
5

Bogs and marshes



51 Raised bogs

Sphagnetalia magellanici, *Scheuchzerietalia palustris* p., *Utricularietalia intermedio-minoris* p., *Caricetalia fuscae* p.

Highly oligotrophic, strongly acidic communities composed mainly of sphagnum growing on, and forming, peat and deriving moisture and nutrients only from rainfall (ombrotrophic). They form only in cool climates with heavy rainfall and are characteristic of lowlands and hills of north-western and northern Europe, the adjacent Hercynian ranges, the Jura and the Alps. Their independence from ground water is the result either of upward growth or of changes in the water table. Bogs harbour, in addition to various sphagnum species, which are abundant, dominant and the major component of their formation, a small number of acidophilous plants such as *Eriophorum vaginatum*, *Scirpus* (*Trichophorum*) *cespitosus*, *Carex pauciflora*, *C. paupercula*, *Ledum palustre*, *Vaccinium oxycoccos*, *Andromeda polifolia*, *Drosera rotundifolia* and lichens. Animal species are not numerous but those that are adapted to bogs are highly specialized. Among typical invertebrates figure dragonflies (*Leucorrhinia dubia*, *Aeshna subarctica*, *A. caerulea*, *A. juncea*, *Somatochlora arctica*, *S. alpestris*), lepidopterans (*Colias palaeno*, *Boloria aquilonaris*, *Coenonympha tullia*, *Vacciniina optilete*, *Hypenodes turfosalis*, *Eugraphe subrosea*), beetles, ants (*Formica exsecta*), bugs and spiders (*Pardosa sphagnicola*, *Glyphesis cottonae*). Most of the species that bogs harbour are rare and their populations fragmented into isolated relictual elements; several are threatened. The remaining intact or nearly intact communities are exceptional.

(Vanden Berghen, 1951; Ellenberg, 1963, 1988; Pearsall, 1971; Guinochet and Vilmorin, 1973; Westhoff and den Held, 1975; Dierssen, 1978; Tüxen, 1978; Muller, 1978; Pedrotti, 1978; Petermann and Seibert, 1979; Ozenda, 1981, 1985; Condry, 1982; Drachenfels, 1984; Nordiska ministerradet, 1984; Bournières, 1984; Mollet *et al.*, 1985; Bellamy, 1986; Oberdorfer, 1990)

51.1

NEAR-NATURAL RAISED BOGS

Undisturbed, or little disturbed, peat-forming bogs, often taking the shape of a convex lens. Such intact or nearly intact systems have become very rare or even exceptional. They are composed of a number of communities, which form and occupy the topological features of the bog. These communities are interrelated and function as a unit, so that they cannot be regarded as separate subhabitats; their presence and combination, however, characterize the various types of bogs. Simultaneous use of an appropriate selection of the sub-units below can thus contribute to a description of individual bog systems.

51.11

BOG HUMMOCKS, RIDGES AND LAWNS

Sphagnion magellanici, *Oxycocco-Ericion tetralicis* p.

Vegetation of the higher parts of the bog plateau and of its drier, marginal slope.

51.111

Colourful sphagnum hummocks (bulten)

Cushiony domes or buttes, mainly made of red, yellow or brown sphagnums, with other mosses, liverworts (*Odontoschisma sphagni*, *Campylopus pyriformis*, *Mylia anomala*), lichens (*Cladonia* spp., *Cladina* spp.), *Eriophorum vaginatum*, *Carex pauciflora*, *Calluna vulgaris*, *Ledum palustre*, *Andromeda polifolia*, *Vaccinium oxycoccos*, *Scirpus cespitosus*, *Erica tetralix*, *Drosera rotundifolia*.

- 51.1111** *Sphagnum magellanicum* hummocks
Typical Central European hummocks, formed by the swollen-leaved, brownish or greenish-red *Sphagnum magellanicum*.
- 51.1112** *Sphagnum fuscum* hummocks
Shiny brown *Sphagnum fuscum* hummocks replacing or accompanying the *Sphagnum magellanicum* hummocks in eastern, Alpine and some western communities.
- 51.1113** *Sphagnum rubellum* hummock wreaths
Dark red *Sphagnum rubellum* communities often encircling the bases of *Sphagnum magellanicum* or *S. fuscum* hummocks.
- 51.1114** *Sphagnum rubellum* hummocks
Hummocks dominated by *Sphagnum rubellum*.
- 51.1115** *Sphagnum imbricatum* hummocks
Often tall hummocks formed by the large, orange-gold *Sphagnum imbricatum*, mostly western and increasingly uncommon.
- 51.1116** *Sphagnum papillosum* hummocks
Low hummocks of olive-brown or ocre *Sphagnum papillosum*, formed mostly in western bogs.
- 51.1117** *Sphagnum capillifolium* hummocks
Large cushion hummocks formed by the reddish *Sphagnum capillifolium*, mostly western.
- 51.112** **Green sphagnum hummock bases and lawns**
Green or yellow *Sphagnum cuspidatum*, *S. apiculatum*, *S. pulchrum*, *S. papillosum* i.a. communities forming in the transition zone between hollows and hummocks; *Drosera rotundifolia*, *Eriophorum vaginatum*, *Andromeda polifolia*, *Vaccinium oxycoccos* are often common.
- 51.113** **Dwarf shrub hummocks**
Ericaceous dwarf shrub communities forming on the top of drying hummocks, often with the moss *Polytrichum strictum*.
- 51.1131** **Ling dwarf shrub hummocks**
Calluna vulgaris-dominated communities characteristic of Central European formations.
- 51.1132** **Cross-leaved heather shrub hummocks**
Erica tetralix-dominated communities characteristic of Atlantic formations.
- 51.1133** **Crowberry shrub hummocks**
Empetrum nigrum-dominated communities of slightly more mineral-rich formations.
- 51.1134** **Vaccinium shrub hummocks**
Formations of taller hummocks with *Vaccinium uliginosum*, *V. vitis-idaea*, *V. myrtillus* and, locally, *Betula nana*.
- 51.1135** **Labrador tea shrub hummocks**
Ledum palustre communities of tall hummocks of north-eastern bogs.
- 51.1136** **Bog myrtle hummocks**
Myrica gale communities of hummocks of western bogs.
- 51.114** **Bog deergrass communities**
Eriophoro-Trichophoretum cespitosi
Scirpus cespitosus-dominated bogs or parts of bogs, mostly characteristic of Hercynian and peri-Alpine regions.

51 Raised bogs

- 51.115** **Bog *Erica-Sphagnum* communities**
Erico-Sphagnetum p.
 Bogs or parts of bogs dominated by *Erica tetralix* and *Sphagnum papillosum*, characteristic of raised bog systems of Atlantic regions, particularly the British Isles.
- 51.12** **BOG HOLLOWES (SCHLENKEN)**
Scheuchzerietalia palustris p.
 Temporarily or permanently rainwater-filled depressions of bogs, occupied by communities similar to those of larger intermediate mires (54.5, 54.6).
- 51.121** **Deep schlenken**
Caricetum limosae p.
 Constantly submerged hollows with bright green *Sphagnum cuspidatum*, *S. recurvum*, *S. dusenii* and with *Drepanocladus fluitans*, *Lophozia inflata*, *Eriophorum angustifolium*, *Rhynchospora alba*, *Menyanthes trifoliata*, *Carex limosa*, *C. paupercula*, *C. pauciflora*, *Scheuchzeria palustris*.
- 51.122** **Shallow schlenken**
Rhynchosporetum albae
 Temporarily inundated shallow hollows with *Rhynchospora alba*, *R. fusca*, *Drosera intermedia*, *Lycopodiella inundata*.
- 51.13** **BOG POOLS**
 Larger, deep, permanently filled depressions, usually dystrophic, occurring near the centre of raised bogs or along tension lines. Their planktonic communities are original. Floating plant communities may sometimes develop, in particular those comprising *Sparganium minimum* and *Utricularia spp.* (22.45) and, sometimes, beds of *Nymphaea spp.* (22.4311).
- 51.131** **Bog eye (kolk)**
 Large pools or lakes occurring near the centre of Central European raised bogs, often with relatively firm, steep banks colonized by trees or scrub forming a ring of woodland.
- 51.132** **Other bog pools**
- 51.14** **BOG SEEPS AND SOAKS**
 Paths of water runoff carving the marginal slope of the bog, carrying water from the centre to the lagg. They are in part colonized by intermediate mire or acid fen vegetation (54.5, 54.4).
- 51.141** **Bog asphodel seeps**
Narthecium ossifragum colonies in seep rivulets, mostly characteristic of western bogs.
- 51.142** **Bog myrtle soaks**
Myrica gale thickets of Atlantic raised bog soaks.
- 51.143** **Other bog soak and runoff gully communities**
- 51.15** **LAGG**
 Ring of water surrounding raised bogs, often colonized by intermediate mire or acid fen communities (54.5, 54.4), sometimes accompanied by more basicline species typical of neighbouring fens; *Eriophorum angustifolium*, *E. vaginatum*, *Scirpus hudsonianus*, *Carex rostrata*, *C. flava*, *Parnassia palustris* are frequent components.
- 51.16** **BOG PRE-WOODS**
Sphagnetum magellanici pinetosum rotundatae i.a.
 Parts of raised bogs colonized by shrubs or small trees of *Pinus rotundata*, *P. sylvestris* var. *turfosa*, *Picea abies*, *Betula pubescens*, *B. carpatica*, eventually leading to bog woods (44.A).
- 51.2** **PURPLE MOORGRASS BOGS**
Ericion tetralicis p.
 Drying, mowed or burned bogs invaded by *Molinia caerulea*.
 (Lebrun *et al.*, 1949; Noirfalise *et al.*, 1980; Drachenfels, 1984)

52 Blanket bogs

Sphagnetalia magellanici: Oxycocco-Ericion tetralicis (Calluno-Sphagnion papilloso, Erico-Sphagnion papilloso) p.; Scheuchzerietalia palustris p., Utricularietalia intermedio-minoris p., Caricetalia fuscae p.

Communities similar to raised bogs, on flat or gently sloping ground with poor surface drainage, in oceanic climates with heavy rainfall, characteristic of the western and northern British Isles. In spite of some lateral water flow, blanket bogs are mostly ombrotrophic. They often cover extensive areas with local topographic features supporting distinct communities. Sphagnums (*S. papillosum*, *S. tenellum*, *S. compactum*, *S. magellanicum*) play an important role in all of them, accompanied by *Narthecium ossifragum*, *Molinia caerulea*, *Scirpus cespitosus*, *Schoenus nigricans*, *Eriophorum angustifolium*, *E. vaginatum*. High and low altitude forms and numerous variants can be distinguished. Blanket bogs constitute a habitat endemic to north-western Europe, of which intact examples are relatively uncommon.

(Pearsall, 1971; Pearsall and Pennington, 1977; Ratcliffe, 1977, 1980, Doyle and Moore, 1978; Dierssen, 1978; Tüxen, 1978; Heal and Smith, 1978; Currie, 1979; Condry, 1982; White and Doyle, 1982; Polunin and Walters, 1985; Bellamy, 1986; Ellenberg, 1988; Morrison, 1989)

52.1

LOWLAND BLANKET BOGS

Sphagnetalia magellanici: Pleurozio purpureae-Ericetum tetralicis; Scheuchzerietalia palustris p., Caricetalia fuscae p., Utricularietalia intermedio-minoris p., Littorelletalia, Potamogetonalia

Hyper-Atlantic blanket bogs of the western coastlands of Ireland, western Scotland and its islands, Cumberland, northern Wales and Devon, developed under very high rainfall climates. The main vascular plants are *Molinia caerulea*, *Eriophorum angustifolium*, *E. vaginatum*, *Scirpus cespitosus*, *Schoenus nigricans*, *Rhynchospora alba*, *Narthecium ossifragum*, *Carex panicea*, *Calluna vulgaris*, *Erica tetralix*, *Myrica gale*, *Pedicularis sylvatica*, *Potentilla erecta*, *Polygala serpyllifolia*, *Pinguicula lusitanica*, *Drosera rotundifolia*. The colourful mucinal layer comprises the black and crimson liverwort *Pleurozia purpurea*, the black and gold moss *Campylopus atrovirens*, the woolly fringe moss *Rhacomitrium lanuginosum*; it is often dominated by sphagnums (*Sphagnum auriculatum*, *S. magellanicum*, *S. compactum*, *S. papillosum*, *S. nemoreum*, *S. rubellum*, *S. tenellum*, *S. subnitens*), or, particularly in parts of western Ireland, mucilaginous algal deposits (*Zygonium*). Some of the distinctive features of the blanket bog can be, as in 52.1, individualized by the codes below.

52.11

BLACK BOG-RUSH SWARDS

Schoenus nigricans-Rhacomitrium lanuginosum formations, particularly widespread on deep peat in the Galway and Mayo peninsulas of Ireland, local in Scotland. *Pinguicula lusitanica* and *Pedicularis sylvatica* may occur.

52.12

SPHAGNUM-ALGAE CARPETS

Waterlogged pool edges and bog surfaces rich in *Sphagnum magellanicum* or *S. papillosum*, *S. rubellum*, *S. cuspidatum*, *S. auriculatum*, *S. palustre* and *Zygonium* deposits, often with *Drosera anglica*, *D. rotundifolia*, *Menyanthes trifoliata*.

52 Blanket bogs

- 52.13** DEERGRASS SWARDS
Scirpus cespitosus-dominated swards on slopes, tops of slopes, shallow peat, and slightly drier areas, particularly abundant in Scotland and Kerry. *Carex panicea*, *Sphagnum compactum*, *Pinguicula grandiflora* may be prominent.
- 52.14** OBLONG-LEAVED SUNDEW COMMUNITIES
Formations rich in *Drosera intermedia*, with *Riccardia pinguis*, *Rhynchospora fusca* or *Carex limosa* of slope areas submitted to surface water movement and shallow hollows.
- 52.15** BULBOUS-RUSH COMMUNITIES
Formations of *Juncus bulbosus*, *Eleocharis multicaulis* and *Carex panicea* of shallow drainage channels and shallow pools.
- 52.16** FLUSHES, DEEP HOLLOWES AND POOLS
Wet depressions and seeps colonized by communities of the *Scheuchzerietalia palustris* (54.5, 54.6), the *Caricetalia fuscae* (54.4), the *Utricularietalia intermedio-minoris* (22.45), the *Littorelletalia* (22.31) or the *Potamogetonetalia* (22.43), which can be noted by use of appropriate codes. Among important elements are *Potamogeton polygonifolius*, *Eriocaulon aquaticum*, *Lobelia dortmanna*, *Menyanthes trifoliata*.
- 52.2** UPLAND BLANKET BOGS
Sphagnetalia magellanici: *Vaccinio-Ericetum tetralicis*; *Ericion tetralicis* p., *Scheuchzerietalia palustris* p., *Caricetalia fuscae* p., *Utricularietalia intermedio-minoris* p., *Littorelletalia*, *Potamogetonetalia*
Blanket bogs of high ground, hills and mountains in Scotland, Ireland, western England and Wales. Characteristic species are *Eriophorum vaginatum*, *Calluna vulgaris*, *Erica tetralix*, *Rubus chamaemorus*, *Narthecium ossifragum*, *Scirpus cespitosus*, *Drosera rotundifolia*, *Rhacomitrium lanuginosum* and abundant sphagnum mosses.
- 52.21** COTTONGRASS-LING BOGS
Upland blanket bogs dominated by *Eriophorum vaginatum* and *Calluna vulgaris* with *Rubus chamaemorus*, *Sphagnum rubellum*, *Hypnum cupressiforme*.
- 52.22** COTTONGRASS BOGS
Species-poor upland blanket bogs, dominated by *Eriophorum vaginatum*, mostly widespread in the Pennines.
- 52.23** UPLAND SPHAGNUM MATS
Sphagnum papillosum, *S. magellanicum*, *S. rubellum*, *S. imbricatum*, *S. fuscum* carpets and hummocks of the cottongrass-ling blanket bogs.
- 52.24** DWARF SHRUB-COTTONGRASS BOGS
Upland cottongrass-ling blanket bogs with an abundance of *Empetrum hermaphroditum*, *E. nigrum*, *Betula nana*, *Vaccinium uliginosum*, *V. myrtillus*, *Arctostaphylos uva-ursi*, *A. alpina* and *Sphagnum fuscum*.
- 52.25** WOOLLY FRINGE MOSS HUMMOCKS
Formations dominated by *Rhacomitrium lanuginosum*.
- 52.26** BLANKET BOG WET HEATH
Ericion tetralicis
Formations of *Scirpus cespitosus*, *Myrica gale*, *Erica tetralix*, *Calluna vulgaris*, *Molinia caerulea*, *Sphagnum* spp. (*S. papillosum*, *S. rubellum*, *S. magellanicum*, *S. auriculatum*), *Rhacomitrium lanuginosum* and lichens, similar to 31.1, integrated within blanket bog systems.
- 52.27** FLUSHES, DEEP HOLLOWES AND POOLS
Wet depressions and seeps colonized by communities of the *Scheuchzerietalia palustris* (54.5, 54.6), the *Caricetalia fuscae* (54.4), the *Utricularietalia intermedio-minoris* (22.45), the *Littorelletalia* (22.31) or the *Potamogetonetalia* (22.43).

53 Water-fringe vegetation

Phragmitetea

Reed beds and large sedge communities of the margins of lakes, rivers, and brooks and of fens and eutrophic marshes.

53.1

REED BEDS

Phragmiton australis, *Scirpion maritimi*

Reed bed formations of tall helophytes, usually species-poor and often dominated by one species, growing in stagnant or slowly flowing water of fluctuating depths, and sometimes on waterlogged ground. They can be classified according to the dominant species, which gives them a distinctive appearance.

(Lebrun *et al.*, 1949; Ellenberg, 1963, 1984; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Noirfalise *et al.*, 1980; Molinier and Martin, 1980; Rivas-Martinez *et al.*, 1980; Wheeler, 1980a; Pignatti, 1982; Rivas-Martinez *et al.*, 1984; Polunin and Walters, 1985; Wolff, 1987; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Arriza and Peinado Lorca, 1987; Costa, 1987; Oberdorfer, 1990)

53.11

COMMON REED BEDS

Phragmitetum (*Scirpo-Phragmitetum p.*, *Typho-Phragmitetum maximi*, *Scirpo lacustris-Phragmitetum mediterraneum*)

Beds of *Phragmites australis*.

53.111

Flooded *Phragmites* beds

Permanently inundated reed beds.

53.112

Dry *Phragmites* beds

Reed beds dry for at least a large part of the year, often invaded by other species.

53.113

Giant *Phragmites* beds

Formations of the very tall *Phragmites* 'maximus', occurring locally in the Mediterranean basin, in particular on islets of lagoons of the east coast of Spain, where they harbour the very local, spectacular *Kosteletzkya pentacarpos*.

53.12

COMMON CLUBRUSH BEDS

Scirpetum lacustris (*Scirpo-Phragmitetum p.*)

Scirpus lacustris formations, intolerant of drying, tolerant of water circulation, and thus forming the outer belts of reedbeds.

53.13

REEDMACE BEDS

Typhetum angustifoliae, *Typhetum latifoliae* (*Scirpo-Phragmitetum p.*)

Typha latifolia, *T. angustifolia*, *T. domingensis*, *T. laxmannii* formations, usually extremely species-poor and sometimes almost pure, tolerant of extended periods of dryness and of pollution.

53.14

MEDIUM-TALL WATERSIDE COMMUNITIES

Formations of shorter, mostly non-graminoid helophytes emerging from mesotrophic or eutrophic, stagnant or slow-moving, shallow water, and constituting fringes or patches within or alongside reedbeds.

53.141

Arrowhead communities

Sagittario-Sparganietum emersi

Formations of *Sagittaria sagittifolia* and *Sparganium emersum* of slowly flowing, and sometimes standing, meso-eutrophic waters.

53.142

Neglected bur-reed communities

Glycerio-Sparganietum neglecti

Formations dominated by *Sparganium neglectum*, characteristic of standing or slowly flowing waters on mineral-rich, lime-poor muddy substrates.

- 53.143** **Erect bur-reed communities**
Sparganietum erecti
 Formations rich in *Sparganium erectum*, characteristic of riparian reedbeds along standing waters on lime-rich, mineral-rich muddy substrates.
- 53.144** **Sweet flag communities**
Acoretum calami
 Formations dominated by the long-introduced thermophile *Acorus calamus*.
- 53.145** **Flowering rush communities**
Butometum umbellati
 Usually open formations dominated by, or rich in, *Butomus umbellatus* characteristic of strongly fluctuating still or slow-flowing base- and mineral-rich waters.
- 53.146** **Water dropwort-great yellowcress communities**
Oenanthro-Rorippetum amphibiae
 Formations, often at the edges of reedbeds, rich in *Oenanthe aquatica* or *Rorippa amphibia*.
- 53.147** **Water horsetail beds**
 Low, often extensive, homogeneous, usually inundated formations dominated by *Equisetum fluviatile*.
- 53.148** **Water parsnip communities**
 Formations dominated by, or rich in, the tall umbellifer *Sium latifolium*.
- 53.149** **Marestail beds**
 Formations, usually of still or running, clear, cold to temperate nutrient-rich water, dominated by *Hippuris vulgaris*.
- 53.14A** **Common spikerush beds**
 Low, often extensive and very homogeneous formations dominated by *Eleocharis palustris*.
- 53.15** **REED SWEETGRASS BEDS**
Glycerietum maximae
Glyceria maxima formations, rather low, usually constituting strips in or along ditches or small streams, often in grasslands, requiring fairly constant inundation by eutrophic water and with a fairly rich associated flora.
- 53.16** **REED CANARY-GRASS BEDS**
Phalaridetum arundinaceae
Phalaris arundinacea formations, pure or mixed with *Phragmites australis*, very tolerant of drying, pollution and perturbation, susceptible of forming the landward belt of reedbeds and often characteristic of degraded systems.
- 53.17** **HALOPHILE CLUBRUSH BEDS**
Scirpion maritimi
 Formations of *Scirpus tabernaemontani*, *S. maritimus*, *S. triqueter*, *S. litoralis*, *S. pungens* mostly characteristic of brackish or saline waters to 1.5 m deep.
- 53.2** **LARGE SEDGE COMMUNITIES**
Magnocaricion
 Formations of large Cyperaceae of genera *Carex* or *Cyperus* occupying the edge or the entirety of humid depressions, oligotrophic mires and rich fens, on ground that can be dry for part of the year. They occur, in particular, on the landward side of reedbeds in waterside successions and as colonists of humid depressions on mineral soils, or of acid and alkaline fens.

- 53.21** **LARGE CAREX BEDS**
Formations of social sedges of genus *Carex*, usually dominated by one species that can be either tussock-forming or bed-forming. They can be arranged according to dominant species.
(Ellenberg 1963, 1988; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Rivas-Martinez *et al.*, 1980; Wheeler, 1980a; Jermy *et al.*, 1982; Pignatti, 1982; Dethioux, 1982; Rivas-Martinez, Diaz *et al.*, 1984; Wolff, 1987; Navarro Andres and Valle Gutierrez, 1987; Asensi Marfil and Diez Garretas, 1987; Costa, 1987; Rivas-Martinez *et al.*, 1987; Ladero Alvarez, 1987; Oberdorfer, 1990)
- 53.211** **Brown sedge beds**
Caricetum distichae
Formations of *Carex disticha* of humid alluvial meadows on clay and of temporarily drying peatbogs; often in contact with grasslands of the *Calthion* and sometimes placed in that alliance; they tolerate fairly long dessication and have a relatively rich accompanying flora.
- 53.212** **Slender tufted sedge beds and related communities**
Formations dominated by *Carex acuta*, *C. acutiformis* or their relatives.
- 53.2121** **Slender tufted sedge beds**
Caricetum gracilis
Formations of *Carex acuta* of wet, alkaline or slightly acid depressions with mineral soil; *C. acuta* does not tolerate prolonged dessication.
- 53.2122** **Lesser pond sedge beds**
Carex acutiformis is more tolerant of dessication than *C. acuta*. It forms beds on mesotrophic, base-rich, neutral to slightly acid, peaty or mineral soils. Large beds may form in fens, often with *Carex paniculata*; otherwise, they are widespread along watercourses on the landward side of *Carex acuta* or *C. vesicaria* beds, in alluvial plains, ditches and depressions of humid meadow systems; they may occupy stations that almost totally escape periodical inundation.
- 53.2123** **Inn sedge beds**
Caricetum oenensis
Formations of *Carex oenensis*, restricted to oligotrophic, base-rich streamsides of the pre-Alpine Bavarian plateau.
- 53.2124** **Banat sedge beds**
Caricetum buekii
Carex buekii formations of mesotrophic sandy or clay soils in Franconia, eastern Bavaria, Saxony and northern Italy.
- 53.2125** **Water sedge beds**
Caricetum aquatilis
Mesotrophic *Carex aquatilis* formations of Lower Saxony, Wales, Lakeland, Scotland and Ireland.
- 53.2126** **Brotero sedge beds**
Galio broteriani-Caricetum broterianae
Carex acuta ssp. *broteriana* formations of Iberia, lining river courses on the inner side of alder galleries, or replacing them.
- 53.213** **Greater pond sedge beds**
Caricetum ripariae, *Caricetum vulpino-ripariae*, *Leucojo-Caricetum ripariae*
Formations of *Carex riparia*, mostly characteristic of larger valleys and southern regions, intolerant of dessication. They form on mineral or thinly peaty substrates, often in areas almost permanently inundated by somewhat lime-rich water.
- 53.214** **Bottle and bladder sedge beds**
Caricetum vesicariae, *Caricetum rostrato-vesicariae*, *Caricetum acuto-vesicariae*
Formations of *Carex vesicaria* and *C. rostrata* of moderately to strongly acid, fairly constantly inundated soils and poor fens.

- 53.2141** **Bottle sedge beds**
Dense formations of *Carex rostrata*, of usually very wet, meso-oligotrophic substrates.
- 53.2142** **Bladder sedge beds**
Formations of *Carex vesicaria*, usually characteristic of less oligotrophic situations than the previous ones. *C. vesicaria*, however, often accompanies *C. rostrata*, forming then the outer, drier edge of the sedge bed.
- 53.215** **Tufted sedge and sward sedge tussocks**
Formations dominated by the large, tussock-forming *Carex elata* or its relatives.
- 53.2151** **Tufted sedge tussocks**
Caricetum elatae
Formations of large, often crowded tussocks of *Carex elata*, of alkaline or eutrophic, peaty or organic soils. *Carex elata* is, in particular, one of the constituents of species-rich sedge communities in alkaline fens. It is also typical of the flood plain of large, slow-flowing rivers.
- 53.2152** **Sward sedge tussocks**
Caricetum cespitosae
Formations of *Carex cespitosa*, characteristic of nutrient- and base-rich, neutral to acid peaty soils of north-eastern Central Europe and northern Italy.
- 53.216** **Greater tussock sedge tussocks**
Caricetum paniculatae, *Galio palustri-Caricetum lusitanicae*
Formations of large, usually well-spaced tussocks of *Carex paniculata*, of alkaline to acid, usually mesotrophic, often somewhat shady, habitually peaty stations, including marshy woods. *C. paniculata* is also a constituent of species-rich alkaline fen sedge communities
- 53.217** **Fibrous tussock sedge tussocks**
Caricetum appropinquatae p.
Formations of *Carex appropinquata*, alone or mixed with *C. paniculata*, essentially of mesotrophic, basicline peaty or mineral soils.
- 53.218** **Cyperus sedge tussocks**
Cicuto-Caricetum pseudocyperi
Formations of *Carex pseudocyperus* of mostly slightly acid peaty soils, in very wet situations.
- 53.219** **Fox sedge tussocks**
Caricetum vulpinae
Formations of *Carex vulpina* or *C. otrubae*, of eutrophic humus-poor clay soils, inundated for part of the year.
- 53.2191** **True fox sedge tussocks**
Formations of the very large *Carex vulpina*.
- 53.2192** **False fox sedge tussocks**
Formations of the often less robust *Carex otrubae*.
- 53.21A** **Club sedge beds**
Beds of *Carex buxbaumii* of wet grasslands, lake shore swamps and fens, on temporarily inundated relatively nutrient-rich, somewhat acid peaty sandy or clay soils of eastern France, southern and eastern Germany, the southern Alps and the central Apennines.
- 53.22** **TALL GALINGALE BEDS**
Formations dominated by large perennial Cyperaceae of genus *Cyperus* other than *Cyperus papyrus*.
- 53.221** **Common galingale beds**
Cyperetum longi
Cyperus longus formations of Greece and Italy.
(Horvat *et al.*, 1974; Pignatti, 1982)

- 53.222** **Slender galingale beds**
Formations dominated by *Cyperus laevigatus*, characteristic, in particular, of saline depressions in the Canary Islands and of thermal water bodies on Pantelleria. (Brullo et al., 1977; Pignatti, 1982; Wildpret de la Torre and del Arco Aguilar, 1987)
- 53.23** **PAPYRUS SWAMP**
Cyperus papyrus ssp. *siculus* gallery of the Cyane river in south-eastern Sicily. Taxonomic and historical evidence strongly suggest that this unique station is of natural origin, an extraordinary relict of an extensive Tertiary distribution. (Tournay, 1950; Pignatti, 1982)
- 53.3** **FEN-SEDGE BEDS**
Cladietum marisci i.a.
Cladium mariscus-dominated formations, mostly limited in the northern part of their range, where they have a distinct relict distribution, to alkaline and sometimes acid fens and to the land-building zone of calcareous lakes, somewhat more widespread in the Mediterranean region as a waterside vegetation. (Ellenberg 1963, 1988; De Sloover, 1970; Schumacher, 1977; Rivas-Martinez et al., 1980; Pignatti, 1982; Bournérias, 1984; Rivas-Martinez et al., 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Oberdorfer, 1990)
- 53.31** **FEN CLADIUM BEDS**
Species-rich, fairly open *Cladium mariscus* beds of alkaline and sometimes acid fens, accompanied by cortèges of the *Caricion davallianae* or of the *Caricion lasiocarpae*. These formations are in grave decline throughout their range.
- 53.32** **VALENCIA CLADIUM ISLANDS**
Hydrocotylo-Cladietum marisci
Endangered endemic association of peaty islets of the Albufera de Valencia, with *Kosteletkia pentacarpus*. (Rivas-Martinez et al., 1980)
- 53.33** **RIPARIAN CLADIUM BEDS**
Species-poor *Cladium mariscus* formations of mostly Mediterranean riversides or lakesides, with a *Phragmition* cortège.
- 53.4** **SMALL REED BEDS OF FAST-FLOWING WATERS**
Glycerio-Sparganion
Formations of small helophytes, *Glyceria fluitans*, *G. plicata*, *G. nemoralis*, *G. declinata*, *Leersia oryzoides*, *Catabrosa aquatica*, *Sparganium neglectum*, *S. microcarpum*, *Nasturtium officinale*, *N. microphyllum*, *Veronica beccabunga*, *V. anagallis-aquatica*, *Apium nodiflorum*, *Sium erectum* occupying, throughout the Community, the banks of small rivers or springs on alluvial or peaty soils. (Ellenberg 1963, 1988; Westhoff and den Held, 1975; Schumacher, 1977; Bournérias, 1979, 1984; Rivas-Martinez et al., 1980; Rivas-Martinez et al., 1984; Diaz Gonzalez and Fernandez Prieto, 1987; Asensi Marfil and Diez Garretas, 1987; Alcaraz Ariza and Peinado Lorca, 1987; Martinez Parras et al., 1987; Wolff, 1987; Oberdorfer, 1990)
- 53.5** **TALL RUSH SWAMPS**
Agropyro-Rumicion crispi p.
Formations of *Juncus* invading heavily grazed and trampled marshes or fens or (with *Juncus effusus*) eutrophized poor fens and bogs as in the vicinity of bird colonies. Similar formations developing within the environment of wet meadows have been listed under 37.241. (Westhoff and den Held, 1975; Oberdorfer, 1990)
- 53.6** **RIPARIAN CANE FORMATIONS**
Mediterranean beds of tall canes along permanent or temporary water courses.

53.61

RAVENNA CANE COMMUNITIES

Imperato-Erianthion

Mediterranean tall cane formations of temporary water courses, formed by *Imperata cylindrica*, *Saccharum (Erianthus) ravennae*, *S. strictum*, *Arundo plinii*.
(Pignatti, 1982; Izco, *et al.*, 1984)

53.62

PROVENCE CANE BEDS

Very tall formations of the long-introduced *Arundo donax* along water courses.

54 Fens, transition mires and springs

Small-sedge and related communities of fens, transition mires and quaking bogs; vegetation of springs.

54.1

SPRINGS

Montio-Cardaminetea i.a.

Gushing springs (rheocrenes), spring basins (limnocrenes) and seepages (helocrenes) and the communities closely associated with them and dependent on the peculiar microclimatic and hydrological situation created by the spring. These comprise the specialized spring communities (*Montio-Cardaminetea*) as well as the fen communities (*Caricetalia davallianae*, 54.2, *Caricetalia fuscae*, 54.4) or other communities (*Caricion bicoloris-atrofuscae*, 54.3, *Festuco-Brometea*, 34.3), that are interwoven with them. (Ellenberg, 1988)

54.11

SOFT WATER SPRINGS

Cardamino-Montion, Myosotidion stoloniferae i.a.

Acid or neutral, oligotrophic to eutrophic non-calcareous springs.

The specialized spring communities belong to the various associations of the *Cardamino-Montion* or, in the Iberian mountains, the *Myosotidion stoloniferae*; some of them are individualized below. The associated swamp communities belong to the *Caricetalia fuscae* and their presence can be indicated by use, simultaneously with one of the codes of 54.11, of a code of 54.4.

(Ellenberg 1963, 1988; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Schumacher, 1977; Guinochet and Vilmorin, 1978; Bournérias, 1979, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Martinez Parras *et al.*, 1987; Oberdorfer, 1990)

54.111

Soft water bryophyte springs

Montienion (Cardamino-Montienion)

Spring communities of waters poor in lime dominated by bryophytes, mostly characteristic of northern upland and high montane, alpine or subalpine levels, also locally of well-lit lowland sites. The principal mosses that compose them are *Philonotis fontana*, *P. seriata*, *Anthelia julacea*, *Pohlia wahlenbergii*, *Scapania paludosa*, *Bryum schleicheri*, *Sphagnum auriculatum*. A few small vascular plants accompany them, in particular *Montia fontana*, *Saxifraga stellaris*, *S. rivularis*, *S. aquatica*, *Cerastium cerastoides*, *Epilobium anagallidifolium*.

54.112

Bittercress springs

Cardaminenion

Spring communities of mostly collinar and montane, shaded waters poor in lime, with *Ranunculus hederaceus*, *Cardamine amara*, *C. flexuosa*, *C. raphanifolia*, *Chrysosplenium oppositifolium*, *C. alternifolium*, *Saxifraga clusii* ssp. *lepismigena*, ranging south-west to the Cordillera Cantabrica.

54.113

Forget-me-not springs

Myosotidion stoloniferae

Spring and rivulet communities of the high Iberian mountains, characteristic of the oro- and cryo-Mediterranean levels of the Cordillera Cantabrica, and of the Cordillera Central, the Iberian Range, the Sierra Nevada, with *Myosotis stolonifera*, *Veronica langei*, *Festuca rivularis*, *Stellaria alsine*, *Saxifraga stellaris* ssp. *alpigena*.

54.12

HARD WATER SPRINGS

Cratoneurion i.a.

Calcareous, often petrifying, springs. Their specialized communities, usually dominated by bryophytes, belong to the *Cratoneurion commutati*. Characteristic species are the mosses *Cratoneuron filicinum*, *C. commutatum*, *C. commutatum* var. *falcatum*, *Catoscopium nigratum*, *Eucladium verticillatum*, *Gymnostomum recurvirostrae*, with *Equisetum telmateia*, *E. variegatum* and flowering plants including *Cochlearia pyrenaica*, *Arabis soyeri*, *Pinguicula vulgaris*, *Saxifraga aizoides*. The associated swamp communities belong to the *Caricetalia davallianae* and their presence can be recorded by the use, simultaneously with one of the codes of 54.12, of a code of 54.2. Large petrifying springs form tufa cones that

constitute singular habitats with several interacting plant and animal communities; they have thus been individualized below.

(Ellenberg 1963, 1988; Braun-Blanquet *et al.*, 1964; Parent, 1973; Horvat *et al.*, 1974; Westhoff and den Held, 1975; Braun-Blanquet, 1978; Guinochet and Vilmorin, 1978; Bournérias, 1979, 1984; Oberdorfer, 1990)

54.121

Tufa cones

Large tufa deposits of petrifying springs. When active, they comprise a hydrosere in which the *Cratoneurion* plants, and in particular, *Cratoneuron spp.*, are accompanied by fen species such as *Carex lepidocarpa* and *Sesleria caerulea*; the latter may physiognomically dominate both the hydrosere and the adjacent xerosere, developed on fossil tufa deposits, in which it is accompanied by *Brometalia* plants.

54.122

Calcareous springs

Other calcareous springs, with their associated flush.

54.2

RICH FENS*Tofieldietalia (Caricetalia davallianae): Caricion davallianae*

Wetlands mostly or largely occupied by peat- or tufa-producing small sedge and brown moss communities developed on soils permanently waterlogged, with a soligenous or topogenous base-rich, nutrient-poor, often calcareous water supply, and with the water table at, or slightly above or below, the substratum. Peat formation, when it occurs, is infra-aquatic. Calciphile small sedges and other Cyperaceae usually dominate the mire communities, which belong to the *Caricion davallianae*, characterized by a usually prominent 'brown moss' carpet formed by *Campylium stellatum*, *Drepanocladus intermedius*, *D. revolvens*, *Cratoneuron commutatum*, *Acrocladium cuspidatum*, *Ctenidium molluscum*, *Fissidens adiantoides*, *Bryum pseudotriquetrum* and others, a grasslike growth of *Schoenus nigricans*, *S. ferrugineus*, *Eriophorum latifolium*, *Carex davalliana*, *C. flava*, *C. lepidocarpa*, *C. hostiana*, *C. panicea*, *Juncus subnodulosus*, *Scirpus cespitosus*, *Eleocharis quinqueflora*, and a very rich flora including *Tofieldia calyculata*, *Dactylorhiza incarnata*, *D. traunsteineri*, *D. traunsteinerioides*, *D. russowii*, *D. majalis* ssp. *brevifolia*, *D. cruenta*, *Liparis loeselii*, *Herminium monorchis*, *Epipactis palustris*, *Pinguicula vulgaris*, *Pedicularis sceptrum-carolinum*, *Primula farinosa*, *Swertia perennis*. Wet grasslands (*Molinietalia caerulea*, 37), tall sedge beds (*Magnocaricion*, 53.2), reed formations (*Phragmition*, 53.1), fen-sedge beds (*Cladietum mariscae*, 53.3), may form part of the fen system, with communities related to transition mires (54.5, 54.6) and amphibious or aquatic vegetation (22.3, 22.4) or spring communities (54.1) developing in depressions. The sub-units below, which can, alone or in combination, and together with codes selected from the categories just mentioned, specify the composition of the fen, are understood to include the mire communities *sensu stricto* (*Caricion davallianae*), their transition to the *Molinion*, and assemblages that, although they may be phytosociologically referable to alkaline *Molinion* associations, contain a large representation of the *Caricion davallianae* species listed, in addition to being integrated in the fen system; this somewhat parallels the definition of an integrated class *Molinio-Caricetalia davallianae* in Rameau *et al.*, 1989. Outside of rich fen systems, fen communities can occur on small surfaces in dune slack systems (16.3), in transition mires (54.5), in wet grasslands (37), on tufa cones (54.121) and in a few other situations. The codes below can be used, in conjunction with the principal code relevant, to signal their presence. Rich fens are exceptionally endowed with spectacular, specialized, strictly restricted species. They are among the habitats that have undergone the most serious decline. They are essentially extinct in several regions and gravely endangered in most. A very few large systems remain, in particular in pre-Alpine Bavaria, in the Italian pre-Alps, in collinar and montane eastern France, in north-eastern Germany, in the coastal marshes of northern France, in south-eastern and northern England, in Wales and in Ireland.

(Duvigneaud, 1947; Braun-Blanquet, 1954, 1971a; Ellenberg 1963, 1988; Vanden Berghen, 1963; Braun-Blanquet *et al.*, 1964; Berset, 1969; Géhu and Wattez, 1971; Herbauts, 1971; Parent, 1973; Westhoff and den Held, 1975; Schumacher, 1977; Guinochet and Vilmorin, 1978; Dierssen, 1978; Ratcliffe, 1980; Wheeler, 1980a, b, c; Jermy *et al.*, 1982; Lembrechts and Van Straaten, 1982; Wheeler *et al.*, 1983; Schmid, 1984; Nordiska ministerradet, 1984; Bournérias, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Gruber, 1984; Dupias, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)

- 54.21** **BLACK BOG-RUSH FENS**
Schoenetum nigricantis (*Orchio-Schoenetum nigricantis*, *Schoeno-Juncetum subnodulosi*, *Juncus baltici-Schoenetum nigricantis*)
Schoenus nigricans-dominated or -rich communities, of wide distribution, though less common in Alpine and peri-Alpine regions than the next unit, and confined to lower altitudes. Rushes, *Juncus subnodulosus* in British and western continental inland fens, *J. balticus* in dune-slack fens, are often abundant. Other accompanying species include *Carex lepidocarpa*, *C. hostiana*, *C. panicea*, *C. pulicaris*, *Eriophorum latifolium*, *Molinia caerulea*, *Dactylorhiza incarnata*, *D. praetermissa*, *D. purpurella*, *D. traunsteineri*, *D. traunsteinerioides*, *Epipactis palustris*, *Parnassia palustris*, *Pinguicula vulgaris*, brown mosses and, locally, *Pinguicula lusitanica* and *Drosera anglica*. These communities have enormously regressed, particularly in northern and north-western continental Europe, and are extinct in many regions.
- 54.22** **BROWN BOG-RUSH FENS**
Schoenus ferrugineus-dominated communities.
- 54.221** **Peri-Alpine brown bog-rush fens**
Primulo-Schoenetum ferruginei
Schoenus ferrugineus-dominated formations of Alpine and peri-Alpine regions, with a predominance of *Schoenus ferrugineus* among the gramineous growth which is often overwhelming, imparting to the fens a distinctive brown tone in summer. *Schoenus ferrugineus* may be accompanied by *Schoenus nigricans*, *Eriophorium latifolium*, *Carex hostiana*, *C. davalliana*, *C. panicea*, *C. flacca*, *C. lepidocarpa*, *C. demissa*, *C. dioica*, *Eleocharis quinqueflora*, *Molinia caerulea*; non-gramineous herbs include *Pinguicula vulgaris*, *Gentiana utriculosa*, *Drosera anglica*, *Primula farinosa*, *Parnassia palustris*, *Dactylorhiza traunsteineri*, *D. lapponica*, *Tofieldia calyculata*; the rich moss layer is formed by *Drepanocladus intermedius*, *D. revolvens*, *Campylium stellatum*.
- 54.222** **Scottish brown bog-rush fens**
Pinguiculo-Caricetum dioicae p.
Schoenus ferrugineus stands of base-rich Perthshire flushes, with *Eleocharis quinqueflora*, *Carex hostiana*, *C. panicea*, *C. lepidocarpa*, *Saxifraga aizoides*, *Scirpus cespitosus*, *Eriophorum latifolium*, *E. angustifolium*, *Tofieldia pusilla*, *Pinguicula vulgaris*, *Scorpidium scorpioides*.
- 54.223** **Baltic brown bog-rush fens**
Schoenus ferrugineus-dominated fens of north-eastern Jutland, the Danish archipelago and north-eastern Germany, with *Carex panicea*, *Tofieldia pusilla*, *Andromeda polifolia* and brown mosses.
- 54.23** **DAVALL SEDGE FENS**
Caricetum davallianae
Diverse, often extensive, fen communities, with *Carex davalliana*, *C. hostiana*, *C. lepidocarpa*, *C. capillaris*, *C. panicea*, *C. nigra*, *C. demissa*, *C. flava*, *C. pulicaris*, *Eriophorum latifolium*, *Blysmus compressus*, *Schoenus ferrugineus*, *Eleocharis quinqueflora*, *Juncus articulatus*, *Scirpus cespitosus*, *Molinia caerulea*, *Dactylorhiza traunsteineri*, *Tofieldia calyculata*, *Allium schoenoprasum*, *Potentilla erecta*, *Swertia perennis*, *Primula farinosa*, *Parnassia palustris*, *Pinguicula vulgaris* and a moss layer formed by *Drepanocladus intermedius*, *Cratoneuron glaucum*, *Campylium stellatum*, mostly characteristic of Alpine and peri-Alpine regions, with outlyers in the Hercynian system. This extremely species-rich community is still represented by a few large, very well-preserved examples on the Bavarian plateau. These are a refuge for many rare species, including the relict, threatened *Pedicularis sceptrum-carolinum* and the orchids *Dactylorhiza traunsteineri*, *D. ochroleuca*, *D. incarnata*, *Herminium monorchis*, *Epipactis palustris*. Elsewhere in their range, the Davall sedge fens have undergone a drastic reduction, leading to extinction in many areas.
- 54.231** **Species-rich Davall sedge fens**
Caricetum davallianae
Small *Carex*, *Eriophorum* and herb-rich facies of Davall sedge fens, with high species diversity.

54.232

Deergrass Davall sedge fens*Caricetum davallianae trichophoretosum*

Generally impoverished *Scirpus cespitosus*-dominated facies of Davall sedge fens. Common companions are *Carex davalliana*, *Parnassia palustris*, *Potentilla erecta* and the mosses *Campylium stellatum*, *Drepanocladus intermedius*.

54.24

PYRENEAN RICH FENS*Carici davallianae-Eriophoretum latifoliae*, *Pinguiculo grandiflorae-Caricetum davallianae*, *Pediculari sylvaticae-Caricetum davallianae*

Uncommon calcareous fens of the Pyrenees, with *Eriophorum latifolium*, *Carex davalliana*, *C. lepidocarpa*, *C. echinata*, *C. rostrata*, *C. flacca*, *C. panicea*, *C. paniculata*, *C. ovalis*, *Eleocharis quinqueflora*, *Juncus articulatus*, *J. inflexus*, *Tofieldia calyculata*, *Epipactis palustris*, *Crepis paludosa*, *Parnassia palustris*, *Succisa pratensis*, *Pinguicula grandiflora*.

54.25

DIOECIOUS-FLEA-YELLOW SEDGE FENS

Diverse rich fen communities dominated by small sedges, among which *Carex dioica*, *C. pulicaris* or species of the *Carex flava* group, are usually prominent, but with little or no *Carex davalliana*. They mostly have a distinctly western distribution, occurring, in particular, in Denmark, on the western Hercynian periphery, in the Causses, in Iberia and in the British Isles.

54.251

British dioecious-yellow sedge fens*Pinguiculo-Caricetum dioicae*

Small *Carex* swards of calcareous, soligenous mires on peat or mineral gleys, with *Carex dioica*, *C. lepidocarpa*, *C. demissa*, *C. nigra*, *C. hostiana*, *C. flacca*, *C. panicea*, *Eriophorum latifolium*, *Eleocharis quinqueflora*, *Blysmus compressus*, *Scirpus setaceus*, *Pinguicula vulgaris*, *Primula farinosa*, *Bartsia alpina*, *Tofieldia pusilla* and sometimes, *Juncus articulatus*, *J. alpinoarticulatus*, *Molinia caerulea*, *Equisetum variegatum*, *Anagallis tenella*, *Epipactis palustris* and the bryophytes *Campylium stellatum*, *Bryum pseudotriquetrum*, *Drepanocladus revolvens*, *Riccardia pinguis*, *Cratoneurum commutatum*, *Fissidens adianthoides*, characteristic mostly of northern England and Scotland.

54.252

Scandinavian dioecious-yellow sedge fens

Short *Carex*-dominated fen communities with *Carex flava* s.l., *C. panicea*, *C. dioica*, *Eriophorum latifolium*, *Tofieldia pusilla* and brown mosses.

54.253

Middle European yellow sedge fens

Fen communities of middle latitudes of continental western Europe (the Netherlands, Belgium, western Germany, France, northern Italy), with *Carex dioica*, *C. lepidocarpa*, *C. demissa*, *C. serotina*, *C. panicea*, *Eriophorum latifolium*, *Juncus articulatus*, *J. alpinoarticulatus* and *Campylium stellatum*.

54.254

Cantabrian yellow sedge fens*Pinguiculo grandiflorae-Caricetum lepidocarpae*, *Primulo farinosae-Caricetum lepidocarpae*

Rare exiguous alkaline spring and gully communities of the montane level of the Cordillera Cantabrica, with *Carex lepidocarpa*, *C. demissa*, *C. davalliana*, *C. echinata*, *C. nigra*, *C. panicea*, *Eriophorum latifolium*, *Eleocharis quinqueflora*, *Juncus articulatus*, *Equisetum variegatum*, *Pinguicula grandiflora*, *Parnassia palustris* and, in more eastern communities, *Tofieldia calyculata*, *Primula farinosa*, *Bartsia alpina*.

54.255

Eastern Iberian rich fens

Calcareous fens of the southern Iberian Range (Sierra de Gudar, Sierra de Javalambre).

54.256

Flea sedge fens*Parnassio-Caricetum pulicaris*, *Campyllo-Caricetum dioicae*

Fen formations intermediate between the *Caricion davallianae* and the *Caricion fuscae*, often developed in ecotonal situations, with *Carex pulicaris* and *C. dioica*, dispersed over a fairly wide range in continental middle Europe.

54.26

BLACK SEDGE ALKALINE FENS

Rich fen communities dominated by *Carex nigra*, accompanied by calciphile species and brown mosses.

- 54.27** **RUSSET SEDGE FENS**
Carex saxatilis-dominated mires of high calcareous mountains of the central Highlands of Scotland, with *Carex saxatilis*, *Juncus triglumis*, *J. castaneus*, *Saxifraga aizoides* and brown mosses.
- 54.28** **ICE SEDGE FENS**
Caricetum frigidae (*Saxifrago-Caricetum frigidae*, *Tofieldio-Caricetum frigidae*, *Cariceto frigidae-Pinguiculo grandiflorae*, *Primulo-Caricetum frigidae*, *Soldanello-Caricetum frigidae*)
 Mostly subalpine formations dominated by *Carex frigida*, colonizing seepages and flushes on stony slopes of the Alps, the Pyrenees and the Black Forest, with *Carex davalliana*, *C. demissa*, *C. panicea*, *C. nigra*, *Juncus triglumis*, *J. castaneus*, *Blysmus compressus*, *Tofieldia calyculata*, *Parnassia palustris*, *Pinguicula vulgaris*, *P. grandiflora*, *Primula farinosa*, *Saxifraga aizoides*, *Campylium stellatum*.
- 54.29** **BRITISH SAXIFRAGE-SEDE FLUSHES**
Carex demissa-Saxifraga aizoides communities of sub-montane base-rich seeps in northern Wales, northern England, southern Scotland and, mostly, the Scottish Highlands, with *Juncus articulatus*, *Carex panicea*, *Eleocharis quinqueflora*, *Selaginella selaginoides* and brown mosses. Montane saxifrage-sedge flushes with glacial relicts have been listed under 54.34.
- 54.2A** **SPIKE-RUSH FENS**
Eleocharis quinqueflora-dominated rich fen communities, for the most part species-poor pioneering formations.
- 54.2B** **GREEK FLAT SEDGE FENS**
Blysmus compressus-dominated communities of Greek mountains, with *Parnassia palustris*, *Veronica balcanica*, *V. anagallis-aquatica*, *Eleocharis uniglumis*, *E. quinqueflora*, *Carex hirta*, and with *Juncus thomasi*, *Bellis perennis* or *Leontodon hispidus* on limestone, *Pinguicula hirtiflora*, *P. balcanica*, *Soldanella pindicola*, *Eriophorum latifolium*, *Carex nigra* on ophiolites.
- 54.2C** **BOTTLE SEDGE ALKALINE FENS**
Carex rostrata-dominated formations of very wet sites in rich fens, usually with a carpet of brown mosses and few vascular plants other than the sedge; these grade into transition mire communities of 54.5.
- 54.2D** **ALPINE DEERGRASS ALKALINE FENS**
Scirpus hudsonianus-dominated stands of fens, less common than those of transition mires (54.5).
- 54.2E** **DEERGRASS ALKALINE FENS**
Scirpus cespitosus stands of rich fens, other than those that occur as facies of Davall sedge fens.
- 54.2F** **MIDDLE EUROPEAN FLAT SEDGE FENS**
Blysmus compressus-dominated stands of rich fens other than Greek flat sedge fens (54.2B).
- 54.2G** **SMALL HERB ALKALINE FENS**
 Simplified fen communities formed by a few non-gramineous species, in particular, *Anagallis tenella* and *Parnassia palustris*.
- 54.2H** **CALCAREOUS DUNAL RUSH-SEDE FENS**
Cariceto-Drepanocladetum
 Formations of *Carex trinervis*, *C. scandinavica*, *Juncus anceps*, *J. subnodulosus*, *Parnassia palustris*, *Gentianella amarella*, *Herminium monorchis*, *Drepanocladus aduncus*, *Campylium stellatum*, without, or with little, *Schoenus nigricans*. These communities, characteristic of calcareous Belgian and northern French wet dune slacks are limited to dunal systems and this code will thus be used in conjunction with 16.33. They are gravely threatened.

54.2I

TALL HERB FENS

Fens invaded by *Peucedanum palustre*, *Eupatorium cannabinum*, *Cicuta virosa*, *Symphytum officinale*, *Lysimachia vulgaris*, *Cladium mariscus*, *Phragmites australis*, *Glyceria maxima*, *Calamagrostis canescens*.

54.3

ARCTO-ALPINE RIVERINE SWARDS

Caricion bicolori-atrofuscae

Rare Alpine, peri-Alpine and northern British communities of glacial relicts colonizing neutral or basic gravelly, sandy, stony, sometimes somewhat argilous or peaty substrates soaked by cold water, in moraines and on edges of springs, rivulets, glacial torrents of the alpine or subalpine levels, or on alluvial sands of pure, cold, slow-flowing rivers and calm backwaters. The highly characteristic constituents are *Carex bicolor*, *C. microglochin*, *C. maritima*, *C. atrofusca*, *C. vaginata*, *Kobresia simpliciuscula*, *Scirpus pumilus*, *Juncus arcticus*, *J. alpinoarticulatus*, *J. castaneus*, *J. triglumis*, *Typha minima*, *T. lugdunensis*, *T. shuttleworthii*, *Tofieldia pusilla*; they are often accompanied by *Carex davalliana*, *C. dioica*, *C. capillaris*, *C. panicea*, *C. nigra*, *Blysmus compressus*, *Eleocharis quinqueflora*, *Scirpus cespitosus*, *Primula farinosa*, *Equisetum variegatum*, *Drepanocladus intermedius*, *Campylium stellatum*.

(Braun-Blanquet, 1954, 1967, 1971; Braun-Blanquet *et al.*, 1964; Dierssen, 1978; Guinochet and Vilmorin, 1978; Ratcliffe, 1980; Jermy, 1982; Ellenberg, 1988; Oberdorfer, 1990)

54.31

ARCTO-ALPINE RIVERINE FALSE SEDGE SWARDS

Kobresietum simpliciusculae

Communities of *Kobresia simpliciuscula*, *Carex microglochin*, *Scirpus pumilus*, *Tofieldia pusilla*, *Carex dioica*.

54.32

ARCTO-ALPINE RIVERINE CURVED SEDGE SWARDS

Caricetum maritimae

Communities of *Carex bicolor*, *C. maritima*, *C. atrofusca*, *Juncus arcticus*.

54.33

ARCTO-ALPINE RIVERINE TYPHA SWARDS

Equiseto-Typhetum minimae

Typha minima, *T. shuttleworthii*, *Juncus alpinoarticulatus*, *Equisetum variegatum* communities of cold slow-flowing waters.

54.34

BRITISH MICA FLUSHES

Rare communities of micaceous stony flushes of the Highlands of Scotland and of upper Teesdale, with *Carex atrofusca*, *C. microglochin*, *C. demissa*, *C. dioica*, *C. panicea*, *Juncus triglumis*, *J. biglumis*, *J. castaneus*, *Kobresia simpliciuscula*, *Tofieldia pusilla*, *Saxifraga aizoides*, *Thalictrum alpinum*, *Equisetum variegatum*, *E. hyemale* and the moss *Blindia acuta*.

54.4

ACIDIC FENS

Caricetalia fuscae, *Caricion fuscae*

Topogenous or soligenous valley, basin or spring mire systems fed by waters poor in bases. As in the rich fens, the water level is at or near the surface of the substratum and peat formation is infra-aquatic. The mire communities themselves, dominated by small sedges and brown mosses or sphagnum, belong to the *Caricetalia fuscae*, but, in large fen systems, they are accompanied by acidocline wet grasslands (*Molinietalia caeruleae*), large sedge beds (*Magnocaricion*) and reed or related communities (*Phragmition*). Sphagnum hummocks (51.11) form locally and transition mires (54.5) or aquatic (22.3), amphibian (22.2) and spring (54.1) communities colonize small depressions. Thus, codes from all the above categories are used in conjunction with the ones below to completely describe the fen. The subdivisions listed here are, in any case, understood to include, besides strict mire communities, their transitions to humid grasslands, and groupings phytosociologically affiliated with *Molinion* associations, but rich in species of the *Caricion fuscae*, provided they are integrated in a fen system (somewhat paralleling the *Junco acutiflori-Caricetalia nigrae* of Rameau *et al.*, 1989). Acidic fen communities also occur on small surfaces or within mosaics in other ecosystems, in particular in typical humid grasslands (37), humid woodlands and thickets (44), decalcified dune slacks (16.3) and spring systems (54.1). Their presence can be indicated by codes from this unit used in conjunction with the relevant main codes. Characteristic species of acidic mire communities are *Carex canescens*, *C. echinata*, *C. nigra*, *Eriophorum angustifolium*, *E. scheuchzeri*, *Scirpus cespitosus*, *Juncus filiformis*, *Agrostis canina*, *Viola palustris*, *Cardamine pratensis*, *Ranunculus flammula* and the mosses *Calliargon sarmentosum*, *C. stramineum*, *C. cuspidatum*, *Drepanocladus exannulatus*, *D.*

fluitans, *Sphagnum recurvum*, *S. auritum*, *S. cuspidatum*, *S. subsecundum*, *S. apiculatum*, *S. papillosum*, *S. russowii*.

(Braun-Blanquet, 1954, 1971; Ellenberg 1963, 1988; Berset, 1969; Schumacker and Froment, 1971; Parent, 1973; Westhoff and den Held, 1975; Schumacker, 1976; Wattez, 1976; Schumacher, 1977; Brasseur *et al.*, 1977; Guinochet and Vilmorin, 1978; Brasseur *et al.*, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Prieto, 1983; Nordiska ministerradet, 1984; Rivas-Martinez, Diaz *et al.*, 1984; Bournérias, 1984; Ochsenbein, 1984a, b; Gamisans, 1985; Dias Gonzalez and Fernandez Prieto, 1987; Martinez Parras and Peinado Lorca, 1987; Rivas-Martinez *et al.*, 1987; Martinez Parras *et al.*, 1987; Rameau *et al.*, 1989; Salomez *in litt.*, 1989; Oberdorfer, 1990)

54.41

ALPINE COTTONGRASS LAKE GIRDLES*Eriophoretum scheuchzeri*

Almost pure swards of *Eriophorum scheuchzeri* fringing small, cold, acidic lakes above the tree limit. Permanently inundated, they include few other vascular plants, limited to a few individuals of *Carex nigra*, *C. rostrata*, *C. lachenalii*, *C. brunnescens*, *Juncus filiformis*, *Eriophorum angustifolium*; the moss *Drepanocladus exannulatus* is usually present and abundant.

54.42

BLACK-WHITE-STAR SEDGE FENS*Caricetum fuscae s.l.*

Acidic fen communities of middle Europe, the Alpine system, the Pyrenees and northern Iberia, rich in *Carex nigra*, *C. canescens*, *C. echinata*, often accompanied by *Eriophorum angustifolium* and *Juncus spp.*, with a muscinal layer of brown mosses, sphagnum or both.

54.421

Alpine black sedge fens*Caricetum fuscae (Caricetum nigrae) s.s.*

Acidophilous small sedge communities of the alpine and subalpine levels of the Alps and Alpine periphery, occupying wet gentle slopes and plateaux where melt water lingers or encircling small lakes on the landward, usually emerged, side of the *Eriophoretum scheuchzeri* girdle. The sward is formed by *Carex nigra*, *C. canescens*, *C. echinata*, *Juncus filiformis* variously accompanied by *Eriophorum angustifolium*, *Carex magellanica*, *C. lachenalii*, *C. norvegica*, *C. panicea*, *C. demissa*, *Phleum alpinum*, *Agrostis canina*, *Viola palustris*, *Parnassia palustris*, *Pedicularis palustris*; the moss layer is formed by *Scapania paludosa*, *Paludella squarrosa*, *Drepanocladus exannulatus*, *D. revolvens*, *D. intermedium*, *Calliergon stramineum*, *C. sarmentosum*, *Willemetia stipitata*, *Sphagnum recurvum*.

54.422

Sub-Atlantic black-white-star sedge fens*Caricetum curto-echinatae (Carici canescenti-Agrostitetum caninae)*

Acidic fen communities of lowland, collinar and montane areas of northern and western Europe, excluding the British Isles and the Iberian peninsula. *Carex nigra*, *C. canescens* and *C. echinata* are always represented, often accompanied by dispersed *C. rostrata*. Rushes, *Juncus filiformis*, *J. articulatus*, *J. acutiflorus*, *J. effusus*, may be numerous, often marking the transition towards humid grasslands of the *Molinietalia*, the moss layer is formed by *Sphagnum apiculatum*, *S. cuspidatum*, *S. recurvum* and *Polytrichum commune* in the more oligotrophic, acidic sites, by brown mosses *Drepanocladus fluitans*, *Calliergon stramineum*, *C. cuspidatum*, in more mesotrophic situations. Other characteristic species include *Eriophorum angustifolium*, *E. vaginatum*, *Agrostis canina*, *Molinia caerulea*, *Pedicularis palustris*, *Viola palustris*, *Parnassia palustris*, *Comarum palustre*, *Drosera rotundifolia*, *Menyanthes trifoliata*, *Ranunculus flammula* and *Willemetia stipitata*. Included in this unit are the extensive peatlands of Hercynian valley fens, often invaded by rushes, and with characters both of the transition mires and of the humid grasslands.

54.4221

Sub-Atlantic *Carex* acidic fens

Sedge-dominated formations in which *Carex canescens*, accompanied by *Agrostis canina*, is often the most abundant, with a brown moss layer that can sometimes be very partial; *Carex nigra* and *C. echinata* facies also occur.

54.4222

Sub-Atlantic *Carex-Juncus* acidic fens

Acidic fen formations in which *Carex nigra*, *C. canescens*, *C. echinata*, and sometimes *C. rostrata* are accompanied by, and sometimes dominated by, abundant rushes, in particular *Juncus filiformis* and *J. acutiflorus*, and with a pleurocarpic moss layer.

- 54.4223** **Sub-Atlantic *Carex-Sphagnum* fens**
Sphagnum peatlands in which the herbaceous sward is formed by *Carex nigra*, *C. canescens*, *C. echinata* and *C. rostrata*, generally with *Eriophorum angustifolium* and *E. vaginatum*. These very wet formations are closely related to transition mires.
- 54.4224** **Sub-Atlantic *Carex-Juncus-Sphagnum* fens**
Sphagnum peatlands in which the herbaceous sward is formed by *Carex nigra*, *C. canescens*, *C. echinata*, *C. rostrata* and abundant rushes, in particular *Juncus filiformis* and *J. acutiflorus*, generally with *Eriophorum angustifolium* and *E. vaginatum*. These formations are often related to wet grasslands.
- 54.423** **British black-white-star sedge acidic fens**
Acidic sphagnum fens of the British Isles in which the herbaceous sward is formed by *Carex echinata*, *C. canescens*, *C. nigra* or *Carex rostrata* and sometimes *Juncus effusus*, *J. acutiflorus* or *Nardus stricta*.
- 54.4231** **British *Carex-Sphagnum* fens**
Acidic sphagnum fens of the British Isles dominated by *C. canescens*, *C. echinata*, *C. nigra*, *C. panicea*, *C. demissa*, *C. rostrata*, with *Sphagnum recurvum*, *S. papillosum*, *S. russowii*.
- 54.4232** **British *Juncus-Sphagnum* fens**
Acidic sphagnum fens of the British Isles physiognomically dominated by *Juncus effusus* and *J. acutiflorus*, with *Carex echinata*, *C. nigra*, *Agrostis stolonifera*, *Sphagnum recurvum*, *Polytrichum commune*.
- 54.4233** **British high montane *Sphagnum* fens**
Very local fens of the high Scottish Highlands, with *Carex echinata*, *C. nigra*, *C. bigelowii*, *C. aquatilis*, *C. rariflora*, *Saxifraga stellaris*, *Sphagnum recurvum*, *S. lindbergii*, *S. riparium*, *S. russowii*.
- 54.424** **Pyrenean black sedge acidic fens**
Caricetum fuscae p.
Carex nigra-dominated acidic fens of the Pyrenees, very similar to those of the Alps, in particular to the floristically rather impoverished south-western Alpine communities.
- 54.425** **Iberian black sedge acidic fens**
Caricetum carpetanae, *Sphagno recurvi-Caricetum carpetanae*
Carex nigra ssp. *carpetana*-dominated communities of acid infra-aquatic peat mires of the montane and subalpine levels of the Cordillera Cantabrica and of the Cryo-Mediterranean level of the Cordillera Central.
- 54.43** **APENNINE ACIDIC FENS**
Rare infra-aquatic acidic peat mire communities of the Apennines south to the Sila, with *Carex nigra*, *C. echinata* and *C. panicea*.
- 54.44** **INTRICATED SEDGE POZZINES**
Oro-Mediterranean *Carex intricata* (*Carex nigra* ssp. *intricata*)-dominated formations of the Sierra Nevada, Corsica and the Nebrodi.
- 54.441** **Nevadan Borreguile fens**
Ranunculo-Caricetum intricatae
Formations occupying permanently waterlogged peaty soils of glacial depressions and edges of their small lakes, and also waterholes in *Nardus* grasslands, at the oro-Mediterranean level of the Sierra Nevada, dominated by *Carex intricata*, with *C. echinata*, *Eleocharis uniglumis*, *Viola palustris*, *Cerastium cerastoides*, *Veronica repens* and Sierra Nevada endemics *Ranunculus alismoides*, *Festuca frigida*, *Pinguicula nevadensis*, *Leontodon microcephalus*.
- 54.442** **Corsican intricated sedge pozzines**
Caricetum intricatae
Peaty swards surrounding waterholes, in particular glacial lakes, in the subalpine level of Corsica, dominated by *Carex intricata*.

- 54.443** **Nebrodi pozzines**
Isolated *Carex intricata* stations of Mount San Fratello in the Nebrodi mountains of Sicily.
- 54.45** **DEERGRASS ACIDIC FENS**
Acidic fen communities dominated by *Scirpus cespitosus*.
- 54.451** **Alpine deergrass acidic fens**
Trichophoretum caespitosum
Scirpus cespitosus-dominated communities of subalpine and alpine fens of the Alps, generally installed on somewhat drier ground than the *Caricetum fuscae* and providing the transition between it and the wetter fringe of the *Nardus* grasslands.
- 54.452** **Pyrenean deergrass acidic fens**
Primulo integrifoliae-Trichophoretum caespitosi, *Nartheccio ossifragi-Trichophoretum caespitosi*
Scirpus cespitosus-dominated formations of acidic fens of the Pyrenees, often, particularly in the west, rich in *Narthecium ossifragum*, and with *Carex frigida*.
- 54.453** **Cantabrian deergrass acidic fens**
Erico tetralicis-Trichophoretum germanici
Subalpine formations of the Cordillera Cantabrica, and, very locally, of the Orensano-Sababrian mountains and the Cordillera Central, dominated by *Scirpus cespitosus* and *Narthecium ossifragum*, usually forming an outer fringe to the *Caricetum carpetani*, on somewhat less wet ground. Among companion species are *Carex echinata*, *C. fusca*, *C. binervis*, *Drosera rotundifolia*, *Erica tetralix*.
- 54.454** **Sub-Atlantic deergrass acidic fens**
Scirpus cespitosus-dominated communities of lowland and collinar middle European acidic fens.
- 54.455** **Corsican deergrass fens**
Pinguiculo-Trichophoretum caespitosi
Scirpus cespitosus-dominated formations of subalpine pozzines of Corsica, mostly confined to the edge of rivulets.
- 54.46** **ERIOPHORUM ANGUSTIFOLIUM MIRES**
Eriophorum angustifolium-dominated swards of usually very wet sites within acidic fens, generally with a sphagnum carpet, formed in particular by *Sphagnum cuspidatum*.
- 54.47** **DUNAL SEDGE ACIDIC FENS**
Caricetum trinervi-fuscae
Formations of *Carex nigra*, *C. trinervis*, *C. x timmiana*, *Juncus anceps*, *J. subnodulosus* and introduced *Vaccinium macrocarpum*, restricted to wet, peaty, acidified dune slacks of the continental North Sea coast. This unit is to be used in conjunction with 16.33.
- 54.5** **TRANSITION MIRES**
Scheuchzerietalia palustris: *Caricion lasiocarpae*, *Rhynchosporion albae* p. i.a.
Wetlands mostly or largely occupied by peat-forming plant communities developed at the surface of oligotrophic or meso-oligotrophic water reaching a level above, sometimes well above, the substratum, providing little or no mineral or nutrient supply. Their characteristics are thus intermediate between those of soligenous and topogenous mires and those of strictly ombrogenous bogs. In large systems, the most prominent communities are swaying swards, floating carpets or quaking mires formed by medium-sized or small sedges, associated with sphagnums or brown mosses. They are accompanied by aquatic and amphibious communities (22.3, 22.4) and by formations transitional to these on the one hand, to fens (54.2, 54.4), bogs (51.1) or humid grasslands (37) on the other; sphagnum buttes (51.11), in particular, are often an important feature. Tall sedge and reed communities (53), willow and alder carrs (44) invade part of the peatland. Transition mires form mostly as colonists of oligotrophic ponds and lakes, large bog pools or lags. Their distribution is mostly northern peri-Alpine, peri-Hercynian and northern European. Outside of transition mire systems, their communities can be found in bog hollows (51.12), in blanket bogs (52), in depressions of rich or acidic fens (54.2, 54.4), in spring systems (54.1), in humid heaths (31.1) and a few other habitats. Characteristic species include *Eriophorum gracile*, *Carex lasiocarpa*, *C. chordorr-*

hiza, *C. limosa*, *Scheuchzeria palustris*, *Hammarbya paludosa*, *Liparis loeselii*, *Calla palustris*. Transition mires are an extremely important refuge of specialized, threatened species of both plants and animals; their richness and diversity in remarkable invertebrates, dragonflies among others, is even greater than that of most other mire ecosystems.

(Robyns, 1958; Ellenberg, 1963, 1988; Braun-Blanquet, 1971; Géhu and Wattez, 1971; Parent, 1973; Lambinon, 1974; Westhoff and den Held, 1975; Willems *et al.*, 1975; Guinochet and Vilmorin, 1978; Muller, 1978; Schumacker, 1978; Bresseur *et al.*, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Lembrechts and Van Straaten, 1982; Jermy *et al.*, 1982; Nordiska ministerradet, 1984; Bournérias, 1984; Ochsenein, 1984a, b; Fabri *et al.*, 1985; Mollet *et al.*, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)

54.51

SLENDER-SEDGE SWARDS*Caricetum lasiocarpae*

Usually floating meadows of the medium-sized *Carex lasiocarpa* associated with either sphagnum or pleurocarps and often accompanied by *Eriophorum gracile*, *Menyanthes trifoliata*.

54.511

Brown moss slender-sedge swards*Caricetum lasiocarpae scorpidietosum*

Basiline quaking mires and floating mats dominated by *Carex lasiocarpa* associated with *Scorpidium scorpioides* and other pleurocarps, and with charophytes. Among characteristic accompanying species are *Pedicularis palustris* and *Liparis loeselii*.

54.512

Sphagnum slender-sedge swards*Caricetum lasiocarpae sphagnetosum recurvae* (*Sphagno-Caricetum lasiocarpae*)

Acidocline quaking mires and floating mats dominated by *Carex lasiocarpa* associated with sphagnum (*Sphagnum angustifolium*, *S. recurvum*, *S. lindbergii*, *S. pulchrum*, *S. balticum*, *S. dusenii*, *S. papillosum*, *S. subsecundum*, *S. riparium*, *S. subnitens*, *S. cuspidatum*, *S. flexuosum*, *S. fimbriatum*, *S. palustre*, *S. auriculatum*) and *Polytrichum commune*. Characteristic accompanying species include *Carex rostrata*, *C. nigra*, *C. panicea*, *Equisetum fluviatile*, *Narthecium ossifragum*, *Dactylorhiza sphagnicola*, *Comarum palustre*, *Vaccinium oxycoccus*.

54.52

CAREX DIANDRA QUAKING MIRES*Caricetum diandrae* (*Scorpidio-Caricetum diandrae*)

Usually open swards formed by *Carex diandra* in association with *C. lasiocarpa*, *C. appropinquata*, *C. limosa*, *C. lepidocarpa*, *Eriophorum gracile*, *E. angustifolia*, *Menyanthes trifoliata*, *Comarum palustre*, *Hydrocotyle vulgaris*, *Pedicularis palustris* and an abundance of bryophytes, including the pleurocarps *Campylium stellatum*, *Drepanocladus intermedius* and the liverwort *Riccardia pinguis*. These mires are an important habitat for the threatened *Liparis loeselii*.

54.53

BOTTLE SEDGE QUAKING MIRES

Usually sparse low formations of *Carex rostrata* on sphagnum or, sometimes, pleurocarp carpets.

54.531

Acidocline bottle sedge quaking mires*Sphagno-Caricetum rostratae*

Mats of acidophilous sphagnum with a usually low, open growth of *Carex rostrata*, accompanied by *C. nigra*, *C. canescens*, *C. limosa*, *Vaccinium oxycoccus*; the main sphagnum are *Sphagnum recurvum*, *S. angustifolium*, *S. auriculatum*, *S. flexuosum*, *S. riparium*, *S. obtusum*, *S. dusenii*.

54.532

Basiline bottle sedge quaking mires

Formations of *Carex rostrata* and basiphilous sphagnum or pleurocarps.

54.5321

Basiline sphagnum-bottle sedge quaking mires

Mats of basiphilous sphagnum, *Sphagnum contortum*, *S. teres*, *S. warnstorffii*, *S. squarrosum* with *Carex rostrata*.

54.5322

Brown moss-bottle sedge quaking mires

Carex rostrata formations, with *Calliargon cuspidatum*, *C. giganteum*, *Campylium stellatum*, *Scorpidium scorpioides*.

- 54.54 MUD SEDGE SWARDS
Caricetum limosae p.
Low floating or quaking swards of *Carex limosa*.
- 54.541 **Brown moss mud sedge swards**
Caricetum limosae hypnetosum
Basicline *Carex limosa* swards and floating rafts, with *Carex lasiocarpa*, *C. lepidocarpa*, *Eriophorum gracile* and a rich bryophyte cortège formed by the mosses *Scorpidium scorpioides*, *Drepanocladus revolvens*, *Calliergon giganteum*, *C. trifarium*, *C. stramineum*, *Campylium stellatum*, *Bryum pseudotriquetum*, the liverwort *Riccardia pinguis*, and occasionally sphagnums. *Scheuchzeria palustris* or *Liparis loeselii* may be present. Outside of transition mires, elements of these communities occur in the depressions of rich fens.
- 54.542 **Sphagnum mud sedge swards**
Caricetum limosae sphagnetosum recurvi
Acidocline *Carex limosa* swards and floating rafts, with *Scheuchzeria palustris*, *Drosera rotundifolia*, *D. anglica*, *Menyanthes trifoliata* and the sphagnums *Sphagnum recurvum*, *S. subsecundum*, *S. imbricatum*, *S. papillosum*. Outside of transition mires, elements of these communities, and notably *Scheuchzeria palustris*, occur in deep hollows of bogs (51.121), with *Rhynchospora alba* and *Carex pauciflora* and often without *Carex limosa*.
- 54.55 **STRING SEDGE SWARDS**
Drepanoclado-Caricetum chordorrhizae
Short to medium-tall, usually inundated, swards formed by the Scandinavian, pre-Alpine, eastern-Hercynian, and, very locally, Scottish, *Carex chordorrhiza*, associated with *Carex limosa* and with varied pleurocarps, *Scorpidium scorpioides*, *Calliergon trifarium*, *C. stramineum*, *Campylium stellatum*, *Paludella squarrosa*, *Drepanocladus exanulatus*, *D. revolvens*, *D. procerus* or, occasionally, with sphagnums.
- 54.56 **PEAT SEDGE SWARDS**
Caricetum heleonastae
Short to medium-tall swards formed by *Carex heleonastes*, often associated with *Meesea triquetra*, in transition mires and in bog hollows of peri-Alpine areas.
- 54.57 **BEAK-SEDE QUAKING BOGS**
Sphagno-Rhynchosporetum albae
Rhynchospora alba-rich formations of transition mires, with *Drosera anglica*, *D. intermedia*, *D. rotundifolia*, *Vaccinium oxycoccus*, *Carex limosa*, *C. rostrata*, *Sphagnum recurvum* and sometimes with *Eleocharis quinqueflora*, *Eriophorum latifolium*, *Andromeda polifolia* or *Scheuchzeria palustris*.
- 54.58 **SPHAGNUM AND COTTONGRASS RAFTS**
Floating, sometimes drifting, carpets of sphagnums (*Sphagnum cuspidatum*, *S. recurvum*, *S. obesum*) or of sphagnums and *Eriophorum angustifolium*. They may form fairly large transition mire communities in permanent heath pools, peri-glacial palsas, large raised bog and blanket bog pools and in former peat-extraction holes. They often constitute the stage succeeding 54.59 in the colonization process. They have an appearance that ranges from low, barely emerging sphagnum mats to fairly dense cottongrass beds. *Drosera rotundifolia* is often abundant. The sphagnum and common cottongrass communities are an important habitat for the threatened *Hammarbya paludosa*.
- 54.59 **BOG BEAN AND MARSH CINQUEFOIL RAFTS**
Pioneering floating carpets of *Menyanthes trifoliata*, *Potentilla palustris* (*Comarum palustre*), *Hydrocotyle vulgaris*, often with *Equisetum fluviatile*, *Carex rostrata*, *Cicuta virosa* or sphagnums, forming the transition between amphibious communities and mire communities. Initial stages have *Potamogeton polygonifolius* or *P. coloratus*, late stages, *Carex nigra*, *Juncus acutiflora*, *Molinia caerulea*.
- 54.5A **BOG ARUM MIRES**
Calletum palustris i.a.
Floating meadows, quaking bogs or sphagnum mats dominated by, or rich in, *Calla palustris*, often with *Potentilla palustris*.

54.5B

BROWN MOSS CARPETS

Formations dominated by *Drepanocladus exannulatus*, *D. revolvens*, *Scorpidium scorpioides*, *Calliergon giganteum*, *C. cuspidatum*, *C. richardsonii*, *Campylium stellatum*, *Paludella squarrosa*, associated with sparse *Carex limosa*, *C. rostrata*, *C. lasiocarpa*, *C. chordorrhiza*, *C. aquatilis*, sometimes with *Potentilla palustris*, *Equisetum fluviatile*, *Sphagnum recurvum*, *S. dusenii*, *S. riparium*, *S. squarrosum*, *S. subsecundum* or *Sphagnum teres*, *S. warnstorffii*, *S. contortum*, *S. auriculatum*, *S. platyphyllum*, characteristic of mesocline or basicline quaking bogs, often occurring in mosaic with *Carex lasiocarpa* or *Carex diandra* formations.

54.5C

HARESTAIL COTTONGRASS QUAKING BOGS

Transition mire communities in which the grass layer is dominated by *Eriophorum vaginatum*, on a thick mat of *Sphagnum recurvum*, with *Polytrichum commune* often forming a second moss layer. Associated plants include *Carex nigra* and *Agrostis canina*. Typical raised bog plants are few, often limited to *Carex pauciflora* and *Vaccinium oxycoccos*.

54.5D

PURPLE MOORGRASS QUAKING BOGS

Molinia caerulea-dominated formation with *Sphagnum cuspidatum*, *Eleocharis palustris*, *Rhynchospora alba*, characteristic of lowlying areas in wet heaths and the periphery of fluctuating oligotrophic moor and heath pools.

54.5E

NARROW SMALL-REED QUAKING BOGS

Basicline transition mire communities characterized by the very rare, decreasing, threatened glacial relict *Calamagrostis stricta*, often associated with *Carex diandra*, of northern Ireland, northern Scotland, East Anglia, northern Netherlands, northern, eastern and pre-Alpine Germany.

54.5F

ALPINE DEERGRASS QUAKING BOGS

Transition mire communities dominated by *Scirpus hudsonianus*. It is in these that the species finds its principal habitat.

54.5G

IBERIAN QUAKING BOGS

Erico mackayanae-Sphagnetum papillosoi i.a.

Sphagnum communities of the collinar, and locally, montane, areas of north-western Iberia, intermediate between transition mire and bog, with *Drosera rotundifolia*, *Carex durieui*, *Narthecium ossifragum*, *Sphagnum tenellum*, *S. subnitens*, *Odontoschisma sphagni*, *Aulacomnium palustre*.

54.6

WHITE BEAK-SEDGE COMMUNITIES

Rhynchosporion albae

Highly constant pioneer communities of humid exposed peat or, sometimes, sand, with *Rhynchospora alba*, *R. fusca*, *Drosera intermedia*, *D. rotundifolia*, *Lycopodiella inundata*, forming on stripped areas of blanket bogs or raised bogs, but also on naturally seep- or frost-eroded areas of wet heaths and bogs, in flushes and in the fluctuation zone of oligotrophic pools with sandy, slightly peaty substratum. These communities are similar, and closely related, to those of shallow bog hollows (51.122) and of transition mires (54.57).

(Ellenberg, 1963, 1988; Depasse *et al.*, 1970; Guinochet and Vilmorin, 1973; Parent, 1973; Westhoff and den Held, 1975; Muller, 1978; Schumacker, 1978; Dierssen, 1978; Petermann and Seibert, 1979; Ratcliffe, 1980; Nordiska ministerradet, 1984; Bournérias, 1984; Mollet *et al.*, 1985; Diaz Gonzalez and Fernandez Prieto, 1987; Rameau *et al.*, 1989; Oberdorfer, 1990)