CONSERVATION INNOVATION GRANTS

Final Report

Cover Page

Grantee Name: Ann Swinker and Donna Foulk, Penn State University Extension	
Project Title: **Pennsylvania Small Farm Environmental Stewardship Program: Implementing Conservation Practices on Small Farms and Using Environmental Stewardship as a Marketing Tool**	
Agreement Number: 69-3A75-11-180	
Project Director: Ann Swinker and Donna Foulk	
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Period Covered by Report: 10/31/2011 thru 10/30/2015	
Project End Date: 10/30/2015	

Project Deliverables:

1. Development of a “user friendly” model to quantitatively evaluate pastures. (Page 25)
2. Develop an educational outreach effort, Environmental Stewardship Short Course and teaching materials, notebook, activities guide, and evaluation tools (page 9). 400 farm managers will complete the course, with 80% adopting of at least two strategies, impacting 8,350 acres. (Page10)

Other educational efforts: DVDs, power points for web-based methods, including web-sites and webinars. Horse farm mangers lean how to implement best-management practices by conducting other “Environmental Stewardship Programs” reaching an additional 30,000. (Page 19)

3. Offering educational programs for agricultural industry personnel, NRCS and soil conservation district representatives to help them understand & assist equine clients. (Page 27)
4. Pasture seeding equipment program - Help small farm owners improve pasture quality and increase canopy cover by providing them with access to no till drills. Of the 20 cooperators, 100% will report that they will implement at least two identified practices designed to reduce phosphorous levels in their feed and /or reduce soil and nutrient loss by increasing canopy cover within the pastures. 100% of the farmers will develop plans to improve pastures canopy cover, forage quantity, and pasture conditions. The 20 farms will increase canopy cover from 60 to 80% reducing sediment loss by over 1 ton per acre, per year resulting in a potential soil loss savings of 37 tons per farm. (Page 20)
5. Develop and market an "Eco Friendly Farm" brand to market farms that adopt sustainable conservation practices. (Page 24)

Pennsylvania Small Farm Environmental Stewardship Program: Implementing Conservation Practices on Small Farms and Using Environmental Stewardship as a Marketing Tool

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Executive Summary:

In Pennsylvania and other N. E. states, there is increased emphasis on farm and nutrient management practices on equine operations due to expansion of environmental regulations. Of the 31,000 operations which house horses in Pennsylvania, 23,250 are non-commercial operations and over 75 percent are on limited acreage, requiring intensive management. Since managers of equine operations and other small farms frequently do not have agricultural backgrounds and often need assistance in developing farm management plans, our "Project Team" is offering an Environmental Stewardship Program. For the above reasons, this project began October 2011, with the idea to address environmental stewardship and sediment and nutrient losses, for high density livestock/horse operations by using an extensive educational program to provide the knowledge and skills necessary to adopt sustainable and environmentally sound farm management practices. This project team targeted all small farm livestock species, but mainly focused on equine, because of the large number of high density horse operations in the state.

The Equine Environmental Stewardship Short Course Program (EES) is an educational series providing (8-12 hours) practical hands-on experiences, with a goal of helping farm owners and agricultural industry service providers develop necessary knowledge/skills to adopt environmentally sound management practices, promote an understanding of the relationships between sustainable farm management practices, soil health, pasture quality, and reduction in nutrient/sediment loss. By providing hands-on experiences in a classroom setting and in the field, ninety-four EES programs conducted reaching 2,801 farm operators (managing over 56,020 acres of land). The curriculum consists of eight lessons: Forage Biology & Grazing Management; Forage Species and Renovations; Pasture Soil Fertility Management; Weed Management in Pastures; Danger in the Grass Toxic Plants; Small Farms & Water Quality Regulations; Manure Compost the Renewable Source; Basic Equine Nutrition (if requested).

Participants reported adopting at least two Best Management Practices (BMPs) strategies to improve farm conditions; 74% planned to add stress lots to reduce grazing pressure; 72% planned on renovating pastures; 86% planned to apply nutrients based on soil testing results; 66% planned to develop a manure storage facility; 80% planned to contact agencies for assistance; 100% worked on farm's Manure Management Plan. Participants indicated, after course completion; 90% had a large increase in knowledge on forage biology/growth, how to renovate pastures; identify forage species, properly store/utilize manure, how nutrients affect plant growth/how to apply nutrients based on a soil test report, weed identification, and who to contact for assistance with pasture and nutrient management planning.

Additionally, 95 farm operations (1,086.90 ac.) participated in a project designed to implement practices to increase canopy cover and desirable forages in pastures and reduce nutrient and sediment loss. The team provided individual assistance to help owners locate resources, technical assistance and funding. All farm managers (n=95) farms were visited documenting conservation/management practices, BMPs already in place and identification of areas of concern/improvement needs. The team finalized field farm survey instruments, quantitatively documented pasture plants/canopy cover, sampled feed/hay/soil, and conducted nutrient management audits. Pasture data was collected using line point intercept and Equine Pasture Evaluation Disc (EPED) methodology. All plant species were documented with pasture

condition scores generated by using pasture condition score sheets. On 43 farms (744.55 ac. collectively), pastures were targeted for improvement, soil tested and prepared for methods to improve the pasture grass stands. Twenty-seven of these farms utilized reseeding by usage of a no-till drill, 8 farms utilized conventional plowing and 8 farms utilized broadcasting and/or frost free seeding. The remaining 48 farms did not need to reseed and instead received recommendations on how to improve and manage existing forage quality through improving or utilizing BMPs. Four farms did not continue involvement in the program after the initial farm visit by the team.

Results of the information gathered in the team's EES programs has been used and examined by state agencies, assisting in development of in-service training for their personnel, used in revising potential regulations and assistance concerning equine farm operations.

Keywords: Equine, educational, conservation, environmental

Introduction:

A poorly managed farm will contribute nutrients and sediments from exposed soil and manure into the water. Pollutants from horse and other operations, especially those that stock pile manure, can contribute to groundwater contamination. Proper pasture and nutrient management is needed to maintain adequate canopy cover in pastures. Precise management of equine operations requires a series of complementing BMPs that implement strategies on pasture land to preserve vegetative cover, to balance nutrient production with nutrient utilization, to properly manage excess manure nutrients, and to manage equine operations for minimal release of sediment. Controlling excess sediment and nutrient runoff from manure is important to prevent negative health implications, not only to the environment, but also to people and animals.

For the above reasons, this project began October 2011 with the idea to address environmental stewardship and sediment and nutrient losses, for high density livestock/horse operations by using an extensive educational program to provide the knowledge and skills necessary to adopt sustainable and environmentally sound farm management practices. This project team targeted all small farm livestock species but mainly focused on equine because of the large number of high density horse operations in the state. The work team identified the lack of knowledge of environmental stewardship as an area of concern that needed to be addressed, and highlighted the need to provide assistance and educational programs for horse and small farm managers/owners. This approach would be effective in reaching and motivating farmers to use the introduced BMPs now and in the future. In addition environmentally friendly farms need to be recognized by local agencies and the public for their extra effort.

The team worked through our existing Cooperative Extension network of main campus faculty and staff and county-based agricultural educators; in addition to Conservation Districts and Natural Resources Conservation Service (NRCS) representatives. The Penn State University (PSU) Equine Team combined research with outreach by establishing an innovative Equine Environmental Stewardship curriculum. After participating in programs participants indicated that they had a large or very large increase in knowledge about: forage biology and growth; how to renovate pastures; how to identify forage species; how to properly store and utilize manure;

compost; how nutrients effect plant growth; how to apply nutrients based on a soil test report; and the importance of identifying weeds in pastures.

Penn State University, Cooperative Extension specialists and educators developed the curriculum, teaching materials, and tools to evaluate pasture improvements and document impact. Donna Foulk and Dr. Ann Swinker served as the project Primary Investigators (PIs) and subject matter experts to coordinate the development and review of the short course and educational learning lessons. Together the PIs and the project team members worked directly with the equine/livestock farms, which participated in the project. Additionally, other agency specialists and experts were utilized as project advisors, consultants, on-farm coordinators and workshop facilitators. Team members were as follows:

Dan Kniffen, Ph.D., PSU Extension Specialist, Dept. of Animal Science, Farmer, On Farm Research Coordinator
Helene McKernan, PSU Extension Associate
Andrew Frankenfield, Montgomery County (PA), Agricultural Extension Educator
Marvin Hall, Ph.D., PSU, Forage Specialist, Dept. of Crop & Soil Science
Lisa Jones, York County (PA), Extension Educator
Jessica Moldofsky, Agr. Conservation Specialist, Montgomery (PA) Conservation District
Dave Schaffer, Bucks County (PA), Extension Educator
Douglas B. Beegle, Ph.D., PSU, Soil Fertility, Dept. of Crop & Soil Science
Burt Staniar, Ph.D., PSU, Animal Nutrition, Dept. of Animal Science
Suzette Truax, South Central PA Grazing Specialist, USDA NRCS
Frank Schneider, PA Dept. of Environmental Protection (DEP)
Susan Perry, PA USDA NRCS
Michael Brubaker, Nutrient Management Program, PA State Conservation Commission
Robert Meinen, PSU Senior Extension Associate
Ron Hoover, PSU Extension Associate, On-Farm Research Coordinator
Berry Foulk, Stable Manager, On-Farm Research Coordinator, Common Ground Farm, Stroudsburg, PA
Lisa Blazure, Chesapeake Bay Technician, Clinton County (PA) Conservation District,
Jennifer Grooms, 4-H Educator, Warren County (PA) Extension Office
Nicole Santangelo Carutis, Field & Forage Crops Educator, McKean/Potter County (PA) Extension Office
Cynthia Searight, 4-H Educator, Beaver County (PA) Extension Office
Darleen Krisher-Meehan, Country Crossroads Feed and Seeds, Andover NY
Nancy Kohler, Director of Bromeley-Daggett Equestrian Center, Alfred University, Alfred, NY
Alicia Spangler, Extension Educator, Armstrong County (PA) Extension Office
Kevin L. Brown, Bradford County (PA) Conservation District
Terri Springer and Pierce Willson, Fayette County (PA) Conservation District
Adam Cotchen, Water Resource/Agriculture Specialist and Brooke Esarey, Watershed Specialist, Indiana County (PA) Conservation District
Andrea Boyce, Ag. Conservation Technician, Tioga County (PA) Conservation District
Hannah Hoblitzell, Agricultural Technician, Washington County (PA) Conservation District

Daniel E. Griffith, Nutrient Mgmt Specialist/Ag Conservation Tech/GIS, Westmoreland County (PA) Conservation District,
Susan Parry, PA State Grassland Conservationist USDA-NRCS, PA NRCS GLCI Coordinator
Cory Kieschnick, Chair, Dept. of Equine Science & Management Assistant Professor, IHSA Head Coach, Delaware Valley University, Doylestown, PA
John Rowehl, Extension Educator, Lancaster County (PA) Extension Office
Ed Jedrzejewski, DVM, PSU Department of Animal Science

The Pennsylvania Equine Council helped with the educational efforts to help horse farm owner's gain conservation concept acceptance; and hosting annual Issues Forums and Expos featuring and facilitating the Environmental Stewardship Programs educational efforts.

The major goal of this project is to provide new farm owners, and managers of small, high density livestock/horse operations with the knowledge, skills and equipment necessary to implement pasture, nutrient and sediment management systems for their operations. Farmers can use the adoption of these conservation principals as a marketing tool. There are three major components of this project.

- ***Environmental Stewardship Short Course and Educational Outreach***
- ***Environmentally Friendly Farm Recognition and Marketing Brand***
- ***Renovation & Improvement of Pastures on Equine & Small Farm Livestock Operations***

The project was possible because of the existing Cooperative Extension network of Extension Educators and their relationships with the farmers and farm managers in their area. The "hard" funding that is already in place from County and State sources allowed Penn State to cost-share the contribution from USDA. In addition, the farm managers participating in this project offered the use of a part of their farm to demonstrate innovative pasture and nutrient management practices. The farmers also committed to participating at the EES Short Courses, field days and providing their property for use in the project. The cost share contribution was: $223,350.00 (744.5 acers X ($300 to $500 cost of renovations). The project was funded by a national USDA-NRCS Conservation Innovation Grant and cost-shared with contributions from Penn State University and collaborating farmers.

Background:

This project targeted traditionally underserved communities throughout PA with a major emphasis on farm operations in the Chesapeake Bay Watershed. Underserved communities include new and beginning farmers and managers of small livestock and equine operations. These farmers, owners and managers of small farms and equine operations historically had low participation in USDA conservation programs and research has shown that 70% of PA horse operations are managed by women. Equine operations, which were previously unregulated, now fall under nutrient management regulations in PA. These regulations are requiring a completed Manure Management Plan on file at the farm. Increasing attention is being paid to nutrient and sediment loss from equine and small livestock operations within the Chesapeake Bay watershed. New farm owners and managers of small farms and equine operations need to be made aware of regulations, government programs and sources of assistance.

In Pennsylvania, the fastest growing segment of the livestock industry is the equine sector. According to the American Horse Council's 2005 survey the state of Pennsylvania's equine population has increase from 1993 to 2005 (170,000 to 255,000). In October 2004, the PA DEP convened a workgroup to identify BMPs that would minimize nutrient and sediment loss from equine and small acreage animal farms. This project targeted all small farm livestock species, but mainly focused on equine, because of the large number of high density horse operations in the state. The project team identified the items listed below as areas of concern that needed to be addressed, and highlighted the need to provide assistance and educational programs for horse and small farm managers/owners:

1. A poorly managed farm, will contribute nutrients and sediments from exposed soil and manure. Pollutants from horse and other operations, especially those that stock pile manure, can contribute to groundwater contamination. Proper pasture and nutrient management is needed to maintain adequate canopy cover in pastures.

2. Proper management of equine operations requires a series of complementing BMPS that implement strategies on pasture land to preserve vegetative cover, to balance nutrient production with nutrient utilization, to properly manage excess manure nutrients, and to manage equine operations for minimal release of sediment (Pennsylvania Department of Environmental Protection, 2001).

3. Manure, when stored, composted, and applied properly result in the utilization of a valuable resource that contains nitrogen, phosphorus, potassium, sulfur and various micronutrients, is high in organic matter, and can enhance soil quality by improving soil structure, increasing water and nutrient-holding capacity and reducing susceptibility to erosion (Pennsylvania Department of Environmental Protection, 2001).

4. Numerous equine operations, especially those near urban areas, maintain high stocking densities and require intensive management systems.

5. Agencies, such as Conservation Districts, USDA Natural Resources Conservation Service and Cooperative Extension have not traditionally worked with equine operations. These agencies have reported that they do not have the personnel, resources or training to deal with this clientele. In the past, Pennsylvania's USDA-NRCS conservation assistance programs such as: EQUIP, CBWI, WIP have not been available to equine operations. However, recently, many of the conservation practices and programs available are looking more favorable for horse farms.

6. Many horse and new farm owners have little or no agricultural background and lack the knowledge and skills necessary to make good management decisions. Manure management, erosion control, and pasture management is a whole new area of concern for the equine industry.

7. Horse farms have not been eligible for cost-share funding in the past and have not been regulated directly. Under newly revised regulations, equine operations with fewer than 8 Animal Equivalent Units (AEUs) will not be regulated under the Nutrient Management Act.

Farms with fewer than 8 AEUs frequently have fewer acres per animal unit and have the potential to pose a significant environmental risk (SCC, 2006). According to Foulk, 2005, smaller operations with fewer than 10 equine rarely have nutrient management plans for their farms and are more likely to stock pile manure and leave it on the premises unused.

8. Recent regulations allow horse owners to participate in Pennsylvania EQUIP and other conservation programs. The program requirements are determined by Pennsylvania's NRCS standards. The change in equine eligibility has enabled more equine operations to participate in these conservation programs.

Many equine operations as well as new and beginning livestock farmers own and manage operations near urban environments and market direct to consumers. These farms often have high stocking densities and require extensive management to protect environmental resources. Since many of the newer farmers and equine farm managers do not have agricultural backgrounds, extensive training needs to be available to assist the farmers in making sound and sustainable land and livestock stewardship decisions. Short courses, hands-on workshops and demonstrations help provide the knowledge and skills needed to prepare and implement a sound management plan and modify the plan if needed.

An obstacle that owners of equine operations and small farms face is the lack of equipment and tools needed to manage and maintain high quality pastures on their farm. Research has shown that it is important to maintain at least 70% to 75% canopy cover in pastures. Below that percent, erosion and significant sediment and nutrient loss can occur. Nutrients and sediments can have a negative effect on both ground and surface water quality. A pasture canopy cover that is above 70% is considered good and will adequately prevent extensive soil erosion. Ideally, canopy cover should be maintained at 80%. With the increasing emphasis on canopy cover in pastures, farmers need to utilize pasture rotation and stress lots to maintain high quality pastures. Workshops that include topics of pasture quality evaluation, nutrient management, forage species selection and weed control help the farm operator address renovation, maintenance and maintaining of their operation. Although, most managers of livestock and equine operations own tractors and mowers, many do not own the proper equipment needed to seed and fertilize pastures. For many small farm operations, it is not cost effective to purchase and maintain no-till drills to renovate pastures when needed. A major obstacle in maintaining high quality pastures is lack of access to the equipment that is necessary to renovate and manage pastures. No-till drills need to be readily available to managers of equine and small livestock operations, so that pastures can be renovated as needed. Productive pastures enhance farm economic sustainability, enhance animal's health and reduce potential nutrient and sediment loss to the environment.

Review of Methods:

What is innovative about this project?

Environmental Stewardship educational program was developed is to provide horse owners/small farm managers (targeting traditionally underserved farm owners) with the knowledge and skills necessary to adopt sustainable and environmentally sound farm management practices. This program was met with the use of three programming areas:

1. Educational Stewardship Short Course and Educational Outreach
2. Renovation & Improvement of Pastures
3. Environmentally Friendly Farm Recognition and Marketing Brand

1. Environmental Stewardship Short Course and Educational Outreach

A major goal of the project is to develop and offer an Environmental Stewardship Short Course. A series of course topics was offered at various locations, providing beginning farmers, and owners of small livestock and equine operations with the knowledge and skills necessary to adopt sustainable and environmentally sound farm management practices. Environmental Stewardship Short Course was developed as an educational series that provides a minimum of 8-12 hours of practical hands-on experiences, along with individual modules and stand - alone workshops and field days. The short course and workshops are designed to help small acreage owners and others involved in the industry:

- Understand the role that pastures play in providing nutrition and enhancing physical development and overall health.
- Learn to manage the potential health risks that may be associated with pasture forages and toxic plants.
- Understand the importance of maintaining adequate plant canopy cover in absorbing soil nutrients and reducing soil erosion.
- Properly collect soil samples, interpret the soil test results, and implement an environmentally sound fertility program based on the soil test report.
- Evaluate pasture productivity and quality.
- Learn to identify the major forage species.
- Identify and develop a plan to manage weeds and toxic plants associated with equine pastures.
- Develop sustainable pasture management plans by incorporating rotation, dry lots, and limited turnout into the grazing plan.
- Understand the link between erosion, sediments, and excess nutrients and water quality.
- Properly store and apply manure to reduce potential ground and surface water contamination.
- Understand and comply with current nutrient management regulations within the state.

The program team conducted 94 Environmental Stewardship Short Courses Workshops, an educational series that provided (8-12 hours) 1 to 4 days of practical hands-on experiences that helped farm owners develop the knowledge and skills necessary to adopt environmentally sound farm management practices. The short course is a four-part educational series that promotes an understanding of the relationships between sustainable farm management practices, soil health, pasture quality, and reduction in nutrient and sediment loss from farms. The course provides practical, hands-on experiences in a class room setting and in the field. The team with the help of state specialists developed a standard curriculum and associated teaching materials, notebook, activities guide, and evaluation tools for the Environmental Stewardship Short Course.
The short courses that were offered throughout Pennsylvania were evaluated documenting change in knowledge and adoption of conservation practices.

The Equine Environmental Stewardship Course Curriculum Consists of a Series of Seven Lessons:

- Module 1: Grass is Always Greener Forage Biology & Grazing Management
- Module 2: The Grass is Always Greener Forage Species and Renovations
- Module 3: Pasture Soil Fertility Management
- Module 4a: Weed Management in Pastures
- Module 4b: Danger In the Grass Toxic Weeds
- Module 5: PA Small Farms & Water Quality Regulations
- Module 6: Manure Compost the Renewable Source
- Module 7: Basic Equine Nutrition (some workshop sites requested this topic)

Educational Materials, Fact Sheets, Pamphlets Utilized in the EES Workshop Participants Contents:

The Pennsylvania State University

- Power Point Modules *Arena Footing and Management,* Penn State University,
- EE0094 *Agronomy Facts #76: Nitrogen Management to Reduce Environmental Losses*
- EPED Fact Sheet, *Equine Pasture Evaluation Disc*, Donna Foulk, Extension Educator, Equine Natural Resources
- IVC7b 7M385 *Comparing Fertilizer Materials*
- R3M1298ps *Stream Bank Fencing: Green Banks, Clean Streams*
- UC038 *Agronomy Fact Sheet #3: Soil Acidity and ag lime*
- The Agronomy Guide 2015-2016, Penn State University College of Agricultural Sciences
- UA273 *Agricultural Alternatives: Boarding Horses*
- UA442 *Nutrient Budgets for Pennsylvania Cropland: What Do They Reveal and How Can They Be Used?*
- UB033 *Horse Facilities #1: Stall Design*
- UB034 *Horse Facilities #2: Fire Safety in Horse Stables*
- UB035 *Horse Facilities #3: Horse Stable Manure Management*
- UB036 *Horse Facilities #4: Horse Stable Flooring Materials and Drainage*
- UB037 *Horse Facilities #5: Fence Planning for Horses*
- UB038 *Horse Facilities #6: Riding Arena Footing Materials Selection & Management*
- UB039 *Horse Facilities #7: Horse Stable Ventilation*
- UC068 *2008 Forage Trials Report*
- UC080 *Agronomy Facts #19: Ryegrass*
- UC083 *Agronomy Facts #21: Red Clover*
- UC084 *Agronomy Facts #22: White Clover*
- UC086 *Agronomy Facts #25: Timothy*
- UC088 *Agronomy Facts #25: Orchardgrass*
- UC089 *Agronomy Facts #26: Reed Canary Grass*
- UC090 *Agronomy Facts #27: Smooth Bromegrass*
- UC091 *Agronomy Facts #28: Tall Fescue*
- UC092 *Agronomy Facts #29: Warm-Season Grasses*
- UC095 *Agronomy Facts #30: Forage Quality in Perspective*
- UC096 *Agronomy Facts #31-A: Soil fertility management for forage crops Pre-establishment*

- UC097 *Agronomy Facts #31-B: Soil fertility management for forage crops Establishment*
- UC098 *Agronomy Facts #31c: Soil Fertility Management for Forage Crops-Maintenance*
- UC099 *Agronomy Facts #32: Pasture & Hay for Horses*
- UC102 *Agronomy Facts #35: Some Facts About Soil Basics*
- UC107 *Agronomy Facts #38a: A Nutrient Management Approach for PA,- Introduction to the Concepts*
- UC108 *Agronomy Facts #38b: A Nutrient Management Approach for PA, Plant Nutrient stocks and flows*
- UC109 *Agronomy Facts #38c: A Nutrient Management Approach for PA, Nutrient Management Decision Making*
- UC111 *Agronomy Facts #40: Nutrient Management Legislation in Pennsylvania: A Summary of 2006 Regulations*
- UC114 *Agronomy Facts #43: Four Steps to Rotational Grazing*
- UC115 *Agronomy Facts #44: Forage Quality Testing - Why, How, and Where*
- UC117 *Agronomy Facts #46: Multiflora Rose Management in Grass Pastures (An Integrated Approach)*
- UC122 *Agronomy Facts #49: Successful Forage Crop Establishment*
- UC129 *Agronomy Facts #50: Kentucky Bluegrass*
- UC149 *Agronomy Facts #54: Pennsylvania's Nutrient Management Act (Act 38): Who Is Affected?*
- UC172 *Agronomy Facts #62: Weed Management in Pasture Systems*
- UC207 *Agronomy Facts #69: Manure Sampling for Nutrient Management Planning*
- UN008 *West Nile Encephalitis in Horses*
- XFO276 *Pest Management Recommendations for Horses*

Other Publications provided to the participants (developed by other sources)

- A3637 *Identifying Pasture Grasses*, Dan Undersander, Michael Casler, Dennis Cosgrove, Neal Martin: Wisconsin Cooperative Extension
- A3787 *Identifying Pasture Legumes*, Dennis Cosgrove, Dan Undersander: Wisconsin Cooperative Extension
- *Common Weed Seedlings of the North Central States*, Andrew J. Chomas, James J. Kells, J. Boyd Carey; Department of Crop and Soil Sciences, Michigan State University
- EC 1558 May 2003 *Managing Small-acreage Horse Farms: For green pastures, clean water, and healthy horses*, Oregon State University, Extension Service
- ID-74 *Planning Fencing Systems For Intensive Grazing Management*, University of Kentucky Cooperative Extension Service
- *Land Application of Manure: A supplement to Manure Management for Environmental Protection, Manure Management Plan Guidance*, 361-0300-002, Pennsylvania Department of Environmental Protection
- *Managing Grasslands for Profit: Guide to grazing management in the Southeast*, USDA Natural Resources Conservation Services
- *Pasture Plants of the Northeastern United States*, Sarah Goslee, USDA-ARS Pasture Systems and Watershed Management
- Range & Pasture ID Guide, Southern Edition, Dow AgroSciences

- *Understanding Forage Quality*, D. M. Ball, M. Collins, G.D. Lacefield, N.P. Martin, D.A. Mertens, K.E.Olson, D.H. Putnam, D.J. Undersander, and M. W. Wolf, 2001, American Farm Bureau Federation Publication 1-01, Park Ridge, IL
- Weeds of the Northeast, Richard H. Uva, Joseph C. Neal and Joseph M. DiTomaso, Cornell University Press

What did the producer have to do differently to accommodate the project?

To date, the Project Team developed and conducted 94 Environmental Stewardship Short Courses; reaching 2,801 horse owners with the Equine Environmental Stewardship (EES) Course workshops, offered in Pennsylvania and New York (see Table 1 for dates, locations and attendance). As a result of completing the EES short course 90% of participants indicated that they had a large increase in knowledge about forage biology and growth, how to renovate pastures, how to identify forage species, how to properly store and utilize manure, how nutrients affect plant growth, how to apply nutrients based on a soil test report, the importance of identifying weeds in pastures, and who to contact for assistance with pasture and nutrient management planning.

Over 2,801 of the workshop participants (managing over 56,020 acres of land) reported adopting at least two BMPs strategies to improve conditions on their farm. Workshop participants reported that they planned to adopt the following BMPs strategies:

- 74% planned to add additional paddocks, stress lots to reduce grazing pressure
- 72% planned to generate a forage, weed and toxic plant inventory for their farm
- 72% planned to renovate pastures to thicken the stand
- 86% planned to apply nutrients based on soil test results
- 66% planned to develop a better manure storage facility
- 80% already contact or planned to contact agencies for assistance
- 100% worked on their farm's Manure Management Plan.

Because of the recently developed Pennsylvania state regulation, the team took this opportunity to educate horse farm managers on guidance in writing manure management plans. The team conducted Manure Management Plan Writing Workshops, in addition to the Equine Environmental Stewardship (EES) course, to help with the development of the farm's Manure Management Plan. This additional education and guidance increased participation in the overall program.

The PSU Equine Team offered educational programs for equine and other agricultural industry personnel, NRCS and soil conservation district representatives, to help them better understand and assist their equine clients and share the program results and information.

Schedule of events

Table 1. Workshops, Conferences, Short Courses Conducted from 2012 to 2015

2012 Penn State Extension Equine Planned Events
• Jan 26-30, Environmental Stewardship Program (EES), Manure Plans Writing,

Chester County, PA, attendance 51.
• Feb 4, Piecing Together the Pieces Program, Eden Resort & Conference Center, Lancaster, PA, attendance 80.
• Feb 23 - 26, PA Horse World Expo, How Green Is Your Farm, Manure Management and Composting, Pasture Management, Harrisburg, PA, presenters Helene McKernan, Ann Swinker, Sarah Cooke, Donna Foulk, attendance 1,200.
• Feb 29, Manure Management Program, Calico Creek Pet Store, Mill Hall, PA, attendance 19.
• March 7, EES program Lehigh, Allentown, PA, attendance 27
• March 20, Pasture Management, PSU Chaps Group, main campus PSU, attendance 23.
• March 28, EES program Lehigh, Allentown, PA, attendance 27.
• April 3, EES Program, Columbia County, attendance 18.
• April 5, EES Program, Wayne County, attendance 25.
• April 17, EES Program, Columbia County, attendance 18.
• April 18, Introduction to EES Program, Erie Saddle Club, Waterford, PA, attendance 53.
• April 26, EES Program, Wayne County, attendance 25.
• May 8, EES Program, York County, attendance 22.
• May 16, EES Short Course, York County, attendance 36.
• May 23, EES Short Course, York County, attendance 36.
• May 30, EES Short Course, York County, attendance 36.
• June 6 & 27, Manure Management Workshop, Northampton County, attendance 12.
• June 21, EES Program, Warren County, attendance 12.
• July 19, EES Program, Dauphin County, attendance 30.
• July 26, EES Program, Dauphin County, attendance 27.
• Aug 2, EES Program, Dauphin County, attendance 30.
• Aug 6, Farm Manure Management for Horse and Small Farm Owner, York County, attendance 18.
• Aug 9, EES Program, Dauphin County, attendance 29.
• Aug 14 – 16, Manure Happens, APD, Rock Springs, PA, attendance 17.
• August 19, How Green Is Your Farm and Pasture Management, EES, Pennsylvania Furnace, PA, Attendance, attendance 15.
• Aug 20, ESS Program, York County, attendance 30.
• Sept 11, Pasture Walk, Manure Management, PSU Student Class, Windy Butte Farm, Spring Mills, PA, attendance 22.
• Sept 22, EES Pasture Demo, Ryerss Farm, Field Day, Pottstown, PA. attendance 57.
• Oct 10 &17 Manure Management Workshop, Northampton County, attendance 12.
• Nov 1, Manure Management Workshop, Lehigh County, attendance 10.

• Dec 9 – 12, Grazing Lands Conference, Equine Environmental Stewardship: A Comprehensive Approach to Enhancing Adoption of Best Management Practices on Equine Operations & Involving Youth In Livestock And Horse Environmental Stewardship Projects, Profile Of The Equine Industry's Grazing Best Management Practices In Pennsylvania, Orlando, Florida, attendance 260.
2013 Penn State Extension Equine Planned Events
• Jan 15, EES Workshop Equine Nutrient Management, Rutgers University Feeding Management Program, Bordentown, NJ at the Rutgers University, attendance 30.
• Feb 13, Manure Management, Calico Creek Pet Store, Mill Hall, PA, attendance 23.
• Feb 21 – 24, EES Workshop Topics, Horse World Expo, Farm Show Complex, Harrisburg, PA, attendance 320.
• February 21, Horse Keeping on Limited Acres & Resources, World Horse Expo, Farm Show Complex, Harrisburg, PA, attendance 90.
• Mar 14, Healthy Farms, Healthy Horses, Lehigh Valley, Lehigh County, attendance 27.
• Mar 24, Introduction to Manure Management, Armstrong County, attendance 20.
• April 1, Nutrient Management Regulations and the Equine Industry, Proceedings, Waste to Worth: Spreading Science and Solutions, Denver, CO, attendance 80.
• April 4, EES Program, Armstrong County, Kittanning, PA, attendance 35.
• April 14, EES, Lehigh County Ag Center, attendance 23.
• April 11, EES Program, Armstrong Count Kittanning, PA, attendance 36.
• April 18, EES Program, Armstrong Count Kittanning, PA, attendance 32.
• April 19, Manure and Pasture Management, (youth), Armstrong County, attendance 20.
• April 22, Manure Regulation and Composting Horse Manure, University Park, PA, students 23.
• April 25, EES Program, Armstrong County Kittanning, PA, attendance 30.
• April 25, Tools for Equine Health and Soundness, Bethlehem, PA, attendance 150.
• April 27, EES Program, Beaver County Penn State Campus, Manaca, PA, attendance 34.
• May 29, Adoption of best management practices on equine operations using an Equine Environmental Stewardship Program. Equine Science Society, Ruidoso, NM, attendance 350.
• June 24, EES Program, Indiana County, Indiana, PA, attendance 10.
• June 28, Introduction to Manure Management, PA JR Arabian Games, Centre Hall, PA, attendance 9.
• July 25, EES Program, Warren County, attendance 16.

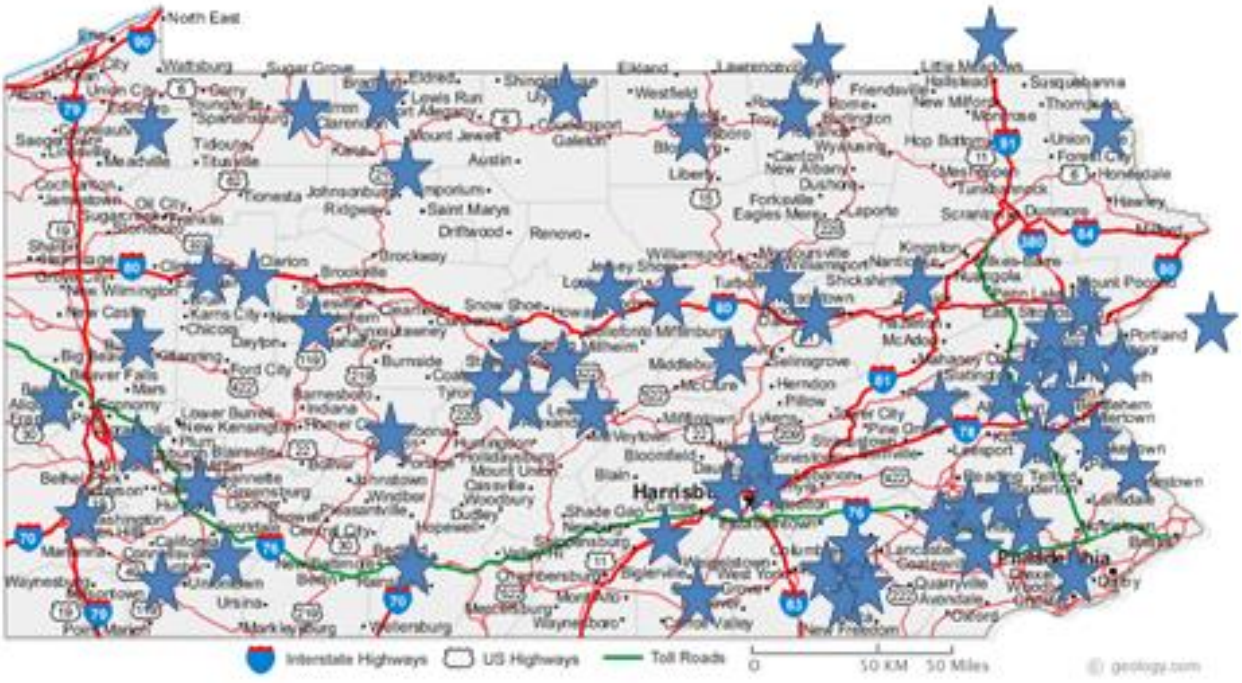
• Aug 13 - 15, High Density Grazing Demonstrations, Pennsylvania Ag Progress Days, NRCS, SCC, PSU Exhibit, attendance 180.
• August 16, Building & Managing Horse Arenas to Limit Dust, Best Management Practices for Horse Owners – Course, SDSU Extension, Brookings, SD, attendance 55.
• September 9, Beef Production Course, Pasture Condition Scoring and Pasture Management, Spring Mills, PA, attendance 18.
• Sept 17, The EPED - Developing a "User-Friendly" Method of Quantitatively Evaluating Horse Pastures, Joint Council of Extension Professionals (JCEP), Pittsburgh, PA, attendance 38.
• Sept 17, Pasture Walk, Manure Management, PSU Student Class, Windy Butte Farm, Spring Mills, PA, attendance 17.
• Sept 18, Equine Industry's Best Management Practices and Environmental Impact in Pennsylvania, Joint Council of Extension Professionals(JCEP), Pittsburgh, PA, attendance 52.
• Oct 3, Equine & Livestock Manure Management Plan Writing Workshop: Healthy Farms, Healthy Animals, Keystone International Livestock Expo Forum, Environmental Stewardship, Farm Show Complex, Harrisburg, PA, attendance 12.
• Oct 10, Working with the Equine Industry - Choosing BMPs that Work, Union County, Lewisburg, Bucknell University, agencies personnel, attendance 103.
• Oct 19, Environmental Stewardship Workshop, Clinton County Extension Office, Beech Creek, PA, attendance 10.
• November 2, State Equine Issues Forum, EES Topics, Pa Equine Council Annual Meeting, Bethlehem, PA, attendance 42.
• Nov 9, Manure Management Writing Plans Workshop, Luzerne County, Wilkes Barre, PA, attendance 33.
• November 26, Riding Arena Footing and Management, My Horse University and eXtension HorseQuest free monthly webcasts, attendance 24. http://www.myhorseuniversity.com/resources/webcasts/ridingarenafooting
2014 Penn State Extension Equine Planned Events
• January 27, 2014, Horse Industry and Economic and Environmental Impacts, Pennsylvania Farm Bureau Agricultural Commodity Committee, Camp Hill, PA, attendance 60.
• Feb 4, Poster Presentation on Ag Progress Days (APD) research, Ag Progress Days Grazing Demonstration Provided Education on How to Maintain Livestock on Pasture Areas, NE Pasture Consortium, State College. attendance 89.
• February 4, 2014, Profile of the Equine Industry's Grazing Best Management Practices in Pennsylvania, North East Pasture Consortium Annual Meeting, State College, PA, attendance 89.
• Feb 10 & 12, Manure Management, Northampton County, attendance 24 & 17.
• February 13, Environmental Stewardship Focus Group, PSU Cross-Cutting Research Area Focus Group, Ag Admin. Building, University Park, PA,

attendance 15.
• Feb 13, Manure Management Plan Writing Workshop, Northampton County, attendance 24.
• Feb 27 - March 2, EES Topics, PA Horse World Expo, Harrisburg, PA, attendance 23,000.
• March 5, EES Program, Lehigh County, Quakertown, PA, attendance 43.
• March 12, EES Program, Lehigh County, Quakertown, PA, Attendance 42.
• March 10, Working with the Equine Industry - Choosing BMPs that Work, Bucknell University, Agencies, attendance 104.
• March 15, EES Program, Short Course, Manure Management Regulations, York, PA, attendance 23.
• March 15, EES Program, Short Course, Composting Manure, York, PA, attendance 23.
• March 20, EES Program, Bucks County, attendance 46.
• March 26, Manure Management Plan Workshop, Lehigh County, attendance 36.
• March 27, EES Program, Bucks County, attendance 46.
• April 2, Manure Management Plan Writing, Bucks County, attendance 46.
• April 5, How Green Is Your Farm - Cumberland County PEC Chapter, attendance 12.
• April 8, How Green is Your Farm? And Pasture Management and Manure Regulations, Fayette County Conservation District, Lemont Furnace, PA, attendance 31.
• April 9, Grassland Council GLCI Meeting and USDA Conference, State College, PA, State Technical Committee, PSU Extension Stewardship Report, attendance 17.
• April 17, EES, Hidden Hazards, Bethlehem, PA, attendance 48.
• May 17, EES, Horse Pasture Management Course, York Extension Office, York, PA, attendance 22.
• May 21, Manure Management Workshop, York County, attendance 23.
• May 28, Equine Environmental Stewardship Program and State Regulations, ANSC 407 Equine Management, PSU, University Park PA, Students 34.
• May 28, Equine Management Workshop, Indiana Conservation District, Indiana, PA, attendance 27.
• June 4, Equine Environmental Stewardship Program Farm Bureau, Camp Hill, PA, attendance 15.
• July 1, Pasture Renovation using a no-till drill, Northampton, County, attendance 14.
• June 14, Equine Pasture Field Day, Delaware Valley College, PA. attendance 39.
• July 9, Grassland Council PAGLC Meeting and Pasture Walk Conference, Spring Mills, PA, State Technical Committee, PSU Extension Stewardship Report, attendance 23.
• July 17, Lehigh Valley Horse Council, Pasture Field Day, Northampton County, attendance 25.

• August 12 - 14, Ag Progress Days, Grazing and Pasture Demonstration, attendance 173.
• August 13-15, Pennsylvania Environmental Stewardship Research Report, Multistate Research Project, NE1041 CERE Conference, Environmental Impacts of Equine Operations, South Dakota State, Brookings, SD, attendance 13 states universities, 22 researchers.
• August 15, South Dakota Equine Environmental Stewardship Horseman's Meeting, Brookings, SD. attendance 25.
• Aug 21, Eastern PA Grazing Conference - Manure Management Presentation, Penn National Race Track, Grantville, PA, attendance 90.
• Aug 26, EES Bradford County Conservation District, PA, Part 1, attendance 24.
• Aug 27, Pasture Management McKean County Ext. PA, attendance 6.
• Oct 5, Keystone International Livestock Expo Forum, Environmental Stewardship, Farm Show Complex, Harrisburg, PA, attendance 11.
• Sept 9, Pasture Evaluation and Management, PSU student class, Windy Butte Ranch, Spring Mills, PA, 16 students.
• October 15, Grassland Council GLCI Meeting and USDA Conference, State College, PA, State Technical Committee, PSU Extension Stewardship Report, attendance 17.
• Sept 16, EES Bradford County Conservation District, PA, Part 2, attendance 24.
• Oct 19, EES Workshop, Clinton County Ext Resource Center, Mill Hall, PA, Attendance 21.
• October 31- Nov 1, Pennsylvania Equine Environmental Stewardship State Report, Coalition of State Horse Councils, Grafton, Illinois, attendance 22.
• Nov 8, Manure Management, PA Equine Council Annual Meeting and Issues Forum, State College, PA, attendance 60.
• Nov 10, York County Horses 101 State Conservation Commission, In-Service Training, Certified Nutrient Plan Writers, York, PA, attendance 55.
• Nov 13, Columbia County, Horses 101 State Conservation Commission, In-Service Training, Certified Nutrient Plan Writers, attendance 48.
• Nov 17, Horses 101, Bedford County, Horses 101 State Conservation Commission, In-Service Training, Certified Nutrient Plan Writers, Bedford, PA. attendance 18.
• Nov 20, Horses 101, Horses 101 State Conservation Commission, In-Service Training, Certified Nutrient Plan Writers, Lamar, PA, attendance 17.
2015 Penn State Extension Equine Planned Events
• Jan 17, Parasite Control: A Whole Farm Approach, Lancaster, PA, attendance 58.
• Feb 7, Parasites: A Whole Farm Approach, Northampton County PA, attendance 65.
• Feb 28, Piecing Together the Pieces, Parasite Workshop, Prospect, PA, attendance 50.
• March 5 – 8, PA Horse World Expo, Harrisburg, PA, attendance 35,000.
• March 13, PA Environmental Educators Conference, Raystown, PA, attendance

37.
• March 17, EES Program, Alfred University Equestrian Center, Alfred, NY, attendance 27.
• August 16-18, Pennsylvania EES Research Report, Multistate Research Project, NE1041 CERE Conference, Environmental Impacts of Equine Operations, North Carolina State University, Raleigh, NC, attendance 18.
• March 21, EES Program, Indiana County Conservation District, Indiana, PA, attendance 10.
• March 30, Piecing Together the Pieces, Parasite Program, Lancaster County, PA, attendance 25.
• April 7, EES Program, Alfred University Equestrian Center, Alfred, NY, attendance 29.
• April 14, Piecing Together the Pieces, Parasite Program, Lancaster County, PA, attendance 85.
• April 20, AN SC 407 Horse, Production, Nutrient Management Regulations and the Equine Industry, University Park, PA, students 35.
• April 22, PSU Team Meetings and Reports, PSU Conf. Center, University Park, PA, attendance 78.
• April 29, Piecing Together the Pieces, Parasite Program, Butler County, PA, attendance 51.
• July 13 – 15, North American Manure Expo, Equine Environmental Issues, Demos and Composting Manure, Chambersburg, PA, attendance 3,200.
• July 22, EES Program, Washington County Conservation District, Washington, PA, attendance 30.
• July 27, EES Program, Pasture Walk, Standing Ovation Equestrian Center, Port Matilda, PA, attendance 21 Pony Clubbers, 6 Adults.
• July 29, EES Program, Washington County Conservation District, Washington, PA, attendance 30.
• August 16-18, Pennsylvania Research Report, Multistate Research Project, NE1041 CERE Conference, Environmental Impacts of Equine Operations, North Carolina State University, Raleigh, NC, attendance 17.
• Aug 18 – 20, APD, presentations, facilitated research tour, Rock Springs, PA, attendance 45.
• September 1, Pasture Walk, Manure Management, PSU Student Class, Windy Butte Farm, Spring Mills, PA, attendance 14.
• September 2, Beef Production Course, Pasture Condition Scoring and Pasture Management, Spring Mills, PA, students 13.
• September 16, Building & Managing Horse Arenas to Limit Dust, University of MN Extension, Webinar, attendance 20.
• Best Management Practices for Horse Owners – Course, Minnesota State University Extension, Webinar, attendance 55.
• Oct 15, Grassland Council GLCI Meeting and USDA Conference, State College, PA, State Technical Committee, PSU Extension Stewardship Report, attendance 17.

• Oct 15, Panel on Equine Environmental Issues, Precarious Alliance Conference, Delaware Valley University, Doylestown, PA, attendance 45.
• October 17, Beef Production Course, Manure Management Plan and State Regulations, University Park, PA, students 17.
• Oct 23 -24, Manure Management & Regulations, PA Equine Council Annual Meeting and Issues Forum, Penn State University, Ann Swinker, PhD, Equine Specialist presenter, attendance 43.
• Nov 24, EES Program, Tioga County Conservation District, Wellsboro, PA, attendance 20.



Map 1. Locations of Environmental Stewardship Programs (EES), Short Courses and Workshops (2012 to 2015)

Webinars, Technical Trainings, Expos, State/Regional/National Conference Environmental Programs

Starting in 2012, the team presented shorter versions of the EES short courses and/or adapted sections to accommodate variety of programs. These programs were offered to over 64,417 individuals. These presentations were part of larger equine events such as conferences, expos, open houses, trade shows and annual meetings:

- Ag Progress Days (equine participants 3,200, total event attendance 25,000 per year), http://agsci.psu.edu/apd
- PA Horse Council States' Issue Forums (attendance 60 per year)
- World Horse Expo at the Farm Show Complex in Harrisburg, PA (1,800 participants, total even attendance 35,000y per year.) http://www.horseworldexpo.com/PAmain.shtml
- Keystone International Livestock Expo, Harrisburg (1,500 per year).

Team members provided technical assistance to veterinarians, municipal officials, agency representatives, legislators and representatives of the seed and feed industry. Additionally, yearly over 34,146 individuals visit the Penn State University Extension Equine web site to view educational information, latest news articles and upcoming events.

Twenty-seven manure management plan writing workshops were held throughout PA. The course has been designed to help teach owners of equine operations how to prepare a manure management plan for their farm and understand and implement conservation practices to comply with Pennsylvania regulations. A total of 372 farm managers completed manure management plans for their farms and generated farm maps, documented pasture conditions, evaluated environmental risks associated with their farm manure storage and animal concentration areas, and determined acceptable manure spreading rates.

Two Pasture and Manure Management Field Days were held at Delaware Valley University. Team members worked with other agencies to partner on the field day, prepared marketing materials, set the agenda, trained interns to teach part of the field day, developed worksheets and educational materials, and maintained forage specimens for identification. Team also conducted programming out of state with the University of Rutgers Horse Management Conference in New Brunswick, NJ, presenting a workshop on Weed Biology and Management. During the Mid-Atlantic Nutritional Conference held in Maryland a workshop on Managing Weeds in Horse Pastures was presented by a team member. Also, a team member presented information on PA programs to Ag Experiment Station project 1441 members at the Multi-state workshop held at the Penn State University, the University of North Carolina, University of Vermont and the South Dakota State. In New York State a workshop on Equine Environmental Stewardship was conducted in Orange County and one also was conducted at Alfred University at the Bromeley-Daggett Equestrian Center, located at the Maris Cuneo Equine Park, in Alfred, New York. Fifty-eight staff/faculty professionals, students from Alfred University and Houghton College, along with area horse owners participated.

2. Renovation and Improvement of Pastures on Equine and Small Farm Livestock Operations.
The second project worked directly with farm operators to identify, evaluate, and implement pre-determined, environmentally sound strategies to increase pasture quality and canopy cover in

order to reduce the potential for sediment and nutrient loss to the environment. Extension education and project team members provided individual assistance to help all farm owners locate resources, technical assistance and funding for identified practices. The farm operations maintained horses, beef, sheep, alpacas, goats, and deer. Pastures chosen for reseeding had low forage yields and canopy covers less than 50%.The major obstacle that owners of equine operations and small farms faced was lack of equipment and tools needed to maintain high quality pastures.

Using funds from a USDA NRCS, Conservation Innovation Grant (CIG), two Esch drills were purchased and made available to managers of equine and small livestock operations that were enrolled in the CIG pasture improvement project. The drill, which is pulled behind the farmer's tractor or borrowed tractor, cuts a slit and places seed in the soil resulting in rows of new plants that are five inches apart.

132 farm operations, many who participated or completed the Penn State Environmental Stewardship Short Course, made contact to participate in the project designed to implement practices to increase canopy cover and desirable forages in pastures and reduce nutrient and sediment loss from farms. Ninety-five pastures were evaluated by the team for inclusion in the project. All pastures were soil tested and the % plant canopy cover and desirable plants were recorded prior to reseeding.

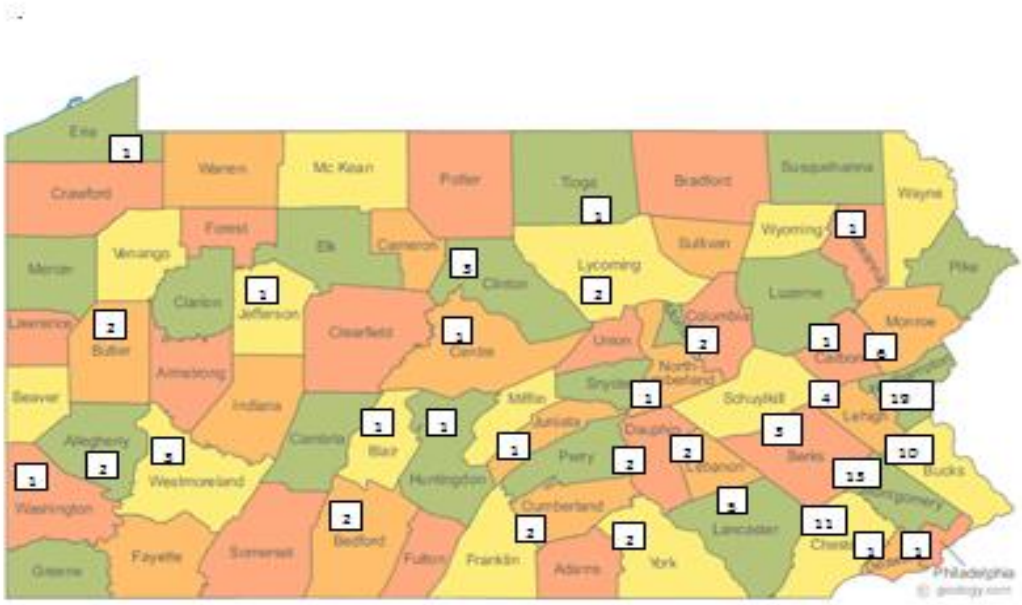
Of the 95 farms, representing 1086.90 acres, there were 48 farms totally 513.25 acres with pastures that did not need reseeding (Table 2). The farms that did not need reseeding, were able to improve pasture quality and improvement by the following year, by utilizing team member's recommendations for rotational grazing, mowing, reduced stock density, lime application, fertilization and weed control.

Table 2. Total Equine and Small Farms Visited by Project Team between 2012 through 2015

Farms visited	95 (See Appendix 4.)
Total farm acreage	1,086.90
Total Farm acreage not known	26 farms (leased, changes yearly)
Total Farm acreage that did not need reseeding	48 farms, total 513 AC (recommendations for rotational grazing, mowing, reduced stock density, lime, fertilization, weed control)

Ninety-five (n=95) farm managers were re-contacted by members of the equine team and farms were revisited (Map 1). The visits documented conservation and management practices, BMPs already in place on equine/animal operations and identify areas of concern and improvement. The research team finalized field farm survey instruments, quantitatively documented pasture plants and canopy cover, sampled feed, hay and soil, conducted nutrient management audits and documented conservation and farm management practices. Pasture data was collected using line point intercept and EPED methodology. Data included % canopy cover, % basal stem cover, % quality forage, % bare ground, and % herbaceous litter. All plant species were documented in the

target area. Pasture condition scores were also recorded for all pastures on the farms using and adjusted equine pasture condition score sheet.



Map 2. Locations by county and the number of farms visited by the project team members.

On the 43 farms that needed reseeded, one pasture on each farm was targeted for improvement, soil tested and prepared for no-till seeding or other methods to improve the pasture grass stands. Recommendations were discussed with the farm owner or manager. Twenty farms reseeded by use of the no till drill purchased through the grant. Seven farms had the ability to use their own no till drill and/or borrow a neighboring farm's drill. Eight farms reseeded, by utilizing conventional plow methods, due to topography that didn't accommodate the no till drill and/or thickness/height of existing forage coverage. Eight farms reseeded by broadcast or frost free seeding methods. This method was utilized in pastures that only needed to reseed sections of the pasture or had < 1 acre. In some cases the location of the farm did not provide space for large equipment, such as a no till drill and tractor, due to local roadway construction and/or insufficient gate entries into pastures. The team quickly realized that often equine farm operations were constructed without consideration of future accessibility for equipment to conduct necessary renovations and projects (Table 3). Pastures chosen for reseeding had to have low forage yields and canopy covers less than 50% in order to be in the no till drill program. After reseeding some of the pastures had yields increase to 1.0 to 2.0 tons per acre resulting in an economic gain that averaged $450 to up to $600 per tons per acre.

Table 3. Methods of Reseeding Used by the 43 Project Farms and Acreages Seeded

No Till Drill using purchased by grant	20 farms	176.3 AC
No Till Drill (owned or borrowed)	7 farms	277 AC
Conventional Plow method 8	8 farms	144 AC
Broadcast &/or frost free seeding	8 farms	65.25 AC

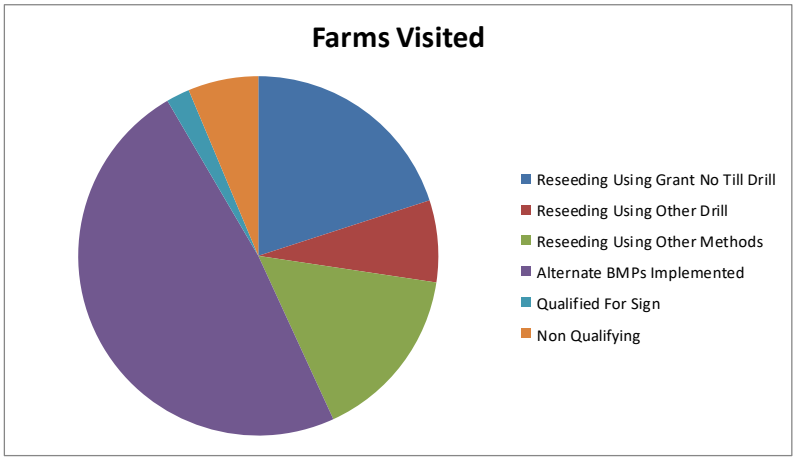
The Team noted that most farm owners are committed to adopting practices that maintain healthy horses, healthy farms, and a healthy environment, but do not have the knowledge, skills or equipment to implement practices. The Equine Team worked with each of the farms visited to select and implement one or more BMPs on pastures that were of concern. BMPs were chosen to increase pasture canopy cover and improve pasture quality by increasing perennial grasses and desirable forages. Practicing rotational grazing, utilizing sacrifice areas, soil testing and applying lime and fertilizers are BMPs farmers were encouraged to implement. Farms that decided to reseed pastures were provided with a seed mix that was custom blended for their farm, based on soil conditions, pasture needs and level of pasture use (see table 4).

Table 4. Seed mixes Used on the All Project Farms and Number of Acres Reseeded

649.55 acres - Standard Mix: 67.25% Potomac Orchardgrass, 9.99% Kentucky Bluegrass, 9.94% Savory Forage Tall Fescue, 9.74% Respect Forage Perennial Ryegrass
13 acres - Standard Mix with Clover: 23.75% Hulled Orchardgrass, 21.25% Kentucky Bluegrass, 19.60% Enhanced Brand Tall Fescue, 14.96% Troya Perennial Ryegrass, 14.93% Ladino Clover)
75 acres - Crop seed (cover crop, winter wheat, rye, corn)
7 acres - Special mix (5 acres straight alfalfa, 2 acres straight Bermuda Grass)

Map 3. Locations of the 20 farms that used the no-till drills (CIG grant) to re-seed

Figure 1. Showing all farms visited during the project and the action they took



Reseeding Using Grant No Till Drill - 19%
Reseeding Using Other No Till Drill - 7%
Reseeding Using Other Methods - 15%
Alternative BMPs Implemented - 46%
Qualifying for Environmentally Friendly Sign - 2%
Non Qualifying - 6%
*Percentages were rounded off, not mutually exclusive

3. Environmentally Friendly Farm Recognition and Marketing Brand

A third component of the project was to develop an "Environmentally Friendly Farm" program brand that will identify those farmers that meet pre-determined criteria to display and utilize the brand. A list of very specific criteria was established allowing farm owners to identify important environmental conservation practices that are practiced on their farms. The program encompasses a positive, non-regulatory approach that allows farmers to showcase what they already do well and add additional practices that will benefit the environment and their operation. Criteria may include, but is not limited to: Total exclusion of livestock from water ways *(Natural Resources Management Bullet 1.),* development of a precision feeding program, maintaining pasture canopy cover greater than 70%, utilizing rotational grazing and heavy use areas to prevent overgrazing, and implementing a manure management plan for the farm, which includes properly storing and applying manure based on soil nutrient levels and environmental risk factors. The branded signs and materials are used to market equine operations to potential clients that seek a healthy environment for their horses. The brand can also be used to identify the livestock operation that produce food and agricultural products using sustainable conservation practices and provides customer recognition for the farm. (*Natural Resource Management Bullet 1. and Program Outreach Bullet 3.)*

A team consisted of representatives of the PA Department of AG, NRCS, Conservation District, Cooperative Extension, local conservation organizations and owners of small livestock and equine operations was organized. The team:

- Developed the Environmentally Friendly Farm logo
- Developed the standards for use of the logo
- Developed press releases and brochures to market the program
- Developed materials to promote the program to the public
- Key personnel (with buy in from all agencies) are responsible for helping farm owners adopt practices that are necessary to display the logo, reviewing applications for logo use, visiting the farm to ensure compliance and awarding the Environmentally Friendly Farm designation. The participating farms are required to meet pre-determined criteria to be awarded this designation on an Environmentally Friendly Farm.

The Eco-Friendly Farm Recognition and Marketing Brand (third part of the grant project) title was changed to **"Environmentally Friendly Farm Recognition Program."** The Environmentally Friendly Farm Program identifies and rewards managers of equine operations that maintain an environmentally healthy farm. Farmers complete a farm-specific environmental assessment. When the information on the assessment is verified, farmers receive an Environmentally Friendly Farm sign and a logo that can be used on their website, brochures and marketing materials. This third part of the grant project did not begin formally until 2013. A lengthy review process of criteria was conducted where the representatives from the PA Department of Environmental Protection and the State Soil Conservation Commission reviewed program materials and together with the team developed criteria to be utilized in recognizing Environmentally Friendly Farms. These agencies provided help and support in promoting the program and verifying information supplied by farms on the application and assessment would meet regulations and were environmentally correct. To date, 8 farms are in the process to be

approved; 21 farms have filled out applications requesting this recognition. (See attached information on the thumb dirve.)

The Environmentally Friendly Farm Program identifies and rewards managers of equine operations that maintain an environmentally healthy farm. Farmers complete a farm-specific environmental assessment. When the information is verified, farmers receive an Environmentally Friendly Farm sign and a logo that can be used on their website, brochures and marketing materials. The Equine Team is proud to feature the few select farms as on-farm partners in the Penn State Environmental Stewardship Program on the PSU Extension Equine website. Farm owners had to be willing to have their management practices posted to the PSU web sites. (See Appendix 3.)

This part of the project is still in progress and will require more time to thoroughly activate program. The largest challenge was obtaining agency approval of the program's criteria and required BMBs to have in the farm assessments. In addition another challenge was having enough specialists from PSU and the agencies able to visit the farms for the agency assessments.

Highlighted on the web site are the Environmental Stewardship Farm Partners (http://extension.psu.edu/animals/equine/environmentally-friendly-farm-program/partners/pohopoco-creek-alpaca-farm)

Example of Promotion: *Pohopoco Creek Alpacas, located in Effort, PA has been recognized by Penn State Extension as an Environmentally Friendly Farm. The farm owners, Mary and Rob Baxter, have implemented and maintain environmental stewardship practices designed to benefit the environment, animals and community.*

Figure 2. Pohopoco Creek Alpacas, Effort, PA recognized as a Environmentally Friendly Farm.

Equine Pasture Evaluation Disc (EPED) User friendly model to quantitatively evaluate pastures developed by this team:
Pasture data were collected using line point transect methodology and/or the Equine Pasture Evaluation Disc (EPED). Data included percent canopy cover, percent basal stem cover, percent quality forage, percent bare ground, and percent herbaceous litter. All plant species were documented in the target area. (See attached EPED article)

Figure 3. Pasture Evaluation Disc (EPED).

The EPED is easy to use and provides accurate, random information from the entire pasture, the Equine Pasture Evaluation Disc (20 cm plastic flat spear) was developed to identify data collection points. The EPED is randomly tossed throughout the entire pattern by walking a W pattern. An arrow on the edge of the disc indicates the location that the data is to be collected. Only plants that touch the point of the arrow are recorded. This method of evaluating a pasture was easier for the equine operators who are not familiar with identifying specific forage species and enable them a method to obtain forage coverage percent for their operations.

What did the producer have to do differently to accommodate the project

What farm mangers were willing to do:
Producers all soil tested their pastures, corrected nutrient deficiencies, managed weeds, and selected appropriate forages prior to renovation. Participants all were required to have a plan to rest and rotate pastures to maintain pasture quality and canopy cover after renovations or reseeding. Farms that could not or were unwilling to rest and rotate pastures were not able to renovate pastures using project equipment. Pasture composition and canopy cover were documented quantitatively using line intercept methodology and pre and post pasture condition scores were documented *(Natural Resources Management Bullet 4.).*

Twelve farms constructed sacrifice lots to reduce grazing pressure on pastures; ten farms increased pasture rotation. One farm utilized an intensive rotational grazing system, moving horses on a 2 - 5 day schedule. Twelve farms followed a detailed management plan developed for their farm which provided weed control, fertilization and over seeding recommendations. Two farms adopted specific conservation practices by fencing stream corridors and constructing bioswales to intercept water from heavy use areas.

Four participants completed pasture renovation projects. Before renovation, pasture canopy covers ranged from 25% to 65% with 10% to 35% of the canopy composed of desirable forage. Three of the four renovated pastures produced canopy covers of over 98% with desirable plant populations exceeding 88%. The seeding on the fourth farm failed due to heavy flooding caused by two tropical systems. And this past year (2015) started out very wet and by July developed into a drought that lasted until late October.

The project's cooperating small farms were visited to evaluate the operation's environmental best management practices (BMPs) and provided site-specific recommendations; and were assisted with increasing pasture canopy cover. However, what was found on many of the horse farms, before renovation, was that pasture canopy cover was near 80%, which is acceptable to reduce erosion. However, only 50% of the canopy cover contained desirable forage grasses or legumes. The remaining 30% consisted of summer annuals and perennial weeds. On one of the farms, after reseeding the pasture, conditions improved with vegetated cover increased from 80% to 100% with 98% of the cover consisting of perennial plants that can provide erosion protection in winter and early spring. The concentration of forage that supplies nutrition for the horses increased form 50% to 94%.

The Equine Team and farm operators faced challenges in renovating pastures and implementing BMPs, for weather conditions and effects often dictated the abilities of renovations. During one year of the project, the season started out extremely wet and rainy, making reseeding and innovations difficult. Then by July this same region was affected by a drought and extreme dry spell that lasted until late Oct. Farms that had been reseeded lost seedlings due to excess and/or lack of water, with all renovations being redone the following year.

Information taken from the written surveys reported that 67% of farm managers incorporated the suggested practices into their operations. The remaining 33% reported that they wanted to utilize the suggested practices, but required financial assistance or more technical information. (Profile of Pennsylvania equine industry's environmental impact and best management practices. J. of NACAA, 6 (1), 2013. ISSN 2158-9429) (See Appendix 1.)

Collaborations:

Agencies, such as Conservation Districts, USDA Natural Resources Conservation Service, and Cooperative Extension have not traditionally worked with equine operations and often lack the manpower and training to work with the equine industry. Additional stakeholders for educational programming include NRCS, Conservation District representatives, veterinarians, agricultural service providers, and municipal officials that implement land use regulations.

To help these professionals understand the horse industry, the team prepared teaching materials (PowerPoint presentations, fact sheets and worksheets) which have been made available to Extension, Conservation District, NRCS, and agricultural industry personnel to assist them in helping horse farm managers complete their manure management plan. The team offered 6 trainings "Horses 101" of 3 hours accredited educational program designed to teach agency staff about the horse industry and how to select and implement workable BMPs that apply to equine

operations. "Horses 101" is supported by a grant from DEP and the State Conservation Commission. The PSU Equine Team scheduled, advertised and taught four "Horses 101" trainings which were attend by 195 agency staff.

One team member was asked to teach a workshop on "Choosing BMPs that Work for the Equine Industry" for 97 Conservation District staff at their annual employees in-service meeting in State College PA. Many horse farm operators have little or no agricultural background and lack the basic knowledge and skills necessary to make good environmental management decisions. When these farm owners contact the Conservation Districts for assistance they expect to have the visiting conservation staff member familiar with the needs of equines. Few Conservation District staff has any equine knowledge or background. Therefore, this workshop benefited the Conservation District staff members by helping them understand the unique health and managing issues the owner must also consider when they are implementing environmental practices for their farm operation.

The PSU Equine Team works directly with an advisory group (established in 2012), which includes farm managers and members of the PA Department of Ag, DEP, the State Conservation Commission, District Conservation Offices and PA-NRCS. Several of the Environmental Stewardship Workshop Courses were requested and co-hosted by the above agencies as a result of their involvement in the advisory group. Working together and sharing information at advisory group meetings enables both the team and agency representatives to have a more collective and practical approach understanding and helping equine farm owners.

Summarize what worked, what didn't work, and why.

Smaller farm operators reported that a major hurdle to renovating pastures is lack of knowledge and lack of equipment. We purchased two smaller 5 foot no-till drill that are designed for small acreages and can be pulled with a 35 to 40 horse power tractor. Cost will still be a factor since most farms will not pay for a piece of equipment that they will not repeatedly use. The equine farm operators had little or no knowledge on using equipment such as the no till drill or operating tractors, therefore the PSU Equine Team had to be present at the farms to assist in reseeding efforts. In many cases the team had to provide the tractor to pull the no till drill, for the farm operators did not have tractors over the size of an ordinary lawn tractor or the knowledge to operator/program either piece of equipment. Conservation districts did not want to be involved in owning or renting equipment due to liability and cost issues. Therefore, the PSU Equine team considered options available for equine farmers in locating sufficient equipment to do reseeding and other land improvements on their farm operation. The team decided to focus on researching equipment options and adaptions to meeting the farm management system.

The team has 20 farms that requested our help with no-till seeding of pastures. These farms have completed the preparation recommended to assure successful germination and pasture grass stands and they are willing to keep animals off the pasture for the required time needed for forage establishment. The team's biggest challenge is the lack of farmer's equipment (tractors size, type of and working hydraulics) and manager/operational agricultural skills. The team will have to utilize expertize from other Penn State Departments and personal to keep this part of the

project on track. This part of the project needed at least one additional growing season to accomplish its original objects, due to the challenges and weather constrictions that occurred.

The team continues to evaluate cost effective equipment that already is available on some farms or can be reasonably purchased. Equipment includes drags, harrow, discs, and cone spreaders. Analysis of comparison of seeding and reseeding on farms using the no-till drill versus alternative cost effective adaptions and equipment needs to be evaluated. Farms will evaluate the equipment for ease of use, time involved in reseeding pastures, cost effectiveness, and stand viability. This still need to be evaluated.

The first two year's fall seasons (during the project) have not been easy on reseeding; due to floods or droughts in certain areas of the state. The summer drought and 2011 fall floods have had a real impact on the research field farm pasture reseeding project. In 2013 central PA had several flooding with some of the demonstration farms having to be reseeded several times in order to re-establish pasture stands. A multi-agency partner demonstration area was developed for public viewing and hands on involvement at the annual Ag Progress Days Event held in Rock Springs, PA. The technical partners on the project included Penn State's College of Agricultural Sciences and Extension, Pennsylvania Grazing Lands Coalition, PA Capital RC&D, the USDA Natural Resources Conservation Service (NRCS) and the Agricultural Research Service. The first year of the partnered project was affected by the diverse weather conditions in 2013 and basically failed as what the project was intended to demonstrate and that was displaying rotational grazing and preferred forage species for equine (http://agsci.psu.edu/apd/news/2013/new-ag-progress-days-demo-will-help-producers-maintain-livestock-on-pasture-areas). The partners still had the demonstration area available for viewing at the 2013 event and used the failure as an educational lesson on how nature can make seeding, over seeding and reseeding difficult. In the following year the demonstration area was re-seeded twice and after the additional growing season the original objective of the demonstration area was successful and utilized in the 2014 Ag Progress Days event. This demonstration will be utilized again in 2016.

Due to these weather related situations that affected the PSU Equine Team's ability to successful stay on track with the project goals and assessments, the team requested a no-cost extension on the CIG grant. The extension was granted due to recognition of the external factors, such as natural disasters, drought, weather extremes, economy and governmental regulations, which were affecting or had affected the abilities of the team to successful accomplish grant goals and outcomes.

The PSU Extension Team felt that this grant project led to some final outcomes, impacts and conclusions concerning PA state policies, regulations and required BMPs on equine operations.

- The team has indirectly affected all Pennsylvania horse owners by conducting research that is being used to establish farm policy and regulations.

- Team members were selected to serve on the PA Grazing Lands Coalition, the State Conservation Commission's Nutrient Management Advisory Committee, State Conservation Commission's Odor Management Advisory Committee, PA Forage Grasslands Council and the Pa Farm Bureau's Manure Manual Review Team.

- Team members have provided technical assistance to agency and legislative representatives initiating nutrient regulation revisions. The data collected on project farms was utilized to revise horse manure nutrient levels, served as a baseline data for the DEP Manure Manual, and was used in the PA Agronomy Guide, animal body weight tables.

What would be done differently if this project were started today?

- We were unaware that many of the farms were not equipted with their own tractors or were unable to operate implements suchas a no-till drill. We would have hired an operator with the grant.

- We needed to purchase a truck and trailer to transport the drill to distant location.

- The farms that showed an marked improvement in pasture grass canopy cover it would be nice to go back and measure soil health and the organic matter of that soil a few years later.

- We needed to conduct nore educational programming efforts in the western part of Pennsylvania.

- With the Environmentally Friendly Farm Program we should not have included so many agencies in the development of the required criteria.

Discussion of Quality Assurance

Program Evaluation analysis, qualiity control etc.

The Environmental Stewardship Short and other workshops had the following evaluation studies completed: Before-After (before and after program), Retrospective (post program), After Only (post program), During (during program) and Case Study. (See Appendix 2. evaluation samples)

Evaluation Results, based on program evaluations and information obtained from industry surveys, exhibits a strong need to continue to offer programs that address environmentally and economically sustainable farm management practices and issues dealing with equine health and well-being that will affect abilities to provide environmental improvements to operations. Horse owners have cited that their lack of information, knowledge and funding as major barriers to implementing best management practices.

Evaluation and questionnaire surveys were completed, with a 20% response rate. Data was transferred from SurveyWriter.com or Survey Monkey into a numerical data set using Excel 2007 (Microsoft Corp., Redmond, WA). Following the transfer, data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL) for descriptive statistics. Frequencies and percentages were determined for all responses. Cross tabulations were used to determine the relationship between management practices and farm management demographics.

Project site description, characteristics, rationale for locations

A total of 43 farms, with 513.3 acres volunteered for reseeding of farms that housed horses, beef, sheep, alpacas, goats, and deer. The farms were located in Northampton, Lehigh, Carbon, Centre, Dauphin, Bucks, Lycoming, Huntington, Monroe, Philadelphia and Montgomery Counties in PA. One pasture per farm was chosen for reseeding. The farm had to have low forage yields and canopy covers less than 50% to qualify and had to be willing to keep the grazing animals off the pasture until grasses fully recovered or were established, in order to be considered for the project. The farm had to be willing to do pre-seeding preparation, such as soil testing, liming, fertilization, and address weed control. The farm operators had to be willing to plant the pasture seed mix recommended and developed by the project team specifically for their farm and be willing to pay for any additional costs not covered under the grant's specifications for reseeding.

Sampling procedures

The farm visits documented conservation and management practices, BMPs already in place on equine/animal operations and identified areas of concern and needs of improvement. The research team finalized field farm survey instruments, quantitatively documented pasture plants and canopy cover, sampled feed, hay and soil samples, conducted nutrient management audits and documented conservation and farm management practices. Pasture data was collected using line point intercept and EPED methodology. Data included % canopy cover, % basal stem cover, % quality forage, % bare ground, and % herbaceous litter. All plant species were documented in the target area. Pasture Condition scores were also generated for all pastures on the farms using pasture condition score sheets.

Calibration of filed equipment

The project purchased two 5- foot no till drill (Esch, Lancaster, PA) to take to farms to increase successful pasture renovation by use of no till drilling. The drill need to be re-calibrated for the specific seed and location at each farm. No-Drill calibration was done by following the recommendations of the manufacturer.

Findings

Outreach

As a result of completing the EES short course participants reported adopting at least two BMPs strategies to improve farm conditions; 74% planned to add stress lots to reduce grazing pressure; 72% planned on renovating pastures; 86% planned to apply nutrients based on soil testing results; 66% planned to develop a manure storage facility; 80% planned to contact agencies for assistance; 100% worked on farm's Manure Management Plan. Participants indicated, after course completion; 90% had a large increase in knowledge on forage biology/growth, how to renovate pastures; identify forage species, properly store/utilize manure, how nutrients affect plant growth/how to apply nutrients based on a soil testing report, weed identification, and who to contact for assistance with pasture and nutrient management planning questions.

Changes in pasture over the project period

It was estimated that after reseeding, several farms pasture forage yields increased to 1.0 to 2.0

tons per acre resulting in an economic gain that averaged $450 to $600 tons per acre.

Research
The equine farm's participation in the program has demonstrated to the equine industry agronomic and environmental benefits. Information gathered from the team's research generated several scientific publications, abstracts, and presentations at national meetings, several popular presses, tread magazine and social media articles. Results of the information gathered in the team's program has been used and examined by state regulatory agencies assisting the agencies in developing and revising potential regulations and assistance concerning equine farm operations.

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PSU DAS web site; http://www.das.psu.edu/research-extension/equine/adult-education Environmental stewardship Project and Equine Science Newsletter websites. Site is visited by 6,020, subscribers 540, and forwarded to an additional 1,500 email addresses.

Federal eXtension web based internet program, USDA-Extension, Horse Quest-National Equine Resource Team. (Swinker serves as the National chair for the Pasture Management Section of the Equine Community of Practice, Pasture committee and chair for the Stewardship Section) eXtension is a national interactive learning environment delivering Web site.

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Conclusions and Recommendations

In general most of the small farm operations an equine farms managers wanted to do the right thing and in most cases were not aware of what the right thing was. This population works really hard to assure that there animals are kept healthy. So we took the approach of "healthy horse - healthy environment." This approach was well received with this audience.

It was apparent that this audience was easier to encourage attending face-to-face meetings. They enjoyed attending the meetings and the interaction that they received with other producers. Most of these farm owners were unaware that what they were doing with… overgrazing, not using sacrifice lots, not properly managing manure was an issue.

Most of the farm managers that we worked with were very naïve and really did not have a good understanding of agriculture practices. Farm owners were not aware that animals needed to be removed off of the pasture in order for the pastures to recover and that animals need to be removed in some cases up to one year after renovation. The farm visits documented conservation and management practices, BMPs already in place on equine/livestock operations and identified areas of concern and improvement. A lot of the equine facilities were unaware that they were using best management practices on pastures or conduct manure management; they just wanted the farms to look good.

We noticed regional differences across the state of Pennsylvania not only with attitudes but also on their ability to know where to go to receive help. Some of the farm managers in the eastern part of the state were unable to locate anyone to help them with bringing in equipment to help them reseed their pastures. However, many of the people in the central to western part of the state were aware of farmers nearby they could hire that had the required equipment to help properly manage their pastures. Several of the farms that were visited did not require reseeding.

After farm managers began utilizing the recommended the best management practices they begin seeing improvement to pastors enough that they did not need to be reseeded. Many of the property owners, without equipment, were willing to use a pitch fork and wheel barrel to remove manure from pastures. Most farm managers were willing to work hard at these improvements.

The farm owners are committed to adopting practices that maintain healthy horses, healthy farms, and a healthy environment. Each of the farms listed worked with the Equine Team to select and implement one or more Best Management Practices (BMPs) on their farm. BMP's were chosen to increase pasture canopy cover and improve pasture quality by increasing perennial grasses and desirable forages. Practicing rotational grazing, utilizing sacrifice areas, soil testing and applying lime and fertilizers are BMPs farmers were encouraged and adopted. Farms that decided to reseed pastures were provided with a seed mix that was specifically custom blended for their farm based on soil conditions, farm management, pasture needs and level of use. A large number of farms did not meet the Environmentally Friendly farm criteria, due to insufficient BMPs on their operations and difficulties in coordinating the multi-agency support and assessment agencies that were to evaluate, assess and approve the farm operation as an Environmentally Friendly Farm. But they can try again after implementing future BNPs.

Several of our specialists recommended using Roundup herbicide to control annual weeds such as crabgrass, which extended the abilities to incorporate reseeding for that current year and moved reseeding into the following growing season. The team tried a new approach by waiting for the annual weeds to die down in the middle to late September then re-seeding with the drill that fall. This practice resulted in successful establishment of good stands of forage for the following year. The same approach was used on ragweed resulting in the same success rate of establishing desirable forage pastures for the following year.

The team recommends incorporating more agency personal in the teaching, conducting and education the equine owners through Environmental Stewardship workshops and programs. The team feels there is a continual need to include during the workshops and short courses educational assistance in understanding and completing the Pennsylvania's Manure Nutrient Management Plan Regulations. Verbal assessment at programs conducted during this grant period revealed that most equine farm operators are unfamiliar with manure management regulations that are in PA and are not as knowledgeable of programs for assistance as are the other more traditional livestock operations. This is partly due to the fact that equine only recently were considered by regulating agencies as part of the livestock population and also, due to the fact many horse operations exist as more "pleasure/pet" type operations.

The team discovered that most farms did not have tractors big enough to pull no-tills seed drills, and conservation districts did not want to be involved in renting them, therefore the team decided to focus on availability of smaller more friendly equipment options for equine operations. Options are being investigated with companies, programs and agencies where adaptions and alternative methods could improve the abilities of equine operations in addressing environmental issues more affectively.

Several farms have requested the team's help with no-till seeding of pastures for this spring and next fall (2016). These farms have completed the preparation recommended to assure successful

germination and pasture grass stand. They are willing to keep animals off the pasture for the required time needed for establishment. The biggest challenge is the farmer's lack of equipment of adequate tractor size, type of and working hydraulics to enable use of no till drilling, pasture preparation and maintenance, along with the farm operator's lack of agricultural skills and knowledge on farm systems and procedures. The team found it necessary to utilize expertize from other Penn State Departments and personal to keep the project on track for during the grant period and for future endeavors. Due to this lack of skills, knowledge and equipment availability, this project needed an additional growing season to accomplish its original goals.

To accommodate the vast geographically need of assistance across the state and the lack of available staff to visit farms or conduct workshops and short courses, the team suggests that on-line webinars be offered to equine owners across the state. On-line webinars would provide a means for these operators to learn on their schedule and from the comfort of their home. The PSU Equine Team is in the process of developing these types of on-line webinars, but need additional financial support and available staffing to accomplish these goals. In the meantime, the team continues to work to help farm mangers do the improvements such as; soil testing, weed control, liming, fertilization, rotational grazing, cross fencing, animal sacrifice areas (ACAs) and other preparations needed before they can reseed their pastures.

Appendix 1.

Journal of the NACAA

ISSN 2158-9429
Volume 6, Issue 1 - May, 2013

Profile of Pennsylvania Equine Industry's Environmental Impact and Best Management Practices

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ABSTRACT

Proper management of equine operations requires the adoption of Best Management Practices (BMPs) to balance nutrient production and prevent erosion. Government agencies are concerned about non-point sources of water pollution and have focused on equine operations. Many state's laws regulate equine farms requiring farm managers to incorporate BMPs. BMP utilization on horse farms needs to be quantified before regulations are adopted. The objectives of this survey are to quantify and assess the use of the equine industry's BMPs in pasture management, erosion control and examine any potential environmental impacts. A 37 question online survey (Survey Writer LLC, Chicago, IL) was designed. A list of 1817 email addresses was developed, consisting of horse farm managers from Pennsylvania. The surveys resulted in a 20% response rate. Data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL). Most operations were used for recreational purposes (65.7%) and 34.3% for business. Respondents housed 8.1 ± 1.9 horses on 21.3 ± 1.8 ha (52.7ac) of pasture (businesses reported a mean of 13.4 head / year). An average of 1.5 ha (3.8 ac) were dedicated to heavy use areas. In this study horse farms reported that during winter months 28% of horses were on pastures 24 hours/day. During the growing season,

in the spring months 38.6% of horses were turned out on pasture 24 hours/day; in the summer 45%; and in the fall 43%. During winter (32%) and spring (25%) months horse farm managers used limited turn out periods of 6 but no more than 12 hours/day. This grazing strategy is ideal for horse boarding stables or small properties to limit grazing. Almost half (49.8%) indicated they have never performed soil fertility tests on their pastures, with 25.4% testing soil every 1-3 yrs. Farms reported applying seed to pastures when needed (27.8%), while 24.9% never having applied seed to their pastures. Most farms (96.2%) mowed pasture on average 4 times per year to control weeds. Approximately one third of farms, composted manure and used it on the farm. Horse owners (52.3%) reported storing manure on unprepared sites. One third of farms never apply lime to pastures, 17.3% applied lime according to soil test results. Approximately, 13% reported their operation has an Agricultural Erosion and Sedimentation Plan or current Conservation Plan dealing with soil erosion and animal heavy use areas. Only 22.7% reported having a Manure Management, Pasture Grazing or Nutrient Management Plan for their operation. More research and education is needed to assess the effect of horse farm management on Mid-Atlantic water quality.

Keywords: equine, environment, BMPs, pasture, manure

Introduction

States located in the Northeast region have reported horses are the fastest growing segment of the livestock industry. Nationwide, equine has increased by 77% since 1997; and it is reported there are approximately 9.5 million horses in the United States (AHC, 2005). Pasture is a good source of nutrition and 94% of U.S. equine operations allowing horses to graze pastures (USDA, APHIS: VS, 1998). Proper management of equine operations requires the adoption of Best Management Practices (BMPs) to balance nutrient production and prevent erosion. Government agencies are concerned about non-point sources of water pollution and have focused on agriculture, including equine operations, as a major contributor to water quality issues. Many state's laws have regulated equine farms requiring farm managers to incorporate BMPs. BMP utilization on horse farms needs to be quantified before regulations are adopted. The objectives of this survey are to quantify and assess the use of the equine industry's BMPs in pasture management, erosion control and to examine potential environmental impacts. Few studies have investigated horse BMPs in the region (USDA: APHIS: VS, 1998; Westerdorf, 2010; Swinker et al., 2011 and Fiorellino et al., 2013). More research is needed to assess the effect of horse farm management on Mid-Atlantic water quality.

Materials and Methods

A 37 question online survey (Survey Writer LLC, SurveyWriter.com, Chicago, IL) was designed. A list of 2,363 names and email addresses was developed, consisting of horse owners/farm managers from Pennsylvania and surrounding states. The survey opened on 12/10/10 and closed 1/1/2/11. The email included survey information and a link to the survey. One follow-up reminder was sent to non-responding addresses. Undeliverable addresses (508) and 38 people who no longer owned horses were removed, resulting in a total of 1817 addresses. A total of 373 surveys were completed, with a 20% response rate. Data were transferred from

SurveyWriter.com into a numerical data set using Excel 2007 (Microsoft Corp., Redmond, WA). Following the transfer, data were analyzed using SPSS 16.0 (SPSS Inc., Chicago, IL) for descriptive statistics. Frequencies and percentages were determined for all responses. Cross tabulations were used to determine the relationship between management practices and farm management demographics.

Results

The majority of owners (82.6%) housed their horses at a self-owned facility, 13.4% boarded. Nearly 74% were women and 26% were men. Participant's mean age was 50 years old with 52.4% over the age of 51. Primary use of horse farms was recreational (62.2%), boarding (13.6%), breeding (6.8%), training (5.6%), rescue/retirement (4.6%), lessons (3.4%) and other (3.8%). Most operations were used for recreational purposes (65.7%) and 34.3% for business (Table 1). Respondents housed 8.1 ± 1.9 horses on 21.3 ± 1.8 ha (52.7ac) of pasture (businesses reported a means of 13.4 head / year). For all farms, an average of 1.5 ha (3.8 ac) were used for heavy use areas (barns, rings, holding areas etc.).

Table 1. Primary use of the horse farms in the survey

	Count	%
Boarding	**44**	**13.6%**
Breeding	**22**	**6.8%**
Training	**18**	**5.6%**
Lesson Program	**11**	**3.4%**
Pleasure/Recreation	**201**	**62.2%**
Retirement/Rescue	**15**	**4.6%**
Therapeutic Center	**6**	**1.9%**
Other	**6**	**1.9%**
Total	**323**	**100.0%**

As many as 65% of horse farms have reported using a rotational pasture system, 38.6% have a pasture management plan and 25% continuously grazed horses. Only 23.8% allowed pasture to recover to a recommended grazing height and 45.3% reported sometimes resting pastures. Most respondents (75.4%) assessed their pasture vegetative cover at 80% or better, 5% reported poor vegetative cover, and 1.9% reported utilizing bare ground. Most (54%) reported not using sacrifice loafing lots (non-grassy areas) on their property. The remainder used sacrifice lots for confinement during inclement weather or drought (68.1%), to control consumption of grass (61.1%), used to grain feeding and to control exercise (31.9%). Uses were not mutually exclusive. As outlined in Table 2 the reasons listed describe why farm managers using sacrifice or dry lots for horses.

Table 2. Reasons horse farm managers use sacrifice or dry lot		
	Count	%
For feeding controlled exercise	46	31.9%
Confinement during inclement weather or drought conditions	98	68.1%
Protect from over grazing	98	68.1%
Control horse consumption of grass	88	61.1%
Other	15	10.4%
Total	144	239.6%

It is estimated horses spent from 10 to 17 hours per day grazing or about 40 to72% of a 24-hour period (Henning et al., 2000). The goal of any pasture system should be to maximize yield and protect pasture grasses. Grazing should be managed year round to keep both the grass and animals healthy. This study shows the pasture systems and the amount of time horses were turned out on pastures, as reported by horse owners through the seasons (i.e., Tables 3 and 4). Continuous grazing systems require management in order to maintain minimal environmental impacts. In this study (Table 3) horse farms reported that during winter months 28% of horses were on pastures 24 hours/day. During the growing season, in the spring months 38.6% of horses were turned out on pasture 24 hours/day; in the summer 45%; and in the fall 43%. Continuous grazing systems utilize less available forage than those that implement rotational grazing systems (Henning et al., 2000).

Limited turn out allows the horse daily access to pasture for shorter periods (1-hour to less than 24 hours per day). In this study, the majority of horse farm managers used limited turn out periods of 6 but no more than 12 hours/day, throughout all seasons (i.e., table 3 and 4). This grazing strategy is ideal for horse boarding stables or small properties. This system gives every horse some grazing time and is ideal for horses with laminitis or other disorders related to grazing.

Table 3. The hours (6-24 hours) per day horses spend turned out on pasture by season						
	24 hours continuous		Less than 24 more than 12		Less than 12 more than 6	
	Count	%	Count	%	Count	%
Winter	89	27.8%	60	18.8%	103	32.2%
Spring	123	38.6%	72	22.6%	80	25.1%
Summer	143	44.8%	94	29.5%	59	18.5%
Fall	138	43.1%	87	27.2%	64	20.0%

Table 4. The hours (0-6 hours) per day horses spend turned out on pasture by season

	Less than 6 more than 3		Less than 3		No pasture turn out		Total	
	Count	%	Count	%	Count	%	Count	%
Winter	28	8.8%	13	4.1%	27	8.4%	320	100.0%
Spring	28	8.8%	13	4.1%	3	.9%	319	100.0%
Summer	18	5.6%	4	1.3%	1	.3%	319	100.0%
Fall	22	6.9%	8	2.5%	1	.3%	320	100.0%

Nearly half of horse farm operators (49.8%) indicated they have never performed soil fertility tests on their pastures, with 25.4% testing soil every 1-3yr and 24.8% allowing more than 3 yrs. between tests. Most (36.5%) farms never apply lime to pastures, 17.3% applied lime according to soil test results and the majority 46.2% sometimes applied lime with or without test results. Farm operators reported regularly applying seed to pastures when needed (27.8%), applied seed when it was sometimes needed (47.3%) and never having applied seed to their pastures (24.9%). Most farms (96.2%) mowed pasture on average 4 times per yr. to control weeds. When asked to describe the use of herbicide (weed control) in your horse pastures; 8% regularly used, 25.5% sometimes used, and 62.5% never used herbicides.

Methods participants used to manage manure were composting and using that compost on the farm (34.1%), hauled off the farm fresh (10.9%), spread fresh on crop/pasture fields daily (10.6%), composted and hauled off farm (7.7%), horses pastured 24 hrs./day with manure harrowed or removed (16.4%), horses pastured 24 hrs./day with manure never managed (7.1%), manure collected and stored (6.1%), commercial contractor removes manure from property (2.3%) and other (4.8%). Manure within sacrifice areas was either removed on a daily or weekly basis (55.9%), occasionally removed (33.3%) or never removed (10.8%). Horse owners (52.3%) reported storing manure on unprepared sites and 36.3% stored manure on a hard packed or paved surface. Only 4.3% of horse owners stored manure in a constructed, covered compost facility and 7% covered stored manure in piles. Most manure storage sites (85.4%) were greater than 45.7 m (150 ft.) from surface water, while 2.2% were less than 15 m (50ft).

Most horse farms (51.3%) did not have surface water on their property. Of the farms with surface water, 21.7% were restricted by fencing horses away from water, 8.3% controlled access for drinking/crossing; while 18.8% allowed horses unlimited access to surface water.

Approximately, 13% reported their operation has an Agricultural Erosion and Sedimentation Plan or current Conservation Plan dealing with soil erosion and animal heavy use areas. Only 22.7% reported having a Manure Management Plan or Nutrient Management Plan for their operation. When asked about soil erosion in pastures 2.9% reported obvious soil erosion and 25% indicated some was present. The majority of horse operations (76.3%) had some rainwater runoff systems to divert runoff or for a collection systems on barns and sheds; while 23.7% reported having no rainwater runoff control.

Nearly all survey respondents (93%) reported having some pasture and nutrient management questions. Resources participants used for information included books, magazines, publications (79.4%), internet resources (79.1%), knowledgeable acquaintances (65%), agencies, extension, NRCS, conservation district, etc. (60.5%), multi-media (27.8%), private businesses or companies (15.7%) and 2% reported using none, see Table 5. Participants indicated that the primary limitation to them altering current management practices was finances (75%), knowledge (37.5%), regulations (13.7%), and an inability to obtain services (11.7%).

Table 5. Information resources use by equine farm operations

	Count	%
Books, magazines, publications	**243**	**79.4%**
Multi-media resources	**85**	**27.8%**
Internet resources	**242**	**79.1%**
Agencies: Extension, District Conservation Offices, Departments of Agriculture, Natural Resources Conservation Service, etc.	**185**	**60.5%**
Private businesses or companies	**48**	**15.7%**
Knowledgeable acquaintances	**199**	**65.0%**
Other	**24**	**7.8%**
None	**6**	**2.0%**
Total	**306**	

Discussion

Knowledge of the current scope and nature of equine industry management practices are important when developing regulations and laws that will govern land management on equine operations. Recently, several state environmental regulations are having a direct impact on equine operations. In some states horse operations have not been eligible for cost-share funding in the past and have not been regulated directly. But horse farms are expected, by state agencies, to incorporate costly environmental BMPs into the management of their farms. In Pennsylvania, under revised regulations, concentrated equine operations fall under Act 38, Pennsylvania Nutrient Management Regulations and are required to have a certified nutrient management plan for the farm (operations with 8 Animal Equivalent Units (AEUs) housed on high density acreages of 2 AEUs or less per acre). However, horse farms frequently manage horses on fewer acres per animal unit and have the potential to pose a significant environmental risk (State Conservation Commission, 2006).

This data shows that many horse farms are utilizing BMPs to help reduce environmental impact. However, there are several areas, such as soil testing and the use of sacrifice loafing areas in pasture management, where educational programming and cost share funding is needed to target specific BMPs underutilized by the equine industry. In order to help stable managers understand the principles of sustainable best management practices, Cooperative Extension can conduct state-wide "Environmental Stewardship Short Courses." These educational programs need to be a comprehensive series of educational programs (face-to-face meeting or webinars) to promote adoption of best management practices on equine operations. This study showed nearly, 80 percent of this audience is receiving most of their educational information from publications, magazine articles and the internet. So, Extension needs to reach horse farm managers with what we do best, factsheets, popular press articles and meetings.

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ACKNOWLEDGEMENTS
USDA, NRCS-CIG grant for funding this project. In addition the Agencies that have provided personnel and support: PA Equine Council, USDA Natural Resources Conservation Service, State Conservation District, Penn State University Extension and PA Dept. of Environmental Protection.

Appendix 2.

Equine Environmental Stewardship Short Course

In order to help us evaluate the success of this conference and plan future programs, we would appreciate it if you would complete this evaluation.

Part I. Pasture Management

Please rank each of the following items, on a scale of 1-4 to reflect your change in knowledge as a result of attending this session.

	1 Very large increase	2 Large increase	3 Moderate Increase	4 No change
The importance of forage and pastures for equine nutrition and health.				
Forage growth and sugar and carbohydrate production and storage				
The importance of resting paddocks to allow forages to recover from grazing.				
How to determine pasture stocking rates.				
How to design rotational paddocks and stress lots.				
How to choose the right forage species for your farm situation.				
How to over seed and renovate your pastures				
How to identify pasture forages.				
The differences in managing annual and perennial weeds				
How to manage pasture weeds culturally, mechanically and chemically.				

How to evaluate the quality of pastures.				

For the following statements, please check:
A. For all the actions that you were already completing before attending the course.
B. For all the actions that you plan to complete over the next two years.
C. For all actions that you do not plan to complete.

Action:	A	B	C
Add additional paddocks and/or split existing paddocks in order to rest paddocks.			
Add a stress lot to help rest pastures.			
Reduce turn-out time when pastures are stressed by warm temperatures or lack of rain.			
Eliminate turn out when pasture are muddy and grasses are just staring to grow.			
Mow pastures regularly at the proper heights.			
Inventory forages in your pastures.			
Inventory weeds and toxic plants in your pastures.			
Reduce weeds using chemical herbicides.			
Manage turn-out time to reduce risk of high sugar and starch levels for metabolically challenged horses.			
Renovate pastures to thicken the stand.			
Renovate pastures to introduce new varieties of forages.			
Evaluate you pastures using the PA Pasture Condition Score Sheet			
Determine canopy cover and the % of the pasture that is composed of desirable plants using the EPED.			

Other – please fill in			

Part II. Managing Manure and Nutrients

Please rank each of the following items, on a scale of 1-4 to reflect your change in knowledge as a result of attending this short course.

	1 Very large increase	2 Large increase	3 Moderate increase	4 No change
Threat that manure nutrients create for aquatic systems				
The nutrients that are in manure and benefits they can provide for pastures.				
How much manure a horse produces?				
What levels of soil phosphorous are optimum and how much is excessive?				
How to properly compost manure.				
How to properly store manure.				
How to decide when, where, and how to spread manure.				
What farms are required to have a nutrient management plan				
What farms are required to have a manure management plan?				
Options available to dispose of manure.				
How to collect soil samples for analysis				
How nutrients effect plant growth and health.				
How to apply the correct fertilizer based on soil test reports.				
Who to contact for assistance with				

pasture and nutrient management planning				
How to reduce the amount of nutrients in your horses' ration and manure.				

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For the following statements, please check:

A. For all the actions below that you were already completing.
B. For all the actions that you plan to complete over the next two years.
C. For all actions that you do not plan to complete.

Action:	A	B	C
Contact Penn State Cooperative Extension Cooperative Extension for additional assistance with pasture or nutrient management planning			
Contact the Soil Conservation District or NRCS for additional assistance with pasture or nutrient management planning.			
Have a nutrient management plan written for your farm.			
Have a manure management plan developed for your farm.			
Conduct soil tests on your farm.			
Apply fertilizer to your pastures based on soil test recommendations.			
Apply manure to your pastures based on soil test recommendations.			
Properly compost manure on your farm.			
Develop a properly sited manure storage facility.			
Contract with a commercial hauler to remove all manure off site.			
Develop a plan to reduce nitrogen and phosphorous in your horse's nutritional program.			
Other – please fill in			

Appendix 3.

August Moon Farm

August Moon Farm, located in East Nottingham, Chester County, PA, has been recognized by Penn State Extension as an Environmentally Friendly Farm.

The farm owners, Kathe and George Allen have adopted and maintain environmental stewardship practices designed to benefit the animals, environment, and community. The Allen's have dedicated their lives to providing the very best care for their horses and show the same level of commitment in caring for the land.

George and Kathe have an extensive history with horses. Kathe began riding at 4 years of age on her father's 150 acre farm in Upper Mount Bethel, Northampton County, PA. George became involved with horses while working at Cook College, Rutgers University. This interest led to the purchase of a small farm in Northampton County where they kept three horses.

Work eventually caused them to relocate to Allentown, PA, where they lived in a development and kept their horses at Boots & Saddle Riding club in Lehigh County. One of their horses, Swedish Blend, a rescue horse from the New Holland Sale, won under saddle class at the Hampton Classic and competed at the National Horse Show.

Work eventually relocated the pair to Chester County where they purchased a small 3 acre farm in Oxford and began breeding horses. They were hooked on producing their own foals, when one of their homebreds won classes at large shows, including Devon and Radnor. Another of their horses, Sequoia, won ladies side saddle hunter classes at Devon, Harrisburg and the National Horse Show in New York City.

The increase in horse population required more land and once again they decided to relocate – this time to a 10 acre, horse farm in East Nottingham, Chester County, PA. The farm was named August Moon Farm, symbolic of change and transition. Driving horses became their new passion. George states that supposedly driving is a gentler and kinder sport for aged humans with aches and pains that come from a life with horses. Today their barns are filled with a large Animal Projection Service (LAPS) rescue horse, and a retired Standardbred gelding and mare. Their other stalls are occupied by their retired show horses and off spring from their broodmares that became too special to part with.

The Allens are dedicated care takers of their horses and the land that supports them. As George explains, they now have 6 acres of pasture and 300 cubic yards of manure/bedding to deal with. As their horse population increased, the couple tirelessly worked to become good stewards of their land. They learned about wetlands and riparian stream corridors from representative of the Department of Environmental Protection and the Chester County Conservation District, who were working with a development adjacent to their farm. They moved their pasture fences to allow more space for riparian buffer, to protect the stream that skirted their property. They spent many hours reading articles produces by Penn State Extension, learning about pasture grasses, hay, soil fertility, no-till seeding, and composting. They tested their soil, added the recommended lime and other nutrients, seeded orchard grass in their newly designated pasture/hay fields, planted blue grass in their turn outs and waited for results. If only it were so simple. The first winter conditions wiped out most of the blue grass and a large portion of the orchard grass. There was so much more to learn.

The Allen’s participated in the Penn State Extension Equine Environmental Stewardship Short Course. Recorded on-line webinars became a weekly event as they discovered a wealth of presentations on all kinds of animal care, forage management and land stewardship. George states that without question their ability to do all of these improvements so quickly is a direct result of Penn State Extension seminars and webinars along with access to knowledgeable agricultural extension specialists.

August Moon land utilization now consists of 4 acres of hay and grazing pasture that routinely supplies grazing and 16 tons of hay. George reports that soil testing and applying nutrients based on the recommendations really does work. The Allen’s have two turnouts for the horses that are approximately one acre in size. The couple works hard to maintain high quality pastures by restricting horse access when conditions are not conducive to the growth of the pasture grasses.

This supplies ample time for the grasses to rest and regrow and prevent overgrazing. They also utilize a sacrifice turnout for bad weather days. One additional pasture is now used for a heifer turnout during the summer.

The farm confronted a special challenge, when due to special health needs of several of the horses; they transitioned from straw to pellets/shavings as bedding. When the horses were bedded on straw, the manure was picked up monthly and they were paid for the manure resource. When the manure was mixed with wood shavings, they were faced with a manure pile that nobody wanted and now have to pay for removal. The manure pit had been constructed for straw usage and when they started to use pellets/shavings, the manure pit quickly became a mud pit. The pit had to be graded and a hard surface installed for George's utilization of his front end loader. This hard surface additionally serves to protect the ground water. Vegetation around the manure storage absorbs the nutrients and prevents run-off.

George states that he is fortunate to live near Amish farmers, who bale the hay and rent the heifer field. His Amish neighbors agreed to take the manure, but the manure had to be stored for 6 months. George states that he soon learned that composting shrunk the size of the pile, eliminated the odors and didn't breed flies. They continue to experiment with composting and are still learning what does and does not work.

The Allen's transition in life to managing young horses and their aging and special needs equines led them to experiment, learn and implement environmentally friendly ways to deal with soil, pastures, hay, turnouts and manure management. They state that restorations led to a better farm for care of their equines and land renovations brought improved water quality, by enhancing riparian buffers and attracting habitat for local wildlife.

The Environmentally Friendly Farm program, which is supported by funds from the Natural Resource Conservation Service (NRCS) - Conservation Innovation Grant, has been designed to provide recognition for farms that adopt environmentally sound management practices that protect water quality and the environment.

All commercial and non-commercial livestock and equine operations, large and small, are eligible to apply for the program. Participants in the program will benefit by engaging in an ongoing partnership with representatives of Penn State Extension and other agencies that provide on-farm education and individual assistance.

Applicants complete a farm assessment checklist, which consist of a series of statements that identify potential on-farm practices that farmers adopt to protect the environment. Once the paperwork has been received, a farm site visit will be scheduled. A representative from Penn State Extension, the county Conservation District, or the Natural Resource Conservation Service (NRCS) will visit farms to verify that statements made in the application and checklists are accurate. At the same time, additional information and assistance can be provided to help improve farm management and develop appropriate renovations for the farm.

Appendix 4.

County and Farms Visited by the Project Team Members:

Eastern PA
Visited Farms

County	Name	Farm Name	
Berks	Roger DeLong		
Bucks	Delaware Valley University Equine Center		
Bucks	Veronique Noe		1115 Strawtown Rd Quakertown, PA 18951
Bucks	Donna Schnecter		5119 New Hope Rd New Hope, PA 18938
Bucks	Jennifer Frasier	Golden Spike Farm	1359 Allentown Road, Quakertown, PA
Bucks	Millard D. Freeman	Spirit Horse Stables	1554 Elephant Road, Perkasie, PA, 18944
Bucks	Veronique Noe	Strawntown Farm	1115 Strawntown Road, Quakertown, PA 18951
Bucks	Donna Hungartner		2045 Eston Rd Quakertown, PA
Bucks	Tina Gleim		100 Schultz Rd Sellersville, PA
Bucks	Jan Cobb Sholtis	Country Place Farm - sign and no till drill	197 Old Forge Rd, Upper Black Eddy, PA 18972
Carbon	Bob Daniels		110 Doney Drive Palmerton, PA (State Coach Road West) al PA
Chester	George and Kathe Allen	August Moon Farm	
Chester	Paul Marshall	Marshall's Half Hill Farm	2226 Charlestown Rd, Malvern, PA 19355
Chester	Jacqueline Tradewell	Coventry Forge	3551 Coventryville Rd, Pottstown, PA 19465
Chester	Jill Green		4221 Howell Road, Malvern, PA 19355
Chester	Marilyn & Martin Tully	Horse Hill Farm	347 Youngs Rd, Coatesville, PA 19320
Chester	Martha Masiello	MarGar Farm	316 Lafayette Road, Coatesville, PA, 19370
Columbia	Carl Osborg	Bonnie View Farm	1256 Ridge Rd, Stillwater, PA 17878
Columbia	Linda Quodomine		41 Schoolhouse Road & 70 Schoolhouse Road
Dauphin	Lisa Capp	L & B Farms	727 Bellaire Rd, Hershey, PA 17033
Delaware	Devin Cunningham	Delco 4H Farm	395 Bishop Hollow Road, Newtown Square, PA 19073
Lackawanna		Marley's Mission	2150 Pt Royal Rd Clarks Summit, PA
Lancaster	Albert		3383 Harvest Rd Elizabethtown, PA 17022
Lancaster	Robert Croteau		River Hill Rd Lancaster, PA
Lancaster		Greystone Manor	1063 Hartman Station Rd Lancaster, PA
Lancaster	Jillian Costella		244 E. Mt Hope Rd Manheim, PA 17545
Lancaster	Ginny Gibble	Rhovanian	30 Schoolhouse Road, Lancaster, PA, 17603
Lebanon	Denise McHenry	Aisling Farm	2170 Colebrook Road, Lebanon, PA 17042
Lehigh	Jen Kelly		799A Ebert Rd Coopersburg, PA
Lehigh	John Jones		111 Alfalfa Rd Smithville, PA 11111
Lehigh	Joann Givler	Y-Nott Alpacas	6324 Hunters Hill Rd Germansville, PA
Lehigh	William G. Ash	Hillside Equestrian Center	5976 Dogwood Drive, New Tripoli, PA
Monroe	Fran Weiss		Neolar Rd Appenzell, PA
Monroe	William & Mary Baxter	Pohopoco Creek Alpacas	127 Waterway Rd, Oxford, PA 19363
Monroe	Michelle Casale		204 Bellis Court Stroudsburg, PA 18360
Monroe	Jim Smith		800 Smith Hill Rd Stroudsburg, PA
Monroe	Donna and Barry Foulk	Common Ground Farm	

Montgomery	Donna Sickenberger		3420 Fry Rd Harlesyville, PA
Montgomery		Ryrss	1710 Ridge Rd Pottstown, PA 19465
Montgomery	Sue McGinnis		3130 Water Streed Rd Eagleville, PA
Montgomery	Deanna Hertzog		794 Halterman Rd Souderton, PA
Montgomery	Krissy Degenshein		2617 Hill Rd Green Lane, PA 18054
Montgomery	???	Blue Slate Farm	3669 Coventry Rd Pottstown, PA 19565
Montgomery	Jim Rittenhouse	Ritten House	697 Godshall Rd Telford PA 18969
Montgomery	Scott Clemens	Quarry Hill Farm	620 Quarry Rd Harleysville, PA 19438
Montgomery	Dale Frankenfield	Frankenfield Farm	644 Elroy Rd Souderton, PA 18964
Montgomery	Kim Trick		Webber Rd Tylersport, PA
Montgomery	Sue Penngelly	Misty Knoll Farm	103 Benner Rd Royersford, PA
Northampton	George Milander	Milander Farm (Beef Farm)	819 South Oaks Road, Bath, PA 18014
Northampton	Charles Cole		9 Riverton Rd Mount Bethel, PA 18343
Northampton	Harold Norstrom	Wood Smoke Whitetails, LLC	106 Nordstrom Lane Mt. Bethel, PA 18343
Northampton		Heart's Journey Farm	State Rd Wind Gap, PA
Northampton	Nathan Werkheiser	no till drill	1701 Kesslerville Rd Easton, PA
Northampton	Judy A Kneebone	Spring Valley Farms	750 Mt Pleasant Rd, Bangor, PA 18013
Northampton	Debra Hutchison	Equi-Librium Inc	524 Fehr Road, Nazareth, PA 18064
Northampton	Bruce Predmore	Predmore Farms	264 Sunrise Blvd, Mt. Bethel, PA 18343
Norhtampton	Mike Frick		790 Lahr Rd Nazareth, PA
Norhtampton	Tom Simpson		3435 Jacksonville Rd Bethlehem, PA
Northampton	Charles & Janice Graver	Graver Farmstead (Beef Farm)	820 S. Delps Road, Bath, PA, 18014
Philadelphia	Kevin Kellerman	Saul High School horse pastures	7100 Henry Avenue, Philadelphia, PA 19128
York	Donna Strickenberger Tina Gleim		34 North Peifferr Rd Wellsville, PA

To Be Scheduled

Lackawanna	Paul & Danielle Walters		4090 Madisonville Rd. Madison Twp. PA 18444
Lancaster	Jillian Costarella	Mt Hope Horse Rescue	2244 E Mt Hope Rd, Manheim, PA 17545
Montgomery	Leslie Blair		2022 Creek Lane, Green Lane, PA 18054
York	Michele E. Emenheiser		4671 Bentz Road, Spring Grove, PA, 17362

No Application

Lehigh		Boots and Saddles
Monroe	Smith	Cattle Farm
Northampton	Pete Zakanycz	Cow Sancturary

Western PA:

Visited Farms

County	**Name**	**Farm Name**	**Farm Address**
Blair	Cathy Caber	n/a	Tipton/Altoona Area
Bradford	Ellen and Carl Sisco	Infinity Farm	1053 Wilkes Road, Gillett, PA, 16925
Bradford	Laura H Hewitt	Hewitt Farms	1711 W Warner Hill Rd, Ulster, PA 18850
Butler	Alicia Surrena	Goldenrod Stables	111 Goldenrod Lane,Zeilenople, PA 16123
Butler	Theresa Malky	Little Shepherd Ranch	529 E. Vanderbilt Dr. Mars, PA 16046
Clinton	Heidi Leitzel		1061 Little Sugar Run Rd Beech Creek, PA 16822
Clinton	Fred & Allan Berry	Berry Farm	

			613 Haagen Ln Beech Creek, PA 16822
Clinton	Jim Matthews	Ohnmeiss Farm	3693 E. Valley Rd Loganton, PA 17747
Centre	Terri Eagles		595 Lucas Road Bellefonte, PA 16823
Centre	Gavin Glenney & Claire van Ogtrop		192 Sports Rd PO Box 224 Pine Grove Mills PA 16868
Centre	Scott Summey	Eagle Valley Equestrian Centre	1049 S. Eagle Valley Rd Milesburg, PA 16853
Centre	Mark Traband	Carousel Farm	201 Carousel Farm Drive Centre Hall, PA 16828
Centre	Mary Wodecki		434 Agricultural Administration Building University Park, P
Centre	Patty Lambert		2354 W. Gatesburg Rd Warriors Mark, PA 16877
Centre	Mike Sevick		825 Pine Grove Rd Pine Crove Mills, PA 16868
Centre	Lance Potter	Potter Mills Farm	1763 Brush Valley Rd., Centre Hall, PA 16828
Cumberland	Grant Bilbrey	Doubling Gap Ranch	1167 Doubling Gap Rd Newville, PA 17241
Dauphin	Louise Champagne		546 N Fairville Ave Harrisburg, PA 17112
Cumberland	Jane Palmer		150 Pin Oak Dr Carlisle PA 17015
Erie	Ed McAtee		5230 Florek Road, Edinboro, PA, 16412
Huntingdon	Trudy Lytle		9523 Sugar Grove Rd
Jefferson	Robert & Barbara Hanley		1556 Cunningham Rd, Punxsatawney, PA 15707
Juniata	Timothy Brown	Harmony Ranch	194 Clark Place Road, East Waterford, PA, 17021
Lebanon	Joyce Luscian		1357 Cold Spring Rd Elizabethtown, PA 17022
Lycoming	Robin Gardner		Youngs Rd Linden PA
Lycoming	Bonnie Maddox		Horseshoe Ln Salladasburg, PA
Northumberland	Doris Cochron		2170 Old State Rd, Turbotville, PA 16772
Tioga	Jeff Rush	Three Springs Ministries Camp	874 Linck Hill Rd, Morris, PA 16938
Washington	Paula Mattes	Mattes Stables	71 Mosier Hill Road, Claysville, PA 15323
Westmoreland	Catherine Markosky	STAT, Inc. Therapeutic Program	PO Box 527 Ligonier PA 15658
Westmoreland	Tammy and Ron Marsh	n/a	664 Solomon Temple Road, Latrobe, PA, 15650
Westmoreland	Kimberley Reynolds	Nickers 'N Neighs	260 Mountain Trails Lane, Acme, PA, 15610
NYS - Allegany	Nancy Kiohler	Alfred Equestrian Center	5174 Lake Road Alfred Station, NY 14803

Other farms visited

Allegheny	Allegheny Co.Parks and Rec.	South Park, PA 15102