that of Parc-y-Gaer in the parish of Llandissilio East. Previously unknown prehistoric sites are continuously being discovered.

Roman Carmarthenshire (AD43 – 410)

The Roman period had a significant impact on the landscape of the county, leaving a sequence of marching camps, at least two forts, one of only two Roman towns in Wales and the only identified gold mine in Britain. The site of the Roman fort at Carmarthen was associated with a quay on the Towy estuary. The civil settlement that developed outside the east gate of the fort became the town of Moridunum - the civitas capital of the Demetae - which featured an amphitheatre beyond its east gate. A network of Roman roads connected all these sites. Many of their general courses have been followed by later and even modern roads, while several sections of the road network are known through excavation and aerial photography. As well as these major sites a number of Roman artefacts have been recovered from across the county including coins, both as single finds and hoards; jewellery; figurines and statuette and domestic objects such as needles and wine strainers. Pottery fragments represent both everyday and high status vessels.

Early Medieval (410 – 1066)

The long period of time between the end of Roman rule in Britain and the beginnings of the Norman Conquest of Wales is important in terms of cultural heritage, and in laying the foundations for later medieval settlement and land-use. Dated archaeological evidence for the post-Roman, pre-Norman conquest period is limited to just one site, the bishop-house at Llandeulyddog, Carmarthen, where sections of four ditches were found below the level of the cemetery of the later Augustinian priory. At least one of these ditches may have defined the early medieval monastic enclosure. Undated evidence, in the form of cemetery sites suggested by long-cist burial, occurs only at Pontargothi, although thirty-six certain Early Medieval inscribed stones spanning the sixth to ninth/tenth century types are known of in Carmarthenshire.

Medieval (1087 – 1485) and Post-Medieval (1486 – 1899)

The medieval period saw the development of castles and castle boroughs in the county, the majority of which, such as Kidwelly, Laugharne and Llansteffan are a product of the initial phase of the Anglo-Norman conquest. There are also a small number of undated earthwork castles and a group of well-preserved Welsh castles of which Dinefwr, Dryslwyn and Carreg Cennen are examples. Settlements developed outside the castle gates with many towns, such as Laugharne, having their origin in such foundations. Dryslwyn and Dinefwr were founded under Welsh patronage outside the adjacent castles.

In the coastal zone of the Tywi, Taf and Gwendraeth valleys the concept of towns and boroughs was most readily accepted, and consequently towns here flourished. Outside the areas of Anglo-Norman influence a dispersed settlement pattern was more typical. This

period also saw the introduction of alien tenurial systems and farming methods such as open three-field farming. In the heavily Anglicised coastal zone the effects of this introduction are still readily apparent in the historic landscape: open field strips still surviving around Llanybri, Kidwelly/Llansaint and particularly Laugharne, where the Hugden, Whitehill Down and Lees open field systems are unique survivals.

The post-medieval period saw the reclamation of land in the coastal zone around Laugharne, Kidwelly and Pembrey. An important feature of the present day landscape in these areas is the legacy of early industrial transport systems, the canals, railways and shipping places that later served the concentration of coalfields in the southeast of the county began to be developed at this time. Meanwhile, in the north of the county, fulling mills were being established in the areas that would eventually come to dominate the domestic textile industry. The limestone ridge that runs northeast-southwest from the Black Mountain to Kidwelly was heavily exploited in the post-medieval period and the archaeological remains of this industry survive all along the ridge.

Modern Carmarthenshire (1900 – present)

Modern day Carmarthenshire was founded on the textile, coal and lime industries although quarrying and agriculture also played a critical part in the economy. Traces of all of these industries can be found throughout the county and at sites like Drefach Felindre and Kidwelly/Llanelli the remains of the industrial past are particularly spectacular. The strategic importance of the coastline has long been recognised, and it has been defended and fortified across the centuries. Remains of airfields, like that at Pembrey, and other structures are an important part of the archaeological landscape, and are a clear link to the more recent past.

Period	Number of records
Prehistoric (used when the specific period of prehistory is not known)	328
Palaeolithic	2
Mesolithic	7
Neolithic	73
Bronze Age	894
Iron Age	258
Roman	249
Early medieval	147
Medieval	1513
Post-medieval	1016
Modern	344

Breakdown of records by period.

It is possible to record uncertainty about the period of a site using a question mark, e.g. Medieval? Those sites that have been entered in this way have been included in the above table. Uncertainty about the period of a site can also be recorded using double entry e.g., Medieval?;Post Medieval?. When querying the dataset such entries are counted once for the medieval period and once for the post-medieval, thus slightly skewing the above statistics.

Carmarthenshire's Historic Environment: opportunities and threats

The wealth of Carmarthenshire's archaeological resource is a valuable asset that has the benefit of existing across all areas of the county. Understanding and appreciation of the

archaeological sites and historic landscapes can help to ensure their future conservation and survival through careful farming practices and enable their recognition as assets whose promotion increases the economic potential of rural areas. Archaeology offers an opportunity for farmers with an understanding of the sites on their land to link up with existing tourism businesses in the area, or to develop new tourism initiatives.

The importance of the historic environment for our understanding of the past and of the processes that have created Wales as it exists today cannot be underestimated. This is emphasized by the fact that almost five-hundred of the recorded sites have statutory status as nationally important Scheduled Ancient Monuments. The surviving monuments, protected or otherwise, are a finite resource and care must be taken to ensure that neither the creation of access to them nor any subsequent increase in visitor numbers results in damage to the monuments.

11. RECREATION & ACCESS- below is Pembs section

Previous sections of this report have provided an account of what natural resources exist in Carmarthenshire; this section outlines some of the principle ways in which they may be used. Any advocated use may be consumptive (hunting and fishing) provided this is sustainable and acceptable, or non-consumptive (bird-watching, photography, tourism). Some of the major wildlife attractions or resources for recreational enjoyment are presented on Map 6.

(WWBIC has been granted permission by Pembrokeshire Coastal Forum to use recreation data from their Coastal Recreation Audit in this report. The sea angling data on Map 6 are an example of these data. However, because the emphasis of this report is primarily terrestrial and freshwater and because the geographic nature of the recaudit data is not yet well defined we will leave this until further feedback from Planed.)

Bird-watching

There is no study of the contribution of bird-watching to the Welsh economy but on the basis of the red kite example, the hundreds of 'twitchers' who flock to a sighting of a rare bird, the incidence of these rare sightings in West Wales and the beautiful surrounds for a bird-watching holdiday, the reality and the potential opportunity for the region must be highly significant. It is through the accommodation and the restaurants and cafes that most economic benefits from bird-watching would be realised so farmers considering opening B&Bs would do well to market this local natural resource. A bird list for species likely to be encountered could be included with proposed site-specific reports. A selection of the top bird watching sites in Pembrokeshire is shown on Map 6.

Rock-pooling

Rockpooling can be a very enjoyable way of spending time while relaxing on holiday. A few sample rock-pooling and intertidal sites are shown on Map 6 and here are some favourites in West Wales:

Llangrannog Beach
A small, sheltered cove of sands and Rock pools faces Cardigan Bay where there is a good chance of seeing bottle-nosed dolphins or grey seals. Llangrannog Beach is a good spot for rock pooling or just relaxing.

Marros Sands
The beach is an extensive stretch of sand with some rock pools backed by shingle and boulders. Inland heathland covers the coastal slopes. There are extensive views across Carmarthen Bay and to the Gower and to the North Devon coast.

Pendine Sands
A huge expanse of sandy beach with dunes and rock pools. This is a perfect spot to look for sand dune plants and also a great place for children to search for a variety of crabs, molluscs

and rock pool fish. Worth a visit in winter too for the huge flocks of common scoters that are often seen in Carmarthen Bay.

Watwick Bay
A quiet, sheltered sandy beach just a short walk from the historic Dale Fort and only accessible from the coastal path. Watwick bay has rocks densely covered with seaweed, plenty of interesting rock pools and a small sandy beach. The bay is backed by woodland with some lovely walks.

Manorbier
The ruins of the magnificent Manorbier Castle overlook the small bay. The sandy beach is backed by sand dunes and there are rock pools and a stream running across the beach. Crabs, molluscs and rock pool fish are all to be found and the adjacent cliffs have a host of wildflowers.

Angle Point
Not a beach for swimming and sunbathing, Angle Bay is a wide sweep of mud and sand flats in the Milford Haven estuary. Dense seaweed growths cover large parts of the site and there in a rich array of shellfish, molluscs, anemones etc. to be found.

Cycling and Walking

There are wonderful opportunities for visitors and residents to enjoy the Carmarthenshire landscape and natural history on foot or on bike. Here are a few top sites in West Wales.

(This section can be expanded after we receive data on public access)

The Preseli Ridge
A walk along the Preseli ridge gives spectacular views across Ceredigion, Pembrokeshire and to the sea at Cardigan Bay. This walk across the open moorland follows a route that dates back to the Neolithic period, 5,000 years ago. The jagged Preseli tors that outcrop all along the ridge are the result of many thousands of years of erosion by harsh weather on the dolerite or bluestone rock, the source of the stones used to build the inner ring of Stonehenge.

Plynlimon
The highest point of this huge hill range is Pen Plynlimon Fawr at 752 metres above sea level. A number of other summits in the range also approach this height. From any of theses peaks most of the mountains of Wales, from the Brecon Beacons in the south to Snowdon in the north can be seen. There are also views of the broad sweep of Cardigan Bay, from Strumble Head to Bardsey Island.

Monk's Trod
A magnificent upland walk that follows the medieval “Monk's Trod” from Strata Florida over to the Elan Valley. The walk takes in valley oak woods, rocky tors and wild heath and moorlands all in an area of unspoilt natural beauty and stunning mountain scenery. This is an excellent place to see rarities such as Red Kites, Peregrines, Pied Flycatchers and Redstarts.

Fan Foel - Bannau Sir Gaer - Llyn y Fan Fach

Bannau Sir Gaer is part of the "Carmarthen Fans", a westerly extension of the famous Brecon Beacons. There is plenty of good walking in this area particularly where foot paths cross the northern escarpment of Bannau Sir Gaer, offering fine views of its horizontal strata of old red sandstone and millstone grits. At Fan Foel there is a prehistoric stone circle and views of the lake of Llyn y Fan Fawr and the scarp slope of Fan Brycheiniog.

Carreg Cennen

A picturesuque upland walk runs from Carreg Cennen Castle up to Trap and over the Black Mountain. Highlights along the way include the ruins of Carreg Cennen Castle, the rugged limestone uplands, prehistoric stone cairns, blanket bogs and moorland.

Fishing

A detailed appraisal of fishing and other recreational activities relating to freshwater rivers and lakes has been carried out for all the major water bodies in Wales by Environment Agency Wales. They may be consulted for detailed information relating to a specific location or stretch of river. For the purposes of the audit we have included on Map 6 graphical representation of the potential for fishing on major river stretches. This means the extent to which a particular stretch is already being used (red areas indicate fully occupied stretches where there is already competition). Unfortunately many sites still have no data (shown in grey) so perhaps EAW may be contacted by farmers near these locations. Nevertheless, some opportunities for fishing are identified above and below Llys y Fran Reservoir.

(we can inlcude some assessment for coarse vs game fishing in final draft)

Hunting/ Shooting

In Wales, the shooting industry has been valued at £73m per annum (British Association for Shooting and Conservation or BASC). Shooting within Pembrokeshire remains a popular past time. It is estimated by BASC that 90% of the county is shot over for rabbits (*Oryctolagus cunniculus*), ring-neck pheasants and woodcock (*Scolopax rusticola*). These shoots could range from one single person with their dog, to a large organised syndicate that takes place on estates. Most release sites put down a few hundred birds each year but there are a few large enterprises who put down many more and 10% of sites include red-legged partridge in addition to ring-neck pheasants. Other wader species shot include: common snipe (*Gallinago gallinago*), golden plover (*Pluvialis apricaria*) (shoots of this species on Castlemartin estate by MOD personnel are perhaps harming numbers). Shoots take place on private land or within the Crown Estate.

The Pembrokeshire Wildfowlers Association operates on specific lengths of the Milford Haven estuary complex (see Map 6) for very restricted periods of the year. Here hunters concentrate on waterfowl species such as mallard (*Anas platyrhynchos*), teal (*Anas crecca*), wigeon (*Anas penelope*), golden-eye (*Bucephala clangula*), Canada geese (*Branta Canadensis*), pochard (*Aythya farina*), gadwall (*Anas strepera*), tufted (*Aythya fuligula*). A very small minority of these hunters still employ the old punt gunning method.

In terms of opportunities for diversification, the opinion of BASC is that within Pembrokeshire there is no money to be made in shooting. It is mainly local people who take

part in the shoots. The very large shooting syndicates take place further east and within England. BASC are keen to promote shooting opportunities to farmers in the region but cautioned that farmers could not expect big earnings from this and that if there were big earnings, the use would be unsustainable.

The Shooting clubs have moratoria in place on hunting for greylag and white-fronted geese and jack snipe to ensure numbers recover.

BASC feel that there is or ought to be a great incentive for farmers to cooperate in conservancies. Efforts were made with Game Conservancy Trust to establish a greylegged partridge release site on a large part of the Marloes peninsula. For a variety of reasons (including habitat use and suitability) this did not take place, nevertheless the BASC representatives still feel there is a major opportunity for these sort of cooperative conservation and sustainable use efforts to be made.

BASC is a membership based organisation rather than an advisory service. There is no readily available information service to farmers wanting to establish shoots unless they are prepared to pay a large sum of money for a Game Conservancy Trust assessment. As yet the potential rewards do not justify these sorts of costs. A recent example of a farmer diversifying with a large scale shoot on his farm near Brawdy has not been financially successful and this farmer was not interested in driven woodcock shoots which would quickly deplete local numbers and do damage to the habitats. Low intensity shooting seems to be the favoured option in West Wales and much of this is done as recreational enjoyment on the basis of a 'bottle of whisky' for shooting rights rather than serious economic endeavours. There is a more obvious economic benefit to B&Bs accommodating people on shoots nearby (satellite accounting would link these) especially if these B&Bs permit dogs.

A problem exists in forested areas (more relevant to Carmarthenshire) where opening up access to the public is closing down the economic opportunities for deer hunting for health and safety reasons

Further information can be obtained from BASC:
Marford Mill
Rossett
Wrexham LL12 0HL
Tel: 01244 573000
Website: www.basc.org.uk

The Game and Wildlife Conservation Trust can advise on practical game management, such as game bird rearing and releasing, and shoot cost analysis.

The Game and Wildlife Conservation Trust
Fordingbridge
Hampshire
SP6 1EF
Tel: 01425 652381
Website: www.gct.org.uk