United States Department of Agriculture
Natural Resources Conservation Service
Plant Materials Program

2012 ANNUAL TECHNICAL REPORT

NORMAN A. BERG NATIONAL PLANT MATERIALS CENTER

Finding innovative vegetative solutions for emerging conservation challenges in Delaware, Maryland, Pennsylvania and Virginia for over 77 years.

A roller crimper and planter plant corn in for the soil health study in May 2013

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
NORMAN A. BERG NATIONAL PLANT MATERIALS CENTER

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NATIONAL PLANT MATERIALS PROGRAM
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TABLE OF CONTENTS

PLANT MATERIALS CENTER HISTORY

The National Observational Nursery Project was established in Beltsville, Maryland in 1935 as a conservation plant nursery for the Soil Conservation Service (SCS) Division of Nurseries. By 1939, the campus of buildings and greenhouses had been constructed by the Civilian Conservation Corps. In the early years, vast quantities of grass seed and trees were produced to facilitate SCS programs restoring farmland devastated by the Dust Bowl. Over time, the nursery's mission would evolve to address diverse resource concerns, from finding alternative oil and rubber crops to supporting the nation's war effort in Europe, collecting and distributing foreign plant materials, and developing native conservation plant releases.

In May 2009 the National Plant Materials Center was renamed the Norman A. Berg National Plant Materials Center (NPMC) honoring Norman A. Berg, an early SCS administrator and life-long conservationist. Mr. Berg's legacy has inspired generations of conservationists, having a positive and lasting impact on NRCS.

Current research activities at the NPMC include designing optimal forage for managed grazing systems, increasing diversity in NRCS conservation plantings, and designing herbaceous buffers to control poultry house emissions.

Since 1939, the NPMC has had 12 Managers (see Table 1), including landscape restoration pioneer Franklin J. Crider and current National Program Leader John Englert.

Table 1: National Plant Materials Center managers, 1939 to present.

CENTER MANAGERS	DATES OF SERVICE
Franklin J. Crider	1939 - 1948
Wilmer W. Steiner	1948 - 1955
Robert B. Thornton	1955 - 1968
H. Wayne Everett	1969 - 1973
Gilbert Lovell	1973 - 1978
Michael McCrary	1978 - 1979
Stephen K. Salvo	1979 - 1983
James Briggs	1983 - 1989
J. Eric Scherer	1990 - 1991
J. Scott Peterson	1991 - 1994
John Englert	1995 - 2008
Jeremy West	2009 - 2012

SITE AND CLIMATE INFORMATION

The NPMC is located in Beltsville, Maryland (Latitude 39N 1' 1.9482" and Longitude 76W 51' 7.7574") in the Northern Coastal Plain region of the North Atlantic Slope Diversified Farming Land Resource Area (MLRA) (see Figure 1). This area is characterized by rapid urbanization and the resultant development-related water quality degradation.

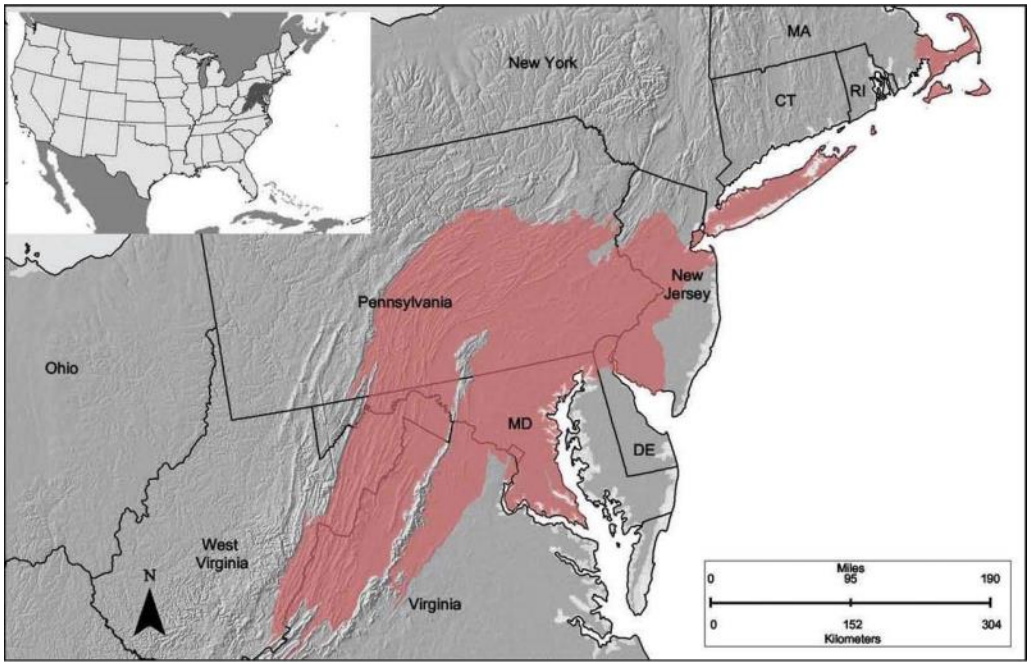

Figure 1: The North Atlantic Slope Diversified Farming Land Resource Area (red) covers approximately 40,865 square miles of nine Mid-Atlantic States and the District of Columbia (MLRA Explorer Custom Report).

The 285 acre, NRCS-owned farm site is on the east campus of the Beltsville Agricultural Research Center, among approximately 7,000 acres of federal properties utilized by such entities as Agricultural Research Service, Secret Service and National Aeronautics and Space Administration. The principle use of the surrounding federal properties is agricultural research.

The NPMC's mean elevation is 147 feet above sea level. The most common soil map units are Russett-Christiana complex (30%) and Christiana- Downer complex (24%). Other soil map units include the Downer-Hamonton complex (8%), frequently flooded Zekiah and Issue soils (8%) and others (31%). Surface soil textures tend to be silt loam (34%) or fine sandy loam (30%) with some loamy sand (20%) or sandy loam (10 %). Forty-one percent of the soils at the NPMC belong to Non-irrigated Land Capability Class 2 and are soils with moderate limitations for crop production. Twenty-two percent of the soils belong to Land Capability Class 3 and are soils with severe limitations for crop production. Less than 3% of the total acreage belongs to Land Capability Class 1 with few limitations. Over 63% of the NPMC is considered prime farmland, with 22% of this area considered farmland of state importance and 12% requiring irrigation to reach prime potential.

Based on climate data provided by the University of Maryland, precipitation in Beltsville during 2012 was below the preceding 71 year average for all months except October (see Figure 2). The cumulative precipitation for all months except October was 65% below the 71 year average for those months. The month of October, 2012 showed an increase of 234% over the 71-year average for October. Excessive October precipitation was largely due to Tropical Storm Andrea.

The average monthly temperature during 2012 was approximately 3.5 degrees higher than the preceding 71 years, with the greatest increases of 9.8 degrees in March (see Figure 3). Only November was colder than the 71 year average.

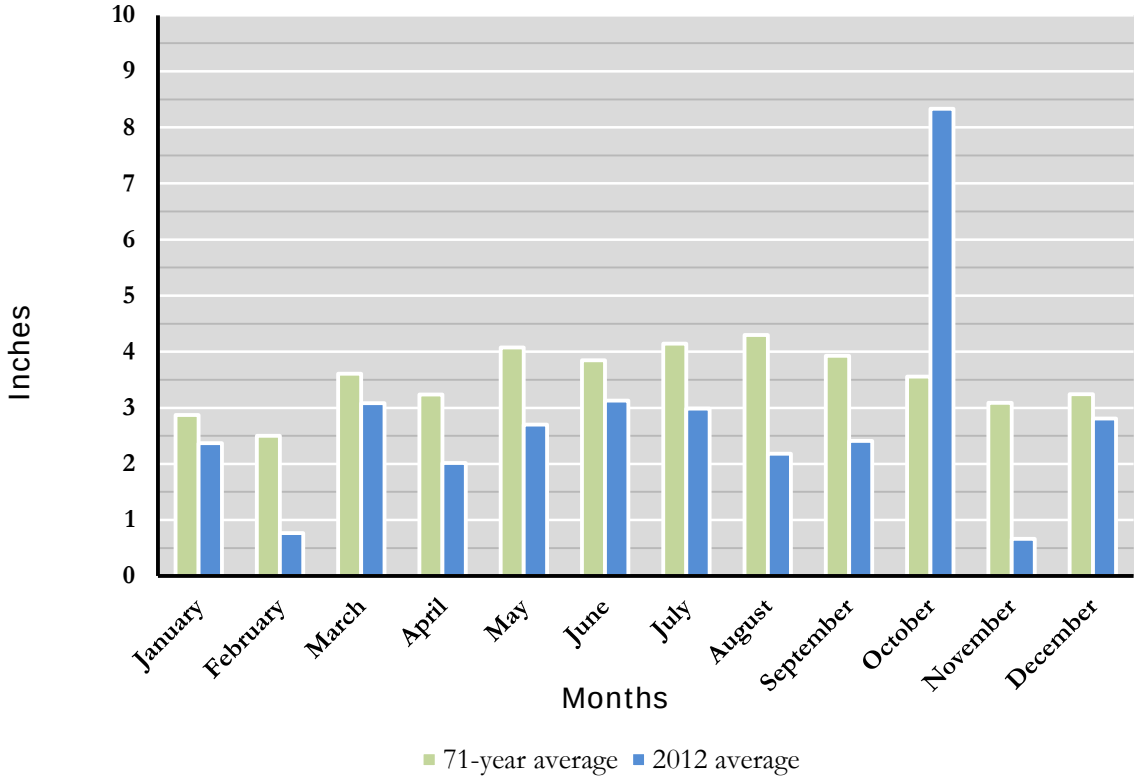

Figure 2: Beltsville weather data: average monthly precipitation (snow and rainfall) for 1941-2012 and 2012. Data provided by University of Maryland, Department of Atmospheric and Oceanic Science.

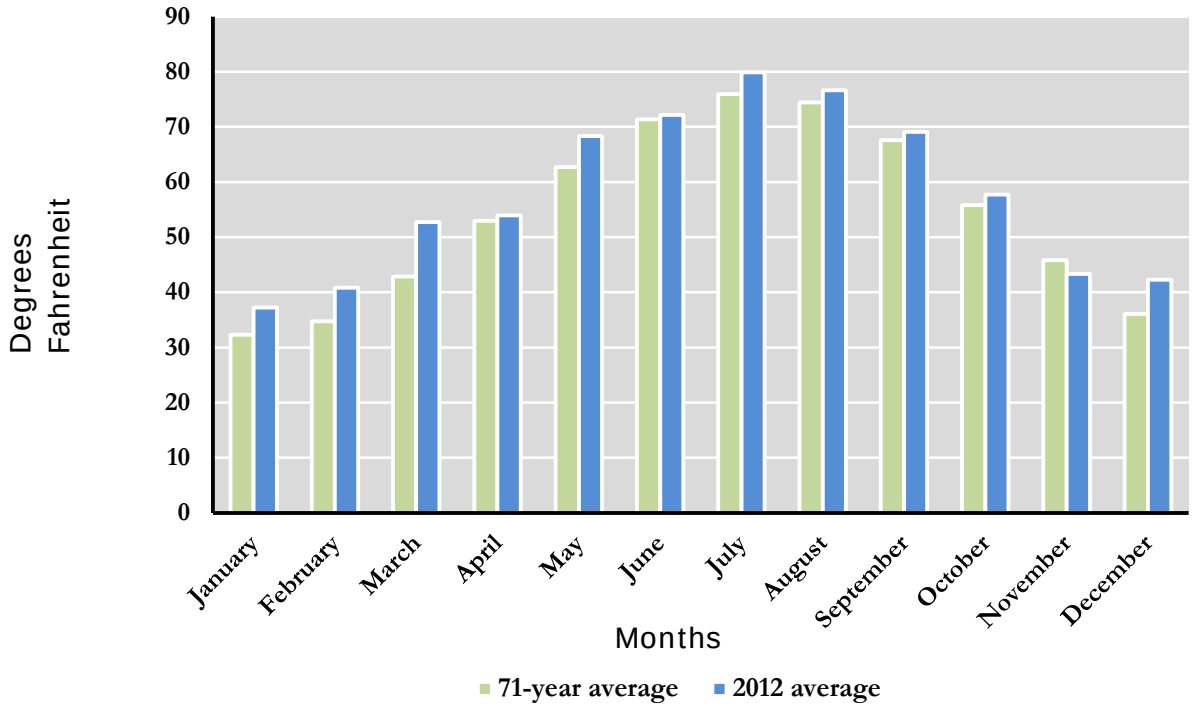

Figure 3: Beltsville weather data: average monthly temperatures for 1941-2012 and 2012. Data provided by University of Maryland, Department of Atmospheric and Oceanic Science.

SERVICE AREA

The NPMC does not have a defined Service Area. The NPMC's area of focus is the Chesapeake Bay, in particular the states of Delaware, Maryland, southern Pennsylvania and northern Virginia. The NPMC also plays an integral role supporting the Plant Materials Program nationwide.

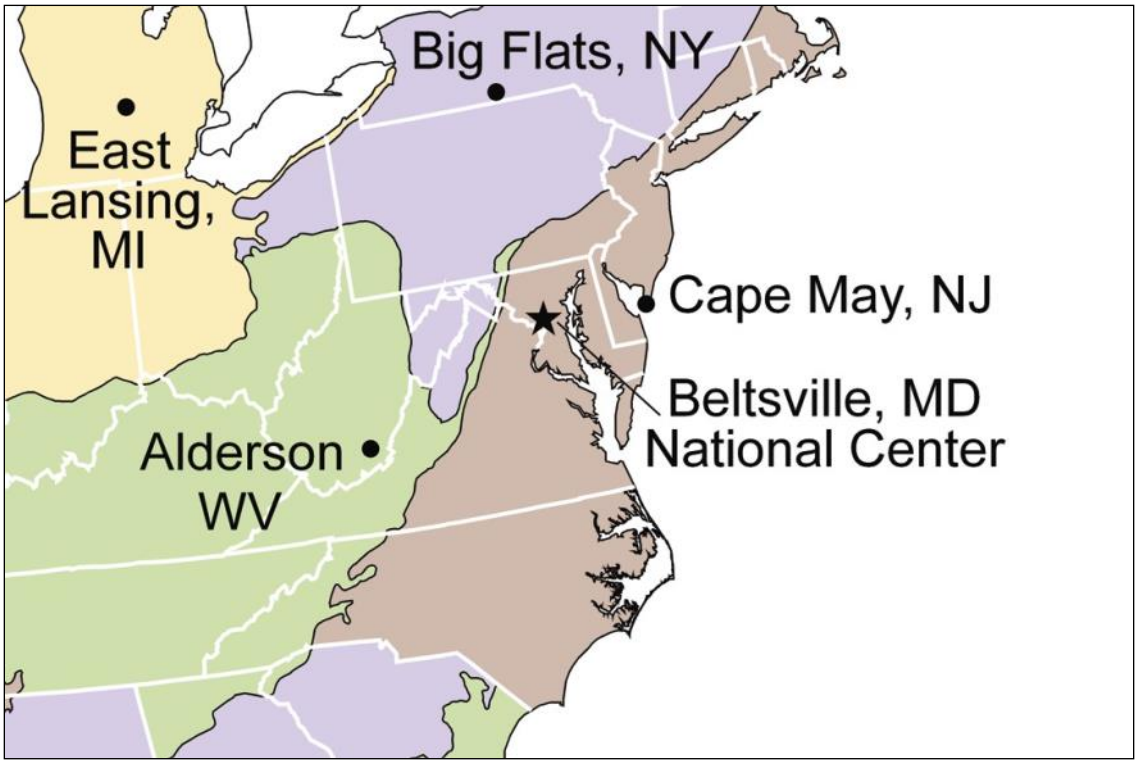

Figure 4: Map showing the NPMC focus area and adjacent PMCs.

LONG RANGE PLAN

The Long Range Plan (LRP), or strategic plan, for the NPMC is designed to guide operations from 2012 through 2017. The LRP was adopted in 2012, from goals and objectives determined by the PMC State Conservationist Advisory Committee in 2011. The LRP was developed in collaboration with the Cape May PMC. The goals and objectives are utilized by both NPMC and Cape May PMC, with each PMC responsible for specific research activities or strategies.

The 2012-2017 LRP GOALS and OBJECTIVES are listed below:

GOAL I: MANAGE AND RECOVER EXCESS NUTRIENTS TO REDUCE IMPACTS TO SURFACE AND GROUND WATER EFFICIENTLY AND ECONOMICALLY.

- Obj. A: Develop cover crop/green manure technical resources.
- Obj. B: Enhance NRCS field staff capacity with training and public understanding of nutrient management and ground water quality with information/education.

GOAL II: IMPROVE SOIL HEALTH AND SOIL QUALITY WHILE MINIMIZING INPUTS AND MAXIMIZING OUTPUTS TO INCREASE SUSTAINABLE YIELDS ON WORKING AGRICULTURAL LANDS AND FORESTS.

- Obj. A: Evaluate plants to improve soil quality.
- Obj. B: Evaluation and management of desirable plants for bio-fuels.
- Obj. C: Enhance NRCS field staff capacity with training and public understanding of soil health and quality issues with information/education.

GOAL III: MANAGE NATURAL RESOURCES TO ENSURE CLEAN AND ABUNDANT AIR AND WATER FOR HEALTHY AND SUSTAINABLE ECOSYSTEMS, BEING RESPONSIVE TO CHANGING ENVIRONMENTAL FACTORS.

- Obj. A: Develop vegetative methods to protect water quality.
- Obj. B: Plant materials evaluations for environmental mitigation.
- Obj. C: Enhance NRCS field staff capacity with training and public understanding of conservation challenges with information/education.

GOAL IV: MAINTAINING, PROTECTING AND RESTORING HEALTHY PLANT AND ANIMAL COMMUNITIES WITH SUSTAINABLE HABITATS THAT WILL PROVIDE ECOSYSTEM BENEFITS.

- Obj. A: Conserve pollinators/beneficial insects.
- Obj. B: Vegetative methods to improve wildlife habitat.
- Obj. C: Invasive plant control in critical areas, weed control/invasives without herbicides.
- Obj. D: Enhance NRCS field staff capacity with training and public understanding of sustainable and healthy plant and animal communities with information/education.

2012 TECHNOLOGY TRANSFER

PUBLICATIONS

- 2010 Annual Technical Report
- 2011 Annual Technical Report
- 2011 Great Smoky Mountains National Park (annual report)
- Norman A. Berg National PMC 2011 Progress Report of Activities
- Smooth Oxeye Plant Fact Sheet
- Narrowleaf Evening Primrose Plant Fact Sheet
- Eelgrass Plant Fact Sheet
- Selected List of Plant Species in Maryland Producing Fruit or Seed for Wildlife
- Conservation Cover 327, Herbaceous Plantings for Pollinator Habitat
- Conservation Cover 327, Warm-Season grasses, Conservation Practice Job Sheet
- Maryland Native Warm-Season Grass Management Trial
- Maryland Cool-season Grass Forage Trial Final Report
- Maryland Native Warn-Season Grass 2011 Forage Trial Report
- Development of Mid-Atlantic Composite Releases of Virginia and Southeastern Wildrye-Final Report
- Development of Mid-Atlantic Composite Release of Beaked Panicgrass – Final Report
- Development of Mid-Atlantic Composite Release of Gray Goldenrod – Final Report
- Warm Season Grasses Ability to Mitigate Poultry Tunnel Fan Emissions on the Delmarva Peninsula (poster)

TRAINING SESSIONS

- Basics of Plant Propagation (training-general public)
- McKinley Technical Student Tour and Greenhouse Training (PMC tour/ training)

PRESENTATIONS/EXHIBITS/TOURS

- 2012 Maryland State Fair (exhibit/program outreach)
- Vegetative Environmental Buffers of Poultry Facilities Flintrock and Hillandale Farms (project tour general public/NRCS)
- Adventures in Soil Science – Prince George's County 4-H (PMC tour general public)
- AgDiscovery Camp 2012 (PMC tour general public)
- Overview of NRCS and NPMC; history mission and activities (PMC tour/program outreach)
- NAPPC-NACD Farmer Rancher and the Pollinator Advocate Awards Reception (exhibit/program outreach)

2012 STUDIES

The NPMC staff works with the Technical Advisory Committee and Regional Plant Materials Specialist to plan and develop research studies addressing conservation challenges identified in the Long Range Plan. All studies active in 2012 are listed in Table 2.

Table 2: Study numbers, names and objectives for active 2012 studies at the NPMC.

ID Number: MDPMC-T-10-PA **Name:** Adaptation Trial of Superior Warm-Season Grasses (gamma grass, big bluestem, Indiangrass and switchgrass) Selected for Advanced Testing **Objective:** Evaluate the area of adaptation for gamma grass, big bluestem, Indiangrass and switchgrass. **Status:** Data collection to continue in 2012.
ID Number: MDPMC-T-0501-PA **Name:** Native Warm-Season Grass Forage Variety Trial **Objective:** Provide producers with the latest information on variety performance in Maryland's growing conditions. **Status:** Project will continue with an offsite evaluation and palatability study.
ID Number: MDPMC-T-0503-PA **Name:** Bermudagrass Forage Variety Trail **Objective:** Provide producers with the latest information on production of commercially available Bermudagrass. **Status:** Project will continue with offsite evaluation.
ID Number: MDPMC-T-0602-WI **Name:** Plant species for use as vegetative environmental buffers (VEBs) to improve air quality and poultry production facilities **Objective:** Develop VEBs to improve air quality at poultry production facilities. **Status:** Project will continue with offsite evaluation.
ID Number: MDPMC-T-9604-RE **Name:** NRCS-NPS Great Smoky Mountains Revegetation Project **Objective:** Provide seed cleaning services to Great Smoky Mountain National Park to facilitate parkland revegetation efforts. **Status:** Needs will be reassessed annually by NPS.
ID Number: MDPMC-T-1202-CP **Name:** Effect of Mixed Species Cover Crops on Soil Health (Nat. Soil Health Study) **Objective:** Document and demonstrate the effects of cover crop species composition and seeding rate on soil health and crop yield. **Status:** Year one of three year study.

Adaptation Trial of Superior Warm-Season Grasses (Gamagrass, Big Bluestem, Indiangrass and Switchgrass) Selected for Advanced Testing

Study ID Code: MDPMC-T-10-PA

Study Leader: Shawn Belt, NPMC Horticulturist

Objective: To evaluate the area of adaptation for Eastern gamagrass, big bluestem, Indiangrass and switchgrass cultivars.

Introduction: Plant materials selected for release are tested to determine their area of adaptation. The NPMC works with PMCs, universities, private industry and other government agencies to determine the performance of selected plants in the mid-Atlantic region. There have been a limited number of evaluations conducted on prevarietal gamma grass, big bluestem, Indiangrass and switchgrass releases. Data from these trials can be used to improve NRCS planting guidelines.

Potential Products: Technology Transfer and Comparative Evaluation

Resource Consideration/Problems: Water Quality, Erosion Control, Pastureland Improvement.
Switchgrass, Eastern gamagrass, big bluestem and Indiangrass are important components of the following conservation practices: conservation cover (327), critical area plantings (342) and pasture and hay plantings (512).

Progress or Status: Plugs of the tested grasses were planted in June 2008 or May 2009. Data collection began in 2011 and continued in 2012. Table 3 shows a planting map of the observation trial. Each observational unit consists of individuals planted on one-foot centers into a 20-foot long linear row. Ten feet of space was between rows with a seven-foot border on either end of the row. Three selections of Eastern gamma grass; 14 selections of big bluestem; nine selections of Indiangrass, and 19 selections of switchgrass are being evaluated for survival, height, width, boot stage and flowering dates. Maximum growth size measurements were conducted at the boot stage period.
Gamagrass: In the 2011 season data (Tables 7 and 8) suggest that the Eastern gamagrass variety 'Meadowcrest' is the largest; however; 'Pete' and 'Highlander' have higher rates of survival. The Southern Corn Stalk Borer seriously affected all three gamma grass varieties. All plants were either dead or just a few shoots remained. A nearby plot of Meadowcrest gamagrass was also seriously affected by this pest. The Southern Corn Stalk Borer equally affected all cultivars.
Big Bluestem: Two thousand eleven data showed that there were no a major differences in the plant size of the 14 big bluestem varieties. Of the fourteen big bluestem varieties tested, 'Camp Dawson', 9046932 and OZ-70 produced larger plant sizes, survival percentages were all over 90% (with the exception 9094220 -60%).
Of the nine Indiangrass varieties tested, 9044933 'Rumsey' and 591811 produced larger plant sizes, while all tested varieties had very high survival percentages. These three top performers were also the largest varieties in 2011.
Of the 18 switchgrass varieties tested 'Timber', EG1102 and 'Kanlow' produced larger plant sizes, all tested varieties had very high survival percentages (over 85%) with the exception of EG1101 (40%).

Indiangrass: Two thousand eleven data showed that The Indiangrass varieties 'Rumsey', 591811 and 9044933 produced larger plants and all varieties survived well. The switchgrass

varieties expressed no major differences in plant size or survival percentages; however, in this trial EG 1101 from Blade Energy was smaller in size and had a lower rate of survival.

Table 3: Field planting map showing warm-season grass varieties as planted by row. The top of this map is North, with Soil Conservation Road immediately to the East of the end of the rows.

Row 1	Meadowcrest Eastern gamagrass	Pete Eastern gamagrass	Highlander Eastern Gamagrass	Empty
Row 2	Suther Germplasm Big Bluestem	Southlow Michigan Big Bluestem	Niagara Big Bluestem	9093699 Big Bluestem
Row 3	Bonanza' Big Bluestem	Goldmine Big Bluestem	Roundtree Big Bluestem	Bonilla Big Bluestem
Row 4	Kaw Big Bluestem	Earl Big Bluestem	OZ-70 Big Bluestem	9046932 Big Bluestem
Row 5	9094220 Big Bluestem	Camp Dawson Big Bluestem	Empty	Empty
Row 6	Prairie View Germplasm Indiangrass	Empty	Empty	Empty
Row 7	Suther Germplasm Indiangrass	Coastal Germplasm Indiangrass	Southlow Michigan Indiangrass	Nebraska 54 Indiangrass
Row 8	Americus Indiangrass	Rumsey Indiangrass	591811 Indiangrass	9046933 Indiangrass
Row 9	Alamo Switchgrass	Blackwell Switchgrass	Bo Master Switchgrass	Carthage Switchgrass
Row 10	Cave In Rock Switchgrass	Dacotah Switchgrass	EG 1101 Switchgrass	EG 1102 Switchgrass
Row 11	Forestburg Switchgrass	High Tide Switchgrass	Kanlow Switchgrass	Pathfinder Switchgrass
Row 12	Shawnee Switchgrass	Shelter Switchgrass	Sunburst Switchgrass	Switchgrass Southlow
Row 13	Timber Switchgrass	Empty	Empty	Empty

Table 4: Height, width, boot stage month, flowering month and survival for 2012.

Species/Release Name	Accession Number	Height (inches)	Width (inches)	Boot Stage (month)	Flowering (month)	Survival (%)
Big Bluestem – *Andropogon gerardii*						
'Camp Dawson'	9093698	40.4	28.9	June	July	95
	9046932	39.1	23.3	June	July	100
'OZ-70'		38.7	17.7	July	August	100
'Roundtree'	674216	36.4	21.8	June	July	100
	9094220	36.3	23.0	June	July	60
'Kaw'	421276	32.3	16.3	June	July	95
'Niagara'	315656	32.1	18.4	June	July	100
Southlow Michigan Germplasm	642398	30.2	19.9	June	July	100
'Goldmine'	641702	28.2	22.6	August	September	90
'Bonanza'		26.3	18.7	August	September	100
'Bonilla'	315658	26	18.3	June	July	100
'Earl'	408932	24.6	15.5	July	August	100
Suther Germplasm	9082318	24.1	16.0	August	September	100
	9093699	19.7	16.6	August	September	100
Indiangrass – *Sorghastrum nutans*						
(unreleased)	9046933	39.8	26	July	August	100
Rumsey	315747	38.7	26	August	September	100
(unreleased)	591811	37.7	26	July	August	100
Americus	514673	32.8	26	August	September	100
Southlow Michigan	9094765	30.3	26	July	August	100
Prairie View	642387	28.8	25	August	September	100
Nebraska-54	91096307	26.5	26	August	September	100
Coastal	642396	22.7	26	July	August	100
Suther Germplasm	9081282	20.2	25	July	August	100
Switchgrass – *Panicum virgatum*						
Timber	9081259	66.6	45.1	July	August	100
EG 1102	Blade Energy Co	64.3	40.1	August	September	95
Kanlow	421521	64.8	38.2	August	September	100
High Tide Germplasm	9094764	63.5	38.7	July	August	100
Bo Master	91096039	60.6	39.1	July	August	85
Shawnee	591824	58.6	38.9	August	September	100
Alamo	422006	54.5	36.0	August	September	100
Blackwell	421520	47.0	39.0	July	August	95
Cave In Rock	469228	51.4	33.0	July	August	100
Carthage	421138	46.7	32.8	July	August	100
EG 1101	Blade Energy Co.	49.2	28.4	August	September	40
Shelter	430240	41.6	28.9	July	August	100
Trail Blazer	9106042	38.3	26.3	July	August	90
Sunburst	9106041	37.6	25.0	July	August	100
Southlow	9084512	38.7	23.5	August	September	85
Pathfinder	9106040	38.6	22.05	August	September	100
Forestburg	478001	30.9	15.3	August	September	90
Dacotah	537588	19.3	12.6	July	August	80

Table 5: List of cultivars and accessions in the study.

Species/Release Name	NRCS Accession Number	Origin	Source of Plant Material
Eastern Gamagrass – *Tripsacum dactyloides*			
Meadowcrest	591483	Beltsville, MD	Big Flats PMC
Pete	421612	Kansas and Oklahoma	Manhattan PMC
Highlander	634941	Montgomery Co., TN	MS PMC
Big Bluestem – *Andropogon gerardii*			
Suther Germplasm	9082318	Cabarrus Co., NC	Cape May PMC
Southlow Germplasm	642398	Lower peninsula MI	Rose Lake PMC
Niagara	315656	Erie Co., NY	Big Flats PMC
	9093699	WV composite	Roundstone Seed Co.
Bonanza	341701	derived from 'Pawnee' - Pawnee Co., NE	Sharp Bros. Seed Co.
Goldmine	641702	derived from Kaw	Sharp Bros. Seed Co.
Roundtree	674216	Moorehead, IA	Sharp Bros. Seed Co.
Bonilla	315658	Bonilla, ND	Sharp Bros. Seed Co.
Kaw	421276	Manhattan KS	Manhattan PMC
Earl	408932	Riley Co., KS	Manhattan PMC
OZ-70	16052	Ozark Region	Elsberry PMC
(unreleased)	9046932	New Eng. composite	Big Flats PMC
(unreleased)	9094220	South MA	Cape May PMC
Camp Dawson	9093698	Kingwood, WV	WV PMC
Indiangrass – *Sorghastrum nutans*			
Prairie View	642387	Central & Southern Indiana	Ernst Conservation Seed
Suther Germplasm	9081282	Cabarrus Co., NC	Ernst Conservation Seed
Southlow Michigan	642396	Lower peninsula MI	Ernst Conservation Seed
Coastal	9094765	CT, RI, &MA	Cape May PMC
Nebraska-54	9106307	Nebraska composite	Sharp Bros. Seed Co.
Americus	514673	AL & GA	Jimmy Carter PMC
Rumsey	315747	Jefferson Co., IL	Ernst Conservation Seed
(unreleased)	591811	NY	Big Flats PMC
(unreleased)	9046933	New England composite	Big Flats PMC
Switchgrass – *Panicum virgatum*			
Alamo	422006	Frio River TX	Ernst Conservation Seed
Blackwell	421520	Blackwell, OK	Ernst Conservation Seed
Bo Master		NC ARS and NC State Univ.	Ernst Conservation Seed
Carthage	421138	Carthage, NC	Cape May PMC
Cave In Rock	469228	southern Illinois	Ernst Conservation Seed
Dacotah	537588	Breien, ND	Sharp Bros. Seed Co.
EG 1101		Blade Energy Co.	Blade Energy Co.
EG 1102		Blade Energy Co.	Blade Energy Co.
Forestburg	478001	Sanbourn Co., SD	Sharp Bros. Seed Co.
High Tide Germplasm	9094764	Perryville, MD	Cape May PMC
Kanlow	421521	Wetumah, OK	Sharp Bros. Seed Co.
Pathfinder	9106040	NE & KS	Sharp Bros. Seed Co.
Shawnee	591824	nursery cross	Ernst Conservation Seed
Shelter	430240	Pleasants Co., WV	Ernst Conservation Seed
Southlow	9106038	MI	Rose Lake PMC
Sunburst	9106041	WI	Cape May PMC
Timber	9081259	NC	Cape May PMC
Trail Blazer	9106042	NE	Sharp Bros. Seed Co.

Native Warm-Season Grass Forage Variety Trial

Study No: MDPMC-T-0501-PA

Study Leader: R. Jay Ugiansky, Resource Conservationist

Objective: Determine the yield of warm-season grass varieties grown in Maryland in a simulated rotational grazing system by harvest date and annual total. Forage production information helps farmers optimize sustainable production, conserving natural resources and benefiting their bottom line. Yield data may be used for planning and optimizing managed grazing systems.

Introduction: Native warm-season grasses in a rotational grazing system provide valuable summer forage when cool-season grasses are less productive. Native warm-season grasses are useful for forage and pasture, wildlife habitat, soil stabilization and biofuels. There are many cultivars, selected ecotypes and source identified native warm-season grasses available today, here referred to collectively as varieties. With many varieties and a lack of comparative forage production information for Maryland, it is difficult to decide which varieties will provide the best forage production. Many forage varieties have not been adequately tested in Maryland and other non-forage varieties are available that may prove valuable for forage production. Better forage productivity data is needed to effectively utilize these grasses. This trial was conducted jointly by Maryland NRCS and Maryland Cooperative Extension, with annual funding from Maryland Grazing Lands Conservation Initiative Coalition.

Procedure: The trial includes 36 varieties of eight different species (Eastern gamagrass, switchgrass, big bluestem, Indiangrass, little bluestem, coastal little bluestem, Florida paspalum, and coastal panicgrass). The trial was conducted on Galestown-Evesboro loamy sands, 0-8% slope, somewhat excessively drained (available water holding capacity in a 60-inch soil profile is 3.7 inches) at the NPMC located in Beltsville, Maryland. With the exception of Eastern gamagrass, varieties were seeded in six-row plots with five-inch row spacing using a cone-seeder. Eastern gamagrass varieties were seeded in two, 30-inch rows per plot. All varieties were seeded June 16, 2005. Switchgrass, little bluestem and Florida paspalum were seeded at eight pounds PLS per acre and the other species were planted at 10 pounds, as shown in Table 6. The trial was planted in a randomized complete block design with four replications. Plot size is three feet by 20 feet with yield measurements taken from the entire plot area. Soil test (October 4, 2007) values were pH 5.5, P = 111 ppm (very high), and K = 85 ppm (medium). Pelletized dolomitic lime was applied at one ton per acre in early May 2008. Nitrogen was applied at a rate of 100 pounds per acre at the beginning each growing season except the seeding year and 2011. Irrigation was only applied during establishment (2005 and 2006) and was not applied in 2007, 2008 or 2009. The trial will continue for a minimum of four years as a simulated grazing system.

The plots were not harvested until 2007 to allow grasses to fully establish. Cuttings were made using a Carter flail-type harvester and cut to a height of eight inches. Harvests were made three times each growing season (Table 9). Harvested material was weighed green in the field and samples were collected for dry matter determinations from two of the four replications.

Potential Products: Maryland grazing standards and recommendations. Growth curve data obtained from study will be used to refine the grazing models in the C-Graze computer program. Yearly summary reports and final report.

Status of Project:

The eastern gamagrass, switchgrass and coastal panicgrass varieties were consistently among the highest yielding varieties, leading to the highest 5-year average yields. 'Meadowcrest' gamagrass was the highest yielding of all varieties but not significantly greater yielding than the other gamagrass varieties and the highest yielding switchgrass varieties. Eastern gamagrass varieties began growth earlier and produced greater yields at the first harvest than other varieties. This early season growth was the major contributor to greater season total yield. Switchgrass varieties also exhibiting high yields and reliable under dry conditions include the switchgrass varieties 'Carthage', 'Kanlow', 'Cave in Rock', 'Blackwell', 'Shawnee', 'Shelter' as well as 'Atlantic' coastal panicgrass. Hightide Germplasm switchgrass yielded significantly lower than the other switchgrass varieties; however this may be due to it also having the poorest stand. In 2012 'Carthage' and 'Kanlow' switchgrasses out yielded the highest yielding gamagrass varieties.

The Florida paspalum exhibited excellent stand establishment and yielded remarkably well in 2008 considering it is an unimproved collection. However, it did not yield as well in 2009 and declined from 2010 to 2012, indicating poor persistence.

Yields were low in 2011 as expected due to no applied nitrogen and very dry weather in May, June and July. Interestingly the yields of switchgrass and coastal panicgrass varieties did not drop as much as the gamagrass varieties. Under these dry and lower fertility conditions the yields of gamagrass were comparable to the switchgrass and coastal panicgrass varieties. Yields of all big bluestem, Indiangrass, Florida paspalum, and little bluestem were more severely reduced in 2011 than either switchgrass or gamagrass varieties. Yields were high in 2010 despite fewer harvests and adverse hot-dry weather, indicating that two harvests may be better than three, but more data would be required before making this conclusion. In the 2009 season, yields were on average slightly lower than in 2008. There was a large difference in yields between the July 25, 2008 and August 3, 2009 harvests which were both the second harvest of the season. These lower yields may be due to well below average rainfall in July of 2009.

The eastern gamagrass varieties 'Highlander,' 'Meadowcrest,' 'Pete' and 'Verl' are recommended for high yields when grown in Maryland in a managed grazing system. These varieties also can be grazed earlier and later in the season than other varieties, but require a longer establishment period.

Switchgrass and coastal panicgrass varieties are also recommended for reliably high yields, however these varieties need to be managed carefully to avoid palatability issues when over mature.

Florida paspalum due to its initial vigor, but poor persistence may be suitable as a companion to the slower establishing Gamagrass varieties. It is possible that Florida Paspalum is more persistent in wetter conditions than it was in this trial since it naturally grows in poorly drained soils. More testing will need to be done to test its performance as a companion crop and its persistence in less well drained soils.

Table 6: Forage yield (lbs./acre) by species, variety and year.

		Forage Yield (lb/acre)								
	Stand	2007	2008	2009	2010	2011	----------2012----------			'08-'12
Species/Variety	Jul-08	Total	Total	Total	Total	Total	Jul. 14	Aug. 24	Total	Average
Eastern Gamagrass										
'Meadowcrest'	99	**2873**	**11090**	**9336**	**16737**	**7959**	7150	4629	11779	***11380***
'Highlander'	91	**3442**	**12120**	**10582**	**14009**	**6795**	5676	4245	9920	***10685***
'Pete'	89	**2377**	**9861**	**10311**	**14433**	**6399**	5934	3942	9876	***10176***
'Verl'	86	**2864**	**11015**	**8957**	**12757**	**6022**	5435	4063	9498	***9650***
Switchgrass										
'Carthage'	100	**9790**	**9764**	**9251**	**13632**	**7336**	7604	5426	13030	***10603***
'Kanlow'	80	**8303**	**8632**	**8362**	**12180**	**6713**	8089	6861	14949	***10167***
'Cave in Rock'	86	**6963**	**9019**	**7757**	**10291**	**7949**	5734	4542	10275	***9058***
'Blackwell'	95	**5879**	**9313**	**7020**	**9574**	**6079**	7030	4021	11051	***8607***
'Shawnee'	96	**6666**	**9523**	**7938**	**8387**	**5454**	6769	3781	10550	***8370***
'Shelter'	87	**3608**	**7796**	**8153**	**8891**	**6664**	6374	3409	9783	***8257***
Hightide Germplasm	68	**3293**	**5428**	**4195**	**5014**	**3093**	3167	3036	6203	***4787***
Coastal Panicgrass										
'Atlantic'	79	**9934**	**8849**	**8477**	**11306**	**7028**	4931	5615	10546	***9241***
Big Bluestem										
Suther Germplasm	86	**2089**	**6594**	**5994**	**8932**	**1952**	5086	2173	7259	***6146***
'Niagara'	95	**1149**	**6899**	**7029**	**7531**	**2088**	4801	1638	6439	***5997***
'Rountree'	98	**1737**	**6295**	**6174**	**6413**	**2284**	4456	3008	7464	***5726***
Southlow Michigan G.	85	**849**	**5864**	**5178**	**6585**	**1908**	5964	2132	8095	***5526***
Indiangrass										
'Osage'	93	**4503**	**7108**	**5158**	**7918**	**1985**	1952	3768	5720	***5578***
NY unreleased	94	**1995**	**7083**	**6477**	**7795**	**1624**	2136	2271	4407	***5477***
'Americus'	91	**4525**	**7065**	**5540**	**6802**	**2004**	3135	2597	5732	***5428***
Suther Germplasm	99	**3906**	**6416**	**5803**	**5606**	**2348**	1025	2100	3126	***4660***
Southlow Michigan G.	86	**1412**	**6586**	**4911**	**5379**	**748**	1609	2502	4111	***4347***
MD unreleased	90	**1776**	**5140**	**4867**	**5635**	**1194**	1434	1801	3234	***4014***
'Rumsey'	85	**2869**	**5590**	**5049**	**4866**	**1237**	1483	1704	3187	***3986***
'NE-54'	96	**2386**	**5955**	**5646**	**4045**	**796**	770	2139	2909	***3870***
'Holt'	90	**1085**	**4821**	**3527**	**3215**	**903**	1091	2340	3430	***3179***
Florida Paspalum										
Mid Atlantic G.	93	**5672**	**9053**	**6193**	**2603**	**588**	1434	2164	3598	***4407***
Little Bluestem										
'Cimarron'	76	**4587**	**4640**	**1551**	**3742**	**293**	1305	4176	5480	***3141***
'Aldous'	86	**2410**	**5374**	**2169**	**2844**	**621**	1348	2653	4000	***3002***
'Camper'	80	**2564**	**4556**	**1315**	**2687**	**677**	1591	2791	4382	***2724***
Southlow Michigan G.	87	**1068**	**4234**	**2072**	**2716**	**193**	1115	2385	3500	***2543***
'Blaze'	83	**1268**	**3562**	**916**	**3059**	**0**	811	2941	3752	***2258***
Coastal little blue	95	**1060**	**3583**	**1312**	**778**	**561**	659	1677	2336	***1714***
Mean	89	**3591**	**7151**	**5851**	**6992**	**3172**	3657	3202	6859	**5967**
LSD[1/] (0.05)	15	**1705**	**2033**	**2321**	**4025**	**1807**	1946	1262	2459	**3343**
% CV[2/]	12	**34**	**20**	**28**	**41**	**41**	38	28	26	**40**

Bermudagrass Variety Trial for High Use Areas

Study ID Code: MDPMC-T-0503-PA

Study Leader: R. Jay Ugiansky, NPMC Resource Conservationist

Objective: Determine the best wear and grazing tolerant sprigged Bermudagrass varieties for use in high animal use areas in Maryland. Canopy cover and standing dry matter will be evaluated for three most adapted and available varieties on several working farms. Information from this study will inform livestock managers as well as sprig growers to facilitate availability and use of appropriate varieties. Trial plantings will be also used for demonstration and training events such as “pasture walks” for other farmers to learn and evaluate for themselves.

Introduction: High-use areas often become devoid of plant cover at agricultural operations with livestock. These areas not only produce negligible forage but are significant sources of sediment and nutrient runoff and dust. Bermudagrass has shown great potential as plant cover and forage for high-use areas however; there is little knowledge and experience in the use of commercial varieties in Maryland. This knowledge will enable farmers to make informed decisions, maximize production in a sustainable manner, and conserve natural resources.

This variety trial is being conducted by Maryland NRCS and University of Maryland Cooperative Extension to develop information on the agronomic performance of Bermudagrass varieties in high use areas. Information gathered will benefit the farmers of Maryland and surrounding states, the Maryland Cooperative Extension and NRCS. Criteria for selecting varieties for inclusion in the trial included superior hardiness, potential durability and/or forage production under high use conditions, and availability.

Procedure: Sprigs of ‘Quickstand’ and ‘Tufcote’ were provided by the Plant Materials Center and sprigs of ‘Patriot’ were purchased by the farms from a commercial source. Sprigged varieties are to be established by spreading sprigs over freshly tilled plots, then lightly tilling/disking sprigs into the soil and then firmly packing the soil. ‘Quickstand, ‘Tufcote’ and ‘Patriot’ varieties with be planted in 3 replicates per high use area on several farms. Fertilizer applications of phosphorous and potash are to be applied to meet soil test recommendations.

Potential Products: The plantings will be used for demonstrations and trainings during and after establishment. Maryland grazing standards and recommendations. Yearly summary reports and final report.

Status of Project: Establishment is scheduled for spring 2013 on three farms using ‘Quickstand, ‘Tufcote’ and ‘Patriot’ .

Plant Species for Use as Vegetative Environmental Buffers (VEB) to Improve Air Quality around Poultry Production Facilities

Study ID Code: MDPMC-T-0602-WI

Study Leader: Shawn Belt, NPMC Horticulturist

Objective: To determine plants that survive the hostile environment adjacent to poultry fans, to improve air quality, increase the diversity of potential plants used and to quantify the amount of ammonia, dust and odors remediated.

Introduction: The Delmarva Peninsula is home to one of the country's highest concentrations of poultry farms. The 2007 National Agricultural Statistical Service placed poultry and egg production as the most valued commodity in Maryland and Delaware and the second most valued commodity in Pennsylvania. Poultry houses generate dust, odor and ammonia which are expelled by the ventilation system. Ammonia is the gas of greatest concern to the poultry industry; plants have the ability to absorb aerial ammonia. Dust (a pollutant regulated by the Environmental Protection Agency) is linked to respiratory effects in poultry workers and can be a nuisance for neighbors who live near farms. Ammonia emitted from poultry houses has been linked to degradation of both air and water quality in the Chesapeake Bay. Warm season grass, tree and shrub buffers absorb gaseous ammonia, precipitate out dust by slowing the air speed from exhaust fans and deflect the odor plume into the atmosphere above the buffer in a very cost-effective way. Odor from poultry houses typically travels downwind, along the ground, in a concentrated plume. By planting grasses, trees and shrubs around poultry houses farmers can disrupt the plume and mix it with the prevailing winds to dilute odor. Reductions in odor of up to 70% have been measured at a distance of 50 feet behind a four row windbreak (George Malone and David Parker 2012). The 2008 tech note *Windbreak Plant Species for Odor Management around Poultry Production Facilities* speculated that certain street trees could survive poultry farm emissions due to their ability to tolerate urban conditions and emissions. The primarily native street trees used in this study were derived from that tech note.

Potential Products: Technology Transfer

Resource Consideration/Problems: Air and water quality.
Air - High levels of gaseous ammonia, odors and dusts [particulate matter (p.m.) 2.5 and 10] expelled by poultry farms
Water - Nutrient uptake by vegetative buffers can reduce nutrients which are expelled by poultry farms improving water quality.

Progress or Status: Designing and testing poultry windbreaks involves many variables: poultry farm type (broiler or egg), fan to plant distances, fan types, aspect, potential snow loads, soil types, and roads. In order to accurately test various plant species, different amounts of time are necessary. Grasses should survive at least one to two years, while shrubs and trees should survive a minimum of three years. Figure 5 shows the three different ventilation fan configurations. Fan configuration type 1 (denoted by the blue lines) is a single row of tunnel fans opposite test plants. Fan configuration type 2 (denoted by the yellow lines) has two rows of tunnel fans. Fan configuration type 3 (denoted by the red lines) is sidewalls fans which, although smaller and produces less velocity, run more frequently and emit higher amounts of ammonia and dust. Evergreens (denoted by green lines) serve as visual screens.

Figure 6 shows the test site soil types, quantities, and locations of the and plants listed in Table 7 show the plants currently being tested and the fan type emissions warm season grasses are being tested at 12 sites on the Delmarva Peninsula and Pennsylvania. To date all plants have survived.

Figure 5: Poultry farm fan types shown by colored line: fan type 1 (blue lines) are single rows of tunnel fans, fan type 2 (yellow lines) are double rows of tunnel fans and fan type 3 (red lines) are sidewall fans. Visual screens composed of evergreen plantings are also indicated (green lines).

Figure 6 shows the twelve test sites, locations, and soil types in Maryland, Delaware and Pennsylvania. The lower number test sites (1 – 6) were used primarily to test warm season grasses in 2008 - 2010. Test sites 7 – 12 are the more recent sites (2009 – present).

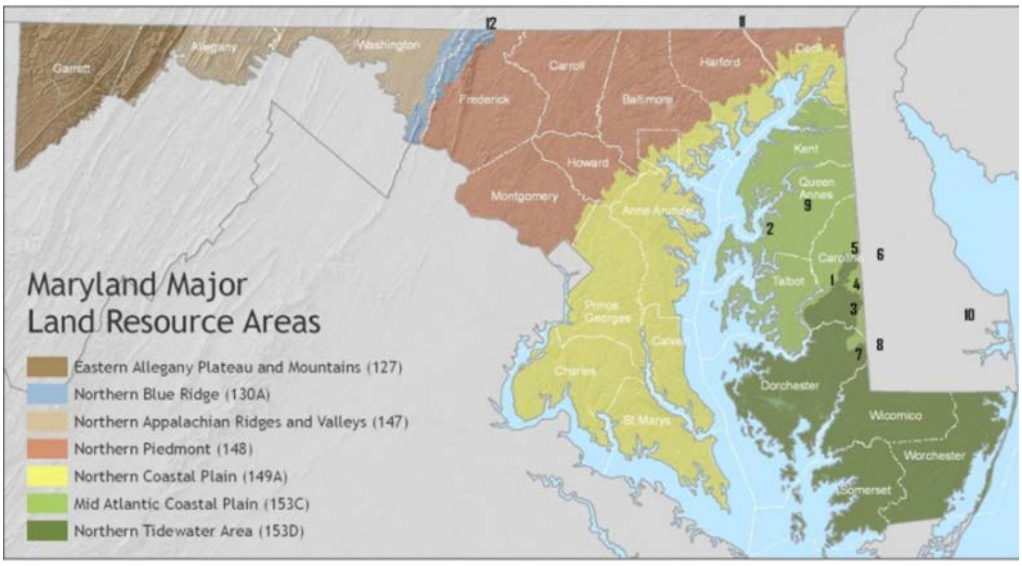

Figure 6: Test sites in Maryland, Delaware and Pennsylvania by MLRA soil type.

Table 7: Six VEB test sites in MD, DE and PA. Information identifying an individual farm obscured.

Biglersville, PA: all plants irrigated and mulched

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Acer rubrum	Red Maple	8	34	100
Alnus serrulata Panbowl	Alder	6	34	99.17
Celtis occidentalis	Hackberry	6	45	78
Juniperus virginiana	Eastern Red Cedar	8	45	64
Miscanthus x giganteus	Giant Miscanthus	30	30	170
Morella pennsylvanica	Bayberry	8	30	72.5
Panicum amarum Atlantic	Coastal Switchgrass	24	30	115
Panicum virgatum Northwind	Switchgrass	90	30	125
Panicum virgatum Thundercloud	Switchgrass	30	30	150
Populus deltoides x nigra Spike	Poplar	12	45	252.86
Quercus rubra	Red Oak	10	45	107
Robinia pseudoacacia	Black Locust	11	34	132
Salix alba x matsudana Austree	Hybrid Willow	55	45	260
Salix purpurea Streamco	Purpleoisier Willow	62	34	100
Thuja *occidentalis* Affinity	Northern White Cedar	8	56	163.12
Thuja occidentalis	Northern White Cedar	8	56	55
Thuja standishii x plicata Green Giant	Arborvitae	6	56	156.67
Ulmus americana Valley Forge	American Elm	17	45	188

Grantville, PA: irrigation, 67% plant survival

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Ulmus americana New Harmony	American Elm	1	37	81
Ulmus americana Valley Forge*	American Elm	2	37	84

Denton, MD: no irrigation, 100% plant survival

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Ulmus americana New Harmony	American Elm	2	20	89
Ulmus americana Valley Forge	American Elm	6	20	84

Queen Anne's Co., MD: no irrigation, 90% plant survival

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Ulmus americana New Harmony	American Elm	3	30	165
Ulmus americana Valley Forge	American Elm	8	30	164

Centreville, MD: no irrigation, 100% plant survival

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Ulmus americana New Harmony	American Elm	2	40	246

Rhodesdale, MD: irrigation, 100% plant survival

Botanical Name	Common Name	Qty.	Distance from fans (ft)	Average height (cm)
Ulmus americana New Harmony	American Elm	2	30	94
Ulmus americana Valley Forge	American Elm	4	30	88

Table 8 shows the twenty-five plant species tested, location, quantity, fan type, and when the test was initiated. Table 9 shows the quantity of plants species tested in each year, 2008 four species (four grasses, one tree), 2009 one species (tree), 2010 seven species (two shrubs, five trees) and 2011 thirteen species (six grasses, four shrubs and three trees).

Table 8: Test plant species by fan type, site location and initial test year. Site locations can be found in Figure 19.

Plant Species	Botanical Name	Fan Type	Site Location	Initial Test Year
Switchgrass	*Panicum virgatum (6 cultivars)*	1, 2, 3	1, 2, 3, 8, 11, 12	2008
Giant Miscanthus	*Miscanthus x giganteus*	1, 2, 3	1, 2, 3, 8, 11, 12	2008
Coastal Switchgrass	*Panicum amarum* Atlantic	1, 2, 3	1, 2, 3, 8, 11, 12	2008
Osage Orange	*Maclura pomifera* White Shield	1, 2	11, 12	2008
American Elm	*Ulmus Americana* Valley Forge, New Harmony	1, 2, 3	3, 5, 6, 11, 12	2009
Bayberry	*Morella pennsylvanica*	1, 2	7, 8, 11, 12	2010
Smooth Alder	*Alnus serrulata* Panbowl	1, 2, 3	5, 8, 11, 12	2010
Red Oak	*Quercus rubra*	1, 3	11, 12	2010
Northern White Cedar	*Thuja occidentalis* Affinity	1, 3	11	2010
Black Locust	*Robinia pseudoacacia*	1, 3	11, 12	2010
Hackberry	*Celtis laevigata, Celtis occidentalis*	1, 2	8, 11, 12	2010
Red Maple	*Acer rubra*	1, 3	11, 12	2010
Saltmeadow Cordgrass	*Spartina patens*	1, 2	3, 7, 11	2011
Big Bluestem	*Andropogon gerardii*	1, 2	4, 7, 8, 11, 12	2011
Florida Paspalum	*Paspalum floridatum* Mid Atlantic	1,2	4, 7, 8, 11, 12	2011
Eastern Gamagrass	*Tripsacum dactyloides* Pete, Meadowcrest	1, 2	4, 8, 11	2011
Giant Cane	*Arundinaria gigantea*	1, 2, 3	4, 7, 11	2011
Emory Sedge	*Carex emoyorii*	1, 2	8, 9, 11	2011
Chinquapin	*Castanea pumila* Golden	1, 3	11	2011
Purple Osier Willow	*Salix purpurea* Allegany, Fish Creek, Onodaga	1, 2, 3	4,11	2011
Hybrid Purple Osier Willow	*Salix purpurea x miyabeana* Millbrook	1,2,3,	4,11	2011
Wax Myrtle	*Morella cerifera*	1, 2	6, 7, 8	2011
Chestnut Oak	*Quercus prinus*	1, 3	11	2011
Scholar Tree	*Sophora japonica*	1, 3	11	2011
Southern Magnolia	*Magnolia grandiflora*	1, 3	7, 11	2011

In 2009 and 2010 'New Harmony' and 'Valley Forge' American elms were planted at various sites in Maryland, Delaware and Pennsylvania. These two cultivars of American elm were introduced by the U.S. National Arboretum and have been tested for tolerance to the Dutch elm disease which has decimated elm populations throughout the U.S. Elms are adaptable to various cultural growing conditions and soils, grow quickly (up to three feet a year) and have been used extensively for street trees. Table 9 shows the survival and growth of the plants which were planted in 2009 and 2010.

Table 9: Test plant survival and growth by farm and location.

Biglersville, PA

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
32	12	Egg	Valley Forge	2010	35	1	yes	240	140	
33	12	Egg	Valley Forge	2010	35	1	yes	280	140	
34	12	Egg	Valley Forge	2010	35	1	yes	230	140	
35	12	Egg	Valley Forge	2010	35	1	yes	230	140	
36	12	Egg	Valley Forge	2010	35	1	yes	160	55	
37	12	Egg	Valley Forge	2010	35	1	yes	240	90	
38	12	Egg	Valley Forge	2010	35	1	yes	240	90	
39	12	Egg	Valley Forge	2010	35	1	yes	190	55	
40	12	Egg	Valley Forge	2010	35	1	yes	220	110	
41	12	Egg	Valley Forge	2010	35	1	yes	220	110	
42	12	Egg	Valley Forge	2010	35	1	yes	220	110	
43	12	Egg	Valley Forge	2010	35	1	yes	245	110	
44	12	Egg	Valley Forge	2010	35	1	yes	235	110	
45	12	Egg	Valley Forge	2010	35	1	yes	200	110	
46	12	Egg	Valley Forge	2010	35	1	yes	300	110	
47	12	Egg	Valley Forge	2010	35	1	yes	265	110	
48	12	Egg	Valley Forge	2010	35	1	yes	235	110	
49	12	Egg	Valley Forge	2010	35	1	no	70	30	control 75% survival
50	12	Egg	Valley Forge	2010	35	1	no	dead		control
51	12	Egg	Valley Forge	2010	35	1	no	70	35	control avg. ht 67.5 cm x wd. 30 cm
52	12	Egg	Valley Forge	2010	35	1	no	60	25	control
				Totals				**208**	**97**	

Grantville, PA

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
28	10	Broiler	Valley Forge	2009	37	3	intermittent			dead Spr - '11
29	10	Broiler	Valley Forge	2009	37	3	intermittent			dead Spr - '11
30	10	Broiler	Valley Forge	2009	37	3	intermittent			dead Spr - '11
31	8	Broiler	Valley Forge	2009	25	2	no			dead Spr - '11
				Totals				**0**	**0**	

Denton, MD

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
20	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
21	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
22	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
23	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
24	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
25	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
26	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
27	3	Broiler	Valley Forge	2009	20	1	no			dead sum-'11
			Totals					**0**	**0**	

Queen Anne's Co., MD

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
10	1	Broiler	New Harmony	2009	30	3	no	90	40	
11	1	Broiler	New Harmony	2009	30	3	no	140	100	
12	1	Broiler	Valley Forge	2009	30	3	no			dead sum-'11
13	1	Broiler	Valley Forge	2009	30	3	no	100	30	
14	1	Broiler	Valley Forge	2009	30	3	no	130	55	
15	1	Broiler	Valley Forge	2009	30	3	no	135	60	
16	1	Broiler	Valley Forge	2009	30	3	no	150	70	
17	1	Broiler	Valley Forge	2009	30	3	no	150	70	
18	1	Broiler	Valley Forge	2009	30	3	no			dead sum-'11
19	1	Broiler	Valley Forge	2009	30	3	no	230	120	
			Totals					**141**	**68**	**80% survival**

Centreville, MD

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
1	2	Broiler	New Harmony	2009	40	3	no	203	61	
2	2	Broiler	New Harmony	2009	40	3	no	246	92	dead (voles)
			Totals					**225**	**77**	**100% survival**

Rhodesdale, MD

Plant #	Site #	Farm type	Cultivar	Year Planted	Fan dist (ft.).	Fan type	Irrigation	Height (cm)	Width (cm)	notes
3	7	Broiler	New Harmony	2009	30	2	intermittent			dead sum-'11
4	7	Broiler	Valley Forge	2009	30	2	intermittent			dead sum-'11
5	7	Broiler	Valley Forge	2009	30	2	intermittent			dead sum-'11
6	7	Broiler	Valley Forge	2009	30	2	intermittent			dead sum-'11
7	7	Broiler	Valley Forge	2009	30	2	intermittent			dead sum-'11
8	7	Broiler	Valley Forge	2009	30	2	intermittent			dead sum-'11
9	1	Broiler	New Harmony	2009	30	3	no	75	30	
				Totals				**75**	**30**	

In well maintained sites which are more than thirty feet from single or sidewall fans, high survival rate and quick growth are possible. Irrigation plays an important role in the endurance of American elms during the establishment period (initial 1- 2 growing seasons). Broiler farms (higher ammonia emissions) are a more challenging environment than egg farms (higher dust emissions.)

Cooperators for this work include the following individuals:
Dr. Paul Paterson, Professor, Department of Poultry Science, Penn State University,
Dr. George (Bud) Malone, Extension Poultry Specialist (Retired), University of Delaware
James Passwaters, Delmarva Poultry Industry, Georgetown, DE
Dr. Cathleen Hapeman, USDA, ARS, Beltsville, MD
Dr. Laura McConnell, USDA, ARS, Beltsville, MD

Study No: MDPMC-T-9604-RE

Study Leader: Shawn Belt, Horticulturist

Objective: Provide seed cleaning services to Great Smoky Mountain National Park (GRSM) to facilitate parkland revegetation efforts at GRSM and the Foothills Parkway using site collected seed.

Introduction: The current Interagency Agreement between Great Smoky Mountains National Park (GRSM) and the Norman A. Berg National Plant Materials Center (NPMC) was signed in March 2010, for the fiscal years 2011-2013 and is funded on an annual basis. GRSM and Foothills Parkway (FHP) have a need to preserve their native plant resources and revegetate parklands. The National Park Service (NPS) requires that restoration of native plants will be accomplished using germplasm from populations as closely genetically related as possible to park populations. GRSM has harvested seed from indigenous populations, but does not have the personnel, expertise, facilities or equipment needed to clean, process, test and store the seed. The NPMC does have the personnel and is equipped to clean, process and store quantities of seed sufficient to meet NPS needs within the required time frame. Technical expertise as necessary to achieve this goal will be provided by the NPMC under this agreement.

Progress or status:
ACCOMPLISHMENTS – *Seed Cleaning*

This is the second report for the 2011-2013 contract periods. The Cades Cove increase fields and FHP harvest resulted in over 801 lbs. of bulk grass, legume, wildflower, tree and shrub seed. Table 10 lists the 18 different lots of seed cleaned (removed from the fruit for the woody species, de-bearded and then run through a clipper for the grasses and wildflowers) by NPMC staff to yield 271 lbs. Pure Live Seed (PLS = bulk x purity x viability).

The last section of Table 10 lists three lots in which our efforts resulted in low amounts of PLS. Those lots were cleaned for a second time and samples sent to the Kansas Seed Testing Lab to make sure we are continuing to deliver high quality seed to GRSM.

Table 10: Seed harvested and cleaned in 2012, by common name. Table provides harvest year, bulk amount, PLS, seed test date and NPS source.

Common Name	Species Code	Bulk Amount (lbs.)	PLS (lbs./ g.)	Seed Test Date	Source
Cades Cove Increase Fields					
1. big bluestem	ANGE	102.9	34.4	3-2012	Cades Cove
2. Virginia wildrye	ELVI3	4.0	3	*	Cades Cove
3. common sneezeweed	HEAU	.7	0.2	*	Cades Cove
4. swamp sunflower	HEAN2	10.45	2.2	3-2012	Cades Cove
5. roundheaded lespedeza	LECA8	11.55	1.85	*	Cades Cove
6. wild bergamot	MOFI	11.4	.75	*	Cades Cove
7. beaked panicgrass	PAAN	37.1	18.4	3-2012	Cades Cove
8. wild quinine	PAIN3	24.3	2	10-2012	Cades Cove
9. clustered mountainmint	PYMU	8.1	.05	*	Cades Cove
10. beardgrass	SAGI	7.4	.3	*	Cades Cove
11. little bluestem	SCSC	83.0	2.2	10-2011	Cades Cove
12. Maryland senna	SEMA11	12.8	3.5	10-2011	Cades Cove
13. Indiangrass	SONU2	280.6	53.7	10-2011	Cades Cove
14. purpletop	TRFL2	206.6	134.8	10-2012	Cades Cove
Totals		**801.1**	**257.2**		
Foothills Parkway Woody Species					
15. sumac	RHUS	12.3	9.5		FHP
Totals		**12.3**	**9.5**		

Distribution

The NPMC distributed six different shipments of seed totaling 178 lbs. (PLS) in 2012. Some uses for this cleaned seed included: plug production for the Cades Cove increase fields and revegetation of FHP sites.

Virginia Wildrye Increase Field at the NPMC

In 2010 an attachment to the current agreement was created for the production of 300 lbs. of Virginia wildrye (*Elymus virginicus*) seed. This native, perennial, cool season grass germinates quickly, making it a highly used species for slope stability and revegetating disturbed sites throughout the park. Another important benefit of Virginia wildrye seed is it maintains high viability percentages over a long period (over ten years) while in storage. Ideally, native seed mixes contain up to 25% Virginia wildrye for these reasons.

The one-half acre increase field plants (planted spring 2010) are currently well established. Field maintenance during seedling establishment included soil testing, soil amendment application (primarily lime), supplemental watering when necessary, pre-emergant herbicide application, and tillage. After establishment only pre-emergant herbicide application and mowing to limit weed pressure were necessary.

The field was harvested for the second time in September 2012. The increase field yielded over 50 lbs. of bulk seed. Subsequent Virginia wildrye harvests will significantly increase as the plants continue growing.

Figure 7: Images from the Foothills Parkway F8E15 project (completed in 2009) show how effective slope stabilization is realized using vegetation. This project is the first project on the east end of the Missing Link Section. The top two images show the slope soon after construction in 2009 and the bottom in 2011.

Effect of Mixed Species Cover Crops on Soil Health (National Soil Health Study)

Study No: MDPMC-T-1202-CP

Study Leader: R. Jay Ugiansky, NPMC Resource Conservationist

Objective: Document the effects of cover crop species composition on changes in soil health. Determine optimum seeding rates for cover crop mixes to affect soil health. Demonstrate the use of cover crops in rotation with a commodity crop.

Introduction: Multispecies cover crop mixes have demonstrated improvements to soil health and crop yield, however the optimum cover crop species composition and optimum seeding rates have yet to be determined. This study aims to inform these cost/benefit decisions and demonstrate to farmers and planners the use of cover crop mixes in rotation with a commodity crop. This variety trial is being conducted at 6 plant materials centers across the county in cooperation with the regional plant materials specialists, NRCS Soil Heath Team, and ARS.

Participating Locations:

1. Florida PMC - Brooksville, FL
2. National PMC – Beltsville, MD
3. Missouri PMC – Elsberry, MO
4. North Dakota PMC – Bismarck, ND
5. Washington PMC – Pullman, WA
6. California PMC – Lockeford, CA

Procedure: Three cycles of cover crop followed by a grain corn crop will be evaluated in the same field locations to determine cumulative effects on the soil. The 10 cover crop treatments including the control are replicated 4 times in a randomized complete block design. Each plot is divided into 3 subplots designated randomly for each year of evaluation and so sampling does not influence subsequent evaluations. Complete a soil characterization on 100' x 100' grid for the area was conducted in cooperation with the state soils staff. Weather data for the site is collected from weather station installed adjacent to the site. Soil moisture and temperature in plots is collected at planting of cover crop and commodity crop. Primary purpose is to provide living roots in the plots between cover crop cycles. No supplemental fertilizer is to be applied, but is irrigated as needed.

Treatments:

Seeds/ft^2	lbs/acre	Cover Crop (lbs/acre)
20	27	Rye (23.99), Crimson Clover (2.90)
40	54	Rye (47.97), Crimson Clover (5.81)
60	81	Rye (71.96), Crimson Clover (8.71)
20	37	Rye (21.59), Crimson Clover (1.31), Hairy Vetch (12.01), Radish (2.56)
40	75	Rye (43.18), Crimson Clover (2.61), Hairy Vetch (24.02), Radish (5.12)
60	112	Rye (64.76), Crimson Clover (3.92), Hairy Vetch (36.03), Radish (7.69)
20	36	Rye (10.79), Crimson Clover (1.31), Hairy Vetch (12.01), Radish (1.28), Oats (10.10), Rape (0.28)
40	72	Rye (21.59), Crimson Clover (2.61), Hairy Vetch (24.02), Radish (2.56), Oats (20.21), Rape (0.56)
60	107	Rye (32.38), Crimson Clover (3.92), Hairy Vetch (36.03), Radish (3.84), Oats (30.31), Rape (0.83)
0	0	Control - No Cover Crop

Evaluations:

		Prior to Cover Crop Seeding	At Cover Crop Termination
Soil Bulk Density		X	
Soil Resistance		X	
Soil Biological Assessment		X	X
Soil Indicators		X	
Soil Temp and Moisture			X
Cover Crop Photos	Every 15 days		
Canopy Cover	Every 30 days		
Plant Height	Every 30 days		
Biomass Yield			X
Corn Yield	At corn harvest		

Potential Products: Tech Note, revise FOTG standards, article, journal publication, webinars, training, tours and demonstration.

Progress or status: Prior to evaluations, sampling procedures were tested and sampling tools were constructed. Bulk density sampling tool improvements were made and sampling tools constructed for all of the centers participating in the study. Sampling procedures prior to first year cover crop planting were completed late August and early September 2012. Cover crop treatments were seeded September 20, 2012. Photos, canopy cover and plant height data was collected at prescribed intervals. Sampling and data at cover crop termination was completed at the end of May 2013. The Cover crop was rolled and the corn was planted on June 4, 2013. Observations made and data collected thus far will be summarized and presented in a Webinar scheduled for September 2013.

Figure 8: Sampling for soil bulk density.

Figure 9: Planting Cover Crop.

Figure 10: Cover crop mixes (green) on May 3, 2013. Crimson clover is in full bloom but is only visible in the field border outside of plots.

Figure 11: Cover crop rolling and corn seeding.

Figure 12: Weedy control plot evident at corn planting.