	BIOSPHERE RESERVE NOMINATION FORM **Final version dated 28 January 2008**	
	Biosffer Dyfi Biosphere	

PART II : DESCRIPTION

CONTENTS

6. LOCATION (LATITUDE AND LONGITUDE):

Point	Co-ordinate	Degrees	Minutes	Seconds
Centroid	Longitude	-3	54	14.04
	Latitude	52	36	23.76
North	Longitude	-3	38	43.44
	Latitude	52	47	55.32
East	Longitude	-3	31	49.8
	Latitude	52	36	25.2
South	Longitude	-4	13	44.76
	Latitude	52	24	43.92
West	Longitude	-4	6	0.48
	Latitude	52	25	58.8

7. AREA (see map in Part 1):

7.1 Size of terrestrial Core Area(s): 3,093.28 ha;
Size of marine Core Area(s); __7,786.39 ha

7.2 Size of terrestrial Buffer Zone(s): _1423.71 ha;

7.3 Approx. size of terrestrial Transition Area(s): _The terrestrial biogeographic unit (including terrestrial Core and Buffer areas) is 68,079 ha (681 sq. kilometres) but this does not necessarily define the limit of the Transition Area.

Approximate size of marine Transition Area(s); Some 1,500 ha of the Pen Llyn a'r Sarnau SAC is adjacent to the Core Area.

7.4 Brief rationale of this zonation (in terms of the various roles of biosphere reserves) as it appears on the zonation map.

In line with guidance from the UK MAB Committee (Appendix W) it was decided that only areas that had statutory protection through international designations should be eligible to be part of the Core Area. This could have included the whole of the Dyfi RAMSAR site and the Dyfi SPA, but small parts of those areas are in private ownership. To ensure control of the Core Area in the estuarine area, it was decided to restrict it to the two SACs, Cors Fochno and Pen Llyn a'r Sarnau. The community responded positively to the suggestion of including Coed Cwm Einion SAC in the Core Area. This was agreed, since it adds a different (woodland) habitat and its drainage water feeds directly into the estuary. The Pen Llyn a'r Sarnau SAC extends a long way west and north in the sea. It was decided to limit the Core Area to waters of less than 10m depth, on the grounds that the dunes are going to be impacted by currents and tides, but particularly waves, which impact on sediments down to 5 m. It was felt that the piece of Berwyn SAC within the river catchment was too remote and different to be included.

In line with guidance from the UK MaB Committee, it was decided that only areas that had statutory protection through UK national designations should be eligible to be part of the Buffer Zone. The area that is National Park was felt to be too extensive and much of it was felt to be too remote from the Core Area. The ten largest SSSIs were considered. Two of these (Berwyn and Pumlumon) were excluded because they are spurs of much larger upland SSSIs. Coed Cwm Einion was excluded once it was defined as Core Area. The remaining 7 were included. The Dyfi SSSI covers the same land and estuary as the two Core Area SACs, plus some surrounding land. The others are connected to the Core Area through drainage. Afon Dyfi ger Mallwyd and Ceunant Twymyn are in the upper catchment but it was felt that this may increase community involvement in the Biosphere by those communities.

The formal Consultation Document (available as Appendix L) took the catchment area of the river Dyfi as its starting point for discussing the Transition Area, as had been recommended by the Review of Biosphere Reserves in the UK. The Consultation Document suggested two options: either the sum of the 13 Town and Community Council areas that approximate the catchment, or that area with the addition of the Aberystwyth area. The majority of respondents favoured the first option but some were keen to ensure that Aberystwyth was not excluded. By its nature, the flexible Transition Area does not have a defined boundary, so people and enterprises who feel they can help the area work towards the Dyfi Biosphere's vision are being invited to liaise with those coordinating the Biosphere development process. This is why no formal outer limit has been set for the Transition Area. In addition to the zones required under the Seville Strategy (Core, Buffer and Transition), maps of the Dyfi Biosphere indicate the extent of the biogeographic unit that underpins the designation. On land this is the catchment area of the river Dyfi and at sea it is the coastal sub-cell out to a depth of 10m. The rest of the southernmost part of Pen Llyn a'r Sarnau SAC (in the sea, to the west and south of the Core Area) will also be indicated.

8. BIOGEOGRAPHICAL REGION:

The proposed Dyfi biosphere falls within the Temperate Broadleaf Forests or Woodlands biogeographical region.

However, it should be noted that the area is within the Atlantic oceanic zone and that (based on the assumptions that the maritime influence will persist and the climax vegetation will always be affected by this, and that a significant part of the reserve is aquatic for at least some of the time) it is probably better described as Temperate Coastal/Marine Zone, as proposed for the North Devon Biosphere Reserve, UK.

9. LAND USE HISTORY:

The area shows abundant evidence of past land use with early settlements and exploitation of its various natural resources from prehistoric times to the present day.

a) Farming

Livestock farming (sheep in the hills, cattle and sheep in the valleys) is the traditional primary agricultural practice in this region. Historically, hill sheep farming has been particularly important on the extensive upland rough grazings, with more improved and semi-improved pastureland in the valleys. In medieval times cattle and sheep were managed by transhumance, which utilised the summer grazing in the hills and later in the Middle Ages some hill grazing areas became permanently occupied holdings.

Considerable impact was made upon many of the moorland and marginal upland areas during the 1970s and early 1980s as a result of grant-aided land improvement schemes. These led to widespread stone clearance, upland pasture improvement and the construction for the first time of tracks which improved vehicle access to the hills.

The period since the mid 1980s saw the introduction of various conservation initiatives which have had significant impact upon the landscape, including the grant-aided agri-environment schemes which have fostered traditional farming methods and conservation of the natural and historic environment, including traditional farm buildings and boundary types.

In the past most farms in the area also grew their own vegetables, producing a small surplus for the local market, though this practice has largely been abandoned. There are now few diary farms and very little arable land.

The area is a stronghold for the breeding of the traditional Welsh Black cattle.

There has been extensive drainage of the low-lying land between Ynyslas and Ynyshir for agricultural purposes. The canalization of the Afon Leri, which diverted its natural course to the sea to discharge into the estuary, facilitated drainage of large areas. This resulted in major loss of peatland and wet grassland habitat. Large areas of farmland are occasionally inundated by flood water. There are 24 km of maintained earth flood banks on the Leri, Clettwr and Einion and the railway embankment on the south side of the estuary functions as a sea defence. All these structures restrict the natural gradation between estuarine and flood plain habitats. The estuarine marshes and surrounding land have traditionally been used by farmers to graze horses, cattle and sheep,

b) Woodlands

The native woodland which developed over much of the area in postglacial times was greatly reduced from Neolithic times onward. Remnants of native woodland survive in the valleys and on the lower hillsides. Traditionally the woods provided timber for building, for fuel (including charcoal), and fencing and oak bark was harvested for tanning. Oak timber and bark was exported in large quantities to Ireland until the 1890s.

The Ancient Woodlands Inventory reports that 1,325h of the 75,868h in the biogeographic unit (1.7%) is classified as Ancient Semi Natural Woodlands and an additional 1,359h (1.8%) as Plantations on Ancient Woodland Sites, giving a total land cover of 3.5% for ancient woodland in the river catchment area.

Large areas of the catchment were acquired by the Forestry Commission in the 1930s and many upland sheep walks planted with conifer species alien to Wales. In the 1960s – 1980s private commercial conifer forests were developed as well. Currently 14 % of the whole area is conifer woodland.

This form of land use can exacerbate acidification, increase soil erosion, reduce water yield and increase flood risk if not managed properly. Policy and practice changes over the last several decades have been driven by the need for sustainability and have been reinforced by the United Kingdom Forestry Standard (2004), The UK Woodland Assurance Scheme and (for many woodland areas) Forest Stewardship Council certification and its annual audit (see Appendix V). Nowadays, woodlands are being managed to mitigate pressure on flood, water quality, soil sediment and nutrient movement and native woodland restoration programmes have been rolled out.

As the timber crops mature, and in areas of crop failure, the FC's Forest Design Plans are developing a more diverse woodland structure and encouraging more native broadleaved species. These large tracts of state-owned woodland offer an important recreational opportunity for local residents and visitors who come here to enjoy the excellent walking, horse riding and mountain biking experiences.

c) Historic Landscapes

The whole landscape is of cultural importance but within it Cadw has identified specific Landscapes of Outstanding and Special Historic Interest that represent particularly important layerings of different phases of historical significance and contribution to wider Welsh culture. These Outstanding and Special Historic Landscapes are:

Landscapes of Outstanding Historic Interest	**Landscapes of Special Historic Interest**	**Landscapes, Parks and Gardens of Special Historic Interest**
Upland Ceredigion	Clywedog Valley	Plas Machynlleth
	Dysynni Valley	

(i) Upland Ceredigion

Parts of this historic landscape run adjacent to the south eastern boundary of the Dyfi Biosphere. Upland Ceredigion is an extensive area of dissected upland plateaux situated on the west side of the Cambrian Mountains in Ceredigion, containing rich and diverse evidence of land use from the prehistoric period to the recent past. The area includes: prehistoric to recent mining remains and settlements; Strata Florida Abbey and lands; Drover's routes; Parliamentary Enclosures; historic literary and artistic associations and the setting for Thomas Jones's Hafod; modern changes in land use typified by the forestry plantations and the Nant-y-Moch hydro-electric scheme.

(ii) Clywedog Valley

The Clywedog Valley and its catchment adjoining the upper reaches of the Severn Valley in Mid Wales, contain significant evidence of human activity from the late prehistoric period to the recent past. The area includes: Iron Age hillforts and settlements; a Roman fort; important post-medieval and recent lead mines and historic centre of the woollen and textile industries; the Clywedog dam, the highest mass concrete structure in Britain; significant historic and legendary associations.

(iii) Dysynni Valley

The Dysynni Valley fringes with the North-western biogeographic boundary of the Dyfi Biosphere. This picturesque valley bears diverse evidence of human occupation and activity from the prehistoric period to the recent past. The area includes: crop-marks of hidden, possibly pre-historic settlements, Iron Age hill-forts; a centre of Early Christian activity; medieval earthwork and masonry defence sites; distinctive remains of a native Welsh castle, probably begun by Prince Llywelyn ab Iorwerth ('the Great') around 1221; two of the finest gentry estates in Meirionnydd, Ynysmaengwyn and Peniarth, the former having had a significant impact on the landscape through extensive and pioneering agricultural improvement, land reclamation and drainage schemes during the late 18th and early 19th centuries.

(iv) Plas Machynlleth

Plas Machynlleth contains a large Grade II listed house of several periods and a small formal garden. Pleasure grounds partly remain as a public park. The main reasons for grading the site is due to the survival of much of an important and attractive Victorian park, in a fine natural setting, on the edge of Machynlleth. The mansion house became home to the marquesses of Londonderrry, who owned extensive estates in the area. The house and garden were later given to the town of Machynlleth as a public park, and the historical development of the site reflects that of the town.

d) Minerals

The Dyfi Biosphere incorporates the northern sector of the Central Wales Ore Field which was exploited for lead, copper and zinc ores and for silver. Although recent archaeological investigations indicate that mining may have occurred during Bronze Age, Roman and Medieval times, the ore field reached an acme of production during the last half of the 19th Century and production ceased during the first quarter of the 20th Century. There are numerous abandoned mines throughout the area, one of the largest being at Dylife which has a total recorded production of over 36,000 tons of lead ore, 1,500 tons of copper ore and nearly 400 tons of zinc ore. Most of the mines required substantial hydro-power for pumping, raising and crushing the ore, so leats, weirs and reservoirs were created to transport and store water. These, together with the spoil tips and remaining mine infrastructure, form a distinctive feature of the local landscape.

There were a few smelting sites, take the hamlet of Furnace for example. Generally the crushed ore was transported by pack horses, carts or tramways to riverside settlements like Glandyfi for transport by boat to the main collection point at Aberdyfi.

Water run-off and leachate from abandoned spoil tips, and discharges from underground mine workings can contain very high concentrations of heavy metals, including lead, zinc, copper and cadmium. Often these concentrations can be far in excess of those required to comply with European Quality Standards.

Quarrying for slate was a major source of employment that peaked in the second half of the 19th Century. Quarries were centred on the Dulas valley, with the last actively remaining quarry at Aberllefenni until recently.

e) Boating / navigation

Borth and Aberdyfi are closely linked by a long sea-faring tradition. Borth provided many seamen for Aberdyfi based ships which sailed world wide. Boats at Borth had to be beached on the shingle ridge because only Aberdyfi has a harbour and moorings.

The Dyfi was navigable for the transport of goods, including coal, culm and limestone, as far up river as Derwenlas until the little port closed in 1863. Most boat building was based at Aberdyfi, Derwenlas and the mouth of the Leri in the period 1840-60s. A 45 ton vessel was built at Llugwy in 1788.

In the early 1800s timber was imported to Aberdyfi from North America and the export of slate, oak timber and bark enjoyed a boom in the latter half of the 19th century. Aberdyfi had declined as a major port by 1900.

Ynyslas no longer has a ferry service but there are records of boats crossing the estuary mouth in the 14th century.

f) Fishing

There are many opportunities for fishing both at sea and in freshwater. The estuary and river further inland have long-established public and private fishing rights. The Dyfi has an important sea trout fishery and significant salmon catch but has suffered significant decline in recent decades.

There are seine netting licences in force below Dyfi Junction bridge. Of the freshwater lakes, Llyn Bugeilyn is noted for its wild brown trout.

Herring fishing was important in autumn months until the 20th century.

Historically the estuary has been used by locals for cockle fishing.

g) Energy

Wood and peat have been exploited for fuel. Peat was cut in the more accessible upland areas and particularly on the south side of the estuary around the periphery of Cors Fochno. Church records refer to peat cutting at Cors Fochno as far back as the 1300s. Renewed interest in wood as a heating fuel includes the proposal for a district heating scheme at Dinas Mawddwy, using chipped wood.

During the last two decades, some areas have seen the impact of renewable energy schemes, including the wind farms at Mynydd y Cemmaes (24 turbines of 300kw capacity later repowered to 18 turbines of 850kW), Mynydd Gorddu (19 turbines with a total of 10.2 MW) and Carno (56 at 600 kW). There has also been a revival of interest in electricity from water power, which provided electricity to many villages and farms until the coming of the national distribution system in the 1940's and 1950's. The 100 kW scheme at Maesglas, near Mallwyd, has attracted the attention of other farmers interested in diversifying into energy capture.

The Machynlleth area has a number of solar photovoltaic installations, including those at the Dyfi Eco Park. In addition, a small number of households throughout the area use solar water heating.

h) Tourism and recreation

Visitors have been attracted by the scenery since the late 18th century. There are long-established coaching inns and hotels throughout the area. The Victorians made excursions to see the Llyfnant valley and Artist's valley and the coastal resorts of Aberystwyth, Borth, Aberdyfi and Tywyn. In the post war period caravan accommodation developed rapidly to accommodate large numbers of summer visitors mainly from the Midlands.

See section 14.2 for information about the present day.

i) Communications

The deep indentation of the Dyfi forms a major physical divide between north and south Wales. There is no bridge crossing below Machynlleth so this has been a focal point for centuries. The A487 Fishguard to Bangor trunk road, the north-south artery serving the western half of Wales, passes through the town. The strategic A470 trunk road linking North and South Wales also passes through the Biosphere.

In the past fording the river may have been possible, e.g. on the Roman route to the fort at Pennal, and boats were known to ferry people across the mouth of the estuary as far back as the 1300s. For centuries the drovers moved livestock along ancient routes from this area into the English markets. The coming of turnpike roads provided easier options but required payment. By the 1860s the railway link from Shrewsbury to Machynlleth arrived with its branches to Aberystwyth and the north Wales coast. It continues to be a very important asset.

j) Human settlement

The pattern of settlements reflects physical features, such as historical river crossing points, and routes through the hills. Three registered Landscapes of Historic Interest in Wales, named the Dysynni valley, the Clywedog valley and Upland Ceredigion, just overlap the periphery of the Biosphere area.

There are many Bronze and Iron Age remains.

Roman activity is known at Pennal, Talybont and a fort at Penygrocbren close to the Dylife mines which were possibly worked at that time.

The report on the Historic Landscape for LANDMAP (the national information system, devised by the Countryside Council for Wales, for taking landscape into account in decision-making) characterises four aspects (as well as the Machynlleth settlement) of that part of Powys that lies within the Biosphere: part of the Dyfi forest (to the north); a strip of regular fieldscape (along the river Dyfi); a large block of irregular fieldscape (to the south of the river); and large areas of marginal land.

There are numerous Scheduled Ancient Monuments including prehistoric barrows, cairns, standing stones, Roman fortlets, field systems, etc.

10. HUMAN POPULATION OF PROPOSED BIOSPHERE RESERVE:

[Approximate number of people living within the proposed biosphere reserve]

Permanently / seasonally

10.1 Core Area(s): _____0_____ / _____0_____

10.2 Buffer Zone(s): _____0_____ / _____0_____

10.3 Transition Area(s): 13,000 people live in the biogeographic unit (river catchment). The adjacent Aberystwyth area has a resident population of 12,000, swelled by an international University student population of approximately 8,000. In addition, thousands of people stay for a short time on holiday each year but are not resident.

10.4 Brief description of local communities living within or near the proposed Biosphere Reserve

The Dyfi Biosphere lies within the administrative boundaries of three local Authorities – Ceredigion, Gwynedd and Powys – and includes part of the Snowdonia National Park Authority area.

The Biosphere area is very diverse, varying between traditional agricultural areas and those affected by tourism; between traditional rural communities and those communities that have seen rapid growth in the past 50 or so years.

The Electoral Wards are described below, grouped according to local authority area. Please see Appendix M for a fuller description.

a) Ceredigion Ward Descriptions

(i) Aberystwyth (multiple wards)

Aberystwyth is the largest town in proximity to the Dyfi Biosphere, located at the southern extreme. It includes the Communities First area of Aberystwyth - Penparcau and has a resident population of some 12,000 swelled by an international University student population of approximately 8,000. The town has approximately 7592 households.

Aberystwyth also has existing links with the UNESCO UK Man and the Biosphere Committee, being home to the Parc Natur Penglais Local Nature Reserve - which was given the Urban Wildlife Award for Excellence in 1997 by the Urban Forum of the UNESCO UK MAB Committee. Parc Natur Penglais Local Nature Reserve is the site of a disused quarry, last worked in the 1800's, just outside Aberystwyth. The 12-hectare site has been used for recreational purposes for decades by local people and in 1991 Ceredigion County Council and local residents drew up a conservation plan for the site. The site has been improved to include paths, signs, guided walks, view points, picnic areas and nature trails to allow visitors to enjoy the wildlife of the site.

(ii) Borth Ward

The Borth ward covers some 2549 Hectares and includes the settlements of Y Borth, Upper Borth, Llandre, Dol-y-bont, and Ynyslas – where the Core Area of the Biosphere lies.

Borth ward has a resident population of 2258 people and 972 households with a population density of 0.89 (persons per Hectare). Employment is predominantly public sector and education, closely followed by the wholesale, retail and repairs sector. Tourism plays an important part in the ward's economy.

(iii) Ceulanamaesmawr Ward

The Ceulanamaesmawr ward is the northernmost ward of the county and covers some 13,638 Hectares and includes the settlements of Eglwysfach, Furnace, Tre'rddôl, Tre Taliesin, Talybont and Bontgoch.

Ceulanamaesmawr ward has a resident population of 1917 people and 820 households with a very low population density of 0.14 (persons per Hectare). Employment is predominantly public sector and education, closely followed by the wholesale, retail and repairs sector.

(iv) Tirymynach Ward

The Tirymynach Ward is a small ward of 1453 hectares that includes the settlements of Llangorwen and Bow Street.

Tirymynach ward has a population of 1888 in 782 dwellings and has a population density of 1.30. Employment is predominantly public sector and education, closely followed by the wholesale, retail and repairs sector.

b) Gwynedd Ward Descriptions

(i) Aberdyfi/Pennal Ward

The **Aberdyfi ward** covers some 5298 Hectares and includes the settlements of Aberdyfi, Cwrt, Pennal and Caethle.

Aberdyfi ward has a resident population of 1136 people and 551 households with a population density of 0.21 (persons per Hectare).

Tourism plays an important part in the ward's economy as illustrated by the largest number of people being employed in the Hotels and restaurants sector, closely followed by the wholesale, retail and repairs sector and then public sector and education.

(ii) Corris/Mawddwy Ward

The **Corris/Mawddwy ward** covers some 16,490 Hectares and includes the settlements of Pantperthog, Corris, Corris Uchaf, Aberllefenni, Aberangell, Mallwyd, Minllyn, Dinas Mawddwy, Cwm Cewydd, AberCywarch and Llanymawddwy.

Corris/Mawddwy ward has a resident population of 1216 people and 553 households with a population density of 0.07 (persons per Hectare).

Employment is predominantly public sector and education, closely followed by the wholesale, retail and repairs sector. Tourism and Agriculture also play an important part in the ward's economy.

c) Powys Ward Descriptions

(i) Machynlleth town ward

The **Machynlleth town ward** covers some 506 Hectares and is the main settlement within the Biosphere. Machynlleth has a resident population of 2147 people and 995 households with a population density of 4.24 (persons per Hectare).

As would be expected for a town ward employment is predominantly wholesale, retail and repairs sector, closely followed by the Health and Social work sector, with the manufacturing sector being the third highest employment category.

(ii) Glantwymyn/Cadfarch ward

The **Glantwymyn/Cadfarch ward** covers some 22,169 Hectares and includes the settlements of Derwenlas, Forge, Glantwymyn, Commins Coch, Darowen, Abercegir, Abergwydol and Penegoes.

Glantwymyn ward has a resident population of 1955 people and 815 households with a population density of 0.09 (persons per Hectare).

The majority of employment is balanced between the public sector and education, the wholesale, retail and repairs sector and the agricultural sector.

(iii) Llanbrynmair ward

The **Llanbrynmair ward** covers some 12,953 Hectares and includes the settlements of Llanbrynmair, Dylife, Pennant, Bont Dolgadfan, Llan, Pandy and Plas-Rhiw-Saeson.

Llanbrynmair ward has a resident population of 958 people and 381 households with a population density of 0.07 (persons per Hectare).

Employment is widely spread across a number of employment categories as would be expected of a large but sparsely populated county. Employment is predominantly public sector and education, closely followed by Agriculture, then the wholesale, retail and repairs sector.

d) Snowdonia National Park Authority

Part of the Dyfi Biosphere area falls within the boundaries of the Snowdonia National Park Authority and the communities concerned (Aberdyfi, Pennal and Mawddwy) are included within the Gwynedd section above. National Parks in the UK are IUCN Category V Protected Landscapes. The designations are in place to aid the conservation of the natural beauty of these areas and their enjoyment by the public, but within a framework of viable communities.

10.5 Name(s) of nearest major town(s):

Aberystwyth

10.6. Cultural significance:

The following points are included below:

- continuity of human occupation and exploitation of the area from the earliest times
- parliaments at Machynlleth and Pennal at the turn of the 14th century (Owain Glyndŵr)
- mining and smelting of metal ores and the quarrying and shipping of slate - plus woollen mills - peaking during the 18th & 19th centuries
- farming and maritime tradition
- one of the strongholds of the Welsh language
- tradition of sustainable living

The Dyfi is sometimes seen as an area of transitions within Wales. It is where North and South Wales meet, where the landscape changes from pastoral hills to rugged mountains, and where the peoples of Wales feel their cultural differences come together.

Historically, the area has seen human occupation from the Bronze Age with a number of hill forts evident in the area. The discovery by Cambria Archaeology in 2004 of a Prehistoric timber track way on the southern part of Cors Fochno emphasises the continuity of human occupation and exploitation

of the area from the earliest times. There is strong evidence of Roman occupation and industrial activity within the Cors Fochno vicinity, although more research is needed to better understand the influence of the Roman occupation on this area.

At the turn of the 14th century, the last native Prince of Wales, Owain Glyndŵr, an educated and outlawed Welsh nobleman, led a decade of rebellion against the English king Henry IV. His efforts to create an independent Wales – even going so far as to establish 'parliaments' at Machynlleth and Pennal – ended in defeat, but not before he established himself as an icon of national hope and pride still revered by many today.

The dominant historical land use has been – and remains – agriculture (see map: Appendix Z), with latterly an emphasis on forestry. As with many upland areas of Wales, the farming economy is dependent mostly on stock-rearing, principally sheep – a practice introduced to the area during the Medieval period. Access to Cardigan Bay and the tidal banks of the Dyfi with its fishing and navigation, together with the mineral riches of its hinterland, has meant that this area has seen significant and varied industrial development from earliest times, which the creation of its water-control systems and the introduction of the railway in the early nineteenth century further encouraged. Small-scale extractive industries were conducted within the area – peat-cutting at Cors Fochno, and a short-lived venture to extract salt at Ynyslas.

The first maritme mention and records of the ferry across the river of Aberdyfi date back to the 1100's and during the Elizabethan period Aberdyfi already had a notable fishing industry but little built development. During the 16th & 17th centuries Aberdyfi was still enjoying prosperity from the Herring fishing industry and was finding added business from exporting the locally mined Lead Ore. When the Lead industry became less profitable in the 19th Century the port had developed to take advantage of the growing Slate quarrying industry. The port has its first lifeboat in 1837. The end of Aberdyfi as a sea port came about with the decline in shipbulding in the late 1800's, a reduction in Herring stocks and a general decline in the local economy leading up to the depression and the first world war. Since then Aberdyfi has grown as a tourism destination and a base for marine leisure activities.

The mining and smelting of metal ores and the quarrying and shipping of slate were important economic activities, peaking during the 18th & 19th centuries - provoking the development and growth of some of the rural settlements in the area. Other cottage industries developed to support the industrial activity and the needs of the often-isolated communities including Hat-makers, Coopers, Blacksmiths, Boot-makers, Bakers, Millers, Masons, Rope-makers, Maltsters and Brewers, Herring fishermen, Clog makers, Charcoal burners and the development of many woollen mills brought trades such as Weavers, Tailors and Dress-Makers.

From the days of Early Christianity, religion has influenced settlement patterns, as seen in the high numbers of settlements carrying the *llan* (meaning Church) prefix. While the Established Church appears to be dominant because of the place names, the area was also influenced by Nonconformity, testified to by the presence of chapels of varying design and a range of denominations. Many have lost their congregations over the past half-century, and some have disappeared. As an architectural type, those that remain are dominant in the streetscape of settlements. Noncomformity remains an important influence among Welsh speakers in social and political as well as spiritual terms.

While the mines and quarries along with the narrow gauge railways and other transport routes that linked them are now closed, the villages they supported remain as shadows of their former selves. Although retaining a strong sense of local identity, they lack the self-sufficiency of local trades they once had and now are serving as mainly residential bases for people who travel to work in towns such as Machynlleth and Aberystwyth.

The arrival of the railway in the 1800's brought tourism to the area and this is now an important economic sector - particularly in Aberdyfi, Borth and Aberystwyth - but with strong influence on the wider area. Many people have diversified into providing tourism-based facilities and rely on the natural and cultural attractions of the area as an extra source of income.

During the 1970s, Mid and West Wales attracted a large number of young people searching for alternative lifestyles. They occupied and renovated old farm dwellings or miners' cottages that stood empty due to the decline of these industries. In the Dyfi area in particular, these people have subsequently helped to generate a strong community interest in environmental issues and sustainable living.

Machynlleth is the most central settlement in the Biosphere area. It is a market town and major (road and rail) crossing point of the Dyfi river. There has been a settlement here since the Iron Age and the town has a strong sense of historical importance. The wide main street dominated by the clock tower, reflects its long established importance as a market town.

The opening of a large maintenance depot has reinforced the traditionally strong role that Machynlleth has played in the railway industry and while most of the manufacturing and industrial jobs are disappearing from the area, the knowledge-based and service type businesses are doing well.

In common with much of rural Wales, the valley has a high rate of self-employment, reflecting the large agricultural and tourism industries. There is a substantial reliance on employment within the public sector in the area. Tourism, education, health care, retailing and distribution are the largest employers in the dominant services sector, which collectively accounts for well over half the workforce.

The area has particular strengths in bilingual publishing. Y Lolfa, a family owned company based in Talybont, is a leading publisher of popular Welsh fiction and factual titles. It also produces books in English on Welsh topics and published for example works by economist/philosopher Leopold Kohr, originator of the term 'small is beautiful'. The Dyfi Eco Park has been selected as the editorial base for 'Y Byd' (The World), the first Welsh language daily newspaper, to be launched on March 1 2008.

The Biosphere area is set within a broader regional context in which, from an economic development perspective, rural Wales as a whole is perceived to be one of the most marginal areas of western Europe. The Dyfi valley lies largely within EU Objective One / Convergence Funding areas (Ceredigion and Gwynedd) and to a smaller degree in an Objective Two / Competitiveness Funding area (Powys). The Powys part of the area is also recognised as a "Communities First" area under the Welsh Assembly Government's programme to reduce poverty and deprivation and help to improve livelihood opportunities. The Welsh Assembly Government thus sees the need for a long-

term commitment to support work that addresses social exclusion and lack of access to services in this area.

The area is rich in natural beauty and cultural heritage, and as has been shown above has a strong farming and maritime tradition and a unique sense of identity amongst its people. This thriving bilingual community has a strong tradition of sustainable living. There are, however, a number of issues of concern for local people including:

- The uncertainty that exists within the farming community as it struggles to adapt to change;
- The problems facing lower lying communities in respect of climate change and sea-level rise;
- The question of how to capitalise on tourism (and the income this generates) in terms of protecting local services and producing the greatest benefit locally;
- The need to retain more young people within local communities; and
- Concern over the dilution of the Welsh language and culture, some of which is linked to tourism and related inward migration.

The Dyfi Valley's development since the war, and more particularly since the 1970s, reflects two world-wide cultural shifts.

One is from exploitation of land (to serve fundamental human needs) to sustainable management of land (as a vital but fragile resource). It is remarkable that the area should articulate so powerfully both the traditional Western European imperative to develop and to exploit land and the successor mentality, of environmental conservation and respect.

The other is from land as a productive resource to a leisure resource. Cheaper travel, greater free time and a growing awareness of ecological issues have meant that many parts of the developed world have become part of the culture of recreation. Though this trend is evident from the eighteenth century onwards, it was accelerated by the coming of the railways in the nineteenth century, when resorts like Borth offered more opportunities for working-class people (who were not well-off) a holiday by the sea.

The Dyfi Biosphere faces an economic challenge to support its agricultural sector. Farm subsidies, incomes and employment are falling, exacerbating the problems faced by the rural economy and strengthening the need for new business and employment opportunities.

The report 'Valuing our environment – Economic Impact of the National Parks of Wales' (Countryside Council of Wales 2006) points out that relatively remote market towns rely on the supply of goods and services from wholesalers in larger towns. The shops provide for the day-to-day needs of locals and provide a range of goods and services for visitors. Retailers typically experience a strong seasonal fluctuation in sales – often around 70% greater in summer than in winter. The franchised supermarkets are tied to their centralised distribution systems. Many of the public houses are managed locally but owned and supplied by big brewers. Even smaller retailers are constrained by the restricted availability of local products (meat excepted).

The Dyfi valley is one of the strongholds of the Welsh language, and the Welsh language and its associated culture are an important and integral part of community life. More than 60% of residents

can speak Welsh, although the distribution of Welsh speakers is skewed towards the upper valley (see map: Appendix Y). The monthly Welsh-language Papurau Bro, produced by volunteers for their own communities, have large and loyal readerships.

In cultural terms the area also has particular strengths in choral singing, with several mixed and male choirs as well as a vibrant youth musical theatre group which provides performances of original works on traditional themes in contemporary mode. It is also home to an award winning group of poets who use the traditional 'cynghanedd' strict metre forms which are largely unchanged since medieval times. Appreciation of landscape, heritage, wildlife and language are important themes in composition.

The upper Dyfi valley is also the heartland for "canu plygain" – a unique form of unaccompanied, harmonic, carol singing, traditionally by small family groups. It was originally used to greet the new year but is now the basis of performances in several localities throughout the festive season.

Cultural events can be seen as being influenced by the use of Welsh and English - with Eisteddfodau (competitive Welsh cultural festivals) and the Noson Lawen (Welsh entertainment evenings) where Welsh is dominant, and other activities where English is the main language. The use of the Welsh language in everyday life and certainly in tourism is perceived to be advantageous by both Welsh and English speakers alike.

A very high proportion of the agricultural workforce and farming families use the Welsh language verbally for most cultural, social, commercial and official communication, making a substantial contribution to local creative, cultural activities in terms of support, organization, participation and performance. This includes poetry and drama, choral and instrumental music as well as some traditional crafts. The local dialect includes a number of unique terms relating to wildlife, landscape and traditional agricultural practices.

This is an area where the rich and vibrant cultural tradition is linked to language and indigenous continuity, Reasons for the decline in use of the Welsh language have been linked with natural loss, outward migration related to economic factors, and in-migration. Over the past thirty years levels of in-migration have increased and although some newcomers make valiant and successful efforts to learn Welsh their presence often contributes to a decline in the use of the language.

A significant development has been the Dyfi valley's growing importance as a focus for environmental and green concerns, reflected in the establishment of the Centre for Alternative Technology at Pantperthog and a number of 'spin-out' initiatives. It is important to emphasise that the ecological focus which many of these groups share does not make them into a unified culture. Dulas Ltd, for instance, stresses that it is a business, and that it adopts a hard-headed (though no less socially responsible) approach to its operations, whereas many of the people who have made their home in the area will be following a more radical and individualistic agenda. These activities are mainly prompted by, and attract, incomers.

These social and institutional changes do not reflect a complete break with the past. Much of the area continues to be farmed by long-established families, Welsh in speech and outlook, and determined to sustain their own way of life. This has meant that there has been limited discussion between the established agricultural community and newcomers eager to develop an ecological

focus. As noted elsewhere, enlargement of the Biosphere could provide a fresh impetus for dialogue among the groups identified above.

The Tabernacl cultural centre, located in a converted chapel, is a remarkable asset for a small town. It has been established through much voluntary effort and one family's patronage. It houses the Museum Of Modern Art Wales as well as a concert auditorium and teaching spaces. As well as the Welsh-medium choirs in the valley, there are two community choirs who attract mainly English-speakers. Many people are involved in social activities based around Women's Institutes, Merched y Wawr, chapels and the usual range of clubs and societies.

Architecturally, the nineteenth century farm-complexes and the farmhouses (or the houses that were formerly the centres of farms) that are almost Alpine 'Gothic' in character are substantial, well-built structures, for the most part well-maintained. They typically are stone-built but with the distinctive local use of brick to form flattened arches in doors and windows.

11 PHYSICAL CHARACTERISTICS

11.1. General description of site characteristics and topography of area:

The Dyfi valley lies in Central Wales, extending some 47kms from the Aran Mountains (900 metres) in the east, to the mouth of the Dyfi estuary at Aberdyfi on the west coast. The area includes one of the most spectacularly beautiful estuaries in Wales, offering fine views of the mountains of Snowdonia National Park to the north and the uplands of Pumlumon and the Cambrian Mountains to the south. While the northern part is separated from the rugged Cadair Idris range only by Talyllyn lake, to the east the gentle north Powys lowlands lie the other side of the Talerddig pass.

Upstream of the estuary, the river Dyfi flows through some of the most attractive scenery in Wales. The upper valley catchment is within the Snowdonia National Park - Wales first and largest National Park[1] The river dominates the character of the landscape throughout the catchment. It flows along a major line of weakness through Ordovician and Silurian strata which fringe the south and south eastern edge of Snowdonia, comprising primarily Cambrian and Pre-Cambrian rocks with igneous intrusions. During the Pleistocene, Wales was an area of high relief and there was considerable snowfall; ice sheets radiated from northern Snowdonia and the effects of glaciation are to be seen everywhere. South of Cadair Idris (northern fringe of the area) the topography has a more rounded appearance. The upper Dyfi valley and Dysynni valleys have U-shaped cross sections, and other evidence of glaciation (drumlins, moraine dammed lakes, boulder clay soils and outwash gravels) are to be seen in the landscape.

The Dyfi Biosphere encompasses a wide range of topographic features which characterize the unique landscape of the area. The Dyfi drains from Creiglyn Dyfi (732m above mean sea level). The river flows to the south west and follows a steep gradient for approximately 4.5km until it reaches the

[1] National Parks in the UK are IUCN Category V Protected Landscapes. The designations are in place to aid the conservation of the natural beauty of these areas and their enjoyment by the public, but within a framework of viable communities. Snowdonia was designated a National Park in 1951.

valley floor at Pennant at 169m above sea level, a drop of 563m. On route to sea, both the Cywarch and Cerist Rivers join the Dyfi, as well as numerous other tributaries that enter before Machynlleth. The total catchment area of the Dyfi is 200 sq miles. The river dominates the character of the landscape throughout the area.

The area is characterized by a patchwork of hills, shallow lakes, streams, waterfalls, forests, wetlands and rich sand dunes. The largest topographic feature in the area is the Aran Fawddwy which lies to the north of Dinas Mawddwy and has an elevation of 905 metres.

The Dyfi Biosphere extends westwards into the Irish Sea, in marine, shoreface, blown sand and beach deposits fringing the coasts. The sandy estuary has a sediment spit at the mouth and a well developed funnel shaped profile, tidal meanders and tidal delta. An extensive area (c1210ha) of intertidal sand and mudflats are present as well as salt marshes (550ha). Actively growing sand dunes have formed on both sides of the estuary at Ynys Las and Aberdyfi and together extend to around 180ha. The North-South dune covered spit projects into the mouth of the Dyfi estuary and partially overlies a storm beach ridge of gravel and cobbles from Borth to Ynyslas.

The whole of the estuary and surrounding in-shore waters are part of the Pen Llyn a'r Sarnau European Marine Site (SAC & SPA). Sarn Cynfelin, south of the Dyfi estuary, is one of three very unusual shallow subtidal reefs, which extend many kilometres from the coast into Cardigan Bay. The Sarnau are glacial moraines (resulting from the last glaciation) and are composed entirely of boulders, cobbles and pebbles mixed with various grades of sediments. Fast tidal streams and strong wave action have a profound influence on the marine communities present.
A unique estuarine raised bog lies south of the estuary, near Borth (Cors Fochno). This peat bog is of high international importance, retaining an active peat-forming dome of c200ha (the largest uncut area of raised bog in Britain), surrounded by a further c450ha of modified bog. Cors Fochno is a SSSI and a Geological Conservation Review site (number 1352) that records Holocene environmental, sea level and vegetational changes. Peat has also formed as thin blankets on high-level valley slopes. Upstream along the Dyfi valley are remnants of native oak woodland. Broad leaved/mixed woodlands are located throughout much of the Biosphere area, whilst coniferous woodlands are scarcely found in parts of the Biosphere.

Most of the topography of the Biosphere can be attributed to the Late Devensian phase of Glaciation, in which ice dispersed from the Welsh centres.

11.2.1 Highest elevation above sea level: 905 metres at Aran Fawddwy summit

11.2.2 Lowest elevation above sea level: 0 metres (sea level)

11.2.3 For coastal/marine areas, maximum depth below mean sea level: 10 metres

11.3. Climate:

The climate of the Dyfi Biosphere, according to the Köppen climate classification system (1928) has a Cf climate (C: humid and mid-latitude climate with mild winter; f: moist, with adequate precipitation in all months and no dry season). The area has a marine climate due to the prevailing

westerly movement of moist air masses from the Atlantic Ocean. The weather of Britain itself is dominated by tracks of frontal depressions which form in the mid Atlantic and advance eastwards over Wales bringing precipitation. The climate of Wales is wetter than the English lowlands, as Wales is situated in the path of the prevailing Westerly winds from the Atlantic Ocean.

The principal factor that influences the climate of the area is its geographic location and close proximity to the Atlantic Ocean. Winters are mild in the area and summers are warm. The local weather is dominated by the local elevation and conditions can vary considerably from day to day. The coastal climate is considered mild but wet, whilst the higher ground is cold and extremely wet. With increasing height above sea level, temperatures fall and precipitation increases.

The mean annual temperature for the area is 10°C, which decreases by 0.5°C for each 100m increase in altitude. With distance inland the precipitation also increases steadily. There is no markedly wet or dry season, however the driest month is generally May and the wettest month is December. Over a period of 16 years (at Machynlleth Station), December had a monthly average rainfall of 262mm, whilst May only had a monthly average of 104mm. Snowfall is only significant in the uplands and generally occurs between November-March. The growing season in the Dyfi valley is dependant on local conditions. On the lowlands it extends from late February to mid-December, whilst on the higher ground the growing season can be 13-17 weeks shorter.

11.3.1 Average temperature of the warmest month at Machynlleth Station (Pantperthog): 16.4°C (based on data over 17 yrs).

Average temperature of the warmest month at Foel Friog Station (Aberllefenni): 17.05°C (based on 3 years data).

11.3.2 Average temperature of the coldest month at Machynlleth Station: 3.9 °C (based on data over 20 yrs).

Average temperature of the coldest month at Foel Friog Station: 5.1 °C (based on 3 years data).

11.3.3 Mean annual precipitation: 2118 mm, recorded at an elevation of 75 metres (Machynlleth Station).

Mean annual precipitation: 1262.2 mm, recorded at an elevation of 85 metres (Cors Fochno Station).

Mean annual precipitation: 1943.5 mm, recorded at an elevation of 90 metres (Foel Friog Station).

11.3.4 Several meteorological stations are located in the proposed Biosphere Reserve.

Listed below are details indicating the year since climatic data has been recorded:

a) manually: 1985_____

b) automatically: 2006_____

c) Name and location of station: Machynlleth Station at Centre for Alternative Technology, Pantperthog. Cors Fochno AWS, Borth. Foel Friog Station, Aberllefenni

11.4. Geology, geomorphology, soils:

GEOLOGY

Lithostratigraphy
The geological succession within the Dyfi Biosphere spans the mid-Ordovician (Caradoc Series) to mid-Silurian (Wenlock Series) interval of Earth history. The oldest Ordovician rocks occur in the northern part of the area where the Aran Fawddwy Formation comprises 350-400m of acid ash-flow tuffs. Farther south, late Ordovician (Ashgill Series) argillaceous sedimentary rocks crop out in the core of the Machynlleth Inlier and in periclinal folds along the western margin of the Plynlimon Inlier. The Ordovician sequence is conformably overlain by Silurian sedimentary rocks dominated by a thick succession of turbiditic mudstones. The sedimentary sequence records prolonged deposition within the Lower Palaeozoic Welsh Basin which received sediment-laden turbidity currents derived from shallow shelf areas around its margins.

Structure
The sedimentary rocks of the Welsh Basin were strongly deformed by the Acadian phase of mountain building during the Devonian Period, approximately 400 million years ago. This deformation tilted, folded and fractured the rocks within the Dyfi Biosphere. Major folds such as the Machynlleth and Plynlimon inliers have a NNE trend and are cut by ENE-trending transverse faults (e.g. Llyfnant and Pennal faults), NNE-trending strike faults and several west-dipping thrusts. Accompanying the folds, the Acadian deformation also produced a cleavage that is particularly well developed within finer-grained mudstones of the Welsh Basin. Cleavage formation essentially involves the re-crystallization of platy minerals such as micas and thereby enables the rocks to be split along surfaces that are not necessarily parallel to their original bedding layers. The development of a strong cleavage gave rise to the late Ordovician slate deposits that until recently were quarried around Corris and Aberllefenni.

Mineralisation
The Dyfi Biosphere incorporates the northern and north-western parts of the Central Wales Ore Field. Numerous mines occur throughout the area and are the legacy of a long history of metal mining that reached an acme during the second half of the 19th Century. The mines exploited a series of narrow, steeply-inclined and dominantly ENE-striking mineralised fractures that were formed over a long interval following the end of the Acadian deformation. The main minerals worked in the orefield were galena (PbS), sphalerite (ZnS) and chalcopyrite ($CuFeS_2$), with silver occurring both in association with the galena and another mineral called tetrahedrite.

GEOMORPHOLOGY

During the Quaternary Period (2.6 million – present), the Dyfi area suffered several major phases of glaciation. Most of the glacial landforms and associated deposits seen today are, however, mainly due to the most recent Late Devensian glaciation that lasted from about 27,000-16,000 years ago. During this period, large glaciers flowed south into the Dyfi Valley from the Aran mountains and west from the uplands around Pumlumon. The ice may have been up to 800m thick in southern Snowdonia so that many of the mountain peaks, such as Aran Fawddwy, formed nunataks that protruded out of the ice. With the possible exception of Pumlumon, the entire area south of the Dyfi Valley was completely covered by ice. Following ablation and a period of gradual warming, a major

climatic deterioration was experienced during the Younger Dryas between about 11,000-10,000 years ago, when glaciers are believed to have re-occupied many of the upland cirques.

The Late Devensian phase of glaciation and subsequent deglaciation generated a wide range of glacial and fluvioglacial landforms and associated deposits within the Dyfi Biosphere. These include spectacular cirques and U-shaped glacial valleys, such as those around Aran Fawddwy and west of Dinas Mawddwy, nivation cirques, roches moutonnées, glacial meltwater channels, gorges, alluvial fans and kettle holes.

The start of the Holocene Stage, 10,000 years ago, witnessed a continuation of the warming that had begun earlier in the Late Devensian. Sea level, which at the end of the last glaciation had been up to 65m lower than at present, continued to rise. Vegetation began to flourish around the coastal margins, with the establishment of oak and pine forests by about 6,000 years ago as recorded by the fossil forest at Borth. The death of the forests around 4,500 years ago may have been a result of wetter conditions caused by sea level rise or increased rainfall. At Borth, the progressive northward growth and inland migration of the Ynyslas coastal barrier, combined with a rising water table, led to the development of the world famous Sphagnum raised bog known as Cors Fochno.

SOILS

The main soils of the Dyfi valley are podzolic soils, ground water gleys and peat. Podzolic soils have a peaty surface layer and humus and/or iron enriched subsoils. These soils form in areas that are wet, cold and have short warm winters. They are also characterized by moderate leaching. Ground water gleys are formed along the River Dyfi and are permeable, seasonally waterlogged and affected by the groundwater table. Peat soils are classified as having more than 40cm of organic material that has a well drained surface layer.

The marked climatic gradient with altitude in the Dyfi valley produces zones of different soil types, which are further complicated by variations in aspect, exposure and physiography. The soil profile is also influenced by the nature of the parent material. Around the Core Area the lower Palaeozoic sedimentary rocks of the district provides most of the mineral to the soils. The soils of the alluvial flats and terraces that occur in the Dyfi valley are gleyed and peaty soils. Cors Fochno (Borth bog) has a carbon rich peat soil which is naturally wet and has a very low fertility. Rare sandwich soils can be found at Ynyslas along with the freely drained sand dune soils. All of these are of great conservation interest.

In the estuary, although the groundwater seeping from adjacent soils is relatively mineral-rich, pH values of the soils are below 4.5 in places. Saltmarsh soils, located along the estuary, are naturally wet, have a loamy texture and are lime-rich, but saline. Loamy and clayey floodplain soils and soils of the coastal flats have a natural high groundwater with moderate fertility, and support mainly grassland. A high coverage of freely drained acid loamy soils can be seen in the Dyfi area, which has a low fertility that supports grassland and rough grazing. Very acid loamy soils with a wet peaty surface layer are located in the uplands and support only moorland grazing, forestry and grassland as they have a very low fertility rate.

A commonly found soil in Wales is the Manod soil (typical brown podzolic soil), which supports biological interest of the SSSI's of the area e.g. Coed Cwm Einion in the Core Area. The Hafren Soils (Ferric stagnopodzols) are formed at Pengarreg Gopa, part of the Buffer Zone. The less common Conway soils (typical alluvial gley soils) and Tanvats soils (typical alluvial gley soils) are found in parts of the Dyfi valley. The Rheidol series occurs only in a few acres in the lower Dyfi valley. These are described as brown earths with organic matter. The Conway series is formed in silty alluvium influenced by a high water table and is present in the Dyfi valley at altitudes from near sea level to over 500 ft.

12. BIOLOGICAL CHARACTERISTICS

DISTRIBUTION

12.1. First type of habitat/land cover: _LOWLAND PEATLAND_____Local

12.1.1 . Characteristic species:

Lower plants: 14 species of bog mosses including *Sphagnum austinii, S. fuscum* and *S. pulchrum*, and liverworts including: *Odontoschisma sphagnii*, *Pallavicinia lyelli*.
Graminoids including: *Eriophorum angustifolium, E.vaginatum, Scirpus caespitosus, Rhyncospora alba, Rhyncospora fusca* and in poor fen/ brackish fen/ swamp areas *Molinia caerulea, Carex panicea, Phragmites australis, Schoenus nigricans, Juncus maritimus, Carex paniculata*.
Ferns including: *Osmunda regalis*
Dwarf shrubs/ shrubs including: *Erica tetralix, Calluna vulgaris, Myrica gale and Frangula alnus*.
Flowering plants including: a) Raised bog: *Andromeda polyfolia, Drosera anglica, D.intermedia, D. rotundifolia, Menyanthes trifolia, Narthecium ossifragum, Utricularia minor, Vaccinium oxycoccus*. b) Poor fen/ brackish fen/ swamp: *Anagallis tenellum, Eupatorium cannabinium, Iris pseudocorus*, *Lotus uliginosus, Lycopus europaeus, Lythrum salicaria, Platanthera bifolia, Pedicularis palustris, Potentilla palustris, Succissa pratense,*
Mammals including: Pygmy shrew, water shrew, harvest mouse, otter.
Breeding birds including: Cuckoo, curlew, garganey, grasshopper warbler, lapwing, linnet, redshank, reed bunting, reed warbler, sedge warbler, shoveler, common snipe, skylark, stonechat, teal.
Wintering birds including: Hen harrier, merlin, peregrine falcon, short-eared owl.
Reptiles include: Adder, grass snake, slow- worm and common lizard.
Invertebrates including: i) Lepidoptera, eg; *Crambus silvella, Idaea muricata, Hypenodes humidialis, Coenophila subrosea, Coenonympha tullia*, ii) Hemiptera eg: *Micracanthia marginalis, Paradelphacodes paludosus, Pachybrachius luridus* iii) Coleoptera eg. *Enochrus affinis, Stictonectes lepidus, Agonum erecti, Biblioplectus tenebrosus*. iv) Odonata eg.: *Bracytron pratense, Ceriagrion tenellum* v) Diptera eg: *Anatella dampfi, Allodia embla, Erioptera nielseni, Exechia pectinivalva*. vi) Araneae eg: *Agraecina striata, Drassylus lutetianus, Heliophanus dampfi, Maso gallicus*. vii) Orthoptera: *Metrioptera bracyptera*

12.1.2. Important natural processes:

- Ombrogenous (rainfall-generated) raised mire growth, with carbon sequestration and intimate linkage of hydrology, vegetation, surface microtopography and the peat body.
- Encroachment of tidal influence on mire margin.

12.1.3. Main human impacts:

- Drainage & tidal control
- Peat- cutting (non-commercial, hand cutting)
- Agricultural exploitation
- Fire
- Deposition of atmospheric nutrients

12.1.4. Relevant management practices:

- Hydrological restoration
- Removal of alien species
- Control of scrub invasion
- Low intensity conservation grazing of fen/poor fen margins.
- Control of access

12.2 Second habitat/land cover: MARINE/INTERTIDAL

DISTRIBUTION
Local

12.2.1 Characteristic species:

Subtidal sandbanks support a variety of marine wildlife: burrowing worms, crustaceans, molluscs and echinoderms live within the sandbank sediments, whilst more mobile species such as shrimps, molluscs, crabs and fish live closer to and on the surface. Subtidal sandbanks are important nursery areas for fish, and feeding grounds for seabirds.

The upper part of the open coast shores are species poor with a strandline community of sandhoppers (amphipods such as *Talitrus saltator*). The mobile sand in the mid and lower shores is characterised by small burrowing crustacea (amphipods and isopods such as *Erydice pulchra*). Where the sand is very soft and aerated only burrowing amphipods and occasional bivalve molluscs occur and, where the water movement is less, well sorted fine sand has polychaete worms such as *Nephtys cirrosa*, the thin tellin shell *Angulus tenuis* and sand-eels *Ammodytes tobianus*. Mobile sand in the upper estuary is commonly populated with a community of amphipods *Bathyporeia* sp. and *Corophium* sp. Muddy sand is dominated by the lugworm (*Arenicola marina*) and bivalves such as the cockle *Cerastoderma edule*, the baltic tellin *Macoma balthica*, the sand gaper *Mya arenaria* and the thin tellin *Angulus tenuis*. Stable muddy banks have numerous peppery furrow shell *Scobicularia plana*. In the upper reaches of the Leri and at Glandyfi the muddy shores support numerous ragworms (*Hediste diversicolor).* Clumps of the edible mussel *Mytilus edulis* have also been recorded from the mid shore on fine mud. In the upper estuary mobile sand a community of the amphipods *Bathyporea* sp. and *Corophium* sp. is common, whilst in the upper reaches of the estuaries, oligochaete worms are the main species present in the lower shore muddy sand and gravel habitats.

Intertidal rock communities occur primarily as a thin band around the shore, dominated by yellow and grey lichens and the tar lichen *Verrucaria maura* at higher elevations, with fucoid seaweeds (*Pelvetia canaliculata*, *Fucus* spp. and *Ascophyllum nodosum*) lower down. The brown seaweed

Fucus ceranoides is also present, reflecting the reduced salinity of the estuaries. Clumps of the edible mussel *Mytilus edulis* occur in the lower shore where rocky outcrops are found.

There are a number of mobile species in the estuary such as crabs and shrimps, and thirty species of fish have been recorded from the Dyfi estuary. It is an important migratory route for salmon and sea trout as they make their transitions between fresh and salt water conditions. The saltmarsh creeks form important nursery areas for sea bass *Dicentrarchus labrax* and mullet species.

The marine invertebrate communities and fish provide food for numerous waders and wildfowl, including shelduck, red breasted merganser, pintail, dunlin, redshank, oystercatcher and curlew. Great crested grebe and common scoter winter off the estuary mouth. Chough breed and feed on adjacent sea cliffs.

The estuary provides important feeding habitat for otters.

The bottlenose dolphin *Tursiops truncatus* and grey seal *Halichoerus grypus* occasionally use the off-shore waters.

12.2.2 Important natural processes:

This is a highly dynamic environment with interactions between saline and fresh water, tides and currents, accretion and erosion in response to short-term and long-term factors. Sediment movement is a key process within the estuary with constant interchange and movement of sediment within the estuary and between the estuary and coastal and marine areas. The sediment spit, ebb-tide delta and tidal meanders are important structural components of the estuary which depend on natural processes. Aeolian processes are vital in the transfer of sediment from the intertidal sandbanks to the nearby coastal dunes.

The type of intertidal mudflat and sandflat communities present in the estuarine and open coast areas are largely determined by the physical nature of the available sediment and the influence of the prevailing physical conditions such as the degree of exposure to wave action and tidal currents and the salinity regime of the surrounding water. The estuary is tide-dominated and displays a wide variation in salinity regime. This has an important influence on the zonation of the biological communities within the estuary.

12.2.3 Main human impacts:

The construction of tidal floodbanks in the 19th century has reduced the extent of estuary inter-tidal habitats, and removed the former maritime transitions, notably from saline marsh to raised mire. The flood defences constrain the ability of the estuary to translate inland ('roll-over') in response to sea level rise.

Sea defences (sea walls and groynes) on the adjacent coast have modified and constrain the near shore form and processes.

Other impacts include:

- Fishing and shellfishing, which are significant activities in the area

- Localised dredging of estuary channels
- Use of powered water-craft
- Recreational use of beaches
- Disposal of treated effluent

12.2.4 Relevant management practices:

Restoration of the condition of at least part of the estuary feature is a realistic and positive aspiration in terms of the conservation management of the estuaries. There is the potential to increase and re-establish estuary communities that have been reduced or lost due to past interventions in the estuaries. In the light of predicted sea level rise, and the potential inundation of coastal habitats, restoration may become more critical to the management of the SAC and Biosphere in order for this feature to be in favourable condition. There is great potential here for restoration in terms of biodiversity benefits. Because of its relatively undeveloped hinterland, this estuary may pose fewer constraints on restoration than many others in the UK.

In the light of potential sea level rise a coastal and flood defence strategy of 'holding the line' may become less viable, and flood defence resources may need to be optimised by focussing on public safety and key capital assets. Working with natural systems instead of constraining them could bring significant economic benefits in terms of the cost effectiveness of coastal defence and flood defence management, and have additional benefits. For example, if some of the flood banks were not maintained the sea would be allowed to flood larger areas at times of high tides/heavy rainfall, thus reducing the risk of flooding to the buildings situated near the presently constrained estuaries.

As a general principle, a reduction in the artificial constraints (such as flood banks) on the tidal limits within the estuaries would provide opportunities for improving and restoring the condition of this feature. CCW is keen to apply this principle in its approach to management of the estuaries, working through a process of negotiation and agreement with landowners, statutory organisations and other interested parties to take advantage of opportunities that arise in the future. Opportunities will need to be considered on a case-by-case basis; in some cases, removing artificial constraints will not be practical (for example, structures that defend major capital assets) and/or may conflict with other nature conservation objectives. However, CCW considers that this approach could provide significant benefits in the long-term management of this natural asset.

The whole of the estuary and surrounding in-shore waters are part of the Pen Llyn a'r Sarnau European Marine Site (SAC & SPA) and are subject to the provisions of Regulation 33 of the Conservation (Natural Habitats, &c.) Regulations 1994.

A code of conduct exists for powered water-craft users, which is designed to limit disturbance within the estuary and promote safe practice.

A visitor management scheme operates at Ynyslas beach to help integrate high public usage with environmental quality.

Fishing and shellfishing is regulated by the North-west & North Wales Sea Fisheries Committee.

The area is covered by a marine pollution contingency plan.

12.3 Third habitat/landcover: SALTMARSH_____ DISTRIBUTION _____Local

12.3.1. Characteristic species:

The saltmarshes exhibit characteristic zonation from low to high marsh.
Pioneer zone: Glasswort *Salicornia* spp. Annual sea-blite *Sueda maritima* and Common cordgrass *Spartina anglica*
Low-mid marsh: Sea meadow grass *Puccinellia maritima*, Sea purslane *Atriplex portulacoides*, Sea aster *Aster tripolium*, Greater sea spurrey *Spergularia media*.
Mid- upper marsh: Red fescue *Festuca rubra*, Saltmarsh rush *Juncus gerardi*, Thrift *Armeria maritima*, Sea milkwort *Glaux maritima*, Sea arrow grass *Triglochin maritima*, Sea plantain *Plantago maritima*, Sea rush *Juncus maritimus*.
There are also important transition zones into other habitats such as freshwater marsh and mire with Sea club rush *Scirpus maritimus* Glaucous bulrush *Scoenoplectus tabernaemontani* and black bog rush *Schoenus nigricans*.

The Dyfi saltmarshes are of notable significance for the variety and quality of their invertebrate faunas. Characteristic ground beetles such as *Bembidion laterale*, *B. minimum* and *B. iricolor* are present and the scarce scarabaeid *Aphodius plagiatus* is frequent amongst strandline debris. In addition, Roesel's bush-cricket *Metriopters roesellii* occurs on the upper saltmarsh, its only location in Wales.

Grazing wildfowl include important populations of Greenland whitefronted goose, Barnacle goose and Eurasian Wigeon. Hen harrier and peregrine falcon hunt over saltmarsh.

12.3.2 Important natural processes:

The saltmarshes are subject to changes in response to the dynamic physical environment. Vegetational changes are evidenced through colonisation of open sediments and successional development towards high marsh. This is countered by localised erosion associated with river channels, creeks and saltpans.

12.3.3 Main human impacts:

- Past interventions have resulted in some loss of native saltmarsh and transitional areas extending into brackish, maritime and freshwater habitats.
- The deliberate introduction of common cord-grass *Spartina anglica* in 1920 resulted in rapid expansion of the saltmarsh particularly after 1945. Much of this Spartina marsh has now been replaced by native saltmarsh vegetation.
- Wildfowling (shooting ducks and geese) takes place over part of the estuary.

12.3.4 Relevant management practices:

- Grazing by domestic stock plays a significant role in determining the character of the saltmarsh. Until recently grazing levels were determined principally by agricultural production and high sheep numbers maintained short swards. Much of the saltmarsh is now grazed less intensively and with a greater proportion of cattle, producing a more varied sward height.
- Wildfowling takes place under a permit scheme, which defines a shooting zone in the western part of the estuary and prescribes quarry species and monitoring requirements.

12.4 Fourth habitat/landcover: SAND DUNES_____ DISTRIBUTION _____Local

12.4.1 Characteristic species:

Ynyslas dunes alone support 70 or more **plants** rare in Ceredigion county.
Strandline/ embryo dune: Sea rocket *Cakile maritima*, Prickly saltwort *Salsola kali*, Sand couch grass *Elymus farctus*
Mobile- semi-fixed dunes: Marram *Ammophila arenaria*, Sea spurge *Euphorbia paralias*, Restharrow *Ononis repens,* Sand sedge *Carex arenaria* and fungi such as: Dune bird's nest *Cyathus stercoreus*, dune cup fungus *Peziza ammophila*, dune stickhorn *Phallus hadrianus.*
Dune grassland: Bee orchid *Ophrys apifera*, Birdsfoot trefoil *Lotus corniculatus*, Biting stonecrop *Sedum acre,* Burnet rose *Rosa pimpinellifolia,* Carline thistle *Carlina vulgaris*, Common centaury *Centaurea erythraea*, Cat's ear *Hypochaeris radicata*, Dog violet *Viola canina*, Dovesfoot cranesbill *Geranium molle*, Hound's tongue *Cynoglossum officinale,* Ladies bedstraw *Galium verum*, Sticky mouse ear *Cerastium glomeratum*, Pyramidal orchid *Anacamptis pyramidalis*, Wild thyme *Thymus praecox.*
Dune slacks: Marsh orchids including: Early marsh *Dactylorhiza incarnata ssp coccinea*, Southern marsh *D. majalis ssp praetermissa*, Marsh Helliborine *Epipactis palustris*, Yellow-wort *Blackstonia perfoliata*, Bog pimpernel *Anagallis tenella*, Lesser water plantain *Baldellia ranunculoides*, Marsh pennywort *Hydrocotyle vulgaris*, Water mint *Mentha aquatica*, Lesser spearwort *Ranunculus flammula*, Creeping willow *Salix repens*, Brookweed *Samolus valerandi*.

The sand dunes of Ynyslas support their own special and nationally important **invertebrate** assemblage. The most remarkable inhabitant amongst a rich spider fauna is the recently discovered nocturnal hunting spider *Agroeca dentigera*, which is unknown elsewhere in Britain and rare in Europe. The site is also special for solitary bees and wasps providing a home for many notable species and four national rarities, including the Welsh vernal mining bee *Colletes cunicularius*. Other specialised invertebrates include moths such as the shore wainscot which feeds on marram grass, and the thyme Pug which feeds on wild thyme. The rich beetle fauna includes nearly 30 nationally notable species. Many of the specialist species are associated with the diverse, winter-flooded dune slacks and the dynamic habitats close to the beach including the strandline.

Mammals: Rabbit are important in the dune ecology, and polecat is resident.

Reptiles: The Sand lizard has been reintroduced at Aberdyfi; Adder, grass snake, common lizard and slow worm are present.
Amphibians: Common frog
Birds: breeding birds include: shelduck, linnet, meadow pipit, skylark, stonechat, common whitethroat, reed bunting, and ringed plover.

12.4.2 Important natural processes:

- The sand dunes are near-natural systems where environmental factors override the influence of man. Dune formation depends on marine and aeolian processes to supply the sand and psammoseral processes to develop and vegetate the dunes. The dune systems must be viewed in the context of large geomorphological units, or 'coastal cells', which encompass extensive offshore deposits. Due to the large sand supply the dunes are actively accreting on both sides of the estuary.
- Evidence of past changes in sea levels is seen at the "submerged forest" of stumps of pine, birch and alder in peat on the west beach at Ynyslas.

12.4.3 Main human impacts

- Shoreline management – sea defences have modified the natural processes away from the estuary mouth (but within the coastal cell), and may be responsible for localised erosion.
- Parts of the dune systems have been developed for golf courses and holiday camps resulting in some loss of older dune habitat and increased stabilisation of the systems.
- A number of alien invasive species have been introduced by visitors or spread from adjacent property, notably New Zealand pygmy weed *Crassula helmsii*.
- Recreation – for many years in this popular holiday area the dunes at Ynyslas and Aberdyfi have been very heavily used by large numbers of people. There is widespread modification of the dune vegetation due to trampling, and dog fouling and litter are further impacts of the recreation pressure.

12.4.4 Relevant management practices

- A visitor management scheme has been in operation at Ynyslas for 30 years. A team of seasonal wardens is employed annually to run a Visitor Centre, providing interpretation/information to the public and wardening the site during the spring and summer months.
- Signage and boardwalks are maintained to facilitate pedestrian access across the dunes, and vehicle access is restricted to designated part of the upper shore.
- Past dune erosion control measures, included brushwood fencing and marram planting are no longer considered necessary. Small seasonal enclosures are set up to protect ringed plover nests from disturbance.
- Rabbits have been the main control on scrub encroachment in the past, but regular outbreaks of disease have reduced their effectiveness. Limited mowing and scrub cutting are now carried out, and some winter pony grazing.
- *Crassula helmsii* is controlled annually by herbicide treatment.

DISTRIBUTION

12.5 Fifth habitat/landcover: BROADLEAVED WOODLAND__ _Local

12.5.1 Characteristic species:

There is great variation in the woodland species depending on the aspect, soils, gradients, drainage, etc.
On acid soils sessile oak is dominant with downy birch, and a ground cover of bilberry *Vaccinium myrtillus*, heather *Calluna vulgaris*. The wetter woods have an abundance of bryophytes, typically *Rhytidiadelphus loreus, Hypnum jutlandicum* and *Polytrichum formosum*, with some notable western Atlantic species, eg. the moss *Dicranodontum denudatum* and the liverworts *Mylia taylori, Bazzania trilobata* and *Plagiochila spinulosa*, amongst others. Ferns are often abundant, including *Blechnum spicant, Dryopteris aemula*, and Wilson's filmy-fern *Hymenophyllum wilsonii.*
The rich lichen flora of the woodlands indicates low atmospheric pollution. The *Parmelietum laevigatae* lichen community, characteristic of woodlands in high rainfall areas, is particularly well developed. Other notable lichens include *Sticta canariensis* (blue-green morphotype), *Parmeliella jamesii* and *Peltigera collina*.
The woodland shrub layer often consists of hazel, holly and rowan with gorse and bracken in more open areas. At more base-rich sites primrose, early purple orchid, wood anemone, dog's mercury and woodruff are found.

Coed Cwm Einion is a mixed wood with mainly ash, wych elm and small leaved lime. Its bryophyte and lichen flora is especially rich with a large number of Atlantic species. The lichen *Parmelia robusta* occurs here at its only site in Great Britain.

Another wood, Coed Afon Pumryd, with cool, shaded, north-facing, humid conditions has an exceptional number of slime moulds (myxomycetes) associated with wet moss-covered rocks.

Schistostega pennata, a luminous moss, occurs at Cwm Llyfnant.

Several molluscs associated with ancient woodlands occur, including *Spermodea lamellata*, *Zenobiella subrufescens* and *Vertigo substriata*.

Mammals include the hazel dormouse, which is known from several sites including Pantperthog, Ynyshir and Cwm Einion.
Polecats and badgers are widespread
The characteristic birds include redstart, pied flycatcher, and wood warbler.

12.5.2 Important natural processes:

Although woodlands give an impression of stability, largely because the dominant trees are long-lived, the seasonal movements of organic matter, energy and nutrients, etc. show a highly dynamic nature. Woodland habitats have a special significance in conservation because they form the natural 'climax' vegetation over most of this area. Trees toppled by gales and occasional landslides on steep

slopes create opportunities for successional changes to develop. The gradual decay of ancient trees creates special microhabitats for fungi and invertebrates.

Climate, soils, topography and aspect have major influences in the valley. Ancient woodlands have undisturbed, or relatively undisturbed, soils. They have escaped ploughing, liming, etc., which alters their natural layered structures and chemical status. Over time the process of leaching, the removal of trees & other forest products will have exacerbated nutrient depletion.

In Wales the moist and generally frost-free Atlantic conditions favour the mosses, bryophytes and ferns characteristic of the western wooded gorges. The conditions of high rainfall, high humidity and dense shade are evident at several sites providing some of the best sites for Atlantic bryophytes in NW Europe.

12.5.3 Main human impacts

Many woodlands owe their survival to the fact that they lie on soils too poor or too wet to cultivate, and it is no coincidence that many of the remaining woods in the Biosphere area are on steep hillsides. But the woods today are islands of habitat, remnants of formerly extensive natural forests. Various traditional methods of woodland management developed in medieval times and survive today. Typical objectives were to provide large timber, fuel wood, bark for tanning, shelter for stock, grazing, sporting, etc. These objectives have given rise to definable management systems, e.g. high forest (to produce large timber), coppice (to provide regular crops of small wood) and wood-pasture (to yield timber in the presence of grazing animals & for amenity).

Traditionally farmers in the area have valued woodland for providing shelter and grazing especially for sheep. Many woodlands have existed alongside a pastoral system for centuries, so grazing has been a major factor in the development of the vegetation. No wood can regenerate in the presence of prolonged and heavy grazing and this accounts for the poor condition, in both structure and species, of some sites.

Non native species have been planted, notably *Rhododendron ponticum* which causes serious problems in Snowdonia due to its highly invasive nature and ability to suppress regeneration of all other plant species through toxins contained in its leaf-litter.

12.5.4 Relevant management practices:

- Restructuring to diversify even-aged canopy, especially in neglected coppiced woods.
- Restoration of broadleaves on ancient semi-natural woods which have been coniferised.
- Establish new links between isolated woods
- Control grazing where regeneration prevented
- Rhododendron control/elimination by cutting and herbicide treatment.
- Protect ancient trees

DISTRIBUTION

12.6 Sixth habitat/landcover: UPLAND MOORLAND___ Local

12.6.1 Characteristic species:

The drier heathland supports a number of species but is typically dominated by heather *Calluna vulgaris* and bilberry *Vaccinium myrtillus*. Other species include crowberry *Empetrum nigrum,* cross-leaved heath *Erica tetralix*, and Fir club moss *Huperzia selago*

The flatter and wetter places are largely covered by blanket bog which supports cotton grass *Eriophorum vaginatum*, deer grass *Trichophorum cespitosum*, purple moor-grass *Molinia caerulea*, bog-rosemary *Andromeda polifolia,* lesser twayblade *Listera cordata*, bog asphodel *Narthecium ossifragum*, round leaved sundew *Drosera rotundifolia*, cranberry *Vaccinium oxycoccos* and various sedges including *Carex limosa* and *C. magellanica*. Sphagnum mosses are an important component of these mires and *Sphagnum magellanicum* together with the liverwort *Cephalozia loitlesbergeri* occur at Llanbrynmair Moors.

The crags and screes associated with these upland areas support rose root *Sedum rosea*, mountain sorrel *Oxyria digyna*, welsh poppy *Meconopsis cambrica*, rock stonecrop S*edum forsterianum*, mountain melick *Melica nutans*, the locally rare hawkweed *Hieracium argenteum* and ferns such as green spleenwort *Asplenium viride* and brittle bladder fern *Cystopteris fragilis*.

Lemon-scented fern *Oreopteris limbosperma* can be found in the damp environment along the streams.

Invertebrates – The black darter Sympetrum danae is the typical dragonfly of the upland pools.
Birds - Ring ouzel, tree pipit, wheatear, peregrine, red grouse and black grouse, short eared owl, hen harrier, golden plover, merlin, red kite, raven.
Mammals - Pine marten

12.6.2 Important natural processes:

The bulk of vegetation cover, below the treeline level, is maintained at a stable seral stage, halting the succession to woodland, through grazing and burning practices implemented by local human activity. Subsequently, a natural scattering of trees and scrub provide a diverse enhancement the landscape mosaic. The damp and low temperature conditions of this part of the world have resulted in the development of ombrogenous peat over gentle slopes or in hollows, and blanket bogs with a range of patterned surfaces with pool and hummock systems. The peat forms when conditions are too wet and cold for plant remains to decay in the normal way. They are acidic due to the lack of nutrients in rainwater. The almost continuous flow of water in these heavy rainfall areas washes out any soil nutrients and leaves behind peat that can be metres deep. Depending on the topography, moorlands include grasslands, peatlands and heaths with some woodland and freshwater habitats. They often occur as complex mixtures.

12.6.3 Main human impacts:

- The vegetation communities reflect the effects of management by man over many centuries. Woodland would have covered much more of the area before man removed most of this for settlement and for grazing lands. Grazing would have maintained the essentially open moorland landscape which we see today. Afforestation surrounds some sites as at Llanbrynmair and lies adjacent to others, with consequent effects on climate and hydrology.
- Drainage - moor gripping - was widely practised in the past, the effects were usually localised but contributed to the drying out of blanket bog and the loss of species richness on these wet moorlands. Agricultural reclamation in the area also resulted in the destruction of prime moorland habitats.
- *Rhododendron ponticum* has started to become established in places.
- Some of the moorland within the Dyfi site is within the Tan 8 area (Nant y Moch) identified as appropriate for the establishment of windfarms. On such a visible skyline, turbines will have an effect on the landscape. Where they are established on blanket bog, they can impact on the hydrological regime resulting in drying out of the peat.
- The hydro-electric scheme at Maesglas (above Mallwyd) has two intake structures and the upper stretch of pipe has been laid through moorland. Regeneration has been good.

12.6.4 Relevant management practices:

- Reduction in grazing intensity and alterations to the grazing regime to incorporate cattle and/or ponies and remove/reduce winter grazing would help to restore some of the more degraded moorland.
- Blocking remaining drainage ditches on blanket mire.
- Allowing a more natural transition from woodland to scrub then heath with altitude.
- Where conifer plantings are removed, restore land to broadleaved woodland or moorland.

13. CONSERVATION FUNCTION

13.1. Contribution to the conservation of landscape and ecosystem biodiversity

The land cover types that are most significant for the conservation of biodiversity are described in section 12, above. The maps in Appendices D, E, F & G indicate aspects of the landscape, as recorded using the LANDMAP methodology (see Appendices T i and T ii).

The Core Area has a wide range of significant habitats. In particular the estuary with its saltmarsh, mud flats, sand spit, the active sand dune system at Ynyslas, the very large raised bog system at Borth together with the grasslands and pond at the Ynys Hir RSPB reserve make up a very significant area of international importance. Each of the habitats in this area is reliant on the others for its continuing health and survival and so although four aspect areas have been identified which contain the main components of the system they are all inter-related into a cohesive functioning ecosystem.

The other area of outstanding significance and therefore of international importance is the ancient woodlands that follow the Einion river valley. This woodland with its mix of oak dominated and mixed ash woodland has an extremely rich bryophyte and fern flora and many significant species. It is linked through a series of woodland and woodland edge habitats to other nationally important woodlands of the Cletwr and Llyfnant. This whole block of mixed ancient and planted woodlands forms a significant biological network, which in turn feeds water into the estuary systems and is an important part of the ecosystem as a whole.

Above the estuarine complex the land rises to gently rolling pastures comprising of small fields, mainly bound by hedges, many of which are species-rich. There are a few semi-natural, wet, grassland meadows in this area with interesting species-rich flora. There are occasional arable fields but most of the land is used for pasture or silage making with dairy cattle and sheep / beef systems being the most common agriculture practiced.

The hills are bounded by a zone of open land consisting of improved upland pasture. The valley bottoms often contain a band of wet grassland and willow carr around the stream and the steeper rocky outcrops have patches of heather and gorse scrub. Beyond this the tops of the mountains contain a mixture of *Molinia* marshy grassland and heathland with the steeper, better drained banks supporting dry acid grassland. Within this area are two large planted blocks of coniferous woodland. There are also several small lakes and some disused metal mine sites which add to the diversity of the area.

The coastal cliffs and rocks between Borth and Clarach are also of national significance forming an important part of the marine system. Above the valley, the top of the watershed contains a mixed upland landscape with significant areas of heath, blanket bog and cliff.

Other significant habitats in the area include some old metal mine sites with unusual bryophyte flora and some species-rich wet meadows. The hedges of the area can also be of importance, being species-rich with an interesting flora on the hedge banks.

The Dyfi Estuary forms an unspoilt and highly attractive landscape. It is valued as a haven for boating enthusiasts and contains sweeping, sinuous stretches of sand and mud. It is enclosed with a rural backcloth, and retains a sense of wildness and remoteness. The movement and richness of activity in terms of sky, reflections, water movement and birds creates a visually stimulating scene.

A concentration of fault lines extends north to south on the southern side of the Dyfi Estuary at Tre Taliesin. The landscape displays a characteristic grain, with landforms and woodland orientated north to south and raised landforms sharply contrasting flat areas outside the area of faulting, such as Dyfi Marshland. This pasture farmland, possessing a distinctive rhythmically rolling landform, with occasional hummocks and rock exposures and reinforced with linear belts of deciduous woodland on high points, is classified as Outstanding in the LANDMAP Visual & Sensory report for Ceredigion. Derelict stone buildings are also present with occasional spoil heaps and these remnants of mining activity add further interest.

The upland areas, i.e. above 300m, are typified by upland marginal grazing and moorland, with some of the more exposed ridgelines characterised by wind farm development and some areas of extensive

coniferous forestry plantation. They form the skyline for much of the area, including the distinctive and very popular Cadair Idris, which lies to the north of the Biosphere.

In the upper part of the river catchment area the relatively narrow and wooded/mosaic valleys run east-west into the rest of the Dyfi Valley.

Stone and slate buildings dominate the settlements, including the market town of Machynlleth (population 2,000).

13.2 Conservation of species biodiversity

FUNGI
The dunes support a rich fungal flora with 10 UK Red list species (7 graded vulnerable and 3 rare): *Agaricus xanthodermus* var.lepiotoides, *Agrocybe arenicola*, *Coprinus arenicola*, *Cyathus stercoreus*, *Geastrum elegans*, *G. schmidelii*, *Inocybe vulpinella*. *Melanoleuca cinereifolium*, *M.schumacheri* and *Trichoglossum rasum*.

LICHENS
The lichen species *Parmelia robusta* occurs here at its only known locality in Great Britain

BRYOPHYTES
Ynyslas dunes support populations of EU Annex 2 species *Petallophyllum ralfsii*, and Red Data Book (RDB) species *Bryum marrattii*, *B. calophyllum*,
Cors Fochno has important populations of bog mosses, including *Sphagnum austinii*, *S. fuscum* and *S. pulchrum* which are rare in Wales. The bryophyte flora of the woodlands is also exceptionally rich, with a large number of Atlantic species, several of which are nationally scarce.

FERNS
Sixteen species of fern, including Wilson's filmy fern *Hymenophyllum wilsonii* and Tunbridge filmy-fern *H. tunbridgense* also occur in the woodlands.

MAMMALS
The area is very important for bats and 12 of 17 UK species are thought to be resident including: Lesser Horseshoe, Greater Horseshoe, Serotine, and Barbastelle.
Important populations of the following also occur: Eurasian Otter *Lutra lutra*, Polecat, Hazel dormouse and brown hare. Small populations of Pine marten and red squirrel may be present.

BIRDS
Upland, woodland, farmland, wetland and coastal habitats are each important for rare or threatened bird species. These include the following red list breeding species: Black grouse, nightjar, lesser spotted woodpecker, skylark, ring ousel, song thrush, grasshopper warbler, spotted flycatcher, marsh tit, willow tit, starling, house sparrow, linnet, bullfinch, yellowhammer and reed bunting. Hen harrier is a red list wintering species.
Some 37 ‘Amber’ list species regularly breed including regionally important populations of lapwing, redshank, chough and red kite. Important populations of migratory wildfowl and shorebirds also

occur including the only regular wintering flock of Greenland white-fronted geese in Wales and England.

HERPTILES
Sand lizard *Lacerta agilis* has recently been re-introduced at Aberdyfi dunes.

FISH
The estuary is a nursery area for juvenile sea-bass and mullet species, and helps support other important migratory fish, including Atlantic salmon and sea trout. Sea and river lampreys also occur.

INVERTEBRATES
Aranaea: nocturnal hunting spider *Agroeca dentigera* (RDBk), only UK site; the jumping spider *Heliophanus dampfi* (RDBk) only site in Wales; liniphid spider *Baraphyma gowerense* (RDB3) rare in UK.
Coleoptera: 4 RDB species: *Biblioplectus tenebrosus*, *Dryops nitidulus* and *Omalium rugulipenne*, *Stenichnus poweri*.
Hymenoptera: 4 RDB aculeate hymenoptera including the Welsh vernal mining bee *Colletes cunicularius*, the sphecid wasp *Psen littoralis*, and the cuckoo bees *Stelis ornatula* and *Coelioxys mandibularis*. Also, RDB *Diprion simile*.
Lepidoptera: 2 RDB moths: the rosy marsh moth *Coenophila subrosea*, and the micro-moth, *Crambus silvella*; together with the scarce Large heath butterfly *Coenonympha tullia*.
Diptera: 5 RDB species: *Allodia embla*, *Anatella dampfi*, *Coenosia paludis*, *Exechia pectinivalva*, *Haematopota grandis*.

The estuary is a nursery area for juvenile sea-bass and mullet species, and helps support other important migratory fish, including salmonid populations. A flock of Greenland white fronted geese use the Dyfi to over-winter. Sea and river lampreys occur in the SAC area.

Sarn Cynfelin, south of the Dyfi estuary, is characterised by a large number of species resistant to scour and sand cover. Algal communities are dominant over much of the reefs, with growths of foliose red and brown algae forming very dense beds in many places, in the absence of shading from kelp. The brown algae *Chorda filum* and *Laminaria saccharina* and red algae flourish on or near the reef crest, while the number of algae species on pebbles increases with depth. Rich animal-dominated biotopes are found in the deeper parts of the reefs, including crustaceans, cnidarians, sponges, hydroids and encrusting bryozoans.

The woodlands support a very diverse flora and fauna with species such as dormouse and polecat occurring. The bryophyte and lichen floras are exceptionally rich, with a large number of Atlantic species, several of which are nationally scarce. The lichen species *Parmelia robusta* occurs here at its only known locality in Great Britain. Sixteen species of fern, including oak fern, beech fern, Wilson's filmy fern and Tunbridge filmy-fern also occur in the woodlands. There is also a very rich snail fauna present. Four bat species are known to use the woodlands; brown long eared, myotis, pipistrelle and serotine.

13.3. Conservation of genetic biodiversity:

- The area is important for the native breed of Welsh Black cattle, and for Welsh Mountain ponies (a recognised 'rare breed').
- The traditional hill breed of Welsh mountain sheep is also still important here.
- An isolated wild brown trout population considered to have a unique genetic make up occurs in Llyn Bugeilyn.
- A biotechnology company based near Aberystwyth recently investigated the pharmacological properties of the native species Bog myrtle *Myrica gale*, and isolated a novel chemical compound, which may have some future benefit to society.

14. DEVELOPMENT FUNCTION

14.1. Potential for fostering economic and human development which is socio-culturally and ecologically sustainable:

The area has the potential to serve as a pilot site for promoting the sustainable development of its region, with an international perspective. To a certain extent it does so already, but the measures suggested in this document amplify this. While the Biosphere designation would provide a certain status and momentum to the valley's development, the co-operation and activities carried out under its umbrella are far more important than the "badge". If successful, the approach can be replicated throughout Mid Wales and beyond.

Founded in 1973 in an old quarry site, the Centre for Alternative Technology (near Machynlleth) aims to offer solutions to some of the most serious challenges facing our planet and the human race - including climate change, pollution and the waste of precious resources - and to demonstrate practical ways of addressing these problems. Leading by example, it also aims to show that living more sustainably is not only easy to attain but can provide a better quality of life. The key areas of activity include renewable energy, environmental building, energy efficiency, organic growing and alternative sewage systems. In addition to its on-site activities (visitor centre, information and publications) the Centre for Alternative Technology (CAT) undertakes consultancy, mail order and education work. Over the last 33 years, CAT has grown to become Europe's leading eco-centre. It is staffed by 90 permanent staff and volunteers all year round, and a further 60 people during the summer months. It receives around 65,000 visitors every year.

Another important initiative for the Dyfi Valley is called ecodyfi. Established in 1998, ecodyfi is a locally-controlled "third sector" organisation (that is, neither public nor private sector). Its mission is to foster sustainable community regeneration in the Dyfi valley. The organisation seeks to deliver environmental, economic and social benefits simultaneously and to take a long-term and global perspective in meeting local needs. Ecodyfi also sees itself as a test-bed for partnership working and for meeting local needs through involving local people in sustainable developments.

Several local businesses have been initiated or inspired by CAT, including Dulas Ltd, a very successful renewable energy company based at Dyfi Eco Park. Their consultants specialise in designing and installing a range of renewable energy technologies.

This strong foundation of activities and entrepreneurship based on the notion of sustainability, together with a supportive legislative and policy framework for conservation of natural and cultural resources in the Dyfi Valley, means that it is ideally placed for the establishment of an enlarged UNESCO Biosphere Reserve that will further integrate the interests of development and conservation.

At the same time, the Welsh Assembly Government (WAG)'s Spatial Plan (2004) calls for *'sustainable development projects to be developed to promote best practice in delivering economic as well as environmental benefits'.*

The statutory remit of the Countryside Council for Wales (CCW) - WAG's advisory body on the countryside - allows it to develop experimental projects to this end. The Dyfi Valley is thus one of 3 project areas chosen by CCW to demonstrate the benefits of integrated rural development. The Biosphere Reserve mechanism provides a vehicle through which to achieve this. Some of the indicative projects emerging from the consultative process have been identified around the following themes: branding of local lamb from quality assured farms; addressing fuel poverty and climate change through eco retrofit of hard to heat stone built homes; celebration of people and place through a series of events and installations linked to the river; helping people understand the impact of their spending patterns by using the ecological footprint; sustainable tourism.

14.2. If tourism is a major activity:

- how many visitors come to the proposed Biosphere Reserve each year?

A tourism report by consultants Steer, Davies and Gleave in the 1980's estimated that at least 2 million tourists **passed through** the area each year. The Countryside Council for Wales estimate that some 250,000 people visit the Ynyslas area of the Biosphere each year.

- is there a trend towards increasing numbers of visitors?

The number of visits to the area as a whole is not increasing. The economic activity generated by tourism is very important to the area and local action plans focus on the improvement of the visitor offering. The trend is towards increasing the attractiveness of the area to a more discerning visitor and to increasing the economic impact of those visitors by creating more opportunities for economic interaction with local businesses.

14.2.1. Type(s) of tourism

The majority of visitors to the Biosphere area are attracted by the natural assets of the area, (mainly the coast) or by the availability of accommodation at the large and nationally advertised caravan parks in the area.

Traditionally the majority of visitors to what is now the proposed Biosphere area were attracted by the easy access to the coast provided by railway from the industrial Midlands of England and Valleys of South Wales. They came for their main annual holiday and stayed for one or two weeks during the school and factory holiday period in August. Families returned annually to the same destination with

the same group of friends. Over time this created a lucrative tourism market that led to the opening of many seaside bed and breakfast establishments and guesthouses and ultimately to the proliferation of static caravan parks opening during the 1950's and 1960's.

More recently and due to the decline of industry, the availability of cheaper foreign holidays and the increased use of the private car, the area has seen a reduction in popularity as a choice for main UK holidays. Conversely, and balancing the loss of income from main UK based holidays, there has been a significant increase in the number of visitors taking short-break and second holidays in the area.

The Dyfi Estuary, and more specifically the beaches at Ynyslas, receive approximately ¼ million visitors per year, with substantial numbers of day-visitors coming from nearby Aberystwyth and its hinterland. Staying visitors in the vicinity of the estuary generally seek family-based, seaside holidays. A significant number of visits are made to the RSPB reserve at Ynys Hir specifically for ornithological purposes.

In the more inland parts of the Biosphere area, activity holidays predominate (walking, mountain biking, horse-riding), and farm-based tourism provides an important diversification opportunity for local farming enterprises.

An increasing number of visitors are attracted by their interest in genealogy, stemming from the introduction of workers from around the UK and elsewhere to satisfy the industrial growth of the 18th & 19th centuries and the emigration of many local Welsh (and non-indigenous) families to the New World from the ports of Cardigan Bay. There is a growing interest in industrial heritage, with minority interest groups visiting the area to explore the industrial and maritime history, mills and chapels. The National Library of Wales in Aberystwyth is a leading organisation for this type of research on an international level and acts as a catalyst for visits and exploration of the wider area.

A niche market of increasing importance is for visitors interested in sustainable living, whether to learn more about it or to holiday in a more responsible manner. The Centre for Alternative Technology is a major draw for short breaks and for educational groups. Student groups also come to study the natural environment, often staying at hostels in Borth, Corris and elsewhere, but the general interest (sightseeing) group market is of relatively low importance due to the absence of a large coaching hotel between Tywyn and Aberystwyth.

14.2.2. Tourist facilities and description of where these are located and in which zone of the proposed biosphere reserve:

The Ynyslas shoreline and estuary, which makes up part of the Core Area, attracts high visitor numbers and the Countryside Council of Wales manages a visitor centre and car park at the site. A popular site adjacent to the Core Area is the RSPB reserve at Ynys Hir, mixing the delights of Welsh oak woodland with wet grassland and estuarine salt marshes, stretching along the south side of the Dyfi estuary. A network of short and long nature trails allows exploration of the reserve where many different species of birds can be observed all year round. The site has limited visitor facilities such as a car park, a small shop and toilets.

The Biosphere area has a number of small-scale private and public sector visitor attractions located in the transition area, including Borth Animalarium, Machinations (Llanbrynmair), Meirion (Woollen) Mills at Dinas Mawddwy and King Arthur's Labyrinth with the Corris Craft Centre.

The Biosphere area offers the visitor a range of mostly activity-based opportunities varying from the more adventurous (such as windsurfing, kite surfing, kayaking, canoeing, camping, hiking, sailing, boat trips, horse riding, fishing, cycling, mountain biking, golfing, swimming, archery, climbing, nature trails etc) to the less strenuous activities such as studies of flora and fauna, bird watching, photography and beach based relaxation.

Mountain biking, mostly on forested land, has seen rapid growth over the last several years, using signed rights of way south of Machynlleth ("Mach 1, 2 and 3") and constructed single track from Ceinws ("Cli-machx"), 3 miles to the north.

The area has a substantial public rights of way network, including the 132 mile National Trail Glyndwr's Way that runs though the Transition Area linking Llanbrynmair and Machynlleth. This provides a nationally promoted asset to local accommodation and other service providers, bringing walkers into the area and encouraging walking tourism. Bed and Breakfast accommodation providers have become associated with the route and more are likely to be encouraged to become associated with the route in the near future.

National Cycle Route (number 8) known as Lôn Las Cymru also passes through the Biosphere at Machynlleth, travelling north to south through Wales. The route promotes cycling and cycle tourism, and is aimed at non-cyclists and family groups.

The public rights of way within the Dyfi valley are managed within the County Councils - by a dedicated Countryside Warden in Powys and by Rights of Way Officers in Ceredigion and Gwynedd. Dedicated County Council staff are also associated with long distance routes Lôn Las Cymru (for cyclists) and Glyndŵr's Way (for walkers).

Cultural attractions in the Biosphere include a number of special events throughout the year including the annual weeklong Machynlleth Festival in August and the intermittent El Sueno Existe festival. Regular concerts are also held at the Tabernacl Arts Centre, Machynlleth. Annual summer carnivals are held at Borth and Machynlleth. Aberdyfi and Machynlleth have annual lantern processions. The Machynlleth one in October is part of the Gwyl y Golau light festival, which took the Biosphere as its theme for 2007, incorporating a number of guided walks etc. Agricultural shows and local Eisteddfodau (singing, reciting, literature etc competitions for all ages) are held in local villages and attract people from all over Wales, but many Welsh language events are not visible to visitors (or to English speaking residents).

The area also offers additional cultural and historical tourism opportunities such as the Parliament House / Owain Glyndŵr Centre and the Museum Of Modern Art at the Tabernacl (in Machynlleth) and the Cadw-owned Dyfi Furnace. The ancient market town of Machynlleth in particular receives many tourists and a local market is still held weekly, where visitors can buy local produce and other products. The nearby Centre for Alternative Technology attracts over 65,000 visitors per year.

The busy town of Aberystwyth offers many opportunities for visitors with its many shops, café's, bars, attractions and restaurants. There are a number of festivals throughout the year appealing to people of all ages and there is a comprehensive multi-cultural programme of entertainment at the Aberystwyth Arts Centre.

The beaches within the Biosphere area regularly receive seaside awards and are one of the main visitor attractions to the area:

Location	International Blue Flag	UK Seaside Award	Green Coast Award
Aberdyfi		✔	
Aberystwyth North	✔	✔	✔
Aberystwyth South	✔	✔	✔
Borth	✔	✔	
Clarach		✔	✔

Access to the coastal waters is available at the harbours at Aberystwyth, Aberdyfi and Tywyn with slipways at Clarach and Borth, and beach access at Ynyslas. Watersports enthusiasts enjoy sailing, kayaking, surfing as well as motor powered pursuits such as water-skiing, motor-boating and the use of personal watercraft (jet skis). The long sandy beaches at Borth and Ynyslas are also attracting those with an interest in wind-powered pursuits such as kite-surfing, land-yachting and sail-boarding.

Other tourist facilities include:

- Bike hire outlets in Machynlleth, Tywyn and Llanbrynmair
- Three steam Railways – Talyllyn at Tywyn, the Vale of Rheidol at Aberystwyth and the fledgling Corris Railway
- Swimming and Sports facilities e.g. Leisure Centres in Aberystwyth, Tywyn & Machynlleth
- Tourist Information centres located in Aberystwyth, Borth, Machynlleth and Aberdyfi
- Golf courses in Borth, Aberdyfi, Machynlleth
- Harbours/Marinas at Aberystwyth, Aberdyfi and Tywyn
- Bowling clubs at Aberystwyth and Machynlleth
- Walking and cycling paths
- Angling opportunities

The Dyfi Biosphere provides a wide variety of accommodation including Hotels, Guest Houses, Bed & Breakfast establishments, self-catering cottages, bunkhouses, hostels, camping and caravan sites. The Holiday Home Park (Caravan) sector provides the majority (78%) of the bedspaces available in the southern part of the Biosphere. This is nowhere more prevalent than the Borth area (nearest to the Core Area) where the caravan & camping sector provide 98% of the 7,379 available bedspaces.

It is interesting to note that the biggest single provider of non-caravan based accommodation within easy reach of the Biosphere is the University of Aberystwyth campus. This accommodation is made available for external bookings during recess and is often booked by groups and organisations requiring multiple rooms in a single location.

14.2.3. Indicate positive and/or negative impacts of tourism at present or foreseen:

It is anticipated that Biosphere status will have a wholly positive effect for the area, providing a mechanism for better management and co-ordination of the tourism asset. The seasonality of tourism in the area makes sustainability difficult for many businesses on a 12-month basis. It is expected that the Biosphere designation will provide an umbrella for reducing seasonality. The bringing together of tourism and other related businesses to work towards a common goal can only strengthen the destination offering of the area and the local economy. Developing the will to cohere underpins the concept of Integrated Quality Management and is the key to success for the Biosphere concept.

Many visitors undertake benign activities – walking, cycling, bird watching, photography etc. These activities are generally in sympathy with the environment and have minimal impact. There is however an increasing attraction for those with a more extreme sporting interest in wind-powered pursuits such as kite-surfing, land-yachting and sail-boarding on the beaches at Borth and Ynyslas and powered watercraft such as Personal Water Craft (PWC's or Jet Skis) and power boats in the sea at Aberdyfi, Borth, and Ynyslas.

There are safety concerns for beach and water users where these vehicles are used in close proximity to other (more passive) beach and estuarine users and a degree of management to encourage safe practices would be desirable. It is anticipated that the Biosphere designation and resulting management structure will seek to find compromise with these types of activities – which have the potential to make significant economic contribution to the area.

Alongside the acknowledged economic benefits of tourism, there is a tendency for visitors to buy houses in the area – either as a holiday base (second home) or to retire to. As a result, some dilapidated and unoccupied properties have been rebuilt. On the other hand, this tendency has added to the upward pressure on house prices, making it more difficult for local people to buy homes. It also dilutes the use of the Welsh language in the community and leads to empty houses in winter in places like Aberdyfi, Pennal and Dinas Mawddwy.

14.3. Benefits of economic activities to local people:

The local communities depend on the above activities to supplement existing commercial activities within the Biosphere area. The economic impact of over 250,000 visitors cannot be dismissed. As already said above, the area relies on the economic activity generated by tourism but the seasonality of tourism in the area makes sustainability difficult for many businesses on a 12-month basis.

Income from traditional activities linked to farming is under threat and the majority of the resident workforce is employed outside of their immediate local area. The issue of sustainable local business retaining local – especially young – people in worthwhile jobs is key to the future success of the area in retaining its identity and sense of place.

It is imperative that businesses are encouraged to invest in their workforces by providing training and career enhancement opportunities, and by investing in new technologies and equipment that makes them more competitive in the wider marketplace.

The provision of a quality product or service by businesses throughout the Biosphere area allied to a comprehensive business marketing programme can only be beneficial to local residents.

We anticipate the development and enhancement of knowledge based industries. The Biosphere Reserve might attract more businesses or institutions selling intellectual expertise, in many cases linked to either the Centre for Alternative Technology or Aberystwyth University.

15. LOGISTIC SUPPORT FUNCTION

15.1. Research and monitoring

15.1.1. To what extent has the past and planned research and monitoring programme been designed to address specific management questions in the potential biosphere reserve?

a) Research:

A number of recent research studies commissioned by the Countryside Council for Wales have looked at aspects of the coastal geomorphology and ecology of Wales in relation to climate change and sea level rise. Each of these studies is of particular relevance to the future management of the estuarine unit of the Dyfi:
PYE, K. & SAYE, S. (2005) The Geomorphological response of Welsh Sand Dunes to sea-level rise over the next 100 years and the management implications for SAC and SSSI sites. CCW Contract Science Report no.670.
This study looks at the future management practices required to ensure the maintenance of the sand dune cSAC resource in Wales in terms of both quantity and quality.

HALCROW GROUP Ltd. (2006) Assessment of Constraints Imposed on Future Shoreline Management by Rail Assets Adjacent to the Coast. CCW Research Report.
This study uses predictions of coastal change to examine the extent to which railways may constrain the evolution of designated nature conservation sites over the next 100 years.

A major hydrological and management study at Cors Fochno, commissioned by Countryside Council for Wales in partnership with Environment Agency Wales, and funded through 'Wetlands for Wales' HLF, is currently nearing completion. The research is led by Professor Andrew Baird of Queen Mary, London University. Theme one of the study involved detailed investigation of the raised mire hydrology and the development of a new hydrological model, enabling reliable determination of drainage impacts. Also, climate change data was downscaled to the Dyfi area and used in conjunction with recent LIDAR topographic data to model potential flood scenarios over the next 40 years.

BAIRD, A.J., EADES, P.A., SURRIDGE, B.W.J. & A. HARRIS (2006). *Cors Fochno Hydrological Research and Management Study: Final Report of Theme 1*. Countryside Council for Wales & Environment Agency (Wales), Contract Research Report No. 718.
A second phase of work (now in press) has drawn together all available map-based data sources into a GIS database, as well as carrying out detailed soils analysis across the reclaimed mire margins to enable a reconstruction of pre-disturbance habitat characteristics.
The final phase of work, now underway, is investigating a range of possible management measures, which might be employed to protect the core conservation interest and enable restoration of lost or degraded elements of the of the estuarine mire ecosystem, taking account of the current infrastructure of the area and potential climate-induced change.

Studies relating to human activities in protected areas include:
Christie, M. et al (1998) The economic impact of Welsh National Nature Reserves.
Kennedy K. (1998) A review of human activities in the Pen Llyn a'r Sarnau marine SAC.
OPENspace Research Centre, Edinburgh University (2005) Evaluation of Visitor Experience at Ynyslas, Dyfi National Nature Reserve.

In 1996, the Environment Agency Wales commissioned research that identified the 50 non-ferrous metal mines having the greatest environmental impact. Several of these, including Dylife, Alltycrib and Hafan lie within the biosphere. In the case of Dylife, discharge from the mine workings affects water quality in the Afon Twymyn for a downstream distance of over 20km. In the 2002 EA Metal Mine Strategy, long-term objectives are to design, fund and implement prioritised remedial schemes, but without compromising the numerous stakeholder interests.

b) Monitoring:

The conservation features and important influencing factors are monitored by CCW and partner organisations in each of the statutory conservation sites comprising the core and buffer zones. Monitoring is defined as repeatable observations made with sufficient precision to determine whether a required or target condition is being achieved. Details of monitoring projects /reports are entered under 15.1.3.

15.1.2. Brief description of past research and/or monitoring activities

a) Abiotic research and monitoring

A considerable amount of research has taken place into the physical features and processes and of the Dyfi estuary and Ynyslas spit. The range of studies is indicated by the following list:
BROWN, J.M. 2007. Numerical modelling of the Dyfi estuary and neighbouring coastline. Ph.D. thesis, University of Wales, Bangor.
HAYNES, J & DOBSON, M. 1969. Physiography, foraminifera and sedimentation in the Dyfi Estuary. Geological Journal. 6: 217-256.
JAMALUDDIN, J. 1976. Interaction between wave, tide and wind at the distal end of the sand spit at Ynyslas, Dyfi. M.Sc. thesis, UCW Aberystwyth.

JARVIS, J. 1970. A physical investigation of tidal phenomena in the Dovey Estuary with particular reference to channel development and sediment movement. Ph.D. thesis, UCW, Aberystwyth.
PARR, W., WHEELER, M., & CODLING, I. 1999. Nutrient status of the Glaslyn/Dwyryd, Mawddach and Dyfi estuaries –its context and ecological importance. CCW Contract Science Report, No. 339.
RICHARDS, F.J. 1934. The salt marshes of the Dyfi Estuary IV. The rates of vertical accretion, horizontal extension and scarp erosion. Ann. Bot. 48: 255-259.
SHI, Z. 1992. Late Quaternary stratigraphy and recent sedimentation in the Dyfi estuary, Wales. Ph.D. thesis, UCW Aberystwyth.
SHI, Z. 1993. Recent accretion rates and sea level fluctuations in the Dyfi estuary, central Cardigan Bay, Wales, UK. Geo-marine Letters, 13 (3): 182-188.
SHI, Z. & LAMB, H.F. 1991. Post-glacial sedimentary evolution of a microtidal estuary, Dyfi estuary, west Wales, U.K. Sedimentary Geology 73: 227-246.
SHI, Z. LAMB, H.F. and COLLIN, L. 1995. Geomorphic change of saltmarsh tidal creek networks in the Dyfi estuary, Wales. Marine Geology 128: 73-83.
STEEL, T. 1996. The nature and causes of spatial variations in saltmarsh creek network geometry. Ph.D. thesis, Reading University.
WILKS, P.J. 1979. Mid-Holocene sea-level and sedimentation interactions in the Dyfi Estuary area, Wales. Palaeogeography, Palaeoclimatology, Palaeoecology, 26: 17-36.
WILLIAMS, A.T. CALDWELL, N.E. & YULE, A.P. 1981. Beach morphology changes at Ynyslas Spit, Dyfed, Wales. Cambria 8: 51-69.

Cors Fochno (Borth bog) together with the adjacent submerged forest beds have also received a good deal of attention with studies focussing mainly on post-glacial environment development and hydrology, as shown by the following list:

FOX, A.D. 1984. Aspects of the hydrology of Cors Fochno NNR. Ph.D.thesis, UCW Aberystwyth.
GODWIN, H. & NEWTON, L. 1938. The submerged forest at Borth and Ynyslas, Cardiganshire, data for the study of post-glacial history. New Phytol. 37: 333-344.
GODWIN, H. & WILLIS, E.H. 1969. Borth bog, Cardiganshire. Radiocarbon 6: 128.
HARRIS, A. 2004. An Assessment of the Potential of Optical Remote Sensing as a Tool for the Measurement of Hydrological Conditions in Northern Peatlands. Ph.D thesis. Sheffield University
HUGHES, P.D.M. & SCHULZ, J. 2001. The development of the Borth bog (Cors Fochno) mire system and submerged forest beds at Ynyslas. Quaternary of West Wales Field Guide. Quaternary Research Association, London. p. 104-112.
MOORE, P.D. 1963. An investigation of the stratigraphy and water content of Borth Bog. M.Sc. thesis, UCW Aberystwyth.
SCHULZ, J. 2004. Late Holocene mire development and conservation of the raised peatlands of Cors Caron and Cors Fochno: a palaeoecological approach using high resolution macrofossil analysis. Ph.D. thesis, Southampton University

b) Biotic research and monitoring:

There is a long history of research conducted by biologists from Aberystwyth University in and around the core area. Studies have ranged from aspects succession and productivity in sand dune and saltmarsh vegetation, to description of algae and fungi communities, and study of individual species such as *Ammophila arenaria*, *Spartina* ssp, and Dactylorchids. A similar range of studies have

occurred on the raised bog, where palaeo-ecological studies and *Sphagnum* spp. have received much attention.

Some of the more notable works are as follows:

i) Estuary and dunes

CARTER, N. 1933. A comparative study of the Algal flora of two salt marshes, Part II & III. J.Ecol. 21: 128-208 and 385-403.
CHATER, E.H. 1965. Ecological aspects of the dwarf brown form of Spartina in the Dovey estuary. J. Ecol. 53. 789-97.
GHAYAD, F.I. 1976. Studies on the root growth and nutrition in Ammophila arenaria. Ph.D. thesis, UCW Aberystwyth.
GITAY, H. 1987. Plant community structure in dune slacks. Ph.D thesis, UCW Aberystwyth.
LINTIN, P.A. 1979. A genecological study of the species of Dactylorhiza Necker ex Nevski.on Ynyslas National Nature Reserve, Dyfed. Ph.D. thesis UCW Aberystwyth.
VINHA, S.G. Da 1979. Productivity and succession in sand dunes. Ph.D. thesis, UCW Aberystwyth.
YAPP, R.H., JOHNS, D. & JONES, O.T. 1916. The Saltmarshes of the Dyfi Estuary. 1: Introductory. J.Ecol. 4. 27-42.

ii) Raised bog:

CHATER, E.H. 1967. Ecology and Hydrology of Borth and Tregaron Bogs. Unpublished report. Nature Conservancy Council, Aberystwyth.
HUXLEY, R.J. 2005. An investigation of the distribution and abundance of Andromeda polifolia on Cors Fochno. M.Sc. thesis, Pembrokeshire College.
JONES, J.B. 1940. An investigation of the distribution and surface ecology of peat bogs in Cardiganshire. Ph.D thesis, UCW Aberystwyth.
MOORE, P.D. 1968. Human influence upon vegetational history in North Cardiganshire. Nature 217. 1006-1009.
SLATER, F.M. 1972. Contributions to the ecology of Borth Bog 1. General considerations. Proc 4th Int Peat Congr Helsinki 1. 277-288.
SLATER, F.M. 1974. The vegetation of Cors Fochno and other Welsh peatlands. Ph.D thesis, UCW Aberystwyth.
SLATER, F.M. 1978. The Schoenus nigricans area of Cors Fochno (Borth Bog). Nat. in Wales. 16. 16-19.
SLATER, F.M. & SLATER, E.J. 1978. The changing status of Sphagnum imbricatum on Borth Bog, Wales. J.Bryol. 10. 155-161.

Faunal studies are less numerous but include a wide range of estuarine and terrestrial invertebrate studies:

BEANLAND, F.L. 1940. Sand and mud communities in the Dovey estuary. Journal of the Marine Biological Sciences Association of the United Kingdom, 24, 589-611
.FISH, J.D. 1979. The reproductive biology of Corophium volutator and C.arenarium. J. mar. Biol. Ass. UK. 59: 355-368.
FISH, J.D. & S.FISH 1974. The breeding cycle and growth of Hydrobia ulvae in the Dyfi estuary. J. mar. Biol. Ass.UK. 54: 685-697.

FISH, J.D. & S.FISH 1993. Long-term changes in the benthic invertebrates of the Dyfi estuary. Unpublished report, CCW Aberystwyth.
FOWLES, A.P. 1986. Investigation into the effects of fire on the invertebrate fauna of a coastal raised mire. Unpublished report, NCC Aberystwyth.
FOWLES, A.P., BAILEY, M.P. & HALE, A.D. 2004. Trends in the recovery of a rosy marsh moth Coenophila subrosea (Lepidoptera, Noctuidae) population in response to fire and conservation management on a lowland raised mire. J. of Insect Conservation 8: 149-158.
FOX, A.D. 1985. Effects of ditch-blocking on selected wildlife features at a coastal raised mire site in central west Wales. Unpublished report, NCC Aberystwyth.
FOX, A.D. 1986. Effects of ditch-blocking on adult Odonata at a coastal raised mire site in central west Wales. Odonatologica 15: 324-327.
FOX, A.D. & STROUD, D.A. 1986. The Greenland White-fronted Goose in Wales. Nature in Wales n.s. 4: 20-27.
JONES, J. R. E. 1941. The fauna of the River Dovey, west Wales. J. Anim. Ecol. 10: 12-24.
KELLY, D.F. 1990. Young bass in the Dwyrd/Glaslyn, Mawddach & Dyfi estuaries. Unpublished report.

15.1.3. Brief description of on-going research and/or monitoring activities:

a) Abiotic research and monitoring [climatology, hydrology, geomorphology, etc.]:

i) Research:

The Centre for Catchment and Coastal Research (CCCR) brings together complementary expertise in terrestrial and marine research from the University of Wales, Aberystwyth and the University of Wales, Bangor. CCCR began a major programme of research on the Dyfi in July 2007 – the biggest of its kind in the UK. The programme is bringing river scientists into collaboration with marine scientists and there is a willingness to engage with community stakeholders through the Dyfi Biosphere Partnership. Issues of interest include modelling, gravel movements, erosion, changes in river and estuary course and levels, flood protection and fisheries. There has been a steady decrease in salmon catches in the Dyfi (and in Wales) over the last 12 years. One factor may be a reduction in exposed gravel, required for spawning. Monitoring activities may include a web-based presentation of the Dyfi, including a series of augmented reality web cams.

In 2001-2, internationally renowned eco-hydrologist Professor Andrew Baird of Queen Mary, London, University commenced an on-going research programme using Cors Fochno raised mire as his principal research site. A first major component of his work is investigating aspects of biogenic gas production from active raised bog. The work involves collaboration with an international team of wetland scientists from Sheffield University, East Kilbride Scottish Universities and McMaster University in Canada. The work has already produced the following papers:
BAIRD, A.J. & S. WALDRON (2003). Shallow horizontal groundwater flow in peatlands is reduced by bacteriogenic gas production. *Geophys. Res. Lett., 30*(20), 2043.
BAIRD, A.J., C.W. BECKWITH, S. WALDRON & J.M. WADDINGTON (2004). Ebullition of methane-containing gas bubbles from near-surface *Sphagnum* peat. *Geophys. Res. Lett., 31,* L21505.

KELLNER, E., BAIRD**,** A.J., OOSTERWOUD, M., HARRISON, K., and WADDINGTON, J.M. 2006. The effect of atmospheric pressure and temperature on methane (CH4) ebullition from near-surface peats. *Geophysical Research Letters*

This work is being followed up at QM London by Imelda Stamp who commenced a Ph.D study in 2007 entitled 'Methane ebullition from northern peatlands and temperate estuarine sediments'. This study aims to improve the accuracy of widely varying estimates of CH4 ebullition losses from peat and estuarine ecosystems, and quantify for the first time the contribution of bubble ebullition to the total annual efflux from a raised peat bog. Cors Fochno and Dyfi estuary are principal study sites for this work.

Further research related to that described above is currently being carried out by Dr. Nick Ketteridge and Dr. Andrew Binley of Lancaster University. This work is taking a geophysical approach to identify gas bubbles within peat and to use this data to develop/improve hydrological models. CT scanner and Electrical resistance tomography are being employed to 'view' gas bubbles and water flow (tracers) within cores of peat. In addition, ground-penetrating radar (GPR), which can reveal details of peat stratigraphy, and variations in gas content below the water table, is being used to identify gas bubbles in situ.

A second area of Professor Bairds' research is modelling of various aspects of raised mire hydrology. As part of the Cors Fochno research and management study, outlined in section 15.1.1. Baird devised a state-of-the-art computer model 'Digi-bog', which is now being used and developed in a Ph.D. study by Paul Morris. This study, begun in 2005 and entitled 'Modelling peatlands as complex adaptive systems', is using field data from Cors Fochno to develop computer models of peatland growth and development. This involves in particular, examination of fine scale variations in hydrological conductivity in the acrotelm, plus some work on evaporation and transpiration rates.

ii) Monitoring:

The following table sets out the abiotic monitoring work undertaken and on-going at Dyfi SSSI:

Feature / factor	Measured on site	Measured nearby	Comments
Meteorology: (Automatic Weather Station)	Yes		Station equipped to Environmental Change Network specification installed in November 2006, & fully operational
Meteorology: (Manual W.S.)	No	Yes	Privately run station 1km from Cors Fochno, daily readings made available 1980- present
Atmospheric Chemistry	No		Cors Fochno included in six- month survey by Environment Agency in 2005
Water levels (raised mire)	Yes		Since 1980. Monitoring recently upgraded with data-loggers & additional sites.
Surface water Discharge	No	Yes	EA (Wales) gauging stations on Dyfi & Leri rivers

b) Biotic research and monitoring [flora, fauna]

The following table sets out the biotic monitoring work undertaken and on-going at Dyfi SSSI:

Feature / factor	Measured on site	Measured nearby	Comments
Vegetation – raised mire	Yes		Protocols established & data collection established 2005
Marine inter-tidal biotopes	Yes		Monitored 2007
Breeding Birds	Yes		Annual breeding wader surveys, whole Dyfi; Woodland birds, RSPB Ynys-hir
Rabbit	Yes		Annual rabbit counts at Ynyslas dunes (buffer zone)
Otter *Lutra lutra*	Yes		Activity recording, annual since 2000
Herptile assemblage	Yes		Regular recording since c1995; monitoring protocol in prep.
Petalwort RDB liverwort	Yes		Annual monitoring, Ynyslas dunes since 1995
Bryophyte assemblage, I) sand dune, ii) Peatland	Yes		Every 6yrs, start 2001
Rhyncospora fusca	Yes		Annual flowering stem counts, Cors Fochno.
Butterflies	Yes		ITE Butterfly monitoring Scheme (BMS) at Ynyslas and RSPB Ynys-hir annual since 1976.
Large Heath butterfly	Yes		Annual adult transect, Cors Fochno since 1986
Rosy marsh moth	Yes		Annual larval transect, Cors Fochno since 1987
Small red damselfly	Yes		Annual breeding adult counts, Cors Fochno since 1998
Heliophanus dampfi (RDB spider)	Yes		Sweep-net transect counts, Cors Fochno every 3 yrs. Since 1997
Colletes cunicularis (RDB mining bee)	Yes		Annual nest burrow counts, Ynyslas dunes, since 2002
Invertebrate assemblage I) sand dune ii) Peatland	Yes		Every 6 yrs, Cors Fochno, since 1991

For details of monitoring reports see the bibliography

15.1.4. Brief description of planned research and/or monitoring activities:

Potential researchers have much to gain from formal association with, and approval from, the Biosphere co-ordination mechanism. This would include endorsement of their work, links into wider UNESCO structures and full co-operation from stakeholders and existing researchers. However, in return for this they would be required to:

- ✓ engage with the community research forum that is emerging, and
- ✓ agree to any guidelines that may be developed covering contact with the public and other local stakeholders.

Some planned activities are described in section 15.1.3. In addition:

a) Abiotic and biotic research and monitoring

Cors Fochno, Dyfi NNR is being added to a countrywide Targeted Monitoring Network (TMN) based on, and intended to supplement, the UK's Environmental Change Network (ECN). This will require addition abiotic data collection, on air pollution and soils; and biotic data including: satellite remote sensing of phenology, and additional vegetation, bird and butterfly monitoring protocols.

Dr. K. Szkomik, lecturer in physical geography at Keele University is currently seeking funding for investigating the environmental history of the Dyfi saltmarshes (which lie in a key location in terms of sea-level reconstruction, close to margins of the former British Ice Sheet), Changes in diatom assemblages would be used to reconstruct relative sea level change.
Dr. P. Hughes, of Southampton University is planning work on the pollen record of Cors Fochno and cross- correlation with macro-fossil studies. This will give greater understanding of human influence on local vegetation change.
Dr. A. Harris, of Southampton University is seeking funding for further remote sensing imagery of the mire vegetation at Cors Fochno. This would be used to interpret patterns of surface wetness, and may help in planning and evaluation of mire restoration.

b) Socio-economic research [demography, economics and traditional knowledge]:

The initiative provides opportunities for research on biodiversity values in the context of a developed country where efforts are emerging to promote conservation of bio and cultural diversity and improvement in livelihoods through the facilitation of dialogue, conflict resolution, and deliberative processes. The region is recognized as having high biological and cultural diversity value (Price et al. 1998). A critical issue is how local communities can use the biodiversity and ecosystem services to improve livelihoods. This is particularly important as much of the Dyfi valley is located within an EU Objective 1 / Convergence funding region.

Possibilities include using the Biosphere status as a basis for a branding scheme that signifies product quality and environmental sustainability (e.g. agricultural products from the Dyfi region) or marketing the region for sustainable tourism activities to reduce dependency on external funding sources. Designation is also expected to promote decentralised decision-making and conflict resolution through greater cooperation between the large number of sub-regional groups (governmental councils and other agencies) and the public in similar ways to that experienced in trans-boundary reserves (Duffy, 2006; Hebden, 2006). The University of Aberystwyth would like to explore the cultural, social, spiritual, and economic values of biodiversity and associated ecosystem services and assesses how these values can be better translated into maintaining and enhancing livelihoods and welfare. The University led a joint bid to the European Union for substantial research funding under the FP7 programme to research these questions in several locations around the world, even before re-registration of the Dyfi Biosphere, but the application was ruled to be ineligible on a technicality.

15.1.5. Estimated number of national scientists participating in research within the proposed biosphere reserve on:

- a permanent basis: __regular, on-going about 6 p.a..__
- an occasional basis: _around 20-25 p.a._____

15.1.6. Estimated number of foreign scientists participating in research within the proposed Biosphere Reserve on:

- a permanent basis: ___none_____
- an occasional basis: __1_____

15.1.7. Estimated number of masters and/or doctoral theses carried out on the proposed biosphere reserve each year:

At Dyfi NNR:
Doctoral : 2-5 p.a.
Masters: 3-8 p.a.

15.1.8. Research station(s) within the proposed Biosphere Reserve:

None

15.1.9. Permanent research station(s) outside the proposed Biosphere Reserve:

- Aberystwyth University (Institute of Earth Sciences, Institute of Rural Sciences & Institute of Biological Sciences), Penglais, Aberystwyth, Ceredigion : 8km to south of core area;
- Institute of Grassland and Environmental Research (IGER), Penrhyncoch, Ceredigion: about 6km from core area.

15.1.10 . Permanent monitoring plots

See section 15.1.3.

15.1.11. Research facilities of research station(s)

Currently there is no dedicated research station, but the institutions named in 15.1.9 have a full range of university level facilities.

15.1.12 Other facilities

Borth Youth Hostel has an education room as well as accommodation.

15.2.1 Describe environmental education activities and public awareness activities indicating the target group(s).

a) Environmental Education

The Dyfi National Nature Reserve (NNR) has an established education service focussed at Ynyslas dunes and is used by schools and colleges from Wales and England. The number of students visiting the site varies annually depending on the weather but averages out at about 3000 annually. In 2007 a total of 2835 students in 155 groups visited the site. 53% of these were A-level groups who mainly visit the site to carry out a sand dune transect, usually as part of biology or geography fieldwork. Most of these groups received an introductory talk from site-based staff. 22% were primary school children who come to Ynyslas to do a seashore awareness activity. This activity introduces the basic ecology of the seashore and sand dunes as well as dealing with the impacts that humans have on the

environment. 16% of secondary students undertook studies related to man's impact on the site and site management. Around 12 higher education and specialist groups visit the Dyfi NNR annually, with most receiving guided excursions to learn about various aspects of conservation management.

Similarly, the RSPB has an interpretation centre at its Ynyshir reserve and offers a varied programme of events to members and the general public, including outreach work at Machynlleth market.

Most of the schools in the Biosphere are progressing up the levels in the Eco Schools or Green Schools (Gwynedd) systems, in most cases led by Eco Committees that include pupils, staff and parents. Ecodyfi has managed the delivery of a very effective puppetry based waste minimisation project in primary schools both within the Biosphere and throughout Powys. The UNESCO Cymru Wales Committee supported a photographic project in local secondary schools that enabled pupils to use photography to record and reflect on their impressions of life in the Dyfi Valley.

b) Education for Sustainable Development

Education for sustainability is a major function of the Centre for Alternative Technology (CAT) at Pantperthog. Its Education Department hosts numerous parties of all ages as well as doing outreach activities in local schools.

Ecodyfi delivers education and awareness raising in the local community, mainly through its Waste Watchers and Dyfi Footprint projects. The latter is a partnership programme with CAT, using the ecological footprint to help people consider the impact of their lifestyles and expenditure.

There is a healthy level of voluntary activity through Oxfam, support groups for communities in Africa such as FADECO in northern Tanzania, Gwerin y Coed (Woodcraft Folk youth movement) and a lively Transition Initiative (raising awareness of Peak Oil and climate change). The Dyfi Valley was an early recipient (November 2004) of Fair Trade status and some of the primary schools in northern Ceredigion are working towards Fair Trade status.

c) Public Awareness Activities

As Ynyslas has a large sandy beach it is very popular with visitors in good weather and receives around 200,000 visitors a year. The public events aim to inform visitors to Ynyslas about the nature conservation interest of the site in a less formal way than the education service. A total of 45 events were held in 2007. In aiming to appeal to as many people as possible these were a mixture of quizzes, guided walks, arts & crafts activities and hands-on nature encounter. The last two were especially popular. Also national initiatives such as the Marine Conservation Society's Beach Clean and Beach Awareness Day were included in the programme.

The RSPB has an outreach programme that includes a stall at the weekly Machynlleth market during the summer.

15.2.2 Indicate facilities for environmental education and public awareness facilities.

Ynyslas visitor centre has a number of interpretive displays and a conservation shop. The Centre is staffed and open to the public for six months of the year from Easter until October. The Centre is decorated with artwork that involved the local community and a local primary school in Borth. There is a large book of poetry about the site written by local school children. Interpretation is planned for the recently installed photovoltaic panels and other 'greening' works. Just outside the Centre there is a large wooden snail sculpture, which also acts as a viewpoint. The snail is an important part of Ynyslas' ecology.

The dunes have good access infrastructure as it is important to concentrate the majority of people to key routes in order to reduce pressure on the dunes. There are interpretation boards at intervals around the site.

The Centre for Alternative Technology site is designed for self-guided tours of the interactive displays as well as guided tours on most aspects of sustainable living. Local people can access its Information Service free in person, by post, email or phone.

Montgomeryshire Wildlife Trust has Reserves at Cors Dyfi on the southern side of the estuary and at Glaslyn on upland moorland. The latter is 230 ha in size, including an area of agriculturally improved grassland being returned to heather moorland. Both sites have public access and interpretation boards.

15.3 Specialist training

Not well developed, but currently includes:

- Student training/ projects - At Dyfi NNR around 180 graduate and post-graduate students per annum receive lectures/ lecture tours on conservation management; and a number of undergraduate, masters and doctorate project students are supported annually (including 2-3 student work placements).
- Professional training: - takes place on an occasional basis.
- Staff training: Four 6 month seasonal wardens are recruited and trained annually at Dyfi NNR.

15.4 Potential to contribute to the World Network of Biosphere Reserves

The Partnership is keen to exchange experiences and lessons with other Biosphere Reserves, particularly those with similar conditions (for example river/estuarine location, hill farming, bilingual or multi-lingual community) and has prepared a note to guide its search for partners (see Appendix N). Representatives from Wales have taken part in UNESCO EUROMAB meetings in 2002, 2005 and 2007, with delegates from the Dyfi Biosphere Partnership attending the latter two meetings. Representatives from Rhön and Entlebuch Biosphere Reserves have attended local meetings in conjunction with plans to modernise the Dyfi Biosphere and a representative from the Dyfi Biosphere Partnership has visited Urdaibai Biosphere Reserve in preparation for future collaborations. The Dyfi Biosphere Partnership is keen to explore networking opportunities which minimise the use of air travel and make imaginative use of information and communication technology such as linking by video.

15.4.1. Collaboration with existing biosphere reserves at the national level:

People from the Dyfi and North Devon Biosphere Reserves have undertaken exchange visits and this will continue. Consideration is being given to joint working on the value of ecosystem services, possibly using funding from the EU INTERREG programme. A representative of the Dyfi Biosphere Partnership has made a presentation to key stakeholders working to modernise the Cairnsmore Fleet/Merrick Fells/Silver Flowe Biosphere Reserve. A member of the Dyfi Biosphere Partnership also sits on the UNESCO UK MAB Committee.

15.4.2. Collaboration with existing biosphere reserves at the regional or subregional levels, including promoting transfrontier sites and twinning arrangements

15.4.3 Collaboration with existing biosphere reserves in thematic networks at the regional or international levels

Contacts concerning quality economies exist already with the Rhön and Entlebuch Reserves and it is hoped to interact with the Urdaibai Reserve in the Basque country concerning bilingual culture and other aspects of intangible cultural heritage. As noted above, delegates from Wales regularly take part in the EUROMAB regional network meetings. In this context, a delegation from Biosphere Reserves in Poland and the Czech Republic visited the Dyfi in March 2006 to study interactions between Natura 200 sites and LEADER initiatives in encouraging sustainable development. The UNESCO UK MAB Committee is investigating collaboration with other Biosphere Reserves across the 'Atlantic Arc' region of Europe with potential funding from the EU INTERREG programme.

15.4.4 Collaboration with existing biosphere reserves at the international level (indicate ongoing and planned activities

It is hoped that collaboration with Biosphere Reserves outside the EUROMAB regional network will be established in due course. This is likely to build upon existing links such as those with Venezuela, which resulted in a visit to the Dyfi by a member of the Venezuelan Ministry of the Environment themed around "Oil, Equity and Biosphere".

16. USES AND ACTIVITIES

16.1 Core Area(s):

16.1.1 Describe the uses and activities occurring within the core area(s):

a) Cors Fochno raised bog

i) Scientific research and monitoring. Research and monitoring which supports, and is compatible with the conservation objectives.
ii) Environmental education. Study tours for specialists and higher educational students.
iii) Informal recreation and interpretation. Public guided walks and controlled access via designated route.

iv) Habitat management. Practical measures necessary to restore and maintain 'active raised bog' (including blocking drains, removing scrub and conservation grazing around the disturbed bog margins).

b) Dyfi estuary

i) Fishing. There is a public right of fishing which allows the harvesting of shellfish from the estuary. There is also licensed salmon netting in the upper estuary and non-commercial angling around the estuary mouth.
ii) Wildfowling takes place in part of the estuary, and is regulated by a permit scheme.
iii) Boating. There is a public right of navigation in the estuary, the lower part of which is used by a variety of craft. A code of conduct is in place to control the use of powered craft.
iv) Grazing. The saltmarshes are currently grazed by sheep and cattle in a sympathetic manner respecting the conservation needs of the area.
v) Research and study. The estuary is used as a marine biology teaching resource by Aberystwyth University.
vi) Public access. This is very largely confined to beach areas around the estuary mouth, which are heavily used for informal beach-based recreation.

c) Ynyslas and Aberdyfi dunes

i) Informal recreation. The dune areas have open access for pedestrians and are used for walking, dog walking, picnicking and nature observation

ii) Environmental education. Ynyslas dunes are an important venue for formal education field studies. The visitor centre at Ynyslas provides interpretive information for c.35000 visitors p.a.

16.1.2. Possible adverse effects on the core area(s) of uses or activities occurring within or outside the core area(s):

a) Estuary, dunes and marine areas.

- Shoreline & flood defence management

The character of the estuary and the associated dune systems is determined by, and dependent upon, the continuing supply and accumulation of sediment from a seaward source. This process is particularly important given rising sea levels, and without it the inter-tidal habitats may be submerged.
Existing tidal defence structures, on the open coast and within the estuary, act to prevent the natural rolling inland of the tidal limits and intertidal habitats, which would otherwise occur. The estuarine floodplain has been substantially reduced by past reclamation. In the current scenario of climate change and sea level rise, it is imperative to fully examine 'managed re-alignment' options, for even with continued sediment supply, saltmarsh and inter-tidal sediment habitat may be lost unless they are enabled to roll landwards.

- Dredging

Dredging of sand from the estuary has the potential to cause significant change both within the estuary and in the adjacent dune systems. The impact of any dredging will be dependant on both the volume of sand removed and its location. As stated above any depletion of sand from the estuary

may compromise its ability to maintain its elevation relative to sea level. Additionally, by changing tidal volume and flow characteristics it may trigger erosion and loss of the saltmarshes.

- Nutrient enrichment/ pollution

The Dyfi estuary is naturally low in chemical nutrients derived from the river catchment. Increased concentrations of nutrients (mainly nitrates and phosphates) as a result of, for instance, intensive land management practices or effluent discharges, would pose a significant threat to the estuarine biota including migratory fish and bird populations.

- Shellfish collection

Commercial-scale gathering of shellfish has the potential to inflict damage on the estuary habitats. Even if restricted as at present, to hand gathering only, damage is possible through the use of vehicles on the inter-tidal areas; and through excessive exploitation of the shellfish stocks with knock-on effects for shorebirds etc.

- Recreational activities

Heavy trampling by visitors together with vehicle use, dog fouling and campfires have the potential to damage the sand dunes.

- Grazing/ sward management

The Dyfi saltmarshes and adjacent reclaimed marshes have traditionally been quite heavily sheep grazed, producing a short sward favoured by wintering wildfowl. Also important are low intensity cattle-grazed saltings and freshwater marsh, which support other elements of the flora and fauna, notably breeding waders.

b) Raised mire habitat

- Land drainage

Sphagnum bog and related peat-forming habitats require water levels close to the ground surface throughout the year. The peat shrinkage, oxidation and cracking, which accompany drainage, have a far-reaching and progressive effect on the surrounding habitat. Reversal of such damage is required: i) to replace carbon loss to the atmosphere with a long-term net accumulation; ii) to prevent deterioration of the peat archive and its scientific value; iii) to ensure maximum peat growth and the elevation of the bog surface relative to sea level; and iv) to counteract vegetation changes/ habitat degradation induced by past drainage and peat cutting.
Shoreline management / flood defence management is also of great importance to conservation of the raised bog. Whilst it is desirable to restore transitions to tidal marsh it is of greatest importance to prevent uncontrolled tidal flooding of the active raised bog from the artificial channel of the River Leri, cut through the bog in 1820.

- Nutrient enrichment/ pollution

The raised bog habitat is vulnerable to atmospheric nutrient inputs, notably nitrogen and phosphorous. Drift of lime dust from nearby agricultural use is a further possible problem. .

- Fire

Regular burning of drained, grass-dominated bog was practiced regularly in the past to encourage early grass growth. This resulted in fires spreading and destroying large parts of the peat forming bog vegetation on a number of occasions. Agricultural burning is no longer practiced but fire remains a considerable threat in dry weather.

16.2. Buffer zone(s)

16.2.1 Describe the main land uses and economic activities in the buffer zone(s):

- Nature conservation management (e.g. Invasive species control)
- Traditional or non- intensive agricultural practices (mainly grazing)
- Informal outdoor recreation / tourism (e.g. walking and nature observation)

16.2.2 Possible adverse effects on the buffer zone(s) of uses or activities occurring within or outside the buffer zone(s) in the near and longer terms:

The possible adverse affects are very similar to those described under 16.1.2 above. Additional mention should be made of habitat fragmentation since many of the SSSI are small and relatively isolated units. The decline of traditional land management practices such as coppicing of woodlands and traditional non-intensive grazing are important in some sites.

16.3. Transition area

16.3.1 Describe the main land uses and major economic activities in the transition area(s):

A number of large caravan parks exist, including developments close to the NNR. Aberdyfi, on the north side of the estuary, attracts many summer visitors, with associated water-based activities, and is the focus of a current proposal for the development of harbour facilities. There are golf courses adjacent to the Ynsyslas dunes at Borth and on Aberdyfi dunes, and coastal management issues are common to both sides of the estuary.

A wider discussion of the economy is in section 10.4.

16.3.2 Possible adverse effects of uses or activities on the transition area(s):

Upstream along the Dyfi Valley are areas of native oak woodland. However, in spite of efforts to conserve these, many woods are still grazed, preventing the development of a natural understory. There are many examples of attractive landscapes in the Dyfi catchment but many, such as at Glaslyn could be considered to be fragmented or devalued by relatively recent landscape changes. In particular, the spread of conifer forests; the polarisation between intensively managed and abandoned farmland on the upland margins; and the lack of hedgerow and native woodland management might be looked at.

17. INSTITUTIONAL ASPECTS

17.1. STATE, PROVINCE, REGION OR OTHER ADMINISTRATIVE UNITS:

United Kingdom
Wales (devolved administration)

The Dyfi Valley straddles the corners of three Unitary Authority administrative areas (Powys, Ceredigion and Gwynedd) plus part of the Snowdonia National Park Authority area. The estuary itself marks the boundary between Gwynedd and Ceredigion.

17.2 UNITS OF THE PROPOSED BIOSPHERE RESERVE:

The Dyfi estuary Core area is designated as a Special Area of Conservation, a Special Protection Area and a Ramsar site. Parts of the Dyfi estuary are also a National Nature Reserve.

The Buffer Zones as SSSIs have legal provision for the protection of their special features, as outlined in the following section. Some of these areas are also National Nature Reserves.

Within the biogeographic unit, the Dyfi Biosphere cradles the three Unitary Authorities of Ceredigion, Powys and Gwynedd. The Snowdonia National Park Authority also straddles the Northern area of the biogeographic unit.

17.2.1. Are these units contiguous or are they separate?

Contiguous

17.3. Protection Regime of the core area(s) and, if appropriate of the buffer zone(s)

17.3.1.Core area(s):

a) Special Areas of Conservation (SACs)

Special Areas of Conservation are designated under the **Habitats Directive (Council Directive 92/43/EEC of 21 May 1992)**.

In the UK the Directive has been transposed into national laws in England, Scotland and Wales by means of the **Conservation (Natural Habitats, & c.) Regulations 1994 (as amended)**.These are known as 'the Habitats Regulations'. Most SACs on land or freshwater areas are underpinned by notification as Sites of Special Scientific Interest (SSSIs).

b) Special Protection Areas (SPAs)

Special Protection Areas established to protect wild birds, are designated under the **Birds Directive (Council Directive 79/409/EEC of 2 April 1979)**, commonly known as the 'Birds Directive'.

In England, Scotland and Wales, the provisions of the Birds Directive are implemented through the **Wildlife & Countryside Act 1981 (as amended)** and **The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)**.The 'Habitats Regulations' apply to the UK land area and its territorial sea (to 12 nautical miles from the coast), and are supported by government policy guidance

c) Ramsar

'**The Convention on Wetlands of International Importance especially as Waterfowl Habitat**' (Ramsar Convention or Wetlands Convention) was adopted in Ramsar, Iran in February 1971 and entered into force in December 1975.

Generally Ramsar sites are underpinned through prior notification of these areas as Sites of Special Scientific Interest (SSSIs). Therefore, these receive statutory protection in Wales under the **Wildlife & Countryside Act (WCA) 1981**. In England and Wales, further protection is provided by the **Countryside and Rights of Way (CRoW) Act 2000**. Government in England and Wales has issued policy statements relating to the special status of Ramsar sites. This extends the same protection at a policy level to listed Ramsar sites in respect of new development as that afforded to sites which have been designated under the EC Birds and Habitats Directives as part of the EU Natura 2000 network.

17.3.2 Buffer zone(s):

Sites of Special Scientific Interest (SSSI) are selected and notified by Countryside Council for Wales (CCW) under Section 28 of the Wildlife and Countryside Act 1981 (as amended). The Act states "where CCW are of the opinion that any area of land is of special interest by reason of any of its flora, fauna, or geological or physiographical features, it shall be the duty of the Council to notify that fact." Notification of an SSSI forms the statutory bedrock for protecting land to conserve its natural features. When notifying an SSSI CCW must legally serve notice on all owners and occupiers of the land and numerous public bodies. The notification documents comprise of a citation, map, list of operations likely to damage the special interest (OLDSI list) – a list of operations which owners and occupiers must consult CCW upon prior to commencing the operation, and a site management statement (SMS). The SMS is the Council's views about the management of the land (including any views the Council may have about the conservation and enhancement of that flora or fauna or those features). Under the Wildlife and Countryside act 1981 CCW is also responsible enforcing the legislation relating to SSSI.

17.4. Land use regulations or agreements applicable to the transition area (if appropriate)

All land in receipt of Single Farm Payment under the 2005 reform of the Common Agricultural Policy must meet the requirements set out under Cross Compliance. Cross Compliance is a European Union (EU) requirement setting out standards that land managers have to meet in order to receive the Single Farm Payment (SFP). There are two elements to Cross Compliance:

i) **Statutory Management Requirements** (SMRs) – see Appendix U
There are currently 19 SMRs which relate to the traceability of livestock and animal health and welfare, the protection of groundwater, conservation of flora and fauna, conservation of birds, protection of soils and environmental regulations concerning pesticides and sewage.

ii) **Regulations on Standards** consistent with keeping the land in "Good Agricultural and Environmental Condition" (GAEC).

There are also two all-Wales voluntary agri-environment schemes, which may be operating on farms within the Dyfi area. These are Tir Cynnal and Tir Gofal.

i) **Tir Cynnal** is the agri-environment entry level scheme for Wales. Farmers who join this scheme must protect the important environmental areas and features on their land. It is a 10 year scheme.

Although participation is voluntary but once farmers enter the scheme agreements must run for a minimum for 5 years after which they will have the option of continuing for the full 10 years. Tir Cynnal is a whole farm scheme and farmers must agree to enter all of the land within that business over which they have full management control into the scheme and meet the conditions of the scheme.

ii) **Tir Gofal** is an agri-environment scheme, available on farmed land throughout Wales, which rewards farmers for caring for the wildlife, historical and cultural features on their land. It is designed to support the farming community in protecting the rich heritage of rural Wales and reflects the Welsh Assembly Government's priorities for a sustainable farming, coupled with greater opportunities for public enjoyment of the countryside. Agreements apply to the whole farm and last for ten years with a break clause after five years.

17.5. Land tenure of each zone:

17.5.1.Core area(s):

Organisation	Land owned (ha)
Countryside Council for Wales (CCW)	911.8
Royal Society for the Protection of Birds (RSPB)	89.12
Common Land	89.72

17.5.2. Buffer zone(s):

Organisation	Land Owned (ha)
CCW	113.35
RSPB	477.1
South Wales Wildlife Trust	4.53
Forestry Commission	4.53
Common Land	23.16

17.5.3. Transition area(s):

Organisation	Land owned (ha)
CCW	1.28
RSPB	97.65
South Wales Wildlife Trust	12
Forestry Commission	7965.04
National Trust	148.7
Common Land	1684.97

Remaining land is predominately in agricultural use under private ownership.

17.5.4. Foreseen changes in land tenure:

There are no foreseen changes in land tenure.

17.6. Management plan or policy and mechanisms for implementation

17.6.1. Indicate how and to what extent the local communities living within and next to the proposed biosphere reserve have been associated with the nomination process

The stakeholder engagement and nomination process has been taking place since April 2006 and has been overseen by the Dyfi Biosphere Partnership. Its members are:

- Ceredigion County Council (Unitary Authority)
- Powys County Council (Unitary Authority)
- Gwynedd Council (Unitary Authority)
- Snowdonia National Park Authority
- Welsh Language Board (parastatal body)
- Countryside Council for Wales (parastatal body)
- Welsh Assembly Government: (Devolved Administration)
  - Department of Economy and Transport
  - Department of Environment, Sustainability and Housing
  - Forestry Commission Wales
- Ecodyfi (voluntary body)
- National Farmers Union
- Farmers Union for Wales
- Environment Agency Wales (parastatal body)
- Tourism Partnership Mid Wales (tourism development body)
- Allan Wynne Jones (individual, co-opted to focus on cultural aspects)

The Countryside Council for Wales (on behalf of the Partnership) contracted ecodyfi to manage the community engagement locally. Ecodyfi employed a Community Engagement Officer to lead on this. The Community Engagement Officer and members of the Partnership have given information about biosphere areas, discussed possible benefits the designation could bring to the area and listened to people's responses. This has happened through presentations for groups, public meetings, one to one talks, newspapers, publications, the website www.dyfibiosphere.org.uk and other means.

Those involved with the engagement process have endeavoured not to prejudice the response by being over-enthusiastic: it was felt to be important to give doubts and fears plenty of room to be expressed and considered. It has also been emphasised that the content of any action plan or management plan needs to be constructed collaboratively by stakeholders, not proposed in a prescriptive manner by partnership members.

It took some time for this highly collaborative, non-prescriptive approach to be understood by the local community in an area where initiatives have traditionally been imposed in a 'top-down' fashion by government. However, in an area where there has been a high degree of scepticism and opposition to centrally-imposed landscape conservation initiatives, the approach adopted to

stakeholder engagement by the Dyfi Biosphere Partnership has created no organised opposition to the proposal to modernise the Biosphere Reserve.

In early May 2007 the Partnership published its consultation document, responding to comments and questions received during the first phase and offering firmer options for consideration. At the same time, the website was re-designed and an interactive Forum was added. People were asked to return the Response Form by the end of June if possible.

Overwhelmingly, the community's response has been positive. Of all the evidence collected between July 2006 and August 2007, only two people stated that they didn't want the initiative to proceed. Even this was not out of principle, but was because the individuals concerned were not convinced the added value would be worth the expenditure.

Further detail is provided in Appendix O "Report on the Dyfi Biosphere consultation". In summary, it is estimated that the Partnership has organised 16 public meetings in 8 localities, attended by 360 persons. In addition, presentations have been made to 236 persons at meetings of 13 organisations, including 8 of the 15 Town and Community Councils (the most local tier of local government). 268 written representations have been received as well as numerous one to one conversations.

Funding for the process was provided by the Welsh Assembly Government through the Countryside Council for Wales, the Department for Economy and Transport and the UNESCO Cymru Wales Committee.

17.6.2 Main features of management plan or land use policy

a) **Our vision statement** is:

"The Dyfi Biosphere will be recognised and respected internationally, nationally and locally for the diversity of its natural beauty, heritage and wildlife, and for its people's efforts to make a positive contribution to a more sustainable world. It will be a self confident, healthy, caring and bilingual community, supported by a strong locally-based economy."

b) Benefits will flow from addressing the following **objectives**:

1. To keep and improve the area as a great place to live, work and bring up children - and to create more opportunities for them to stay here
2. To place a greater value on our natural environment and on Welsh language culture
3. To increase activity in nature conservation through voluntary means
4. To encourage discussion, agreement and co-ordination between people and organisations with different values and priorities
5. To develop a more self-reliant local economy; less dependent on fossil fuel, with growth driven by local knowledge and resources
6. To develop a more sustainable area; with residents and visitors choosing locally-produced goods more often and reducing our impact on the world
7. To use the Biosphere 'brand' to promote the quality of local agricultural & other products and tourism experiences

8. To ensure education and training in sustainable development, as well as research in the natural and social sciences, in support of the Biosphere vision
9. To take advantage of help and advice from UNESCO and other Biosphere Reserves across the world

These objectives will be refined during the process of drawing up a strategy and action plan for the Biosphere. This will take place during the period November 2007 to September 2008. The Consultation Document of April 2007 (attached as Appendix L) outlined a number of candidate projects for the action plan, but others are expected to arise from Forums and thematic initiatives.

c) The **principles and aspirations** that will guide activities linked to Biosffer Dyfi Biosphere ("This is how we do things around here – how about you?") are as follows:

1. People – their attitudes and activities – are central to the Biosphere process.
2. The Dyfi Biosphere is a place where people's feeling of well being is enhanced, where people are empowered and involved in deliberation, decision-making and co-delivery.
3. The role of government and statutory organizations is to facilitate sustainable development and to encourage and enable people to take responsibility.
4. The Dyfi Biosphere is an exemplary area, setting the benchmark for "green", bilingual living.
5. Our economy is becoming more self reliant and less carbon intensive, based largely on local culture, resources, products and environmental assets.
6. Constructive change occurs, but almost incidentally as a result of protecting, strengthening and celebrating elements of life and the world which the community values and wants to pass on to future generations.

d) Hambrey Consulting's report into the "**Social, economic and environmental benefits** of World Heritage sites, Biosphere Reserves, and Geoparks" (March 2007) reviews the literature and seven case studies in European countries. It states:

"Many of the sites appear to deliver four key benefits:

- Enhanced leverage to pull in funding for a wide range of purposes;
- Stimulus to awareness raising and educational initiatives;
- Enhanced tourism image and profile;
- Enhanced opportunities for niche branding of local products and services

These benefits appear to be enhanced in those cases where there is substantial community buy-in, and this varies according to the approach taken to designation, as well as local circumstance and tradition."

It goes on to summarise the common social, environmental and economic benefits:

"All designations seek to increase social inclusion in terms of both governance and opportunity. The sense of place, community and collective opportunity may be strengthened, and education and awareness benefits are likely to run deeper. Enhanced inclusion, in the widest sense of the word, is likely to increase **social and community sustainability**.

None of the designations confer increased statutory **environmental protection**, although they do provide a mechanism and impetus for improved site management. Designation does however confer some leverage, since there is always the possibility of de-listing.

Although **local economic benefits** are likely to result from an increased inflow of funds, branding and tourism opportunities, it is more difficult to identify a significant contribution to the wider or national economy. Costs can also be significant – the direct costs of setting up the administrative arrangements, and a range of indirect "transaction" costs associated with establishing a major new integrated initiative."

The Dyfi initiative seeks to bring about all the benefits mentioned in the preceding three paragraphs. The extent to which it does so will depend on the imagination and commitment of participants and on the initiatives undertaken. An additional potential benefit is to improve coordination between the various initiatives in the Dyfi Valley. Their relationship is discussed in Appendix P, "Adding value and avoiding duplication".

e) Appendix Q, "Towards an action plan for the Dyfi Biosphere", indicates **a number of initiatives** that are either planned or have potential, together with likely outcomes.

It is anticipated that Biosphere staff will act as enablers and facilitators to projects developed by the Biosphere management structures, including fora based on sectoral interests such as tourism, agriculture etc.

The Biosphere initiative will incorporate the National and Local Biodiversity Action Plans and the management plans of those responsible for the Core Areas and Buffer Zones. For example, the heavy recreational use of the Ynyslas dunes has led to an intensive and long-standing visitor management scheme incorporating interpretive displays and programmes, wardening, boardwalks and vehicle controls. A full management plan for the NNR was written in 1989, and summary update plans were completed for Cors Fochno and for Dyfi estuary and Ynyslas dunes in 1997. Sub-plans for the other parts of the SSSI are in preparation, together with an overview plan for the whole SSSI. A management scheme is also being produced for the Pen Llyn a'r Sarnau marine SAC, through consultation between the large number of involved organisations, including CCW, Environment Agency Wales, county councils, water authorities, Snowdonia National Park Authority, and the local Sea Fisheries Committee.

The LANDMAP Landscape Habitats report for the part of the Biosphere that is in Ceredigion says: "Overall, management is generally appropriate. However in nearly all cases there are opportunities to enhance the biodiversity of the areas by changing management practices. This part of north Ceredigion has many elements of connectivity. This is provided by many mechanisms including, for instance, aquatic connectivity through the water which travels from the blanket peats of the uplands down through the species-rich wooded valleys to the estuary. The important woodland network of CRDGNLH013, Glandyfi woodland mosaic, where a significant amount of woodland forms a good biodiversity corridor is also significant. The estuary system itself is also highly dependent on both coastal and marine management practices as well as inland management. Building on these elements of connectivity will enhance the biodiversity of the whole area." The report (Appendix R)

includes several specific suggestions for changes in management that will be explored as the action plan is formulated.

f) The Biosphere Area action plan will **seek to draw together all the strategies and initiatives which impact on the Dyfi Valley**. It will be far more than a framework for the management of protected areas and will attempt to guide the actions of all concerned so that they are pulling in the same direction - to prosper by providing an example to the world of how people can live in productive harmony with the natural world.

It will be important that key development strategies (particularly for the economy and tourism) of statutory bodies such as Ceredigion, Powys and Gwynedd Councils and the Snowdonia National Park Authority, together with the Community Strategies for those three county areas, are aligned with the Biosphere concept.

The Dyfi Valley Tourism Growth Area (which is separate to the Ceredigion TGA) already has a strategy to guide tourism development in a compatible manner. The Ceredigion Tourism Growth Area Implementation Plan builds on the environmental strengths of the County and acknowledges the importance of the Dyfi Biosphere as an asset to the area. It also outlines the importance of adopting Integrated Quality Management principles.

The Bro Ddyfi Communities First area (addressing rural disadvantage and exclusion) forms the Powys part of the enlarged Biosphere as proposed. Its strategy is still in preparation and indications are that it will be compatible with Transition Area activities.

The Biosphere will also meet the objectives of the Wales Spatial Plan for Central Wales. The Vision for Central Wales is for 'high-quality living and working in smaller scale settlements set within a superb environment, providing dynamic models of rural sustainable development, moving all sectors to higher value added activities.'

The Wales Spatial Plan, entitled ‘People, Places, Futures’ is a 20-year plan for the sustainable development for Wales. The plan incorporates five guiding themes based on building sustainable communities; promoting a sustainable economy; valuing our environment; achieveing sustainable accessibility; and respecting distinctiveness. The Dyfi Biosphere will be be a pioneering project in Central Wales, taking forward both the sustainable principles of UNESCO, but also through leading Wales’ own sustainable development agenda.

17.6.3 The designated authority or coordination mechanisms to implement this plan or policy

The stakeholder engagement and nomination process has been overseen by the Dyfi Biosphere Partnership as described in 17.6.1. This Partnership extended its role and added the Royal Society for the Protection of Birds to its membership in August 2007; it is acting as a coordination mechanism until such time as the nomination is accepted by UNESCO. It will use this intervening period to develop the new co-ordination structure.

The following principles, guiding co-ordination, have been adopted from Section 3.2 of the Consultation Document:

1) Everybody living or working in the area should be given opportunities to be involved
2) There should be partnership arrangements to oversee progress towards agreed objectives
3) Such partnerships should be accountable to the local community as well as to whoever provides money to carry out actions
4) Best practice should apply, e.g. open communication, no one body should dominate, respect for all participants, fully bilingual process
5) Where possible, initiatives should be led by businesses or groups in the private, voluntary and community sectors
6) Arrangements need to allow landowners and public bodies to go about their day-to-day business and fulfil their legal responsibilities

The co-ordination mechanisms are being developed along the lines of the Appendices called:

- Organisation Chart (Appendix S)
- Adding value and avoiding duplication (Appendix P)

The first of these Appendices proposes coordinating the various actors in the Biosphere through four Tiers of organisation, as follows:

Tiers One and Two seek to ensure widespread community and business accountability and involvement. The main feature is **an annual meeting open to all**, preferably set within the context of one or more celebratory and/or educative events. It reviews progress and selects a significant proportion of the Joint Advisory Committee's members, based on their activism and knowledge but with a view to having a broad geographic spread as well. These members will be encouraged to involve others in developing initiatives relevant to their sector or interest (through **a "Forum" if appropriate**). Such Forums will have varying degrees of formalisation and will change over time.

Tier Three is to guide policy and monitoring and to provide accountability to public sector and funding partners. **The Joint Advisory Committee** takes an overview and advises stakeholders how best they can help fulfil the Biosphere's vision, whether through voluntary effort or through the exercise of their statutory powers. Public sector representation is at a senior level, including Members of the local authorities, as well as the community and business members.

Tier Four is for delivery, via (a) projects (that may be managed independently by **any body that liaises with the Biosphere**), (b) **staff (or a Secretariat)** that is answerable to (c) **an Officer Group** (appointed by the Joint Advisory Committee).

17.6.4 The means of application of the management plan or policy

The Core and Buffer areas are regulated by the Countryside Council for Wales according to the statutory designations described in Section 17.3.1. The Transition Area will be managed through discussion and incentives. An example of the latter is a £21,000 grant scheme established by the Welsh Assembly Government during 2007/08 for projects benefiting nature conservation or climate change. Farming activities are subject to compulsory Cross Compliance standards and optional Agri

Environment schemes. We anticipate that the Biosphere Reserve concept and strategy will be adopted into local planning framework documents.

17.6.5 Indicate how and to what extent the local communities participate in the formulation and the implementation of the management plan or policy

The Action Plan for Biosffer Dyfi Biosphere will be compiled while UNESCO is considering this Nomination. Some indicative projects are listed in Appendix Q, "Towards an action plan for the Dyfi Biosphere" and in Section 14.1 above. During this period, staff of ecodyfi and Biosphere partners will work with community groups, businesses and individuals to develop project proposals that are both realistic and ambitious. While existing partners will in many cases provide stimulation and guidance, the intention is that activities will be led by business and community interests. This intention is reflected in the collaborative coordination structure described in Section 17.6.3. above.

17.6.6 The year of start of implementation of the management plan or policy

2008

17.7. Financial source(s) and yearly budget:

At this point, the level of resources required – and their source - is still under discussion. The following points provide the basis for discussing an annual budget of £140,000, part of which would be 'in kind' rather than in cash.

1. It is assumed that in the first instance CCW / Welsh Assembly Government provide the money for the 'central activities' of co-ordination, administration, networking, publicity, awareness raising and "light touch" project facilitation e.g. early development, putting actors together & assistance with fundraising. The Countryside Council for Wales has provisionally allocated a budget of £30,000 per year, over the next three financial years to the project.
2. Other partners, especially local authorities, will provide staff time, expertise and facilities "in kind" and use their best endeavours to secure funds for project activities.
3. These central Biosphere functions will need at least one full time member of staff, and probably two.
4. CCW would act as banker for these funds.
5. More significant projects will be funded separately and their resources managed by the lead body for that project.

Some activities, like marketing initiatives, may pay for themselves by increasing profits from businesses. Other activities, such as cultural projects, may need to raise funds from other sources.

17.8. Authority(ies) in charge

17.8.1. The proposed biosphere reserve as a whole:

Name: Countryside Council for Wales, on behalf of the Joint Advisory Committee (or whatever name is eventually adopted for the coordination mechanism for the Dyfi Biosphere)

If appropriate, name the National (or State or Provincial) administration to which this authority reports: Welsh Assembly Government

17.8.2. The core area(s):

Name(s): Countryside Council for Wales
Legal powers: The Council's powers derive from Part VII of the Environment Protection Act 1990 (see Appendix X). Its functions include:
(a) the conservation and enhancement of natural beauty in Wales and of the natural beauty (including the conservation of its flora, fauna and geological and physiographical features) and amenity of the countryside in Wales
(b) encouraging the provision or improvement, for persons resorting to the countryside in Wales, of facilities for the enjoyment thereof and for the enjoyment of the opportunities for open-air recreation and the study of nature afforded thereby;
and shall have regard to the social and economic interests of rural areas in Wales.

17.8.3. The buffer zone(s)

Name: Countryside Council for Wales

18. SPECIAL DESIGNATIONS:

		Name:
( )	UNESCO World Heritage Site	
(X)	RAMSAR Wetland Convention Site	Dyfi
( )	Other international/regional l conservation conventions/directives	
(X)	Long term monitoring site	Cors Fochno
( )	Other [Please specify]	

19. SUPPORTING DOCUMENTS (to be submitted with nomination form)

(X) General location map – Appendix A

(X) Biosphere Reserve zonation map – Appendices B & C

(X) Vegetation map or land cover map – Appendices D, E, F & G

(X) List of legal documents – Appendix H

( ) List of land use and management plans

(X) Species list – Appendix I

(X) List of main bibliographic references – Appendix J, K and Section 15

20. ADDRESSES

20.1 Contact address of the proposed biosphere reserve:

Name: Countryside Council for Wales _____
Street or P.O. Box: Plas Gogerddan, Penrhyncoch _____
City with postal code: Aberystwyth SY23 3EE _____
Country: Wales, UK _____
Telephone: 01970 821100_____
Telefax (or telex): _____
E-mail: h.manley@ccw.gov.uk and helen.davies@ccw.gov.uk _____
Web site: http://www.ccw.gov.uk

20.2. Administering entity of the core area:

Name: Countryside Council for Wales _____
Street or P.O. Box: Plas Gogerddan, Penrhyncoch _____
City with postal code: Aberystwyth SY23 3EE _____
Country: Wales, UK _____
Telephone: 01970 821100_____
Telefax (or telex): _____
E-mail: h.manley@ccw.gov.uk and helen.davies@ccw.gov.uk _____
Web site: http://www.ccw.gov.uk

20.3. Administering entity of the buffer zone:

Name: Countryside Council for Wales _____
Street or P.O. Box: Plas Gogerddan, Penrhyncoch _____
City with postal code: Aberystwyth SY23 3EE _____
Country: Wales, UK _____
Telephone: 01970 821100_____
Telefax (or telex): _____
E-mail: h.manley@ccw.gov.uk and helen.davies@ccw.gov.uk _____
Web site: http://www.ccw.gov.uk

List of Appendices

A	Location Map (Fig 1)
B	Zonation Map (Fig 2)
C	Core & Buffer Map
D	Landscape Habitats Classification map
E	Landscape Habitats Evaluation map
F	Visual & Sensory Landscapes Classification map
G	Visual & Sensory Landscapes Evaluation map
H	Terms of Reference for coordinating body 2005-8
I	Species list
J	Bibliography Dyfi SSSI
K	Literature Review
L	Consultation Document
M	Additional description of communities
N	Partner search (Briefing Note)
O	Report on the Consultation Process
P	Adding value & avoiding duplication
Q	Towards an action plan for the Dyfi Biosphere
R	LANDMAP report Landscape habitats (Ceredigion only)
S	Organisation Chart
T i	Summary of the LANDMAP methodology
T ii	LANDMAP methodology
U	Regulation of farming
V	Regulation of forestry & woodlands
W	Guidelines for Zonation in UK Biosphere Reserves March 07
X	Legal status of Countryside Council for Wales
Y	Welsh One Skill map
Z	Agricultural Employment map

Annex to Biosphere Reserve Nomination Form

MABnet Directory of Biosphere Reserves

Biosphere Reserve Description

Administrative details

Country: Wales, United Kingdom
Name of BR: Biosffer Dyfi Biosphere
Year designated: (*to be completed by MAB Secretariat)*
Administrative authorities: Countryside Council for Wales, Welsh Assembly Government
Name Contact: Helen Davies, Countryside Council for Wales
Contact address: Plas Gogerddan, Penrhyncoch, Aberystwyth, Ceredigion SY23 3EE Wales, UK
Related links *(web sites)*: **www.dyfibiosphere.org.uk**

Description

General description:

The Dyfi valley lies in Central Wales, extending some 47kms from the Aran Mountains (900 metres) in the east, to the mouth of the Dyfi estuary at Aberdyfi on the west coast. The area includes one of the most spectacularly beautiful estuaries in Wales, offering fine views of the mountains of Snowdonia National Park to the north and the uplands of Pumlumon and the Cambrian Mountains to the south.

The Dyfi Biosphere extends westwards into the Irish Sea. The whole of the estuary and surrounding in-shore waters are part of the Pen Llyn a'r Sarnau European Marine Site (SAC & SPA). An extensive area (c1210ha) of intertidal sand and mudflats are present as well as salt marshes (550ha). Actively growing sand dunes have formed on both sides of the estuary. A unique estuarine raised bog lies south of the estuary, near Borth (Cors Fochno). This peat bog is of high international importance, retaining an active peat-forming dome.

The Buffer Zones as SSSIs have legal provision for the protection of their special features. Some of these areas are also National Nature Reserves.

The Dyfi Biosphere lies within the administrative boundaries of three local Authorities – Ceredigion, Gwynedd and Powys - and includes part of the Snowdonia National Park Authority area.

The Biosphere area is very diverse, varying between traditional agricultural areas and those affected by tourism; between traditional rural communities and those communities that have seen rapid growth in the past 50 or so years.

The area is rich in natural beauty and cultural heritage, and has a strong farming and maritime tradition and a unique sense of identity amongst its people. This thriving bilingual community has a strong tradition of sustainable living. The Dyfi valley is one of the strongholds of the Welsh language, and the Welsh language and its associated culture are an important and integral part of community life.

Major ecosystem type: Temperate Coastal/Marine Zone

Major habitats & land cover types: Lowland peatland; Marine intertidal; Saltmarsh; Sand dunes; Broadleaved woodland; Upland moorland
Location 52 degrees 24 minutes – 52 degrees 47 minutes North; 3 degrees 31 minutes – 4 degrees 6 minutes West
Area (ha):
Total: 81,882
Core area*(s):* 10,879.67 (of which, 7,786.39 marine)
Buffer zone*(s):* 1,423.71
Transition area*(s):* approximately 69,579 (of which, 1500 marine)
Different existing zonation:
Altitudinal range: minus 10 to plus 905 metres above sea level

Research and monitoring

Brief description:

The core area is part of an all-Wales network of integrated monitoring sites for climate and environmental change. Additional key site conservation features are also monitored.

The Centre for Catchment and Coastal Research (CCCR) is conducting a major research programme on the Dyfi estuarine-riverine system, examining physical and biological features and processes in relation to climate change. Researchers from Queen Mary London and other UK universities are working on various aspects of raised mire processes including, post-glacial environmental development, biogenic gas production and release and remote sensing of surface condition.

Specific variables

Abiotic		Biodiversity	
Abiotic factors	x	Afforestation/Reforestation	
Acidic deposition/Atmospheric factors	x	Algae	
Air quality	x	Alien and/or invasive species	x
Air temperature	x	Amphibians	
Climate, climatology	x	Arid and semi-arid systems	
Contaminants		Autoecology	
Drought		Beach/soft bottom systems	x
Erosion	x	Benthos	x
Geology	x	Biodiversity aspects	
Geomorphology	x	Biogeography	
Geophysics	x	Biology	x
Glaciology		Biotechnology	
Global change	x	Birds	x
Groundwater	x	Boreal forest systems	
Habitat issues	x	Breeding	x
Heavy metals		Coastal/marine systems	x
Hydrology	x	Community studies	x
Indicators	x	Conservation	x
Meteorology	x	Coral reefs	
Modeling	x	Degraded areas	x

Monitoring/methodologies	x	Desertification	
Nutrients	x	Dune systems	x
Physical oceanography	x	Ecology	x
Pollution, pollutants		Ecosystem assessment	
Siltation/sedimentation	x	Ecosystem functioning/structure	x
Soil	x	Ecotones	
Speleology		Endemic species	
Topography	x	Ethology	
Toxicology		Evapotranspiration	x
UV radiation		Evolutionary studies/Palaeoecology	x
		Fauna	x
		Fires/fire ecology	
		Fishes	x
		Flora	x
		Forest systems	
		Freshwater systems	x
		Fungi	x
		Genetic resources	
		Genetically modified organisms	
		Home gardens	
		Indicators	x
		Invertebrates	x
		Island systems/studies	
		Lagoon systems	
		Lichens	
		Mammals	x
		Mangrove systems	
		Mediterranean type systems	
		Microorganisms	
		Migrating populations	x
		Modeling	
		Monitoring/methodologies	
		Mountain and highland systems	
		Natural and other resources	
		Natural medicinal products	
		Perturbations and resilience	
		Pests/Diseases	
		Phenology	
		Phytosociology/Succession	x
		Plankton	
		Plants	x
		Polar systems	
		Pollination	
		Population genetics/dynamics	
		Productivity	
		Rare/Endangered species	x
		Reptiles	x
		Restoration/Rehabilitation	x
		Species (re) introduction	

		Species inventorying	x
		Sub-tropical and temperate rainforest	
		Taxonomy	
		Temperate forest systems	
		Temperate grassland systems	
		Tropical dry forest systems	
		Tropical grassland and savannah systems	
		Tropical humid forest systems	
		Tundra systems	
		Vegetation studies	x
		Volcanic/Geothermal systems	
		Wetland systems	x
		Wildlife	x

Socio-economic		Integrated monitoring	
Agriculture/Other production systems	X	Biogeochemical studies	
Agroforestry		Carrying capacity	
Anthropological studies		Conflict analysis/resolution	
Aquaculture		Ecosystem approach	X
Archaeology		Education and public awareness	X
Bioprospecting		Environmental changes	X
Capacity building	X	Geographic Information System (GIS)	
Cottage (home-based) industry		Impact and risk studies	X
Cultural aspects	X	Indicators	
Demography		Indicators of environmental quality	
Economic studies		Infrastructure development	
Economically important species		Institutional and legal aspects	
Energy production systems	X	Integrated studies	
Ethnology/traditional practices/knowledge		Interdisciplinary studies	
Firewood cutting		Land tenure	
Fishery		Land use/Land cover	
Forestry	X	Landscape inventorying/monitoring	
Human health	X	Management issues	
Human migration		Mapping	
Hunting		Modeling	
Indicators		Monitoring/methodologies	
Indicators of sustainability	X	Planning and zoning measures	
Indigenous people's issues		Policy issues	
Industry		Remote sensing	
Livelihood measures		Rural systems	
Livestock and related impacts	X	Sustainable development/use	X
Local participation	X	Transboundary issues/measures	
Micro-credits		Urban systems	
Mining		Watershed studies/monitoring	X
Modeling			
Monitoring/methodologies			
Natural hazards			
Non-timber forest products			
Pastoralism			
People-Nature relations			
Poverty			
Quality economies/marketing	X		
Recreation			
Resource use			
Role of women			
Sacred sites			
Small business initiatives			
Social/Socio-economic aspects			
Stakeholders' interests	X		
Tourism	X		
Transports			