
ECOLOGICAL SYSTEM: NORTH-CENTRAL APPALACHIAN SEEPAGE FEN

Summary: This system is found in scattered locations in the central Appalachians and eastern Great Lakes regions. Mostly non-forested, these open fens develop on shallow to deep peat over a sloping substrate, where seepage waters provide nutrients. Conditions are often circumneutral to alkaline. Sedges are the major dominants. *Packera aurea* (golden ragwort), *Symplocarpus foetidus* (skunk-cabbage), and *Lobelia kalmii* (Ontario lobelia) are among the characteristic forbs. Some of these areas are kept open by grazing, and succession to shrublands may occur in the absence of disturbance.

High-ranked Species: *Carex schweinitzii* (G3G4, schweinitz's sedge), *Carex* sp. 2 (G1, fen sedge), *Chelone cuthbertii* (G3, cuthbert's turtlehead), *Glyptemys muhlenbergii* (G3, bog turtle), *Neonympha mitchellii* (G1G2, Mitchell's satyr), *Parnassia grandifolia* (G3, largeleaf grass-of-parnassus), *Poa paludigena* (G3, bog bluegrass)

Range: This system is found in scattered locations from central New England and New York west to Lake Erie and south to western Virginia (Central Appalachians ecoregion). United States: CT, MA, MD, NJ, NY, PA, VA, VT, WV?

Delaware Estuary Associations:

- Calcareous Shrub Fen
- Northern Piedmont Rich Fen
- Pasture Fen
- Prairie Sedge - Tussock Sedge Fen
- Sedge - Cottongrass Peatland Fen
- Skunk-cabbage Seepage Meadow

CLASSIFIERS FOR NORTH-CENTRAL APPALACHIAN SEEPAGE FEN

Primary Division: 202

Land Cover Class: Herbaceous Wetland

Spatial Scale & Pattern: Small patch

Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Wetland

Diagnostic Classifiers: Herbaceous; Seepage-Fed Sloping; Organic Peat (>40 cm)

Non-diagnostic Classifiers: Lowland; Shrubland (Shrub-dominated); Temperate; Isolated Wetland [Partially

Isolated]; Circumneutral Water; 1-29-day hydroperiod; Short (50-100 yrs) Persistence

CALCAREOUS SHRUB FEN

Cornus amomum - *Salix candida* / *Dasiphora fruticosa* ssp. *floribunda* / *Carex stricta* Shrubland

Range: This association occurs in Pennsylvania, New Jersey, Massachusetts, Connecticut, and New York. It occurs in Pennsylvania in the Delaware Estuary.

Environmental Description: This calcareous fen shrubland is characterized by hummocky microtopography and dense patches of shrubs with small interspersed graminoid openings. A portion of the water budget is comprised of strongly minerotrophic seepage water. Substrate is typically woody peat.

Vegetation Description: Shrubs such as *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), and *Salix* (willow) spp. (*Salix candida* (hoary willow), *Salix petiolaris* (meadow willow), *Salix serissima* (autumn willow), and *Salix discolor* (pussy willow)) are dominant and very characteristic of this association. Other shrubs include *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil), *Alnus incana* (speckled alder), *Toxicodendron vernix* (poison-sumac), *Myrica gale* (sweet gale), and *Viburnum*

dentatum (southern arrow-wood). *Carex stricta* (tussock sedge) is a characteristic sedge; other herbaceous associates include *Carex aquatilis* (aquatic sedge), *Eupatorium maculatum* (spotted joe-pyeweed), *Solidago patula* (roundleaf goldenrod), *Solidago uliginosa* (bog goldenrod), *Spiranthes cernua* (nodding ladies'-tresses), *Trollius laxus* (American globeflower), *Thelypteris palustris* (eastern marsh fern), *Muhlenbergia glomerata* (spiked muhly), *Parnassia glauca* (fen grass-of-parnassus), *Drosera rotundifolia* (roundleaf sundew), *Carex lacustris* (lake sedge), *Ludwigia palustris* (marsh seedbox), *Equisetum fluviatile* (water horsetail), and *Deschampsia caespitosa* (tufted hairgrass). *Juniperus virginiana* (eastern red-cedar) occurs as scattered individuals and is characteristic of this association in New Jersey.

Characteristic Species: *Carex stricta* (tussock sedge), *Cornus amomum* (silky dogwood), *Cornus sericea* (red-osier dogwood), *Salix discolor* (pussy willow)

Reference Sites: none identified

Global and State Conservation Ranks and Reasons: G3? (23-Jan-1998). NJ: S2S3, PA: SNR. This association is restricted to wetlands of calcareous regions in New Jersey and Pennsylvania. Although it is not currently documented from other states, it is likely to occur in Connecticut, Massachusetts, and New York; however, only 150 maximum occurrences are estimated rangewide, and total acreage is not likely to exceed 4500 acres.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689618

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Metzler and Barrett 2001, Metzler and Barrett 2004, Motzkin 1994, Rawinski 1984, Swain and Kearsley 2001

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus amomum</i> (silky dogwood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Cornus sericea</i> (red-osier dogwood)
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	<i>Salix discolor</i> (pussy willow)
Herb (field)	Graminoid	<i>Carex stricta</i> (tussock sedge)

NORTHERN PIEDMONT RICH FEN

Morella pensylvanica - *Dasiphora fruticosa* ssp. *floribunda* / *Carex sterilis* - *Carex flava* Shrub Herbaceous Vegetation

Range: This association is limited to New Jersey and Pennsylvania and possibly southwestern New York.

Environmental Description: This spring-fed calcareous fen community generally occurs with minimal peat accumulation over mineral soil or marl substrate particularly where groundwater emerges.

Vegetation Description: Although the shrubs are generally of sparse cover (less than 25%), they are characteristic of this vegetation, with *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil) and *Morella*



Photo by Pennsylvania Natural Heritage Program

pensylvanica (northern bayberry) common and *Toxicodendron vernix* (poison-sumac), *Acer rubrum* (red maple), and *Juniperus virginiana* (eastern red-cedar) as frequent associates. Wettest portions of these fens lack woody vegetation. The herbaceous flora is rich and diverse, and includes the sedges *Carex sterilis* (sterile sedge), *Carex flava* (yellow sedge), *Carex cryptolepis* (northeastern sedge), *Rhynchospora capillacea* (limestone beaksedge), *Rhynchospora alba* (white beaksedge), as well as *Parnassia glauca* (fen grass-of-parnassus), *Sanguisorba canadensis* (Canada burnet), *Drosera rotundifolia* (roundleaf sundew), *Sarracenia purpurea* (purple pitcherplant), *Lobelia kalmii* (Ontario lobelia), *Panicum flexile* (wiry panicgrass), *Deschampsia caespitosa* (tufted hairgrass), *Juncus brachycephalus* (small-head rush), *Juncus nodosus* (knotted rush), and *Spiranthes cernua* (nodding ladies'-tresses). The diagnostic characteristic is the presence of *Morella pensylvanica* (northern bayberry) in the shrub layer. This association is restricted to New Jersey, Pennsylvania, and perhaps New York.

Characteristic Species: *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil), *Morella pensylvanica* (northern bayberry)

Dynamics/Successional Trajectory: This calcareous fen association is characterized by herbaceous vegetation maintained by groundwater springs.

Management Concerns: Most occurrences are associated with areas of historic or current grazing, which apparently limits shrub establishment. In areas where grazing has been discontinued, the fens are often rapidly filling with shrubs, particularly *Cornus racemosa* (gray dogwood) or *Cornus sericea* (red-osier dogwood). In other areas, disruptions in local hydrology caused by nearby development has had a negative effect on the condition of some occurrences. These often contain many weedy species, both native and exotic.

Reference Sites: none identified

Global and State Conservation Ranks and Reasons: G2 (12-Jan-1998). NJ: S2, PA: SNR. This "fen" vegetation type is restricted in distribution to a few calcareous or limestone areas in the non glaciated regions of New Jersey and Pennsylvania. There are fewer than 15 known occurrences of this vegetation, with a potential for 5-10 more. The occurrences are generally very small in size, often only an acre or two.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689623

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Fike 1999

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Dasiphora fruticosa</i> ssp. <i>floribunda</i> (shrubby-cinquefoil)
Short shrub/sapling	Broad-leaved evergreen shrub	<i>Morella pensylvanica</i> (northern bayberry)
Herb (field)	Graminoid	<i>Carex flava</i> (yellow sedge)
Herb (field)	Graminoid	<i>Carex sterilis</i> (sterile sedge)

PASTURE FEN

Juniperus virginiana / *Dasiphora fruticosa* ssp. *floribunda* / *Carex flava* - *Carex tetanica* Shrub
Herbaceous Vegetation

Range: This association occurs in New Jersey and Pennsylvania. It occurs in the Pennsylvania portion of the Delaware Estuary.

Environmental Description: This association is a saturated wetland of turfy mineral soil occurring over calcareous bedrock, a fen supporting a number of calciphitic species.

Vegetation Description: *Juniperus virginiana* (eastern red-cedar) occurs as scattered individuals over an herbaceous understory characterized by *Carex flava* (yellow sedge), *Carex tetanica* (rigid sedge),

Juncus brachycephalus (small-head rush), *Juncus dudleyi* (dudley's rush), *Juncus nodosus* (knotted rush), *Equisetum fluviatile* (water horsetail), *Bromus kalmii* (Kalm's brome), *Castilleja coccinea* (scarlet Indian-paintbrush), *Sisyrinchium angustifolium* (narrowleaf blue-eyed-grass), *Solidago uliginosa* (bog goldenrod), *Eupatorium maculatum* (spotted joe-pyeweed), *Cypripedium parviflorum* (lesser yellow lady's-slipper), *Thelypteris palustris* (eastern marsh fern), *Lobelia kalmii* (Ontario lobelia), *Liatris spicata* (bog blazingstar), *Spiranthes lucida* (shining ladies'-tresses), *Trollius laxus* (American globeflower), *Rudbeckia fulgida* (orange coneflower), *Pedicularis canadensis* (Canadian lousewort), and *Pedicularis lanceolata* (swamp lousewort), which is intermixed with the dwarf-shrubs *Betula pumila* (bog birch) and *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil).

Characteristic Species: *Carex flava* (yellow sedge), *Carex tetanica* (rigid sedge), *Dasiphora fruticosa* ssp. *floribunda* (shrubby-cinquefoil), *Juniperus virginiana* (eastern red-cedar)

Dynamics/Successional Trajectory: This vegetation has been generally affected by grazing in the past, which in some cases continues to the present, and as such this vegetation is known locally as a pasture fen.

Management Concerns: Community historically grazed.

Reference Sites: none identified

Global and State Conservation Ranks and Reasons: G1G2 (23-Jan-1998). NJ: S1S2, PA: SNR. This association is restricted to saturated wetlands of turfy mineral soil occurring over calcareous bedrock in New Jersey and possibly Pennsylvania. Ten to twenty estimated occurrences in New Jersey, possibly the same number from Pennsylvania. These fens are 0.1-1.5 acres in size, with a total of 20-40 acres known from New Jersey. The total potential acreage of this type is well below 200 acres rangewide.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685846

References: Breden et al. 2001, Eastern Ecology Working Group n.d., Edinger et al. 2002, Fike 1999, Radis 1986

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Tree canopy	Needle-leaved tree	<i>Juniperus virginiana</i> (eastern red-cedar)
Herb (field)	Graminoid	<i>Carex flava</i> (yellow sedge)
Herb (field)	Graminoid	<i>Carex tetanica</i> (rigid sedge)

PRAIRIE SEDGE - TUSSOCK SEDGE FEN

Carex prairea - *Carex stricta* - *Pycnanthemum virginianum* Herbaceous Vegetation

Range: This community occurs within the Pennsylvania portion of the Delaware Estuary.

Environmental Description: These are open sedge-dominated wetlands that occur on organic soil saturated by base-rich groundwater.

Vegetation Description: Dominant sedges typically include *Carex prairea* (prairie sedge) and *Carex stricta* (tussock sedge). Associated sedges include *Carex sterilis* (sterile sedge), *Carex lacustris* (lake sedge), *Carex aquatilis* (aquatic sedge), *Carex leptalea* (bristly-stalk sedge), and *Carex lasiocarpa* (wiregrass sedge). Associate herbs include *Pycnanthemum virginianum* (Virginia mountainmint), *Verbena hastata* (swamp verbena), *Maianthemum stellatum* (starflower false Solomon's-seal), *Eupatorium maculatum* (spotted joe-pyeweed), *Epilobium leptophyllum* (bog willowherb), *Typha latifolia* (broadleaf cattail), *Galium tinctorium* (stiff marsh bedstraw), *Onoclea sensibilis* (sensitive fern), *Cirsium muticum* (swamp thistle), *Impatiens capensis* (orange jewelweed), and *Juncus balticus* (Baltic rush). A ground

layer of mosses is typical, dominated by *Campylium stellatum* (star campylium moss), *Thuidium delicatulum* (delicate fern moss), and *Sphagnum teres* (sphagnum).

Characteristic Species: *Campylium stellatum* (star campylium moss), *Carex prairea* (prairie sedge)

Dynamics/Successional Trajectory: This community is an herbaceous community with low or absent woody plant cover. Woody plants may be inhibited by saturated soil conditions, though most occurrences have had some history of grazing or other human-induced disturbance in the past. Fire events during drought years may also reduce woody plant colonization, but evidence is limited.

Management Concerns: This community is susceptible to native and non-native invasive species, including *Phragmites australis* (common reed), *Typha* (cattail) spp., *Lythrum salicaria* (purple loosestrife), and others. Periodic monitoring and weed management may be required. Maintenance of hydrology is critical and should be assessed for potential threats.

Reference Sites: Sinking Spring (Berks), PA (all known PA occurrences are on private land)

Global and State Conservation Ranks and Reasons: GNR (8-Jul-1999). PA: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.687924

References: Eastern Ecology Working Group n.d., Fike 1999

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Carex prairea</i> (prairie sedge)
Herb (field)	Graminoid	<i>Carex stricta</i> (tussock sedge)

SEDGE - COTTONGRASS PEATLAND FEN

Carex canescens - *Eriophorum virginicum* - *Sphagnum* spp. Herbaceous Vegetation

Range: This fen community occurs in the Pennsylvania portion of the Delaware Estuary.

Environmental Description: This community consists of sedge-dominated peatlands of higher elevations in the Central Appalachians. It occurs in sandstone areas at mid to high elevations. These fens characteristically occur in a mosaic with other peatland types.

Vegetation Description: Typical dominants of this community are *Carex canescens* (silvery sedge), *Eriophorum virginicum* (tawny cotton-grass), and *Carex utriculata* (beaked sedge). Associates include *Polytrichum commune* (haircap moss), *Juncus effusus* (soft rush), *Juncus canadensis* (Canadian rush), *Scirpus cyperinus* (woolgrass bulrush), *Triadenum virginicum* (Virginia marsh St. John's-wort), *Thelypteris palustris* (eastern marsh fern), and *Photinia melanocarpa* (black chokeberry). The herbaceous layer is dominated by a well-developed *Sphagnum* (peatmoss) ground mat. It lacks the very acid-loving plants (*Drosera* (sundew), *Vaccinium oxycoccos* (small cranberry), etc.) of related associations.

Characteristic Species: *Carex canescens* (silvery sedge), *Carex utriculata* (beaked sedge), *Eriophorum virginicum* (tawny cotton-grass)

Dynamics/Successional Trajectory: Needs more study.

Management Concerns: Monitoring for invasive wetland plants, maintenance of hydrology (especially groundwater flows).

Reference Sites: Wolf Creek Reservoir Watershed, Eisenhuth Reservoir, Schuylkill County, PA

Global and State Conservation Ranks and Reasons: GNR (8-Jul-1999). PA?: SNA.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.689030

References: Eastern Ecology Working Group n.d.

MOST ABUNDANT SPECIES		
STRATUM	LIFEFORM	SPECIES
Herb (field)	Graminoid	<i>Carex canescens</i> (silvery sedge)
Herb (field)	Graminoid	<i>Eriophorum virginicum</i> (tawny cotton-grass)

SKUNK-CABBAGE SEEPAGE MEADOW

Symplocarpus foetidus Herbaceous Vegetation

Range: This community is found throughout the upper midwestern region of the United States and adjacent Canada, where it develops around spring heads and in broader areas of groundwater discharge. The type extends from Indiana and possibly Ontario and Ohio, west to Minnesota and Iowa. It occurs in the Pennsylvania portion of the Delaware Estuary.



Photo by Pennsylvania Natural Heritage Program

Environmental Description: This community develops around spring heads and in broader areas of groundwater discharge, where water flows to the surface in a diffuse rather than concentrated flow. Peat may be present in some areas, and perhaps locally can be as deep as 1 m, but it is typically less than 0.4 m deep. Stands can occur along the lower slopes of glacial moraines, ravines and in deep glacial meltwater-cut river valleys at the bases of slopes separating stream terraces. Soils are seasonally to more-or-less permanently saturated (MNNHP 1993).

Vegetation Description: This is an herbaceous-dominated community. Tree and shrub cover may vary, particularly from overhanging upland trees, but trees and shrubs rooted in the stand are less than 25% cover. Forbs dominate the community. *Symplocarpus foetidus* (skunk-cabbage) and *Angelica atropurpurea* (great angelica) are the leading dominant and indicator species. Other forbs and ferns present include *Caltha palustris* (yellow marsh-marigold), *Chelone glabra* (white turtlehead), *Epilobium coloratum* (purpleleaf willowherb), *Impatiens capensis* (orange jewelweed), *Impatiens capensis* (orange jewelweed), *Pedicularis lanceolata* (swamp lousewort), *Pilea pumila* (Canadian clearweed), *Saxifraga pennsylvanica* (eastern swamp saxifrage), *Solidago patula* (roundleaf goldenrod), and *Thelypteris palustris* (eastern marsh fern). Graminoid cover is generally low, less than 25%, and may include *Carex bromoides* (brome-like sedge), *Carex comosa* (longhair sedge), *Carex lacustris* (lake sedge), *Carex stricta* (tussock sedge), and *Carex trichocarpa* (hairy-fruit sedge) (White and Madany 1978, MNNHP 1993).

Noteworthy Associated Plant and/or Animal Species: *Floerkea proserpinacoides* (false mermaidweed), *Hydrocotyle americana* (American marsh pennywort), *Poa paludigena* (bog bluegrass)

Characteristic Species: *Angelica atropurpurea* (great angelica), *Symplocarpus foetidus* (skunk-cabbage)

Reference Sites: none identified

Global and State Conservation Ranks and Reasons: G4? (3-Oct-1996). NJ: SNR, PA: SNR.

VegBank Link for Plot Data: http://vegbank.org/natureserve/element_global.2.685623

References: Fike 1999, INAI unpubl. data, MNNHP 1993, Midwestern Ecology Working Group n.d., Newbold 1993, Newbold 1996, White and Madany 1978