[APPROVED BY MOTION AT OCTOBER 2014 MEETING. THIS DOCUMENT IS MADE AVAILABLE TO THE PUBLIC PURSUANT TO OPEN MEETINGS LAW §103(e)]

New York State Soil & Water Conservation Committee
10B Airline Drive, Albany, NY 12235 -- Telephone (518) 457-3738
Partnership Meeting: Cornell College of Agriculture and Life Sciences, Cornell Cooperative Extension
Food Science Building
411 Tower Road
Ithaca, NY 14853
September 23, 2014

Meeting At A Glance:
"Given the current climate, budgetary concerns, and all other limitations and opportunities, what is the role of the partnerships between Cornell Cooperative Extension, the Cornell College of Agriculture and Life Sciences, and the State Soil and Water Conservation Committee—and how should that role evolve in the next five to ten years?" – Deborah Grantham, opening remarks

Present:
G. Proios, Chair; D. Stein, D. Brass, J. Dickinson, C. Colby, Voting Members; B. Steinmuller, Assistant Director; R. Bush, B. Brower, C. Frasier, G. Albrecht, V. DiGiacomo, S. Fickbohm, G. Spitzer, L. Lyons-Swift, T. Clark, SWCC; K. Boor, Dean Cornell College of Agriculture and Life Sciences; C. Watkins, Director Cornell Cooperative Extension; T. Overton, Assistant Director Cornell Cooperative Extension; A. Chatrchyan, C. Gooch, M. Hoffman, P. Woodbury, K. Czymmek, Q. Ketterings, A. Fagan, Cornell; L. Williams, NYFB; J. Littrell, NYACD; N. Billharat, NYCDEA; A. Ristew, Tompkins County SWCD; D. Kirby, Orleans County SWCD; A. Barber, Cortland County SWCD/Upper Susquehanna Coalition; S. Wojtowicz, NYS DOS Office of Planning and Development; T. Sweeney, NYS DAM; J. Lendrum, NYS DEC; V. Green, USDA FSA; G. Kist, D. DeWeese, USDA NRCS.

Call to Order, In Memoriam
G. Proios called the meeting to order. Welcomes were given by G. Proios and B. Steinmuller on behalf of the State Committee, and by Deborah Grantham on behalf of Cornell. The theme of the meeting is to discuss the partnership efforts—current, past, and, most importantly, future—between Cornell Cooperative Extension, Cornell College of Agriculture and Life Sciences, and the State Committee.

G. Proios mentioned the loss of R. Murray Mahany, former chairman of the Steuben County Soil and Water Conservation District and voting member of the Soil and Water Conservation Committee, who passed away on September 5. He farmed, together with his children, more than 2500 acres of potatoes, corn, wheat, oats, green beans, and alfalfa. He was involved in a number of civic institutions other than the State Committee and Steuben County District, including the Steuben County Farm Bureau, Susquehanna River Basin Commission, NYS Fish and Wildlife Board, among others. The State Committee observed a moment to remember Murray and sends condolences to his family and community.

Review/Approval of Minutes
D. Brass moved to approve the July 2014 minutes; seconded by. Motion passed; carried.

Morning Session: Current Research and Collaborations between Cornell scientists and the State Committee

Cornell Institute for Climate Change and Agriculture, Allison Morrill Chatrchyan, ICCA Director; Michael P. Hoffman, CU Agricultural Experiment Station Director/Associate Dean

The goal of the Institute is serve as a focal point to facilitate research, education, and outreach to reduce the agricultural sectors' collective impact on the climate, and help farmers become more resilient to climate change. Currently, they are working on developing the infrastructure necessary to advance research and support for climate change and agriculture issues. There will be a conference next July on Climate Change and Dairy Farming.

AEM Tier 2 Greenhouse Gas Reduction Worksheet, Brian Steinmuller

The AEM Tier 2 Greenhouse Gas Reduction Worksheet, currently in the final stages of development, is a great example of collaboration between Cornell scientists and the State Committee. The research by Peter Woodbury, Jeni Wightman, and Karl Czymmek is being applied through the AEM framework to help NY farmers make better environmental decisions. The worksheet will undergo review by the SWCC, Districts, and other partners for an anticipated release in the coming months.

Food and More: Ecosystems from Farms, Peter Woodbury

P. Woodbury researches the role of agriculture within broader ecosystems, both how ecosystem issues such as climate change impact agriculture and how agriculture (through specific management choices including tillage and fertilizer use) impacts ecological issues such as climate change.

Dairy's contribution to GHG emissions is largely through methane emitted through stored manure, while cropland's GHG emissions are largely nitrous oxide from nitrogen fertilizer use. The different crops require different strategies, but technologies are available. The research on the impacts of various technologies on production needs and the natural environment is available to the State Committee as it discusses the best ways to meet the needs both of farmers and of natural resource conservation. The powerpoint presentation is appended to these minutes.

Manure Management and Storage, Curt Gooch

C. Gooch works on research and applied research through PRO-DAIRY. He studies manure management, anaerobic digestion systems, agricultural air emissions, and other issues related to dairy agriculture.

Manure stored in large lagoons emits methane, ammonia, and nitrous oxide. The technologies for alternative (more climate friendly, less environmentally risky) manure management systems are there, but adoption is slow. More needs to be done through public policy, including through the State Committee, to make adoption of these methods easier for New York farmers. The powerpoint presentation is appended to these minutes.

Farmer Tools for Supporting Healthy Soils, Harold van Es

H. van Es works on researching and meeting the environmental and financial needs of farmers through the Cornell Initiative on Computational Agriculture.

Excessive nitrogen use increases GHG emissions as well as the risk of water pollution through over-fertilization of the waterways, which can cause loss of entire zones of aquatic ecosystems. Adapt-N is a product farmers or farming consultants can use to know precisely how much fertilizer to apply given inputs such as soil type, weather, crops, and prices. It includes data on nitrogen leaching losses and nitrogen emissions losses, so farmers can see how their work impacts the larger ecosystem. The Cornell Soil Health Test includes physical and biological components of soil health, in addition to the more commonly tested chemical components. Both of these tools can help farmers make more informed decisions about their farms, to both adapt to and mitigate the effects of climate change. The State Committee has been working from this science on promoting soil health practices and systems, such as reduced tillage and cover cropping, through workshops and the Agricultural Non-Point Source program. The powerpoint presentation is appended to these minutes.

Nutrient Management Spear Program, Quirine Ketterings

Q. Ketterings' research focuses on whole farm nutrient management for New York dairy operations, use of organic nutrients for fertility management, fertilizer guidelines for field crops, and soil testing issues.

The Spear program (report here) focuses on adaptive management and on-farm trials of nutrient balances across the farm. It largely focuses on dairy farms, and has been able to analyze nutrient management needs on both across farms and within individual fields. Q. Ketterings' research, through Spear, on nutrient release and risk for runoff and leaching losses depending on soil type, hydrology, and specific of the applications may be useful for further Committee discussions on the best ways to balance farm needs and natural resource conservation.

Afternoon Session: Individual Visions and Partnership Discussion

Partnership Case Study: Upper Susquehanna Watershed, Jackie Lendrum

In 2008-2009, The US Environmental Protection Agency developed a Total Maximum Daily Load (TMDL) requirement for all watersheds that flow into the Chesapeake Bay. The Susquehanna River originates in New York State and flows south to the Bay, so New York State is party to the TMDL agreements, which dictate how much nutrients, pollutants, and sediment can enter relevant waterbodies in particular segments. The DEC was able to argue on behalf of New York State farmers, landowners, and other stakeholders because of data that Cornell scientists had been developing, and the requirements placed on New York State were lessened because of the partnerships between the DEC and Cornell, and the goal both share of creating science-based policy. In addition, the Upper Susquehanna Coalition (a coalition of Districts in New York State and Pennsylvania) have been able to do important work within the watershed, and the Agricultural Environmental Management and Agricultural Non-Point Source programs have helped farmers reduce their footprint.

Welcome to new Technical Advisory Committee Member Charles Bornt!

Director Watkins and Dean Boor are happy to announce that they are filling the second Cornell seat on the Technical Advisory Committee. Deborah Grantham will continue to fill the Cornell College of Arts and Sciences seat as a technical advisor, and Charles Bornt will fill the Cornell Cooperative Extension seat as a technical advisor. Welcome!

Vision for College of Agriculture and Life Sciences, Dean Kathryn Boor

Cornell College of Agriculture and Life Sciences (CALS) is a land grant institution, and historically, has always had a mission to incorporate practical education within a larger liberal arts framework. CALS includes two schools, 15 departments, 350 faculty members, and 3500 students.

CALS has just completed its new five-year strategic plan. [Note: at the time of the meeting, the plan had not yet been released. It has since, and it is linked here.] Among other topics, it promotes building capacity to research nutrition and food security, climate change and agriculture, social and socio-ecological resilience to climate change, biological systems and evolution, big data analysis of biological, agricultural, and social phenomena, and media and communication technologies.

Vision for Cornell Cooperative Extension, Director Chris Watkins

Cornell Cooperative Extension (CCE) varies from other Extension programs as it is run through the county rather than a central Extension office, yet there is still a role for a central vision (and strategic plan) to focus the Extension Offices' work. CCE is currently working on making limited budgets stretch farther by regionalization of operational needs (shared business networks), educational outreach, and specialists. They are also working on staff development, including recruitment and retention, and expanding their capacity to help farmers through technology. They are also working to recruit younger faculty at Cornell to get involved in extension work and outreach.

Soil and Water Conservation Committee's Strategic Plan, Brian Steinmuller

The State Committee recently completed its new strategic plan. The planning process involved working with Districts, Technical Advisory Committee Members, the New York Association of Conservation Districts, the New York Conservation Districts Employees Association, and other stakeholders. The plan has four areas of focus: Conservation District Operations, Technical Services and Program Delivery, Comprehensive Natural Resources Management, and Cooperative Conservation. The last area is especially important in moving forward in partnership with CALS and CCE.

Continuation of Partnership Discussion

A frank and productive discussion ensued on a number of areas of interest to partnership efforts between CALS, CCE, and the State Committee, and everyone agreed that working together is essential to achieve all of our missions. A number of themes and issues emerged, including:

- All of the partners, including NRCS, are facing budgetary constraints as well as aging workforces, which leads to institutional knowledge being lost as experts leave and are not rehired. How can we

form partnerships such that farmers have access to generalists who are available to answer questions on a more regular basis as well as specialists who are experts in particular areas of farming?
    - The roles of Districts, Extension, NRCS, Farm Bureau, and others can vary by county, so local solutions are important. However, in every situation, farmers need generalists who can be easily reachable to answer questions and direct them to further support as well as specialists who can provide detailed answers to highly specific and technical questions. These roles can and should be divided up among the players supporting farmers—the question then becomes how to best establish the partnerships in each local context.
- Ideally, agricultural support starts with a local need, which leads to research on a particular topic, which yields implementable solutions, which are then given back to the farmer, perhaps with government/policy support, to implement. How can we make sure each link in that chain is flowing as cleanly as possible? How can we engage all partners in this process, including agricultural consultants and other players in the agricultural industry? How can the State Committee and Districts best tap into the tremendous resource of CALS/CCE scientists and researchers?
    - The research highlighted in the morning session reflects the ways in which these linkages are working. The AEM Tier 2 worksheet in particular meets a policy need exposed by research, and Cornell scientists collaborated with SWCC staff to create it. These partnerships and collaborations should continue.
- How can Districts, local Extension offices, and those working on Agricultural/Farmland Protection Boards work together to form a "farming lobby" in the county budgeting process, so that Districts and Extension are working together rather than competing for county appropriations? It is important that these coalitions and outreach to legislators extend beyond just the county budgeting process.
    - In Lewis County, such a coalition hosts farm tours for legislators that highlight the achievements of the District and the Extension office. These have been effective, both in convincing the legislators of the value of appropriations to the District and Extension and in fostering cooperation and partnership between the offices. This should be replicated in other counties.
- How can Districts, Extension offices, NRCS, and others continue to work together to address issues of agriculture and climate change?
    - Dean Boor offered that her office and Cornell scientists are always available to answer questions or discuss particular issues the State Committee is discussing.
- The agricultural plastics pilot program has suffered from communications failures. Follow up is needed to ensure future success.
- CALS/CCE has an internship program where students work in the field, often in Extension offices. Could this be expanded include placement in District offices?

Amendments for State Committee Consideration

Ulster County SWCD – Implementation of Agricultural Best Management Practices in the Lower Esopus Creek Watershed – Round 16 – C700995

Request: Time Extension from 8/1/14 to 8/1/15

Reason: While implementation at one farm is about 85% complete, the farmer has been unable to complete his remaining deliverables due to extenuating personal circumstances. The other farm has undergone an ownership change during the course of design development. The new owners have reaffirmed their support for implementing the design, which is now completed. An extension will allow the landowners who remain committed to the project, to complete the remaining implementation.

Note: Brian Steinmuller, Assistant Director, supports this time extension request.
Previous Amendments: None

D. Brass moved to approve the time extension; seconded by D. Stein. Motion passed; carried.

Wayne County SWCD – Central Canal Corridor Agricultural Program: Phase 2 Black Brook –Round 17 – C701047

Request: Time Extension from 5/13/15 to 12/31/15

Reason: The four (4) farms that have not completed their implementation have had complications with their operations and/or personnel issues which have impeded the ability to complete the design and implementation of the contract BMP's. All producers have been working with the Wayne AEM program to continue to prep for implementation and complete the design plan for implementation. A considerable amount of design work is already completed for the remaining BMP systems. All landowners with work still outstanding have re-committed to completing their projects.

Note: Victor DiGiacomo, Region 1 AEA, supports this time extension request.
Previous Amendments: Change in BMP's

D. Stein moved to approve the time extension; seconded by J. Dickinson. Motion passed; carried.

Lewis County SWCD – Black River Watershed Implementation, Phase 3 – Round 16 – C700974
Request: Time Extension from 8/1/14 to 10/1/15
Reason: Due to several factors including changes in farm management, weather, and contractor availability additional time is needed to complete project deliverables.

Note: Bob Brower, Region 4 AEA, supports this time extension.
Previous Amendments: None

D. Brass moved to approve the time extension; seconded by J. Dickinson. Motion passed; carried.

Lewis County SWCD – Black River Watershed Implementation, Phase 2 – Round 15 – C700940
Request: Time Extension from 3/15/14 to 3/15/15
Reason: Due to several factors including changes in farm management, weather, and contractor availability additional time is needed to complete project deliverables.

Note: Bob Brower, Region 4 AEA, supports this time extension.
Previous Amendments: None

J. Dickinson moved to approve the time extension; seconded by D. Brass. Motion passed; carried.

Meeting adjourned.

Audiocast available at: http://www.agriculture.ny.gov/webcasting.html

Food and More: Ecosystem Services from Farms

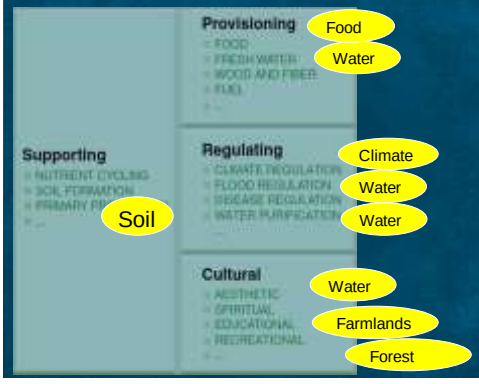
Peter Woodbury
Department of Crop and Soil Sciences, Cornell University

New York State
Soil and Water Conservation Committee Meeting
23 September, 2014

We want a lot from the land – food, feed, fiber, fuel

Ecosystem Services -- a way to think about these multiple needs

Ecosystem Services involve soil, water, climate, and farms



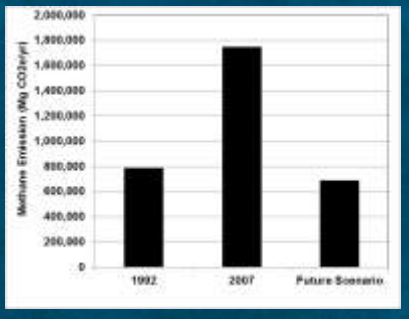
Research Project: Reducing Greenhouse Gas Emissions with Manure Management

Two questions for New York State dairy farms:

(1) How has the shift from daily spreading towards liquid storage affected methane emissions?

(2) How much could we reduce methane emissions in the future by covering manure storage units and flaring the methane?

Methane emissions from NY dairy manure



The future scenario would cover manure storage units and flare methane from 88% of the total herd.

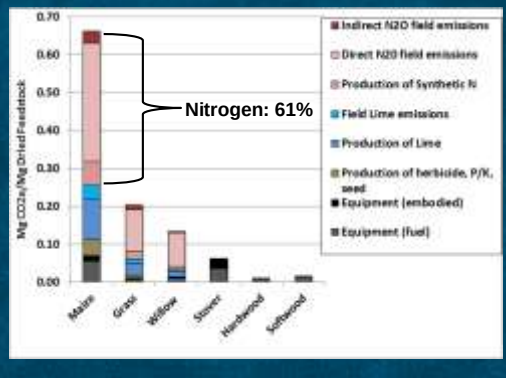
Research Project: Reducing Greenhouse Gas Emissions with Nitrogen Fertilizer Management

Two questions for corn production in NY:

(1) How much of the total greenhouse gas emissions from corn is due to nitrogen fertilizer?

(2) How can we reduce greenhouse gas emissions from nitrogen fertilizer?

Greenhouse gas emissions from NY crops and forests



How can we reduce GHG emissions from nitrogen fertilizer on corn fields?

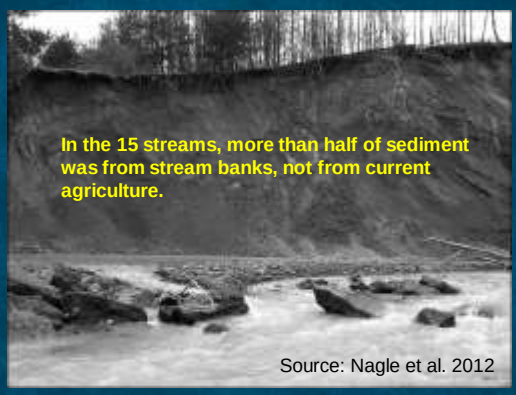
Tools such as Adapt-N (Harold van Es and others) use sophisticated models and current weather data to address the "4 Rs":
(1) right source,
(2) right rate,
(3) right time,
(4) right place.

Such tools can maintain or increase crop yields, while saving money and reducing nitrogen losses including leaching and volatilization.

Current research is developing the ability of Adapt-N to quantify how improved fertilizer management can reduce nitrous oxide emissions, an important greenhouse gas.

Research Project: Where does stream sediment come from?

We examined sediment from 15 streams in the Southern Tier and Central New York.



Source: Nagle et al. 2012

Summary

We want a lot from the land:
food, feed, fiber, and fuel,
clean air, clean water, and more …

Ecosystem services is one way to think about these multiple needs.

Thinking about multiple ecosystem services can help us to avoid creating a new problem while solving an old one.

In addition to other benefits from farm and forest land, there is the potential to reduce greenhouse gas emissions.

Soil and Water Conservation Committee

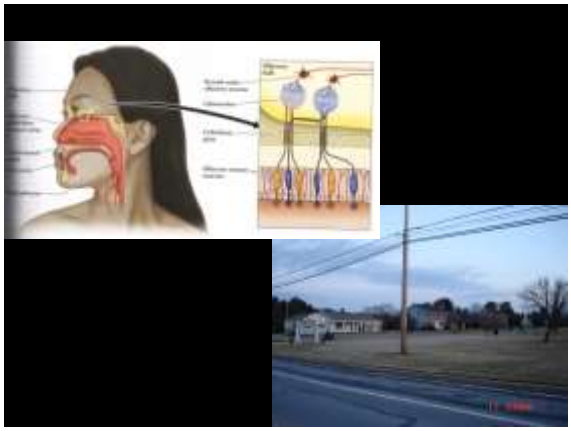
State Committee Meeting

"Manure Management and Storage"

Curt A. Gooch, P.E.

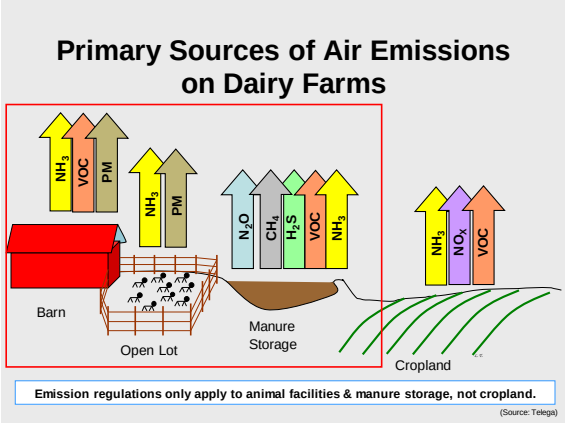
Dairy Environmental Systems Engineer
Biological and Environmental Engineering
Cornell University

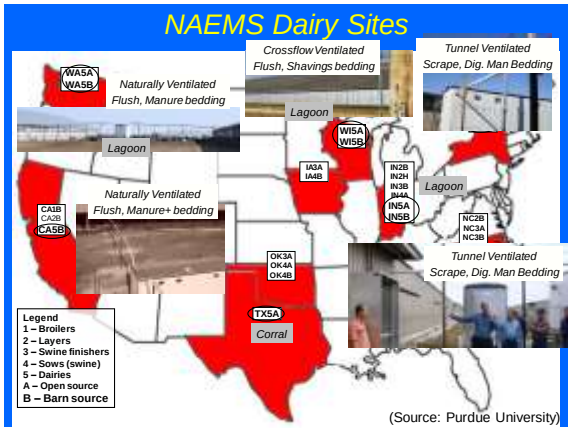
www.manuremanagement.cornell.edu

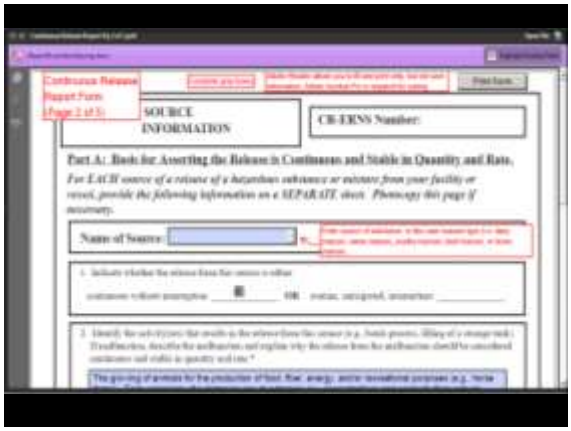


Recent Court Findings (2004)

- Ag is regulated
- Poor data is no defense
  - Buckeye ordered to monitor at own expense!
- "Sources" are additive
- Larger farms more vulnerable???





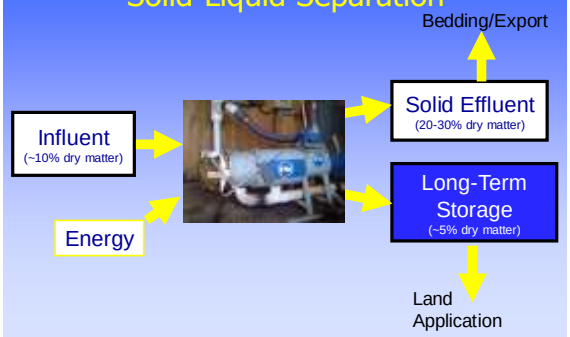


Dairy Environmental Related Challenges…

- Water pollution
- Air pollution
- Odor
- Public Image
- Neighbor Relations
- Profitability!!!

Manure Treatment

Solid-Liquid Separation



Alternative manure treatment systems can be considered. . .

…when animal densities increase beyond the point where manure can sustainably be managed on the surrounding land using traditional manure management practices.

Alternative manure treatment systems can be considered. . .

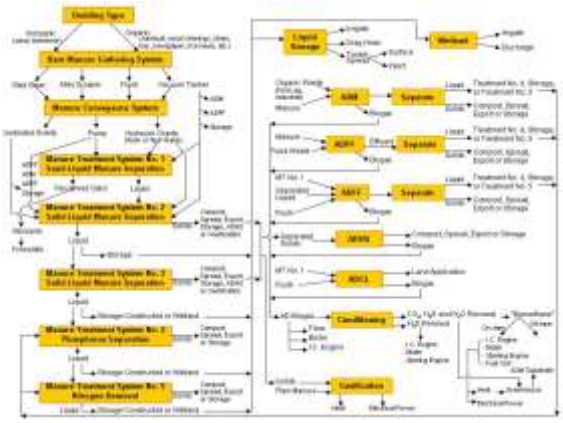
…when animal densities increase beyond the point where manure can sustainably be managed on the surrounding land using traditional manure management practices.

…when weather results in increased storage capacity needs or delays in application.

OR…

Integrated Manure Treatment System

An assembly of manure handling/treatment processes, arranged in a strategic fashion, to accomplish identified farm, water quality, and/or air quality goals and objectives.



Manure Treatment
Sand-Manure Separation

Manure Treatment
Anaerobic Digestion – Energy Generation

Farm Needs/Goals/Wants

- Odor Control
- Pathogen Reduction
- Energy
- Greenhouse Gas Reduction
- Fertilizer for Field Crops
- Low Cost Manure Application
- Nutrient Concentration/Exportation
- Revenue

} **ADS**

Manure Treatment
Phosphorous Flocculation

Manure Treatment
Ammonia Stripping

NEW YORK DAIRY FARM TO RECYCLE DAIRY MANURE INTO DRINKING WATER

BLISS, NY (Sept 15, 2014) – McCormick Farms, a 2,000-cow flush dairy and the largest potato grower in the state of New York, is the latest to install a manure treatment system designed by Livestock Water Recycling, Inc. at their Maxwell Road location in Bliss, NY. The system will recycle clean water and concentrate valuable nutrients from dairy manure for reuse around the farm.

Jim McCormick, president and CEO of the 68 year old family farm says "We take great pride in growing high quality agricultural products, promoting environmental sustainability and most importantly being a good neighbor." He adds "We use the most modern farming techniques available to ensure the continuous success of our farm."

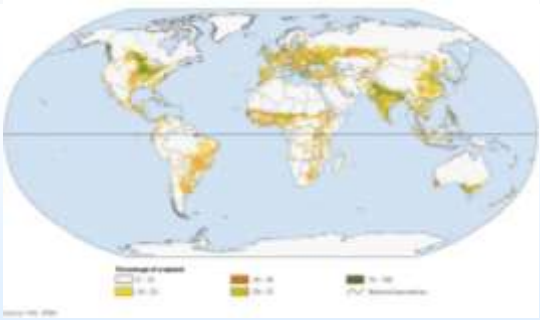
"Our system generates a clean, reusable water source that will allow McCormick Farms the ability to recycle the majority of the water they are using in their barns." Says Ross Thurston, President of LWR. "They will now be able to flush their barns with an abundant and renewable source of clean water."

All parts of the manure are reused as a valuable output, which is what differentiates the LWR System from any other manure management system on the market.

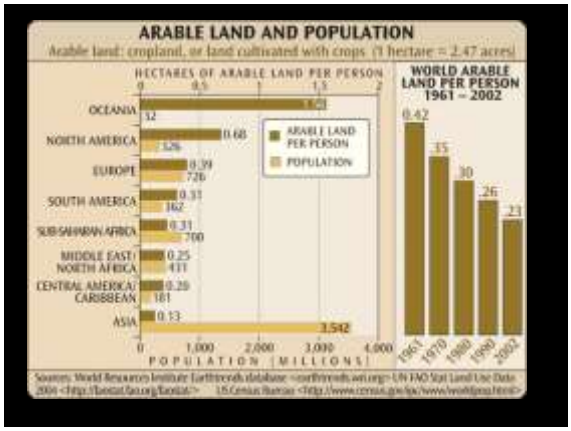
Manure recovery is one of the few truly sustainable environmental opportunities and one that impacts farmers, farm employees, and neighbors.

Manure Application

Distribution of Cropland



Source: FAO (2006)



Farmer Tools for Supporting Healthy Soil Environments:

Adapt-N and Soil Health

Harold M. van Es

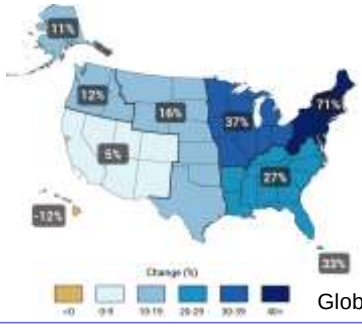
Cornell University
College of Agriculture and Life Sciences

School of Integrative Plant Science
Crop and Soil Sciences Section

Context

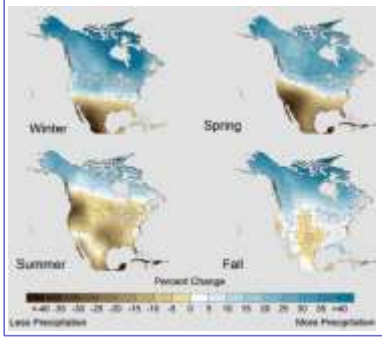
- Climate Change
- Data-Driven Management and CIT
- National Initiatives

Regional Increases in Very Heavy Precipitation Events (1958-2007)



Globalchange.gov

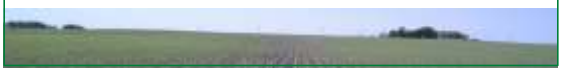
Projected Change in Precipitation by 2080



Globalchange.gov

Win-Win Adaptation-Mitigation Opportunities Two Examples

- **Adapt-N:** Adapt nitrogen inputs based on weather, soil and crop information
- **Cornell Soil Health Management Framework:** Improve soil health by measuring and managing soil constraints



Nitrogen Concerns in Corn Production Systems

Agronomic/Economic

- ~ $5 billion/yr of N fertilizer applied to corn; large input costs for farmer
- N use efficiency low (30-70%)
- High uncertainty, and sensitivity to climate change

Environmental (negative externalities)

- Largest energy input into cropping system
- Greenhouse gas emissions (esp. N_2O)
- High groundwater nitrate levels
- Hypoxia/anoxia in estuaries

Control Points for Reducing N Losses in Corn Production

1. Input management (higher N use efficiency – 4R)
2. Fate and transport mechanisms (drainage, irrigation, cover crops)
3. Remedial actions (filters, buffers, wetlands)

Cloud Computing and Communication

- Universal access through web-based services
- Move from generalized to adaptive, real-time, site-specific recommendations
- Communication and convenience functionality

8

Adapt-N.com

Adapt-N disclosure

According to Cornell University policy, I am disclosing that I have an equity interest in Agronomic Technology Corporation, which has received a license for the use and further development of the Adapt-N tool.

This tool was developed as part of my Cornell research program, and Agronomic Technology Corporation is providing some support to my program for the further development of this technology.

agronomic TECHNOLOGY

What factors does *Adapt-N* include in making a recommendation?

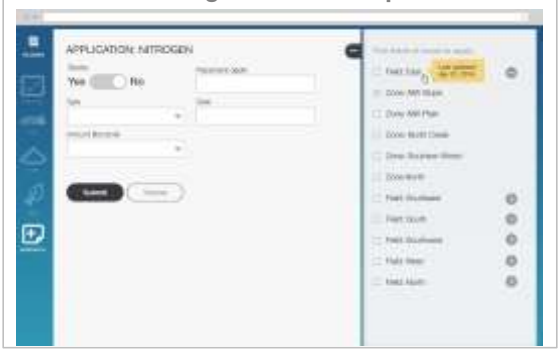
- **Weather:**
  - High resolution daily P &T, and SR data
  - Irrigation amounts and dates
- **Soil:**
  - texture/soil type, slope, rooting depth, % organic matter
  - Tillage: fall or spring plowing; conservation tillage/residue management
  - Fertilizer and manure applications: date, rate, type, N analysis, placement
- **Crop:**
  - Cultivar; planting date, maturity class, Population and expected yield
  - Rotations: soy, corn - silage or grain, or sod - last 3 yrs, % legume, surface killed or incorporated
- **Economics**: Fertilizer and grain prices & profit loss risk

Adapt-N Interface Entering Soil Information

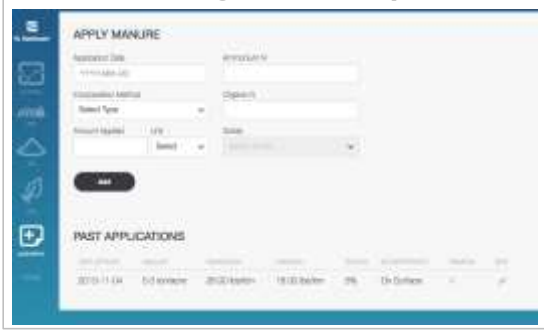
Adapt-N Interface
Entering Soils Information

Adapt-N Interface
Entering Crop Information

Adapt-N Interface
Entering N Fertilizer Inputs



Adapt-N Interface
Entering Manure Inputs



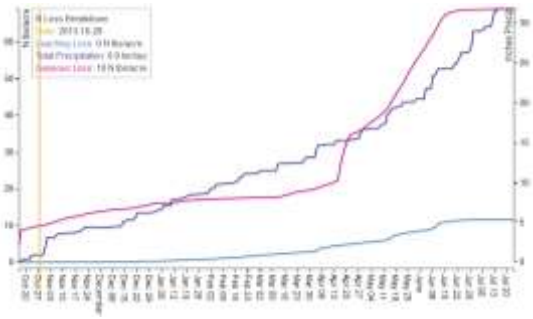
Adapt-N Interface
Entering Irrigation Inputs

Zone Recommendation

Date selection

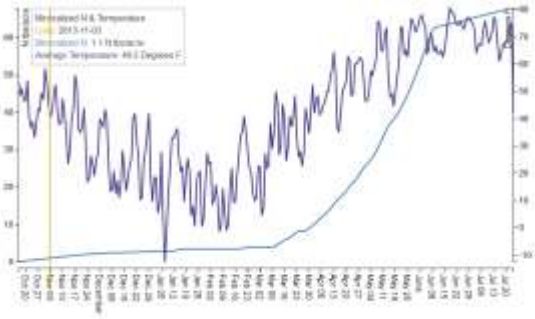
Adapt-N Graphs

cumulative precipitation; leaching and gaseous N losses



Adapt-N Graphs

Mineralized N and Temperature



Daily Alerts

Farm Summary

Standard Report - PDF

2011 – 2013 Adapt-N On-Farm Trials

Over 100 replicated trials in 10 states.

- Adapt-N vs. Grower rate: side-by-side; some with zer
- N response trials (4-6 N rates)

On-Farm Trial Performance

(Sample group includes only farms engaging in sidedress already)

Comparison	Iowa			New York			Combined
(Adapt-N rate - Grower Rate)	**2011**	**2012**	**2013**	**2011**	**2012**	**2013**	**(n=104)**
N fertilizer input (lb/ac)	-24	-36	-19	-60	-65	+20	**-43**
Yield (bu/ac)	+2	-1	+1	-3	1	21	**+3**
Profit ($/ac)	+$26	+$17	+$12	+$26	+$32	+$94	**+$35**
Trials with greater profit	78%	74%	67%	86%	79%	82%	**77% ***

*Adjusting for verified model improvements and optimal tool use, 88% of trials would have resulted in greater profit.

Bottom Line: What are Adapt-N's Benefits?

- Profit increases, with overall less N use
- Economic and environmental benefits
- Transparency and insights
- Incentives for better management

Walmart:

"fertilizer is by far the "hottest" input in our supply chain"

Soil Health Initiatives

The Soil Renaissance will focus on four initiatives:
Measurement: To incorporate soil-health measures into standardized soil testing that is readily available, affordable, and commercial viable.
Economics: To quantify the effects of soil health on economic risks and returns.
Education: To reawaken the public to the importance of soil health.
Research: To convene the research community to advance soil health.

Farmfoundation.org

Soilhealthpartnership.org

Our ultimate goals are to **MEASURE AND COMMUNICATE THE ECONOMIC AND ENVIRONMENTAL BENEFITS** of different soil management strategies and provide a set of regionally specific, data-driven recommendations that farmers can use to improve the productivity and sustainability of their farms.

USDA Strategic Plan 2014-18

Director for new USDA-NRCS Soil Health Division:
Dr. Bianca Moebius-Clune

Quantification

"You don't know if you don't measure…."

"What gets measured, get done….."

Cornell Soil Health Test

18 indicators; available since 2006

Indicator	Value	Rating	Constraint
Available Water Capacity	0.24	30	
Surface Hardness	200	[illegible]	[illegible]
Subsurface Hardness	340	[illegible]	[illegible]
Aggregate Stability	17.7	[illegible]	[illegible]
Organic Matter	2.4	[illegible]	[illegible]
ACE Soil Protein Index	9.1	[illegible]	[illegible]
Root Pathogen Pressure	1.2	[illegible]	
Respiration	0.01	[illegible]	[illegible]
Active Carbon	280	[illegible]	[illegible]
pH	6.8	[illegible]	
Phosphorus	20.0	[illegible]	
Potassium	150.0	[illegible]	
Minor Elements		[illegible]	
Overall Quality Score		48	Low

Cornell Soil Health Test identifies Constraints

→ ties each Indicator to Soil Function and Processes

Physical Indicators	Soil Functions and Processes
Aggregate Stability	Resistance to falling apart during rainfall; aeration, infiltration, germination, prevent runoff & erosion
Available Water Capacity	Water that plant can use; drought resistance, prevent leaching
Surface Hardness	Penetration resistance 0"- 6"; aeration, surface rooting, infiltration, germination, prevent runoff & erosion
Subsurface Hardness	Penetration resistance 6" - 18"; deep rooting, drought resistance, water movement and drainage, extreme precipitation resilience
Biological Indicators	**Soil Functions and Processes**
Organic Matter	Water and nutrient storage/release, long-term energy storage, C sequestration
Active Carbon	carbon easily available as short-term microbial food source
Root Pathogen Pressure	disease suppressiveness of microbial community for vegetables
2014: Soil Proteins	N containing fraction of organic matter, N release
2014: Respiration	microbial activity, nutrient release

Chemical Indicators: Standard Soil Test Analysis included

Management Recommendations

Constraint	Short Term Management Suggestions	Long Term Management Suggestions
[illegible]	• Add stable organic materials, mulch • Add compost or biochar • Incorporate high biomass cover crop	• Reduce tillage • Rotate with soil crops • Incorporate high biomass cover crop
[illegible]	• Perform some mechanical soil loosening (strip till, aerators, broadfork, spader) • Use shallow-rooted cover crops • Use a living mulch or perennial cover crop	• Shallow-rooted cover/intercrops • Avoid traffic on wet soils, monitor • Avoid increase traffic/tillage loads • Use controlled traffic patterns/lanes
[illegible]	• Use targeted deep tillage (subsoiler, broadfork plow, chisel plow, spader) • Plant deep rooted cover/cash crops (radish)	• Avoid plows/disks that create pans • Avoid heavy loads • Reduce traffic when subsoil is wet
[illegible]	• Incorporate fresh organic materials • Use shallow-rooted cover/intercrops • Add manure, green manure, mulch	• Reduce tillage • Use a surface mulch • Rotate with soil crops and incorporate high biomass
[illegible]	• Add stable organic materials, mulch • Add compost and biochar • Incorporate high biomass cover crop	• Reduce tillage/mechanical cultivation • Rotate with soil crop • Incorporate high biomass cover crop
[illegible]	• Add N rich organic matter (low C:N source like manure; high N well/fertilized compost) • Incorporate living, green, cover crop biomass • Plant legumes and grass/legume mixtures • Incorporate biomass seed meal, Bioactive & check for nematodes	• Reduce tillage • Rotate with Rhizo legume soil crop • Cover crop and add fresh manure • Scout grit at 0-1-0-1 (Judge ⅓ Rotation) • Monitor C:N ratio of inputs
[illegible]	• Use disease-suppressive cover crops • Plant on edge/raised beds • Monitor respiration • Biofumigate	• Use disease-suppressive cover crops • Increase diversity of crop rotation • Sterilize seed and equipment • Suppress disease/nematode organisms

Important Considerations

- Report is a management guide, not a prescription
- Different management approaches can mitigate same problem
- One management practice can affect multiple constraints
- Adapt report information to a mgmt strategy to fit your field/farm
- Soil health changes slowly over time

SH Management Planning Process Overview

1. Determine farm background and management history

Compile background info: history by management unit, farm operation type, equipment, access to resources, situational opportunities or limitations.

2. Set goals and sample for soil health

Determine number and distribution of soil health samples needed according to operation background and goals.

3. For each management unit: identify and explain constraints, prioritize

Soil Health Report identifies constraints, guides prioritization. Explore results based on background, and adjust priorities.

4. Identify feasible management options

Management suggestions table available as part of Soil Health Report, or online with NRCS practice designs

5. Create short and long term Soil Health Management Plan

Integrate agronomic science of 2-4 with grower realities of 1 to create a specific short-term schedule of management practices for each management unit and an overall long-term strategy

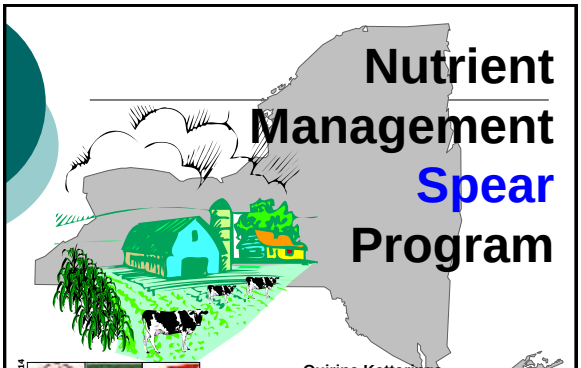
6. Implement, monitor, and adapt

Implement and document management practices. Monitor progress, repeat testing, and evaluate outcomes. Adapt plan based on experience and data over time.

Website...

http://soilhealth.cals.cornell.edu

Nutrient Management Spear Program



Sept 23, 2014

Quirine Ketterings
Nutrient Management Spear Program and PRODAIRY
Department of Animal Science, Cornell University
http://nmsp.cals.cornell.edu

Nutrient Management Spear Program

website

http://nmsp.cals.cornell.edu

Nutrient Management Spear Program

Overall Goal

Enhance farm productivity while protecting the environment for long-term sustainability of agriculture in New York

The sustainability of

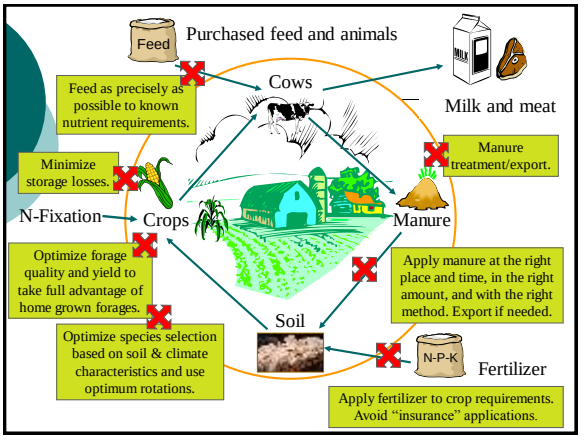
dairy and livestock farms

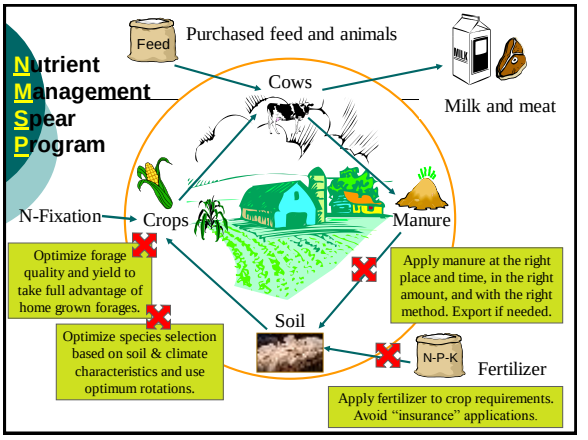
in New York State will depend greatly on their ability to

protect air and water quality

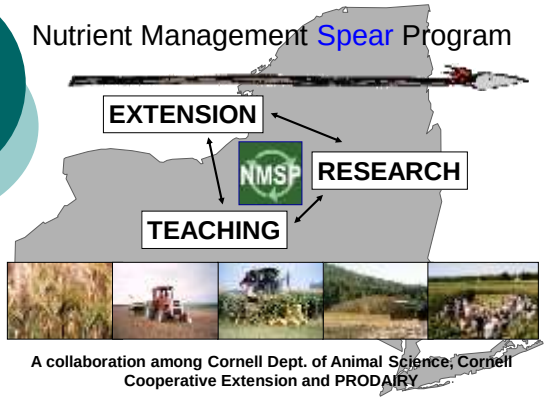
from the effects of

excess nutrients!





Nutrient Management Spear Program



A collaboration among Cornell Dept. of Animal Science, Cornell Cooperative Extension and PRODAIRY

Nutrient Management Spear Program

NMSP project foci:

1. Fertilizer recommendations
2. Land application of manure/compost/whey
3. Tools for fertility management
4. Software tools for nutrient management implementation
5. New York On-farm Research Partnership
6. Whole farm nutrient management

The NMSP Team

Key Collaborator:
Karl Czymmek
Senior Ext. Associate, PRODAIRY

Graduate Students:
Emma Long
Animal Science, MS '15
Keenan McRoberts
Animal Science, PhD '15
Jeff Liebert
Soil and Crop Sciences, MS/PhD

Undergraduate Students:
Elyce Buell, B&E Engineering
Andrew LeFever, Agricultural Sciences
Tyler Pardoe, Agricultural Sciences
Rachel Breslauer, Agricultural Sciences

Staff:
Greg Godwin, Research Support Specialist
Sanjay Gami, Research Associate
Sheryl Swink, Research Aide
Sebastian Cela, Postdoc
Pilar Berenguer, Postdoc
Amir Sadeghpour, Postdoc
Aristotelis Tagarakis, Postdoc
Melanie Soberon, Postdoc

In collaboration with:
- **Field crop extension educators**
- **Crop consultants and planners**
- **Agency staff (NRCS/SWCD)**
- **Ag industry representatives**
- **Colleagues in many departments/ institutes within and outside Cornell**

Nutrient Management Spear Program

Current Research Projects
- Phosphorus Index revisited (CB project)
- Manure injection for corn, alfalfa, grass (CB project)
- Corn yield potential and adaptive management with CSNT
- Winter cereals as forage double crops
- Statewide P and N balances
- Whole farm mass nutrient balances
- Greenseeker technology for N for corn
- Greenhouse gas emissions from manure (multistate DairyCap)
- Yield monitors; evaluation of accuracy and precision
- Cover crop nitrogen credits
- Spatial variability of corn stalk nitrate test results
- Corn and alfalfa management with manure or compost
- Land application of whey
- Cation exchange capacity
- Sulfur for alfalfa
- Potassium for alfalfa

Manure Injection for corn and hay

Injection into grass and alfalfa
Six replications

Greenhouse gas emissions

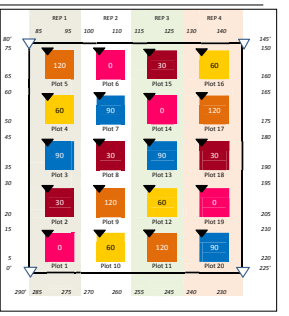
Dairy Cap –
Collaboration with Wisconsin, Penn State, and many other universities and institutes

Winter cereals as forage double crops

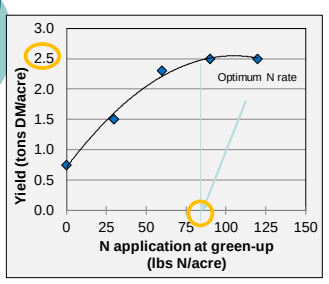
56 on-farm trials completed in 2 years

Winter cereals as forage double crops

- Fields of cereal rye, triticale, or wheat harvested as forage
- Homogenous looking areas of 65 by 80 ft.
- 4 replications, 5 N rates:
  - 0 lbs of N/acre
  - 30 lbs of N/acre
  - 60 lbs of N/acre
  - 90 lbs of N/acre
  - 120 lbs of N/acre



Winter cereals as forage double crops

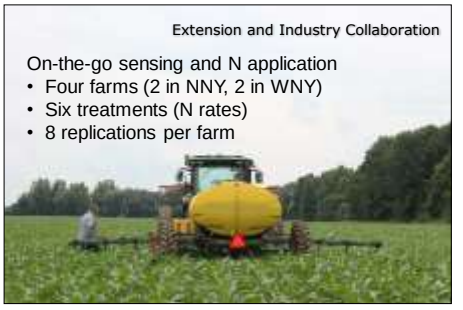


- To determine the optimum N rate, use five N rates (curved response is essential).
- Trials are be replicated four times.
- 56 trials done

Such trials fall under the "adaptive management strategy" of NRCS

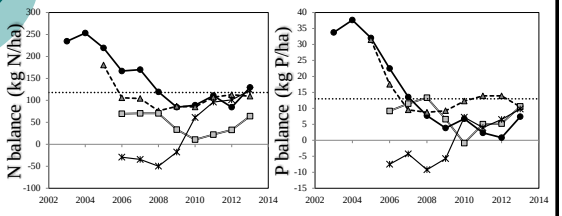
Sensor technology – precision ag

Agrinetix and Cornell Cooperative Extension



Whole farm nutrient balances

More than 500 farm balances collected to date
Working with farm data to set feasible benchmarks



Development of TIER2 sheets

Nutrient Management Spear Program

Whole farm nutrient balances

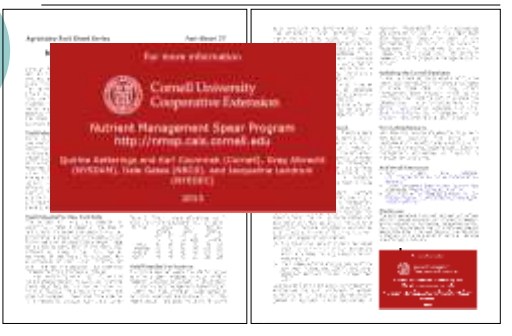
Nutrient Management Spear Program

"The history of collaboration and trust between the public, academic, and private sector stakeholders in New York State has led to a track record of efficient problem solving. Involve stakeholders in the process and hold them accountable to create real solution."

- Private consultant

New Adaptive Management Approach

New Adaptive Management Approach



SWCC and Cornell

Shall we discuss the establishment of a more formal committee structure to discuss science and its application for AEM?

Thank You!

Quirine M. Ketterings
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qmk2@cornell.edu - http://nmsp.cals.cornell.edu