



## INDICATORS FOR BIOLOGICAL DIVERSITY IN BELGIUM

### Covering letter

As a response to Notification 2001-05-17/02 from the Executive Secretary of the Convention on Biological Diversity, the Belgian National Focal Point has elaborated this report on indicators for biological diversity in Belgium.

The objective of the report is to compile a set of indicators that are currently being used by Belgium as part of its monitoring processes. The report is based on an indicative list of biological diversity indicators provided as a reference point by the CBD Secretariat. The list was extended to include indicators specific to the Belgian context and comments were added, for example mentioning the specific purpose for which a particular indicator was used.

Indicators developed under other processes such as the State of the Environment Reporting were also included, as suggested by the Executive Secretary.

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## 1. Background and legal framework

The main references to indicators are to be found in Article 7 of the Convention on Biological Diversity and in Decision V/7 of the Conference of the Parties, both recalled hereafter.

### 1.1. Article 7. Identification and monitoring

Each contracting Party shall, in accordance with its particular conditions and capabilities:

- a) Identify components of biological diversity important for its conservation and sustainable use; and
- b) Monitor through sampling and other techniques, the components of biological diversity identified pursuant to paragraph (a) above, paying particular attention to those requiring urgent conservation measures and those which offer the greatest potential for sustainable use.

### 1.2. Decision V/7. Identification, monitoring and assessment, and indicators.

The Conference of the Parties,

1. Requests the Executive Secretary, in broad consultation with Parties, drawing on the roster of experts, and in collaboration with other relevant organizations, bodies and processes, to carry out the pending activities set out in the work programme on indicators of biological diversity as approved by decision IV/1 A of the Conference of the Parties and, in particular, to develop:
  - (a) A set of principles for designing national-level monitoring programmes and indicators;
  - (b) A key set of standard questions and a list of available and potential indicators, covering the ecosystem, species and genetic levels, taking into account the ecosystem approach, that may be used by Parties at their national level and in national reporting and that also allow for regional and global overviews on the state and trends of biological diversity and, if possible and appropriate, any responses from policy measures;
2. Encourages Parties and Governments to establish or increase regional cooperation in the field of indicators, monitoring and assessment and invites the Executive Secretary to establish a process through which the documents mentioned above are reviewed and broadly discussed at regional workshops on the basis of case-studies submitted by Parties, Governments and relevant organizations;
3. Acknowledges that the capacity of many countries, particularly least developed countries, to reliably and consistently monitor indicators is limited and that, therefore, indicators will need to be developed incrementally over time, based on national priorities;
4. Invites Parties, Governments and organizations to undertake appropriate actions to assist other Parties (particularly developing countries) to increase their capacity to develop and use indicators. Appropriate actions may include:
  - (a) Provision of training;
  - (b) Assisting in the development of national networks;
  - (c) Sharing experiences between and among countries, regions and organizations involved in the development and use of indicators;
5. Requests the Executive Secretary to produce an interim report on progress, including the ongoing work on indicators in the thematic and other work programmes, for review by the Subsidiary Body on Scientific, Technical and Technological Advice prior to the sixth meeting of the Conference of the Parties and to submit a final report on the conclusions of this initiative to the Conference of the Parties at its sixth meeting.

## 2. Framework of biological diversity monitoring in Belgium

Belgium is a Federal State which consists of Communities and Regions. There are three Communities based on language – the Flemish Community, the French Community and the German-speaking Community, and three Regions – the Flemish Region, the Brussels Capital Region and the Walloon Region.

Environmental responsibilities are shared by the Federal Government and the Regions. The Regions are *inter alia* competent in the fields of nature and water management, land zoning and nature conservation, spatial planning and public works.

In this context, each Region has been developing its own biological diversity monitoring programme and there is little co-ordinated information or inventory available at national level. Most inventories are conducted in the frame of on-going research projects or at the request of regional governmental administrations or agencies.

In the case of agriculture, some indicators are compiled at national level by the Federal Ministry of Agriculture and by the National Institute of Statistics. Research and nature conservation activities related to the North Sea are carried out at the Federal level by the Management Unit of the North Sea Mathematical Models<sup>1</sup> and the Sea Fisheries Department<sup>2</sup>, in cooperation with regional institutions.

For the reason evoked above, this report presents data on biological diversity indicators in Belgium at regional level rather than at national level.

## 3. Overview of indicator and monitoring programmes in the three Regions

### 3.1. The Brussels Capital Region

The Brussels Institute for Management of the Environment<sup>3</sup> (BIME) collects and analyses environmental data for the Brussels Capital Region. Since 1991, there has been co-ordinated biological diversity research in the Brussels Capital Region, notably in the context of the establishment of a bio-indicator information network. This research has been undertaken in collaboration with universities, naturalist organisations and associations.

For the BIME, the development and use of sustainable development indicators is one of its priority research projects. Biological diversity indicators are included in the research. Several indicators are thought relevant, and are either being developed or already in use, including:

- State indicators (status of the flora and fauna, *i.e.* species per group, area of green spaces, area of ponds and length of rivers);
- Pressure indicators (influence of economical production on biological diversity);

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<sup>1</sup> Unité de Gestion Mathématique de la Mer du Nord (UGMM) – Beheerseenheid Mathematisch Model Noord-zee (BMM) [http://www.mumm.ac.be/docs\\_en/intro.html](http://www.mumm.ac.be/docs_en/intro.html)

<sup>2</sup> Département de la Pêche en Mer (DPM) – Departement voor Zeevisserij (DvZ): <http://www.dvz.be/>

<sup>3</sup> Institut Bruxellois pour la Gestion de l'Environnement (IBGE) – Brussels Instituut voor Milieubeheer (BIM). <http://www.ibgebim.be/>

- Response indicators
  - policy measures (protection of the flora and fauna, *i.e.* protected and threatened species, protected areas, areas of high ecological interest, Natura 2000 areas);
  - response of the population to the state of the environment (public awareness: how aware is the public of biological diversity issues?);
  - response of the population to the policy measures (*i.e.* public participation, impacts on politicians, no. complaints recorded).
  - indicators assessing the integration of biological diversity considerations into urban planning policies (cf. Concertation Committees of the Brussels Capital Region; % of green spaces with high ecological value as total of green spaces, green and blue network: cohesion and continuity of habitats with high ecological value).

For further information :

F. Onclinckx. Indicators for sustainable development in the Brussels Capital Region. Brussels Institute for Environmental Management (in preparation).

### 3.2. The Flemish Region

An inventory of the main ecosystems and species is given in the first Nature Report of Flanders (1999). This inventory is being complemented by the development of an integrated information system and an overall data bank on scientific research. The Flemish Institute of Nature Conservation<sup>4</sup> is responsible for reporting on the state of nature in Flanders, including applied ecological and hydrogeological research with a view to nature conservation. It is also in charge of a number of inventories, the compilation of species Red Lists and of the establishment of the Biological Evaluation Map. The Institute for Forestry and Game Management<sup>5</sup> has a similar function for forests. It is also responsible for scientific research on fish stock and their management.

The Flemish Impulse Programme Nature Development (VLINA) was started in 1996 as a means to stimulate research on nature conservation in Flanders. Biological diversity indicators are one of the five themes treated within the scope of the programme, with indicators of forest biological diversity being the first ascribed research assignment.

The Flemish Environmental Agency<sup>6</sup> is a para-governmental institution complementary to the environmental administration. One of the tasks of the VMM is to establish and run the monitoring programme on surface water quality.

The first forest inventory in Flanders (1997 - 1999) was carried out by the Forest and Green Areas Division, Ministry of the Flemish Community. It allowed to have precise and up-to-date information on forest composition, age, class, timber volume, etc. and is used to generate a more efficient forest management.

Some of the major biological diversity indicators that are used for evaluation of, and reporting about, nature conservation activities are listed below:

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<sup>4</sup> Instituut voor Natuurbehoud (IN): <http://www.instnat.be/>

<sup>5</sup> Instituut voor Bosbouw en Wildbeheer (IBW): <http://www.ibw.vlaanderen.be/>

<sup>6</sup> Vlaamse Milieumaatschappij (VMM): <http://www.vmm.be/>

- State indicators: *i.e.* status of fauna and flora, trends in species, Red List species, changes in land use, etc.;
- Pressure indicators: *i.e.* impacts of agriculture and agri-environmental measures on species and habitats;
- Impact indicators: % of the country area where critical level of pollution is exceeded, impact of species management plans;
- Response indicators: *i.e.* protected areas or nature management sites, no. projects for rehabilitation, species management plans; degree of rehabilitation of the natural structure of water and river systems.

Additional indicators for the evaluation of nature policies are currently being developed.

For further information:

- Nature Report 1999 (in Dutch), online at <http://www.instnat.be/Natuurrapport/index.htm>.
- Mira 2000: Environment and Nature Report for Flanders 2000 (in Dutch).
- VRIND 2000 (Vlaamse Regionale Indicatoren): Indicators for Flanders, online at [http://fred.vlaanderen.be/statistieken/publicaties/vrind/vrind2000/elekVRINDexcel/pdf\\_2000/vrind2000.htm](http://fred.vlaanderen.be/statistieken/publicaties/vrind/vrind2000/elekVRINDexcel/pdf_2000/vrind2000.htm) (in Dutch).
- Forest and Green Areas Division, 2001. The Forest Inventory of the Flemish Region. Results of the first inventory 1997-1999. Ministry of the Flemish Community, 480 pp. (in Dutch).

### 3.3. The Walloon Region

An Observatory of Fauna, Flora and Habitats<sup>7</sup> has been set up at the Nature, Forests and Wood Research Centre of the Walloon Region. Its tasks are to co-ordinate the collection and analysis of biological diversity data. The Observatory works in close collaboration with a network of naturalists, scientists and officials of the Nature and Forestry Division. Activities of the OFFH are divided into four work programmes:

- Inventory and monitoring of biological diversity (ISB) and monitoring of the state of the environment through bio-indicators (SURWAL), to describe and monitor the distribution of species belonging to various major biological groups.
- Inventory and monitoring of habitats (ISH), to make a standardised inventory of habitats and to monitor their regional dynamics.
- Inventory of sites of great biological interest (SGIB), to gather information on areas that harbour species and habitats of great biological interest.
- System of information on biological diversity in Wallonia (SIBW), to disseminate information collected within the scope of the first three programmes.

The Permanent Inventory of Forest Resources has for objectives to have an up-to-date knowledge of the forest status in Wallonia. This inventory is complemented by a Forest Health Monitoring Programme, that monitors 1500 sample trees annually for discoloration and defoliation.

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<sup>7</sup> Observatoire de la Faune, de la Flore et des Habitats (OFFH):  
<http://mrw.wallonie.be/dgrne/sibw/organisations/OFFH/home.html>

The Directorate General of Natural Resources and the Environment (DGRNE)<sup>8</sup> is the institution responsible for surface water monitoring activities in the Walloon region. It carries out physico-chemical and biological monitoring throughout the region.

The biological quality of watersheds is evaluated using the biotic index method (Belgian Biotic Index<sup>9</sup>), based on the sampling of macro-invertebrate communities.

These programmes are used as a basis for the establishment of environmental and biological diversity indicators, that are reported regularly in a technical document, the State of the Walloon Environment. In the 2000 edition, four types of biological diversity-related indicators are used :

- State indicators: *i.e.* status of flora and fauna, forest composition, etc.;
- Pressure indicators: *i.e.* pressure from urbanisation, public pressure through leisure activities, agricultural fertilisers and pesticides, hunting, etc.;
- Impact indicators: *i.e.* forest health, atmospheric fallout on forests, big game impact on forest health and composition, etc;
- Response indicators: *i.e.* protected areas, biological diversity considerations outside protected areas, public awareness, environmental spending by the private sector, etc.

For further information:

- State of the Walloon Environment 1993 and 2000 (in French), both reports can be found online at <http://environnement.wallonie.be/>
- See also the System of Information on Biological diversity in Wallonia (in French): <http://mrw.wallonie.be/dgrne/sibw/home.html>

#### 4. List of indicators for biological diversity in Belgium

The report is based on an indicative list of biological diversity indicators provided as a reference point by the CBD Secretariat. The Notification from the Executive Secretary and the reference list of indicators can be found on the CBD Clearing-House Mechanism at the following URL: <http://www.biodiv.org/doc/notifications/>

The proposed tables were filled in with indicators currently used in Belgium. Indicators marked in red were added to the proposed list, and are specific to the Belgian context.

*A clear distinction between actual “official” indicators for biological diversity and available data on status/trends of biodiversity is not always easy. Much more data are collected than presented in regional indicator reports, such as VRIND for Flanders or EEW for Wallonia. In this regard, we have opted to include in this report all relevant published information used by Belgium in its biological diversity monitoring process.*

When an asterisk (\*) is found next to an indicator number, it refers to an explanatory note at the end of the table.

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<sup>8</sup> Direction Générale des Ressources Naturelles et de l’Environnement: <http://environnement.wallonie.be/>

<sup>9</sup> De Pauw, N. & G. Vanhooren (1983): Method of biological quality assessment of watercourses in Belgium.- Hydrobiologia 100: 153-168.

#### 4.1. Forest biological diversity

INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders
<b>Forest biological diversity</b>					
Total forest area	1		x	x	x
Total forest area as a % of total land area	2		x	x	x
% forest cover by forest type ( <del>primary, secondary</del> semi-natural or plantation)	3*			x	x
% forest cover by forest owner (private, public, etc.) and by forest composition per owner	4*			x	x
% forest areas by forest type, by age, class and successional stage	5			x	x
Changes in forest composition	6*			x	x
Ratio between exotic species and native species in plantation area	7				x
Forest area change by forest type ( <del>primary, secondary</del> semi-natural or plantation)	8*			x	x
Per capita wood consumption	9			x	x
Change in land use, conversion of forest land to other land uses (deforestation rate)	10*				x
Self-generating area per habitat type	11				
Self-generating area as a % of total area	12				
Fragmentation of forests	13*		x	x	
% protected area of total forest area	14		x	x	x
% protected area with clearly defined boundaries	15				x
% forest managed for wood production	16*			x	x
% forest land managed for recreation and tourism to total forest area	17*			x	x
Area and % of forests managed for catchment protection	18				
% forest protected areas by forest type, by age, class, and successional stage	19*		x partim		x
Area and length and numbers of biological corridors	20				
Annual volume and area of timber harvested-indigenous and plantation	21			x	x
Contribution of forest sector to GDP	22			x	
Number and size of forest fires	23				
Reforested and afforested areas	24*			x	x partim
Area and extent of degraded lands reclaimed through forest operations	25				x partim
Relationship between forest cover and frequency of flooding	26				
Changes in the proportions of stands managed for conservation and utilization of genetic resources (gene reserves, seed collection stands, etc.)	27*			x	x
Area and % of forest area affected by anthropogenic effects (logging, harvesting for subsistence).	28*		x	x	x
Area and percentage of forest area affected by natural disasters (insect attack, disease, fire and flooding)	29*			x occasional	x partim
Forest conversion affecting rare ecosystems by area	30				
Extent of mixed stands	31*			x	x
Managed forest ratio	32				
Wood harvesting intensity	33			x	x partim
Estimate of carbon stored	34				
Big game damage	35*			x	
Forest health	36*			x	x
Atmospheric fallout on forests	37*			x	x
Amount of public awareness activities	38*			x	
Amount of public pressure on forests	39*			x	

ECOSYSTEM / HABITAT



SPECIES	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders	
	Absolute and relative abundance, density, volume, basal area, cover, of various tree species	40*				x	x
	Changes in the volume of wood of different species	41*				x	x
	Threatened tree species as a percentage of the 20 most used for commercial purposes	42	Not applicable				
	Number of threatened, keystone, flagship species	43*				x partim	x partim
	Number of extinct, endangered, threatened, vulnerable and endemic forest dependent species by group (e.g. birds, mammals, vertebrates, invertebrates)	44*				x partim	x partim
	List of flora and fauna	45*			x	x partim	x partim
	Existence of procedures for identifying endangered, rare, and threatened species	46*			under development		x
	Existing strategies for <i>in situ/ex situ</i> conservation of genetic variation within commercial, endangered, rare and threatened species of forest flora and fauna.	47					
	Number of forest dependent species whose populations are declining	48			x partim		x partim
	Population levels of representative species from diverse habitats monitored across their range	49			x partim		x
	Number and extent of invasive species	50					
	Number of ancient forest plant species	51*					x (under development)
	Indices	52*					x (under development)
	Pressure exerted by hunting	53*				x	x

3) There are no truly natural forests in Belgium. Most forests are planted, a few are semi-natural.

4) Wallonia and Flanders: this indicator is used to establish ownership (private, state, local communities). In Wallonia, there is a big difference in forest composition between privately- and publicly-owned land. Therefore, this indicator indirectly shows how private owners evolve in the management of their land (*i.e.* whether they plant more hardwoods or conifers, what species they choose, etc.).

6 and 8) Wallonia: the undergoing forest inventory has been compared to previous inventories (1970's and 1980's), in order to assess changes in forest composition (trends in areas covered by hardwoods or conifers, trends in areas of given tree species such as Norway spruce, beech, etc.). Flanders: changes in forest composition and change of forest area by forest type are obtained by comparing the results of the first forest inventory (1997-1999) with the forest map of Flanders (1990).

10) Flanders: the deforestation rate is obtained by comparing the forest map of 1990 with the forest map of 2000. For example, the total forest area amounted to 152,488 ha in 1990 and 146,381 ha in 2000.

13) Wallonia: the fragmentation of forests is assessed using the number and average size of forests ownership.

16-17) Flanders: the two indicators are important indicators for Flanders, as forests have not only have an ecological and an economical function, but also a very important social function (recreation and tourism). Only the forest reserves and the open areas in forests have no production function.

- 19) Flanders: i.e. the distribution (%) of forest reserves by forest type, by age class and successional age.
- 24) Wallonia, Flanders: data concerning reforested areas can be deduced from data concerning money granted for reforestation. However, not all forest owners ask for a subsidy and/or not every reforestation project qualifies for such subsidies. Data concerning the afforested areas can similarly be inferred from subsidies for afforestation of agricultural land (see agri-environmental measures, indicator 76).
- 27) Wallonia: stands managed for the utilisation of genetic resources (genetic protection zones which are stands whose trees are selected for seed collection). Flanders: data available at the Institute for Forestry and Game management, Gaverstraat 4, 9500 Geraardsbergen.
- 28) All regions: logging activities (major economic function of forests in Belgium).s
- 29) Wallonia: occasional censuses are carried out following natural disasters such as storms (volume of windfalls, 1990) or insect attacks (volume of Norway spruce attacked by spruce bark beetles, 1992 or beech attacked by beech bark beetles, 2000). However, they are not used regularly as forest indicators.
- 31 and 40) Flanders: the extent of mixed stands and data concerning volume, basal area, cover of various tree species can be deduced from the first forest inventory of Flanders.
- 35) Wallonia: this indicator gives the % of stands and volume of wood suffering from big game damage (browsing, bark-peeling, etc. by deer, roe deer, wild boar) per stand type. It is useful in the context of finding the right balance between big game and forest foraging capacity.
- 36) Wallonia and Flanders: forest health monitoring is part of a European initiative. Indicators gives the % of trees affected by defoliation and discoloration, as well as the average level of defoliation per species.
- 37) Wallonia: this indicator gives nitric oxide and sulphur dioxide fallouts (kg/ha/year) at given sites in Wallonia, and reflects the air pollution level in areas relatively distant from polluting sources
- 38) Wallonia: this indicator gives the number of public awareness activities each year, especially oriented towards sustainable forest management and use.
- 39) Wallonia: this indicator gives the number of infringements to the forest legislation, reflecting the public pressure on forests.
- 41) Flanders: the changes in the volume of wood of different species will be available at the end of the second forest inventory.
- 43) Wallonia and Flanders: threatened species mostly, and for some groups only. There has been little work on keystone and flagship species in Belgium so far, especially in forested ecosystems. Wallonia: the black stork is used as a flagship species for migratory birds. In Belgium, the preferred habitat of the black stork is forested areas; the bird is used essentially to raise awareness on the problem of vanishing habitats for migratory birds (see indicator 145).
- 45) In all Regions, species are used as biodiversity indicators and red list are elaborated for major groups, including for species in forest ecosystems (vascular plants, mammals, birds, invertebrates, etc.). See indicators 145 and 155-170.
- 46) Flanders: red lists. See 45) above.
- 51) Flanders: A research project is under way to estimate the quality of “ancient forest species” as biological diversity indicators. Historical-ecological research has pointed out differences in species composition between ancient (old-growth) and young forests. The so-

called ancient forest species are usually confined to ancient forests. These species are excellent indicators of the ecological value of forest communities and can be used to understand the *colonisation* process of newly created forests.

52) Flanders: Indices of biological diversity are under development. These indices incorporate species richness and rarity (Species Quality Index, SQI), as well as species abundances and vulnerability (Site Conservation Quality Index, SCQI). Data must be collected via continuous and similar sampling techniques. They are elaborated using i.a. invertebrate species.

53) Wallonia: this indicator refers to the number of animals killed by hunting as compared to the number of animals alive in spring, before the new births.

## 4.2. Agricultural biological diversity

	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders
ECOSYSTEM	Land use for agriculture: agricultural area, no. of farms; average agricultural area per farm	54*	x	x	x	x
	Agricultural area by crops (cereal, oil crops, forage, woodlands)	55*	x	x	x	x
	Agricultural area (intensively farmed, semi-intensively farmed and uncultivated)	56*	x partim			
	Change in area of agricultural land (conversion to or from agriculture)	57*	x		x	
	Organic farming	58*	x		x	x
	Use of agricultural pesticides	59*	x		x	x
	Use of agricultural fertilizers	60*	x		x	x
	Afforestation of agricultural land (ha); incl. Christmas tree plantations not including hedges	61*	x		x	
SPECIES	Number of species threatened by agriculture by group e.g. birds, mammals, vascular plants, vertebrates, invertebrates)	62*			x partim	x partim
	Number of vertebrate or invertebrate species using habitat on agricultural land by species	63*				x partim
	Differences in species diversity and abundance of arthropods and earthworms in organically and conventionally cultivated arable land	64				
	Rate of change from dominance of non-domesticated species to domesticated species	65	Not applicable			
	Species diversity used for food	66				
	Erosion/Loss of genetic diversity patrimony	67				
GENES	Crops/livestock grown as a percentage of number of 30 years before	68				
	Accession of crops and livestock in ex-situ storage (number or percentage)	69				
	Replacement of landraces with few imported ones	70				
	Replacement of indigenous crops	71				
	Accessions of crops generated in the past decade (per cent)	72				
	Coefficient of kinship or parentage of crops	73				
	Inbreeding/outbreeding rate	74				
OTHER	Rate of genetic interchange between populations (measured by rate of dispersal and subsequent reproduction of migrants)	75*				x partim
	Use of agri-environmental measures (amount of money granted)	76*			x	x

54-55) These indicators are compiled annually by the National Institute of Statistics (NIS), both at federal and regional level. See agriculture indicators of the NIS at [http://www.statbel.fgov.be/figures/agriculture\\_fr.htm](http://www.statbel.fgov.be/figures/agriculture_fr.htm)

56) The NIS provides some data at national level on extensively farmed land: total area of extensive vegetable cultivation and high-stem orchards.

57) The NIS compiles annually the total area of land taken away from agricultural production, both at national and regional level.

58) The NIS also provides data on organic farming, through the number of organic farms and the total area for organic pastures and cultivated land.

59-60) Data is compiled at federal level by NIS, but additional data is available at regional level. The main indicators used are the product quantity/ha/year (amount of fertilizers used or amount of active matter used for pesticides). Flanders: A monitoring programme specifically

evaluates agricultural pressures (MAP - Manure Action Plan). In this regard, the region assesses the pressure from manure spreading on the soil and ground- and surface-water quality (amount of manure produced and spread on fields, in terms of phosphate and nitrogen production).

61) The NIS estimates annually the total area of agricultural land afforested (including the total area of Christmas tree plantations), both at federal and regional level. Wallonia also uses as an indicator the total area concerned by financial support for afforestation (area/tree species planted).

62-63) Flanders: exhaustive species inventories and red lists have been established for a wide range of habitats, including grasslands. Information is also available for agricultural lands. Species include vascular plants, butterflies, spiders (see indicators 145 and 155-170). Trends analysis has been carried out for some bird species in agricultural areas. Wallonia: data are available for birds in agricultural areas.

75) Flanders: a research project is carried out at regional level on 3 vulnerable vascular plant species (*Primula vulgaris*, *P. veris* en *P. elatior*) typical of agricultural areas.

76) Wallonia, Flanders: the financial assistance (amount of money) given for the implementation of the EU's agri-environmental measures is used as an indicator by both Wallonia and Flanders. These measures include the plantation of hedges, late mowing practices, rare cattle breeds and extensive grazing, establishment of wetlands and ponds, etc.

### 4.3. Inland Waters Biological diversity

	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders
ECOSYSTEM/HABITAT	<b>Inland Waters Biological diversity</b>					
	Surface water quality: Nitrogen, dissolved oxygen, pH, pesticides, heavy metals, temperature	77*		x	x	x
	BOD on water bodies (re: eutrophication)	78*			x	x
	Ground water quality: nitrates, salinity, toxicants	79*			x	
	Stream flow	80*			x	
	Stream sediment storage and load	81				
	Changes in vegetation type along water courses	82*				x
	Water resource vulnerability index	83*			x	x
	Ratio between maximum sustained yield and actual average abundance	84				
	Glacier fluctuations	85	Not applicable			
	Groundwater level (water table level)	86*			x	
	Wetland area	87		x	x	x
	Extent of wetland drainage and filling	88				
	Fish family diversity <b>and changes over time</b>	89*			x	x
	Benthic macro-invertebrates communities (biological quality of surface water)	90*		x (under development)	x	x
	Macrophytes: species composition and depth distribution	91				
	<b>Land managed for catchment protection</b>	92*			x	
	<b>Amount of irrigation (% of irrigated land, area of irrigated land)</b>	93	x		x	
	<b>River contracts (agreement to protect, restore and manage sustainably water resources)</b>	94			x	
	SPECIES	Threatened freshwater fish species as a % total freshwater fish species known	95*			x
Number of inland fish species introduced		96				x
Number of exotic flora and fauna species e.g. fish, aquatic weeds		97				x
Number of endemic flora and fauna		98	Not relevant (no true endemics in Belgium)			
Changes in distribution and abundance of native flora and fauna		99				
Number of extinct, endangered, threatened/endangered/vulnerable/ endemic inland water species by group e.g. birds, aquatic mammals, invertebrates, amphibians, vascular plants, bottom fauna.		100*		x partim	x partim	x partim
Changes in fish catches by species		101				
Species richness (number per unit area, number per habitat)		102				
Indicator species		103				
<b>Pressure exerted by recreational fishing</b>	104*			x	x (studies under way)	

77) Flanders: temperature, sulfates, chlorides, pH, nitrates and nitrites, EC 20, dissolved oxygen, organic matter, ammonium, phosphate, total phosphor. Wallonia: temperature, dissolved oxygen, pH, chlorides, sulfates, total cyanides, ammonium, Kjeldahl Nitrogen, total phosphor, heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Zn), anionic detergents, HAP, pesticide residuals (e.g. Lindane). Brussels: surface water quality is evaluated among others for the Senne, the Woluwe and the canal Brussels-Charleroi. Analysis is made at the physico-chemical level, biological level and through the analysis of sediments (heavy metals, PCB, non-degradable organic matter).

78) Biochemical Oxygen Demand during 5 days (Flanders: BZV<sub>5</sub>, Wallonia DBO<sub>5</sub>).

79) Wallonia: number of catchments, nitrate concentration (mg/l), pesticide concentration (including atrazine, µg/l), heavy metals (As, Cd, Cr, Cu, Hg, Ni, Pb, Sb, Se, Zn).

- 80) Wallonia : data are collected by the Ministry of Transport and Equipment (MET) for large rivers and by DGRNE for smaller rivers and streams.
- 82) Flanders: see note on indicators 120-121 for the Scheldt estuary.
- 83) Flanders, Wallonia: data are available for water production and water consumption. Flanders: data are collected on the number of sewage installation and wastewater treatment plants.
- 86) Wallonia: piezometric level measurements of the groundwater tables are carried out at about 200 locations. Potential follow-up could amount to 2000 locations.
- 89) and 95) Both Flanders and Wallonia have carried out inventories of freshwater fish species in their rivers. Flanders has established red lists for brackish- and freshwater fish, and has several research projects under way to study the distribution, ecology, habitat use and migration of several species. It is also carrying on research for the establishment of an Index of Biotic Integrity characterising fish populations and the quality of Flandrian water bodies.
- 90) The Belgian Biotic Index (BBI) is used in both Flemish and Walloon regions. It is derived from the French “Indice Biotique”. In Wallonia, both the Belgian and French standards are used. List of species can be obtained on demand. In Brussels, a research project is under way to assess the feasibility to use macro-benthic invertebrates for water quality evaluation.
- 92) Wallonia: this indicator contributes to the evaluation of the implementation of the groundwater protection policy. There are 4 levels of protection depending on the distance from the catchment area. These protection zones are a recent prevention tool to protect groundwater quality, and only 2 have been approved to this day.
- 100) As for the other ecosystems, monitoring and red lists are being elaborated for a number of groups and species (see indicators 145 and 155-170), including vascular plants, waterfowl, amphibians and dragonflies.
- 104) In Belgium, fishing is mostly done as a recreational activity. It is both carried out in artificial areas created for the purpose or in natural rivers. Fishing activities generate important revenues (fish farming, commerce, tourism) but can also some inflict more or less heavy pressures on the environment (artificial stocking of ponds and rivers, overfishing, etc.)

#### 4.4. Coastal and Marine Biological diversity

	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders
Species	<b>Coastal and Marine Biological diversity*</b>					
	% coastal zone with populations exceeding 100 inhabitants/km <sup>2</sup>	105				
	Annual rate of mangrove conversion	106	Not applicable			
	Frozen ground activity	107	Not applicable			
	Coral chemistry and growth pattern	108	Not applicable			
	Lake levels and salinity	109	Not applicable			
	Shoreline position	110	Not applicable			
	# of large scale bottom trawling vessels per 1000km. of coastal area	111				
	E.coli counts and nutrient levels as % of baseline levels	112*				x
	Surface displacement	113				
	Amount of poison chemicals and dynamite used for reef fishing	114	Not applicable			
	Algae index	115				
	Threatened fish species as a percentage of total fish species known	116				
	Change in proportion of fish catches by species per specific season	117*	x			
	List of terrestrial and marine flora and fauna	118*	x partim			x partim
	Number of extinct, endangered, threatened, rare and vulnerable terrestrial species by group (plants and animals)	119*				x partim
	Benthic communities	120*	x			x
Counts of beached seabirds	121*	x			x	
Indices	122*				x	

\* General note: The Belgian coast borders the North Sea and extends in a straight line for 66.5 km. It has been in continuous urbanization for decades because of popular tourism. In matters of environmental protection, the Federal Government is competent for dealing with pollution at sea, marine nature conservation, fisheries, etc. Other aspects concerning the North Sea are dealt with through co-operation agreements, established between the Federal State and the Flemish Region. Although the Brussels-Capital and Walloon Regions do not have access to the sea, they are involved in the decision-making process together with the Federal Government and the Flemish Region, through their participation in the “Steering Committee for the North Sea” (e.g. for waste water). The responsibility for planning and implementing the national policy concerning the North Sea is thus shared by the Federal Government and the Regions.

112) Flanders: the Flemish Environmental Society carries out yearly inventories of the quality of Flemish recreational waters, both at the coast and inland (about 40 inventory locations at the coast). Indicators used are the total content of *E. coli* bacteria / 100 ml, the fecal *E. coli* bacteria / 100 ml, the fecal Streptococci bacteria / 100 ml and Salmonella / liter.

117) For commercial fish, the Sea Fisheries Department (SFD) carries out weekly market samplings in the two most important Belgian fishing harbours, Zeebrugge and Oostende. In the southern North Sea, specific surveys are conducted with the Research Vessel "Belgica" to obtain fishery independent estimates of the distribution and abundance of adult flatfish, and to collect information on their migrations. Annually, young fish surveys are carried out in the flatfish nursery areas along the Belgian coast. These data are used to study the biotic and abiotic factors that affect the dynamics of juvenile sole, plaice and dab, and they are



incorporated in the annual stock assessments, which eventually lead to the formulation of catch quota.<sup>10</sup>

118-119) Federal level: studies of marine mammal populations such as seals and dolphins along the coast and in the Scheldt Estuary. Flanders: exhaustive species inventories and red lists have been established for a wide range of habitats, including sand dune ecosystems (see indicators 145 and 155-170). More specific projects include the study of the population dynamics and spatial distribution of vascular plants and of invertebrate species in coastal dune ecosystems (e.g. carabid beetles, Diptera, etc.). Monitoring of sea- and shorebirds is carried out all year round and is used as an indicator of the sea quality. Methods include boat, plan and land-based inventories, as well as breeding birds surveys. Another intensively studied coastal ecosystem is the Scheldt Estuary, for which vegetation and birds are monitored along the gradient salty-, brackish-, freshwater. The macro-benthos of the estuary is also monitored regularly and serves as indicator of stress and pollution.

120) Flanders: research is under way (under Federal funding) to evaluate which species of benthic communities (*i.e.* shallow sand banks systems) can be best used as indicators for marine ecosystem health.

121) Flanders: in order to assess the level of oil pollution at sea, regular counts of beach seabirds are being carried out each year since the 1960's. It is Belgium's contribution to the "International Beached Birds Surveys"<sup>11</sup>. The counts of beached seabirds are not really used as indicators for biological diversity, but they are essential for providing data on trends of oil pollution.

122) Flanders: see indicator no. 52.

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<sup>10</sup> [http://www.dvz.be/pop\\_dynamics.htm](http://www.dvz.be/pop_dynamics.htm)

<sup>11</sup> <http://www.instnat.be/Soorten/Zeevogels/zeevogels.htm>

#### 4.5. General indicators of Biological diversity

	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders
ECOSYSTEM/HABITAT	<b>General indicators</b>					
	Frozen ground activity	123	Not applicable			
	Karst activity	124*			x	
	Slope failure (landslides)	125				
	Relative wilderness index ( please give your definition)	126				
	Changes in limiting factors for key species e.g. nest holes for parrots, fruit bat roosting trees	127				
	Soil quality	128				x partim
	Volcanic unrest	129	Not applicable			
	Total area of a particular habitat type	130*		x	x	x
	Changes in largest block of a particular habitat type	131				x partim
	Changes in average size of a particular habitat type	132				
	Change in mean nearest distance between blocks of a particular habitat type	133				
	Change in average width of break in an identified habitat corridor	134				
	Total area of protected areas (use IUCN definition of protected areas)	135*		x	x	x
	% of protected area to total area	136*		x	x	x
	Change in habitat boundaries	137				
	Percentage area in strictly protected status	138*		x	x	x
	Percentage of area dominated by non-domesticated species	139				
	Degree of connectivity of food web	140				
	Existence of an ecological network (area, connectivity, composition)	141*			x	x under dev
Existence of institutional capacity, policy and regulatory framework for the planning, management and conservation of biological diversity	142			(x)	x	x
Size and distribution of protected areas	143*			x	x	x
Nature outside protected areas (area)	144*			x	x	x

124) Wallonia: the Karst Atlas (Atlas du Karst) has been established for the Region.

130) Major habitat types are inventoried in all regions.

Brussels: private green spaces (gardens, etc.), open green spaces (forests, parks), railway embankments, scrubland, agricultural areas, other green spaces (cemeteries, road embankments, etc.), blue spaces (ponds, rivers, wetlands).

Flanders (total area, % area of Flanders): coastal dunes, heathlands and bogs, wetlands, grasslands, forests, scrubland, inland waters (including estuaries).

Wallonia: the CORINE typology is used: 2- non-marine waters, 3- scrub- and grassland, 4- forests, 5- bogs and marshes, 6- inland rocks, screes and sands, 8- agricultural land and artificial landscapes, 9- wooded grasslands and scrubs.

See <http://mrw.wallonie.be/dgrne/sibw/habitats/home.html>

135-136, 138, 144) Major types of protected areas are:

Brussels: nature reserves, forest reserves, Natura 2000 areas, green spaces.

Flanders: nature reserves, forest reserves, military areas managed for conservation purposes, protected coastal dune areas (Duinendecreet), areas of international status such as Natura 2000 (including special protection areas and special areas of conservation) and Ramsar areas.

Wallonia: nature reserves, forest reserves, wetlands of biological interest, underground cavities of scientific interest, Natura 2000 areas (including special protection areas and special areas of conservation), natural parks (see indicator 144 for natural parks). See <http://mrw.wallonie.be/dgrne/sibw/sites/home.html>

141) Brussels: the Region is working on establishing green and blue networks, which are planning concepts emphasizing the cohesion and continuity of green spaces (parks, gardens, railway embankments, woods, etc.) and waterways (rivers, ponds) within the urban structure. See <http://www.ibgebim.be/ESPACES-VERTS/MAILLAGE/index.htm>.

Flanders: the Region is developing a “functional ecological network for Flanders” (VEN + IVON) linking sites of ecological value (including nature reserves and Natura 2000 areas).

144) Brussels: see 141. Wallonia: several measures are being taken to preserve nature outside protected areas. They include natural parks, local management plans (plans communaux de développement de la nature), thematic operations (late mowing of roads banks, adequate fitting of church towers to attract owls), financial support for hedge plantations, agri-environmental measures. Flanders: regional management plans (gewestplannen).

	INDICATORS	No.	Federal level	Brussels	Wallonia	Flanders	
SPECIES	Change in number and/or distribution of keystone, flagship or indicator species	145*		x partim	x partim	x partim	
	# of introduced species and genomes	146*		x partim	x partim	x partim	
	Change in presence, location, area, numbers of invasive plant or animal species	147*			x partim		
	Quantity of specimens or species of economic/scientific interest removed from the environment	149					
	Density of road network	150			x	x	
	Percentage of area dominated by non domesticated species occurring in patches greater than 1 000 sq. km.	151					
	Population growth and fluctuation trends of special interest species	152				x	
	Sex ratio, age distribution and other aspects of population structure for sensitive species, keystone species, and other special interest species	153					
	Presence of taxa on environmental integrity	154					
	Recorded species present by group	155*			x partim	x partim	x partim
	Indigenous species present by group	156*			x partim	x partim	x partim
	Non-indigenous species present by group	157*			x partim	x partim	
	# of endemic/threatened/ endangered/vulnerable species by group	158*			x partim	x partim	x partim
	Temporal change in number of species (increase/decrease )	159*				x partim	x partim
	Temporal change in number of populations (increase/decrease )	160*				x partim	x partim
	Change in composition of species overtime	161					
	Species Group: total number versus threatened species	162*			x	x	x
	Species with small populations vs larger population size	163					
	Spatial differences in the number of rare vs common species	164					
	Spatial differences in the restricted vs wide range species	165					
	Representativeness of intra-specific variability of endangered and economically important species	166					
	Diversity of native fauna	167*			x partim	x partim	x partim
	Species richness (number, number per unit area, number per habitat area)	168					
	Species threatened with extirpation	169					
	Species threatened with extinction (number or percent)	170*			x partim	x partim	x partim
	Endemic species threatened with extinction	171	Not relevant (no endemics in Belgium)				
	Species risk index	172					
	Species with stable or increasing populations	173					x partim
	Species with decreasing populations	174*			x	x	x
	Threatened species in protected areas	175*			x	x	x
	Endemic species in protected areas	176	Not relevant (no endemics in Belgium)				
	Threatened species in ex-situ collections	177					
	Threatened species with viable ex-situ populations	178					
	Species used by local residents	179					
	Pressures from urban areas	180*				x	
	Pressures from transport	181*				x	

145) and 155 to 170) Major groups have inventoried in all regions and are used as biological diversity indicators. Red lists have been established for those species, and population trends are monitored for most groups. Some species/groups are used as bio-indicators but few species/groups are used as keystone or flagship species/groups.

Brussels: vascular plants, fungi, amphibians and reptiles, birds (incl. waterfowl), mammals (incl. bats). Some data on mosses and lichens.

Flanders: list of species and red lists are available for vascular plants, mosses and liverworts (list of species but no red list yet), lichens (idem), amphibians and reptiles, fishes (fresh- and brackishwater fishes), some invertebrate groups (long-legged flies, butterflies, carabid beetles, dragonflies, spiders) birds (breeding bird surveys, overwintering birds, migrating birds), mammals. See <http://www.instnat.be/Soorten/index.htm>

Wallonia: regularly monitored groups are orchids, butterflies, dragonflies, reptiles and amphibians, birds and bats. Lists of species are available for orchids, some invertebrate groups (crayfishes, butterflies, dragonflies, ladybirds), reptiles and amphibians, freshwater fishes, birds and mammals. Red lists are available for mammals, birds, butterflies and dragonflies. See <http://mrw.wallonie.be/dgrne/sibw/especes/home.html>

When projects on flagship or keystone species exist, they usually are not utilised as biodiversity indicators. However, a few examples of projects are given hereafter for information purposes. Projects on flagship species are often oriented towards birds. Two projects with a high public awareness impact use storks as flagship species for migratory bird species (one project on white storks in Flanders and one on black storks in Wallonia)<sup>12</sup>. In Wallonia, another project by a NGO is oriented towards the protection of the bittern (*Botaurus stellaris*), which is used as a flagship species for reedbeds habitats. As for keystone species, most projects are still only at the research level. For example, one project uses the common red starfish (*Asterias rubens*) as a keystone species for coastal biotopes of the North Sea (open and closed estuarine branches, intertidal and offshore zones).

149-150-157) Brussels: some data on introduced / naturalised species are available for vascular plants (incl. trees), amphibians and reptiles, birds. Follow-up of some species of those group is carried out, for example in waterfowl populations. Wallonia: some data is available for some groups such as birds, vascular plants, mammals and invertebrates (e.g. crayfishes). Studies are carried on an occasional basis.

180) Wallonia: urbanization (total cover and distribution of rural and non rural areas) is used to evaluate the pressure of urban development on natural areas. It also gives an indication of the fragmentation of these natural areas.

181) Wallonia: pressure from transport is evaluated through the average distance covered per person and per year for major transport categories (foot, bike, motorbike, car, train, bus, cab, underground). This indicator is complemented by an indicator on pressure by aerial transport.

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<sup>12</sup>White storks: <http://www.ooievaars.vlaanderen.be/en/>, black storks: <http://www.explorado.org/solon-new/index.htm>