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WEC (RWES) in a European context: EUNIS & the Water Framework Directive

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ABSTRACT:

European directives have a significant impact on policies developed in the individual countries within the European Union. The Water Framework Directive requests all participating countries to (1) classify and (2) monitor the surface waters within countries according to guidelines which are applicable for the whole of the European Union. Even though directives provide a pan-European legislative framework, they generally do not explicitly state how this framework should be implemented into national policies. Two classification methods are compared within the scope of their usability within Europe:

1. EUNIS (**European Nature Information System)** is one of the new habitat classification systems to be used within Europe.
2. The **Water Ecotope Classification** system (WEC, *rijkswateren ecotopen stelsel*) is designed for water systems in the Netherlands managed by the national authorities (*Rijkswaterstaat*)

The **objectives** of this report are twofold:

- firstly, to indicate the usefulness of the WEC in relation to the objectives and requirements stated in the Water Framework Directive;
- secondly, to compare the differences between the WEC and EUNIS classification and to try to indicate in which way the two methods can benefit from each other (e.g. by implementing specific features).

Conclusions

The Water Ecotopes Classification appears a suitable tool in the context of article 5 of the Water Framework Directive. As a quality status monitoring tool (required for article 8) it can not be used.

EUNIS focuses on standardizing the inventory of habitats throughout Europe. In this perspective completeness is of greater importance than the fact that habitat scales are varying. It enables the identification of areas which are important for nature conservation. This gives EUNIS the advantage of being able to 'qualify' areas if syntaxa are used on the most detailed level.

WEC on the other hand was mainly designed to be a practical tool in describing landscape units related to the water bodies managed by the national authorities in the Netherlands. Therefore it uses a limited but useful set of criteria, which enables the stratification of a River Basin using a relatively easy method. Also, it may help predicting significant landscape changes on ecotope scale as a result of alteration of management schemes, since these alterations can be linked to the criteria used within the WEC.

Thus, although designed with different objectives in mind, the two classification systems can be used together when describing landscape units: the WEC out of practicality and EUNIS out of quality perspective. Alongside each other they form a useful tool within the European legislative framework.

REFERENCES:

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1 Introduction

1.1 Scope

European directives have a significant impact on policies developed in the individual countries within the European Union. One of these directives is the '*Directive 2000/ EC of the European Parliament and of the Council of establishing a framework for Community action in the field of water policy'* (further referred to as the Water Framework Directive, WFD) (European Communities, 2000). This directive requests all participating countries to (1) classify and (2) monitor the surface waters within countries according to guidelines which are applicable for the whole of the European Union. From this perspective two other important EU directives are the EU Habitats Directive (European Communities, 1992) and the Birds Directive (European Communities, 1979), which call for pan-European habitat classification and species protection schemes initiated by the Convention of Bern (Council of Europe, 1979).

Even though directives provide a pan-European legislative framework, they generally do not explicitly state how this framework should be implemented into national policies. Therefore, pan-European methods (in this context especially focussing on classification) have been in development for a long time as a reaction to these directives. In 1987 CORINE (European Communities, 1991) was introduced followed by the Palearctic habitat classification in 1993 (Devillers and Devillers-Terschuren, 1996). From these two classifications the present proposal for EUNIS evolved (Davies and Moss, 1999). Still relatively new, EUNIS is the acronym for **European Nature Information System**. It is an initiative of the European Environment Agency (EEA), developed and maintained by the European Topic Centre on Nature Conservation. EUNIS information is being used to support NATURA2000 (European Communities, 2001) and international co-ordination, e.g. with the Bern Convention (Council of Europe, 1979) and directives written in response to this convention such as the Habitat Directive (European Communities, 1992). It is expected that the EUNIS classification will become a standard tool for classification of habitats within Europe, which includes the classification of surface waters.

Water management policy in the Netherlands already requires the development of similar methods for (1) classification and (2) monitoring of surface waters and adjacent land units throughout the country since a few decades. Various systems have been developed, one of these classification systems is the Water Ecotope Classification system (WEC, *rijkswateren ecotopen stelsel*) (Wolfert, 1996). It is designed for water systems in the Netherlands managed by the national authorities (*Rijkswaterstaat*) and introduced in 1994 with the River Ecotopes Classification System (Rademakers and Wolfert, 1994). Since then the WEC has been fine-tuned and matured into a useful practical classification system for all national waters.

1.2 Objectives

The objectives of this report are twofold:

- firstly, to indicate the usefulness of the WEC in relation to the objectives and requirements stated in the Water Framework Directive;
- secondly, to compare the differences between the WEC and EUNIS classification and to try to indicate in which way the two methods can benefit from each other (e.g. by implementing specific features).

1.3 Readers guide

Chapter two gives a description of the Water Framework Directive, the EUNIS classification and the Water Ecotopes Classification system. A comparison of the Water Framework Directive and the EUNIS classification with the WEC will be given in chapter three. Conclusions are summarised in chapter four.

2 Description

2.1 General

This chapter gives a short description of the water policy directive formulated in 2000 (PE-CONS 3639/00, Water Framework Directive), the EUNIS classification method and the Water Ecotopes Classification. It will mainly focus on those point relevant for the formulated objectives as stated in chapter one. After giving a summary of the basic objectives and requirements a reflection is written on the interpretation of these documents.

2.2 Water Framework Directive

Basic objectives and requirements

The Water Framework Directive aims at maintaining and improving the aquatic environment. It is primarily concerned with the quality of the waters concerned, and control of quantity is an ancillary element in securing good water quality. Therefore, measures on quantity, serving the objective of ensuring good quality, should also be established. The elimination of 'priority hazardous substances' and 'no further deterioration of the status of a water' are amongst the other aims (European Communities, 2000).

Three requirements are relevant to surface water management:

1. An analysis of the characteristics of the River Basin District[1], which includes a review of the environmental impact of human activity and economic analysis of water use (Article 5)
2. Monitoring of surface water status (also for groundwater status and protected areas (Article 8))
3. A River Basin Management Plan should be made (Article 13)

It should also be noted that Article 6 emphasises the registration of specifically defined protected areas. The protected areas are mainly defined according to the Habitat Directive (European Communities, 1992) and the Birds Directive (European Communities, 1979) (see appendix A for a brief overview of the European legislative framework with respect to nature conservation issues). These are areas which have been designated since they require special protection of their surface water and groundwater, or for the conservation of habitats and species directly depending on water (registration should be completed at the latest 5 years after date of entry into force).

[1] *River Basin Districts are defined as the area of land and sea, made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters, which is identified as the main unit for management of river basins. Small river basins may be combined with larger river basins or joined with neighbouring small basins where appropriate.*

For each requirement mentioned above a more detailed description is given below. To this end, both texts from the mentioned articles and relevant Annexes are included.

Article 5

For each River Basin District within a country (or that part of an international River Basin District which is within the boundaries of a country) the following requirements should be met within 4 years after the date of entry into force of the Directive and every six years thereafter:

- An analysis of its characteristics
- A review of the impact of human activity on the status of surface waters and on groundwaters
- An economic analysis of water use

The actions necessary to meet these requirements are listed in Annex II and Annex III. From these actions the following are important in relation to surface water management:

Characterisation of surface water body types should be met by reporting the following features

- Categories: rivers, lakes, transitional waters and coastal waters (or artificial or heavily modified surface water bodies)
- Each category should be differentiated according to either type A (ecoregion based classification[2]) or type B (using a set of descriptors that characterise physical and chemical features of the river and hence the biological population structure and composition)
- Maps (GIS-based) with the geographical location of the types consistent with the degree of differentiation required for type A are submitted.
- The establishment of type-specific reference conditions[3] for surface water body types is required, representing the values of the hydromorphological and physiochemical quality elements for that surface water body type at high ecological status.
- The type and magnitude of the significant anthropogenic pressures should be monitored (point source pollution, urban, industrial, agricultural and other anthropogenic pressures).
- Impact assessments should be carried out.

Article 8

[2] *If system A is used, the surface water bodies shall first be differentiated by the relevant ecoregions in accordance with the geographical categories, after which they are differentiated by the descriptors as set for these geographical categories in system A (i.e. altitude, size, geology)*

[3] *In case of highly modified or artificial surface water bodies a maximum ecological potential should be defined. These reference conditions may be either spatially based and/or based on modelling (expert judgement where the former methods are not possible).*

- *For spatially based types specific biological reference conditions, a reference network should be developed, consisting of a sufficient number of sites of high status to provide a sufficient level of confidence.*
- *For type specific biological reference conditions based on modelling using either predictive models or hindcasting methods, using historical, palaeological and other available data should be used.*

This article deals with the monitoring of surface water status (and also groundwater status and protected areas) and required features are listed in Annex V. It requires the monitoring of:

- the volume and level or rate of flow to the extent relevant for ecological and chemical status and ecological potentials
- the ecological and chemical status and ecological potential

The monitoring programmes shall be operational at the latest six years after the date of entry into force of the directive, and frequency of monitoring differs per element ranging from ones every month (priority substances) to once every six years (morphology).

The quality elements for the classification of ecological status are derived for the recognised surface water bodies (rivers, lakes etc.) and classified into:

- biological elements (composition and abundance of aquatic flora and fauna)
- hydromorphological elements supporting the biological elements
- chemical and physiochemical elements supporting the biological elements

The monitoring of ecological status and chemical status for surface waters should be implemented by using normative definitions. These are either 1) High, 2) Good, 3) Moderate, 4) Poor or 5) Bad (mapped using colour codes). It shall include a comprehensive overview of ecological and chemical status within each river basin on a more detailed level.

Article 13

The directive requires countries to make River Basin Management Plans for each river basin (partially) within that country. The first plan should be published at the latest 9 years after the date of entry into force of this Directive. Plans shall be reviewed and updated at the latest 15 years after date of entry into force and every six years thereafter.

Annex VII lists that River basin management plans should include:

- map of the location and boundaries of water bodies
- map of the ecoregions and surface water body types within the river basin
- identification of reference conditions for the surface water body types
- summary of significant pressures and impact of human activity on the status of surface water and groundwater,
- map of the protected areas
- map of monitoring networks
- list of environmental objectives
- summary of the economic analysis of water use
- summary of measures to achieve management objectives
- register of more detailed programs and management plans for the river basin district
- summary of public information and consultation measures taken
- list of competent authorities
- data gathering methods

Reflection

Biodiversity is the central indicator used by the Water Framework Directive to establish the ecological status of both surface waters, groundwater and protected areas. It does not explicitly aim at the protection of particular species, communities, biotopes or habitats, but focuses mainly on the quality of in-water situations. The terrestrial parts of water systems as recognised in the Netherlands (e.g. floodplains) are not explicitly taken into account. For the terrestrial part of water systems the Habitat Directive and the Birds Directive are referred to by the Water Framework Directive. Also it does not require a detailed description of water quantity issues, but only notes this in relation to water quality issues.

Summarising, the Water Framework Directive requires both the stratification of water body types (characterisation according to Annex II) and the monitoring of surface water body types (according to Annex V). The spatial scale level for the classification is relatively coarse, but for monitoring more detailed analyses are required. All information should be used to define River Basin District plans.

2.3 EUNIS

Basic objectives and requirements

According to http://www.mrw.wallonie.be/dgrne/sibw/eunis/eunis.intro.html#Objectives:

> 'The aim during development of the EUNIS Habitat classification has been to create a common European reference set of habitat units with a common description of all units and a common hierarchical classification. This will enable referencing and reporting habitat data in a comparable manner for use in nature conservation (inventories, monitoring, assessment). It will not supplant existing national or sectoral systems, unless member countries or institutions so want.
>
> The specific requirements are that the classification should:
> - provide a common and easily understood language for the description of all marine, freshwater and terrestrial habitats throughout Europe
> - be objective and scientifically based, with clear definitions and principles
> - hold information in a relational database allowing interrogation based on a number of parameters
> - seek as far as possible to achieve a consensus amongst those concerned with habitat classification as developers or users
> - be comprehensive, but applicable at a number of hierarchical levels of complexity in recognition of the variety of its applications
> - be flexible so as to evolve and allow the admission of new information, but also sufficiently stable to support users of its predecessors and other systems.

The classification is based on general vegetation science with additions of a series of non-vegetated landscape elements, which are important animal habitats or form the basis for colonisation of vegetation. Marine elements are also included, whether or not colonised by plants or animals, including those composed of substrates of animal origin.

A parameter database has been built up, starting from one developed for the Nordic Council's classification of Nordic Vegetation types. The database includes reference systems for climates, soils, water quality as well as vegetation, physiographic elements, characteristic or dominant plants and animals. Further work is required to populate the database with assessments of the parameters describing EUNIS habitats.

Applications

- to provide broad categories for the assessment of the state and trends of nature for use in the European Environment Agency's reporting process
- to support the development of the EU NATURA2000 network[4] for extension to new countries and the possible revision of Annex I of the Habitats Directive, and also for the development of the Council of Europe EMERALD network (Bern Convention)
- to map habitats at a level appropriate to the scale, whether or not in cross-reference to CORINE Land Cover maps
- to obtain an overview of habitat distribution at European level
- to enable national nature conservation authorities to place and assess their habitats in a European context
- to evaluate habitat diversity values in biodiversity assessments
- to provide a practical system for the description and monitoring of habitat types for national, regional and local nature inventory, evaluation and management relevant to both site and species information
- to identify and document the character and distribution of the most threatened habitat types in Europe e.g. in national or regional red lists.'

Three classification levels can be distinguished within the EUNIS classification. Criteria diagrams (Figure 2.1) are used to classify the habitats within these three levels. EUNIS contains information on selected species, habitat types and sites, based on national data collected through EIONET (The European Environment Information and Observation Network of EEA) and from international organisations. The classification scheme allows the typification of habitats throughout Europe and is therefore a useful tool when monitoring valuable habitats.

[4] *The EU Natura2000 Network can be compared with the Dutch Ecological Main Structure.*

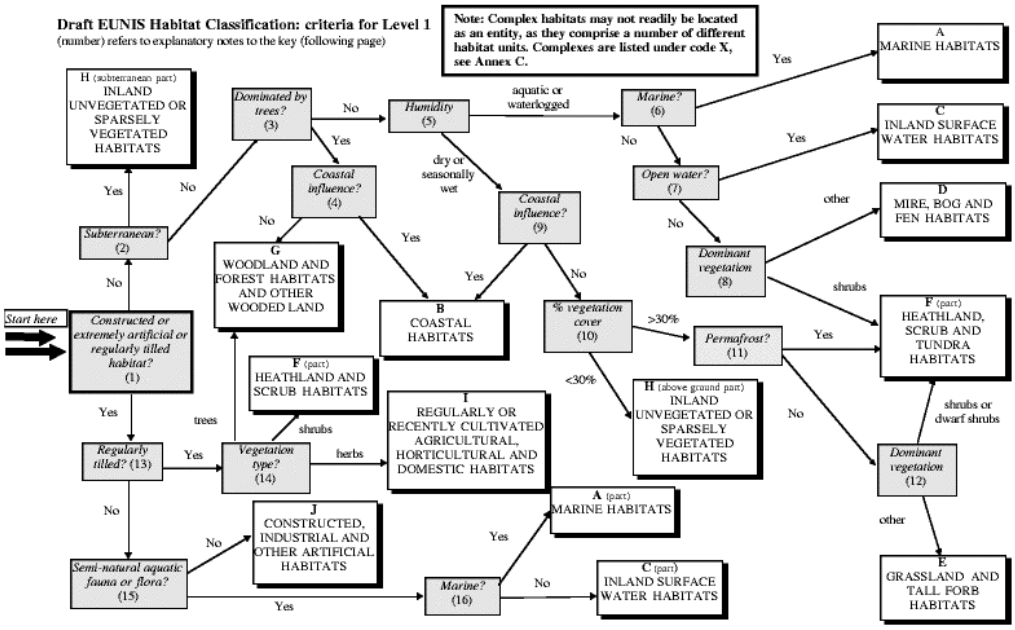

Figure 2.1 Criteria diagram for Level 1 within the EUNIS classification system

Reflection

As stated in the applications, EUNIS is mainly designed to provide a practical system for the description and monitoring of habitat types. It can be used on national, regional and local scale and is applicable for nature inventories, evaluation and management strategies relevant to both site and species information. Its design makes it possible to be used throughout Europe. The hierarchical system consists of 3 main levels with the possibility of additional distinctions on a lower level. This extra distinction of habitats is given, mainly based on species, location and climate. However, there is no criteria diagram for this final subdivision. The criteria diagrams can be used like any hierarchical key and are already developed into a digital tool[5].

The EUNIS classification comprises all habitats (not only water related) and is not limited by size. This can be regarded as both an advantage (it is an accurate and detailed method, taking rare habitats into account) and a disadvantage (mapping of small habitats is difficult). Up to level three the classification is useful on a European scale for instance for monitoring as required by the Water Framework Directive. Lower levels might be especially useful for inventories on national or regional scale and still allow extrapolation to other European regions.

[5] *see http://www.mrw.wallonie.be/dgrne/sibw/eunis/*

2.4 Water Ecotopes Classification

Basic objectives and requirements

The Netherlands Ministry of Transport, Public Works and Water Management requested the development of an ecotope classification system[6] to be used in the preparation of water management policy and its implementation. The Water Ecotopes Classification system (WEC) is therefore developed, especially focussing on the water bodies managed by the national authorities. WEC is mainly intended to be used on a relatively coarse scale (1:5,000 m. - 1:25,000 m.) and should not address detailed local issues such as the management and monitoring of small (nature conservation) areas, although it caters as a starting point. Obviously, the Water Ecotope Classification is no aim on itself, but a tool that may be useful within the process of integrated water management (Wolfert, 1996).

One of the primary requirements when developing the WEC focused on the practical use of the system. Ecotopes should be easy to map and assess. Scales are chosen according to this requirement and therefore small spatial elements are not included.

Figure 2.2 gives an overview of the system in which the ecotopes are identified. This identification start with criteria based on positional factors, related to large scale processes. After this division, each ecotope classification is based on the dominating processes determining the appearance of the water systems. These conditional factors are described and classified for morphodynamics, hydrodynamics and land use. Conditional factors are mostly abiotic conditions determining operational factors such as moisture regime, nutrient availability and acidity. The criteria used to define ecotope types differ per classification system (Appendix B). The classes for each criterion are linked to relevant ecological features of the subdivision in the WEC and categorise different ecological units, e.g. possible presence of a thermocline at a certain water depth in lakes or frequency of flooding related to vegetation in river floodplains.

[6] *An ecotopes classification system is intended for the classification and mapping of ecotopes. Ecotopes are spatially defined ecological units, the composition and development of which are determined by the local abiotic, biotic and anthropogenic conditions.*

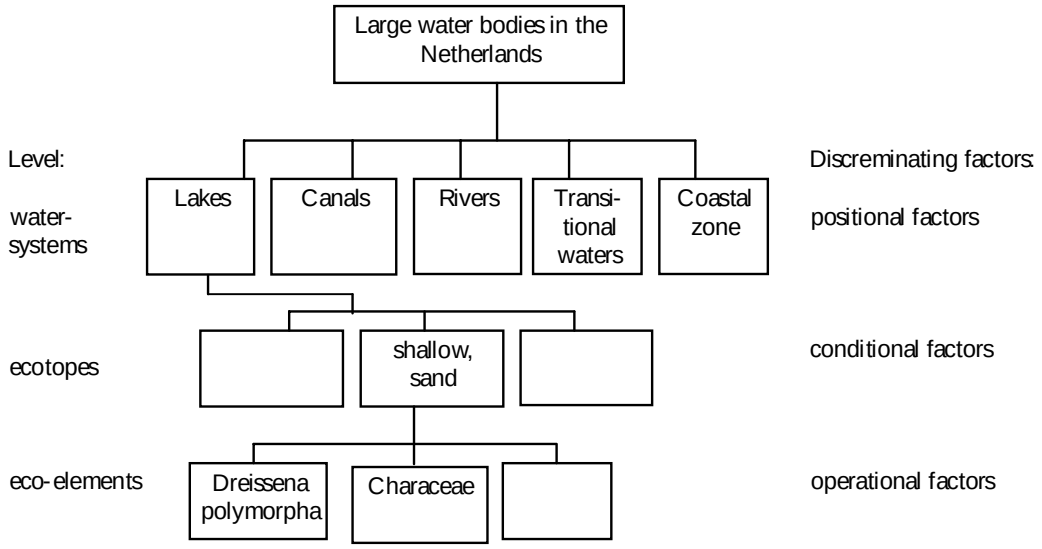

Figure 2.2 Overview of the hierarchical construction of the WEC (adapted from Wolfert, 1996)

The positional factors divide the WEC in 5 ecotope groups (fresh water delta, brackish water delta, large lakes, canals and the north sea). The first WEC subsystem introduced was the River Ecotope Classification. Since the start of the development of the WEC, several adjustments and changes in opinion have occurred. One of the main remarks about the WEC is that the different classification systems were not always sufficiently ecologically relevant. Also, a number of ecotope types appeared to be overlapping with other types, but using a different set of criteria to describe the same land unit. In response to these remarks two supplements have been made for the WEC: the WEC aquatic and the WEC banks and shorelines. These two supplements are considered to be better ecologically founded and to be applicable to the whole range of surface water bodies under the management of national authorities (except for the coastal zone, which is not included in the WEC aquatic) (Figure 2.3) (Van der Molen *et al.,* 2000)

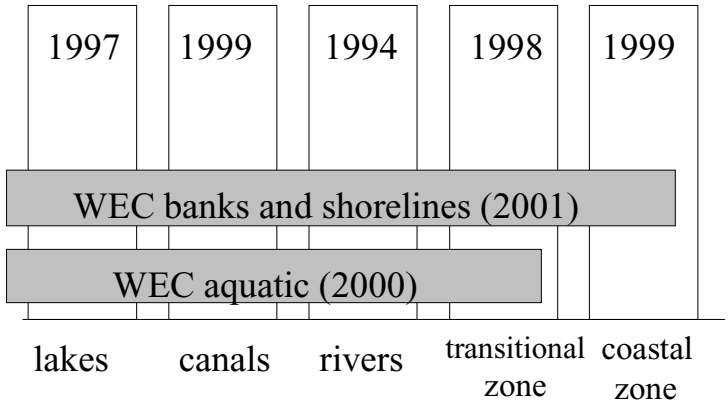

Figure 2.3 Layout of the WEC (source Van der Molen *et al.,* 2000)

Reflection

A characteristic feature of the WEC, other than the integral nature of its units, is the coupling of classification characteristics with policy and management measures (Wolfert, 1996). It aids the prediction and evaluation of the effects of interventions in wetland ecosystems and large water bodies.

The WEC is hierarchical in structure. Different classification characteristics are applied for each of the various levels. At the level of groups of water systems, the positional factors are the most significant: slope, tidal influence and salinity levels. At ecotope level, conditional factors constitute the basis for the classification: morphodynamics, hydrodynamics and management activities.

The WEC are used in the MWTL-program (monitoring program for large freshwater bodies in the Netherlands (RIKZ/RIZA, 1997)). A recurrent mapping of ecotopes in and along all water systems under the management of national authorities happens every 8 years as one of the main elements within the monitoring program. The recurrent mapping is based on remote sensing and GIS techniques combined with field surveys where necessary.

3 Comparison

3.1 Possibilities for the use of WEC within the Water Framework Directive

The Water Framework Directive requires both the stratification of River Basin Districts by means of classifying them according to article 5 and the monitoring of River Basin Districts as described in article 8. To reach the objectives of article 5 the directive requires maps to be used when reporting about River Basin characteristics and WEC provides a system which allows easy mapping. Either system A or B can be used when differentiating River Basin Districts according to type. The ecoregion types (system A) are defined on a much larger scale than the ecotopes used in the WEC. System B uses a set of descriptors in which only altitude, latitude, longitude, geology and size are obligatory factors. The set of optional factors[7] can be related to the WEC criteria, but no classes within each factor are distinguished (e.g. the only requirement is to report on for example, the average depth or width or of water body). The WEC is therefore more detailed than required, but can used to classify water body types.

The ecotope types can serve as a description of reference conditions, which need to be defined for highly modified or artificial surface water bodies (article 5). The abiotic criteria needed for realising these desired ecotopes can be influenced by changing management strategies.

The directive focuses mainly on in-water situations and for adjacent terrestrial systems it refers to the Habitat and Bird Directives. The WEC also takes terrestrial water-related ecotopes into account and covers therefore more than necessary for the Water Framework Directive.

The requirements stated in article 8 are not met by the WEC, since the WEC can not assess the status of an ecotope. Also, the directive requires the classification and monitoring of groundwater and protected areas, features which are not included in the WEC system. However, other programs used in the Netherlands, such as the MWTL (which also uses WEC as a tool), are capable of doing this and also monitor the status of a water body. The necessary repeated classification and monitoring over the years can be done using the ecotope types. One of the advantages of the ecotopes is that they enable reflection on changes in landscape patterns by comparing maps of different years.

In general, the WEC appears a useful tool for the execution of the Water Framework Directive. The scale required for describing the River Basin Districts is not very detailed and the WEC is capable of describing ecotopes at an even greater detail than required.

[7] *Optional factors for rivers: distance from river source, energy of flow, mean water width, depth and slope, form and shape of main river bed, discharge, valley shape, transport of solids, acid neutralising capacity, mean substratum composition, chloride, air temperature range, mean air temperature and precipitation.*

3.2 Comparison WEC and EUNIS classifications

3.2.1 Criteria

For the comparison of WEC and the EUNIS classification three landscape units were selected as examples. These landscape units are described by the ecotope which resembles them. The selected ecotopes are *floodplain softwood forest, river parts characterised by shallow gravel beds* and *shallow open water with macrophytes* (Rademakers and Wolfert, 1994; Van der Meulen, 1997). Each landscape unit is classified according to both WEC and EUNIS. A comparison of the used criteria is given.

Before starting with the comparison a short description of the criteria used by either WEC or EUNIS needs to be given. The five Ecotope Classifications do not use comparable criteria (see §2.4 and Appendix B). For the three examples both the River Ecotope Classification and the Lakes Ecotope Classification need to be used. The criteria in these classifications differ from one another and are displayed in table 1. The described ecotopes for the River Ecotope Classification are listed in Appendix C.

Table 3.1 WEC criteria used for the classification of lake and river ecotopes (Rademakers and Wolfert, 1994; Van der Meulen, 1997)

WEC ecotopes criteria LAKES	WEC ecotopes criteria RIVERS
Morphodynamics: Three classes very large - large dynamics (a) moderate dynamics (b) small - non dynamic (c)	**Morphodynamics:** Four classes very large dynamics (a) large dynamics (b) moderate dynamics (c) and small dynamics (d)
Groundwater level (GWL) for summer conditions Eight classes very deep open water (>10 m.) deep open water (5-10 m) moderate deep open water (2-5 m) shallow open water (0.3-2 m) wet amphibic zone (0-0.3 m) very moist (swampy) terrestrial zone (-0.3 - 0 m) moist (marshy) terrestrial zone (GWL -0.5 to -0.3 m) relatively moist terrestrial zone (GWL -1.2 to -0.5 m) dry terrestrial zone (GWL lower than -1.2 m)	**Hydrodynamics:** Seven classes deep water (0) permanently flooded (1) shore face (2) frequently flooded (3) periodically flooded (4) seldomly flooded (5) never flooded (6)
User dynamics (terrestrial ecotopes) Three classes 1. non or very extensive management and use. Code N (natural) 2. management and use focussed on nature conservation. Code S (semi natural) 3. commercial management and use. code C	**Users dynamics:** Four classes Completely natural (1), natural (2) , semi-natural (3), cultural(4). Includes anthropogenic land use functions as well forestry (b), water management (r) pasture (g) and arable land (a) and urban

(cultural)	functions (s)

Stream velocity 1. Stagnant. Code M (velocity below 0.1 - 0.2 m/s) 2. Flowing. Code F (velocity between 0.1 - 0.2 and 0.8 -1.0 m/s)	**Other factors**: can be used to distinguish to a more detailed level (for example tidal/non tidal)
Salinity Three classes fresh (<0.3 g Cl/l) moderate brackish (0.3 - 3.0 g Cl/l) brackish (3.0 - 10.0 g Cl/l) (saline (10.0 - 17.0 g Cl/l))	
Sediment type Four classes 1. shells 2. sand (including gravel) 3. silt/clay **4.** peat	
Other factors: can be used to distinguish to a more detailed level (e.g. water quality)	

EUNIS uses a hierarchical key based on a broad range of criteria which is divided into several levels. Figure 3.1 displays the key for the second level of the EUNIS classification system for Woodland and forest habitats and other wooded land, appendix D gives the other keys on levels two and three used to classify the landscape units discussed in this report. Appendix E lists the habitats as described on the fourth level for broad-leaved deciduous woodlands and surface waters, which are too detailed to take into further consideration.

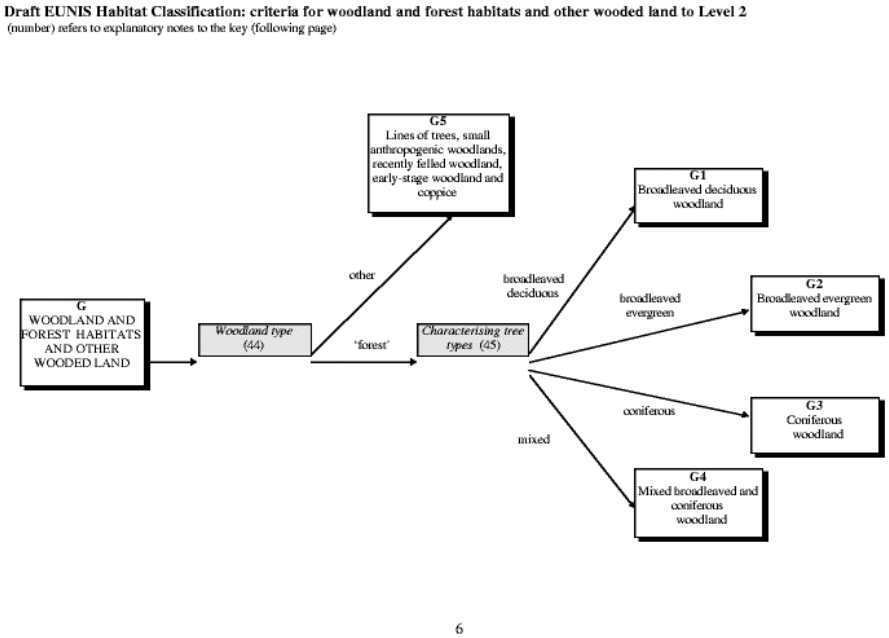

Figure 3.1 Criteria diagram of the second level in the EUNIS classification

3.2.2 Examples

Example 1. Floodplain Softwood Forests

Question: Is EUNIS (implicitly) using similar criteria in order to identify the WEC ecotope type *floodplain softwood forests*?
Method: For EUNIS the complete list of questions (most often with a dichotomic character) is displayed in the criteria diagrams. The criteria used in the WEC are accurately defined (e.g frequently flooded locations have 50-150 days of flooding), for these definitions see §2.4 and Rademakers and Wolfert (1994).
Result: The results for the comparison of WEC and EUNIS regarding ecotope type *floodplain softwood forest* are displayed in tables 3.2a and 3.2b.

- Morphodynamics is no explicit criterion in EUNIS, although the fact that this is a not highly artificial site might indicate that morphodynamics are not disturbed within this riparian zone and functions likewise.
- Hydrodynamics of WEC are distinctly different from the criterion of riparian hydrology in EUNIS classification. EUNIS does take hydrology into account, but uses completely different criteria (classes in EUNIS are riparian/alluvial, waterlogged and dry/seasonally wet)
- User dynamics criteria can be related to the EUNIS question whether a habitat is artificial or not, although EUNIS is not as detailed in its division.
- The ecotope floodplain softwood forest would classify as type G1.1 Riparian Willow Alder and Birch woodland.

Conclusion: Although the criteria in WEC are more quantified than the EUNIS ones, it is possible to classify landscape units such as *floodplain softwood forest*.

In addition the question whether the reverse is also possible was addressed by using the criteria for EUNIS type G1.1 to classify this land unit as an ecotope type. This is only done for this example.
Question: Is it possible to define the WEC ecotope corresponding to EUNIS type G1.1?
Result:

- The morphodynamics criteria of WEC cannot be derived from the descriptors of type G1.1
- Hydrodynamics are not specified for the alluvial location, but this is implicitly included since the RES is only developed for the alluvial systems. Type G1.1 is not described using a certain amount of days of flooding, which causes problems in choosing the right WEC-hydrodynamica criteria, since these are based on days of flooding per year.
- User dynamics defined for type G1.1 are not applicable for the much more detailed scale within the WEC, (also the WEC criteria will need very distinct definitions on European scale).

Table 3.2a Choices made when using the EUNIS criteria diagrams as displayed in figure 3.1 and appendix D

EUNIS Habitat Classification
Level 1: Not constructed or extremely artificial or regularly tilled habitat Not subterranean dominated by trees no coastal influence Type G: woodland and forested habitats and other wooded land
Level 2: diagram for type G Not highly artificial riparian or alluvial hydrology (in contrast to waterlogged and dry or seasonally wet) Within the riparian zone Dominant species willow alder or birch Type G1.1 Riparian willow alder and birch woodland
Level 3: This is even further unravelled by using location and species (see appendix E for complete list of last level).

Table 3.2b. Ecotope criteria

WEC ecotopes
Morphodynamics: c: moderate dynamics **Hydrodynamics:** 3: frequently flooded **Users dynamics:** 1, 2, 3b **Other factors:** succession stadium

Conclusion:
It is more difficult to translate EUNIS habitats to ecotope types than the other way around. Taxa are not taken into account in the WEC (in the description of the ecotope, species are mentioned, both flora and fauna, but they are no classification criterion). Another remark is that beforehand one has to decide to use the River Ecotope System and not, for example, the BES or lakes system.

Example 2. Flowing water with shallow gravel beds

For the ecotope flowing water with shallow gravel beds the same approach as in example 1 is applied. Here as well it is possible to translate the ecotope type into a EUNIS classification type which has a similar character. Tables 3.3a and 3.3b give an overview of the results.

Table 3.3a Choices made when using the criteria diagrams as displayed in appendix D

EUNIS Habitat Classification
Level 1:
Not constructed or extremely artificial or regularly tilled habitat
Not subterranean
Not dominated by trees
Aquatic or waterlogged
not marine
Open water
Type C: inland surface water habitat
Level 2: diagram for type C
Not shallow water with waterfringing emergent vegetation, periodically inundated or high humidity shores.
Running water
Type C2: Surface running waters
Level 3: Diagram for type C2
Not temporary
Not upwelling
Water not within substrate or in thin sheets over rock
Not tidal
Flow turbulent and fast, not slower and rending towards laminar
Type C2.2: Permanent non-tidal, fast, turbulent watercourses
This is even further unravelled by using location and species (see appendix E for complete list of last level).

Table 3.3b Ecotope criteria

WEC ecotopes
Morphodynamics:
a: very large dynamics
Hydrodynamics:
1: permanently flooded
Users dynamics:
1, 2, 3r, 4r, 4s
Other factors:
main channel; in transport zone only

Remarks: The last part of the EUNIS classification gives a choice between slow and fast, however no distinct measure is given. Only a small footnote gives extra information:

"Watercourses where the flow-rate is fast and turbulent are distinguished from rivers where flow is slower and tends towards becoming laminar. Note that where flow is fast and turbulent, the oxygen concentration is high, and the bed usually composed of rocks, stones or gravel with only occasional sandy and silty patches; where flow is slower, oxygen concentration deficits may occur at times, and normally the substrate is mainly sand and mud. Rivers that are fast but with laminar flow follow path = slower and tends towards becoming laminar."

The description for this criteria in EUNIS appears very important for the final step in the classification system. In some situations it might be difficult to make a proper decision on the type of habitat which is present at a site, since patches of gravel and sand may be present within a river with a large variety in microhabitats. The ecotope description shallow gravel river is only present in dynamic gravel river reaches and more distinctly defined.

Example 3. Standing open water with macrophyte species

Table 3.4a Choices made when using the criteria diagrams as displayed in appendix D

EUNIS Habitat Classification
Level 1: Not constructed or extremely artificial or regularly tilled habitat Not subterranean Not dominated by trees Aquatic or waterlogged not marine Open water Type C: inland surface water habitat
Level 2: diagram for type C Not shallow water with water fringing emergent vegetation, periodically inundated or high humidity shores. Standing waterType C1: Surface standing waters
Level 3: Diagram for type C1 Not temporary Not saline Trophic status eutrophic Type C1.3: Permanent eutrophic lakes, ponds and pools Type C1.33 Rooted submerged vegetation of eutrophic water bodies (see Appendix E)

Table 3.4b. Ecotope criteria

WEC ecotopes
Groundwater level 4-5 (between 0-2 m) **Stream velocity** M, F **Morphodynamics:** b, c: moderate/non dynamics **Users dynamics:** N,S. **Salinity** f: fresh water **Sediment type** not determined **Other factors:** water quality and biotic influences

Remarks: The use of a different subdivision of the WEC (the Lakes Ecosystem Classification, instead of the River Ecosystem Classification) results in the use of different criteria (see table 1).

Within EUNIS the same criteria diagrams are used, although it is necessary to take one extra level into account when wanting to describe the presence of submerged vegetation. The submerged vegetation is not mentioned in the criteria of the ecotopes but is indicated in the name of the ecotope and the 'Other factors' criteria, which makes up for this. So for both the WEC and EUNIS this type of landscape unit seems almost to detailed and one can suffice with the description like given by EUNIS 'Permanent eutrophic lakes, ponds and pools' which from an ecological perspective is not sufficient, but from a landscape unit system suffices.

3.2.3 Advantages of WEC over EUNIS : mapping

WEC only uses a small set of quantified variables. However, there is a substantial overlap between different classes. For example, when a landscape unit can be described using both morphodynamics c and d, or hydrodynamics 3, 4 and 5, apparently the classes do not provide enough distinction. Also, when a landscape unit is classified with morphodynamics c, hydrodynamics 2 and land use dynamics 2 this can be either a clayey side channel, a tidal side channel or a connected floodplain channel. The extra differentiating criterion of 'permanently flowing water' or 'influenced by tides' or instead 'shallow water periodically isolated' needs to be used to distinguish between these three possibilities.

Thus, the WEC criteria in themselves are very useable with the extra criteria added. The nomenclature of ecotope types usually refers to vegetation, which makes this a practical system with definite boundaries, creating the possibilities to map the features easily on a predefined scale which is applicable to the complete range of ecotopes. The mapping of habitats as described in EUNIS can be very difficult, since scale differences are not taken into account. However it depends of the level of detail chosen whether or not a habitat becomes to small to map.

Since the WEC uses criteria which can be influenced by management, it is possible to predict changes in ecotope types as a result of changes in management.

3.2.4 Advantages of EUNIS over WEC : identification

The EUNIS classification covers the complete range of European habitats, both aquatic and terrestrial. It was designed while focussing on requirements set in the Habitat Directive and takes all habitats (also small but important ones) into account, although this complicates the process of mapping. In this way it adds a quality aspect to the classification system.

EUNIS enables the identification of habitats on different hierarchical levels. The choice of detail level needed when identifying a habitat, is linked to the objectives stated for a specific assessment. For example, for differentiation on a regional scale, a habitat assessment may be using the most detailed fourth level description, while for a national inventory the third level may be sufficient. The WEC classification does not specifically describe ecotopes on such a very detailed level as the fourth EUNIS level. However, the examples in §3.2.2 indicate the possibility of describing ecotopes using the EUNIS classification at the third level. Therefore, EUNIS may also be useful for further specification of ecotopes using the fourth level descriptions.

The criteria used in the criteria diagrams of EUNIS do not appear to be ordered according to a theoretical structure, such as done in the WEC. Rather the EUNIS criteria are chosen because of practical reasons, which require a quick and easy system.

4 Conclusions

The Water Ecotopes Classification appears a suitable tool in the context of article 5 of the Water Framework Directive. As a quality status monitoring tool (required for article 8) it can not be used. The monitoring of quality status is already made possible within a different program (the MWTL). Since the directive focuses mainly on in-water systems and WEC also includes adjacent terrestrial ecotopes, the WEC is encompassing more features than necessary. However, the WEC remains restricted to the water systems managed by the national authorities of the Netherlands and for both the Birds and Habitat Directive the WEC can only be used as a starting point. Also, it does not pay a lot of attention to specific taxa, that can be indicative for the quality or value of a system. Neither WEC nor EUNIS are capable of monitoring the quality status of a water body.

It is necessary to take into account the objectives and requirements of both the Water Framework and Habitat Directives and the classification systems mentioned in this report. EUNIS and WEC were both designed with a different purpose in mind. EUNIS focuses on standardizing the inventory of habitats throughout Europe. In this perspective completeness is of greater importance than the fact that habitat scales are varying. It enables the identification of areas which are important for nature conservation. This gives EUNIS the advantage of being able to ‘qualify’ areas if syntaxa are used on the most detailed level. WEC on the other hand was mainly designed to be a practical tool in describing landscape units related to the water bodies managed by the national authorities in the Netherlands. Therefore it uses a limited but useful set of criteria, which enables the stratification of a River Basin using a relatively easy method. Also, it may help predicting significant landscape changes on ecotope scale as a result of alteration of management schemes, since these alterations can be linked to the criteria used within the WEC.

One of the main differences between WEC and EUNIS is that WEC does not take small scale, rare habitats into account and only provides a relatively broad picture of the water system. EUNIS, more than WEC, is a system which can identify rare and valuable habitats, and in that way approaches a quality aspect (especially on the most detailed level) with regard to nature conservation.

Thus, although designed with different objectives in mind, the two classification systems can be used together when describing landscape units: the WEC out of practicality and EUNIS out of quality perspective. Alongside each other they form a useful tool within the European legislative framework.

One of the questions that remains is 'In which way can the EUNIS and WEC system benefit from each other?'

- WEC can take advantage of the already described terrestrial habitats in EUNIS if this ecotope system will also be used for non-water related issues.
- EUNIS can take advantage of the WEC by also taking more 'map-able' features into account and define criteria more quantified.
- EUNIS can take advantage of the WEC by choosing criteria which can be influenced by management, so that the prediction on development of landscape units becomes possible.

5 References

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A Overview of European Nature Protection Legislation

The following documents are grouped as the Nature Protection Legislation of the European Union. A few of these documents are mentioned frequently in this report. Therefor a short summary for these documents is included here. For a more detailed overview of directives, see also http://europa.eu.int/comm/environment/enlarg/handbook/nature.pdf

- Council Directive 79/409/EEC on the conservation of wild birds
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora
- Council Directive 83/129/EEC concerning the importation into Member States of skins of certain seal pups and products derived therefrom
- Council Regulation (EC) No. 338/97 on the protection of species of wild fauna and flora by regulating trade therein
- Council Regulation (EEC) No. 348/81 on common rules for imports of whales or other cetacean products
- Council Regulation (EEC) No 3254/91 prohibiting the use of leghold traps in the Community and the introduction into the Community of pelts and manufactured goods of certain wild animal species originating in countries which catch them by means of leghold traps or trapping methods which do not meet international humane trapping standards
- Council Decision 98/145/EC on the approval, on behalf of the European Community, of the amendments to Appendices I and II to the Bonn Convention on the conservation of migratory species of wild animals as decided by the fifth meeting of the Conference of the parties to the Convention

The Birds Directive (1979)
This Directive requires Member States to protect naturally occurring wild birds and their habitats by designating and managing Special Protection Areas and prohibiting certain harmful activities. This involves taking special conservation measures to ensure that wild birds and their habitats, in particular Annex 1 species, are protected and that the populations of all wild birds are maintained at levels which correspond to ecological, scientific and cultural requirements. Member States are required to take measures to ensure that these objectives are met, including preserving, maintaining and re-creating habitats. The measures are not restricted to actions within protected areas. There are some exceptions
that allow hunting of certain species, and allow governments to take action to prevent serious damage caused by birds.

The Habitats Directive (1992)
The aim of this directive is to contribute to the protection of biological diversity in the EU. This is to be achieved by establishing a European ecological network of representative sites (known as Natura 2000) and ensuring that selected habitats and species are maintained and protected in order to maintain and/or restore them at a ‘ favourable conservation status’.

Special Areas of Conservation (SAC) are to be designated in order to ensure habitat and species protection.

Convention on the Conservation of European Wildlife and Natural Habitats
Opened for signature in Bern, Switzerland: 1979. Entered into force: 1982
The Bern Convention aims to conserve wild flora and fauna in their natural habitats, to promote co-operation between countries in their conservation efforts and to give particular emphasis to endangered and vulnerable species. In its provisions, the convention lays out measures to be taken by the parties to maintain the populations of wild flora and fauna and their habitats in general, as well as special protection actions needed for species listed in Appendix I (strictly protected plants), Appendix II (strictly protected animals) and Annex III (protected animals). It should be noted that the convention covers any country where European wildlife occurs naturally, whether or not the country is in Europe.
This chiefly applies to migratory species moving to Asia and Africa. Overview of the WEC

NATURA2000 and the EMERALD network
http://www.ecnc.nl/doc/lynx/publications/emerald.html
In order to assure coherence between the network of Areas of Special Conservation Interest (ASCIs) to be designated under the Bern Convention and the network of Special Areas of Conservation (SACs) designated under the Habitats Directive, the Standing Committee to the Convention thought preferable to wait for the establishment of the proper mechanism by the Directive. In January 1996, a sufficient number of States of Central and Eastern Europe had become Parties to the Convention and were requesting the development of the network of ASCIs. The Standing Committee, realising this wish and noting that the Habitats Directive was already sufficiently advanced in its work to build NATURA 2000, decided to adopt its Resolution No. 3 (1996), in which it resolved to "*set up a network (EMERALD Network) which would include the Areas of Special Conservation Interest designated following its Recommendation No. 16*"; it furthermore "*encouraged Contracting Parties and observer states to designate Areas of Special Conservation Interest and to notify them to the Secretariat*".

Relations of the EMERALD Network with NATURA 2000
The Bern Convention (1979) and the Habitats Directive (1992) have a complete coincidence of objectives. Both are international legal instruments aimed at the conservation of wild flora, fauna and natural habitats. Their main differences come from the territory they apply to (European Union member states for the Directive and the whole of Europe and part of Africa for the Convention) and to the fact that the Directive is more explicit on the obligations concerning conservation of natural habitats.

The Directive is a piece of legislation designed to implement the Bern Convention in the European Community and, as such, it is fundamentally coherent with the Convention. Regarding the networks NATURA 2000 and EMERALD the only logical and feasible interpretation is that the member states of the European Union will satisfy the habitat requirements of the Bern Convention mostly through the designation of sites to the NATURA 2000 network. If the EU member states so decide, the Special Areas of Conservation of NATURA 2000 will also become Areas of Special Conservation Interest of the EMERALD Network. This will ensure the coherence of the Network for the whole of Europe. No other designation will be requested for EU member states.

Most of the work to be done in the building of the EMERALD Network will be concentrated in states which are not members of the European Union. In this way it will be possible to extend to the whole of Europe a homogeneous network of areas, helping to break down in this sector the barriers that history, politics and economic reality have imposed on the European continent.

B Water Ecotope Classification System

The Dutch Water Ecotopes System (WEC) is subdivided into 5 subsystems:

- fresh water delta ecotopes system;
- brackish water delta ecotopes system;
- large lakes ecotopes system;
- canals ecotopes system;
- north sea ecotopes system.

As an addition to this a more general ecological description is made in the aquatic ecotopes system and the margin ecotopes system. For each ecotopes system the main features are displayed here

Table B.1 Determinants used to interpret the conditional factors for the elaboration of the Water Ecotope Classification for the different water systems

Determinants / Water system	Lakes	Canals	Rivers	Transitional waters	Coastal zone
Morphodynamics					
- flow regime	-	anthropogenic (sluice control)	natural (river discharge)	natural (tidal movement, river discharge)	natural (tidal movement)
- wave regime	wind	navigation	navigation	navigation/ wind	wind / tidal regime
Hydrodynamics					
- water depth	+	+	+	+	+
- flooding (duration / frequency)	-	-	+	+	+
-(ground)water table	+	+	-	-	-
Land use	+	+	+	+	+

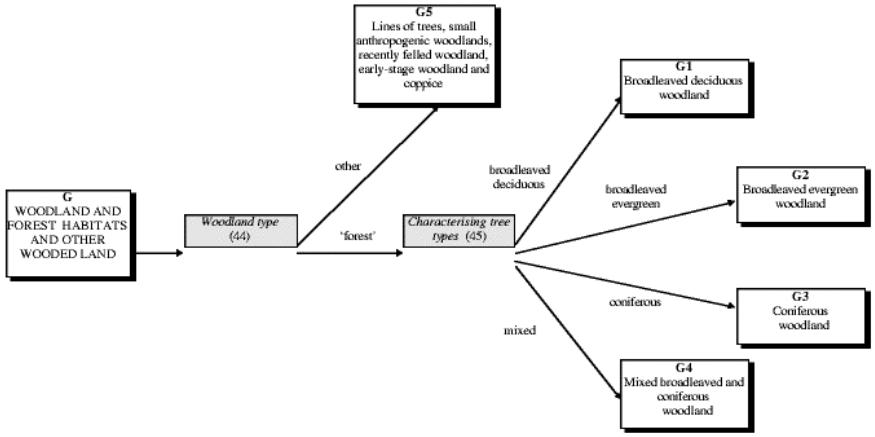
C Overview of River Ecotope Criteria

Ecotope	Morphodynamics a b c d	Hydrodynamics 0 1 2 3 4 5 6	Land use dynamics 1 2 3b 3r 3s 4b 4r 4g 4a 4s	Other differentiating criteria
Zd Deep riverbed	a b	0	1 2 4r 4s	**main channel**
Zo Shallow riverbed	a b c	1	1 2 3r 4r 4s	**main channel**
Zo-1 shallow gravel bed	a	1	1 2 3r 4r 4s	in transport zone only
Zo-2 shallow sand bed	b	1	1 2 3r 4r 4s	
Zo-3 shallow tidal bed	b c	1	1 2 3r 4r 4s	influenced by tides
Zs Bar/beach/bank	a b c d	2 3	1 2 3r 4r 4s	**shoreface main channel**
Zs-1 gravel bar	a	2	1 2 3r	in transport zone only
Zs-2 sand bar/sandy beach	b	2	1 2 3r	influenced by shipping and wind
Zs-3 clay bar/clayey beach	c	2	1 2 3r	influenced by tides and barrages
Zs-4 rushes bank	c d	2	1 2 3r	influenced by tides and barrages
Zs-5 eroding bank/steep bank	a b c	2 3	1 2 3r	in transport zone mainly
Zs-6 groyns/revetments	a b c	2 3	4r 4s	
Ob Forested natural levee	b	4 5	1 2 3b 4b	
Ob-1 natural levee hardwood forest	b	4 5	1 2 3b	natural climax vegetation or part of mosaic
Ob-2 natural levee hardwood shrubs	b	4 5	1 2 3b	transition vegetation or part of mosaic
Ob-3 natural levee softwood forest	b	4 5	1 2 3b	transition vegetation or part of mosaic
Ob-4 natural levee softwood shrubs	b	4 5	1 2 3b	pioneer vegetation
Ob-5 natural levee production forest	b	4 5	4b	
Or Herbaceous natural levee	b	4 5	1 2 3r 4r 4a 4s	
Or-1 herbaceous river dune	b	5	1 2 3r	natural levees strongly influenced by wind
Or-2 herbaceous natural levee	b	4 5	1 2 3r 4r	no strong influence by wind
Or-3 arable natural levee	b	4 5	4a	
Or-4 built up natural levee	b	4 5	4s	
Og Grassed natural levee	b	4 5	2 3g 4g	
Og-1 natural levee pasture	b	5	2 3g 4g	
Og-2 natural levee hayfield	b	4	2 3g	
Og-3 natural levee production meadow	b	4 5	4g	

Ub Forested floodplain	c d	3 4 5	1 2 3b 4b	
Ub-1 floodplain hardwood forest	c d	4 5	1 2 3b	natural climax vegetation or part of mosaic
Ub-2 floodplain hardwood shrubs	c d	4 5	1 2 3b	transition vegetation or part of mosaic
Ub-3 floodplain softwood forest	c	3	1 2 3b	transition vegetation or part of mosaic
Ub-4 floodplain softwood shrubs	c	3	1 2 3b	pioneer vegetation
Ub-5 floodplain hardwood production forest	c d	4 5	4b	
Ub-6 floodplainsoftwood production forest	c	4 5	4b	
Ur Herbaceous floodplain	c d	3 4 5	1 2 3r 4r 4a 4s	
Ur-1 rich structured herbaceous floodplain	c d	5	2 3r	
Ur-2 poor structured herbaceous floodplain	c	3 4	1 2 3r 4r	
Ur-3 arable floodplain	c d	4 5	4a	
Ur-4 built up floodplain	c d	4 5	4s	
Ug Grassed floodplain	c	3 4 5	2 3g 4g	
Ug-1 rich structured floodplain pasture	c d	3 4	2 3g	
Ug-2 floodplain hayfield	c d	5	2 3g	
Ug-3 floodplain production meadow	c d	4 5	4s	
Mb Marshy floodplain forest	c d	3 4 5 6		influenced by high water-tables
Mb-1 marshy floodplain hardwood forest	c d	4 5	1 2 3b 4b	natural climax vegetation or part of mosaic
Mb-2 marshy floodplain softwood forest	c d	3	1 2 3b	transition vegetation or part of mosaic
Mb-3 marshy floodplain shrubs	c d	3	1 2 3b	pioneer or transition vegetations
Mb-4 floodplain seepage forest	d	5	1 2 3b	permanently high water-tables
Mr Marshy herbaceous floodplain	c d	3 4 5	1 2 3r 4r	Influenced by high water-tables
Mr-1 herbaceous swamp	c d	3 4	1 2 3r	
Mr-2 reed swamp	c d	3	1 2 3r	
Mr-3 seepage swamp	d	5	3r	permanently high water-table
Mg Marshy grassed floodplain	c d	3 4 5	2 3g 4g	
Mg-1 rich structured marshy floodplain pasture	c d	3 4 5	2 3g	
Mg-2 marshy floodplain production meadow	c d	3 4 5	4g	
Mg-3 marshy floodplain seepage pasture	d	5	3g	permanently high water-tables

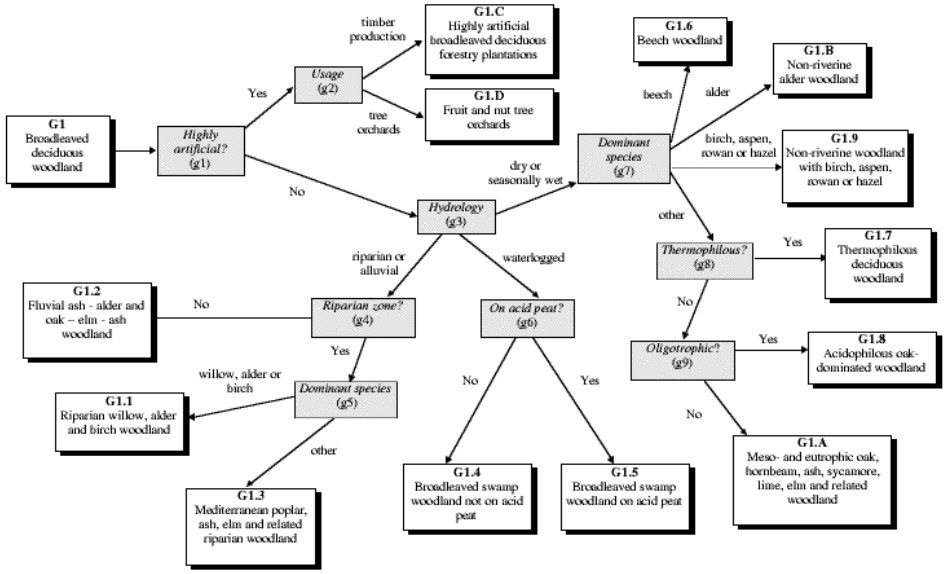
D Criteria diagrams for EUNIS type G and C

Draft EUNIS Habitat Classification: criteria for woodland and forest habitats and other wooded land to Level 2
(number) refers to explanatory notes to the key (following page)



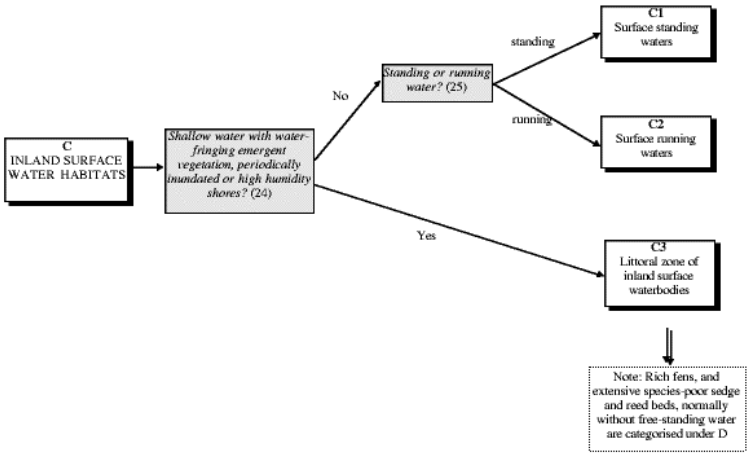
6

Draft EUNIS Habitat Classification: criteria for broadleaved deciduous woodland (G1) to Level 3
(number) refers to explanatory notes to the key



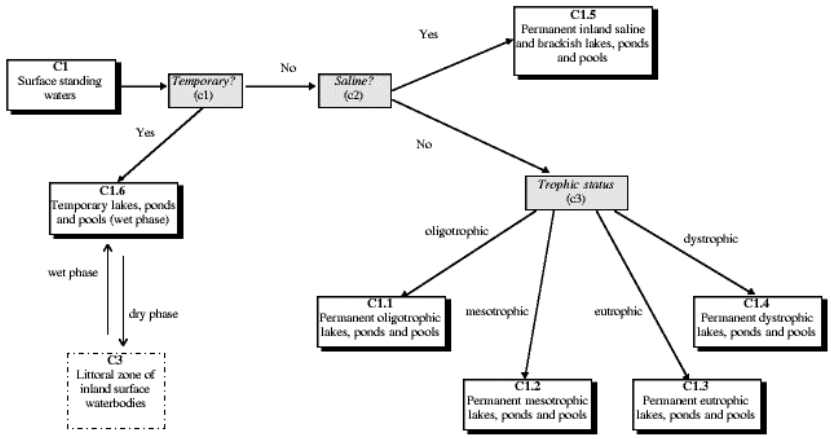
5

Draft EUNIS Habitat Classification: criteria for inland surface water habitats to Level 2.
Note that the key to Level 1 shows two pathways to reach habitat type C: these are recombined here.
(number) refers to explanatory notes to the key (following page)



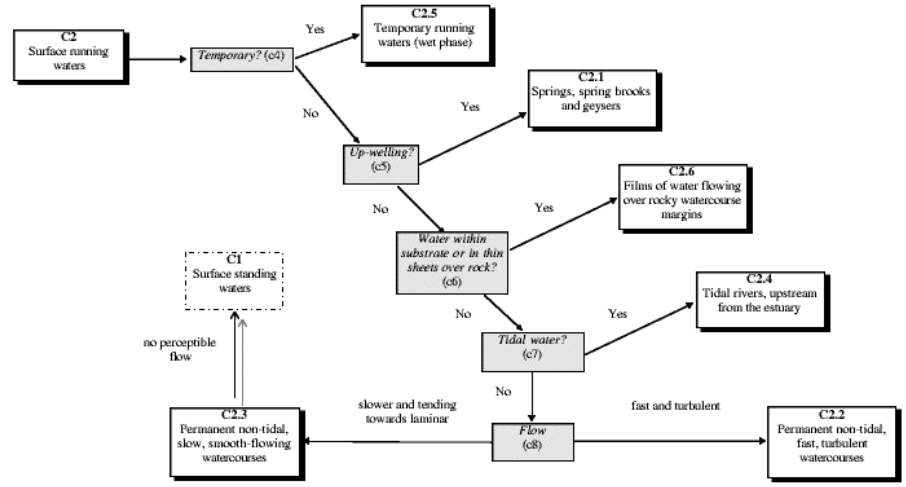
8

Draft EUNIS Habitat Classification: criteria for surface standing waters (C1) to Level 3
(number) refers to explanatory notes to the key



2

Draft EUNIS Habitat Classification: criteria for surface running waters (C2) to Level 3
(number) refers to explanatory notes to the key



3

E EUNIS level 4 description type G and C

List of habitats classified as broad-leaved deciduous woodland (G) and inland waters (C) to level 4

G	**Woodland and forest habitats and other wooded land**
G1	**Broadleaved deciduous woodland**
G1.1	*Riparian [Salix], [Alnus] and [Betula] woodland*
G1.11	Riverine [Salix] woodland
G1.111	Middle European [Salix alba] forests
G1.112	Mediterranean tall [Salix] galleries
G1.113	Canarian [Salix] galleries
G1.114	Continental [Salix] galleries
G1.12	Boreo-alpine riparian galleries
G1.121	Montane [Alnus incana] galleries
G1.122	Dealpine [Alnus incana] galleries
G1.123	Boreal [Alnus incana] galleries
G1.124	Boreal [Alnus glutinosa] galleries
G1.125	Western Siberian [Betula] and pine galleries
G1.126	Eastern boreal riverine galleries
G1.127	Ponto-Caucasian montane [Alnus] galleries
G1.13	Southern [Alnus] and [Betula] galleries
G1.131	Southern [Alnus glutinosa] galleries
G1.132	[Rhododendron] - [Alnus] galleries
G1.133	Corsican [Alnus cordata] and [Alnus glutinosa] galleries
G1.134	Relict [Betula] galleries of Cordillera Oretana
G1.2	*Fluvial [Fraxinus] - [Alnus] and [Quercus] - [Ulmus] - [Fraxinus] woodland*
G1.21	Riverine [Fraxinus] - [Alnus] woodland, wet at high but not at low water
G1.211	[Fraxinus] - [Alnus] woods of rivulets and springs
G1.212	[Fraxinus] - [Alnus] woods of fast-flowing rivers
G1.213	[Fraxinus] - [Alnus] woods of slow rivers
G1.214	Northern Iberian [Alnus] galleries
G1.22	Mixed [Quercus] - [Ulmus] - [Fraxinus] woodland of great rivers
G1.221	Great medio-European fluvial forests
G1.222	Residual medio-European fluvial forests
G1.223	South-east European [Fraxinus] - [Quercus] - [Alnus] forests
G1.224	Po [Quercus] - [Fraxinus] - [Alnus] forests
G1.225	Sarmatic riverine [Quercus] forests
G1.3	*Mediterranean [Populus], [Fraxinus], [Ulmus] and related riparian woodland*
G1.31	Mediterranean riparian [Populus] forests
G1.32	Mediterranean riparian [Ulmus] forests
G1.33	Mediterranean riparian [Fraxinus] woods
G1.34	Mediterranean riverine [Ostrya carpinifolia] galleries
G1.35	Mediterraneo-Pontic riverine [Fraxinus] forests
G1.36	Ponto-Sarmatic mixed [Populus] riverine forests
G1.37	Irano-Anatolian mixed riverine forests
G1.38	[Platanus orientalis] woods
G1.39	[Liquidambar orientalis] woods
G1.4	*Broadleaved swamp woodland not on acid peat*
G1.41	[Alnus] swamp woods not on acid peat
G1.411	Eastern Carpathian [Alnus glutinosa] swamp woods
G1.412	Steppe swamp [Alnus glutinosa] woods
G1.42	[Quercus] swamp woods
G1.43	[Populus tremula] swamp woods

G1.44	Wet-ground woodland of the Black and Caspian Seas
G1.5	*Broadleaved swamp woodland on acid peat*
G1.51	Sphagnum [Betula] woods
G1.52	[Alnus] swamp woods on acid peat
G1.6	*[Fagus] woodland*
G1.61	Medio-European acidophilous [Fagus] forests
G1.62	Atlantic acidophilous [Fagus] forests
G1.63	Medio-European neutrophile [Fagus] forests
G1.64	Pyreneo-Cantabrian neutrophile [Fagus] forests
G1.65	Medio-European subalpine [Fagus] woods
G1.66	Medio-European limestone [Fagus] forests
G1.67	Southern medio-European [Fagus] forests
G1.68	Southern Italian [Fagus] forests
G1.69	Moesian [Fagus] forests
G1.6A	Hellenic [Fagus] forests
G1.6B	Mediterraneo-Moesian [Fagus] forests
G1.6C	Illyrian [Fagus] forests
G1.6D	Dacian [Fagus] forests
G1.6E	Pontic [Fagus] forests
G1.6F	Dobrogea [Fagus] forest
G1.6G	Crimean [Fagus] forests
G1.6H	Caucasian [Fagus] forests
G1.6I	Caspian [Fagus] forests
G1.6J	Eastern oro-Mediterranean [Fagus] forests
G1.7	*Thermophilous deciduous woodland*
G1.71	Western [Quercus pubescens] woods and related communities
G1.72	Cyrno-Sardinian [Quercus pubescens] woods
G1.73	Eastern [Quercus pubescens] woods
G1.731	Aegean [Quercus brachyphylla] woods
G1.732	Pannonian [Quercus pubescens] woods
G1.74	Italo-Illyrian [Ostrya carpinifolia] sub-thermophilous [Quercus] woods
G1.75	South-eastern sub-thermophilous [Quercus] woods
G1.76	Balkano-Anatolian thermophilous [Quercus] forests
G1.77	Afro-Iberian thermophilous [Quercus] forests
G1.78	[Quercus trojana] woodland
G1.79	Mediterranean [Quercus macrolepis] woodland
G1.7A	Euro-Siberian steppe [Quercus] woods
G1.7B	[Quercus pyrenaica] woodland
G1.7B1	Central Iberian [Quercus pyrenaica] forests
G1.7B2	Cantabrian [Quercus pyrenaica] forests
G1.7B3	Maestrazgan [Quercus pyrenaica] forests
G1.7B4	Baetic [Quercus pyrenaica] forests
G1.7B5	French [Quercus pyrenaica] forests
G1.7C	Mixed thermophilous woodland
G1.7C1	[Ostrya carpinifolia] woods
G1.7C2	Oriental [Carpinus betulus] woods
G1.7C3	Thermophilous [Acer] woods
G1.7C4	Thermophilous [Tilia] woods
G1.7C5	[Celtis australis] woods
G1.7C6	Thermophilous [Fraxinus] woods
G1.7C7	Pannonic [Juniperus] - [Populus] steppe woods
G1.7C8	Sub-Mediterranean and Pannonic mixed woods
G1.7D	[Castanea sativa] woodland
G1.8	*Acidophilous [Quercus]-dominated woodland*
G1.81	Atlantic [Quercus robur] - [Betula] woods
G1.82	Atlantic acidophilous [Fagus] - [Quercus] forests
G1.83	British and Irish [Quercus petraea] woods

G1.84	Aquitano-Ligerian [Quercus] forests on podsols
G1.85	Aquitano-Ligerian [Quercus] forests on leached or acid soils
G1.86	Ibero-Atlantic acidophilous [Quercus] forests
G1.87	Medio-European acidophilous [Quercus] forests
G1.88	Insubrian acidophilous [Quercus] forests
G1.89	Portuguese [Quercus robur] forests
G1.9	*Non-riverine woodland with [Betula], [Populus tremula], [Sorbus aucuparia] or [Corylus avellana]*
G1.91	[Betula] woodland not on marshy terrain
G1.911	Atlantic lowland and collinar [Betula] woods
G1.912	British sub-boreal [Betula] woods
G1.913	Hercynio-Alpine [Betula] woods
G1.914	Corsican [Betula] woods
G1.915	Montane [Betula celtiberica] woodlands
G1.916	Mount Etna [Betula] stands
G1.917	Oro-boreal [Betula] woods and thickets
G1.918	Western Eurasian boreal [Betula] woods
G1.919	Siberian steppe [Betula] woods
G1.91A	Ponto-Caspian [Betula] woods
G1.92	[Populus tremula] woodland
G1.921	Inner Alpine [Populus tremula] woods
G1.922	Lowland nemoral [Populus tremula] woods
G1.923	Montane [Populus tremula] stands
G1.924	Sub-Mediterranean [Populus tremula] stands
G1.925	Boreal [Populus tremula] woods
G1.926	Anatolian [Populus tremula] forests
G1.93	[Sorbus aucuparia] woodland
G1.94	Inland dune [Quercus] - [Betula] woods
G1.95	[Populus tremula] and [Betula] woods with [Sambucus]
G1.96	[Corylus avellana] woods
G1.A	**Meso- and eutrophic [Quercus], [Carpinus], [Fraxinus], [Acer], [Tilia], [Ulmus] and related woodland**
G1.A1	[Quercus] - [Fraxinus] - [Carpinus betulus] woodland on eutrophic and mesotrophic soils
G1.A11	Mixed Atlantic [Quercus] forests with [Hyacinthoides non-scripta]
G1.A12	Aquitanian [Fraxinus] - [Quercus] and [Quercus] - [Carpinus betulus] forests
G1.A13	Sub-Atlantic [Fraxinus] - [Quercus] forests with [Primula elatior]
G1.A14	Sub-Atlantic [Quercus] - [Carpinus betulus] forests with [Stellaria]
G1.A15	Famennian [Quercus] - [Carpinus betulus] forests
G1.A16	Sub-continental [Quercus] - [Carpinus betulus] forests
G1.A17	Sub-Atlantic calciphile [Quercus] - [Carpinus betulus] forests
G1.A18	Southern Alpine [Quercus] - [Carpinus betulus] forests
G1.A19	Pyreneo-Cantabrian [Quercus] - [Fraxinus] forests
G1.A1A	Illyrian [Quercus] - [Carpinus betulus] forests
G1.A1B	Pannonic [Quercus] - [Carpinus betulus] forests
G1.A1C	South-eastern European [Quercus] - [Carpinus betulus] forests
G1.A2	Non-riverine [Fraxinus] woodland
G1.A21	[Fraxinus] - [Sorbus aucuparia] - [Mercurialis perennis] forests
G1.A22	British [Fraxinus] - [Acer campestre] - [Mercurialis perennis] forests
G1.A23	Pyreneo-Cantabrian [Fraxinus] forests
G1.A24	Baltic [Fraxinus] - [Acer pseudoplatanus] forests with [Adoxa moschatellina]
G1.A25	Mixed Atlantic [Fraxinus] forests with [Hyacinthoides non-scripta]
G1.A26	Aquitanian [Fraxinus] forests
G1.A27	Sub-Atlantic [Fraxinus] forests
G1.A28	Lutetian calciphile [Fraxinus] forests
G1.A29	Post-cultural [Fraxinus] woods
G1.A3	[Carpinus betulus] woodland

G1.A31 Western [Carpinus betulus] woodland
G1.A32 Eastern [Carpinus betulus] woodland
G1.A4 Ravine and slope woodland
G1.A41 Medio-European ravine forests
G1.A42 Hercynian slope forests
G1.A43 Peri-Alpine mixed [Fraxinus] - [Acer pseudoplatanus] slope forests
G1.A44 Pyreneo-Cantabrian mixed [Ulmus] - [Quercus] forests
G1.A45 Thermophilous Alpine and peri-Alpine mixed [Tilia] forests
G1.A46 South-eastern European ravine forests
G1.A47 Euxinian ravine forests
G1.A5 [Tilia] woodland
G1.A51 Western [Tilia] forests
G1.A52 Sub-boreal [Tilia] forests
G1.A53 East-European [Tilia] forests
G1.A54 Trans-Volgan [Tilia] forests
G1.A55 Crimean [Tilia] forests
G1.A6 Non-riverine [Ulmus] woodland
G1.A61 [Ulmus minor] woods
G1.A62 [Ulmus glabra] and [Ulmus laevis] woods
G1.A7 Mixed deciduous woodland of the Black and Caspian Seas
G1.A71 Euxinian mixed mesic forests
G1.A72 Sub-Euxinian mixed [Quercus] - [Carpinus betulus] forests
G1.A73 Caucasian [Quercus] - [Carpinus betulus] forests
G1.A74 Hyrcanian mixed mesic forests
G1.B Non-riverine [Alnus] woodland
G1.B1 [Alnus cordata] woods
G1.B2 Nemoral [Alnus] woods
G1.B3 Boreal [Alnus] woods
G1.C Highly artificial broadleaved deciduous forestry plantations
G1.C1 [Populus] plantations
G1.C2 Deciduous exotic [Quercus] plantations
G1.C3 [Robinia] plantations
G1.C4 Other broadleaved deciduous plantations
G1.D Fruit and nut tree orchards
G1.D1 [Castanea sativa] plantations
G1.D2 [Juglans] groves
G1.D3 [Prunus amygdalus] groves
G1.D4 Fruit orchards
G1.D5 Other high-stem orchards

C Inland surface water habitats

C1 Surface standing waters

C1.1 Permanent oligotrophic lakes, ponds and pools
C1.11 Benthic communities of oligotrophic waterbodies
C1.12 Rooted submerged vegetation of oligotrophic waterbodies
C1.13 Rooted floating vegetation of oligotrophic waterbodies
C1.14 Charophyte submerged carpets in oligotrophic waterbodies
C1.15 Peatmoss and [Utricularia] communities of oligotrophic waterbodies
C1.16 Dune-slack pools
C1.2 Permanent mesotrophic lakes, ponds and pools
C1.21 Benthic communities of mesotrophic waterbodies
C1.22 Free-floating vegetation of mesotrophic waterbodies
C1.221 Floating [Hydrocharis morsus-ranae] rafts
C1.222 Floating [Stratiotes aloides] rafts
C1.223 Floating [Utricularia australis] and [Utricularia vulgaris] colonies
C1.224 Floating [Salvinia natans] mats

C1.225 Floating [Aldrovanda vesiculosa] communities
C1.23 Rooted submerged vegetation of mesotrophic waterbodies
C1.24 Rooted floating vegetation of mesotrophic waterbodies
C1.241 [Nelumbo nucifera] beds
C1.242 [Ranunculus] communities in shallow water
C1.25 Charophyte submerged carpets in mesotrophic waterbodies
C1.26 Peatmoss and [Utricularia] communities of mesotrophic waterbodies
C1.3 Permanent eutrophic lakes, ponds and pools
C1.31 Benthic communities of eutrophic waterbodies
C1.32 Free-floating vegetation of eutrophic waterbodies
C1.33 Rooted submerged vegetation of eutrophic waterbodies
C1.34 Rooted floating vegetation of eutrophic waterbodies
C1.341 [Hottonia palustris] beds in shallow water
C1.4 Permanent dystrophic lakes, ponds and pools
C1.41 Benthic communities of dystrophic waterbodies
C1.42 Rooted submerged vegetation of dystrophic waterbodies
C1.43 Rooted floating vegetation of dystrophic waterbodies
C1.44 Charophyte submerged carpets in dystrophic waterbodies
C1.45 Peatmoss and [Utricularia] communities of dystrophic waterbodies
C1.46 Raised bog pools
C1.47 Lagg
C1.5 Permanent inland saline and brackish lakes, ponds and pools
C1.51 Salt basin benthic communities
C1.52 Submerged charophyte carpets in inland saline or hypersaline waterbodies
C1.53 Brackish water floating vegetation
C1.54 Submerged macrophyte communities of inland saline and brackish waters
C1.6 Temporary lakes, ponds and pools (wet phase)
C1.61 Lime-deficient oligotrophic temporary waters
C1.62 Mesotrophic temporary waters
C1.63 Eutrophic temporary waters
C1.64 Dystrophic temporary waters
C1.65 Lime-rich oligo-mesotrophic temporary waters
C1.66 Temporary inland saline and brackish waters
C1.67 Turlough and lake-bottom meadows
C1.68 Benthic communities of temporary waters
C1.69 Rooted floating vegetation of temporary waterbodies
C2 Surface running waters
C2.1 Springs, spring brooks and geysers
C2.11 Soft water springs
C2.111 Fennoscandian mineral-rich springs and springfens
C2.12 Hard water springs
C2.121 Petrifying springs with tufa or travertine formations
C2.13 Geysers
C2.14 Thermal springs
C2.141 Mediterranean thermal springs
C2.142 Macaronesian thermal springs
C2.143 Icelandic thermal springs
C2.144 Peri-Alpine thermal springs
C2.145 Peri-Caucasian hot springs
C2.15 Saline springs
C2.16 Crenal streams (spring brooks)
C2.17 Thermal spring brooks
C2.18 Acid oligotrophic vegetation of spring brooks
C2.19 Lime-rich oligotrophic vegetation of spring brooks
C2.1A Mesotrophic vegetation of spring brooks
C2.1B Eutrophic vegetation of spring brooks
C2.2 Permanent non-tidal, fast, turbulent watercourses

C2.21 Epirhithral and metarhithral streams
C2.22 Hyporhithral streams
C2.23 Glacial meltwaters
C2.24 Waterfalls
C2.25 Acid oligotrophic vegetation of fast-flowing streams
C2.26 Lime-rich oligotrophic vegetation of fast-flowing streams
C2.27 Mesotrophic vegetation of fast-flowing streams
C2.28 Eutrophic vegetation of fast-flowing streams
C2.3 Permanent non-tidal, slow, smooth-flowing watercourses
C2.31 Epipotamal streams
C2.32 Metapotamal and hypopotamal streams
C2.33 Mesotrophic vegetation of slow-flowing rivers
C2.34 Eutrophic vegetation of slow-flowing rivers
C2.4 Tidal rivers, upstream from the estuary
C2.41 Brackish water tidal rivers
C2.42 Freshwater tidal rivers
C2.43 Mesotrophic vegetation of tidal rivers
C2.44 Eutrophic vegetation of tidal rivers
C2.5 Temporary running waters (wet phase)
C2.6 Films of water flowing over rocky watercourse margins