

# **INTEGRATED WETLAND ASSESSMENT PROGRAM**

## **Part 2: An ordination and classification of wetlands in the Till and Lake Plains and Allegheny Plateau regions**

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INTEGRATED WETLAND ASSESSMENT PROGRAM  
PART 2: AN ORDINATION AND CLASSIFICATION OF WETLANDS  
IN THE TILL AND LAKE PLAINS AND ALLEGHENY PLATEAU REGIONS

John J. Mack<sup>1</sup>

ABSTRACT

An *a priori* classification system was developed and refined for wetlands in the Till and Lake Plains and Allegheny Plateau regions of Ohio to aid in the implementation of wetland restoration, management, and permitting programs. The *a priori* system incorporates two main divisions: dominant landscape position and dominant plant community. Seven landscape positions were initially identified: depression, impoundment, riverine, slope, fringing, and coastal. Based on the results of the ordination a "bog" class was added. There were three main plant community divisions: forest, emergent, and shrub. Major subclasses included several types of forest and shrub dominated wetlands and marshes, sedge-grass dominated wetlands including fens, and various types of bogs. The scheme was intended to be specific enough to reflect observable differences in wetland plant communities, but general enough to accommodate the "Gleasonian" individuality of those same communities. The purpose of the evaluation presented here was to determine whether the scheme exceeded the limits of what quantitative plant community data could define, with the goal of a data-driven and supported classification sufficiently specific to reflect real world conditions, but sufficiently general to be useful and used by wetland practitioners. Detrended Correspondence Analysis (DCA) and Cluster Analysis were used to evaluate the classification. Species composition and abundance data was collected from 20m x 50m plots (0.1ha) fixed plots located with the community of interest (156 plots and nearly 647 species). The wetlands sampled were located in five ecological regions. The ordinations confirmed the separation of the most of the plant community classes and subclasses in the *a priori* wetland classification and also detected differences between disturbed and undisturbed natural wetlands and between natural wetlands and created or restored wetlands. The ordinations and cluster analyses performed here clearly support the recognition of the three broad vegetation classes outlined by Cowardin et al. (1978): emergent, forest, and shrub. Within these broad classes, multiple subtypes are also supported: bogs, fens, other sedge-grass dominated wetlands (Oak Openings sand prairies and other wet prairies), and several emergent marsh types most notably mixed emergent marshes. The plant community ordinations performed also clearly support the recognition of several Hydrogeomorphic classes including slope, coastal, impoundment, and bog wetlands. Depression and riverine wetlands also could be distinguished from these other classes but depressions did not ordinate as clearly from riverine wetlands. This may be do to similarities in their hydrologic pathways (evapotranspiration driven) after spring flood events have stopped in riverine systems.

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<sup>1</sup> Present address: Wetland Ecology Group, Division of Surface Water, Ohio Environmental Protection Agency, 122 S. Front St., P.O. Box 1049, Columbus, Ohio 43216-1049, john.mack@epa.state.oh.us.

## INTRODUCTION

An *a priori* classification system was developed and refined for wetlands in the Till and Lake Plains and Allegheny Plateau regions of Ohio over a period of years (e.g. Mack 1998, Mack et al. 2000, Mack 2001) with the goal of being practical as well as comprehensive. The system was developed to aid in the implementation of wetland restoration, management, and permitting programs. It specifically had the purpose of aiding in the development of wetland specific IBIs (index of biotic integrity) (e.g. Mack 2004c; Micacchion 2004, Knapp 2004). This system was developed by modifying and adapting existing classification systems (Cowardin et al. 1978, Anderson 1982, Brinson 1993, Cole et al. 1999) and based on the author's field experience in visiting and/or sampling hundreds of wetlands across the State of Ohio.

Classifications, on average, tend towards over-specificity versus generality. A recent example of intense specificity is the classification system recently proposed by The Nature Conservancy (Grossman et al. 1998; Anderson et al. 1998). General systems for wetlands are best typified by the classification adopted by the U.S. Fish and Wildlife Service (Cowardin et al. 1978), although even this system has numerous class modifiers. An Ohio specific scheme intermediate between these two in terms of specificity is the preliminary classification of Ohio plant communities developed by Anderson (1982). Highly complex schemes tend to be ignored or avoided as too cumbersome to learn and/or apply since real-world plant communities have a high level of uniqueness and can be difficult to ascribe to an overly divisive classification system. Wetlands more than a few hectares in size are frequently geographically heterogeneous matrices of several community classes. Even what appear at first to be relatively homogeneous forest stands can form shifting complexes of canopy dominants.

The *a priori* system summarized in Tables 1A and 1B incorporates two main divisions: dominant landscape position and dominant plant community. Within each of these main divisions, are classes and subclasses. There are eight landscape positions identified: depression, impoundment, riverine, slope, fringing, bog, and coastal (Lake Erie) with a modifier for indicating mitigation wetland types (Table 1A). The bog class was added based on the results of this paper. These positions correspond generally to the hydrogeomorphic classification system outlined by Brinson (1993), Smith et al. (1995), and others.

There are three main plant community divisions: forest, emergent, and shrub. Within each of these are several important subclasses. The forest division is divided into three main classes: swamp forests of various community compositions, bog forests, and forest seeps. Emergent wetlands are divided into

marshes, various sedge-grass communities (fens, oak opening sand prairies, wet prairies, etc.), and sphagnum bogs. Finally, shrub wetlands are divided in bog and fen shrub swamps and into a general shrub swamp class (buttonbush, alder, mixed).

The *a priori* scheme developed here (Tables 1A, 1B) was intended to be specific enough to reflect observable differences in wetland plant communities, but general enough to accommodate the "Gleasonian" individuality of those same communities. The purpose of the evaluation presented here was to determine whether the scheme exceeded the limits of what quantitative plant community data could define, with the goal of a data-driven and supported classification sufficiently specific to reflect real world conditions, but sufficiently general to be useful and used by wetland practitioners.

## METHODS

The *a priori* system (Table 1) was evaluated using Detrended Correspondence Analysis (DCA) (Hill and Gauch 1980) and Cluster Analysis (Sneath and Sokal 1973) with PC-ORD (McCune and Mefford 1999). Species abundance composition and abundance data was collected (relative cover for herb and shrub strata; importance values, stem density and basal area for shrub, subcanopy and canopy strata). Detrended Correspondence Analysis is an indirect gradient analysis multivariate statistical technique that is commonly used to analyze large plant community datasets (Gauch 1982; Kent and Coker 1992). In DCA the scale of the ordination axes are in units of  $\beta$ -diversity (units of species standard deviations or species turnover). The further apart two sites are along an axis, the fewer species they have in common. There is almost complete species turnover when sites are more than four standard deviation units apart along the DCA axes (Gouch 1982). In the graphs presented below 1 unit species standard deviation equals 100 on the ordination axes. For the DCA, Euclidean distance was calculated and rare species were down weighted.

Cluster analyses can be both agglomerative and divisive. A polythetic, agglomerative technique was used with relative Sorensen similarity as the distance measure and Wards's Method as the linkage method. Although Cluster Analyses were performed along with every DCA, cluster dendrograms are not generally presented since most were highly redundant with the DCA or were unrepresentable when more than 50 plots were analyzed.

Fixed plots were sampled using methods of Peet et al. 1998 as discussed and summarized in Mack (2000, 2001a, 2002). These were generally 20m x 50m plots (0.1ha) located with the community of interest. Following the recommendations of Gouch (1982), the data set was edited. Given the large size of the data set (156 plots and nearly 700 species), species

with less than 1% total cover for any plot were not included in the analysis. Preliminary analyses showed that occasional upland species exerted an erroneously strong effect on the ordinations. Because all plots were located within the wetland's jurisdictional boundary (Environmental Laboratory 1987), plant species with facultative-up (FACU) and upland (UPL) wetland indicator statuses (Reed 1988, 1997) were also deleted to further reduce the size of the data set.

The wetlands sampled were located in five ecological regions: Eastern Corn Belt Plains (till plains), Erie-Ontario Drift and Lake Plains (glaciated Allegheny Plateau), Huron-Erie Lake Plains (lake plains), Michigan-Indiana Drift and Lake Plains (till plains), and the Western Allegheny Plateau (unglaciated Allegheny Plateau) (Omernik 1987; Woods et al. 1999). To the extent that the wetlands sampled are typical of these ecoregions, the results of this study should be relevant to other states that share these ecoregions (Indiana, Pennsylvania, and Kentucky).

Given the large number of species, sites, and potential plant communities in the data set, a stepwise approach was used in the analysis. Gouch (1982) describes this approach as a "polythetic, divisive" classification technique termed "ordination space partitioning." He states that after initial ordinations, "Successive partitions are then drawn in the ordination to generate a divisive, hierarchical classification. The partitions may be placed subjectively by drawing boundaries in ordination graphs by hand. Subjective partitions can be particularly useful when (1) divisions through sparse regions of the cloud of sample points are desired, because none of the other clustering techniques considered here can take sparse regions into consideration, (2) field experience or previous analyses have provided a general understanding of the data that the investigator wants to incorporate into the analysis but cannot specify precisely or supply to the computer...and (3) subjective clustering is sufficient for the purposes of a given study" (Gouch 1982, p. 200).

An additional complicating factor was that the wetlands studied included wetlands that were moderately to highly degraded by human disturbances as well as least-impacted or "reference standard" (Smith et al. 1995) wetlands. In the initial steps all sites were analyzed together. Obvious, meaningful clusterings were noted as well as outlier sites or site(s) causing artificial noise in the ordination. Noise was most often caused by including highly disturbed wetlands in the ordination, although bog and fen communities were also removed because of their strong influence on the ordination. The ordination was then repeated with all sites from that group (disturbed, undisturbed, etc.). This process was continued until there were too few plots, no ecologically interpretable groupings were observed, or the overall inertia (variance) explained by the ordination was low.

## RESULTS

The DCA ordinations and the Cluster Analyses confirmed the separation of the most of the plant community classes and subclasses in the *a priori* wetland classification (Table 1, Figure 1). A woody group comprised of swamp forests and shrub swamps, a broad "marsh" class (disturbed and undisturbed inland marshes, coastal marshes, mitigation wetland marshes), sphagnum bogs of very types, sedge-grass dominated wetlands (fens, wet prairies, oak openings sand prairies), and some intermediate groups (e.g. a "shrubby marsh, or marsh shrub swamp group between the woody and marsh clusters). In the next step, the data set was partitioned into a "woody" group and an "emergent" group. A few shrub swamps and marshes which appeared to have intermediate characteristics were included in both groups.

### *Emergent communities*

Very strong clusterings were observed within the emergent group between various "marsh" communities, open sphagnum bogs, and various sedge-grass dominated wetlands (deep soil wet prairies, fens, oak opening sand prairies) (Figure 2). Bog and sedge-grass dominated wetlands were removed and analyzed separately (see below); inland marshes of varying quality, Lake Erie coastal marshes and mitigation wetland marshes were then analyzed together.

Marsh communities ordinated by quality and type (Figure 3). Good to excellent inland marshes communities separated from moderately to severely disturbed inland marshes and most coastal marshes (Figure 3). Coastal marshes in this data set were all somewhat to severely disturbed with the possible exception of Arcola Creek (Lake Co., Ohio) and North Pond on Kelleys Island (Erie Co., Ohio). West St. Marsh (far left in Figure 3) is a disturbed coastal marsh located in downtown Huron, Ohio that is dominated by dense stands of *Peltandra virginica* (arrow arum) and *Rumex verticillatus* (swamp dock), two generally more conservative species, such that it tends to ordinate with better quality inland marshes with strong broad-leaved aquatic components.

Coastal marshes ordinate strongly from inland marshes (Figure 6, below) and were removed from the marsh ordination. Inland marsh communities (including mitigation<sup>2</sup> wetlands) continued to ordinate strongly based on type and quality (Figure 4) with mitigation marshes and disturbed natural wetlands generally ordinating together. Other factors observable in the

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<sup>2</sup> In this discussion "mitigation" refers to created wetlands (on non-hydric soils) or restored wetlands (on hydric soils or soils with substantial hydric inclusions).

ordination are *Typha* dominance, and an emergent to broad-leaved aquatic separation. A cluster analysis dendrogram of the sites ordinated in Figure 4 is presented to provide additional definition of a broad and heterogeneous “marsh” class (Figure 5). *Typha*-dominated wetlands (*T. latifolia*, *T. angustifolia*, and/or *T. xglauca*), including *Typha*-dominated mitigation wetlands, cluster strongly apart from all other marshes in the data set. *Typha* dominance, especially by *T. angustifolia* and *T. xglauca* is often an indicator of moderate to severe disturbances in natural wetlands.

The marsh communities next cluster into two broad classes: 1) a class comprised of mitigation wetlands, reed canary grass (*Phalaris arundinacea*) dominated natural wetlands, various types of “impounded” wetlands (recent or older beaver impoundments, railroad impoundments), and wetlands impacted by acid mine drainage (AMD); and 2) mostly undisturbed to somewhat disturbed natural marshes (Figure 5). The defining factor separating these groups are high natural or human disturbance. The undisturbed to somewhat disturbed group is a heterogeneous mixed emergent marsh class with a shifting assemblage of dominants. Based on the species lists for these sites and the authors personal knowledge, the following types are identifiable: 1) “boggy” marshes with appreciable *Sphagnum* cover and other “bog” associate species like cinnamon and royal ferns (*Osmunda cinnamomea*, *O. regalis*), glaucous sedge (*Carex canescens*), and highbush blueberry (*Vaccinium corymbosum*); 2) burreed (*Sparganium* sp.) marshes; 3) river bulrush (*Bolboschoenus fluviatilis*) marshes; 4) decodon (*Decodon verticillatus*) marshes; 5) marshes with a high percentage of broad-leaved emergent, floating-leaved species and submersed species like spatterdock (*Nuphar advena*), arrowhead (*Sagittaria* spp.), arrow arum (*Peltandra virginica*), bladderwort (*Utricularia* spp.), duckweed (*Lemna trisulca*, *L. minor*, *Spirodela polyrhiza*), coontail (*Ceratophyllum demersum*, *C. echinatum*), etc.; and, 5) marshes with strong emergent graminoid components.

A final marsh ordination was performed with only plots from undisturbed or least impacted, natural wetlands included to remove “noise” resulting from human disturbance (Figure 6). Coastal marshes and “boggy” marshes ordinate apart from a broad, inland mixed emergent marsh group (Figure 6). Within this broad inland group interpretable patterns are observable but not strongly defined. Several sites, because of dominance by a species not present in any other plot or by a unique group of species, are “classes” of one, e.g. Eagle Creek Beaver (Portage Co., Ohio) with strong presence of *Carex utriculata* in its emergent zone; Zoar Church Road (Jackson Co., Ohio) by a combination of abundances of species not replicated at any other site. A more broad-leaved emergent/floating-submersed dominated marsh versus or more “emergent”

community is also observable (Figure 6). Further definition of types of marsh communities may require a more intensive and randomized sampling scheme or ordinating subplots of a plot as separate data points (see Mack 2002 for an example of this approach).

#### *Fens, Bogs, and Prairies*

The bog and sedge-grass dominated communities identified in Figures 1 and 2 were ordinated separately to further refine community patterns (Figure 7). A tripartite division is readily apparent from left to right in the ordination graph of the first two axes: bog communities, fen communities (and a single data point from a deep soil wet prairie), and oak openings sand prairie communities. The length of axis 1 (nearly 7 species standard deviations) indicates exceptionally high  $\beta$ -diversity with complete species turnover occurring nearly twice along the length of axis 1. Strongly shrub dominated or forested bogs separated from more “open” bogs. Similarly, shrubby fens ordinated away from more “open” fens. Of note is the isolated position of degraded bog and fen plots (Figure 7).

Bog community data points with the exception of Mud Lake Bog plots<sup>3</sup> were removed and the ordination repeated with just fen and prairie plots (Figure 8). Even though they are a grass-dominated wetland, reed canary grass dominated wetlands were removed from this ordination since they were strong outliers in preliminary ordinations. They were included in the marsh community analyses (see above). The Mud Lake Bog plots continued to separate strongly from the other fens and prairies arguing for their treatment as an intermediate class of “boggy fens” or that they are in fact more “bog” than “fen” and should be considered bogs. Oak openings sand prairies also continue to group strongly together and away from the other sedge-grass communities due to the high dominance of twigrush (*Cladium mariscoides*), Great

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<sup>3</sup>

There is some disagreement as to the whether Mud Lake Bog State Nature Preserve in Williams Co., Ohio is a “bog” or a “fen” (DNAP 1996). Sample plots were established on the north and south sides of Mud Lake Bog, with the south side often characterized as a “bog” because of its high *Sphagnum* cover and numerous stems of poison sumac (*Toxicodendron vernix*) and the north side often characterized as a “fen.” In various other cluster analyses not presented here, the north and the south side Mud Lake Bog plots clustered strongly with other bog communities. However, in Figure 8 there is some suggestion of the Mud Lake Bog plots occupying an intermediate position between fens and bogs. Because of this, they were included in all subsequent “fen” ordinations.

Lakes goldenrod (*Euthamia remota*), and bluejoint grass (*Calamagrostis canadensis*, *C. stricta*). Interestingly, Daughmer Savannah, a largely intact deep soil prairie sedge meadow in Crawford Co., Ohio (Mack 2002), is in an intermediate position between the Oak Openings sand prairies and the true fen group. This is due to the fact that it has species in common with both communities (e.g. *Carex stricta*, *C. atherodes*, *C. sartwellii*, *C. pellita*, *Calamagrostis canadensis*, *Lythrum alatum*, *Lycopus americanus*).

The fen group is defined by the fact that all of these communities have ground-water (often high carbonate and alkaline) driven hydrologies. They can all be considered "slope" wetlands (Brinson 1993 and discussion below). Again, fens with strong shrub components ordinate somewhat away from more open fens. The Cemetery Road fen (Killbuck Swamp, Wayne Co., Ohio) is unique in that it is the only plot dominated by *Carex trichocarpa*, although it otherwise has an identical hydrology to the other fens.

A final fen ordination was performed with the Oak Openings plots removed (Figure 9). Axis 1 is interpretable as a pH gradient from weakly to strongly minerotrophic. Axis 2 is largely meaningless being driven by the unique dominance of Daughmer Savannah by *Carex atherodes* and Cemetery Road by *Carex trichocarpa*.

#### Forest and Shrub Wetland Communities

When canopy, subcanopy, shrub and herb species abundances of woody communities were analyzed a strong separation from various emergent communities was observed (Figure 1). Forests and shrub swamps (including more "open" shrub swamps and some "shrubby" marshes) were then ordinated separately (Figure 10). Axis 1 of this ordination was a gradient of woody bogs and fens to highly degraded wetland forests. Axis 2 was a possible light gradient of closed forests to open shrub communities. No clear patterns of more specific community types emerged. Degraded sites and bogs and fens were removed and the ordination repeated using canopy, subcanopy, shrub and herb species abundances (Figure 11). Again, closed forests, closed shrub swamps, and open shrubs basically separated, but further community definition was not readily apparent using a combined canopy to herb layer data set.

The data set was partitioned into closed canopy forest plots and shrub swamp plots and the ordinations repeated with the canopy to herb layer data set. Few patterns emerged and a review of species plots indicated that inclusion of the herb and possibly the shrub layer was obscuring patterns in forest canopy communities, with the same thing possibly occurring for shrub swamp communities. Importance values for just woody tree species were then analyzed for closed canopy forests (Figure 12). Separation in this

ordination was interpretable in terms of more "traditional" forest community descriptions (e.g. maple-ash) when the IVs greater than 0.1 were ranked for the sites occupying similar positions in the ordination space (Figure 12).

The forest canopy community types observed in this data set included the following:

1. Silver maple (*Acer saccharinum*) swamps. These are forests where silver maple is the clear canopy dominant although other species like elm (*Ulmus* spp.), oaks (*Quercus palustris*, *Q. bicolor*), or ash (*Fraxinus* spp.) may be present in lesser abundances. These swamp forests can be variously termed maple-ash, maple-oak, maple-elm, maple-ash-oak, etc. A plot located in Fowler Woods State Nature Preserve had pumpkin ash (*Fraxinus profunda*) as a strong subdominant but silver maple was still the clear dominant in the stand, so "pumpkin ash" swamp would be a mischaracterization.
2. Green ash (*Fraxinus pennsylvanica*) swamps. These are (often disturbed) forests almost completely dominated by green ash.
3. Oak dominated swamps. These are swamp forests where swamp white oak and/or pin oak are dominants with other species like elm, ashes or maples as subdominants. Included here would be swamp white oak forests and pin oak swamps, although no pure pin oak stands were sampled as of 2002.
4. Various mixed forests with red maple (*Acer rubrum*) instead of silver maple as co-dominant to dominant. These are not pure stands of red maple and are perhaps best termed a type of "mixed swamp forests." Because of its commonness and association with disturbed forests, the co-dominance of red maple is probably overlooked when characterizing midwest wetland forests. These are forests with a strong presence of red maple that is generally co-dominant with oaks, ashes, or elms. A variant of this community particular to the glaciated Allegheny Plateau (northeast Ohio) included red maple with black gum (*Nyssa sylvatica*) or yellow birch (*Betula alleghaniensis*).
5. "Facultative" mixed swamp forests. These are somewhat unusual swamp forests with strong micro-relief where more mesic upland species have a strong presence in the stand. For

example, the plot from Bradley Woods Metropark (Cuyahoga Co., Ohio) was dominated by silver maple with beech (*Fagus grandifolia*) and yellow birch as subdominants. Similarly, a plot in a forested area of Morgan Swamp (Ashtabula Co., Ohio) was dominated by silver maple with black gum, elm, and tulip tree (*Liriodendron tulipifera*).

6. "Disturbed" forests. These are usually somewhat small, highly disturbed swamp forests. Cottonwood (*Populus deltoides*) and black willow (*Salix nigra*) are abundant along with green ash, pin oak, and elms.



Calamus Swamp, Pickaway Co., Ohio. Mixed Emergent Marsh. Depression. Photo: J.Mack.

These patterns in canopy communities were obscured or disappeared when shrub and herb layer data was included in the forest ordinations. Moreover, many of these putative forest communities are less than 1 standard deviation apart on axes 1 and 2 of the ordination (Figure 12) indicating less than 50% species turnover amongst all of these canopy communities.

Results were similar when shrub community plots were ordinated (Figure 13). While "pure" examples can be found, many of the community descriptions (buttonbush swamp, alder swamp, etc.) do not capture the variability found in real shrub swamps where dominance by buttonbush or alder may occur in different areas of the same wetland. Bog and fen shrub swamps clearly ordinated apart from other sites (Figure 13). Removal of bogs and fens resulted in separation of Lake Erie coastal communities, beaver impoundments and "open" shrub swamps with strong marsh components (Figure 14). Restricting the ordination further, revealed a tightly clustered core of pure or nearly pure buttonbush swamps with outlying plots in the ordination explainable in terms of buttonbush swamps which varied in some way from the core community assemblage (Figure 15). Ordination of importance values of shrub species from the woody

stem counts in the sample plots yielded very similar results and did not result in further definition of shrub swamp communities (results not shown).

## DISCUSSION

Classification, and especially plant community classification, can recognize ever finer community gradations. Eventually, some Clementsian limit is reached when communities differ by a single species. This was not the approach taken here. Instead, a Gleasonian approach was taken where broadly repeatable community types were recognized with admittedly considerable intercommunity variation based on the unique circumstances surrounding the initial and subsequent development of every wetland and individualistic responses of plant species occurring within the wetland over time. The overall approach was one of "lumping" versus "splitting" with a goal of as few classes as possible and necessary.

The ordinations and cluster analyses performed here clearly support the recognition of the three broad vegetation classes outlined by Cowardin et al. (1978): emergent, forest, and shrub. Within these broad classes, multiple subtypes are also supported: bogs, fens, other sedge-grass dominated wetlands (Oak Openings sand prairies and other wet prairies), and several emergent marsh types most notably "mixed emergent marshes." Each recognized plant community is discussed in detail below. Lists of characteristic species, relative abundances, and other community characteristics are provided in the Appendix.

### *Mixed Emergent Marshes*

By its very name, this is a heterogenous community type that is highly variable from site to site. Marsh communities can be considered an early successional sere on the pathway to closed canopy forests. But, marshes can also be stable, long-term communities in the Ohio landscape. Where there is high beaver activity, e.g. the Morgan Swamp complex owned by The Nature Conservancy in Ashtabula Co., Ohio (glaciated Allegheny Plateau), there is a shifting mix of young to old marshes interwoven with shrub or forest dominated wetlands of varying ages. While each particular marsh might be a stage in the successional pathway to closed forest, marshes from a landscape perspective are stable and recurring features. Mixed emergent marshes are wetland communities dominated by herbaceous vegetation and include, in usually somewhat equal, proportions emergent graminoid (grading towards sedge meadow or cattail marshes), emergent broad-leaved, floating-leaved, and submersed aquatic areas. Pure types of any of these subcommunities are relatively uncommon and can be referred to their own class as with sedge-grass communities or cattail marshes, or in few instances to

"submergent" marshes or "floating-leaved" marshes. In most marshes, all communities are present across a gradient of increasing inundation frequency and water depth, although human disturbance can destroy one or several of these subcommunities (some other pure types may also be artifacts of past or ongoing disturbance).

Mixed emergent marshes occur in virtually every landscape position (depressional, riverine, impoundment, coastal) and occasionally slopes,



Gallagher Fen, Clark Co., Ohio. Fen with marl meadows. Slope, riverine. Photo: J. Mack.

although most slope wetlands are fens (fens often grade into mixed emergent marshes where the fen meets a floodplain) (Table 1A). With the exception of coastal marshes and mitigation wetlands that are mixed emergent marshes, strong definition of the depression and riverine hydrogeomorphic classes was not observed when plant community composition was ordinated (Figures 5 and 6).

Typical species in mixed emergent marshes can include *Sagittaria* spp., *Typha* spp., *Sparganium* spp., *Peltandra virginica*, *Pontederia cordata*, *Nuphar advena*, *Decodon verticillatus*, *Polygonum* spp., *Carex* spp., *Juncus* spp., *Scirpus* spp., *Cyperus* spp., *Eleocharis* spp., *Poaceae* spp., *Lycopus* spp.,



Silver Lake Fen, Miami Co., Ohio. Lacustrine fen. Slope wetland on shallow glacial kettle lake. Photo: J. Mack.

*Scutellaria* spp., *Iris* spp., *Lemna* spp., *Wolffia* spp., *Spirodela polyrhiza*, *Ceratophyllum* spp., *Potamogeton* spp., *Elodea canadensis*, and other wetland forbs and floating aquatic plants. Most mixed emergent marshes also have narrow to wide bands of shrub vegetation around their perimeters or in small shrubby islands. Shrub species can include vegetation typical of shrub swamps (see below) but are more likely to include willows (*Salix amygdaloides*, *S. exigua*, *S. sericea*, *S. nigra*), dogwoods (*Cornus amomum*, *C. sericea*, *C. racemosa*), and *Viburnum recognitum*. Areas which could be considered sedge meadows can also occur within mixed emergent marshes. These areas may be dominated by bulrushes like *Scirpus cyperinus* (woolgrass) and *Bolboschoenus fluviatilis* (river bulrush) or various sedge species (*Carex lacustris*, *C. hyalinolepis*, *C. utriculata*, *C. stricta*).

#### Wet Meadow Emergent Communities: Fens

Andreas (1985, p. 116) defines fens as communities "...characterized by having (1) relatively clear water coming from an artesian source which surfaces as springs or seeps, (2) a wet, springy calcareous substrate which supports minerotrophic species of *Sphagnum* and other bryophytes which do not accumulate to form a continuous mat, (3) vegetation



Baker Swamp, Jackson Co., Ohio. Mixed emergent marsh. Riverine headwater depression. Photo: J. Mack.

dominated by members of the Cyperaceae, Compositae, Rosaceae and Graminae [Poaceae] with approximately 20% of the vegetation made up of shrubs, usually including *Potentilla fruticosa*, and (4) water pH between 5.5 and 8.0." According to Amon et al. (2002) midwestern fens are not easily differentiated into floristic types. The one defining feature in Ohio fens seems to be a dominance of graminoid (usually Cyperaceae) species. The position of Amon et al. (2002) is generally confirmed here with the exception of strongly calcareous fens (generally with marl meadows) that have a calciphile assemblage of plants which ordinated them somewhat apart from other fens (Figures 7, 8, and 9). Amon et al. (2002) define fen



Marl meadow at Prairie Rd. Fen, Clark Co., Ohio with *Parnassia glauca*, *Deschampsia cespitosa*, *Silphium terebinthinaceum*. Photo: J. Mack.

types based on landscape position and direction of groundwater discharge: horizontal (slope), vertical (mound) and lacustrine (fringing natural kettle lakes with horizontal or vertical upwelling) and this approach is incorporated into the "slope" HGM class (Table 1A). Slope fens occur at breaks in slope where floodplains meet valley walls or on hillsides. Examples of slope fens in this data set are Gallagher Fen and Prairie Road Fen in Clark Co., Ohio. Mound fens are large or small "mounds" where groundwater is expressing vertically. Examples of mound fens are Gott Fen in Summit Co., Ohio and a fen at Blue Heron Reserve Park, Sandusky Co., Ohio. Lacustrine fens typically occur around the margins of natural kettle lakes in glaciated Ohio. An excellent example of a lacustrine fen is the south side of Silver Lake in Miami Co., Ohio.

Anderson (1982) recognized several Ohio fen plant community types: cinquefoil-sedge fens, tamarack fens, arbor vitae fens, and marl meadows. All of his types are fens associated with alkaline, mineral-rich, nutrient poor groundwater and have a strong presence of obligate calciphile plant species like *Cacalia plantaginea*, *Carex flava*, *C. sterilis*, *C. lasiocarpa*, *Deschampsia flexuosa*, *Eleocharis rostellata*, *Eriophorum viridicarinatum*, *Parnassia glauca*, *Potentilla fruticosa*, *Rhynchospora capillacea*,



Daughmer Savannah, Crawford Co., Ohio. Prairie sedge meadow dominated by *Carex atherodes*, *C. stricta*, and *C. lacustris* grading into bluejoint-cordgrass slough. Depression. Photo: J. Mack.

*Solidago ohioensis*, and *Triglochin* spp.

Of the types recognized by Anderson (1982), the arbor vitae fen is a class of one (Cedar Bog, Champaign Co., Ohio) and is better interpreted as a relict stand of Atlantic white cedar (*Thuja occidentalis*) than a community type. Tamarack fens are also uncommon or not otherwise distinctive from other fens in the rest of their flora; and, in the case of Mud Lake Bog (Figures 7 and 8) may have more in common with bogs than fens. Marl meadows are better considered a subcommunity which occurs because of the quality and quantity of the groundwater or the age of the fen. This leaves cinquefoil-sedge fens, and again, these fens are not necessarily distinguishable from other fens except for the presence of shrubby cinquefoil (*Potentilla fruticosa*). Many other fens do not have tamarack, Atlantic white cedar, or shrubby cinquefoil but are clearly groundwater driven wetlands that are slopes,



Holmesville Prairie, Holmesville Co., Ohio. *Carex stricta* dominated fen with *Acorus americanus* on the floodplain of Killbuck Creek. Photo: J. Mack.

mounds, or fringing with recurring assemblages of sedges and forbs such that they ordinate together (Figures 7, 8, and 9). These wetlands are often called generically "sedge meadows" or "wet meadows" but are clearly "fens." Common species in these fens include *Carex stricta*, *C. leptalea*, *C. utriculata*, *C. interior*, *C. suberecta*, *C. trichocarpa*, *C. pellita*, *Solidago patula*, *Aster puniceus*, as well as other marsh and wet prairie species. The classification developed here takes the view of Amon et al. (2002) that Ohio fens are not easily differentiable floristically, with the exception of marl meadow areas. Fens are classed as type of sedge-grass dominated emergent wetland along with wet prairies, Oak Openings sand prairies, and reed canary grass meadows (see below, Table 1B).

In peatland classification schemes developed for northern peatlands (e.g. Moore and Bellamy 1974), peatland classes range from strongly ombrotrophic (precipitation only, low pH, low conductivity, slow water movement) to strongly minerotrophic peatlands (artesian groundwater, high pH, high conductivity, fast

water movement). Between these extremes, intermediate classes can be recognized based on water chemistry and flora including moderately and weakly ombrotrophic and weakly and moderately minerotrophic (Table 3). Ohio fens without obligate calciphile plant species are likely in the moderately minerotrophic range (Table 3).

#### *Other Wet Meadow Emergent Communities*

Sedge and/or grass communities that have not had hydrologies dominated by artesian groundwater include deep soil wet prairies and prairie sedge meadows, Lake Plains sand prairies and reed canary grass meadows. Hydrologic pathways of these



Irwin Prairie State Nature Preserve, Lucas Co., Ohio. Oak Openings sand prairie dominated by *Cladium mariscoides*, *Calamagrostis canadensis*, *C. stricta*, *Carex cryptolepis*, and *Euthamia remota*. Photo: H. Tucker.

sedge-grass emergent wetlands are dominated by precipitation and evapotranspiration and/or inputs from rivers and streams.

“Wet prairies” in Ohio generally correspond to Curtis' (1959) wet-mesic prairie, wet prairie, and southern sedge meadow (Mack 2002). Extensive areas of prairie existed in Ohio at the time of European settlement in the former Sandusky Plains (Crawford, Marion, Wyandot Counties), Darby Plains (Madison, Union Counties), Pickaway Plains (Pickaway Co., Ohio), Mad River Interlobate prairies (Champaign, Clark, Green, Montgomery Counties), Sandusky Bay Prairies (Sandusky, Erie Counties) and few other scattered areas (e.g. Darke and Van Wert Counties) (Sears 1926, Dobbins 1937, Gordon 1966; Mack 2002).

Wet prairie is dominated by the wetland grasses *Calamagrostis canadensis* and *Spartina pectinata*, *Carex* spp., “prairie” forbs and grasses like *Muhlenbergia mexicana*, *Lythrum alatum*, *Pycnanthemum virginianum*, *Liatris spicata*, etc. Wet-mesic prairies have all these species but also high dominance of big bluestem (*Andropogon gerardi*) and panic grass (*Panicum virgatum*). Mesic prairies, wet-mesic prairies and wet prairies may grade into each other and into southern sedge meadows (Curtis 1959),

i.e. “prairie sedge meadows”. Prairie sedge meadows are dominated by various sedge species including *Carex atherodes*, *C. lacustris*, *C. stricta*, *C. sartwellii*, and *C. pellita*.

“Lake plains sand prairies” occur in the Oak Openings region of Ohio in Lucas, Wood, Fulton, and Henry counties. Lake plains sand prairies form where low permeability lacustrine clay is overlain by extensive beach sand deposits. In areas where the ground water table extends above the soil surface, a sandy peat/muck soil develops and typically sedge-dominated wetlands occur. Dominant species include twigrush (*Cladium mariscoides*), slender sedge (*Carex lasiocarpa*), Great Lakes goldenrod (*Euthamia remota*), and bluejoint grass (*Calamagrostis canadensis*, *C. stricta*). Other sedges, grasses, and forbs occur as well as species more typically thought of as fen species.

#### *Bogs*

Bog communities are characterized by continuous carpets of *Sphagnum* and/or other acidophilic mosses. Large bog systems often include areas of floating-leaved marsh in peripheral moats (laggs) or in the center as well as other marsh or shrub dominated areas. Bog communities dominated by trees or shrubs are discussed below. Ohio bogs are relicts of



Triangle Bog, Portage Co., Ohio. “Classic” ringed sphagnum bog with tamarack perimeter. Photo: unknown.



Leatherleaf bog within Kent Bog Tamarack Forest, Portage Co., Ohio. Photo: J. Mack.

the Wisconsin glaciation. Most Ohio bogs present prior to European settlement have been destroyed or degraded. Gordon (1966) maps several large bog complexes in northeast (Geauga, Portage, Summit, Stark, Trumbull Counties), north-central (Seneca, Crawford, Morrow Counties), and south-central Ohio (Licking, Fairfield, Perry Counties). The plant and animal species present in Ohio bogs are often at the southerly limits of their distribution and represent important reservoirs of genetic diversity. Andreas (1985, p. 116) defines a "sphagnous bog" as community that,

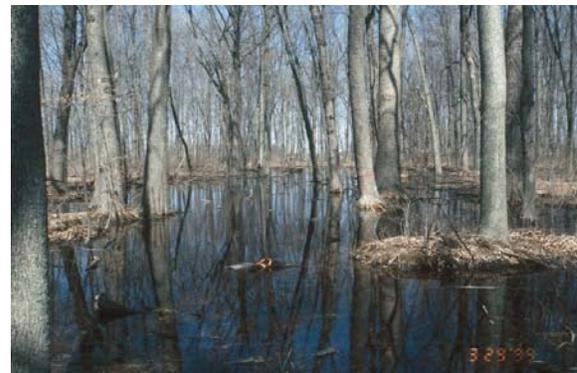
...(1) develops in an area where drainage is blocked and there is little or no circulation of water, (2) contains a *Sphagnum* dominated ground layer which accumulates to form a more or less continuous mat, (3) has a shrubby vegetation dominated by members of the Ericaceae and a herbaceous layer primarily dominated by members of the Cyperaceae, and (4) has a water pH between 3.5 and 5.5. Typically, bog waters are brown due to the accumulation of organic material. In Ohio, plant communities with the above characteristics are referred to as *Sphagnum* mats, leatherleaf bogs, ericaceous shrub bogs, tamarack bogs, and more recently, ombrotrophic to weakly minerotrophic swamps...



Collier Woods State Nature Preserve, Seneca Co., Ohio. Silver maple swamp with swamp cottonwood. Riverine mainstem depression. Photo: J. Mack.

From the perspective of more northerly peatland classification schemes (Table 3), most Ohio bogs likely fall in the moderately to weakly ombrotrophic class given their southerly position near the limits of the Wisconsin glaciation. Most of Ohio was ice-free by 14,000 to 18,000 years before present (Shane 1987) so Ohio bogs have been developing and succeeding to non-bog communities for several thousand years longer than many of their more northern counterparts. According to Andreas (1985), most Ohio extant Ohio bogs receive some ground water or surface water inputs such that they are not strongly ombrotrophic.

The bogs sampled here range from late-successional tamarack-hardwood and tall shrub bogs with sphagnous hummock and hollow habitat and little or no standing water, to "classic" leatherleaf bogs dominated by sphagnum, leatherleaf, pitcher plant, cranberries, etc. with active peat accumulation and circumneutral lags (moats) around their perimeters and



Big Woods Preserve, Miami Co., Ohio. Maple-ash-oak swamp with "vernal pools." Depression. Photo: Mick Micacchion.

sometimes within the bog proper. Related to the bogs are swamp forests or shrub swamps with a strong bog element to their floras. These are typically found in the glaciated Allegheny Plateau of northeast Ohio and northwest Pennsylvania and Michigan-Indiana Drift and Lake Plains of far northwest Ohio, Michigan, and Indiana. Another distinction observable, likely attributable to age and ombrotrophic class is species richness. Tamarack-hardwood bogs and tall shrub bogs are often species rich communities, whereas sphagnum bogs and leatherleaf bogs are often species poor. The former are likely weakly ombrotrophic and have been colonized by other wetlands species in addition to a strict bog flora; the latter are more strongly ombrotrophic with a flora limited to bog obligates.

#### Wetland Forest Communities

Wetland forests are plant communities characterized by closed to somewhat open canopies of tree species. Wetland forests are grouped under the generic term "swamp forests" (Table 1B) to distinguish



Slate Run Metropark, Pickaway Co., Ohio. Ash dominated margins of buttonbush pool. Riverine headwater depression with *Ranunculus flabellaris* in bloom. Photo: J. Mack.

them from shrub dominated swamps (shrub swamps). Swamp forests occur in virtually every landscape position: depressional, riverine, slope, and coastal (Table 1A). Little definition of these hydrogeomorphic classes was observed when overall plant community or canopy community composition was ordinated. About the only consistent hydrogeomorphic factor for Ohio swamp forests is a seasonally inundated or saturated hydroperiod since Ohio wetland trees do not tolerate permanent inundation; in wetland forests with permanently saturated conditions, trees occupy areas of microrelief where root zones are not anaerobic for much of the growing season. This said, there are individual species, typically in the herb layer, which are more typical of swamp forests in riverine versus depressional versus slope (forest seep) landscape positions. For example, skunk cabbage (*Symplocarpus foetidus*) and marsh marigold (*Caltha palustris*) are often associated with forest seep (slope) wetlands. *Carex bromoides* (brome-like sedge) is common in shallowly inundated to saturated areas of depressional forests but generally absent from floodplains.

Wetland forests in Ohio are dominated by a variable assemblage of relatively few tree species, the most important of which are silver and red maple, swamp white and pin oak, green, red, and black ash,



Graham Rd. Woods. Degraded red maple swamp. Depression. Photo: J. Mack.

and slippery and American elm. To this list can be added a few species characteristic of certain parts of the state (*Betula alleghaniensis*, *Nyssa sylvatica*, and *Pinus strobus* in northeast Ohio swamp forests; *Betula nigra* in southeast Ohio swamp forests) and a two less common species often associated with high quality wetlands (*Fraxinus profunda*, *Populus heterophylla*). Typical tree species assemblages associated with disturbed and undisturbed wetland forests are summarized in Table 3.

Common names for wetland forests in Ohio include oak-maple swamps, oak-maple-ash swamps, maple-ash swamps, pin oak swamps (or flats), pumpkin ash swamps, mixed swamp forests, red maple swamps, white pine bogs, cottonwood swamps, and river birch swamps (Anderson 1982). All of these descriptions refer to one or more dominant or easily observable tree species common in a particular wetland. Closer examination of quantitative forest surveys will usually reveal that even relative "pure" stands have strong



Mitchell Woods (aka Big Woods), Huron Co., Ohio. Maple-ash-oak swamp with mature canopy. Depression. Photo: J. Mack.

representation of other wetland tree species. The lack of strong within-forest community definition in the ordinations (Figures 10, 11, and 12) suggests that such terms have more to do with heuristic botanical shorthand than with meaningful differences in canopy dominants. Although strict community definition may be lacking, patterns associated with wetland quality or disturbance are apparent. While certain species are ubiquitous in Ohio wetland forests regardless of wetland quality or disturbance (e.g. red and silver maple, green ash, elms), other species appear to be associated with intact wetland forests and disappear or are reduced with disturbance (e.g. swamp white oak, pumpkin ash, swamp cottonwood) (Table 3).

In the herb and shrub layer, Ohio wetland forests also have a repeating assemblage with site-specific or regional variations. Common forest shrub species include winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), highbush blueberry (*Vaccinium corymbosum*), alders (*Alnus serrulata*, *A. incana*), and stunted forms of common elder (*Sambucus canadensis*)



Mohican State Forest, Ashland Co., Ohio. Forest seep dominated by *Symplocarpus foetidus*. Slope, riverine. Photo: J. Mack.

and buttonbush (*Cephalanthus occidentalis*). In the herb layer, there are many species which recur from forest to forest although usually not all are located in any one stand (Appendix) and some are found only abundant in certain regions.

There are three additional variations in the swamp forest community. One is "forest seeps": closed canopies of tree species with strong "break in the slope" groundwater expression, mucky soils, and often densely vegetated in the herb layer with *Carex* spp., skunk cabbage (*Symplocarpus foetidus*), marsh marigold (*Caltha palustris*) and often other fen associates (e.g *Solidago patula*).

The second is a late-successional bog community called "tamarack-hardwood bogs" dominated by tamarack and other hardwood species (yellow birch, red maple, blackgum, quaking aspen that form a closed canopy over peat or muck soils with many characteristic bog or "bog associated" understory species in a "hummock and hollow" microtopography. Tamarack-hardwood bogs can often grade into other swamp forest types.

The third type is a boreal "Tamarack bog" characterized by continuous sphagnous carpets and closed to open canopies of tamarack (*Larix laricina*).



Tamarack forest, Kent Bog, Portage Co., Ohio. Photo: J. Mack.

This is vary uncommon community in Ohio today. Kent Bog in Portage Co., Ohio is probably the best example of this community type.

#### *Wetland Shrub Communities*

Shrub swamps can also be considered, along with marshes, a sere on the successional trajectory to closed canopy forest. Like marshes they can be stable communities in the midwest landscape that exist for decades or even centuries. Beaver activity can rather quickly convert a wetland forest to a shrub swamp or marsh. Characteristic shrub swamp species include buttonbush, alders, dogwoods, willows, blueberries, spirea, chokeberry (*Aronia melanocarpa*), and winterberry (*Ilex verticillata*). Narrow bands or islands of "shrub" vegetation may occur on the margins of emergent communities as these wetlands transition to upland areas or more woody dominated wetlands. Shrub vegetation like this is a common component of these emergent communities and, from a classification perspective, would not be classified as a "shrub swamp." Obviously, where you draw the line is a matter judgment.



Mixed shrub swamp, Huron Co., Ohio. Photo: J. Mack.,

Buttonbush swamps are probably the most common type of shrub swamp in Ohio. They occur in every part of the state and in all landscape positions. In Eastern Corn Belt Plains and Huron-Erie Drift and Lake Plains (Omernik 1987), buttonbush swamps are only type of wetland shrub community. Elsewhere (Glaciated and unglaciated Allegheny Plateaus), alder swamps or mixed shrub swamps are also common, although these often occur in the less inundated or saturated margins of swamps otherwise dominated by buttonbush. Anderson (1982) states that a buttonbush swamp or alder swamp has more than 50% of its canopy dominated by buttonbush or alder, respectively.

A variation on the shrub community are bogs with a closed canopy of shrub species. These are termed "tall shrub bogs" (Anderson 1982) and are characterized by massive, continuous sphagnum carpets, in addition to bog shrubs and herbs. Shrub species include willow (*Salix* spp.), chokeberry (*Aronia melanocarpa*), winterberry, catberry (*Nemopanthus*

*mucronatus*), blueberries, *Gaylussacia baccata* (huckleberry), alders, poison sumac (*Toxicodendron vernix*), arrowwood, and dogwoods, etc. In the glaciated Allegheny Plateau (Erie-Ontario Drift and Lake Plains), true bogs may grade into "boggy" mixed shrub, alder, or buttonbush swamps, or marshes but these lack sphagnum carpets. Especially in the "snow belt" region of northeast Ohio (Geauga, Lake, Ashtabula, Trumbull, Summit, Portage Counties), many shrub swamps, and also wetland forests, have a strong bog element to their floras.

A final variation of shrub community types are shrub dominated fens. These are wetlands with artesian ground water inputs identical to "open" emergent fens but where shrub species, especially willows (e.g. *Salix discolor*, *S. sericea*, *S. serrissima*, etc.), dogwoods (*Cornus sericea*, *C. amomum*), and poison sumac and also highbush blueberry (*Vaccinium corymbosum*), buckthorn (*Rhamnus alnifolia*), and arrowwood. In the herb layer, these shrub dominated fens have herb layers under the shrubs or in canopy gaps within the shrub swamp dominated by fen assemblages indistinguishable from open fens.

*Hydrogeomorphic Types in Wetlands in the Till Plains, Lake Plains, and Allegheny Plateau Regions*

The plant community ordinations performed here clearly support the recognition of several Hydrogeomorphic classes (Table 1A). "Slope" wetlands are clearly recognizable in most instances as various types of "fen" or "forest seep" plant communities. In a few instances, a less clear expression of a slope hydrology in the plant community can be



Wilson Swamp, Mercer Co., Ohio. Buttonbush swamp in the "Thoroughfare" complex of the St. Marys River. Riverine mainstem depression. Photo: J. Mack.

found in forested wetlands associated with the fore slopes of former beaches (e.g. Edison Woods, Erie Co., Ohio, North Kingsville Sand Barrens Swamp, Ashtabula Co., Ohio). Lake Erie coastal marshes also ordinate apart of from inland marshes, due to a shift in plant community assemblages presumably adapted to the daily, yearly, and decadal variations in lake levels. The ordinations also suggest that "impoundments," both

human and beaver-induced, separate from non-impounded marsh systems (Figure 5)<sup>4</sup>.

At least two types of wetlands could arguably



Buttonbush swamp, Slate Run Metropark, Pickaway Co., Ohio. Riverine headwater depression. Photo: J. Mack.

comprise their own hydrogeomorphic class. First, although classified as a type of "depression," the Oak Openings or lake plains sand prairies of Lucas, Henry, and Fulton Counties in northwest Ohio, could be a separate class. These wetlands form on sandy soils of earlier stages of Lake Erie underlain by a tight lacustrine clay. The water table is perched on the clay layer. In places where the water table rises seasonally to or above the ground surface, sedge-derived sandy mucks develop with *Carex-Cladium-Calamagrostis* (sedge-twig rush-bluejoint) dominated "prairies" developing. This unique hydrologic setting and plant community could at least arguably be elevated to class status. It is treated here as a type of emergent community forming on depressions (Tables 1A and 1B).

Second, the ordinations strongly support splitting ombrotrophic bogs from the depression class given their unique combination of precipitation-driven hydrology, water chemistry, peat substrate, *Sphagnum* dominance, and a distinct, species poor, flora (Figures 1, 2, 7, and 13). Strongly to moderately ombrotrophic bogs are relatively few in number; late successional bogs (weakly ombrotrophic) are more common. A bog HGM class is created with weakly, moderately, and strongly ombrotrophic bogs as subclasses. However, "boggy" depressional marshes and swamps, i.e. wetlands with a bog element to their floras, are still considered to be depressions.

Less clear is the definition by plant community composition of a riverine class from a depressional class, although to the extent that they constitute

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<sup>4</sup> To the extent that most mitigation wetlands are technically various types of impoundments, their classification with other types of impoundments is perhaps not surprising.

everything that is not a slope, coastal, and impoundment, bog, and fringing, they are definable as a broad "everything else" categories. Depressions do not ordinate clearly from riverine mainstem depressions



Riverine mainstem depression, Marie Delarme Creek, Paulding Co., Ohio. Maple-ash-oak swamp. Photo: J. Mack.

and riverine headwater depressions even when analyses were carried out after splitting the data set by emergent, forest, and shrub vegetation classes. One factor explaining this similarity is that riverine depressions in the midwest shift to a vertical hydrologic pathway dominated by evapotranspiration once spring flood events have stopped. Thus, during much of the growing season they are hydrologically similar to inland depressions. Keeping track of depressional versus riverine landscape positions is important for other reasons, e.g. replacing functions or values lost due to permitted wetland destruction. Differences have also been noted between depressions and riverine systems in metric values and index of biotic integrity scores (Mack 2004c).

#### *Depression*

Depressions are wetlands located in landscape positions where they are not associated with a stream, river, lake, or reservoir. Depressions are characterized by a vertical hydrologic pathway with precipitation



Depression, disturbed cattail marsh in Fairfield Co., Ohio. Photo: S. Fennessy.

(including overland flow and/or interflow) and evapotranspiration in the growing season as the dominant hydrodynamic. Depressions may be "closed" (i.e. without discernable inlets or outlets) or "open" (with inlets and/or outlets). The inlets or outlets are on the order of swales or rivulets associated with storm events, not actual streams. Depressions may have organic (peat, muck) or mineral soils. There are two subclasses of depressions: 1) surface water depressions which have precipitation and overland flow as their sources of water, and 2) ground water depressions which also receive substantial ground water inputs (interflow) as well as precipitation and overland flow.

Virtually every type of plant community can occur in a depressional landscape position. Forested depressions are often called "vernal pools" as are some shrub swamps. Buttonbush swamps are often found in depressions. Most emergent communities except for fens can be found in depressional settings including marshes, wet prairies, prairie sedge meadows, etc.

Depressions are abundant throughout glaciated regions and uncommon or lacking in the unglaciated Allegheny Plateau where virtually all wetlands would be classed as impoundment, riverine or slope wetlands.



Beaver pond, Morgan Swamp complex ("Long Pond"), Ashtabula Co., Ohio. Photo: J. Mack.

#### *Impoundment*

Impoundments are wetlands that develop due to the collection of water due to some type of natural or artificial barrier. Note that fringing wetlands that have developed around larger reservoirs that develop "lake" characteristics (e.g. stratification) are classified as a type of lacustrine system and are included in the "Fringing" class. But, the distinction between an Impoundment, a Fringing wetland, and a Riverine wetland may be hard to determine. For example, the potential inundation zones of many reservoirs can extend upstream from a dam for many miles, but the wetlands located there may be better classified as Riverine, even though they are sometimes affected by impounded water.

There are two subclasses of Impoundments:



Riverine channel marsh, mouth of Tare Cr. where it enters E. Branch of the Cuyahoga River, Geauga Co., Ohio. Photo: J. Mack.

Beaver Impoundments and Human Impoundments. Human impoundments occur most frequently because of road or railroad construction. Water impounds behind the road or railroad grade and over time a wetland develops. These can be considered inadvertent wetland creations or restorations (if they occurred on hydric soils). Although they can occur anywhere, they are very common in the floodplains and valleys of the unglaciated Allegheny Plateau. Many intentionally created or restored wetlands (mitigation wetlands), to the extent they use dikes to impound water to create or restore wetland hydrology, are also impoundments.

Beaver Impoundments are wetlands that are created, expanded, or modified by beaver activity. They are usually marshes or sometimes shrub swamps since trees are drowned or cut down by the beavers. By impounding streams, beavers can cause a wetland to



Mantua Bog, Portage Co., Ohio. Slope, riverine fen dominated by *Carex interior*, *Potentilla fruticosa*, *Melanthium virginicum*, and *Silphium trifoliatum*. Note how fen grades into cattail marsh as it approaches stream towards the treeline. Photo: J. Mack.

develop. They can also expand and/or modify existing wetlands by raising water levels and/or shifting the wetland to a more permanently inundated hydrology.

Beavers were (and are becoming again) an important type of natural disturbance which would have created a mosaic of wetland types of varying successional ages. An excellent example of this type of disturbance today is The Nature Conservancy preserve Morgan Swamp, in Ashtabula Co., Ohio where chronosequences of young beaver ponds with numerous standing dead trees and an open marsh community to very old abandoned ponds well on their way to reforestation occur in a 400 ha wetland mosaic.

#### Riverine

Riverine wetlands are wetlands associated with a stream or river that has a hydrology driven by annual or regular flood events or perennial interaction of water between the stream and the wetland. There are three subclasses of riverine wetlands: Riverine Headwater Depressions, Riverine Mainstem Depressions, and Riverine Channel wetlands. Note that Coastal river mouth wetlands would be a type of Riverine Mainstem system but are treated as a subclass of Lake Erie Coastal wetlands

Riverine Headwater Depressions are wetlands associated with 1<sup>st</sup> and 2<sup>nd</sup> order streams. They are typically broad flat areas on terraces or valley floors. They often can be large wetlands at the top of a watershed that eventually become major rivers. Watercress Marsh in Columbiana Co. is good example. It is the headwater of the Mahoning River and is a large marsh complex with low gradient braided channels that eventually coalesce into a flowing stream. Fens are also present along portions of the valley walls (Slope wetlands). Headwater depressions can also be smaller when they are associated with smaller streams or watersheds.

Riverine Mainstem Depressions are wetlands



Riverine mainstem depression, Raccoon Cr., Vinton Co., Ohio, during spring flood event. Photo: M. Micacchion.

associated with 3<sup>rd</sup> order or greater streams or rivers. They are typically located on the floodplain in old oxbows, cut off channels, or low areas behind natural alluvial dikes which receive annual to regular flood inputs from the stream or river. In some, situations interflow from the stream or ground water may be hydrologic inputs. But, by midsummer, mainstem



Barrier-beach lagoon marsh, North Pond, Kelleys Island, Erie Co., Ohio, during low water period. Photo: J. Mack.

depressions are often dominated by a vertical hydrologic pathway dominated by precipitation and evapotranspiration. In this regard, they have a hydrology similar to "Depressions" once flood events for the year have ceased.

In Ohio today, Riverine Channel wetlands are found in mainstem areas of rivers and streams and are characterized by perennial or nearly perennial hydrologic interaction with the stream or river. These wetlands are sometimes called "wetland streams." Wetland vegetation grows in the actual stream course. Soils are often organic and flow can be sluggish or braided. An excellent example of this type of wetland is a wetland complex associated with the East Branch of the Cuyahoga River and Tare Creek in Geauga Co., Ohio. The river and creek flow through broad beds of spatterdock, pondweeds, and other floating or submersed aquatic plants and buttonbush grows in the



Dike coastal marshes (managed), Ottawa National Wildlife Refuge, Ottawa Co., Ohio. Photo: Mick Micacchion.

stream channel in places. There is often no natural alluvial dike separating the channel from the rest of the

floodplain such that small increases in flow spill out across large areas of wetland. This HGM class was formerly much more common on Ohio's landscape but with stream channelization and the down cutting from increased hydrologic loading of streams, Riverine Channel wetlands have disappeared or been cut off from the channel (and are now mainstem depressions).

As with Depressions, virtually every type of plant community can occur in Riverine landscape positions, although swamp forests and shrub swamps are perhaps the most abundant type of Riverine plant community.

### *Slope*

Slope wetlands are dominated by unidirectional (often horizontal) flow of ground water. Typically ground water is expressing (discharging) on a topographic slope or on break-in-the slope where a valley wall meets a floodplain. The defining feature of Slope wetlands is a ground water driven hydrology.

Included in the Slope class are ground water driven wetlands where the ground water is expressing vertically. This occurs where there is a break in an impermeable confining layer allowing ground water from an aquifer to express vertically. Amon et al. (2002) term this situation a "mound fen." Also included as Slope wetlands are fens that fringe natural kettle lakes. Amon et al. (2002) call these "lacustrine fens." Slope wetlands are further classified by their landscape position: isolated, headwater, mainstem, and lacustrine.

Three types of wetland plant communities have been observed on slopes: fens, forest seeps, and swamp forests on the fore slopes of ancient beaches (e.g. portions of Edison Woods, Erie Co., Ohio and North Kingsville Sand Barrens Swamp, Ashtabula Co., Ohio). Slope wetlands occur throughout the state but are most abundant in glaciated areas especially the in esker-kame complexes with former glacial interlobate areas, e.g. the Summit or Mad River Interlobate subregions (Woods et al. 1999).

### *Fringing*

Fringing wetlands have a lake-driven hydrology, are located on the edges (fringes) of lakes and reservoirs, and typically have a perennial interaction with lake waters. Several types of "fringing" wetlands are classified separately (e.g. Lake Erie Coastal Marshes, lacustrine fens). The fringing wetlands around natural inland lakes that have been sampled to date have all been lacustrine fens (a type of "Slope"). No data has been collected yet from fringing wetlands around reservoirs. It is retained as a class until further data is collected.

### *Coastal*

Coastal wetlands are associated with the



Drowned river mouth (barred) of Chappel Cr., Beulah Beach, Erie Co., Ohio. Photo: J. Mack.

shoreline of Lake Erie. The hydrology of these wetlands are partly or wholly controlled by lake-level fluctuations, near shore currents, seiches, and/or ice-scour. Although they occur across the entire Lake Erie shoreline of Ohio, Coastal wetlands are most abundant in the western basin. Detailed hydrogeomorphic classifications have been developed for Great Lakes coastal wetlands (Albert et al. 2003; Chow-Fraser and Albert 1998; Minc and Albert 1998). They divide Great Lakes wetlands into three broad classes: lacustrine (active and constant interaction from Lake), riverine (associated with mouths of Great Lakes tributary rivers) and barrier-protected (located behind geomorphic features which inhibit active and constant lake interaction). Lacustrine systems include open and closed embayments and shoreline wetlands; riverine systems include open and barred river mouth wetlands, delta wetlands, and connecting channel wetlands; and, barrier-protected systems include barrier-beach lagoon and swale complex wetlands (Albert et al. 2003). Some of these types were always uncommon along the south shore of Lake Erie; and with the extensive modification, destruction, and management of the remaining acreage, unmodified Coastal wetlands are very uncommon in Ohio. These more detailed natural wetland schemes have been simplified and condensed to reflect types that still exist in Ohio.

The most abundant type of Coastal wetland in Ohio are various types of diked (hydrologically restricted) wetlands. These fall into three types: 1) managed wetlands where water levels are actively manipulated by pumping and/or opening or closing water level control structures; 2) unmanaged wetlands where dikes are maintained but water levels are not actively manipulated; and 3) formerly diked wetlands where the dikes of partly or wholly failed. Examples of these types of diked Coastal wetlands in public ownership can be found at Ottawa National Wildlife Refuge and Crane Creek State Park, both in Ottawa Co., Ohio.

With regards to undiked (hydrologically unrestricted) wetlands, the most abundant remaining

type are wetlands associated with small or large rivers that flow into the lake. These have been variously called drowned river mouths, lacustraries, open or barred river mouths, estuarine, fresh-water estuarine, etc. Both barred and open river mouth Coastal wetlands occur in Ohio. Examples of barred river mouths include Old Woman Creek, Erie Co. and Arcola Creek, Ashtabula Co. Plum Brook in Erie Co. is a fairly intact example of an open river mouth the debauches into Sandusky Bay (an open embayment).

Only a few examples remain of barrier-protected wetlands. Sheldons Marsh (Erie Co.), North Pond (Kelleys Island, Erie Co.) and Foxes Marsh (North Bass Island, Ottawa Co.) are perhaps the only remaining barrier-beach lagoon wetlands in Ohio. Small remnants of swale complexes may be found in the Cedar Point area of Ottawa National Wildlife Refuge and in the Mentor Headlands (Lake Co.).

Although hydrogeomorphically distinct, there are too few examples of undisturbed Ohio Lake Erie Coastal marshes to observe floristic community distinctions between these subclasses (Figure 6). However, as a group they clearly ordinate apart from inland marshes supporting their treatment as a distinct HGM class.

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This work would not have been possible without the foundational work of Dennis Anderson who first attempted a comprehensive description of Ohio plant communities. Thanks also to Robert Brooks, Andrew Cole, and Denise Wardrop for their thorough, useful, and adaptable hydrogeomorphic classification for Pennsylvania. Finally, thanks to many Ohio botanists and plant ecologists for conversations over the years including Siobhan Fennessy, Rick Gardner, Jim McCormac, and Tim Walters. Special thanks to all my interns who helped to collect the data that made this possible including Lauren Augusta, Gregg Sablak, Mike Brady, Kelly Maynard, Cynthia Caldwell, Chad Kettlewell, Nina Grout, Heather Haynes, Joni Lung, Andrew Mercer, and Dan Gill.

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**Table 1A. Hydrogeomorphic classes for wetland classification system for Ohio wetlands adapted from Brinson (1993), Mack (2001b, Tables 6, 7, and 42), Mack (2000a, Table 1) Smith et al. (1995); Cole et al. (1997); Anderson (1982), Cowardin et al. (1978), Chow-Fraser and Albert 1998; Minc and Albert 1998.**

<b>class</b>		<b>class modifiers</b>
I	Depression (incl. areas that could be considered flats, e.g. "wet woods")	(A) Surface water (sheet flow, precipitation) (B) Ground water (seasonal to permanent input)
II	Impoundment	(A) Beaver (B) Human
III	Riverine	(A) Headwater depression (1 <sup>st</sup> or 2 <sup>nd</sup> ) (B) Mainstem depression (3 <sup>rd</sup> order or >) (C) Channel
IV	Slope (incl. hillside fens, mound fens, and lacustrine fens)	(A) Riverine (B) Isolated (C) Fringing
V	Fringing (does not include lacustrine fens)	(A) Reservoir (B) Natural lake
VI	Coastal	(A) Open embayment (B) Closed embayment (C) Barrier-protected (D) River mouth (barred and open) (E) Diked - managed (F) Diked - unmanaged (G) Diked - failed
VII	Bog	(A) Strongly ombrotrophic (B) Moderately ombrotrophic (C) Weakly ombrotrophic
add code	Mitigation	Add appropriate pre-code to HGM class: mr - mitigation, restoration mc - mitigation, creation e.g. "mrlI" = mitigation, restoration, impoundment

**Table 1B. Plant community modifiers for wetland classification system for Ohio wetlands adapted from after Brinson (1993), Mack (2001b, Tables 6, 7, and 42), Mack (2000a, Table 1) Smith et al. (1995); Cole et al. (1997); Anderson (1982), Cowardin et al. (1978).**

(1) Forest	(2) Emergent	(3) Shrub
(a) Swamp forest	(a) Marsh	(a) Shrub Swamp
(I) oak-maple (ii) oak -maple-ash (iii) maple-ash (iv) pin oak (v) pumpkin ash (vi) mixed forest (vii) red maple (viii) white pine (ix) cottonwood (x) river birch (xi) other (specify)	(I) submergent marsh (ii) floating-leaved marsh (iii) mixed emergent marsh (iv) cattail marsh	(I) buttonbush swamp (ii) alder swamp (iii) mixed shrub swamp (iv) other (specify)
(b) Bog Forest	(b) Wet meadow	(b) Bog shrub swamp
(I) tamarack bog (ii) tamarack-hardwood bog	(I) wet prairie (ii) oak openings sand prairie (iii) prairie sedge meadow (iv) fen (v) reed canary grass meadow (vi) other (specify)	(I) tall shrub bog (ii) leatherleaf bog
©) Forest seep	©) Sphagnum bog (incl. open kettle bogs with scattered shrubs, classic ringed bogs with open water centers and perimeters of shrubs and tamarack )	©) Tall shrub fen
(I) skunk cabbage seep (ii) sedge seep (iii) skunk cabbage-sedge seep (iv) other (specify)		

**Table 2. Narrative summary of common peatland classification schemes.**

<b>class</b>	<b>type</b>	<b>pH</b>	<b>conductivity</b>	<b>water movement</b>	<b>plant species richness</b>	<b>Table 1B communities</b>
ombrotrophic	strongly	very low	very low	negligible	very low	May not presently exist in Ohio given time since Ohio ice free 14000-18000 years before present
	moderately	low	low	slow	low	Most Ohio bogs, e.g. Triangle Bog, Fern Lake Bog, Singer Lake Bog, Kent Bog
	weakly	circumneutral	moderate	some	moderate to high	Late successional bogs, e.g. Tamarack-hardwood bogs, Tall shrub bogs
minerotrophic	weakly	circumneutral	moderate	moderate to high	moderate to high	Many forest seeps including skunk cabbage seeps, other wetlands with some type of groundwater input
	moderately	moderately high	moderate to high	moderate to high	moderate to high	Most "other" fens usually without calciphile obligates
	strongly	high	very high	high	high	Calcareous fens usually with marl meadows

**Table 3. Mean importance value for selected frequently observed tree and shrub species by the regulatory category of forested wetland where species observed. *Carya* spp. include *C. cordiformis*, *C. glabra*, *C. laciniosa*, *C. ovalis*, *C. ovata*, and *C. tomentosa*. *Cornus* spp. include *C. amomum*, *C. drummondii*, and *C. racemosa*. Category 1 are typically low quality, highly disturbed wetlands; Category 2 good quality wetlands; Category 3 wetlands are high quality, usually undisturbed wetlands (Ohio Administrative Code 3745-1-54, Mack 2001a). Importance values based on data from 1996-2000. Table adapted from Mack 2001b.**

species	Category 1	Category 2	Category 3
<b>TREES</b>			
<i>Acer rubrum</i>	0.003	0.307	0.154
<i>Acer saccharinum</i>	0.186	0.163	0.306
<i>Carpinus caroliniana</i>	---	0.035	0.019
<i>Carya</i> spp.*	---	0.039	0.008
<i>Fagus grandifolia</i>	---	0.003	0.083
<i>Fraxinus nigra</i>	0.288	0.067	0.021
<i>Fraxinus pennsylvanica</i>	0.442	0.184	0.126
<i>Fraxinus profunda</i>	---	---	0.107
<i>Populus deltoides</i>	0.351	0.127	0.158
<i>Populus heterophylla</i>	---	---	0.024
<i>Quercus bicolor</i>	---	0.102	0.057
<i>Quercus palustris</i>	0.066	0.107	0.018
<i>Salix nigra</i>	0.280	---	0.012
<i>Tilia americana</i>	---	0.022	0.009
<i>Ulmus americana</i>	0.051	0.098	0.075
<i>Ulmus rubra</i>	0.013	0.049	0.047
<b>SHRUBS</b>			
<i>Alnus incana/serrulata</i>	---	0.120	0.008
<i>Aronia melanocarpa</i>	---	---	0.024
<i>Cephalanthus occidentalis</i>	---	0.153	0.122
<i>Cornus</i> spp.**	0.024	0.015	0.031
<i>Ilex verticillata</i>	---	0.098	0.136
<i>Lindera benzoin</i>	---	0.055	0.132
<i>Nemopanthus mucronata</i>	---	---	0.014
<i>Toxicodendron vernix</i>	---	---	0.007
<i>Vaccinium corymbosum</i>	---	---	0.064
<i>Viburnum recognitum</i>	---	0.067	0.100

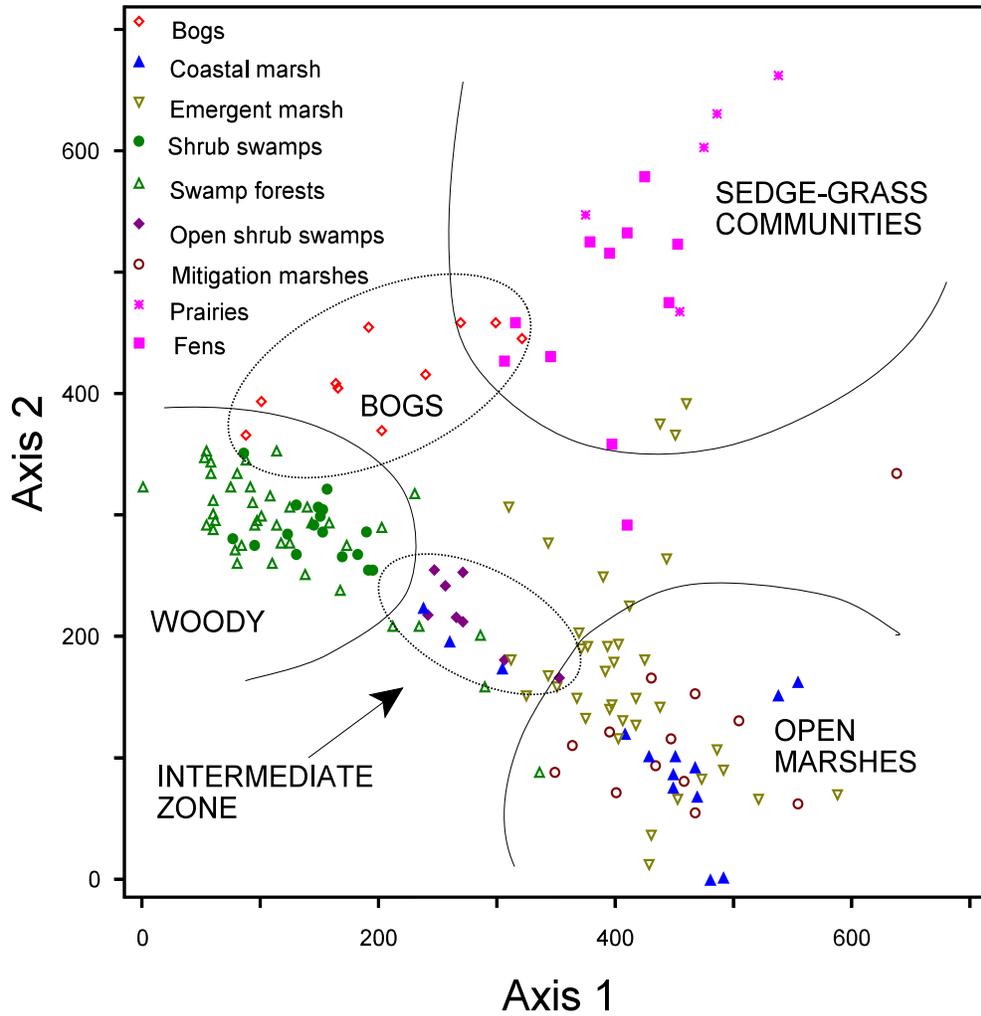


Figure 1. Detrended correspondence analysis of wetland vegetation data from 1999-2002 (n=156 plots). Total inertia (variance) in species data = 21.52; eigenvalues = 0.783, 0.706, 0.558 axes 1, 2, and 3, respectively.

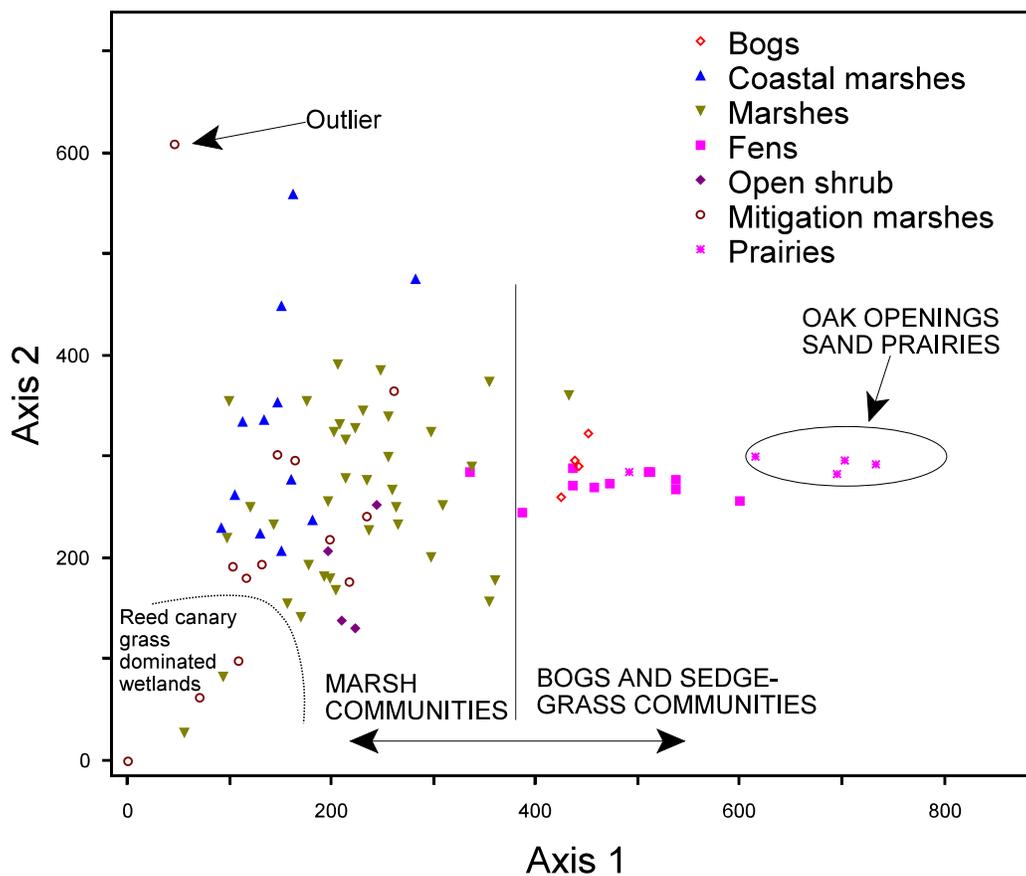


Figure 2. Detrended correspondence analysis of non-woody (except for some “open shrub” plots) wetland vegetation data from 1999-2002 (n=86 plots, 361 species). Total inertia (variance) in species data = 19.49; eigenvalues = 0.812, 0.679, 0.0.532 axes 1, 2, and 3, respectively.

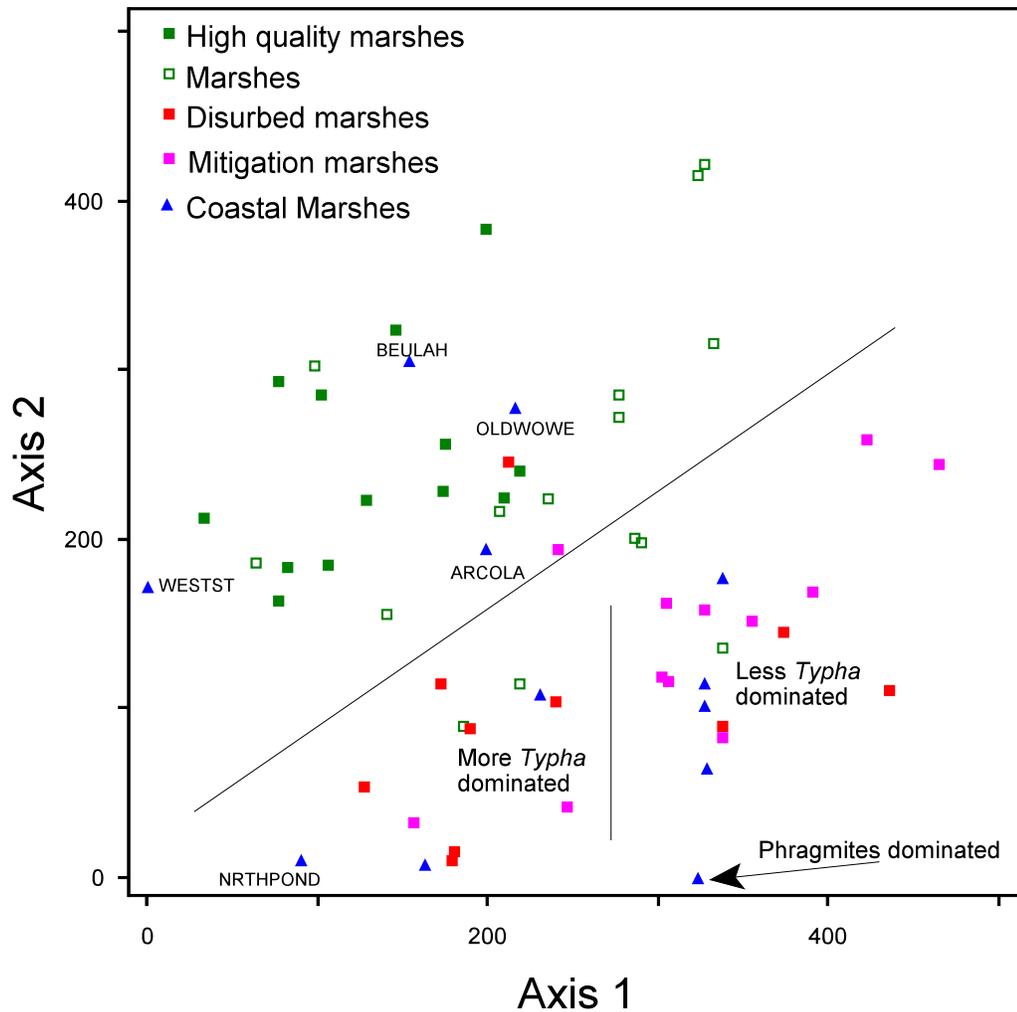


Figure 3. Detrended correspondence analysis of marsh wetland vegetation data from 1999-2002 (n=62 plots, 234 species). Total inertia (variance) in species data = 12.48; eigenvalues = 0.608, 0.550, 0.458 axes 1, 2, and 3, respectively. Most good to high quality natural marshes ordinate in the upper left of the plot with disturbed natural marshes, mitigation marshes and most coastal marshes ordinating towards the bottom right. Some exceptions occur for the coastal marshes (North Pond Kelleys Island, Arcola Creek, Beulah Beach and West St. Marsh (discussed in text).

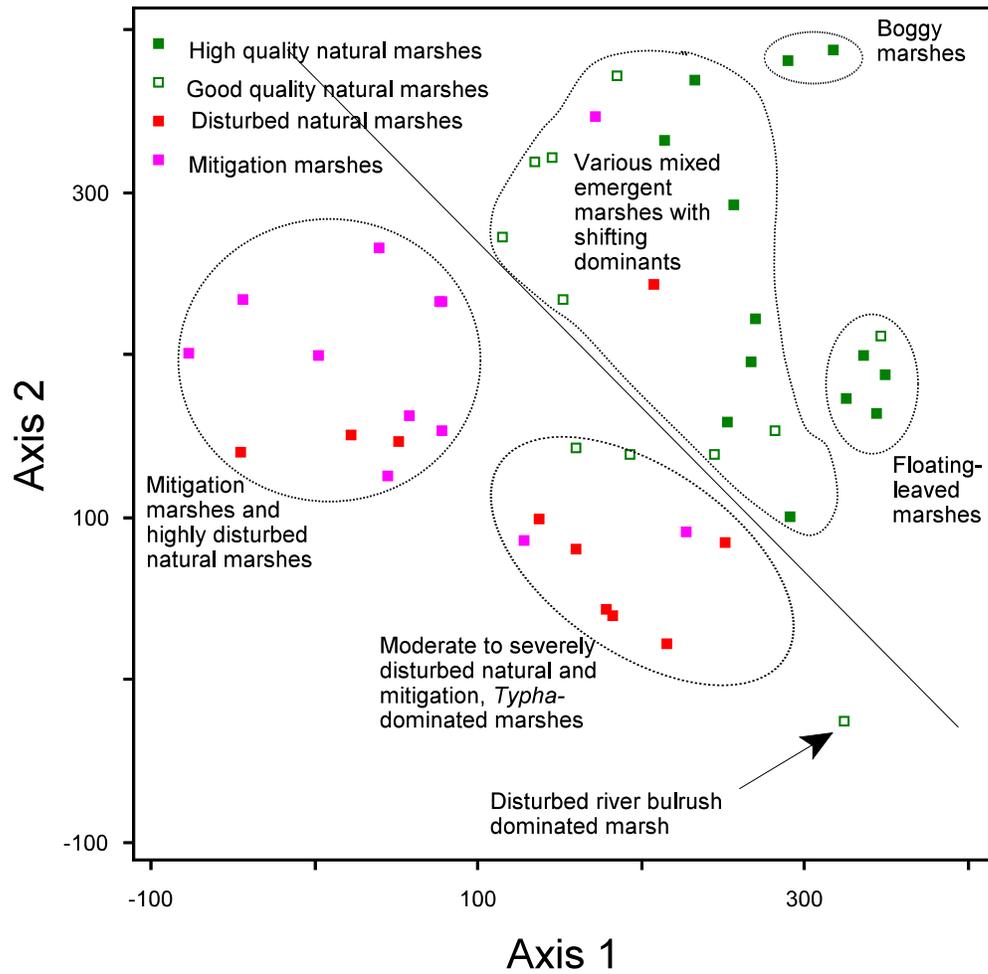


Figure 4. Detrended correspondence analysis of inland marsh (including mitigation marshes) wetland vegetation data from 1999-2002 (n=47 plots, 213 species). Total inertia (variance) in species data = 10.49; eigenvalues = 0.653, 0.560, 0.409 axes 1, 2, and 3, respectively.

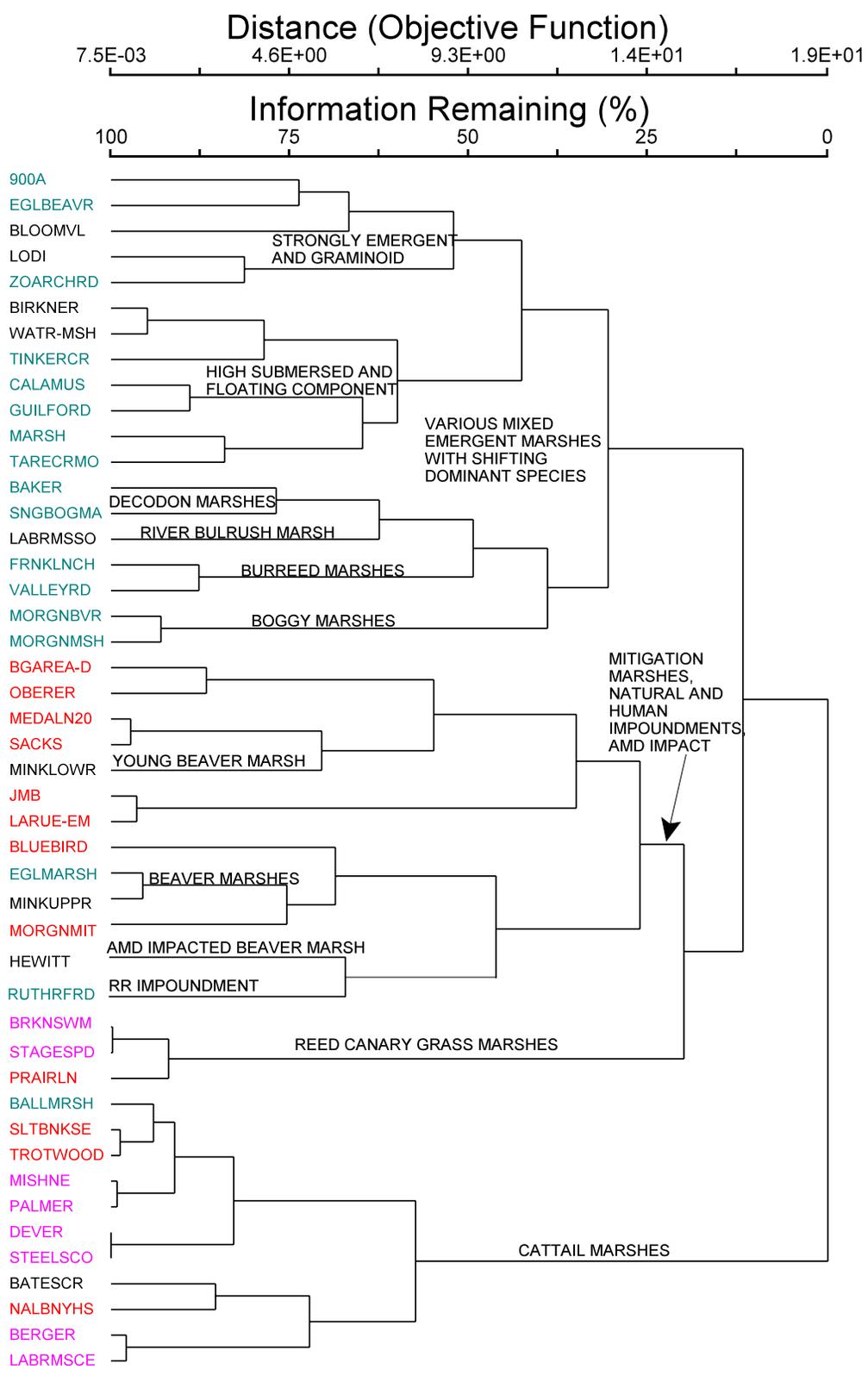


Figure 5. Cluster analysis of inland marsh data wetland vegetation data from 1999-2002 (n=47 plots, 213 species). Red=mitigation marshes, magenta=highly disturbed natural marshes, teal=undisturbed, high quality natural marshes, black=somewhat to moderately disturbed natural marshes.

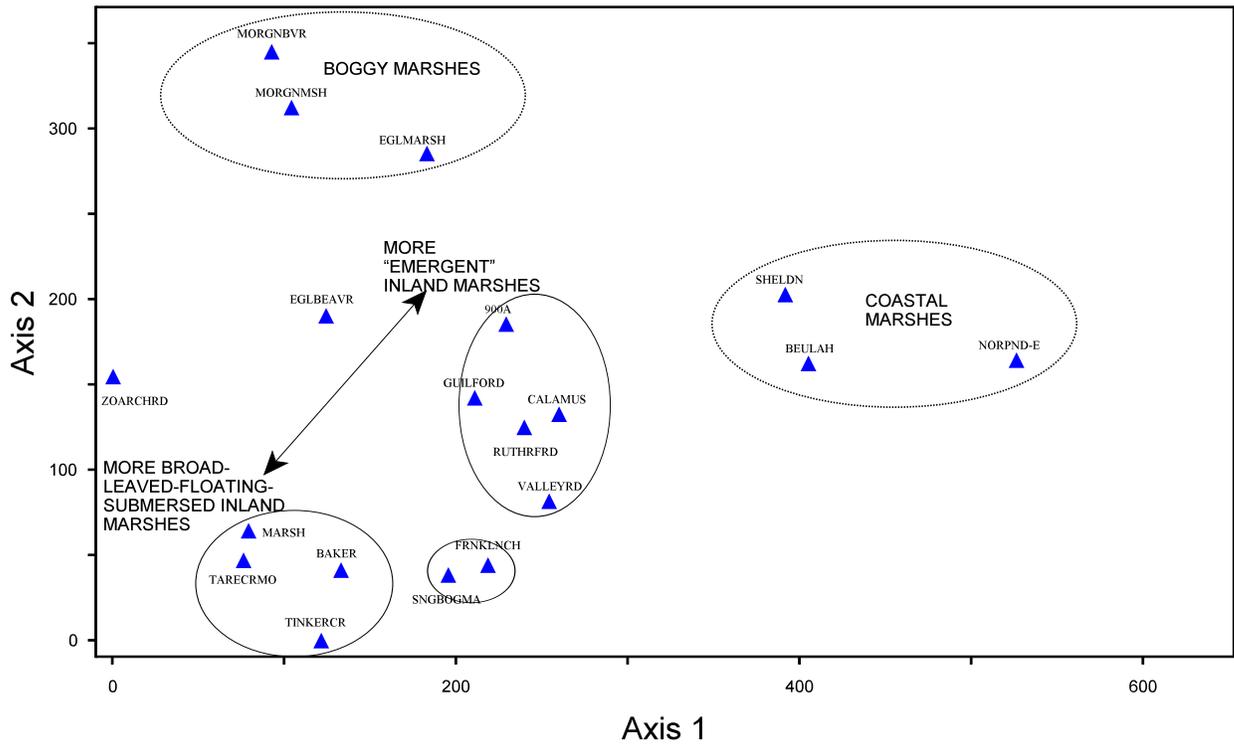


Figure 6. Detrended correspondence analysis of good to high quality inland marsh wetland vegetation data from 1999-2002 (n=19 plots, 153 species). Total inertia (variance) in species data = 6.58; eigenvalues = 0.641, 0.509, 0.330 axes 1, 2, and 3, respectively.

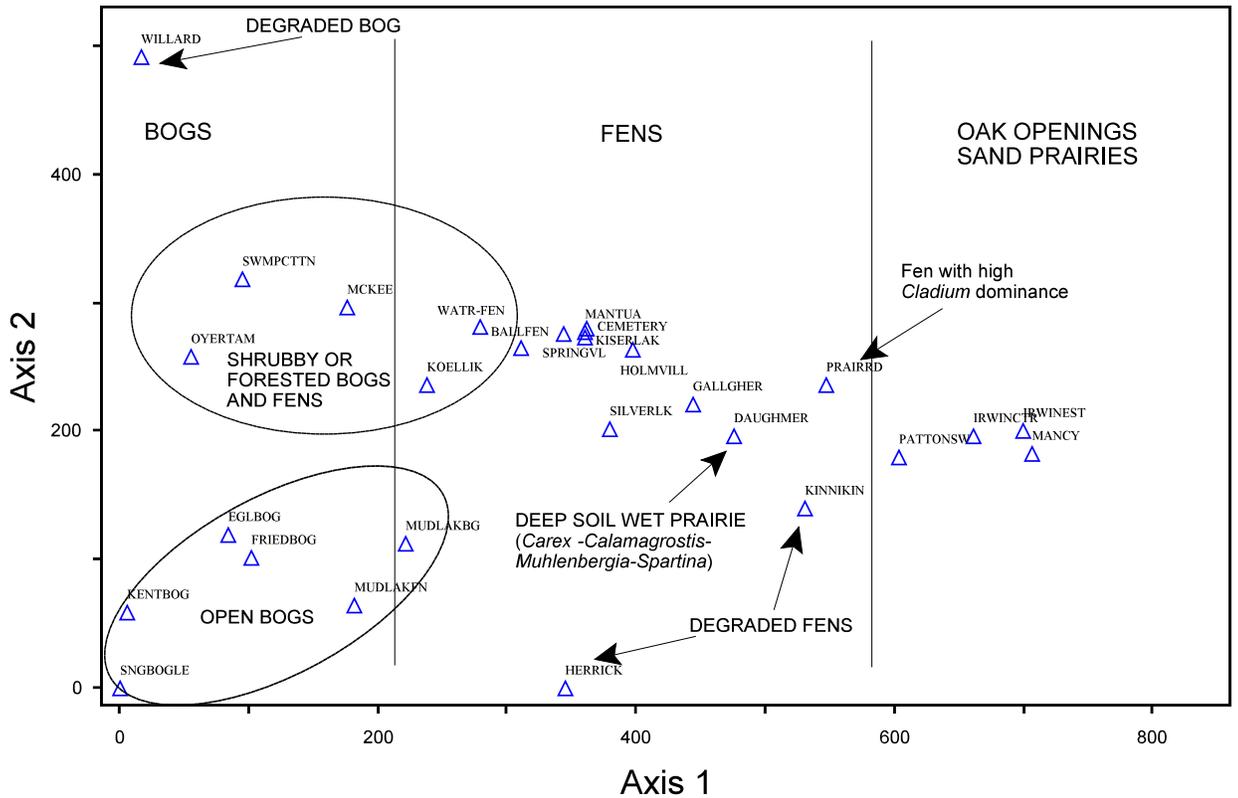


Figure 7. Detrended correspondence analysis of BOG, FENS, WET PRAIRIE, AND OAK OPENING SAND PRAIRIE vegetation data from 1999-2002 (n=28 plots, 246 species). Total inertia (variance) in species data = 9.75; eigenvalues = 0.851, 0.611, 0.512 axes 1, 2, and 3, respectively.

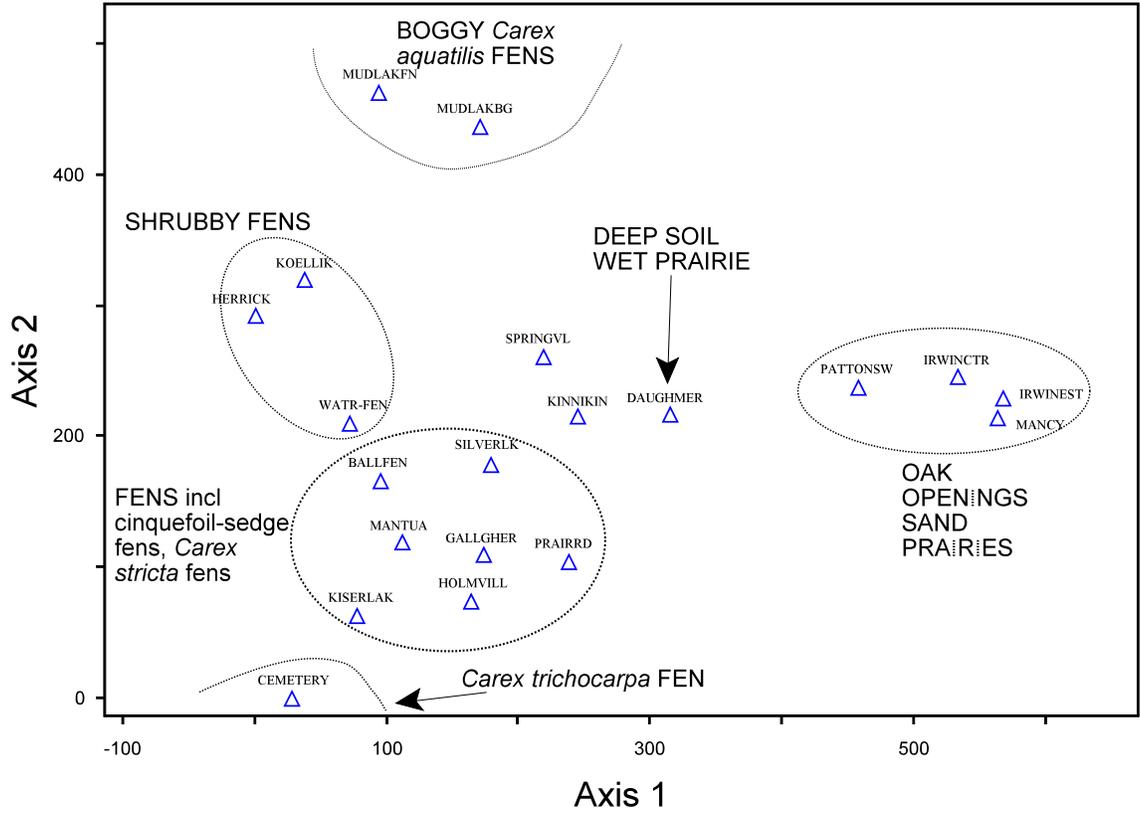


Figure 8. Detrended correspondence analysis of sedge-grass dominated wetlands (excluding degraded *Phalaris arundinacea* meadows) from 1999-2002 (n=20 plots, 214 species). Total inertia (variance) in species data = 7.58; eigenvalues = 0.815, 0.590, 0.590 axes 1, 2, and 3, respectively.

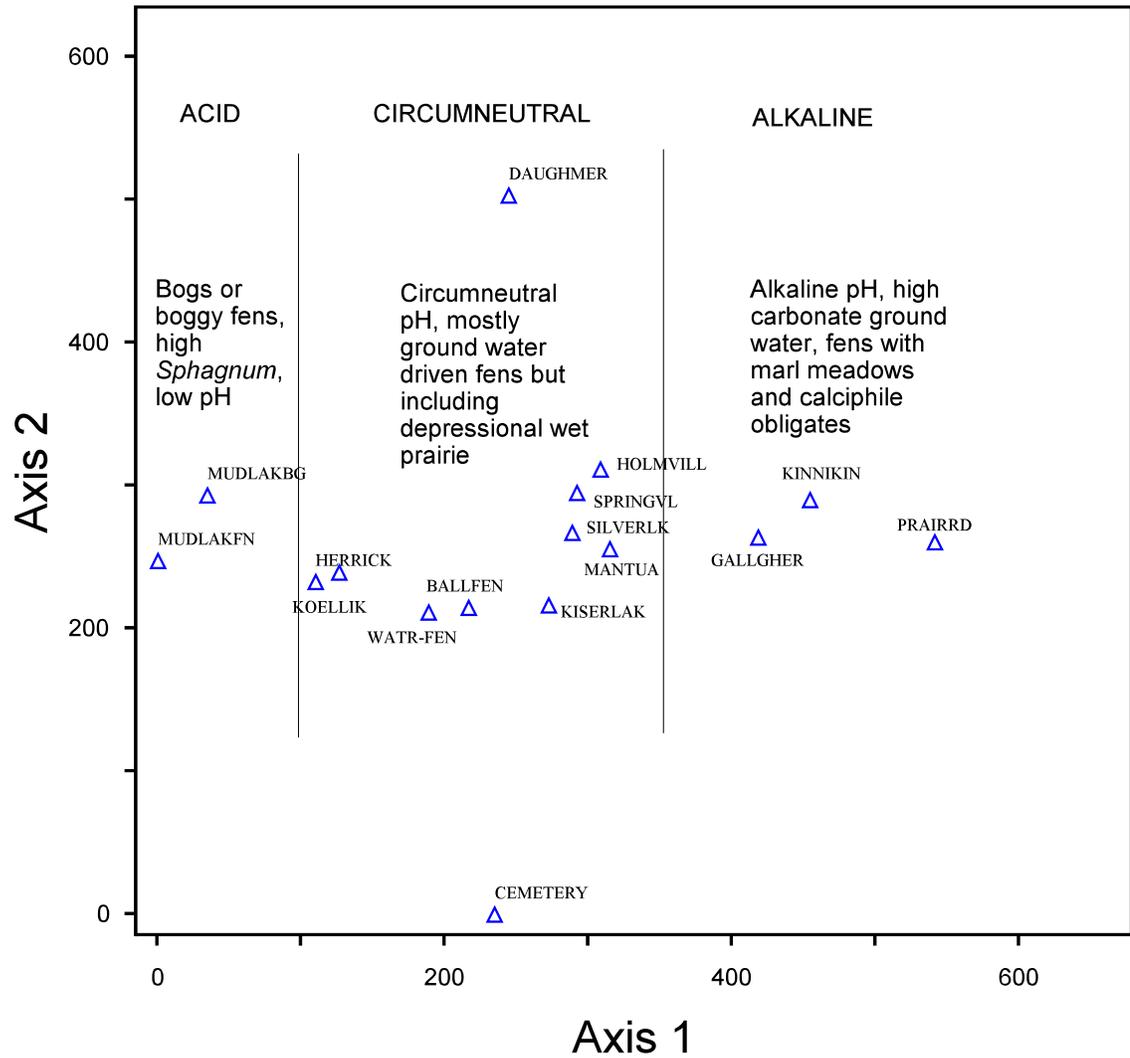


Figure 9. Detrended correspondence analysis of sedge-grass dominated wetlands (excluding Oak Openings sand prairies) from 1999-2002 (n=16 plots, 197 species). Total inertia (variance) in species data = .24; eigenvalues = 0.710, 0.583, 0.367 axes 1, 2, and 3, respectively.

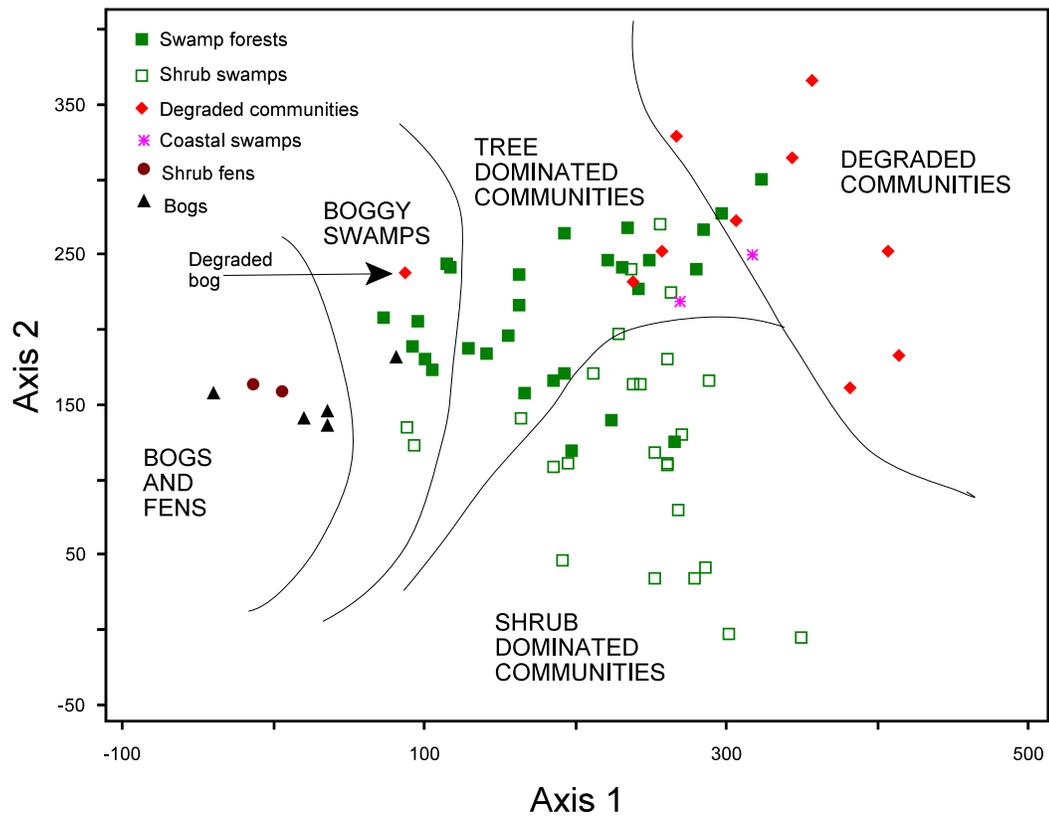


Figure 10. Detrended correspondence analysis of wetlands dominated by woody species from 1999-2002 (n=72 plots, 300 species). Total inertia (variance) in species data = 9.05; eigenvalues = 0.557, 0.433, 0.291 axes 1, 2, and 3, respectively.

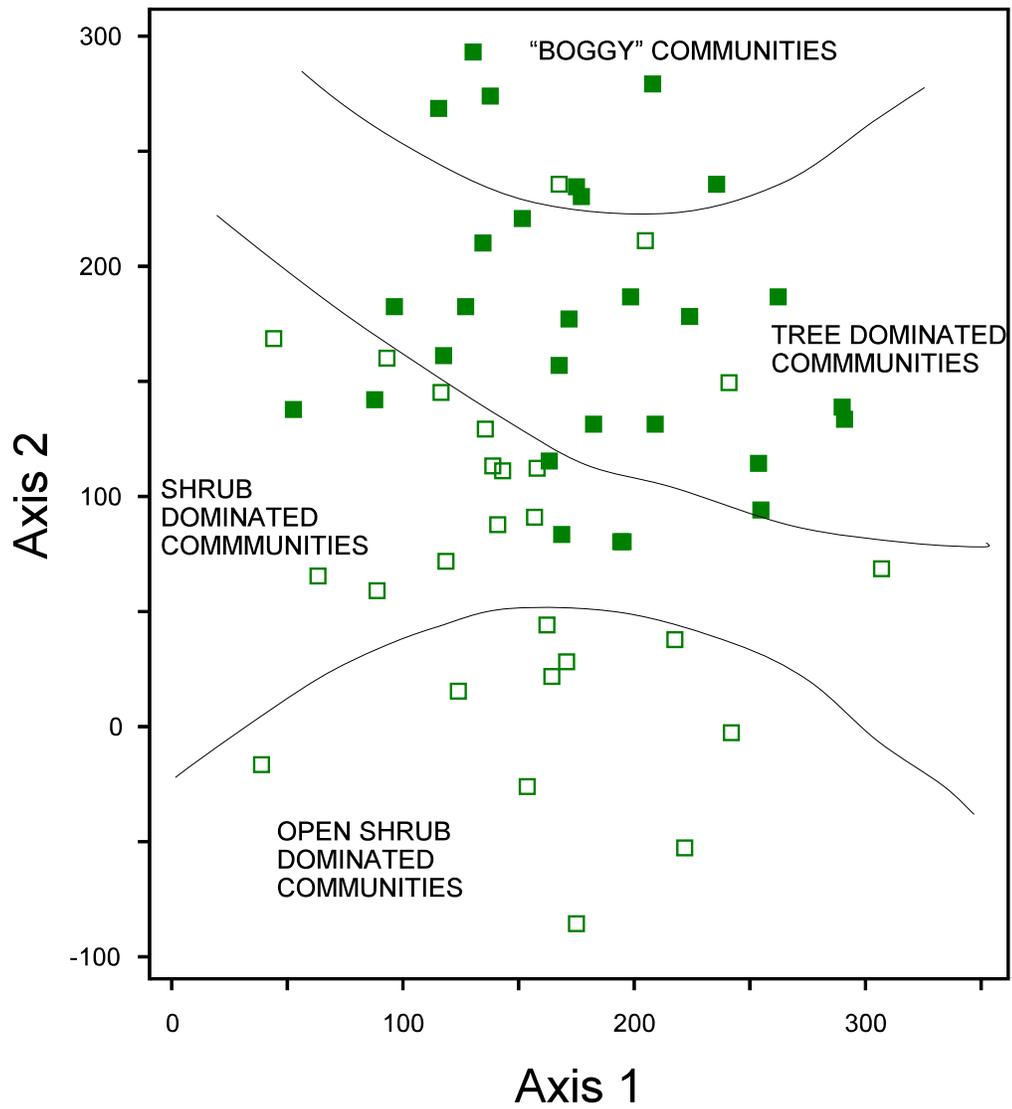


Figure 11. Detrended correspondence analysis of wetlands dominated by woody species (excluding bogs, fens, and degraded sites) from 1999-2002 (n=55 plots, 243 species). Total inertia (variance) in species data = 6.42; eigenvalues = 0.482, 0.322, 0.261 axes 1, 2, and 3, respectively.

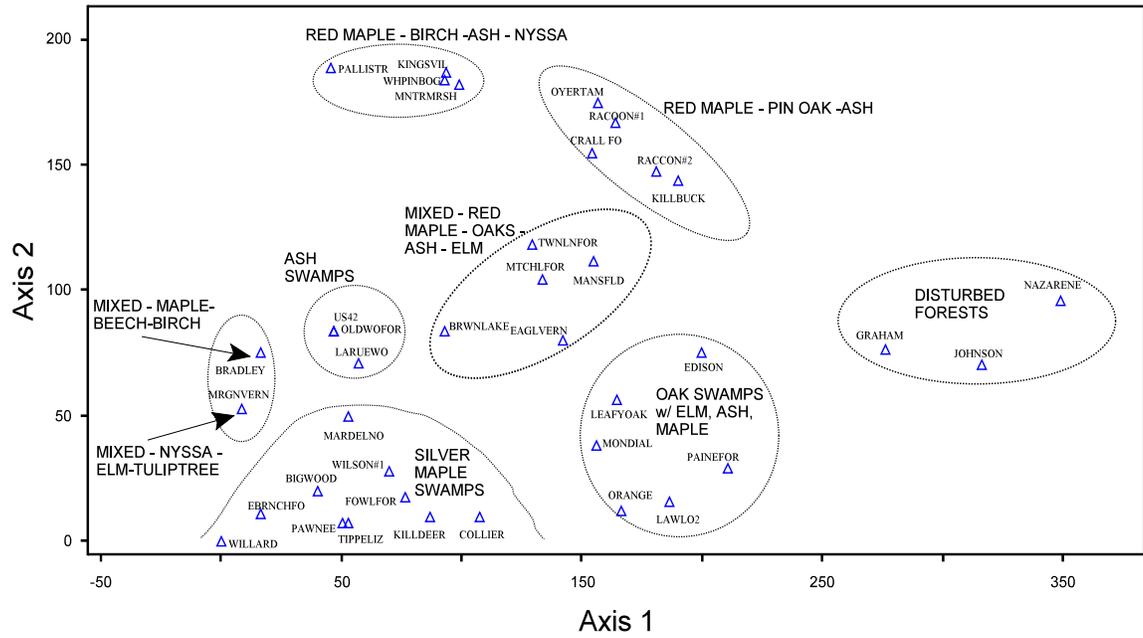


Figure 12. Detrended correspondence analysis of tree canopy species of forested from 1999-2002 (n=55 plots, 243 species). Total inertia (variance) in species data = 2.91; eigenvalues = 0.524, 0.347, 0.192 axes 1, 2, and 3, respectively.

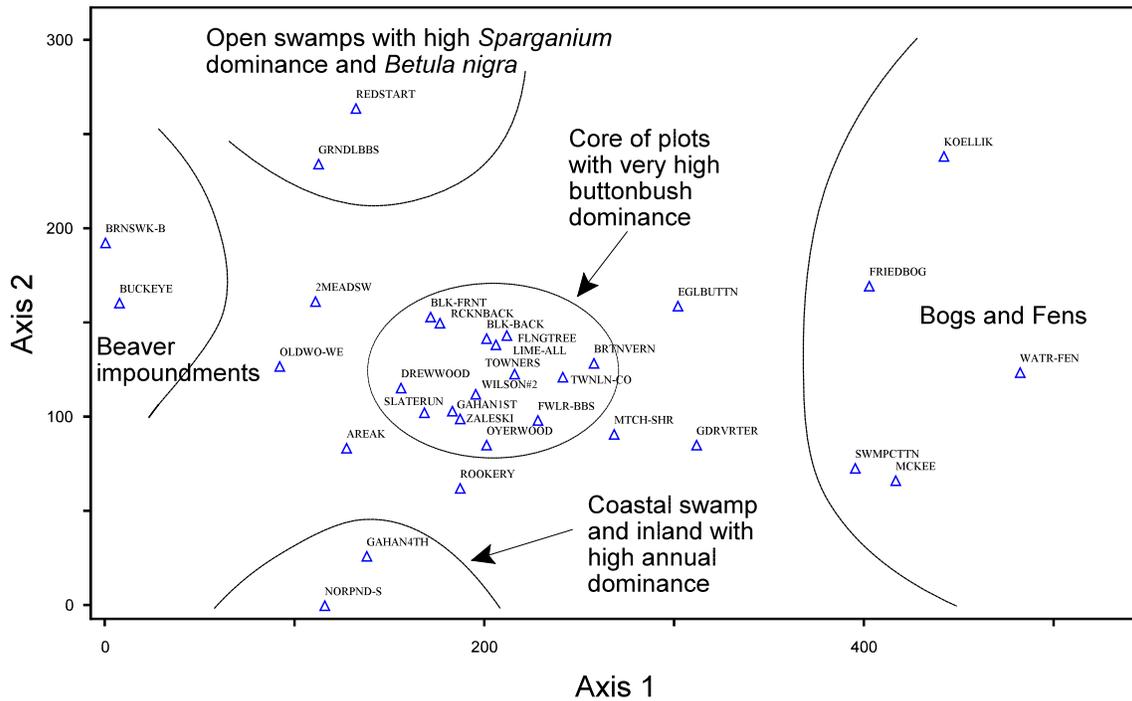


Figure 13. Detrended correspondence analysis of shrub swamps from 1999-2002 (n=33 plots, 186 species). Total inertia (variance) in species data = 6.352; eigenvalues = 0.685, 0.351, 0.264 axes 1, 2, and 3, respectively.

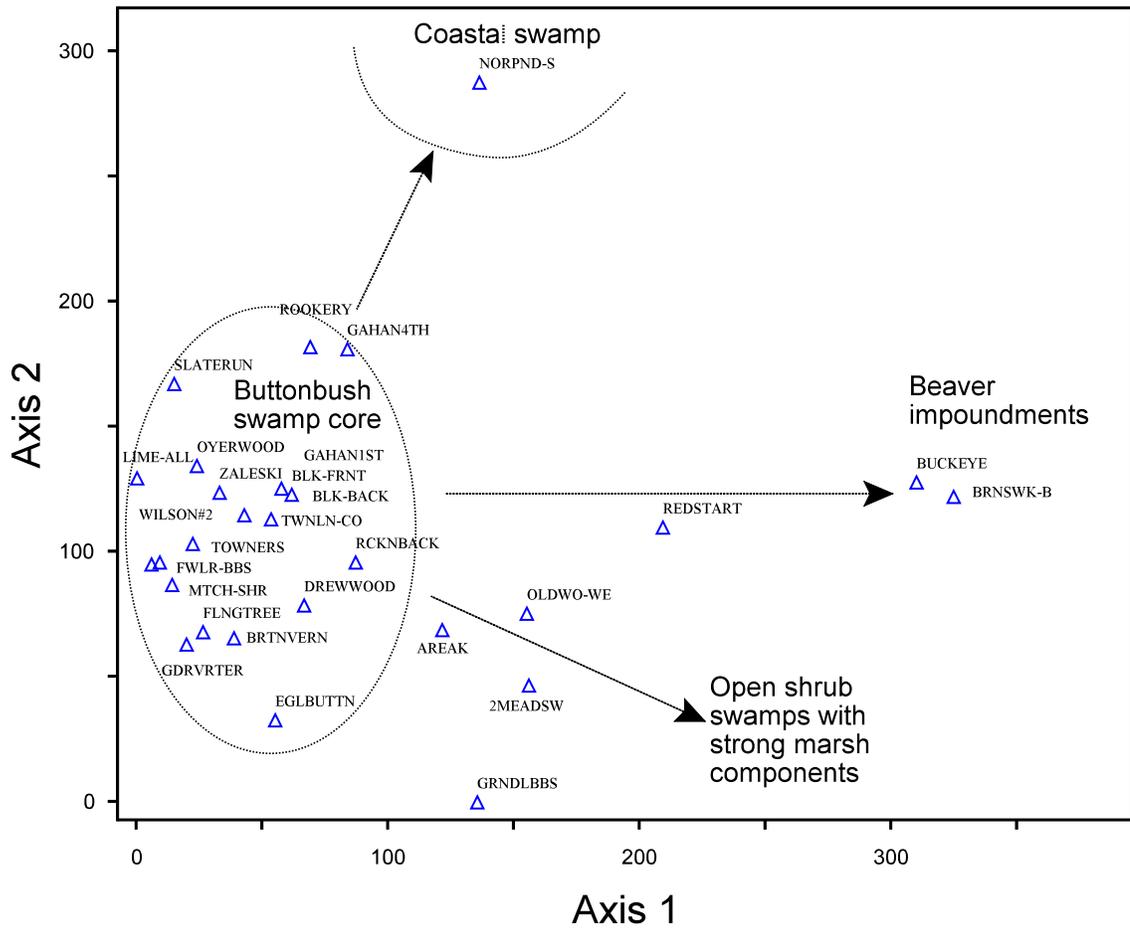


Figure 14. Detrended correspondence analysis of shrub swamps with no bog or fen sites, from 1999-2002 (n=28 plots, 159 species). Total inertia (variance) in species data = 4.884; eigenvalues = 0.658, 0.345, 0.227 axes 1, 2, and 3, respectively.

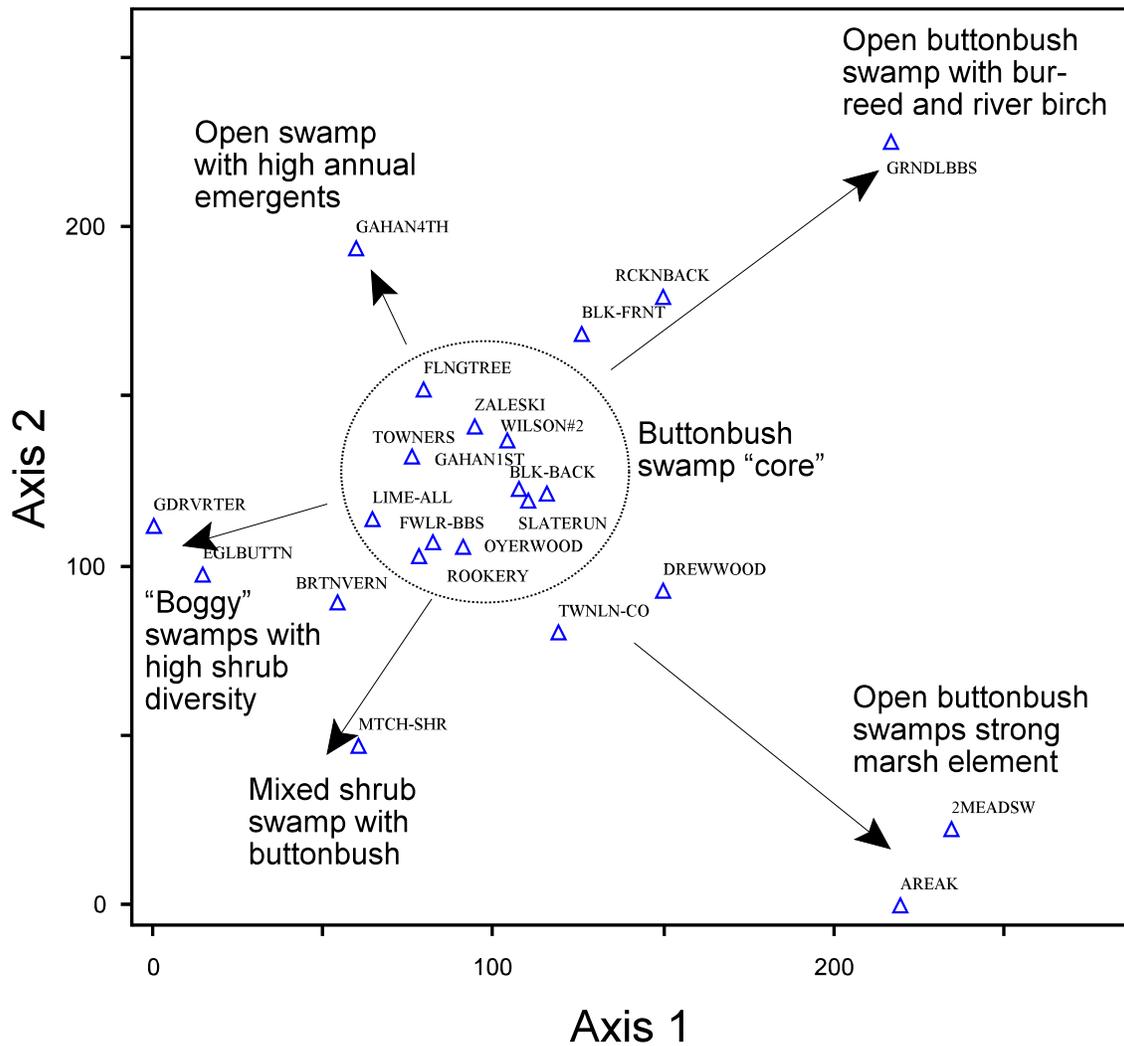


Figure 15. Detrended correspondence analysis of shrub swamps with no bog, fen, Lake Erie coastal sites, or beaver impoundments from 1999-2002 (n=23 plots, 133 species). Total inertia (variance) in species data = 3.733; eigenvalues = 0.418, 0.349, 0.193 axes 1, 2, and 3, respectively.

## **APPENDIX**

### **REPRESENTATIVE COMMUNITY SPECIES TEMPLATES**

EXPLANATION OF APPENDIX. Species lists are provided for most plant communities and hydrogeomorphic classes discussed in the text and summarized in Tables 1A and 1B. A relative abundance value is also provided based on average values from vegetation plots in sites listed below each community title. For tree species in forest and shrub communities, the abundance number is the importance value of that tree species (the average of relative frequency, density, and basal area). In every other instance, the abundance value is the relative cover of that species. In a few instances, plant community classes are further refined and species lists are provided for these subtypes. In particular the “swamp forest” class is divided into “vernal pools” and “wet woods”. Vernal pools are swamp forests that usually seasonally inundated and provide breeding habitat for ambystomid salamanders. They can often be rather sparsely vegetated. Wet woods are shallowly inundated to only saturated on a seasonal basis and can have abundant diverse herb and shrub layers. Data is also presented separately for swamp forests located on the fore slopes of ancient beach ridges (a type of forested “slope” wetland different from fens); and for Bradley Woods, a “hummock-hollow” swamp forest located at on the lake bed below and ancient beach ridge.

TYPE	SPECIES	ABUNDANCE
<b><u>Bog, tall shrub</u></b>	<i>Acer rubrum</i>	0.21200
Frieds Bog, Geauga Co.	<i>Acer saccharinum</i>	0.06230
Swamp Cottonwood, Medina Co.	<i>Aronia melanocarpa</i>	0.03961
	<i>Betula alleghaniensis</i>	0.21750
	<i>Bidens connata</i>	0.00037
	<i>Bidens discoidea</i>	0.00076
	<i>Boehmeria cylindrica</i>	0.00111
	Bryophyte	0.01012
	<i>Calla palustris</i>	0.05192
	<i>Carex bromoides</i>	0.00853
	<i>Carex canescens</i>	0.03115
	<i>Carex debilis</i> var. <i>debilis</i>	0.00183
	<i>Carex intumescens</i>	0.00061
	<i>Carex prasina</i>	0.00001
	<i>Carex seorsa</i>	0.03656
	<i>Carpinus caroliniana</i>	0.02820
	<i>Cephalanthus occidentalis</i>	0.07087
	<i>Cicuta bulbifera</i>	0.00074
	<i>Cinna arundinacea</i>	0.00037
	<i>Dulichium arundinaceum</i>	0.16690
	<i>Epilobium coloratum</i>	0.00037
	<i>Eupatorium perfoliatum</i>	0.00037
	<i>Fagus grandifolia</i>	0.09900
	<i>Festuca subverticillata</i>	0.00487
	<i>Fraxinus pennsylvanica</i>	0.13070
	<i>Galium tinctorium</i>	0.00074
	<i>Glyceria striata</i>	0.00183
	<i>Ilex verticillata</i>	0.12325
	<i>Impatiens capensis</i>	0.00446
	<i>Leersia oryzoides</i>	0.00520
	<i>Lycopus americanus</i>	0.00148
	<i>Lysimachia ciliata</i>	0.00001
	<i>Lysimachia thyriflora</i>	0.00148
	<i>Maianthemum canadense</i>	0.07129
	<i>Maianthemum racemosum</i>	0.00427
	<i>Mitchella repens</i>	0.01280
	<i>Nyssa sylvatica</i>	0.39155
	<i>Onoclea sensibilis</i>	0.00269
	<i>Osmunda cinnamomea</i>	0.08928
	<i>Osmunda regalis</i>	0.01084
	<i>Polygonum arifolium</i>	0.00037
	<i>Polygonum hydropiperoides</i>	0.00037
	<i>Polygonum sagittatum</i>	0.00149
	<i>Populus heterophylla</i>	0.22130
	<i>Potentilla simplex</i>	0.00001
	<i>Quercus bicolor</i>	0.16160
	<i>Quercus palustris</i>	0.03350
	<i>Rosa palustris</i>	0.10054
	<i>Rubus hispidus</i>	0.01122
	<i>Rumex orbiculatus</i>	0.00001
	<i>Salix bebbiana</i>	0.02820

TYPE	SPECIES	ABUNDANCE
	<i>Salix discolor</i>	0.02860
	<i>Salix sericea</i>	0.08220
	<i>Sambucus canadensis</i>	0.00427
	<i>Scirpus cyperinus</i>	0.00148
	<i>Sium suave</i>	0.00122
	<i>Sparganium eurycarpum</i>	0.00260
	<i>Sphagnum sp.</i>	0.15566
	<i>Symplocarpus foetidus</i>	0.05015
	<i>Thelypteris palustris</i>	0.05934
	<i>Toxicodendron vemix</i>	0.08856
	<i>Triadenum virginicum</i>	0.06020
	<i>Trientalis borealis</i>	0.00183
	<i>Typha latifolia</i>	0.00075
	<i>Ulmus americana</i>	0.02980
	<i>Ulmus rubra</i>	0.09020
	<i>Vaccinium corymbosum</i>	0.11366
	<i>Viburnum recognitum</i>	0.01828
<b><u>Bog, Tamarack-Hardwood</u></b>	<i>Acer rubrum</i>	0.52980
Oyer Tamarack, Williams Co.	<i>Actaea alba</i>	0.00001
	<i>Boehmeria cylindrica</i>	0.00001
	Bryophyte	0.06026
	<i>Caltha palustris</i>	0.00129
	<i>Carex atlantica</i> var. <i>atlantica</i>	0.00947
	<i>Carex lacustris</i>	0.00172
	<i>Carex leptalea</i>	0.00043
	<i>Carex trisperma</i>	0.00904
	<i>Coptis trifolia</i>	0.04304
	<i>Cypripedium acaule</i>	0.00001
	<i>Dryopteris carthusiana</i>	0.00129
	<i>Fagus grandifolia</i>	0.02960
	<i>Fraxinus nigra</i>	0.13080
	<i>Galium tinctorium</i>	0.00172
	<i>Glyceria striata</i>	0.00043
	<i>Huperzia lucidula</i>	0.00301
	<i>Ilex verticillata</i>	0.17380
	<i>Larix laricina</i>	0.22830
	<i>Leersia oryzoides</i>	0.00001
	<i>Lysimachia terrestris</i>	0.00088
	<i>Maianthemum canadense</i>	0.07748
	<i>Mitchella repens</i>	0.06026
	<i>Nyssa sylvatica</i>	0.03340
	<i>Onoclea sensibilis</i>	0.00301
	<i>Osmorhiza claytonii</i>	0.00001
	<i>Osmunda cinnamomea</i>	0.07748
	<i>Osmunda regalis</i>	0.00775
	<i>Parthenocissus quinquefolia</i>	0.00301
	<i>Pogonia ophioglossoides</i>	0.00044
	<i>Quercus bicolor</i>	0.02900
	<i>Rubus hispidus</i>	0.01593
	<i>Rubus pubescens</i>	0.05122
	<i>Solidago patula</i>	0.00043
	<i>Sphagnum sp.</i>	0.25396

TYPE	SPECIES	ABUNDANCE
<b><u>Bog, small kettle</u></b> McKee Bog, Richland Co. Eagle Creek, Portage Co.	<i>Symplocarpus foetidus</i>	0.01291
	<i>Thelypteris palustris</i>	0.00215
	<i>Toxicodendron vernix</i>	0.06150
	<i>Trientalis borealis</i>	0.01894
	<i>Ulmus americana</i>	0.03010
	<i>Vaccinium corymbosum</i>	0.12913
	<i>Viola blanda</i>	0.00172
	<i>Acer rubrum</i>	0.19868
	<i>Aronia melanocarpa</i>	0.05184
	Bryophyte	0.00620
	<i>Carex atlantica</i> var. <i>atlantica</i>	0.00620
	<i>Carex canescens</i>	0.11396
	<i>Carex lacustris</i>	0.01329
	<i>Carex lasiocarpa</i>	0.06643
	<i>Carex seorsa</i>	0.04429
	<i>Cephalanthus occidentalis</i>	0.01857
	<i>Dryopteris carthusiana</i>	0.00266
	<i>Dulichium arundinaceum</i>	0.06054
	<i>Eriophorum virginicum</i>	0.02065
	<i>Galium tinctorium</i>	0.00266
	<i>Glyceria striata</i>	0.00620
	<i>Ilex verticillata</i>	0.16386
	<i>Impatiens capensis</i>	0.00620
	<i>Lysimachia thyrsiflora</i>	0.00071
	<i>Menyanthes trifoliata</i>	0.03100
	<i>Osmunda cinnamomea</i>	0.02713
	<i>Osmunda regalis</i>	0.00620
<i>Parthenocissus quinquefolia</i>	0.00266	
<i>Quercus bicolor</i>	0.00214	
<i>Rosa palustris</i>	0.03322	
<i>Rubus hispidus</i>	0.00071	
<i>Salix bebbiana</i>	0.03940	
<i>Sambucus canadensis</i>	0.03070	
<i>Scirpus cyperinus</i>	0.06186	
<i>Sium suave</i>	0.00266	
<i>Sphagnum</i> sp.	0.22096	
<i>Spiraea alba</i>	0.00620	
<i>Symplocarpus foetidus</i>	0.06677	
<i>Toxicodendron vernix</i>	0.18454	
<i>Vaccinium corymbosum</i>	0.07024	
<i>Vaccinium macrocarpon</i>	0.05992	
<i>Viburnum recognitum</i>	0.02657	
<b><u>Bog, leatherleaf</u></b> Singer Lake Bog, Summit Co. Kent Bog, Portage Co.	<i>Acer rubrum</i>	0.22740
	<i>Aronia melanocarpa</i>	0.02088
	<i>Betula populifolia</i>	0.31800
	Bryophyte	0.01601
	<i>Calla palustris</i>	0.00199
	<i>Carex canescens</i>	0.00036
	<i>Carex oligosperma</i>	0.00302
	<i>Cephalanthus occidentalis</i>	0.01060
	<i>Chamaedaphne calyculata</i>	0.39928
	<i>Decodon verticillatus</i>	0.04771

TYPE	SPECIES	ABUNDANCE
	<i>Eriophorum virginicum</i>	0.00818
	<i>Larix laricina</i>	0.30770
	<i>Nuphar advena</i>	0.01988
	<i>Osmunda cinnamomea</i>	0.01044
	<i>Polygonum amphibium</i>	0.00530
	<i>Sphagnum</i> sp.	0.44626
	<i>Toxicodendron vernix</i>	0.00133
	<i>Triadenum virginicum</i>	0.00070
	<i>Vaccinium corymbosum</i>	0.03234
	<i>Woodwardia virginica</i>	0.02088
<b><u>Buttonbush swamp (ECBP region)</u></b>	<i>Acer rubrum</i>	0.31149
Gahanna Woods, Franklin Co.	<i>Acer saccharinum</i>	0.34786
Slate Run, Pickaway Co.	<i>Acer saccharum</i>	0.16480
Drew Woods, Mercer Co.	<i>Agrimonia parviflora</i>	0.00001
Area K, Marion Co.	<i>Agrostis hyemalis</i>	0.00112
The Rookery, Delaware Co.	<i>Asclepias incarnata</i>	0.00040
	<i>Bidens connata</i>	0.00382
	<i>Bidens coronata</i>	0.00319
	<i>Bidens discoidea</i>	0.02028
	<i>Boehmeria cylindrica</i>	0.04986
	Bryophyte	0.05020
	<i>Cardamine pensylvanica</i>	0.00001
	<i>Carex bromoides</i>	0.03644
	<i>Carex cristatella</i>	0.00822
	<i>Carex grayi</i>	0.08215
	<i>Carex intumescens</i>	0.00002
	<i>Carex laevivaginata</i>	0.00202
	<i>Carex lupulina</i>	0.00619
	<i>Carex muskingumensis</i>	0.11775
	<i>Carex stipata</i>	0.00256
	<i>Carex tribuloides</i>	0.00120
	<i>Carpinus caroliniana</i>	0.11100
	<i>Cephalanthus occidentalis</i>	0.37898
	<i>Cinna arundinacea</i>	0.00110
	<i>Cornus amomum</i>	0.01314
	<i>Cryptotaenia canadensis</i>	0.00234
	<i>Cuscuta gronovii</i>	0.00000
	<i>Decodon verticillatus</i>	0.03194
	<i>Dryopteris carthusiana</i>	0.00220
	<i>Fraxinus nigra</i>	0.29655
	<i>Fraxinus pennsylvanica</i>	0.24128
	<i>Galium asprellum</i>	0.01211
	<i>Galium tinctorium</i>	0.00199
	<i>Galium triflorum</i>	0.00000
	<i>Glyceria septentrionalis</i>	0.16058
	<i>Glyceria striata</i>	0.02898
	<i>Impatiens capensis</i>	0.01378
	<i>Iris versicolor</i>	0.04976
	<i>Laportea canadensis</i>	0.00767
	<i>Leersia oryzoides</i>	0.00254
	<i>Lemna minor</i>	0.09434
	<i>Lindera benzoin</i>	0.02544

TYPE	SPECIES	ABUNDANCE
	Ludwigia palustris	0.00658
	Lycopus rubellus	0.00338
	Lysimachia terrestris	0.00102
	Onoclea sensibilis	0.00677
	Osmorhiza claytonii	0.00350
	Pilea pumila	0.00235
	Polygonatum pubescens	0.00123
	Polygonum amphibium	0.05782
	Polygonum hydropiperoides	0.04141
	Polygonum punctatum	0.13088
	Polygonum virginianum	0.00350
	Populus deltoides	0.08920
	Proserpinaca palustris	0.00986
	Prunus virginiana	0.01620
	Quercus bicolor	0.15893
	Quercus palustris	0.09214
	Ranunculus abortivus	0.00005
	Ranunculus flabellaris	0.01212
	Ranunculus hispidus	0.00471
	Ribes americanum	0.00818
	Riccia fluitans	0.01294
	Ricciocarpos natans	0.01101
	Rosa palustris	0.03286
	Rubus pubescens	0.00002
	Rumex verticillatus	0.00546
	Salix nigra	0.17673
	Scutellaria lateriflora	0.00592
	Sium suave	0.01234
	Sphagnum sp.	0.00080
	Spirodela polyrhiza	0.23095
	Symplocarpus foetidus	0.00254
	Ulmus americana	0.12412
	Ulmus rubra	0.11525
	Veronica scutellata	0.00119
	Viola sp.	0.00118
	Vitis riparia	0.00848
<b>Buttonbush swamp (EOLP region)</b>	Acer rubrum	0.34997
Grand River Terraces, Ashtabula Co.	Acer saccharinum	0.12950
Fowler Woods, Richland Co.	Agrimonia parviflora	0.00084
Towners Woods, Portage Co.	Aronia melanocarpa	0.00467
Townline Rd., Richland Co.	Asclepias incarnata	0.00200
	Betula alleghaniensis	0.32870
	Bidens discoidea	0.07685
	Boehmeria cylindrica	0.02001
	Bryophyte	0.03438
	Caltha palustris	0.00084
	Carex bromoides	0.12667
	Carex folliculata	0.00067
	Carex gracillima	0.00169
	Carex lupulina	0.00002
	Carex scoparia	0.00467

TYPE	SPECIES	ABUNDANCE
	<i>Carex seorsa</i>	0.06602
	<i>Carex stipata</i>	0.00076
	<i>Carex tribuloides</i>	0.00067
	<i>Carpinus caroliniana</i>	0.04465
	<i>Carya ovata</i>	0.02900
	<i>Cephalanthus occidentalis</i>	0.49160
	<i>Cinna arundinacea</i>	0.01267
	<i>Dryopteris carthusiana</i>	0.00892
	<i>Eupatorium perfoliatum</i>	0.00067
	<i>Festuca subverticillata</i>	0.00003
	<i>Fraxinus pennsylvanica</i>	0.13970
	<i>Galium tinctorium</i>	0.00668
	<i>Glyceria acutiflora</i>	0.02113
	<i>Glyceria septentrionalis</i>	0.00200
	<i>Glyceria striata</i>	0.04012
	<i>Hamamelis virginiana</i>	0.02980
	<i>Ilex verticillata</i>	0.03116
	<i>Impatiens capensis</i>	0.03659
	<i>Lemna minor</i>	0.00192
	<i>Lindera benzoin</i>	0.02194
	<i>Lycopus rubellus</i>	0.00192
	<i>Lysimachia thyriflora</i>	0.04803
	<i>Maianthemum canadense</i>	0.01201
	<i>Mitchella repens</i>	0.00200
	<i>Nyssa sylvatica</i>	0.15510
	<i>Onoclea sensibilis</i>	0.01030
	<i>Osmunda cinnamomea</i>	0.06416
	<i>Parthenocissus quinquefolia</i>	0.00204
	<i>Polygonatum biflorum</i>	0.00003
	<i>Polygonum sagittatum</i>	0.01001
	<i>Polygonum virginianum</i>	0.02533
	<i>Populus heterophylla</i>	0.24970
	<i>Prunus virginiana</i>	0.06130
	<i>Quercus bicolor</i>	0.11050
	<i>Quercus palustris</i>	0.32650
	<i>Ranunculus abortivus</i>	0.00253
	<i>Rosa palustris</i>	0.08734
	<i>Rubus hispidus</i>	0.00600
	<i>Salix exigua</i>	0.01001
	<i>Salix nigra</i>	0.05415
	<i>Sambucus canadensis</i>	0.00076
	<i>Sium suave</i>	0.00002
	<i>Sphagnum sp.</i>	0.05604
	<i>Symplocarpus foetidus</i>	0.09289
	<i>Tilia americana</i>	0.02930
	<i>Ulmus americana</i>	0.15310
	<i>Ulmus rubra</i>	0.20100
	<i>Vaccinium corymbosum</i>	0.03800

TYPE	SPECIES	ABUNDANCE
	<i>Viburnum recognitum</i>	0.06815
	<i>Viola</i> sp.	0.00084
	<i>Woodwardia virginica</i>	0.08339
<b><u>Mixed shrub swamp</u></b>	<i>Acer rubrum</i>	0.18344
Mitchell Swamp, Huron Co.	<i>Acer saccharinum</i>	0.07426
Eagle Creek, Portage Co.	<i>Betula alleghaniensis</i>	0.00430
Burton Lakes, Geauga Co.	<i>Bidens connata</i>	0.07154
	<i>Bidens discoidea</i>	0.04608
	<i>Boehmeria cylindrica</i>	0.00346
	Bryophyte	0.02110
	<i>Carex atlantica</i> var. <i>atlantica</i>	0.04744
	<i>Carex bromoides</i>	0.01400
	<i>Carex canescens</i>	0.00519
	<i>Carex comosa</i>	0.00445
	<i>Carex stipata</i>	0.00168
	<i>Carex tribuloides</i>	0.01316
	<i>Cephalanthus occidentalis</i>	0.29942
	<i>Cicuta bulbifera</i>	0.00374
	<i>Circaea lutetiana</i>	0.00003
	<i>Cornus amomum</i>	0.05180
	<i>Cornus sericea</i>	0.02467
	<i>Cuscuta gronovii</i>	0.00222
	<i>Dryopteris carthusiana</i>	0.01582
	<i>Dryopteris clintoniana</i>	0.01260
	<i>Epilobium ciliatum</i>	0.00519
	<i>Epilobium coloratum</i>	0.00286
	<i>Eupatorium perfoliatum</i>	0.00493
	<i>Fagus grandifolia</i>	0.02970
	<i>Festuca subverticillata</i>	0.00332
	<i>Galium tinctorium</i>	0.00344
	<i>Glyceria septentrionalis</i>	0.00430
	<i>Glyceria striata</i>	0.03154
	<i>Ilex verticillata</i>	0.10520
	<i>Impatiens capensis</i>	0.05467
	<i>Iris versicolor</i>	0.00741
	<i>Leersia oryzoides</i>	0.00284
	<i>Lemna minor</i>	0.00922
	<i>Lindera benzoin</i>	0.00222
	<i>Lycopodium obscurum</i>	0.00143
	<i>Lycopus americanus</i>	0.00143
	<i>Lycopus rubellus</i>	0.01334
	<i>Lysimachia thyrsoflora</i>	0.00164
	<i>Maianthemum canadense</i>	0.00143
	<i>Nuphar advena</i>	0.00593
	<i>Nyssa sylvatica</i>	0.07240
	<i>Onoclea sensibilis</i>	0.01053
	<i>Osmunda cinnamomea</i>	0.03458
	<i>Osmunda regalis</i>	0.01203

TYPE	SPECIES	ABUNDANCE
	<i>Polygonum sagittatum</i>	0.00596
	<i>Quercus palustris</i>	0.00222
	<i>Ribes americanum</i>	0.03060
	<i>Ribes cynosbati</i>	0.00658
	<i>Riccia fluitans</i>	0.00371
	<i>Rosa palustris</i>	0.09788
	<i>Rubus hispidus</i>	0.00112
	<i>Rumex verticillatus</i>	0.01480
	<i>Salix discolor</i>	0.24950
	<i>Salix lucida</i>	0.12010
	<i>Salix nigra</i>	0.20920
	<i>Salix sericea</i>	0.07224
	<i>Sambucus canadensis</i>	0.00650
	<i>Solidago rugosa</i>	0.00143
	<i>Sparganium americanum</i>	0.01112
	<i>Sphagnum</i> sp.	0.02214
	<i>Spiraea tomentosa</i>	0.00222
	<i>Symplocarpus foetidus</i>	0.00284
	<i>Thelypteris palustris</i>	0.00222
	<i>Toxicodendron vernix</i>	0.16310
	<i>Triadenum virginicum</i>	0.05708
	<i>Ulmus americana</i>	0.29020
	<i>Ulmus rubra</i>	0.13155
	<i>Vaccinium corymbosum</i>	0.04784
	<i>Viburnum recognitum</i>	0.02754
	<i>Viola</i> sp.	0.00294
	<i>Acer rubrum</i>	0.49650
	<i>Alnus serrulata</i>	0.18200
	<i>Betula nigra</i>	0.18900
	<i>Boehmeria cylindrica</i>	0.00048
	Bryophyte	0.00800
	<i>Carex crinita</i> var. <i>crinita</i>	0.00286
	<i>Carex intumescens</i>	0.00095
	<i>Carex lupulina</i>	0.02089
	<i>Carex stipata</i>	0.00000
	<i>Carex tribuloides</i>	0.00380
	<i>Cephalanthus occidentalis</i>	0.32630
	<i>Elodea canadensis</i>	0.51277
	<i>Galium tinctorium</i>	0.00560
	<i>Glyceria striata</i>	0.00095
	<i>Hibiscus moscheutos</i>	0.00285
	<i>Ilex verticillata</i>	0.04789
	<i>Juncus effusus</i>	0.00769
	<i>Leersia oryzoides</i>	0.00285
	<i>Lemna minor</i>	0.01406
	<i>Ludwigia palustris</i>	0.01329
	<i>Onoclea sensibilis</i>	0.00570
	<i>Osmunda regalis</i>	0.02508
<b><u>Buttonbush Swamp (WAP region)</u></b>		
Greendale Swamp, Hocking Co.		
Falling Tree, Vinton Co.		

TYPE	SPECIES	ABUNDANCE
	<i>Polygonum hydropiperoides</i>	0.02089
	<i>Polygonum sagittatum</i>	0.00002
	<i>Quercus palustris</i>	0.20130
	<i>Rosa palustris</i>	0.00342
	<i>Scirpus cyperinus</i>	0.00114
	<i>Scutellaria lateriflora</i>	0.00002
	<i>Sparganium americanum</i>	0.03856
	<i>Spiraea tomentosa</i>	0.01997
	<i>Thelypteris noveboracensis</i>	0.00114
	<i>Triadenum virginicum</i>	0.00002
	<i>Ulmus rubra</i>	0.00570
	<i>Utricularia gibba</i>	0.34204
	<i>Wolffia brasiliensis</i>	0.04938
<b><u>Fen, calcareous</u></b>	<i>Acer rubrum</i>	0.00076
Prairie Rd. Fen, Clark Co.	<i>Agrimonia parviflora</i>	0.00000
Gallagher Fen, Clark Co.	<i>Allium canadense</i>	0.00569
Silver Lake Fen, Miami Co.	<i>Alnus incana</i>	0.01819
Mantua Bog, Portage Co.	<i>Andropogon gerardii</i>	0.02844
	<i>Angelica atropurpurea</i>	0.00757
	<i>Apios americana</i>	0.00076
	<i>Aronia melanocarpa</i>	0.02426
	<i>Asclepias incarnata</i>	0.00153
	<i>Aster puniceus</i>	0.00544
	<i>Betula lenta</i>	0.00002
	<i>Bromus ciliatus</i>	0.00606
	Bryophyte	0.00430
	<i>Cacalia suaveolens</i>	0.02972
	<i>Calamagrostis stricta</i>	0.00459
	<i>Caltha palustris</i>	0.01178
	<i>Campanula aparinoides</i>	0.00090
	<i>Cardamine pensylvanica</i>	0.00001
	<i>Carex buxbaumii</i>	0.00509
	<i>Carex flava</i>	0.00253
	<i>Carex granularis</i>	0.00001
	<i>Carex hystericina</i>	0.00247
	<i>Carex interior</i>	0.06541
	<i>Carex lacustris</i>	0.00002
	<i>Carex lasiocarpa</i>	0.01441
	<i>Carex leptalea</i>	0.00455
	<i>Carex pellita</i>	0.00229
	<i>Carex prairea</i>	0.03127
	<i>Carex sterilis</i>	0.01598
	<i>Carex stipata</i>	0.00459
	<i>Carex stricta</i>	0.15567
	<i>Carex suberecta</i>	0.02040
	<i>Carex tenera</i> var. <i>echinodes</i>	0.00066
	<i>Carex tetanica</i>	0.00299
	<i>Cicuta maculata</i>	0.00126

TYPE	SPECIES	ABUNDANCE
	<i>Cirsium muticum</i>	0.00536
	<i>Cladium mariscoides</i>	0.02260
	<i>Clematis virginiana</i>	0.00494
	<i>Cornus amomum</i>	0.01040
	<i>Deschampsia cespitosa</i>	0.04007
	<i>Dioscorea villosa</i>	0.00076
	<i>Drosera rotundifolia</i>	0.00126
	<i>Eleocharis elliptica</i>	0.01742
	<i>Eleocharis erythropoda</i>	0.00459
	<i>Eleocharis rostellata</i>	0.19258
	<i>Elymus trachycaulus</i>	0.00002
	<i>Equisetum laevigatum</i>	0.00128
	<i>Eupatorium maculatum</i>	0.00809
	<i>Eupatorium perfoliatum</i>	0.00627
	<i>Eupatorium purpureum</i>	0.00721
	<i>Filipendula rubra</i>	0.02900
	<i>Galium asprellum</i>	0.02752
	<i>Galium boreale</i>	0.00076
	<i>Galium tinctorium</i>	0.01441
	<i>Helianthus giganteus</i>	0.00076
	<i>Impatiens capensis</i>	0.00026
	<i>Juncus arcticus</i>	0.00076
	<i>Juncus dudleyi</i>	0.00763
	<i>Juncus torreyi</i>	0.00917
	<i>Lathyrus palustris</i>	0.00197
	<i>Liatris spicata</i>	0.05372
	<i>Lycopus americanus</i>	0.00076
	<i>Lysimachia ciliata</i>	0.00076
	<i>Lysimachia quadriflora</i>	0.00528
	<i>Lythrum alatum</i>	0.00038
	<i>Maianthemum stellatum</i>	0.00229
	<i>Melanthium virginicum</i>	0.03487
	<i>Monarda fistulosa</i>	0.00002
	<i>Onoclea sensibilis</i>	0.00531
	<i>Osmunda cinnamomea</i>	0.00834
	<i>Osmunda regalis</i>	0.02881
	<i>Oxypolis rigidior</i>	0.00531
	<i>Parnassia glauca</i>	0.00229
	<i>Phlox maculata</i>	0.00063
	<i>Physostegia virginiana</i>	0.00210
	<i>Polygonatum pubescens</i>	0.00063
	<i>Potentilla fruticosa</i>	0.08728
	<i>Pycnanthemum virginianum</i>	0.02737
	<i>Rhamnus alnifolia</i>	0.00227
	<i>Rhynchospora capillacea</i>	0.00459
	<i>Rosa palustris</i>	0.00334
	<i>Rubus hispidus</i>	0.00303
	<i>Rumex orbiculatus</i>	0.00197

TYPE	SPECIES	ABUNDANCE
	<i>Rumex verticillatus</i>	0.00076
	<i>Salix discolor</i>	0.00634
	<i>Salix petiolaris</i>	0.00983
	<i>Salix sericea</i>	0.00000
	<i>Sambucus canadensis</i>	0.00612
	<i>Sanguisorba canadensis</i>	0.03497
	<i>Schoenoplectus acutus</i>	0.04550
	<i>Schoenoplectus pungens</i>	0.03276
	<i>Schoenoplectus tabernaemontani</i>	0.00229
	<i>Scirpus atrovirens</i>	0.00305
	<i>Senecio aureus</i>	0.00382
	<i>Silphium terebinthinaceum</i>	0.01833
	<i>Silphium trifoliatum</i>	0.07422
	<i>Solidago ohioensis</i>	0.04969
	<i>Solidago patula</i>	0.01046
	<i>Solidago rugosa</i>	0.06368
	<i>Sorghastrum nutans</i>	0.02946
	<i>Sphagnum sp.</i>	0.04462
	<i>Symplocarpus foetidus</i>	0.00684
	<i>Thalictrum dasycarpum</i>	0.00569
	<i>Thelypteris palustris</i>	0.01824
	<i>Tofieldia glutinosa</i>	0.00330
	<i>Toxicodendron vemix</i>	0.01085
	<i>Triglochin maritima</i>	0.00298
	<i>Typha latifolia</i>	0.00160
	<i>Ulmus rubra</i>	0.00705
	<i>Urtica dioica var. procera</i>	0.00067
	<i>Vaccinium corymbosum</i>	0.00227
	<i>Vaccinium oxycoccus</i>	0.00227
	<i>Verbena hastata</i>	0.00459
	<i>Viola sp.</i>	0.00063
	<i>Vitis riparia</i>	0.00076
<b><u>Fen, other</u></b>	<i>Acer rubrum</i>	0.01031
Ballfield Fen, Knox Co.	<i>Acorus americanus</i>	0.08512
Cemetery Rd., Wayne Co.	<i>Agrimonia gryposepala</i>	0.03416
Holmsville Prairie, Holmes Co.	<i>Alnus incana</i>	0.03627
Kiser Lake, Champaign Co.	<i>Angelica atropurpurea</i>	0.00621
Mud Lake (bog), Williams Co.	<i>Apios americana</i>	0.01310
Mud Lake (fen), Williams Co.	<i>Asclepias incarnata</i>	0.00686
Kinnikinnick Prairie, Ross Co.	<i>Aster novae-angliae</i>	0.00658
	<i>Aster puniceus</i>	0.03858
	<i>Bromus ciliatus</i>	0.00167
	<i>Bryophyte</i>	0.04841
	<i>Calamagrostis canadensis</i>	0.01548
	<i>Caltha palustris</i>	0.01948
	<i>Campanula aparinoides</i>	0.00320
	<i>Cardamine pensylvanica</i>	0.00158
	<i>Carex annectens</i>	0.00213

TYPE	SPECIES	ABUNDANCE
	<i>Carex aquatilis</i>	0.13846
	<i>Carex atlantica</i> var. <i>capillacea</i>	0.00158
	<i>Carex hystericina</i>	0.02072
	<i>Carex interior</i>	0.01422
	<i>Carex lacustris</i>	0.07759
	<i>Carex lasiocarpa</i>	0.06466
	<i>Carex leptalea</i>	0.00983
	<i>Carex pellita</i>	0.02783
	<i>Carex stricta</i>	0.26183
	<i>Carex trichocarpa</i>	0.28061
	<i>Ceratophyllum demersum</i>	0.00252
	<i>Cicuta bulbifera</i>	0.00077
	<i>Cirsium muticum</i>	0.00326
	<i>Cornus amomum</i>	0.00574
	<i>Cornus sericea</i>	0.01464
	<i>Drosera rotundifolia</i>	0.03353
	<i>Eleocharis elliptica</i>	0.02114
	<i>Eleocharis erythropoda</i>	0.06210
	<i>Epilobium coloratum</i>	0.00003
	<i>Equisetum arvense</i>	0.00734
	<i>Eupatorium maculatum</i>	0.02201
	<i>Eupatorium perfoliatum</i>	0.00708
	<i>Euthamia graminifolia</i>	0.00260
	<i>Filipendula rubra</i>	0.00001
	<i>Galium tinctorium</i>	0.00565
	<i>Galium trifidum</i>	0.00002
	<i>Glyceria striata</i>	0.00352
	<i>Helenium autumnale</i>	0.00940
	<i>Impatiens capensis</i>	0.01005
	<i>Iris versicolor</i>	0.00764
	<i>Juncus brachycephalus</i>	0.01786
	<i>Juncus dudleyi</i>	0.01669
	<i>Juncus effusus</i>	0.01172
	<i>Juncus torreyi</i>	0.00752
	<i>Larix laricina</i>	0.00052
	<i>Lathyrus palustris</i>	0.00224
	<i>Leersia oryzoides</i>	0.02802
	<i>Lobelia kalmii</i>	0.00282
	<i>Lobelia siphilitica</i>	0.00047
	<i>Lycopus americanus</i>	0.00502
	<i>Lysimachia terrestris</i>	0.00362
	<i>Lythrum alatum</i>	0.00251
	<i>Mentha arvensis</i>	0.00269
	<i>Mimulus ringens</i>	0.00274
	<i>Muhlenbergia mexicana</i>	0.03524
	<i>Onoclea sensibilis</i>	0.05447
	<i>Osmunda regalis</i>	0.01294
	<i>Physocarpus opulifolius</i>	0.00158

TYPE	SPECIES	ABUNDANCE
	<i>Physostegia virginiana</i>	0.00002
	<i>Pilea pumila</i>	0.02315
	<i>Platanthera leucophaea</i>	0.00129
	<i>Poa palustris</i>	0.00421
	<i>Polygonum amphibium</i>	0.03654
	<i>Polygonum arifolium</i>	0.00126
	<i>Polygonum sagittatum</i>	0.00421
	<i>Pycnanthemum virginianum</i>	0.06036
	<i>Ribes americanum</i>	0.00001
	<i>Ribes hirtellum</i>	0.00543
	<i>Rosa palustris</i>	0.01513
	<i>Rosa setigera</i>	0.00053
	<i>Rubus hispidus</i>	0.00562
	<i>Rumex verticillatus</i>	0.00426
	<i>Salix amygdaloides</i>	0.00001
	<i>Salix discolor</i>	0.00928
	<i>Salix exigua</i>	0.02115
	<i>Salix humilis</i>	0.00789
	<i>Salix petiolaris</i>	0.00000
	<i>Salix sericea</i>	0.00724
	<i>Saxifraga pensylvanica</i>	0.00140
	<i>Schoenoplectus acutus</i>	0.00034
	<i>Schoenoplectus pungens</i>	0.00329
	<i>Schoenoplectus tabernaemontani</i>	0.01842
	<i>Scirpus atrovirens</i>	0.00450
	<i>Scirpus cyperinus</i>	0.00250
	<i>Scleria verticillata</i>	0.00329
	<i>Scutellaria galericulata</i>	0.00003
	<i>Sium suave</i>	0.00159
	<i>Solidago gigantea</i>	0.01264
	<i>Solidago ohioensis</i>	0.27725
	<i>Solidago patula</i>	0.02606
	<i>Solidago rugosa</i>	0.00843
	<i>Sorghastrum nutans</i>	0.16635
	<i>Sparganium eurycarpum</i>	0.10188
	<i>Sphagnum sp.</i>	0.24467
	<i>Spiraea alba</i>	0.00352
	<i>Stachys tenuifolia</i>	0.00379
	<i>Stellaria longifolia</i>	0.00141
	<i>Symplocarpus foetidus</i>	0.01552
	<i>Thelypteris palustris</i>	0.07464
	<i>Toxicodendron vemix</i>	0.04190
	<i>Tradescantia ohiensis</i>	0.01770
	<i>Triadenum virginicum</i>	0.01245
	<i>Typha latifolia</i>	0.01182
	<i>Vaccinium corymbosum</i>	0.01244
	<i>Verbena hastata</i>	0.00582
	<i>Verbena stricta</i>	0.00003

TYPE	SPECIES	ABUNDANCE
	<i>Verbesina alternifolia</i>	0.00133
	<i>Viburnum recognitum</i>	0.00000
	<i>Viola macloskeyi</i>	0.00274
	<i>Viola</i> sp.	0.00019
	<i>Vitis riparia</i>	0.00001
<b>Fen, tall shrub</b>	<i>Alnus incana</i>	0.05646
Koelliker Fen, Geauga Co.	<i>Angelica atropurpurea</i>	0.01888
Watercress Fen, Columbiana Co.	<i>Apios americana</i>	0.00252
	<i>Arisaema dracontium</i>	0.00141
	<i>Asclepias incarnata</i>	0.00517
	<i>Aster puniceus</i>	0.04453
	<i>Betula alleghaniensis</i>	0.00329
	<i>Bidens coronata</i>	0.00329
	<i>Boehmeria cylindrica</i>	0.00047
	<i>Bromus ciliatus</i>	0.00047
	Bryophyte	0.00793
	<i>Campanula aparinoides</i>	0.00141
	<i>Carex bromoides</i>	0.04091
	<i>Carex cristatella</i>	0.00189
	<i>Carex hystericina</i>	0.00165
	<i>Carex interior</i>	0.06293
	<i>Carex leptalea</i>	0.02328
	<i>Carex lurida</i>	0.00063
	<i>Carex scabrata</i>	0.00944
	<i>Carex stricta</i>	0.12229
	<i>Chelone glabra</i>	0.00204
	<i>Cirsium muticum</i>	0.00511
	<i>Clematis virginiana</i>	0.04139
	<i>Collinsonia canadensis</i>	0.00189
	<i>Cornus amomum</i>	0.01411
	<i>Cornus racemosa</i>	0.00329
	<i>Cornus sericea</i>	0.18250
	<i>Epilobium ciliatum</i>	0.00126
	<i>Epilobium coloratum</i>	0.00001
	<i>Equisetum fluviatile</i>	0.00047
	<i>Eupatorium maculatum</i>	0.00714
	<i>Eupatorium perfoliatum</i>	0.00534
	<i>Galium asprellum</i>	0.00376
	<i>Ilex verticillata</i>	0.01975
	<i>Impatiens capensis</i>	0.00518
	<i>Juncus effusus</i>	0.00189
	<i>Leersia oryzoides</i>	0.00150
	<i>Lindera benzoin</i>	0.02203
	<i>Lycopus americanus</i>	0.00189
	<i>Lycopus rubellus</i>	0.00047
	<i>Lysimachia ciliata</i>	0.00126
	<i>Muhlenbergia mexicana</i>	0.00047
	<i>Onoclea sensibilis</i>	0.05035

TYPE	SPECIES	ABUNDANCE
	<i>Osmunda cinnamomea</i>	0.00063
	<i>Pilea pumila</i>	0.00282
	<i>Polygonum amphibium</i>	0.00329
	<i>Polygonum arifolium</i>	0.00001
	<i>Polygonum hydropiperoides</i>	0.00189
	<i>Polygonum sagittatum</i>	0.00291
	<i>Rhamnus alnifolia</i>	0.01385
	<i>Ribes americanum</i>	0.00141
	<i>Rosa palustris</i>	0.01693
	<i>Rumex orbiculatus</i>	0.00047
	<i>Sagittaria latifolia</i>	0.00102
	<i>Salix discolor</i>	0.01258
	<i>Salix exigua</i>	0.00800
	<i>Salix sericea</i>	0.01570
	<i>Salix serrissima</i>	0.00944
	<i>Saxifraga pensylvanica</i>	0.00315
	<i>Scirpus atrovirens</i>	0.00189
	<i>Scirpus cyperinus</i>	0.00944
	<i>Scutellaria galericulata</i>	0.00047
	<i>Sium suave</i>	0.00047
	<i>Solidago patula</i>	0.08193
	<i>Solidago rugosa</i>	0.00692
	<i>Sparganium androcladum</i>	0.00063
	<i>Sparganium eurycarpum</i>	0.00470
	<i>Sphagnum sp.</i>	0.07552
	<i>Spiraea alba</i>	0.00314
	<i>Symplocarpus foetidus</i>	0.00441
	<i>Thelypteris palustris</i>	0.04370
	<i>Toxicodendron vernix</i>	0.14988
	<i>Typha latifolia</i>	0.03176
	<i>Ulmus rubra</i>	0.00658
	<i>Vaccinium corymbosum</i>	0.00441
	<i>Verbena hastata</i>	0.00944
	<i>Viburnum recognitum</i>	0.03528
<b><u>Beach Ridge Bottom Swamp Forest</u></b>	<i>Acer rubrum</i>	0.12000
Bradley Woods, Cuyahoga Co.	<i>Acer saccharinum</i>	0.46040
	<i>Betula alleghaniensis</i>	0.12960
	Bryophyte	0.04506
	<i>Carex crinita</i> var. <i>crinita</i>	0.00006
	<i>Carex louisianica</i>	0.00563
	<i>Carex seorsa</i>	0.06759
	<i>Cephalanthus occidentalis</i>	0.00845
	Cinna arundinacea	0.00845
	<i>Dryopteris carthusiana</i>	0.03661
	<i>Fagus grandifolia</i>	0.19150
	<i>Lindera benzoin</i>	0.40838
	<i>Liriodendron tulipifera</i>	0.03640
	<i>Maianthemum canadense</i>	0.04788

TYPE	SPECIES	ABUNDANCE
	<i>Mentha arvensis</i>	0.00563
	<i>Mitchella repens</i>	0.00845
	<i>Nyssa sylvatica</i>	0.03380
	<i>Osmunda cinnamomea</i>	0.03943
	<i>Scutellaria lateriflora</i>	0.00006
	<i>Trientalis borealis</i>	0.00563
	<i>Ulmus rubra</i>	0.03010
	<i>Vaccinium corymbosum</i>	0.00845
	<i>Viburnum recognitum</i>	0.06196
<b><u>Beach Slope Swamp Forest</u></b>	<i>Acer rubrum</i>	0.26360
N. Kingsville Sand Barrens, Ashtabula Co.	<i>Acer saccharum</i>	0.19610
Edison Woods, Erie Co.	<i>Actaea alba</i>	0.00072
	<i>Arisaema triphyllum</i> subsp. <i>triphyllum</i>	0.02257
	<i>Asimina triloba</i>	0.02880
	<i>Athyrium filix-femina</i>	0.02158
	<i>Betula alleghaniensis</i>	0.10240
	Bryophyte	0.01515
	<i>Carex bromoides</i>	0.00364
	<i>Carex gracillima</i>	0.01275
	<i>Carex lacustris</i>	0.01275
	<i>Carex laevivaginata</i>	0.00001
	<i>Carex radiata</i>	0.00364
	<i>Carex shortiana</i>	0.00182
	<i>Carex squarrosa</i>	0.00364
	<i>Carex tribuloides</i>	0.00182
	<i>Carpinus caroliniana</i>	0.05820
	<i>Carya ovata</i>	0.32850
	<i>Cinna arundinacea</i>	0.01821
	<i>Circaea lutetiana</i>	0.00911
	<i>Coptis trifolia</i>	0.00072
	<i>Dryopteris intermedia</i>	0.00719
	<i>Fraxinus nigra</i>	0.25220
	<i>Fraxinus pennsylvanica</i>	0.13840
	<i>Glyceria striata</i>	0.00654
	<i>Hamamelis virginiana</i>	0.10950
	<i>Hydrophyllum appendiculatum</i>	0.05827
	<i>Impatiens capensis</i>	0.10926
	<i>Lindera benzoin</i>	0.28775
	<i>Liriodendron tulipifera</i>	0.49570
	<i>Lysimachia ciliata</i>	0.10926
	<i>Maianthemum canadense</i>	0.03741
	<i>Onoclea sensibilis</i>	0.01842
	<i>Osmunda cinnamomea</i>	0.03741
	<i>Parthenocissus quinquefolia</i>	0.02544
	<i>Polygonatum pubescens</i>	0.00289
	<i>Polygonum virginianum</i>	0.00728
	<i>Prunus virginiana</i>	0.00144
	<i>Quercus bicolor</i>	0.26910

TYPE	SPECIES	ABUNDANCE
	<i>Quercus palustris</i>	0.22110
	<i>Ranunculus abortivus</i>	0.00007
	<i>Sambucus canadensis</i>	0.01295
	<i>Symplocarpus foetidus</i>	0.45680
	<i>Tiarella cordifolia</i>	0.01870
	<i>Tilia americana</i>	0.02960
	<i>Ulmus rubra</i>	0.21375
	<i>Viola cucullata</i>	0.01093
	<i>Vitis riparia</i>	0.00004
<b><u>Forest seep</u></b>	<i>Acer rubrum</i>	0.31415
East Branch Forest, Geauga Co.	<i>Acer saccharinum</i>	0.68580
White Pine Bog, Geauga Co.	<i>Acer saccharum</i>	0.02910
City of Mansfield, Richland Co.	<i>Agrimonia parviflora</i>	0.01692
Redstart, Vinton Co.	<i>Alisma subcordatum</i>	0.00212
	<i>Alliaria petiolata</i>	0.00116
	<i>Alnus incana</i> (EOLP only)	0.12885
	<i>Alnus serrulata</i>	0.06335
	<i>Apios americana</i>	0.00636
	<i>Aster puniceus</i>	0.00141
	<i>Betula alleghaniensis</i>	0.21210
	<i>Betula nigra</i> (WAP only)	0.64290
	<i>Bidens connata</i>	0.00213
	<i>Bidens frondosa</i>	0.00213
	<i>Boehmeria cylindrica</i>	0.00910
	Bryophyte	0.02734
	<i>Caltha palustris</i>	0.05114
	<i>Campanula aparinoides</i>	0.00141
	<i>Carex bromoides</i>	0.02680
	<i>Carex crinita</i> var. <i>crinita</i>	0.00213
	<i>Carex cristatella</i>	0.00814
	<i>Carex lupulina</i>	0.00234
	<i>Carex lurida</i>	0.01892
	<i>Carex stipata</i>	0.00248
	<i>Carex tribuloides</i>	0.09680
	<i>Carpinus caroliniana</i>	0.12720
	<i>Carya cordiformis</i>	0.00001
	<i>Carya ovata</i>	0.03440
	<i>Carya tomentosa</i>	0.02960
	<i>Cephalanthus occidentalis</i>	0.07285
	<i>Cicuta maculata</i>	0.00212
	<i>Cinna arundinacea</i>	0.01503
	<i>Coptis trifolia</i>	0.00888
	<i>Cornus amomum</i>	0.04465
	<i>Cornus racemosa</i>	0.10170
	<i>Dioscorea villosa</i>	0.00071
	<i>Dryopteris carthusiana</i>	0.05618
	<i>Dryopteris cristata</i>	0.00354
	<i>Epilobium coloratum</i>	0.00001

TYPE	SPECIES	ABUNDANCE
	<i>Eupatorium perfoliatum</i>	0.00212
	<i>Eupatorium purpureum</i>	0.00494
	<i>Fagus grandifolia</i>	0.22510
	<i>Fraxinus nigra</i>	0.18230
	<i>Fraxinus pennsylvanica</i>	0.27890
	<i>Galium tinctorium</i>	0.00917
	<i>Glyceria striata</i>	0.02324
	<i>Hydrocotyle americana</i>	0.00888
	<i>Ilex verticillata</i>	0.20880
	<i>Impatiens capensis</i>	0.11458
	<i>Leersia oryzoides</i>	0.04480
	<i>Lindera benzoin</i>	0.17500
	<i>Lobelia cardinalis</i>	0.00212
	<i>Ludwigia palustris</i>	0.00001
	<i>Lysimachia ciliata</i>	0.01933
	<i>Maianthemum canadense</i>	0.01015
	<i>Mitchella repens</i>	0.00634
	<i>Nemopanthus mucronatus</i> (EOLP only)	0.05710
	<i>Nyssa sylvatica</i>	0.06080
	<i>Onoclea sensibilis</i>	0.03068
	<i>Osmunda cinnamomea</i>	0.18805
	<i>Peltandra virginica</i>	0.05114
	<i>Pilea pumila</i>	0.00381
	<i>Platanthera peramoena</i>	0.00423
	<i>Polygonum arifolium</i>	0.01520
	<i>Polygonum sagittatum</i>	0.01253
	<i>Quercus bicolor</i>	0.08060
	<i>Quercus palustris</i>	0.03250
	<i>Ribes americanum</i>	0.00213
	<i>Rosa palustris</i>	0.03460
	<i>Sambucus canadensis</i>	0.04510
	<i>Senecio aureus</i>	0.01692
	<i>Sparganium americanum</i>	0.13045
	<i>Sphagnum</i> sp.	0.00254
	<i>Spiraea alba</i>	0.03100
	<i>Symplocarpus foetidus</i>	0.34758
	<i>Thalictrum dasycarpum</i>	0.00781
	<i>Ulmus rubra</i>	0.10818
	<i>Vaccinium corymbosum</i>	0.05329
	<i>Verbesina alternifolia</i>	0.00423
	<i>Veronica americana</i>	0.00213
	<i>Viburnum recognitum</i>	0.10340
	<i>Viola</i> sp.	0.00705
<b><u>Vernal pool (ECBP region)</u></b>	<i>Acer rubrum</i>	0.17920
Big Woods, Miami Co.	<i>Acer saccharinum</i>	0.46760
Leafy Oak, Hardin Co.	<i>Arisaema triphyllum</i> subsp. <i>triphyllum</i>	0.00008
Collier Woods, Seneca Co.	<i>Asimina triloba</i>	0.03952
	<i>Boehmeria cylindrica</i>	0.03739

TYPE	SPECIES	ABUNDANCE
	Bryophyte	0.07233
	Cardamine pensylvanica	0.00011
	Carex bromoides	0.00768
	Carex crus-corvi	0.05474
	Carex intumescens	0.00096
	Carex lupulina	0.09604
	Carex stipata	0.00672
	Carex tribuloides	0.02785
	Carpinus caroliniana	0.08990
	Carya ovalis	0.02960
	Cephalanthus occidentalis	0.22508
	Cinna arundinacea	0.04706
	Circaea lutetiana	0.00007
	Dryopteris carthusiana	0.00007
	Fraxinus nigra	0.03220
	Fraxinus pennsylvanica	0.36587
	Glyceria septentrionalis	0.00960
	Glyceria striata	0.13926
	Impatiens capensis	0.08448
	Iris versicolor	0.00960
	Lindera benzoin	0.16077
	Lobelia siphilitica	0.00288
	Lysimachia thyrsoflora	0.00096
	Maianthemum racemosum	0.00007
	Maianthemum stellatum	0.00098
	Osmorhiza longistylis	0.02885
	Parthenocissus quinquefolia	0.03705
	Penthorum sedoides	0.03649
	Poa nemoralis	0.00007
	Polygonum hydropiperoides	0.00672
	Polygonum virginianum	0.01164
	Populus heterophylla	0.06860
	Prunus virginiana	0.13073
	Quercus bicolor	0.04634
	Quercus palustris	0.01481
	Ranunculus abortivus	0.00005
	Ulmus americana	0.23673
	Vernonia gigantea	0.00002
	Viola sp.	0.00006
	Vitis riparia	0.00772
<b><u>Vernal Pool (EOLP region)</u></b>	Acer rubrum	0.34627
Pallister, Ashtabula Co.	Acer saccharinum	0.69230
Eagle Creek, Portage Co.	Agrimonia parviflora	0.00554
Crall Woods, Ashland Co.	Asimina triloba	0.01292
Morgan Swamp, Ashtabula Co.	Athyrium filix-femina	0.00554
	Betula alleghaniensis	0.29120
	Bidens connata	0.00216
	Boehmeria cylindrica	0.02725

TYPE	SPECIES	ABUNDANCE
	Bryophyte	0.06931
	<i>Caltha palustris</i>	0.01292
	<i>Carex bromoides</i>	0.05662
	<i>Carex brunnescens</i>	0.04049
	<i>Carex canescens</i>	0.02531
	<i>Carex grayi</i>	0.01515
	<i>Carex intumescens</i>	0.00258
	<i>Carex lupulina</i>	0.00185
	<i>Carex seorsa</i>	0.10019
	<i>Carex tribuloides</i>	0.00554
	<i>Carpinus caroliniana</i>	0.11180
	<i>Carya ovata</i>	0.00216
	<i>Cephalanthus occidentalis</i>	0.23704
	<i>Cinna arundinacea</i>	0.03184
	<i>Circaea lutetiana</i>	0.02768
	<i>Coptis trifolia</i>	0.00576
	<i>Dryopteris carthusiana</i>	0.03686
	<i>Fagus grandifolia</i>	0.07412
	<i>Festuca subverticillata</i>	0.00662
	<i>Fraxinus nigra</i>	0.06240
	<i>Fraxinus pennsylvanica</i>	0.10983
	<i>Glyceria septentrionalis</i>	0.07011
	<i>Glyceria striata</i>	0.00266
	<i>Hamamelis virginiana</i>	0.03181
	<i>Hydrophyllum virginianum</i>	0.00738
	<i>Ilex verticillata</i>	0.02550
	<i>Impatiens capensis</i>	0.09384
	<i>Laportea canadensis</i>	0.02895
	<i>Leersia oryzoides</i>	0.06717
	<i>Leersia virginica</i>	0.00554
	<i>Lemna minor</i>	0.00384
	<i>Lindera benzoin</i>	0.09506
	<i>Liriodendron tulipifera</i>	0.08275
	<i>Maianthemum canadense</i>	0.07504
	<i>Maianthemum racemosum</i>	0.00004
	<i>Mitchella repens</i>	0.02202
	<i>Nyssa sylvatica</i>	0.23240
	<i>Onoclea sensibilis</i>	0.00406
	<i>Osmorhiza longistylis</i>	0.02768
	<i>Osmunda cinnamomea</i>	0.05672
	<i>Osmunda regalis</i>	0.01771
	<i>Parthenocissus quinquefolia</i>	0.00990
	<i>Polygonum virginianum</i>	0.01845
	<i>Prunus virginiana</i>	0.05130
	<i>Quercus bicolor</i>	0.07572
	<i>Ribes cynosbati</i>	0.00649
	<i>Riccia fluitans</i>	0.01343
	<i>Rubus hispidus</i>	0.03298

TYPE	SPECIES	ABUNDANCE
	<i>Sambucus canadensis</i>	0.01806
	<i>Sphagnum</i> sp.	0.00855
	<i>Symplocarpus foetidus</i>	0.01519
	<i>Thelypteris palustris</i>	0.05567
	<i>Trientalis borealis</i>	0.04030
	<i>Ulmus americana</i>	0.10920
	<i>Ulmus rubra</i>	0.09215
	<i>Vaccinium corymbosum</i>	0.05043
	<i>Viburnum recognitum</i>	0.11135
	<i>Viola cucullata</i>	0.00192
	<i>Viola</i> sp.	0.00005
<b><u>Vernal pool (HELP region)</u></b>	<i>Acalypha rhomboidea</i>	0.00824
Marie DeLarme Cr, Paulding Co.	<i>Acer saccharinum</i>	0.46380
	<i>Agrostis hyemalis</i>	0.00005
	<i>Asimina triloba</i>	0.05970
	<i>Aster lateriflorus</i>	0.01648
	<i>Bidens discoidea</i>	0.00280
	<i>Boehmeria cylindrica</i>	0.19770
	Bryophyte	0.02471
	<i>Carex bromoides</i>	0.02471
	<i>Carex hyalinolepis</i>	0.10434
	<i>Carex lupuliformis</i>	0.00824
	<i>Carex lupulina</i>	0.00275
	<i>Carex muskingumensis</i>	0.00275
	<i>Carex tribuloides</i>	0.01098
	<i>Carpinus caroliniana</i>	0.03570
	<i>Carya ovata</i>	0.10660
	<i>Cephalanthus occidentalis</i>	0.01922
	<i>Cinna arundinacea</i>	0.00824
	<i>Circaea lutetiana</i>	0.00005
	<i>Dryopteris carthusiana</i>	0.01098
	<i>Elymus virginicus</i>	0.00275
	<i>Fraxinus pennsylvanica</i>	0.39180
	<i>Glyceria striata</i>	0.01922
	<i>Impatiens capensis</i>	0.00824
	<i>Leersia virginica</i>	0.00275
	<i>Lindera benzoin</i>	0.12430
	<i>Lycopus rubellus</i>	0.00011
	<i>Onoclea sensibilis</i>	0.00824
	<i>Parthenocissus quinquefolia</i>	0.03844
	<i>Pilea pumila</i>	0.01922
	<i>Polygonum hydropiperoides</i>	0.00005
	<i>Polygonum virginianum</i>	0.01098
	<i>Quercus bicolor</i>	0.02980
	<i>Sambucus canadensis</i>	0.02746
	<i>Scutellaria lateriflora</i>	0.01378
	<i>Ulmus rubra</i>	0.25200

TYPE	SPECIES	ABUNDANCE
<b><u>Vernal pool (WAP region)</u></b> Raccoon Creek, Vinton Co.	<i>Acer rubrum</i>	0.43230
	<i>Acer saccharinum</i>	0.00153
	<i>Asimina triloba</i>	0.03150
	<i>Boehmeria cylindrica</i>	0.53591
	Bryophyte	0.02450
	<i>Carex intumescens</i>	0.00459
	<i>Carex tribuloides</i>	0.02603
	<i>Carex tuckermanii</i>	0.03675
	<i>Carex typhina</i>	0.04287
	<i>Carya cordiformis</i>	0.03530
	<i>Carya ovata</i>	0.03150
	<i>Cephalanthus occidentalis</i>	0.18374
	<i>Cinna arundinacea</i>	0.00459
	<i>Fraxinus americana</i>	0.03150
	<i>Lindera benzoin</i>	0.05780
	<i>Onoclea sensibilis</i>	0.00459
	<i>Panicum capillare</i>	0.00153
	<i>Quercus palustris</i>	0.28220
	<i>Triadenum virginicum</i>	0.01991
	<i>Ulmus rubra</i>	0.06570
<i>Verbesina alternifolia</i>	0.00003	
<b><u>Wet Woods</u></b> Fowler Woods, Richand Co. Mitchell Woods, Huron Co. Pawnee Rd., Medina Co. Paine Crossing, Hocking Co. Brown Lake Bog, Holmes Co. Crall Woods, Ashland Co.	<i>Acer rubrum</i>	0.33315
	<i>Acer saccharinum</i>	0.33704
	<i>Acer saccharum</i>	0.17690
	<i>Arisaema triphyllum</i> subsp. <i>triphyllum</i>	0.00576
	<i>Aronia melanocarpa</i>	0.07280
	<i>Bidens connata</i>	0.03353
	<i>Boehmeria cylindrica</i>	0.02557
	Bryophyte	0.05581
	<i>Caltha palustris</i>	0.16543
	<i>Carex atlantica</i> var. <i>capillacea</i>	0.00500
	<i>Carex bromoides</i>	0.08209
	<i>Carex crinita</i> var. <i>crinita</i>	0.01074
	<i>Carex gracilescens</i>	0.00082
	<i>Carex gracillima</i>	0.00494
	<i>Carex grayi</i>	0.00082
	<i>Carex intumescens</i>	0.08055
	<i>Carex lupulina</i>	0.20401
	<i>Carex lurida</i>	0.00716
	<i>Carex prasina</i>	0.00494
	<i>Carex seorsa</i>	0.01766
	<i>Carex squarrosa</i>	0.00007
	<i>Carex stipata</i>	0.00146
	<i>Carex tribuloides</i>	0.02184
	<i>Carex vesicaria</i>	0.01074
	<i>Carex viriscens</i>	0.00285
	<i>Carpinus caroliniana</i>	0.04083
	<i>Carya cordiformis</i>	0.09430

TYPE	SPECIES	ABUNDANCE
	<i>Carya ovata</i>	0.01957
	<i>Celastrus scandens</i>	0.00004
	<i>Cephalanthus occidentalis</i>	0.03588
	<i>Cinna arundinacea</i>	0.05837
	<i>Circaea lutetiana</i>	0.00071
	<i>Cryptotaenia canadensis</i>	0.00321
	<i>Dryopteris carthusiana</i>	0.02202
	<i>Dryopteris cristata</i>	0.00001
	<i>Fagus grandifolia</i>	0.03141
	<i>Festuca subverticillata</i>	0.00126
	<i>Fraxinus nigra</i>	0.14590
	<i>Fraxinus pennsylvanica</i>	0.17773
	<i>Fraxinus profunda</i>	0.28950
	<i>Galium concinnum</i>	0.00210
	<i>Galium obtusum</i>	0.00082
	<i>Galium tinctorium</i>	0.00007
	<i>Galium triflorum</i>	0.00210
	<i>Geranium maculatum</i>	0.04033
	<i>Glyceria septentrionalis</i>	0.04848
	<i>Glyceria striata</i>	0.03316
	<i>Hydrocotyle americana</i>	0.06566
	<i>Hydrophyllum virginianum</i>	0.03872
	<i>Ilex verticillata</i>	0.20042
	<i>Impatiens capensis</i>	0.05727
	<i>Laportea canadensis</i>	0.06292
	<i>Leersia virginica</i>	0.01071
	<i>Lindera benzoin</i>	0.10609
	<i>Lysimachia terrestris</i>	0.00007
	<i>Maianthemum racemosum</i>	0.01893
	<i>Maianthemum stellatum</i>	0.01236
	<i>Mitella diphylla</i>	0.00126
	<i>Onoclea sensibilis</i>	0.03162
	<i>Osmorhiza claytonii</i>	0.00263
	<i>Osmorhiza longistylis</i>	0.00906
	<i>Osmunda cinnamomea</i>	0.15835
	<i>Osmunda regalis</i>	0.02217
	<i>Ostrya virginiana</i>	0.03010
	<i>Parthenocissus quinquefolia</i>	0.00273
	<i>Phlox divaricata</i>	0.00391
	<i>Pilea pumila</i>	0.00003
	<i>Poa alsodes</i>	0.07516
	<i>Poa sylvestris</i>	0.00210
	<i>Polygonatum biflorum</i>	0.00107
	<i>Polygonatum pubescens</i>	0.01028
	<i>Polygonum sagittatum</i>	0.00254
	<i>Polygonum virginianum</i>	0.00459
	<i>Populus heterophylla</i>	0.03300
	<i>Prunus americana</i>	0.00210

TYPE	SPECIES	ABUNDANCE
	<i>Quercus bicolor</i>	0.10139
	<i>Quercus palustris</i>	0.36950
	<i>Ranunculus abortivus</i>	0.00039
	<i>Rubus hispidus</i>	0.00214
	<i>Sambucus canadensis</i>	0.03789
	<i>Senecio aureus</i>	0.02883
	<i>Sium suave</i>	0.00002
	<i>Sphagnum sp.</i>	0.00144
	<i>Stellaria longifolia</i>	0.00247
	<i>Symplocarpus foetidus</i>	0.09846
	<i>Thalictrum dasycarpum</i>	0.01812
	<i>Tilia americana</i>	0.06240
	<i>Toxicodendron vemix</i>	0.00500
	<i>Ulmus americana</i>	0.25865
	<i>Ulmus rubra</i>	0.13925
	<i>Vaccinium corymbosum</i>	0.02156
	<i>Viburnum recognitum</i>	0.07022
	<i>Viola sp.</i>	0.00542
<b><u>Marsh, depression (ECBP region)</u></b>	<i>Acer rubrum</i>	0.00619
Calamus, Pickaway Co.	<i>Acer saccharinum</i>	0.00001
Rickenbacker, Franklin Co.	<i>Agrostis hyemalis</i>	0.00003
	<i>Alisma subcordatum</i>	0.02631
	<i>Asclepias incarnata</i>	0.00155
	<i>Bidens connata</i>	0.00070
	<i>Bolboschoenus fluviatilis</i>	0.20715
	Bryophyte	0.00155
	<i>Carex comosa</i>	0.01475
	<i>Carex lupulina</i>	0.02631
	<i>Carex tribuloides</i>	0.02631
	<i>Cephalanthus occidentalis</i>	0.18568
	<i>Ceratophyllum demersum</i>	0.00211
	<i>Ceratophyllum echinatum</i>	0.00983
	<i>Cicuta bulbifera</i>	0.00070
	<i>Cornus amomum</i>	0.10835
	<i>Decodon verticillatus</i>	0.02458
	<i>Eleocharis obtusa</i>	0.00155
	<i>Eleocharis palustris</i>	0.00929
	<i>Fraxinus pennsylvanica</i>	0.01083
	<i>Galium tinctorium</i>	0.00422
	<i>Hibiscus laevis</i>	0.00984
	<i>Juncus acuminatus</i>	0.02167
	<i>Juncus effusus</i>	0.01548
	<i>Juncus tenuis</i>	0.00158
	<i>Leersia oryzoides</i>	0.00464
	<i>Lemna minor</i>	0.10182
	<i>Lemna trisulca</i>	0.03160
	<i>Ludwigia alternifolia</i>	0.00003
	<i>Ludwigia palustris</i>	0.00464

TYPE	SPECIES	ABUNDANCE
	<i>Lycopus americanus</i>	0.00310
	<i>Nuphar advena</i>	0.21768
	<i>Penthorum sedoides</i>	0.00774
	<i>Polygonum amphibium</i>	0.01849
	<i>Polygonum hydropiperoides</i>	0.00830
	<i>Polygonum persicaria</i>	0.00492
	<i>Riccia fluitans</i>	0.07795
	<i>Ricciocarpos natans</i>	0.11657
	<i>Rumex verticillatus</i>	0.04003
	<i>Sagittaria latifolia</i>	0.00070
	<i>Salix nigra</i>	0.00464
	<i>Scirpus cyperinus</i>	0.00155
	<i>Sium suave</i>	0.00072
	<i>Sparganium eurycarpum</i>	0.03441
	<i>Spirodela polyrhiza</i>	0.00421
	<i>Typha latifolia</i>	0.00675
	<i>Ulmus rubra</i>	0.01083
	<i>Utricularia vulgaris</i>	0.00702
<b><u>Marsh, depression (EOLP region)</u></b>	<i>Acer rubrum</i>	0.00535
Morgan Swamp, Ashtabula Co.	<i>Agrostis hyemalis</i>	0.00003
Singer Lake, Summit Co.	<i>Alisma subcordatum</i>	0.02631
Valley Rd., Wayne Co.	<i>Alnus serrulata</i>	0.00066
	<i>Asclepias incarnata</i>	0.00155
	<i>Bidens connata</i>	0.01653
	<i>Boehmeria cylindrica</i>	0.00321
	Bryophyte	0.00844
	<i>Carex canescens</i>	0.01577
	<i>Carex comosa</i>	0.01766
	<i>Carex cristatella</i>	0.00002
	<i>Carex lacustris</i>	0.17254
	<i>Carex lupulina</i>	0.02631
	<i>Carex lurida</i>	0.00002
	<i>Carex scoparia</i>	0.00002
	<i>Carex tribuloides</i>	0.02631
	<i>Cephalanthus occidentalis</i>	0.08379
	<i>Ceratophyllum echinatum</i>	0.00663
	<i>Cicuta bulbifera</i>	0.03821
	<i>Cornus amomum</i>	0.03825
	<i>Decodon verticillatus</i>	0.01922
	<i>Dulichium arundinaceum</i>	0.00526
	<i>Eleocharis obtusa</i>	0.00804
	<i>Eleocharis palustris</i>	0.00929
	<i>Epilobium coloratum</i>	0.00241
	<i>Eupatorium perfoliatum</i>	0.00075
	<i>Fraxinus pennsylvanica</i>	0.01083
	<i>Galium tinctorium</i>	0.00231
	<i>Hypericum mutilum</i>	0.04807
	<i>Impatiens capensis</i>	0.00241

TYPE	SPECIES	ABUNDANCE
	<i>Juncus acuminatus</i>	0.01121
	<i>Juncus effusus</i>	0.00775
	<i>Juncus tenuis</i>	0.00158
	<i>Leersia oryzoides</i>	0.02261
	<i>Lemna minor</i>	0.00265
	<i>Ludwigia alternifolia</i>	0.00003
	<i>Ludwigia palustris</i>	0.00464
	<i>Lycopus americanus</i>	0.00310
	<i>Lycopus rubellus</i>	0.00492
	<i>Lysimachia terrestris</i>	0.00225
	<i>Mimulus ringens</i>	0.00002
	<i>Nuphar advena</i>	0.10632
	<i>Nyssa sylvatica</i>	0.00225
	<i>Osmunda cinnamomea</i>	0.00075
	<i>Osmunda regalis</i>	0.00002
	<i>Penthorum sedoides</i>	0.00774
	<i>Pilea pumila</i>	0.00241
	<i>Polygonum amphibium</i>	0.12233
	<i>Polygonum arifolium</i>	0.00241
	<i>Polygonum hydropiperoides</i>	0.03693
	<i>Polygonum punctatum</i>	0.05408
	<i>Polygonum sagittatum</i>	0.00225
	<i>Proserpinaca palustris</i>	0.03380
	<i>Rubus hispidus</i>	0.00753
	<i>Rumex verticillatus</i>	0.00241
	<i>Sagittaria latifolia</i>	0.15620
	<i>Salix discolor</i>	0.00225
	<i>Salix exigua</i>	0.09389
	<i>Salix nigra</i>	0.00513
	<i>Salix sericea</i>	0.00002
	<i>Sambucus canadensis</i>	0.00002
	<i>Scirpus cyperinus</i>	0.04138
	<i>Scutellaria galericulata</i>	0.00402
	<i>Scutellaria lateriflora</i>	0.00002
	<i>Sium suave</i>	0.00080
	<i>Sparganium americanum</i>	0.04883
	<i>Sparganium eurycarpum</i>	0.24878
	<i>Sphagnum sp.</i>	0.05784
	<i>Spiraea alba</i>	0.00630
	<i>Spiraea tomentosa</i>	0.02178
	<i>Spirodela polyrhiza</i>	0.05042
	<i>Symplocarpus foetidus</i>	0.00241
	<i>Thelypteris palustris</i>	0.00225
	<i>Triadenum virginicum</i>	0.06745
	<i>Typha latifolia</i>	0.00415
	<i>Ulmus rubra</i>	0.01083
	<i>Utricularia vulgaris</i>	0.00075
	<i>Viburnum recognitum</i>	0.00656

TYPE	SPECIES	ABUNDANCE
<b><u>Marsh, headwater (EOLP region)</u></b>	<i>Acer rubrum</i>	0.00626
Guilford Marsh, Columbiana Co.	<i>Alnus incana</i>	0.01341
900a Marsh, Summit Co.	<i>Asclepias incarnata</i>	0.01330
Eagle Creek, Portage Co.	<i>Aster praealtus</i>	0.00114
	<i>Bidens coronata</i>	0.00228
	<i>Boehmeria cylindrica</i>	0.01822
	Bryophyte	0.01480
	<i>Carex alata</i>	0.00002
	<i>Carex comosa</i>	0.03898
	<i>Carex lacustris</i>	0.03187
	<i>Carex lurida</i>	0.00114
	<i>Carex scoparia</i>	0.00002
	<i>Carex utriculata</i>	0.06260
	<i>Ceratophyllum demersum</i>	0.01719
	<i>Cicuta bulbifera</i>	0.00788
	<i>Cornus amomum</i>	0.01440
	<i>Cornus sericea</i>	0.00096
	<i>Decodon verticillatus</i>	0.13324
	<i>Dulichium arundinaceum</i>	0.00002
	<i>Eleocharis erythropoda</i>	0.03130
	<i>Eleocharis intermedia</i>	0.00002
	<i>Eleocharis obtusa</i>	0.02954
	<i>Elodea canadensis</i>	0.12224
	<i>Epilobium ciliatum</i>	0.00797
	<i>Epilobium leptophyllum</i>	0.02278
	<i>Eupatorium maculatum</i>	0.00114
	<i>Eupatorium perfoliatum</i>	0.00683
	<i>Eupatorium purpureum</i>	0.00268
	<i>Galium tinctorium</i>	0.02176
	<i>Glyceria canadensis</i>	0.00114
	<i>Hypericum mutilum</i>	0.01480
	<i>Impatiens capensis</i>	0.01026
	<i>Iris versicolor</i>	0.02951
	<i>Juncus effusus</i>	0.00836
	<i>Leersia oryzoides</i>	0.00342
	<i>Lemna minor</i>	0.13983
	<i>Ludwigia palustris</i>	0.00350
	<i>Lycopus rubellus</i>	0.00102
	<i>Lysimachia terrestris</i>	0.00626
	<i>Lythrum salicaria</i>	0.02278
	<i>Mentha arvensis</i>	0.02847
	<i>Myosotis laxa</i>	0.00228
	<i>Nuphar advena</i>	0.42498
	<i>Onoclea sensibilis</i>	0.00436
	<i>Osmunda cinnamomea</i>	0.00114
	<i>Penthorum sedoides</i>	0.00114
	<i>Pilea fontana</i>	0.02278
	<i>Pilea pumila</i>	0.00089

TYPE	SPECIES	ABUNDANCE
	<i>Polygonum hydropiperoides</i>	0.04571
	<i>Polygonum pennsylvanicum</i>	0.00000
	<i>Polygonum sagittatum</i>	0.00342
	<i>Quercus bicolor</i>	0.00002
	<i>Riccia fluitans</i>	0.03954
	<i>Ricciocarpos natans</i>	0.00144
	<i>Rosa palustris</i>	0.01088
	<i>Rumex orbiculatus</i>	0.00268
	<i>Sagittaria latifolia</i>	0.02126
	<i>Salix discolor</i>	0.00387
	<i>Salix sericea</i>	0.00770
	<i>Schoenoplectus tabernaemontani</i>	0.04613
	<i>Scirpus cyperinus</i>	0.13506
	<i>Scutellaria galericulata</i>	0.00002
	<i>Solidago patula</i>	0.00002
	<i>Solidago rugosa</i>	0.00342
	<i>Sparganium eurycarpum</i>	0.06465
	<i>Sphagnum</i> sp.	0.00528
	<i>Spiraea alba</i>	0.00833
	<i>Spiraea tomentosa</i>	0.00114
	<i>Spirodela polyrhiza</i>	0.00955
	<i>Thelypteris palustris</i>	0.01330
	<i>Toxicodendron vemix</i>	0.00089
	<i>Typha latifolia</i>	0.05641
	<i>Utricularia vulgaris</i>	0.08675
	<i>Verbena hastata</i>	0.01070
	<i>Viburnum recognitum</i>	0.02070
	<i>Viola</i> sp.	0.00342
<b><u>Marsh, headwater (WAP region)</u></b>	<i>Acer rubrum</i>	0.00936
Baker Swamp, Jackson Co.	<i>Agrimonia gryposepala</i>	0.00571
Zoar Church Rd., Jackson Co.	<i>Agrostis hyemalis</i>	0.00278
	<i>Alnus serrulata</i>	0.00648
	<i>Asclepias incarnata</i>	0.00082
	<i>Bidens frondosa</i>	0.14813
	<i>Boehmeria cylindrica</i>	0.00550
	Bryophyte	0.01389
	<i>Callitriche</i> sp.	0.00093
	<i>Carex comosa</i>	0.00093
	<i>Carex lurida</i>	0.00245
	<i>Carex tribuloides</i>	0.00093
	<i>Cephalanthus occidentalis</i>	0.02322
	<i>Ceratophyllum demersum</i>	0.24897
	<i>Ceratophyllum echinatum</i>	0.03888
	<i>Cornus amomum</i>	0.00278
	<i>Cuscuta pentagona</i>	0.01224
	<i>Cuscuta polygonorum</i>	0.06286
	<i>Cyperus strigosus</i>	0.00463
	<i>Decodon verticillatus</i>	0.03020

TYPE	SPECIES	ABUNDANCE
	<i>Eleocharis acicularis</i>	0.00002
	<i>Eleocharis obtusa</i>	0.00185
	<i>Eupatorium purpureum</i>	0.00245
	<i>Euthamia graminifolia</i>	0.00082
	<i>Galium tinctorium</i>	0.01418
	<i>Impatiens capensis</i>	0.00446
	<i>Iris versicolor</i>	0.00278
	<i>Juncus effusus</i>	0.00332
	<i>Leersia oryzoides</i>	0.01582
	<i>Lemna minor</i>	0.03104
	<i>Lobelia cardinalis</i>	0.00833
	<i>Lobelia inflata</i>	0.00002
	<i>Ludwigia alternifolia</i>	0.00002
	<i>Ludwigia palustris</i>	0.00278
	<i>Lycopus rubellus</i>	0.00555
	<i>Nuphar advena</i>	0.09144
	<i>Onoclea sensibilis</i>	0.00245
	<i>Panicum rigidulum</i>	0.00002
	<i>Penthorum sedoides</i>	0.00093
	<i>Polygonum amphibium</i>	0.00455
	<i>Polygonum hydropiperoides</i>	0.23346
	<i>Polygonum punctatum</i>	0.41661
	<i>Polygonum sagittatum</i>	0.00245
	<i>Quercus palustris</i>	0.00082
	<i>Riccia fluitans</i>	0.01118
	<i>Rosa palustris</i>	0.02000
	<i>Salix sericea</i>	0.01224
	<i>Sambucus canadensis</i>	0.01224
	<i>Scirpus atrovirens</i>	0.00093
	<i>Scirpus cyperinus</i>	0.00332
	<i>Scutellaria lateriflora</i>	0.01944
	<i>Solidago rugosa</i>	0.00245
	<i>Sparganium americanum</i>	0.00093
	<i>Spiraea tomentosa</i>	0.00002
	<i>Spirodela polyrhiza</i>	0.10775
	<i>Triadenum fraseri</i>	0.00002
	<i>Triadenum tubulosum</i>	0.00002
	<i>Utricularia gibba</i>	0.01182
	<i>Vitis labrusca</i>	0.00082
	<i>Wolffia brasiliensis</i>	0.02597
	<i>Wolffia columbiana</i>	0.00977
<b><u>Marsh, mainstem (EOLP region)</u></b>	<i>Acer rubrum</i>	0.00522
Tinkers Creek, Summit Co.	<i>Acer saccharinum</i>	0.01136
Marsh Wetlands, Portage Co.	<i>Acorus americanus</i>	0.02356
Franklin Church Rd., Richland Co.	<i>Alnus incana</i>	0.00522
Tare Creek, Geauga Co.	<i>Alnus serrulata</i>	0.00162
	<i>Apios americana</i>	0.00003
	<i>Asclepias incarnata</i>	0.01627

TYPE	SPECIES	ABUNDANCE
	<i>Bidens connata</i>	0.00003
	<i>Bidens discoidea</i>	0.01571
	<i>Bidens frondosa</i>	0.03571
	<i>Boehmeria cylindrica</i>	0.00119
	<i>Cardamine pensylvanica</i>	0.05681
	<i>Carex comosa</i>	0.00224
	<i>Carex crinita</i> var. <i>crinita</i>	0.00120
	<i>Carex frankii</i>	0.00002
	<i>Carex grayi</i>	0.00002
	<i>Carex lupulina</i>	0.00079
	<i>Carex lurida</i>	0.00134
	<i>Carex scoparia</i>	0.00069
	<i>Carex stipata</i>	0.00236
	<i>Carex tribuloides</i>	0.00362
	<i>Carex typhina</i>	0.00002
	<i>Carex vulpinoidea</i>	0.00550
	<i>Cephalanthus occidentalis</i>	0.02140
	<i>Ceratophyllum demersum</i>	0.06266
	<i>Cicuta bulbifera</i>	0.00224
	<i>Cinna arundinacea</i>	0.00276
	<i>Cornus amomum</i>	0.00512
	<i>Decodon verticillatus</i>	0.03571
	<i>Eleocharis obtusa</i>	0.00001
	<i>Elodea canadensis</i>	0.17230
	<i>Elymus virginicus</i>	0.00550
	<i>Epilobium coloratum</i>	0.00002
	<i>Eupatorium purpureum</i>	0.00075
	<i>Fraxinus pennsylvanica</i>	0.00944
	<i>Galium tinctorium</i>	0.00144
	<i>Glyceria striata</i>	0.00550
	<i>Humulus lupulus</i>	0.02435
	<i>Ilex verticillata</i>	0.00439
	<i>Iris versicolor</i>	0.00902
	<i>Juncus effusus</i>	0.00546
	<i>Leersia oryzoides</i>	0.02764
	<i>Lemna minor</i>	0.15489
	<i>Lindernia dubia</i>	0.02922
	<i>Ludwigia palustris</i>	0.00950
	<i>Lycopus americanus</i>	0.02272
	<i>Lycopus rubellus</i>	0.00079
	<i>Mentha arvensis</i>	0.00003
	<i>Mimulus ringens</i>	0.00188
	<i>Myosotis laxa</i>	0.00487
	<i>Nuphar advena</i>	0.05406
	<i>Onoclea sensibilis</i>	0.00174
	<i>Peltandra virginica</i>	0.24904
	<i>Polygonum amphibium</i>	0.02781
	<i>Polygonum arifolium</i>	0.00079

TYPE	SPECIES	ABUNDANCE
	<i>Polygonum hydropiperoides</i>	0.00079
	<i>Polygonum sagittatum</i>	0.00077
	<i>Polygonum virginianum</i>	0.00079
	<i>Pontederia cordata</i>	0.05746
	<i>Potamogeton foliosus</i>	0.02318
	<i>Quercus bicolor</i>	0.00063
	<i>Riccia fluitans</i>	0.01178
	<i>Rosa palustris</i>	0.00724
	<i>Rumex verticillatus</i>	0.00950
	<i>Sagittaria latifolia</i>	0.05850
	<i>Salix discolor</i>	0.01119
	<i>Salix exigua</i>	0.02435
	<i>Salix nigra</i>	0.00188
	<i>Salix sericea</i>	0.08116
	<i>Schoenoplectus tabernaemontani</i>	0.00063
	<i>Scirpus cyperinus</i>	0.00071
	<i>Scutellaria galericulata</i>	0.00075
	<i>Scutellaria lateriflora</i>	0.00314
	<i>Sium suave</i>	0.00224
	<i>Sparganium eurycarpum</i>	0.05214
	<i>Spiraea alba</i>	0.00654
	<i>Spirodela polyrhiza</i>	0.12112
	<i>Typha latifolia</i>	0.00592
	<i>Utricularia vulgaris</i>	0.00439
	<i>Vaccinium corymbosum</i>	0.00188
	<i>Verbesina alternifolia</i>	0.00162
	<i>Viburnum recognitum</i>	0.00854
	<i>Vitis riparia</i>	0.00487
	<i>Woffia brasiliensis</i>	0.16809
<b><u>Marsh, mainstem (WAP region)</u></b>	<i>Agrimonia parviflora</i>	0.00295
Rutherford, Hocking Co.	<i>Alisma subcordatum</i>	0.00590
	<i>Asclepias incarnata</i>	0.00590
	Bryophyte	0.00295
	<i>Carex scoparia</i>	0.00098
	<i>Carex tribuloides</i>	0.00002
	<i>Carex vulpinoidea</i>	0.00295
	<i>Cephalanthus occidentalis</i>	0.21629
	<i>Eleocharis acicularis</i>	0.02261
	<i>Eleocharis obtusa</i>	0.01966
	<i>Eupatorium perfoliatum</i>	0.00098
	<i>Galium tinctorium</i>	0.00787
	<i>Hibiscus moscheutos</i>	0.05604
	<i>Juncus effusus</i>	0.02949
	<i>Juncus marginatus</i>	0.00002
	<i>Leersia oryzoides</i>	0.07570
	<i>Lemna minor</i>	0.01278
	<i>Ludwigia palustris</i>	0.01772
	<i>Polygonum hydropiperoides</i>	0.05112

TYPE	SPECIES	ABUNDANCE
	Ricciocarpos natans	0.00002
	Rosa palustris	0.02163
	Salix nigra	0.00295
	Sambucus canadensis	0.02360
	Scirpus cyperinus	0.01278
	Solidago rugosa	0.00295
	Sparganium eurycarpum	0.23792
	Spirodela polyrhiza	0.00100
	Stellaria longifolia	0.00002
	Triadenum virginicum	0.00002
	Typha latifolia	0.07865
	Ulmus rubra	0.01475
<b><u>Beaver impoundment marsh</u></b>	Acer rubrum	0.00071
Morgan Swamp, Ashtabula Co.	Agrimonia parviflora	0.00395
Eagle Creek, Portage Co.	Asclepias incarnata	0.00198
Hewitt Fork, Athens Co.	Betula nigra (WAP only)	0.02236
	Boehmeria cylindrica	0.00526
	Bryophyte	0.00789
	Carex atlantica var. atlantica	0.01144
	Carex canescens	0.01372
	Carex comosa	0.02203
	Carex crinita var. crinita	0.00367
	Carex lurida	0.01054
	Carex scoparia	0.00908
	Carex stipata	0.00367
	Carex tribuloides	0.00370
	Cephalanthus occidentalis	0.12320
	Cicuta bulbifera	0.00198
	Cornus amomum	0.01736
	Cornus sericea	0.00122
	Dulichium arundinaceum	0.04063
	Eleocharis acicularis	0.01316
	Eleocharis obtusa	0.01560
	Eupatorium purpureum	0.00003
	Galium tinctorium	0.00482
	Hypericum mutilum	0.00921
	Ilex verticillata	0.00960
	Impatiens capensis	0.00381
	Juncus acuminatus	0.03683
	Juncus effusus	0.11124
	Leersia oryzoides	0.00129
	Lemna minor	0.05018
	Ludwigia alternifolia	0.00132
	Ludwigia palustris	0.07070
	Lysimachia thyrsoflora	0.00960
	Mimulus ringens	0.00066
	Nuphar advena	0.14401
	Nyssa sylvatica	0.00411

TYPE	SPECIES	ABUNDANCE
	<i>Onoclea sensibilis</i>	0.00446
	<i>Osmunda cinnamomea</i>	0.01920
	<i>Osmunda regalis</i>	0.00960
	<i>Polygonum arifolium</i>	0.00857
	<i>Polygonum hydropiperoides</i>	0.08812
	<i>Polygonum sagittatum</i>	0.00132
	<i>Rosa palustris</i>	0.00062
	<i>Rubus hispidus</i>	0.06858
	<i>Rumex verticillatus</i>	0.00122
	<i>Sagittaria latifolia</i>	0.00816
	<i>Salix discolor</i>	0.00252
	<i>Salix nigra</i>	0.03947
	<i>Sambucus canadensis</i>	0.00367
	<i>Schoenoplectus tabernaemontani</i>	0.00857
	<i>Scirpus cyperinus</i>	0.03345
	<i>Sparganium americanum</i>	0.15677
	<i>Sphagnum sp.</i>	0.06858
	<i>Spiraea alba</i>	0.12239
	<i>Spiraea tomentosa</i>	0.05525
	<i>Symplocarpus foetidus</i>	0.00122
	<i>Thelypteris palustris</i>	0.09601
	<i>Triadenum virginicum</i>	0.09329
	<i>Typha latifolia</i>	0.05023
	<i>Ulmus rubra</i>	0.00067
	<i>Urtica dioica var. procera</i>	0.00367
	<i>Utricularia vulgaris</i>	0.01713
	<i>Vaccinium corymbosum</i>	0.00960
	<i>Viburnum recognitum</i>	0.01640
	<i>Alisma subcordatum</i>	0.00133
<b><u>Marsh, Lake Erie Coastal</u></b>		
North Pond, Kelleys Island	<i>Asclepias incarnata</i>	0.00042
Plum Brook, Erie Co.	<i>Bidens cernua</i>	0.04657
Potters Pond, Ottawa Co.	<i>Bidens frondosa</i>	0.00988
Beulah Beach, Erie Co.	<i>Boehmeria cylindrica</i>	0.03080
Sheldons Marsh, Erie Co.	<i>Bolboschoenus fluviatilis</i>	0.07905
Old Woman Creek, Erie Co.	<i>Carex comosa</i>	0.01199
Arcola Creek, Lake Co.	<i>Carex cristatella</i>	0.00282
	<i>Carex frankii</i>	0.00183
	<i>Carex lupulina</i>	0.01519
	<i>Carex lurida</i>	0.00216
	<i>Carex stipata</i>	0.00840
	<i>Carex tribuloides</i>	0.01479
	<i>Carex vulpinoidea</i>	0.00880
	<i>Cephalanthus occidentalis</i>	0.12020
	<i>Ceratophyllum demersum</i>	0.00829
	<i>Cornus amomum</i>	0.02159
	<i>Cyperus erythrorhizos</i>	0.00035
	<i>Cyperus odoratus</i>	0.00126
	<i>Cyperus strigosus</i>	0.00018

TYPE	SPECIES	ABUNDANCE
	<i>Echinochloa muricata</i>	0.00565
	<i>Echinochloa walteri</i>	0.02081
	<i>Eclipta prostrata</i>	0.00141
	<i>Eleocharis erythropoda</i>	0.00141
	<i>Eleocharis obtusa</i>	0.00248
	<i>Eleocharis palustris</i>	0.00035
	<i>Elodea canadensis</i>	0.00133
	<i>Elymus virginicus</i>	0.00400
	<i>Epilobium coloratum</i>	0.01520
	<i>Epilobium hirsutum</i>	0.00141
	<i>Erechtites hieracifolia</i>	0.00802
	<i>Eupatorium perfoliatum</i>	0.00528
	<i>Euthamia graminifolia</i>	0.00247
	<i>Fraxinus pennsylvanica</i>	0.28166
	<i>Galium tinctorium</i>	0.00332
	<i>Glyceria striata</i>	0.00400
	<i>Hibiscus moscheutos</i>	0.05792
	<i>Impatiens capensis</i>	0.01355
	<i>Iris versicolor</i>	0.01319
	<i>Juncus effusus</i>	0.11088
	<i>Juncus torreyi</i>	0.00430
	<i>Justicia americana</i>	0.00133
	<i>Leersia oryzoides</i>	0.07668
	<i>Lemna minor</i>	0.05005
	<i>Lobelia cardinalis</i>	0.00240
	<i>Lobelia siphilitica</i>	0.00001
	<i>Ludwigia palustris</i>	0.00796
	<i>Lycopus americanus</i>	0.00053
	<i>Lycopus asper</i>	0.00427
	<i>Mentha arvensis</i>	0.01312
	<i>Mimulus ringens</i>	0.01936
	<i>Nelumbo lutea</i>	0.23446
	<i>Nuphar advena</i>	0.01106
	<i>Nymphaea odorata</i>	0.12756
	<i>Parthenocissus quinquefolia</i>	0.00040
	<i>Peltandra virginica</i>	0.00072
	<i>Penthorum sedoides</i>	0.08884
	<i>Pilea pumila</i>	0.01060
	<i>Polygonum amphibium</i>	0.05111
	<i>Polygonum hydropiper</i>	0.00212
	<i>Polygonum hydropiperoides</i>	0.25881
	<i>Polygonum lapathifolium</i>	0.02506
	<i>Polygonum pensylvanicum</i>	0.02541
	<i>Polygonum punctatum</i>	0.00278
	<i>Polygonum sagittatum</i>	0.02023
	<i>Pontederia cordata</i>	0.00290
	<i>Populus deltoides</i>	0.01120
	<i>Potamogeton nodosus</i>	0.02169

TYPE	SPECIES	ABUNDANCE
	Rorippa palustris	0.00213
	Rumex verticillatus	0.03252
	Sagittaria latifolia	0.12417
	Salix amygdaloides	0.07404
	Salix eriocephala	0.00002
	Salix exigua	0.01416
	Salix nigra	0.00546
	Salix sericea	0.00280
	Sambucus canadensis	0.01078
	Schoenoplectus tabernaemontani	0.06852
	Scirpus atrovirens	0.00228
	Scirpus cyperinus	0.00439
	Scutellaria galericulata	0.00096
	Silene latifolia	0.00001
	Sium suave	0.00121
	Sparganium eurycarpum	0.01095
	Spirodela polyrhiza	0.00797
	Teucrium canadense	0.00295
	Typha latifolia	0.00923
	Urtica dioica var. procera	0.01475
	Verbena hastata	0.00595
	Verbesina alternifolia	0.00216
	Viburnum recognitum	0.00001
	Vitis riparia	0.00220
	Zannichellia palustris	0.00479
	Zosterella dubia	0.02390
<b><u>Prairie, deep soil wet prairie</u></b>	Agrimonia parviflora	0.00001
Daughmer Savannah, Crawford Co.	Calamagrostis canadensis	0.10913
	Carex atherodes	0.17512
	Carex lacustris	0.17512
	Carex pellita	0.04670
	Carex sartwellii	0.00254
	Carex scoparia	0.00178
	Carex stricta	0.10025
	Cephalanthus occidentalis	0.00888
	Cyperus odoratus	0.01066
	Eleocharis elliptica	0.00076
	Eleocharis erythropoda	0.02538
	Eleocharis obtusa	0.00178
	Euthamia graminifolia	0.00001
	Festuca rubra	0.00077
	Galium obtusum	0.00355
	Juncus effusus	0.00102
	Lathyrus palustris	0.00406
	Lindernia dubia	0.02132
	Ludwigia palustris	0.00102
	Lycopus americanus	0.01802
	Lythrum alatum	0.00914

TYPE	SPECIES	ABUNDANCE
	<i>Mentha arvensis</i>	0.01320
	<i>Mimulus ringens</i>	0.00178
	<i>Muhlenbergia mexicana</i>	0.09137
	<i>Penthorum sedoides</i>	0.00203
	<i>Polygonum hydropiperoides</i>	0.04289
	<i>Pycnanthemum virginianum</i>	0.03426
	<i>Rosa palustris</i>	0.00001
	<i>Salix eriocephala</i>	0.00025
	<i>Salix exigua</i>	0.00025
	<i>Schoenoplectus tabernaemontani</i>	0.00888
	<i>Spartina pectinata</i>	0.02335
	<i>Spiraea alba</i>	0.01269
	<i>Stellaria longifolia</i>	0.00025
	<i>Tradescantia ohiensis</i>	0.00787
	<i>Verbena hastata</i>	0.02411
	<i>Viola sororia</i>	0.00001
<b><u>Prairie, Lakes Plains Sand</u></b>	<i>Acer rubrum</i>	0.00002
Irwin Prairie (2), Lucas Co.	<i>Alisma subcordatum</i>	0.00001
Patton Tract, Lucas Co.	<i>Asclepias incarnata</i>	0.00127
	<i>Aster lanceolatus</i>	0.02802
	<i>Aster novae-angliae</i>	0.00002
	<i>Aster praealtus</i>	0.00841
	Bryophyte	0.00934
	<i>Calamagrostis canadensis</i>	0.13239
	<i>Calamagrostis stricta</i>	0.00562
	<i>Carex alata</i>	0.00226
	<i>Carex atherodes</i>	0.01401
	<i>Carex buxbaumii</i>	0.01214
	<i>Carex cryptolepis</i>	0.02636
	<i>Carex granularis</i>	0.00093
	<i>Carex lasiocarpa</i>	0.16329
	<i>Carex pellita</i>	0.04708
	<i>Carex sartwellii</i>	0.02324
	<i>Carex scoparia</i>	0.00002
	<i>Cephalanthus occidentalis</i>	0.00458
	<i>Cicuta maculata</i>	0.00040
	<i>Cirsium muticum</i>	0.00093
	<i>Cladium mariscoides</i>	0.29318
	<i>Cornus amomum</i>	0.05410
	<i>Eleocharis elliptica</i>	0.03560
	<i>Equisetum laevigatum</i>	0.00006
	<i>Eupatorium maculatum</i>	0.00262
	<i>Eupatorium perfoliatum</i>	0.00040
	<i>Euthamia graminifolia</i>	0.00048
	<i>Euthamia remota</i>	0.16458
	<i>Fragaria vesca</i> var. <i>americana</i>	0.00002
	<i>Fraxinus pennsylvanica</i>	0.00190
	<i>Galium tinctorium</i>	0.00004

TYPE	SPECIES	ABUNDANCE
	<i>Glyceria striata</i>	0.00003
	<i>Ilex verticillata</i>	0.00002
	<i>Iris virginica</i> var. <i>shrevei</i>	0.00741
	<i>Juncus acuminatus</i>	0.00374
	<i>Juncus brachycarpus</i>	0.00560
	<i>Juncus canadensis</i>	0.00132
	<i>Juncus dudleyi</i>	0.01544
	<i>Juncus marginatus</i>	0.00375
	<i>Juncus torreyi</i>	0.01066
	<i>Lathyrus palustris</i>	0.00002
	<i>Liatris spicata</i>	0.00374
	<i>Linum medium</i>	0.00093
	<i>Lobelia kalmii</i>	0.00002
	<i>Lobelia spicata</i>	0.00093
	<i>Ludwigia alternifolia</i>	0.00002
	<i>Lycopus americanus</i>	0.00121
	<i>Lycopus uniflorus</i>	0.00303
	<i>Lythrum alatum</i>	0.01391
	<i>Osmunda regalis</i>	0.00098
	<i>Oxypolis rigidior</i>	0.00002
	<i>Panicum implicatum</i>	0.00264
	<i>Panicum rigidulum</i>	0.00749
	<i>Panicum virgatum</i>	0.04950
	<i>Pycnanthemum virginianum</i>	0.00152
	<i>Quercus palustris</i>	0.01279
	<i>Rosa palustris</i>	0.01779
	<i>Rosa setigera</i>	0.00329
	<i>Rubus flagellaris</i>	0.00098
	<i>Salix bebbiana</i>	0.00280
	<i>Salix discolor</i>	0.01006
	<i>Salix humilis</i>	0.00002
	<i>Salix petiolaris</i>	0.00846
	<i>Schoenoplectus acutus</i>	0.00684
	<i>Scirpus cyperinus</i>	0.00093
	<i>Scirpus pendulus</i>	0.00841
	<i>Solidago riddellii</i>	0.00077
	<i>Solidago rugosa</i>	0.00374
	<i>Spiraea alba</i>	0.02231
	<i>Thelypteris palustris</i>	0.00217
	<i>Triadenum virginicum</i>	0.00088
	<i>Vernonia missourica</i>	0.00093
	<i>Veronica scutellata</i>	0.00002
	<i>Vitis riparia</i>	0.00048