Institute for European Environmental Policy

ESTIMATION OF THE FINANCING NEEDS TO IMPLEMENT TARGET 2 OF THE EU BIODIVERSITY STRATEGY

DRAFT FINAL REPORT – TECHNICAL ANNEXES

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Disclaimer

The authors have full responsibility for the content of this report, and the conclusions, recommendations and opinions presented in this report reflect those of the consultants, and do not necessarily reflect the opinion of the Commission.

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Contents

1 ANNEX 1 CORINE LAND COVER DEFINITIONS AND EQUIVALENT ANNEX I HABITATS

CLC definition: This annex includes the full definitions of the CLC classes, as detailed in Büttner et al (Büttner et al, 2006), including relevant discrepancies between the definition and the actual CLC process used in 2006 (Büttner et al, 2012).

Biodiversity value and ecological definition: This annex includes a discussion of the ecological definition of the ecosystem if this differs significantly from the actual CLC process used in 2006 (Büttner et al, 2012). For some ecosystems it also includes a discussion of where the highest biodiversity values are found within the CLC class.

Heavily modified ecosystem: For some ecosystems, a proportion of the area is defined as being heavily modified. Heavily modified ecosystems are defined as areas where the changes to their characteristics which would be necessary for achieving restoration as described by the Biodiversity Strategy 2020 are so drastic that they cannot be achieved within the Target 2 timeframe. For these ecosystem areas, we have defined less ecologically rigorous but objectively measureable restoration targets, based on accepted standards if possible. These areas include intensively managed and reseeded grassland (see permanent grassland below), plantation forests (see forests below), and artificial or heavily modified water bodies (see freshwater below).

Equivalence to Annex I habitat types: This annex lists the equivalent Annex I habitat types for each CLC class used in this report. We have exclusively applied the Annex I habitat types to one of the CLC classes, unlike the EU Biodiversity Baseline report which used a substantially overlapping allocation (EEA, 2010a). However, as the CORINE mapping system and the Habitats Directive monitoring system are based on completely different methods and criteria, it is impossible to clearly allocate habitat types to CLC classes, because some Annex I habitats include a mixture of vegetation features allocated to different CLC classes, and the CLC class into which the habitat falls can vary under different habitat management conditions (Bölöni et al, 2007; Kleeschulte et al, 2011; Martinez Sanchez et al, 2011; Moss and Davies, 2002). For example, the Annex I habitat type 1230 'Vegetated sea cliffs of the Atlantic and Baltic Coasts' includes both CLC 333 sparse vegetation and areas of heath (CLC 322), scrub (CLC 324) or wood (CLC 312); a grassland habitat type may be assessed in CORINE as transitional scrub if it has been subject to scrub invasion, yet it is still considered to belong to the Annex I habitat type as long as it retains its characteristic grassland vegetation community. We therefore also separately list all the habitat types that may be registered under a different CORINE category.

Equivalent Annex I habitat area: We use the habitat areas in the EU-25 as reported by Member States under Article 17 in 2007 (ETC/BD, 2008a). This means that certain Annex I habitat types are underestimated due to the lack of data from Romania and Bulgaria. We are aware that the Annex I habitat area estimates vary from good quality assessments based on habitat mapping to poor quality estimates based on modelling or even purely on expert judgment (ETC/BD, 2008c), but this uncertainty has not been taken into consideration in this assessment.

Notable occurrences of ecosystem in Member States: The annex lists for some of the ecosystems the most notable occurrences of that ecosystem in Member States, such as the largest sites and sites distinguished by particularly important biodiversity.

1.1 AGRO-ECOSYSTEMS

In this report the agro-ecosystem is considered to include agricultural cropland and temporary grassland, but excludes permanent grassland and scrub. This differs from the EU 2010 biodiversity baseline (EEA, 2010a), which includes pastures, natural grasslands, and scrub habitats within agro-ecosystems because all these habitats require agricultural management (grazing and/or mowing) for their continued existence. The agro-ecosystem is further subdivided in this report into arable crop land (69%), permanent crop land (6%), and mixed agricultural cropland (25%).

CLC 211: non-irrigated arable land
CLC definition: Land with cereals, legumes, fodder crops, root crops and fallow land. Includes flowers and tree (nurseries cultivation) and vegetables, whether open field or under plastic or glass (includes market gardening). Includes aromatic, medicinal and culinary plants. Does not include permanent pasture.

The arable area includes temporary grassland that is part of an arable rotation, ie which is ploughed up and used for an arable crop once or more in every five years. In Denmark (57%), Sweden (69%) and Finland (94%), the majority of grassland is part of an arable rotation[1].

CLC 212: permanently irrigated land
CLC definition: Areas with a permanent irrigation infrastructure (irrigation channels, drainage network), with permanently or periodically irrigated arable crops other than rice, including rotations with temporary grassland. Most of these crops could not be cultivated without an artificial water supply.

Does not include:

- crop land irrigated only sporadically, eg using spray sprinkler lines or rotary sprinklers (CLC 211 non-irrigated arable land);
- underground irrigation pipes or above ground pipes and furrows or drainage networks intended to clean up wet soils (CLC 211, 231 or 242);
- crops under greenhouses (CLC 211 or 222);

CLC 213: rice fields
CLC definition: Land prepared for rice cultivation with irrigation channels and flat surfaces that are periodically flooded. Does not include abandoned rice fields.

The CLC classes 211, 212 and 213 together give an area of arable cropland of **101.5 million ha** for the EU-27.

[1] Figures based on Farm Structural Survey (FSS) 2007 data. ef_lu_ovcropaa Accessed: October 2012

CLC 221, 222, and 223: permanent crops

CLC definition: Areas dominated by vineyards, orchards of fruit trees or nut trees, hop and berry plantations, olive groves or date palm groves, ie if the parcels exceed 50% of the area and/or they determine the land use of the area (even if they are mixed with other crops in complex cultivation patterns). The ground cover under the permanent crops may be grassland or kept clear of vegetation. Includes CLC 221: vineyards, CLC 222: Fruit trees, nut trees and berry plantations, CLC 223: olive groves, CLC 224: date palm groves.

Permanent crops include:

- mixed olives and vines; chestnut, walnut, almond, hazel and pistachio plantations; willows for wicker production; temperate and tropical fruit trees and bushes; coffee, cacao, mulberry, tea; permanent florist plantations of roses;
- permanent crop nurseries inside permanent crop areas; fruit trees under greenhouses;
- abandoned orchards which still preserve characteristic alignments, espaliers or climbers;

Permanent crops exclude:

- permanent crops that are located on permanently irrigated land (CLC 212 permanently irrigated land);
- herbaceous permanent crops such as strawberries or asparagus (CLC 211 non-irrigated arable land);
- areas of trees planted for wood production, eg chestnut, walnut, carob; forest tree nurseries; olive trees that are part of evergreen forest (CLC 311 broad-leaved forest);
- permanent crops mixed with arable land and/or meadows within a single parcel (CLC 241 annual crops associated with permanent crops);
- permanent crops interspersed with significant amounts of natural vegetation, where permanent crop parcels cover less than 40% of the area (CLC 243 land principally occupied by agriculture, with significant areas of natural vegetation);
- abandoned orchards where plantation structures have disappeared (CLC 324 Transitional woodland-scrub).

The CLC classes 221, 222 and 223 together give an area of permanent cropland of **9.5 million ha** for the EU-27.

CLC 241: Annual crops associated with permanent crops

CLC definition: Non-permanent crops (arable lands or temporary grassland) associated with permanent crops on the same parcel (Büttner et al, 2006). The permanent crops, including fruit trees, olive trees, or vines, are either in juxtaposition with the arable or temporary grassland in irregular parcels, or located along the borders of the parcels in a reticulated pattern. The arable land or temporary grassland covers more than 50% of the area, and none of the crops is represented on more than 75%.

This class excludes:

- non-permanent crops associated with forest trees (CLC 244 agroforestry);
- permanent pasture associated with permanent crops (CLC 221, 222, 223) or trees (CLC 324 agroforestry).

This CLC class (ie 25ha polygons) is only registered in Cyprus, Italy, Luxembourg, Portugal and Spain. In this study it is assumed that 60% of the area in each Member State is arable agro-ecosystem, and 40% is permanent crop area.

CLC 242: Complex cultivation patterns

CLC definition: Juxtapositions of small parcels of diverse annual crops, pasture and/or permanent crops, and can include scattered houses, pastures, fallow land, and city gardens if none of these land uses is dominant.

This class includes:

- agricultural lands associated with small plots of permanent crops (fruit trees, berry plantations, vineyards and olive groves),
- complex cultivation patterns in areas with scattered houses inserted within a patchwork structure when built-up parcels cover less than 30% of the patchwork area,
- interstices of non-mineralized free spaces less than 25ha in size in a discontinuous urban fabric (but NB these areas are often included instead in discontinuous urban fabric class 112)
- hobby/city gardens

This class excludes:

- market gardening (CLC 211 non-irrigated arable land),
- large-scale nurseries cultivation (CLC 211 non-irrigated arable land),
- in spite of strong fragmentation, agricultural areas with more than 75% of area under rotation system (CLC 211 non-irrigated arable land),
- areas with scattered houses when they occupy more than 30% of the patchwork area (class 112 discontinuous urban fabric).

In this report it is assumed that the area of complex cultivation patterns (CLC 242 above) and the area of agricultural mosaics (CLC 243 below) can be assigned to the ecosystems used in this study as follows:

Ecosystem to which the area is assigned	242 Complex	243 mosaic
arable	40%	25%
permanent	15%	10%
pasture (improved & semi-natural)	20%	30%
forest	0%	25%
heath/scrub	0%	0%
buildings / artificial surfaces	20%	5%
other (eg water or garden structures or barely vegetated)	5%	5%

CCLC 243: Land principally occupied by agriculture, with significant areas of natural vegetation

CLC definition: Areas principally occupied by agriculture, interspersed with significant natural or semi-natural patches. These patches can include canals, wetlands, water bodies, or rock outcrops. The agricultural area can include arable crops and permanent grassland. This class includes rural mosaics of fields, field boundaries, and woodland patches.

This class includes:

- small mosaic landscape typical of the Mediterranean with a mixture of grazed sclerophyllous macchia (maquis) and extensive olive groves;
- Extensive arable areas interspersed with extensive temporary grassland and natural areas, such as in Spain

This class excludes:

- agricultural lands associated with small plots of fruit trees or olive groves (class 242 complex cultivation patterns),
- areas in which the share of agricultural area is above 75% (classes 21x, 22x or 23x),
- areas in which semi-natural vegetation dominates more than 75% (classes 3xx)

The CLC classes 241, 242 and 243 together give a mixed agricultural cropland area of **39.5 million ha** for the EU-27. Some of this is High Nature Value farmland, as discussed below.

See above for how this area was assigned to the ecosystem groups used in this report.

1.1.1 Biodiversity value

The agro-ecosystem areas of highest biodiversity importance (eg in terms of supporting rare and specialist species and species-rich communities) are the remaining traditional low-intensity farming systems and farming systems that maintain diverse habitats and landscapes, which are often referred to as High Nature Value Farming systems (HNV) (Baldock et al, 1993; EEA, 2004; IEEP, 2007; Oppermann et al, 2012). HNV farming systems are (Paracchini et al, 2008): 1) farmland with a high proportion of semi-natural vegetation; 2) farmland with a mosaic of low intensity agriculture and natural and structural elements, such as field margins, hedgerows, stone walls, patches of woodland or scrub, small rivers etc.; and 3) farmland supporting rare species or a high proportion of European or World populations.

The table below lists the results of an estimate of HNV area in each Member State by the JRC and EEA (Paracchini et al, 2008). The estimate is based on a combination of CORINE 2000 Land Cover data for permanent grassland with other datasets for Natura 2000 sites, International Bird Areas (Heath and Evans, 2000, see (Heath et al, 2011)), Prime Butterfly Areas (van Swaay and Warren, 2003); supplemented with national biodiversity datasets. The proportion of HNV differs considerably between Member States, with the highest proportions of HNV farmland being found in the Mediterranean and central and eastern Member States. However, the methodology does not provide a direct estimate of HNV and there are significant data constraints and uncertainties, particularly in relation to the data for Austria, Cyprus and Finland. Consequently, Paracchini *et al* (2008) state that their estimates provide at best a proxy distribution.

Member State	HNV farmland area (ha)	Total agricultural land (ha) (CLC agricultural and grassland + other HNV areas)	Area share of agricultural land that is HNV
Austria	2,447,292	3,578,621	68.4%
Belgium	347,960	1,786,942	19.5%
Bulgaria	2,509,989	6,734,217	37.3%
Cyprus	342,045	637,043	53.7%
Czech Republic	1,043,973	4,950,869	21.1%
Denmark	172,267	3,446,150	5.0%
Estonia	380,879	1,695,820	22.5%
Finland	1,330,797	2,967,068	44.9%
France	7,797,145	35,311,870	22.1%
Germany	3,162,699	21,607,362	14.6%
Greece	5,349,572	9,122,263	58.6%
Hungary	1,906,124	6,822,877	27.9%
Ireland	1,162,594	5,777,390	20.1%
Italy	6,127,030	18,359,587	33.4%
Lithuania	627,202	4,159,700	15.1%
Luxembourg	12,871	142,632	9.0%
Latvia	568,400	2,853,680	19.9%
Malta			
Netherlands	368,788	2,621,717	14.1%
Poland	4,813,243	20,231,887	23.8%
Portugal	2,900,462	5,035,890	57.6%
Romania	4,860,372	14,433,920	33.7%
Slovakia	547,582	2,485,476	22.0%
Slovenia	591,314	754,255	78.4%
Spain	18,986,960	34,038,906	55.8%
Sweden	1,136,030	4,759,869	23.9%
UK	5,165,466	19,368,468	26.7%
Total	**74,659,056**	**233,684,479**	**31.9%**

The Paracchini *et al* (2008) study concludes that around 30% of agricultural land can be considered as HNV. As this includes permanent grassland as well as mixed cropping areas, it is not directly comparable with the definition of agro-ecosystems we use in this study because we exclude the large areas of permanent grassland. We therefore estimate that **10-20% of agro-ecosystems can be considered as HNV**, mainly farmland with a mosaic of low intensity agriculture and natural and structural elements.

1.1.2 Equivalence to Annex I habitat types

Cropped agro-ecosystems (other than permanent grassland) are not defined in the Habitats Directive Annex I habitat list. However, the total CLC agro-ecosystem area (and particularly CLC class 243) will include a significant number of small patches (>15 ha) of Annex I habitat types, including permanent grassland, woodland, and scrub.

1.2 PERMANENT GRASSLAND

CLC 321: Natural grassland

CLC definition: All areas of low productivity semi-natural or natural grasslands that have more than 50% vegetation cover (where the vegetation is mainly grass, and less than 150 cm high), and that is not obviously enclosed or parcelled. Generally, this covers only grassland that is at a distance from villages and towns. The grasslands generally have a low yearly productivity, less than 1 livestock unit per hectare (=1500 units of fodder/ha), and need extensive grazing and/or mowing. This land cover includes areas of grassland with rocks, trees or shrubs, hedges, dry stone walls, ditches, ponds, or any other feature if they cover less than 25% of the area.

The natural grassland class includes:

a) high-productivity natural alpine meadows far from houses and/or crops;

b) saline grasslands grown on temporally wet areas of saline soils;

c) pasture dominated by grasses of low or no forage value, mainly *Nardus stricta*, *Molinia* spp. or *Brachypodium* spp.;

d) meadows where sedges, rushes, thistles, or nettles cover more than 25% of the parcel;

e) abandoned semi-natural grassland if scrub covers less than 75% and trees cover less than 30% of the area.

The natural grassland class **does not include**:

- agriculturally improved grassland, or degraded or abandoned grassland where the vegetation has been or still is subject to significant human influences such as agricultural intensification or pollution (part of pastures CLC 231);
- high-productivity lowland meadows (part of pastures CLC 231);
- arable land that has been fallow for less than 5 years (part of pastures CLC 231 or agricultural land CLC 211);
- ‘grey’ dunes (part of CLC 331 beaches, sand dunes and sand plains)
- abandoned semi-natural grassland where scrub covers more than 75% of the area (part of moors and heathland CLC 322) and/or trees cover more than 30% of the area (part of transitional woodland scrub CLC 324);

CLC 231: Pasture

CLC definition: The CLC class pasture is grassland that has a clear parcel structure, ie which is generally enclosed by fences, hedges, or dry stone walls, and includes farm structures such as livestock shelters or enclosures, and watering places or drinking troughs. The pasture area includes all >25ha areas of productive grassland that has been agriculturally improved through drainage and/or fertilization and is more than five years old, but also includes a lot of semi-natural grassland. Pasture must be maintained through grazing and/or mowing for hay or silage. The class includes areas of pasture divided by hedges (eg bocage), and may include patches of arable land if they cover less than 25% of the area.

The pasture class **includes**:

- sown grassland that is more than five years old, and that has a significant number of natural vegetation species (such as *Taraxacum officinale*, *Ranunculus* spp. *Leucanthemum vulgare*, *Knautia arvensis*, *Achillea millefolium*, *Salvia* spp.);
- enclosed and agriculturally improved semi-natural pasture and meadows, including enclosed field parcels of grazed coastal salt-marsh, dune grassland, wetland, and peatland;
- sparsely wooded semi-improved grasslands and parklands, if tree cover is less than 30%;
- arable land that has been abandoned for more than 3 years and is used as pasture;
- humid meadows in which sedges, rushes, thistles, or nettles cover less than 25% of the surface area.

The pasture class **does not include**:

- temporary sown grassland that is within an arable rotation and less than five years old, or fodder crops such as Lucerne or clover (see Arable land CLC 2.1);
- parks, lawns and gardens inside urban areas and/or sport and leisure facility areas (see Urban, industrial, transport and quarry and waste sites);
- abandoned grassland where scrub covers at least 25% of the parcel (CLC 322 or 324);
- salt meadows located in intertidal areas (see Coastal wetlands CLC 4.2);
- permanently waterlogged grassland where wetland plant species such as sedges or reeds cover at least 25% of the parcel (see Inland marshes CLC 411).

Errors in CORINE: intensively used grasslands are often classed as CLC 321 (natural grasslands) instead of pastures (CLC 231), despite a visible parcel structure that refers to the strong human impact (Büttner et al, 2012). This does not affect the analysis in this study.

CORINE 244 Agroforestry (including wooded pastures)

CLC definition: Agroforestry areas include grassland and/or annual crops and/or fallow land under the wooded cover of forestry species. The annual crops and/or grazing land occupy less than 50% of the area, and the canopy of the forestry species covers at least 50% and less than 75% of the area. Tree species can include forest species such as spruce (*Abies picea*), carob (*Ceratonia siliqua*), palm trees, or oak (*Quercus* spp.), and mixtures of forest species and permanent crop trees such as chestnut, fruit or olives (if neither is dominant). Agro-forestry areas are only recorded by CLC in Spain, Portugal, and Italy, plus very small areas in France and Austria. In Spain, Portugal, Italy and France, the agroforestry systems are mainly grazed oak forests known as dehesa or montado, including evergreen oak species (*Quercus* spp.) and grazed cork oak forests. In Austria, the agroforestry area includes alpine wooded pasture and grazed orchards. These areas are therefore considered together with the other grassland areas.

In this study, a share of the transitional woodland-scrub area has been added to the semi-natural grassland area for each Member State, in the assumption that some of the transitional woodland-scrub area is abandoned successional grassland. The share of woodland-scrub area for each Member State was calculated according to the proportion of semi-natural grassland versus the three other CLC land covers related to woodland-scrub (forests, heath and sclerophyllous scrub) in that Member State (see CLC forests for more detail).

1.2.1 Heavily modified ecosystem – improved grassland

Agriculturally improved grassland, ie grassland that has been cultivated, reseeded with a commercial grass seed mix, limed, fertilized and drained and/or irrigated, hosts so little biodiversity and bears so little resemblance to European semi-natural grassland habitats that it cannot be regarded as restorable according to the Target 2 definition (see Chapter 2). Most intensively improved grassland is temporary and part of an arable rotation, and therefore included in the agro-ecosystem area, but a proportion of the permanent grassland is also intensively improved. It is not possible to obtain accurate data at an EU level that allows us to distinguish between intensively improved and semi-natural permanent grassland. Some Member States have made efforts to improve the protection of semi-natural grassland, and have established national inventories. For the purposes of the calculations in this report, an expert judgment was made, using this data where possible, about the proportion of CLC pasture area (plus the pasture area in the mixed farming areas) in each Member State that is agriculturally improved (see above), with the rest assumed to be semi-natural. The data and assumptions used for the Member States with most of the grassland area are as follows:

- **France** – French agricultural statistics from 1999 recorded 23% of permanent grassland (2,435,000 ha) as extensively used (and 7,952,000 ha as productive permanent grasslands) (quoted in (Pointereau et al, 2007)). More recent Farm Structural Survey results report 15% of permanent grassland as rough grazing, which corresponds to the proportion of natural grassland CLC vs pasture CLC[2]. For this study it is assumed that **85%** of CLC pasture area is heavily improved.
- **UK** – 1,692,481 ha of semi-natural grassland habitats, of which 215,686 ha is priority grassland habitat for biodiversity (though overall less than 5% of UK managed grassland is considered to be “unimproved”) (UK NEA, 2011b). In Wales, 43% of grassland is considered to be unimproved (CCW, 2012). For this study it is assumed that **75%** of the CLC pasture area is heavily improved.
- **Spain** – Spain’s grassland consists of 50% natural grassland CLC, 40% agroforestry CLC, and 10% pasture CLC. For this study it is assumed that **50%** of CLC pasture area is heavily improved.
- **Germany** – 1,062,322 ha HNV-grassland (Matzdorf et al, 2010); at least 1.313 and maximum 2.026 million ha semi-natural (Güthler & Oppermann, 2005); for this study it is assumed that **75%** of CLC pasture area is heavily improved.
- **Ireland** – for this study it is assumed that **95%** of CLC pasture area is heavily improved.
- **Romania** – 2.4 million ha of semi-natural grasslands (Paracchini et al, 2008); for this study it is assumed that **2%** of CLC pasture area is heavily improved.
- **Poland** - for this study it is assumed that **40%** of CLC pasture area is heavily improved.

[2] Figures based on Farm Structural Survey (FSS) 2007 data. ef_lu_ovcropaa Accessed: October 2012

- **Italy** - for this study it is assumed that **40%** of CLC pasture area is heavily improved.
- **Austria** - according to the Farm Structural Survey, grassland is half rough grazing and half pasture/meadow[3]. For this study it is assumed that **10%** of CLC pasture area is heavily improved.
- **Netherlands** - less than 2% of permanent grassland in the Netherlands is semi-natural according to (Paracchini et al, 2008). For this study it is assumed that **95%** of CLC pasture area is heavily improved.
- **Hungary** – 602,265 ha of semi-natural and natural grassland categories is mapped (Molnár et al, 2008). For this study it is assumed that **40%** of CLC pasture area is heavily improved.
- **Latvia** – 63,568 biologically valuable grasslands are identified (Veenecology, 2012). According to the Farm Structural Survey Latvian grassland is dominated by rough grazing[4], which bears no relationship to the proportion of natural grassland to pasture CLC in Latvia. For this study it is assumed that **20%** of CLC pasture area is heavily improved.
- **Portugal** - for this study it is assumed that **50%** of CLC pasture area is heavily improved.
- **Bulgaria** - for this study it is assumed that **2%** of CLC pasture area is heavily improved.
- **Czech Republic** - for this study it is assumed that **20%** of CLC pasture area is heavily improved.
- **Sweden** –228,919 ha of pasture, 6,600 ha of meadow, 15,104 ha of forest and mountain grazing were considered to be semi-natural in 2002-2004, and 34,546 ha of this was considered to contain significant nature and cultural heritage values. The need for restoration was highlighted, and an inventory update found that 31,222 ha are no longer considered valuable because of negative changes (Paracchini et al, 2008). For this study it is assumed that **30%** of CLC pasture area is heavily improved.
- **Lithuania** - 54,918 ha of important grasslands mapped in 2002-2005 (Rasomaviciuis et al, 2006); for this study it is assumed that **85**% of CLC pasture area is heavily improved.
- **Belgium** - High value semi-natural grassland in Flanders is estimated at between 6,415 and 10,950 ha (Vriens et al, 2011). An additional 44,450 to 58,450 ha of permanent grassland in agricultural use is still more or less species-rich but ecologically degraded. For this study it is assumed that **81%** of CLC pasture area is heavily improved.
- **Slovakia** – mapped 118,444 ha as ecologically important semi-natural and natural grassland, and evaluated another 212,156 ha as degraded grassland (estimated total c 320,000 ha of semi-natural and natural grassland) (Šeffer et al, 2002); for this study it is assumed that **10%** of CLC pasture area is heavily improved.

[3] Figures based on Farm Structural Survey (FSS) 2007 data. ef_lu_ovcropaa Accessed: October 2012
[4] Figures based on Farm Structural Survey (FSS) 2007 data. ef_lu_ovcropaa Accessed: October 2012

1.2.2 Biodiversity value

Grasslands vary enormously from sown or agriculturally improved and intensively managed pasture, which is very biodiversity poor, to unimproved semi-natural grassland which is amongst the most species-rich ecosystems in Europe and has great conservation value, but which has suffered a huge decline in past decades (EEA, 2010a). Semi-natural grasslands span a wide range of climatic, soil and hydrological conditions, from arid to periodically or permanently waterlogged from flooding or groundwater, acidic, calcareous, saline, oligotrophic to mesotrophic etc. Particularly valuable grassland types include:

- **Natural grasslands** that have evolved in situations of environmental stress, such as saline groundwater flooding, aridity, high altitude, steep slopes, or river flooding. These grasslands are now restricted to small patches, and many are degraded as a result of alterations such as drainage or fragmentation. Most areas need sensitive management through very extensive grazing or cutting, but a few natural grasslands, often in remote areas, are better left completely alone, for example high altitude calcareous grasslands. Some of these grassland types have all but disappeared and are critically threatened, for example Pannonic salt steppes and salt marshes.
- **Species-rich hay meadows** that have been traditionally managed through one or two cuts a year for centuries. The removal of hay has removed nutrients, which has restricted plant competition and led to increased biodiversity. More than 30% of Slovakia’s semi-natural grasslands are mesophile *Arrhenatherum* hay meadows (Šeffer et al, 2002). *Calthion* meadows used to be the dominant grassland type in many river valleys in Europe.
- **Calcareous grasslands**
- **Dry and arid grasslands** eg steppe grassland dominated by *Stipa* grasses
- **Wet meadows and pasture**, including fen meadows
- **Wood pastures** - open, grazed woodlands with a mosaic of grassland, shrub and tree patches that cover less than 30% of the area - are of high biological and cultural value and have become a threatened ecosystem in Europe (Bergmeier et al, 2012). Spontaneous tree regeneration in the presence of large grazing animals is an essential process for the restoration of this structurally diverse habitat.
- Semi-natural grassland **interspersed with other valuable wildlife habitats** such as rocks, trees or shrubs, hedges, dry stone walls, ditches, or ponds. For example, many biodiverse grassland types are characterised by the presence of scattered shrubs which play a key role in the maintenance of biodiversity, and can also play a vital role in the restoration of degraded dry grassland (Maestre et al, 2009).

It is important to note that there is a gradual transition from semi-natural extensively used grasslands to improved grasslands and the CLC system cannot distinguish between grasslands important for biodiversity and species-poor grassland. This study therefore uses the total area of Annex I grassland in the EU-25 (9.3 million ha) as an estimate for the semi-natural grasslands with high biodiversity in the EU-27, plus some unknown additional area in Romania and Bulgaria. This implies that 30% of Europe’s permanent grassland contains a significant biodiversity value. Therefore this study assumes a total of **10 million ha of high biodiversity value semi-natural grassland** in the EU-27.

1.2.3 Equivalence to Annex I habitat types

European habitat types (Habitats Directive Annex I) associated with the CLC class 'natural grasslands' and/or 'pastures' include:

	Habitats Directive Annex I habitat types associated with CORINE grasslands	**CLC code**	**Habitat area (ha) in EU-25**
2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands		31,946
2340	Pannonic inland dunes		1,193
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	321, 333	143,405
6120	Xeric sand calcareous grasslands	321, 333	15,326
6130	Calaminarian grasslands of the Violetalia calaminariae	321, 333	4,769
6140	Siliceous Pyrenean *Festuca eskia* grasslands	321	92,085
6150	Siliceous alpine and boreal grasslands	321	839,034
6160	Oro-Iberian *Festuca indigesta* grasslands	321	417,569
6170	Alpine and subalpine calcareous grasslands	321	996,704
6180	Macaronesian mesophile grasslands	231, 321	14,139
6190	Rupicolous pannonic grasslands (Stipo-Festucetalia pallentis)	321	2,599
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia)	231, 321	916,383
6220	Pseudo-steppe with grasses and annuals of the Thero-Brachypodietea	321	1,470,169
6230	Species-rich *Nardus* grasslands, on siliceous substrates in mountain areas (and sub-mountain areas, in continental Europe)	321	352,482
6240	Sub-pannonic steppic grassland	321	27,504
6250	Pannonic loess steppic grasslands	321	20,719
6260	Pannonic sand steppes	321	48,552
6270	Fennoscandian lowland species-rich dry to mesic grasslands	231, 321	44,900
6280	Nordic alvar and precambrian calcareous flatrocks	321	34,850
62A0	Eastern sub-Mediterranean dry grasslands (Scorzoneratalia villosae)	231, 321	90,910
62B0	Serpentinophilous grassland of Cyprus	321	41
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	231, 321	153,429
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion)	321	247,108
6440	Alluvial meadows of river valleys of the Cnidion dubii	231, 321	63,877
6450	Northern boreal alluvial meadows	321	45,400
6460	Peat grasslands of Trodos	321, 231	2
6510	Lowland hay meadows (*Alopecurus pratensis*, *Sanguisorba officinalis*)	231	1,473,659
6520	Mountain hay meadows	231, 321	225,752
	TOTAL GRASSLAND HABITATS		**7,774,506**

Annex I meadow habitat types (6410, 6420, 6440, 6450, 6510, 6520) cover 2,209,225 ha of the total Annex I grassland habitat area, ie 28%, but not all of this is mown – eg some *Molinia* meadows are grazed.

European habitat types (Habitats Directive Annex I) associated with the CLC class 'agroforestry' include the dehesas with evergreen *Quercus* spp. (habitat 6310) and Fennoscandian wooded meadows (habitat 6530) and pastures (habitat 9070).

	Habitats Directive Annex I habitat types associated with CLC 244 Agroforestry	**CLC code**	**Area (ha) in EU-25**
6310	Dehesas with evergreen *Quercus* spp.	244, 324	1,567,420
6530	Fennoscandian wooded meadows	244, 324	5,330
9070	Fennoscandian wooded pastures	244, 324, 311	50,770
	TOTAL AGROFORESTRY		**1,623,520**
	TOTAL GRASSLAND HABITATS WITH ABOVE		**9,398,025**

Notably, Spain has registered a large area of Annex I dehesa habitat (5,716,919 ha), more than double its agroforestry area registered under CLC (2,495,035 ha), and it is therefore likely that much of this habitat is categorized under CLC as natural grassland or forest rather than agroforestry. The Baltic Member States with Annex I Fennoscandian wooded meadows do not register any CLC Agroforestry area. It is likely that the remaining habitat areas are either too small to be registered, or that habitat areas are registered as transitional woodland scrub (CLC 324) due to the lack of management and scrub encroachment.

Some Natura 2000 grassland types may be picked up under a different CLC Land Cover Class;

	Habitats Directive Annex I habitat types associated with CORINE grasslands	**Other CLC class in which habitat may be included**	**Area (ha) in EU-25**
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	333 sparsely vegetated	143,405
6120	Xeric sand calcareous grasslands	333 sparsely vegetated	15,326
6130	Calaminarian grasslands of the Violetalia calaminariae	333 sparsely vegetated	4,769
6280	Nordic alvar and precambrian calcareous flatrocks	333 sparsely vegetated	34,850
6310	Dehesas with evergreen *Quercus* spp.	324 transitional woodland scrub or 311 deciduous forest (if abandoned and overgrown)	1,567,420
6530	Fennoscandian wooded meadows		5,330
9070	Fennoscandian wooded pastures		50,770
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	321/231 grassland	153,429
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion)	411 inland marshes	247,108
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	411 inland marshes, 511 water courses (NB linear habitats are generally underestimated by CORINE)	233,379
6440	Alluvial meadows of river valleys of the Cnidion dubii	411 inland marshes	63,877
6450	Northern boreal alluvial meadows	411 inland marshes	45,400
6460	Peat grasslands of Trodos	411 inland marshes	2
	TOTAL THAT MAY BE OTHER ECOSYSTEM		**2,565,065**

Some other Annex I habitat types may be registered as grasslands under the CLC system, although they fall under other broad habitat categories in the Habitats Directive. This study counts these habitats listed below as part of the CLC class in which they are primarily included according to the CLC definitions (Büttner et al, 2006).

	Habitats Directive Annex I habitat types that may be associated with CORINE grasslands	CLC class in which habitat is primarily included	Area (ha) in EU-25
1510	Mediterranean salt steppes (Limonietalia)	333 sparsely vegetated	52,645
1530	Pannonic salt steppes and salt marshes	411 inland marsh	201,525
1630	Boreal Baltic coastal meadows	421 saltmarsh	22,870
21A0	Machairs	331 dunes	16,053
2230	Malcolmetalia dune grasslands	331 dunes	8,302
2240	Brachypodietalia dune grasslands with annuals	331 dunes	9,000
3170	Mediterranean temporary ponds	512 water bodies	61,558
3180	Turloughs	512 water bodies	11,986
	TOTAL OTHER GRASSLAND		**383,939**

1.3 HEATHS AND TUNDRA

CLC 322: Heathland

CLC definition: This ecosystem type mainly comprises CLC type 323, referred to as 'moors and heathland'. This is generally described as vegetation with low and closed cover dominated by bushes, shrubs and herbaceous plants (heather, briars, broom, gorse, laburnum, etc.). The CLC types comprise Atlantic heaths (upland heaths often being referred to as moors), subalpine heaths and tundra. The CLC typology initially outlined by Büttner et al (2006) did not include tundra in this class, but in CLC 333 (sparsely vegetated areas). However, as described by Büttner et al (2012) the current consensus is that tundra land cover is in fact captured by the CLC type 322. Atlantic moors are secondary formations resulting from forest degradation (moors composed of European gorse, bracken, etc. (tall growth) and moors composed mainly of Ericaceae (heathers) (low growth). Subalpine moors are formations based on rhododendrons, bilberries and *Calluna*, generally succeeding subalpine forest and grazing land. Heath and moorland occurs in an ecological continuum with natural grassland (CLC 321) and forest (CLC 311, 312 or 313), and it is often difficult to distinguish them as separate habitats. Heathland vegetation also grows on drained peat soils that were originally blanket bog or raised bog, or fen. Tundra consists of dwarf shrub vegetation, sedges and grasses, mosses, and lichens. Scattered trees grow in some tundra.

This class includes

- wet heath distributed on humid or semi-peaty soils (peat depth < 30 cm) with *Erica tetralix/ciliaris, Sphagnum spp.* and *Molinia* spp.;
- *Pinus mugo* coverage above the upper tree limit in the Alpine zone or in the bottom of large
- depressions with temperature inversion;
- maritime, prostrate, wind-swept and cushiony heaths with maritime ecotypes;
- heath and scrub formation in Atlantic, sub-Atlantic and sub-continental areas with gorse (*Ulex*
- *spp.*), *vaccinium* heaths (*Calluna vulgaris, Vaccinium spp.*), heather (*Erica spp.*), bracken or
- gorse (*Genista spp.*), bilberry heaths (*Vaccinium myrtillus*), briar patch (*Rubus spp.*);

- moors in supra-Mediterranean area with box trees and gorse, hedgehog-heaths (*Buxus spp., Astragalus spp., Bupleurum spp.*, etc.);
- sub Alpine tall herbs with dominating bushy facies (*Calluna spp., Vaccinium spp., Rubus spp., Juniperus nana,* etc.);
- arctic moors areas with moss, lichen, gramineous coverage and small dwarf or prostrate shrub formations (*Betula nana, Salix lapponum, Salix glauca, Juniperus alpina, Dryas spp*.);
- thickets and brush woods in temperate climate areas (box, bramble thickets, broom fields, gorse thickets, bracken fields, common juniper-scrubs);
- brush woods and bush-like forest in Alpine area with dwarf mountain pine scrub or green alder scrub (*Pinus mugo ssp. mughus and Alnus spp*.) Alpine willow brush, etc., accompanied by *Rhododendron spp*.;
- thickets and bush-like forest in arctic area with *Betula nana* and *Salix lapponum/glauca* spp.;
- abandoned crops where ligneous/semi-ligneous species cover more of 25 % of the surface;
- coastal dunes (so-called brown dunes) covered and fixed with shrubs (*Hippophae spp., Empetrum spp., Salix spp*.);
- herbaceous coverage formations mainly composed of non-palatable gramineous species such as *Molinia spp., Brachypodium spp*., etc.

This class excludes:

- low maquis/mattoral vegetation (class 323);
- heathland under recolonizing process where tree-like species cover more than 30% of the surface (class 324).

CLC 324 transitional woodland scrub

In this study, a share of the transitional woodland-scrub area has been added to the heathland area for each Member State, in the assumption that some of the transitional woodland-scrub area is abandoned successional heathland. The share of woodland-scrub area for each Member State was calculated according to the proportion of heath versus the three other CLC land covers related to woodland-scrub (forests, sclerophyllous scrub and semi-natural grassland) in that Member State (see CLC forests for more detail).

1.3.1 Equivalence to Annex I habitat types

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types primarily associated with CLC 322 heathlands and tundra	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
2140	Decalcified fixed dunes with *Empetrum nigrum*	331 sand dunes	22,792
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	331 sand dunes	5,612
2160	Dunes with *Hippophae rhamnoides*	331 sand dunes	11,557
2310	Dry sandy heaths with *Calluna* and *Genista*	331 sand dunes	17,352
2320	Dry sandy heaths with *Calluna* and *Empetrum nigrum*	331 sand dunes	4,734
4010	Northern Atlantic wet heaths with *Erica tetralix*		484,634
4020	Temperate Atlantic wet heaths with *Erica ciliaris* and *Erica tetralix*		152,800
4030	European dry heaths		2,882,396
4040	Dry Atlantic coastal heaths with *Erica vagans*		1,599
4050	Endemic Macaronesian heaths		150,480
4060	Alpine and Boreal heaths	333 sparsely vegetated	3,371,884

4070	Bushes with *Pinus mugo* and *Rhododendron hirsutum* (Mugo Rhododendretum hirsuti)		253,029
4080	Sub-Arctic *Salix* spp scrub		167,883
4090	Endemic oro-Mediterranean heaths with gorse	323 sclerophyllous scrub	2,359,169
40A0	Subcontinental peri-Pannonic scrub		2,229
40B0	Rhodope *Potentilla fruticosa* thickets		n/a
40C0	Ponto-Sarmatic deciduous thickets		n/a
	TOTAL HEATHS		**9,888,150**

Another Annex I habitat types that may be included in this CLC land cover class rather than their main class is:

	Habitats Directive Annex I habitat types related to CLC 322 heathland	Primary CLC class	Area (ha) in EU-25
1610	Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation *(if they are covered in Calluna and/or Juniperus)*	331 beaches & dunes	23,940

1.4 SCLEROPHYLLOUS SCRUB

CLC 323: Sclerophyllous vegetation

CLC definition: The CLC class sclerophyllous vegetation includes all areas with evergreen sclerophyllous bushes and scrubs, with isolated trees, including maquis, garrigue, mattoral and phrygana. These habitats are found around the Mediterranean region. The class does not include sclerophyllous scrub that forms a dense cover underneath sclerophyllous oaks (*Quercus suber/ilex/rotundifolia*), or olive trees, or pines (these areas are either CLC classes 311 or 312 or transitional woodland shrub CLC class 324). The vegetation is generally interspersed with *Quercus* forest thickets (CLC class 311), areas of open grassland (CLC class 321), and sparsely vegetated rock formations (CLC class 333).

This heading includes:

- mattoral of arid zone with pre-desert brushes and tall *Ziziphus lotus*;
- laurel mattoral with *Laurus nobilis*;
- cypress mattoral with native or planted cypressus;
- tree-spurge formation with dense stands of *Euphorbia dendroides* in thermo-Mediterranean area;
- palmetto brush formations with dominating *Chamaerops humilis*;
- pre-desert scrub with halo-nitrophyllous scrubs and gypsum scrubs: jujube brush (*Ziziphus lotus*), shrubs of African affinities (spiny brush formation of acacia);
- abandoned olive groves.

This heading excludes:

- arborescent mattorals which are a pre- or post-broad-leaved evergreen forest formation with more or less dense arborescent cover with a usually thick high evergreen shrub stratum organized around evergreen oaks (*Quercus suber/ilex/rotundifolia*) olive trees or pines the crown cover of which is more than 30% (CLC 311). If the crown cover is less than 30%, it is assigned to transitional woodland-scrub (CLC 324).

Maquis is a dense vegetation association composed of shrubby species on siliceous soils. It includes heather and isolated *Quercus ilex*. Garrigue is a type of discontinuous bushy vegetation found on calcareous plateaus in the Western Mediterranean. Typical species are kermes oak (*Quercus coccifera*), *Arbutus* spp., *Cytisus* spp., and aromatic shrubby herbs such as lavender and thyme. Phrygana consists of vegetation types similar to garrigue on calcareous soils in the Eastern Mediterranean. Mattoral is a general term for a range of diverse vegetation types with mixed grassland and scrub or scrubby trees such as *Juniperus* or *Cytisus* species.

In this study, a share of the transitional woodland-scrub area has been added to the sclerophyllous scrub area for each Member State that has sclerophyllous scrub, in the assumption that some of the transitional woodland-scrub area is abandoned successional scrub. The share of woodland-scrub area for each Member State was calculated according to the proportion of sclerophyllous scrub versus the three other CLC land covers related to woodland-scrub (forests, heath and semi-natural grassland) in that Member State (see CLC forests for more detail).

1.4.1 Equivalence to Annex I habitat types

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types associated with CLC 323 sclerophyllous scrub	**Other CLC classes in which the habitat might be included**	**Area (ha) in EU-25**
1430	Halo-nitrophilous scrubs (Pegano-Salsoletea) *(mostly occur on Canary Islands)*	333 sparsely vegetated	46,801
1520	Iberian gypsum vegetation (Gypsophiletalia)	333 sparsely vegetated	216,705
5110	Stable xero-thermophilous formations with *Buxus sempervirens* on rock slopes (Berberidion pp)	322 heath (eg FR)	110,494
5120	Mountain *Cytisus purgans* formations	322 heath (eg FR)	340,908
5130	*Juniperus communis* formations on heaths or calcareous grasslands	322 heath (eg FR)	143,954
5140	*Cistus palhinhae* formations on maritime wet heaths	322 heath	n/a
5210	Arborescent matorral with *Juniperus* spp.	312 coniferous forest	986,689
5220	Arborescent matorral with *Zyziphus*	311 deciduous forest	8,200
5230	Arborescent matorral with *Laurus nobilis*	311 deciduous forest	25,498
5310	*Laurus nobilis* thickets	311 deciduous forest	1,756
5320	Low formations of *Euphorbia* close to cliffs	333 sparsely vegetated	6,820
5330	Thermo-Mediterranean and pre-desert scrub	333 sparsely vegetated	1,215,355
5410	West Mediterranean clifftop phryganas (Astragalo-Plantaginetum subulatae)		8,720
5420	*Sarcopoterium spinosum* phryganas		252,200
5430	Endemic phryganas of the Euphorbio-Verbascion		45,130
	TOTAL		**3,409,230**

In France, some of these sclerophyllous habitat types are in France considered to fall under CLC 322 heath, whereas habitat 4090 Endemic oro-Mediterranean heaths with gorse is counted as sclerophyllous scrub {5156}.

The EU 2010 biodiversity baseline assessment (EEA, 2010a) includes some more Annex I habitats as sclerophyllous scrub, although they are more likely to fall in a different CLC class (as is assumed in this report):

	Habitats Directive Annex I habitat types related to CLC 322 moor & heath or 323 sclerophyllous scrub	**CLC class used in this report**	**Area (ha) in EU-25**
1420	Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi)	421 salt marshes	88,309
2250	Coastal dunes with *Juniperus* spp.	331 sand dunes	18,260
2260	Cisto-Lavenduletalia dune sclerophyllous scrub	331 sand dunes	43,141
4090	Endemic oro-Mediterranean heaths with gorse	322 heath	2,359,169

1.5 FORESTS

CLC definition: Forest includes all areas where the vegetation cover is composed principally of trees, including shrub and bush understories. Under normal climatic conditions the trees are higher than 5m, with a canopy closure of at least 30%. Plantation forests have a density of at least 500 subjects/ha.

The forest classes include:

- naturally regenerated and planted forests, including all transitional woodland areas where the canopy closure of trees is at least 50% and the average breast diameter of trees is at least 10 cm;
- wooded or afforested dunes, bogs, fens and wetlands with a canopy cover of at least 30%;
- arborescent mattoral where tree crown cover is more than 30% of area;
- stable/climax tree formations with a tree height below 4m in height in extreme climatic conditions (eg sub-arctic or alpine);

Forest areas exclude:

- patches of forest vegetation smaller than 25 ha in size or where forest trees cover less than 50% but more than 30% of the area (CLC 324 transitional woodland scrub);
- regenerating but still open burnt or clear cut areas, heavily damaged forest areas with more than 50% dead trees (CLC 324 transitional woodland scrub);
- forest nurseries and plantations situated inside forest areas (CLC 324 transitional woodland-scrub);
- large recently burnt areas inside forest areas (CLC 334 burnt areas);
- scrub with tree species smaller than 5m high and/or with crown cover density of less than 30% of area (CLC 322 moors and heathland; 323 sclerophyllous vegetation; 324 transitional woodland-scrub);

CLC 311: Broad-leaved forest

CLC definition: The CLC type 'Broadleaved forest' is described as vegetation composed principally of trees, including shrub and bush understories, where broadleaved species represent more than three-quarters of the canopy. In areas where the proportional coverage by broadleaved species is lower, the land type is generally classified as mixed forest (CLC type 313). Broadleaved forest includes young coppice, broadleaved plantations and broadleaved wooded dunes.

CLC 312: Coniferous forest

CLC definition: The CLC type 'Coniferous forest' is defined as vegetation cover composed principally of trees, including shrub and bush understories, where coniferous species predominate. Coniferous species must represent at least 75% of the total surface area of the forest unit, otherwise it is classified as mixed forest (CLC 313).

CLC 313: Mixed forest

CLC definition: The CLC type 'Mixed forest' is defined as vegetation cover composed principally of trees, including shrub and bush understories, where neither broad-leaved nor coniferous species predominate (ie each is less than 75% of canopy).

CLC324: Transitional woodland scrub

CLC definition: Bushy or herbaceous vegetation with scattered trees. Can represent either forest degradation (eg after burning or clear felling) or forest plantation, succession, or regeneration.

This heading **includes**:

- abandoned agricultural land, grassland, or industrial land where the forest tree canopy already covers more than 30% but less than 50% of the area;
- natural grassland areas with small forests under 25ha and/or intermixed with trees which cover more than 30% of the surface (but not dehesa or montado);
- land planted with young trees, and forest nurseries inside forest areas;
- arborescent mattorals, which are either regenerating into or degrading from broad-leaved evergreen forest, with a usually thick evergreen shrub stratum underneath trees composed of evergreen oaks (*Quercus* spp.), olive trees, carob trees or pines, the crown cover density of which is less than 30% of the area;
- clear cuts and regenerating areas within forests up to maximum 5-8 years after clearance or disturbance;
- burnt forest areas which no longer show black tone in the satellite image but are still visible;
- forest areas heavily damaged by wind, snow-breakage or acid rain with more than 50% dead trees;
- marginal zones of bogs with a vegetation composed of shrubs and pines which cover more than 50% of the surface;
- bare rocks with scattered trees that cover more than 10% of the surface.

This heading **excludes**:

- agricultural land with patches of forest vegetation covering less than 50% of the area (CLC 243 Land principally occupied by agriculture, with significant areas of natural vegetation);
- stable/climax tree formations with a tree height less than 4m, including *Pinus mugo* forests (CLC 322 moor and heathland);
- transitional woodland areas where the canopy closure of trees is at least 50% and the average breast diameter of trees is at least 10 cm (CLC 311, 312, 313 forests);

- arborescent mattoral where tree crown cover is more than 30% of area (CLC 31x);

- abandoned olive groves (CLC 323);

Transitional woodland-scrub is a transitional habitat between degrading or regenerating forest. It may represent degraded forest (eg after wildfires), in which case it can be restored to forest, or it may represent successional stages of abandoned heathland, sclerophyllous scrub, or semi-natural grassland. In this study, the transitional woodland-scrub area has therefore been split between these four CLC categories (forest, heath, sclerophyllous scrub, or semi-natural grassland) for each Member State, according to the proportion of those four CLC land covers in that State, and then added to those ecosystem areas.

CLC 334: Recently burnt areas
CLC definition: Areas affected by recent fires, still mainly black.
This heading includes:
- burns which are younger than three years and when they are still visible in the satellite images,
- all natural and semi-natural vegetated areas.

This heading excludes:
- human farming management by burning arable lands (class 211).

1.5.1 Equivalence to Annex I habitat types

European forest habitat types in the Habitats Directive Annex I are listed below, grouped according to the Forest Europe European Forest Types classification system (EEA, 2006a).

	Habitats Directive Annex I forest types listed by European Forest Type (Forest Europe)	**CLC class in which the habitat may be included**	**Area in EU-25 (ha)**
	WOODED DUNES		
2180	Wooded dunes of the Atlantic, Continental and Boreal region	311, 312, 331 dunes	121,402
2270	Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*	312, 331 dunes	46,551
91N0	Pannonic inland sand dune thicket (Junipero-Populetum albae)		1,675
1	**BOREAL FOREST**		
9010	Western Taiga	312, 313	3,555,400
9050	Fennoscandian herb-rich forests with *Picea abies*	313 mixed	430,100
2	**HEMIBOREAL FOREST AND NEMORAL FOREST**		
9020	Fennoscandian hemiboreal natural old broad-leaved deciduous forests *Quercus*, *Tilia*, *Acer*, *Fraxinus* or *Ulmus* rich in epiphytes	311	17,550
91C0	Caledonian forest	312	25,440
91T0	Central European lichen scots pine forests		502
91U0	Sarmatic steppe pine forest		175,100
3	**ALPINE CONIFEROUS FOREST**		
9060	Coniferous forests on, or connected to, glaciofluvial eskers	312	726,700
91BA	Moesian silver fir forests	312	n/a
91P0	Holy Cross fir forest (Abietetum polonicum)	312	6,500
91Q0	Western Carpathian calcicolous *Pinus sylvestris* forests	312	2,182
91R0	Dinaric dolomite Scots pine forests (Genisto januensis-Pinetum)	312	2,500
9410	Acidophilous *Picea* forests of the montane to alpine levels	312	805,895

9420	Alpine *Larix decidua* and/or *Pinus cembra* forests	312	160,142
9430	Subalpine and montane *Pinus uncinata* forests (* if on gypsum or limestone)	312	100,458
4	**ACIDOPHILOUS OAK AND OAK-BIRCH FOREST**		
91A0	Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	311	96,222
9190	Old acidophilous oak woods with *Quercus robur* on sandy plains	311	233,279
5	**MESOPHYTIC DECIDUOUS FOREST**		
9160	Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli	311	280,722
9170	Galio-Carpinetum oak-hornbeam forests	311	799,207
9180	Tilio-Acerion forests of slopes, screes and ravines	311	195,653
91G0	Pannonic woods with *Quercus petraea* and *Carpinus betulus*	311	198,822
91L0	Illyrian oak-hornbeam forests (Erythronio-carpinion)	311	104,500
91Y0	Dacian oak & hornbeam forests	311	47,400
91Z0	Moesian silver lime woods	311	595,671
6	**BEECH FOREST**		
9110	Luzulo-Fagetum beech forests	311	1,740,230
9120	Atlantic acidophilous beech forests with *Ilex* and *Taxus* in shrub layer	311	272,179
9130	Asperulo-Fagetum beech forests	311	2,558,115
9150	Medio-European limestone beech forests of the Cephalanthero-Fagion	311	323,704
91K0	Illyrian *Fagus sylvatica* forests (Aremonio-Fagion)	311	317,300
7	**MONTANE BEECH FOREST**		
9110	Luzulo-Fagetum beech forests	311	As above
9120	Atlantic acidophilous beech forests with *Ilex* and *Taxus* in shrub layer	311	As above
9130	Asperulo-Fagetum beech forests	311	As above
9140	Medio-European subalpine beech woods with *Acer* and *Rumex arifolius*	311	45,121
91K0	Illyrian *Fagus sylvatica* forests (Aremonio-Fagion)	311	As above
91S0	Western Pontic beech forests		64,732
91V0	Dacian Beech forests (Symphyto-Fagion)		30,200
91W0	Moesian beech forests		920,150
91X0	Dobrogean beech forests		301,421
9210	Apeninne beech forests with *Taxus* and *Ilex*	311	55,500
9220	Apennine beech forests with *Abies alba* and beech forests with *Abies nebrodensis*	313	29,250
9270	Hellenic beech forests with *Abies borisii-regis*	313	48,547
8	**THERMOPHILOUS DECIDUOUS FOREST**		
91AA	Eastern white oak woods	311	n/a
91B0	Thermophilous *Fraxinus angustifolia* woods	311	127,270
91H0	Pannonian woods with *Quercus pubescens*	311	71,059
91I0	Euro-Siberian steppic woods with *Quercus pubescens*	311	31,666
91M0	Pannonian-Balkanic turkey oak –sessile oak forests		1,561,810
9230	Galicio-Portuguese oak woods with *Quercus robur* and *Quercus pyrenaica*	311	22,350
9240	*Quercus faginea* and *Quercus canariensis* Iberian woods	311	124,575
9250	*Quercus trojana* woods	311	481
9260	*Castanea sativa* woods	311	90,300
9280	*Quercus frainetto* woods	311	140

9310	Aegean *Quercus brachyphylla* woods		140
9350	*Quercus macrolepis* forests		10,200
93A0	Woodlands with *Quercus infectoria* (Anagyro foetidae-Quercetum infectoriae)		450
9	**BROADLEAVED EVERGREEN FOREST**		
91J0	*Taxus baccata* woods of the British Isles	312	1,411
9290	*Cupressus* forests (Acero-Cupression)	312	184,548
9320	*Olea* and *Certonia* forests		184,548
9330	*Quercus suber* forests		298,543
9340	*Quercus ilex* and *Quercus rotundifolia* forests		2,146,858
9360	Macaronesian laurel forests (*Laurus, Ocotea*)		55,200
9370	Palm groves of *Phoenix*		22,114
9380	Forests of *Ilex aquifolium*		8202
9390	Scrub and low forest vegetation with *Quercus alnifolia*		10,000
9560	Endemic forests with *Juniperus* spp		194,460
9570	*Tetraclinis articulata* forests		566
9580	Mediterranean *Taxus baccata* woods		4133
9590	*Cedrus brevifolia* forests (Cedrosetum brevifoliae)		400
10	**CONIFEROUS FOREST OF MEDITERRANEAN, ANATOLIAN, MACARONESIAN REGIONS**		
9510	Southern Apennine *Abies alba* forests	312	7,100
9520	*Abies pinsapo* forests	312	1,224
9530	(Sub-) Mediterranean pine forests with endemic black pines	312	443,291
9540	Mediterranean pine forests with endemic Mesogean pines	312	1,550,373
9550	Canary Island endemic pine forests	312	80,350
95A0	High oro-Mediterranean pine forests	312	n/a
11	**MIRE AND SWAMP FORESTS**		
9080	Fennoscandian deciduous swamp woods	311	176,300
91D0	Bog woodland	412 bogs	2,038,862
12	**FLOODPLAIN FOREST**		
9030	Natural forests of primary succession stages of landupheaval coast	311/312/313 forest	31,000
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)	411 inland wetlands	884,181
91F0	Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (Ulmenion minoris)	411 inland wetlands	156,774
92A0	*Salix alba* and *Populus alba* galleries	311, 411 inland wetlands	124,575
92B0	Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others	311, 411 inland wetlands, 511 water courses	481
92C0	*Platanus orientalis* and *Liquidambar orientalis* woods (Platanion orientalis)	311	90,300
92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	411 inland wetlands	48,547
13	**NON-RIVERINE ALDER, BIRCH OR ASPEN FOREST**		
9030	Natural forests of primary succession stages of landupheaval coast	311/312/313 forest	As above
9040	Nordic subalpine/subarctic forests with *Betula pubescens* ssp *czerepanovii*	313 mixed	1,595,000
	TOTAL		**27,417,983**

1.5.2 Biodiversity value and ecological definition

Most European forests can be qualified as "semi-natural" but there are few undisturbed forest areas remaining in the EU (EEA, 2006a). Even forests of nature conservation importance are either planted or have been managed over long periods of time. Forests with natural forest dynamics are characterized by natural tree composition and age structure, sufficient dead wood, and natural regeneration processes, in an area large enough to maintain these dynamics. Most "virgin" or "old growth" forest areas are limited to small patches in cultivated landscapes or to less accessible locations in larger (managed) forests.

The values of biodiversity indicators must be interpreted within the context of the natural conditions of the locality and forest type (Puumalainen et al, 2003). Forest Europe has begun to collect data on forest indicators by forest type, but it is not yet possible to use this for cross-country comparisons (Forest Europe et al, 2011).

1.5.3 Heavily modified ecosystem: plantation forests

A plantation is a forest stand that has been established by planting or/and seeding (including afforestation and reforestation), either 1) of introduced species, or 2) intensively managed stands of indigenous species of which there are only one or two species at plantation, of an even age class, and regularly spaced (EEA, 2006a). Exotic stands which were established as plantations but which have been without intensive management for a significant period of time are considered semi-natural, because it is expected that they have a more diverse age structure and species composition. Similarly, some intensively managed semi-natural forest stands are quite different from an undisturbed growth stand, with a low number of decaying trees and low deadwood levels. The interpretation of plantation therefore differs in different European countries (Forest Europe et al, 2011).

For the purpose of this study, we use the proportion of plantation declared by Member States to Forest Europe in 2011 (Forest Europe et al, 2011), and assume **7% plantation or heavily modified forest**.

1.6 MIRES

CLC 412 Peat bogs and fens

CLC definition: The CLC vegetation class 412 includes all bogs and fens (collectively known as mires) characterized by plant communities associated with a thick peat layer (more than 30cm of peat) and less than 30% tree cover (Büttner et al, 2006). It excludes many (sub)arctic and (sub)alpine areas with a shallow peat layer. As it is impossible to verify depth of peat from satellite imaging, the CLC peatland distribution is in effect determined by the presence of the characteristic vegetation types.

The CLC class 412 includes:

- ombrotrophic raised peat bogs fed only by direct precipitation dominated by *Sphagnum* mosses, with other acidophilous plants such as sedges (*Scirpus* spp., *Carex* spp.), *Drosera* spp., *Eriophorum vaginatum*, dwarf shrubs *Vaccinium oxycoccus*, *Andromeda* spp., and lichens
- boreal peat bogs with reticulated structure (aapa mires) with *Sphagnum* spp., sedges, *Erophorium* spp., *Utricularia* spp., *Drosera* spp., dwarf shrubs *Empetrum* spp., *Vaccinium* spp., and dwarf trees *Betula nana*, *Salix nana*

- fossil arctic peat bogs (palsa mires) with lichens, sedges, dwarf shrubs *Vaccinium* spp., *Betula nana*, *Salix lapponum* and *Salix glauca*
- blanket bogs with *Sphagnum* mosses, *Molinia* grasses, *Scirpus* spp., *Schoenus* spp., *Eriophorum* spp., *Narthecium* spp.
- alkaline fens fed by ground water or streams with mosses (*Drepanocladus* spp.) and *Carex* spp. or *Schoenus* with scattered occurrence of shrubs and trees of *Salix* spp., *Betula* spp. and *Alnus* spp.
- active peat extracting areas.

The class excludes:
- large pools or lakes (over 25 ha) near the centre of raised bogs (bog eye) (CLC 512),
- transitional bogs or fens on peaty soils less than 30cm thick (CLC 411),
- wooded or afforested peat bogs and fens (CLC 31x),
- drained peat bogs (CLC 411),
- abandoned peat milling areas with thin peat layer (CLC 32x),
- upland areas dominated by *Nardus, Molinia* or other deciduous grasses where peat does not accumulate (CLC 321).

Errors in CLC 2006: It is a common mistake in CLC 2006 that afforested areas in peatland are mapped as peat bog rather than forest (Büttner et al, 2012).

1.6.1 Ecological definition and biodiversity value

Mires (bogs and fens) differ ecologically from inland marshes because they are dependent on autonomous water supplies from precipitation or groundwater.

- **Bogs** are peat-accumulating wetlands that have no significant inflows or outflows. Water and nutrient inputs come entirely from precipitation, and bogs are characterised by acid water and low nutrient levels. Peat is created by acidophilic mosses, particularly *Sphagnum* species. Where it forms on wet floodplains or in basins it becomes a raised peat bog, where it forms across a hilly landscape it becomes blanket bog.
- **Fens** are peat-accumulating wetlands that receive some inflow from surrounding mineral soil through surface run-off and/or groundwater, as well as rainfall (BRIG, 2008; JNCC, 2011). The water has neutral pH and moderate to high nutrient levels. Fens where water movements in the peat or soil are generally vertical are known as basin fens and floodplain fen. Fens where water movements are predominantly lateral are associated with springs, rills and flushes, or are within or around peat bogs. Fens are usually dominated by sedge, reed, shrubs or trees, and fen areas may naturally progress into wet woodlands if not managed.

Bogs and fens form part of an ecological continuum with acidic grassland, heath and moor, and some types of inland marsh, and the separation of these habitats can be difficult, as the surface vegetation (i.e. land cover) maybe very similar and the division rests on the depth of peat. A peatland landscape can display a complex combination of these types; upland blanket bogs are often interspersed with nutrient poor fens (trackways and ladder fens), and raised bogs can grade into fringing 'lagg' fens. Some tree-covered peatlands are also recognised as mires, such as bog woodland, spruce mires, or ash, black alder and birch forests. For example, more than half of the total mire area in the Nordic countries is wooded (Normander et al, 2009). However, these areas are picked up by the CLC classes for woodland.

Drainage of peat lowers the water table, drying out the peat, which causes drastic changes to its physical and chemical properties. In lowland peat, a lowering of the water table causes the peat to subside and decompose, both due to physical breakdown and consolidation of dry peat in surface layers and accelerated mineralization of organic matter. Once peat dries it often becomes hydrophobic and cannot regain its initial moisture content (Holden et al, 2004). The dry peat particles are susceptible to erosion, which can destroy the peat soil very rapidly. In blanket peat, macropores and soil pipes are significant pathways for water movement, and can increase in drained peat when it is exposed to weathering through freeze-thaw activity and summer desiccation (Holden et al, 2004). These pipes and macropores are able to rapidly transmit water to deeper layers within the peat, which increases the fluctuation of the water table and the risk of soil erosion, and alters the hydrochemistry of the water run-off. Blockage of ditches may actually increase soil pipe water flow, hindering restoration. Drainage also leads to an increased influence of rainwater, changing the hydrochemistry.

1.6.2 Equivalence to Annex I habitat types

Related Annex 1 Habitat types include:

	Habitats Directive Annex I habitats primarily related to CLC 412 peat bogs & fens	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
7110	Active raised bogs	311 forest if wooded	734,837
7120	Degraded raised bogs still capable of natural regeneration	322 moors & heath or 321 grassland	289,208
7130	Blanket bogs (* if active bog)	322 moors & heath	2,606,266
7140	Transition mires and quaking bogs	411 inland wetlands	2,009,542
7150	Depressions on peat substrates of the Rhynchosporion	411 inland wetlands	27,257
7160	Fennoscandian mineral-rich springs and springfens	411 inland wetlands	9,090
7210	Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae	411 inland wetlands	35,954
7220	Petrifying springs with tufa formation (Cratoneurion)	411 inland wetlands	21,662
7230	Alkaline fens	411 inland wetlands , 311 forest if wooded	994,063
7240	Alpine pioneer formations of the Caricion bicoloris-atrofuscae	411 inland wetlands	13,154
7310	Aapa mires	311 or 312 forest if wooded	3,016,100
7320	Palsa mires	311 or 312 forest if wooded	66,800
	TOTAL MIRES		**9,823,933**

The following Annex I habitat types are associated with bogs and fens but are not strictly included in the CLC class definition:

	Habitats Directive Annex I habitats secondarily related to CLC peat bogs & fens (412)	Primary CLC class	Area (ha) in EU-25
3160	Natural dystrophic lakes and ponds	512 water bodies	2,122,297
91D0	Bog woodland	311 forest	2,038,862
	TOTAL MIRES OTHER		**4,161,159**
	TOTAL MIRES ALL TYPES		**13,985,092**

Annex I habitat 7120 (degraded raised bogs still capable of natural regeneration) may be included in this CLC class if the bog vegetation is still intact, but if the peat has been damaged through drainage, burning, or erosion, and the vegetation changed, then the habitat will be picked up in the CLC classes transitional scrub (324) or marsh vegetation (411) or natural grassland (321). Where peaty soils become thin because of drainage or erosion, they will develop either species-poor *Molinia*-dominated grassland or wet heath vegetation dominated by cross-leaved heath *Erica tetralix* (JNCC, 2011). Freely draining areas may become dry heath with *Calluna vulgaris*, or become invaded by bracken, scrub such as gorse, and eventually woodland. If the area is heavily grazed after drainage, it often becomes acid *Nardus stricta* grassland.

Peat bogs often also include dystrophic lakes or ponds (Annex I habitat type 3160). If these are large they will be included in CLC 511 water bodies, but if they are significantly smaller than 25 ha they will be included in the peat bog area.

1.6.3 Notable occurrences of ecosystem in Member States

Peat bog and fen habitat is heavily concentrated in a few countries. The CLC data shows 37% of the EU's bog and fen in Sweden, 29% in Finland, and 14% in Ireland and the UK. Other Member States have 2% or less. Some other sources of information on the extent of bog and mires in these Member States plus Romania and Bulgaria are listed:

- **Sweden (37% of CLC 412)**: Sweden reported over 2.9 million ha of Annex I bog and fen habitat in 2007, representing the most extensive areas of Aapa mires and quaking bogs in the EU. Sweden also reported 5.7 million ha of bog woodland (ETC/BD, 2008a). Excluding the woodland, this is comparable to the CLC area, but much less than reported to IMCG. However, it is likely that Sweden has substantially more area of habitat that is not declared under Annex I or recorded under CLC (possibly because it is partly degraded).
- **Finland (29% of CLC 412)**: The Finland Peatland Strategy 2011 refers to a total mire area of 17.8 million ha, plus 153,300 ha of active peat extraction and 497,500 ha of fields on degraded peatland (MMM, 2011). Finland declared just under 2.6 million ha of Annex I bog and fen habitat in 2007, including 2.15 million ha of Aapa mires (ETC/BD, 2008a). Finland also declared 8.1 million ha of Annex I bog woodland (ETC/BD, 2008a). In 2005 Finland recorded 8.96 million ha of mires, mostly wooded mires plus an estimated area of around 41,500 ha of palsa mires (Normander et al, 2009). The CLC data is therefore likely to be underestimating the area of still more or less intact bog and fen in Finland.

- **Ireland (14% of CLC 412)**: Ireland reported only 450,313 ha of Annex I peat habitat, including 48,070 ha of degraded blanket bog still capable of natural restoration (Annex I habitat type 7120), plus 150 ha of bog woodland, but the CLC land cover records over 1 million ha. This may be an indication of the extent of degraded peat bog in Ireland, as noted in Ireland's Article 17 report (National Parks and Wildlife Service, 2008).
- **UK (14% of CLC 412)**: The UK recorded around 2.7 million ha of bog, fen and peaty marsh in 2006, mostly blanket bog, but the CLC land cover registers less than this (UK NEA, 2011c). The UK has some 6,000 ha of BAP priority habitat lowland raised bog, and 1.5 million ha of blanket bog soil, although there is no data on how much of this is still covered in blanket bog vegetation (BRIG, 2008). The UK contains a much larger cover of peat soils than bog and fen habitat because roughly 13% of the peat soil is covered by heathland, 18% with acid grassland, and around 11% with conifer plantation (JNCC, 2011). Much of this area cannot be considered to be restorable any longer.
- **Latvia (2% of CLC 412)**: Latvia has reported 316,712 ha of peatland, which includes some forest types, drained peatlands and peat extraction sites, with some very large bogs and fen complexes more than 1,000 ha in size (Minayeva et al, 2009). Latvia declared 245,833 ha of Annex I bog and fen habitat, plus 200,000 ha of bog woodland (ETC/BD, 2008a). The CLC area is therefore an underestimate for Latvia.
- **Estonia (2% of CLC 412)**: Around a fifth of Estonia is peat soil (Kimmel et al, 2010). Estonia has reported 325,000 ha of mire (Minayeva et al, 2009), and 268,800 ha of Annex I mire habitats, most of which as active raised bog, as well as 49,000 ha bog woodland (ETC/BD, 2008a). Estonia still has large mire areas; more than 16,500 Estonian peatlands cover areas greater than 1 ha, 1,626 extend to more than 10 ha, and 143 to more than 1,000 ha (Minayeva et al, 2009). The CLC area is therefore an underestimate for Estonia. Estonia also has 0.5 million ha of drained peatland under forestry and 0.7 million ha under agricultural use.
- **Germany (1.2% of CLC 412)**: Germany reported nearly 79,000 ha Annex I habitat (plus 42,000 ha bog woodland), but 60% of this was classed as degraded raised bog still capable of natural regeneration. Germany still has around 30,000 ha of raised bog according to WWF[5], but more than 95% of Germany's peatland has been drained and converted to other land uses[6].
- **Lithuania**: Lithuania has reported 145,400 ha of peatlands and 185,000 ha of drained peatland (Minayeva et al, 2009), and 44,300 ha of Annex I bog and fen habitats, plus 50,800 ha bog woodland. The CLC data is therefore an underestimate for Lithuania.
- **Denmark:** Denmark declared 16,560 ha of Annex I bog and fen habitat, plus 3,900 ha of bog woodland (ETC/BD, 2008a), which is less than the CLC area. All habitat types are considered to be in an unfavourable state.
- **Poland:** A 2003 report records 6,664 ha of transition mires and 186,591 ha of fens (Bragg et al, 2003). Poland reported 19,770 ha Annex I bog and fen habitat types (mostly quaking bog), plus 80,300 ha bog woodland (ETC/BD, 2008a). These areas are significantly more than the CLC data. Poland also has very large areas of drained

[5] http://www.wwf.de/themen-projekte/fluesse-seen/lebensraeume/moore/
[6] http:/F/www.nabu.de/themen/moorschutz/11778.html

peatlands most of which are now used as grassland or forest (EEA, 2010g), but most of this area cannot be considered to be restorable any longer.

- **France**: France registered around 855,000 ha of Annex I bog and fen habitat, nearly all alkaline fen (plus 186,900 ha of bog woodland) (ETC/BD, 2008a), but only a fraction of this is picked up by the CLC data. It is likely that a lot of the fen area is being picked up as inland marsh (see section **Error! Reference source not found.**) or natural grassland.

Member States that did not submit data to Article 17 report:

- **Romania**: Romania is reported to have some 7,100 ha of peatland, including 6,286 ha in the Carpathian mountains (Minayeva et al, 2009). However, as most of these sites are currently under agricultural use, mainly as pasture, plus some arable crops such as hemp and sunflower, they are not picked up under the CLC class for peatbogs.
- **Bulgaria**: Bulgaria has 2,300 ha of waterlogged and water covered peatland ("blato") along the Danube river (Minayeva et al, 2009). No data are available on upland peatlands. One of the most important Balkan wetland complexes lies below the Pirin Mountains near the towns of Razlog and Bansko in Bulgaria. Spring fens cover ca 1.5 km^2 in the 5km^2 site (Šefferová et al, 2008).

1.7 FRESHWATER ECOSYSTEMS - INLAND MARSHES

1.7.1 CLC 411 Inland marshes

CLC definition: The CLC type 'inland marshes' is defined as low-lying, non-forested land which is usually flooded in winter and more or less saturated by water all year round. The habitat is covered by characteristic communities of low ligneous, semi-ligneous or herbaceous vegetation and includes; water-fringe vegetation of reed beds, sedge communities, tall rush swamps, high floating vegetation, marsh vegetation in the margin zones of raised bogs, and inland alkali marshes. It also includes established artificial wetlands. Inland wetlands are characterized by a variety of vegetation types and land cover types, which are often found in a mosaic. If the marsh vegetation area is relatively small, it will not be picked up by the CLC, and the area may be classified as water bodies, natural grassland, or transitional woodland-scrub.

The CLC system differentiates between permanently waterlogged land without peat, and waterlogged land with a substantial peat layer more than 30cm thick, which is classified as 'peat bog' (CLC class 412), so includes all active fens, mires and peat bogs (Middleton et al, 2006). The 'inland marshes' class includes ground or surface water-fed fen or bog vegetation without peaty ground, which are either pioneer areas in transition to new fens or bogs (which are rare), or they are meadows formed after modest drainage of a fen, known as "fen meadows" in Europe (Middleton et al, 2006), or degraded raised bog. The 'inland marshes' class **does not include** humid meadows which are water logged at between 10 and 30 cm depth. These and also any other areas characterized by field structure with grass cover are considered to be pasture (CLC 231).

The inland marshes land cover also **does not** include:

- free water space in wetlands (CLC 512 Water bodies),
- humid forests with a crown cover more than 30% (CLC 31x forests),
- salt marshes (CLC 421 salt marshes),
- salt meadows in intertidal zone (CLC 421 salt marshes),
- irrigated rice fields (CLC 213),
- polders with reticulated channels bordered by hydrophilic vegetation (CLC 2xx agricultural land),
- low floating aquatic vegetation (CLC 512 water bodies).

Freshwater wetlands include a complex of open water, marshes, reed beds, fens, bogs, alluvial grasslands, wet heath, and alluvial forest. As well as the CLC classes 'water courses', 'water bodies', and 'inland marshes', these freshwater wetland complexes may include 'peat bogs' (incl. fens), and some parts of the classes 'natural grasslands', 'moors and heathlands', 'deciduous forest', or 'transitional woodland scrub'. Notable occurrences of the ecosystem in Member States can be found below in the rivers and lakes section.

1.7.2 Equivalence to Annex I habitat types

Related European habitat types from Habitats Directive Annex I include:

	Habitats Directive Annex I habitats related to CLC 411 inland marshes	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
1340	Inland salt meadows	321/231 grassland	2,849
1530	Pannonic salt steppes and salt marshes	321/231 grassland	201,525
6430	Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels	321/231 grassland, 511 water courses (NB linear habitats are generally underestimated by CORINE)	233,379
	TOTAL INLAND MARSHES		**437,753**

The following Annex I habitat types are associated with inland marsh areas but are not strictly included in the CLC class definition. In France, for example, a number of these habitats have been assigned to inland marshes rather than bogs and fens {5156}.

	Habitats Directive Annex I habitats related to CLC inland marshes (411)	**Primary CLC class**	**Habitat area (ha) in EU-25**
2190	Humid dune slacks	331 dunes	19,975
6410	*Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	321/231 grassland	153,429
6420	Mediterranean tall humid herb grasslands of the Molinio-Holoschoenion	321/231 grassland	247,108
6440	Alluvial meadows of river valleys of the Cnidion dubii	321/231 grassland	63,877
6450	Northern boreal alluvial meadows	321/231 grassland	45,400
6460	Peat grasslands of Trodos	321/231 grassland	2
2170	Dunes with *Salix repens* ssp. *argentea* (Salicion arenariae)	331 dunes or 311 forest	6,673
7140	Transition mires and quaking bogs	412 mires	2,009,542
7150	Depressions on peat substrates of the Rhynchosporion	412 mires	27,257
7210	Calcareous fens with *Cladium mariscus* and species of the Caricon davallianae	412 fens	35,954
7220	Petrifying springs with tufa formation (Cratoneurion)	412 fens or 333 sparsely vegetated	21,662
7230	Alkaline fens	411 inland	994,063

		wetlands , 311 forest if wooded	
7240	Alpine pioneer formations of the Caricion bicoloris-atrofuscae	412 fens or 333 sparsely vegetated	13,154
91E0	Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae)	311 forest	884,181
91F0	Riparian mixed forests of *Quercus robur*, *Ulmus laevis* and *Ulmus minor*, *Fraxinus excelsior* or *Fraxinus angustifolia*, along the great rivers (Ulmenion minoris)	311 forest	156,774
92A0	*Salix alba* and *Populus alba* galleries	311 forest	124,575
92B0	Riparian formations on intermittent Mediterranean water courses with *Rhododendron ponticum*, *Salix* and others	311 forest	481
92D0	Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)	311 forest	48,547
	TOTAL AREAS ASSOCIATED WITH INLAND MARSH (OTHER THAN MIRES)		**4,852,654**

The two habitat types 7220 and 7240 occur in small point or linear formations which are unlikely to be registered by the CLC process (European Commission, 2007).

The Annex I habitat types for freshwater lakes and rivers (Annex I habitat types 3110 through to 3290) are also likely to be closely associated with inland marsh land cover areas, because they include the riparian vegetation areas, which are included in CLC 411 and not CLC 3xx. The EU 2010 Biodiversity Baseline report considered all of these habitats together in order to assess the baseline status of wetland ecosystems.

1.8 FRESHWATER ECOSYSTEMS – rivers, lakes

1.8.1 CLC 511 Water courses

CLC definition: Water courses include all natural or artificial water courses and canals serving as water drainage channels that are wider than 100 m. Water courses include sand or gravel accumulations along streams that are under 25 ha in area. The land cover excludes large infrastructures associated with water courses, such as hydroelectric dams or artificial surfaces.

1.8.2 Heavily modified ecosystem (water courses)

The Water Framework Directive allows Member States to define heavily modified water bodies[7], which can be exempted from the obligation to achieve Good Ecological Status by 2015. It can be assumed that it will also not be feasible to restore these water bodies to the ecological condition envisaged by Target 2 of the EU Biodiversity Strategy 2020 (see Chapter

[7] Heavily modified water bodies are those in which the changes to the hydromorphological characteristics of that body which would be necessary for achieving Good Ecological Status would have significant adverse effects on the wider environment and/or the essential services provided by the modified water body to sustainable human development (WHERE those essential services provided by modified characteristics of the water body cannot, for reasons of technical feasibility or disproportionate costs, reasonably be achieved by other more environmentally beneficial means). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy, Article 4(3)(a) and (b).

2). So far, Member States have reported 12% of river length (16.6% of river bodies), or 120,263 km out of a total 974,381 km, as heavily modified (Kampa & Laaser, 2009). The total river length of 974,381 km declared under the WFD cannot be directly compared to the 10,042 km^2 of river under CLC 2006, as the WFD river length includes river stretches of unknown but greatly varying widths, whereas the CLC 2006 river area is roughly equivalent to maximum 100,423 km of river (assuming a constant 100m width). However, for the purposes of the calculation of restoration costs in this report, we assume that **12%** of the CLC river area is heavily modified, and therefore degraded due to substantial structural modifications such as artificial river channels, dams etc.

1.8.3 Equivalence to Annex I habitat types

The Annex I freshwater river habitat area and the CLC water courses land cover cannot be considered to be fully equivalent because the CLC measures only the water surface area, but measures only rivers wider than 100m, whereas the Annex I habitat designation includes areas of associated riparian vegetation and rivers of all widths.

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitats primarily related to CLC water courses (511)	**Other CLC classes in which the habitat might be included**	**Area (ha) in EU-25**
3210	Fennoscandian natural rivers	321 natural grasslands, 331 gravel and sand plains, 411 inland wetlands	164,700
3220	Alpine rivers and the herbaceous vegetation along their banks	321 natural grasslands, 331 gravel and sand plains, 411 inland wetlands	1,059,565
3230	Alpine rivers and their ligneous vegetation with *Myricaria germanica*	311 broad-leaved forest, 331 gravel and sand plains, 411 inland wetlands	6,035
3240	Alpine rivers and their ligneous vegetation with *Salix elaeagnos*	311 broad-leaved forest, 331 gravel and sand plains, 411 inland wetlands	35,521
3250	Constantly flowing Mediterranean rivers with *Glaucium flavum*	311 broad-leaved forest, 331 gravel and sand plains, 411 inland wetlands	30,409
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation	various	211,007
3270	Rivers with muddy banks with *Chenopodion rubri* spp and *Bidention* spp vegetation	various	32,790
3280	Constantly flowing Mediterranean rivers with Paspalo-Agrostidion species and hanging curtains of *Salix* and *Populus alba*	311 broad-leaved forest, 331 gravel and sand plains, 411 inland wetlands	28,130
3290	Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion	311 broad-leaved forest, 331 gravel and sand plains, 411 inland wetlands	7,615
	TOTAL WATER COURSES		**1,575,772**

Notable occurrences of ecosystem in Member States: see below under CLC 512 Water bodies.

1.8.4 CLC 512 Water bodies

CLC definition: Water bodies include any natural or artificial stretches of water that are not considered to be water courses. It includes Europe's large freshwater lakes, archipelagos of lakes inside land areas, and water surfaces used for stocking fresh-water fish, but also includes inland salt lakes where evaporations results in progressive accumulation of mineral salt. The numerous smaller lakes and ponds are also covered under this CLC type, although water bodies under 20 ha in size may not be picked up in the CLC data. The land cover includes water bodies with low floating aquatic vegetation with species such as *Nuphar* spp., *Nymphaea* spp., *Potamageton* spp. and *Lemna* spp., but the land cover class excludes reed beds and other areas of surface plant species characteristic of standing water (e.g. *Typha latifolia*, *Carex riparia*, *Glyceria maxima*, *Sparganium erectum* and *Phragmites communis*. These are counted as class 411 inland marshes. It also excludes all other riparian vegetation or habitats, unlike the European Habitats Directive freshwater habitat types. Habitats associated with water bodies and crucial for their biodiversity value include forests, inland marshes, natural grasslands and pastures, moor and heathland, and other natural vegetation. The open water parts of peat bogs and fens are also included as peat bogs CLC 412, not water bodies. Temporary, seasonal lakes and other water bodies, including turloughs and Mediterranean temporary ponds, are counted as natural grassland (CLC 321) or inland marsh (CLC 411) depending on the vegetation that grows when the water dries out.

1.8.5 Heavily modified ecosystem (water bodies)

The Water Framework Directive allows Member States to define heavily modified water bodies[8], which can be exempted from the obligation to achieve Good Ecological Status by 2015. It can be assumed that it will also not be feasible to restore these water bodies to the ecological condition envisaged by Target 2 of the EU Biodiversity Strategy 2020 (see Chapter 2). So far, Member States have reported 37.5% of lake area (17.1% of lake bodies), or 15,906 km^2 out of a total 42,373 km^2 as heavily modified (Kampa & Laaser, 2009). The total lake area declared under the WFD cannot be directly compared to the lake area under CLC 2006. However, for the purposes of the calculation of restoration costs in this report, we assume that at least **35%** of the CLC lake area is heavily modified, and therefore degraded due to substantial structural modifications such as artificial reservoirs, dams etc.

[8] Heavily modified water bodies are those in which the changes to the hydromorphological characteristics of that body which would be necessary for achieving Good Ecological Status would have significant adverse effects on the wider environment and/or the essential services provided by the modified water body to sustainable human development (WHERE those essential services provided by modified characteristics of the water body cannot, for reasons of technical feasibility or disproportionate costs, reasonably be achieved by other more environmentally beneficial means). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy, Article 4(3)(a) and (b).

1.8.6 *Equivalence to Annex I habitat types*

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types primarily related to CLC 512 water bodies	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
3110	Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae)	411 inland marshes	1,443,117
3120	Oligotrophic waters containing very few minerals generally on sandy soils of the West Mediterranean, with *Isoetes* spp	411 inland marshes	1,360
3130	Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoeto-Nanojuncetea	411 inland marshes	959,953
3140	Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp	411 inland marshes	307,468
3150	Natural eutrophic lakes with Magnopotamion or Hydrocharition -type vegetation	411 inland marshes	1,089,493
3160	Natural dystrophic lakes and ponds	411 inland marshes, 412 peat bogs	2,122,297
3170	Mediterranean temporary ponds	411 inland marshes, 321 natural grassland	61,558
3180	Turloughs	411 inland marshes, 321 natural grassland	11,986
3190	Lakes of gypsum karst	411 inland marshes, 332 bare rock	61
31A0	Transylvanian hot-spring lotus beds	411 inland marshes	n/a
	TOTAL WATER BODIES		**5,997,293**

1.8.7 *Notable occurrences of ecosystem in Member States*

Major freshwater areas in Europe include:

- **Sweden**: Around 10% of Sweden's land area is covered by lakes with associated wetlands (Normander et al, 2009); including the large lakes Vanern (565,500 ha), Vattern (189,300 ha), and Maleren (114,000 ha). Northern Sweden's boreal forest is drained by a series of river basins from the mountainous border with Norway into the Baltic.
- **Finland:** over 56,000 lakes larger than 1 ha in size; almost 10% of Finland's land area is covered by lakes with associated wetlands (Normander et al, 2009).
- **Poland**: river Vistula and Biebrza Marshes, and many other wetland and fen areas.
- **Germany**: Rhine, Elbe, Em, Weser and Oder rivers and their tributaries. Lake Constance/Bodensee. Eider-Treene Depression wetlands, Federsee, and many other lakes and wetlands, often together with peat habitats.
- **Romania:** Lower Danube basin, plus three major tributaries[9]. The Danube delta (around 4510 km^2) still forms the largest and most species rich area of wetland in Europe, although over 80% of the original wetland area has been lost to agricultural

[9] Olt, Siret and Prut

intensification through drainage or behind dykes. Around half the remaining delta area is permanently aquatic, the other half seasonally flooded.

- **France**: Mediterranean: Rhone river and delta wetlands. Atlantic: Garonne, Loire and wetlands, coastal wetlands Marais du Cotentin et du Bessin, Marais Poitevin. Inland wetlands: La Brenne, Etangs de la Champagne humide.
- **Netherlands:** Rhine and Meuse/Maas, Ijsselmeer and Markermeer, Oostvaardersplassen marsh.
- **Spain**: Atlantic: Guadalquivir river and delta (Coto Doñana), Guadiana, Tagus and Douro rivers (with Portugal). Mediterranean: Segura, Ebro river and delta. Spain has 637 important freshwater wetlands including floodplain marshes, inland saline lagoons, reservoirs, coastal freshwater lagoons.
- **Italy**: Largest river basin is the Po (682 km length). Largest lakes are Lago di Garda (370 km^2), Lago Maggiore (210 km^2), Lago di Como (146 km^2), Lago Trasimento (124 km^2), Lago di Bolsena (114 km^2). Freshwater wetlands include the Pontine Marshes. Many wetland areas are associated with coastal lagoons.
- **Estonia**: Lake Peipus, Narva river (with Russia). Most of Estonia's wetlands are associated with peatland (see mires above).
- **Hungary:** Middle Danube basin, Drava and Tisza rivers. Gemenc floodplains, Tisza Hortobagy marshes. Lake Balaton (605km^2) and Kis-Balaton reservoirs. Hungary shares the Neusiedler See (315km^2) with Austria; more than half of its area consists of reedbeds (cf. inland marshes above).

1.9 COASTAL ECOSYSTEMS

CLC definition: Coastal ecosystems include estuaries, coastal lagoons, intertidal areas, beaches, sand dunes, rocky shores and cliffs, and coastal wetlands. Coastal wetlands are defined by CLC as 'non-wooded areas tidally, seasonally or permanently waterlogged with brackish or saline water'.

The coastal wetlands category includes salinas for commercial salt production (CLC 422), but salinas are not considered as natural ecosystems in need of restoration (although they may support similar specialised birds and invertebrates as natural lagoons) and are therefore neglected in this study.

Coastal ecosystems also include rocky shores and cliffs, which fall into CLC class 332 bare rocks or CLC class 333 sparsely vegetated areas. This is discussed in a separate section below.

1.9.1 Notable occurrences of ecosystem in Member States

Atlantic: The Atlantic coasts of France, Spain, Portugal, the UK and Ireland have big estuary areas. Large Atlantic coastal lagoons occur in France, Spain and Portugal, but Ireland and the UK have only a few. All Atlantic coasts have significant areas of dunes and beaches, salt marshes, and intertidal mudflats, but also long stretches of rocky coastline. In the Outer Hebrides in Scotland and the west of Ireland the prevailing winds have formed the extensive cultivated sandy plain or 'machair'. On rising coastlines of northern Ireland and Scotland, large dune systems form a sequence of prograding ridges 'parallel' to the coast, interspersed with species rich dune slacks. The Atlantic French coast has one of the most extensive dune systems in Europe, 60% of the coastline of Portugal has sand dunes, and south western Atlantic Spain has dune systems with barrier islands and spits, built up with river sediments.

North Sea: Large estuaries are found on the North Sea coasts of Germany (Weser, Elbe, Eider), the Netherlands (Rhine), Belgium (Schelde) and the UK (Thames, Ouse, Humber, Forth, Tay). Large North Sea coastal lagoons are found in Germany and Denmark, but the Netherlands does not have any coastal lagoons according to the CLC data. The North Sea coastlines also have extensive areas of dunes and beaches, salt marshes, and intertidal mudflats. The Wadden Sea includes sand bars and spits which lie parallel to the coast.

Baltic: Most of the Baltic's non-rocky coastal habitats are found along the southern coastline, with large Baltic coastal lagoons on the Danish, German, Polish, and Lithuanian Baltic coasts, and a smaller area in Estonia. All these countries plus Latvia have long stretches of beach and dunes (for example Poland's coastline is 80% sand dunes, sand bars and spits), and some saltmarsh. The northern Baltic coastline is mainly rocky: according to the CLC data, Finland is not considered to have coastal lagoons or intertidal flats, and only a relatively small estuarine area, although it has over 20% of the EU's coastline. Finland does have 4% of the saltmarsh area in the form of brackish coastal meadows, particularly Liminganlahti bay. Sweden, with over 18% of the EU's coastline, also has a mainly rocky coast, with relatively small areas of dune and saltmarsh, but with large areas of estuary and coastal lagoons.

Mediterranean: Mediterranean estuary areas are found in Italy, France and Spain, and these countries have more than 36 large Mediterranean coastal lagoons (including Sardinia and Sicily). Italy also has 24% of the EU's beaches and dune systems and 14% of saltmarsh along 6% of the EU's coastline. The CLC data registers no estuary or coastal lagoon area for Greece, but this is likely to be an error as Greece has around 43,500 ha of coastal lagoons along 10% of the EU's coastline, including the Ambracian Gulf, Messolongui-Etoliko lagoons, Agiasma in the Nestos delta, and Vistonis and Porto-Lagos lagoon (Pérez-Ruzafa et al, 2011). Western Mediterranean dune systems are narrower with less obvious successional development than Atlantic dunes, and there have been huge losses to development[10]. Today remaining dune areas are present around the whole coastline, but only in a few protected areas, like the National Park of Circeo, is it possible to see natural development. In the Eastern Mediterranean, dune systems are associated with river deltas, and often enclose coastal lagoons.

Black Sea: The Black Sea coastline is primarily known for the Danube delta (some 450,000 ha in area), but also has long stretches of wide beaches and dune systems, with a few rocky headlands. Behind the shoreline, a series of coastal lakes, marshes and lagoons provide important habitat, including the Razim-Sinoe Lake System of large brackish lagoons separated from the sea by a sandbar. Both lake Razim and lake Sinoe are now primarily

[10] Almost the entire Mediterranean coast of Spain is made up of sandy beaches and dunes, interrupted by harbour developments.

freshwater oligotrophic lakes influenced by the Danube water as seawater influence has reduced.

Six Member States have no coastal ecosystem as defined in this report: Austria, Czech Republic, Hungary, Luxembourg, Malta (which has mainly rocky cliffs), and Slovakia.

1.9.2 CLC 331: Beaches, sand dunes, sand and gravel plains

CLC definition: This CLC class includes coastal sand dunes, sand or shingle above the high water mark. It includes coastal sparsely vegetated shifting dunes and white dunes, but also includes the 'grey' dunes that are more or less permanently stabilised by vegetation and machair (Moss & Davies, 2002). Older dunes or shingles covered in grassland, heaths, thickets or woods are classified as grassland (CLC 321), or heath or scrub (CLC 322, 323 or 324) or forest (CLC 311, 312 or 313).

This CLC class includes (Büttner et al, 2006):

- river dune formations in the immediate vicinity of great rivers,
- inland and lacustrine dunes
- shifting dunes with mobile, un-vegetated or open grasslands (white dunes),
- 'grey dunes' fixed, stabilized or colonized by more or less closed perennial grasslands,
- machair formations (nature coastal sand-plane with more or less surface and grass land vegetation),
- ergs (continental dune field located in desert),
- accumulation of gravels along lower section of alpine rivers.

This CLC class excludes (Büttner et al, 2006)

- vegetated sea cliffs and stone banks (CLC 333 sparsely vegetated areas or 332 bare rock)
- inland dune heaths (crowberry and heather brown dunes) (CLC 322 moors and heath),
- inland dune thickets occupied by dense formations of shrubs including sea-buckthorn, privet, elder, willow, gorse or broom often festooned with creepers (CLC 322 moors and heath),
- dune juniper thickets and woods (CLC 322 moors and heath or CLC 31x forest),
- dune sclerophyllous scrubs (CLC 323 sclerophyllous vegetation),
- wooded dune (CLC 31x forest),
- humid dune-slacks (CLC 411 wetland),
- un-vegetated gravels on steep alpine mountain side (CLC 332 bare rocks),
- vegetated islands inside stream beds (CLC 3xx).

Based on the proportions of Annex I habitats listed below, it can be assumed that of the total beach and dune area (324,693 ha), 31% is beach (with at least 11% shingle), 15% is embryonic and shifting dunes, 23% is vegetated dunes, 6% is dune slacks and other wet dune habitat, and 25% is dune grassland (plain) and machair[11].

The definition of the CLC land cover type includes inland dune formations. However, this study assumes that as most of these inland dune habitat areas are now completely vegetated, they are unlikely to be registered as dune in the CLC 2006 data. The CLC 2006 data does not register any inland dune area for Hungary, or other countries where this habitat is present. This study therefore assumes that the inland dune area is either registered as grassland or heath, or is in small patches that are subsumed into other land cover. In this study, inland dune restoration is therefore not costed together with coastal dunes but instead is considered to be part of either the heathland ecosystem or the semi-natural grassland ecosystem.

The CLC land cover type definition also includes inland expanses of sand, pebbles or gravel along river courses and flood plains, and beds of stream channels with a torrential regime, if they are >25 ha in size. This study assumes that these areas are insignificant compared to the coastal habitat area (as very few of these areas are >25 ha in size, and smaller areas will be included in the river or lake land cover area), and therefore does not attempt to separate them from the total.

[11] As part of the overall coastal ecosystem: 4% beach with at least 1% shingle, 2% embryonic and shifting dunes, 3% vegetated dunes, 1% dune slacks and other wet dune habitat, and 3% dune grassland and machair

1.9.3 Equivalence to Annex I habitat types

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types primarily related to CLC 331 beaches & dunes	**Other CLC classes in which the habitat may be included**	**habitat area (ha) in EU-25**
1210	Annual vegetation of drift lines	423 Intertidal flats	29,173
1220	Perennial vegetation of stony banks	333 sparsely vegetated	44,247
1610	Baltic esker islands with sandy, rocky and shingle beach vegetation and sublittoral vegetation	322 heath scrub (if *Calluna, Juniperus* are present)	23,940
1620	Boreal Baltic islets and small islands	523 seas and ocean	7,760
1640	Boreal Baltic sandy beaches with perennial vegetation	various	24,325
2110	Embryonic shifting dunes	n/a	23,782
2120	Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')	n/a	36,860
2130	Fixed coastal dunes with herbaceous vegetation (grey dunes)	321 natural grassland	85,486
2170	Dunes with *Salix repens* ssp. *argentea* (Salicion arenariae)	311 broad-leaved woodland	6,673
2190	Humid dune slacks	411 inland marshes	19,975
21A0	Machairs	231 pastures, 243 agriculture and natural vegetation	16,053
2210	Crucianellion maritimae fixed beach dunes	n/a	8,148
2220	Dunes with *Euphorbia terracina*	n/a	1,040
2230	Malcolmietalia dune grasslands	n/a	8,302
2240	Brachypodietalia dune grasslands with annuals	321 natural grassland	9,000
	TOTAL COASTAL BEACHES AND DUNES		**344,764**

The CLC interpretation process exclude some of the coastal and dune Annex I habitat types, although if they occur in relatively small patches (less than 15 ha) they will nevertheless be mostly included in CLC 331 (Büttner et al, 2012).

	Habitats Directive Annex I habitat types that may not included in CLC 331 beaches & dunes	**Primary CLC type**	**Area in EU-25 in 2007 (ha)**
2140	Decalcified fixed dunes with *Empetrum nigrum*	322 moor and heath	22,792
2150	Atlantic decalcified fixed dunes (Calluno-Ulicetea)	322 moor and heath	5,612
2160	Dunes with *Hippophae rhamnoides*	322 moor and heath	11,557
2180	Wooded dunes of the Atlantic, Continental and Boreal region	311 broad-leaved woodland	121,402
2250	Coastal dunes with *Juniperus* spp.	323 sclerophyllous vegetation	18,260
2260	Cisto-Lavenduletalia dune sclerophyllous scrubs	323 sclerophyllous vegetation	43,141
2270	Wooded dunes with *Pinus pinea* and/or *Pinus pinaster*	312 coniferous forest	46,551
	TOTAL OTHER BEACHES & DUNES		**269,315**

In this study, inland dune habitats are not considered under coastal ecosystems.

	Habitats Directive Annex I habitat types not included in beaches & dunes in this study	Primary CLC type	Area in EU-25 in 2007 (ha)
2310	Dry sandy heaths with *Calluna* and *Genista*	322 moors and heath	17,352
2320	Dry sandy heaths with *Calluna* and *Empetrum nigrum*	322 moors and heath	4,734
2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands	321 natural grassland	31,946
2340	Pannonic inland dunes	321 natural grassland	1,193
	TOTAL INLAND DUNES		**55,225**

1.9.4 CLC 421: Salt marshes

CLC definition: Salt marshes are vegetated low-lying areas on the coast susceptible to flooding by sea water. They are often in the process of filling in, gradually being colonised by halophilic plants. They can consist of vegetated flats, creeks, pools and saline reed beds (Büttner et al, 2006).

This heading includes:

- intertidal sand, silt or mud-based habitats colonized by halophytic grasses such as: *Puccinelia* spp., *Spartina* spp, rushes such as *Juncus* spp. and *Blismus rufus* and herbs such as *Limonium* spp., *Aster tripolium*, *Salicornia* spp., including all flowering plant communities which are submerged by high tides at some stage of their annual cycle,
- salt meadow shep areas,
- Long-abandoned salines.

This heading excludes:

- inland salt marshes with halophile and gypsophile communities (CLC 411 inland marshes or 333 sparsely vegetated areas),
- humid meadows of low vegetation dominated by *Joncus gerardis, Carex divisa, Hordeum marinum* or *Trifolium* spp. and *Lotus* spp. of the edge of brackish lagoons (CLC 411 inland marshes).

1.9.5 Equivalence to Annex I habitat types

	Habitats Directive Annex I habitat types primarily related to CLC 421 salt marshes	Other CLC classes in which the habitat may be included	Area (ha) in EU-25
1310	*Salicornia* and other annuals colonizing mud and sand	423 mudflats	43,380
1320	*Spartina* swards (*Spartinion maritimae*)	423 mudflats	21,538
1330	Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	n/a	100,538
1410	Mediterranean salt meadows (*Juncetalia maritimi*)	321 natural grassland	76,900
1420	Mediterranean and thermo-Atlantic halophilous scrubs (*Sarcocornetea fruticosi*)	323 sclerophyllous scrub	88,309
1630	Boreal Baltic coastal meadows	321 natural grassland	22,870
	TOTAL		**353,535**

Some habitat types are associated with saline environments and could thus be considered similar to salt marshes {5156}, but they do not fall under the CLC 421 definition.

	Habitats Directive Annex I habitat types associated with saline habitats	CLC class in which the habitat is primarily included	Area (ha) in EU-25
1340	Inland salt meadows	411 inland marshes	2,849
1430	Halo-nitrophilous scrubs (Pegano-Salsoletea) *(mostly occur on Canary Islands)*	323 sclerophyllous scrub	46,801
1510	Mediterranean salt steppes (Limonietalia)	333 sparsely vegetated, 321 natural grassland	52,645

1.9.6 CLC 423: Intertidal flats

CLC definition: Intertidal flats are generally un-vegetated expanses of mud, sand or rock lying between high and low tide water-marks (up to 0m marine contour line). They include all intertidal seaweed-covered boulders, cliffs and out cropping base-rocks. Intertidal flats that are inside large estuaries are included in the CLC class estuaries (CLC 522). This land cover is not present in the Baltic Sea because it has a tidal range of only a few centimetres, except for the Skagerakk and Kattegat, which have tidal amplitudes of 5-10cm, maximally 20-40cm when spring tides and storms combine. Similarly, the Black Sea tidal range is 2cm to maximum 9cm and there is no intertidal habitat. The Mediterranean Sea has a tidal range of less than 1m and the intertidal habitat is very small, and therefore does not register under CLC.

These intertidal areas are excluded (Büttner et al, 2006):

- Intertidal areas colonised by halophytic vegetation (see CLC 421 salt marshes),
- broadening of rivers entering the sea (CLC 522 estuaries),
- part of lagoon area directly connected to the sea which is artificially separated (CLC 521 coastal lagoons).

1.9.7 Equivalence to Annex I habitat types

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types primarily related to CLC 423 intertidal flats	Other CLC classes in which the habitat may be included	Area (ha) in EU-25
1140	Mudflats and sandflats not covered by seawater at low tide	n/a	973,552

Other Annex I habitat types that may be partly included in this CLC class rather than their main class are:

	Habitats Directive Annex I habitat types related to CLC 423 intertidal flats	Primary CLC class	Area (ha) in EU-25
1160	Large shallow inlets and bays	521 coastal lagoons	2,812,590
1170	Reefs	523 seas and ocean	29,838,676
	TOTAL		**32,651,266**

1.9.8 CLC 521: Coastal lagoons

CLC definition: The CLC area 'Coastal lagoons' is defined as 'stretches of salt or brackish water in coastal areas which are separated from the sea by a tongue of land or other similar topography'. These water bodies can be connected to the sea at limited points, either permanently or for parts of the year only (Büttner et al, 2006).

Heavily modified ecosystem areas: see discussion under CLC 522 estuaries below.

1.9.9 Equivalence to Annex I habitat types

The Habitats Directive Annex I habitat type 1150 Coastal lagoons identifies the most ecologically valuable habitats of this type. Some Annex I habitat type 1160 may also be registered as coastal lagoons, depending on the width of the connection with the sea.

	Habitats Directive Annex I habitat types related to CLC 521 coastal lagoons	Other CLC class	Area (ha) in EU-25
1150	Coastal lagoons	n/a	403,217
1160	Large shallow inlets and bays	523 seas & ocean	2,812,590

1.9.10 CLC 522: Estuaries

CLC definition: Estuaries are river mouths within which the tide ebbs and flows, and which are dominated by salty or brackish water. The CLC estuary area includes all the intertidal and salt-water dominated fringing habitats within the estuary area, except for large (> 25 ha) salt marsh areas (Büttner et al, 2006).

This heading includes:

- the water and the channel bed with the fringing vegetation zone > 25 ha.

This heading excludes:

- bays and narrow channels (CLC 523 sea & ocean),
- fjords or fiards, ryas and straits (CLC 523 sea & ocean),
- fringing vegetation along the estuary channel bed > 25 ha (CLC 421 salt marsh).

1.9.11 Heavily modified ecosystem areas (estuaries)

The Water Framework Directive allows Member States to define heavily modified water bodies[12], which can be exempted from the obligation to achieve Good Ecological Status by 2015. It can be assumed that it will also not be feasible to restore these water bodies to the ecological condition envisaged by Target 2 of the EU Biodiversity Strategy 2020 (see Chapter 2). So far, Member States have reported as heavily modified (Kampa & Laaser, 2009):

[12] Heavily modified water bodies are those in which the changes to the hydromorphological characteristics of that body which would be necessary for achieving Good Ecological Status would have significant adverse effects on the wider environment and/or the essential services provided by the modified water body to sustainable human development (WHERE those essential services provided by modified characteristics of the water body cannot, for reasons of technical feasibility or disproportionate costs, reasonably be achieved by other more environmentally beneficial means). Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy, Article 4(3)(a) and (b).

- 53.4% of transitional river (ie estuary) length (26.3% of transitional water bodies), or 4,746 km out of 8,895 km
- 4.7% of coastal water area (9.8% of coastal water bodies), or 11,574 km^2 out of a total 247,618 km^2

The total estuary length of 8,895 km declared under the WFD cannot be directly compared to the 10,042 km^2 of estuary under CLC 2006. However, for the purposes of the calculation of restoration costs in this report, we can assume that **at least 50% of the CLC estuary area is heavily modified**, and therefore degraded due to substantial structural modifications such as industrial and urban infrastructure, channel excavation or dumping of sediments etc.

1.9.12 Equivalence to Annex I habitat types

The Habitats Directive Annex I habitat type 1130 Estuaries identifies the most ecologically valuable habitats of this type.

	Habitats Directive Annex I habitat types related to CLC 522 estuaries	**CLC class**	**Area (ha) in EU-25**
1130	Estuaries	522 estuaries	762,601

1.10 MARINE ECOSYSTEM

CLC 523: Sea and ocean

CLC definition: Zones seaward of the lowest tide limit.

This heading excludes:

- archipelago of lands located inside sea/ocean areas,
- sea water areas as part of port areas which include sea water to reach zone > 25 ha.

1.10.1 Equivalence to Annex I habitat types

Related European habitat types (Habitats Directive Annex I) are:

	Habitats Directive Annex I habitat types primarily related to CLC 523 marine	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
1110	Sandbanks which are slightly covered by sea water all the time	n/a	3,460,345
1120	*Posidonia* beds (*Posidonion oceanicae*)	n/a	586,422
1160	Large shallow inlets and bays	521 coastal lagoons	2,812,590
1170	Reefs	423 intertidal flats	29,838,676
1180	Submarine structures made by leaking gases	n/a	7,000
1650	Boreal Baltic narrow inlets	n/a	50,400
8330	Submerged or partially submerged sea caves	n/a	53,0529
	TOTAL MARINE		**37,285,962**

	Habitats Directive Annex I habitat types that may fall under CLC 523 marine	**CLC class under which it primarily falls**	
1620	Boreal Baltic islets and small islands	331 beaches & dunes	7,760

This report has NOT considered some of the CLC classes, including urban and artificial surfaces, and rocky, desert and mountain habitats. The reason why these are not considered is discussed in Chapter 2. The definitions of these classes are:

1.11 URBAN AND ARTIFICIAL SURFACES

1.11.1 CLC 111-142 Urban areas and other built-up and artificial surfaces

CLC definition: Urban and other built-up and artificial surface areas include urban and suburban areas and larger villages, industrial areas, transport networks, quarries and waste sites, and urban green areas. The CLC classes include:

CORINE land cover type	CLC code	Types of area and habitat	CLC area in EU-27 (ha)
Continuous urban fabric	111	buildings, derelict spaces, pavements and gardens	587,049
Discontinuous urban fabric	112	buildings, paths and gardens	12,937,227
Industrial or commercial units	121	urban, suburban and rural industrial and commercial sites, highly artificial man-made waters and associated structures, and sewage works	2,633,854
Road and rail networks and associated land	122	hard surfaced areas, weed communities	
Port areas	123	Hard surfaced areas, weed communities	
Airports	124	Hard surfaced areas, grassland/ weed communities	
Mineral extraction sites, dump sites, construction sites	131, 132, 133	Active or recently abandoned quarries, opencast mines, waste and landfill sites, slag heaps, construction waste heaps, construction sites	810,230
Green urban areas, sport and leisure facilities	141, 142	grass lawns, parks, garden areas, sports fields, golf courses	1,195,958
TOTAL			**18,164,318**

1.11.2 Extent and distribution

In total, this ecosystem covers 4% of the EU-27 land surface area. Over 74% of this area is discontinuous urban fabric, which consists of buildings, roads and artificially surfaced areas on 30 to 80% of the area, with 20% or more vegetated areas and bare soils[13]. This includes low density urban and suburban areas, and areas of countryside where villages, ribbon settlements and transport lines form a dense network. It also includes 7% (nearly 1.2 million ha) of large green areas, including urban parks and gardens, and green sports and leisure facilities such as golf courses.

1.12 ROCK, DESERT AND MOUNTAIN HABITATS

CLC 332 bare rocks

CLC definition: Scree, cliffs, rock outcrops (including active erosion), limestone, karst and lapiaz pavement, unvegetated abandoned quarries, volcanic ash, lava and lapilli fields, rocks and reef flats situated above the high-water mark, where 90% of the land surface is covered by rocks.

[13] Theoretically, some of these vegetated areas should be included in class 242 complex cultivation patterns; however, mixing of 112 and 242 classes in suburban areas is a frequent mistake in CORINE mapping.

This heading excludes (Büttner et al, 2006):

- white dunes (class 331 beaches & dunes),
- medio-littoral rocky sea beds (class 423 intertidal flats).
- bare rocks with scattered trees that cover more than 10% of the surface (class 324 transitional woodland-scrub)

CLC 333 sparsely vegetated areas

CLC definition: Scattered vegetation with bare soil, rocks, stones or sand. Scattered vegetation (15 to 50%) is composed of gramineous and/or ligneous and semi-ligneous species for determining the ground cover percentage, excluding cryptogams. Includes sparsely vegetated scree and rock, cliffs, limestone pavement, and sub-desertic steppes (Büttner et al, 2006).

This heading includes:

- sparsely vegetated and instable areas of stones, boulders, or rubble on steep slopes where vegetated layer covers between 15% and 50% of the surface,
- sub-desertic steppes with scattered scrubby species (*Artemisia* spp.) mixed with grass (*Stipa* spp.) when they cover between 15% and 50% of the surface,
- vegetation of "lapie" areas or limestone paving
- bare soils inside military training areas,
- karstic areas of gramineous, ligneous and semi-ligneous vegetation

This heading excludes:

- windblown parts of dune areas (class 331 beaches & dunes),
- areas where bare ground covers more than 85% of the surface (class 332 bare rocks),
- areas where vegetated layer covers more than 50% of the surface (class 321 natural grasslands),
- dense grass (*Stipa*) coverage (class 321 natural grasslands).

CLC 335 Glaciers and perpetual snow

CLC definition: Land covered by glaciers or permanent snow fields.

1.12.1 Extent and distribution

The rock, cliff, mountain and desert area covers 1% of the EU-27 land surface area. Not surprisingly, the land cover is mainly found in the alpine and arctic Member States, so Austria, France, Italy, Spain, Sweden and the UK have most of the area, whilst the other Member States have 2% to none. Most of Sweden's tundra habitat falls under CLC 411 heath rather than in this category.

1.12.2 Equivalence to Annex I habitat types

Related habitat types in the Habitats Directive Annex I include the following (caves are not considered here):

	Habitats Directive Annex I habitats related to CLC 332, 333 or 335	Other CLC classes in which the habitat may be included	Area (ha) in EU-25
8110	Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani)	n/a	303,515
8120	Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii)	n/a	639,883
8130	Western Mediterranean and thermophilous scree	n/a	68,904

8140	Eastern Mediterranean screes	n/a	11,655
8150	Medio-European upland siliceous screes	n/a	11,782
8160	Medio-European calcareous scree of hill and montane levels	n/a	75,944
8210	Calcareous rocky slopes with chasmophytic vegetation	n/a	2,043,919
8220	Siliceous rocky slopes with chasmophytic vegetation	n/a	659,472
8230	Siliceous rock with pioneer vegetation of the Sedo-Scleranthion or of the Sedo albi-Veronicion dillenii	n/a	279,718
8240	Limestone pavements	324 transitional woodland-scrub	146,608
8320	Fields of lava and natural excavations	n/a	91,370
8340	Permanent glaciers	n/a	164,993
	TOTAL BARE OR SPARSELY VEGETATED		**4,497,763**

Related habitat types in the Habitats Directive Annex I may include the following IF their vegetation cover is very sparse (otherwise they will be included in other CLC classes as listed):

	Habitats Directive Annex I habitats related to CLC 332, 333 or 335	**Other CLC classes in which the habitat may be included**	**Area (ha) in EU-25**
1220	Perennial vegetation of stony banks	331 beaches & dunes	44,247
1230	Vegetated sea cliffs of the Atlantic and Baltic coasts	various	65,358
1240	Vegetated sea cliffs of the Mediterranean coasts with endemic *Limonium* spp	various	41,504
1250	Vegetated sea cliffs with endemic flora of the Macaronesian coasts	various	88,200
1430	Halo-nitrophilous scrubs (Pegano-Salsoletea) *(mostly occur on Canary Islands)*	323 sclerophyllous scrub	46,801
1510	Mediterranean salt steppes (Limonietalia)	321 natural grassland	52,645
1520	Iberian gypsum vegetation (Gypsophiletalia)	323 sclerophyllous scrub	216,705
2330	Inland dunes with open *Corynephorus* and *Agrostis* grasslands	321 natural grassland	31,946
6110	Rupicolous calcareous or basophilic grasslands of the Alysso-Sedion albi	321 natural grassland	143,405
6120	Xeric sand calcareous grasslands	321 natural grassland	15,326
6130	Calaminarian grasslands of the Violetalia calaminariae	321 natural grassland	4,769
6280	Nordic alvar and precambrian calcareous flatrocks	321 natural grassland	34,850
	TOTAL OTHER SPARSELY VEGETATED		**753,810**

2 ANNEX 2. MEASURES UNDER THE CAP WITH A FOCUS ON BIODIVERSITY

Table 1 Measures with a direct focus on the provision of biodiversity and habitats and ecosystem services

Measures with a DIRECT FOCUS on the provision of biodiversity and habitats and ecosystem services		
Pillar 2	Rural Development[1]	Agri-Environment (214) Non-Productive investments (216)
Pillar 1	Cross compliance - GAEC standards[2]	Compulsory GAEC standards for: • The retention of landscape features; • The protection of permanent pasture; • Avoiding the encroachment of unwanted vegetation on agricultural land; and, • (From 2012) the establishment of buffer strips along watercourses. Optional GAEC standards for: • Minimum stocking rates or appropriate regimes; and, • (From 2010) establishment or retention of habitats.
	Cross compliance[2]	Permanent Pasture quantitative requirements under Article 6(2).
	Article 68[2]	Special support for: • Specific types of farming which are important for the protection of the environment - Art. 68 (1)(a)(i); and, • Specific agricultural activities entailing additional agri-environment benefits - Art. 68 (1)(a)(v).
Other CAP measures	SAPARD[3] and IPARD[4]	Agri-environment (214)
	Community Programme for the genetic resources in agriculture[5]	Actions to support conservation of genetic resources for plants, trees and animals.
	National frameworks for environmental measures in the fruit and vegetable sector[6]	Actions directly aimed at protection of biodiversity and habitats (for example, maintenance of unfarmed margins; maintenance of landscape features; use of local crop varieties; etc)*.
	Organic farming[7]	Actions aimed at maintenance and enhancement of soil, soil stability and soil biodiversity.

Notes: 1. Council Regulation (EC) No 1698/2005 of 20 September 2005 on support for rural development by the European Agricultural Fund for Rural Development (EAFRD).

2. Council Regulation (EC) No 73/2009 of 19 January 2009 establishing common rules for direct support schemes for farmers under the common agricultural policy and establishing certain support schemes for farmers.

3. Council Regulation (EC) No 1268/1999 of 21 June 1999 on Community support for pre-accession measures for agriculture and rural development in the applicant countries of central and eastern Europe in the pre-accession period.

4. Article 12 of Council Regulation (EC) No 1085/2006 of 17 July 2006 establishing an Instrument for Pre-Accession Assistance (IPA).

5. Council Regulation (EC) No 870/2004 of 24 April 2004 establishing a Community programme on the conservation, characterisation, collection and utilisation of genetic resources in agriculture.

6. Council Regulation (EC) No 1182/2007 of 26 September 2007 laying down specific rules as regards the fruit and vegetable sector.

7. Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing Regulation (EEC) No 2092/91

Table 2 Measures with a partial or no direct focus on biodiversity and habitats and ecosystem services

Measures with a PARTIAL FOCUS on the provision of biodiversity and habitats and ecosystem services		
Pillar 2	Rural Development	• Advice, training and information measures (111, 114, 115, 331); • Farm modernisation (121); • LFA measures (211, 212); • Natura 2000 (213 and 224); • First afforestation of agricultural land (221); • First establishment of agro-forestry systems on agricultural land (222); • Conservation and upgrading of the rural heritage (323); and, • LEADER (411, 412, 413).
Other CAP measures	National frameworks for environmental measures in the fruit and vegetable sector	Actions indirectly aimed at protection of biodiversity and habitats (eg integrated production; integrated pest management; alternative plant protection)**.
	Farm Advisory System[2]	Obligations under Article 12 and 13.
Measures with NO DIRECT FOCUS but that may have a positive impact on the preservation of biodiversity and ecosystem services		
Pillar 2	Rural Development	• Adding value to agricultural products (123); • Infrastructure development (125); • Diversification into non-agricultural activities (311); • Support for the creation and development of micro-enterprises (312); • Encouragement of tourism activities (313); and, • Village renewal and development (321).
Pillar 1	Decoupled direct payments	Payments to stabilise farm incomes
	Cross compliance - GAEC standards	GAEC standards focussing on: maintaining soil functionality or protection and management of water.
	Article 68	Special support to address specific disadvantages affecting farmers in the dairy, beef, veal, sheepmeat and goatmeat and rice sectors in economically vulnerable or environmentally sensitive areas, or in the same sectors, for economically vulnerable types of farming – Art. 68 (1)(b).

Table 3 Types of operation and the potential effects of measures under the EAFRD

Type of operation	Articles and measures	Potential effects
Climate change adaptation and mitigation		
Soil management practices (e.g. tillage methods, catch crops, diversified crop rotations)	Article 39: agri-environment payments	Reduction of nitrous oxide (N2O), carbon sequestration, adaptation to the effects of climate change on soil
Prevention actions against forest fires and climate-related natural disasters	Article 48: restoring forestry potential and introducing prevention actions	Carbon sequestration in forests and avoidance of carbon dioxide (CO2) emissions, reduction of negative effects of climate change on forests
Conversion to more resistant forest stand types	Article 47: forest-environment Article 49: non-productive investments	Reduction of negative effects of climate change on forests
Water		
Wetland restoration Conversion of agricultural land into swamps	Article 41: non-productive investments Article 39: agri-environment payments Article 38: Natura 2000 payments	Conservation of high value water bodies, protection and improvement of water quality
Development of semi-natural water bodies Creation of natural banks Meandering rivers	Article 39: agri-environment payments Article 57: conservation and upgrading of the rural heritage	Conservation of high value water bodies, protection and improvement of water quality
Soil management practices (e.g. catch crops, organic farming, conversion of arable land into permanent pasture)	Article 39: agri-environment payments	Contributing to the reduction of losses of different compounds to water, including phosphorus
Information and dissemination of knowledge related to water management	Article 21: vocational training and information actions Article 58: training and information	Raising awareness and knowledge and thus, indirectly, the efficiency of operations related to water management
Biodiversity		
No application of fertilizer and pesticides on high nature value agricultural land. Extensive forms of livestock management Integrated and organic production	Article 39: agri-environment payments	Conservation of species rich vegetation types, protection and maintenance of grasslands
Perennial field and riparian boundary strips and bio-beds Setting up of management plans for Natura 2000 Construction/management of biotopes/habitats within and outside Natura 2000 sites Land use change (extensive grassland management, conversion of arable land to permanent pasture, long-term set-aside) Management of high nature value perennials Setting up and preservation of meadow orchards	Articles 38 and 46: Natura 2000 payments Article 39: agri-environment payments Article 41: non-productive investments Article 47: forest-environment payments Article 57: conservation and upgrading of the rural heritage	Protection of birds and other wildlife and improvement of biotope network, reducing entry of harmful substances in bordering habitats, conservation of protected fauna and flora

Conservation of genetic diversity	Article 39: agri-environment payments	Conservation of genetic diversity
Information and dissemination of knowledge related to biodiversity	Article 21: vocational training and information actions Article 58: training and information	Raising awareness and knowledge and thus, indirectly, the efficiency of operations related to biodiversity

Source: Council Regulation 1698/2005, Annex II

3 ANNEX 3 DETAILED DESCRIPTIONS OF INNOVATIVE FINANCING INSTRUMENTS

3.1 Introduction

This Annex assesses the suitability of the mechanisms identified in Chapter 9 for financing Target 2 actions against the following criteria:

> Suitability: The instrument/source of private finance needs to be suitable to leverage private funding for activities that would be triggered under target 2, i.e. restoration activities or activities for the establishment of green infrastructure.
> Private sector acceptability – rate of return: The instrument should ensure sufficient return on investment[14] to attract private funding (considering the uncertain returns and therefore potentially high risks associated with investment in restoration/the establishment of green infrastructures).
> Private sector acceptability – timing of return: Instrument should be suited to address the time lag issue, i.e. the time that elapses between the moment investment takes place and the moment return on investment can be captured, which can be large in relation to ecosystem restoration.
> Financial Scale: The instrument needs to be able to contribute a sufficient proportion of the resources required to deliver Target 2 restoration objectives.
> Spatial Scale: The instrument/source of private finance has to be able to be deployed at a scale large enough for it to make a contribution to enhancing and maintaining ecosystem services and helping meet the 15 % restoration target.
> Equity: The financing proposed should not have inequitable social implications. In general greater social acceptability reduces project risks.
> Transaction costs: Transaction costs to the public sector of using this instrument/source of private finance should be commensurate with the benefits obtained.
> Added value: Instrument needs to go beyond good current management practice or offsetting of losses/impacts, which do not bring overall restoration.

3.2 Potential of private non-profit sources to fund actions under Target 2

3.2.1 Description

Private non-profit funding arrangements for biodiversity play an important role in biodiversity conservation. The main sources of funds are from NGOs and foundations. Foundations may be set up to channel philanthropic expenditure from the for-profit sector, and so overlaps with that source discussed in Section 2 below. However, foundations are included in this analysis because the purpose of the foundation is non-profit. Thus funds in this category do not have an element of CSR-motivation that funds from for-profit sources often have.

[14] Note that the return on investment does not have to be solely defined as monetary returns, they can also be reputational.

NGOs have also played an important role in the development of innovative financing measures such as:

- Debt-for-nature swaps (i.e. whereby a portion of a developing nation's debt is written off in exchange for investments in local conservation measures);
- The development of in-kind payments (i.e. those that do not involve the exchange of money) which can be important in a local context and lead to restoration activities being carried out in return for access and use (within limits) of protected areas under their management by local communities, and
- Brokering new markets for ecosystem services, such as PES, which can finance restoration (see Section 5).

A type of private finance that involves an element of philanthropy is impact investing. These investments seek their returns in a combination of financial in non-financial terms. They make accept lower rate of profit, or even a slight loss, financially. However, they also seek returns through social or other impacts. Impact investing has been applied to environmental objectives, in particular reductions in carbon emissions. It has potential to be applied to ecosystem restoration impacts, but will face barriers due to lack of standardised measurement of ecosystem impacts (see 2.3).

3.2.2 Suitability

Given their motivations, NGOs and foundations could make an important contribution to financing restoration projects where these appear to deliver high benefits to biodiversity but have more limited prospects as regards financial return on investment, which would have made the restoration activity attractive to the private (for-profit) sector.

NGOs and foundations can be well suited to playing a role as investment partners and intermediaries for financial institutions. They can provide local knowledge about environmental investments to the financial institution, and is some cases have acted as a local minority investment partner, reducing risk to commercial investors. At a smaller scale NGOs and foundations have played important roles in supporting SMEs looking to engage in new markets which have a neutral or positive impact on biodiversity, as a result of the lack of support from conventional financial institutions (Bishop et al, 2008; see also below). Howevr, NGOs do not always have legitimacy with all sectors.

3.2.3 Private sector acceptability – rate and timing of return

The rate and timing of financial returns on expenditure is not a significant concern for funds from this source, and their motivations are primarily altruistic. However, where funds are committed to actions to broker other private sector expenditure, then the efficiency of those mechanisms, including their rate and timing of financial return, become important.

NGOs are well placed to help lever private finance, especially from private companies, as the latter can use their collaboration with NGOs on restoration projects or projects in the interest of a wider public (i.e. establishment of green infrastructure) for communication purposes. To encourage donation to charities (whether from private individuals or companies) and spending by foundations on ecosystem restoration, governments can give tax relief on funds donated.

3.2.4 Scale

The scale of contributions may range considerably from in-kind payments to large investments from foundations. Estimating the overall contribution of the non-profit sector to biodiversity is complicated by the lack of central data sources and the potential for double-counting monies from government grants. Nonetheless, it can be substantial. For example, Morling (2008) estimated that UK NGOs spend £144m domestically and £15m overseas on biodiversity, constituting between 39% and 75% of the UK Government's respective domestic and overseas spend.

NGOs can be a conduit to private funds from companies and the public sector to ecosystem restoration. Therefore assessing NGO, public and private finances separately is likely to significantly double-count sources of funds. However, some of the funds channelled through NGOs are additional, either in the sense that they are generated by the NGO from the wider public, or that the NGO motivated a public or private funder to provide them.

NGOs might face barriers in scaling up their fundraising in order to fund restoration measures in amounts significant enough to contribute to meeting the 15% restoration target. Such a contribution would require that restoration enabled greater fundraising. This can be the case, for example where restoration results in Green Infrastructure that can attract funding from different sources in return for the ecosystem services it provides.

Foundations have provided very substantial funds to social objectives (e.g. the Gates foundation). Therefore foundations could potentially provide significant funds to support ecosystem restoration. However, attracting such funds would be in competition with social objectives such as health treatments (e.g. malaria, AIDS) and schooling, and therefore need to make a very strong case.

3.2.5 Equity

No major equity concerns are identified with this mechanism.

3.2.6 Transaction costs

Non-profit sources may be able to undertake transactions more efficiently than public or for-profit funders at a local level. They can motivate volunteers, and have a local presence and social connections that reduce transactions costs (see PBB and Investments). However, at a larger scale the activities of numerous NGOs and foundations can duplicate, and this may mean higher transactions costs.

3.2.7 Added value

NGOs definitely have a powerful role to play as an intermediary, but whether they can raise more money themselves for restoration is less certain.

3.3 Philanthropic donations by companies from private for-profit sources to fund actions under Target 2

3.3.1 Description

Philanthropic or charitable donations can refer to all donations whereby the private company has no formal obligations, environmental or financial dependencies to the restoration site. It is assumed that altruism and reputational enhancement are the key motivations behind such donations. Certainly if it was purely altruistic, no websites or promotional material would be created. Differences exist between CSR and corporate philanthropy. Corporate philanthropy relates to how profits are distributed, CSR is concerned with how those profits are earned[15]. Despite this, there is likely to be considerable overlap and both are considered in this report.

In the course of searching for case studies across Europe of the potential funding sources being used to support ecosystem restoration, philanthropic donations were the easiest to find. This could be partly because philanthropy is likely to be promoted by the donor company, but also because it currently appears to be one of the more frequent channels of private financing of environmental actions. Donations to not for profit organisations are often tax deductible. Establishing or furthering such tax breaks could be used to leverage funds towards conservation (see Section 6).

Private funding via this mechanism often works with intermediaries experienced in the natural environment concerned to undertake the restoration. Such partnerships aim to help target donations as effectively as possible.

3.3.2 Suitability

Philanthropic donations are potentially suitable for a wide range of restoration actions. In particular they can potentially support projects for which there is little prospect of commercial returns motivating investments. Donations can also provide upfront investments in restoration actions. Where these actions lead to potentially profitable activities, but the scale of initial investment required in restoration is a barrier, donations could overcome this – a potential form of 'impact investing'.

3.3.3 Private sector acceptability – rate of return

Philanthropic donations are not directly associated with a purely financial rate of return. Any donation that is well publicised could potentially enhance the reputation of company. The extent to which reputation enhancement translates into a measurable rate of return is not widely assessed. Certain levels of philanthropic giving and CSR activity are required as part of access to Sustainable and Responsible Investment (SRI) funds. According to research by Eurosif (2010), total SRI assets under management (AuM) amounted to €5 trillion in Europe, as of December 31, 2009.

Private funding classified as philanthropic donations may in practice have an element of non-altruistic motivation. For example, a company enhancing a local nature reserve, apparently through philanthropy, may also be receiving ecosystem services benefits.

[15] http://www.kpmg.co.uk/pubs/Tax_and_CSR_Final.pdf

Enhancing the environment in which its employees live may improve its workforce's performance and the company's staff recruitment and retention activity.

3.3.4 Private sector acceptability – timing of return

A purely philanthropic donor may not be concerned with the timing of returns if their philanthropy extends to future generations. Reputational returns on philanthropic giving can be said to have been achieved once the investment has been made in an environmental project. Therefore the timing of the return is not critical to the success of any donation, including for ecosystem restoration that takes longer periods to be achieved.

3.3.5 Financial and Spatial Scale

Although at present this is a significant source of finance for restoration, philanthropic donations may not be the most suitable large-scale source of private finance towards target 2. As shown in the case studies, companies tend to focus on one particular area, not multiple areas. Therefore to make a significant contribution to Target 2, a significant increase in the number of companies prepared to make philanthropic donations would be required throughout Europe.

The size of this contribution will be dependent on the economic climate in Europe over the coming years. There are two determinants of the size of philanthropy budgets, firstly the amount available to donate (the size of the pot itself), and secondly the appetite to donate (share of the pot allocated to charitable giving). Economic pressures may increase focus on achieving profitability, reducing inclination and capacity for philanthropic actions.

The current economic challenges in Europe mean that the prospects for increasing the amounts of private funds being donated to philanthropic causes are not strong. The appetite to donate to environmental causes will be driven by public attitudes. When a customer base is environmentally aware, a company is more likely to engage in philanthropic donations to environmental causes. How public attitudes will develop in relation to ecosystem restoration is unclear.

3.3.6 Equity

No major equity concerns are identified with this mechanism.

3.3.7 Transaction costs

Philanthropic funders are able to seek the most efficient routes for donations to restoration actions. Usually this involves working with an NGO or local organisation to undertake restoration actions. This organisation provides an established presence in an area, through which to channel funding. The costs of using this funding channel may be low as they may already be sunk within the organisation's remit. Therefore this method of financing has low transaction costs compared to several of the other mechanisms analysed.

3.3.8 Added value and Conclusions

Philanthropic donations are a simple and direct means of allocating funds to restoration efforts. Where the impetus is present they can be an effective and valuable source of funds for the restoration targets. With greater priority and profile for ecosystems restoration, they could be expected to increase slightly as a funding source. However, their voluntary nature means that, in the current economic climate in the EU, they are unlikely to increase in such a way that will provide a significant contribution to target 2.

3.4 Public private partnerships and bonds for green infrastructure

3.4.1 Description

This section draws on work for the UK Ecosystem Markets Taskforce (for Defra, in prepration)[16]. A bond is a tradable financial security representing a promise that the organisation that sold it will pay whoever holds the security a pre-specified interest payment at pre-defined intervals over the bond's lifetime and its full value on maturity[17]. A bond simply converts a lenders obligation to repay into a tradable financial instrument.

Bonds are an alternative to self-funding or borrowing from a single lender; issuing a bond creates a pool of creditors, as opposed to a few large ones. From the investor's point of view bonds are a lower risk investment option than shares; whilst bonds are usually secured against some form of collateral and their ability to repay externally rated by independent agencies, shares are unsecured, i.e. if the issuing entity fails shareholders stand to lose their entire investment[18].

Environmental bonds are an emerging type of bond that use the capital raised through their issuance to finance projects with a beneficial environmental impact. A large variety of environmental bonds have recently been proposed including green investment bank bonds, green infrastructure bonds, and woodland creation bonds. The defining characteristic of 'so-called' environmental bonds is the assurance they provide with regard to the initial and on-going social and environmental impact of funded projects.

Green infrastructure is a new concept that features in the 2011 EU biodiversity strategy[19], adopted on 3 May 2011 and endorsed by the Environment Council on 21 June 2011. It refers to the spatial organization of habitats and ecosystems that support the provision of ecosystem services to society over the long term. Restoring or enhancing green infrastructure can provide value through improved ecosystem services over the long term. A bond may be a suitable instrument to attract this investment. The bond can be secured against the green infrastructure.

Where the ecosystem services are predominantly public goods, but significant up-front investment is required that exceeds available public annual budgets, public funding is needed. This can be in the form of guaranteed future payments for ecosystem services (similar to 10-year agri-environment scheme contracts).

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[16] http://www.defra.gov.uk/ecosystem-markets/

[17] Cranford, Parker and Trivedi (2011) Understanding forest bonds. Global Canopy Programme (online) available at: http://www.globalcanopy.org/sites/default/files/UnderstandingForestBonds_0.pdf

[18] EnviroMarket (2012) Exploring the use of environmental bonds to support woodland creation (online) available at: http://www.forestry.gov.uk/pdf/ENVBOND.pdf/$FILE/ENVBOND.pdf

[19] http://ec.europa.eu/environment/nature/biodiversity/comm2006/2020.htm

A potential for of a bond instrument in these circumstances is a public private partnerships (PPP). PPP involves upfront investment by the private sector, made against a contract for public-payments over the long term in return for specified services. Bonds could be issued to finance investment in green infrastructure with some government assistance (e.g. giving a minimum level of return). The government involvement could be to guarantee a certain level of payback to the private investor.

3.4.2 Suitability

Bonds and PPP can be a way to source private finance of investments in ecosystem restoration. Ecosystem restoration often involves significant up front investment in restoration actions (link to Section on this). This restoration provides benefits over longer periods as ecosystems recover.

The use of bonds and PPP is therefore potentially very suitable way to raise investments against the expected future returns from ecosystem restoration. They can raise funds where commercially viable restoration opportunities exist, or where the public sector wishes to purchase the outputs from restoration in the long term (e.g. through agri-environment schemes) but cannot afford the investment required in the short term.

For ecosystem restoration, environmental bonds and PPP arrangements could be linked to a certain level of environmental performance (e.g. ecosystem service provision, and/or condition of environmental capital). In this case, they may take on an element of altruistic motivation or impact investing (ie investors proactively seek investments with positive social and/or environmental benefits in addition to financial returns).

3.4.3 Private sector acceptability – rate of return

The returns on environmental bonds will depend on the specific market opportunities arising from the restoration, as discussed under other sources in this section. They can potentially finance ecosystem restoration where there are associated commercial activities with profitable rates of return.

A barrier to the use of environmental bonds is the lack of approaches to identifying acceptable rates of returns on bonds for ecosystem restoration (and environmental bonds generally). Consistent and comparable measures of expected returns are needed.

3.4.4 Private sector acceptability – timing of return

Bonds are a long term investment instrument; they can fund large up front investments and receive returns in long term. This makes them suitable to finance the long term nature of returns on environmental investments like green infrastructure.

3.4.5 Financial and Spatial Scale

Bonds need to work at a relatively large spatial scale in order to be of a large enough value to justify the costs of establishing them, and to spread risk across a series of investments. PPPs can work at a smaller scale, potentially for large individual restoration projects.

Bonds can potentially be applied over large areas, (e.g. whole river catchments, or a series of catchments). There is no limit to the scale at which they could be used to fund restoration actions with sufficient financial viability. However, that viability is unproven and uncertain, not least because the ecosystem service outcomes from large-scale management are often poorly understood (e.g. how much will river catchment management improve water quality or reduce flood risk?).

3.4.6 Equity

As large scale financial instruments, bonds and PPP arrangements may not be accessible to many stakeholders in ecosystem restoration (e.g. local communities). This may lead to equity issues if these stakeholders are not involved in the management of the instruments.

3.4.7 Transaction costs

There are transactions costs involved in establishing a bond or PPP arrangement. For bonds, these would be expected to have an element of fixed costs. Therefore transactions costs are potentially high if investments are on too small scale, but can be lower for larger investments.

3.4.8 Added value

Environmental bonds and PPP arrangements have potential to enabling funding of large short-term investments in ecosystem restoration which give long-term returns. They need to operate at a large scale and be connected to specific sources of returns. These characteristics make them potentially suitable to finance green infrastructure.

3.5 Insurance sector mitigating of environmental risk

3.5.1 Description

Environmental risks such as river flooding, coastal flooding and storms are expected to increase in intensity and/or frequency as a result of climate change. The uncertainty and scale of such events are a considerable threat to the insurance sectors whose business models rely on the estimation of risk. To skew the risk calculation in their favour, insurance companies may consider financing protection from extreme events. In many cases effective management of the natural environment can provide protection against natural hazards. For example planting trees or restoring wetlands can provide protection against floods. Such actions would have the benefit of contributing to Target 2.

3.5.2 Suitability

If the reduction in risk to the insurance sector is genuine and offers real savings, the key question is why has this not occurred already? The answer relates to market failures in the management of the ecosystems involved.

The insurance sector is a competitive market. If a single insurance company was to invest in natural flood defences that would protect a city and therefore reduce the population's risk, the other insurance companies who have customers in this city would be able to 'free ride' on this investment. This would deter investment. If there was a way in which insurance firms could collaborate on such projects, this mechanism becomes more feasible.

In many countries the financial risk from extreme weather events isn't solely borne by the insurance company, but instead by the government, or a partnership between government and the insurer. The responsibility lies for insuring or compensating those properties affected by extreme weather is opaque in many countries, and therefore the incentive for insurers to invest in natural protection is uncertain. In the UK an interesting example exists. Insurance companies and the government agreed on a Statement of Principles whereby insurers agreed to cover those households that have been flooded in the past, if the government continues to improve and invest in flood defences.

3.5.3 Private sector acceptability – rate of return

There is significant uncertainty as to the extent that ecosystem restoration will contribute to natural hazard regulation. Ecosystem restoration may have natural hazard mitigation, environmental and cultural benefits, but private investments are being made by the insurance companies are judged against private returns from natural hazard mitigation, unless co-funding with other beneficiaries can be organised as discussed in other sections.

It is important to consider additionality of private sector involvement in any scheme. If environmental sites are to provide multiple benefits (flood protection and subsequent avoided costs and associated biodiversity services) then the insurance company may question whether pubic funds should instead cover the cost of restoration of environmental sites (or a package should be sought for co-investment). For this reason it is possible that flood defences budget of the public sector environment agencies could be used to co-fund some of the schemes that might appeal to insurers. This can also help tackle the investment uncertainty related to the uncertainty in environmental responses (as described above). A good practice standard could be developed by national government to guide and certify those schemes meeting specified standards.

3.5.4 Private sector acceptability – timing of return

Any impact from ecosystem restoration on natural hazard risks is likely to happen over several years. Insurance markets typically work on annual cycles (e.g. household insurance is bought annually). The long term nature of returns to target 2 actions is therefore a major barrier for involvement of the insurance sector.

3.5.5 Financial and Spatial Scale

This is a potentially a very large market and with extensive coverage of land. But this mechanism remains largely untried and therefore of very uncertain financial scale.

3.5.6 Equity

Insurers funding of natural hazard mitigation through ecosystem restoration is not based on polluter pays principle. It is therefore potentially inequitable in alleviating the responsibility on those who have caused increased natural hazard risks for others as a result of ecosystem degradation to address that risk.

3.5.7 Transaction costs

The transaction costs for effective implementation of this policy are considerable given current insurance market structures. The initial institutional change and collaboration required potentially mean that pilot approaches are likely to be suitable at this stage.

3.5.8 Added value and Conclusions

Funding from insurance to fund restoration faces many barriers to implementation. The potential gains from this approach are large, but the uncertainties surrounding the return on natural protection, climate change and institutional arrangements make it highly unlikely to proceed at present. Significant work is required with those in the insurance sector to understand whether genuine possibilities to support Target 2 exist with this approach.

3.6 Payments for ecosystem services (PES)

3.6.1 Description

Payments for Ecosystem Services (PES) are a new (voluntary) market mechanism in which service suppliers are paid by beneficiaries to manage the ecosystems in such a way to enhance or continue the service provision. Agri-environment payments that have been in place for a long time are examples of PES and new applications are emerging in Europe (e.g. on water catchments – SCAMP and Vittel for example).

PES schemes have been tried in many different contexts and therefore they are relatively well understood and ready for further implementation attempts. Further work is needed to explore the potential involvement of the private sector to purchase ecosystem services. For example through the extent to which existing schemes for water services (see the case studies) can be replicated.

3.6.2 Suitability

Privately financed PES schemes outside of those industries that use water directly are rare in Europe. This research didn't find examples of private PES application outside of this area. Water is particularly suited to PES for the following reasons:

- Security of water supply and water quality are direct, tangible, quantifiable inputs to many industries, and is well understood by those industries.
- The science linking upstream areas and down-stream water quality is relatively robust.
- Catchments and water courses are bounded, i.e. there is generally one direction of provision of ecosystem services, and therefore the link between a downstream buyer and upstream seller of ecosystem services is strong.
- Those companies that use water have a strong understanding of the direct ties they have to the ecosystem services. The perception of the dependence between an industry and an ecosystem service influences the potential application of privately financed PES.

A scheme depends on providers having sufficient control over environmental assets so that they can manage them to provide improvements in ecosystem services to beneficiaries. These conditions are not always available, even in bi-lateral relationships between providers and beneficiaries. There are even greater challenges in organising multilateral schemes over appropriate spatial scales. It should be noted that where scales become large and require significant capital investment PPP arrangements or bonds may be suitable.

3.6.3 Private sector acceptability – rate of return

The financial constraints applied to PES are that the payment from ecosystem service (ES) beneficiary to ES provider must not exceed the *perceived* benefits accruing to the beneficiary and exceed the *perceived* opportunity cost faced by the provider in entering the PES scheme. If the balance between the perceived costs and benefits between individual providers and beneficiaries is not positive there is unlikely to be a deal. If the balance is uncertain and the risks involved are off putting, it is possible to aggregate buyers and sellers to minimise either the level of payment for each individual buyer or minimise the opportunity cost faced by each seller of ES.

Achieving financial viability may be difficult for a number of reasons. Reliance on ES may be too distant, risky or uncertain for any private entity to justify restoring an environmental site. However, there are already extensive publicly funded PES schemes for ecosystem restoration (e.g. EU agri-environment and silvi-environment schemes).

Financial viability is most likely to be achieved through a combination of private and public funds. For example, in the successful SCAMP PES scheme in the UK (see case studies), the commitment of 10 years of public funding of agri-environment schemes (AES) was made alongside water company capital investments. The return to the water company was too uncertain to have stimulated this capital payment without the guarantee of AES funds, and the AES funds alone where not high enough to incentivise farmers to restore the catchment. However, in combination the public and private funds were sufficient to make the PES scheme financially viable.

Public funding processes could be adapted to be more supportive of achieving these kinds of outcomes, i.e. to work with private investments to improve their rate of return, more readily. This requires flexibility of timescales, and ability to commit in principle to finance projects during their development.

3.6.4 Private sector acceptability – timing of return

There are two temporal considerations to be taken into account.

i. Environmental payback period

The time period for ecosystem restoration investments to be recouped is dependent on the nature of the ecosystem services present on a site and what is being invested in. A water company may invest in short term measures to prevent soil erosion, which would have short-term beneficial impacts on their bottom line. Or a governmental body may pay for reforestation for aesthetic or carbon sequestration purposes, which will take a longer time period to see the returns. Payment for actions which see faster returns are likely to be the most attractive to any private investor and also the easiest ideas to communicate when introducing PES.

Restoration actions can produce relatively fast responses from water provision ecosystem services. For example, payments for sensitive grazing to minimise soil erosion, which has beneficial downstream impacts on a municipal water provider in the short run. However, many restoration actions can take considerable periods of time to produce beneficial ecosystem services changes. This timing of returns is a barrier to private financing of these actions through PES arrangements.

ii. Permanence of the scheme

Perpetual funding of PES (not large one off capital expenditure), and therefore of ongoing restoration activities, requires continued reliance on the ecosystem service resulting from the site and a level of additionality (the PES results in action that would not have occurred anyway). If the business paying for the ES either no longer relies on the ecosystem service, or their payment is not required then the PES scheme will cease. For this reason PES schemes must be chosen in areas where there is long term benefit from provision of the ES and a persistent threat exists to that ES.

3.6.5 Financial and Spatial Scale

Individual PES arrangements are a transaction between two bodies. It is not prescriptive in the scale over which it can take place. International PES exist, such as in the Clean Development Mechanism, but this is not a private scheme, but they also can take on a local basis such as in the Vittel example (see case studies). PES arrangements could be used to fund ecosystem restoration at large scales - however PES deals at larger scales may have greater transactions costs.

Private finance of restoration through PES schemes is a relatively new idea, and the potential areas of application that have been identified mainly relate to industries that rely on water. The scale of the water companies' involvement in catchments can spread over a large area, so it is therefore possible that there is significant potential scale for this specific application. However, it is unlikely water companies would want to bear this cost on their own and their funding of any restoration activities will be limited to those actions that improve water quality and or supply.

PES schemes are ultimately flexible in scale and could be matched to scale of ecosystem restoration actions, as long as dependence on ecosystem services can be demonstrated and are accepted.

3.6.6 Equity

At its core PES brings ecosystem services into a market system, a concept that many people are uncomfortable with. Proponents of PES would argue that these ecosystem services are currently unvalued in the market economy and therefore the full benefits they support is not fully recognised by policy. PES provides incentives to manage the environment, by those who value its services.

PES arrangements do not comform with the polluter pays principle. Those whose actions prevent the full provisioning of ecosystem services are paid to curtail these actions. Whether this is inequitable depends on the distribution of property rights for environmental services.

PES is by definition voluntary: buyers and sellers are not legally obligated to take part. This implies that the damage being done to the environment by the seller's activities is not sufficient for regulation to have occurred. The 'pollution' in the polluter pays principle in PES circumstances has not warranted regulation. Therefore in order to restore ecosystem services regulation which is in line with polluter pays principle could be introduced or PES, which forgoes the requirement for regulation.

3.6.7 Transaction costs

PES require careful application to ensure that the required ecosystem services are being delivered, or at least that the activities that will ensure ecosystem services are being undertaken. This requires careful monitoring and poses an additional cost to the project.

PES schemes often work through a local NGO or organisational presence that can act as a trusted broker and intermediary between buyers and sellers. This can reduce transactions costs, but the heterogeneity of ecosystem services benefits of target 2 actions means that associated PES deals are likely to have high verification costs.

3.6.8 Added value and Conclusions

As long as circumstances allow in theory, PES is a potentially permanent solution for funding ecosystem restoration and maintenance actions. It is a proven route for leveraging private finance towards ecosystem restoration in the water sector in Europe, but its use in other sectors is limited. It is a flexible mechanism (in scale, and habitats covered) is has potential to make a significant contribution to ecosystem restoration actions. It could work in combination with other mechanisms – a widespread use of PES would create more market opportunities for PPP and bonds investment structures to be used.

3.7 Tax Relief on capital assets in good environmental management

3.7.1 Description

Tax reliefs can be offered to provide incentives for certain types of economic activity. Such practices are widespread in the tax system (e.g. the UK charges lower rates of VAT on childrens clothes).

Relevant tax instruments for ecosystem restoration depend on national taxation structures, but generally relate to those that are raised on capital assets, particularly land, and that provide incentives over time. Relevant instruments include capital gains tax, corporation tax, inheritance tax and the way that business property is classified for tax purposes. Lower rates of tax can be offered in association with ecosystem restoration management outcomes (e.g. certification of forest management, or condition of Natura 2000 sites[20]). To work with the tax system in this way, these outcomes need to be pre-determined, clearly defined, and verifiable to the tax authorities.

Tax relief has a cost in terms of income forgone to the government. The strength of the incentive to landowners depends on the value and opportunity costs associated with the land. However, the restrictions on activities within many environmental sites for conservation reasons reduce opportunity costs, and so can make this a viable option.

The distinction between this instrument and hypothecated tax revenues is that tax relief results in avoiding the costs of a certain amount of tax altogether. Under hypothecation the amount of tax is not paid to government, but the amount due is paid in the form of certain types of expenditure.

3.7.2 Suitability

Applying tax relief to encourage restoration of ecosystems in Europe would involve:

- Defining exemptions from taxes relating to the restored ecosystems. For example, inheritance tax or property sales taxes could be lower or exempted when restored condition is achieved.
- Allowing different classification of ecosystems for tax purposes when they have been restored. This means that property (land) can be treated differently in tax systems. Defining such an instrument requires detailed knowledge of Member States tax systems. Generic examples related to how property could be treated for accounting purposes to affects tax rates include:
    - Assets related to sites could be given a different tax classification or tax rate if they are being restored. Such assets could be the land itself, or stocks on it (e.g. timber or carbon).
    - Accounts that are not in profit attract lower rates of tax. Therefore accounting rules like rates of depreciation, or how revenues are recognised (e.g. public payments for managing sites that are restored could be exempt from tax) could be applied in order to reduce the profits recorded, and therefore levels of tax due.

Changes to tax rules can be made relatively quickly under the existing management of the tax system. They can take time to take effect because they may depend on sites being recognised as being restored, which in turn requires restoration objectives to be in place (which can take more than a year) and for a restoration plan to be implemented and take effect (which can take several years).

While the concept of tax relief may seem abstract, its powerful effects on the environment can be demonstrated by experience in the UK during the 1980s. A tax relief incentive was provided investment in commercial forestry. This led to large-scale development of forestry

[20] This could be defined through actual condition or through proxy measures such as the implementation of an approved management plan. Either way it would need some independent regulation to verify.

plantations (mainly in Scotland and northern England) that were monocultures of fast-growing non-indigenous species. Not only did these forests have very low biodiversity value, they were often planted on areas with high landscape (e.g. upland areas in the highlands of Scotland) and/or biodiversity values (e.g. blanket bog), including some sites now designated within the Natura 2000 network and undergoing restoration. Following objections from nature conservation interests the tax incentive was removed, and this slowed the rate of new commercial forestry development in the UK significantly.

The predominance of planting in the north of the UK reflects the lower opportunity costs of land in these areas, and so demonstrates the influence of economic returns (as opposed to regulations or other policy instruments) within land management incentives. Where the opportunity costs of land were much higher, the tax incentives had less effect.

3.7.3 Private sector acceptability – rate of return

The rate of return depends on the tax relief on offer. The absolute return depends on the asset that is to be taxed and also the tax entities financial situation: if it is not profitable, then it is unlikely to be paying much tax anyway. This leads to uncertainty of effects.

The rate of return on tax relief relates depends on the costs of ecosystem restoration and value of the tax relief. In a business sense, the opportunity cost of pursuing the restoration actions that will result in the tax relief, must not be greater than the tax relief itself. However, other motivations may be involved in calculating the rates of return, particular where ecosystems are owned by private individuals or large companies that do not want to sell or radically change them. In these cases, a tax relief could make it easier and thereby encourage a business or family owner of an ecosystem to undertake restoration actions that they want to do anyway.

3.7.4 Private sector acceptability – timing of return

Changes to the tax system are commonly used as an economic management tool because they fit with existing financial management processes on annual basis. For ecosystem restoration, a choice would need to be made about when a tax relief or incentive is applied. This could be only once an ecosystem is restored, or when restoration actions have been started or completed.

Tax incentives for restoration actions would give a more immediate return and therefore a stronger incentive to landowners. However, it would be harder to regulate as whether ecosystem restoration actions are being undertaken effectively is harder to verify that whether an ecosystem has been restored. Tax incentives applied to ecosystems that have been restored could have lower additionality, as it could be paid on restoration activities that would have happened anyway.

This time dimension is important, and suggests that parts of the tax system that work in the longer term may provide more appropriate instruments. For example, through inheritance tax, land could be required to be restored, and then maintained in a restored condition, for 10 years before inheritance occurred, creating an incentive for long-term land management in line with restoration requirements.

3.7.5 Financial and Spatial Scale

This instrument would operate across a tax jurisdiction (national or regional) so would be expected to work at a large scale. Financially, it would be able to cover as much ecosystem restoration activity as can be appropriately defined in the tax system.

Spatially, the take-up of tax incentives for ecosystem restoration may be more likely if the tax entity has control over large ecosystems. Some sectors (forestry, mining) and some landowners (e.g. of private estates) do own such large areas. However, in other sectors (e.g. small family farms in agriculture) ownership of ecosystems may be small and therefore the incentive may work less well – the size of the financial gain may be small, and individual's costs for obtaining it may be higher if they do not have specialist tax knowledge (in the way large landowners or companies do).

3.7.6 Equity

This measure may be more likely to incentivise larger land owners (see above). Therefore may not work equitably if it is harder to access for those undertaking smaller scale ecosystem restoration actions. If applied to restoration activities, rather than restored ecosystems, tax relief could be inequitable in not providing benefits to landowners who already have restored ecosystems.

This measure represents a loss of income to wider society (in the form of forgone tax revenue), which is transferred to the owners of ecosystems in return for undertaking restoration actions. If these owners are responsible for the ecosystem's degradation then it could be argued that supporting restoration with money from elsewhere is society is inequitable.

3.7.7 Transaction costs

The transaction costs associated with organising tax relief in the tax system are likely to be front loaded. Changing the tax structures has one-off administration costs and can also have political ramifications. However, once these changes are established they would operate as an additional part of existing tax administration practices, and therefore would be expected to have low transaction costs. In particular, they might be lower relative to the costs of administering public sector payments to support restoration actions.

The transactions costs of verifying that ecosystem restoration actions qualified for tax relief could be more significant. A more specific and targeted the tax relief could have greater additionality, but also higher transactions costs. However, verifying that ecosystem restoration actions are being carried out is a cost that all measures to encourage such actions are likely to face. Need to be more efficient than equivalent public spending forgone.

It may be easier to target specific restoration actions through tax instruments applied to a specific sector (e.g. forestry, aggregates). However, these opportunities will be limited in scale to tax entities that can be identified as part of these sectors, and sector specific actions will have higher transaction costs.

3.7.8 *Added value*

Tax incentives could operate within existing tax arrangements across a large spatial and financial scale and covering many types of restoration actions. They obviously have a cost in terms of tax revenue forgone, but have the potential to efficiently provide incentives to stimulate private sector actions to restore ecosystems.

3.8 Hypothecated tax funds

3.8.1 *Description*

A specific potential use of tax instruments is to lever private finance by requiring matched funding against expenditure diverted into particular spending plans in lieu of paying taxes to government. The funds diverted are forgone tax revenue and therefore are not additional to public spending. However, the matched funding requirement means that additional private finance is obtained. Two instruments that have used this arrangement in the UK and have supported ecosystem restoration in the last 10 years are the aggregates levy sustainability fund (Natural England, 2011) and the landfill communities fund[21].

The logic behind this arrangement has two key points. Firstly that both the activities involved (aggregates extraction and landfill sites) have a particular local disamenity aspect. This should be compensated for through local expenditures that are best administered locally rather than through central government. Secondly, in undertaking this expenditure locally and through the companies involved, other funds can be levered into projects, and there is a payback in terms of positive local publicity for the businesses involved.

The expenditures allowed under the funds are defined in the rules of the schemes. This often includes the geographical area in which expenditures can take place and environmental objectives. They are organised through taxation policies, which are adjusted annually, and applied nationally. They can be relatively successful at investing money in ecosystem restoration, both directly and through leverage of further funds from other sources.

As with tax relief, these instruments result in a loss of public tax revenue, but have strong potential as an efficient way of directing a mixture of public and private funding towards ecosystem restoration.

3.8.2 *Suitability*

This mechanism requires taxes that provided a suitable basis for hypothecation to ecosystem restoration. This involves:

- An ongoing, predictable and stable tax base from which to hypothecate funds.
- Raising large enough amounts of tax compared to the funds required for ecosystem restoration. This creates a risk to the Government that too much tax revenue will be foregone, but this can be limited by the rules of the scheme.

[21] http://www.entrust.org.uk/home/lcf

- Being paid in enough geographical locations such that they can be associated with sufficient ecosystem restoration opportunities for receiving the hypothecated funds.

The successful adoption of hypothecated tax funds will have to overcome political barriers, especially given current 'austerity' pressures on public spending. To justify forging tax revenue through the hypothecation, it will be necessary to demonstrate that it is a good use of public money. The design of the tax hypothecation scheme can influence this, in particular through the way that rules:

- Determine which spending on ecosystem restoration qualifies for funding under the scheme. There is a balance to be achieved here between allowing local choice about priorities (which may be more efficient at delivering benefits for local communities and individual sites), and achieving restoration outcomes. For the UK landfill tax, a funding board made up of stakeholder representatives (landfill operators, conservation NGOs, local government) was set up to give approval to project applications.
- Require matched funding. There are three aspects to this:
  i. Firstly, the amount of matched funding required is a difficult judgement, as lower levels mean that less ecosystem restoration spending is achieved per € of tax forgone, but higher levels mean that fewer restoration schemes will be sufficiently attractive to private funders to provide matched funding for.
  ii. Secondly, what other funding sources qualify as matched funding needs to be defined. For example, it can include other public funding (e.g. from local government where this is justified by the relevant outcomes). On the one hand this can help support schemes that deliver a wide range of public benefits and so justify strong public funding, but on the other hand it reduces the imperative to lever private funding to deliver schemes. It is suggested that matched funding contributions from other public sources should at least be limited in some way.
  iii. Thirdly, what types of activities are defined as additional 'matched funding'. In addition to financial contributions, 'funding' can be defined in a variety of ways, such as in-kind capital or operating cost, and volunteers' contributions to ecosystem restoration. In-kind contribution of capital cost could include capital works (e.g. a water engineering company could help undertake works to improve the hydrology of an environmental site), or operating costs such as NGO staff employed at to manage sites (e.g. work to complete restoration plans). These can be costed at commercial rates and counted as matched funding. Inputs from volunteers (e.g. organised by an NGO) can also be valued in this way. Some auditing of this 'funding' is important to ensure best value from the hypothecated tax revenues.

3.8.3 Private sector acceptability – rate of return

The purpose of using this instrument would be to lever private funding into ecosystem restoration alongside foregone tax revenues. The tax revenue that was forgone would have to be from an existing tax instrument. The choice of the tax and design of this instrument would need to take into account:

- the volume of funds it raises,
- where and how it is levied and the connection of this to restoration actions,
- the regularity with which it is paid, and
- the attractiveness to private funding sources of providing matched funding.

In the UK schemes discussed above, the attractiveness to private sources was mainly based on improved community relations and other CSR outcomes associated with investment in nature conservation (i.e. cultural ES). However, other motivations could include other ES values associated with ecosystem restoration.

3.8.4 Private sector acceptability – timing of return

There is some 'CSR return' to the private sector, the timing of matched funding required has to be realistic so that the private sectors spend is worthwhile in this context. As CSR return can be from investments as well as outcomes, this is not a large barrier.

3.8.5 Financial and Spatial Scale

These factors demonstrate that the tax rules allowing hypothecation and the nature of the tax base for the taxes being hypothecated are key factors in the scalability of this instrument. For financial viability, the CSR returns to the private sector are important for leveraging sufficient matched funding. This depends on distinct additional ecosystem restoration actions being undertaken, which can be publicised as providing clear benefits to local communities.

3.8.6 Equity

No major equity concerns are identified with this mechanism.

3.8.7 Transaction costs

In establishing the rules for this tax scheme, some flexibility may be appropriate to get best value from hypothecated taxes. For example, different rules (such as auditing requirements or the level of matched funding) can be applied for different sizes of schemes. So for example, a small-scale scheme could have lower transactions costs, but require higher matched funding.

The rules controlling these factors will also bring transactions costs to the scheme, so there is a trade-off between more detailed funding criteria and monitoring of outcomes, and the higher transactions costs this brings which reduces the amount of funding reaching the schemes outputs.

3.8.8 Added value

This mechanism can potentially provide a strong incentive to lever private sector finance into ecosystem restoration actions. It can promote innovation in ecosystem restoration investments due to leadership from the private sector. However, it requires action from tax authorities and political will to use the tax system to support ecosystem restoration.

3.9 Risk-sharing investment structures (first-loss loans, subordinated debt, etc.)

3.9.1 Description

Specific financial instruments can be designed by the public sector (directly as government, or through a public investment bank like the European Investment Bank (EIB) or KfW in Germany) to share the risks of investments in ecosystem restoration. Such risk-sharing has been undertaken in other environmental policy areas. An example of this is the European risk sharing facility (RSFF). RSFF uses equal funding from the EIB and the European Community to spread the risk between the two. The RSFF has been used to finance improved energy efficiency and reduce greenhouse gas emissions through financing initiatives such as European Clean Transport Facility (ECTF) and the KIDS Fund Energy Efficiency Facility.

Similar risk-sharing opportunities may exist where private and public sector funders can co-invest in ecosystem restoration (e.g. as in the use of green Bonds – see Section 3). The principle for target 2 is that there are potential investments in restoring ecosystems that lead to business activities (e.g. investments to create habitat for a habitat banking market), but that these are not taking place because the market risk-reward ratio is poor. Public intervention is justified for two reasons. Firstly, because there are non-market public benefits (related to nature conservation) that the investments would create that provide ‘return’ on public spending. Secondly, part of the risk associated with investment relates to policy changes (e.g. to agri-environment rules) and so public investment in businesses relying on these policies creates a counter-risk stake for government in relation to policy changes.

A third benefit of intervention can be that by encouraging investments to take place, they provide examples of projects. Where this demonstrates success, this can reduce the perceived risk in similar investments, thereby enabling investment levels to increase.

Many different instrument forms exist though which public institutions can take a share of risks, for example:

- First-loss shares means that the publicly-owned share is the first to lose its stake if the investment makes a loss.
- ‘Soft loans’ can be provided on favourable terms (i.e. lower interest rates).
- Guarantees can be given, ensuring a minimum return on investments.

A number of options available for 'softer' approaches to reduce risk in pro-biodiversity investments are defined above. A key issue is often policy or regulatory risk. Policy can be designed to reduce the risks associated with it (CEMEP[22]), to:

- Include long-term commitments in order to reduce the risk from policy-changes in environmental markets (especially those where regulation of externalities is a driver of the market);
- Be clearly and boldly communicated, and
- Be backed by legal instruments in order to give the right conditions for development of environmental markets.

These actions can be pursued independently or simultaneously and can complement risk-sharing initiatives. The issue of policy design is particularly important to environmental compliance markets, as discussed under bio-carbon and biodiversity offsets.

As risk is a cross-cutting issue, the response to the risk barriers that prevent private sector investment in ecosystem restoration must also be cross-cutting. Two options are suggested.

3.9.2 Suitability

Risk-sharing is an enabling action; they can help finance viable commercial habitat restoration activities. They are thus potentially suitable to support all different types of private sector ecosystem restoration activities, as discussed in this Section.

Where the rate or timing of return on investments in ecosystem restoration would be unattractive to private sector in pure commercial sense, these instruments can be used to make them attractive. This is a different way of using public spending: to broker a commercial deal, rather than through direct grants (the usual approach). The returns can be compared: ecosystem gain per £ in return for grant (e.g. through agri-environment scheme) vs ecosystem gain per public £ from the overall commercial activity being subsidised.

3.9.3 Private sector acceptability – rate of return

For private sector investors, risk is a function of yield (i.e. the variability around realising intended yield), which is in turn based on business models. There are many different types of risks involved in financing of projects in ecosystem restoration. There are issues with measurement units, reporting and the underlying issue of climate change making it very difficult for the private sector to invest.

To be viable the investments supported by these instruments need to be close to being financially viable in market terms. The risk-sharing intervention is then designed to improve their returns by the small amount needed to make them actually viable. They also need to exist on a sufficient scale for an investment approach to be worthwhile. Coverage of a range of different ecosystem restoration projects (in terms of different locations and/or types of ecosystems) leads to a more varied investment portfolio, which reduces risks.

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[22] http://webarchive.nationalarchives.gov.uk/+/http://www.bis.gov.uk/policies/business-sectors/low-carbon-business-opportunities/cemep

3.9.4 Private sector acceptability – timing of return

Investment arrangements of this type typically work over several years (e.g. a 5-year period) in which they place investments, and then expect returns over longer periods. These timescales are suited to some types of private investments (e.g. Bonds), for which, restored environmental assets can theoretically have attractive risk profiles. For example, sustainable forestry management investments are potentially ideal for long-term investors such as pension funds and insurance companies, who are responsible for managing most private sector capital.

3.9.5 Financial and Spatial Scale

Risk-sharing actions need to work through financial market activities. This means they can only work at a relatively large scale, at which the application of financing instruments is worthwhile: for example, the EIB refers to investments of <€10m as 'proof of concept' (i.e. full-scale pilots). That may be appropriate for some ecosystem restoration actions, (e.g. large GI-type restoration investments), but is not the usual scale at which ecosystem restoration activities are organised. Ideally risk-sharing instruments will support ecosystem restoration investments as a package across geographical areas, as this spreads risks (which it is in the public interest to do as a way of supporting ecosystem restoration investments).

3.9.6 Equity

A drawback of risk-sharing approaches is that they can only work at a relatively large scale through financial activities. This means they may not reach some potential ecosystem restoration activities organised on a smaller scale. Getting them to make a difference at this level, by filtering down through the financial system to smaller businesses, requires additional actions, such as through pro-biodiversity business structures.

3.9.7 Transaction costs

Risk-sharing practices bring additional transactions costs through the need to involve financial specialists in designing instruments. Their unit costs can be relatively high for the environment sector, but involve a large element of fixed costs, so the key for reducing them to a smaller % of overall spending is to make the investment arrangements of a sufficient size.

3.9.8 Added value

These instruments offer a new way of spending public money to support private investment in ecosystem restoration. They have been used in other fields (e.g. to subsidise research or energy efficiency investments), and could play a useful role in delivering target 2, by facilitating investments that otherwise would not happen.

3.10 Pro-biodiversity business (PBB) models - investment funds & funding platforms

3.10.1 Description

Pro-biodiversity businesses (PBBs) are businesses whose commercial operations benefit biodiversity. Examples include nature-sensitive farming activities, or the management of fishponds that provide wetland habitats. Support for PBBs can lead to ecosystem restoration through expansion of their activities. This support can attract private investors, possibly in conjunction with public spending (e.g. through a risk-sharing structure – see mechanism 8 above).

PBBs are often SMEs, and so may not exist on a large enough scale to attract private sector investments, but there are approaches that can be taken to improve their access to investment funds in order to expand their activities. Mechanisms for this kind of support can include:

- Improving access to capital - as many PBBs will be micro-businesses, they may not have sufficient assets against which to borrow capital at commercial rates. This may require risk-sharing investments.
- Improving access to a range of existing public support mechanisms. Businesses may qualify for existing funds from many sources (e.g. for small business development, rural development and environmental outcomes), but access to these funds is too bureaucratic and time-consuming to be practical.

The solution can be to create a funding platform (a 'one-stop-shop' service), through which PBB SMEs can access all relevant public funds and private finance. Such a platform can be targeted on a geographical area (e.g. where a particular ecosystem restoration objective exists – e.g. a degraded river catchment). This brings agglomeration benefits for restoration activities, and for business, for example by creating clusters of businesses that can share product certification based on restored ecosystems (see Section 10). Many PBBs focus on the use of certification of biodiversity-friendly products and services.

3.10.2 Suitability

PBB business funding is potentially suitable to support all types of commercially viable ecosystem restoration actions. By increasing the efficiency of investments in PBBs it can also improve the returns on such investments. A PBB funding platform model could be suitable to target funds at the large numbers of SMEs (including, and in particular, farmers) managing degraded ecosystems. In particular where sites are under the ownership/management of numerous SMEs, there may be efficiencies in using such a targeted funding model.

Commercial banks are often not well placed to provide loans to businesses in these circumstances, for example because they are unfamiliar with the public funding context and environmental objectives this is linked to, and because the risks and transactions costs are relatively high compared to normal 'high street' business. NGOs with expertise in ecosystem restoration can perform an important role as an intermediary in these circumstances. A PBB funding platform provides a structure for combining NGO and banking expertise in this way.

A funding platform can be an efficient way to use public funding alongside private investment. It can improve SME's access to existing advice and funds from multiple sources. Advice might include how to apply tax relief in sites, or access to support provided by NGOs. Funds could come from: agri-env and woodland management grants; small business loans;

or PES that were relevant to a specific geographical area (e.g. a particular ecosystem restoration objective).

3.10.3 Private sector acceptability – rate of return

The financial viability of this approach is dependent on the viability of ecosystem restoration actions undertaken by PBBs, and this in turn is often dependent on public subsidies, particularly through the CAP. It is considered to have merit as an approach, based on experiences from 'Biodiversity Technical Assistance Units', and is expected to feature in the next EU multi-annual financial framework.

Where small business loans are offered, this can also be a route for levering private investment into PBBs. For SMEs, this could involve relatively small amounts of investment in activities to restore ecosystems that are not commercially viable in market terms, but which have a positive financial return when current sources of public funding (e.g. agri-env or woodland management payments) are factored in. Public funding influences potential returns because subsidies can increase the opportunity costs of undertaking restoration – coordination of target 2 actions with CAP payments is thus an important part of determining rates of return.

3.10.4 Private sector acceptability – timing of return

The long-term nature of ecosystem restoration actions means that returns may only arise on long timescales. The timescales for this approach is influenced by the timescales over which EU funding is dispersed (typically 5-year budgets), and the periods over which returns on private investments are expected. Ecosystem restoration may encounter problems in that the returns are too long term for many SMEs who could potentially undertake restoration actions, or for using PBB models.

3.10.5 Financial and Spatial Scale

In order to support a PBB investment fund, these activities would need to be organised at a sufficient financial scale. To achieve this would require some coordination across different types of investments. This could be done across different ecosystem restoration investments (e.g. a combined investment in several PBB funding platforms), or by combining them with other types of environmentally-friendly investments (e.g. in energy efficiency). The latter approach would also help to spread risk, and could appeal to the substantial socially-responsible investment market.

3.10.6 Equity

PBB approaches can potentially involve all types of businesses and restoration actions, so do not face major equity issues.

3.10.7 Transaction costs

A dedicated PBB funding platform would have expertise to assess and provide loans for ecosystem restoration actions, based on understanding of the context and objectives, which thus reduces risks, and through a structure that minimises transactions costs. The loans provided in this way could be from a mixture of public and private funds, with public money used to improve the risk-return relationship to the private funds.

A PBB platform could reduce the transactions costs associated with managing and coordinating the different sources of public sector funding that could potentially support businesses undertaking ecosystem restoration. A current pilot project trialling a 'single pot approach' in the UK involves:

- Different public agencies agreeing to work together within a specific geographic area (e.g. a local government boundary) and spending remit (e.g. environmental protection).
- Producing a shared analysis of their priorities in terms of outcomes they want to achieve.
- Sharing breakdowns of their levels and effectiveness of spending towards these different objectives.
- Actions are taken to move funds towards the most efficient ways of achieving the objectives, and to share information to improve the effectiveness of individual agency's functions.

A simple example of the changes that can be made is in relation to illegal waste disposal. This can be a very expensive problem to cleanup (for the local councils) and investigate and prosecute (for the police), but there are effective and relatively cheaper preventative actions that can be taken by the environment agency and local government through their waste regulation and collection activities. Therefore, an agreement could be reached for the police to support local government and environment agency actions by seconding relevant staff into their teams undertaking preventative actions.

3.10.8 Added value

A funding platform can improve the efficiency with which the funds involved are spent. This can be achieved through a 'single pot approach' such as a PBB funding platform. This can provide a focus for channeling private sector funds into ecosystem restoration actions that would not otherwise exist, therefore potentially motivating increased private sector funding.

3.11 Product labelling and certification

3.11.1 Description

This is a particular mechanism through which to support ecosystem restoration actions. Certification can increase access to new markets and improve corporate image. Certain private corporations have been instrumental in setting up performance standards, such the Forest Stewardship Council (FSC; established by UK company B&Q) and the Marine Stewardship Council (MSC; established by Unilever in partnership with WWF). By 2009, 8% of total global forest area had been certified (UNECE/FAO, 2009).

Certification requires an existing product, whose production can be undertaken alongside restoration of ecosystems. This then needs to be verified through an auditable process, which necessitates traceability of products through supply chains (e.g. MSC fish must be handled by certified fish traders and retailers). A recognizable logo for the products is needed to ensure consumers can efficiently differentiate them from products not originating from restored ecosystems. There are already a range of 'sustainable' labels on different processes and products (fairtrade, organic, MSC, FSC, rainforest-alliance coffee, etc) and so there is a danger of proliferation diluting the impact of labelling. Clear messages and advertising may be required to establish and maintain the impact of certification over time.

An example of this is organic farming, which restores soil ecosystems while maintaining agricultural production.

Labels do not always ensure a sufficient price premium to justify the costs of the production practices prescribed by the certification process. However, where ecosystem restoration is being undertaken, labelling can be a way of extracting value from consumers for this process.

3.11.2 Suitability

This instrument is potentially appropriate where ecosystems can be restored and managed to produce commercial goods (often through traditional production processes). The outputs from these processes have commercial value, and therefore a challenge for financing ecosystem restoration is to gain the greatest possible revenue for these products. One way to do this is to make them recognizable to consumers as having been produced in a way that has helped restore ecosystems in Europe. It could be possible to produce an 'ecosystem restoration' label, or to encourage existing ecosystem-friendly labels to ensure they support ecosystem restoration within their eligibility criteria.

Certification is potentially appropriate where site restoration objectives and plans are in place. These plans lay the basis for an auditable way to identify products associated with ecosystem restoration, which is important for any certification to have credibility. It should be noted that certification often attracts scrutiny from civil society and the media, and so transparency and robust information are important.

3.11.3 Private sector acceptability – rate of return

Whether certification results in increased revenue for producers depends on consumers being prepared to pay a price premium for certified produce. The levels of price premiums on certified products are variable in the many different certified markets, so returns are uncertain. They will partly depend on communicating to customers that production practices that work with ecosystem restoration are worthy of a price premium. Any payback from marketing a product in this way depends on the successful launch of the labelled product.

Certification can also result in more stable revenue streams to producers if the retailers can be attracted to commit to stocking certified food. This is because the certification restricts the numbers of suppliers – making it less likely that producers will be undercut by competitors.

3.11.4 Private sector acceptability – timing of return

This instrument could be established relatively quickly, because environmental certification processes are well understood. Markets for certified products can be established more quickly if they are associated with existing commercial markets. It may be an issue that the upfront investment costs to join certification schemes take a long time to be fully recouped, for example certification as Organic agriculture can take a significant time before the initial investment is repaid. However, financing instruments (e.g. risk-sharing structures and/or pro-biodiversity business models) can help tackle these timing barriers.

Commitments by retailers to stock certified products can work best in marketing terms when presented as long-term arrangements. This can translate into longer-term contracts for producers, giving more reliable, if not higher income streams.

3.11.5 Financial and Spatial Scale

A key question would be the scale and branding of the certification. The process of certification should be the same for all produce associated with ecosystem restoration (reflecting restoration plans). However, the scale at which certification is defined to consumers could vary. It could be for all restoration activities or for more specific local ecosystems.

Smaller market areas may be more likely to receive a price premium for restoration actions if consumers see greater connection to their local environment. However, they also face issues of the reliability of production within a smaller area, which may increase risks of supply variations to retailers, and price volatility to producers.

3.11.6 Equity

Labelling schemes enter into a market where a consumer can choose whether the purchase a labelled good or not. The success of the scheme for Target 2 will be dependent on the choice of the consumer. This appears an equitable outcome.

Labelling schemes are often associated with a price premium. Such a premium may make the goods unaffordable to certain consumers, but they should be able to access standard alternatives.

3.11.7 Transaction costs

Certification and labelling schemes have initial and ongoing transactions costs. The initial upfront costs can be diluted with scale. The need to identify certified produce through supply chains means that there are ongoing transactions costs, which will be greater for products with more complex supply chains.

If numerous labelling schemes are in place, retailers and consumers are faced with many schemes that all some research. The i-seal alliance is a response to this[23].

3.11.8 Added value and Conclusions

Labels provide information through a privately organised verification system. Therefore they add value for consumers, for investors to target funding towards certain actions, and for governments to direct spending (e.g. to subsidise MSC fisheries or organic certification). However, their value for target 2 is limited to the extent that consumer attitudes will want to support ecosystem restoration, and by problems with proliferation of labelling schemes. Therefore their potential contribution to target 2 is uncertain.

3.12 Bio-Carbon markets

3.12.1 Introduction

There are a number of ways in which the carbon market could support the protection of carbon-rich ecosystems, such as peatlands and forests in the EU. The nature of the greenhouse gas reduction from peatlands requires consideration use of project based emissions reductions or carbon offsets. While emissions trading results in the dynamic trade of emissions reductions, with reductions occurring on a daily basis in some cases, reductions created by projects are typically generated over a longer timeframe. In addition, the potential to issue credits from carbon offsets projects will need to consider the emissions reduction targets of the country from which they originate. Project based emissions reductions in the EU have only been undertaken in new member states under the aegis of the Kyoto Protocol and Joint Implementation (JI); reductions that fall outside the scope of EU climate policy.

There were two project based mechanisms created by the Kyoto Protocol: the Clean Development Mechanism (CDM) under Article 12, and Joint Implementation (JI) under Article 6. The CDM allows developed countries (Annex I countries) to purchase emissions reductions from projects in developing countries (non-Annex I countries). Given that non-Annex I countries do not have greenhouse gas reduction (GHG) targets under Kyoto, there is no ceiling on the issuance of carbon credits. Under JI however, Annex I countries are required to issue carbon credits out of their national account. Credits would be subtracted from their total amount of allowable emissions or total assigned amount units (determined on the basis of emissions in 1990), which with the exception of economies in transition that received surplus AAUs due to economic restructuring in 1990, is required to meet Kyoto targets. While Member States are able to use reductions from community level projects without any quantitative limit under the Effort Sharing Decision (406/2009/EC), national decisions regarding credit issuance would still be required.

With respect to afforestation and reforestation, it has not typically been possible to claim credits from sinks projects for national compliance as part of the Linking Directive (2004/101/EC) given GHG measurement complexity and the issue of permanence (ie whether carbon sinks can be guaranteed into the future). For this reason, the potential to

[23] http://www.isealalliance.org/

use the carbon market to finance GHG mitigation from peat lands requires a discussion of the appropriate methodology to quantify greenhouse gas emissions, and the corresponding monitoring and verification protocols. A new methodology may be required for soil rewetting for example, although it would be possible to apply the methodology associated with afforestation and reforestation under the CDM.

GHG Quantification and Peat lands

Projects that reduce GHG emissions from peat lands are likely to comprise a combination of mitigation approaches within a given project boundary. Given that the aim of greenhouse gas mitigation is to leverage biodiversity co-benefits, the scope of combined mitigation approaches will need to consider local realities and for this reason is likely to vary as part of different projects. Combined mitigation approaches could include soil drainage and rewetting, reforestation and afforestation techniques. While it would be possible to apply quantification approaches for forestry from the CDM, a new methodology may be required to balance methane reductions from soil draining with the need to need to maintain ecosystems as part of rewetting approaches.

There has been some support for the quantification of greenhouse gas emissions from peatlands in the context of international climate negotiations, but GHG emissions are not currently covered as part of national greenhouse gas inventories.[24] According to the relevant UNFCCC negotiating text, and based on discussions at COP 16 in Cancun, the decision to explore the mitigation potential of wetlands more generally was expressed as follows:

"*Requests* the Subsidiary Body for Scientific and Technological Advice to consider developing a work programme at its Xth session to explore concepts, methodologies and definitions for force majeure, harvested wood products, rewetting and drainage, and alternative methods of accounting for forest management, for consideration by the Conference of Parties serving as the meeting of Parties to the Kyoto Protocol in time for possible inclusion in the third commitment period of the Kyoto Protocol, if appropriate.[25]"

Given the lack of a standardised methodology to quantify GHG emissions from wetlands, the prospect to sell carbon from peat lands restoration will be challenging. Based on previous attempts to monitor oxidation of biomass under the CDM, in relation to composting projects for example, it will be necessary to establish the correct data monitoring protocols; data would need to be gathered based on the appropriate spatial and temporal criteria.[26] Obtaining a representative data set that demonstrates GHG reductions are occurring is crucial in order to guarantee the right data confidence level (typically 95%). Given the uncertainty associated with this type of project, there is the possibility that a pilot phase would be required before annual reductions could actually be claimed and sold. Project based emissions reductions or carbon offsets often require longer lead time in terms of claiming potential reductions and for this reason, they are often sold at a lower price than other carbon assets.

[24].http://www.forestsclimatechange.org/fileadmin/tropical-workshop/Plenary-1/4A_EmmerI_Peatland%20rewetting.pdf
[25]. See: FCCC/KP/AWG/2010/CRP.4/Rev.4, p. 23.
[26]. http://cdm.unfccc.int/methodologies/DB/VYLVMEVLH8QDL95P7KBOEDF6DH1AVD

Issues for further discussion

The potential to develop a carbon market that could leverage investment in to peat lands restoration, will require the development of the appropriate quantification, monitoring and verification protocol. Steps have been taken to create this in the voluntary carbon market in the U.S.; it is possible that these lessons could be applied to the development of an offsets market in the EU.[27] Carbon credits from offsets need to be issued by a government agency responsible for tracking emissions and ensuring that emissions reductions are accurately subtracted from national emissions totals. If countries have stringent reduction targets, they may be less inclined to issue credits that jeopardize compliance with the EU-ETS and Kyoto. Decisions will need to be made at the Member State level regarding potential issuance.

3.12.2 Description

Carbon credit actions of interest here are those that arise through actions that restore ecosystems at the same time as delivering carbon objectives. Possibilities for instruments of this type exist globally in the form of the Clean Development Mechanism with biodiversity features. They also exist in the EU and its periphery in terms of habitat restoration projects that prevent releases of soil carbon (in particular through peatland conservation projects).

3.12.3 Suitability

Restoration actions will often but not always store or reduce releases of carbon. The types and size of carbon benefits will vary for different habitats and locations. However, carbon credits are potentially a suitable instrument for obtaining private sector funding for ecosystem restoration actions.

Restoration of some habitats can increase carbon emissions. For example, converting a plantation woodland to a more biodiversity-rich open structure might reduce carbon storage, but this depends on the management practices followed and the tree species involved.

3.12.4 Private sector acceptability – rate of return

The carbon benefits of some ecosystem restoration actions (e.g. woodland planting, peat bog restoration) are known to be significant, and therefore carbon credit sales have already started to develop for these ecosystems. The extent to which such credits can be sold from restoration actions across large areas of these ecosystems, and from other ecosystems, remains uncertain. However, there are other habitats that are known to store significant quantities of carbon (e.g. intertidal sediments) and therefore further potential exists in this area.

The level of returns are dependent on wider carbon markets, and uncertainties in these markets, and over global climate commitments are therefore a risk to achieving returns. However, some actions by private companies are continuing despite these uncertainties, and therefore some market demand for carbon offsets should be available in the future.

[27] . http://v-c-s.org/sites/v-c-s.org/files/AFOLU%20Requirements%20WRC_public%20consultation.pdf

Identifying viable potential markets requires comparisons of the value of the expected carbon benefits to the costs of restoration activity. Where the value of the carbon benefits is insufficient on its own to support restoration actions, bio-carbon credits could still be a useful source of finance. For example, it could co-finance restoration actions alongside other funding sources (e.g. PES, green infrastructure bonds).

3.12.5 Private sector acceptability – timing of return

Restoration actions can lead to carbon benefits relatively quickly, for example trees sequester carbon as they grow, re-wetting bogs immediately halts loss of stored carbon. In other cases there could be a delay before returns can be realised. Carbon benefits can persist over a long period of time, so this instrument can be suitable for financing maintenance, as well as restoration, of ecosystems.

3.12.6 Financial and Spatial Scale

The scale of this instrument depends on the levels of carbon benefits obtained from restoring different ecosystems. If bio-carbon financing opportunities are available, this could be the subject of detailed further research. The scale of financing that this mechanism could bring to ecosystem restoration is relatively small in the context of global markets for industrial carbon emissions mitigation. Therefore, there are unlikely to be limits on demand for carbon from ecosystem restoration, provided that markets to trade this carbon can be established. Therefore this mechanism can potentially be applied at a large spatial and financial scale.

3.12.7 Equity

As a source of financing bio-carbon credits are in line with the polluter pays principle. However, in the context of ecosystem restoration, they may result in payments to those who have previously degraded ecosystems. This is not in line with the polluter pays principle, and potentially inequitable.

Provided approaches can be established that minimise transactions costs, bio-carbon finance could potentially be accessible to relatively small restoration projects.

3.12.8 Transaction costs

Bio-carbon trading has transactions costs in relation to trading in carbon markets, and in the measurement and verification of carbon credits. Carbon is a homogenous product so carbon markets can be relatively efficient.

Habitats are more heterogeneous, so establishing credits from individual ecosystem restoration locations will have higher costs. The measurement and verification costs can be reduced with standardised measurement protocols s (such as the woodland carbon code[28]). Similar standards for other ecosystems will reduce transactions costs and help markets to develop.

[28] www.forestry.gov.uk/**carboncode**

3.12.9 Added value

Bio-carbon credits can be sold as a result of ecosystem restoration actions, providing a new source of funding for ecosystem restoration. This may be a sufficient source of funding for the restoration of some high-carbon habitats (e.g. peat bogs), or could be complimentary to other financing instruments for a wider range of ecosystems.

3.13 Biodiversity Offsets and Habitat Banking

3.13.1 Description

A biodiversity offset is a mechanism where unavoidable harm to biodiversity caused by a development project is offset by conservation activity elsewhere. It is designed to provide compensation for biodiversity loss (eftec, IEEP et al., 2010). It provides a flexible approach to biodiversity losses within the planning process. Businesses have a choice in how to compensate for the damage caused which provides an efficient approach to regulation. Habitat banking occurs through an intermediary, with offsetting credits being bought from the bank to compensate for current or future environmental damage.

Offsets are funded by developers – often the private sector. At present where it exists in Europe, biodiversity offsetting is mainly a voluntary approach to meeting regulatory standards for compensation, and is not widely used. Therefore, the level of net gain of ecosystems (i.e. restoration) is very small. A mandatory offset system would drive a significantly greater level of action on offsets, and so potentially could make a greater contribution to ecosystem restoration.

3.13.2 Suitability

Strictly 'like for like' compensation, towards a goal of no net loss is unlikely to provide any contribution towards target 2, as any improvements to ecosystems merely compensate for damage elsewhere. However, BBOP's guidelines on offsets ([29]) suggest delivery of net gain is preferable, in particular for critical biodiversity. Planning for net gain can be a response to the uncertainties surrounding the offset process. These gains (but not the rest of the offset) can be a contribution to target 2.

Net gains from offsetting may be more likely to contribute to key aspects of target 2 under a habitat banking system, in which compensation may be undertaken more strategically, and therefore net gain can be directed to contribute to key restoration actions. However, the amount of net gain may be smaller within a habitat banking system. This is because offsets planned as a one-off response to a development projects are unlikely to be completed ex-ante of the development going ahead. This increases the risks involved, which can result in a greater element net gain being built into offset requirements. Within habitat banking there is more certainty if offsets have already been undertaken and stored in a bank, and therefore the level of risks of failure and net gain allowed for may be lower.

[29] http://bbop.forest-trends.org/pages/guidelines

3.13.3 Private sector acceptability – rate of return

Within voluntary offsets markets, private returns can be generated through faster development processes, better access to finance or other business benefits. Considerable regulatory burdens are associated with activities that harm biodiversity. Risks to biodiversity can cause delays accessing new sites and failing to manage the risks appropriately can mean that a business may become uncompetitive with businesses with better practice in managing such risks. Offsets provide a simple, certifiable option for negotiating these regulatory hurdles and consequently are attractive to business. However, these benefits are not currently motivating substantial offsetting activity in Europe. If offsetting is mandatory, a compliance market is formed, in which legal compliance rather than rate of return is the key issue.

In either case, delivering net gain and therefore a contribution to target 2 as part of the biodiversity offsets process may produce CSR returns.

3.13.4 Private sector acceptability – timing of return

Outcomes from offset actions can only be verified after biodiversity improvements have taken place, which may mean delays in realising returns. However, CSR returns can be realised quickly by demonstrating ongoing activities or investments.

3.13.5 Financial and Spatial Scale

Currently, although offsetting is required in Germany and France, it is primarily a voluntary measure elsewhere in the EU and therefore makes little contribution to target 2. However, the EU intends to develop a no net loss policy by 2015 that is likely to increase offsetting, possibly through some form of mandatory requirement. This would undoubtedly greatly increase the scale of offsetting.

3.13.6 Equity

Offsetting is predicated on the notion that the loss of one area of land can be compensated by restoring another piece of land elsewhere. This assumes that biodiversity can be replaced and that the biodiversity *in situ* on the land to be developed have no 'rights' in terms of location.

Offsets designed purely to deliver no net loss of biodiversity may not deliver no net loss of all associated ecosystem services, some of which (e.g. access to nature) are highly location specific.

3.13.7 Transaction costs

The transaction costs for offsetting are can be considerable (determining the rate exchange for damage, establishing sites, regulatory buy-in, etc). In terms of contributing to target 2, the additional transactions costs of delivering net gain rather than no net loss are expected to be small.

3.13.8 Added value and conclusions

While offsets are a voluntary instrument across most of the EU, the amount of offsets activity and contribution to target 2 is likely to remain very limited. This could change if offsets where mandated in more countries or circumstances, and if they are strongly regulated (to ensure protection measures are not weakened and offsets deliver long-lasting additional benefits), strategically planned (eg to help overcome fragmentation impacts) and lead to significant net gains - but the prospects for this are uncertain.

4 ANNEX 4 - CASE STUDIES OF PRIVATE SECTOR FINANCING OF RESTORATION

4.1 Philanthropic donations by companies private for–profit sources to fund actions under Target 2

4.1.1 Quarry rehabilitation, Matasaru, Romania

Parties Involved
Lafarge S.A. (cement/aggregates); World Wildlife Fund (NGO)

Value
€80,000

Funding Source
Privately funded by Lafarge

Objectives
Rehabilitate a 40-year-old aggregates quarry used by Lafarge situated adjacent to the Arges River, one of Romania's most degraded waterways. The land is located on floodplains that have Natura 2000 designated status.

In addition to direct environmental goals the project also sought to improve the environmental education for surrounding inhabitants to promote sustainable agriculture, recreation and fishing practices.

Habitat restoration actions
Lafarge and WWF worked together to improve the biodiversity on 100ha of this 3,600ha Natura 2000-designated floodplain with key actions involving:

- the connection of two lakes to enable frogs and other aquatic species to populate new habitats;
- creating a vegetation belt with native plants to prevent erosion;
- monitoring and removing invasive species; and
- keeping waste-dumping and overfishing in check.

Role of private financing
This restoration project is privately funded by Lafarge working in partnership with WWF. The estimated cost of €80,000 was used directly on conservation projects and earthworks to link the waterways as well as on the construction of a community education centre to train Lafarge employees from other quarry sites and local communities.

Conditions which enabled development
In 2000, Lafarge entered into a conservation partnership with WWF aimed at minimising the company's impact upon the environment and improving its public image through expanded CSR efforts and greater transparency in its CSR reporting.

The collaboration with WWF focuses on five key areas of Lafarge's environmental impact: carbon footprint; persistent pollutants; water consumption; sustainable construction and biodiversity. Importantly the partnership is not project-specific, but is ongoing and has been renewed in 2005 and again in 2009.

Since forming the partnership Lafarge has undertaken biodiversity screening across 94% of its 700+ active quarries, and half of the sites that are in protected areas and/or contain IUCN red-listed endangered species now have Biodiversity Management Plans in place.

For projects such as the Matasaru quarry, the collaboration with a one of the world's largest environmental NGOs meant that Lafarge was able to draw upon WWF's knowledge in conducting site analysis and community consultations during the restoration process, experience that Lafarge's own employees may not have had.

Source:
http://wwf.panda.org/what_we_do/how_we_work/businesses/corporate_support/business_partners/cp_lafarge.cfm
http://riverwiki.restorerivers.eu/wiki/index.php?title=Case_study%3AMatasaru_Area_-_A_new_life_on_the_river_Arges

4.1.2 Moorland Protection Fund, Lower Saxony, Germany

Parties Involved
Volkswagen Leasing Gmbh (motor vehicles); German Nature and Biodiversity Conservation Union (NABU)

Value
€1.6million (on-going)

Funding Source
Funding is provided by VW Leasing which is one the main business lines of the parent company. VW contributes a fixed amount for every new vehicle leased from its Green Fleet each month towards protection of the moorlands: €6.50 for every Passat model leased and €4.50 for a Golf (2009 figures).

Objectives
The project aims to restore moorland in the 'Grosses Moor' region in northern Germany, including the rehabilitation of the 240ha Theikenmeer Lake. The area contains 150 endangered animal species and 40 endangered vascular plant species.

In addition to biodiversity gains, the project also aims to offset some of VW's carbon emissions through the protection of the peat moors which act as natural carbon sinks. The long term objective is to prevent a total of 800,000 tonnes of greenhouse gases being emitted from degraded moorlands. These carbon objectives are not linked to regulatory carbon requirements however and should therefore be viewed only as philanthropic or CSR activity.

Habitat restoration actions

One of the main activities is the reintroduction of water to wetland and bogs that had been severely degraded through long-term drainage (up to 95% drained), peat extraction and over-use of fertiliser on adjacent farmland. Money has also been allocated towards reconnecting fragmented habitats through small-scale purchases of private property in the Aller Valley region.

Role of private financing

NABU uses the money donated by VW to fully fund the moorland restoration projects. In 2011 VW reaffirmed its partnership with NABU and announced it will commit a further €1.6 million to the moorland fund over the next five years.

Conditions which enabled development

VW has worked in partnership with NABU since 2009 to promote sustainable development and CSR activities. NABU is Germany's largest nature conservation organisation and has been in operation for over 100 years. Therefore NABU offers VW a wide-range of experience in the field of conservation and actively advises VW on political and community engagement regarding sustainability issues.

VW and NABU's collaboration includes not only the moorlands restoration fund, but also an education and reintroduction program for native wolves in Germany, the 'Welcome, Wolf' campaign which is financed by VW.

More generally VW has shown a broad willingness to engage with CSR activities and participates in the Dow Jones Sustainability Index. VW was also a founding member of the Biodiversity in Good Company Initiative in 2008 which aims to promote best-practice in biodiversity management from member companies. Despite the German Government ending public funding in 2011 the member companies have take over responsibility and the Initiative is now privately-led.

Source:

http://www.volkswagen-nabu.de/aktivitaeten/biodiversitaet/theikenmeerhttp://www.volkswagenag.com/content/vwcorp/info_center/en/news/2011/12/fonds.html
http://www.business-and-biodiversity.de/en/

4.2 Tax Relief on capital assets in good environmental management

4.2.1 Dutch Green Funds Scheme – tax incentives for environmentally friendly investments, The Netherlands

Parties Involved
Dutch Government; private 'green' banks; private individuals providing finance; projects (e.g. entrepreneurs or farmers) receiving funding.

Value
€12 billion invested over the period 1995-2011.

Funding Source
Tax compensation provided by the Dutch Government provides an incentive to private individual investors who save or invest in green institutions below market returns. 250,000 private households from across the Netherlands have provided finance through the scheme.

Objectives
To promote the greater involvement of financial institutions and small private investors in financing sustainable development projects.

Habitat restoration actions
One of the components of the Green Funds Scheme is the selection and certification of eligible projects, known as the Green Projects Scheme. If meeting the strict requirements, projects are certified as being 'green' by the government agency Agentschap NL and are then eligible to receive funding. There are nine categories of projects, including 'Nature, forests and landscape', 'Organic farming' and 'Soil decontamination' which may specifically lead to ecosystem restoration.

However it is important to note the majority of funds (roughly two-thirds) were directed towards energy efficient greenhouses and renewable energy projects rather than specific nature or biodiversity projects. Nevertheless between 2003-2009 250 square kilometres of organic farming was created through the scheme as well as 1,250 square kilometres being transformed to nature conservation.

Role of private financing
A second important aspect of the Green Funds Scheme is a subsection known as the Green Institutions Scheme whereby specially created 'green banking' arms of major Dutch banks select, finance and monitor projects that meet the Green Projects Scheme criteria. The institutions act as the intermediaries between the projects and private investors by offering deposits; issuing green bonds or green shares in green investment funds. Importantly the interest rate or dividend paid by the bank is generally lower than the market rate, which means that the bank can in turn invest the funds in green projects at a lower interest rate. The time frame of the loan is a maximum of 10 years. In the case of nature development projects, it is 30 years. Under the scheme, at least 70% of the funds must be placed in

certified Green Projects while the remainder can be used in other areas to spread risk (Rubik et al. 2009).

As of April 2011, the green financial institutions operating under this scheme were: ABN Amro Groenbank, ASN Groenprojectenfonds, ASN Groenbank, BNP Paribas Groen Fonds, Fortis Groenbank, ING Groenbank, Nationaal Groenfonds, Rabo Groen Bank, Stichting NOTS RE Investments, and Triodos Groenfonds.

The third aspect of the scheme is the tax exemptions given to private individual investors. Green investors are given an exemption from the 1.2% capital gains tax as well as a reduction on their income tax of 1.3% for investments up to a maximum of €55,145 per person (this figure is valid for 2010 but changes with inflation). Because of these tax exemptions, investors are willing to accept a lower than market interest rate on their savings or slightly lower returns on green investments.

By 2011, the Green Funds Scheme had facilitated over 6,000 projects worth a cumulative €12 billion and over 250,000 private households from across the Netherlands were involved. Over the same period it has been estimated that the scheme 'cost' the Dutch Government around €150 million in granting exemptions.

Conditions which enabled development

The 'Green Funds Scheme' was launched by the Dutch Government in 1995 and the decision to create tax exemptions for green investors allowed private finance to develop. Thus while Dutch banks were already offering socially and environmentally responsible products prior to this, the scheme and its associated government certification greatly increased demand for these products and led to a greater diversity of environmentally friendly financial products offered by the banking sector. The Dutch government plays an important role by providing the legislative basis for the scheme, regulating the green banks, and ensuring that green projects are properly certified by Agentschap NL.

The Green Funds Scheme may also owe some of its success to its flexibility, for instance the original list of project categories has been expanded over time to include less direct environmental impacts (e.g. creation of bike paths) in order to promote ongoing community interest and involvement in what are seen as key priority areas.

Challenges

Although the Green Funds Scheme has undoubtedly contributed to an increase in environmentally friendly investment in the Netherlands, there have been a number of challenges including:

- Strong bias towards energy efficiency (greenhouses) and renewable energy projects while biodiversity projects have attracted far less funding;
- Criticism that the cap on tax exemptions (circa €55,000) is too low and may discourage some wealthier investors;
- Investors have also been found to be extremely sensitive to proposed government changes in fiscal/tax policies which has led to fluctuations in investment;
- Additionality issues regarding whether projects financed by the scheme may have sourced private finance from elsewhere at market rates;

- Information dissemination and community engagement in the scheme require continual effort.

Sources:

Scholtens, B. (2011), The sustainability of green funds. Natural Resources Forum, 35: 223–232.

Rubik F. et al, (2009), 'Innovative Approach in European Sustainable Consumption Policies', Institute for ecological economy research, http://www.ioew.de/uploads/tx_ukioewdb/IOEW-SR_192_Sustainable_Consumption_Policies_01.pdf

4.3 Payments for ecosystem services (PES)

4.3.1 Sustainable Catchment Management Programme (SCaMP), northern England, UK

Parties Involved

United Utilities (water utility); local farmers; Natural England (quasi-government); Royal Society for the Protection of Birds (NGO); DEFRA & government environment/water regulators

Funding Source

United Utilities has provided the bulk of private funding; capital costs have also been recouped through grant-aid from Natural England (through the Higher Level Stewardship agri-environment scheme) and the Forestry Commission (English Woodland Grant Scheme).

Value

The total costs of SCaMP I activity were £12.5m (€15.88m). This is split between public (agri-environment scheme) support of £3.5m (€4.45m), and private sector funds from United Utilities of £9m (€11.43m)[30].

For SCaMP II, UU have proposed to spend £11.6m over the period 2010-2015 (€14.7m). This will be spread over 53 projects, six of which are on common land.

Objective

The primary goal of SCaMP is to invest in conservation activities on water catchment land to secure a wide range of environmental benefits, including improving and maintaining high water quality. The drivers of SCaMP were:

- To deliver government targets for Sites of Special Scientific Interest (SSSIs);
- To enhance UU's biodiversity strategies;
- To boost financial viability of tenant farmers;
- To protect and improve water quality especially water colour; and
- To reduce run off, sediment loads and downstream flooding.

[30] Source: Tinch (2009). Costs calculated at a rate of £1 = €1.27, 16/8/12.

Habitat restoration actions

SCaMP I	SCaMP II
20,000 ha land	**30,000ha land**
13,000ha designated as SSSI	**4,000 designated as SSSI**

Completed habitat restoration actions include:

- All Natura 2000 sites in the Southern Estate and most of those in Bowland are now in favourable or unfavourable-recovering condition (including 98.6% of designated blanket bog);
- 273ha new native broadleaved woodland was created;
- 23ha of degraded Upland Hay Meadow was brought into favourable management;
- 10ha of Upland Heath was restored; and
- 9.3km of new native species hedgerows were established (United Utilities, 2011).

Role of private financing

The main areas of expenditure are on infrastructure such as farm buildings and fencing (necessary to support altered farming systems compatible with the restored ecosystem) of £2m (€2.54m), and moorland restoration expenditure of £10.5m (€13.36m).
Most of the restoration expenditure occurs at the start of the project, but the agro-environment funding is mostly spread across annual payments (through the HLS scheme). UU provided some capital upfront for farmers to undertake capital works enabling them to be eligible for the scheme. This money is paid back to UU from the grants received when farmers become eligible for the agri-environment scheme.

Conditions which enabled development

Key conditions enabling the development of this project included:

- Clear business and environmental case: identification of nature conservation and water colouration problems which are both connected to degradation of upland habitats.
- NGO-private sector partnership in land management developed over several years creating an environment of trust and allowing cooperation between the parties.
- PES schemes need well-defined property rights and multi-beneficiaries from the deal (i.e. win-win) otherwise there will be a lack of incentive to join the scheme: SCaMP was helped due to United Utilities being the landowner and landlord to tenant farmers (it cannot sell the land under the terms of its privatisation). This allocation of property rights meant that farmers had a strong incentive to enter the scheme (e.g. favourable lease conditions, renewal of lease).
- Financial coordination between public and private sectors: long-term public funding through agri-environment schemes was a necessary component for the scheme to be financially viable. However, such funding is normally awarded on a competitive basis to individual farms. Therefore, special arrangements were made: firstly to coordinate an agri-environment funding award across the numerous farms in the project area that could meet the funding criteria; and secondly to arrange in-principle approval for funding, thereby reducing risks to the private water company that its investments would not be matched by the necessary public expenditure.
- This was complimented by the upfront capital provided by UU to farmers for improvement works.
- Willingness of the water company, and other stakeholders, to innovate.

- Support from environmental regulators to attempt innovative catchment approach.

Challenges

- Detailed quantitative data availability on the socio-economic benefits of PES schemes such as SCaMP remain scarce.
- Current Ofwat regulations don't allow expenditure for works on lands not owned by water utilities to be classified as expenditure, but rather it must be reported under 'revenue' – thus potentially reducing the profit margin and acting as a disincentive to scale up. This regulation is currently under review and may change.
- PES schemes require farmers to be interested in participating; it has been noted that in the SCaMP case this was perhaps more straightforward because the farmers involved were tenants on the land owned by the water utility (IEEP 2012). However getting landholder 'buy-in' to PES schemes may be more difficult in cases where the land in question is all privately owned by farmers, or indeed common land, in which case there may be competing incentives (i.e. maximising private returns (stock numbers) vs. biodiversity protection).

Source

http://corporate.unitedutilities.com/about-scamp.aspx
IEEP (2012) Case study "Sustainable catchment management programme: a water company led project in Northern England" for the Natura 2000 Farmland Guidelines study.
Tinch (2009) CASE STUDY ON THE ECOSYSTEM SERVICES PROVIDED BY A SUSTAINABLE CATCHMENT MANAGEMENT PROGRAMME (IN THE UK UPLANDS). Output of the EC project Financing Natura 2000: Cost estimate and benefits of Natura 2000 Contract No.: 070307/2007/484403/MAR/B2

4.3.2 Water catchment management PES, Vittel, France

Parties Involved

Vittel/Nestlé Waters (bottled water); Rhin-Meuse Water Agency; French National Agronomic Institute; Agrivair (agri-environmental consultancy created by Nestlé); local farmers.

Value

Total cost of the scheme between 1993 and 2000 has been estimated at €24.25 million, or approximately €980/ha/year. This breaks down into the following categories for the period between 1992-1999:

- Land acquisition - €9.14 million
- Farm equipment - €3.81 million
- Farm financial compensation - €11.3 million

These figures do not include costs linked to establishing and operating Vittel's Agrivair subsidiary, although the organisation has become partially self-financed through external consulting activities.

Funding Sources

The following funding sources were in place for this project:

- An initial four-year research project was funded by the French National Agronomic Institute (INRA).
- Vittel (owned by Nestlé Waters) privately funded land acquisition, farmer subsidies, ongoing monitoring and the costs involved with the creation of Agrivair.
- A quasi-public body, the Rhin-Meuse Water Agency has also contributed 30% of the building modernisation monitoring costs.

Objectives
Vittel sought to protect the high quality of its aquifer water sources in a water catchment of around 5,100 ha located in the Vosges Mountains in north-eastern France. The primary threat to the quality of its water was contamination of the water table from nitrates and pesticides used by neighbouring farmers for intensive agriculture. Vittel needed to reduce the trend of growing water contamination in order to retain the right to market its product as 'natural mineral water' and preserve its brand.
The PES scheme therefore sought to reduce the run-off of chemicals into the water table by providing incentives to farmers to modernise equipment and modify their fertilisation practices.

Habitat restoration actions
By 2004 the scheme involved the 26 largest farming landowners in the water catchment and covered 92 percent of the watershed area around Vittel's sources. The original number of farmers involved was 37, however a number of the smaller operators sold their farms during the scheme which led to a consolidation of the sector.
Overseen by agricultural consultants from Agrivair, specific conservation actions encouraging farmers to convert to less intensive farming practices included:

- Ending large-scale maize cultivation in the watershed, which had been leaching high levels of nitrates into the soil;
- Replacing maize with low-impact dairy farming and complimenting this with better pasture management involving crop rotation between hay and alfalfa;
- Reducing existing animal stocks to more sustainable levels;
- Managing animal waste and run-off through better composting practices;
- Replacing agrochemicals with organic products (compost) where possible;
- General modernisation of farm equipment and structures to minimise waste generation.

The scheme is widely judged to have successfully changed farming practices, reducing nitrate levels to acceptable levels so that Vittel can continue drawing and selling bottled water from the region.

Role of private financing
The PES scheme created by Vittel is complex and money from Vittel has been used in a number of ways to compensate farmers for any loss of income they may have suffered as a result of changing their farming practices.
Specific actions included:

1. Long term security through 18- or 30-year contracts.
2. Abolition of debt linked to land acquisition, and land acquired by Vittel left in usufruct for up to 30 years.

3. Subsidy of, on average, about €200/ha/year to ensure a guaranteed income during the transition period and reimburse the debt contracted before entering the programme for the acquisition of farm equipment. The exact amount was negotiated on a farm-by-farm basis.
4. Approximately > €150,000 per farm to cover the cost of all new farm equipment and building modernisation.
5. Free labour supplied by Agrivair to apply compost in farmers' fields. This is to address the labour bottleneck and ensure optimal amounts are applied on each plot. These amounts are calculated for each plot for each farm every year, and individual farm plans are developed every year.
6. Free technical assistance including annual individual farm plans and introduction to new social and professional networks. This is particularly important as giving up the intensive agricultural system alienated farmers from traditional farming networks and support organisations such as the Farmers Federation and the Chamber of Agriculture.

Conditions which enabled development

Vittel (owned by Nestlé Waters) created an intermediary organisation, Agrivair, to negotiate with farmers and implement the project. As an environmental consultancy, Agrivair entered into extensive dialogue with farmers and the local community and also offered on-going support (e.g. labour provision) during the transitional phase of farming practices. The establishment of Agrivair was seen as a key step. Many Agrivair employees had previous working relationships with local farmers and were able to overcome any trust issues between farmers and the large multinational. Such trust was essential for the PES to operate effectively.

This success of PES in this application has also been seen by Danone Water France who own a number of bottled water brands. They are involved in PES schemes in the watersheds surrounding its Evian and Volvic sources since 1992 in an effort to ensure the security of its water quality.

Challenges

The following are the challenges faced in operating this type of PES scheme:

- PES schemes involving multiple private landowners are costly and complex to set up, they make take a number of years to function effectively;
- Building trust between the parties is essential and may require an intermediary (e.g. Agrivair);
- France has strict laws governing the re-zoning of agricultural land to other uses.

Source:

Perrot-Maître, D. (2006) The Vittel payments for ecosystem services: a "perfect" PES case? International Institute for Environment and Development, London, UK. Hyperlink: http://www.katoombagroup.org/~katoomba/documents/tools/TheVittelpaymentsforecosystemservices.pdf

4.3.3 The 'Drinking water forest' water catchment PES/offset, Rhön Biosphere Reserve, Germany

Parties Involved
BIONADE Gmbh (soft drink producer); Trinkwasserwald e.V. (Environmental NGO); private and public landowners

Value
Circa €1 million between 2008-2011 (ongoing commitment).

Funding Source
This project is privately financed by BIONADE using Trinkwasserwald e.V. as the project delivery manager.

Objectives
These are the objectives of the project:

- Safeguarding the quality and long-term supply of BIONADE's water source by creating 130ha of deciduous broadleaf forest
- Offset the amount of water used by BIONADE for its products and improve the quality and management of watershed to ensure continued high supply of water for its products.
- Long term goals are to generate 100 million litres of additional groundwater or drinking water (equivalent to the annual consumption of potable water by BIONADE).
- Improve the biodiversity in water catchment areas.
- Improve education and awareness of the importance of water resources and catchment areas.

Habitat restoration actions
Trinkwasserwald e.V. has been involved in the conversion of monoculture coniferous forest into deciduous broadleaf forest to increase the generation and filtration of groundwater. With the funding received by BIONADE, Trinkwasserwald e.V. has planted over 60ha of deciduous forest on eleven different sites since 2008 (both public and private forest). Each hectare converted into deciduous forest from monoculture is estimated to provide an additional 800,000 litres of water per hectare per year. Conversion involves specific actions such as: ground preparation, buying nursery stock, planting and fencing, possible re-plantings and on-going monitoring and upkeep.

Role of private financing
BIONADE Corporation has covered the costs of converting forest and the associated restoration actions undertaken by Trinkwasserwald e.V. Costs of converting one hectare of monoculture coniferous forest to deciduous broadleaf forest are estimated to be approximately €6,800/ha. This figure includes potential ongoing costs such as maintenance of seedling cultures and replanting and Trinkwasserwald e.V. pays landowners for the upkeep as the costs occur.

Conditions which enabled development

The Drinking Water Forest scheme is another example of the private sector forming a partnership with an NGO that has experience in biodiversity management. Trinkwasserwald e.V. has been in operation since 1995 and specialises in converting forests to increase their biodiversity richness and water generation. In 2008 when BIONADE sought to minimise its environmental impact and protect its water sources it formed a partnership with Trinkwasserwald e.V. which has enabled BIONADE to privately finance projects while using Trinkwasserwald's expertise in land-use management as an intermediary between forest landowners and BIONADE. BIONADE is also a member of the now privately-led Biodiversity in Good Company Initiative.
The varied objectives of BIONADE's involvement in habitat restoration mean that it does not clearly fit into a single category of private finance mechanism. While BIONADE's financing of restoration efforts in its own supply watershed may be classified as a PES scheme, restoration actions at other sites in Germany with the express aim of compensating for the 100,000 million litres used by the company annually, may be more akin to a voluntary offset program. Finally, BIONADE's education and awareness campaigns can be labelled as CSR or philanthropic financing.

Source:
http://www.business-and-biodiversity.de/jp/factbook/bionade.html
http://www.wrrl-info.de/docs/wrrl_steckbrief_waldumbau.pdf
http://www.forestry.gov.uk/pdf/FRMG004_Woodland4Water.pdf/$FILE/FRMG004_Woodland4Water.pdf

4.4 Industry-led certification schemes

4.4.1 Wildlife Estates label – industry-led certification of hunting estates that are being managed in a biodiversity sustainable manner, Europe-wide

Parties Involved
European Landowners Organisation (organising body) & various private hunting/fishing estates from Belgium, Czech Republic, Denmark, Finland, France, Germany, Portugal, Spain, Sweden, UK (mainly Scotland)

Value
Undisclosed

Funding Source
Funded privately by the various estate landowners.

Objectives
Broadly speaking, the Wildlife Estates initiative seeks to help landowners involved in the hunting and recreational fishing industry bring their environmental management in-line with European legislation such as the Habitats Directive and Birds Directive that make up Natura 2000. On some estates this may involve a programme of ecosystem restoration actions.

More specifically the Wildlife Estate's website lists the following objectives:

- Estates must engage the private and public sectors in collaboration to halt and reverse the loss of biodiversity;
- Estates must promote, implement and share contemporary best practices in game and wildlife management to maximise the range of benefits they deliver;
- Estates must improve the political and public understanding and perception of private estate management, and what they deliver in terms of economic and other public benefits;
- Estates must provide a framework within which management initiatives designed to resolve conflicts and secure a sustainable balance between different interests and species can be developed and promoted;
- Estates must provide and disseminate robust information about wildlife management for educational, decision-taking and policy-making purposes.

Habitat restoration actions

The Wildlife Estates Label represents a public commitment by land owners to voluntarily set out to achieve the highest standards of wildlife management and conservation that deliver a wide range of social, economic and environmental public benefits. Estates wanting to be certified must provide an environmental management framework that outlines how recreational and biodiversity interests will be balanced moving forward.

To receive the WE label, an estate or territory must fulfil all eligibility and generic criteria and obtain a minimum total score. There are also further specific indicators assessed against an evaluation grid that varies depending on the bio-geographical region (in-line with the regional classifications contained in the Habitats Directive 92/43 CEE, 21 May 1992).

Under the Level 1 certification landowners must adhere to the following ten commitments:

- Identifying a manager and supervisor of the estate concerned.
- Undertaking active wildlife management following a long-term integrated wildlife management plan.
- Maintaining records and monitoring the implementation of the wildlife management plan.
- Undertaking sustainable shooting, stalking and/or fishing according to the European Charter on Hunting and Biodiversity.
- Managing for a sustainable balance of game and wildlife and their shared habitats.
- Improving, whenever possible, biodiversity and species notably those favourable to pollinators.
- Compliance with all legal requirements, relevant National codes of practice and European Environmental legislation (e.g. Natura 2000).
- Adhering to the requirements of the Agreement between Birdlife International and FACE on Directive 79/409/EEC, the European Charter on Hunting and Biodiversity and the EU Commission's Guide on Hunting under the Birds Directive.
- Maintaining active engagement with local communities and undertaking education/awareness raising activities.
- To make the required effort to apply for Level 2 Accreditation process within 2 years.

Role of private financing
Under an industry-led certification scheme such as the Wildlife Estates initiative, landowners must use their own money to improve their environmental performance to at least the minimum standard required to become accredited.

Conditions which enabled development
The Wildlife Estates initiative was created in 2005, driven by industry discussion on bringing sustainable hunting/recreational fishing that promoted biodiversity in line with Natura 2000 as landowners wanted to be proactive in abiding by stricter EU laws regarding land management. A core focus of founding members was to encourage the dissemination of best practice principles in estates management across different sites in Europe.

One of the key steps has been bringing the scheme under the overall direction of the European Landowners' Organisation (ELO) which has streamlined the certification process between estates in different countries as well as coordinated interaction with the EU, where the ELO was already substantially engaged.

The Wildlife Estates label has also received political support from the EU's Environment Commissioner, Janez Potocnik, which may further add to its credibility and ability to attract new members.

Source:
http://www.wildlife-estates.eu/

4.5 Hypothecated Funds

4.5.1 Landfill Communities Fund (LCF), UK

Parties Involved
Landfill operators; ENTRUST (regulator); environmental/conservation bodies.

Funding Source
Habitat restoration actions undertaken by environmental bodies are funded by taking a percentage of the payments made by landfill operators to the Landfill Tax.

Value
As of December 2012, the LCF has received over £1.2 billion from landfill operators over the programme's life since 1996.
Nearly £48 million has been spent specifically on over 1,300 biodiversity conservation projects (see objective DA below).

Objective
Money granted under the LCF is used to 'offset' some of the negative impacts that landfill sites have on the surrounding environment.

Habitat restoration actions

There are six main categories of works that money from the LCF may be used for encompassing a range of social and environmental projects. An important principle is that the projects are not-for-profit and generally located within ten miles of the landfill site. Most pertinent to biodiversity restoration is:

- Object DA: Protect or enhance a species or its environment where it naturally occurs – past projects have included restoring estuarine salt marshes, improving otter habitats.

The following two objectives may also contribute to biodiversity restoration in certain projects:

- Object A: Remediation or restoration of land which cannot now be used because of a ceased activity - past projects have involved soil decontamination of industrial sites.
- Object B: Reduction of pollution – past projects have involved fish re-stocking in previously polluted waterways.

Role of private financing

The LCF is a hypothecated tax credit scheme whereby operators of landfill sites contribute money to accredited Environmental Bodies (EBs) carrying out projects that meet environmental objectives contained in the Landfill Tax Regulations.

Landfill operators can contribute up to 5.6% of their landfill tax liability to EBs, and reclaim 90% of this contribution as a tax credit. They may bear the remaining 10% themselves, or else an independent third party can make up this 10% difference to the landfill operator.

Conditions which enabled development

The LCF was created during the introduction of the Landfill Tax that was introduced in 1996 as a means to reduce the amount of land-filled waste and to promote a shift to more environmentally sustainable methods of waste management. Under the scheme landfill operators have a statutory obligation to pay a tax to the Government for every tonne of waste that they dispose of in the landfill site.

Challenges

Hypothecated tax funds such as the LCF are often subject to criticism from central government finance ministries for diverting revenue away from central accounts and general public expenditure. This scrutiny over the justification of hypothecated funds is likely to be intensified in the current climate of austerity.

Hypothecated funds for biodiversity restoration will work most effectively when a direct link can be drawn between the costs associated with the revenue raising source (in this case the landfill industry's negative effects on the environment) and the benefits obtained from spending the fund (restoring habitats near landfills). In the case of the LCF there is a clear link between the negative externalities arising from landfills and the Objectives A (land remediation/restoration), B (reduction, prevention or mitigation of effects of pollution) and DA (conservation of specific species or habitat) providing that they are located within the geographical impact zone of a landfill. One example is the £150,000 that was spent under Objective DA on Mid Yare Fen Restoration in Norfolk (matched by £177,000 from Natural England) involving the clearing of 27ha of scrub and rehabilitation of silted-up ditches over a total fenland area of 104ha – a clearly linked biodiversity benefit. However, the LCF has also

funded skateboarding parks, arts centres and religious buildings under Objective E (repair, maintenance or restoration of a Place of Worship or a Place of Architectural Importance).
Therefore any potential for scaling up hypothecated funds should maintain the direct link between the damage and restoration actions, as well as being proportional (i.e. not penalising current operators for historical industry damage).

Ecosystem Targeting
A hypothecated fund could be created to specifically benefit Natura 2000 sites and/or restoration of ecosystems, but being targeted solely at these might be regarded as too restrictive for the businesses involved and relative to the locations required. For the businesses spending their own money alongside the hypothecated tax, they want to fund a range of things which give them the best CSR and PR profile with the local communities. Only allowing investment in certain circumstances restricts the range of options they could invest in.

Source
http://www.entrust.org.uk/home/lcf

4.5.2 Aggregates Levy Sustainability Fund (ALSF), UK

Parties Involved
Department for Environment, Food and Rural Affairs; Natural England (quasi-government environmental manager); private sector companies involved in aggregates extraction; various community and conservation groups UK-wide.

Funding Source
Habitat restoration actions undertaken by environmental bodies were funded by a percentage of payments made under the Aggregates Levy tax that is paid by companies involved in the extraction of aggregates.

Value
During the 9 years during which the ALSF grants scheme has operated, Natural England awarded some 777 projects worth in the order of £49.5 million (Natural England, 2011).

Objective
The ASLF aimed to provide and promote practical conservation and improvement of the landscape, biodiversity and geo-diversity elements of the natural environment. Specifically projects funded under the ASLF sought to either:

- address or prevent damage arising from aggregates extraction in areas of high nature conservation or landscape value; or
- consolidate the positive effects of aggregate extraction.

Habitat restoration actions
Money from the ASLF was used to fund a number of habitat restoration actions including:

- on-site quarry rehabilitation;

- supporting delivery of national, regional and local targets for Biodiversity Action Plans, Geodiversity Action Plans, Habitat Action Plans and Species Action Plans;
- supporting delivery of objectives of local and national policies and plans, e.g.: Areas of Outstanding Natural Beauty, Local Conservation Areas

Role of private financing
The ALSF was a hypothecated tax scheme whereby a percentage (around 7%) of money paid by aggregates companies under the Landfill Levy (worth nearly £300 million annually) was diverted into the ALSF to be used on restoration projects.

Conditions which enabled development
The ALSF was setup using money generated from the introduction of the Aggregates Levy in April 2002. Under the scheme any company involved in aggregates extraction in the UK must pay the levy (£2.00 per tonne) to deal with the costs to society arising from the extraction process not already covered by regulation.

The Aggregates Levy aims to bring about environmental benefits by making the price of aggregate extraction better reflect its effects on the surrounding environment such as noise, dust, visual intrusion, amenity loss and biodiversity loss. It also aims to encourage the aggregate extraction and related industries to minimise resource use, use alternatives and recycle products where possible.

Challenges
Following a spending review driven by austerity measures, the ALSF was scrapped by DEFRA in 2011. This decision was widely criticised by both conservation groups as well as industry groups such as the Mineral Products Association that has called for a modified ALSF to be reintroduced.

Source
http://www.naturalengland.org.uk/ourwork/conservation/biodiversity/funding/alsf.aspx
http://www.mineralproducts.org/11-release022.htm

4.6 Risk-sharing investment structures (first-loss loans, subordinated debt, etc.)

4.6.1 Verde Ventures debt financing scheme for small and medium enterprises (SMEs)

Parties Involved
Conservation International/Verde Ventures; partner investors; more than 40 beneficiary SMEs;

Funding Source
Verde Ventures receives funding from a range of investors from the public (e.g. French Development Agency) and private spheres as well as non-governmental organisations (Global Environment Facility).

One prominent private investor has been the Starbucks Coffee Company which has provided $4.5 million to be used as loans for capital purchases by small-scale coffee and cocoa producers.

Value
$19.9 million invested (as of June 2012)

Objective
Provide financial support (through available and affordable capital) to SMEs operating in sectors that benefit conservation and human well-being e.g. agro-forestry; alternative fuels; ecotourism; sustainable fisheries.

Habitat restoration actions
To June 2012, Verde Ventures' loans have directly supported the protection and restoration of over 464,000ha of habitat. Financially, the money invested is estimated to have generated over $134 million in sales of eco-friendly goods and services.

One project that has been highlighted by Conservation International as a success has been the use of Verde Ventures loans to part finance an expansion and capital works at the Playa Viva eco-hotel in Mexico. Playa Viva opened in 2010 and plays an active role in the conservation of the highly endangered Leatherback Turtle at its 'La Tortuga Viva' nesting site managed by local fishermen, staff and volunteers.

Role of private financing
Verde Ventures provides debt financing of between $30,000 - $500,000 for SMEs that are environmentally friendly and contribute to sustainable development.

Conditions which enabled development
Conservation International, the parent organisation behind Verdes Ventures, is a large, well-established environmental NGO that has developed expertise in ecosystem finance and built partnerships with private companies over more than two decades. Conservation International has worked with Starbucks Coffee since 1998 on ethical sourcing of its products and was thus able to convince the company to sign up to the Verde Ventures loan programme.

Verde Ventures has also been able to scope potential projects and attract investors through Conservation International's local networks in over forty countries.

Challenges
Although Verde Ventures presents an informative case study in providing debt financing for projects contributing to ecosystem restoration, it has not yet funded any activities in Europe despite the backing of European donors.

Source
http://www.conservation.org/GLOBAL/VERDEVENTURES/Pages/partnerlanding.aspx

http://www.playaviva.com/pressroom/news/conservation-internationals-verde-ventures-to-fund-next-growth-development-at-playa-viva

4.7 Pro-biodiversity business (PBB) models - investment funds & pro-biodiversity business models - funding platform

4.7.1 EBRD pilot study to establish pro-biodiversity businesses in the steppe zones, and Biodiversity Technical Assistance Units (BTAU)

Parties Involved
Steppes Project: European Bank for Reconstruction and Development (EBRD); Royal Society for the Protection of Birds (RSPB); Fieldfare International Ecological Development; local small and medium enterprises (SMEs)

BTAU: EC DG Environment; European Bank for Reconstruction and Development (EBRD); Royal Society for the Protection of Birds (RSPB); local conservation partners; local small and medium enterprises (SMEs)

Value
Unknown

Funding Source
Steppes Project: European Bank for Reconstruction and Development
BTAU: EC DG Environment

Objective
Create a platform through which local small and medium enterprises (SMEs) can become involved in delivering economically viable biodiversity conservation activities in the Eurasian Steppes region.

Both projects aimed to identify financial instruments and market mechanisms that can ensure the long-term sustainability of ecologically friendly SME operations in the region. Specific measures include developing:

- An adapted company assessment toolkit
- The establishment of one or more Biodiversity Technical Assistance Units
- A biodiversity monitoring system
- Identifying and applying financial mechanisms and instruments for investment
- Information on PBBs and lessons learnt disseminated

Habitat restoration actions
There may be both direct and indirect benefits to the local environment from the creation of pro-biodiversity business models. One of the potential direct benefits is the conversion of intensively farmed land (and its associated use of pesticides and agro-chemicals) into

organic farming that requires far less chemical inputs. In the Eurasian Steppes region, in addition to more sustainable forms of livestock grazing, organic farming/viticulture may also encompass activities such as medicinal plants and honey production.

Another form of pro-biodiversity business model that could be adopted by local SMEs is an emphasis on ecotourism activities such as bird watching or sustainable recreational fishing/hunting.

A final business model may be the use of organic material such as manure to contribute to renewable energy production although this is likely to be only on a very small scale. Potentially a larger opportunity may be in the restoration and management of land such as peat bogs for carbon sequestration.

Role of private financing
Using a Public-Private Partnership (PPP) model, the pilot schemes seek to link commercial loan funding with public subsidies to produce long-term sustainable outcomes. The schemes encourage active ecosystem management to be undertaken principally by private businesses, involving SMEs who commit a proportion of their own efforts to ecosystem restoration.

Conditions which enabled development
Pilot of technical research report.

Challenges
Despite a number of pilot schemes being conducted in Eastern Europe and the steppe region, there is a lack of available quantified data regarding the tangible outcomes of efforts to create pro-biodiversity businesses.

Source
http://www.smeforbiodiversity-steppes.com/index.php
http://www.smeforbiodiversity.eu/

4.8 Biodiversity offsets

4.8.1 CDC Biodiversité pilot offsets scheme, Saint-Martin-de-Crau, France

Parties Involved
CDC Biodiversité (subsidiary of Caisse des Dépôts); Bouches-du-Rhône Chamber of Agriculture; Mediterranean Institute of Marine and Terrestrial Biodiversity and Ecology; developers; local conservation groups;

Value
Approximately €13 million for the purchase and rehabilitation of the site.
This equates to around €38,000/ha (estimated 2012)

Funding Source
Initial land purchases (i.e. setting up the habitat bank) were made by CDC Biodiversité. Objective is then to on-sell land to developers to recoup costs for sourcing and maintenance of offsets with contracts lasting 30 years. To date, two developers have agreed to 30-year contracts.

Objective
Located near a high-growth corridor of southern France between Marseille and Montpellier, and adjacent to the Cossouls de la Crau Nature Reserve, the aim of the pilot scheme is to see whether CDC Biodiversité can successfully create and operate an offsets scheme whereby it acts as a third party intermediary between developers and groups concerned with biodiversity conservation.

More specifically, the habitat banking scheme aims to restore 357 hectares of peach orchards (the 'domaine de Cossure' which was abandoned due to bankruptcy in 2005) into sustainable grazing areas for ewe herds as well as suitable habitats for the many endangered bird species found in the area.

Maintaining some sustainable economic activity on the site is also an objective and in addition to the employment created during the realisation of the project, small-scale low-intensity grazing has been encouraged.

Habitat restoration actions
Rehabilitating the site to its natural state (as the last Western European steppe) has required substantial effort with work commencing in 2009 on the removal of the old peach orchard and windbreaks; removing irrigation equipment and filling in ditches; and decontaminating the soil from agricultural residue. Where possible, these uprooted trees were then used for firewood and the PVC pipes were recycled for use on nearby projects. Large amounts of earthworks have also been required to recreate as far as possible the pre-existing topography, soil and vegetation.

Another key element of the rehabilitation of the site is the reintroduction of sheep grazing (using a local breed from Arles) which commenced in 2010. Under the management of two shepherds, there are now over 1,600 sheep grazing on the Crau site under strictly controlled temporal guidelines, helping to maintain healthy vegetation levels and keep invasive species at bay.

Role of private financing
Although backed financially by a quasi-public investment agency, CDC Biodiversité has essentially acted in a private manner in taking-on the risk of the project until developers can be enticed into the scheme. By November 2011, two contracts had been signed with development authorities that covered 80 hectares of the site, just under a quarter of the total.

Conditions which enabled development
CDC Biodiversité is a 100% subsidiary of the Caisse des Dépôts, a public French investment bank that was created to finance projects that have overriding benefits to society such as

social housing, transport and environmental conservation. Using the finances provided by Caisse des Dépôts, CDC Biodiversité was able to pay upfront to purchase the land in one hit, ensuring a contiguous offset site, something local community groups or even developers may not have been able to afford without similar backing.

Challenges

Although developers in France have been required to compensate for any loss of biodiversity through their actions for several decades, strict like-for-like offsets are not legal requirements in France and the market is much less developed than in other countries such as Australia or the USA – countries that have legislatively explicit offset requirements (e.g. Victorian Natural Vegetation Management Framework and its requirement of No Net Loss).

Source

Eftec: http://ec.europa.eu/environment/enveco/pdf/eftec_habitat_case_study.pdf
http://www.actu-environnement.com/ae/news/cdc-biodiversite-cnrs-imbe-restauration-compensation-vergers-cossure-16042.php4
Pauline REY-BRAHMI, 'Premiers contrats de compensation biodiversité dans la plaine de la Crau', 16-11-2011, http://www.novethic.fr

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