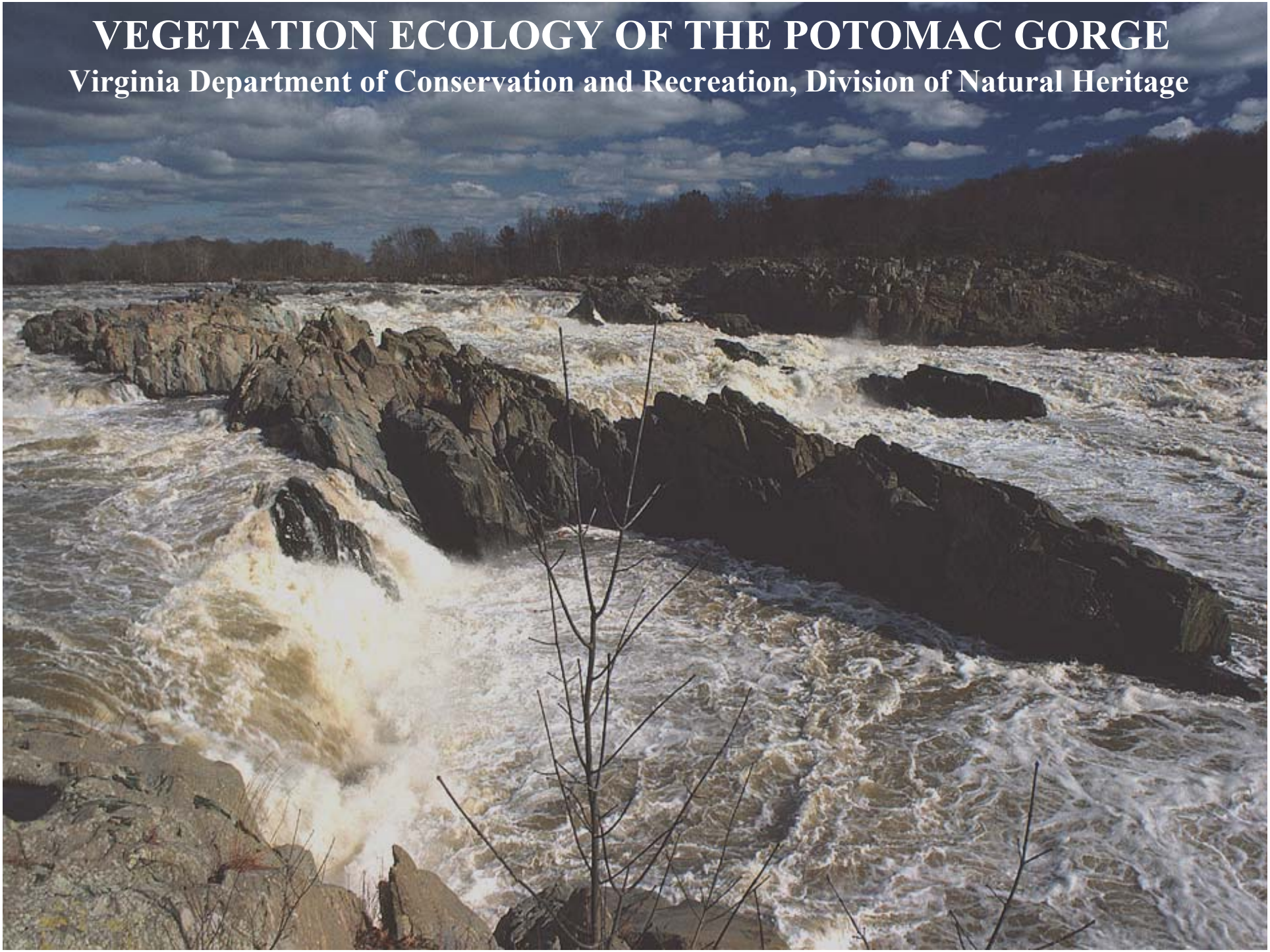
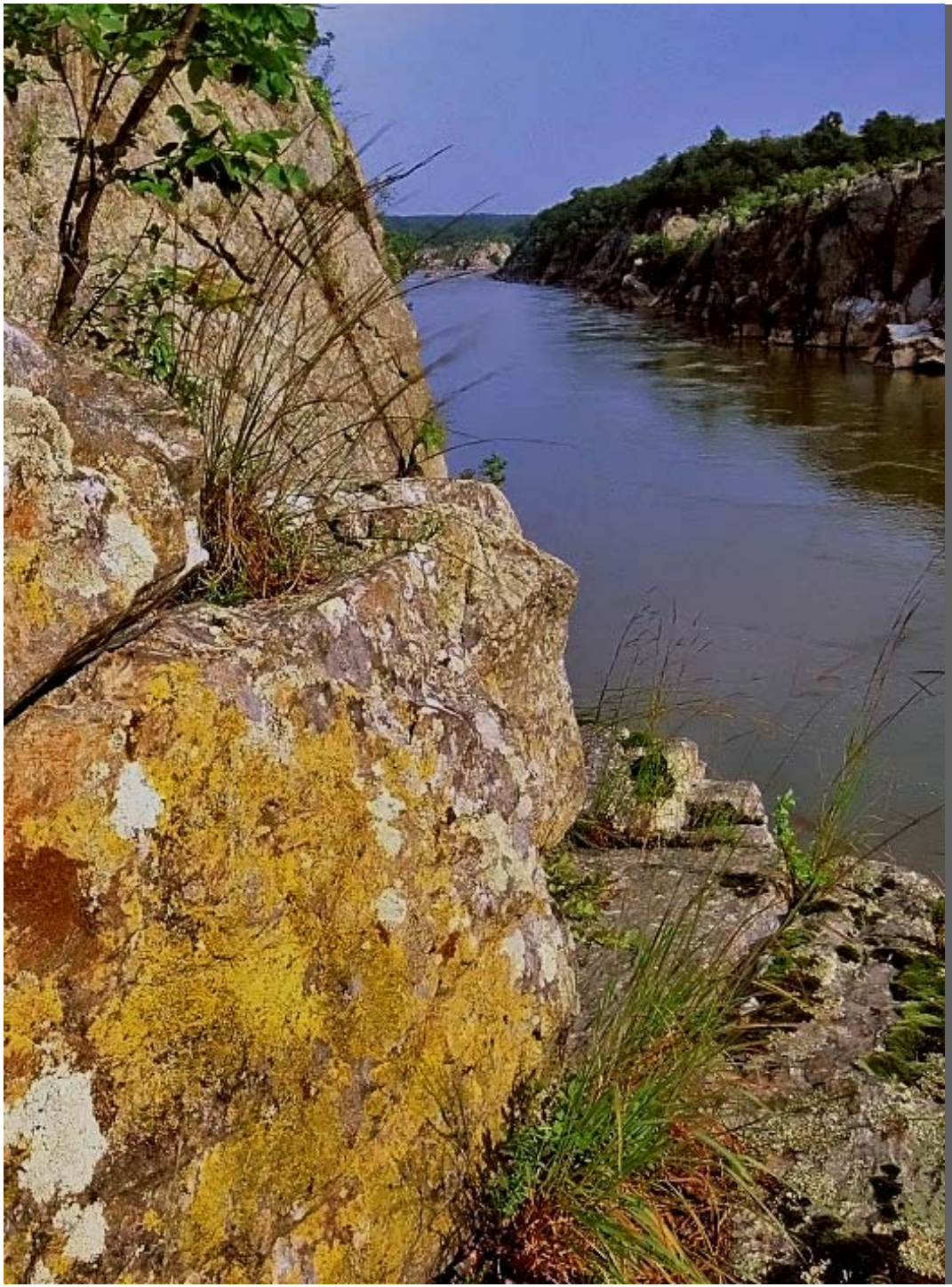
VEGETATION ECOLOGY OF THE POTOMAC GORGE

Virginia Department of Conservation and Recreation, Division of Natural Heritage





The Potomac Gorge

- entrenched valley of the Potomac River as it passes through the Piedmont "fall line" for 24 km from Great Falls to Washington, D.C.

- considered one of the most important natural areas in the Mid-Atlantic region

- 3900 ha conservation site containing >400 occurrences of 200 rare plants and natural communities (TNC)

Potomac Gorge Vegetation Ecology Study
Virginia Natural Heritage Program

- **Four-year study (2003-2006) dedicated to the inventory and classification of ecological communities on the Virginia side, and integration with previous work on the Maryland/D.C. side.**

- **Funded (in part) by the National Park Service, George Washington Memorial Parkway; supported by The Nature Conservancy, Fairfax County Park Authority, Madeira School.**

- **Application of a "coarse filter" approach to biological conservation that emphasizes the protection of ecological communities and all associated organisms.**

Objectives of the Potomac Gorge Vegetation Ecology Study by VANHP

- Expand and refine the partial existing information on ecological communities of the Gorge

- Facilitate conservation planning based on landscape-scale targets and criteria

- Provide an ecologically and biologically based framework for management / stewardship activities and site mapping

- Reduce redundancy in management strategies for multiple rare species

- Assist in targeting and prioritizing future inventory work

Other vegetation ecology studies of the Potomac Gorge

Abrams, M.D. and C.A. Copenheaver. 1999. Temporal variation and species recruitment and dendroecology of an old-growth white oak forest in the Virginia Piedmont, USA. Forest Ecology and Management 124: 275-284.

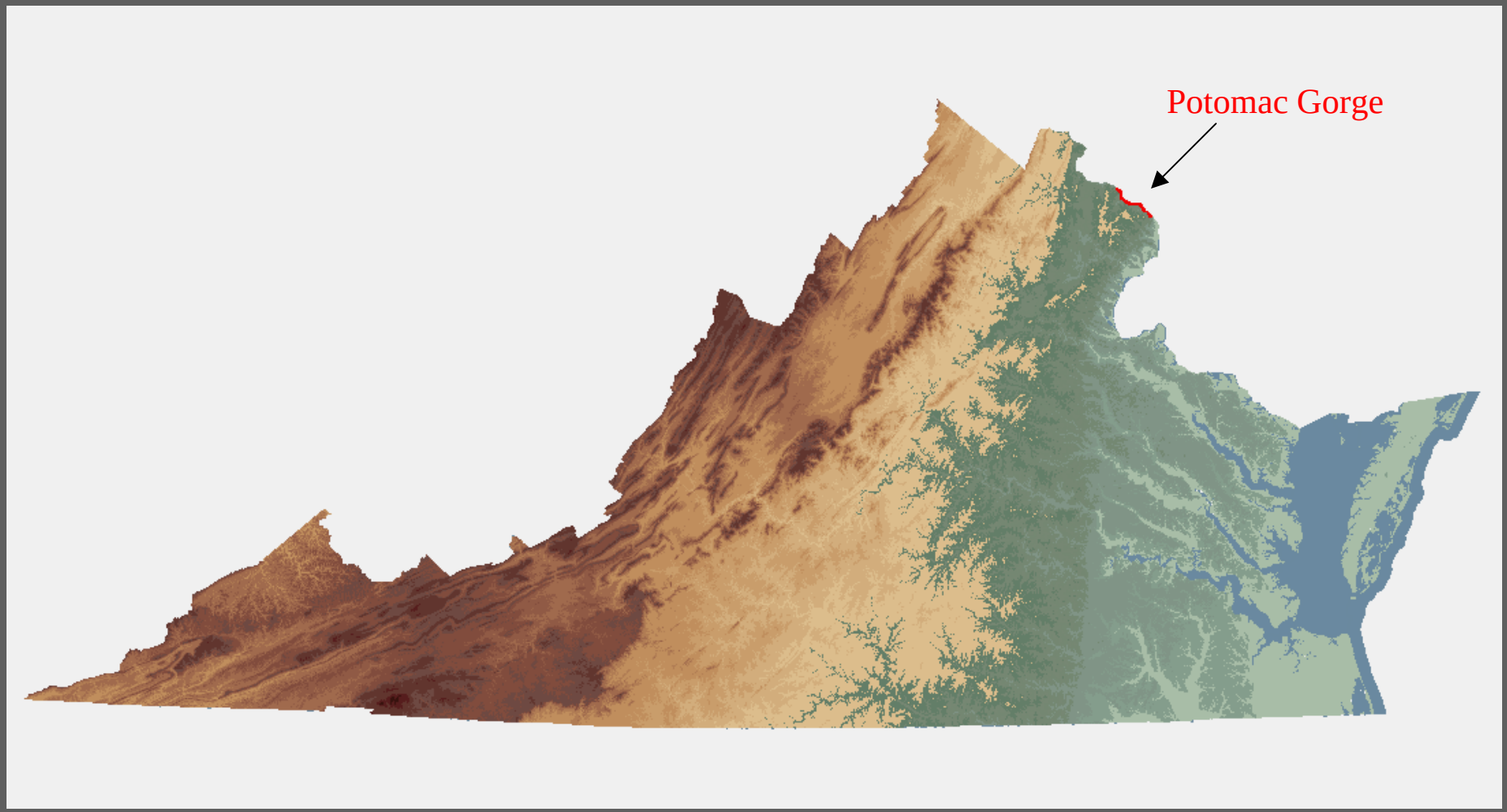
Lea, C. 2000. Plant communities of the Potomac Gorge and their relationship to fluvial factors. Unpublished M.S. Thesis, George Mason University. 219 pp.

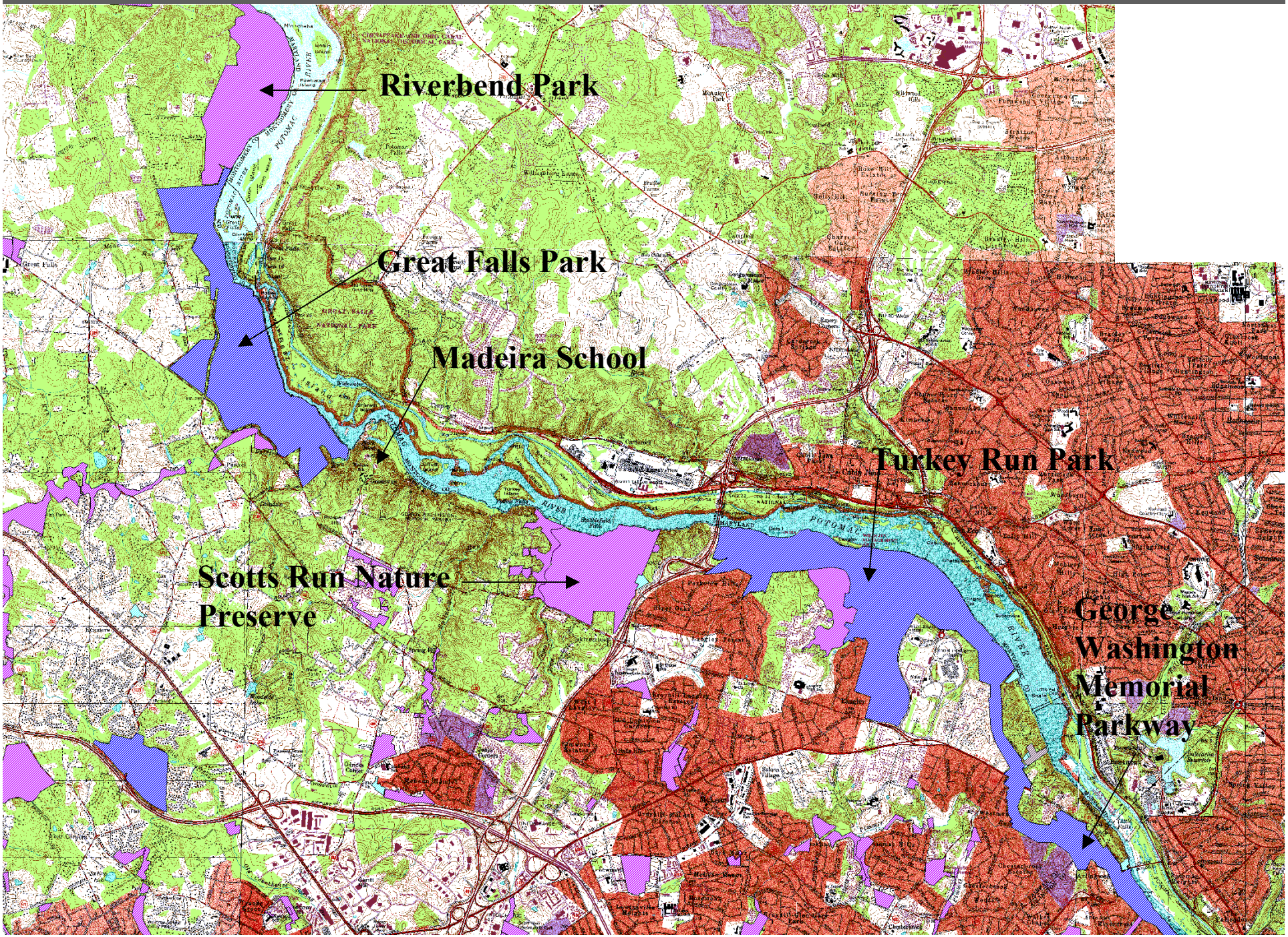
Lea, C. and R. Simmons. USGS/NPS Vegetation Mapping Program: vegetation classification of the Gold Mine Tract, C&O Canal National Historical Park. Unpublished report submitted to the National Park Service and The Nature Conservancy. 67 pp.

National Capital Region Vegetation Mapping Project – multijurisdictional project (DC, MD, VA, WVA) that includes the entire Potomac Gorge and much of the mainstem Potomac River valley in Maryland along C&O Canal NHP.

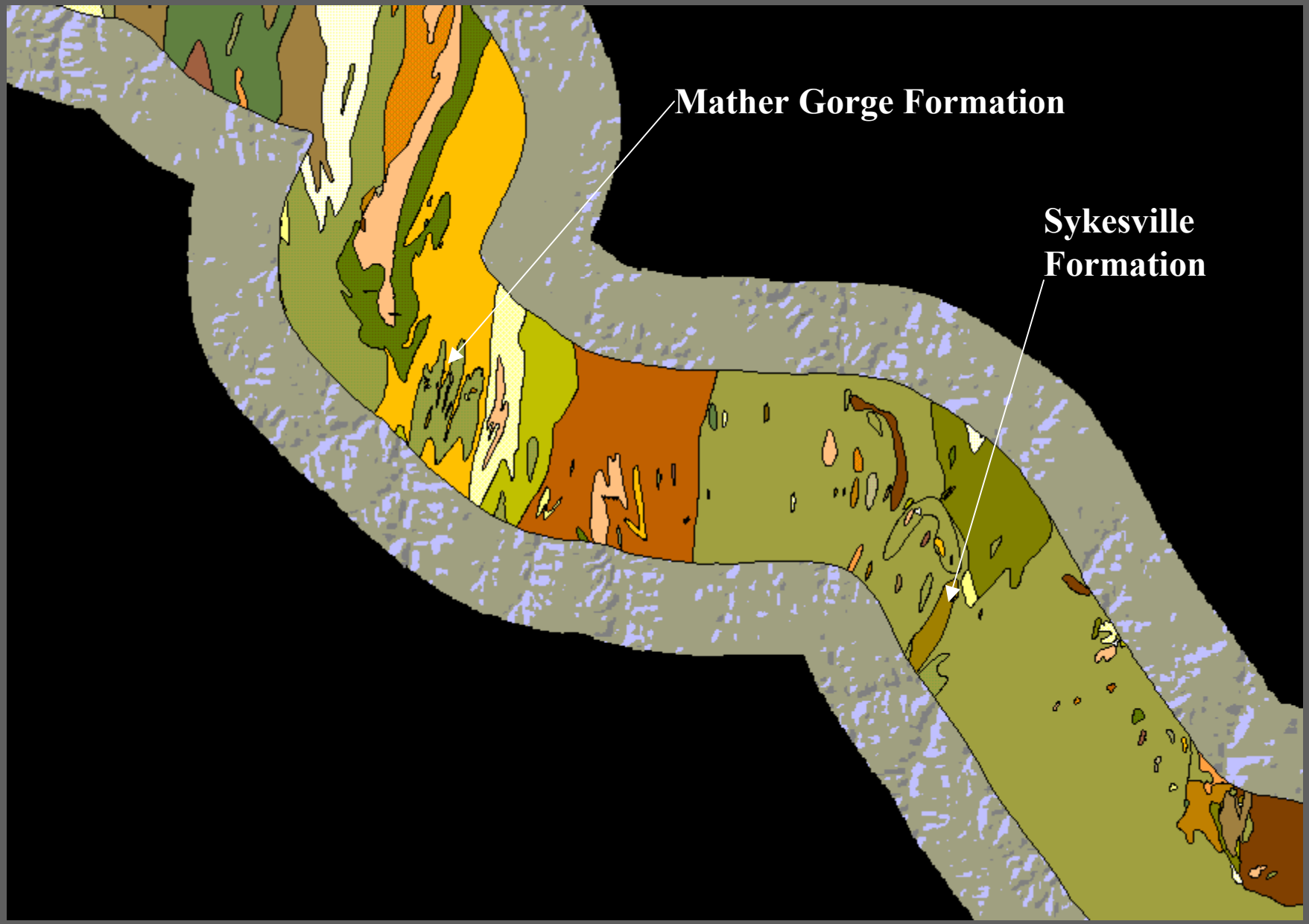

STUDY AREA

Study Area Location




Riverbend Park
Great Falls Park
Madeira School
Turkey Run Park
Scotts Run Nature Preserve
George Washington Memorial Parkway

Bedrock Geology



MATHER GORGE FORMATION

Quartzose and mica schist; metagraywacke; migmatitic schist; mafic, ultramafic, and granitoid intrusions and debris.

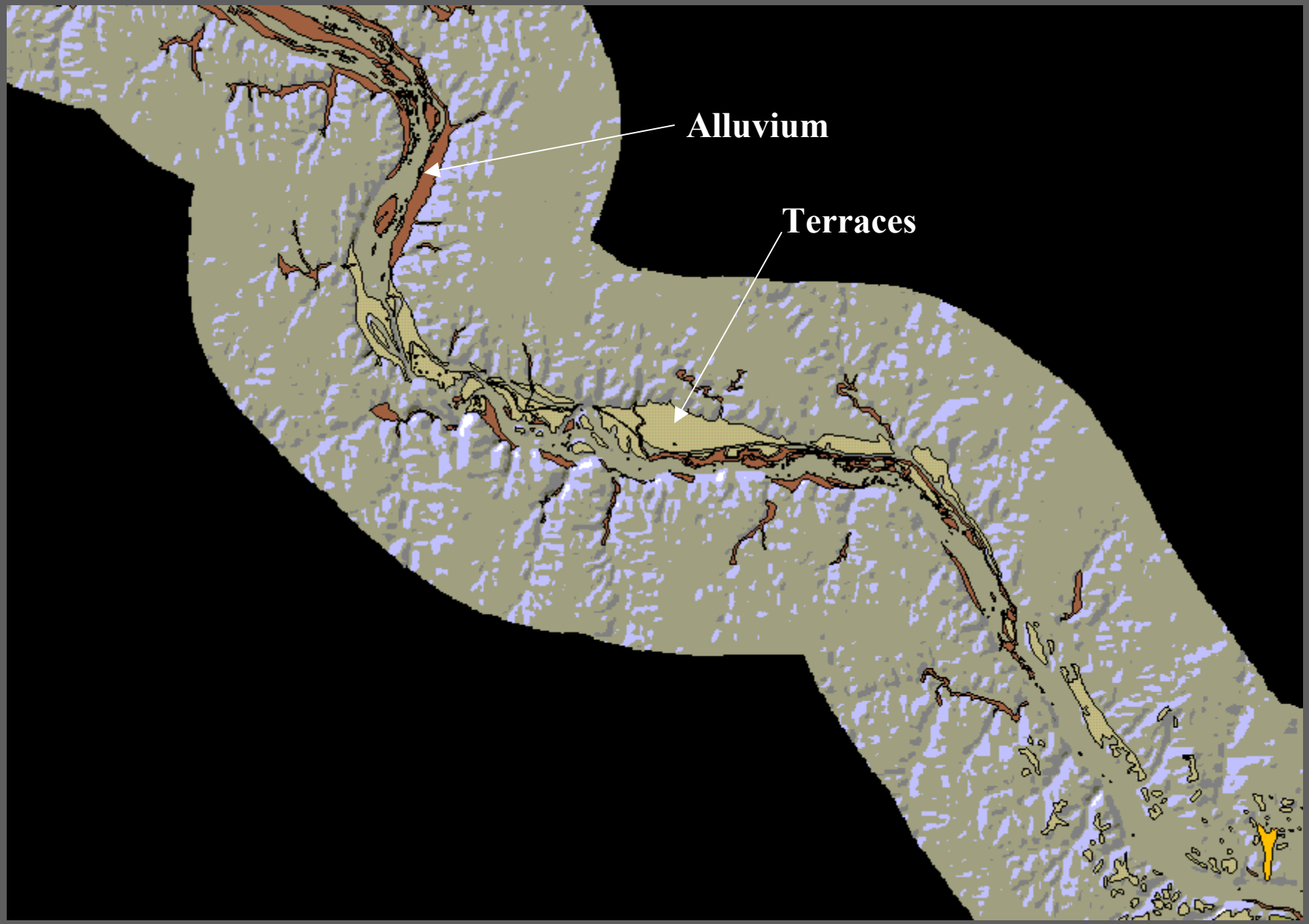
Interbedded metagrawacke and schist

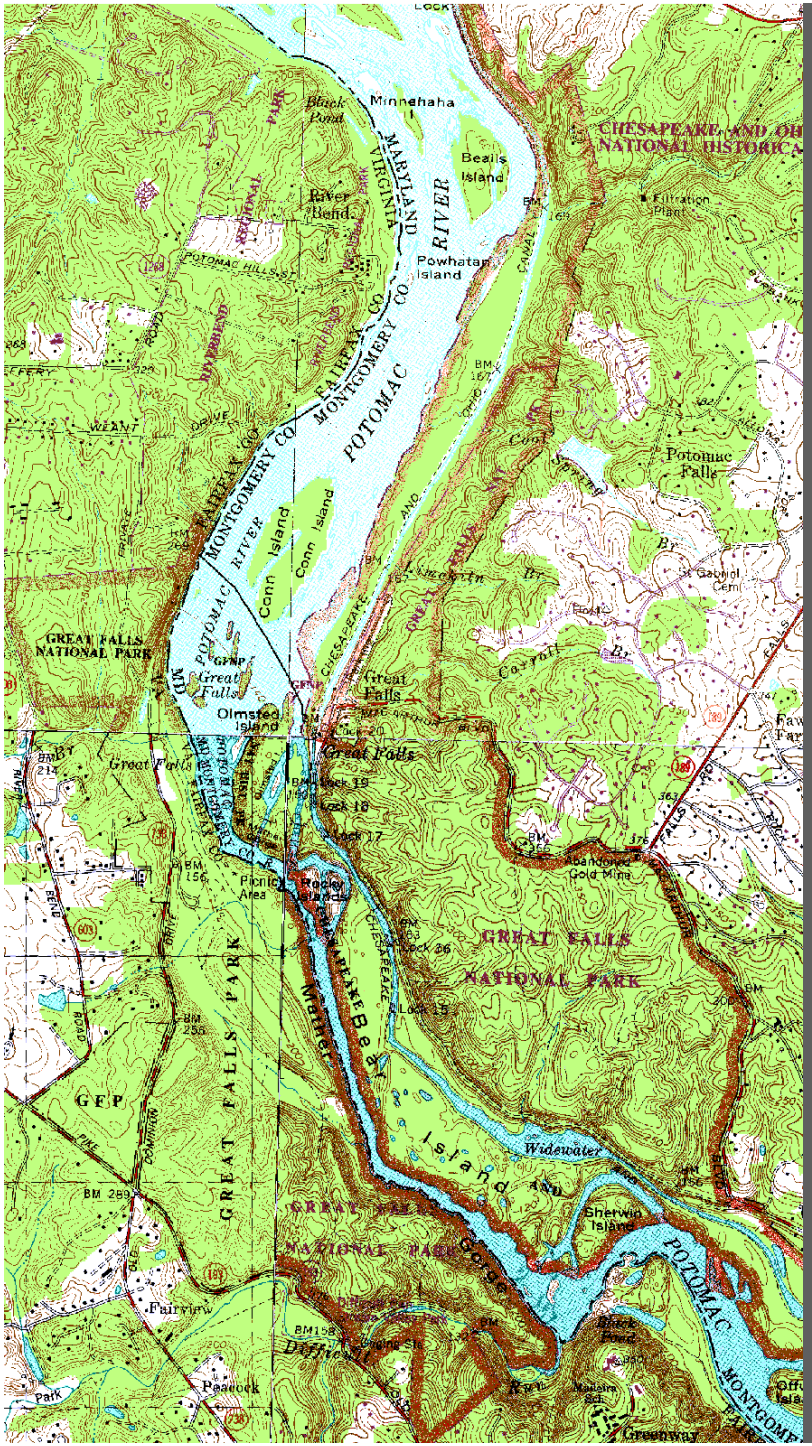
SYKESVILLE FORMATION

Metasedimentary melange; quartzo-feldpathic matrix with heterogeneous fragments and mappable intrusions of mafic, ultramafic, and granitoid rocks.

Sykesville matrix with fragments

Surficial Geology





Potomac Gorge: Upper Section

Above Great Falls

Channel at Great Falls

View of Great Falls from bedrock terrace

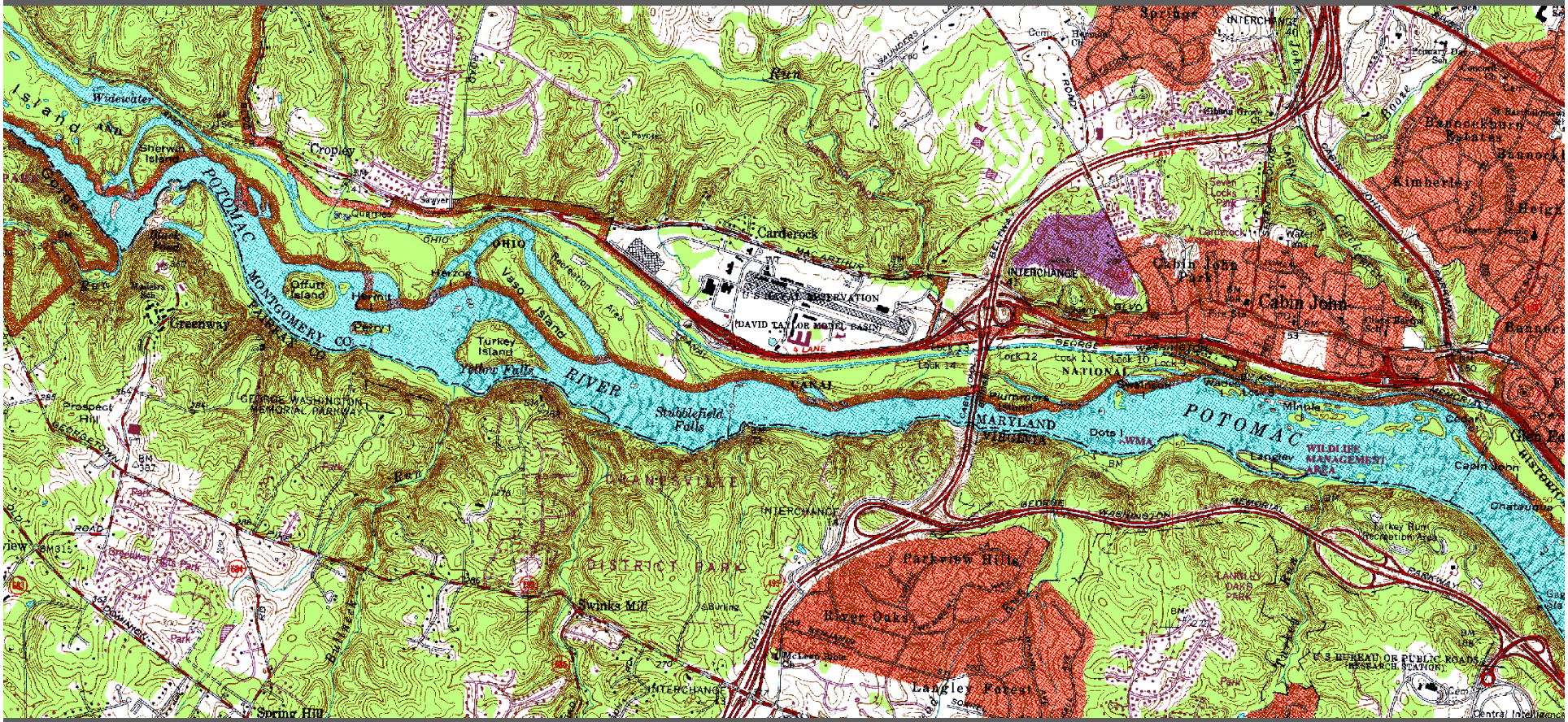
Upper Mather Gorge

Middle Mather Gorge

Lower Mather Gorge

Difficult Run

Potomac Gorge: Middle Section



Bedrock terrace at Madeira School

Black Pond at Madeira School

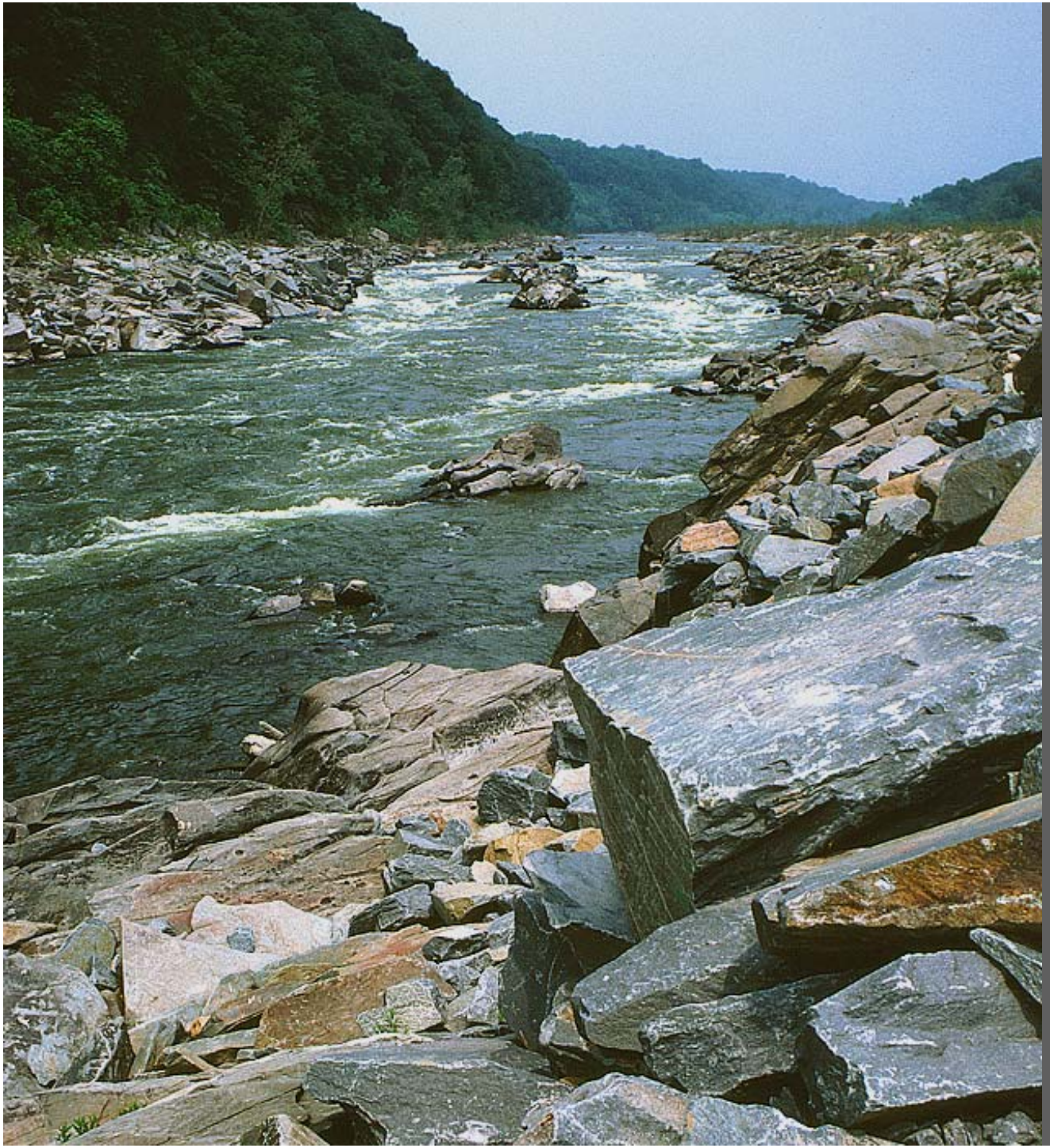
Channel around Offut Island

Offutt Island and Virginia shore

Scott's Run and Stubblefield Falls

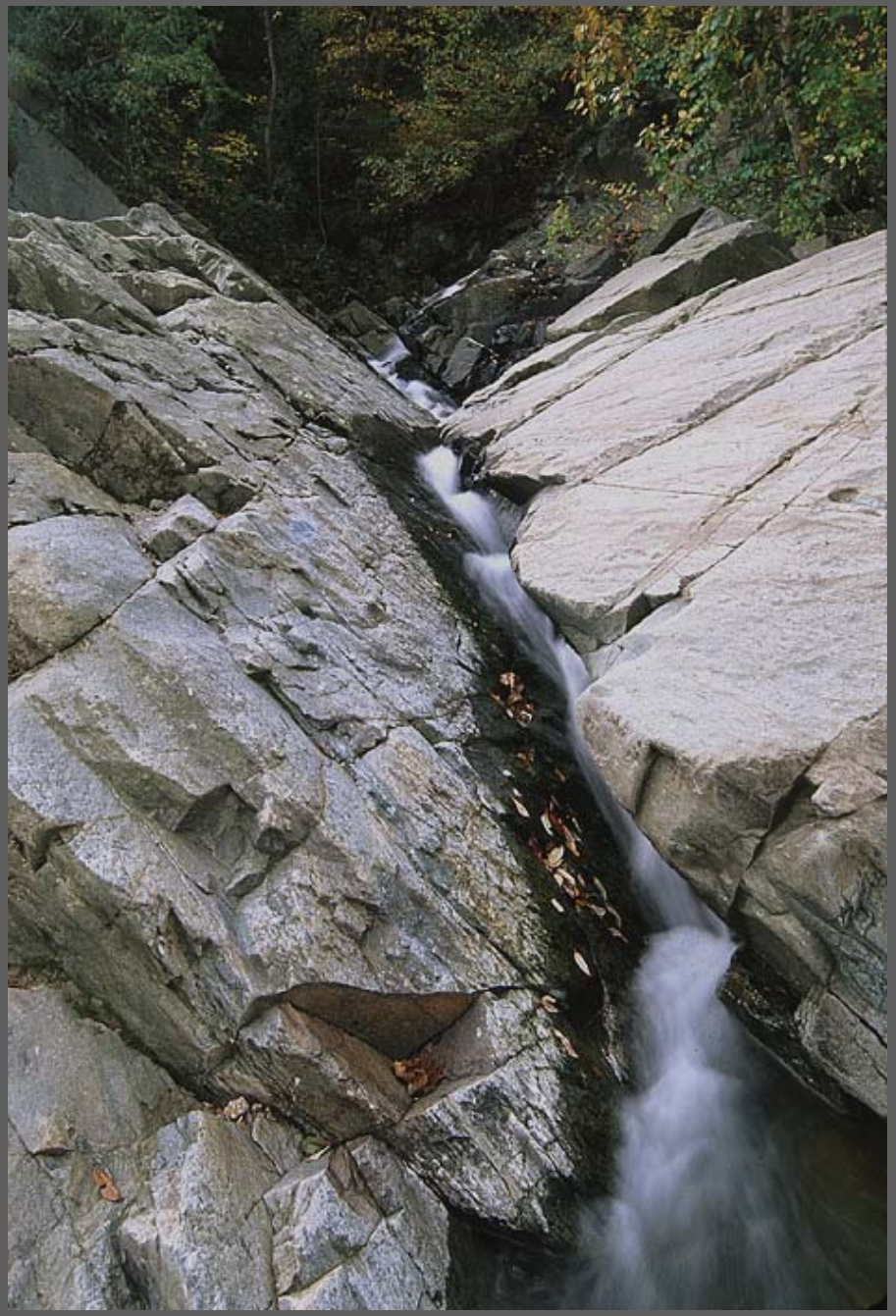
Below Stubblefield Falls

Potomac Gorge: Lower Section



Little Falls

Arlington bluffs and Chain Bridge Flats



Gulf Branch and rocky Arlington shore

Potomac Gorge: Hydrology and Flooding Regimes

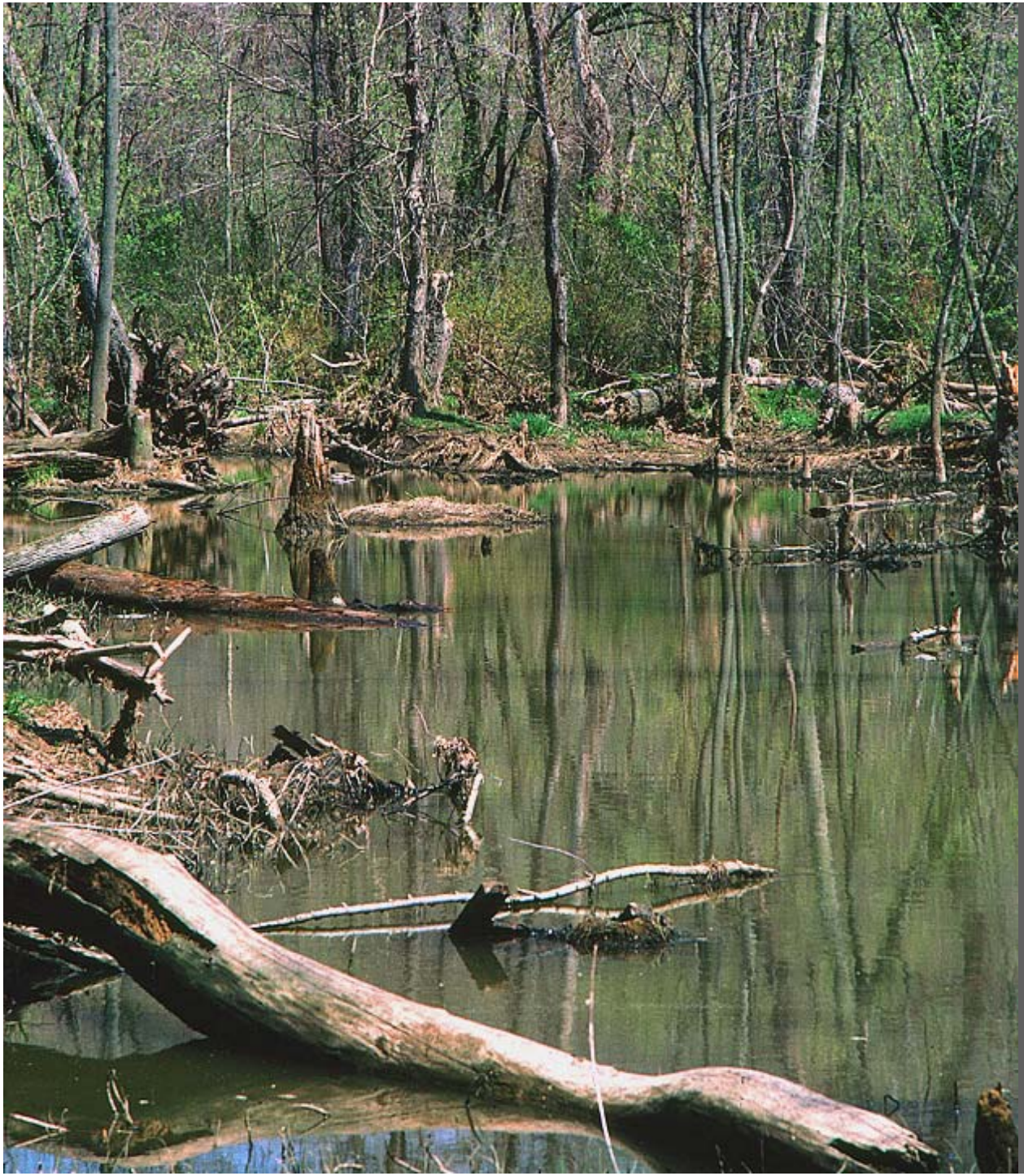
View of Mather Gorge with normal water level

Same view during flooding following Hurricane Agnes, 1972

Inundated floodplain forest, December, 2003

Flood damage near Cabin John

Potomac Gorge ice flows



Mechanical damage to floodplain forest from ice floods

Low flows and seasonally exposed shores

Factors contributing to the biotic richness of the Potomac Gorge

- Complex geology, geomorphology, and topography.
- Diversity of soils and edaphic environments, including swamps, rich alluvium, various upland soils weathered in residuum, and rock outcrops.
- Diversity of wetlands and hydrologic regimes.
- A large river with largely intact, powerful flooding regime.
- A major water course serving as a optimal corridor for ongoing migrations of plants between the Appalachians and Coastal Plain.


METHODS

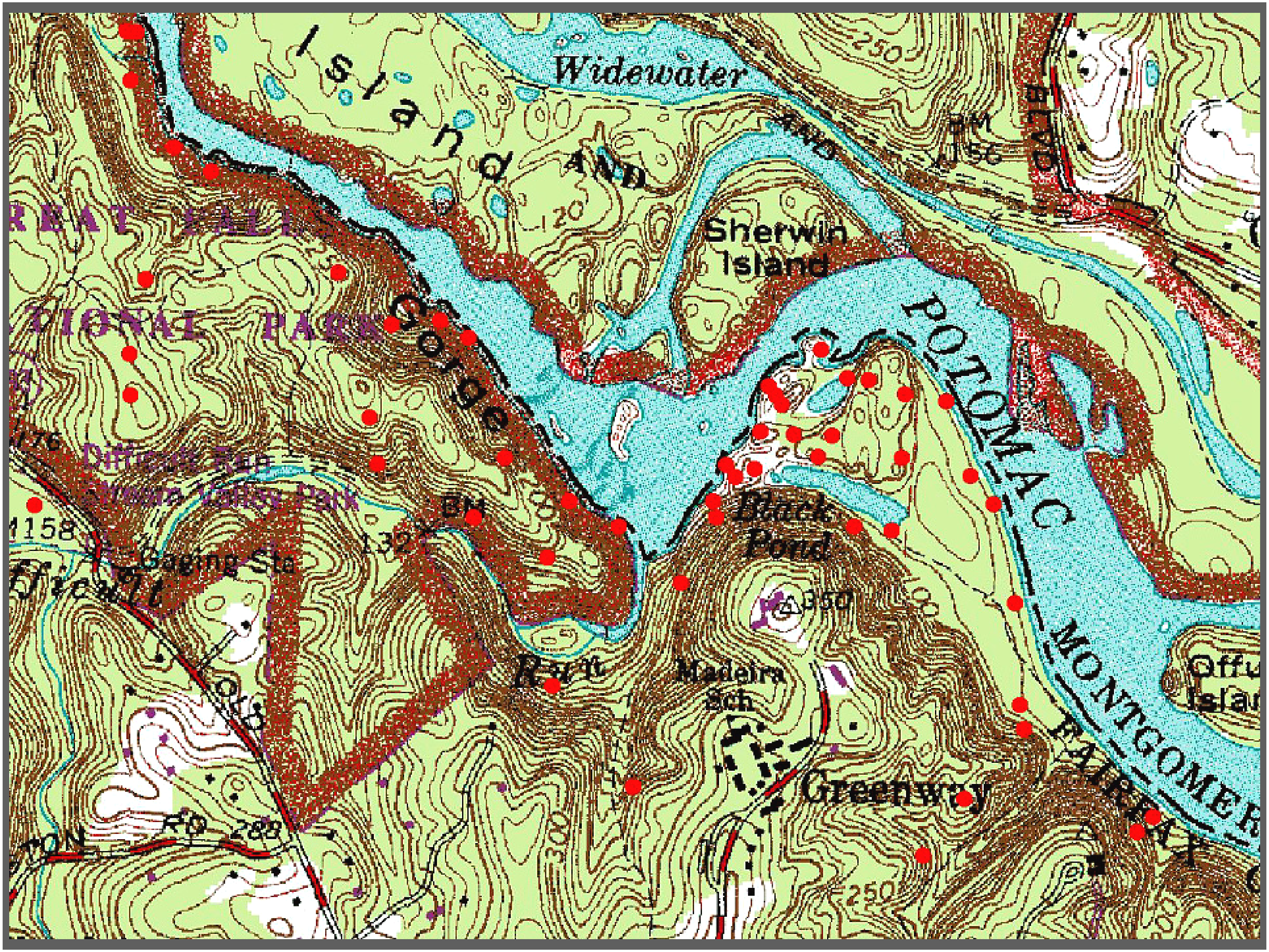
Field Sampling Methodology

PLOT SIZE
- 400 sq. m. for Forests and Woodlands
- 100 sq. m. for Shrubland and Herbaceous Vegetation

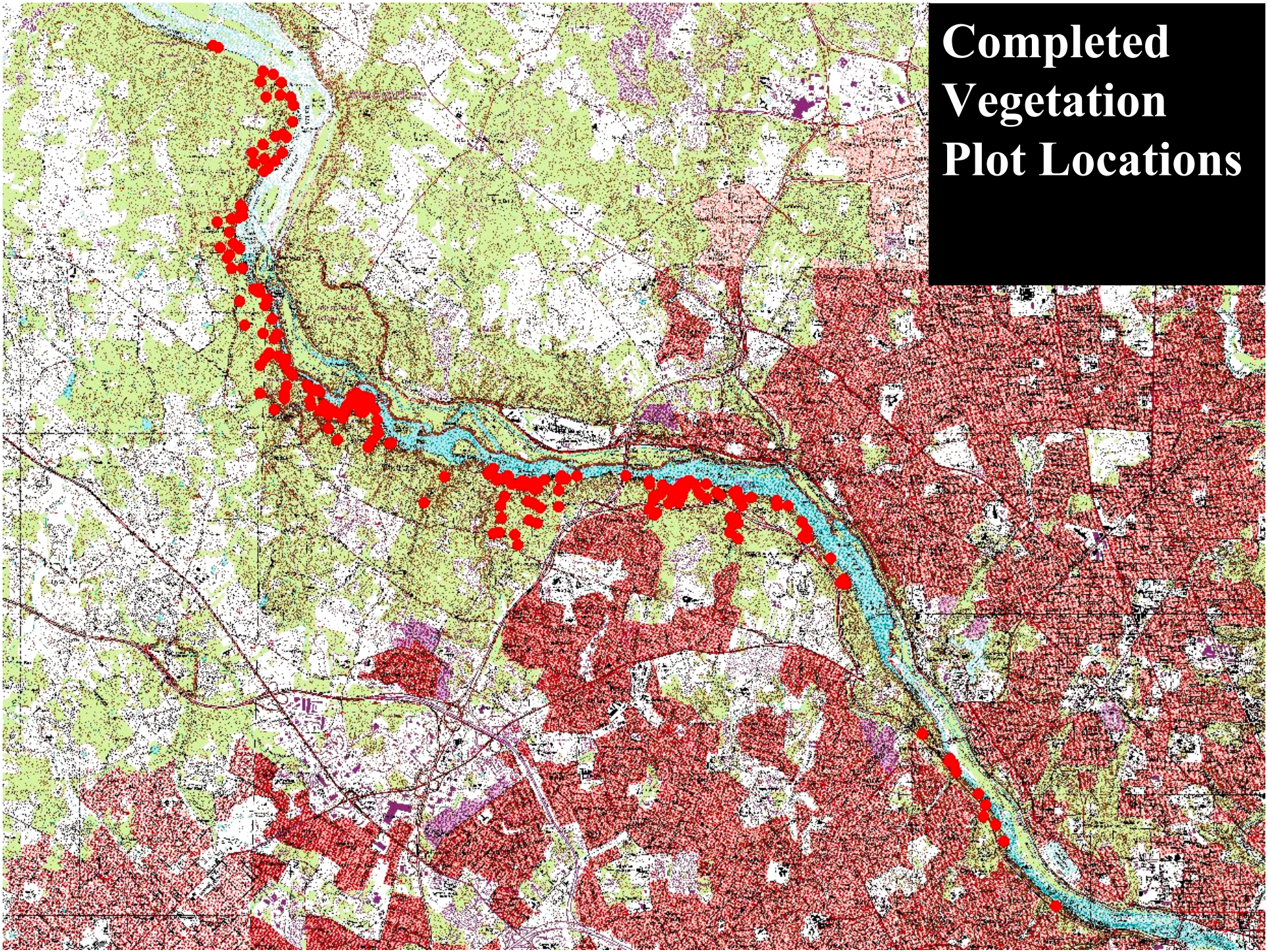
LOCATION DATA
- recorded to ≤ 10 m accuracy with GPS unit

VEGETATION DATA
- Presence and cover of all vascular taxa at six height strata
- Maximum canopy height
- Measurements of all woody stems ≥ 2.5 cm DBH

ENVIRONMENTAL DATA
- Topographic Position
- Cover of surface substrates (wood, bedrock, boulders, etc.)
- Slope inclination
- Aspect
- Slope shape (horizontally and vertically)
- Soil samples (3-4 combined) for chemical and textural analyses



Island
Widewater
AND
Sherwin Island
Gorge
POTOMAC
Black Pond
Madeira Sch
Greenway
Run
Gaging Sta
FAIRFAX
BLVD
250
120
350
132

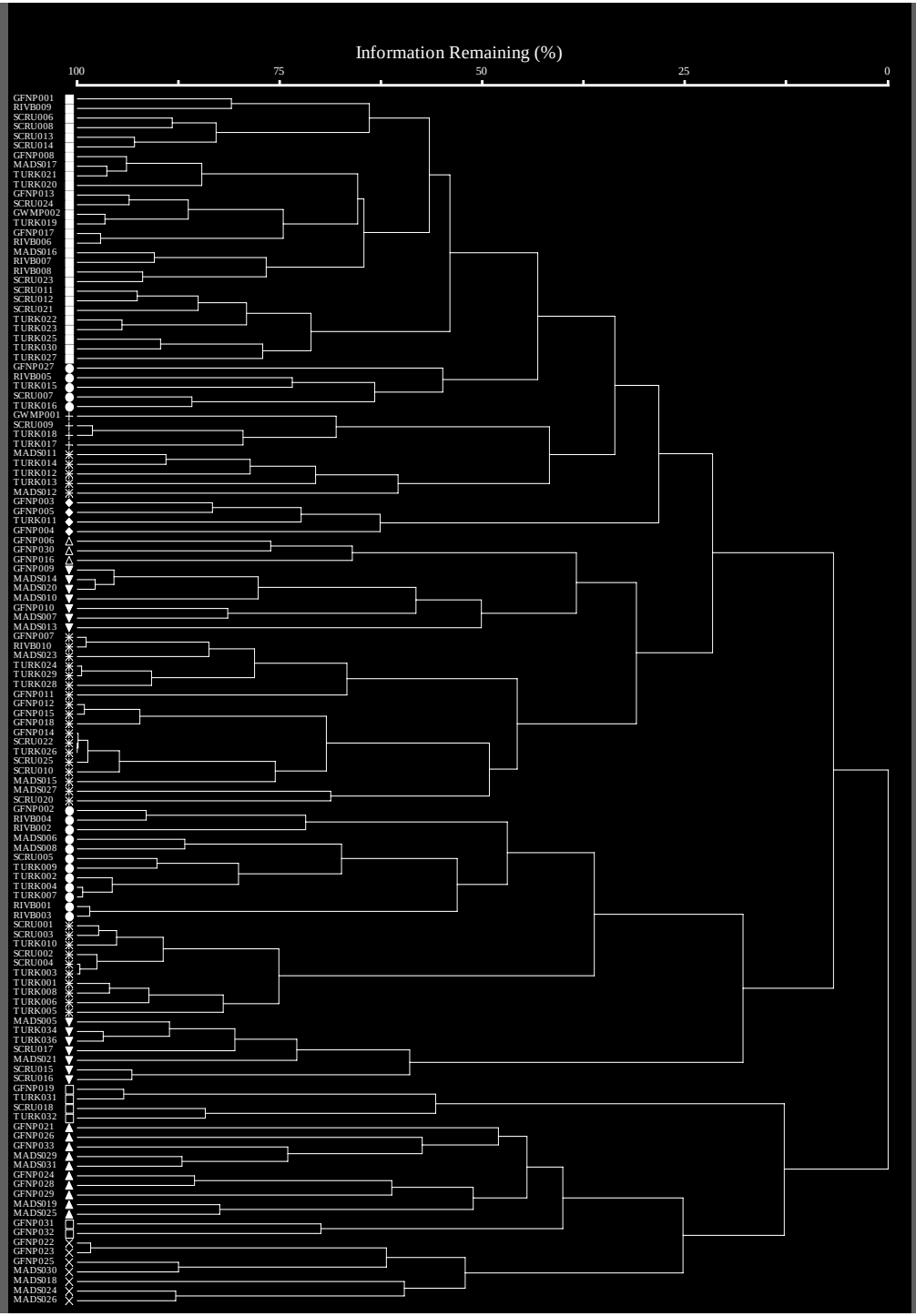

Completed
Vegetation
Plot Locations

Seasonal variation in vegetation composition

View 1: Riverbend floodplain in April

Seasonal variation in vegetation composition

View 2: Riverbend floodplain in August



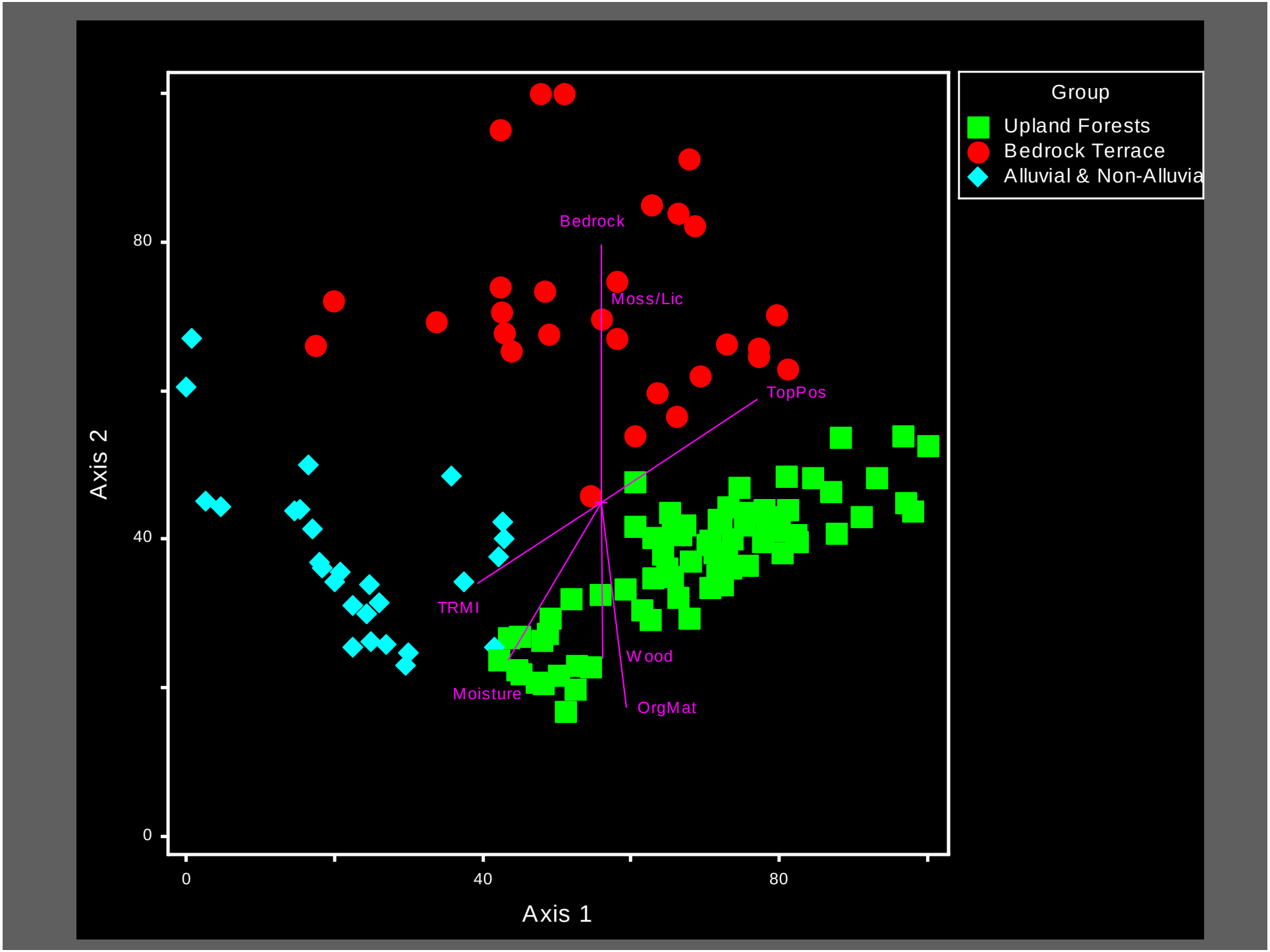
Dendrogram showing Cluster analysis of 133 Potomac Gorge plots

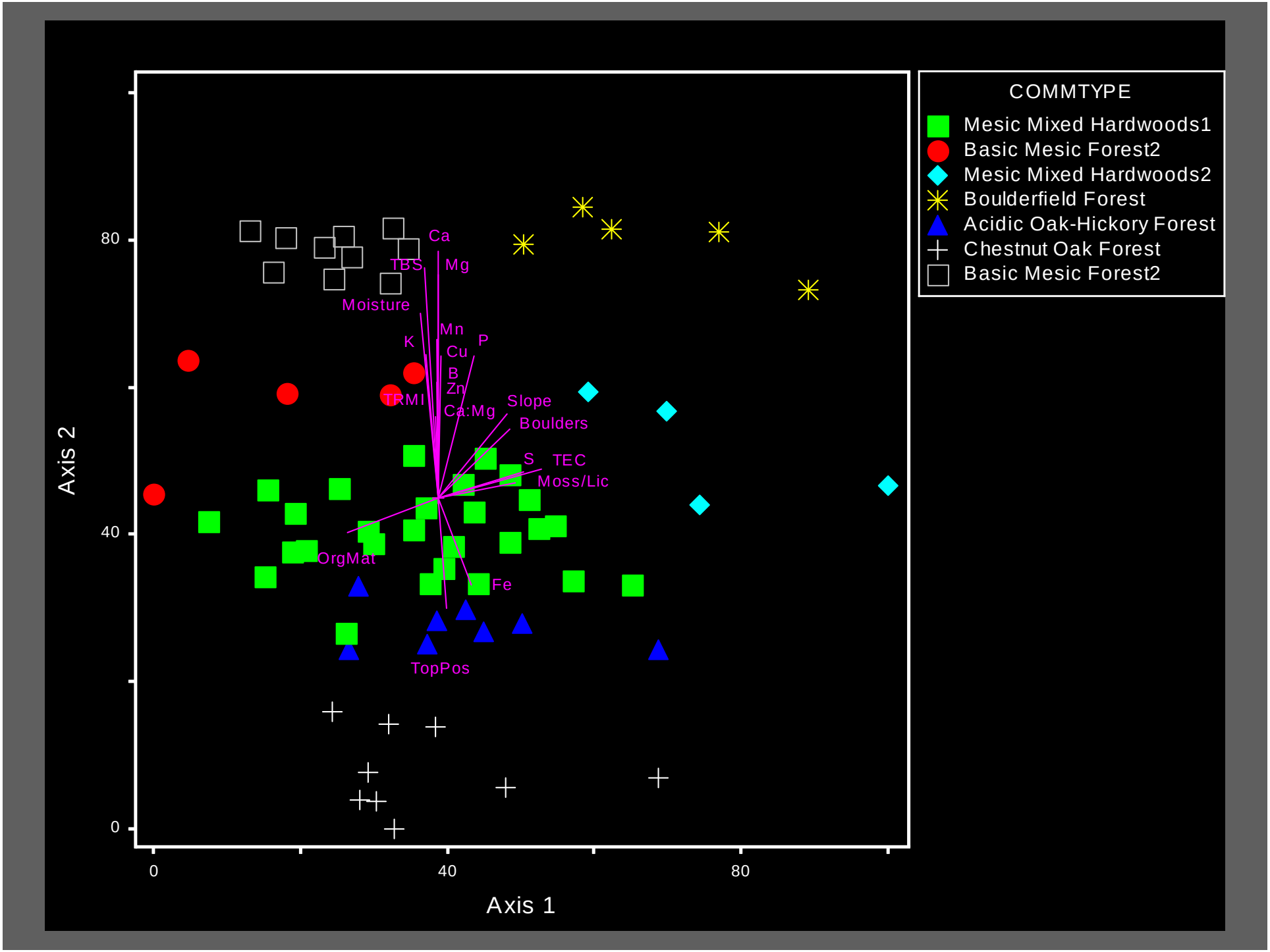
Example of compositional summary statistics for a group of plots

	TOTAL FREQ	TOTAL MEAN COVER	Frequency	Mean Cover	Relative Cover	Constancy	Fidelity	Diagnostic Value	Adj DV (scaled)	Adj DV (unscaled)
Acer saccharinum	15	4	8	8	++++	100	53	53	47	853
Acer negundo	46	5	8	7	++	100	17	17	14	70
Lindera benzoin	72	5	8	6	+	100	11	11	7	22
Boehmeria cylindrica	21	2	8	4	++	100	38	38	17	152
Microstegium vimineum	38	2	8	3	+	100	21	21	7	42
Leersia virginica	24	2	8	2	0	100	33	33	7	33
Laportea canadensis	17	2	7	5	+++	88	41	36	20	288
Asimina triloba	92	6	7	5	-	88	8	7	4	3
Ageratina altissima var. altissima	27	2	7	4	++	88	26	23	10	91
Polygonum virginianum	34	2	7	4	++	88	21	18	8	72
Verbesina alternifolia	23	2	7	3	+	88	30	27	9	53
Oxalis stricta	18	1	7	2	+	88	39	34	8	68
Urtica dioica ssp. dioica	15	3	6	6	+++	75	40	30	20	240
Glechoma hederacea	17	2	6	4	++	75	35	26	12	106
Fraxinus pennsylvanica	28	3	6	4	+	75	21	16	7	32
Parthenocissus quinquefolia	103	2	6	3	+	75	6	4	1	9
Cynanchum laeve	11	1	6	2	+	75	55	41	9	82
Pilea pumila	12	1	6	2	+	75	50	38	8	75
Artemisia annua	18	1	6	2	+	75	33	25	6	50
Viola sororia	44	2	6	2	0	75	14	10	2	10
Ulmus americana	35	3	5	5	++	63	14	9	5	36
Platanus occidentalis	28	4	5	5	+	63	18	11	6	22
Asarum canadense	27	3	5	3	0	63	19	12	4	12
Toxicodendron radicans	66	2	5	3	+	63	8	5	2	9
Rudbeckia laciniata	6	1	5	2	+	63	83	52	12	104
Cryptotaenia canadensis	14	1	5	2	+	63	36	22	5	45
Impatiens capensis	14	1	5	2	+	63	36	22	5	45
Bidens frondosa	15	1	5	2	+	63	33	21	5	42
Acalypha rhomboidea	17	1	5	2	+	63	29	18	4	37
Osmorhiza claytonii	26	2	1	1	-	13	4	0	0	0
Osmorhiza longistylis	26	2	1	1	-	13	4	0	0	0
Mean Species Richness	**43**									
Homoteneity	**0.686**									
Number of Plots	**8**									

Example of woody stem data summary for a group of plots

	Tree Density	Large Tree Density	TOTAL DENSITY	RELATIVE DENSITY	BASAL AREA	RELATIVE BASAL AREA	IV
Acer saccharinum	25	122	147	38.70	54.770	77.72	58.21
Acer negundo	116	25	141	32.14	8.615	14.90	23.52
Lindera benzoin	72	0	72	10.09	0.069	0.11	5.10
Ulmus americana	25	3	28	6.28	0.939	1.09	3.69
Asimina triloba	41	0	41	5.52	0.086	0.13	2.83
Platanus occidentalis	3	6	9	1.59	2.788	3.08	2.33
Parthenocissus quinquefolia	25	0	25	3.25	0.024	0.03	1.64
Juglans nigra	3	3	6	0.86	1.169	1.90	1.38
Fraxinus pennsylvanica	0	3	3	0.78	1.037	1.03	0.90
Toxicodendron radicans	3	0	3	0.78	0.003	0.00	0.39


Group
Upland Forests
Bedrock Terrace
Alluvial & Non-Alluvia
Bedrock
Moss/Lic
TopPos
TRMI
Moisture
Wood
OrgMat
Axis 2
Axis 1
0
40
80
0
40
80


COMMTYPE
Mesic Mixed Hardwoods1
Basic Mesic Forest2
Mesic Mixed Hardwoods2
Boulderfield Forest
Acidic Oak-Hickory Forest
Chestnut Oak Forest
Basic Mesic Forest2
Ca
Mg
TBS
Moisture
Mn
K
P
Cu
B
Zn
TRMI
Ca:Mg
Slope
Boulders
S
TEC
Moss/Lic
OrgMat
Fe
TopPos
Axis 2
Axis 1
0
40
80
0
40
80

EXAMPLE OF CLASSIFICATION HIERARCHY:

***SYSTEM*: PALUSTRINE**

***ECOLOGICAL CLASS*: ALLUVIAL FLOODPLAIN COMMUNITIES**

***ECOLOGICAL GROUP*: PIEDMONT / MOUNTAIN FLOODPLAIN FORESTS**

***COMMUNITY TYPES*:**

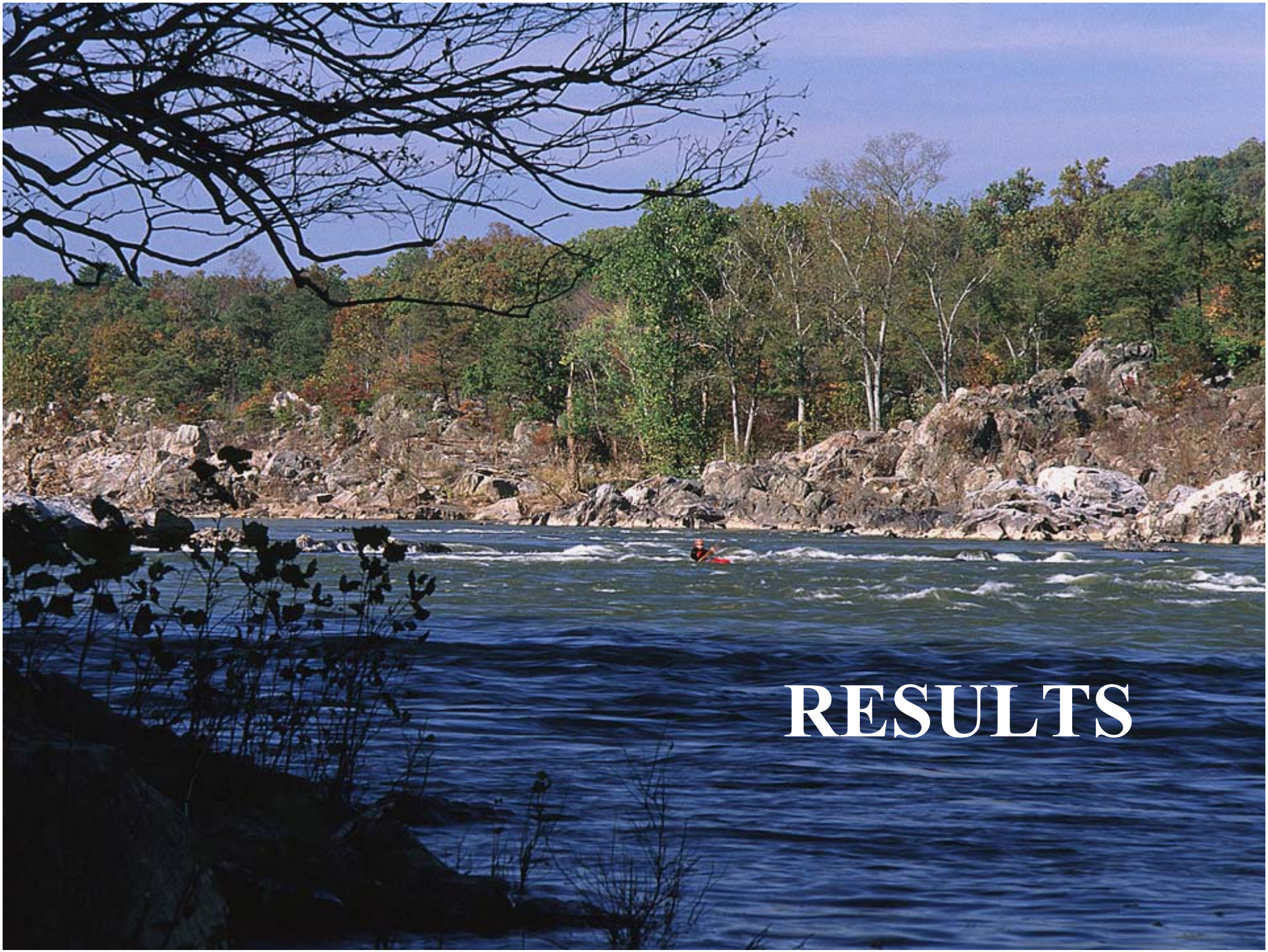
***Acer saccharinum – Acer negundo / Laportea canadensis – Boehmeria cylindrica – Ageratina altissima* Forest** (Piedmont / Central Appalachian Silver Maple Floodplain Forest, G4/S4)

***Platanus occidentalis – Acer negundo – Juglans nigra / Asimina triloba / Mertensia virginica – Hydrophyllum canadense* Forest** (Piedmont / Central Appalachian Rich Floodplain Forest, G4/S4)

For more information about the Virginia state ecological community classification system, go to:

VIRGINIA NATURAL HERITAGE PROGRAM COMMUNITY ECOLOGY WEB PAGE

http://www.dcr.virginia.gov/dnh/nchome.htm


RESULTS

VEGETATION AND FLORISTIC SUMMARY
POTOMAC GORGE, VA

Total number of plots: 215
forest/woodland: 175
shrubland/herbaceous: 40

Vascular taxa recorded: 767
Indigenous spp: 644 (84%)
Introduced spp: 123 (16%)

Mean spp. richness / plot: 50.85

COMPARISON WITH OTHER SITES

PROJECT	AREA (ha)	# PLOTS	# TAXA	MEAN SPP RICHNESS	BETA DIVERSITY	# COMM TYPES
Potomac Gorge (VA)	1,200	214	767	50.85	15.08	25
Bull Run Mountain, VA	5,700	72	366	40.97	8.93	10
Shenandoah Natl Park, VA	120,000	311	762	45.31	16.82	33
New River Gorge, WVA	29,198	283	825	35.56	23.20	31

Most frequent and abundant species of Potomac Gorge dataset

SPECIES	COMMON NAME	TOTAL FREQ	TOTAL MEAN COVER	TOTAL ABUND
Parthenocissus quinquefolia	Virginia creeper	155	2	354
Asimina triloba	paw-paw	141	6	688
Liriodendron tulipifera	tulip-poplar	124	6	609
Toxicodendron radicans	poison-ivy	118	2	289
Acer rubrum	red maple	117	6	587
Lindera benzoin	spicebush	114	4	442
Fraxinus americana	white ash	112	4	429
Fagus grandifolia	American beech	110	6	664
Polystichum acrostichoides	Christmas fern	103	4	342
Aster divaricatus	white wood aster	98	3	263
Maianthemum racemosum	Solomon's-plume	97	2	191
Quercus rubra	northern red oak	91	5	427
Alliaria petiolata	garlic mustard	88	4	290

Most important woody species of forested plots

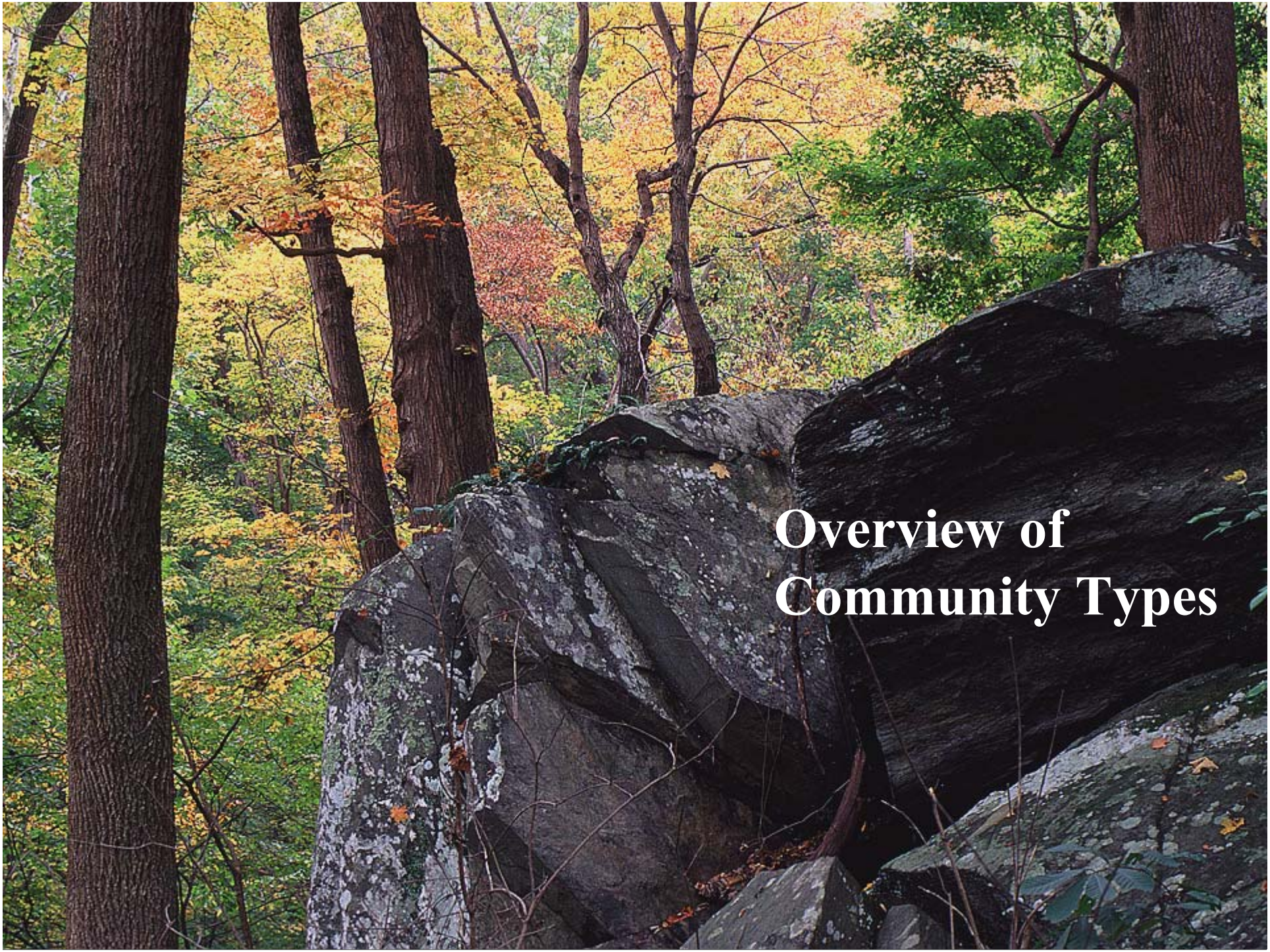
SPECIES	COMMON NAME	TREE DENSITY	LARGE TREE DENSITY	TOTAL DENSITY	RELATIVE DENSITY	BASAL AREA	REL. BASAL AREA	IMP. VAL.
Fagus grandifolia	American beech	119	11	130	15.80	3.95	8.52	12.16
Liriodendron tulipifera	tulip-poplar	18	17	35	3.95	6.79	12.80	8.38
Quercus montana	chestnut oak	19	16	35	3.23	5.05	10.65	6.94
Acer rubrum	red maple	91	2	93	9.83	1.23	3.87	6.85
Asimina triloba	paw-paw	134	0	134	11.30	0.29	0.67	5.99
Quercus alba	white oak	5	11	16	1.98	4.00	8.43	5.21
Acer saccharinum	silver maple	2	10	13	3.01	4.67	6.53	4.77
Acer negundo	boxelder	28	4	33	4.79	1.60	3.19	3.99
Quercus rubra	northern red oak	20	5	25	2.20	2.24	5.06	3.63
Acer saccharum	sugar maple	35	3	38	3.93	1.05	2.94	3.44
Platanus occidentalis	sycamore	5	8	13	1.52	3.77	5.03	3.27
Nyssa sylvatica	black gum	54	1	55	4.54	0.78	1.77	3.15
Pinus virginiana	Virginia pine	29	0	29	2.56	0.72	3.67	3.12
Fraxinus americana	white ash	16	5	21	1.83	1.68	3.77	2.80
Carya glabra	pignut hickory	18	2	20	1.78	1.10	3.25	2.51
Tilia americana	American basswood	14	2	16	1.64	1.11	2.51	2.07
48 other spp. comb.		245	18	263	26.12	7.32	17.33	21.72
TOTALS		854	117	970	100.00	47.35	100.00	100.00

Largest individuals of major tree spp. in Potomac Gorge plots

SPECIES	COMMON NAME	DBH (CM)	DBH (IN)	HT (M)	HT (FT)	SITE
Acer saccharinum	Silver maple	166	65	37	121	Bullneck Run
Platanus occidentalis	American sycamore	148	58	42	138	Turkey Run Park
Ulmus americana	American elm	131	52	34	112	Madeira School
Quercus rubra	Northern red oak	116	46	34	112	Great Falls Park
Liriodendron tulipifera	Tulip-poplar	111	44	33	108	G.W. Mem. Pkwy.
Acer rubrum	Red maple	110	43	36	118	Great Falls Park
Quercus alba	White oak	105	41	38	125	G.W. Mem. Pkwy.
Fraxinus americana	White ash	100	39	36	118	Scotts Run NP
Quercus montana	Chestnut oak	95	37	30	98	Turkey Run Park
Quercus velutina	Black oak	94	37	35	115	Scotts Run NP
Quercus coccinea	Scarlet oak	93	37	36	118	Great Falls Park
Fagus grandifolia	American beech	90	35	34	112	Turkey Run Park
Carya glabra	Pignut hickory	89	35	37	121	Scotts Run NP
Tilia americana	American basswood	82	32	25	82	Turkey Run Park
Quercus shumardii	Shumard oak	81	32	32	105	Riverbend Park
Fraxinus pennsylvanica	Green ash	79	31	33	108	Riverbend Park
Tsuga canadensis	Eastern hemlock	77	30	36	118	Scotts Run NP
Carya cordiformis	Bitternut hickory	72	28	36	118	Turkey Run Park
Carya ovalis	Red hickory	71	28	30	98	Turkey Run Park
Populus deltoides	Eastern cottonwood	70	28	34	112	Madeira School
Acer saccharum	Sugar maple	67	26	33	108	Scotts Run NP
Acer negundo	Boxelder	67	26	29	95	Turkey Run Park
Ulmus rubra	Slippery elm	66	26	33	108	Turkey Run Park
Carya alba	Mockernut hickory	64	25	32	105	Turkey Run Park
Quercus stellata	Post oak	63	25	29	95	Great Falls Park
Celtis occidentalis	Hackberry	60	24	32	105	Turkey Run Park
Juglans nigra	Black walnut	59	23	34	112	Turkey Run Park
Nyssa sylvatica	Black gum	56	22	27	89	Great Falls Park

Platanus occidentalis **(American sycamore) 148 cm DBH, 42 m tall, Turkey Run Park**

Quercus shumardii **(Shumard oak) near Lock 7, C&O Canal National Historical Park**


Overview of
Community Types

Ecological Group: Mesic Mixed Hardwood Forests

Fagus grandifolia – Quercus (*alba, rubra*) *– Liriodendron tulipifera / Polystichum acrostichoides* Forest

Mature *Fagus grandifolia* (American beech) 90 cm DBH, 36 m tall, Turkey Run Park

Mid-Atlantic Mesic Mixed Hardwood Forest

- mesic, infertile slopes throughout
- silt loam soils; extremely acidic with low base status
- 33 plots
- Mean species richness = 53
- Conservation Ranks: G5/S5

Forest floor in a mesic mixed hardwood forest

Deer-browsed stand with patchy *Thelypteris noveboracensis* (New York fern), Riverbend Park

***Polystichum acrostichoides* (Christmas Fern)**

Ecological Group: Basic Mesic Forests

Liriodendron tulipifera – Fagus grandifolia – Carya cordiformis / Lindera benzoin / Podophyllum peltatum Forest

Liriodendron tulipifera (tulip-poplar)

Northern Coastal Plain / Piedmont Basic Mesic Forest

- mesic, moderately fertile slopes; locally throughout the Gorge
- silt loam soils with relatively high pH, Mg, and total base saturation; high Mn
- 22 plots
- Mean species richness = 56
- Conservation ranks: G4?/S3

Cimicifuga racemosa (black bugbane)

Uvularia perfoliata (perfoliate bellwort)

Adiantum pedatum (maidenhair fern)

***Podophyllum peltatum* (may-apple) in a mature basic mesic forest at Turkey Run Park**

Ecological Group: Basic Mesic Forests

***Acer* (*nigrum, saccharum*) – *Tilia americana* / *Asimina triloba* / *Jeffersonia diphylla* – *Caulophyllum thalictroides* Forest**

Central Appalachian/Piedmont Rich Slope Forest (Twinleaf – Blue Cohosh Type)

- mesic, N to E-facing ravines and lower slopes near mafic and ultramafic intrusions; local in middle section of the Gorge (VA side only?)
- silt loam soils with relatively high Ca, Mg, and Mn
- 13 plots
- Mean species richness = 46
- Conservation ranks: G4G5/S4S5

Trillium sessile (toadshade; red form)

Toadshade; yellow form

Jeffersonia diphylla (twinleaf)

Acer saccharum (sugar maple)

Dicentra cucullaria (Dutchman's-breeches)

Erythronium americanum (yellow trout-lily)

Caulophyllum thalictroides
(blue cohosh)

Ecological Group: Low-Elevation Boulderfield Forests & Woodlands

Acer saccharum – Tilia americana / Staphylea trifolia / Dryopteris marginalis – (Impatiens pallida) Forest

Staphylea trifolia (bladdernut)

Central Appalachian / Piedmont Rich Boulderfield Forest

- very steep, boulder-strewn, lower and middle river-fronting slopes; extensive in middle section of Gorge (VA side only?)
- intersticial silt loam soils with high Ca, Mg, Mn
- 10 plots
- Mean species richness = 35
- Conservation ranks: G3G4/S3

Tilia americana var. *americana* (American basswood)

Parthenocissus quinquefolia (Virginia creeper)

Impatiens pallida (yellow jewelweed)

Boulderfield forest with Toxicodendron radicans (poison-ivy), Scotts Run NP

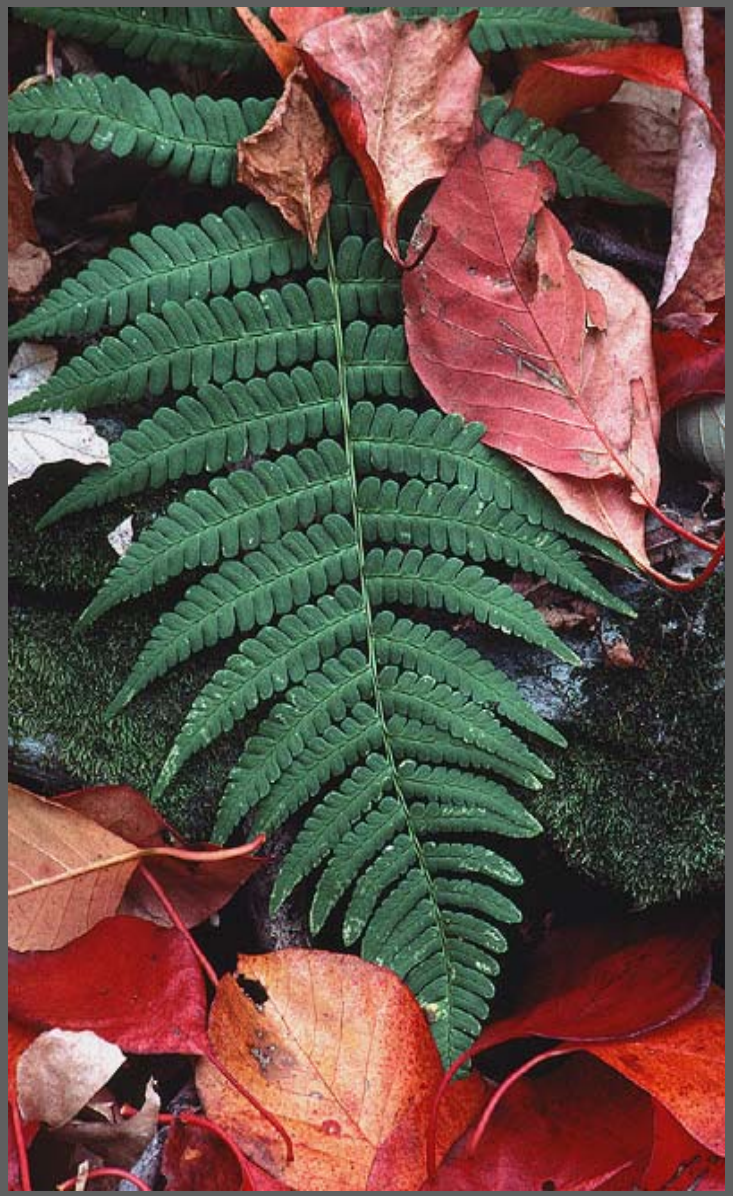
Northern copperhead (*Agkistrodon contortrix mokasen*) at Scotts Run NP

Ecological Group: Montane Mixed Oak & Oak-Hickory Forests

***Quercus montana* – *Quercus rubra* / *Hamamelis virginiana* Forest**

Central Appalachian Chestnut Oak – Northern Red Oak Forest

- very steep, N-facing middle and upper slopes; local in middle and lower sections of Gorge (VA only?)
- silt loam soils; extremely acidic with low base status
- 7 plots
- Mean species richness = 54
- Conservation ranks: G5S5



Dryopteris marginalis
(marginal wood fern)

Aster divaricatus
(white wood aster)

Hamamelis virginiana
(witch-hazel)

Ecological Group: Acidic Oak-Hickory Forests

Quercus alba – *Quercus* (*rubra, coccinea*) – *Carya* (*alba, glabra*) / *Vaccinium pallidum* Forest

Cornus florida (flowering dogwood)

Piedmont Acidic Oak-Hickory Forest

- submesic to subxeric, convex middle to upper slopes, usually S to W-facing
- silt loam soils; acidic with moderate base status
- 8 plots
- Mean species richness = 80
- Conservation ranks: G5?/S5
- oak recruitment very poor and many stands succeeding to beech / mesic mixed hardwoods

Quercus velutina (black oak)

Carya (hickory) leaves unfolding in spring

Cunila origanoides (wild dittany)

Young *Fagus grandifolia* (American beech) invading an acidic oak-hickory forest

Ecological Group: Oak / Heath Forests

Quercus montana – (*Quercus coccinea, Quercus rubra*) / *Kalmia latifolia* / *Vaccinium pallidum* Forest

Quercus coccinea (scarlet oak)

Central Appalachian / Northern Piedmont Chestnut Oak Forest

- xeric crests and upper slopes, some very rocky
- silty clay loam soils; extremely acidic with low base status
- 17 plots
- Mean species richness = 25
- Conservation ranks: G5/S5

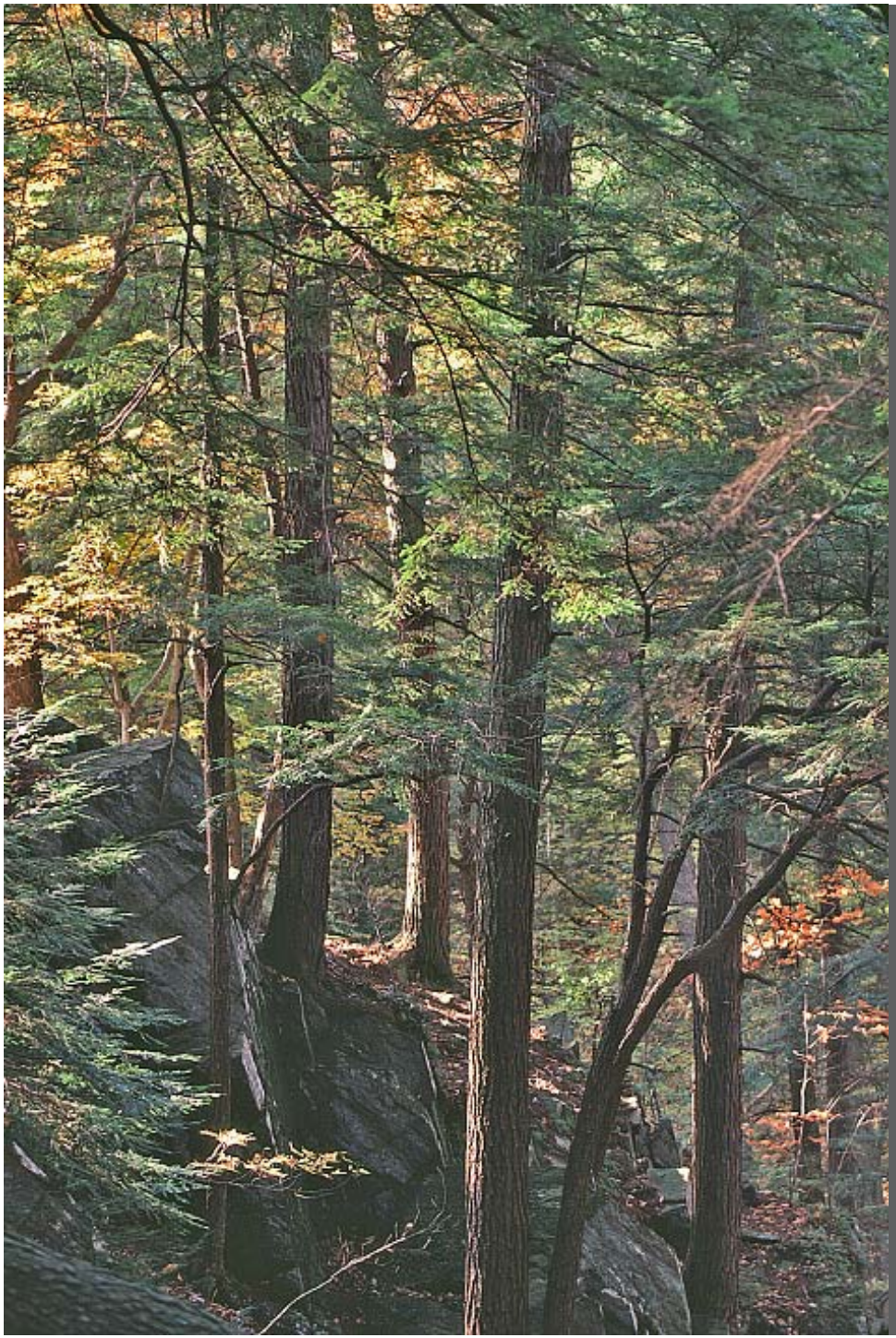
Gaylussacia baccata (black huckleberry)

Kalmia latifolia (mountain-laurel)

Pinus pungens
(table-mountain pine)

Rhododendron maximum
(great rhododendron)

Castanea dentata
(American chestnut)



Ecological Group: Eastern Hemlock-Hardwood Forests

***Tsuga canadensis – Fagus grandifolia – Quercus* (*montana*, *alba*) Forest**

Tsuga canadensis (eastern hemlock)

Betula lenta (sweet birch)

Piedmont Eastern Hemlock – Hardwood Forest

- mesic, sheltered, rocky lower slopes; very local (VA side only)
- silt loam soils; extremely acidic with low base status
- 4 plots
- Mean species richness = 30
- Conservation ranks: G2G3/S2
- threatened with extirpation due to woolly adelgid infestation

Polypodium virginianum (rock polypody)

Ecological Group: Basic Oak-Hickory Forests

Carya glabra – Quercus (*rubra, montana*) *– Fraxinus americana / Viburnum rafinesquianum / Melica mutica* Forest

Potomac River Bedrock Terrace Oak-Hickory Forest

Quercus stellata (post oak)

- subxeric, gentle, rocky bedrock terraces
- 30 to 85-year flood return interval
- shallow, sandy loam soil; extremely acidic with low base status
- 5 plots
- Mean species richness = 93
- Conservation ranks: G1G2/S1
- Endemic to the Potomac Gorge (Md and Va)

Chionanthus virginicus (fringetree)

Ptelea trifoliata (hop-tree)

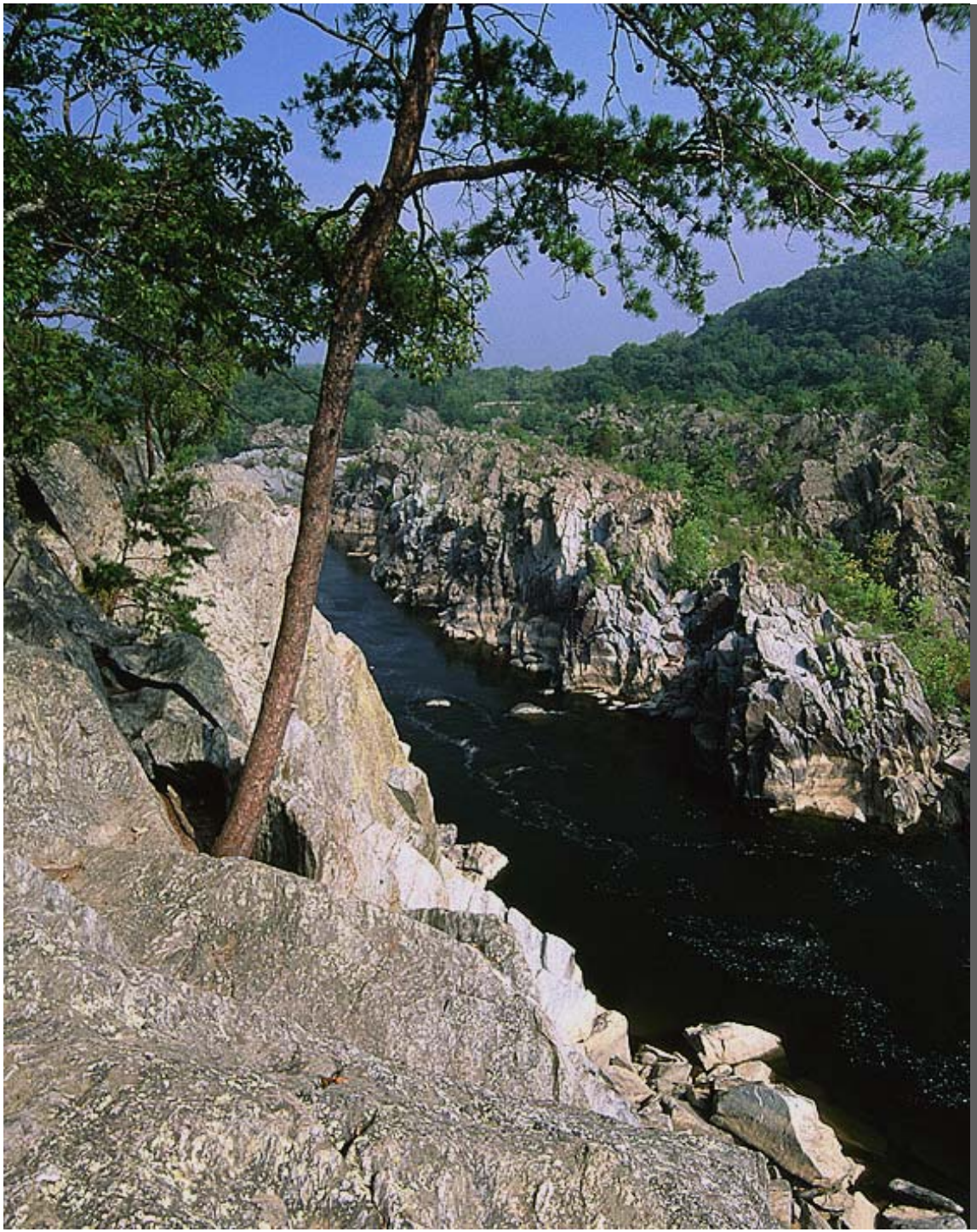
Viburnum rafinesquianum (downy arrow-wood)

***Piptochaetium avenaceum* (Eastern needlegrass)**

***Dichanthelium boscii* (Bosc's panic grass)**

***Dichanthelium laxiflorum* (soft panic grass)**

***Carex pensylvanica* (Pennsylvania sedge)**

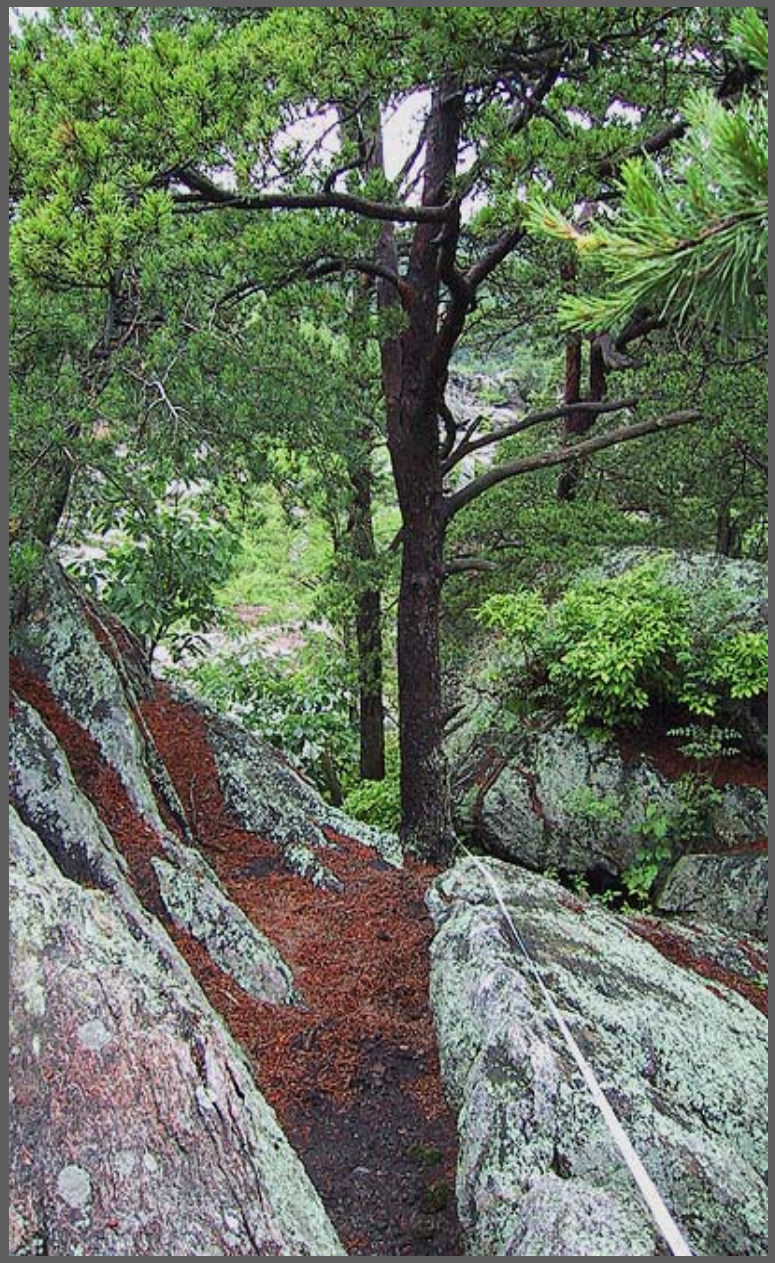


Ecological Group: Mountain / Piedmont Acidic Woodlands

***Pinus virginiana – Juniperus virginiana / Vaccinium pallidum / Danthonia spicata* Woodland**

Riverside Bedrock Terrace Woodland

- xeric rimrock of bedrock terraces
- 12 to 30-year flood return interval
- sparse to shallow, sandy loam soil; extremely acidic with low base status
- 5 plots
- Mean species richness = 35
- Conservation ranks: GNR/S1
- Known only from Potomac Gorge (Va and Md) and New River Gorge (WVa)



Pinus virginiana (Virginia Pine)

Juniperus virginiana (eastern red cedar)

Vaccinium pallidum (lowbush blueberry)

Red cedar and Virginia pine in bedrock terrace woodland on Bear Island

Ecological Group: Riverside Prairies

Fraxinus americana / Andropogon gerardii – Sorghastrum nutans – Schizachyrium scoparium – Pycnanthemum tenuifolium Wooded Herbaceous Vegetation

Bedrock terrace prairie near mouth of Difficult Run, Madeira School

Andropogon gerardii (big bluestem)

Piedmont / Central Appalachian Riverside Outcrop Prairie

- very rocky, elevated bedrock terraces; ephemeral pools usually present
- 0.5 to 7-year flood return interval
- loamy sand soils with high pH and Ca
- 9 plots
- Mean species richness = 88
- Conservation ranks: G1/S1

Pycnanthemum tenuifolium (narrowleaf mountain-mint)

Liatris spicata (dense blazing-star)

Baptisia australis **(wild blue indigo)**

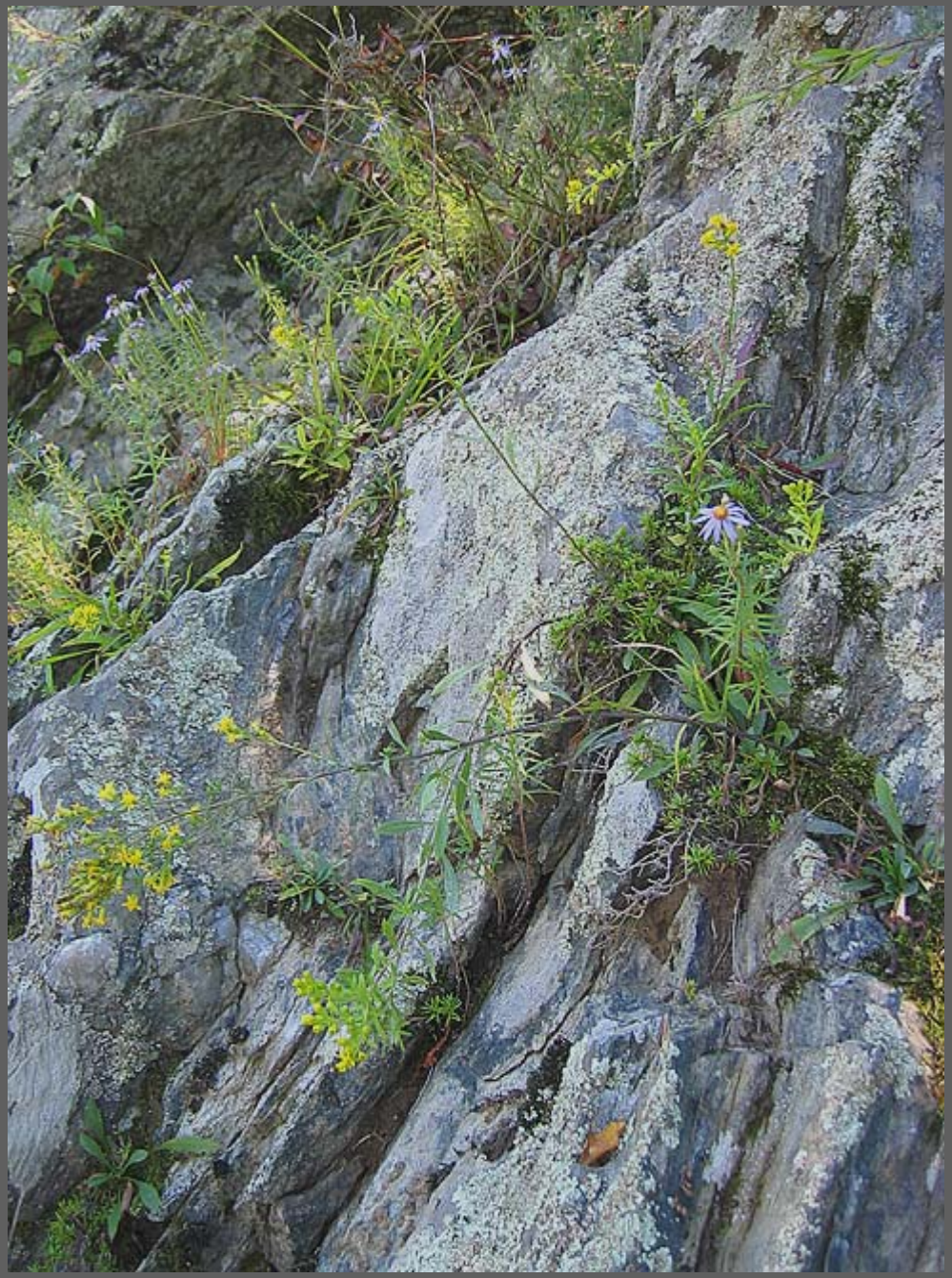
Sorghastrum nutans **(indian-grass)**

Bedrock terrace prairie on upper Bear Island in Maryland

Channel-shelf riverside prairie on Chain Bridge Flats in the District of Columbia

Ecological Group: Riverside Outcrop Barrens

Leucothoe racemosa / Schizachyrium scoparium – Solidago racemosa – Ionactis linariifolius Sparse Herbaceous Vegetation



Potomac Gorge Riverside Outcrop Barren

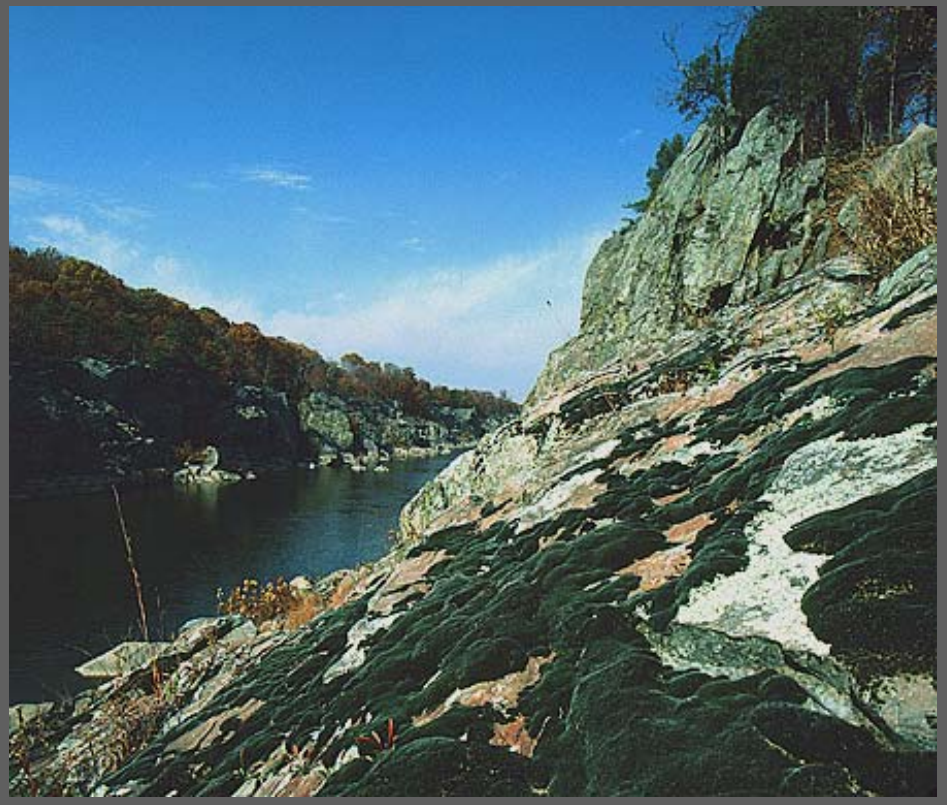
- very xeric, exposed, periodically scoured rock outcrops
- 1 to 12-year flood return interval
- mineral soil extremely sparse to absent (could not be extracted from plots)
- 9 plots
- Mean species richness = 22
- Conservation ranks: G2?/S1
- Endemic to the Potomac Gorge

Solidago racemosa (sticky goldenrod)

Schizachyrium scoparium (little bluestem)

Sparse vegetation dominated by the lichen *Xanthoparmelia conspersa*, *Schizachyrium scoparium* (little bluestem), and *Solidago racemosa* (sticky goldenrod)

Crustose lichens on undisturbed outcrop



***Grimmia laevigata* on ephemerally wet outcrop**

Ecological Group: Rocky Bars and Shores

Carpinus caroliniana – Ilex decidua Shrubland

Piedmont River-Scour Shrubland

Carpinus caroliniana (hornbeam)

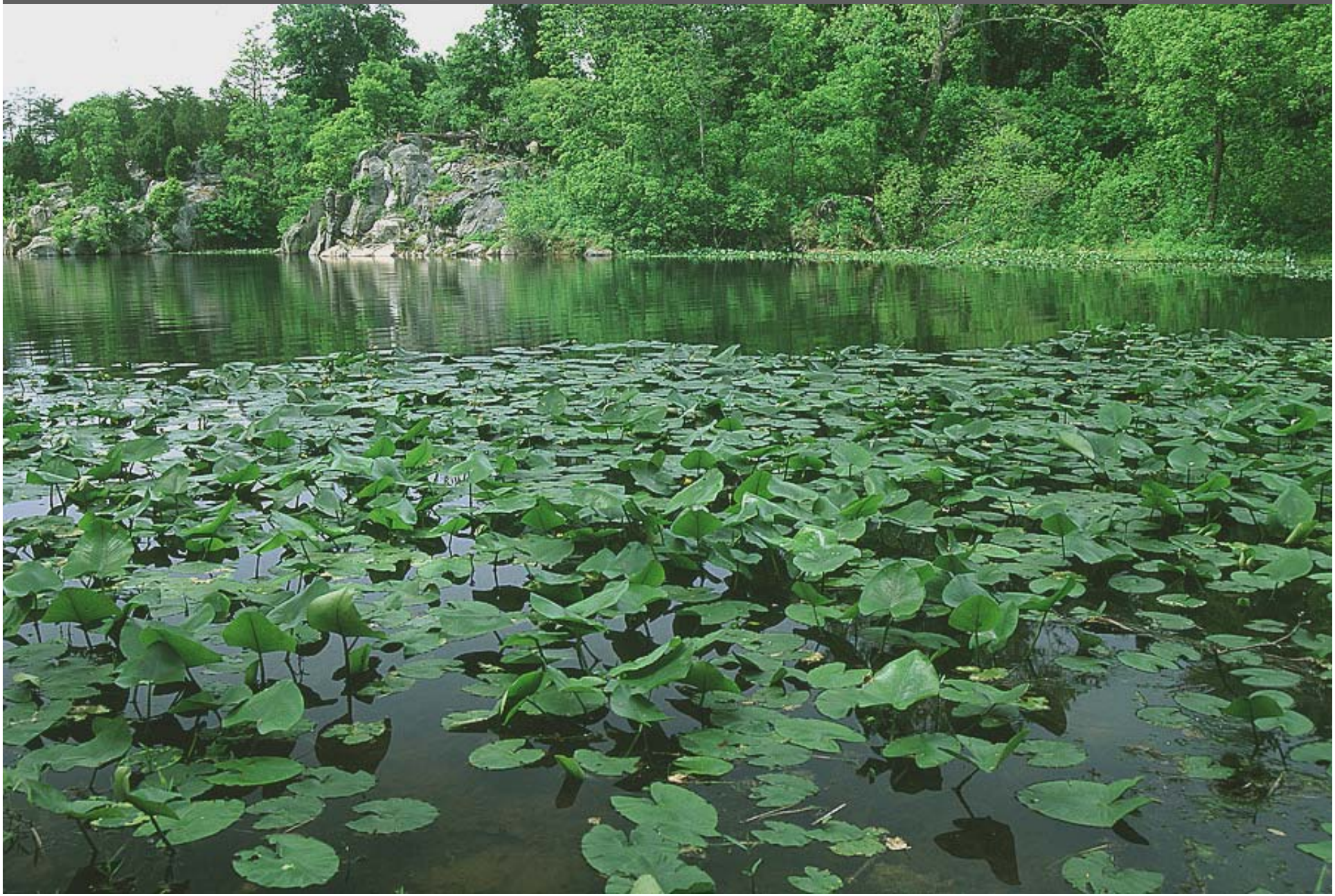
Ilex decidua (deciduous holly)

- eroding bluffs and bedrock terraces that are periodically flood-scoured
- mean flood return interval = 1-15 yrs
- seasonally dry, stony soils with moderately high base status
- vegetation of dense shrubs and tree saplings
- 1 plot (additional plots from MD side)
- Mean species richness = 68
- Conservation ranks: G1?S1
- Endemic to the Potomac and Rappahannock Rivers

Chasmanthium latifolium (river oats)

Ecological Group: Floodplain Pools and Ponds

Nuphar advena Semipermanently Flooded Herbaceous Vegetation



Nuphar advena (spatterdock)

Sparganium americanum (American bur-reed)

Floodplain Pool / Pond (Spatterdock Type)

- borders of deep bedrock terrace pond
- substrate more or less permanently flooded except during prolonged dry periods
- sand substrate; moderately fertile
- 1 plot
- Species richness = 4
- Conservation ranks: GNR/SNR
- probably a very rare natural community type

Ecological Group: Coastal Plain / Piedmont Basic Seepage Swamps

Acer rubrum – Fraxinus (*pennsylvanica, americana*) / *Lindera benzoin* / *Symplocarpus foetidus* Forest

Northern Piedmont / Lower New England Seepage Swamp

- flat, groundwater-saturated stream bottoms
- silty clay loam soils with relatively high pH, Ca, Mg; very high Fe
- 5 plots
- Mean species richness = 51
- Conservation ranks: G4G5/S3

Acer rubrum (red maple)

Ilex verticillata (winterberry)

Symplocarpus foetidus (skunk-cabbage)

Osmunda cinnamomea (cinnamon fern)

Ecological Group: Piedmont / Mountain Floodplain Forests

Acer saccharinum – Acer negundo / Ageratina altissima – Laportea canadensis – (Elymus virginicus) Forest

Piedmont / Central Appalachian Silver Maple Floodplain Forest

- riverbanks and low floodplain terraces
- 0.35 to 2-year flood return interval
- loamy sand soils with very high pH, Ca, Mg, and total base saturation
- 11 plots
- Mean species richness = 44
- Conservation ranks: G4/S4

Photo: Karen D. Patterson

Laportea canadensis **(wood-nettle)**

Ageratina altissima
(white snakeroot)

Populus deltoides
(eastern cottonwood)

Elymus macgregorii
(MacGregor's wild rye)

Elymus virginicus
(Virginia wild rye)

Ecological Group: Piedmont / Mountain Floodplain Forests

Platanus occidentalis – Acer negundo – Juglans nigra / Asimina triloba / Mertensia virginica Forest

Piedmont / Central Appalachian Rich Floodplain Forest

- elevated floodplain terraces and alluvial berms
- 2 to 12-year flood return interval
- sandy or silt loam soils with high pH, Ca, Mg, total base saturation
- 12 plots
- Mean species richness = 43
- Conservation ranks: G4/S4

Platanus occidentalis **(American sycamore)**

Erythronium albidum **(white trout-lily)**

Asarum canadense **(wild ginger)**

Phlox divaricata **(wild blue phlox)**

Large clone of *Hydrophyllum canadense* (Canada waterleaf), Turkey Run Park

Ecological Group: Rocky Bars and Shores

Justicia americana Herbaceous Vegetation

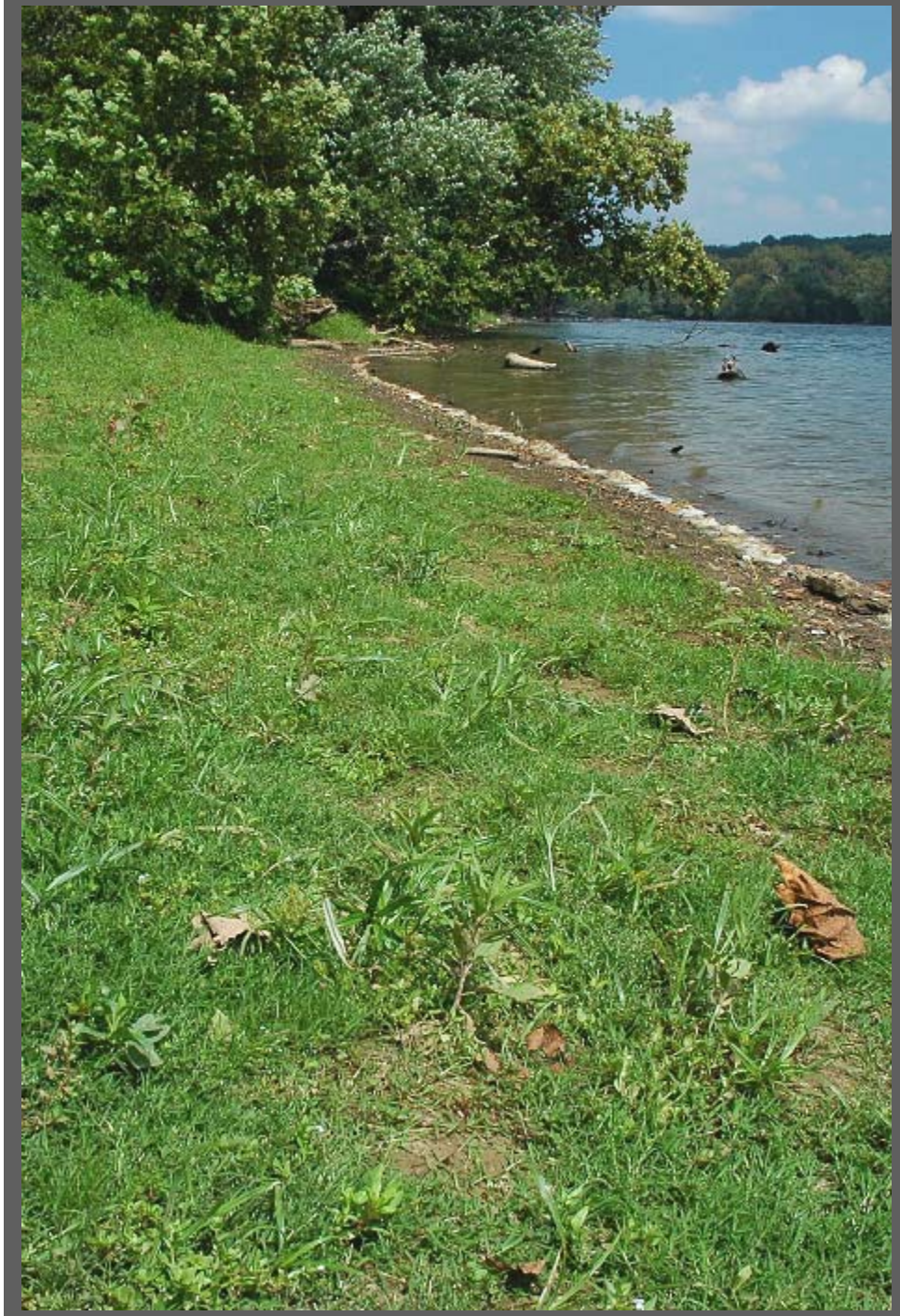
Water-Willow Rocky Bar and Shore

- bouldery and cobbley river shores / depositional bars
- flooded > 50% of the year
- sparse, sandy soil; very high pH and Ca levels
- 5 plots
- Mean species richness = 9
- Conservation ranks: G4G5/S4

Hibiscus laevis **(halberd-leaf rose-mallow)**

Ecological Group: Sand / Gravel / Mud Bars and Shores

Eragrostis hypnoides – Ludwigia palustris – Lindernia dubia – Cyperus squarrosus Herbaceous Vegetation



Piedmont / Central Appalachian Draw-Down River Shore

- habitats seasonally exposed during low-water periods
- fine-textured silty soils with very high calcium and total base saturation
- vegetation predominantly of low herbaceous annuals
- 9 plots
- Mean species richness = 50
- Conservation ranks: G3S2
- Occurs along major rivers throughout the Piedmont and Mountain regions

Eragrostis hypnoides **(creeping lovegrass)**

Lindernia dubia* var. *dubia **(false pimpernel)**

Cyperus squarrosus **(awned flatsedge)**

Ecological Group: Sand / Gravel / Mud Bars and Shores

Eupatorium serotinum – Polygonum (*punctatum, lapathifolium, pensylvanicum*) Herbaceous Vegetation

Piedmont / Central Appalachian Scour-Bar Herbaceous Vegetation

- fine-textured, slightly elevated river shores and depositional bars with frequent sediment turnover during floods
- flooded once or more annually
- sandy soils with very high calcium and total base saturation
- vegetation predominantly of tall, coarse annuals and fast-growing perennials
- 6 plots
- Mean species richness = 67
- Conservation ranks: GNRSNR
- Occurs along the upper Potomac and probably other Mid-Atlantic rivers

Eupatorium serotinum **(late thoroughwort)**

Polygonum lapathifolium **(dock-leaf smartweed)**

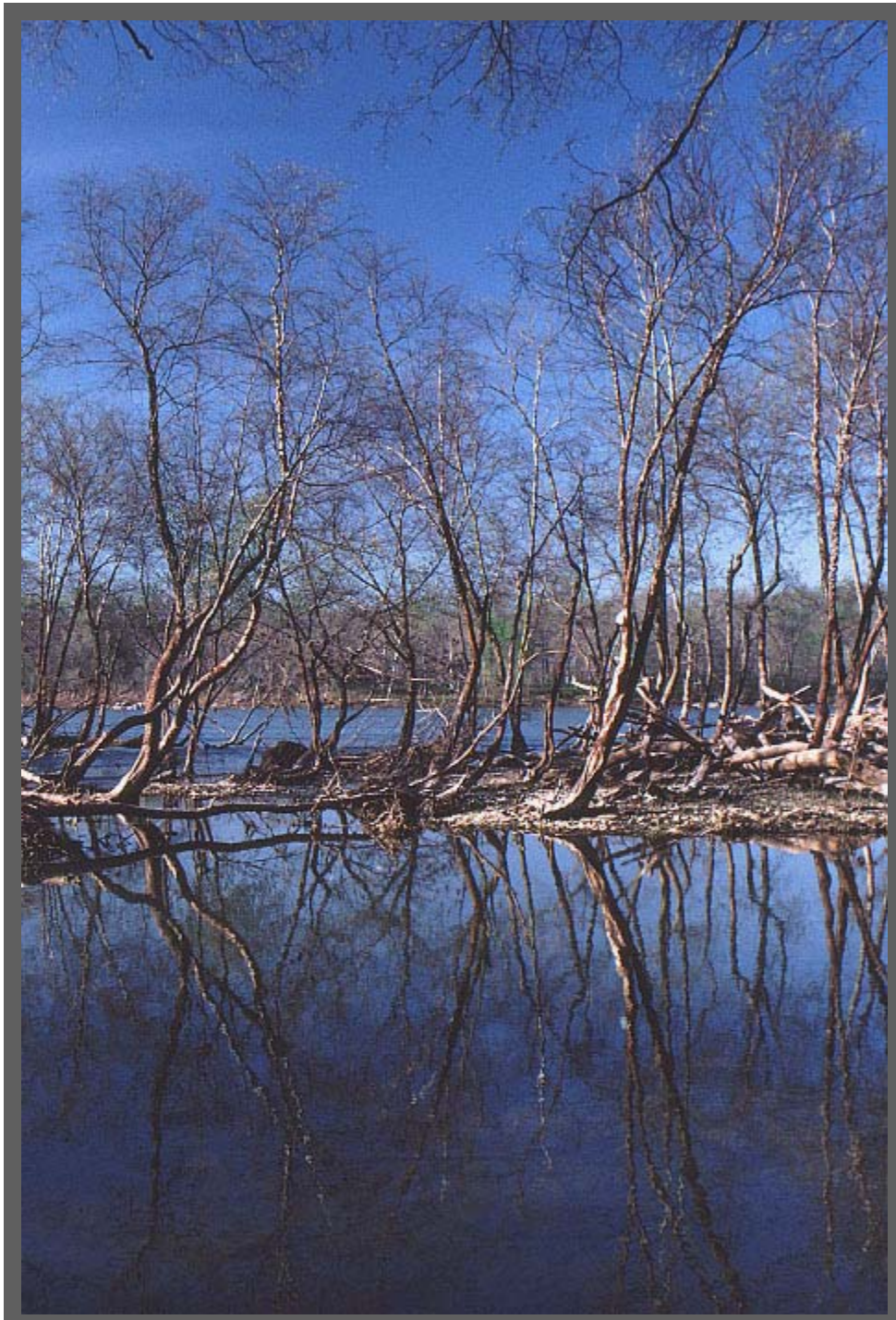
Verbesina alternifolia **(wingstem)**

Eupatorium coelestinum **(mistflower)**

Polygonum punctatum **(dotted smartweed)**

Ecological Group: Rocky Bars and Shores

Platanus occidentalis – Betula nigra – Salix (*nigra, caroliniana*) Woodland



Piedmont / Central Appalachian Sycamore – River Birch Scour Woodland

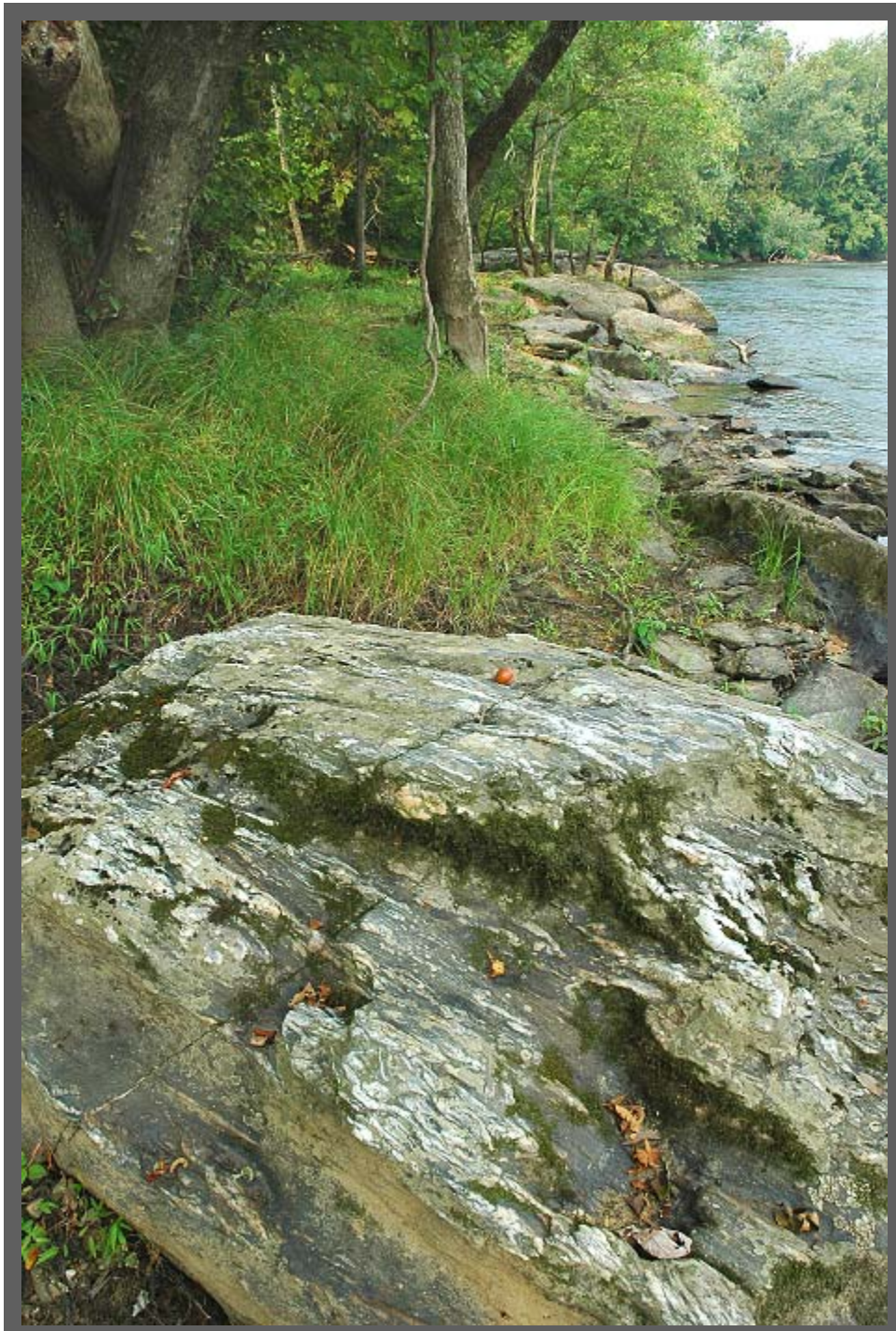
- coarse, bouldery-cobbly, frequently flood-scoured depositional bars
- < 1-year flood return interval
- sandy, moderately fertile soil is largely interstitial; may be sparse
- vegetation usually exhibits extensive mechanical damage and flood-training
- 8 plots
- Mean species richness = 63
- Conservation ranks: G4G5S4
- Widespread along high-gradient rivers in the Mid-Atlantic Piedmont and Mountains

Flood-trained trees on a rocky bar at Scotts Run Nature Preserve

Ecological Group: Rocky Bars and Shores

Platanus occidentalis – Acer saccharinum – Betula nigra – Fraxinus pennsylvanica / Boehmeria cylindrica – Carex emoryi Woodland

Photo: J.C. Ludwig



Central Appalachian / Piedmont Bedrock Floodplain Woodland

- occupies bedrock floodplains with irregular microtopography and some soil development
- < 1-year flood return interval
- fertile, sandy soil developed locally
- vegetation very diverse and species-rich, trees usually damaged and flood-trained from frequent scouring
- 4 plots
- Mean species richness = 111
- Conservation ranks: G2?S1
- possibly endemic to the Potomac drainage

***Carex emoryi* (Emory's sedge) clone in woodland at Riverbend**

Threats documented by plot data

Pervasive Threats

- Invasive introduced plants
- Excessive browsing/grazing by white-tailed deer

Local AreaThreats

- Insect and fungal pathogens
  - dogwood anthracnose
  - hemlock woolly adelgid
  - butternut canker
  - gypsy moth
- Visitor over-usage (trampling, etc.)
- Fire exclusion (dry oak forests)

Leading introduced invasives in Potomac Gorge dataset

90% of 215 plots contained at least one introduced species

TAXON	TOTAL FREQ	CONST	NO. OF COMM. TYPES	TOTAL MEAN COVER	TOTAL ABUND
Alliaria petiolata	88	41	16	4	290
Lonicera japonica	82	38	17	2	202
Microstegium vimineum	72	33	17	2	173
Celastrus orbiculatus	59	27	15	2	96
Veronica hederifolia	58	27	11	3	182
Polygonum caespitosum var. *longisetum*	57	27	15	2	116
Artemisia annua	42	20	9	2	99
Prunus subhirtella	41	19	8	1	61
Ailanthus altissima	31	14	16	1	41
Glechoma hederacea	31	14	12	2	90
Chamaesyce humistrata	26	12	6	1	50
Perilla frutescens	26	12	6	2	53
Rosa multiflora	26	12	11	1	56
Urtica dioica ssp. dioica	26	12	8	3	96
Arthraxon hispidus	24	11	6	1	45
Rubus phoenicolasius	23	11	11	1	45
107 others (mean)	6	3		1	10
AVERAGES	10.56	4.91	11.00	1.70	28.08

Microstegium vimineum **(stilt grass)**

Alliaria petiolata **(garlic-mustard)**

***Hedera helix* (English ivy)**

***Phyllostachys* sp. (bamboo)**

Prunus subhirtella
(winter-flowering cherry)

Viburnum dilatatum **(Linden arrowwood)**

Effectiveness of "Coarse Filter" Approach to Inventory

- **70% of Va-side flora (767 of ~1100 taxa) captured in plots (area < 8 ha)**

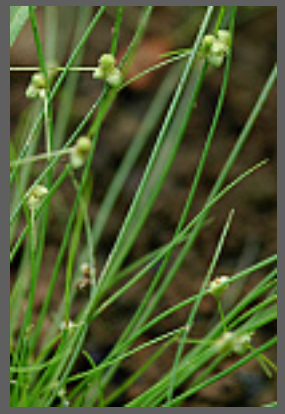
- **78% (28 of 36) of extant (Va) species of conservation concern captured in plots**
- **148 occurrences of species of conservation concern in plots**
- **82 plots (38% of dataset) contained at least one species of conservation concern**

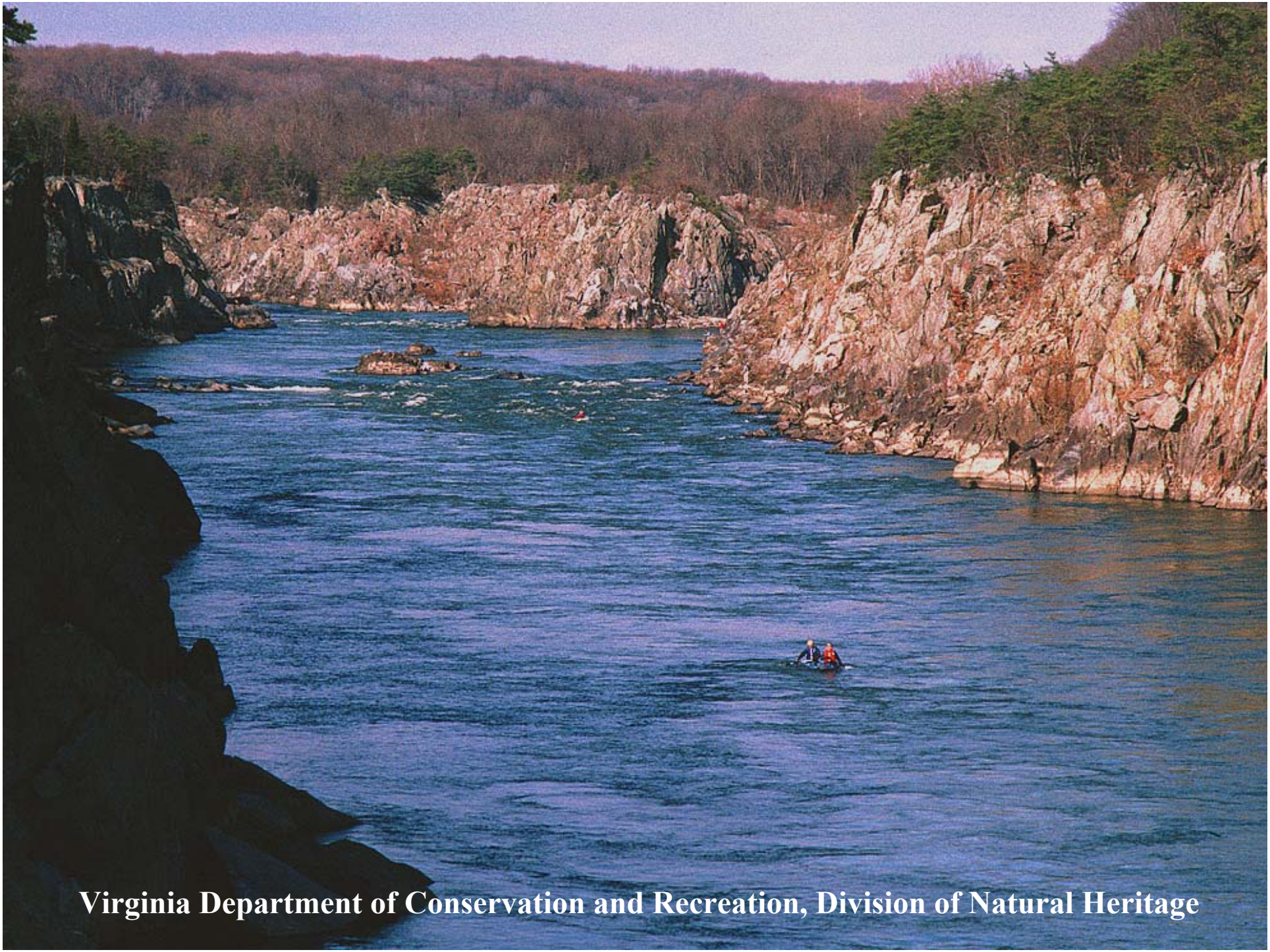
Species of Conservation Concern	Grank	Srank	No. of Plots	No. of Comtypes
Acalypha deamii	G4?	S3	1	1
Amelanchier nantucketensis	G3Q	S1	2	1
Baptisia australis var. *australis*	G5TNR	S3	7	3
Carex careyana	G4G5	S3	2	2
Carex conjuncta	G4G5	S3	4	2
Carex straminea	G5	S1	2	1
Cerastium arvense ssp. *velutinum*	G5G4T?	S2?	9	3
Cornus amomum ssp. *obliqua*	G5T5	SNR	3	2
Desmodium cuspidatum var. *cuspidatum*	G5T5?	S2	1	1
Eleocharis compressa	G4	S2	4	2
Erigenia bulbosa	G5	S3	16	5
Erythronium albidum	G5	S2	3	1
Floerkea proserpinacoides	G5	S3	8	3
Hasteola suaveolens	G3G4	S2	2	2

Extant (Va) species of conservation concern captured in plots, continued:

Species of Conservation Concern	Grank	Srank	No. of Plots	No. of Comtypes
Helianthus occidentalis	G5	S1	5	2
Hemicarpha micrantha	G5	S1	7	2
Maianthemum stellatum	G5	S2?	1	1
Matteuccia struthiopteris var. *pensylvanica*	G5T5	S1	4	3
Onosmodium virginianum	G4	S2	2	2
Packera paupercula	G5	S3?	7	2
Phacelia covillei	G2	S1	6	4
Rhododendron arborescens	G4G5	S2	4	3
Rorippa sessiliflora	G5	S1	1	1
Sanicula trifoliata	G4	S3	12	4
Solidago racemosa	G5T3?	S1	23	4
Solidago rupestris	G4?	S1	3	3
Spartina pectinata	G5	S2	2	2
Valeriana pauciflora	G4	S2	3	2





Virginia Department of Conservation and Recreation, Division of Natural Heritage