



JAMES MADISON UNIVERSITY.

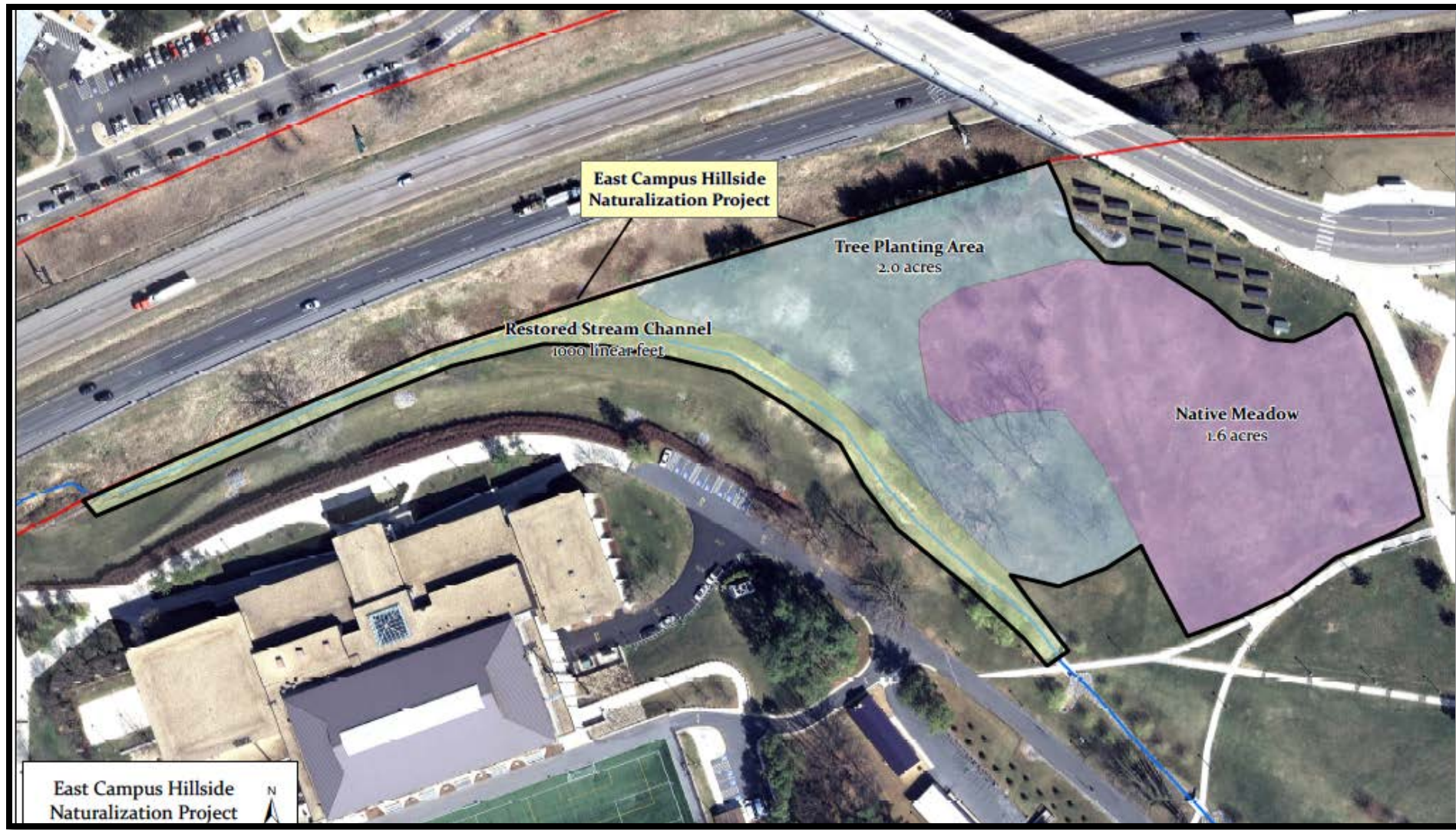
# Developing a Natural Educational Landscape on Campus Grounds

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Smart and Sustainable Campuses Conference

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# The Project Area



# ***Presentation Outline***

project proposal process, collaborative design,  
challenges, resource requirements, and  
lessons learned

learning outcomes and course applications

small group discussions

# ***Project Process***

- 2002 – faculty member vision for meadow
- 2006 – first formal draft of a proposal
- 2009 – Visiting Scholar and collaboration
- 2010 – staff vision
- 2011 – grant for stream channel restoration
- 2011 – contracted planting
- 2012 – class tree planting
- 2012 – stream restoration
- 2013 to present – ongoing maintenance; development and implementation of courses

# *Collaborative Design*

- Senior administration support
- Scholar-in-Residence, Michael Singer
- Faculty, students, and Scholar-in-Residence: hillside interactions
- Dean
- Facilities Management
- Advisory Committee



*Photo by Travis Erkenbrack*

# **Hillside Evolution**

## ***Soil Sampling (prior to grass kill)***



# Grass Kill, May 2011



# *Seeding, June 2011*





# ***Full Cover, August 2011***



# ***Cover Crop Decline, September 2011***



# ***Cover Crop Decline, October 2011***



# *Hillside Vista, August 2012*



# ***Weeding, Every Late Spring***



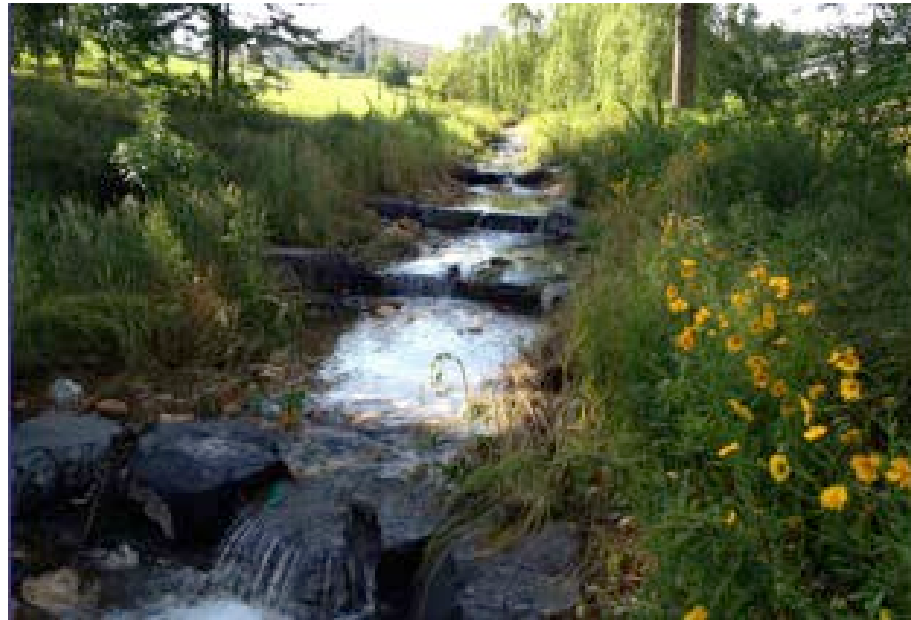
# *Tree Planting, April 2012*



# ***Stream Rehabilitation, April 2012***



# ***Stream Rehabilitation, April 2013***





# ***Resource Requirements***

- Initial project oversight for each portion
- Grant writing, collaboration, and management
- Ongoing management- office and advisory committee
- Maintenance
- Faculty curriculum development
- Facilities Management support

# ***Challenges and Lessons Learned***

- **Communication**
  - Establishing protocols for Facilities Management and faculty interaction
  - Developing a calendar of activities
  - Changing the culture
  - Tracking use
- **Aesthetics**
  - Understanding visual appeal
  - Weeds
- **Implementation**
  - Erosion prevention, grass strip creation, and access
  - Weeding
  - Winter habitat and cover
  - Ongoing funding needs for courses
  - Assumption of risk

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# ***Courses Engaged with Hillside***

- GEOG 210: Physical Geography
- GEOG 290: Human Interactions with the Physical Environment
- GEOG 322: Agricultural Systems
- GEOG 340: Biogeography
- GEOG 470: Senior Seminar on Global Biodiversity
- GEOG 390-490-496: Capstones
- ISAT112: Environmental Issues in Science and Technology
- ISAT 320: Fundamentals of Environmental Science
- ISAT 424/GEOG 342: Natural Resource Management
- ISAT 429/GEOG 429: Sustainability- An Ecological Perspective
- BIO 366: Plants and Environment

# *Course Application Example 1*






## **ISAT 320: Fundamentals of Environmental Science**

### **Learning Objectives:**

- Identify plant species and populations
- Execute proper field techniques for soil collection and preparation for storage and analysis
- Articulate fundamental soil properties



# Outcomes

Test	Results	SOIL TEST RATINGS					Calculated Cation Exchange Capacity	
		Very Low	Low	Medium	Optimum	Very High		
Soil pH	5.6						<b>10.5</b> meq/100g	
Buffer pH	6.69							
Phosphorus (P)	61 ppm						<b>Calculated Cation Saturation</b>	
Potassium (K)	162 ppm							
Calcium (Ca)	1301 ppm						%K	4.0
Magnesium (Mg)	135 ppm						%Ca	62.0
Sulfur (S)							%Mg	10.7
Boron (B)							%H	23.3
Copper (Cu)							Hmeq	2.4
Iron (Fe)								
Manganese (Mn)								
Zinc (Zn)								
Sodium (Na)								
Soluble Salts								
Organic Matter	4.7 % ENR 129							
Nitrate Nitrogen								
							<b>K : Mg Ratio</b>	
							0.37	

Longitudinal data set on soil moisture, pH, and porosity

# *Ongoing Developments*

- Analysis of soil testing in Fall 2014
- Soil improvement experiment designed
- Compost spread on plots
- JMU's compost connection
- Continuing soil analysis Fall 2015 and onward, ISAT 320
- Soil carbon and soil nutrient analysis through senior projects
- Continuing inventory of plant and wildlife as meadow matures

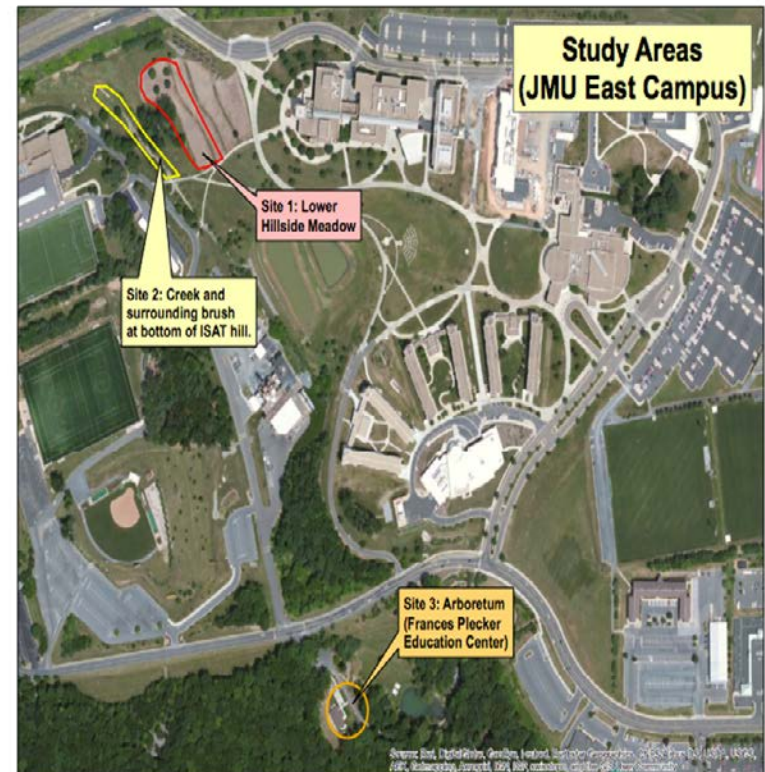


# Course Application Example 2

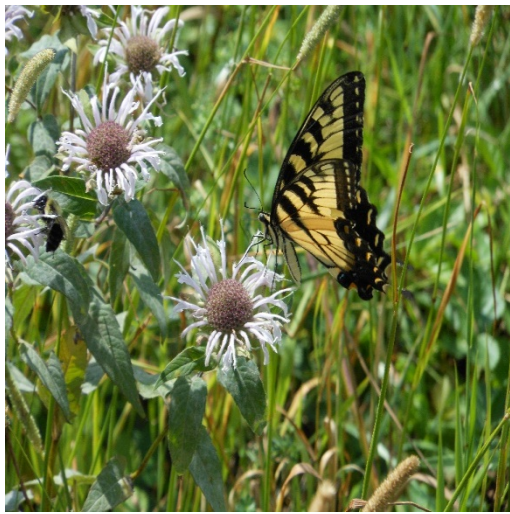
## GEOG 470: Geographic Science Senior Seminar, Global Biodiversity

### Learning Objectives:

- 1 Explain the importance of expertise for identification of species
- 2 Describe how biodiversity of butterfly species is measured
- 3 Explain how expertise influences knowledge of global biodiversity
- 4 Develop a guide to butterflies







Swallowtails

# ***Outcomes: Butterfly Families Observed on the JMU Campus***



Whites and Sulphurs



Hairstreaks



Brushfoots



Skippers

# ***Outcomes: Understanding of Observational Data and Errors***



Fiery Skipper: *Hylephila phyleus*  
*Photo by Travis Erkenbrack*



Sachem skipper: *Atalopedes capestris*  
*Photo by Heather Hunter Nichols*

## **Observations**

Species common name	Team 1	Team 2
Cabbage White	X	X
Clouded Sulphur	X	X
Orange Sulphur	X	X
Unidentified Sulphur	X	X
Pearl Crescent	X	X
Monarch	X	X
Silver-spotted Skipper	X	
Wild Indigo Dusky Wing	X	
Checkered Skipper	X	
Least Skipper	X	
Fiery Skipper		X
Sachem Skipper	X	X
Skipper (other)	X	

# *Course Application Example 3*

## **GEOG 390-490-495 Senior Capstone**

### **Baseline Study of the East Campus Hillside Meadow**

#### **Students' Objectives:**

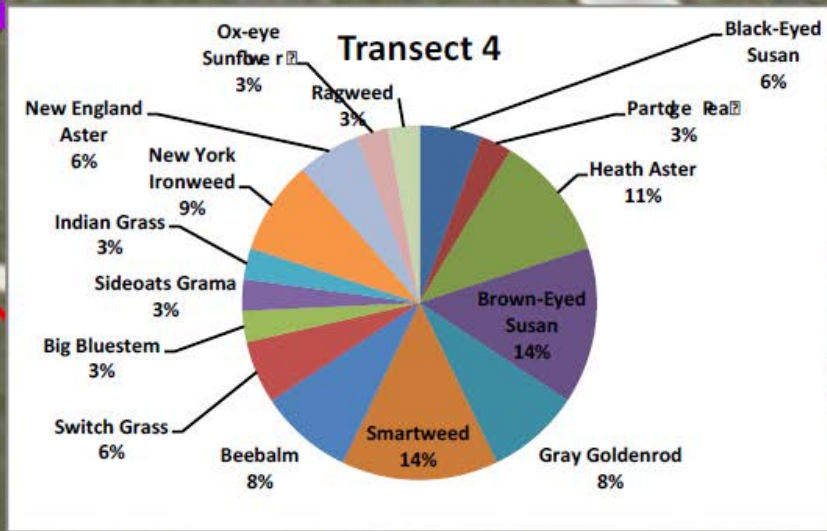
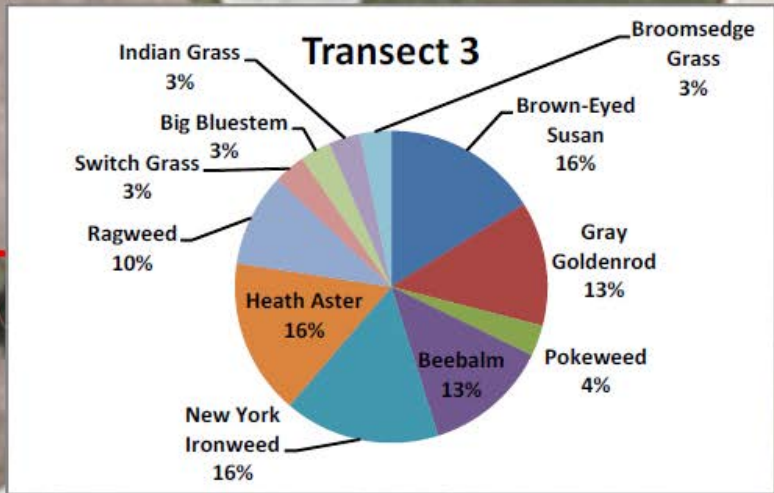
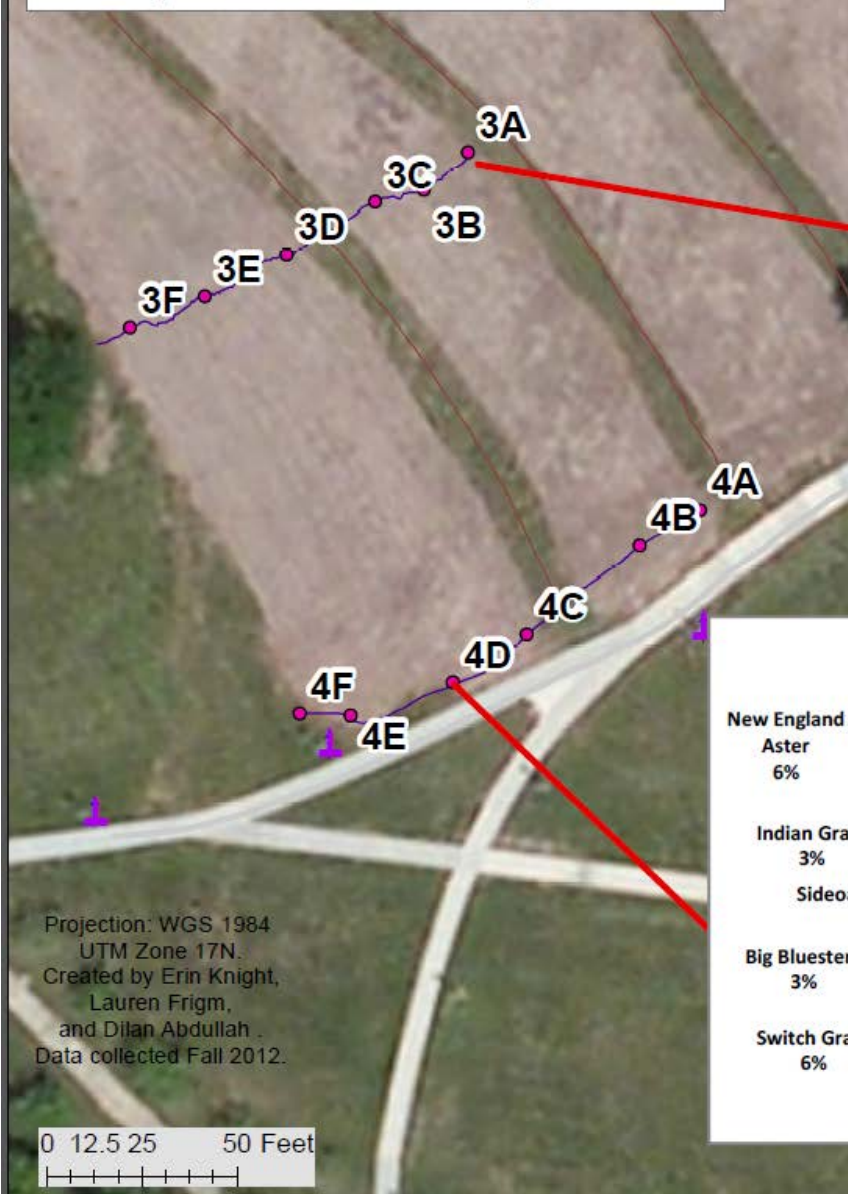
- Supply the university with a keyed guide for plant identification for future use
- Create a baseline of the meadow's development through transect survey of vegetation
- Analyze vegetation distribution based on recommendations outlined by the Society for Ecological Restoration International Primer



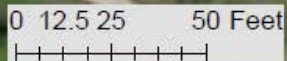
1965 aerial photo showing meadow area as agricultural field

# Outcomes: Species Distribution

Forb Species Distribution by Transect



Projection: WGS 1984  
 UTM Zone 17N.  
 Created by Erin Knight,  
 Lauren Frigm,  
 and Dilan Abdullah.  
 Data collected Fall 2012.



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# ***Small Group Discussions***

- Are there places suitable for this activity?
- Who are the potential partners?
- What are the channels?
- Who has long-term commitment for oversight?
- What faculty will participate and what are their goals (including management)?
- What are potential initial and ongoing funding source?

# ***Appendix: Reference Materials***



# Seeds Planted

COMMON NAME	BOTANICAL NAME	PERCENT IN MIX
<b><u>Forbs - 10 lbs PLS</u></b>		
Common Milkweed	<i>Asclepias syriaca</i>	5
Butterfly Weed	<i>Asclepias tuberosa</i>	1
Columbine	<i>Aquilegia canadensis</i>	3
New England Aster	<i>Aster novae-angliae</i>	5
Aromatic Aster	<i>Aster oblongifolius</i>	4
Heath Aster	<i>Aster pilosus</i>	3
Wild Blue Indigo	<i>Baptisia australis</i>	5
Partridge Pea	<i>Chamaecrista fasciculata</i>	13
Woodland Sunflower	<i>Helianthus divaricatus</i>	3
Ox-eye Sunflower	<i>Heliopsis helianthoides</i>	4
Shaggy Blazing Star	<i>Liatris pilosa</i>	8
Blazing Star	<i>Liatris spicata</i>	3
Wild Bergamot	<i>Monarda fistulosa</i>	3
Beebalm	<i>Monarda punctata</i>	3
Appalachian Beardtongue	<i>Penstemon canescens</i>	11
Black-eyed Susan	<i>Rudbeckia hirta</i>	8
Brown-Eyed Susan	<i>Rudbeckia triloba</i>	3
Wild Senna Senna	<i>hebecarpa</i>	5
Early Goldenrod	<i>Solidago juncea</i>	5
Gray Goldenrod	<i>Solidago nemoralis</i>	3
New York Ironweed	<i>Vernonia noveboracensis</i>	3
Slender Mountain Mint	<i>Pycnanthemum tenuifolium</i>	3
		100
<b><u>Grasses - 20lbs PLS</u></b>		
Big Bluestem	<i>Andropogon gerardii</i>	7
Broomsedge Bluestem	<i>Andropogon virginicus</i>	7
Sideoats Grama	<i>Bouteloua curtipendula</i>	20
Switch Grass	<i>Panicum virgatum</i>	3
Little Bluestem	<i>Schizachyrium scoparium</i>	48
Indiangrass	<i>Sorghastrum nutans</i>	15
		100





# Trees Planted

## Overstory hardwoods (6-10 ft tall)

Northern red oak – *Quercus rubra*  
Southern red oak – *Quercus falcata*  
White oak – *Quercus alba*  
Willow oak – *Quercus phellos*  
Pin oak – *Quercus palustris*  
Overcup oak – *Quercus lyrata*  
Blackjack oak – *Quercus marylandica*  
Pignut hickory – *Carya glabra*  
Mockernut hickory – *Carya tomentosa*  
Shagbark hickory – *Carya ovata*  
Bitternut hickory – *Carya cordiformis*  
Sourwood – *Oxydendron arboreum*  
tuliptree – *Liriodendron tulipifera*  
Painted buckeye – *Aesculus sylvatica*  
Horsechestnut – *Aesculus hippocastanum*  
Kentucky coffee tree – *Gymnocladus dioica*  
Yellow birch - *Betula alleghaniensis*  
hornbeam – *Carpinus caroliniana*  
hophornbeam – *Ostrya virginiana*  
Carolina ash – *Fraxinus caroliniana*

## Understory hardwoods (3-6 ft tall)

redbud – *Cercis canadensis*  
dogwood – *Cornus florida*  
Spice bush – *Lindera benzoin*  
Black tupelo – *Nyssa sylvatica*  
Persimmon – *Diospyros virginiana*  
witch-hazel – *Hammamelis virginiana*  
Red maple – *Acer rubrum*  
Pawpaw – *Asimina triloba*  
Carolina silverbell – *Halesia tetraptera*  
(*Halesia carolina*)

## Gymnosperms (6-15 ft tall)

Carolina hemlock – *Tsuga caroliniana*  
Red spruce – *Picea rubens*  
Balsam fir – *Abies balsamea*

# Hillside Plant Guide



## Switchgrass (*Panicum virgatum*)

3-5 feet in height

The stem is round and can have a red to straw colored tint

Grows in bunches

Have a single flowered spikelet (tan in color) where seeds are located



## Little Bluestem (*Schizachyrium scoparium*)

1-3 feet in height

Very flat, bluish stem s; plants are green but often purplish at base of stem

Leaves are smooth, but covered in hair at base; fold with maturity

Seed head clusters about 3 inches long and are hairy



## Ox-Eye Sunflower (*Heliopsis helianthoides*)

5-1.5 meters in height

Smooth, unbranched stem; fibrous roots

Leaves opposite attached with coarsely serrated margins and taper to a point tip

Flowers have orange-yellow center disk and yellow petals

Each flower has 10 or more petals



## Shaggy Blazing Star (*Liatis pilosa*)

Leaves long, narrow and lance shaped; leaves alternate on the plant stem

Flower heads on a spike and are purple and contain 5-60, 5-lobed flowers

1-2 feet in height

Long, pink corollas

Leaves reduce gradually going up the stem

Flowers appear shaggy



## Blazing Star (*Liatis pycnostachya*)

About 1.5 meters in height

Narrow, dark green leaves with a light colored mid-rib and are alternately arranged; the

leaves shorten in length going up the stem; both stems and leaves display short hairs

Flowers on a spike (up to 60 cm long); heads consist of 5-7 individual rose-purple

flowers, each with 5 long, slender, pointed petals; extended white stamens (or pistils)



## Big Bluestem (*Andropogon gerardii*)

Blue coloration at the base of the stem

Purplish 3-parted flower clusters that resemble the shape of a turkey's foot; spike-like

Up to 3m tall, erect, and covered in a waxy blue layer

Leaf blades are flat; smooth below and rough above



## Broomsedge Bluestem (*Andropogon virginicus*)

2-4 feet in height

Leaves are flat or partly folded, 10 to 15 inches long and 1/8 inch long; colorless or

yellow, rest of plant is a pale greenish yellow

Fringed at the top of the plant



## Sideoats Grama (*Bouteloua curtipendula*)

1-2 feet in height

Wide leaves; zig-zag stalk with small compressed spikes dangling on one side at even intervals; distinct hairs branching off of the leaf

# Case Study Including Stream Restoration



Chesapeake Bay Stewardship Fund  
[www.nfwf.org/chesapeake](http://www.nfwf.org/chesapeake)



## *Community Solutions to Stormwater Pollution in Blacks Run*

**Organization:** Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation

**Project Partners:** Eastern Mennonite University, James Madison University, Shenandoah Valley Soil and Water Conservation District, City of Harrisonburg, Boxerwood Gardens, Harrisonburg Redevelopment and Housing Authority, Virginia Department of Environmental Quality

**Grant Award:** \$ 325,000

**Matching Funds:** \$ 460,339 (Non-Federal Match expended to date = \$450,023; Federal Match expended to date = \$40,000)

**Project Description:** This project is designed to reduce stormwater pollution and enhance stormwater management on three scales in the Blacks Run Watershed, which is located in the City of Harrisonburg: 1) neighborhood/individual 2) institutional and 3) community/watershed scale. Project partners were identified based on their capacity to implement management practices at these different scales, and to work with large and small property owners to increase local capacity to continue to address stormwater management in the Blacks Run watershed. This project will result in the installation of over 200 best management practices (BMPs) including a series of residential rain gardens, rain barrels and pet waste digesters, several larger bioretention facilities, a rainwater harvesting cistern, streambank stabilization and riparian buffer planting projects, and a small green roof. In addition, this project will provide training and capacity building for the community and landscaping professionals to use cost-effective methodologies for the design, installation and maintenance of stormwater practices that will continue to benefit the community and watershed after this NFWF project is complete. Collectively these actions will reduce pollution that may result in improved water quality conditions in Blacks Run.

### **Goals and Outcomes:**

Installation of approximately 200 stormwater BMPs treating 124 urban/residential acres in the Blacks Run watershed:

- ❖ 170 rain barrels
- ❖ 14 rain gardens
- ❖ 8 bioretention/infiltration practices
- ❖ 7 riparian buffer plantings (> 1acre)
- ❖ 2,850 ft of stream bank stabilization
- ❖ 65 pet waste digesters
- ❖ Additional 8 acres of trees planted (3,250 trees)
- ❖ Four cisterns (1 14,000 gallons of rainwater harvested)
- ❖ One green roof



- ❖ Estimated reductions of 509 lbs/year of nitrogen, 78 lbs/year of phosphorous, and 19 tons/year of sediment
- ❖ Documented improvement in water quality conditions after the project has completed its third year
- ❖ Foster a stewardship ethic within a community through neighbor to neighbor communication.
- ❖ Increase knowledge of landscapers, municipal employees, and home owners about rain gardens and vegetated buffers
- ❖ Lower the cost of rain garden design and installation and buffer maintenance throughout the watershed
- ❖ Increase the exposure and understanding of the residents of Blacks Run to stormwater pollution prevention issues.

[http://www.nfwf.org/chesapeake/Pages/home.aspx#.VRBW\\_VrZf8](http://www.nfwf.org/chesapeake/Pages/home.aspx#.VRBW_VrZf8)

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