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Final database on linkages between species/habitat-types and broad ecosystems

Sabine Roscher, Sophie Condé, Jérôme Bailly Maitre

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ALTERRA AOPK-CR ECNC Ecologic ILE-SAS ISPRA JNCC MNHN SC-NAT SLU Space4environment UBA

Authors' affiliation:

Sabine Roscher, Muséum national d'Histoire naturelle (FR)
Sophie Condé, Muséum national d'Histoire naturelle (FR)
Jérôme Bailly Maitre, Muséum national d'Histoire naturelle (FR)

EEA project manager:

Mette Palitzsch Lund

ETC/BD production support:

Muriel Vincent, Muséum national d'Histoire naturelle (FR)

Context:

The Topic Centre has prepared this Technical paper in collaboration with the European Environment Agency (EEA) under its 2015 work programmes as a contribution to the EEA's work on the biodiversity data center.

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European Topic Centre on Biological Diversity
c/o Muséum national d'Histoire naturelle
57 rue Cuvier
75231 Paris cedex, France
Phone: + 33 1 40 79 38 70
E-mail: etc.biodiversity@mnhn.fr
Website: http://bd.eionet.europa.eu/

Contents

1 Introduction / background

For reporting on state and trends of biodiversity from an ecosystem perspective, information on the association of species and habitat types to ecosystems is required. Hence in 2013 the ETC/BD prepared reference data sets - building on preliminary work done in 2010 -, where all mammal, reptile and amphibian species listed in European Atlases, all species and habitats considered for reporting under Article 17 of the Habitats Directive and all bird species considered for reporting under Article 12 of the Birds Directive are allocated to ecosystem-types as defined by the MAES typology (under Target 2 of the EU 2020 Biodiversity Strategy). This allocation of species and habitat per ecosystem is done for each of the nine terrestrial biogeographical regions (according to the Habitats Directive) and each marine region (according to the Marine Strategic Framework Directive). As part of a public consultation the information for butterflies could be added.

Table 2-1 provides the overview on the species and habitats included in the database. The 'association categories' used and the rules for the use of these categories are shown in table 2-2.

1.1 Relevance of the data base

The requirement and importance of this data base is due to the need for reporting on state and trends of biodiversity form an ecosystem perspective. The association of species and habitat types to ecosystems allows the use of data resulting from reporting on species and habitat types for building statistics, indicators and maps on the ecosystem level such as MAES.
Concrete example for the use are the presentation of results from Article17 reporting per main ecosystem type in order to communicate sector specific messages and the assessment of progress towards target 3 of the EU biodiversity strategy.

2 Methodology

2.1 Preparation of a draft matrix and public consultation

A first draft matrix showing the association of species and habitats to ecosystems had been produced by the ETC/BD. This draft matrix was based on the information – distribution maps and reports -resulting from the Member States (EU 25) reporting under article 17 of the Habitats Directive in 2007. In addition, published literature and internet sources represented other main sources of information about species and habitats distribution (see the list of references).

In order to aggregate information on MAES ecosystem types, which was originally based on either habitat types or land cover classes, cross-linkages between the different typologies have been used.
The equivalence between the current MAES ecosystem types, the EUNIS habitats level 1 and the Corine Land Cover classification is provided in the cross-linkage tables in Annex III.

The draft matrix was prepared in the form of 'user friendly' excel files, which were used in a process of consultation organised by EEA NSV. The consultation took place between

December 2013 and January 2014. Box 2.1 gives a ovierview on the feedback received from the Eionet and the Expert Group on Reporting.

Box 2.1 Feedback from Eionet and Expert Group on Reporting

19 replies received from
- 14 countries
- 4 specialist NGOs (BatLife, BirdLife, Butterfly Conservation Europe*, European Environmental Bureau)
- 1 from DG ENV

* We'd like to thank specifically Butterfly Conservation Europe for their important contribution on European butterflies based on the most current distribution atlas of European butterflies (Kudrna et al. 2011).

The species and habitats included in the database are listed in table 2-1. The categories used and the rules for the use of the categories are shown in table 2-2.

Table 2-1: Species and habitat types included in the data base

Habitat types	• Habitat types covered by the Habitats Directive Annex I
Species	• Amphibians, Reptiles, Mammals and Butterflies from published European Atlases • Species covered by the Habitats Directive, Annexes II and IV • Species covered by the Habitats Directive, Annex V except: genera *Lycopodium*, *Sphagnum* and *Cladonia*
Bird species	• All species of naturally occurring birds in the EU and a selection of non-native birds to be reported under Article 12 of the Birds Directive

Table 2-2 Categories and rules for the allocation of non bird species to ecosystems

	Categories used	Comment
P	**Preferred ecosystem** The ecosystem which is the most important one for the species. Usually the ecosystem which is used for its life circle or to which its largest population is linked to.	
S	**Suitable ecosystem** The ecosystem where the species regularly occurs other than	

	the preferred one.	Only used for non bird species
O	**Occasional ecosystem** The ecosystem in which the speices lives sometimes, but only a margianlly or a small part of the species population uses this ecosystem	Only used for non bird species

Rules applied	
Non bird species	• Terrestrial/freshwater species: maximum of 2 preferred ecosystems (P) are assiciated • Marine species: maximum of 3 preferred ecosytems (P) • Non bird species: can be associated with several suitable ecosystems (S) or occasional ecosystems (O)
Habitat types	• Terrestrial habitat types are only associated with one major ecosystem • Marine habitat types: due to the complexity of marine environment, in some cases, several major ecosystems have been associated with one habitat type
Bird species	• The indication of the preferred ecosystem is differentiated by breeding and wintering populations • Maximal 2 preferred ecosystems (P) are associated
Bird species aggregation on EU level	• The indication of the preferred ecosystem is differentiated by breeding and wintering populations • Maximal 3 preferred ecosystems (P) are associated

2.2 Specific remarks on the EU level aggregation for birds

The "MAES table for birds[1]" is a subset of the reference data set on "association of species and habitat types to ecosystems". It includes all species of naturally occurring birds in the EU and a selection of non-native birds to be reported under Article 12 of the Birds Directive.
In the original reference data set on "association of species and habitat types to ecosystems" the association of the birds species to their preferred ecosytems was done on the European Biogeographical level. However due to the specific rules for the Art 12 reporting, it was necessary to have information on the association between bird species and ecosystems **at EU level.** Thus an aggregation from the biogeographical level to the EU level was done using the following rule:
If the total number of preferred ecosystems for a bird population across all biogeographical regions was lower or equal to 3, the information on the preferred ecosystem were taken over

[1] species_birds_maes_EU27

into the EU table. In cases where more than 3 preferred ecosystems were indicated, a selection was made based on literature (Tucker & Evans, 1997).

2.3 Know limitations in the use of the data base

The **species nomenclature** is mainly based on what was used in the input data, namely the reporting and the atlases. The names were not fully linked to one taxonomic reference list, thus the species names include synonyms. Also recent lumping and splitting of taxa due to new knowledge in taxonomy is not reflected.

The data base is mainly used to support the creation of statistics reporting on state and trends of biodiversity from an ecosystem perspective, that means in combination with other data. **Statistics based only on the tables** in this data base – i.g. counting the number of amphibians present in wetlands – are not considered as sound and **should not be carried out**. It needs to be considered that the number of the species per species group listed here are not necessarily complete and only represent the status of knowledge when the atlases were published. Since then new knowledge has be gained.

3 Overview on the structure of the data base

The database is kept in a flat structure; where species names are also listed in the Natura 2000 species list the respective code has been added to the table, same for the EURING code. For the ecosystem types a new code was introduced using camel case; the look-up table indicates which of these types are according to the MAES typology (see table 3-1).

Although the MAES typology does not distinguish agricultural mosaics, it was felt useful to have the species and habitat types that are associated with agricultural mosaics in an additional table. In the MAES table this habitat type is included in the cropland. Annex III shows the equivalence between the current MAES ecosystem types, the EUNIS Habitats level 1 and the Land Cover classification.
As the species names used in the database are sometimes synonyms and not accepted speciesnames. Therefore an additional table with the acceptances status of the scientific species names and their synonyms was created mainly based on the Catalogue of Life[2].

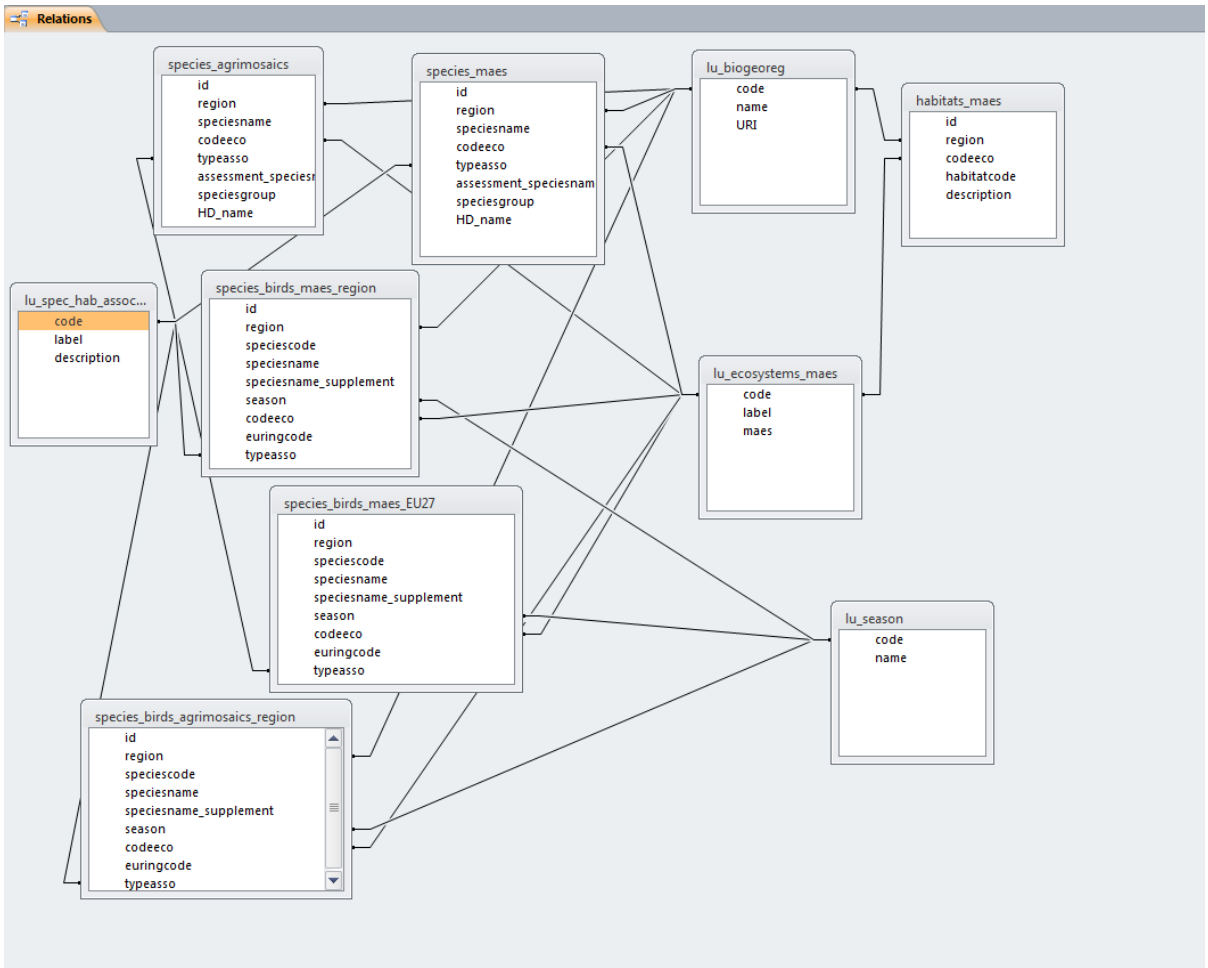
The coding for the biogeographical and marine regions is according the EEA vocabulary bioreg. The relationship of the tables is shown in figure 3-1, the name of lookup tables starts with ‘lu’.

[2] http://www.catalogueoflife.org/

Table 3-1 look-up table ecosystem types

lu_ecosystems_maes		
code	**label**	**maes**
urban	Urban	y
cropland	Cropland	y
AgriMosaics	Agricultural Mosaics	n
grassland	Grassland	y
heathlandShrub	Heathland and shrub	y
wetlands	Wetlands	y
riversLakes	Rivers and lakes	y
sparselyVegetated	Sparserly vegetated land	y
woodlandForest	Woodland and forest	y
marineInlets	Marine inlets and transitional waters	y
ocean	Open ocean	y
shelf	Shelf	y
coastal	Coastal	y

Figure 3-1 Entity Relationship diagram



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Annex I Data base

The database has been uploaded to forum (link to the data base)

Annex II Table definitions

Table habitats_maes	
Data on the association between habitat types of the Habitats Directive and ecosystems (MAES typology) at the regional level	
id	Primary key
region	Biogeographical or marine region, lookup table: lu_biogeoreg
codeeco	Code ecosystems (MAES typology), lookup table: lu_ecosystems_maes
habitatcode	Code Habitats Directive habitat type
description	Description of the habitat type as in the Habitat Directive Annex I
Table species_maes	
Data on the association between species of the Habitats Directive and ecosystems (MAES typology) at the regional level	
id	Primary key
region	Biogeographical or marine region, lookup table: lu_biogeoreg
codeeco	Code ecosystems (MAES typology), lookup table: lu_ecosystems_maes
speciesname	Scientific species name
typeasso	Type of species/habitat association, lookup table: lu_spec_hab_association
assessment_speciesname	Name of species used for EU assessment. Only species/regions which are part of Art.17 reporting are indicated in this field (i.e. If there is no assessment at the EU level for a given species in a given region, the assessment speciesname is not available)
speciesgroup	Higher taxonomic group (simplified)
HD_name	Species name according to the Annexes of the Habitats Directive
Table species_birds_maes_EU27	
Data on the association between bird species of the Birds Directive and ecosystems (MAES typology) at the EU level	
id	Auto generated unique identifier
region	Regional scope (here the EU27) on which the relation to the MAES classification is relevant for a given species and season
speciescode	Code for species "concept" according to Birds Directive Article 12 reporting

speciesname	Part of species "concept", Scientific name of the species
speciesname_supplement	Part of species "concept", this supplement differentiates flyways and taxonomic units according to Birds Directive Article 12 reporting
season	Season in which data were collected, lookup table: lu_season
codeeco	Code ecosystems (MAES typology), lookup table: lu_ecosystems_maes
euringcode	Code for species according to EURING
typeasso	Type of species/habitat association, lookup table: lu_spec_hab_association
Table species_birds_maes_region	
Data on the association between bird species of the Birds Directive and ecosystems (MAES typology) at the regional level	
id	Primary key
region	Biogeographical or marine region, lookup table: lu_biogeoreg
codeeco	Code ecosystems (MAES typology), lookup table: lu_ecosystems_maes
speciescode	Code for species "concept" according to Birds Directive Article 12 reporting
speciesname	Part of species "concept", Scientific name of the species
speciesname_supplement	Part of species "concept", this supplement differentiates flyways and taxonomic units according to Birds Directive Article 12 reporting
season	Season in which data were collected, lookup table: lu_season
euringcode	Code for species according to EURING
typeasso	Type of species/habitat association, lookup table: lu_spec_hab_association
Note : The codes for 'species' are unique for the combination of species name and subspeciesUnit (flyway)	
Table species_agrimosaics	
Data on the association between species of the Habitats Directive and agricultural mosaics (not from MAES typology) at the regional level	
id	Primary key
region	Biogeographical or marine region, lookup table: lu_biogeoreg
codeeco	Code ecosystems (not from MAES typology), lookup table: lu_ecosystems_maes
speciesname	Scientific species name
typeasso	Type of species/habitat association, lookup table: lu_spec_hab_association
assessment_speciesname	Name of species used for EU assessment. Only species/regions which are part of Art.17 reporting are indicated in this field (i.e. If there is no assessment at the EU level for a given species in a given region, the assessment speciesname is not available)
speciesgroup	Higher taxonomic group (simplified)
HD_name	Species name according to the Annexes of the Habitats Directive
Table species_birds_agrimosaics_region	
Data on the association between bird species of the Birds Directive and agricultural mosaics (not from MAES typology) at the regional level	

id	Primary key
region	Biogeographical or marine region, lookup table: lu_biogeoreg
codeeco	Code ecosystems (not from MAES typology), lookup table: lu_ecosystems_maes
speciescode	Code for species "concept" according to Birds Directive Article 12 reporting
speciesname	Part of species "concept", Scientific name of the species
speciesname_supplement	Part of species "concept", this supplement differentiates flyways and taxonomic units according to Birds Directive Article 12 reporting
season	Season in which data were collected, lookup table: lu_season
euringcode	Code for species according to EURING
typeasso	Type of species/habitat association, lookup table: lu_spec_hab_association
Note : The codes for 'species' are unique for the combination of species name and subspeciesUnit (flyway)	
Table scientificnames_status	
Status of scientific names used in the dataset. Information on accepted name when the scinetific name is a synonym	
speciesname	scientific species name
acceptedName	accepted name in case that species name is a synonym
acceptedName_author	species author of the accepted name
status	acceptance status mainly taken from Catalogue of Life
Table lu_biogeoreg	
Lookup table for the coding of the biogeographical or marine regions	
code	Code biogeograpical or marine region
name	Label biogeographical or marine regions
URI	URI to the EEA vocabulary
Table lu_ecosystems_maes	
Lookup table for the coding of ecosystems	
code	Code ecosystem
label	Label ecosystem
maes	Indication for MAES ecosystems (y: this is a MAES ecosystem, n: this is not a MAES ecosystem)
Table lu_spec_hab_association	
Lookup table for the coding of the species/habitat association	
code	Code for the type of species/habitat association
label	Label for the type of species/habitat association

description	Description of the species/habitat association
Table lu_season	
Lookup table for the coding of the season for bird species	
code	Code for season
name	Description of the season

Annex III Equivalence between the current MAES ecosystem types, the EUNIS Habitats level 1 and the Land Cover classification.

MAES typology of ecosystems		Representation of habitats (functional dimension by EUNIS level 1 and MSFD for marine ecosystems)	Representation of land cover (spatial dimension)
Major ecosystem category (level 1)	**Ecosystem type for mapping & assessment (level 2)**		
Terrestrial	**Urban**	**J Constructed industrial & other artificial habitats**	Urban, industrial, commercial and transport areas, urban green areas, mines, dump and construction sites
	Cropland	**I Regularly or recently cultivated agricultural, horticultural & domestic habitats**	Annual and permanent crops
	Grassland	**E Grasslands & land dominated by forbs, mosses or lichens**	Pastures and (semi-) natural grasslands
	NOT A MAES TYPE, but added in the context of this project Agricultural mosaics (*)	**X Habitat complexes limited to** Crops shaded by trees, Intensively-farmed crops interspersed with strips of semi-natural vegetation, Pasture woods (with a tree layer overlying pasture), Mosaic landscapes with a woodland element (bocages)	
	Woodland and forest	**G Woodland, forest & other wooded land**	Forests
	Heathland and shrub	**F Heathland, scrub and tundra**	Moors, heathland and sclerophyllous vegetation
	Sparsely vegetated land	**H Inland unvegetated or sparsely vegetated habitats**	Open spaces with little or no vegetation (bare rocks, glaciers and beaches, dunes and sand plains included)
	Wetlands	**D Mires, bogs and fens**	Inland wetlands (marshes and peatbogs)
Freshwater	**Rivers and lakes**	**C Inland surface waters**	Water courses and bodies incl. coastal lakes (without permanent connection to the sea)
Marine	**Marine inlets and transitional waters**	Pelagic habitats: Low/reduced salinity water(of lagoons) Variable salinity water (of coastal wetlands, estuaries and other transitional waters) Marine salinity water (of other inlets) Benthic habitats: Littoral rock and biogenic reef Littoral sediment Shallow sublittoral rock and biogenic reef Shallow sublittoral sediment	Coastal wetlands: Saltmarshes, salines and intertidal flats Lagoons: Highly restricted connection to open sea, reduced, often relatively stable, salinity regime Estuaries and other transitional waters: Link rivers to open sea, variable, highly dynamic salinity regime. All WFD transitional waters included Fjords/sea lochs: Glacially derived, typically elongated and deep; marine salinity regime Embayments: Non-glacial origin, typically shallow, marine salinity system Pelagic habitats in this type include the photic zone, benthic habitats can include it or not
	Coastal	Pelagic habitats: Coastal waters Benthic habitats: Littoral rock and biogenic reef Littoral sediment Shallow sublittoral rock and biogenic reef Shallow sublittoral sediment	Coastal, shallow-depth marine systems that experience significant landbased influences. These systems undergo diurnal fluctuations in temperature, salinity and turbidity, and are subject to wave disturbance. Depth is up to 50-70 meters. Pelagic habitats in this type

MAES typology of ecosystems		Representation of habitats (functional dimension by EUNIS level 1 and MSFD for marine ecosystems)	Representation of land cover (spatial dimension)
Major ecosystem category (level 1)	**Ecosystem type for mapping & assessment (level 2)**		
			include the photic zone, benthic habitatscan include it or not
	Shelf	Pelagic habitats: Shelf waters Benthic habitats: Shelf sublittoral rock and biogenic reef Shelf sublittoral	Marine systems away from coastal influence,down to the shelf slope. They experience more stable temperature and salinity regimes than coastal systems, and their seabed is below wave disturbance. Depth is up to 200 meters. Pelagic habitats in this type include the photic zone, benthic habitats are beyond the photic limit (aphotic)
	Open ocean	Pelagic habitats: Oceanic waters Benthic habitats: Bathyal (upper, lower) rock and biogenic reef Bathyal (upper, lower) sediment Abyssal rock and biogenic reef Abyssal sediment	Marine systems beyond the shelf slope with very stable temperature and salinity regimes, in particular in the deep seabed. Depth is beyond 200 meters. Pelagic habitats in this type are, in proportion, mostly aphotic, benthic habitats are aphotic

(*) Although the MAES typology does not distinguish Agricultural mosaics, it was felt useful to add this category in the context of this project io allow more precise reporting if needed for other purposes than MAES. It is a level 1 class in the EUNIS habitat classification.