

1.6 Wetlands

1.6.1 Location

Apart from the actual water bodies the WFD also encompasses – with regard to their water needs – terrestrial ecosystems and wetlands directly depending on aquatic ecosystems. These include mires, freshwater meadows and coastal meadows.

In Denmark, mires, freshwater meadows and coastal meadows are encompassed by Section 3 of the Protection of Nature Act if their individual area or combined area with other protected habitat types exceeds 2 500 m². Mires are also protected if they occur in connection with protected lakes or watercourses.

Mires are together defined as “uncultivated or extensively cultivated areas characterized by a natural or predominantly natural freshwater vegetation associated with the average water level...” (Danish Forest and Nature Agency, 1993). The term “mires” as used here encompasses various types of swamp forests, swamps, open fens and raised bogs. It also encompasses the swamp springs that can occur in the various types of mire except raised bogs. Raised bogs are included as groundwater-dependent wetlands even though their vegetation only receives water and nutrients with the precipitation. Raised bogs have developed from other types of mire, however, and lowering of the water table would therefore entail subsidence of the foundation upon which they are built.

Like the mires, the freshwater meadows are dependent on a high water level, but differ from them in that the pressure of human activity is greater, for example through grazing, haymaking, fertilization or occasional rotation/catch crops.

Coastal meadows are a relatively flat, low-lying, coastal habitat type. Those located adjacent to the coast can occasionally be flooded by the sea. The vegetation in the more humid parts of coastal meadows is dominated by one or more salt-tolerant plants.

The distribution of the protected habitat types in Odense River Basin is indicated in Figure 1.6.1.

Wet meadows established under the support scheme for agri-environmental measures and wetlands re-established under Action Plan on the Aquatic Environment II represent some of the natural habitat types encompassed by the WFD.

According to Action Plan on the Aquatic Environment II, 160 km² of wetland is to be re-established in Denmark over the period 1999–2003. The figure was subsequently reduced to 125 km²,

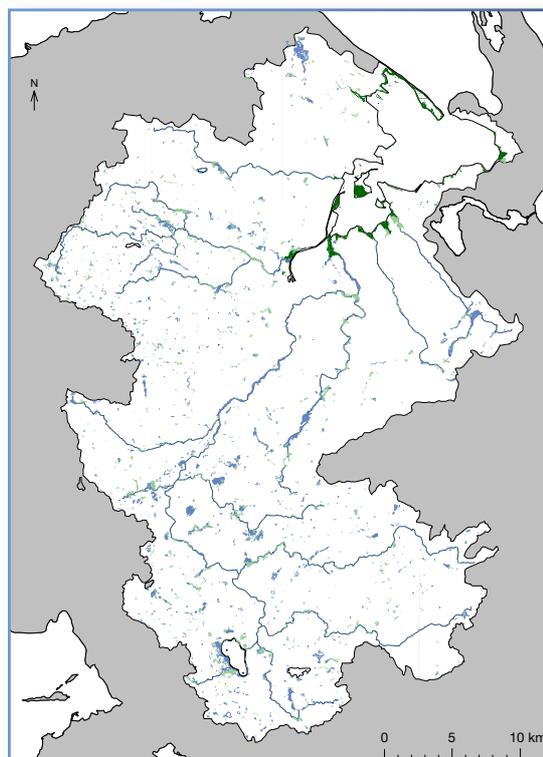


Figure 1.6.1
Distribution of protected habitat types in Odense River Basin.

■ Freshwater meadows
■ Coastal meadows
■ Mires

however. The aim is to reduce nitrogen loading from rural areas by 5 600 tonnes N (subsequently 3 500 tonnes N). The agricultural sector and the Counties have been assigned responsibility for carrying out this task. For Fyn County, the goal is 16 km² of wetland.

Areas covered by agreements to re-establish permanent wetlands are indicated in Figure 1.6.2 together with the potential wetlands. Wetlands have already been re-established in Odense River Basin under Action Plan on the Aquatic Environment II, namely at Karlsmosen Mire (0.62 km²), on the River Odense at Tørringe Brook (0.78 km²), at Geddebækken Brook (0.39 km²) and at Sandholdt (0.29 km²), a total of 2.08 km². These wetlands have been re-established by raising the water level through relocation of drains, switching off pumps and/or re-meandering watercourses to a greater or lesser extent during which the bed has been raised.

Compared with the situation in 1890 (Figure 1.6.3), at which time there were approx. 108.13 km² of extensively managed lowland areas in Odense River Basin, the area of extensively managed lowland is estimated to have decreased by approx. 45% to approx. 59.90 km² (lowland areas encompassed by Section 3 of the Protection of Nature Act and

by agri-environmental agreements, and wetlands). It should be mentioned that lowland pastures in rotation are not included in the calculations as per 1 January 2003.

Some of the agreements to re-establish wetlands encompass land that is concomitantly protected under Section 3 of the Protection of Nature Act, while others are 5-year, 20-year or permanent (i.e. recorded in the Land Registry) agreements on wet meadows and wetlands pursuant to Action Plan on the Aquatic Environment II, and which are expected to eventually develop into wet natural habitats.

1.6.2 Typology

Mires

These wetland types are subdivided according to their hydrology and vegetation.

Raised bogs are characterized by the fact that their vegetation is not in contact with the groundwater, but exclusively meets its water and nutrient requirements via precipitation.

Fens have arisen in depressions in the terrain with a relatively flat water table typically either directly on moist soil or through lakes becoming overgrown. Springs, in contrast, are characterized by upwelling groundwater. Depending on the soil

conditions and management, fens and springs can be subdivided into rich fens, poor fens and various types of swamp. Information on the occurrence of these habitat types in Odense River Basin is not available in electronic form and cannot easily be collated for the basin as a whole. Efforts are being made to place the data in a database, however.

The various mire habitat types operated with in Denmark are only partly reflected in the habitat types listed in the Habitats Directive, which encompass Northern Atlantic wet heaths with *Erica tetralix* (4010), active raised bogs (7110), degraded raised bogs (7120), quaking bogs (7140), depressions on peat substrate of the *Rhynchosporion* (7150), calcareous fens with saw grass (7210), petrifying springs (7220), alkaline fens (7230), bog woodland (91D0) and alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (91E0).

Freshwater meadows

Fyn County has visited all freshwater meadows larger than 5 ha and identified them on the basis of the dominant plant species. No actual typology has been applied to the meadows. Only one of the types of meadow in the list of habitat types encompassed by the Habitats Directive is found in Fyn County (periodically wet meadow often with purple moor grass – 6410), but this is probably not represented in Odense River Basin.

Table 1.6.1
Relationship between county registration of protected wet habitat types and some of the corresponding habitat types with which the Habitats Directive operates. Indication is also given of whether the habitat type is present in Odense River Basin. See also Sections 1.5.4 and 1.8.4.

County registration of protected wet habitat types		HD Habitat types		Reference conditions/ Favourable conservation status cf. Habitats Directive
Protected habitat type	Subtype	Code*	Occurrence in ORB	
Raised bogs		7110	x	See Section 1.6.4.
		7120	x	
Fens/springs/swamps	Rich fens	7210	x	
		7220	x	
		7230	x	
	Poor fens	4010	x	
		7140	x	
		7150	?	
	Swamp forests	91D0	?	
91E0		x		
Swamps	7210	x		
Freshwater meadows		6410	x	
Coastal meadows	Atlantic salt meadows	1330	x	
	Salt swamps	–	x	
	<i>Salicornia</i> etc. on sand/mud	1310	x	
	Coastal lagoons	1150	x	
	Dry salt meadows	1220	x	

*Habitat type codes as per Annex 1 of the Habitats Directive.

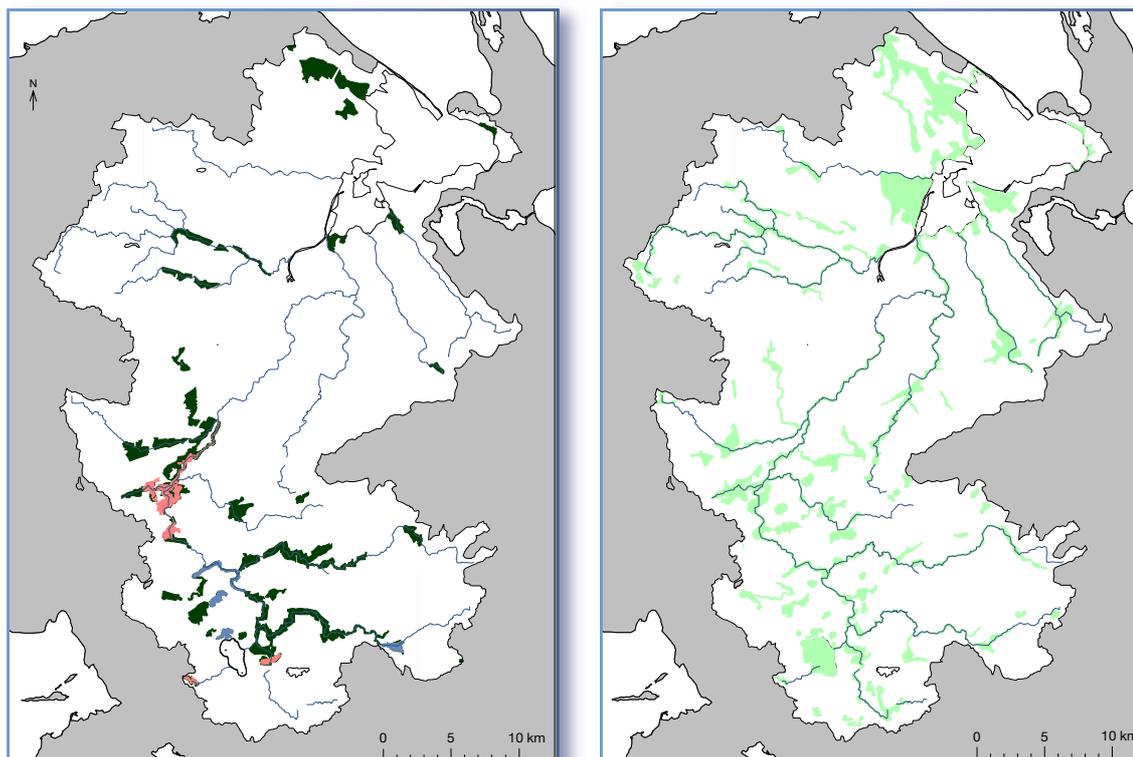


Figure 1.6.2 (left) Agreements to re-establish wetlands in Odense River Basin made under Action Plan on the Aquatic Environment II. Potential wetlands are also shown.

Figure 1.6.3 (right) Extensively managed lowland areas in Odense River Basin in 1890.

Table 1.6.2 Proposed correlation between conservation objectives (cf. Habitats Directive), environmental quality objectives (cf. Water Framework Directive (WFD)), the National Environmental Research Institute (NERI) status assessment and Fyn County's nature quality objectives.

WFD objective and status assessment NERI status assessment	Habitats Directive and status assessment	Fyn County – nature quality objectives
High status	Favourable conservation status	A – International/national nature area
Good status		B – National/regional nature area
Moderate status	Unfavourable conservation status	C – Regional nature area
Poor status		Regional/local nature area
Bad status		

Coastal meadows

In Fyn County's habitat registration, coastal meadows are identified on the basis of the dominant plant species and the occurrence of morphological features such as anthills of the yellow meadow ant (*Lasius flavus*), tidal channels, beach ridges and/or dykes. Information on the occurrence of the various habitat types of coastal meadows, to some extent corresponding to the habitat types Atlantic salt meadows (1330), *Salicornia* and other annuals colonizing mud and sand (1310), coastal lagoons (1150) and perennial vegetation of stony banks (1220), is available in non-electronic form.

Over the next two years, Fyn County will register the occurrence of the natural habitat types listed in the Habitats Directive within the areas designated as habitat sites pursuant to the Directive.

1.6.3 Physical modification

Used here, modification is understood to mean interventions that affect the water level in mires, freshwater meadows and coastal meadows or that affect the quality of the water in adjacent water bodies.

The total number of modified mires, freshwater meadows and coastal meadows in Odense River Basin is unknown. However, information about 387 mires in Faaborg, Tommerup and Odense Municipalities, which cover a large part of Odense River Basin, provides a good indication of the main modifications.

Of the 387 mires, 132 (34%) are directly affected by drainage in that drainage ditches have been established in the localities in question. The exact figure for the number affected by a lowered water level is probably considerably greater as

it has not been possible to include localities affected by lowering of the water level attributable to larger drainage projects such as channelization of watercourses or to groundwater abstraction.

In addition, 86 (22%) have been filled up to some extent, and excavation has been carried out in 45 (12%). Still others have completely disappeared, are affected by former peat mining or are treated with fertilizer. Finally, a small number are affected by soil preparation (often at the edges or when establishing food fields for wildlife).

It can therefore be concluded that drainage/lowering of the water level, filling-up and excavation as well as the input of fertilizer and soil preparation are the main modifying factors. In addition, lowering of the water level in wetlands can also occur as a result of watercourse regulation and groundwater abstraction.

1.6.4 Reference conditions

At the present time, there are no national criteria to describe the reference conditions for wetlands.

It seems reasonable, though, that the reference conditions for wetlands should be assessed on the basis of biological, chemical, physical and management parameters. Based on these parameters, wetlands with reference conditions should have a natural hydrology and morphological features that are characteristic for the types. Moreover, they must not be affected by fertilizer and/or pesticides. Finally, the reference conditions for some wetlands depends on continual management in the form of cutting or hay harvesting.

The reference conditions will thus probably be reflected in a number of indicators for the nutrients, species and morphological features present in the habitat type in question. In this connection, it is recommended that scientifically-based operational criteria are developed for describing the reference conditions for natural habitat types rather than just referring to a situation at specific times, as for example with the entry into force of the Habitats Directive in 1992 (see Table 1.6.1).

The majority of mires and springs are affected by lowering of the water level and groundwater abstraction. At the same time, nitrogen input (mainly via deposition) to the most sensitive types of mire such as raised bogs, poor fens and rich fens is so great as to exceed their critical loads. Moreover, Fyn County's habitat registration shows that just over 80% of the mires are becoming overgrown, and that several plant species have disappeared from Fyn County (Tranberg et al., 1995; 1996;

Vinter & Tranberg, 2002).

The majority of freshwater meadows have arisen through drainage of mires and are to a large extent affected by fertilization and regular cultivation. Such meadows cannot meet reference conditions.

In coastal meadows meeting reference conditions, the hydrology must be virtually natural, i.e. they must be freely exposed to the sea and unaffected by structures such as dykes, drainage channels, etc. Coastal meadows meeting reference conditions must therefore contain coastal morphological features such as tidal channels, beach ridge systems, spit formations and coastal lagoons. This definition does not take into account whether the coastal meadows have developed along a natural or an artificial coastline. In addition, grassy coastal meadows must have a long continuity, as expressed, for example, by the presence of anthills of the yellow meadow ant (*Lasius flavus*) and the occurrence of characteristic coastal meadow plants. The vegetation must not be affected by the use of fertilizer or pesticides. Virtually all the coastal meadows within Odense River Basin are affected by drainage to some degree.

Based on the above-mentioned parameters, the initial assessment is that only very few coastal meadows in Odense River Basin meet reference conditions. With the information currently available it is not possible to positively identify their location, however. Parts of the coastal meadows at the base of the spit named Enebærødd might possibly meet the criteria for reference conditions.

1.6.5 Provisional establishment of objectives

Both the Habitats Directive and the WFD stipulate different categories for use in assessing the status of the habitat types. Moreover, the individual categories are used to describe objectives for the status that the individual habitat types should achieve. The WFD operates with five classes, while the Habitats Directive only operates with two.

The two classes in the Habitats Directive are "Unfavourable conservation status" and "Favourable conservation status". The basic requirement in the Habitats Directive is that the conservation status must be favourable in the habitat types that serve as the basis for selecting the individual habitat sites. In this context, favourable conservation status is defined on the basis of the habitat's area, structure and function and its typical species. The National Environmental Research Institute has drawn up proposals for operational definitions

of favourable conservation status for each of the habitat types referred to in Section 1.6.2 (Søgaard et al., 2003).

The status categories with which the WFD operates are high, good, moderate, poor and bad. The basic requirement is that the status of the habitat types encompassed by the Directive should be high or good. At present, there are no operational definitions of the status classes for the individual wetland habitat types.

The National Environmental Research Institute is also developing a system for assessing the status of habitat types. This uses the same classes as the WFD, but operational definitions of the status classes have not yet been developed for the individual habitat types (Skov, 2003).

Fyn County has set nature quality objectives for the terrestrial habitat types encompassed by Section 3 of the Protection of Nature Act. The objectives encompass the categories A: Areas of international or national significance; B: Areas of national or regional significance; C: Areas of regional significance; and D: Areas of regional or local significance. The objectives have been set on the basis of a number of parameters such as the current or former nature content of the areas, their size and structure, continuity of management, the potential for nature restoration and their current and potential landscape ecological significance. They are primarily a tool for use in administration and for prioritization of nature management, and a system for assessing whether the areas meet the objectives set for them has not yet been developed.

Table 1.6.2 shows a hypothetical correlation between the above-mentioned systems (see Dahl et al, in press; Skov, 2003). As final criteria for assessing the status of the habitat types have not yet been established, it may prove necessary to adjust the correlations between the systems. Dahl et al. (in press) thus suggest that it may be necessary for favourable conservation status of certain marine habitat types to correspond to high status under the WFD.

According to instructions from the Ministry of the Environment, quality objectives are not to be set for wetlands re-established under Action Plan on the Aquatic Environment II as these are

re-established with the aim of serving as filters to reduce nutrient loading of the water bodies. However, a criterion has been set for approval of the projects such that in addition to nutrient removal, they must represent an improvement in the natural state of each individual new wetland.



Cuckoo flower (Cardamine pratensis).

Photo: Bjarne Andresen, Fyn County

1.6 Wetlands



*Re-established wetland
at Karlsmosen, 2002.*

Photo: Lars Bangsgaard, Fyns Amt