

**AGRICULTURE AND BIODIVERSITY:
REPORTING ON TRENDS AT EUROPEAN LEVEL**
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Ecosystem/Habitats Impacted by Agricultural Activities

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ABSTRACT

Agriculture is one of the main driving force which influences biodiversity in Europe, both in the European Union (15 countries) and on the whole continent. It is a support to biodiversity as well as a source of pressure. All main ecosystems are affected though in different ways, depending on the type and intensity of the pressures, such as dramatic change in land-use towards intensification or abandonment of land. Important differences also occur depending on the biogeographic context. The political framework is evolving rapidly towards enlargement of the European Union, as well as towards commitment for a Sustainable Development. There is an increasing need to monitor trends of biodiversity in relation to main sectors, such as agriculture. Compared to other environmental fields, Biodiversity indicators had remained little developed till recently, mostly due to data limitations, in particular temporal information. On behalf of EEA, the European Topic Centre on Nature Protection and Biodiversity is working towards the development of a Core set of indicators to be used for regular reporting on biodiversity state and trends at European level but also as a guidance for a future regular monitoring at European level. Preliminary work has been done on indicators related to grasslands. Collaboration between international organisations acting in this field, including OECD, is very much needed.

Key-words: Agriculture, biodiversity, impacts, ecosystems, Europe, indicators, grasslands, monitoring.

INTRODUCTORY STATEMENTS

Whether we consider Europe as a continent or as the ensemble of the 15 countries which constitute the European Union (EU), the historical dimension of its human occupation remains as an essential characteristic and, as one of its results, a high proportion of its surface area is dedicated to agriculture (in 1997 about 42% of the pan-European territory and 44% of the European Union). This means that contrary to tropical and subtropical systems in which biological diversity is concentrated in ecosystems sparsely populated by humans, European biodiversity is largely shaped and determined by agricultural and pastoral activities at different degrees, depending upon biogeographical and bioclimatic characteristics and economic situations.

However, even if shaping biodiversity, agricultural practices may be and actually are an important source of pressures on biodiversity, as witnessed by some effects of the Common Agricultural Policy during the first thirty years of its implementation, between 1960 and 1992, at a time when no environmental considerations had been taken into account. During the last decade, a number of legal measures and initiatives have been launched in order to counteract the negative effects of policies adopted in the past.

According to its founding regulation (EC Regulation 1201/90 amended 933/99) (European Environment Agency, 1999a), the European Environment Agency (EEA) - created in 1990 and officially launched in 1993 in Copenhagen - “aims to support sustainable development and to help achieve significant and measurable improvement in Europe’s environment, through the provision of timely, targeted, relevant and reliable information to policy making agents and the public”. A major political framework is the Sixth Environment Action Programme of the European Community 2001-2010: “Environment 2010, Our Future, Our Choice”, still under discussion (European Commission 2001a), which identifies four priority areas: Climate Change, Nature and Biodiversity, Environment and Health, Natural Resources and Waste. The recent adoption of a European Union Strategy for Sustainable Development (European Commission 2001b) is also an important background.

Reporting on environmental trends at European level as a result of European policies is thus a key mission of the EEA. Five Topic Centres are in charge of specific thematic areas, in support to the EEA. The European Topic Centre on Nature Protection and Biodiversity (ETC/PNB), established in Paris at the National Museum of Natural History as a decentralised branch of the EEA, is in charge of evaluating and quantifying the current status and trends of European biodiversity.

Collection of information on biodiversity at European level still faces large difficulties, due to differences in reporting format by countries, scarcity of some data, lack of long-term series of data. Furthermore, there is still a considerable lack of knowledge on cause-effects relationships allowing to relate some biodiversity trends to certain types of pressures. In addition, contrary to air or water quality, waste or noise, it is very difficult to define both a baseline and a target for an «optimal biodiversity» as an expression of sustainability. Building on existing information available from Countries, international NGOs, EUROSTAT, Commission data, OECD, as well as other sources, EEA and its ETC/NPB have started to assess some aspects related to Agriculture and Biodiversity issues.

AGRICULTURE AND BIODIVERSITY IN EUROPE: COMPLEX INTERACTIONS

Looking at the overall relationship between agriculture and biodiversity, main driving forces to changes in European landscapes and ecosystems include:

- Spatial competition between land dedicated to agriculture and land maintained in a natural or semi-natural state
- Fragmentation of natural and semi-natural habitats, intensively cultivated areas acting as a barrier to some vulnerable and specialised species
- Agriculture intensification or conversion to plantation forestry with consequent overexploitation of natural resources, pollution and eutrophication by damaging use of pesticides and fertilisers
- On the other hand, abandonment of land in marginal agricultural regions, with consequent progression towards fallow and scrubs, often leading to a more banal type of biodiversity
- Differences in farm management

Ostermann (1998) proposes a scheme which highlights the correlation between polarisation of agricultural activities, towards intensification or abandonment and loss of biodiversity values; the highest biodiversity values being generally associated with low intensity systems, i.e extensification of practices (Fig. 1)

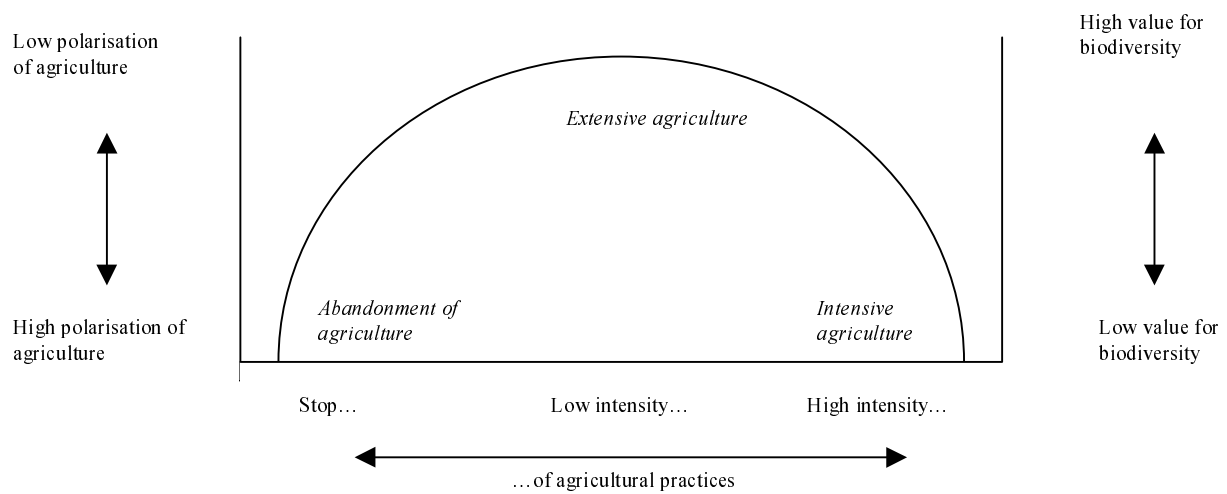


Fig. 1 Relationship between biodiversity values in agricultural lands and the polarization of agriculture.

This is in a way confirmed when comparing the estimated proportion of agricultural land under low-intensity farming in some European countries (Table 1) and the proportion of country surface area proposed as Sites of Community Interest (SCI) under the Council Directive on the conservation of natural habitats and of wild fauna and flora (92/43/EEC) – so-called Habitats Directive -, a major Community legal instrument for nature protection in the European Union (Table 2):

European Country	Land surface area (ha)	Utilised Agricultural Area (UAA ha)	Farmland under low-intensity systems (ha)	Low-intensity farmland as percentage of UAA
France (EU)	54 702 600	31 016 400	7 754 000	25
Greece (EU)	13 194 400	9 183 300	5 600 000	61
Hungary (AC)	9 303 000	6 493 500	1 500 000	23
Ireland (EU)	7 028 300	5 650 750	2 000 000	35
Italy (EU)	30 122 500	22 650 000	7 100 000	31
Poland (AC)	31 267 700	19 135 800	2 735 000	14
Portugal (EU)	9 208 200	4 558 100	2 735 000	60
Spain (EU)	50 478 200	30 589 800	25 000 000	82
United-Kindom (EU)	24 413 900	18 425 500	2 000 000	11

EU = Country belonging to the European Union

AC= Accession Country

Table 1 : Estimates of areas of low-intensity farmland in each of the nine European countries studied by Baldock et al (1994)

In the case of Denmark and Netherlands the percentage of national territory proposed as Sites of Community Interest (SCI) under the Habitat Directive is quite high but this is a bias due to the large proportion of marine area (Waddensee in NL). Apart from this, Spain, Greece and Portugal reach the higher score. The SCIs proposed by these countries include large areas in hilly or mountainous regions, steppe plains, the Iberian Dehesas and Montados, all types of extensively farmed systems.

European Union Country	Nb of proposed Sites of Community Interest (SCI)	Surface area proposed	Percentage of the national territory proposed as SCI
Austria	127	9 144	10,9%
Belgium	209	1 105	3,6%
Denmark	194	10 259	23,8%
Finland	1 381	47 154	13,9%
France	1 030	31 444	5,7%
Germany	2 196	20 434	5,8%
Greece	236	27 228	20,7%
Ireland	362	9 907	14,1%
Italy	2 507	49 364	16,4%
Luxembourg	38	352	13,6%
Netherlands	76	7 078	17%
Portugal	94	16 502	17,9%
Spain	1 208	115 505	22,9%
Sweden	2 455	50 908	12,4%
United Kingdom	499	21 658	8,4%

The table only relates to European Union countries (not AC), where the Habitats Directive applies

Table 2: Progress in proposition of Sites of Community Interest (SCI) by EU countries under the Habitats Directive (April 2001) (European Commission, 2001)

Pressures due to agriculture vary in nature and intensity depending on the ecosystems-types (Table 3).

Ecosystem	Pressures and impacts due to Agriculture
All ecosystems	Intensification Displacement of traditional practices Loss of indigeneous plant varieties and breeds Soil biodiversity affected
Marine and coastal	Eutrophication Drainage of salt marshes Overgrazing
Freshwater	Eutrophication Pesticides residues Excess water abstraction Pesticide drift to waterside habitats
Wetlands	Drainage Eutrophication Loss of rotations
Grassland, heath and scrub	Conversion to arable land Abandonment of extensive practices Loss of semi-natural habitats Over or under-grazing Terrestrial eutrophication
Woodland	Overgrazing Fragmentation Neglect of small woodlands
Arable land	Pesticides Conversion to monocultures Loss of marginal features Changes in management practices (e.g autumn ploughing, stubble burning) Irrigation

Table 3: Summary of pressures related to agriculture which affect biodiversity in Europe (Adapted from European Commission, 1998a)

Dominance of pressures on ecosystems also depend on the biogeographic context where they occur, as demonstrated by Petit *et al* (1998): while large lowland areas in the Atlantic part of Europe are sensitive to intensification of agricultural practices, land abandonment is a major threat in large areas of the Mediterranean region as well as mid-mountains in the Alpine region.

REPORTING ON EFFECTS OF AGRICULTURE ON DIFFERENT ECOSYSTEM-TYPES

There are many ways to report on biodiversity trends in relation to agriculture, from the genetic level, to species, ecosystem or landscape level. Assessment techniques and data sources are quite different in each case and involve many fields of expertise.

A number of co-ordinated research projects are presently on-going at European level, trying to encompass these various levels and tackle the complexity of the issue at stake in an integrate way.

However, the increasing request for biodiversity indicators by decision-makers and the multiplicity of political frameworks where their need is addressed leads to still simplified approaches, on the basis of available data, and in a partial way. Within the Elisa project (Washer 2000), an extensive review of possible agri-environmental indicators related to biodiversity and landscape has been done. At international level, OECD is actively working on such issues (OECD, 2001). However only once a consolidated monitoring scheme in each country and co-ordination at European level is established can we hope to have fully sound, documented and reliable indicators.

The Convention of Biological Diversity (UNCED, 1992) proposes a framework for reporting through the development of indicators by main ecosystem-type (UNEP/CBD/SBSTTA/5/12). Similarly, the EEA-ETC/NPB has initiated work for European Environment Agency regular reporting series “Environmental Signals”, following the DPSIR scheme (Driving Force/ Pressure/ State/ Impact/ Response). Thus a first approach on the development of indicators at European level has been tempted on wetlands (EEA, 2000) and on grasslands (EEA, 2001), with a specific concern for dry-mesic grasslands.

Some examples on grasslands are shown below. The indicators do not, by far, cover all aspects relevant to grasslands and biodiversity. In particular, the spatial dimension of it, both mapping the distribution of main grassland-types and assessing the effects of fragmentation through remote sensing techniques is lacking. These aspects still need further work. However, the selection below shows the interest to monitor specific group of species (insects and plants), in addition to already well-know species groups like Birds (Tucker and Heath 1994). Also to assess the impact of afforestation on grasslands.

Policy context of grassland conservation

Permanent grasslands are spread all over Europe from very wet to very dry conditions, from coasts to mountains. Most of them are only maintained because of long term continued management, either by grass mowing/hay cutting or by grazing. They are therefore extremely vulnerable to changes in management such as intensification, abandonment and afforestation.

Permanent grasslands are important for biodiversity, in particular the unimproved grasslands –also called semi-natural grasslands. They play a major, but not always well recognised or understood, environmental and social role (e.g. agro-forestry production, employment). They are the homes of the ancestors of many widespread crop, garden and medicinal plants. Since the last 50 years, semi-natural grasslands have dramatically declined both in surface area and in quality due to factors such as fragmentation, improper management and acid, nutrient-rich precipitation (Van Dijk, 1991).

The importance of wet grasslands is clearly addressed through the Convention on Wetlands of International Importance (1971), the so-called Ramsar Convention. Importance of dry/mesic grasslands for biodiversity and their vulnerability were also recognised in the 1980's by the Council of Europe which encouraged European countries to include them in the network of Biogenetic Reserves (Council of Europe, 1981). Several types of grasslands habitat-types and species are considered under two major nature protection regulations: the Habitat Directive (1992), which apply only in the 15 EU countries, and the Convention on the conservation of European wildlife and natural habitats (1979) – the so-called Bern Convention (Council of Europe, 1979), which applies in 44 European states. Furthermore many countries have included permanent grassland in national sustainability programmes, regulations and action plans to implement the CBD, and some have general protection for all permanent grasslands.

Pressure indicators

An important threat to grasslands as “open” systems with often high biodiversity value is afforestation, whether natural - due to abandonment- or through active plantation. Under the Common Agricultural Policy, some measures promoted afforestation of agricultural land, under EC-Regulation 2080/92: 60 % of the area afforested in 13 EU countries was formerly permanent pastures and meadows, but the situation varies among countries. In Denmark for instance where law prevents against afforestation on permanent grasslands almost only arable lands were concerned, while in Ireland, Austria and United Kingdom, mostly permanent pasture and meadows were afforested. Active afforestation is likely to continue and increase for carbon sink purposes.

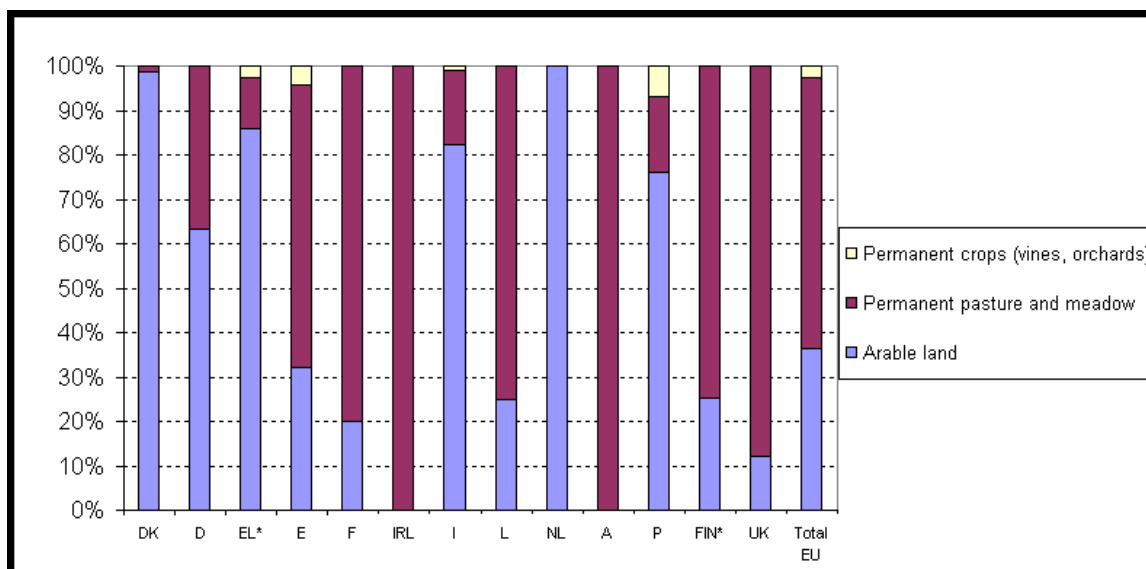


Figure 2: Change in use of permanent pastures and meadows. Agricultural land afforested between 1993 and 1997 in EU15: previous use of the land (as percentage of the areas) (European Commission, 1999b)

State indicator

Some figures on species richness in semi-natural dry and mesic grasslands:

- 1080 different species of butterflies (macro and microlepidopterae) recorded on a 9,5 ha of steppic grassland in Austria (Kasy, 1979)
- 63 plant species/m² on the Slovak karst meadow (Ministry of the Environment of the Slovak Republic, 1998)
- 588 of higher plant species are recorded - of which 34% are considered as endangered - are recorded in drylands in Germany (Korneck and Sukopp, 1988)

State and impact indicators

Following the enlargement of the European Union from EU9 to EU15, the total EU area of permanent grasslands and pastures in 1995 was about 44 000 000 ha. However, the total grassland area in the average EU9 country fell by 12 % between 1975 and 1995, with increase only in some areas. The overall decline is expected to continue. The data do not allow a detailed analysis of increase or decline of specific grassland-types. The total EU area of permanent grassland will significantly increase with further enlargement, since the Accession Countries contain large areas of highly valuable and vulnerable permanent grassland, but with the expected increase in agricultural intensification on one hand and abandonment on the other hand, these areas will be under great pressure.

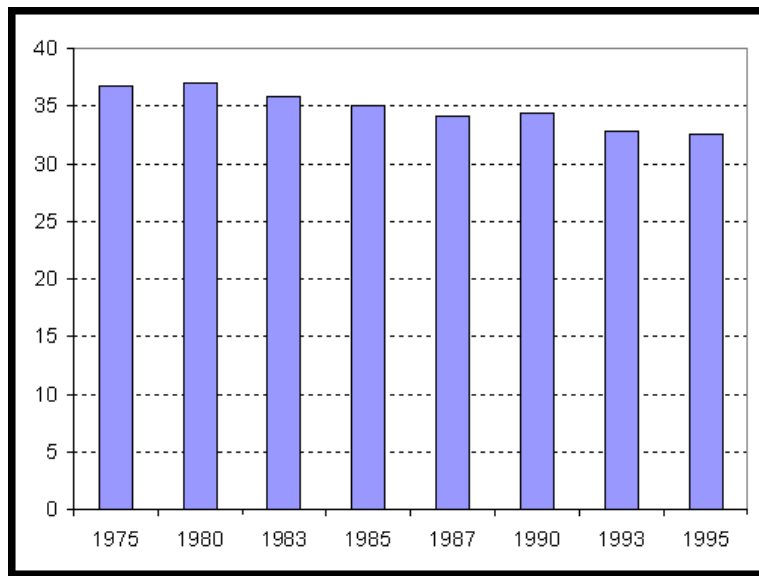


Figure 3: Trend of permanent grassland area in EU9 between 1975 and 1995 (in million ha). Includes permanent grassland and pasture (European Commission, 1999b)

Dry grasslands are among the most threatened types of grassland. They contain many specialised plant and animal species, for example orchids and butterflies, which can survive only in dry, well-lit conditions. Around half of the orchid species in France, and between 35 and 42 % in Belgium, the Netherlands and Luxembourg, occur in dry or mesic grasslands; a very high proportion of these are threatened. The Red list of European Butterflies published in 1999 shows that out of a total of 576 European butterfly species 71 are threatened. Of these around 50 % occur in grasslands with 34 % alone in dry/mesic grasslands (Fig. 4).

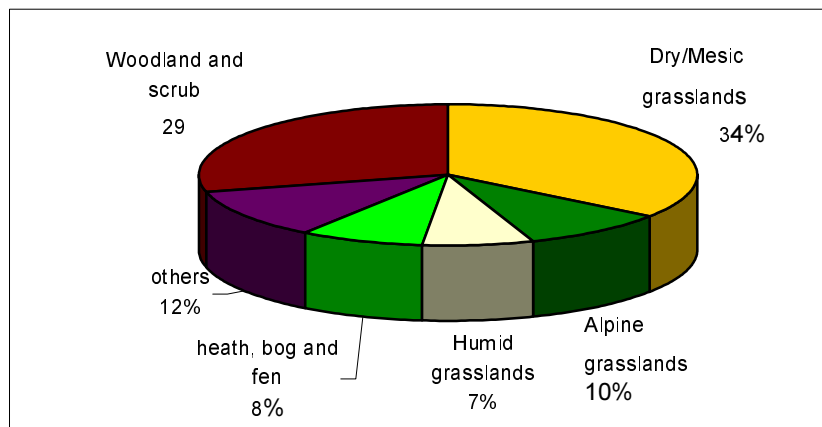


Figure 4: Percentage of threatened butterflies occurring in broad habitat types, including dry and mesic grasslands in European countries (Council of Europe, 1999)

Response indicators

Several national permanent grassland programmes or legislation, both in EU and Accession Countries, seem to have slowed, but not halted or reversed the rate of disappearance of natural and semi-natural grasslands. When fully implemented, the NATURA2000 Network – a network of sites designated under the framework of the Council Directive on the protection of Wild Birds –so-called Bird Directive, as well as under the Habitats Directive (European Commission (1997)- will conserve a significant proportion of

the most important EU-wide natural and semi-natural grasslands. A similar network of sites of importance for nature conservation will be established in the framework of the Bern Convention in countries outside EU, the Emerald Network (Kopaçi, 1998).

Agri-environmental measures which now apply on more than 20% of the EU territory (European Commission, 1999b) as well as regulations to support rural development can obviously contribute to conservation of permanent grasslands, and more specifically semi-natural grasslands. However, existing data do not permit yet to assess the impact of such measures on conservation of grasslands in a detailed way. Such indicators are under development by the European Commission (European Commission 2001c).

The EC Life-nature fund intends to support projects for conservation of species and habitats listed in the Bird Directive (1979) and the Habitat Directive (1992). Table 4 shows the trend in European Community interest on dry grasslands: starting with a few projects from around 1992 there has been a clear increase in the number of projects since 1995-1996. Several other projects related to large carnivores or raptors involve large areas of grasslands under extensive management in a mosaic of habitat types. They could be considered as well.

Country	Restoration and management projects including dry grassland habitat types and species	Projects 1992-1994	Projects From 1995
Austria	Pannonian sand dunes, Alluvial flood plain		2
Finland	Grasslands and pastures in Archipelago		1
France	Dry grasslands, chalk and limestone grasslands, Xerothermic habitats, grassland species	2	7
Germany	Dune and meadow habitats, species	3	4
Greece	Dry grasslands		1
Italy	Various grassland habitat types and species		12
Portugal	Grassland habitat types, Montados, steppic birds	2	1
Spain	Steppic and dry grasslands and species	3	3
United Kingdom	Chalk grassland habitat types		1

Table 4: Increase in European Community support to projects for restoration and management of habitats and species. Examples of use of EC LIFE funds 1992-1999 for dry/mesic grassland areas European Commission, 2000)

CONCLUSIONS

As one of the main driving forces influencing European biodiversity in a variety of ecosystems and in different biogeographic contexts, agriculture is certainly the sector where the most can be done to halt and even reverse negative trends on biodiversity. In the European Union, where the Common Agricultural Policy applies, the political framework is evolving rapidly, as shown with the recent adoption of the Strategy for Sustainable Development. The social demand has also considerably evolved, following the severe crisis due to the “Mad Cow” as well as the Foot and Mouth diseases. With the progressive enlargement of the European Union, the agricultural policy will increasingly influence Accession Countries in which some large extensively farmed areas still remain. It is important to be able to monitor the consequent changes by setting-up tools such as indicators, able to provide signals of adverse trends. Compared to other environmental fields, Biodiversity indicators had remained little developed till recently. Considering the data limitations, in particular temporal information, collaboration between international organisations acting in this field, including OECD, is very much needed. The European Environment Agency is thus setting up an International Working Group on Biodiversity Indicators and Monitoring, in order to improve co-ordination, facilitate exchanges and data flows, and enhance synergy. The group will be launched in January 2002.

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Relevant Web-sites

- EC-DGEnvironment <http://europa.eu.int/comm/dgs/environment/index_en.htm>
- EC DG Agriculture <http://europa.eu.int/comm/agriculture/index_fr.htm>
- European Environment Agency <<http://www.eea.eu.int/>>
- Convention on Biological Diversity <<http://www.biodiv.org/>>
- Habitats Directive <<http://europa.eu.int/comm/environment/nature/habdir.htm>>
- Bern Convention <<http://www.nature.coe.int/english/cadres/berne.htm>>
- Ramsar Convention <<http://www.ramsar.org/>>