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Flora and Vegetation of the Meadow River Wetlands, Greenbrier County, West Virginia

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Chapter I

INTRODUCTION

The Meadow River wetlands comprise the second largest wetland complex within the state of West Virginia, containing approximately 3131 acres (1392 ha) of swamp and wet meadow (Evans et al. 1982). Plant collecting within this complex as determined by available literature and herbarium specimens has been limited in the past and apparently dealt only with the wetlands near the head of Otter Creek. Grafton et al. (1982) conducted walk-through surveys in conjunction with a statewide wetland survey and the West Virginia Department of Highways performed a rather detailed vegetation analysis in the same area as part of an environmental impact statement prior to construction of Interstate 64.

The present research is two fold, first to provide a checklist of the vascular plants of the entire wetland complex and second, to provide a vegetative analysis of six selected seep-springs within the complex. Quantitative studies were limited to these spring seeps because these areas were relatively undisturbed. Bryophytes were included in the seep-spring studies because of their abundance in the springs.

Although much floristic work has been done toward providing a knowledge of West Virginia's wetlands (e.g. Bartgis et al. 1984, Brumfield et al. 1982, West et al. 1982) there remains a need for further research. Wetlands

1982) there remains a need for further research. Wetlands represent a distinct element of a region's flora and are still being filled, drained or permanently flooded at an alarming rate. Wetlands in general are endangered, harbor many endangered species, serve as recharge areas, both in terms of wildlife and ground water, and serve as natural flood control areas. One well thought out case for the value of wetland research and preservation is presented by Brande (1980).

Chapter II

METHODS AND PROCEDURES

Checklist of the flora. The vascular plant inventory was carried out over a period of two and one-half growing seasons (inclusive dates: 17 July 1982 - 23 August 1984) with voucher specimens collected for each new species encountered. Vouchers were deposited in the Herbarium, Marshall University, Huntington, West Virginia 25701 (MUHW). Each vegetation type was visited systematically during each month of the growing season. Collections were taken only from wetland areas as evidenced by hydrologic, edaphic and vegetation characteristics. The surrounding uplands were ignored except for the occasional perched wetland, springs and associated seepage areas.

Habitat descriptions used in the text of Appendix 1 follow the system of Cowardin et al. (1979) but are modified to indicate the primary source of water, i.e., ombrotrophic for runoff or minerotrophic for spring fed.

Identifications and taxonomy follow the treatments of Clayton et al. 1986, Gould et al. 1983, Cronquist 1980, Strausbaugh et al. 1977, Fernald 1970, Mohlenbrock 1975, Voss 1972, Hitchcock 1951, and Mackenzie 1931.

Vegetation of six selected seeps. Six seep springs were selected for vegetation analysis on the basis of: 1) distribution within the entire wetland complex, 2) size, and 3) low degree of disturbance. These six sites represent all sites over approximately 0.2 ha which were large enough to

sample quantitatively. Other sites do exist but were felt to be too small or too disturbed. All quantitative field work was conducted during June and July of 1984.

Line transects with circular plots were used to sample the herbaceous and shrub layers. Trees were not sampled because they were not significant elements within any of the six sites although some sites were shaded by the surrounding forest.

Herbaceous vegetation including bryophytes was sampled using half meter square plots. Plots were distributed randomly along straight line transects using a 100 m metal tape. Transects were run through average terrain of the spring seep and one or two transects were used depending on the size of the site. Number of plots varied from 20 to 40 per site.

Each herbaceous species within a plot was identified and its percent cover recorded. Tree and shrub seedlings under 18 cm in height were recorded as part of the herbaceous layer.

Shrub vegetation over 18 cm in height was sampled using 40 m^2 plots randomized along the same transects. Each species was identified and a stem count recorded. The number of plots for shrubs varied from 2 to 5 per site.

Chapter III

THE STUDY AREA

Location. The Meadow River Wetlands are situated in the western end of Greenbrier County (Figure 1) at the southern boundary of the Allegheny Mountain physiographic section of West Virginia as delineated by Strausbaugh and Core (1978). Elevation of the wetland complex varies from slightly less than 2400 ft (732 m) along the Meadow River to 2420 ft (738 m) along some of the major tributaries. The entire complex lies within the Rupert quadrangle, 7.5 series, US Geological Survey topographical map, 1972, geological coordinates, 80° 40′ W, 37° 56′N.

Geology. Strata of Mississippian age abut and underlie the alluvium of the Meadow River and its tributaries within the study area (Price et al. 1939). Specifically the Mauch Chunk series (Table 1), the upper division of the Mississippian within West Virginia, is most important to the hydrology and existence of the Meadow River Wetlands complex. All springs issue from the Hinton Group of this series and thus determine to a great extent their minerology and influence to a lesser degree the mineralogy of the surface water within the entire complex. The circumneutral character of the abundant seepage areas and springs at the base of the toe slopes surrounding the wetlands is a reflection of the predominance of calcareous strata within this group.

The wetlands complex owes its existence to the erodible

shales of the Hinton Group which have been base leveled behind an erosion barrier of sandstone (Princeton Group, Table 1) which dips below stream level at the northwestern boundary of the study area.

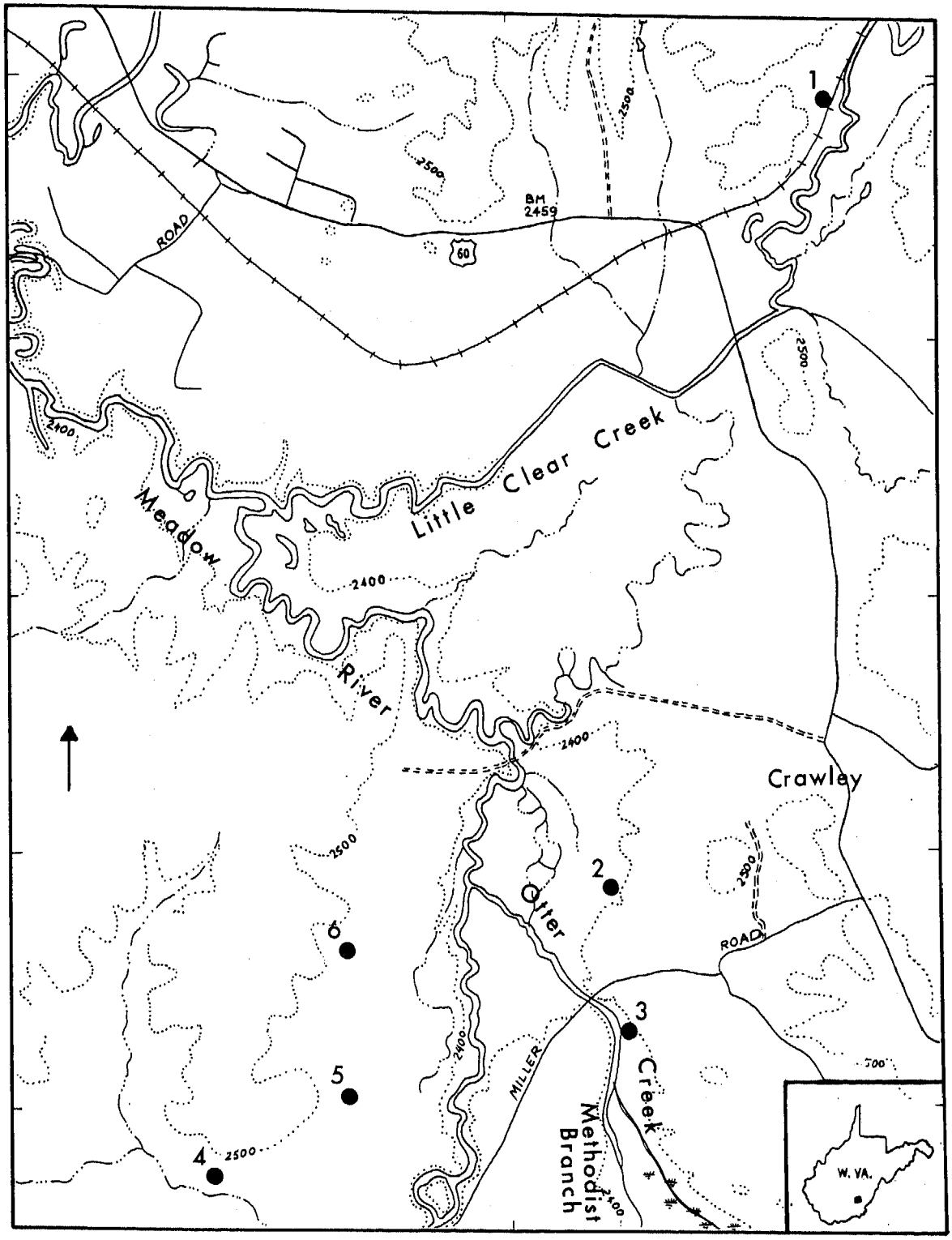

Figure 1. The Meadow River wetlands with the six seep springs indicated (see Table 2, page 10).

Table 1. General section of the Mauch Chunk Series for Greenbrier County (in part).

BLUESTONE GROUP (80 - 675 feet thick)

Shales, red, with some green beds, occasional micaceous sandstone; may contain one or more thin, shaly limestone beds; contains two thin lenticular coaly shales.

PRINCETON GROUP (20 - 80 feet thick)

Sandstone, greenish-grey, or stained reddish-brown by limonite; often a mass of pebbles and these are characteristically poorly sorted; occasional plant fossil.

HINTON GROUP (500 - 850 feet thick)

Shales, red, variegated, interbedded with green to red argillaceous sandstone, some beds highly calcareous. (170 - 270 feet thick)

Sandstone, grey to brown, often shaly, calcareous. (0 - 20 feet thick)

Shale, calcareous, often quite sandy. (0 - 20 feet thick)

Limestone (Avis), steel grey, may be stained yellow by weathering, shaly, very fossiliferous. (10 - 30 feet thick)

Shales, red, variegated, interbedded with greenish-grey

to red sandstones, some beds highly calcareous. 290 - 460 feet thick)

Sandstone (Stony Gap), greenish grey, white or reddish-brown, massive, often cross-bedded, medium grained, resistant to weathering. (30 - 50 feet thick)

Soils and topography. The soils occurring on the bottom lands along the Meadow River and its tributaries are in general categorized as Atkins Silty Clay loam (USDA 1972). Most areas are level but some have slopes as much as two percent. Permeability is very slow, the subsurface layer and subsoil are fine textured, the available moisture capacity is moderate, the soil deep and poorly drained. The water table is at or near the surface for long periods of time. Permeability is slow in the subsoil. Fertility is moderate, and reaction is said to be strongly acid. However, springs throughout the wetland are almost neutral (pH 6.0 - 6.3).

Spring Sites. Site names and characteristics are presented in Table 2.

Table 2. Site names and characteristics.

Site No.	Inundation by Stream	Shade	Moisture	Size (Ha)
1	never	mostly open	deep muck with pockets of standing water	0.4
2	frequent	adjacent forest recently clearcut, shrubby	deep muck with pockets of standing water	0.5
3	frequent, some parts permanently	mostly shaded, very shrubby	deep muck with pockets of standing water	0.8
4	never	mostly open	soil wet but not mucky, no standing water	0.3
5	lower portion frequently, upper portion rarely	open	deep muck with running water	0.4
6	Infrequently	shaded by forest	deep muck with running water	0.3

Site Names	UTM Grid Coordinates
1. Shawvers Crossing Spring	305008
2. Log Landing Springs	297978
3. Saw Mill Springs	297973 and 298972
4. Pond Springs	279967 and 280967
5. Miller Springs	286970 and 287974
6. Sog Hole Spring	286974

Recent history. Within the past century the Meadow River Wetlands have suffered an onslaught of attempts to make the area "productive" in agricultural terms. Streams have been channelized, several acres along US Route 60 have been filled, and most recently the technique of open ditching has been employed in some peripheral areas. Cattle range freely throughout most of the wetlands and the forest is clearcut on a regular basis. The image of cultivated fields on thousands of acres of level land in the midst of this mountainous region has been hard for farmers to resist.

Chapter IV

RESULTS

Checklist of the flora. The checklist (Appendix 1) covers the entire wetland complex and is summarized in Table 1. 3. Twelve species, Hierochloa odorata (L.) Beauv., Carex bromoides Schkuhr., Carex lacustris Willd., Carex lanuginosa Michaux, Carex normalis Mackenzie, Carex trichocarpa Muhl., Carex typhina Michaux, Lemna valdiviana Phil., Ranunculus carolinianus DC., Lysimachia hybrida Michaux, Pedicularis lanceolata Michaux, and Veronica scutellata L. are reported as rare and endangered in West Virginia (Clarkson et al. 1981).

Three species, Carex lupuliformis Sartwell, Eleocharis elliptica Kunth, and Rhynchospora fusca (L.) Aiton f. and one form Juncus canadensis J. Gay forma conglobatus Fernald are reported new for West Virginia (Brant 1987).

Table 3. Summary of the Checklist of the Meadow River Wetland Flora.

Total families	55	--
Total species	243	--
Total pteridophytes	9	3.7%
Total gymnosperms	0	0
Total angiosperms	234	96.3%
monocots	93	38.3%
dicots	141	58.0%
Rare and endangered species	12	4.9%
Taxa new to West Virginia	4	1.6%

Vegetation of six selected seeps. Tables 4 - 8 summarize the 159 species of vascular and non-vascular plants (132 herbaceous and 27 shrub) occurring within plots within the six sites.

Herbaceous Layer. A total of 70 herbaceous species (53%) occurred in only one of the six sites while only six species (5%) occurred in every site (Table 4). There were 123 species (93%) of vascular plants and 9 (7%) were bryophytes. Of the vascular species 6 (5%) were pteridophytes, 44 (33%) were monocots and 73 (55%) were dicots. The widespread dominant herbaceous species for the combined sites (Table 4) were Leersia oryzoides, Aster puniceus, Impatiens capensis, Poa trivialis, Glyceria striata, Carex interior, and Carex stipata. More localized dominants were Carex bromoides, Hierochloa odorata, Symplocarpus foetidus, Glyceria melicaria, Carex prasina, Lysimachia ciliata, and Osmunda cinnamomea.

The dominant herbaceous species for each site are presented in table 5. The sites in this table are ordered on an ecological gradient reflecting amount of shade, moisture, and elevation. A fairly distinct pattern emerges, with site No. 3 representing the wet shady extreme, sites 5, 6, 1, and 2 intermediate, and site 4 least wet and relatively open. The sites were variously shaded, open or most commonly a combination of these (Table 2). This combination of factors was reflected in the dominant herbaceous species (Table 6). The wettest site (No. 3) was dominated by Symplocarpus

foetidus and Glyceria melicaria; co-dominants were Osmunda cinnamomea and Impatiens capensis. All but Impatiens capensis were local dominants for this site only. Widespread dominants in the intermediate sites (6, 5, 2, 1) were Carex stipata, Poa trivialis, Aster puniceus, Glyceria striata, and Leersia oryzoides. The local dominants were Carex prasina (site 6), Carex bromoides (site 5), Carex tribuloides (site 2), and Carex interior (site 1). In site 4, the least wet of the sites, dominants were Hierochloa odorata, Lysimachia ciliata, and Onoclea sensibilis. Co-dominants were Galium tinctorium and Carex scoparia.

Shrub Layer. Shrubs occurring within plots are presented in Table 7. A total of 11 species (41%) were single occurrences while only 1 species, Cornus amomum, (4%) occurred in all sites.

The widespread dominant shrub species for the combined sites (Table 7) were Alnus serrulata, Cornus amomum, Rosa palustris, Ilex verticillata, , and Viburnum recognitum. More localized dominants were Rhododendron arborescens and Aronia prunifolia.

Distinct patterns do not emerge with the shrub layer dominants (Table 8) as they did with the herbaceous layer dominants. In general aspect, sites 2 and 3 have a high number of stems per 100 m^2.

Table 4. Alphabetical summary of herbaceous species presence and mean cover for all sites.

Species	Number of sites in which it occurs	Mean Cover for all sites
Acer rubrum *	1	0.03
Agrostis alba	1	0.03
Alnus serrulata *	2	0.23
Amphicarpa bracteata	1	0.22
Anthoxanthum odoratum	1	0.05
Apios americana	1	2.85
Apocynum cannabinum	1	0.10
Aster puniceus	6	10.82
Bidens cernua	2	0.23
Bidens frondosa	4	0.57
Boehmeria cylindrica	3	0.58
Callitriche heterophylla	1	0.02
Campanula aparinoides	1	0.65
Cardamine parviflora	3	0.48
Carex bromoides	2	9.08
Carex conoidea	1	0.20
Carex crinita	2	1.00
Carex debilis	1	0.15
Carex granularis	2	0.07
Carex grayii	1	0.78
Carex interior	6	5.88
Carex lacustris	1	0.65

Carex lanuginosa	1	0.03
Carex leptalea	3	0.33
Carex lupulina	1	0.10
Carex lurida	4	1.12
Carex prasina	2	5.92
Carex scoparia	2	3.38
Carex stipata	5	5.38
Carex straminea	1	0.02
Carex stricta	1	4.47
Carex tribuloides	4	3.17
Carex vulpinoidea	2	0.27
Chelone glabra	5	3.55
Chrysoplenium americanum	4	3.90
Cicuta maculata	1	4.25
Cinna arundinacea	3	0.43
Clematis virginiana	1	0.02
Climaceum americanum**	1	1.13
Cornus amomum *	2	0.13
Cuscuta gronovii	3	0.43
Cyperus sp.	1	0.05
Daucus carota	1	0.02
Dichelyma capillaceum**	1	0.65
Dryopteris cristata	1	0.20
Dryopteris spinulosa	2	0.23
Eleocharis elliptica	2	2.25
Eleocharis obtusa	1	0.02
Eleocharis tenuis	5	2.57
Epilobium coloratum	3	0.20

Eupatorium fistulosum	4	2.05
Eupatorium perfoliatum	3	0.95
Euthamia graminifolia	1	0.18
Galium asprellum	2	1.37
Galium tinctorium	6	4.33
Galium triflorum	1	0.07
Geum laciniatum	1	0.02
Glyceria canadensis	1	0.08
Glyceria melicaria	1	6.40
Glyceria septentrionalis	1	0.05
Glyceria striata	6	8.05
Gratiola neglecta	3	0.18
Habenaria flava	1	0.12
Hierochloa odorata	1	8.30
Holcus lanatus	1	1.45
Hydrocotyle americana	1	0.37
Hypericum mutilum	4	0.28
Hypericum punctatum	3	0.20
Hypnum curvifolium**	1	1.45
Ilex verticillata *	2	0.10
Impatiens capensis	5	10.37
Isoetes engelmanni	1	0.08
Juncus acuminatus	3	0.17
Juncus dudleyi	1	0.22
Juncus effusus	6	2.33
Juncus tenuis	1	0.17
Leersia oryzoides	6	15.77

Lindera benzoin *	1	0.02
Lindernia dubia	1	0.02
Ludwigia palustris	3	0.22
Lycopus americanus	3	0.33
Lycopus uniflorus	1	0.32
Lycopus virginicus	3	0.33
Lysimachia ciliata	2	5.57
Maianthemum canadense	1	0.45
Mentha arvensis	1	0.07
Mimulus alatus	1	0.13
Mimulus ringens	2	0.15
Mnium sp.**	1	0.07
Mnium cuspidatum**	1	0.05
Mnium drummondii**	1	0.03
Onoclea sensibilis	2	4.85
Osmunda cinnamomea	1	5.02
Osmunda regalis	1	0.23
Oxypolis rigidior	3	0.62
Pedicularis lanceolata	2	1.65
Penthorum sedoides	1	0.02
Phalaris arundinacea	1	0.03
Pilea pumila	1	0.12
Plantago lanceolata	1	0.02
Plantago rugellii	1	0.03
Poa trivialis	5	9.73
Polygonum hydropiperoides	1	0.37
Polygonum saggitatum	5	1.83
Proserpinaca palustris	1	0.22

Pycnanthemum verticillatum	1	0.72
Ranunculus carolinianus	3	2.20
Rhododendron arborescens *	1	0.07
Rosa palustris *	3	0.17
Sagittaria latifolia	2	1.37
Sambucus canadensis *	2	0.17
Sanguisorba canadensis	1	0.18
Scirpus sp.	1	0.17
Scirpus polyphyllus	1	4.43
Scutellaria lateriflora	5	1.25
Senecio aureus	2	0.22
Solidago rugosa	2	0.15
Sparganium americanum	1	0.25
Sphagnum cuspidatum**	1	0.12
Stellaria graminea	1	0.08
Symplocarpus foetidus	1	7.70
Taraxacum officinalis	1	0.03
Thalictrum polygamum	4	0.48
Thuidium recognitum**	1	0.12
Thuidium sp.**	1	0.60
Toxicodendron radicans	3	0.45
Trifolium repens	1	0.08
Veronica americana	2	0.48
Veronica scutellata	2	0.18
Viburnum recognitum *	3	0.10

Total species 132 (123 vascular, 9 bryophytes)

* = shrub or tree seedling under 18 cm in height
** = bryophytes

Table 5. Herbaceous vegetation occurrences of 5 percent cover or greater in at least one site. Combined site characteristics are included at bottom of table. Sites are ordered on an ecological gradient reflecting moisture and elevation (see page 13).

	Site Number					
Name	3	6	5	2	1	4
Symplocarpus foetidus	46.2					
Glyceria melicaria	38.4					
Osmunda cinnamomea	30.1					
Carex prasina		34.4	1.1			
Carex bromoides			50.2	4.3		
Sagittaria latifolia		0.3		7.1		
Ranunculus carolinianus		6.2	1.6	5.4		
Chrysoplenium americanum	1.8	14.6	1.7	1.8		
Polygonum saggitatum	0.2	0.8	3.1	0.9	6.0	
Carex stipata	1.0	7.6	3.4	9.6	10.7	
Chelone glabra	3.6	7.2	1.0	8.2	1.3	
Impatiens capensis	26.0	20.2	4.4	5.0	6.6	
Poa trivialis	0.2	2.3	25.4	9.7	15.0	
Aster puniceus	3.6	16.1	13.8	13.0	15.3	3.2
Galium tinctorium	0.4	1.2	0.8	2.6	5.3	15.7
Rubus hispidus	0.2					6.2
Glyceria striata	1.9	1.4	27.4	10.8	5.6	1.2
Juncus effusus	0.1	0.5	4.2	2.2	5.3	1.7

Leersia oryzoides	0.3	5.5	22.6	12.0	52.7	1.5
Carex interior	0.3	0.3	0.6	1.6	32.3	0.2
Eleocharis tenuis		8.6	0.1	0.2	4.1	2.4
Eupatorium fistulosum		6.9	1.3		2.8	1.3
Galium asprellum			0.4		7.8	
Carex tribuloides				17.7	0.3	
Pedicularis lanceolata					8.2	1.7
Eleocharis elliptica					11.9	1.6
Lysimachia ciliata					0.6	32.8
Onoclea sensibilis					6.9	22.2
Carex scoparia					3.6	16.6
Hierochloa odorata						49.8

Combined Site Characteristics

Total species	132	100%
Bryophytes	9	7%
Vascular plants	123	93%
Monocots	44	33%
Dicots	73	55%
Ptridophytes	6	5%
Single site occurrences	70	53%
All site occurrences	6	5%

Table 6. Summary of dominant herbaceous species for combined sites as indicated by mean percent cover of 5 percent or greater.

Species	No. of Sites in which Species Occurs	Mean Cover
Leersia oryzoides	6	15.77
Aster puniceus	6	10.82
Impatiens capensis	5	10.37
Poa trivialis	5	9.73
Carex bromoides	2	9.08
Hierochloa odorata	1	8.30
Glyceria striata	6	8.05
Symplocarpus foetidus	1	7.70
Glyceria melicaria	1	6.40
Carex prasina	2	5.92
Carex interior	6	5.88
Lysimachia ciliata	2	5.57
Carex stipata	5	5.38
Osmunda cinnamomea	1	5.02

Table 7. Alphabetical summary of shrub species presence and mean density for all sites.

Species	No. of Sites in which species occurs	Mean Density
Acer rubrum	3	2.1
Alnus serrulata	4	58.0
Amelanchier arborea	1	0.3
Aronia prunifolia	2	9.8
Clematis virginiana	2	1.1
Cornus amomum	6	52.2
Crataegus crusgalli	1	0.1
Fraxinus nigra	4	0.9
Fraxinus pennsylvanica	1	0.2
Hypericum prolificum	1	0.2
Ilex verticillata	5	25.0
Lindera benzoin	3	4.2
Lyonia ligustrina	1	2.8
Nyssa sylvatica	1	0.2
Parthenocissus quinquefolia	2	1.2
Prunus virginiana	1	0.4
Quercus palustris	1	0.1
Rhododendron arborescens	1	17.3
Rosa palustris	5	41.2
Rubus sp. (blackberry)	1	0.6
Salix sericea	1	2.7
Sambucus canadensis	4	7.2

Smilax rotundifolia	3	1.0
Spirea alba	2	6.5
Toxicodendron radicans	2	1.3
Viburnum lentago	4	6.7
Viburnum recognitum	4	25.4

Total spp. 27

Table 8. Summary of shrub vegetation occurrences of greater than 5 stems per 100 m^2 in at least one site. Combined site characteristics are included at the foot of the table. Sites are ordered on an ecological gradient reflecting moisture and elevation (see page 13).

	Site Number					
Species	3	6	5	2	1	4
Rhododendron arborescens	103.5					
Lyonia ligustrina	17.0					
Clematis virginiana	5.5	1.3				
Parthenocissus quinquefolia		6.3		1.0		
Lindera benzoin		22.5	2.0	0.5		
Toxicodendron radicans			2.5	5.5		
Sambucus canadensis	18.0	17.5		6.5	1.0	
Viburnum recognitum	61.0	1.3	27.0	63.0		
Aronia prunifolia	57.0					1.9
Viburnum lentago	28.5		2.0	9.0		0.6
Acer rubrum	10.5			1.5		0.6
Alnus serrulata	108.0		33.5	186.5		23.1
Cornus amomum	7.0	122.5	63.0	64.5	13.5	42.5
Ilex verticillata	14.0	10.0	15.5	96.5		13.8
Rosa palustris	2.5	43.8		58.5	14.0	128.1
Salix sericea					16.0	
Spirea alba			7.5			31.3

Table continued next page.

Combined Site Characteristics						
Total species	27	--				
Single site occurrences	11	41%				
All site occurrences	1	4%				
Total species/site	16	9	10	15	4	12
Total stems/100 m^2	442	228	156	498	45	247

Chapter V

DISCUSSION

Checklist of the Flora. The area covered by the checklist includes the floodplain of the Meadow River and the floodplains of its tributaries south of the mouth of Little Clear Creek, including the lower reaches of Little Clear Creek, Otter Creek and its tributaries, Methodist Branch and Smoot Branch. The area covers approximately 1000 hectares.

Permanently saturated spring fed seepage areas above the floodplains were also sampled because these areas are important in defining the wetland complex and because they are important in maintaining the overall integrity of the complex, providing a highly stable reservoir of wetland species.

The three newly reported species for West Virginia should be included in the updated rare and endangered flora of the state. Three other species of note include Carex tuckermanni Dewey, known in West Virginia from only two other localities. Thelypteris palustris Schott var. pubescens (Lawson) Fernald, and Trisetum pennsylvanicum (L.) Beauv. need further review and possible listing.

Vegetation of Six Selected Seeps. The sites (Table 1) were all situated around the perimeter of the wetlands at the base of toe slopes. One of the most striking things about these sites was the lack of trees. Within the sites the soil was generally very wet with deep, mucky, poorly drained soil which seems to resist the invasion of trees. However, each site was at least partially or in some cases wholly dominated

site was at least partially or in some cases wholly dominated by dense stands of shrubs. Site 5, Miller Springs, did have a few standing dead trees of Fraxinus nigra and Fraxinus pennsylvanica. There was no obvious reason for their demise other than the permanently saturated soil at the site which has been there for many years. The owner of the property blames their death on beavers. Beavers were common and were observed near this site; however, no teeth marks or banding were evident on the dead trees and no dams were in evidence near the site. Seedlings and saplings of tree species do occur within the sites but are never present in great numbers.

The moisture, elevation, and shade gradient account for a portion of the variation in herbaceous vegetation patterns observed. However; shrubs appeared to be less influenced by this gradient.

Conclusion. In the scant literature concerning the Meadow River Wetlands the soil of the bottoms is described as strongly acid (USDA 1972 and Grafton 1982). This is probably true of the bottoms in general, however, the springs and seepage areas in this report have pH values of 6 - 6.3. The pH measurements were taken with color indicator litmus paper at spring heads and at approximately 5 meter intervals for a distance of 25 meters. These measurements, though not highly accurate, do serve as evidence of the circumneutral character of the spring sites especially when taken in conjunction with the geology (chap. 3) and the calciphilic species present in

rigidior, Carex interior, and Carex lanuginosa.

The Meadow River Wetlands comprise a unique and endangered habitat in West Virginia. Isolated portions of the wetlands, especially the springs and seepage areas, have resisted human interference but are presently being heavily impacted by grazing; timbering alone seems to have little effect on the spring sites because trees do not occur in these wet, open areas. At least portions of the wetlands deserve protection. As evidenced in this study many rare and endangered species are harbored in this rare and endangered habitat.

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APPENDIX 1

Annotated Checklist of the Flora

LYCOPODIACEAE

Lycopodium obscurum L. (typical) - Rare. Mesic tops of alder hummocks at the margin of scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

ISOETACEAE

Isoetes engelmanni A. Br. - Infrequent. Open wetland; semi-permanently flooded; primarily minerotrophic.

OPHIOGLOSSACEAE

Botrychium dissectum Spreng. f. obliquum (Muhl.) Fernald - Infrequent. Hillocks of forested wetland; temporarily flooded; ombrotrophic.

OSMUNDACEAE

Osmunda cinnamomea L. - Locally abundant. Scrub/shrub wetland; saturated and semi-permanently flooded; primarily minerotrophic.

Osmunda regalis L. - Locally abundant. Scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

POLYPODIACEAE

Dryopteris cristata (L.) Gray - Local. Scrub/shrub

wetland; saturated and semi-permanently flooded; ombrotrophic.

Dryopteris spinulosa (O. F. Muell.) Watt var. americana (Fisch.) Fernald - Infrequent. Mesic tops of hummocks and on logs of scrub/shrub wetland; seasonally flooded; ombrotrophic.

Dryopteris spinulosa (O. F. Muell.) Watt var. intermedia (Muhl.) Underw. - Infrequent. Mesic tops of hummocks within scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

Onoclea sensibilis L. - Locally abundant. Open wetland; saturated; primarily minerotrophic.

Thelypteris palustris Schott var. pubescens (Lawson) Fernald - Rare. Scrub/shrub wetland; semi-permanently flooded; ombrotrophic.

TYPHACEAE

Typha latifolia L. - Locally abundant. Open wetland; permanently to semi-permanently flooded; ombrotrophic.

SPARGANIACEAE

Sparganium americanum Nutt. - Abundant. Throughout in open wetland; permanently flooded; ombrotrophic.

Sparganium eurycarpum Engelm. - Rare. Scrub/shrub wetland; semi-permanently flooded; ombrotrophic.

POTAMOGETONACEAE

Potamogeton amplifolius Tuckerman - Rare. Quiet open water; aquatic bed; ombrotrophic.

Potamogeton diversifolius Raf. - Locally abundant. Open water throughout; aquatic bed; primarily ombrotrophic.

ALISMATACEAE

Alisma subcordatum Raf. - Common. Frequently flooded open wetland; saturated and semi-permanently flooded; primarily ombrotrophic.

Sagittaria latifolia Willd. - Common. Open wetland; saturated to permanently flooded; ombrotrophic.

POACEAE

Agrostis perennans (Walter) Tuckerman - Local. Open wetland; seasonally flooded; ombrotrophic.

Alopecurus pratensis L. - Local. Open wetland; semi-permanently flooded; ombrotrophic. Probably sown.

Anthoxanthum odoratum L. - Frequent. Open wetland; temporarily flooded; ombrotrophic.

Cinna arundinacea L. - Common. Open to open canopy forested wetland; periodically flooded; ombrotrophic.

Dichanthelium latifolium (L.) Gould & C. A. Clark - Local. Open wetland; saturated; minerotrophic.

Dichanthelium sphaerocarpon Ell. - Local. Open wetland; saturated; minerotrophic.

Eragrostis hypnoides (Lam.) BSP. - Rare. Open muddy

shore; semi-permanently flooded; ombrotrophic.

Echinochloa crusgalli (L.) Beauv. - Common. Open saturated to semi-permanently flooded; ombrotrophic.

Elymus virginicus L. (typical) - Common. Open wetland; seasonally flooded; ombrotrophic.

Glyceria canadensis (Michaux) Trin. - Local. Open wetland; semi-permanently flooded; ombrotrophic.

Glyceria melicaria (Michaux) F. T. Hubb - Local. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Glyceria septentrionalis Hitchcock - Local. Open and scrub/shrub wetland; semi-permanently flooded; ombrotrophic and minerotrophic.

Glyceria striata (Lam.) Hitchcock - Common. Open to forested wetland; saturated to semi-permanently flooded; ombrotrophic and minerotrophic.

Hierochloa odorata (L.) Beauv. - Infrequent. Open wetland; saturated; primarily minerotrophic.

Leersia oryzoides (L.) Sw. - Common. Open wetland; saturated to permanently flooded; ombrotrophic and minerotrophic.

Leersia virginica Willd. - Common. Margins and hummocks of forested wetland; temporarily flooded; ombrotrophic.

Panicum rigidulum Bosc. - Common. Open wetland; saturated to permanently flooded; ombrotrophic.

Phalaris arundinacea L. - Common. Open wetland; saturated to semi-permanently flooded; ombrotrophic.

Poa pratensis L. - Waif. Open wetland; saturated; ombrotrophic.

Poa trivialis L. - Common. Scrub/shrub wetland; saturated to semi-permanently flooded; primarily minerotrophic.

Trisetum pennsylvanicum (L.) Beauv. - Infrequent. Scrub/shrub wetland; saturated to semi-permanently flooded; minerotrophic.

CYPERACEAE

Carex annectens (Bickn.) Bickn. - Local. Open wetland; saturated; ombrotrophic.

Carex bromoides Willd. - Common. Open and scrub/shrub wetland; saturated to semi-permanently flooded; ombrotrophic and minerotrophic.

Carex caroliniana Schwein - Locally abundant. Margins of scrub/shrub wetland; ombrotrophic.

Carex conoidea Willd. - Local. Margins of open wetland; ombrotrophic and minerotrophic.

Carex crinita Lam. - Frequent. Open to scrub/shrub wetland; saturated to permanently flooded; ombrotrophic.

Carex cristatella Britton - Infrequent. Open wetland; saturated; ombrotrophic.

Carex debilis Michaux var. debilis - Infrequent. Open canopy forested wetland; seasonally flooded; ombrotrophic.

Carex festucacea Willd. - Infrequent. Open wetland; saturated; minerotrophic.

Carex frankii Kunth - Frequent. Open wetland; saturated; ombrotrophic.

Carex gracilescens Steudel - Infrequent. Margins of open wetland; temporarily flooded; ombrotrophic.

Carex gracillima Schw. - Infrequent. Open to closed canopy forested wetland; periodically flooded; ombrotrophic.

Carex granularis Willd. - Infrequent. Open wetland; saturated to semi-permanently flooded; minerotrophic.

Carex grayi Carey var. hispidula Bailey - Common. Open canopy forested wetland; saturated; ombrotrophic.

Carex haydenii Dewey - Rare. Open canopy forested wetland; saturated; minerotrophic.

Carex interior Bailey - Infrequent. Open wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Carex lacustris Willd. - Infrequent. Open to scrub/ shrub wetland; saturated to permanently flooded; primarily ombrotrophic.

Carex lanuginosa Michaux - Infrequent. Open to scrub/ shrub wetland; saturated to semi-permanently flooded; minerotrophic.

Carex leptalea Wahl. - Local. Scrub/shrub wetland; saturated; minerotrophic.

Carex lupuliformis Dewey - Local. Open to scrub/ shrub wetland; seasonally flooded; ombrotrophic.

Carex lupulina Willd. - Common. Open to scrub/shrub wetland; saturated to permanently flooded; ombrotrophic.

Carex lurida Wahl. Common. Open wetland; saturated; ombrotrophic.

Carex normalis Mackenzie - Rare. Open wetland; saturated; ombrotrophic.

Carex prasina Wahl. - Infrequent. Open to closed canopy forested wetland; saturated to semi-permanently flooded; minerotrophic.

Carex rosea Willd. - Common. Hillocks of open canopy forested wetland; seasonally flooded; ombrotrophic.

Carex scoparia Willd. - Frequent. Open to scrub/shrub wetland; saturated and semi-permanently flooded; primarily minerotrophic.

Carex squarrosa L. - Common. Open and forested wetland; saturated; primarily ombrotrophic.

Carex stipata Willd. - Common. Open to scrub/shrub wetland; saturated; ombrotrophic and minerotrophic.

Carex straminea Willd. (C. richii sensu Mackenzie) - Infrequent. Open wetland; saturated; ombrotrophic.

Carex stricta Lam. - Common. Open to scrub/shrub wetland; saturated to semi-permanently flooded; ombrotrophic and minerotrophic.

Carex tribuloides Wahl. - Common. Open wetland; seasonally flooded; ombrotrophic.

Carex trichocarpa Schk. - Rare. Open wetland; saturated; primarily minerotrophic.

Carex tuckermanii Dewey - Rare. Scrub/shrub wetland; saturated to semi-permanently flooded; ombrotrophic.

Carex typhina Michaux - Common. Forested wetland;

seasonally flooded; ombrotrophic.

Carex vesicaria L. - Local. Open wetland; saturated to semi-permanently flooded; ombrotrophic.

Carex vulpinoidea Michaux - Common. Open wetland; seasonally flooded; ombrotrophic and minerotrophic.

Cyperus strigosus L. - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

Dulichium arundinaceum (L.) Britton - Local. Open wetland; semi-permanently flooded; primarily ombrotrophic.

Eleocharis elliptica Kunth - Infrequent. Open wetland; saturated to semi-permanently flooded; minerotrophic.

Eleocharis obtusa (Willd.) Schultes - Common. Open wetland; semi-permanently flooded; ombrotrophic.

Eleocharis smallii Britton - Infrequent. Open wetland; semi-permanently flooded; ombrotrophic.

Eleocharis tenuis (Willd.) Schultes - Common. Open wetland; semi-permanently flooded; ombrotrophic and minerotrophic.

Rhynchospora fusca (L.) Ait. f. - Infrequent. Open wetland; saturated; minerotrophic.

Scirpus atrovirens Willd. - Locally abundant. Open wetland; saturated and semi-permanently flooded; primarily ombrotrophic.

Scirpus cyperinus (L.) Kunth - Common/locally abundant. Open wetland; saturated and semi-permanently

flooded; primarily ombrotrophic.

Scirpus expansus Fernald - Rare. Open wetland; semi-permanently flooded; primarily minerotrophic.

Scirpus polyphyllus Vahl - Infrequent. Open canopy forested wetland; semi-permanently flooded; minerotrophic.

Scirpus validus Vahl - Local. Open wetland; saturated and permanently flooded; ombrotrophic.

ARACEAE

Acorus calamus L. - Rare/locally abundant. Open wetland; semi-permanently flooded; primarily minerotrophic.

Arisaema triphyllum ssp. stewardsonii (Britton) Huttleson - Local. Open and scrub/shrub wetland; saturated and seasonally flooded; ombrotrophic.

Symplocarpus foetidus (L.) Nutt. - Frequent/locally abundant. Scrub/shrub wetland; saturated to semi-permanently flooded; minerotrophic.

LEMNACEAE

Lemna valdiviana Phil. - Rare. Open aquatic bed; permanently flooded; ombrotrophic.

JUNCACEAE

Juncus acuminatus Michaux - Frequent. Open wetland; semi-permanently flooded; primarily ombrotrophic.

Juncus canadensis J. Gay forma conglobatus Fernald

- Rare. Open wetland; semi-permanently flooded; primarily ombrotrophic.

Juncus diffusissimus Buckley - Rare. Open wetland; saturated and seasonally flooded; ombrotrophic.

Juncus dudleyi Wiegand - Local. Open wetland; saturated; primarily minerotrophic.

Juncus effusus L. - Common. Open wetland; saturated to permanently flooded; ombrotrophic and minerotrophic.

Juncus marginatus Rostk. - Local. Open wetland; semi-permanently flooded; primarily minerotrophic.

Juncus tenuis Willd. - Common. Open wetland; saturated to seasonally flooded; ombrotrophic.

Luzula multiflora L. (typical) - Local. Open wetland; saturated; minerotrophic.

LILIACEAE

Lilium canadense L. - Locally abundant. Open canopy forested wetland; seasonally flooded; ombrotrophic.

Lilium superbum L. - Local. Open wetland; seasonally flooded; ombrotrophic.

Maianthemum canadense Desf. - Local. Mesic tops of hummocks within scrub/shrub wetland; saturated; primarily minerotrophic.

Smilax rotundifolia L. - Local. Scrub/shrub wetland; seasonally flooded; primarily minerotrophic.

IRIDACEAE

Sisyrinchium angustifolium Mill. - Rare. Mesic hillock within open canopy forested wetland; seasonally flooded; ombrotrophic.

ORCHIDACEAE

Habenaria flava (L.) R. Br. var. herbiola (R. Br.) Ames & Correll - Locally abundant. Forested and scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Habenaria lacera (Michx.) Lodd. - Rare. Open wetland; saturated; minerotrophic.

Habenaria peramoena Gray - Local. Open wetland; saturated; minerotrophic and ombrotrophic.

SALICACEAE

Salix discolor Muhl. - Local. Scrub/shrub wetland; saturated and seasonally flooded; ombrotrophic.

Salix rigida Muhl. - Common. Scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Salix sericea Marsh. - Infrequent. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

JUGLANDACEAE

Carya ovata (Mill.) K. Koch - Common. Forested wetland; saturated and seasonally flooded; ombrotrophic.

CORYLACEAE

Alnus serrulata (Ait.) Willd. - Common. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Betula nigra L. - Frequent. Scrub/shrub and forested wetland; saturated; ombrotrophic.

Carpinus caroliniana Walt. - Frequent. Scrub/shrub and forested wetland; seasonally flooded; ombrotrophic.

Corylus americana Walt. - Local. Scrub/shrub wetland; seasonally flooded; ombrotrophic.

FAGACEAE

Quercus bicolor Willd. - Frequent. Forested wetland and stream margins; seasonally flooded; ombrotrophic.

Quercus palustris Muenchh. - Common. Forested wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

URTICACEAE

Boehmeria cylindrica (L.) Sw. - Common. Open wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Pilea pumila (L.) Gray - Common. Scrub/shrub and forested wetland; saturated and seasonally flooded; ombrotrophic.

POLYGONACEAE

Polygonum cespitosum Blume var. longesetum (DeBruyn)

Stewart - Local. Forested wetland; seasonally flooded; ombrotrophic.

Polygonum orientale L. - Infrequent. Open wetland; saturated; minerotrophic.

Polygonum sagittatum L. - Frequent. Open wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Tovara virginiana (L.) Raf. - Common. Forested wetland; seasonally flooded; ombrotrophic.

CARYOPHYLLACEAE

Stellaria graminea L. - Local. Open wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Stellaria media (L.) Cyrillo - Infrequent. Mesic tops of hummocks and on logs within scrub/shrub wetland; minerotrophic and ombrotrophic.

RANUNCULACEAE

Clematis virginiana L. - Common. Scrub/shrub wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Ranunculus ambigens Wats. - Rare. Open wetland; semi-permanently flooded; ombrotrphic.

Ranunuclus abortivus L. - Common. Open and scrub/shrub wetland; seasonally flooded; minerotrophic and ombrotrophic.

Ranunculus carolinianus DC. - Locally abundant. Open

and scrub/shrub wetland; saturated; minerotrophic and ombrotrophic.

Ranunculus recurvatus Poir - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

Thalictrum polygamum Muhl. - Frequent. Open and scrub/shrub wetland; saturated; minerotrophic and ombrotrophic.

BRASSICACEAE

Cardamine arenicola Britton - Local. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Cardamine rotundifolia Michaux - Local. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Rorippa islandica (Oeder) Borbas - Common. Open wetland; saturated and semi-permanently flooded; primarily ombrotrophic.

SAXIFRAGACEAE

Chrysosplenium americanum Schw. - Local. Open and scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Penthorum sedoides L. - Common. Open wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Ribes cynosbati L. - Frequent. Forested and scrub/shrub wetland; seasonally flooded ombrotrophic.

ROSACEAE

Agrimonia parviflora Ait. - Frequent. Open canopy forested wetland; seasonally flooded; minerotrophic and ombrotrophic.

Agrimonia gryposepala Wallr. - Frequent. Open wetland; saturated; minerotrophic and ombrotrophic.

Aronia prunifolia (Marsh.) Rehder (Pyrus melanocarpa (Michaux) Willd.) - Frequent. Scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

Crataegus crus-galli L. - Frequent. Open and scrub/shrub wetland; margins of saturated soils; minerotrophic and ombrotrophic.

Fragaria virginicus L. - Infrequent. Mesic tops of hummocks within scrub/shrub wetland; ombrotrophic.

Geum laciniatum Murr. - Frequent. Open wetland; temporarily flooded; ombrotrophic.

Prunus virginiana L. - Infrequent. Margins of forested wetland; temporarily flooded; minerotrophic and ombrotrophic.

Rosa palustris L. - Common. Open and scrub/shrub wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Rubus sp. - Infrequent. Scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

Rubus hispidus L. - Common. Scrub/shrub and forested wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Rubus occidentalis L. - Local. Open canopy forested

wetland; seasonally flooded; ombrotrophic.

Sanguisorba canadense L. - Infrequent. Open wetland; saturated and semi-permanently flooded; minerotrophic.

Spiraea alba Du Roi - Common. Open wetland; saturated and semi-permanently flooded; primarily minerotrophic.

FABACEAE

Amphicarpa bracteata (L.) Fernald - Infrequent/locally abundant. Open wetland; semi-permanently flooded; minerotrophic.

Apios americana Medic. - Frequent. Open and scrub/shrub wetland; seasonally and semi-permanently flooded; minerotrophic and ombrotrophic.

Cassia hebecarpa Fernald - Rare. Open wetland; temporarily flooded; ombrotrophic.

OXALIDACEAE

Oxalis europaea Jord. forma villicaulis Wigand - Frequent. Open canopy forested wetland; seasonally flooded; ombrotrophic.

Oxalis filipes Small - Frequent. Scrub/shrub and open canopy forested wetland; seasonally flooded; ombrotrophic.

EUPHORBIACEAE

Acalypha rhomboidea Raf. - Common. Recently clearcut open wetland; seasonally flooded; ombrotrophic.

ANACARDIACEAE

Toxicodendron radicans Ktze. - Common. Scrub/shrub and forested wetland; seasonally flooded; minerotrophic and ombrotrophic.

AQUIFOLIACEAE

Ilex verticillata (L.) Gray - Frequent. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Sambucus canadensis L. - Common. Open and forested wetland; seasonally and semi-permanently flooded; minerotrophic and ombrotrophic.

ACERACEAE

Acer rubrum L. - Common. Scrub/shrub and forested wetland; semi-permanently and seasonally flooded; minerotrophic and ombrotrophic.

BALSAMINACEAE

Impatiens capensis Meerb. - Common. Open to forested wetland; seasonally flooded; minerotrophic and ombrotrophic.

HYPERICACEAE

Hypericum mutilinum L. - Frequent. Open wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Hypericum prolificum L. - Common. Open and scrub/shrub wetland; semi-permanently flooded; primarily

minerotrophic.

Hypericum punctatum Lam. - Frequent. Open wetland; seasonally flooded; ombrotrophic.

Hypericum virginicum L. - Infrequent. Open wetland; semi-permanently flooded; minerotrophic.

VIOLACEAE

Viola blanda Willd. - Rare. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

Viola cucullata Ait. - Common. Open and scrub/shrub wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Viola primulifolia L. - Rare. Open wetland; saturated and seasonally flooded; ombrotrophic.

NYSSACEAE

Nyssa sylvatica Marsh. - Common. Forested wetland; saturated and seasonally flooded; ombrotrophic.

ONAGRACEAE

Circaea canadensis Hill - Locally abundant. Forested wetland; seasonally flooded; ombrotrophic.

Epilobium coloratum Biehler. - Common. Open wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Ludwigia alternifolia L. - Frequent. Open wetland; seasonally flooded; ombrotrophic.

Ludwigia palustris (L.) Ell. - Common. Open wetland; intermittently exposed.

Oenothera tetragona Roth. var. longistipata (Pennell) Munz - Frequent. Open wetland; saturated and seasonally flooded; primarily ombrotrophic.

HALORAGACEAE

Proserpinaca palustris L. var. crebra Fernald & Grisc. - Frequent. Open wetland; intermittently exposed; primarily ombrotrophic.

APIACEAE

Cicuta maculata L. - Local. Open canopy forested wetland; seasonally flooded; ombrotrophic.

Cryptotaenia canadensis (L.) DC. - Common. Forested wetland; seasonally flooded; ombrotrophic.

Hydrocotyle americana L. - Local. Open and open canopy forested wetland; primarily minerotrophic.

Osmorhiza longistylis (Torrey) DC. - Local. Open wetland; seasonally flooded; ombrotrophic.

Oxypolis rigidior (L.) C. & R. - Local. Scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

CORNACEAE

Cornus ammomum Miller - Common. Open and scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

ERICACEAE

Lyonia ligustrina (L.) DC. - Frequent. Scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Rhododendron arborescens (Pursh) Torrey - Rare. Scrub/shrub wetland; semi-permanently flooded; minerotrophic.

PRIMULACEAE

Lysimachia ciliata L. - Common. Open and scrub/shrub wetland; saturated; minerotrophic and ombrotrophic.

Lysimachia hybrida Michaux - Very local. Open and scrub/shrub wetland; seasonally flooded; ombrotrophic.

Lysimachia nummularia L. - Common. Open wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Lysimachia terrestris (L.) B.S.P. - Common. Open wetland; saturated and seasonally flooded; ombrotrophic.

ASCLEPIADACEAE

Asclepias incarnata L. - Common. Open wetland; saturated; minerotrophic and ombrotrophic.

CONVOLULACEAE

Convolvulus sepium L. - Local. Open wetland; saturated; minerotrophic and ombrotrophic.

Cuscuta gronovii Willd. - Local. Open wetland; semi-permanently flooded; ombrotrophic.

VERBENACEAE

Verbena hastata L. - Common. Open wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Verbena urticifolia L. - Common. Open wetland; seasonally flooded; ombrotrophic.

LAMIACEAE

Lycopus americanus Muhl. - Frequent. Open wetland; saturated and semi-permanently flooded; minerotrophic.

Lycopus uniflorus Michaux - Local. Open wetland; saturated; minerotrophic.

Lycopus virginicus L. - Frequent. Open canopy forested wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Mentha arvensis L. forma glabrata (Benth.) S. R. Stewart - Very local. Open wetland; saturated and semi-permanently flooded; minerotrophic.

Mentha piperita L. - Frequent. Open wetland; saturated and seasonally flooded; ombrotrophic.

Monardia clinipodia L. - Infrequent. Scrub/shrub wetland; seasonally flooded; ombrotrophic.

Prunella vulgaris L. - Common. Open and scrub/shrub wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Pycnanthemum tenuifolium Schrad. - Rare. Open wetland; saturated; minerotrophic.

Pycnanthemum verticillatum (Michaux) Pers. - Infrequent. Open wetland; saturated; minerotrophic.

Pycnanthemum virginianum (L.) Durand & Jackson - Local. Open wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Scutellaria lateriflora L. - Common. Open and scrub/shrub wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Teucrium canadense L. - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

SCROPHULARIACEAE

Chelone glabra L. - Frequent. Scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Gratiola virginiana L. - Common. Open and open canopy forested wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Lindernia dubia (L.) Pennell - Common. Open and open canopy forested wetland; semi-permanently flooded; primarily ombrotrophic.

Mimulus alatus Ait. - Common. Open canopy forested wetland; seasonally flooded and semi-permanently flooded; ombrotrophic.

Mimulus moschatus Douglas - Rare. Open wetland;

semi-permanently flooded; minerotrophic.

Mimulus ringens L. - Common. Open wetland; seasonally flooded and semi-permanently flooded; minerotrophic and ombrotrophic.

Pedicularis lanceolata Michaux - Very local. Open wetland; semi-permanently flooded; minerotrophic.

Veronica americana (Raf.) Schwein. - Very local. Open wetland; semi-permanently flooded; minerotrophic.

Veronica arvensis L. - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

Veronica officinalis L. - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

Veronica scutellata L. - Very local. Open wetland; semi-permanently flooded; minerotrophic.

Veronicastrum virginicum (L.) Farwell - Rare. Scrub/shrub wetland; saturated and seasonally flooded; minerotrophic.

PLANTAGINACEAE

Plantago rugelii Dcne. - Infrequent. Open canopy forested wetland; seasonally flooded; ombrotrophic.

RUBIACEAE

Cephalanthus occidentalis L. - Common. Scrub/shrub wetland; flooded and intermittently exposed; ombrotrophic.

Galium asprellum Michaux - Local. Open wetland; semi-permanently flooded; minerotrophic.

Galium tinctorium L. - Common. Open wetland; semi-permanently flooded; minerotrophic and ombrotrophic.

Galium triflorum Michaux - Common. Open wetland; seasonally flooded and semi-permanently flooded; minerotrophic and ombrotrophic.

CAPRIFOLIACEAE

Sambucus canadensis L. - Common. Open, scrub/shrub and open canopy forested wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Viburnum lentago L. - Frequent. Scrub/shrub wetland; semi-permanently flooded; primarily minerotrophic.

Viburnum recognitum Fernald - Common. Scrub/shrub wetland; minerotrophic and ombrotrophic.

DIPSACACEAE

Dipsacus sylvestris Hudson - Infrequent. Open wetland; seasonally flooded; ombrotrophic.

CAMPANULACEAE

Campanula aparinoides Pursh - Very local. Open wetland; semi-permanently flooded; minerotrophic.

Lobelia cardinalis L. - Common. Open canopy forested wetland; saturated and seasonally flooded; ombrotrophic.

Lobelia inflata L. - Common. Open wetland; seasonally flooded; ombrotrophic.

Lobelia siphilitica L. - Frequent. Open and scrub/

shrub wetland; seasonally flooded; minerotrophic.

ASTERACEAE

Aster dumosus L. var. subulaefolius T. & G. - Rare. Scrub/shrub wetland; saturated; minerotrophic.

Aster pilosus Willd. - Common. Open and scrub/shrub wetland; seasonally flooded; minerotrophic and ombrotrophic.

Aster puniceus L. - Common. Open and scrub/shrub wetland; saturated and semi-permanently flooded; minerotrophic and ombrotrophic.

Bidens cernua L. - Common. Open, scrub/shrub, and forested wetland; semi-permanently flooded; ombrotrophic.

Bidens frondosa L. - Common. Open wetland; semi-permanently flooded; ombrotrophic.

Eupatorium fistulosum Barratt - Common. Open and open canopy forested wetland; saturated to semi-permanently flooded; minerotrophic and ombrotrophic.

Eupatorium perfoliatum L. - Common. Open wetland; saturated to semi-permanently flooded; minerotrophic and ombrotrophic.

Euthamia graminifolia (L.) Nutt. - Frequent. Open wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Helenium autumnale L. var. parviflorum (Nutt.) Fernald - Local. Open wetland; seasonally flooded; ombrotrophic.

Helenium flexuosum Raf. - Local. Open wetland;

seasonally flooded; ombrotrophic.

Hieracium pilosella L. - Rare. Open wetland; seasonally flooded; ombrotrophic.

Rudbeckia laciniata L. - Frequent. Open and scrub/shrub wetland; seasonally flooded; ombrotrophic.

Senecio aureus L. - Local. Open canopy forested wetland; semi-permanently flooded; ombrotrophic.

Solidago purshii Porter - Rare. Forested wetland; seasonally flooded; ombrotrophic.

Solidago rugosa Ait. - Infrequent. Scrub/shrub wetland; saturated; ombrotrophic.

Verbesina alternifolia (L.) Britton & Kearney - Common. Open and scrub/shrub wetland; saturated and seasonally flooded; minerotrophic and ombrotrophic.

Vernonia noveboracensis (L.) Michaux - Frequent. Open wetland; seasonally flooded; ombrotrophic.