Monitoring of Botanical Resources and Project Plantings

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WOTS Program

Outline of this section

- Why monitor?
- Method to set up monitoring for existing vegetation or plantings.
  - National Vegetation Classification System
- Benefits

The Value of conducting Botanical Monitoring

- Provide a better understanding of the plant communities /biodiversity and ecological integrity.
- Identify and maintain the status of threatened and endangered species that occur on Corps lands.
- Provide scientifically defensible metrics to assess mitigation, ecosystem restoration and other built projects.

Monitoring will provide defensible scientific data when looking at specific environmental problems

- Habitat degradation or losses
- Invasive species becoming more prevalent in particular ecosystem and effects on the community
- Disease and pollution affecting the health or killing different organisms within the ecosystem.
- Overexploitation of resources reducing biodiversity
- Climate Change reducing biodiversity and affecting function within the ecosystem.

Successful Monitoring Efforts offer

- Management flexibility
- Assessment of resources and can help prioritize actions
- Scientific data for evaluation and support of Management decisions
- Interagency collaboration with other partners is necessary for success
- Funding justification

Method used to Monitor

- Need an established baseline condition
  - ► To compare monitoring to baseline over time.
  - ► Conduct initial Survey using the **National Vegetation Classification System (NVCS).**

- Use existing database from **Nature Serve** or **State Heritage Program** in your state (if previously surveyed).

- Consider goals of project

- Funding for monitoring (as part of CG funds) held into the future after completion of constructed project.

National Vegetation Classification System (NVCS)

- The NVCS is accepted as a standard approach to be used by all federal agencies, including the Corps.
  - Corps' Level 1 inventory is to the NVCS subclass level.
  - Example: Coniferous Forest
  - Started as The Nature Conservancy methodology. Now can be found at Nature Serve or the State Heritage Program websites.
- NVCS Floristic units arranged under a hierarchy based on physiognomic characteristics –provides species and ecological data
- NVCS designed for classification and GIS mapping at multiple scales.

Levels of the Vegetation Classification Hierarchy

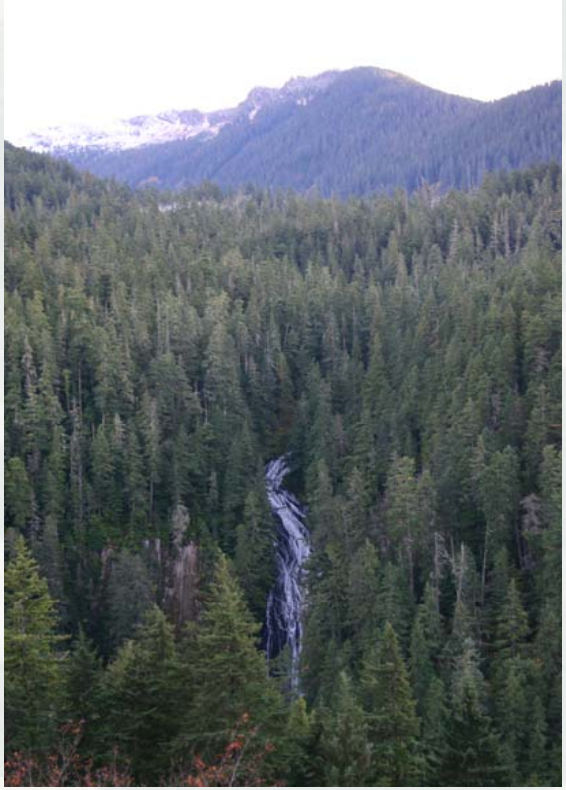
- System
- Physiognomic class
- Physiognomic subclass
- Formation Group
- Formation
- Alliance
- Community element (Association)

System Level

- Types of Systems: 1)Terrestrial, 2) Aquatic 3) Subterranean and 4) Marine
- Each System is structurally complete

Physiognomic Class & Subclass

- **Class**
  - Example: Forest
  - Determined by Height and percentage of cover
- **Subclass**
  - Example: Evergreen Forest
  - **Corps Level 1 inventory**



Formation group

- **Formation group** Combination of climate, leaf morphology and leaf phenology
- Example: Sub alpine evergreen needle-leaved forest

Formation

- Ecological grouping based on broadly defined environmental factors; elevation, hydrologic regime and additional structural factors such as crown shape and life-form of the dominant lower stratum

- Example: Needle-leaved evergreen woodland with conical crowns

Alliance

- Uniform group of plant associations, sharing one or more diagnostic species
- Equivalent to the “cover type”
  (Society of American Foresters)
- Described by diagnostic species
- Example: *Tsuga mertensiana* (Mountain Hemlock) Forest Alliance

Communities

- **Community** is the basic unit of vegetation classification

***This level is needed for adequate surveys and monitoring efforts.**

- Composed of individual plant associations and repeating complex of plant associations
- Community elements of the NVCS are related to a set of environmental factors rather than to a particular site

Communities *(continued)*

- Community element may be composed of a complex of plant associations that constitutes a functioning ecological unit if the associations always occur together.
- "Community element" and "plant association" are both used to refer to the community element.
- Example: *Tsuga mertensiana* / *Vaccinium deliciosum*

Methodology

- Plots data
- Transects data
- Stand data
- GIS mapping of plant communities
  - National Spatial Data Infrastructure; national standards for the floristic level of vegetation classification in the U.S. to the association and alliance levels

National Vegetation Classification System

- Set up plots within the area to be monitored
  - 10m circles or square in each type of area; old field, riparian forest, sagebrush, wetland, etc.
  - Mark center and 4 radial points with plastic survey tape for visibility.
- Locate plot with GPS, date and sign forms and record all environmental data as requested on form.
- Take photos from same vantage point over time
  - Annually or seasonally depending on monitoring effort.

Photo: www. Botanic Gardens.org

Sheet 1

Winfield # 1 2006

Standard Field Form

National Vegetation Classification System, Nature Conservancy 1988

Identifiers / Locators

Plot code Site 1 Polygon code_____

Provisional Community Name_____

State WV Site Name Winfield Locks & Dam

Quad Name Winfield

GPS file name WM1 6/6/06 Field UTM X 17 S 0419038 UTM Y 4265290

Corrected UTM X_____ UTM Y_____ mN UTM Zone_____

Survey Date 6/6/06 Surveyors Pam Bailey

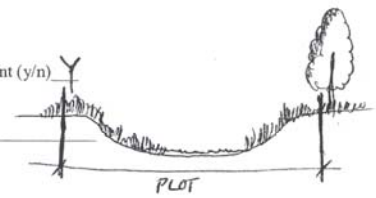
Directions to Plot:

Big mitigation wetland

20 Meter circle

Plot length_____ Plot width_____ Photo #s_____ Plot permanent (y/n) Y

Plot representativeness:



Environmental Description

Elevation 175 M Slope 2.5 to 1 side slopes Aspect S - SE

Topographic Position ON Riverine side bench

Landform constructed mitigation wetland

Surficial Geology None apparent

Cowardian System	Hydrologic modifiers		Salinity Modifiers
__Upland Pond	__Semi-permanently flooded	__ Intermittently flooded	__Saltwater
__Estuarine	__Seasonally flooded	__Permanently flooded	__Brackish
__Riverine	__Saturated	__Tidally flooded	✓ Freshwater
__Palustrine	__Temporarily flooded	__Permanently flooded tidal	
__Lacustrine			

Environmental Comments:

7th Growing season

5th year of monitoring

(First observed in 2002)

Pond level is low; more plant growth in plot.

Soil Taxon/ Description

Not relevent due to fill & manmade pond constructed with liner

Unvegetated surface

__Bedrock	__Wood
__Large rocks (>10 cm)	__Litter
__Small rocks (0.2-10 cm)	4% Bare soil / mud
__Sand (0 – 0.2 cm)	3% Other - water

Soil Texture

__sand	__loamy sand	__sandy loam
__silt	__clay loam	__ silty clay
✓ clay	__peat	__muck
__loam	__silt loam	

Soil Drainage

__Rapidly drained	✓ Well drained UPLand
✓ Moderately drained	__somewhat poorly drained
__Poorly drained	__very poor drained

Sheet 2

Vegetative Description

Leaf phenology (of dominant stratum)	Leaf Type	Physiognomic class	Cover scale for strata & unvegetated surface		Height scale for strata	
Trees and shrubs	___Broad leaf	___Forest	1	<5%	1	<0.5m
___Evergreen	___Needle-leaved	___Woodland	2	5-15%	2	0.5-1m
✓Cold-deciduous	___Mycrophyllous	___Shrubland	3	15-25%	3	1-2m
___Drought-deciduous	___Graminoid	___Dwarf Shrubland	4	25-35%	4	2-5m
___Mixed evergreen cold-deciduous	✓Forb	✓Herbaceous	5	35-45%	5	5-10m
___ Mixed evergreen drought-deciduous	___Pteridophyte	___Nonvascular	6	45-55%	6	10-15m
Herbs		___SparselyVegetated	7	55-65%	7	15-20m
___Annual			8	65-75%	8	20-35m
___Perennial			9	75-85%	9	35-50m
			10	85-95%	10	>50m
			11	95-100%		

Strata	Height Class	Cover Class	Diagnostic species (if known)
T1 Emergent	___	___	
T2 Canopy			
T3 sub-canopy	4	4%	Acer Rubrum
S1 Tall Shrub			
S2 Short Shrub	2	6%	Salix Nigra
S3 Dwarf Shrub			
H Herbaceous	2	160%	Lespedeza cuneata
Grass	1	* IN Pond	Ludwigia palustris
Forb			
Fern			
N Non-vascular			
V Vine/ liana			
E Epiphytic			

Animal Use Evidence:
WATER FOWL
Deer
Bear (SCAT)

Natural and Anthropogenic Disturbance Comments:
PEOPLE CAN ACCESS SITE FOR BIRDING

Other Comments:

Sheet 3

Plot V June 2006

			DBH
N	T. Betula nigra	2%	6.2cm.
	Acer rubrum	2%	5.5cm.
Succession → N	S. Salix nigra	6%	

Species / percent cover. Starting with upper most strata list all species.
For forest and woodlands list all DBH of all trees above 10 cm diameter (separate measurements with a comma). Put * next to any species known that are known diagnostics for a particular community in the classification. List species outside the plot at end of table and designate with a 0 in a cover class column.

	Species names	Cover	Species names	Cover	
N	Juncus effusus	6%	Lespedeza cuneata	15%	I
N	Eupatorium perfoliatum	4%	Andropogon virginiana	<1%	I
N	Juniperus virginiana	1%	Agrostis alba	<1%	N
N	Acer rubra	1%	Dactylis glomerata	1%	I check
N	Juncus tenuis	2%	Polygonum coccineum	1%	N Water smartwe
I	Holcus lanatus	<1%	Trifolium agarium	1%	I
N	Scirpus cyperinus	2%	Vitis vulpina L.	<1%	N winter Grape
N	Carex vulpinodea	2%	Artemisia vulgaru	<1%	I
N	Eleocaris obtusa	1%	Desmodium canescens	1%	N
N	Ludwigia palustris	35%	Lotus corniculatus	1%	I
N	Lycopus americanus	1%	Lolium perenne	<1%	N
N	Carex scoparia	2%	Setaria glauca	<1%	I
N	Cyperus esculentus	1%	Bidens coronata	1%	N
N	Solidago altissima	3%	Diodia teres L.	<1%	N
I	Iris psudacorus	1%	Asclepias quadrifolia	3%	N
N	Sisrinchium angustifolium	<1%	Miscanthus sinensis	<1%	I
I	Rumex crispus	1%	Rudbeckia hirta	<1%	N
N	Lobelia inflata	<1%	Aster dumosus	<1%	N
I	Plantago major	1%	Plantago lanceolata	<1%	I
N	Eupatorium serotinum	1%	Campsis radicans	1%	I
N	Hypericum mutilum	<1%	Phleum pratense	<1%	I
N	Lobelia cardinalis	<1%	Vicia americana	<1%	N
I	Daucus carota	<1%	Rubus occidentalis	1%	N
I	Trifolium pratense	<1%	Cephalanthus occidentalis	1%	N
I	Chrysanthemum leucanthemum	1%	Rosa multiflora	1%	I
N	Ambrosia bidentata	1%			
I	Lotus corniculatus	<1%			
N	Galium aparine	1%			
I	Barbarea vulgare	<1%			
I	Melilotus officinalis	1%			
I	Geranium molle	1%			
N	Typha latifolia	<1%			

Cover Scale for Species

1	<1%
2	1-5%
3	5-25%
4	25-50%
5	50-75%
6	75-100%

59 species

N = 36 = 61%
N-N - 23 = 39%

Sucessional Species Trend

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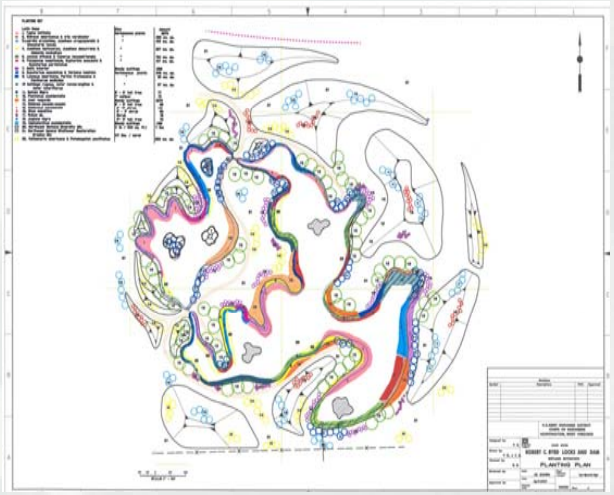
Standard reference for the National Vegetation Classification System http://www.natureserve.org

Grossman D.H., Faber-Langendoen D., Weakley A.S., Anderson M., Bourgeron P., Crawford R., Goodin K., Landaal S., Metzler K., Patterson K.D., Pyne M., Reid M., and Sneddon L. 1998. “International classification of ecological communities: terrestrial vegetation of the United States. Volume I, The National Vegetation Classification System: development, status, and applications. The Nature Conservancy: Arlington, VA.”

Mitigation project

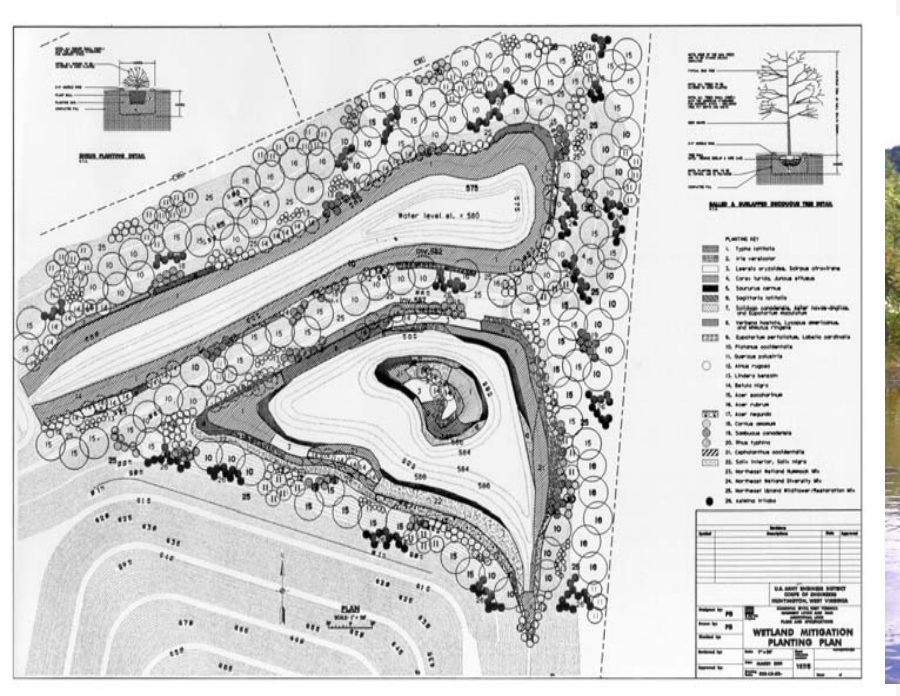
R.C. Byrd Lock and Dam, WV



- Baseline directed the plans, and monitored with the same protocol. Monitoring agreement between the Huntington District and the USFWS
- Started to have a natural plant zonation in the wetland
- Thresholds: 80 % cover and native/invasive ratio

Mitigation plan and monitoring of actual plantings for Marmet Lock and Dam, WV.

Huntington District in partnership with the USFWS



Tumamoc Hill, Arizona Longest Plant Monitoring Program

- Series of plots since 1906, 107 years of ecological data. University of Arizona.
- Long-term data have allowed scientist to estimate life spans for desert perennials, make advances into how ecosystems behave and evolutionary processes.
- Learn how an ecosystem changes over time; - the desert wasn't progressing towards a climax community (as previously believed).

How to determine success

- Record what was successful and what wasn't according to your goals. Use the same consistent methodology for the monitoring as the original survey to be able to compare results/ data.

- Monitor threatened and endangered species
  - Is the population stable, growing or declining?
    - Photo: The threatened Western prairie fringed orchid (*Platanthera praeclara)* by G. N. Rysgaard.
- Record the biodiversity within the plant communities
- Percent cover thresholds for species
  - Native species vs. invasive species

How to determine success (continued)

- Can record successional growth trends as the area develops over time.

- Development of layers (structure) in a complex system: Example a riparian forest will have an herbaceous layer, shrub layer, sub-canopy and canopy.

- Biological integrity –Creating habitat for birds and animals using the area.

- **Ultimate Goal: To restore function and natural processes**

Environmental Benefits

Photo: Rich Fischer

- Monitoring provides a scientifically defensible system to understand how the vegetation is changing and a way to record how function is restored within the ecosystem.
- Genetic and species diversity in our projects increases survivability and reduces project costs
- Monitoring of plant community and native planting establishment allows for development of habitat of the native fauna, supports ecological interactions, and landscape diversity

Adaptive Management scenarios

The ability to be flexible like nature!

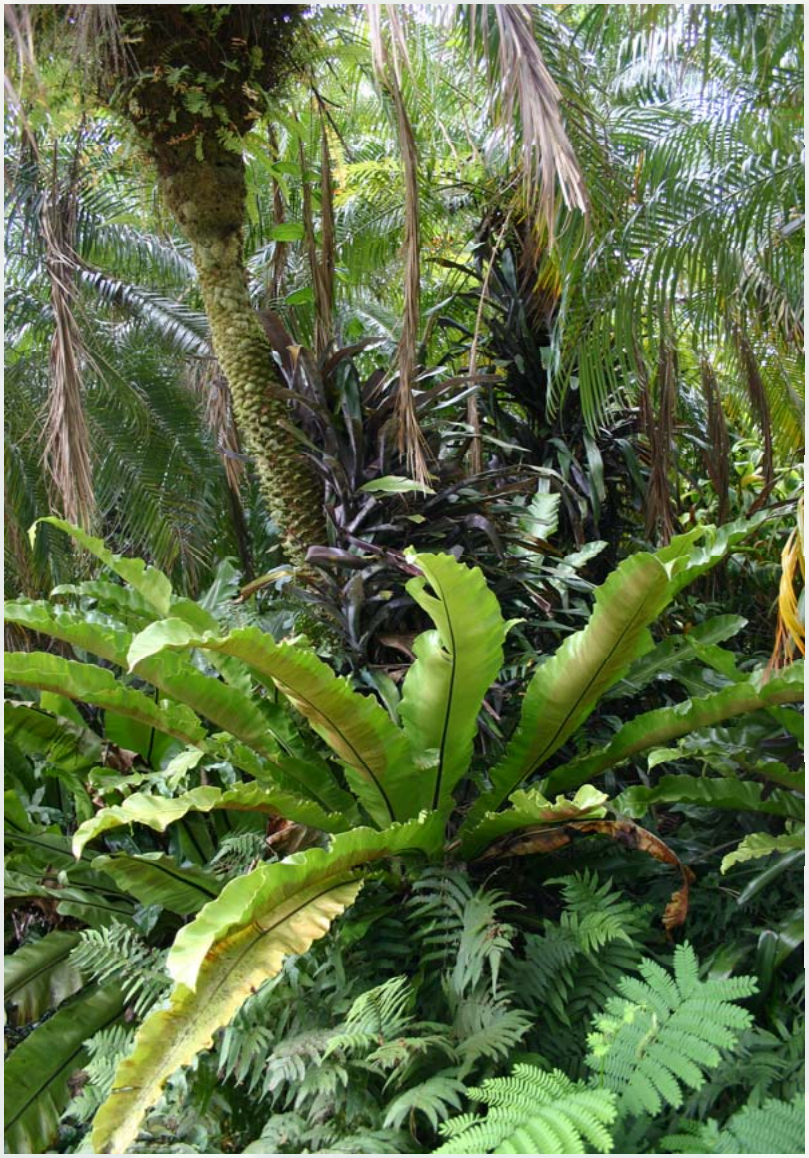
- Restoration Project: Planting a number of species and/or diverse seed mixes; some plant species will do well and others will not. Additionally seed will come into area by wind and wildlife to add to the diversity on site.

- An invasive plant is introduced - it will have to be controlled and the area may need to be replanted.

Plants Additional Sources of information

Natural Heritage Programs
NatureServe

Catalog of New World Grasses
Checklist of World Ferns
North American lichens
American Bryophyte Catalog (NYBG)
Biota of North America Program (BONAP)
CalFlora
Flora of North America
ILDIS LegumeWeb
Index Herbariorum
Index of Fungi (CABI Bioscience)
International Plant Names Index (IPNI)
Missouri Botanical Garden W3TROPICOS
NY Botanical Garden Virtual Herbarium
Royal Botanic Gardens, Kew ePIC
USDA PLANTS Database



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