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Priority Animal Waste Management Research and Education Needs

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Edited by

Peter Wright
Senior Extension Associate
Department of Biological and Environmental Engineering
Cornell University

Jeff Potent
Cooperative Extension Liaison to EPA Region 2

Lee Telega
Senior Extension Associate
Department of Animal Science
Cornell University

Natural Resource, Agriculture, and Engineering Service (NRAES)
Cooperative Extension
PO Box 4557
Ithaca, New York 14852-4557

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Natural Resource, Agriculture, and Engineering Service (NRAES)
Cooperative Extension, PO Box 4557
Ithaca, New York 14852-4557
Phone: (607) 255-7654 • Fax: (607) 254-8770
E-mail: NRAES@CORNELL.EDU • Web site: WWW.NRAES.ORG

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Background

The Animal Waste Initiative is an extension program to help foster regional extension cooperation in providing research and education to address animal waste issues. Non-point pollution is a significant source of the nutrients, BOD, and pathogens that continue to impact the nations surface and ground water. EPA has identified agriculture as the leading source of non-point pollution. Animal agriculture is responsible for a significant portion of the agricultural non-point pollution. With this recognition of the significance of the problem, accelerated regulations, enforcement actions, and other environmental demands are placed on farms. While some practices are easily recognized as good or bad for the environment often the impact of certain practices is either unclear or mixed. It is vital that these actions are based on good science and that both farmers and the public understand the complexities of the issues as policy is made.

Nationally the country was divided into four regions (northeast, south, midwest, and western regions) that would likely have common concerns. A small grant was made available to facilitate a gathering to identify the common needs of each region. The hope was that by identifying common needs that individual states could collaborate on research and educational programs to increase the effect.

The unique aspects of animal agriculture and environmental and demographic conditions in the northeast will contribute to the identification of priority research and education needs for our region. These factors include: types of animal production, for what purpose (commodity products or recreation), scale of operations, proximity to non-agricultural land uses, climatic and ecological conditions, and, the role agriculture plays in local and county economies. Some of these factors that make the northeast unique from many other parts of the nation include: a wide array of animals raised, animal production dominated by small operations, many of which operated as a sideline business or as a hobby; often in close proximity to suburban residential development, and many straddling or in close proximity to streams or other bodies of water. In many counties of our region that include or are adjacent to urban areas, where substantial agriculture may still exist, agriculture no longer represents a significant percentage of the local or county economy. This often presents challenges in terms of local/county decision-making, where the outcomes may have profound impacts on farm operations.

However in recent years a broader view of the value of agriculture, including animal agriculture, in these and other areas of the northeast has led to an array of public initiatives to protect and support farming operations. These include: farmland protection programs (acquisition of land or of development rights), right to farm legislation, public/private partnerships (including land trusts working to preserve farmland as well as open space), and, an array of educational, technical and financial assistance programs to help farmers improve their environmental stewardship. In this region, many of these initiatives grew out of a realization that the value of local agriculture goes well beyond the basic commodity value of its products. Such "non-commodity" values include: open space, rural character, water quality and quantity protection (assuming that the farm is managed effectively), public education, and access to locally produced farm products.

Our efforts to identify animal agriculture research and educational priority needs, and any role that this group plays in helping to facilitate research and educational initiatives, will be informed by the unique dimensions of animal agriculture in the northeast. Recommended initiatives will complement existing national, regional and state activities, helping to bring regional coordination and focus to such endeavors.

Process Used to Identify and Prioritize Needs

Immediately after the NRAES Dairy Manure Systems: Equipment and Technology Conference 3/20-22/01 participants from the conference, and representatives from the northeast states from NRCS, extension, state agricultural departments, regulatory agencies, and private consultants met to identify and prioritize research and educational needs that were common in the Northeast region. The conference preceding this workshop was an excellent introduction and review of what was known of the waste issues confronting animal agriculture in the northeast. Even though the conference focused on dairy manure, the issues and treatments cut across species.

Participants in the workshop had an opportunity to identify priority needs. After all the needs were identified a focused discussion was used to combine and clarify the needs. Each participant was given three stickers each to identify their priority issues in research and education. The results are tabulated below. We verified these results by having each state AWI representative and others who expressed an interest in attending but were unable to, review the document and add additional comments or concerns.

Those attending the workshop were:

Tom Basden	West Virginia University	tbasden2@wvu.edu	304-293-6131 x4210
José R. Bicudo	University of Kentucky	jbicudo@bae.uky.edu	859-257-3000
Jean Bonhotal	Cornell University	jb29@cornell.edu	607-255-8444
Andrea Coats	US-EPA Region 2	coats.andrea@epa.gov	212-637-3850
Nathan Cushman	Cushman Farms		860-642-4711
Jay Dodson	Myrtles Rabbitry		615-790-2349
Tom Fiesinger	NYSERDA	twf@nyserda.org	518-862-1090 x3218
J.E. Folchetti	J. Robert Folchetti & Assoc.	jrfa@westweb.net	914-232-2500
Carl Fuller	VT Dept of Ag	cfuller@agr.state.vt.us	
Larry Geohring	Cornell University	ldg5@cornell.edu	607-255-2481
Robert Graves	Penn State	reg2@psu.edu	
Jeffrey M. Jones	J. Robert Folchetti & Assoc.	jrfa@westweb.net	914-232-2500
Gary Lamont	NRCS	Gary.Lamont@ny.usda.gov	
David Lee	Rutgers University	dlee@aesop.rutgers.edu	
Jerry Martin	Penn State	jmartin@psu.edu	
Richard Meinert	Uconn CES	rmeinert@canr.uconn.edu	
Terry Noto	Environmental Defense	apphiat@aol.com	716-383-0358
Roberta Parry	US-EPA	parry.roberta@epa.gov	
Steve Perschke	NY NRCS	stephen.perschke@ny.usda.gov	
Jeffrey Potent	US-EPA/Cornell/Rutgers	potent.jeffrey@epa.gov	212-637-3857

Marty Sailus	NRAES	mas10@cornell.edu	607-255-2472
Dan Scruton	VT Dept of Ag	dan@agr.state.vt.us	
Tom Simpson	University of Maryland	ts82@umail.umd.edu	301-405-5696
Don Smith	Cushman Farms		860-642-4020
Lee Telega	Cornell Cooperative Ext.	swt2@cornell.edu	518-462-2553
Bob Thompson	VT NRCS	bob.thompson@vt.usda.gov	
Ken Wolfe	MD NRCS	ken.wolfe@md.usda.gov	301-694-6822 x107
Peter Wright	Cornell Cooperative Ext.	pew2@cornell.edu	607-255-2803
Zhiguo Wu	Penn State	zwu@psu.edu or zwu@das.psu.edu	
John Zaginaylo	PA NRCS	john.zaginaylo@pabloomsbu.fsc.usda.gov	570-784-4401 x121

Those reviewing this report were:

CSREES Animal Waste Initiative State Contacts

State	**AWI State Contact**	**Affiliation**	**E-mail**
Connecticut	Richard Meinert	Torrington Extension Center	rmeinert@canr.uconn.edu
Delaware	Greg Binford	University of Delaware	binfordg@udel.edu
Maine	Richard Kersbergen	Waldo County Extension Office	richardk@umext.maine.edu
Maryland	Jim Hanson	University of Maryland	jhanson@arec.umd.edu
Massachusetts	Dan Cooley	University of Massachusetts Microbiology	dcooley@pltpath.umass.edu
New Hampshire	John Porter	UNH Coop. Ext. Merrimack Co. University of New Hampshire	john.porter@unh.edu
New Jersey	Michael Westendorf	Dept. of Animal Science Rutgers University	westendorf@aesop.rutgers.edu
New York	Peter Wright	Cornell University	pew2@cornell.edu
Ohio	Jon Rausch	Food, Ag, and Biological Engineering Ohio State University	rausch.7@osu.edu
Pennsylvania	Robert Graves	Pennsylvania State University 201 Agricultural Engineering Building	reg2@psu.edu
Puerto Rico	Hector Lopez	Ag. Experiment Station University of Puerto Rico	hlopez@inter.edu
Rhode Island	W. Michael Sullivan	Plant Sciences Dept. University of Rhode Island	senmike@uri.edu
Vermont	Bill Jokela	Plant & Soil Science University of Vermont	bill.jokela@uvm.edu
Virgin Islands	Kofi Boateng	University of Virgin Islands	kboaten@uvi.edu
Virginia	Lori Marsh	Dept. of Bio. Systems Engineering Virginia Tech	marshes@vt.edu
West Virginia	Thomas Basden	Center for Ag & Nat Res Dev West Virginia University	tbasden@wvu.edu
US EPA Region 2	Jeffrey Potent	US EPA Region 2 Cooperative Extension Liaison	potent.jeffrey@epa.gov

Priority Research Needs

The following research needs are listed in priority order:

1) Determine the risk of Pathogens from agriculture, their potential impact, and effectiveness of risk reduction practices.

2) Determine the effectiveness of natural and landscape-based treatment methods for runoff control from agriculture.

3) Research and documentation of alternative treatments for manure such as: anaerobic digesters, composting, greenhouse/aquaculture/fish culture alternatives, and or other treatment methods.

4) Determine the challenges and opportunities of multi-farm manure management.

5) Explore phosphorus based CNMP issues.

6) Quantify the movement of nutrients and organics to surface and ground water.

7) Determine the impact of environmental regulations on long-term financial viability of farms.

8) Determine the mass balance of nutrients on farms.

9) Determine the incidence and persistence of antibiotic resistant organisms.

10) Explore the effect and cost of manure odor control.

11) Determine the effectiveness of a complete set of prescribed BMPs by monitoring the water quality impact.

12) Determine the fate of nutrients in a watershed system.

Other Issues/needs identified as priority issues: (not receiving high priority votes): The following issues were brought up and discussed but are not ranked in order of priority. Some of these topics are related to the issues included in the high priority topics, but were not combined with them at the workshop.

- Defining hydrologically sensitive areas for waste application.
- What are operational, source, and transport aspects on a field, farm, and watershed basis that signal high risks?
- How will pollutants from livestock operations be incorporated into Total Maximum Daily Load (TMDLs)?
- Evaluation of the limitations, constraints, and infrastructure changes needed to provide water shed engineering across boundaries.
- Develop and evaluate effective milking center waste treatment practices for large dairies.
- How well do clay liners work in different soils/landscapes?
- What guidance/criteria parameters go into sizing manure storages? Can these be more specific to regulations?
- Justification (risk analysis) for the 25 year-24 hour criteria.
- Applicability/viability of scaling up pilot research on alternative technologies
- Alternatives to dealing with animal mortality.
- How do feed rations (P) adjustments affect reproduction performance in dairy cattle.
- Determine the environmental effects of grazing systems (i.e., rotational, pasture systems)
- Determine the manure utilization/food safety issues of applications to horticultural crops
- Equipment design and application uniformity to integrate with precision agricultural-nutrient utilization.
- What are the nutrient levels/impacts of nutrient stockpiling disposal areas?

Justification for Identified High Priority Research Needs

1) Determine the risk of Pathogens from agriculture, their potential impact, and effectiveness of risk reduction practices.

There is a growing concern about the impact of animal agriculture on the potential for disease outbreaks in human populations. As policy is formed and as producers recognize the need to lower the risk of contamination, science needs to determine the risks and procedures to lower the risk. By implementing a study to quantify the risk for public disease outbreaks from livestock sources proposed practices could be evaluated on a cost / benefit basis to help guide policy decisions. Determining which practices for biosecurity/environmental protection are effective for pathogens would complete this analysis. Systems that could be used to reduce the risk of food safety problems may also decrease the risk of environmental contamination. Already there are proposals for a 100-foot setback from surface water in land application of manure. Without knowing the effectiveness/impact of proposed regulations society runs the risk of implementing potentially costly restraints for unknown benefits. In the same way an analysis to determine the survivability/reduction of pathogens during manure storage and various treatment processes is needed so society can evaluate the risk and producers can implement appropriate practices. Included in a pathogen analysis would also be the background pathogen levels in the environment. The pathogen loads and indicator bacteria levels of both the domestic species and wildlife need to be determined.

2) Determine the effectiveness of natural and landscape-based treatment methods for runoff control from agriculture.

Regulations promulgating no discharge from agriculture as if it were a point source ignore the fact that agricultural operations occur out in the natural environment. There are treatment opportunities utilizing natural systems like wetlands and vegetation. These systems have the potential to control pollution more effectively and at a lower cost than containment and land spreading. Research is needed to determine design parameters and effectiveness of wetlands, organic areas, vegetative filter areas, and leach fields as runoff treatment. This research would quantify nutrient/pathogen removal for each of these systems for nutrient tracking (or trading) and comparison with other prescribed treatment methods. In some instances portions of the runoff can be contained while more diluted runoff is treated. An example of this that needs to be documented is the effectiveness of vegetative filtering for silage high flows. BOD and nutrient control is critical for this practice. Pathogen control may be important when manure is involved.

3) Research and documentation of alternative treatments for manure such as: anaerobic digesters, composting, greenhouse/aquaculture/fish culture alternatives, and or other treatment methods.

Treatment of manure prior to or instead of land application is a solution for animal agriculture to consider seriously. Storage of manure for application at time or with an application method that presents a low risk of water quality contamination may be objectionable either on an economic basis or from the odors produced. Treatment methods that can reduce the risk of pollution and odors may be combined with by-product production such as, the sale of compost, or the generation of electricity and heat, to fully or partially offset the costs of the treatment systems. Combining manure treatment systems with other enterprises that can better utilize the by-products of the treatment needs to be explored. These systems need to be demonstrated and documented to help producers and planners

make appropriate decisions on farms. This analysis would include treatment costs, resulting product quality, end-uses, by-product production, marketability, nutrient losses and cycling, and transport of products. This analysis should also include cost effective alternatives to storage for both large and small producers.

4) Determine the challenges and opportunities of multi-farm manure management.

Manure management is becoming more complex and capital intensive. Farms may be limited in the management expertise and money they can individually commit to their manure management system. There are benefits to developing systems that share the management and costs to achieve the goals of a number of operations. Industrial operations have used similar ideas to substantially reduce their waste. An analysis is needed to describe regional management of nutrient flows including ways to balance nutrient inflows with product outflows while reducing environmental losses. There are situations where farms need to explore the possibility for potential nutrient credits and/or exchanges with other crop farms and /or other users of nutrients. Some treatment and handling systems require coordination with other entities that could be more effective if done on a larger scale. One example would be to determine possible regional coordination on the use and the effectiveness of anaerobic digesters by groups of farms. Impediments to collaboration need to be evaluated. Case studies of cooperative manure management need to be documented. While useful to consider for all farms this strategy is especially applicable to small farms.

5) Explore phosphorus based CNMP issues.

Phosphorous based planning is now required as part of a CNMP by the NRCS. There will be a number of both off farm and on farm effects of this requirement. It is important to evaluate this policy as it is implemented on the farm. There should be an evaluation to determine or refine the appropriateness of thresholds (i.e., agronomic, environmental Soil Tests, and P-Index) for phosphorous. There needs to be an analysis to determine the relationship of phosphorous loading to ambient surface water quality. As P–Indexes are completed there needs to be research to determine which form of P should be targeted, dissolved P or particulate P, in different watersheds. Most P-Indexes include factors to adjust the index for various practices. Research needs to be done to determine the effectiveness in controlling P from various practices, including how tillage systems alter P transport so the P-indexes better represent actual P impact.

6) Quantify the movement of nutrients and organics to surface and ground water.

Many Best Management Practices (BMPs) are being recommended or required by regulators with knowing the effect on water quality. These "BMPs" may or may not be the best practice to lower the risk of pollution. Each practice needs to be evaluated to document performance under a variety of conditions to determine the actual effect on the water quality parameter needing protection. Quantitative factors to define the practices are needed, so actual installation costs and water quality benefits can be determined on specific sites. This should include defensible performance standards and criteria for land application techniques of manure and other nutrient and/or organic materials.

7) Determine the impact of environmental regulations on long-term financial viability of farms.

In an effort to make our water resources as clean as possible society needs to determine the effects on production agriculture. If water quality regulations prevent viable agriculture in a region this should be determined before the regulations are implemented so the full effect on the region can be considered. The Northeast has unique situations where the preservation of the commodity and non-commodity value of farms is a vital part of the community. There needs to be an analysis of the economic scenarios in recent federal regulations to

determine how realistic and applicable they are across all of agriculture. This economic analysis is especially important to determine for small farms that may be more challenged by environmental issues than large farms that can bring more monetary and management resources to bear. This analysis should include a pre and post survey of the effect of manure storage on the business both financially and operationally. Labor management is an important part of this evaluation since some farms will not realistically be able to supply the intensive labor demands of some manure treatment and handling systems.

8) Determine the mass balance of nutrients on farms.

Most farms don't have a nutrient mass balance of their operation showing the amount of nutrients coming on the farm and the amount leaving. Controlling the amount of nutrients leaving is an integral part a nutrient management plan. The inputs coming into the farm are often not recognized as critical to the ultimate control of nutrients. To manage changes measurements are needed. Research is needed to determine the relationship of quality feed production on the farm and the need for imported nutrients. This study should especially include the influence of homegrown forage on the nutrient balance of dairy farms. An analysis of the predicted dry matter intake and their effect on production levels, profit, and nutrient excretion for dairy farms is needed. For all livestock farms a study of how changing rations (N-P-K) affect production, and mass balance of nutrient on the farm and in the environment needs to be completed.

9) Determine the incidence and persistence of antibiotic resistant organisms.

The use and value of antibiotics in livestock productions has been well documented. The risk of this use in creating resistant pathogens is not well known. This information is critical in defining policies that would control antibiotic use. The potential to develop resistant strains of diseases of both humans and domestic livestock needs to be explored to prevent a major outbreak of disease. This research needs to include organisms that already are common in the animal/human populations, but also the potential and the consequences for other organisms to obtain this resistance from incidental contact in the environment.

10) Explore the effect and cost of manure odor control.

Manure odors are the leading cause of conflict between livestock farms and their neighbors. As farms are encouraged to store manure so it can be applied at the most suitable time to provide plant growth and to minimize potential water quality impacts, odor and odor caused conflicts will become more prevalent. There is a need to determine the level of human health risk from odors. The effect has been described in some high production swine areas in the south. Each community will need to determine the intensity and frequency of odors they are willing to tolerate. Information about the amount of odor generated from various production systems and odor reduction practices needs to be available to help communities and farmers make decisions on practices to implement. Studies that determine the effectiveness of manure additives and treatment systems for odor control need to be performed that compare the cost and the benefits to the community.

11) Determine the effectiveness of a complete set of prescribed BMPs by monitoring the water quality impact.

Comprehensive Nutrient Management Plans are being required for large farms and encouraged by all farms. These plans lay out a series of practices that the farm should implement. They range from the implementation of physical structures such as manure storage, to management practices like the use of cover crops. As all these practices are installed it is important to determine the effect on the water quality and on the farm. Monitoring the water quality resulting from this whole-farm plan and the economic results to the farmer will be critical in obtaining the acceptance of this plan on the farming community and the regulatory community.

12) Determine the fate of nutrients in a watershed system.

The fate and interactions of nutrients in a watershed system is not well documented. Various models describe nutrient flows but as TMDL reductions are implemented it will be very important to make sure that models used to set allowable nutrient loading include the complexities of changes in the source of the nutrients, potential sinks of nutrients in the system, various rates of transport, and chemical and biological alterations of the form of nutrients. These parameters need to be known so the proper management changes in the watershed can be determined.

Priority Education Needs

Animal waste concerns have come to the forefront of society's concerns recently. Everyone involved in these issues needs to understand that the management of manure and its impact on the environment will be a critical business issue. To achieve any significant and lasting change in behavior three things are needed. Incentives, consequences, but most of all education. People need to know why a change is needed not just rote activities that are required in order to make the behavioral change real.

The audiences groups while listed in priority order are all vital to the successful implementation of a program that will change the operations of animal agriculture to protect the environment. The subject matter with in each audience groups is prioritized. Again all the subjects listed are important.

Farm operators as the target audience were identified as the top priority since this is where the changed behavior must ultimately occur. Farmers need to understand:

- The risk of agricultural pathogens in the environment and biosecurity issues to limit their growth and control their spread.
- The economics of livestock production and environmental compliance to insure business survival.
- The proper operation and maintenance of BMPs that may be a required part of their CNMP.
- The specific concerns, stakeholders and policy makers in their local watershed.
- What the CAFO regulations are and how to come into compliance.
- How a species-specific environmental assessment can help them set priorities.
- Odor control and management techniques that are suitable for their operation.
- How the hydrology of surface and ground water in and around their farm influences the potential environmental concerns of their neighbors.
- How they can manage phosphorus to reduce the risk of pollution.
- How Total Maximum Daily Loads (TMDLs) can impact their operation.
- Methods for mortality composting and/or proper disposal as rendering becomes scarce.
- How to calibrate nutrient spreading equipment to achieve uniform and appropriate rates of application
- The impacts of nutrient overloading and or stockpiling on fields.

Organizations/support agencies/policy makers as the target audience were identified as the second priority. These people have a large influence on the response of both the agricultural community and their advisors as well as society in general to various regulations, policies and practices that are adopted. This group needs to understand:

- How the marketing (image) of livestock agriculture to the rest of society influences the outcome of policy formation.
- The importance of intra-state policy for manure residual management and transport to ultimately resolve nutrient overloading.
- How best to achieve interagency cooperation to facilitate knowledge transfer to private sector.
- Why a systems approach to Whole Farm Planning is needed.

- The importance of reduced pathogen risk and food safety for directly consumed produce.

- How case studies of sewage cooperatives can serve as models for farm cooperatives in manure treatment and handling.

- The need for cooperative type solutions to animal agriculture's concentration of nutrients.

CAFO Planners, CAFO Inspectors, Engineers, and Farm Medical/nutritional advisors are an important target audience since they will implement many of the practices that farms need to adopt. This group of advisors needs to understand:

- Why a systems approach to Whole Farm Planning is needed.

- Specific information sources or methods to determine waste utilization parameters of various species.

- How their professional advice should be protected by a liability policy.

- Alternative methods of off-farm nutrient utilization to alleviate nutrient imbalances.

- The risk of agricultural pathogens in the environment and biosecurity issues to limit their growth and control their spread.

- What practices on farms are potential contributors to pollution.

- The economics of livestock production and environmental compliance to insure business survival.

- The planning, design, and construction requirements for practices that are needed for pollution reduction.

- How EQIP and other funding sources can be used on their client's farms.

- Planning, design, and construction guidelines for various practices.

- How the over feeding of Phosphorus, and other nutrients can effect the whole farm plan for that farm.

Conclusions and Next Steps

This workshop was intended to provide a starting point to implement integrated research and educational programs targeting the livestock and poultry producers, their advisors and the concerned public with science based knowledge to address livestock issues. The coordination of effort and the beginnings of collaboration to improve research and educational products will help the whole northeast region move forward in dealing with these problems. The documentation of research priorities should help direct researchers and funders address priority issues. The educational needs priority list for each audience should help people develop appropriate materials and programs to meet the identified needs. The information which documents the stakeholder's dialogue in this article is also intended to inform otherss of the needs for research and education.

As the Northeast Animal Waste Initiative group begins to work together to achieve some of the challenges presented here, improved relationships, increased cooperation and collaboration, and better service to our clients can be expected. Periodically these priorities should be reviewed as some priority needs are met by new information that is developed both in the region and outside it, as identified issues become more or less important, and as new issues are raised.

About NRAES

NRAES, the Natural Resource, Agriculture, and Engineering Service (formerly the Northeast Regional Agricultural Engineering Service), is a land grant university outreach program focused on delivering educational materials and training opportunities in support of cooperative extension. The mission of NRAES is to assist faculty and staff at member land grant universities in increasing the public availability of research- and experience-based knowledge. All NRAES activities are guided by faculty from member land grant universities (see the map below for a list of cooperating members).

NRAES began in 1974 through an agreement among the cooperative extension programs in the Northeast. The program is guided by the NRAES Committee, which consists of a representative from each member university, the NRAES director, and an administrative liaison appointed by the Northeast Cooperative Extension Directors Committee.

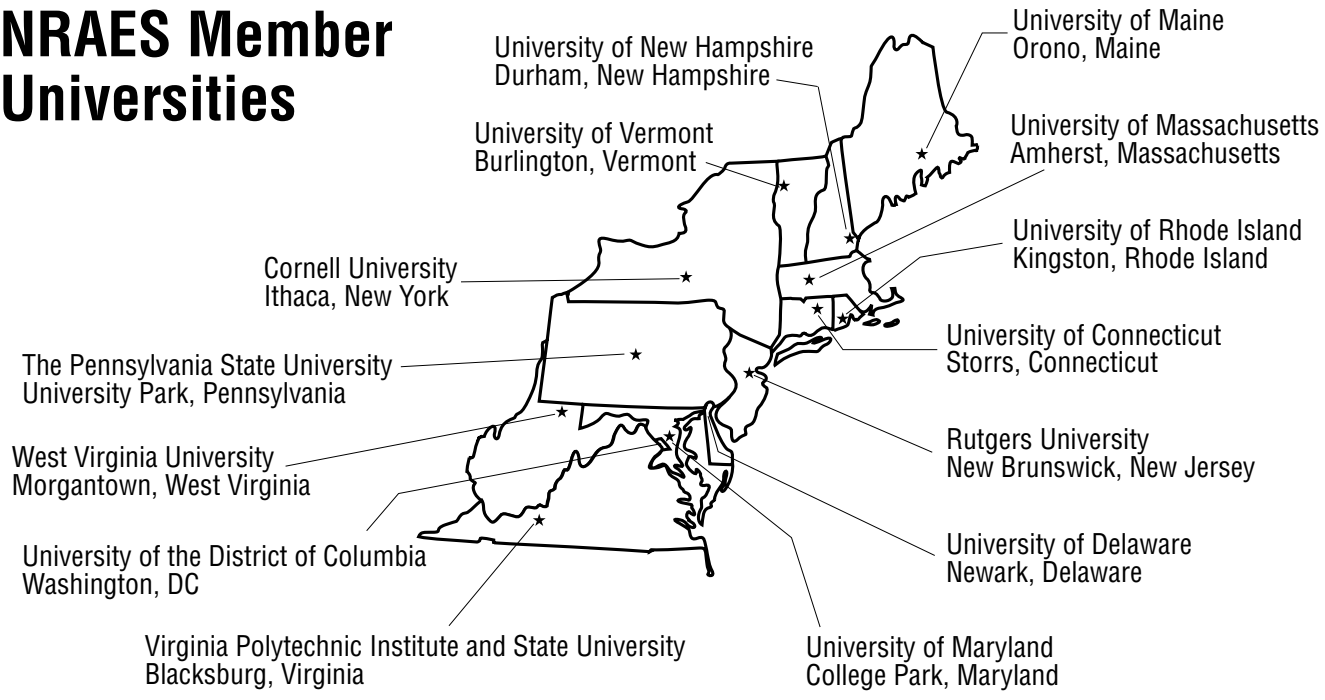
Currently, NRAES has published more than 100 books and distributes more than 180 on topics such as general agriculture, fruit and vegetable production, perennials production, integrated crop management, greenhouse, and composting. For more information and a free catalog, contact NRAES.

Natural Resource, Agriculture, and Engineering Service (NRAES)
Cooperative Extension
PO Box 4557
Ithaca, New York 14852-4557

Phone: (607) 255-7654
Fax: (607) 254-8770
E-mail: NRAES@CORNELL.EDU
Web site: WWW.NRAES.ORG

Marty Sailus, NRAES Director
Jeffrey S. Popow, Managing Editor

NRAES Member Universities



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