NERA

Northeastern Regional Association
of
State Agricultural Experiment Station Directors Meeting

September 20, 2016

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NERA

Northeastern Regional Association
of
State Agricultural Experiment Station Directors Meeting

Jackson Lake Lodge
Jackson, WY

September 20, 2016

7:00-8:45 AM

Agenda

Tuesday, September 20th [Antelope 2]

6:30 am	Breakfast, East Mural Room
7:00 am	Call to Order and Introductions – Cameron Faustman, Chair • Introductions • Agenda Modification (Additions/Deletions) and Approval • Approval of the minutes of June 20-22, 2016 NERA Meeting, Pittsburgh, PA
7:10 am	NERA Executive Committee Report – Cameron Faustman, Chair • Interim Actions • Announcements • New NERA Coordinator, David Leibovitz
7:15 am	NERA Budget – Rick Rhodes, ED
8:00 am	NERA Planning Grant Recommendations – Fred Servello, Chair-MAC
8:15 am	Multistate Activities Committee Report – Fred Servello, Chair-MAC
8:30 am	Best Practices Discussion for March 2017 meeting – Cameron Faustman, Chair
8:40 am	Meeting announcements – Cameron Faustman, Chair

	• APLU Annual Meeting – Austin, TX, November 13-15, 2016 • NERA March 2017 meeting -Admiral Fell Inn, Baltimore, MD; March 7-8, 2017 • NEED/NERA Joint Meeting, Summer 2017 -Conduct in conjunction with NEED, Greenbrier, WV -Suggested dates: June 19-21 and June 12-15 (substantial savings on room) -Meeting agenda planning group (Jan Nyrop, Steve Bonanno, Tim Phipps, incoming NEED chair, 2 CARET reps, NEED Ed, NERA Ed) • ESS meeting, Fall 2017 -Hosted by ESCOP, Chair elect, Gary Thompson -September 25-28, 2016 -Theme: A Question of Balance
8:45 AM	Adjourn

NERA

Northeastern Regional Association
of
State Agricultural Experiment Station Directors Meeting

Sheraton Pittsburgh Hotel at Station Square, Pittsburgh, PA
June 20-22, 2016

Draft Minutes

In Attendance:

Cameron Faustman, Chair
Brad Hillman
Gary Thompson
Margaret Smith
K. Eric Wommack
Bill Miller
Fred Servello
Rick Rhodes III
Tim Phipps
Dan Rossi
Adel Shirmohammadi
Jody Jellison
Jon Wraith
Rubie Mize, Recorder

1. Call to Order and Introductions – Cameron Faustman, Chair
Chair Cameron Faustman called the meeting to order at 10:33AM. All present gave brief introductions.

2. Agenda Modification (Additions/Deletions) and Approval - Cameron Faustman
http://web.uri.edu/nera/files/NERAAgendaJune2016.pdf

Additions to the agenda were -

- Prior Approval for Equipment purchase from USDA
- Travel to other countries with Department of State prohibitions and how institutions handle that
- Brad Hillman presented Resolutions honoring Dan and Rubie for their years of service with NERA. Both were also presented with plaques and gifts. Dan and Rubie thanked the directors for their unwavering support throughout the years.

3. Approval of the March 14-16, 2016 Minutes of the NERA Meeting – Cameron Faustman
http://web.uri.edu/nera/files/NERAMinutesMarch2016.pdf

Motion to approve minutes, seconded and passed.

4. Multistate Activities Committee Report and Discussion – Fred Servello
http://web.uri.edu/nera/files/MACReportJune2016.pdf

Motion to approve NEtemp1640 seconded and passed.

Motion to approve Request to Write for NE1048 seconded and passed.

5. NRSP Review Committee Recommendations – Fred Servello, Dan Rossi

Fred summarized NRSPRC report and will be considered for action at the ESS Meeting in September.

Highlighted were the following:

- NRSPtemp11 business plan was in question, as well as its sustainability. Resubmittal would be accepted but with major revision. To be discussed in detail at Sept. meeting.
- NRSP8 – midterm review
- NRSP7 – Margaret Smith serves as our regional advisor. She noted that it's a great group of people who have done phenomenal work with minimal support. They will apply as a Coordinating Committee. This is animal analogy of IR4. There aren't approved protocols, so this project remedies that. Challenge is minimal budget. Group will look into going back to USDA budget. There is real need to be addressed, and there are approval documents in progress that are held under the name of this group. If this will not continue in existence, then FDA will question the approvals that go through this project.
- Advisor for NE1049 – Tim Phipps
- NERA Planning Grant to be released July 2016
- Cameron F. distributed handouts on NRSP-9 that he's regional advisor for, and noted that group had made significant progress.

6. Review of Joint Session Discussions and Next Steps – Cameron Faustman
Chair asked for feedback – Are we heading to the right direction?

Comments were:
- Interactive presentation engaged participants
- Best Practices was best session, and we should continue to use this format in future meetings
- Want to see summary of Best Practices to bring home to institutions - secret sauces internal and external – hired team builder, aligning faculty reward with agency award, leader dedicated/champion to volunteer and give time, relationship builder, forums bringing faculty together. Flip side are spoilers- small grants have the same transaction costs as big grants. Some players get left out. Challenge also knowing who's out there doing what.
- Heard things that can be acted upon and built linkages to work with. People hear and interpret differently.
- Good to have summary for people to remember and maybe action steps.
- Need more time for discussion, those are great talks.
- Lightning talks can be successful. Discussion will depend on group dynamic.

- Speakers embraced idea that they're in panel and are just introducing topic.
- Good to have Joint Session moderated by chairs
- Ask for input ahead of time and share summary, but what's probability that all will send info?
- Start culture of having facilitator
- Set up meeting with small rounds, perhaps for open discussion.
- How we address integration was dry run for Sept. meeting. Dan Lerner will give presentation on behalf of Northeast at the national meeting and will use same project.
- Chair commented that format worked well - continue next year, have facilitator, room set-up in rounds and hold people to time

Tim P. commended the NERCRD presentation. In one of Board's calls, he suggested that Stephan give this presentation. Extension will be asked to contribute $50K, and NERA also $50K (current is $40,788). Need to get support from institutions to increase funding for all rural development centers. Centers coordinate well. S. Goetz can accomplish a lot in the Northeast with our contribution.

Chair Faustman suggested waiting until next round to discuss increase for NERCRD support under NE59 because NERA did not pass a budget yet.

7. Nominations Committee Report – Tim Phipps

Motion to approve Tim Phipps as Advisor for NE1049 and NERCRD Research Director, seconded and passed.

8. Resolutions Committee Report – Brad Hillman

Resolution of Appreciation for Host – Motion seconded and approved.

Resolution of Appreciation

WHEREAS, the Northeastern Regional Association of State Agricultural Experiment Station Directors participated in an engaging, thought-provoking and productive meetings at the Sheraton Pittsburgh Hotel at Station Square, Pittsburgh, PA, and

WHEREAS, the Directors enjoyed the educational and relaxing tours of Frank Lloyd Wright's Fallingwater house, the Ohiopyle State Park, PNC Park, Heinz Global Innovation and Quality Center and Soergal Orchards. Impacts of Land-grant programs in this region of the State of Pennsylvania, both rural and urban, were highlighted in some of these tours, helping us gain more appreciation for what we do in the region, and

WHEREAS, the Directors express appreciation for a well-planned, well-organized and engaging joint meeting, under the theme of *"The Impact of Innovation on the Environment and Health"*, with the Northeast Extension Directors (NEED), Deans and Administrative Heads (AHS) and Members of the Council for Agricultural Research, Extension and Teaching (CARET) on June 21-22, and

WHEREAS, the Directors enjoyed the tour of the Phipps Conservatory and Gardens, and the delightful dinner at Pittsburgh Field Club, and

NOW, THEREFORE BE IT RESOLVED that the Directors acknowledge their appreciation to Dean Richard Roush, AES Director Gary Thompson, CES Director Dennis Calvin, Mary Seaton, Mary Wirth and Rachel Unger for making the meeting a great success and a memorable experience.

July 22, 2016

Cameron Faustman, Chair (signed)
Northeastern Regional Association of State
Agricultural Experiment Station Directors

9. ESCOP Report – C. Faustman, G. Thompson, R. Rhodes, A. Shirmohammadi, D. Rossi
See report attached.

Dan noted important meetings such as Joint COPs in Austin, TX and ESS/CES Meeting in Jackson Hole, WY. Past chair and new ED will attend Austin meeting.

Gary's B&L committee is looking at capacity evaluation. Bill Brown will take over as Chair of this committee.

Rick's CMC wrote POW last year and implemented it. Number of tasks directly impact directors. CMC is working with kglobal to make statistics in report easily comprehensible. Deans and directors can work with their respective communication officers to help translate. Rick encouraged directors to read kglobal's newsletter, re-tweet etc. and to participate/engage. It's all about getting word out that, "Land grant university is a public value". Educate congressional delegates and key decision makers.

CMC working closely with APLU and Cornerstone to measure impact of our investment. For right now, impact is that we're not experiencing cuts. Is there a way to query congressional staff? Dan said we've had focus group but we need funding to do another one, $133K-$150 from each section.

University communicators are asked to be actively engaged with CMC work. Not asking for more, but help in bringing message to national level. Kglobal can help with that. Newly hired communicators should be included in the national database. Faith Peppers and Sarah Lupis are working with communicators.

Dan noted sensitive issue about distribution of kglobal reports. Those are sent to deans and directors and can share with others at own discretion. CMC Chair will have description of terms accompanying reports. CMC Plan of Work and implementation steps will be shared with directors. Rick also said to contact him if communicator has questions.

There has not been much progress on the Open Access issue.

Diversity Task Force had accomplished a great deal and details will be reported at ESS Meeting.

10. Executive Director's Report – Dan Rossi
See report attached.

- NERA Planning Grants – OED finishing up processing of invoices and travel claims
- Transition to URI underway. Rubie will send out the NERA Invoices and emphasize that checks be sent to URI
- IR-4 coordinator on board at UMD, and one additional staff
- NRSP Review Committee will be chaired by Fred Servello starting 2017
- BAA CLP – need to streamline process and will discuss multi-year priorities.

- Deferred maintenance - Committee from APLU heading and working with Sonny, may be a line item request. High in Sonny's agenda.

11. Executive Director's Goals and Plans – Rick Rhodes
    - Transitioning from Rutgers to URI
        - Cooperative agreement signed by URI, and forward to Cameron for signature – no substantive changes
        - ED position approved by State of Rhode Island. Secured waiver of search
        - Approval of Asst. to ED position – changed title to Coordinator and job requirement, 3 years of prior experience not 5.
        - Established a NERA account
        - NERA Office open for business
        - Migrating listservs and website to URI
        - Immediate goal is seamless transition.
    - Establish Plan of Work and do this collectively and implement
    - Visit all institutions to see/discuss challenges – prepare POW then perform gap analysis. Suggestion is to have a 5 year plan that will include directors' input/vision, needs in states, and see gaps that can be filled by the multistate program.
    - Meeting with other Executive Directors
    - Rick will retain 3 year tenure and also has 3-year contract with NERA
    - NERA to continue to play role of supporting the activities for the region – support summer Planning Committee

12. Equipment Prior Approval for Capacity Grantees

Prior approvals of $5K or more purchase using capacity funds with useful life more than one year needs approval from USDA, even if part of cost is borne through match.

- Concerns that this is problematic. Justifiable for big purchases, but not for smaller investments for equipment that can be funded using other sources and may be used for different purposes.
- McIntire-Stennis can only do purchase it if its written in original project. New requirement essentially saying not to buy equipment using capacity funds.
- Some equipment used partially for AES, so this makes it complicated. Let stations manage funds, and make decisions to meet their needs.
- Need to understand what's driving this? Already have procurement in place in our universities. This is one more bureaucracy.
- Home institutions already restrictive in using capacity funds for equipment purchase.
- USDA thinks these are grants. There's ability to provide feedback up to June 30th. Join webinar and send concerns. Red flags- buying at end of project and splitting costs.
- Send comments to Margaret.ewell@nifa.usda.gov
- Rick will discuss with other EDs, so copy Rick your comments. Good to get response from ESCOP, perhaps B&L.

13. Faculty travel to other countries where there are Dept. of State prohibitions - how do your institutions handle that?
    - UCONN has 8 questions before traveling. What is required by your university?
    - WVU does not restrict faculty but students are asked to get insurance
    - No restriction at Pennstate
    - Cornell required to enter info in general travel registry

- Most universities would warn travelers but not restrict travel

14. Other Business
    - Farm Bill survey – respond by July 1st
    - PBD Plan of Work – respond to Dan and Rick by June 30th

15. Topics for Future Best Management Practices Sessions

- For Sept. meeting – pick topic(s) from attached list
- Chair noted discussion at last meeting to bring communicators to our meeting(s). Summer meeting might be good time to bring them. Directors think it's good idea. Have them participate in meetings and have their own breakout. Also invite kglobal. Take them to joint meeting.
- Rick suggested a follow up to conversation on **'tapping new sources of funding'**. What are success stories? UVM first time to get from FDA. Are there other examples out there? What does it take to send faculty to apply to other agencies? We tend to focus too much on AFRI, and should go after others.
- Impact statements – how to use media and use technology to deliver impacts. A Director commented that REEport is not useful for getting good data. What are other sources for good data to write impacts?
- How to handle budgeting and resource allocation issues? Internally, we handle different types of requests. Do you do a hard budget commitment or do you give an allocation to the department head who then allocates in different way?
- Chair will facilitate discussion and get 3 directors to do 7min talks. Draft 5-6 questions that people can respond to, and summarize if there's any pattern.
- Dan suggested first two topics in potential list for Sept. meeting (see attached list below)
    - Flexible budget and resource allocation methods; i.e., historical, competitive, programmatic, etc.
    - How we handle funds

16. 2016 ESS/SAES/ARD Workshop Program – Dan Rossi
https://conferencereg.colostate.edu/Jackson2016

Our regional example is the UVM project and will be presented by Dan Lerner. Rick will ask Dan Lerner to make sure he covers both research and extension in his presentation.

17. Summary Comments and Adjournment – Cameron Faustman
Chair Cameron Faustman thanked and wished everyone safe travels home.
Meeting adjourned at 2:05PM.

Future Meetings:

- ESCOP Meeting in conjunction with 2016 Joint COPs meeting, San Antonio, TX, July 18-20, 2016
  http://www.aplu.org/meetings-and-events/events/joint-cops-meeting-1
- 2016 Joint CES and ESS Meeting and Workshop, Lake Lodge, Jackson, WY, September 19-22, 2016
  https://conferencereg.colostate.edu/Jackson2016
- ESCOP Executive Committee Meeting, Austin, TX, November 13-15, 2016
  http://www.aplu.org/meetings-and-events/annual-meeting/2016

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Sheraton Pittsburgh Hotel at Station Square, Pittsburgh, PA
June 20-22, 2016

Draft Agenda

Monday, June 20

8:30 am	Optional Tours
3:30 pm	Registration
5:00 pm	Reception and Welcome
7:00 pm	Dinner on Your Own or Optional Baseball Game

Tuesday, June 21

7:00 am	Breakfast and Registration
8:00 am	See Joint Session Agenda http://www.cvent.com/d/3rq5kz
4:30 pm	Adjourn for the Day
5:00 pm	Tour of Phipps Conservatory
6:30 pm	Dinner at Pittsburgh Field Club

Wednesday, June 22

7:00 am	Breakfast

8:00 am	Joint NEED-NERA Meeting – Cameron Faustman • CARET/Cornerstone Update and Discussion • NERCRD Update and Discussion – Stephan Goetz • NEED-NERA Joint Best Practices Session
10:00 am	Break
10:15 am	Call to Order and Introductions – Cameron Faustman, Chair
10:20 am	Agenda Modification (Additions/Deletions) and Approval - Cameron Faustman http://nera.rutgers.edu/workshop/NERAAgendaJune2016.pdf
10:25 am	Approval of the March 14-16, 2016 Minutes of the NERA Meeting – Cameron Faustman http://nera.rutgers.edu/workshop/NERAMinutesMarch2016.pdf
10:30 am	Multistate Activities Committee Report and Discussion – Fred Servello http://nera.rutgers.edu/workshop/MACReportJune2016.pdf
11:00 am	NRSP Review Committee Recommendations – Fred Servello, Dan Rossi
11:15 am	Review of Joint Session Discussions and Next Steps – Cameron Faustman
11:30 am	ESCOP Report – C. Faustman, G. Thompson, R. Rhodes, A. Shirmohammadi, D. Rossi
12:00 pm	Box Lunch
12:30 pm	Executive Director's Report – Dan Rossi
12:45 pm	Executive Director's Goals and Plans – Rick Rhodes
1:15 pm	Topics for Future Best Management Practices Sessions
2:15 pm	2016 ESS/SAES/ARD Workshop Program – Dan Rossi https://conferencereg.colostate.edu/Jackson2016
2:20 pm	Nominations Committee Report – Tim Phipps
2:25 pm	Resolutions Committee Report – Brad Hillman
2:30 pm	Summary Comments and Adjournment – Cameron Faustman
	Future Meetings: • ESCOP Meeting in conjunction with 2016 Joint COPs meeting, San Antonio, TX, July 18-20, 2016 http://www.aplu.org/meetings-and-events/events/joint-cops-meeting-1 • 2016 Joint CES and ESS Meeting and Workshop, Lake Lodge, Jackson, WY, September 19-22, 2016 https://conferencereg.colostate.edu/Jackson2016 • ESCOP Executive Committee Meeting, Austin, TX, November 13-15, 2016 http://www.aplu.org/meetings-and-events/annual-meeting/2016

NERA Meeting

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Experiment Station Committee on Organization and Policy Report

March – June 2016

ESCOP Officers:

- Chair – Shirley Hyman-Parker
- Chair-Elect – Bret Hess
- Past Chair – Robert Shulstad
- Executive Vice Chair – Carolyn Brooks
- ESS Rep to BAA Policy Board – Clarence Watson
- Budget and Legislative Committee Chair – Gary Thompson
- Communications & Marketing Committee Incoming Chair – Richard Rhodes
- Science & Technology Committee Chair – Marikis Alvarez
- NRSP Review Committee Chair – Clarence Watson

NERA Representatives to:

- ESCOP:
  - Tim Phipps
  - Cameron Faustman
  - Mark Rieger
- ESCOP Budget & Legislative Committee
  - Tim Phipps
  - Jon Wraith
- ESCOP Science & Technology Committee
  - Cameron Faustman
  - Adel Shirmohammadi
- NRSP Review Committee
  - Fred Servello

Meetings

- ESCOP Meeting in conjunction with 2016 Joint COPs meeting, San Antonio, TX, July 18-20, 2016
- 2016 Joint CES and ESS Meeting and Workshop, Lake Lodge, Jackson, WY, September 19-22, 2016
- ESCOP Executive Committee Meeting, Austin, TX, November 13-15, 2016

Budget and Legislative Committee

- The ESCOP Budget and Legislative Committee meets monthly by conference call.

- The Committee is monitoring progress and providing input into the BAA Budget and Advocacy Committee in advocating NIFA 2017 budget.
- The Committee continues to coordinate efforts with its ECOP counterpart
- The Committee is closely monitoring the proposed NIFA Capacity Programs Evaluation, the Deferred Maintenance Committee activities and the 2018 Farm Bill development.

Communications and Marketing Committee

- The Communications and Marketing Committee (CMC), a joint ESS, CES and AHS effort to oversee and guide the Communications and Marketing Project (CMP), held its quarterly conference call on June 7, 2016.
- The CMC has prepared an implementation plan for its 2016 plan of work. The plan identifies a number of specific tasks, lead individuals and timetables.
- The CMC chair will distribute the first quarter report and executive summary from kglobal along with an interpretive cover letter.
- The Committee is working on a transition in leadership and support.

Science and Technology Committee

- The ESCOP Science and Technology Committee meets monthly by conference call.
- The Committee continues to focus on USDA's open access policy for data and publications and the recent APLU report on antibiotic resistance
- The Committee has reviewed reviews regional ESS Multistate Research Award nominations and submitted a recommendation for national winner to ESCOP Executive Committee
- The Committee is also helping coordinate the ESS Excellence in Leadership Award process.

National Research Support Review Committee

- The ESCOP NRSP Review Committee met in Atlanta, GA on May 31, 2016 to develop recommendations on five year proposals and budgets.
- The Committee is recommending that the directors not approve the proposed NRSP, "National Agricultural Research Data Network for Harmonized Data," as presented and identified a number of concerns that should be considered prior to resubmission.
- The Committee reviewed the mid-term review for NRSP-8 and agreed project is progressing well and no changes are needed.

Diversity in Research Leadership Task Force

- The Diversity in Research Leadership Task Force was charged to explore the topic of diversity in research leadership across the Land-grant university system, to provide ideas and actions for consideration, and to supplement institutional, regional and national diversity and inclusion efforts. The focus will be primarily on enhancing diversity among the Experiment Station Directors, Research Directors, and their associates and assistants.
- The Task Force is chaired by Karen Plaut of Purdue and meets monthly by conference call.

- The Task Force has focused on three key areas – Recruitment and Mentoring, System Integration and Training that provide key action elements for adoption and implementation over the next several years.
- A draft report of the Task Force has been prepared and will be presented to the ESCOP leadership

NERA Meeting

June 22, 2016
Sheraton Pittsburgh Hotel at Station Square, Pittsburgh, PA

Report of the Office of the Executive Director

March 17, 2016 – June 17, 2016

NERA and Regional Activities

- Planning Grants Program
  - Supported the 2015 NERA and NEED/NERA award recipients
  - Facilitated a review of the 2016 NEED/NERA Integrated Planning Grant proposals.
  - Notified the award recipients
- 2016 Northeast Summer Session
  - Supported the event planning and program planning committees
  - Supported development of joint NEED-NERA meeting agenda
- NERA Chair Support
  - Assisted in the development of the June 2016 NERA meeting agenda and compiled agenda materials
    - Prepared NERA Chair's Interim Actions report
    - Prepared NERA ESCOP Report
    - Prepared NERA OED report
    - Prepared a list of previous and potential best management practice session topics
  - Assisted in the development of the March 2016 NERA Executive Committee meeting agenda
  - Prepared materials for the submittal of the 2016 ESS Multistate Research and Excellence in Leadership nominations and APLU awards program
- NERA Executive Director Search and Transition
  - Assisted in scheduling interviews
  - Prepared draft of offer letter
  - Prepared draft of announcement
  - Prepared draft of NERA URI cooperative agreement
  - Worked with RU SEBS Business Office to initiate closure of NERA accounts
  - Worked with RU Business Office to initiate the transfer funds to URI
- Multistate Activities Committee (MAC) Support
  - Assisted in the development of the June 2016 MAC meeting agenda and compiled agenda materials
  - Worked with advisor and technical committee members to submit full proposal in NIMSS, contact peer reviewers, invite participation and complete revision as suggested by reviewers for project NE_TEMP1640 (currently NE 1040): Plant-Parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems [10/2016-09/2021]

    - Assisted project advisor for NE1227- Ovarian Influences on Reproductive Success in Ruminants [10/2012-09/2017] in submitting Midterm Review in the new NIMSS, to be considered with Request to Write at MAC's fall meeting
    - Assisted a number of multistate projects in submitting their Annual Reports in the new NIMSS.
- NE USDA Climate Hub
    - Participated in bi-monthly conference calls with NE Climate Hub state representatives
    - Participated in monthly calls with NE Climate Hub leadership
- Great Lakes Specialty Crop Climate Consortium
    - Worked with Jeff Jacobsen on next phase of this program.
- IR-4 (NRSP-4)
    - Served as NE Regional Director
    - Served as co-PI on Northeast Region IR-4 2015-16 NIFA grant
    - Continued to work with the University of Maryland on the development of new NE field coordinator office
    - Continued to work with Rutgers to host additional field research which will be transferred from Cornell
    - Chaired the IR-4 Path Forward planning activity
    - Assisted in the preparation for an external organizational review of the IR-4 program
- NE-1049
    - Served as Administrative Advisor
    - Conducted mid-term review

National Activities

- ESS/CES Communications and Marketing Committee
    - Served as the ESS Executive Director point person
    - Assisted in scheduling, planning and agenda development for quarterly Executive Committee and Full Committee conference calls
    - Supported the CMC Chair in developing an implementation plan for the 2016 Plan of Work
    - Prepared monthly reports for ESCOP CAC calls
    - Worked with leadership in transition of Committee support
- ESCOP Chair's Advisory Committee (CAC)
    - Participated in monthly CAC conference calls
- ESS-CES/NEDA Joint Meeting and Workshops
    - Participated in monthly planning calls for 2016 Joint ESS and CES meeting
    - Assisted in the development of the program agenda for the 2016 joint meeting
- ESCOP NRSP Review Committee
    - Served as Executive Director representative to the NRSP Review Committee
    - Participated in annual meeting
- NRSP-1 Management Committee
    - Participated in quarterly conference calls of the NRSP-1 Management Committee

- NIMSS
    - Served as regional NIMSS Coordinator
    - Terminated Amazon Web Service contract
    - Set up accounts for new users and reactivated existing accounts in the new NIMSS
    - Helped experiment station coordinators navigate the new NIMSS to find data and submit forms
    - Reported bugs to administrators and assisted developers in fixing glitches in the new system
    - Joined webinars [for Users and Regional System Administrators] on the new NIMSS and attended a NIMSS Workshop at the NERAOC in Philadelphia.
- ESCOP Leadership Diversity Initiative
    - Participated in monthly ESCOP Diversity in AES Leadership Ad Hoc Committee conference calls
    - Served on two Task Force working groups
    - Assisted in preparation of final report and recommendations
- BAA Committee on Legislation and Policy
    - Participated in initial discussions of 2018 Farm Bill preparation
    - Supported the development of a survey to secure director input into 2018 Farm Bill
- NIFA Programs
    - Monitored (including participating in NIFA teleconferences and webinars) provided feedback on:
        - NIFA Capacity Programs Evaluation
        - NIFA budget developments
        - NIFA competitive grants programs
        - NIFA POW reporting requirements
        - NIFA Hatch MRF utilization

<u>Travel</u>

- April 24-27, 2016 – National Extension and Research Administrative Officers Conference (NERAOC), Philadelphia, PA – Rubie Mize
- May 24-26, 2016 – National Multistate Coordinating Committee Meeting, Washington, DC – Dan Rossi
- May 31, 2016 – National Research support Project Review Committee Meeting, Atlanta, GA – Dan Rossi

NERA Best Practices Session Topics

June 6, 2016

Previous

- Hatch Project Management; i.e., Project Development & Review, Reporting, and Budget Distribution Mechanisms (NERA 3/07)
- Effecting Change, Keeping Institutions Agile, Replacing Unproductive Tenured Staff (NERA 7/07)
- Allocation of Space; i.e., Office, Lab, Greenhouse, Field, etc. (ESS 9/07)
- Re-Directing Non-Productive or Unnecessary Faculty Research Programs (Re-Treading/Re-Training). (ESS 9/07)
- Estimating Costs of Raising and Managing Research Animals and Implementing Per Diem Charges; Decision Processes, Transition, Oversight, etc. (NERA 3/08)
- Budgeting for New Faculty Hires (Including Start-Up and Spousal Hires); Unique Start-Up Packages, Inter-College Spousal Hiring, Funding Start-Ups, etc. (NERA 7/08)
- Managing Significant Budget Reductions; i.e., Selective vs. Across-the-Board, Prioritization, Creative Funding Mechanisms, etc. (NERA 3/09; ESS 9/08)
- Relationships with State Departments of Agriculture (NERA 7/09)
- Institutional and Regional Responses to Budget Reductions (NERA 9/09)
- Managing High Cost Agricultural Research Facilities (ESS 9/09)
- Positioning NERA Institutions and Scientists for the New AFRI RFP (NERA 3/10)
- Adoption of a *"Culture Of Sustainability"* in Our Institutions (NERA 3/10)
- Encouraging Collaborations (NERA 7/10)
- Coordinated Regional Research on Invasive Plants (NERA 9/10)
- Documenting Impacts, How and Why (ESS 9/10)
- How Do We Want to Handle Dairy Support in the Region? (NERA 3/11)
- Intellectual Property: How It is Handled and the Role of Experiment Stations (NERA 3/11)
- Sustainable Campus Operations (ESS 9/11)
- Structuring University-Wide Centers and Institutes; Issues and Solutions (ESS 9/11)
- Program Evaluation in Plans-of-Work and Annual Reports (NERA 3/12)
- Forming, Managing and Benefitting from AES External Advisory and Advocacy Committees; What Works and What Doesn't (NERA 3/12)
- Encouraging Leadership Development for Faculty and Staff – LEAD 21 or campus-based programs (NERA 3/12)
- Future of Animal Research Programs (ESS 9/12)
- Small Farms Viability (ESS9/12)
- Resources/Faculty Sharing (NERA 3/13)
- Establishment of a Grant Support Unit in the Experiment Station, College or University Level (NERA 3/13)
- Resource Use in Our Experiment Station/Research Centers/Facilities (NERA 3/13 and 7/13)
- Northeast Faculty Hiring Decisions (NERA 7/13)
- New Budget/Management Strategies for Dealing with Austerity (ESS 9/13)
- Emerging Needs for Agricultural Engineering Research or Tech Transfer in the NE (NERA 10/14)
- Open Architecture Laboratory Management (NERA 7/15)
- Identifying Gaps in Our Research and Extension Expertise for 21st Century Problems (NE 7/15)

- Meeting the Need for Future Leadership in Teaching, Research and Extension. (NE 7/15)
- An Experiment Station's Role in Helping to Drive Economic Development (NERA 3/16)
- Communications for Telling Our Research Story (NERA 3/16)

Potential

- Flexible budget and resource allocation methods; i.e., historical, competitive, programmatic, etc.
- How we handle funds
- Hiring and supporting mid-level administrative leadership; i.e., department heads, research center directors, etc.
- State-level leadership in major research program areas; i.e., identifying & supporting faculty leaders, relationship with department heads & college administration, degree of administrative load, etc.
- Pesticide and toxic waste management on outlying research stations; i.e., compliance, disposal, personnel training, etc.
- Indirect cost recovery; i.e., commodity groups and state agency grants, use of college portion, etc.
- Developing integrated, interdisciplinary "centers of excellence"; i.e., establishment & funding, leadership, member vs. non-member, etc.
- Research faculty technical support; i.e., appropriate level, sharing technicians, partial salary, etc.
- Developing true multi-state partnerships in research
- Working with our commodity groups for funding research
- Encouraging a culture of publishing in peer-reviewed journals
- Ensuring research stands behind the extension recommendations, especially when the recommendations are referred to in state rules and policy
- Research websites and tying R, T, and E together
- Leading the local experiment station to actively initiate and engage in new initiatives
- Flexible research support for departments/units; i.e., new funding models, department/unit leaders help develop model
- Faculty performance expectations; i.e., publications, grants, teaching, etc.
- Hatch, McIntire-Stennis, and internal competitive project review processes; i.e., new/renewed Hatch & M-S project review, internal RFPs, decision processes, etc.
- Ensuring laboratory security in university settings; i.e., compliance policies, access, oversight, etc.
- Decommissioning outlying stations; i.e., decision process, local public relations, stakeholder communication, faculty/staff reassignment, etc.
- Estimating the costs of managing and supporting greenhouse research and implementing greenhouse or bench charges; decision processes, transition, oversight, etc.
- Purchasing, maintaining and managing shared equipment; oversight, use scheduling, cost sharing, etc.
- Graduate student and post doc costs
- Open access and federal mandate for data archiving – who is doing what?
- Framing the NE region's position in likely future USDA water initiatives
- Crowd-funding as a means to raise money for research et all
- Aligning faculty hires with applied research and extension needs that experiment station directors identify

Northeastern Regional Association of State Agriculutral Experiment Station Directors
Office of the Executive Director
FY16 Final and FY17 Projected Budget Status

	Final FY15		Approved FY16		Projected FY17				
Income									
Assessment	$380,489		$380,489		$380,489				
Meeting fees	$2,250		$2,700		$2,500				
Total Income	$382,739		$383,189		$382,989				
Expenditures									
Salary & Benefits									
Salary									
ED	$171,549		$179,334		$175,000	[1]			
AA	$69,433		$77,532		$50,000	[2]			
Total Salary	$240,982		$256,866		$225,000				
Benefits									
ED					$55,568				
AA					$17,522				
Total Benefits	$93,000	[3]	$103,851	[3]	$73,090	[4]			
Total Salary & Benefits	$333,982		$360,717		$298,090				
Operating									
Travel	$18,308		$17,000		$20,000				
Office Rental	$3,918	[5]	$2,000		$0				
Telephone	$1,046		$1,100		$1,100				
Postage	$45		$200		$100				
Supplies	$495		$500		$500				
Services	$3,135	[6]	$100		$0				
Meeting Expenses	$3,252		$4,500		$4,500				
Memberships	$500	[7]	$500	[7]	$500	[7]			
Total Operating	$30,699		$25,900		$26,700				
Equipment/furnishings	$0		$0		$5,000				
Website Upgrade	$60		$0		$2,500				
Planning Grants	$4,320		$20,000		$20,000				
Conference Support	$0		$0		$0				
Total Expenditures	$369,061		$406,617		$352,290				
Difference	$13,678	[8]	($23,428)	[9]	$30,699	[10]			

[1] 5% of ED salary to be charged to USDA-FAS grant ($11,528)
[2] Coordinator did not join NERA until 10/2/2016 ($16,880)
[3] Based on a 40.43% fringe benefit rate
[4] Actual fringe costs
[5] 2015 rent paid during FY2016
[6] Includes $2,362 to Amazon Web for NIMSS (paid from fund exchange with NIMSS funding)
[7] Membership dues to NC-FAR
[8] Carryover balance of $170,721 (includes $24,218 in late assessment payments minus unpaid rent of $3,918)
[9] The plan was to fund this amount from an estimated $130,379 carryover balance
[10] Expected carryover balance to FY '17: $113,636

2016-17 Planning Grants Program

Northeastern Regional Association of State Agricultural Experiment Station Directors

The Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA) announces the 8th round of its competitive planning grants program. These grants will be awarded to organize agricultural experiment station scientists and research and outreach partners in the region into teams to address high priority research needs and facilitate the transfer of new research-based knowledge to appropriate audiences. To be considered, proposed programs must be 1) in experiment station mission areas, 2) cross-disciplinary, 3) multistate, and 4) address important needs of the northeast region. Proposed programs must have a clearly defined, strong core of research activities. Programs that also contain well-developed outreach or educational components or other appropriate forms of research implementation will be most competitive. Ideally, teams will focus on new and promising research collaborations or integrated research and outreach/educational activities that bring together specialists in diverse fields to apply complementary approaches to work on an important well-defined problem. The team should include scientists from a minimum of three experiment stations in the northeast. Proposals in support of programs that are forward looking or anticipatory are especially encouraged.

NERA invites applications to support teams in the major mission areas of agricultural experiment stations in the region. Potential applicants may find two recent science roadmaps helpful: 1) A Science Roadmap for Food and Agriculture, APLU, 2010 and 2) Science, Education, and Outreach Roadmap for Natural Resources, APLU, 2014. Applicants also should consider current priorities of potential funding agencies in station mission areas (e.g., USDA-AFRI, NSF, NIH, and others) when developing proposals. Please note that all science roadmap or funding agency priorities may not be within station mission areas. For questions on whether topics are appropriate, prospective applicants can contact station directors or the NERA Executive Director.

Proposals will be due on **August 31, 2016**. Proposals are not to exceed **three** single-spaced pages (Times Roman 12 point and one inch margins) not including the cover page and appendices.

A planning grant committee comprised of several NERA directors will review proposals and make recommendations to the full NERA membership for funding approval. Final decisions will be made by date, year. Applicants may apply for a maximum of $10,000 of support. Funding awards will be available for a maximum of one year from the date of award notification. The funds will be administered by the Office of the NERA Executive Director and will only be used to reimburse actual expenses. Unused funds will be retained by NERA. Funds may only be used to support transportation and meeting expenses to bring teams together for planning and organizational purposes. Funds cannot be used to pay indirect costs and in general will not be awarded for salaries or wages. Planning grant funds cannot be used to support initial research or outreach activities of the proposed program.

Proposals for planning grants should include:

- Cover page (example included)
- Mission and goals of the proposed program
- Justification for the program relative to stakeholder needs and potential for sustained external funding
- Activities to be engaged in by team members towards a more complete definition of the

program

- Explanation of roles of team members
- Timetable for completion of the planning activities and preparation of a competitive proposal
- Budget for planning activities (travel, meeting expenses, etc.) not to exceed $10,000
- Leveraging resources
- CV of Team Leader – as an appendix (two page maximum) demonstrating track record of leading cross-disciplinary and/or multi-institutional collaborations

The specific criteria that will be used to evaluate proposals are:
(* = required element. Other elements are preferred only.)

- Addresses an important need in the region*
- Justification demonstrates stakeholder support for the project
- Program has a strong research core*
- Substantial participation by researchers from three experiment station (minimum = 3)*
- Consistent with goals of competitive funding programs*
- Potential for sustained funding*
- Clearly defined planning activities*
- Well-developed outreach or educational components or other research implementation
- Realistic timetable*
- Team members appropriate to proposed activities*
- Team leaders with demonstrated track record*
- Potential support (funding or other) from other entities
- Well written and organized proposal that addresses all the required criteria satisfactorily*

An outcome of a planning grant will be a proposal submitted to a major funding agency specified in the proposal. Grant recipients will provide a written report at the end of the grant period and subsequent periodic reports on the status of resulting proposals.

In order to provide guidance and feedback from the previous rounds of grant proposals, the following are some of the reviewer comments on those proposals:

- Goals not well defined
- Not clear what specific major compelling issues will be addressed
- Priority not well established
- Needs not clearly justified by stakeholder support; did not identify specific clientele being served
- Not a strong team of AES scientists or a strong research program
- No specifics on what activities are being planned – what are the key approaches to be used
- Strategy of individual proposal development and then consolidation not clear
- Proposed collaboration not well described
- Deliverables not clear
- Potential for sustainable funding not clear

Please submit planning grant proposals by close of business on **August 31, 2016** to Dr. Rick Rhodes at rcrhodes@uri.edu.

Proposal # _____

2016 NERA Planning Grants Program

Project Title: _____

_____

Team Members

Name	Discipline	Institution/Agency/Other

(Attach an additional sheet if more space is needed.)

Team Leader Contact Information:

Name:	
Address:	
Phone:	
Fax:	
E-mail:	

2016 NERA Planning Grant

Proposal #	*PI*	*Institution*	*Title*
16-1	Anderson	WVU	Planning for the Future: Ensuring Clean Water on Working Farms and Landscapes Subject to Climate Change and Natural Gas Development Perturbations
16-2	Bradley	UMASS	Northeast Regional Invasive Species & Climate Change (RISCC) Assessment
16-3	Burk	UMASS	Increasing Environmental Stewardship of Horse Farm
16-4	Cantanzaro	UMASS	Deciding the Future of Our Landscapes: A Regional Effort to Address Intergenerational Land Transfer
16-5	Kinchla	UMASS	Addressing the produce safety challenges of small scale
16-6	Kolodinsky	UVM	Economic Impact of Reducing Food Loss on Farms and Community Development Possibilities
16-7	Lansing	UMD	Alternative Inputs and Outputs for Agricultural-based Anaerobic Digesters to Increase Economic Viability and Environmental Benefits
16-8	Mangan	UMASS	Increasing Consumption of US-Grown Fresh Produce among Immigrant Communities in the Northeast Megalopolis
16-9	Obropta	Rutgers	Innovative Solutions using Green Infrastructure - A Northeast Regional Collaboration
16-10	Sibeko	UMASS	Towards Nutritional Health Equity for Women and their Families
16-11	Sutherland	UMASS	Investigating the adaptive potential of a forest indicator species to climate change predictions in Northeastern forest ecosystems
16-12	Zinn	UCONN	Poor maternal nutrition and its impact on neonatal outcomes

Proposal #16-1

2016 NERA Planning Grants Program

Project Title: Planning for the Future: Ensuring Clean Water on Working Farms and Landscapes Subject to Climate Change and Natural Gas Development Perturbations

Team Members

Name	Discipline	Institution
James T. Anderson, Ph.D.	**Division of Forestry and Natural Resources** (Wetlands, Wildlife)	West Virginia University
Patrick Drohan, Ph.D.	**Department of Ecosystem Science and Management** (Pedology, Ecosystem Change)	Penn State University
Heather Gall, Ph.D.	**Department of Agricultural and Biological Engineering** (Ecosystem Science and Management (Contaminant Transport, Hydrology)	Penn State University
Magdeline Laba, Ph.D.	**Soil and Crop Sciences Section** (GIS, Remote Sensing, Climate Change)	Cornell University
Christopher M. Lituma, Ph.D.	**Division of Forestry and Natural Resources** (Avian Ecology, Grasslands)	West Virginia University
Jiuzhou "John" Song, Ph.D.	**Department of Animal and Avian Sciences** (Molecular Biology, Genetics)	University of Maryland

Team Leader Contact Information:

James T. Anderson
West Virginia University
School of Natural Resources
Po Box 6125
Morgantown, WV 26506-6125
304-293-3825 Phone; 304-293-2441 Fax; Jim.anderson@mail.wvu.edu

Background

The northeastern U.S. is home to a diversity of forest systems and agricultural enterprises. Indeed, there are over 180,000 farms resulting in over $17 billion in annual sales (1). Agriculture, forest products and commercial fishing for 8 Northeast states provides $103 billion in economic activity (2). This diversity in commodities lends itself to great potential for adaptations and alternatives for farmers and forest owners, but also presents a number of management challenges for achieving sustainable forest and agricultural practices in relation to climate change and gas exploration.

Mean global air temperature has increased 0.74°C from 1906–2008 (3). In the Northeast temperature change has been greater, with an increase of 1.1°C from 1895–2011(4). From 1895–1997 mean temperature for the Mid-Atlantic Region (MAR) increased by 0.5°C (4). Future temperature projections vary based on global carbon emissions, but range from 1–5°C by 2100 (4–6). The freeze-free season is estimated to lengthen by ≥19 days by 2050, with increases of 3–4 weeks in many areas (8). From 1895–2011, precipitation increased by >10% (13 cm) for the Northeast (4). The occurrence of high intensity rainfall increased over the past 100 years and the Northeast has experienced a greater increase in extreme precipitation events than any other U.S. region from 1958–2010 (4,7). Future precipitation predictions are less certain than for temperature, but the frequency of heavy precipitation events is predicted to increase over the next 100 years (9).

Global demands for alternative and cleaner energy sources to mitigate climate change and carbon emissions continue to grow. Natural gas accounts for 24% of the global energy, but this is expected to increase with the development of contemporary cost-effective hydraulic fracturing (fracking) technologies (10). In 2001, unconventional gas (shale gas horizontal drilling and fracking) in the U.S. accounted for 2% of total natural gas production and currently it accounts for >23% of gas production (11). Marcellus Shale gas reserves in MD, NY, PA, OH, VA, and WV comprise 59% of the total estimated unconventional (shale gas) reserves in the U.S. (12). In PA during 2015, there were an estimated 9,000 active unconventional gas wells, and 16,000 active gas well permits (13). By 2030, PA is projected to have 60,000 unconventional gas wells.

Unconventional gas exploration can provide an alternative energy source for oil and coal, but gas extraction, in particular fracking, is not exempt from environmental concerns. The hydraulic fracturing process involves high-pressure injection of water and chemicals (slick-water) into the coal seams to allow the shale gas to escape and be harvested (14). Though water comprises 90% of the fracking fluid, chemicals representing the remaining 10% are proprietary and company specific. Mercury, selenium, and benzene are known toxic and carcinogenic compounds included in fracking liquid, and post-fracking flowback fluid is highly saline. Chemical products in fracking operations from 2005–2009 used >2500 products comprised of 750 chemicals (14). In PA, fracking produces >6 billion liters of flowback fluid (15). The challenges facing both the fracking industry itself (operational issues) and the associated potential environmental impacts (contaminant transport) are exacerbated by increasing temperatures and frequencies of heavy rainfall events.

Mission and Goals

There is increased concern about how the U.S. can ensure an adequate food and fiber supply under current and predicted climate change scenarios. For example, increasing temperatures in the Northeast are predicted to reduce milk production in dairy cattle (16). Forest composition is expected to change and invasive species may become more prominent (16). Changes in wetland hydroperiods are expected, including some scrub-shrub wetlands losing their entire summer inundation period (7), causing devastating impacts to amphibians that rely on these late spring/early summer inundations for breeding and metamorphosis. Birds are expected to shift their

ranges northward in latitude and elevation, and could suffer reduced reproductive success and survival as a result of phenological food resource disruptions (17).

A critical need exists to understand the impacts of unconventional gas drilling on forest resources, food contamination, wildlife populations, water quality, and other natural processes. Contemporary research is qualitative, opportunistic, and comparative at best, though negative impacts of unconventional gas fracking have been documented for birds, fish, crayfish and other macroinvertebrates, livestock and humans (15,18–19).

In keeping with the mission of NERA Planning Grants to address high priority research needs and facilitate the transfer of new research-based knowledge to audiences we will engage a working group who will focus on the food–water–energy nexus, particularly water, by developing a series of proposals to address this complex interdisciplinary issue of food and fiber security, water quality, climate change resilience, and fracking (all of which are addressed in the APLU Roadmaps (20, 21)) to address the following broad goal addressing research, outreach, and extension:

> *Our goal is to create a climate resilience framework on farms and watersheds that will conserve, create, and maintain clean water; promote biodiversity; and ensure a safe food and fiber supply in a landscape with significant active gas extraction.*

Justification and Potential for Sustained Funding

We believe this line of inquiry will result in significant, sustainable funding opportunities for pursuing grant funding centered on our research and outreach goal. Examples of research avenues stemming from this goal may include: 1) designing optimal placement of wetlands or buffer strips for storing and cleaning water; 2) evaluating impacts of fracking effluent on organic agricultural production; 3) assessing bioaccumulation of toxins in native songbirds and amphibians; and 4) based on climate change statistics, determining which areas should be obtained to best conserve natural resources in the future. Results of these and other related research questions will be of value to landowners and farmers in the northeast as they struggle to adapt to changing climate and perturbations from unconventional gas fracking and have significant implications for policy and management.

In 2016, the Agriculture and Food Research Initiative (AFRI) Competitive Grants Program advertised requests for proposals (RFPs) on Climate Variability, Water, and even the Foundational Program that fit our overall goals. The National Science Foundation (NSF) has funded related work under several different divisions. The National Oceanic and Atmospheric Administration (NOAA) Climate Programs has several water and climate related RFPs that may be suitable. Additionally, foundations, such as the Robert Wood Johnson Foundation, have invested onto this arena in recent years and we will investigate funding from these entities. We expect similar RFPs during 2017 for fiscal year 2018, although we will likely need to make adjustments in our logic for the submitted proposals, but we will still adhere to our theme of water on working landscapes as influenced by climate change and gas development. AFRI's water for agriculture program indicates that in coming years the program may expand to address "…mitigation, and adaptation; research and technology development for evaluating and mitigating the effects of chemicals and pathogens of emerging concern in freshwater…related to U.S. agriculture…., and the ability to provide incentives for behavior change/adoption of water use/conservation practices". Our group will be well positioned to respond to these RFPs.

Activities

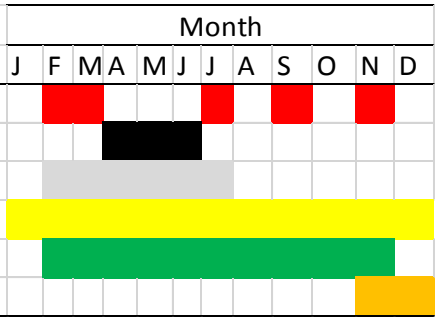
Activities will be standard practices that one would expect when working through a normal grant

submission process. We will meet to discuss ideas, recruit additional co-PIs and partners needed for specific grant applications, build and maintain an online shared library, search for RFPs, write proposals, and submit proposals to funding agencies. Our team will collaborate via regularly scheduled teleconferences and one multiple-day in-person meeting at a centralized location to solidify objectives and ideas for grant applications. We will enlist graduate and undergraduate student help for logistics and multistate proposal development. We will use Google Docs to share and edit proposals and Google Docs or Mendeley to house pdfs of articles. We will submit at least one $200K plus research and outreach application to AFRI or NSF for external funding during the grant period (and expect to submit several more during or after the 1-year grant period).

Roles of Team Members

Dr. Anderson will serve as the overall PI on the project and be responsible for scheduling meetings, ensuring that proposed activities and timelines are met, budgeting, and reporting. He will provide technical expertise on wetlands, wildlife, climate change and watersheds. Dr. Drohan will provide expertise on natural gas development, soil biogeochemistry, soil and water quality, climate change, and land use. Dr. Gall will provide expertise on environmental hydrology and contaminant fate and transport. Dr. Laba will provide expertise on geospatial modeling, wetlands, and agriculture/ environmental management. Dr. Lituma will organize the shared reference library and provide expertise on avian ecology, unconventional gas fracking, and statistics. Dr. Song will provide expertise on genetics, improving livestock performance, and reducing animal disease potential. All team members will search for grant opportunities, contribute to proposal writing, and participate in team-building activities. Several team members have successfully collaborated on past projects. Other researchers, from these or other institutions inside or outside the region, will be recruited as necessary as we identify specific missing expertise required for available RFPs.

Timetable



The overall project runs from 1 Jan 2017–31 Dec 2017, but we will modify the start date as needed to match the grant notification date.

Budget Item	Amount	Justification
Airfare	$500	One round-trip ticket for team member to meet with program manager.
Car Rental and Gas/Mileage	$2,500	Average cost of $100/day @2.5 days for 10 trips
Lodging	$3,000	$150 average per night @ 2 nights/person for 10 persons
Per Diem	$1,020	$51/day @ 1 full day and two partial days (2 total) for 10 people
Room Rental for Meeting	$300	$150 average per day @ 2 days
Refreshments	$200	Snacks and drinks for refreshments breaks during the meeting so team stays energized
Total Travel	$7,520	

Appendix I. CV of Team Leader

Dr. James T. Anderson, Certified Wildlife Biologist
Professor of Wildlife and Fisheries Resources
Davis-Michael Professor of Forestry and Natural Resources
West Virginia University, Morgantown, WV 26506
(304) 293-3825; jim.anderson@mail.wvu.edu

I have over 15 years of experience in developing interdisciplinary teams to address complex natural resource topics. I recently lead a successful 3 institution $10 million NSF EPSCoR water grant application. I possess extensive experience in grant writing, budgeting, conducting research, publishing results and otherwise disseminating information, and implementing demonstration practices.

EDUCATION

University of Wisconsin-Stevens Point	B.S.	1991	Wildlife
Texas A&M University-Kingsville	M.S.	1994	Range and Wildlife Management,
Texas Tech University	Ph.D.	1997	Wildlife Science

PROFESSIONAL EMPLOYMENT

July 2015 – Present: **Professor of Wildlife Ecology and Management; Program Coordinator Wildlife & Fisheries Resources Program**. Davis College of Agriculture, Natural Resources, and Design, West Virginia University, Morgantown, West Virginia.

September 2012 – July 2015: **Professor of Wildlife Ecology and Management; Director Environmental Research Center; Program Coordinator Wildlife & Fisheries Resources Program.** Davis College of Agriculture, Natural Resources, and Design, West Virginia University, Morgantown, West Virginia.

August 2009 – September 2012: **Professor of Wildlife Ecology and Management; Director Environmental Research Center**. Davis College of Agriculture, Natural Resources, and Design, West Virginia University, Morgantown, West Virginia.

August 2007 – August 2009: **Associate Professor of Wildlife Ecology and Management and Associate Director Natural Resource Analysis Center.** Wildlife & Fisheries Resources Program, Division of Forestry and Natural Resources, West Virginia University, Morgantown, West Virginia

August 2004 – August 2009: **Associate Professor of Wildlife Ecology and Management.** Wildlife & Fisheries Resources Program, Division of Forestry, West Virginia University, Morgantown, WV.

January 1999 – July 2004: Assist. Professor of Wildlife Ecology and Management. Wildlife & Fisheries Resources Program, Division of Forestry, West Virginia University, Morgantown, WV.

August 1997 – December 1998. Instructor/Post-doc. Texas Tech University, Lubbock, TX.

TEACHING EXPERIENCE

- WMAN 100 The Tradition of Hunting, 3 CR
- WMAN 200 Restoration Ecology, 3 CR
- WMAN 250 Big Game Ecology and Management, 3 CR
- WMAN 260 Waterfowl Ecology, 3 CR
- WMAN 421 Renewable Resource Policy and Governance, 3 CR
- WMAN 547 Applied Wetlands Ecology and Management, 3 CR

HONORS AND AWARDS

- Distinguished Alumni Award, College of Ag. Sciences & Nat. Res. 2016. Texas Tech University.

- Outstanding Faculty Award for Excellence in Service 2015, Forestry and Natural Resources (WVU)
- Davis-Michael Professor, Davis College of Agriculture, Natural Resource and Design, WVU 2012-
- Outstanding Faculty Award 2011, West Virginia University Forestry Alumni Association
- Outstanding Researcher 2011, Division of Forestry and Natural Resources (WVU)
- Cruiser Dedication, Division of Forestry and Natural Resources, WVU 2009
- Davis-Michael Mid-Career Award, Davis College, WVU 2006-2010
- Outstanding Researcher 2003 Davis College of Agriculture, Forestry, and Consumer Sciences (WVU)
- Outstanding Researcher 2003 Division of Forestry (WVU)
- Hoyt Outstanding Professor 2002 Division of Forestry (WVU)
- Outstanding Researcher 2000 Division of Forestry (WVU)

SELECTED GRANTS RECEIVED (>$16 million total)

1. PI, Cacapon River Watershed Stream and Riparian Restoration Collaborative. National Fish and Wildlife Foundation $650,000.
2. PI, Development of an Environmental Center of Excellence for the Mid-Atlantic Highlands. National Oceanic and Atmospheric Administration $1,705,250.
3. PI, Pilot test the ecological approaches to environmental protection developed in capacity research projects CO6A and CO6B. National Academy of Sciences, $360,628.
4. PI, Creation and assessment of a wetland on the Pleasant Creek Wildlife Management Area. West Virginia Division of Natural Resources. $46,220.50
5. Co-PI. R11 Track 1: Gravitational wave astronomy and the Appalachian Freshwater Initiative (Waves of the future: Capacity building for the Rising Tide of STEM in West Virginia (EPSCOR). WV-HEPC-Div Science and Research. US National Science Foundation $1,943,548.
6. Co-PI, Stream monitoring study for Appalachian Corridor H, Elkins, West Virginia to Virginia State line. West Virginia Department of Transportation, Division of Highways. $1,164,104.

GRADUATE STUDENTS MENTORED OR TRAINED (Total Graduate Advisees as Chair = 34)

Graduated as Chair: 8 PhD, 26 MS Current Students as Chair; 5 PhD, 5 MS

SELECTED PUBLICATIONS (>130)

Anderson, J. T., and C. A. Davis, editors. 2013. Wetland Techniques. Volumes 1-3. Springer, New York, New York. 1,061pp.

Balcombe, C. K., **J. T. Anderson**, R. H. Fortney, and W. S. Kordek. 2005. Aquatic macroinvertebrate assemblages in mitigated and natural wetlands. Hydrobiologia 541:175-188.

Chen, Y., R. C. Viadero, Jr., X. Wei, L. B. Hedrick, S. A. Welsh, **J. T. Anderson**, and L. Lin. 2009. Effects of highway construction on stream water quality and macroinvertebrate condition in a Mid-Atlantic highlands watershed, USA. Journal of Environmental Quality 38:1672-1682.

Gingerich, R. T., and **J. T. Anderson**. 2011. Decomposition trends of five plant litter types in mitigated and reference wetlands in West Virginia, USA. Wetlands 31:653-662.

Pitchford, J. L., C, Wu, L. Lin, J. T. Petty, R. Thomas, W. E. Veselka, D. Welsch, N. Zegre, and **J. T. Anderson**. 2012. Climate change effects on hydrology and ecology of wetlands in the mid-Atlantic Highlands. Wetlands 32:21-33.

Appendix II. Literature Cited

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2. Lopez, R., N. Plesha, B. Campbell, and C. Laughton. 2016. Northeast economic engine: Agriculture, Forest products, and commercial fishing. Second edition. Farm Credit East Report. Accessed 2 Aug 2016 https://issuu.com/farmcrediteast/docs/fce_econimpact_final/1

3. Bates B.C., Z.W. Kundzewicz, J. Palutikof J, S. Wu. 2008. Climate change and water. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva. Accessed 5 Aug 2016 http://www.ipcc.ch/publications_and_data/publications_and_data_technical_papers.htm

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5. Polsky, C., J. Allard, N. Currit, R. Crane, and B. Yarnal. 2000. The Mid-Atlantic Region and its climate: past, present, and future. Climate Research 14:161–173.

6. Moore M.V., M.L. Pace, J.R. Mather, P.S. Murdoch, R.W. Howarth, C.L. Folt, C.Y. Chen, H.F. Hemond , P.A. Flebbe, and C.T. Driscoll. 1997. Potential effects of climate change on freshwater ecosystems of the New England/Mid-Atlantic Region. Hydrological Processes 11:925–947.

7. Pitchford, J.L., C, Wu, L. Lin, J.T. Petty, R. Thomas, W.E. Veselka, D. Welsch, N. Zegre, and J.T. Anderson. 2012. Climate change effects on hydrology and ecology of wetlands in the mid-Atlantic Highlands. Wetlands 32:21-33.

8. National Oceanic and Atmospheric Administration (NOAA) 2013. Regional climate Trends and Scenarios for the U.S. National climate Assessment. Part 1. Climate of the Northeast U.S. NOAA Technical Report NESDIS 142-1. Accessed 3 Aug 2016 http://www.nesdis.noaa.gov/technical_reports/NOAA_NESDIS_Tech_Report_142-1-Climate_of_the_Northeast_U.S.pdf

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Proposal # 16-2

2016 NERA Planning Grants Program

Project Title: **Northeast Regional Invasive Species & Climate Change (RISCC) Assessment**

TEAM MEMBERS

Name	**Discipline**	**Institution/Agency/Other**
Jenica Allen	Plant Invasions & Landscape Ecology	University of New Hampshire, Dept. Natural Resources & Environment
Bethany Bradley	Invasion Biogeography	University of Massachusetts, Dept. Environmental Conservation
Carrie Brown-Lima	Invasion Biology	Cornell University, Dept. Natural Resources
Alex Bryan	Climate Science	NE Climate Science Center, Postdoctoral Fellow
Toni Lyn Morelli	Wildlife Ecology	NE Climate Science Center, USGS
Val Pasquarella	Remote Sensing	NE Climate Science Center, Postdoctoral Fellow
Alyssa Rosemartin	Ecosystem phenology	National Phenology Network (Boston)
Cascade Sorte	Marine Invasions	UC - Irvine (formerly UMass, Boston)
R. Talbot Trotter	Forest Pests	USDA Forest Service, N. Research Station
David Wong	Aquatic Invasions	Mass Dept. Environmental Protection

TEAM LEADER CONTACT INFORMATION:

Name:	Bethany Bradley
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MISSION AND GOALS

Individually, both non-native species invasion and climate change have been identified as two of the five major drivers of human-caused global change (Sala *et al.*, 2000; MA, 2003). Invasive species negatively impact crop systems and economies, costing billions of dollars annually in control costs and crop losses (Pimentel *et al.*, 2000, 2005). Invasive species also threaten ecosystems, significantly reducing the abundance of native species (e.g., Vilà *et al.*, 2011). Similarly, climate change is an increasing threat to agriculture and ecosystems (IPCC, 2014). Warming temperatures and drought substantially reduce crop yield (Lobell & Field, 2007), while a rapidly shifting climate and ocean acidification are projected to cause massive losses of biodiversity (Thomas *et al.*, 2004; Hoegh-Guldberg *et al.* 2007).

Together, invasive species and climate change are likely to further exacerbate existing problems (Dukes & Mooney, 1999). For example, climate change is likely to increase ecological disturbances through extreme events like storms, drought and flood (IPCC, 2013). These disturbances, in turn, tend to advantage fast growing, 'weedy' invasive species (Diez *et al.*, 2012). Warming temperatures also advance growing season phenology (Root *et al.*, 2003), which could advantage invasive species that are able to respond quickly to early season warming and gain a 'priority effect' over native species, simply by being the first to establish and grow (Wolkovich & Cleland, 2011). For example, long-term studies of plants have shown that non-native, invasive species tend to be the most responsive to early season warming, and the most likely to persist under climate change (Willis *et al.*, 2010). In addition, warming climates can enable the establishment of non-native plants (Bradley *et al.* 2010), pests (Gutierrez & Ponti, 2014), and aquatic species (Rahel & Olden 2008) that couldn't survive previously. To make matters worse, native ecosystems stressed by drought and extreme climate events are increasingly vulnerable to invasion, facilitating further establishment and spread (Dukes *et al.* 2009).

However, climate change does not necessarily advantage all invasive species. Comparative studies of plant growth under warming and drought conditions do not show any consistent advantage for invasive plants (Sorte *et al.*, 2013), and modeling studies suggest that reduced invasion risk is just as likely to occur as increased invasion risk (Allen & Bradley, In Review; Bradley *et al.*, 2009). For the vast majority of invasive species, response to climate change remains unknown. This is particularly true in the Northeast where the topic has received comparatively little attention.

The proposed working group aims to evaluate risks to natural and managed systems due to interactions between invasive species and climate change and develop research proposals to meet the information needs of managers on the topic. Over the course of two meetings, we will 1) solicit more ideas and research needs from invasive species managers, 2) review and synthesize existing research on invasive species and climate change in the Northeast, and 3) develop novel research proposals to better understand invasion risk under climate change in the Northeast.

JUSTIFICATION RELATIVE TO STAKEHOLDER NEEDS

We recently launched a joint science/management working group (Northeast Regional Invasive Species & Climate Change – RISCC Management) through the DOI Northeast Climate Science Center and the New York Invasive Species Research Institute. At our initial meeting, twenty scientists and natural resource managers gathered to exchange ideas and identify research questions most important for invasive species management in the face of climate change. Another 30 scientists and resource managers from the Northeast region have expressed interest in future collaboration, but were unable to attend the meeting. This initial meeting was organized because invasive species managers have requested more and better information about how climate change will influence the distribution and abundance of invasive species. Through a day-long discussion, it became clear that climate change is not yet being considered in most invasive species resource management in the northeastern

U.S. Workshop participants identified four critical research needs to improve invasive species management in the context of climate change:

1. Improve species lists for monitoring of imports and for Early Detection & Rapid Response as ranges shift with climate change
2. Understand how climate shifts and extreme events will influence invasive species distribution and abundance.
3. Develop more species-specific risk assessments to predict how existing invasive species and invaded ecosystems might respond to climate change
4. Identify ways that existing invasive species management practices could be adapted to remain effective with climate change

PLANNED ACTIVITIES

The proposed working group will hold two meetings during the summer and fall of 2017. Each three-day meeting will kick off with a joint scientist/manager meeting, leveraging our existing network of invasive species managers in the Northeast. At the first joint scientist/manager meeting, we will coordinate a single day symposium where researchers will present to the working group and regional invasive managers on invasive species/climate change research – a need identified by managers at our initial workshop. The symposium will include afternoon break out groups where participants will be asked to refine the key management questions outlined above. On days 2-3 of the first meeting, core team members will brainstorm ways to address the key management questions and will review additional available literature on invasive species and climate change in the Northeast to identify the most productive research directions that could be supported by one or more proposals.

Example ideas that address management priorities might include 1) Synthesizing lists of potentially problematic species that have not yet arrived in the US (e.g., using EICAT - the Environmental Impact Classification for Alien Taxa; Hawkins *et al.* 2015), 2) Modeling potential shifts in invasive species range due to climate change (team members have performed a comprehensive assessment for plants, but other taxa are lacking; Allen & Bradley, In Review), 3) Developing new experiments, surveys or models to assess responses to climate change and extreme events for species of high management concern, but limited existing research effort, or 4) Analyzing existing actions used to manage invasive species to determine which are most "Climate-Smart" (Stein *et al.* 2014) and promote resilience in the Northeast.

Between the two meetings, team members will communicate regularly through video conferencing (see leveraging resources) to continue outlining proposal ideas. Meeting two will kick off with a second joint scientist/manager meeting, where team members will report back to managers on proposal ideas and solicit feedback. On days 2-3 of the second meeting, core team members will work together to draft a proposal for USDA and/or other outlets by the end of the meeting.

ROLE OF TEAM MEMBERS

The core team members represent an interdisciplinary group of scientists working on various aspects of invasive species and/or climate change research. Invasive species affect a variety of natural and managed systems, including plants (J. Allen), forest pests (R.T. Trotter), vertebrates (T.L. Morelli), aquatic systems (D. Wong), and marine ecosystems (C. Sorte). The team will benefit from scientists with a range of research approaches for studying invasion and climate change, including biogeography (B. Bradley), climate modeling (A. Bryan), satellite remote sensing (V. Pasquarella), and phenology modeling (A. Rosemartin). Lastly, the team will benefit from extensive experience coordinating efforts between invasive species researchers and managers (C. Brown-Lima).

TIMETABLE OF ACTIVITIES

	Summer 2017	Fall 2017
Symposium & first joint scientist/manager meeting	X	
Brainstorm research topics based on manager feedback	X	
Review existing research in Northeast	X	
Identify key research topics and target RFPs	X	
Complete literature review and synthesize findings		X
Second joint scientists/manager meeting - Report back on proposal ideas and research synthesis		X
Draft research proposals		X

BUDGET

We anticipate holding two, three-day meetings for the core team members at the Northeast Climate Science Center at UMass, Amherst. Funds are requested to reimburse speakers and key managers for mileage and lunch at each of the two meetings. The joint manager/scientist meetings will be open and advertised to any regional managers who wish to attend.

Invited speakers and key managers for symposium and single day meetings
Mileage – (average 100 miles round trip @ $0.54/mile) = $54
Lunch per diem = $11
Total = $65
Total for 15 speakers/managers x 2 meetings = $1950

Core team members for two, three-day meetings
Mileage (J. Allen; C. Brown-Lima, A. Rosemartin, R. Trotter, D. Wong – average 260 miles round trip) = $700
Flight and ground transport (C. Sorte) = $1100
Per diem (JA, CBL, AR, CS, RT, DW – 3 days @ $46) = $828
UMass Hotel (JA, CBL, AR, CS, RT, DW – 2 nights @ $120) = $1440
Total for 5 visiting team members x 2 meetings = $8035

Total costs for 2 meetings = $9985

LEVERAGING RESOURCES

The Department of Interior Northeast Climate Science Center (NE CSC) can provide a meeting space that comfortably fits 25 people for discussions, remotely sharing materials over the internet, and video conferencing. Staff can also help to identify larger meeting space on the UMass, Amherst campus for the symposium. The NE CSC will provide staff time from Research Ecologist Toni Lyn Morelli, Research Climatologist Alex Bryan, and Postdoctoral Fellow Valerie Pasquarella.

Based out of Cornell University's Department of Natural Resources, the New York Invasive Species Research Institute (NYISRI) has a mission of coordinating invasive species research to help prevent and manage the impact of invasive species in New York State. From our July 2016 workshop, NYISRI has developed a listserv of >50 Northeast managers interested in invasive species management in the face of climate change. We will use this resource to advertise and recruit managers for our joint science/management meetings. NYISRI will offer staff time from Director Carrie Brown-Lima and Research Support Specialist Audrey Bowe to assist in communications and engage members, as well as lead discussions, synthesize information and develop research proposals. If needed, NYISRI could provide meeting space for the symposium at Cornell University.

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Root TL, Price JT, Hall KR, Schneider SH, Rosenzweig C, Pounds JA (2003) Fingerprints of global warming on wild animals and plants. *Nature*, **421**, 57–60.

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Professional Preparation

Pomona College	Claremont, CA	Geology	BA	2000
Brown University	Providence, RI	Geological Sciences	MSc	2003
Brown University	Providence, RI	Geological Sciences	PhD	2006
Princeton University	Princeton, NJ	Biogeography	Postdoc	2006-2009

Appointments

Associate Professor 2016 – present
Department of Environmental Conservation, UMass, Amherst

Assistant Professor 2010 – 2016
Department of Environmental Conservation, UMass, Amherst

Copeland Fellow 2009-2010
Department of Biology, Amherst College

Representative Publications

Allen, J.M. and **B.A. Bradley**, "*Out of the weeds? Reduced plant invasion risk with climate change*", In review

Early, R., **B.A. Bradley**, J.S. Dukes, J.J. Lawler, J.D. Olden, D.M. Blumenthal, C.M. D'Antonio, P. Gonzalez, E.D. Grosholz, I. Ibañez, L.P. Miller, C.J.B. Sorte and A.J. Tatem, *"Invasive species in the 21st Century: Global threats and national response capacities"*, Nature Communications, In Press

Bocsi, T., J.M. Allen, J. Bellemare, M. Nishino, J. Kartesz and **B.A. Bradley**, *"Plants' native distributions do not reflect climatic tolerance"*, Diversity & Distributions, 22: 615-624, 2016

Bradley, B.A., R. Early, C.J.B. Sorte "*Space to invade? Comparative range infilling and potential range of invasive and native plants*", Global Ecology & Biogeography 24(3):348-359, 2015

Bradley, B.A., *"Remote detection of invasive plants, a review of spectral, textural and phenological approaches"*, Biological Invasions 16(7):1411-1425, 2014

Balch, J.K., **B.A. Bradley**, C.M. D'Antonio, and J. Gomez-Dans, "*Introduced annual grass increases regional fire activity across the arid western USA (1980-2009)*", Global Change Biology, 19(1): 173-183, 2013

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Bradley, B.A., D.M. Blumenthal, R. Early, E.D. Grosholz, J.J. Lawler, L.P. Miller, C.J.B. Sorte, C.M. D'Antonio, J.M. Diez, J.S. Dukes, I. Ibanez, and J.D. Olden, "*Global change, global trade, and the next wave of plant invasions*", Frontiers in Ecology and the Environment **10**(1): 20-28, 2012

Bradley, B.A., D.M. Blumenthal, and D.S. Wilcove, L.H. Ziska, *"Predicting plant invasions in an era of global change"*, Trends in Ecology & Evolution, 25(5): 310-318, 2010

Bradley, B.A., M. Oppenheimer, and D.S. Wilcove, *"Climate Change Increases Risk of Plant Invasion in the Eastern United States"*, Biological Invasions, 12(6), 1855-1872, 2010

Bradley, B.A., M. Oppenheimer, and D.S. Wilcove, *"Climate Change and Plant Invasion: Restoration Opportunities Ahead?"*, Global Change Biology, 15: 1511-1521, 2009

Leadership & Synergistic Activities

- Leader of two inter-disciplinary working groups supported by the USGS Powell Center (15 participants; 2011-2012) and the Borchard Foundation (12 international participants; 2015-2016) focused on model integration for ecological forecasting and invasive species & climate change, respectively.

- Successfully received grant funding for five interdisciplinary, multi-investigator research projects to date as lead PI or co-PI. Collaborative research funding has been awarded from the National Science Foundation, NASA, Joint Fire Sciences Program, the Department of Defense, and the North Central Climate Science Center.

- Initiated large-scale, regional mapping efforts for prominent invasive species in the southeast (2007-2009), western U.S. (2008-2010) and northeast U.S. (2013-present) by soliciting information from extensive networks of natural resource managers. Managers included county weed supervisors for the USDA, county foresters, natural area managers and academics. The resulting maps provide novel and unique information on the distribution and abundance of invasive plants in the U.S.:

  Bradley, B.A. and D.C. Marvin, *"Using Expert Knowledge to Satisfy Data Needs: Mapping Invasive Plant Distributions in the Western U.S."*, Western N. American Naturalist 71(3): 302-315, 2011

  Marvin, D.C., **B.A. Bradley**, and D.S. Wilcove, "*A Novel, Web-based, Ecosystem Mapping Tool using Expert Opinion",* Natural Areas Journal, 29(3), 281-292, 2009

  Cross, T., J.T. Finn and **B.A. Bradley**, "*Frequency of invasive plant occurrence is not a suitable proxy for abundance in the Northeast US*", In review in Ecosphere, 2016

- Mentored 24 undergraduates in research so far in six years at UMass, including two first-year research experience students, 15 semester-long research projects on invasive plant biogeography, three summer research experience students and two undergraduate honors thesis. Undergraduate research projects have culminated in six poster conference presentations and the following two peer-reviewed publications with undergraduate first authors (underlined):

  Bocsi, T., J.M. Allen, J. Bellemare, M. Nishino, J. Kartesz and **B.A. Bradley**, *"Plants' native distributions do not reflect climatic tolerance"*, Diversity & Distributions, 22: 615-624, 2016

  Lehan, N.E., J.R. Murphy, L.P. Thorburn and **B.A. Bradley**, "*Accidental introductions are an important source of invasive plants in the continental U.S.*", American Journal of Botany, 10(7): 1287-1293, 2013

- Education and outreach for managers and the general public through seminars and webinars, including the NY state monthly invasive species webinar (2012), the North American invasive plant short course webinar (2013), the Massachusetts nursery and landscape association summer field day (2013), UMass Science Café (science education series; 2013), the Massachusetts tree wardens and foresters annual meeting (2014), the Ecological Landscaping Alliance (2015), the Massachusetts Envirothon (2015), and the Northeast Regional Invasive Species & Climate Change (RISCC) Management inaugural meeting (2016).

- *Ad hoc* reviewer for 20+ journals and proposals for NSF, NASA and DoD. Proposal review panelist for NASA, NSF and USDA/NIFA. Associate editor for Diversity & Distributions (a journal of conservation biogeography; 2010-present) and Ecography (a journal of pattern & diversity in ecology; 2014-present).

Proposal # 16-3

2016 NERA Planning Grants Program

Project Title: Increasing Environmental Stewardship of Horse Farm Operators

Team Members:

Name	**Expertise**	**Institution/Agency/Other**
1. Dr. Amy Burk	Equine Grazing Management	University of Maryland
2. Dr. Robert Causey	Equine Health	University of Maine
3. Dr. Masoud Hashemi	Environmental Stewardship	University of Massachusetts
4. Dr. Krishona Martinson	Forages for Horses	University of Minnesota
5. Dr. Bridgett McIntosh	Grazing Management	Virginia Tech
6. Dr. Paul Siciliano	Grazing Management	North Carolina State
7. Dr. Anne Swinker	Environmental Stewardship	Penn State University
8. Dr. Michael Westendorf	Manure Management	Rutgers University
9. Dr. Carissa Wickens	Equine Behavior	University of Florida
10. Dr. Carey Williams	Horse Pasture Management	Rutgers University

Team Leader Contact Information:

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Mission and Goals

The goal of this planning grant is to bring together current members of the Multi-State Project NE-1441 Environmental Impacts of Horse Operations working group and other experts to design a large multi-state research and education project to expand environmental stewardship on horse farms. Currently, the NE-1441 multi-state project has provided the opportunity for establishing a working group to conduct research and outreach programs that educate and instill change in horse owners to ultimately reduce their farms' environmental impact. The group consists of extension and research faculty from 9 states that have expertise in equine environmental stewardship. Recently, some of our members met with grant program leaders from 5 different environmental organizations located in the Washington D.C. area. After the meetings, the team was confident that our research and education programs most align with the goals and mission of the U.S. EPA's Environmental Education Grants Program.

Justification

Pasturing horses is a centuries old management tool that provides horses with an excellent source of nutrition, an area for engaging in involuntary exercise, and an opportunity for normal social interactions within the herd. In addition, properly managed grazing can be used to improve pasture ecology and maintain land in pasture rather than woodlands. However, horses are heavy bodied, athletic, selective grazers that produce an average 50 pounds of manure each day. If not managed properly, horses could increase soil compaction, overgraze and kill forage plants, and deposit excess nutrients on the land. Therefore, horse farm operators that use poor manure, pasture, and grazing horse management practices can negatively impact the environment by increasing the movement of sediment, nutrients, and pathogens from their farms into nearby surface waters, causing a decrease in water quality (Bilotta et al., 2007; Hubbard et al. 2004).

Environmental stewardship is a voluntary commitment, behavior, and action that results in environmental protection or improvement. Stewardship refers to an acceptance of personal responsibility for actions to improve environmental quality and to achieve sustainable outcomes. Increasing environmental stewardship of horse farm operators is challenging because they view themselves as animal caretakers first and foremost, are rarely from a farming background where environmental stewardship is practiced, and they are an underserved target audience for conservation programs (Prokopy et al., 2011). Recently it was found that only 40.7% of horse farm operators surveyed believed horse farms had a strong potential to impact the environment (Fiorellino et al. 2013).

Best management practices (BMPs) are defined as effective, practical, structural or nonstructural methods which prevent and/or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or ground water (USEPA, 2003). Examples of BMPs that can be implemented on horse farms to directly reduce environmental impact include, but are not limited to, storing manure covered on an impervious surface, installing 100 ft vegetative buffer strips between surface water and grazed pastures and manure storage areas, fencing horses out of surface water, and prevention of soil erosion in pastures by maintaining a forage stand that is distributed over more than 70% of the pasture. To increase the adoption rate of BMPs on horse farms, educational programs must be developed and tailored specifically to horse farm operators.

Our project aims to increase environmental stewardship by horse farm owners by 1) increasing their knowledge of how poor management practices on horse farms negatively impacts the environment, and 2) increasing their knowledge of how BMPs reduce environmental impact, and 3) increasing their knowledge of how to implement BMPs using available cost share programs.

Specific Activities of the Project

Team members of the NE-1441 working group will meet via conferencing technology and conduct two face-to-face meetings to write a large multi-state research and education project that will increase awareness and knowledge of horse farm environmental issues. The aim is to provide horse farm operators with the skills necessary to make informed environmental decisions and take action that is both responsible and appropriate for their farm.

The team will seek monies to fund multi-state educational programs for horse farm operators as well as for the development of an app for windows, android, and iOS devices that teaches youth and adults about environmental stewardship of horse farms in a fun and engaging way. The goal of the app is to engage horse enthusiast's using today's technologies with the advantage of reaching the broadest audience possible. Similar types of applications that help farmers make smarter on-farm management decisions are gaining in popularity (Delgado et al., 2013).

The multi-state project will be submitting to the U.S. EPA's Environmental Education Model Grants Program in FY17 for a maximum award of $190,000.

Roles of Team Members

Dr. Amy Burk will serve as the P.I. of the project and the overall project supervisor. Dr. Burk has provided educational leadership in equine nutrition and pasture management to horse owners and farm operators in the Mid-Atlantic Region for the past 15 years. She will coordinate all meetings, lead the writing and submission of the grant, and submit required planning grant reports. All other team members will contribute equally to the writing of the grant and the execution of the project once the grant is awarded.

Timetable

Action	**Fall 2016**	**Winter 2016/17**	**Spring 2017**	**Summer 2017**
Conference call to firm up collaborators, review RFP, layout objectives	X			
1st two-day face-to-face meeting in MD to share working document online, layout experimental design, write logic model, finalize budget, assign writing duties		X		
Conference call for members to update progress		X		
2nd two-day face-to-face meeting in NJ to finalize grant			X	
Grant is submitted to outside reviewers prior to submission			X	
Conference call for members to review feedback and delegate revisions				X
Grant routed through sponsored research offices and submitted online using grants.gov				X

Budget

Item	
Travel for 5 to fly and 4 to drive* to two face-to-face meetings including:	
- Parking at airport - $9/day x 2 day x 5 members x 2 meetings	$180
- Airfare - $425 x 5 members x 2 meetings	$4,250
- Mileage - $0.52/mi x 240 mi x 4 members x 2 meetings	$1,000
- Tolls - $7/trip x 3 members x 2 meetings	$42
- Hotel - $140/night x 9 members** x 2 meetings	$2,520
- Meals - $45/d x 2 days x 10 members x 2 meetings	$1,800
Hotel meeting space rental	$200
Total	**$9,992**

*Westendorf and Williams will drive together, so they are counted here as 1.
** Burk and Williams to share room.

Leveraging resources

This NERA planning grant would be instrumental in transitioning our workgroup from focusing on state-level research and education projects to more multi-state approach. We believe we have a strong chance to secure a grant from the US EPA model grants program because our education programs are among the best in the world. In addition, this would the first of many submissions from this group as we learn what each member can bring to the table for multi-state collaborative efforts through this grant planning process.

Literature Cited

Bilotta, G.S., R.F. Brazier, and P.M. Haygarth. 2007. The impacts of grazing animals on the quality of soils, vegetation, and surface waters in intensively managed grasslands. Advances in Agronomy. 94:237-280.

Delgado, J.A, K. Kowalski, and C. Tebbe. 2013. The first nitrogen index app for mobile devices: Using portable technology for smart agricultural management. Computers and Electronics in Ag. 91:121-123.

Fiorellino, N.M., K.M. Wilson, and A.O. Burk. 2013. Characterizing the use of environmentally friendly best management practices by horse farm operators in Maryland. J. Soil Water Conserv. 68:34-40.

Hubbard, R. K., G.L. Newton, and G.M. Gill. 2004. Production, management, and the environment symposium - impact of animal feeding operations on the environment water quality and the grazing animal. J Anim. Sci. 82:E255-E263.

Prokopy, L., R. Perry-Hill, and A. P. Reimer. 2011. Equine Farm Operators: An Underserved Target Audience for Conservation Practice Outreach? J. Equine Vet. Sci. 31(8):447-455. http://dx.doi.org/10.1016/j.jevs.2011.01.008.

U.S. EPA (U.S. Environmental Protection Agency). 2003. National management measures for the control of nonpoint pollution from agriculture. Washington, DC: USEPA.

CV of Team Leader - Amy O. Burk

Associate Professor and Extension Horse Specialist
University of Maryland
Department of Animal and Avian Sciences

EDUCATION

Ph.D., Animal and Poultry Sciences (Equine Nutrition), Virginia Polytechnic Institute and State University, Blacksburg, VA. 2001

M.S., Animal and Poultry Sciences (Equine Nutrition), Virginia Polytechnic Institute and State University, Blacksburg, VA. 1998.

B.S., Biology, James Madison University, Harrisonburg, VA. 1995.

RELEVANT PUBLICATIONS

Shepherd, M.L., M.A. Ponder, A.O. Burk, S.C. Milton, W.S. Swecker. 2014. Fiber digestibility, abundance of fecal bacteria, and plasma acetate concentrations in overweight adult mares. J. Nutr. Sci. 3:e10.

Fiorellino, N.M., J.M. McGrath, B. Momen, S. Kariuki, M. Calkins, and A.O. Burk. 2014. Use of best management practices and pasture and soil quality on Maryland horse farms. J. Equine Vet. Sci. 34:257-264.

Bott, R.C., B. Greene, K. Koch, K.L. Martinson, P.D. Siciliano, C.A. Williams, N. Trottier, A.O. Burk, A. Swinker. 2013. Production and environmental implications of equine grazing. J. Equine Vet. Sci. 32(6):324-326

Fiorellino, N.M., K.M. Wilson, and A.O. Burk. 2013. Characterizing the use of environmentally friendly best management practices by horse farm operators in Maryland. J. Soil Water Conserv. 68:34-40.

Westendorf, M.L., C. Williams, A.O. Burk, N. Trottier, K. Martinson, P.D. Siciliano, A.M. Swinker, E.A. Greene, and R. Bott. 2012. Environmental Impacts of Equine Operations: A U.S. Department of Agriculture Multistate Project. J. Equine Vet. Sci. 32(6):324-326.

RELEVANT GRANTS AND CONTRACTS

2016 Get it under cover! Restoring soil health in high use areas on farms with traffic-tolerant grasses. Maryland Agricultural Extension Service Grant. **$20,719.** Role: P.I. Collaborators: A. Lowrey, T. Turner, B. McIntosh (VT).

2013 A Statewide Approach to Increasing the Adoption of Environmentally-Friendly Best Management by Horse Farm Owners in Maryland. *Chesapeake Bay Trust*. **$15,000.** 1 year. Role: P.I.

2012 Increasing the Adoption of Environmentally-Friendly Best Management by Horse Farm Owners in Maryland. *Chesapeake Bay Trust*. **$15,000.** 1 year. Role: P.I.

2011 Training Horse Farm Owners to Adopt Environmentally Friendly Best Management Practices. *Chesapeake Bay Trust*. **$10,000.** 1 year. Role: P.I.

2007 Training Horse Farm Owners to Adopt Environmentally Sound Best Management Practices for Pasture. Maryland Conservation Innovation Grant. *USDA's Natural Resource Conservation Service*. **$75,000**. 3 years. Role: P.I., Collaborators: L. Vough, E. Dengler, K. Wilson, E. Petersen. Funded for 3 years.

2007 Reducing the Environmental Impact of Horse Farms through Research and Education. *Maryland Cooperative Extension and Maryland Agricultural Experiment Station Integrated Research-Extension Grant Program*. **$33,940.** 2 years. Role: P.I., Collaborators: K. Wilson, E. Denger (NRCS).

RELEVANT INVITED PRESENTATIONS

2015 Changes, Challenges and Opportunities for Sustainable Horse Farms. Spotlight on Stewardship: Equine Land Management Annual Seminar. June 26. Virginia Polytechnic Institute and State University, Middleburg, VA. 70 participants.

2015 Grazing Behavior of Horses. Rutgers Annual Horse Management Seminar - Horse Pasture Management. Rutgers, The State University of New Jersey. February 8. New Brunswick, NJ. 80 participants.

2013 Issues, Challenges, and Efforts in Nutrient Management for Pleasure Horse Operations. University of Delaware Nutrient Management Seminar. June 24. Newark, DE. **(Regional Audience).** 80 participants.

2013 Lessons Learned in Funding, Designing, and Carrying out Research at University Equine Pasture Demonstration Sites. Panelist with C. Williams, B. Greene, and B. McIntosh. Equine Science Symposium. May 30. Mescalero, NM. **(National Audience).** 40 participants.

2013 Assessing Environmental Impact of Horse Operations. Panelist within "Tales from the Green Side – Experiences with designing and conducting equine grazing studies" panel (K. Martinson, A. Burk, L. Warren). Equine Science Symposium. May 30. Mescalero, NM. **(National Audience).** 40 participants.

2013 Training Horse Farm Operators to Adopt pasture BMPs: A four-year Prospective. March 14. Annapolis, MD. Distributed 34 slide PPT handout to ~ 20 NRCS personnel.

2013 Training Horse Farm Operators to Adopt Pasture BMPs: A four-year Prospective. Feed and Ration Management Seminar. Rutgers University, New Brunswick, NJ. February 28.

2013 Health and Nutrition for the Pastured Horse. Delaware Ag Week. January 15. Harrington, DE.

2010 Management of Pasture for Happy Healthy Horses. Pasture Management Short Course. University of Maryland Extension – Eastern Shore. Princess Anne, MD. October 9.

2006 Pasture Management for Horse Farms. Certified Grassland Professional Training. Soil & Water Conservation Society, April 19. West Friendship, MD.

2005 Benefits of Pasture for Horses. North East SARE Mid-Atlantic Equine Pasture Management Initiative Training, December 19. Lancaster, PA.

SELECTED AWARDS AND HONORS

2013 **Excellence in Extension**, College of Agriculture and Natural Resources Alumni Association, University of Maryland.

2010 **Excellence in Extension**, Gamma Sigma Delta, University of Maryland Chapter.

2007 **Outstanding Educator**, Equine Science Society.

Proposal # 16-4

2016 NERA Planning Grants Program

Project Title: Deciding the Future of Our Landscapes:
A Regional Effort to Address Intergenerational Land Transfer

Team Members

Name	Discipline	Institution/Agency/Other
Paul Catanzaro	Human Dimensions	UMass Amherst
David Kittredge	Natural Resource Policy	UMass Amherst
Jessica Leahy	Human Dimensions	University of Maine
Kathleen Bell	Resource Economics	University of Maine
Shorna Allred	Human Dimensions	Cornell University
Marla Lindsay	Resource Economics	UMass Amherst/USDA Forest Service
Brett Butler	Statistics	USDA Forest Service

Team Leader Contact Information:

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E-mail:	cat@umext.umass.edu

Mission and goals

Mission: To inform the intergenerational land transfer decisions of family forest owners in an effort to minimize land conversion and parcelization in order to maintain the essential public benefits these lands provide.

Goal 1: Based on past work, map out a research direction that will best inform extension efforts.

Goal 2: Obtain nationally competitive funding for the research and integrated extension.

Goal 3: Share our research findings and extension resources with other states nationally.

Goal 4: Inform policy and programs to promote conservation-based land transfer.

Justification

Forests cover the majority of the northeast. Family forest owners (FFOs) control more than 50% of these forests. Landscapes dominated by FFOs provide a vast array of important ecosystem services and public benefits. The average age of FFOs is over 60 years old. It is estimated that over 75% of family forest land is owned by people over the age of 55 and nearly 50% is owned by people over the age of 65. In the coming years, nearly 3.8 million FFOs will be deciding the future of their land. We are, in fact, in the midst of the largest intergenerational shift of land our country has ever experienced. The decisions FFOs make about the future ownership and use of their land (e.g., conserve, sell, develop, parcelize, maintain) are the biggest drivers of landscape change in the eastern U.S. and will shape the future benefits those forests provide (or not!).

The implications of FFO decisions shaping our natural resources are noted in national level plans. As stated in the bullet of the first grand challenge of the "Science, Education, and Outreach Road Map to Natural Resources report, "Coupled Human-Natural Systems — Natural resource analyses must account for interrelated human and natural resource systems by improving the knowledge base of interactive processes between ecosystems and growing human populations. There is also the need to understand the influences of social and economic practices and policies on natural resources." In addition, "Intergenerational Land and Other Land Ownership Changes" is listed as a priority issue to be addressed by states in the upcoming FY 2012 – 2016 RREA Strategic Plan. It is not just agencies that rate this intergenerational shift of land a critical issue. According to the USDA Forest Service's National Woodland Owner Survey, FFOs rank their land's 'legacy' as the third most important reason for owning their land. The National Woodland Owners Association rates inheritance taxes and "keeping forest as forest" as two of their top ten top issues for FFOs. In other words, FFOs and state and federal natural resource agencies recognize that the intergenerational transfer of land is a critical issue.

More than five years ago, our team of researchers and extension faculty from across the northeast region began research and extension programs in their own respective states to address this critical issue. Three years ago, we decided that a critical issue of this scale, with so much at stake, necessitated a coordinated, regional approach. We applied for and were awarded a four-year, integrated research-extension NIFA grant to conduct research in MA, NY, VT, and ME through the small and medium farm program area. Our regional collaboration has built foundational knowledge of these FFO land transfer decisions that has informed our own extension work and that of others around the country. Our research points to the importance of

social networks in informing FFO decisions, the need to better understand the spatial pattern of these decisions, and the critical role family members play in deciding the fate of the land. These findings have important relevance to extension efforts. We now have a solid foundation of the basics of these decisions; it's time to take the next step to impact this critical issue.

Our current NIFA funding has helped us initiate our regional collaboration. The NIFA grant funds an annual team meeting to discuss our research results and plan our next year's work. In order to sustain the effort and maximize the value of the time and resources invested in developing this collaboration, we must keep the momentum going. We are requesting that NERA fund an additional one and a half days added onto our existing NIFA team meeting. The NERA funded day and a half would be used by the team to plan two integrated research-extension proposals based on the directions suggested by our recent research.

Activities

- Plan the combined NIFA and NERA meeting for January 2017 in Amherst, MA.
- Send the team relevant support material to review before the meeting to inform discussions.
- Host 1.5 day NIFA meeting funded by the NIFA grant.
- Add a 1.5 day NERA funded planning meeting to the NIFA meeting to determine the most important research and extension directions to pursue through competitive grants.
- Discuss and select the most appropriate NIFA and NSF program areas to apply.
- Develop assignments and timeline for drafts, reviews, edits, and submissions.
- Submit two nationally competitive proposals.

Role of the Team Members

Paul Catanzaro (UMass Amherst) is an Extension Assistant Professor in the Department of Environmental Conservation. Paul will serve as the PI on this project, organizing and facilitating the meeting and leading the effort to apply for additional funding. See appendix for CV.

Dr. David Kittredge (UMass Amherst) is a professor and the Massachusetts State Extension Forester in the Department of Environmental Conservation and is a Policy Analyst at Harvard Forest. David will be involved in the determination of future research directions and design.

Dr. Jessica Leahy (University of Maine): Associate Professor of Human Dimensions of Natural Resources in the School of Forest Resources and president of the Small Woodland Owners Association of Maine. She will be PI on one of our nationally competitive grant proposals.

Dr. Kathleen Bell (University of Maine): Professor of Economics. Her environmental and resource economics, spatial statistics, solutions-oriented research, and project management expertise will inform both the methods and extension work completed as part of the project.

Dr. Shorna Allred (Cornell University): Associate Professor in Cornell University's Department of Natural Resources and Associate Director of the Human Dimensions Research Unit. She will be involved in research and evaluation design and implementation of outreach programs.

Marla Markowski-Lindsay (UMass Amherst) Principal Research Fellow at the USDA Forest Service/UMass Amherst Family Forest Research Center. Marla is a natural resource economist and the Co-PI on the team's NIFA grant. Marla will play a leading role project coordination, research design, methods development, and data analysis.

Brett Butler is a research forester in the USDA Forest Service, Forest Inventory and Analysis Program. Brett is in charge of the USDA Forest Service's National Woodland Owner Survey. He will assist with research methods and data analysis.

Timetable

Activity	O	N	D	J	F	M	A	M	J	J	A	S
Meeting arrangements	X											
Distribute meeting materials		X										
Host NIFA and NERA Planning meetings				X								
NIFA grant extension program delivery					X	X	X	X	X			X
Conference calls with team					X	X	X	X	X			
Proposed deadline for assigned grant sections						X						
Proposal integration							X					
Proposal review and edits								X	X			
Integrate proposal comments										X		
NIFA and/or NSF grants submitted											X	X

Budget

Item	Cost
One way travel to Amherst, MA (.54/mile)	
U. of Maine	$ 167
Cornell University	$ 140
Meeting Expenses	
Hotel Rooms - 2 nights/participant ($175/night)	$ 2,100
Continental Breakfasts - 2 mornings	$ 200
Boxed Lunches - 2 days	$ 350
Team Dinners - 2 nights	$ 700
Total	**$ 3,657**

Leveraging Resources

Adding the NERA-funded planning meeting to the existing NIFA meeting has two major benefits. First, there is a substantial cost savings. We propose that the current NIFA grant pay for half the travel and meeting expenses and the NERA planning grant pay for the other half, thereby cutting the cost of this meeting in half. Second, holding these meeting concurrently allows the team to use the discussions from our on-going research as a springboard for the planning meeting, providing a very solid foundation for planning the next steps to the research.

APPENDIX

Paul Catanzaro

Extension Associate Professor

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EDUCATION

1995 – 1996 State University of New York College of Env. Science and Forestry, Syracuse,NY
M.S. in Forest Resources Management, specializing in Silviculture
1994 – 1995 Slippery Rock University, Slippery Rock, PA
M.S. in Sustainable Systems - Sustainable Natural Resources Management
1989 – 1993 Hamilton College, Clinton, NY
B.A. with a concentration in Cultural Anthropology, minor in Religion

PROFESSIONAL EXPERIENCE

2012 – Present *Extension Associate Professor*, University of Massachusetts Amherst.
2004 – 2011 *Forest Resources Extension Specialist*, University of Massachusetts Amherst.
1997 – 2004 *Service Forester*, Massachusetts Department of Conservation and Recreation.

AWARD

2015 Family Forest Education Award. Given by the National Woodland Owners Assoc. and the National Assoc. of University Forest Resources Programs to the Family Forest Research Center.

RECENT RELEVANT GRANTS AND CONTRACTS

Planning the Future of the Forest: Seeing Landowners "Like Me." *USDA NIFA RREA Focus Funding*. **($60,000)**. PIs: A. Muth, **P.F. Catanzaro**, M. Sissock, and J. Leahy. 2016-2017.

Understanding and Informing Family Forest Owner Decisions Of Intergenerational Land Transfer To Ensure Working Forested Landscapes. *USDA National Institute of Food and Agriculture Integrated Research and Extension Grants* (**$500,000**). PIs: **P.F. Catanzaro**, M. Markowski-Lindsay, S. Allred, J. Leahy, M. Sissock, D.B. Kittredge, B. J. Butler, A. Milman, and E. Markowitz. 2015-2018.

Estate Planning Outreach for Forest Landowners. *MA Dept. of Conservation and Recreation: Bureau of Forestry* (**$380,000**). PIs: **P. F. Catanzaro**, W. Ferris and J. Rasku. 2014 - 2017.

Estate Planning Outreach for Forest Landowners. *MA Dept.of Conservation and Recreation: Bureau of Forestry* (**$388,332**). PIs: **P. F. Catanzaro**, W. Ferris and J. Rasku. 2010 - 2013.

RECENT RELEVANT PEER-REVIEWED PUBLICATIONS

Markowski-Lindsay, M., **P.F. Catanzaro**, A. Milman, D.B. Kittredge. In review. Qualitatively understanding estate planning triggers and conservation bequest decisions of family forest Owners in Massachusetts, U.S.A. Small-scale Forestry.

Andrejczyk, K., B.J. Butler, B.J. Dickinson, J.H. Hewes, M. Markowski-Lindsay, D.B. Kittredge, M.A. Kilgore, S.A. Snyder, **P.F. Catanzaro**. Landowner Assistance Programs in the USA: A Qualitative Exploration of Program Impacts on Behaviour. Small-scale Forestry. First online: 19 August 2015.

Kilgore, M.A.; S.A. Snyder, D. Eryilmaz, M.A. Markowski-Lindsay, B.J.Butler, D.B. Kittredge, **P.F. Catanzaro,** J.H. Hewes, K. Andrejczyk. 2015. Assessing the relationship between different forms of landowner assistance and family forest owner behaviors and intentions. Journal of Forestry 113(1):12-19.

Butler, B.J., M. Markowski-Lindsay, S. Snyder, **P.F. Catanzaro**, D.B. Kittredge, K. Andrejczyk, B.J. Dickinson, D. Eryilmaz, J.H. Hewes, P. Randler, D. Taddle, and M.A. Kilgore. 2014. Effectiveness of landowner assistance activities: An examination of the U.S.D.A. Forest Service's Forest Stewardship Program. Journal of Forestry 112(2) 187-197.

Ma, Z., B.J. Butler, **P.F. Catanzaro**, J.L. Greene, J.H. Hewes, M.A. Kilgore, D.B. Kittredge, and M.L. Tyrrell. 2014. The effectiveness of state preferential property tax programs in conserving forests: Comparisons, measurements, and challenges. Land Use Policy 36(2014) 492-499.

Greene, J.L., B.J. Butler, **P.F. Catanzaro**, J.H. Hewes, M.A. Kilgore, D.B. Kittredge, Z. Ma, and M.L. Tyrrell. 2014. Family forest owners and federal taxes. Forest Policy and Economics 38 (2014) 219-226.

Catanzaro, P., M. Markowski-Lindsay, A. Milman, D. Kittredge. 2014. Assisting Family Forest owners with conservation-based estate planning: A preliminary analysis. Journal of Extension 52(2) #2FEA9.

Ma, Z., B.J. Butler, D.B. Kittredge, **P.F. Catanzaro**. 2012. Factors associated with landowner involvement in forest conservation programs in the U.S.: Implications for policy design and outreach. Land Use Policy 20 (2012):53-61.

RECENT RELEVANT OUTREACH PUBLICATIONS

Van Fleet, T., **P.F. Catanzaro** and D.B. Kittredge. 2014. Ch. 61 programs: Understanding the Massachusetts Ch. 61 current use programs. University of Massachusetts, Cooperative Extension Landowner Outreach Pamphlet, 22 pp.

Catanzaro, P.F., J. Rasku, and W.S. Sweetser. 2010. Revised and reprinted 2013. Your land, your legacy: Deciding the future of your land. University of Massachusetts, Cooperative Extension Landowner Outreach Pamphlet, 41 pp.

Proposal #: 16-5

2016-17 Planning Grants Program

Project Title: Addressing the produce safety challenges of small scale postharvest washing

Team Members:

Name	Discipline	Institution/Agency/Other
Amanda Kinchla (Confirmed)	Food Science: food safety, HACCP, food safety education, application research	Extension Assistant Professor/ Food Science Department, **University of Massachusetts**
Nicole Richard (Confirmed)	Food Science: HACCP, resources for small processors and producers, needs assessment protocols and analysis	Research Associate/Food Safety Specialist, **University of Rhode Island**
Lori Pivarnik (Confirmed)	Food Science: risk management, food safety education.	Coordinator, Food Safety Outreach/Research Nutrition and Food Sciences Department, **University of Rhode Island**
Chris Callahan (Confirmed)	Food Engineering: production efficiency, engineering, produce safety, extension education	Extension Agricultural Engineer; Director of NECAFS **University of Vermont**
Donna Marie Pahl (Confirmed)	Agriculture: produce safety, water quality management	Extension Associate, Produce Safety Alliance **Cornell University**
Elizabeth Bihn (Confirmed)	Agriculture: produce safety, adult education, program development	Director of Produce Safety Alliance **Cornell University**
Lisa McKeag (Confirmed)	Agriculture: vegetable production, produce safety education	Vegetable Specialist **University of Massachusetts**
Robert Hadad (Confirmed)	Agriculture: vegetable production, produce safety education	Agricultural Extension Specialist **Cornell University**
Hans Estrin (Confirmed)	Agriculture: Produce safety	Produce Safety Specialist **University of Vermont**
Kristina Sweet	Government: Produce safety regulation	Produce Program Coordinator **Agency of Agricultural Food & Markets**
Michael Botelho (Confirmed)	Government: Regulation, auditing, produce safety management	Commonwealth Quality Program Coordinator **MA Department of Agriculture**
Jennifer Rushlow	Legal: Regulation, law	Conservation Law Foundation
Andrea Donlon	Water resources, environment	Connecticut River Watershed Council
TBD	Environmental	MA Department of Environmental Production

Team Leader Contact Information:

Name:	Office of Grant & Contract Administration
Address:	University of Massachusetts Amherst 70 Butterfield Terrace, Research Administration Building Amherst, MA 01003
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Mission and Goals of the Proposed Program

The Problem: Scale appropriate and regionally relevant guidance on produce wash water sanitizer use and monitoring does not exist in a form that farms can immediately apply with confidence. Wash water management is a critical mitigation to minimize the risk of pathogen cross-contamination during postharvest produce washing. While there are many different recommended wash/rinse sanitizers (e.g chlorine, peroxy-acetic acid, lactic acid, hydrogen peroxide, etc.) that exist, little is published to provide guidance on selecting and managing these sanitizing treatments in production. There is strong need for technical support to provide scientifically validated process control guidance to improve produce wash water management practices.

The Solution: To develop a strategy to address the challenges of implementing scale appropriate food safety controls for produce wash water for small and medium growers. This proposal seeks financial support for an in-person meeting of Northeast Extension partners from multiple states to enable participants to network with key stakeholders and collaborators involved in local food production. This meeting is aimed at sharing current knowledge, research and outreach capabilities of the Northeast Extension network, establish a coordinated strategy to address this critical need and to promote regional collaboration.

The planning strategy will specifically focus on:

- Leveraging the NE-PHRESH DropBox online data sharing system and expand the scope of work to address the technical support needs specific to postharvest wash water sanitation (see below).
- Establish a communication plan to Northeast Center to Advance Food Safety (NECAFS) to centralize technical support outputs and activities (see below).
- Develop an approach for conducting research-based process validation studies to promote best practices for postharvest produce washing
- Build a strategy for future grant funding to provide the technical resources to further support northeast producers and processors
- Identify resources to further enhance regional programming and training within the Northeast Extension to meet the needs of the regional food producers and processors.

Justification for the program relative to stakeholder needs and potential for sustained external funding

A successful NEED/NERA funded project in 2013 helped to establish a cohort of Northeast Extension team members which later received USDA funding to support a project titled, "*Defining and overcoming economic factors hindering adoption of food safety practices by small and medium sized farms in the New England region*". Through this collaboration, a larger USDA award was secured in support of an improved understanding of food safety practice adoption among small and medium-sized producers in the New England. That project included survey work that illustrated 72% of respondents wash their produce, yet have a food safety competency rank of 72% which is below an acceptable 80% level (data not yet published). There is a strong need for improved, actionable guidance in this area. While the work is on-going, the preliminary data has demonstrated that there is a strong stakeholder need to provide additional technical support and/or guidance to growers specific to postharvest wash water operations. Furthermore, it is the experience of the Northeast Postharvest Research and Extension Service Hub (NE-PHRESH) group that growers are aware that water is a concern but there is a knowledge gap on how to control agricultural water used in postharvest applications (NEED/NERA 2015). One of the outcomes from the 2015 NEED/NERA planning grant was a clearinghouse of produce safety resources including several documented research questions and a joint literature review related produce wash water.

The FSMA Produce Safety Rule states, "a covered farm may choose to add an EPA approved disinfectant to the wash water and dunk tanks to ensure that the water contains no detectable E.coli and of safe and adequate sanitary quality for its intended use" (comment 200 in the FSMA PSR preamble); yet, there is little guidance to growers on how to control the quality of wash water during processing. There is strong scientific evidence to demonstrate the efficacy of postharvest sanitizer as a food safety control to reduce the risk of contamination during produce washing however, there is little information to demonstrate how producers can control the potencies of the added sanitizer in situ and in process to maintain food safety control. Preliminary work conducted with NE-PHRESH partners have evaluated commercially available quality controls (such as test strips and titrations) and have discovered that test strip performance is highly variable and is impacted by organic load, light and time. Titrations require sophisticated lab equipment and additional skills to be conducted accurately. Additional integrated research is required to identify research food safety controls. This group aims to collaborate to 1) share the working knowledge collected in this area, 2) discuss the application challenges in-field, 3) build an integrated outreach approach that leverages the capabilities and resources of the collaborative partners, and 4) addresses the stakeholder needs within the Northeast Region.

Program Sustainability

Over the past several years, the Northeast Region has been able to utilize NEED/NERA funded support as a means to establish collaborations, identify strategic approaches and secure funding to help better address the regional needs of the Northeast. Most recently, a 2015 NEED/NERA facilitated coordination of the NE-PHRESH. Through this established and collaborative network, the team was able to coordinate, submit and receive $950k funding from the FDA for the Northeast Center to Advance Food Safety (NECAFS). The legacy of previous planning support has demonstrated historical success and sustainability. The requested funding aims at further expanding collaborations by involving a diverse group of disciplines (industry, extension, and government) to help to build strategies on the identified needs from previous work. The goals of this project align with AFRI Foundational Program and other initiatives. Through continued NE-PHRESH and NECAFS activity, we have supportive data that identifies the need and funding streams that would support these efforts. However, we need the initial funding to support the planning efforts to build a solid and cohesive strategy. Many funding opportunities call for research and outreach education among multi-state teams. This project will allow collaborators to have a mechanism in place prior to a “request for applications” and allow for a more successful approach to obtaining external funding. Examples of relevant funding that would be alignment with the mission of this project include: Sustainable Agriculture Research & Education (Anticipated initial grant submission date: June 2017), USDA AFRI Foundational Food Safety Grant (Anticipated submission date: July 2017).

Activities to be engaged in by Team Members

This proposal intends to engage team members representing cross-disciplinary stakeholders, such as academic and extension researchers and educators, regulatory entities, government partners, food producers, and processing facility staff who play a role in supporting produce safety. This will allow team members to discuss opportunities and barriers to growth of food production and encourage and promote collaboration. Through the organization of an in-person meeting, team members can begin the process of defining and prioritizing regional research and educational needs and establishing a mechanism for obtaining external funding. PI-Kinchla is well versed in remote meeting software and centralized data management systems and will leverage existing resources initiated by the NE-PHRESH team to facilitate the communication channels for this project (i.e. GoToMeeting: Online meetings;

DropBox.com: online file sharing and content management service) and further expand the technical support for the Northeast Region.

Explanation of Roles of Team Members

Project Lead/PI- Amanda Kinchla will manage the overall planning coordination activities of the project including meeting logistics, managing outputs and deliverables, communication efforts, managing the budget and travel reimbursement administration. **Team Members**– All participating team members (please see cover page) will be responsible for input during conference calls and the face-to-face planning sessions. In addition, team members are also encouraged to help identify other contributors that would help to expand the network of collaboration. **Proposal Committee-** A subset of the Project Team will work to formalize the output of this meeting into a cohesive proposal for funding and the continuation of collaborative efforts.

Timetable for Completion of Planning Activities and Preparation of a Proposal

Timeline	Activities planned for 2017
Q1: Assumed Jan-Mar	• Initial "Kick-off" meeting with the team via phone to review mission and assign tasks • Coordinate centralize literature review on wash water sanitizer research • Investigate grant opportunities (continuous process) • Secure planning details for the 2-day meeting tentatively planned in Amherst, MA (PI-Kinchla)
Q2: Apr-June	• Conference calls: plan meeting, discuss research methods and writing proposal • Field 2 day: face-to-face meeting to share/discuss project goals, objectives, methods and measurable impacts • Issue meeting minutes and project summary report (PI-Kinchla) • Identify Proposal Committee
Q3: Jul-Sept	• Web-conference to finalize the project vision, scope, and proposal outline. • Prepare proposals to NIFA/AFRI or other appropriate source
Q4: Oct-Dec	• Report on the final outcome of this project.

Budget for Planning Activities (travel, meeting expenses, etc.): ~$10,000

Travel to Meeting	Lodging	Meals	Meeting Supplies	Conference Room Rental	**TOTAL**
$3,583	$3,586	$1,980	$300	$531	**$9,980**
Travel breakdown: 2 flights $450 x 2, $212 trans to/from & $50 parking airport, UMass parking $6.35 day x12 x2 days, $2,268 (10 x 420 miles x .54) mileage/ tolls, UMass Hotel 12 x $149.40 x 2 nights, 3 meals per day $65.99 per person (15 attendees) x2 days, $300 AV & meeting supplies, Conference room/tax $265 x2 days.					

Leveraging Resources

The funding requested is primarily to support the collaboration of the contributing team. The team intends to leverage resources where appropriate to maximize efficacy and efficiency. The collaborating team has been thoughtfully crafted to include a diversified group of expertise including food safety, vegetable production, environmental management, extension education and agricultural engineering. Having a cross-sector of expertise is intended to further leverage existing resources for future grant funding. Furthermore, indirect contributions will be utilized by the PI including online conferencing (GoToMeeting) and data sharing software (DropBox.com) to facilitate remote meetings to help facilitate with the goals of the project.

Appendix A – Team Leader CV demonstrating successful track record of collaboration

AMANDA J. (LaCoste) KINCHLA
Department of Food Science
University of Massachusetts – Amherst

EXTENSION FOCUS

Research: Food Safety, Product Development, Food Science Outreach & Extension Education, Commercialization (concept, bench top development, full scale commercialization).

Program summary: The Kinchla Research group focuses on applied research and food safety education to support the food industry. This research team supports development research from concept to commercialization to address technical challenges and deliver against product/business needs from farm to fork. In addition, her group identifies and provides educational outreach opportunities and creates educational programs that address Food Science needs through short courses, training and other outreach venues.

EDUCATION

- M.S. Food Science, Rutgers, The State University, New Brunswick, NJ
- B.S. Food Science, University of Massachusetts, Amherst, MA

PROFESSIONAL EXPERIENCE

Department of Food Science, University of Massachusetts - Amherst
Extension Specialist, Assistant Professor 2012 - present

Kinchla Food Consulting, South Deerfield, MA
Owner, Product Development Consultant 2010 - 2012

Lightlife/ConAgra Foods, Turners Falls, MA
2005 - 2010
Manager, R&D 2010
Senior Food Scientist 2005-2010

Kraft Foods, Tarrytown, NY 1998-2005
Scientist Microbiology/Food Safety 2002-2005
Scientist, Powdered Soft Drinks (PSD) 2001-2002
Associate Research Scientist I & II for Maxwell House Coffee 1998-2001

RITE Foods, Boston, MA 1996-1997
Food Safety Internship

PROFESSIONAL AFFILIATIONS

MA Food Policy Council, Institute of Food Technologists (IFT), New England Institute of Food Technology (NEIFT), International Association of Food Protection (IAFP), IFT Education Ambassador.

GRANTS RECEIVED (as lead Investigator)

- USDA NIFA National Needs. *Improving Produce Safety through Graduate Education to Integrate Research and Industrial Practice*. $241,000 (1/15-12/20).
- UMass Integrated Research and Extension. *Sanitation and Validation of Produce Rinse Water to Enhance Food Safety. $109,000*. (10/12 - 9/16).
- Mushroom Growers Association (AMGA), *Investigate optimizing the use of mushrooms for reduced fat and/or reduced sodium products*. $26,000. (9/14 – 8/15).
- MA Dept. of Agriculture. *Supporting Specialty Crops Through Better Process Control School and Value-Added Production*. ~$8,600. (9/12-9/15).

PUBLICATIONS

PEER REVIEWED

- Wong, K.M., Decker, E.A., Autio, W., **Kinchla, A.J.** Utilizing Mushrooms to Reduce Overall Sodium in Taco Filling. (In preparation).

- Yang, Ti. Zhang, Z.,Zhao, B., Hou, R., **Kinchla, A.**, Clark, J., He, L. Real-time and in situ monitoring of pesticide penetration in edible leaves by surface-enhanced Raman scattering mapping. (Submitted).
- Yang, T., Zhao, B., Hou, R, Zhang, Z., **Kinchla, A.J**., Clark, J.M., He, L., Evaluation of multi-classes pesticide penetration in fresh produce using surface-enhanced Raman scattering mapping. (Accepted, jf-2016-027056.R1).
- Chong, V., **Kinchla, A.J.** Assessing Commercial Quality Control Tools for On-Farm Postharvest Sanitation. Research & Reviews: Journal of Food Processing and Dairy Technology (Accepted, JFPDT-5-26).
- Wang, D., Wang, Z. He, F., Kinchla, A.J., Nugen, S. Enzymatic Digestion for Improved Bacteria Separation from Leafy Green Vegetables. Journal of Food Protection, Vol. 79, No. 8, 2016, Pages 1378–1386. doi:10.4315/0362-028X.JFP-15-581
- Wang, Z., Wang, D., **Kinchla, A**.J., Sela, D., Nugen, S. Rapid screening of waterborne pathogen using phage-mediated separation coupled with real time PCR detection. Analytical and Bioanalytical Chemistry, Accepted, Manuscript No. ABC-00072-2016.R1.
- Alcaine, S., Law, K. Ho, Kinchla, A., Sela, D., Nugen, S. Bioengineering Bacteriophages to Enhance the Sensitivity of Phage Amplification-based Paper Fluidic Detection of Bacteria. Biosensors & Bioelectronics, Vol. 82, February 2016.
- Wang, D., **Kinchla, A**.J., Nugen, S. Rapid detection of Salmonella using a redox cycling-based electrochemical method. Food Control, Vol 62, p81-88, April 2015.
- Hinkley, T., Pandya, J., Decker, E.A., **Kinchla, A.** Determination of Quantitative Sodium Mass Transfer Coefficient during Osmotic Processing of Potatoes. Journal of Food Processing and Preservation, Dec, 2015.

INDUSTRY PUBLICATIONS

- Bashor, M. **Kinchla, A.J.**, Moody, L. Slade, P.J., Stevens, K. Applying HACCP: Guidance and Avoiding Gaps. A Practical Guide. Food Protection Trends, July/August 2015.
- Nugen, S., **Kinchla, A.,** Challenges and Innovations for On-Farm Bacterial Testing. August/September 2013. http://www.foodsafetymagazine.com/magazine-archive1/augustseptember-2013/challenges-and-innovations-for-on-farm-bacterial-testing/

MEDIA

- *Food Science Students Compete to Create Marketable Ice Cream*, University of Massachusetts, http://www.massachusetts.edu/news/featured-stories/video-food-science-students-compete-create-marketable-ice-cream, 2015.
- *Spotlight on Science, At the World Science Festival,* Author: Paloma Kluger, interviewed for Time for Kids, http://www.timeforkids.com/node/95851/print, 2014.
- *The Science and Scientists Behind the Food,* participant for Multimedia Resources for School Counselors, Discovery Education/Institute of Food Technologists. 2005.

OUTREACH EFFORTS

- Product Development Short Course: 2015 (3), 2016.
- Addressing Food Safety with New Food Entrepreneurs, 2015.
- On-Farm Food Safety: New England Fruit and Vegetable Meeting, 2015.
- Product Development: Harvest New England Conference, 2015.
- Massachusetts Food System Plan, Processing Working Group participant, 2014-2015.
- On-Farm Food Safety: Farm to Institution, 2014.
- Food Product Development: Accounting for Food Safety, Quality, Processing & Regulations: 2014
- UMass Food Science Short Courses: 2013: Food Emulsions; 2012: Lipid Oxidation
- Introduction to HACCP: 2013, 2014.
- Better Process Control School: 2012, 2013, 2014, 2015.
- 4H Summer of Science Outreach Program: 2012, 2013, 2014.
- Girls Inc, Eureka! Summer Program: 2013.
- World Science Festival: 2013.

TRAINING & CERTIFICATION

International HACCP Alliance approved instructor, Better Process Control School approved instructor, Good Agricultural Practices.

UNIVERSITY OF MASSACHUSETTS
AMHERST

Research Administration Building
70 Butterfield Terrace
Amherst, MA 01003-9242

Office of Grant and
Contract Administration

voice: 413.545.0698
fax: 413.545.1202

August 30, 2016

Dr. Rick Rhodes
Associate Dean, Research and Outreach
415 CBLS Building
University of Rhode Island
Kingston, RI 02881

Subject: UM Proposal No. 117-0311
Entitled: Addressing the produce safety challenges of small scale postharvest washing

Dear Dr. Rhodes:

Attached for your consideration is the subject proposal submitted on behalf of Professor Amanda Kinchla of the Food Science Department.

If you have questions on technical aspects of the proposal, please contact Professor Kinchla at (413) 545-1017. Administrative concerns may be directed to Kim Lowney, Grant and Contract Administrator, at (413) 545-0698. In all future correspondence about this proposal, please refer to UMass Proposal No. 117-0311.

Sincerely,

Theresa Girardi, CRA
Assistant Director

Tg/jp
enclosure
cc: A. Kinchla, P.I.

Proposal # 16-6

2016 NERA Planning Grants Program

Project Title: Economic Impact of Reducing Food Loss on Farms and Community Development Possibilities

Team Members Name	**Discipline**	**Institution/Agency/Other**
Jane Kolodinsky	Applied Economics; Community Development	University of Vermont
Abby Willard	Food Distribution	VT Agency of Agriculture
Theresa Snow	Executive Director	Salvation Farms, Vermont
Frank Werthheim (and team)	Associate Extension Professor of Agriculture/Horticulture	University of Maine Cooperative Extension
Stacey Purslow (and team)	NH Farm to School Program Coordinator	Sustainability Institute, University of New Hampshire College of Agriculture and Life Sciences
Christopher Brian Watkins (or designee)	Extension Director	Cornell University, College of Agriculture and Life Sciences and Cornell Cooperative Extension

Team Leader Contact Information:

Name:	Jane Kolodinsky
Address:	CDAE
	202 Morrill Hall
	University of Vermont
	Burlington VT 05405
Phone:	802-656-4616
Fax:	
E-mail:	jkolodin@uvm.edu

Mission and goals of the proposed program: The goals of this planning grant relate to APLU/ESCOP 2010 Grand Challenges 4--ensure a safe, secure, and abundant food supply for the United States and the world, and 5--improve human health, nutrition, and wellness of the U.S. population. Planning grant goals are:

1. *Build partner*ships among four northeastern states to understand the regional food system with regard to capitalize on synergies related to surplus crops and their links to food security and economic development;
2. *Expand the network* beyond those included in this proposal; and
3. *Develop a nationally competitive research proposal*.

The first goal of this planning project will be met through monthly meetings of the project team. Two of these meetings will be face to face and 10 will utilize technology (e.g. ZOOM meeting). Partnership development will take priority during the first quarter of the grant period.

The second goal will be addressed during the second quarter of the project when the team invites additional partners. These may include members of the University community, as well as members of the hunger community, farmers and others with an interest in developing an evidence base related to field crop loss, food access, and economic development.

In the third and fourth quarters the correct granting opportunity will be identified and developed. Though it is possible additional funding opportunities may be forthcoming, we are investigating three possible funding programs through USDA:

- Community Food Projects (CFP) Competitive Grants Program
- Agriculture economics and rural communities-AFRI Foundational Program
- AFRI Food Security Challenge Area.

As an emerging partnership, we plan to:

- Explore the diverse "benefits" to farmers engaged in surplus management programs;
- Investigate a system for payment to farmers who distribute surplus crops to charity;
- Define the process to establish and report the quality of surplus crops;
- Define language to address farm liability for product distributed charitably; and
- Investigate alternate business structures or channels to manage farm surplus crops, such as for-profit and non-profit hybrids (L3C), and cooperative and co-pack arrangements.

These activities will form the basis for developing and submitting a proposal with specific research and action items.

Justification for the program relative to stakeholder needs and potential for sustained external funding: Globally 1.3 billion tons of food are wasted annually, accounting for 1/3rd of all food produced (Gustavsson et al. 2011). Per capita waste in the US is 280-300 kg/year accounting for 30 to 40 percent of total US food produced and is valued at $161 billion (Gustavsson et al. 2011). Meanwhile 14% of US household experience food insecurity and 5.6% very low food security (Coleman-Jensen et al. 2015). Many of those facing scarcity live in food deserts, of which there are 6,529 tracts nationally with 2,204 located in rural areas (Dutko et al. 2012).

Fortunately, there are existing market channels that could be utilized to benefit farmers and their communities. In addition to food pantries, business like Whole Foods and Rejuice are targeting traditionally wasted food. In Vermont, Salvation Farms is building partnerships with hospitals, nursing homes, schools and correctional facilities, providing them with nutritious food. Alternatively, neglected food can be used for landfill gas capture, reducing harmful methane emissions and producing useful fuel (Grycova, B., et al. 2016). More research is necessary to determine which strategies will be the most effective for farmers in the Northeast.

As a starting point, Salvation Farms (Vermont) recently released the 2016 Food Loss in Vermont report, which established an annual estimate for on-farm food loss in Vermont (Snow & Dean 2016). This research estimated that 14.3 million pounds of vegetables and berries remain on Vermont farms each year; 32% of which is unharvested and 68% of which is harvested but neither sold or donated. The report concluded that more research is needed in two areas: 1) calculating food loss and 2) reducing food loss. Additionally, a robust "food loss management" plan needs to be crafted and implemented in Vermont with the farmer at its core.

Specific to calculating food loss, the Vermont team is interested in 1) obtaining crop specific losses, especially of high volume crops, 2) more detailed data collection on when and why on-farm food loss occurs, and 3) more diverse farmer participation, for example tree fruit growers.

Specific to reducing food loss, the Vermont team is interested in 1) increasing access to markets for crops that become surplus, 2) increasing incentives for farmers, beyond tax incentives for charitable donations, and 3) expansion, innovative design, and professionalization of crop surplus management initiatives.

Vermont is part of a regional food system, and a regional approach is needed to provide evidence and creative solutions. Network and partnership building will identify additional specific evidence needs that can provide a basis for stakeholders that intersect at the food system and have vested interests in community economic development, citizen health and welfare, natural resource management, and labor to investigate and build a strategic approach to the opportunity that surplus, unharvested crops bring.

The result of this research will be a robust "food loss management" plan throughout the Northeast. This plan will expand market opportunities for farmers, compensate farmers for the foods they produce, and support larger-scale, professionalized gleaning, food rescue, and farm surplus management operations that strengthen farms and the regional food system.

This planning grant aims to initially bring together University research and Extension, community gleaning partners and farmers, but there are a host of stakeholders that will ultimately be necessary to engage. These include people engaged in business sector, job training programs, food banks/shelves, farm to institution, and government/policy making.

In the spectrum of planning activities from nascent to "shovel ready," our planning project is in the middle of the spectrum. There are many activities related to gleaning and crop loss occurring in the Northeast. There are many identified needs and some evidence to support them. To date, however, there has not been a coordinated effort that incorporates evidence to develop/implement a plan to reduce crop loss, increase food access and security, and provide a platform for community economic development.

Activities to be engaged in by team members towards a more complete definition of the program: The one year planning agenda includes holding virtual and face to face meetings, during which we will: establish research goals, methods, timeline, and sharing; establish partner roles; define priority applied work; and develop and submit an integrated research/extension proposal. Four Land Grant Universities will collaborate.

Explanation of roles of team members: The University of Vermont will be responsible for convening meetings and strategic path development. The group will determine priorities and contribute to evidence gathering and proposal development. The expected proposal will be a multi-institutional collaboration between/among 4 Land Grants and community partners.

Timetable for completion of the planning activities and preparation of a competitive proposal

Activity	**Oct 2016**	**Jan 2017**	**April 2017**	**July 2017**	**Sept 2017**
ZOOM meeting (Monthly)					
Face to face (Jan and July)					
Build partnerships					
Establish research goals					
Expand network					
Share current evidence					
Develop proposal					

Budget for planning activities (travel, meeting expenses, etc.) not to exceed $10,000

Item	Amount	Particulars
Travel-2 trips	$1275	3- Ithaca-BTV (604 miles RT x 2) 3 Durham-BTV (380 miles RT x 2) 4 local BTV (up to 50 miles) @$.54/mile
Hotel	$1200	Double occupancy 4 nights (2 meetings x 1 nights) @200/night=6 nights, including tax
Meals	$1000	2 days for distance travelers; (grp bkfst and lunch x 2 days x 12 people
Phone	$300	Conference calls
Incidentals	$100	Meeting materials, etc
Support	$1875	1 hour a week for 50 weeks
Total	**$5750**	

Leveraging resources: The University of Vermont will host ZOOM (or other platform) meetings and provide meeting space, indirect costs, and administrative support beyond the budget outlined above. Total matching = $4575.

References

Coleman-Jensen, A., Rabbitt, M., Gregory, C., & Singh, A. (2015). Household Food Security in the United States in 2014. *United States Department of Agriculture*. http://www.ers.usda.gov/media/1896836/err194_summary.pdf

Cuellar, A., & Webber, M. (2010). Wasted Food, Wasted Energy: The Embedded Energy in Food Waste in the United States. *Environmental Science & Technology,* 44(16), 6464-6469.

Dutko, P., Ver Ploeg, M., & Farrigan, T. (2012). Characteristics and Influential Factors of Food Deserts. *United States Department of Agriculture Economic Research Service,* 140. http://www.ers.usda.gov/media/883903/err140.pdf

Gustavsson, J., Cederberg, C., Sonesson, U., Van Otterdijk, R., & Meybeck, A. (2011). Global Food Losses and Food Waste. *Food and Agriculture Organization of the United Nations*. http://www.fao.org/docrep/014/mb060e/mb060e00.pdf

Grycova, B., Koutnik, I., Pryszcz, A., (2016). Pyrolysis Process for the Treatment of Food Waste. *Bioresource Technology, 218, 1203-1207.*

Snow, T. and Dean, E. (2016). Food loss in Vermont: estimating annual vegetable and berry loss. http://salvationfarms.org/VT_Food_Loss_Study_2016.pdf

Jane Kolodinsky, Ph.D.

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	MM/YY	FIELD OF STUDY
Kent State University, Ohio	B.S.	1981	Dietetics and Nutrition
Kent State University, Ohio	M.B.A	1983	Marketing
Cornell University, New York	Ph.D.	1988	Consumer Economics

A. Positions and Employment

2015-	Special Projects, Dean's Office College of Agriculture and Life Sciences
2015-2016	Lead-development of a Food Systems B.S. degree
2013-2014	Member, Incentive Based Budgeting Steering Committee; Chair, Non-Degree Subcommittee
2010-2012	Chairperson, University Food System Initiative Steering Committee
2009-	Director, Food Systems Research Collaborative University of Vermont
2002-	Chairperson, Community Development and Applied Economics Department, UVM
2009-	Director, Center for Rural Studies, University of Vermont
2003-2004	Interim chairperson, Plant and Soil Science Department, University of Vermont
1999-2009	Co-director, Center for Rural Studies, University of Vermont
1995,2000	Interim Chair Person, Community Development and Applied Economics Department, UVM
1999-2001	Special projects, Provost office, University of Vermont
1999	Professor
1993-1999	Associate Professor
1987-1993	Interim director MPA program, University of Vermont
1987-1993	Assistant Professor

Other Experience and Professional Memberships:

Section Chair Elect, Institutional and Behavioral Economics Section (2016-17) Chair ,Food and Agricultural Marketing (2016-17), Chair, Food Safety and Nutrition (FSN), American Applied Economics Association (all AAEA), 2013-14, Food Systems B.S. Steering Committee Chair, 2016-, Food Systems Graduate Steering Committee, 2012-present, American Council on Consumer Interests (ACCI):Annual Conference Co-Chair, 2008, Joint Conference with the American Agricultural Economics Association, Immediate Past President and Executive Board, 2002, President, 2000

Editorial Boards/Reviewer-- (38 journals total):

Editorial Board, *Journal of Consumer Affairs* 1992—99, 2000-02, 2011-, Editorial Board, *Nutrition Reviews*, 2013- , Editorial Board, *The Journal of Human Sciences and Extension*, 2013-, Editorial Board, *Journal of the Community Development Society*, 2009-2012, Editorial Board, *International Journal of Consumer Studies*, 2004—2010, Reviewer, 2011-, Editorial Board, *Journal of Family and Economic Issues*, 1995-99, 2000---, Editorial Board, *International Journal of Electronic Banking* 2006-, Panel of Reviewers, *Journal of Sustainable Development*, 2013, Reviewer, *Journal of Food Distribution Research*, 2014, Reviewer, *Critical Reviews in Food Science*, 2014, Reviewer, World Medical & Health Policy, 2014, Panel of Reviewers, *Family and Consumer Sciences Research Journal* 1993-2005 Reviewer, 2003, 2004, 2006—, Reviewer, National Science Foundation, 2013, Reviewer, Elementa: Science of the Anthropocene, 2016; Reviewer, *Journal of Food Science and Nutrition*, 2014-- ; Reviewer, Journal of Nutrition Education and Behavior 2015--;Reviewer, Agricultural and Resource Economics, 2015--; Reviewer, *Social Science and Medicine*, 2014, Reviewer, *British Food Journal*, 2014, Reviewer, *Journal of Agriculture, Community Development and Food Systems*, 2010—, Reviewer, *Journal of International Food and Agribusiness Marketing*, 2013, Reviewer, *Journal of Hospitality Marketing and Management*, 2010-, Reviewer, *Ecology of Food and Nutrition*, 2010, Reviewer, *Obesity*, 2010, Reviewer, *Appetite*, 2010-, Reviewer, *Journal of the American Dietetics Association*, 2009-, Reviewer, *Annals of Behavioral Medicine, 2009*, Reviewer, *Food Policy*, 2008-, Reviewer, *Journal of Preventative Medicine*, 2008—, Reviewer, *Preventive Medicine*, 2012-, Reviewer, UDSA National Research Initiative (NRI), 2006- 09, Reviewer, *Research on Aging*, 1999, 2005, 2008, Reviewer, *Women's Health*, 1999, Reviewer, American Agricultural Economics Association conference, 1998, Reviewer, *The Gerontologist*, 1997, 1998, Reviewer, *Family Economics Review*, 1993, 1995, Reviewer, *Journal of Gerontology: Social Sciences*, 1992, 93, 94, 96, 98, Reviewer, *Journal of Family and Economic Issues*, 1993-97, Reviewer, *American Review of Canadian Studies* 1990, Reviewer, *Journal of Consumer Affairs* 1989, 90, 91, Reviewer, *Advancing the Consumer Interest* 1988, 89, Reviewer, *Journal of Consumer Satisfaction, Dissatisfaction, and Complaining Behavior*, 1991-2003

Honors: FSLI (Food Systems Leadership) Faculty Fellow, 2007-08; Vogelmann Award for Research Excellence, UVM, CALS, 2005; Fulbright Senior Fellowship, Institute for Social Medicine and the Hanover, Hanover, Germany, 1998; American Council on Consumer Interests, Mid Career Award for Professional Achievements and Service to the Organization, 1997; State Agricultural Experiment Station, College of Agriculture; Leadership Development Program (ESCOP/ACOP), 1996-97; HERS Women in Higher Education Administration program Fellowship, 1995-96; UVM, College of Agriculture and Life Sciences, Carrigan Teaching Award for outstanding teaching, 1994; 1989 American Council on Consumer Interests Dissertation Award

Publications List, partial, past 5 years

Hamshaw, K., Inwood, S., **Kolodinsky, J.,** and Needle, M. (In Press). Generating knowledge to inform regional planning for sustainability: The roles of community engagement and indicators in the ECOS Project. In S. Kenney, B. McGrath, R. Phillips (Eds.), The Handbook of Community Development: Perspectives from Around the Globe. London: Routledge.

Courtney A. Cuthbertson, Assa Dembélé, John Leatherman, Scott Loveridge, Jessica Tess, Suzanne Lo, Bob Stephens, **Jane Kolodinsky**, Kelly Hamshaw, Holly Larson Lesko, Mary Beth Dunkenberger, Nancy White, Ann Sherrard, Christina MacFarlane (2016). Community-Responsive Behavioral Health Research: Translating Data for Public Consumption and Decision Making. Community Development Practice. 20: 36-48.

Kolodinsky, Jane (2016). Consumer Access and Choice in Sustainable Food Systems. In Morath, Sarah, ed. Farm to Fork, Akron, OH: University of Akron Press.Battista, G. A., Lee, B. H., Kolodinsky, J., & Heiss, S. (2015). Exploring Health Care Accessibility Among Rural Seniors Using A Mixed-Methods Approach. Transportation Research Record, Journal of the Transportation Research Board. 2531:137-145.

Becot, Florence, David Conner and **Jane Kolodinsky** (2015). Where do Agri-Food Entrepreneurs Learn their Job and are there Skills they wished they had Learned? International Journal of Entrepreneurship and Innovation 16(3): 207-215.

Calancie, Leeman, Jilcott Pitts, Kettel Khan, Fleischhacker, Evenson, Schreiner, Byker, Owens, McGuirt, Barnidge, Dean, Johnson, **Kolodinsky**, Piltch, Pinard, Quinn, Whetstone, Ammerman. (2015) Nutrition-related policy and environmental strategies to prevent obesity in rural communities: A systematic review of the literature. Preventing Chronic Disease. 12(E57): 1-15.

Kolodinsky, Jane (2015). Food Labeling. The Sage Encyclopedia of Food Issues. Los Angeles: Sage. Pp. 271-274.

Sitaker, Marilyn **Jane Kolodinsky**, Stephanie Jilcott Pitts, and Rebecca Seguin (2014). Do entrepreneurial food systems innovations impact rural economies and health? Evidence and gaps. *Journal of Entrepreneurship, Special Issue on Rural Entrepreneurship.* 7(2): 4-15.

Conner, D., Becot, F., **Kolodinsky, J**., Resnicow, S. and Finley Woodruff, K. (2014). Fostering the Next Generation of Agri-food Entrepreneurs in Vermont: Implications for University Based Education. *NACTA Journal*, 58 (3), 221-229.

Becot, F., Conner, D., **Kolodinsky, J**. and Mendez, E. (2014). Measuring the Cost of Production and Pricing on Small Diversified Farms: Juggling Decisions Amidst Uncertainties. *Journal of the American Society of Farm Managers and Rural Appraisers.* 2014 JOURNAL OF THE ASFMRA: 174-191.

Donna B Johnson, Emilee Quinn, Marilyn Sitaker, Alice Ammerman, Carmen Byker, Wesley Dean, Sheila Fleischhacker, **Jane Kolodinsky**, Courtney Pinard, Stephanie B Jilcott Pitts and Joseph Sharkey (submitted Feb. 2014). Developing an agenda for research about policies to improve access to healthy foods in rural communities: a concept mapping study. *BMC Public Health*.

Sitaker, Marilyn **Jane Kolodinsky**, Stephanie Jilcott Pitts, and Rebecca Seguin (2014). Do entrepreneurial food systems innovations impact rural economies and health? Evidence and gaps. *Journal of Entrepreneurship, Special Issue on Rural Entrepreneurship.*

Kolodinsky, Jane, DeSisto, Thomas, Propen, David, Putnam, Mathew, Roche, Erin, and Sawyer, W. (2013). It's not how far you go, it's whether you can get there: Modeling the effect of mobility on quality of life in a northern rural climate. *Journal of Transport Geography.* 31 (2013) 113–122 *(IF 2.53)*

Berlin, Linda, **Jane Kolodinsky**, and Kim Norris (2013). Farm-to-School: Implications for Child Nutrition. *Journal of School Health*. 83(8): 589-95. (IF 1.34)

Roche, Conner, **Kolodinsky**, Buckwalter, Berlin, Powers (2012). Social cognitive theory as a framework for considering farm to school programming. *Childhood Obesity*. (8: 4), 322-328.

Becot, F., Nickerson, V., Conner, D. & **Kolodinsky, J.** (2012). Costs of Food Safety Certification on Fresh Produce Farms in Vermont. *HortTechnology*, 22(5). (IF .44)

Kolodinsky, J., Roche, E., DeSisto, T., Sawyer, W., and D. Propen (2012). Understanding Quality of Life in a Northern Rural Climate. *Journal of the Community Development Society*.

Conner, D., King, B., **Kolodinsky, J**., Roche, E., Koliba, C. and Trubek, A. (2012). You can know your school and feed it too: Vermont farmers' motivations and distribution practices in direct sales to school food services. *Agriculture and Human Values*.

Schmidt, M., **J. Kolodinsky**, T. DeSisto, and F. Conte (2011). Supporting a Local Food System: Evaluating a Model that Connects Farmers to Markets to Increase Farm Profitability and Local Food Access. *Journal of Agriculture, Food Systems and Community Development.* 1(4): 1-19.

King, Benjamin, David Conner, Christopher Koliba, Amy Trubek and **Jane Kolodinsky** (2011). Mapping Farm to School Networks Implications for Research and Practice. *Journal of Hunger & Environmental Nutrition*. 6(2): 133 – 152.

Roche, Erin, and **J. Kolodinsky** (2011). Overcoming barriers to provide local produce in school lunches in Vermont. *Journal of Agriculture, Food Systems, and Community Development*. Volume 1, Issue 3 /Winter 2010–2011.

Proposal # 16-7

2016 NERA Planning Grants Program

Project Title: Alternative Inputs and Outputs for Agricultural-based Anaerobic Digesters to Increase Economic Viability and Environmental Benefits

Team Members

Name	Discipline	Institution/Agency/Other
Stephanie Lansing	Ag Engineering / Anaerobic Digestion / Cover Crops / Algae	Associate Professor, University of Maryland
Curt Gooch	Dairy Environmental Systems Engineering / Anaerobic Digestion / Extension	Principal Agent, Cornell University
Serpil Guran	Bioenergy Technologies / Biogas / Extension	Associate Professor and Director of the EcoComplex, Rutgers Univ.
Gary Felton	Anaerobic Digestion / Composting / Extension	Associate Professor, University of Maryland
Kenneth Staver	Biomass Utilization / Extension / Switchgrass / Nutrient management	Associate Research Scientist, University of Maryland
Dan Ciolkosz	Bioenergy crops / Online Bioenergy Education / Extension	Research Associate and Assistant Professor, Penn State University
John Tyson	Ag. Engineer / Dairy Systems Engineer	Extension Educator, Penn State Univ.
Chris Voell	Federal Anaerobic Digestion Programming	National Program Manager, EPA AgSTAR digestion program
Louise Lawrence	MD Manure Technology Program Manager	Program Manager, Office of Resource Conservation, MD Dept of Agriculture
Sarah Lane	Innovative Technology Fund Waste to Energy Program Manager	University of Maryland / Center for Environmental Science / MD DNR
David Dunn	Energy Innovation Center (Industry)	Green Mountain Power
Walter Mulbry	Bioenergy / Anaerobic Digestion / Algae	USDA Agricultural Research Service
David Lansing	Economic Geography / Policy and Economic Drivers of BMP Adoption	Associate Professor, Univ of Maryland Baltimore County
Madhumi Mitra	Bioenergy Education, including K-12, community college, undergraduate and graduate education	Professor of Biological and Environmental Sciences, Coordinator of Biology and Chemistry Education, Univ. of Maryland Eastern Shore
Abhijit Nagchaudhuri	Bioenergy Education, Anaerobic digestion and Bioenergy Engineering Design	Professor of Engineering and Aviation Sciences, Univ. of MD Eastern Shore

Team Leader Contact Information:

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Mission and Goals: To enhance the profitability and environmental benefits of anaerobic digestion (AD), new substrate inputs and digestion products need to be identified, tested and their effects on AD viability quantified. As manure-based digesters operate in the agricultural landscape but are affected by a multitude of federal, state and local policies on carbon, nutrient management, water quality, renewable energy, and power purchasing, the effect of these policies on economic resiliency need to be quantified and policy makers need to be informed. This project will determine how farmers can 1) create biogas and other value-added products from waste, 2) enhance off-farm income through the tipping fees, digestion product sales, and trading credits, 3) determine the effect of innovative substrate inputs and outputs on agricultural-based greenhouse gas emissions and water pollution, and 4) determine policy initiatives that enhance and/or deter digestion implementation in the Northeast.

The dairy sector is an important economic contributor to agriculture in the Northeast, but there are many challenges faced by small and medium dairy farms (most notably low and fluctuating milk prices and increasingly more stringent/new environmental regulations). We know there are economic and environmental benefits of anaerobic digesters (AD) for dairy farms, agribusinesses, and communities (Klavon et al., 2013; Shelford and Gooch, 2012), but there is a great need to track and compile the necessary data for complete economic assessments and use these results as a basis for: 1) making statements about digester economics with regards to the existing policies in the Northeast, and 2) determine what policies would be needed to make more proposed AD sites economically viable.

The innovation for the proposed projects is utilizing alternative substrates as AD inputs (crop residues, cover crops, algae, invasive aquatic plants, switchgrass, poultry litter, pre- and post-consumer food waste) and enhancing digester products (compost, bedding, bioplastic building blocks, nutrient separation technologies), while understanding the effects of these substrates and products in terms of renewable energy output, greenhouse gas reductions, nutrient recycling, reducing water pollution from nutrient runoff, ammonia deposition, and economics. This systematic analysis of the AD landscape in the Northeast and the impact of new innovations in AD have not been conducted.

As stated above, these are large goals and a team needs to be assembled to create specific objectives tailored to multiple funding agencies for successful grant funding. The team of dairy farming, AD, extension, education, and government experts will allow several grant proposals to be written and submitted, with input from stakeholders at the beginning of the proposal writing process.

Justification: According to the 2014 Climate Action Strategy to Reduce Methane Emissions released by the White House, their ambitious goal is to reduce methane emissions from the US dairy industry by 25% by 2020. Currently, the agricultural sector accounts for 36% of the anthropogenic CH_4 emissions in the US. While the majority of these emissions come directly from the cow (enteric methane), the report states, "the most important voluntary opportunities are through manure management with anaerobic digestion and biogas utilization. Biogas systems are proven and effective technology to process organic waste and generate renewable energy. They can reduce the risk of potential air and water quality issues while providing additional revenue for the operation. Yet, there are still relatively few digesters in operation on farms across America" (US EPA, 2014).

The reality is that the US currently has less than 300 agricultural digesters, with less than 1/3 incorporating co-digestion of agricultural residues or food waste, which greatly increases biogas production and improves AD economics through associated tipping fees. Germany, with 24% of US agricultural output, has well over 8,000 agricultural-based AD systems, with the overwhelming majority incorporating co-digestion using predominately ensiled energy crops and manure. In comparison, the US EPA has identified more than 11,000 viable agricultural AD system sites in the US. Based on current technology, if all identified sites adopted AD, 3 million homes could be powered and methane emissions would be reduced by 54 million metric tons of $CO_{2(eq)}$, equal to emissions from 11 million passenger

vehicles (US EPA, 2014). With a more vibrant AD industry, more candidate sites would be identified and more identified sites would proceed to AD construction.

In addition to the climate mitigation benefits of anaerobic digestion, MD, PA, VA and WV have all taken steps toward implementing point-nonpoint nutrient trading. Anaerobic digesters could contribute significantly toward meeting the Chesapeake Bay's TMDL water quality goals while enhancing the profitability (and thus sustainability) of food production, but incorporating AD into agricultural environments is not straight-forward, as diverting food waste from landfills as substrate inputs to digesters means incorporation of the nutrients in the food waste into farm nutrient management plans. There needs to be a careful evaluation of the effect of innovative substrate inputs.

Activities: We will meet face-to-face twice (January and May 2017) at the WYE Research Center in Queenstown, MD and conduct conference calls to discuss and finalize the scope, objectives, experimental design, research plan, and extension and educational activities for each proposal. The following are activities concurrently being conducted and results will be discussed at our meetings:

1) Coordinate our recent research efforts into specific objectives for combining AD substrate additions, including cover crops (Lansing, Gooch), food waste (Lansing, Gooch, Guran), and algae (Lansing, Mulbry), and explore new substrates additions, such as switchgrass (Staver), invasive aquatic plants (Gooch) and other water, urban, and agricultural-based biomass.
2) Coordinate our efforts on creating new innovative AD products, including VFA formation for bioplastics (Lansing), bedding (Gooch, Lansing), and compost (Gooch, Felton, Lansing).
3) Continue to study the effect of AD on nutrient loading/abatement to the Chesapeake Bay watershed using modeling / literature and compare to other BMPs (Lansing, Staver, Lane)
4) Update curriculum on digesters and bioenergy (Ciolkosz, Gooch, Mitra, Nagchaudhuri)
5) Review economic analyses on digester implementation (Lansing, Gooch, D. Lansing)

Targeted competitive funding opportunities include AFRI Coordinated Agricultural Projects (CAP) ($15 million), AFRI Foundational Grants to be submitted by subgroups ($300,000 each) and NSF submissions under the new Innovations at the Nexus of Food, Energy and Water Systems (INFEWS), which is co-funded by AFRI ($3 million each), as detailed below:

- **Coordinated Agricultural Projects (CAP): Development of Regionally-appropriate Biomass Feedstock Systems for Bioenergy, Industrial Chemicals, and Bioproducts**. Last year LOI were due in July for $3 million/year up to 5 years. CAPs are integrated research, education and extension grants on production and delivery of sustainable biomass feedstocks using non-food agriculture or forest feedstock that are converted to advanced fuels, chemicals, polymers, or new and innovative finished biobased products in the context of system economics, biopower, and/or animal feed.
- **Investing in America's Scientific Corps: Preparing a New Generation of Students, Faculty, and Workforce for Emerging Challenges in Bioenergy, Bioproducts, and the Bioeconomy.** Last year proposals were due in July for $3 million total for up to 4 years to stimulate K-12, associate, baccalaureate, and master's level education systems to advance America's bioenergy, bioproducts, and the bioeconomy through interdisciplinary coursework and creatively diverse teams.
- **Foundational Programs** ($300,000 total for up to 3 years). Last year proposals were due July/August.
  - **Bioprocessing and Bioengineering.** Improve efficiency and capacity of biomass, biofuels, bioenergy, and bio-based products by Advancing utilization of waste and byproducts generated in agricultural and food systems and engineer new or improved ag-based products and processes.
  - **Environmental and Natural Resource Economics.** Economic impacts of agriculture, resource management and the environment, land use change, water management, ecosystem services, and/or economic incentives and policies designed to promote resource conservation and sustainability.
  - **Behavioral and Experimental Economic Applications for Agri-Environmental Policy Design.** Insight on what drives decisions on conservation practice adoption and identifying which

conservation incentives are most likely to make a difference, including field-specific conservation needs, program incentives, farm characteristics, and the behavioral tendencies of farmers.

- **Small and Medium-Scale Farms.** Development of new models to appropriate scale technologies to enhance economic efficiency and sustainability, including the viability and competitiveness of small and medium-sized dairy, poultry, livestock, crop, forestry, and other operations.

- **NSF INFEWS**: Last year proposals were due in March. Catalyze interdisciplinary research to transform scientific understanding of the FEW nexus in terms of modeling, decision support capability, innovative technological solutions, and growing the scientific workforce capability.

Team Members Roles: The team includes members from **five** experimental stations (MD, NJ, NY, PA and 1890-UMES) and regional AD experts (C. Gooch - Cornell, S. Lansing - UMD, D. Guran - Rutgers, W. Mulbry – USDA, C. Voell - EPA), with experts in economics (D. Lansing - UMBC), bioenergy education (M. Mitra, A. Nagchaudhuri – UMES, D. Ciolkosz - PSU), engineering dairies (J. Tyson – PSU, C. Gooch - Cornell), extension outreach for biocrops and nutrient management (G. Felton and K. Staver - UMD), government experts in AD (C. Voell, EPA) and manure/nutrient management (L. Lawrence – MDA, S. Lane - UMD), and the energy industry (D. Dunn – Green Mountain Power). We have had AD projects funded by AFRI ($1 million) and NE SARE ($220k), with S. Lansing, C. Gooch, G. Felton as PIs, and D. Dunn, W. Mulbry, and J. Tyson as collaborators.

Timetable

- December 2016 – finalize meeting time, travel plans and the first meeting agenda
- January 2017 brainstorming meeting;
- Feb, March and April conference calls to finalize NSF (due end of March) and develop scopes of work/project narrative outlines for AFRI.
- May 2017 meeting to create full proposal drafts for AFRI, with additional conference calls in June to finalize AFRI proposals before July/August submissions.
- Meetings: Day 1 Agenda: 9am Breakfast, 10am-12pm Meet, 12-1pm Lunch, 2-5pm Meet; Day 2 Agenda: 8am Breakfast, 9-12pm Develop action items, 12-1pm Concluding Lunch

Budget ($9,998): While there are 15 members, only five are from outside the greater Washington DC/Maryland area where the meetings will be held.

- Each outside member will stay in the hotel for two nights for each meeting ($150/night for a total of two nights per meeting for the 5 participants) = **$3,000**
- The Vermont participant will fly in ($400) for each meeting (two total trips) = **$800**
- The Rutgers, Cornell and PSU participants will drive and be reimbursed for their mileage/tolls at $0.54 per mile ($367 per trip for Cornell) and $216 per trip for Rutgers and PSU = **$1,598**
- Local travel expenses/tolls will be $30 per day for 15 people for 4 days = **$1,800**
- Catering of breakfast/lunch for 4 days (8 meals at $350 per meal) = **$2,800**

Leveraging Resources

- There is no conference room fee, as it will be conducted at the UMD WYE Research Center.
- Conference call services are provided for free by the University of Maryland.
- The regional NECC 1501: Sustainable Farm Energy Production and Use project includes some team members, but has a focus and group members much larger than our AD projects. If the meeting dates were coordinated, a portion of NECC travel costs could be offset, but we cannot monetize these costs until the location and date of next year's NECC meeting is set.

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Education:

- 2008, Ph.D. The Ohio State Univ. (Dept. of Food, Ag. and Biological Engineering)
- 2005, M.S. The Ohio State Univ. (Dept. of Food, Ag. and Biological Engineering)
- 2000, B.S. Univ. of Oklahoma (Dept. of Civil and Env. Engineering & Env. Science)

Professional Experience:

- 2016-Present: Associate Professor, Dept. of Environmental Science & Technology, UMD
- 2008-2016: Assistant Professor, Dept. of Environmental Science & Technology, UMD
- 2008-2010: International Anaerobic Digestion Consultant - Haiti and Costa Rica
- 2007-2008: Ohio State University Dissertation Fellow

Teaching Responsibilities:

- ENST 481 and 681: Ecological Design and Advanced Ecological Design
- ENST 415: Renewable Energy
- ENST 499D/689D: Anaerobic Digestion Design and Testing

Research Accomplishments

- Twenty peer-reviewed publications (< 500 citations). Seven publications in the top two ag. engineering journals. My students or I are the first author on 17 of these publications.
- Received > $3.0 million in grant funding from federal agencies (NSF, USDA, USAID), foundations (Gates Foundation), and state agencies, with current grants supporting two post-docs, two PhD students, a MS student, two research associates, and undergraduates.
- Mentored 10 graduate and 30 undergraduate students at UMD
- I have given 40 invited talks, including AAAS and keynotes in S. Korea, China, Germany
- Chair (or Past Chair) of two committees in the American Society of Ag. & Biological Engineers (Food & Organic Waste Management/Utilization and Ecological Engineering)

Extension Accomplishments

- Co-organized three regional digestion conferences for over 100 farmers, policy makers, researchers, and extension agents from Maryland, Pennsylvania and DC.
- USDA Northeast Climate Hub webinar: Emerging Manure to Energy Technologies - Are Cost Effective Small Scale Digesters Possible. Webinar for USDA CEU credit (52 participants for credit, 146 participants total). June 1, 2016. Duration: 1 hour.
- Penn State Extension live presentation and archived webinar: Small and medium-scale anaerobic digesters for temperate regions. October 4, 2011. Duration: 1 hour.
- Host of NECC-1501 Sustainable Farm Energy and Use Regional Committee Annual Meeting. College Park, MD. January 20-21, 2016.

Awards and Honors:

- Junior Faculty Award (2015): UMD Council on the Environment
- Junior Faculty Award (2015): College of Agriculture and Natural Resources
- Mentor of the Year (2014): Institute on Teaching and Mentoring, Compact on Diversity
- Excellence in Mentoring (2016): Department of Environmental Science and Technology
- International Gamma Sigma Delta Service Award (2013): Capital Region Chapter

Select Research Publications (students/post-doc under my research direction are underlined):

Lansing, S., Bowen, H., Gregoire, K., Klavon, K., Moss, A., Lai, Y., Iwata, K., 2016. Determining methane production potential for sanitation improvement in Haiti. Biomass Bioenergy. In Press

Belle, A, Lansing, S., Mulbry, W., Weil, R.R., 2015. Anaerobic co-digestion of forage radish and dairy manure in complete mix digesters. Bioresource Technology 178: 230-237.

Witarsa, F., Lansing, S., 2015. Quantifying methane production from psychrophilic anaerobic digestion of separated and unseparated dairy manure. Ecological Engineering 78: 95-100.

Lansing, S., Klavon, K., Mulbry, W., Moss, A., 2015. Design, validation of field-scale anaerobic digesters treating dairy manure for small farms. Transactions ASABE 58(2): 441-9.

Arikan, O., Mulbry, W., Lansing, S., 2015. Effect of temperature on the methane production from field scale anaerobic digesters treating dairy manure. Waste Management 43: 108-113.

Klavon, K., Lansing, S., Moss, A., Mulbry, W., Felton, G., 2013. Economic analysis of small-scale agricultural digesters in the United States. Biomass and Bioenergy 54: 36-45.

Lisboa, M.S., Lansing, S., 2013. Characterizing food waste substrates for co-digestion through biochemical methane potential (BMP) experiments. Waste Management 33(12): 2664-2669.

Select Extension Publications (students/post-doc under my research direction are underlined):

Arikan, O., Mulbry, W., Lansing, S., 2015. Effect of temperature on the methane production from field scale anaerobic digesters treating dairy manure. eXtension: America's research-based learning network. Available at: http://www.extension.org/pages/72729

Moss, A., Lansing, S.A., Felton, G.K., 2015. Anaerobic digestion: Products. University of Maryland Extension, Fact Sheet 998.

Selected Recent Grants Awarded (2014-2016)

- "Evaluating different manure management practices in controlling spread of antimicrobial resistance from dairy farms." USDA-AFRI: $999,921. Co-PI: Lansing portion: $324,931
- "Novel anaerobic microbial preservation methods for a digestion starter kit." US Air Force through United Technology Corporation (UTC): $99,934. Role: PI.
- "Monitoring poultry litter anaerobic digestion and nutrient capture in Maryland." MD Dept. of Agriculture: $92,326. Role: PI.
- "Tri-generation of heat, power, and potable water from waste." Bill & Melinda Gates Foundation: $50,000. Co-PI: Lansing portion: $20,000.
- "Ammonia removal from digested poultry litter." Maryland Industrial Partnerships (MIPS): $249,913. Role: PI.
- "Incentivizing sanitation with biogas in Haiti: Stage 1 pilot digester evaluation." USAID: $99,987. Role: PI.
- "Optimizing energy-positive waste treatment systems by integrating fundamental aquatic chemistry/microbiology knowledge." NSF ADVANCE at UMD. $20,000. Role: PI.

References

Klavon, K., Lansing, S., Moss, A., Mulbry, W., Felton, G., 2013. Economic analysis of small-scale agricultural digesters in the United States. Biomass and Bioenergy 54: 36-45.

Shelford, T., Gooch, C., 2012. Small Farm Manure-Based Anaerobic Digestion Systems and Barriers to Increasing their Implementation in New York State. Available at http://www.manuremanagement.cornell.edu/Pages/Assessment_Tools/Small_Farm_AD_report_final_12_11_12.pdf

US EPA, 2014. Biogas opportunities roadmap: Voluntary actions to reduce methane emissions, increase energy independence and grow the economy. Available at http://www.epa.gov/climatechange/Downloads/Biogas-Roadmap-Factsheet.pdf.

Proposal # 16-8

2016 NERA Planning Grants Program

Project Title: Increasing Consumption of US-Grown Fresh Produce among Immigrant Communities in the Northeast Megalopolis

Team Members

Name	Discipline	Institution/Agency/Other
Andy Wetherill	Agribusiness & risk management/ production	Delaware State University
Jennifer Sarah Tiffany	Executive Director, Cornell University Cooperative Extension, NYC; Director, Outreach/Community Engagement, Bronfenbrenner Center for Translational Research	Cornell University, NYC
Anu Rangarajan	Director, Cornell Small Farms Program	Cornell University
Carol Parker	Nutrition and Health Program Leader	Cornell University Cooperative Extension, NYC
TBD/Extension Associate	Urban Agriculture	Cornell University Cooperative Extension, NYC
Kathy Kelley	Professor of Horticultural Marketing and Business Management	Penn State University
Rick VanVranken	Sustainable vegetable production	Rutgers University
Matthew Richardson	Agricultural Production	University of the District of Columbia
Yao Afantchao	Production, working with growers	University of the District of Columbia
Lillie Monroe-Lord	Human nutrition	University of the District of Columbia

Dwane Jones	Economics, marketing	University of the District of Columbia
Xiaochu Hu	Economics	University of the District of Columbia
Dwane Jones	Economics, marketing	University of District of Colombia
Xiaochu Hu	Economics	University of District of Colombia
Jason Wight	Agronomy Trials Coordinator	University of Maryland
Neith Little	Extension/urban agriculture	University of Maryland
Manami Brown	City Extension Director	University of Maryland, Baltimore
Ronald Myers	Sustainable agriculture production	University of Maryland
Nevin Dwason	Sustainable Agriculture, Soil Health,	University of Maryland
Frank Mangan	Sustainable vegetable production and marketing	UMass Amherst
Zoraia Barros	Sustainable vegetable production and marketing	UMass Amherst
Dan Lass	Resource Economics, marketing	UMass Amherst
John Taylor	Urban/Rural Sociology, Qualitative Social Research, Environmental Science	University of Rhode Island
Rebecca Brown	Sustainable vegetable production	University of Rhode Island

(Attach an additional sheet if more space is needed.)

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Increasing Consumption of US-Grown Fresh Produce among Immigrant Communities in the Northeast Megalopolis
August 31, 2016

Twenty-four researchers and Extension personnel at eight Land-grant institutions in the Northeast are submitting a proposal for the 2016-17 Panning Grant offered by the Northeast Regional Association of State Agricultural Experiment Station Directors. We have assembled a multi-state and multi-disciplinary team to focus on developing research and outreach activities to promote greater adoption of new crops by commercial farmers desired by the growing ethnic/immigrant population in the Northeastern United States. This planning grant will enable us to create and solidify a new team and provide us the opportunity to thoughtfully develop competitive proposals for multiple funding agencies and programs. We are requesting $7,400 from NERA for this project. We will also use $8,000 provided by four of the cooperating Land grants in support of this project.

I. Introduction

The Northeast Megalopolis, which spans from metropolitan Boston to Washington, DC, is the most urbanized region in the United States (U.S.). Seventeen percent of the U.S. population lives in this region, which accounts for only two percent of the total land area. Eight of the nine states with the highest population density in the U.S. are located in this region, and Washington, DC has a population density greater than any state in the country.

II. Growth of immigrant groups in the Northeastern United States

The U.S. has always experienced a growth of population based on immigration. Prior to the 1970's a majority of the immigrants relocated from Europe (All of Europe is located in a temperate zone.); however, over the past 40 years, an overwhelming proportion of immigrants have come from tropical and sub-tropical regions of the world (Latin America, Asia, Africa, Middle East) The minority/immigrant population in the U.S., again dominated by people from tropical and sub-tropical regions of the world, was 38% of the total U.S. population in 2015 and is projected to rise to 56% of the total U.S. population by 2060.

Many of these immigrant groups who relocate to the U.S. establish themselves in urban areas. For example, Latinos are now the largest race/ethnicity in the public school systems in the five largest cities in Massachusetts, with 45% of total students, followed by African-Americans (23%), non-Hispanic whites (19%) and Asian (9%). Similar trends are found in many other major cities throughout the Northeast Megalopolis.

Latinos are the largest race/ethnicity, after non-Hispanic whites, in the U.S. and continue to grow. Puerto Ricans, the second largest Latino ethnicity in the U.S. after Mexicans, are concentrated in the Northeastern U.S. where they are the largest Latino ethnicity. Recently, Puerto Rican migration to the U.S. has increased dramatically due to the severe economic crisis that occurred in this U.S. territory. Dominicans are the second largest Latino ethnicity in the Northeastern U.S. followed by Mexicans, Salvadorans and Guatemalans.

Growth of Asians in the U.S is increasing at an even greater rate than Latinos. In 2014, more Asian Indians, followed by Chinese, Filipino, Vietnamese, and Koreans immigrated to the U.S. compared to other Asian groups. On average, Asian immigrants have a higher level of education and household income than both the overall immigrant and the U.S.-born populations.

A growing number of African consumers are also immigrating to the U.S. The US Census estimates that the African population in the U.S. has doubled every 10 years since 1970, with 41% of the total African-born population being from Nigeria, Ethiopia, Egypt and Ghana.

New York State has the largest African population in the U.S. and Maryland is fourth. The number of immigrants from the Middle East is expected to increase due to political and economic issues that impact their lives in their home countries.

Like all immigrant groups that have come to the U.S., these consumers desire ingredients to prepare their traditional cuisines, which include specific fresh fruits and vegetables. These growing populations represent opportunities for commercial farmers to produce and market fresh produce desired by these new and expanding markets. Retail sales of ethnic foods in the U.S. was approximately 11 billion dollars in 2013 and made up more than 12% of all retail food sales. This market share is expected to increase by 5% annually.

III. Promoting healthy nutrition among low-income immigrant populations: example of Latinos

Latinos are almost twice as likely as non-Hispanic whites to be diagnosed with diabetes. They have higher rates of diabetes-driven end-stage renal disease and are 50% more likely to die from diabetes as non-Hispanic whites. Latinos are also 1.2 times as likely to be obese than Non-Hispanic whites, and among Latinos who experienced a stroke, 72% had high blood pressure, compared to 66% in non-Hispanic whites. The percentage of Latino consumers who eat five or more servings of fruits and vegetables daily ranged from just 19% (Puerto Rican origin) to 55% (Cuban origin). Puerto Ricans have higher rates of obesity and diabetes than all other Latino ethnicities and it is well known that poor diet contributes to an increase in likelihood of diabetes, obesity and hypertension.

IV. Opportunities for U.S. commercial farmers in the Northeastern United States

There are many crops popular among immigrants from tropical and sub-tropical regions of the world that can be grown in the Northeastern U.S. For example, there are approximately 30,000 acres of vegetables grown in Massachusetts and more than 70% of this acreage is devoted to crops that have their center of origin in sub-tropical and tropical regions. These include sweet corn (*Zea mays*) and squashes and pumpkins (*Cucurbita spp.*), among many others. The growing season in the Northeastern U.S. is very "tropical", with high temperatures and long days, which allow growers in this region to grow annual tropical crops used in the cuisines of immigrant groups coming from tropical and sub-tropic regions. Examples are calabaza (*Cucurbita spp.)*, jiló (*Solanum gilo*) and chipilín (*Crotolaeria longrastrata*), all currently being grown in the Northeast for ethnic markets. In addition, there are agronomic crops popular among these growing immigrant groups that can also be grown in the Northeastern U.S such as tef (*Eragrotis tef*), Amaranth (*Amaranthus spp.*) and specialty sorghums (Sorghum spp.).

V. Economic viability of production and marketing of crops to new markets

U.S. food and agricultural producers need to be competitive in a global environment. As pointed out in A Science Roadmap for Food and Agriculture, APLU, 2010, "For maximum impact the research must be integrated beyond traditional outreach and through to commercialization." Commercial growers not only need information on how to grow these new crops, but also financial and marketing support to make sure their adoption of these crops is economically viable.

Another challenge is the growing competition of agricultural imports to the U.S. that have been dramatically increasing over the last 15 years, from 40 billion dollars in 2000 to almost 120 billion in 2014. The largest growth has been in horticultural products (e.g. vegetables, fruits, cut flowers), which represented 10 billion dollars of imports in 2000 and more than quadrupled to over 42 billion by 2014. The overwhelming amount of these agricultural products

is coming from Latin America. Mexico is the largest exporter of fresh vegetables to the U.S. and four of the next top nine are also in Latin America. This increase in fresh produce imports from Latin America is due to improving production practices and infrastructure in these countries and an increasing disparity between the wages for farm labor in the U.S. and Latin America.

VI. Establish Stakeholder Councils

We will establish two groups of stakeholders based in and near both New York City and Washington, DC areas to provide this group with valuable input on all aspects of the research and outreach activities. They will participate in the in-person meetings to be held in NYC and Washington DC the For each metro city there will be two groups:

a. Commercial growers, including both traditional and ethnic commercial growers.
b. Market owners that sell ethnic produce, including farmers' market vendors.

VII. Current goals and objectives to be evaluated during the planning period

Goal 1. Increase production and viability of agricultural crops popular among the large and growing immigrant/ethnic groups in the Northeastern U.S.

Objective 1.Implement trials at Land-grant research and commercial farms in the Northeastern U.S. to evaluate sustainable production practices for crops popular among growing immigrant/ethnic groups.

Objective 2. Evaluate the economic viability of target crops to be introduced for production by commercial farmers in the Northeastern U.S.

Objective 3. Implement and evaluate culturally and linguistically-appropriate marketing strategies to ensure optimum sales of target crops.

Objective 4. Work with cooperating growers to successfully grow and market these crops.

Goal 2. Develop culturally-appropriate nutrition education for low-income immigrant/ethnic groups using crops being evaluated by project personnel and commercial farmers.

Objective 1. Explore, use and link existing national survey data on demographic and health to examine dietary and health outcome changes as immigrants integrate into the U.S. life style, and what role consumption of ethnic crops plays in this process.

Objective 2. Educate members of the target communities on healthy eating with an emphasis on using locally-grown fresh produce.

VIII. Activities to be engaged in by team members to work towards a more complete clarification of the proposed projects.

A. Conference calls will be held at least monthly during the year. Agendas will be set in advance, notes taken and filed.

B**.** Two in-person meetings will be held during the planning year:Project participants will convene for two days during the planning year, one to be held in New York City and the second to be held in Washington, DC.

These activities will focus on fine-tuning and confirming the goals and objectives of this project, and targeting specific granting agencies for competitive proposals by the end of the planning year. Given the diversity of the team, which is a strong asset, we envision multiple granting opportunities will be relevant for competitive proposals from this group. These include:

- National Institute for Food and Agriculture (NIFA) Specialty Crop Research Initiative
- Foundation for Food and Agriculture Research (FFAR).

- Northeast Sustainable Agriculture Research and Education (SARE)
- AFRI Foundational Program, such as Plant Breeding for Agricultural Production, and Innovation for Rural Entrepreneurs and Communities.

C. A report will be produced summarizing the activities of the monthly conference calls and two in-services and submitted to NERA.

Budget for planning grant			
	Funding sources		
	NERA	**Cooperating Land-grants[1]**	**Total**
Travel/food costs for project participants from cooperating Land-grants[2]			
New York City and Washington, DC	$7,400	$7,000	$14,400
Per diem for stakeholder members[3]			
New York City and Washington, DC	$0	$1,000	$1,000
Total	$7,400	$8,000	$15,400

[1]Administrations of Cornell, UMass Amherst, U. Maryland, U. District of Colombia have committed to $2,000 each to support the organization of this project, for a total of $8,000

[2]One hosted by Cornell NYC and another by UDC; estimated to cost $300/person/meeting; 24 people = $14,400

[3]Each stakeholder will be provided lunch, estimated to be $25.00; 10 stakeholders for marketing and 10 stakeholders for production for both cities: 40 people = $1,000

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2016 ***Extension Professor.*** Stockbridge School of Agriculture. UMass Amherst.

2006 - 2016 ***Extension Associate Professor***. Stockbridge School of Agriculture. UMass Amherst

1998 - 2006 ***Extension Assistant Professor***. Dept. of Plant, Soil & Insect Sci.. UMass Amherst

1991 – 1998 ***Extension Specialist. UMass Extension.*** University of Massachusetts, Amherst

2015 – present ***Director of the Stockbridge School of Agriculture Learning Center***

Professional Expertise

Sustainable vegetable production; Production and marketing of ethnic crops. Soil fertility and alternative nutrient sources; Food systems

Teaching

StockSch 325. Sustainable Vegetable Production. 4-credit junior-year course

StockSch 397. Food Systems in Cuba: Production, Logistics and Marketing. 3-credit junior-year course taught in Cuba

Current and past membership of professional organizations

InterAmerican Society for Tropical Horticulture (Officer)
International Society for Horticultural Science
American Society of Horticultural Sciences
Cuba-US Agroecology Network
New England Vegetable & Berry Growers

Language skills

Spanish: fluent**; Portuguese:** professional

Grants

I have been the PI or CO-PI on grants that have totaled over **four million dollars** as of 2016. Examples of competitive multi-disciplinary and multi-state grants include:

Mangan, F. (co-PI) and Z. Barros. Healthy Incentives Program. Funded by the Food Insecurity Nutrition Incentive (FINI) Grant Program under USDA. 1/1/16 – 12/31/20. UMass component: $240,000 (whole grant 3.4 million)

Govindasamy, R (PI), **Mangan, F.** (Co-PI), G. McAvoy (Co-PI). Locally Grown Ethnic Greens and Herbs: Demand Assessments and Production Opportunities for East Coast Farmers. USDA Specialty Crops Program. 10/1/09 – 12/30/13 $800,000 (UMass component is $200,000).

Mangan, F. (Co-PI). Work with UMass nutrition educators to provide fresh produce at cooperating farmers' markets popular among ethnic groups, and promote culturally-appropriate, healthy recipes at these farmers markets 2003 – 2011. USDA Nutrition Funds. $234,000.

VanVranken, R., An Rangaranjan, and **F. Mangan**. "Developing of Ethnic and Specialty Vegetable Production and Marketing Resources. USDA SARE Program 3-1-01 - 12-30-05. $119,772

Mangan, F. (PI), R. Hazzard, R. Van Driesche, and K. Stoner. "Providing Farmers with New Brassica Species and Management Options for Flea Beetles for Expanding Markets in Massachusetts and Connecticut". USDA SARE Program, 3-1-01 - 11-30-05. $135,632.

I am a co-founder of website worldcrops.org, which has research-based information on production, marketing, promotion and nutrition information for vegetable and herb crops popular among the large and growing immigrant populations in the Northeastern United States. There is information on over 50 crops in this website and it is updated regularly. Here are the links to two crops we are evaluating in 2016:

Mangan, F. and Z. Barros. 2016. Sustainable production, marketing and promotion, and culturally-appropriate nutrition for ají dulce (*Capsicum chinenese*) http://worldcrops.org/crops/aji-dulce

Mangan, F. and Z. Barros. 2016. Sustainable production, marketing and promotion for garden egg (*Solanum gilo*). http://worldcrops.org/crops/garden-egg

Selected Publications related to this project

Mangan, F., Barros, Z., Fernandes , C., Moreira, M., Finger, F. and Almeida , G. 2012. Devoloping Sustainable Production Practices for New Tropical Vegetables for the Northeastern United States. Acta Hort. (ISHS) 936:53-60 http://www.actahort.org/books/936/936_5.htm

Govindasamy, R. R. Van Vranken, W. Sciarapa, A. Aveni, V. Puduri, K. Pappas, J. Simon, **F. Mangan**, M. Lamberts, G. McAvoy. 2011. Ethnic Crop Opportunities for Growers on the East Coast: A Demand Assessment. Journal of Extension. http://www.joe.org/joe/2010december/rb2.php

Mangan, F. R. Mendonça, M. Moreira. S. Nunes, F. Finger, Z. Barros, H. Galvão, G. Almeida, and M. Anderson. 2007. Production and marketing of vegetables for the ethnic markets in the United States. Revista Horticultura Brasileira. Horticultura Brasileira 26: 006-014.

Proposal #: 16-9

2016 NERA Planning Grants Program

Project Title: **Innovative Solutions using Green Infrastructure - *A Northeast Regional Collaboration***

Team Members:

Name	Discipline	Institution/Agency/ Other
Tom Ballestero	Hydrology and water resources engineering	University of New Hampshire
Julia Peterson	Water Resources	University of New Hampshire
David Dickson	Law & Policy	University of Connecticut
Chester Arnold, Jr.	Water Resources	University of Connecticut
Michael Dietz	Water Resources	University of Connecticut
Maureen Hogan, Acting Director, Penn State Center - Pittsburgh	Administration and Management	The Pennsylvania State University
John Byrnes, Director, Penn State Center - Philadelphia	Administration and Management	The Pennsylvania State University
Tommy McCann, Penn State Center - Philadelphia	Horticulture Educator	The Pennsylvania State University
Arthur Gold	Hydrology	University of Rhode Island
Rebecca Tharp	Water Resources	University of Vermont
Stephanie E. Hurley	Water Resources	University of Vermont

Team Leader Contact Information:

Name:	Christopher C. Obropta, Ph.D., P.E.
Address:	Rutgers University
	14 College Farm Road
	New Brunswick, NJ 08901
Phone:	908-229-0210
Fax:	732-932-8644
E-mail:	obropta@envsci.rutgers.edu

MISSION AND GOAL OF THE PROPOSED PROGRAM

The overall goal of this proposal will be to develop new research and Extension programs through regional collaboration that will provide innovative solutions to rural, suburban, and urban communities that are struggling to address stormwater management issues with green infrastructure.

SPECIFIC RESEARCH AND EXTENSION COMPONENTS

This proposal will lead to the development of one of the three recommended outputs:

- Development of new research/Extension programs that provide innovative solutions to issues in the Northeast

PROGRAM JUSTIFICATION AND POTENTIAL FOR SUSTAINED FUNDING

Throughout the United States, communities are embracing the concept of green infrastructure to manage stormwater runoff. Green infrastructure is not a new idea. Green infrastructure is an approach to stormwater management that is cost-effective, sustainable, and environmentally friendly. Green infrastructure projects capture, filter, absorb, and reuse stormwater to maintain or mimic natural systems and treat runoff as a resource. Over the last 20 years, green infrastructure practices have been called stormwater best management practices (BMPs) and stormwater control measures (SCMs). They have been applied as one component of low impact development (LID) when designing and building new development.

The United States Environmental Protection Agency (EPA) has come down hard on cities like Philadelphia, New York, Chicago, Portland, Pittsburgh, and Kansas City to better manage their combined sewer systems. In many large urban centers, sanitary sewers and storm sewers are combined into a single, but divided flow system that carries the wastewater to a wastewater plant for treatment and the stormwater untreated to receiving waters. The problem arises during storm events when this combined system cannot handle the stormwater runoff and overflows the mixture of raw sewage and stormwater into the waterways as well as the streets and basements of these communities. There are two ways to remediate this problem: 1) completely separate the storm sewers from the sanitary sewers, discharging the stormwater directly into the waterways and treating the raw sewerage at the treatment plant or 2) reduce the amount of stormwater entering the combined system to reduce, if not eliminate, these combined sewer overflows. The cost of separating the combined systems into two separate systems is beyond the reach of most cities let alone the fact that even by doing so, additional stormwater management may be necessary, leaving the second option as the only real alternative. This forces cities across the country to embrace green infrastructure to comply with EPA's demands.

In rural and suburban communities, green infrastructure is being used to retrofit existing development. Many of these rural and suburban communities have little or no stormwater management systems, and flooding occurs even during the small storm events. Green infrastructure can help address this issue as well as improve water quality. Green infrastructure also is being used in LID efforts to prevent stormwater impacts from new development. Whether retrofitting existing development or optimizing stormwater management in new development, green infrastructure can enhance climate resiliency by increasing water supplies, reducing flooding, and improving water quality.

Green infrastructure focuses on managing stormwater at its source and requires community engagement for its implementation to be successful. Since green infrastructure can provide numerous ancillary benefits such as harvesting rainwater for community gardens or urban agriculture, creating parks and open space opportunities for recreation, reducing urban heat island effects, and filtering out air pollutants using vegetation, the community should be involved in determining the location of green infrastructure practices. Green infrastructure is not only for cities with combined sewer systems but for rural and suburban communities as well and can play a key role in reducing flooding, improving water quality, and enhancing the aesthetics of a community and related watersheds.

ACTIVITIES AND TIMELINE TO BE ENGAGED IN BY TEAM MEMBERS

Many communities are struggling to address stormwater issues and need technical support to better understand the problems they are facing. Once problems have been identified, a determination must be made as to the best method to address these problems. The land grant universities, working in collaboration, can help these communities throughout the Northeast address these issues. Rutgers, Penn State, University of New Hampshire, University of Rhode Island, University of Vermont, and University of Connecticut are all engaged with many local communities in their states to provide education on stormwater management, particularly green infrastructure and LID. These universities also provide various levels of technical support to these communities. Furthermore, these university are conducting research on the effectiveness of green infrastructure practices and their impact on a watershed scale. By working collaboratively and sharing program ideas and research knowledge across state lines, the communities in the Northeast can enhance their ability to deal with stormwater management issues. A critical obstacle to overcome with green infrastructure is not the technology and the maintenance issues themselves, but the human dimension involved with community decision-making. Often new technologies such as green infrastructure can take years to implement as the adoption of new technologies lags behind their actual development.

Very little attention is being paid to examining stormwater management problems in a holistic fashion. There are many benefits to using green infrastructure beyond just managing stormwater runoff. In many cases, green infrastructure can be used to harvest rainwater for community gardens or urban farms. Moreover, with the proper planning, green infrastructure can be used to enhance the open space of the community and improve the quality of life of its residents. The land grant universities can play a key role in establishing the relationships needed to maximize all the benefits associated with green infrastructure and through research, provide sound science to the decision makers when considering green infrastructure applications.

The proposed work plan builds off of ongoing discussions between faculty engaged in stormwater research, extension, and outreach at land grant universities in the Northeast, including a meeting at the University of Connecticut in June 2015 that included Rutgers, University of New Hampshire, the University of Vermont, University of Rhode Island, and the University of New Hampshire.

The following objectives will be accomplished to achieve this goal.

Objective 1: Identify regional barriers and potential roles for the land grant universities

Task 1: Review and evaluate existing green infrastructure planning and implementation efforts in the Northeast

Task 2: Conduct literature reviews on research regarding green infrastructure planning, implementation, effectiveness, and the human dimension associated with green infrastructure adoption

Task 3: Define the role of land grant universities in conducting needed research and delivering Extension programming related to green infrastructure

Timeline: 4 months

Deliverable: A paper that discusses green infrastructure research and the role Extension can play in addressing the research and outreach needs of the land grant universities

Objective 2: Develop educational programming that focuses on the successes of land grant universities working with communities to plan, design, implement, and evaluate green infrastructure

Task 1: Review existing Extension educational programs to determine best practices

Task 2: Identify a suite of existing educational programs based upon best practices identified in Task 1 for various teaching methods (online, workshops, seminars, etc.)

Timeline: 4 months

Deliverable: A paper on existing educational programming and an online database of these resources

Objective 3: Develop a regional multi-state Hatch proposal to address research and Extension gaps associated with green infrastructure

Task 1: Identify the appropriate research and Extension faculty to participate

Task 2: Host a meeting to craft a multi-state proposal and further explore research and Extension opportunities in green infrastructure

Task 3: Submit proposal to Northeastern Regional Association of State Agricultural Experiment Station Directors (NERA) for approval

Timeline: 4 months

Deliverable: Multi-state Hatch proposal

ROLE OF TEAM MEMBERS

Each participating university brings its own strengths to this project and their own area of expertise. The team members will bring their experiences of working in rural, suburban, and urban communities in designing and delivering green infrastructure educational programs. Each land grant university brings expertise in research on the social, policy, economic, scientific, and engineering aspects of green infrastructure. All team members will participate in monthly conference calls. One face-to-face meeting will be held to foster collaboration among the universities beyond this project and to develop a multi-state Hatch proposal that will continue to bring the existing project team members together as well as expand the project team. This will enable the team members to partner on and develop nationally competitive proposals. Finally, Deno De Ciantis (Penn State) and Christopher Obropta (New Jersey) will disseminate information through the NUEL (National Urban Extension Leaders) group to inform Extension leaders across the nation about these green infrastructure planning efforts.

APPENDIX A: BUDGET ($10,000)

BUDGET

	Planning Grant	Leveraged Resources
Faculty/Staff Salary & Fringe	$2,250	$48,600*
Travel	$6,000 ($1,000 per LGU)	$0
Meeting Expenses	$1,500	$0
Supplies	$250	$0
Other	$0	$0

* This cost was based upon one faculty member from each state (CT, NH, VT, RI, NJ, and PA) for a minimum of 10 hours per month for one year – salary and fringe.

Funding is available through many sources for green infrastructure research and Extension efforts. This group would be in a good position to secure some of these funds for research and Extension. The following are examples of available funding.

- One priority for the United States Environmental Protection Agency (EPA) is green infrastructure. Currently EPA has funding available in Section 319 Nonpoint Source Management Program of the Clean Water Act to fund green infrastructure efforts. Under Section 319, states, territories and tribes receive grant money that supports a wide variety of activities including technical assistance, financial assistance, education, training, technology transfer, demonstration projects, and monitoring to assess the success of specific nonpoint source implementation projects. In 2016, the states were awarded over $163 million dollars in funding from this program.

- Both the United States Department of Housing and Urban Development (HUD) and the United States Department of Transportation (DOT) are supporting green infrastructure efforts. HUD's Sustainable Communities Regional Planning Grant Program and Community Challenge Planning Grant Program recently awarded over $235 million in funding. Since 2009, Congress has dedicated nearly $4.6 billion for seven rounds of TIGER grants to fund projects, which include green infrastructure projects.

- Private foundations also have provided funding for green infrastructure efforts. Over the last three years, Rutgers University alone has been awarded $720,000 from the Surdna Foundation, $820,000 from the National Fish and Wildlife Foundation, and $500,000 from the William Penn Foundation for green infrastructure planning, research, and outreach efforts. There are many more foundations interested in this work.

Proposal #: 16-10

Northeastern Regional Association of State Agricultural Experiment Station Directors Planning Grant, 2016/17

Project Title: Towards Nutritional Health Equity for Women and their Families.

Team Members (in alphabetical order)

Name	Discipline	Institution/Agency/Other
Tatiana Andreyeva, PhD.	Associate Professor of Agricultural and Resource Economics	University of Connecticut and Rudd Center
Lorraine Cordeiro, PhD., MPH	Assistant professor of Nutrition	University of Massachusetts
Kristin McCartney MPH, RD.LD	Extension Specialist, SNAP-Ed Coordinator	West Virginia University
Amy R. Mobley PhD, RD	Assistant Professor of Nutritional Sciences	University of Connecticut
Kathleen Savoie MS,RD	Associate Extension Professor of Nutrition	University of Maine
Pamela Weisberg Shapiro, PhD	Lecturer of Nutritional Sciences	Cornell University
Lindiwe Sibeko, PhD, IBCLC	Assistant Extension professor of Nutrition	University of Massachusetts
Gina Taylor, MAT	Interim Unit Director, Families and Health, Extension.	West Virginia University
Gina Wood, MPH, RD, LD	Extension Specialist EFNEP Coordinator,	West Virginia University
Kate Yerxa, MS, RD	Extension Specialist EFNEP coordinator,	University of Maine

Team Leader Contact Information:

Name:	Lindiwe Sibeko, Ph.D., IBCLC Assistant Extension Professor of Nutrition
Address:	University of Massachusetts Amherst Department of Nutrition
	204 Chenoweth Laboratory 100 Holdsworth Way
	Amherst, MA 01003-9282
Phone:	413.545.1693
Fax:	413. 545.1074
E-mail:	lsibeko@nutrition.umass.edu

Mission and Goals of the Proposed Program

Obesity Burden and Maternal and Child Health

Healthy people 2020 guidelines underscore the improved health and well-being of women and children as a national public health priority, emphasizing a call to action focused on lessening health inequities. In the US, health disparities in racial/ethnic minorities and low-income families are pervasive.

A persistent health risk factor among vulnerable populations is obesity or excessive body weight, widely recognized as a critical contributor to poor maternal and child health (MCH) outcomes. In the last three decades, adult obesity rates have increased dramatically, including for women of childbearing years. Excess weight gain prior to, during, and post pregnancy increases the likelihood of obesity later in life. The short-term and long-term adverse health consequences of obesity are far reaching in both adults and children and include chronic conditions such as cardiovascular disease, type 2 diabetes and hypertension.

Likewise, childhood obesity rates have doubled for young children (6-11 year olds) and quadrupled for adolescents (12-19 years) over the same period, resulting in more than one- third of American children and adolescents classified as overweight or obese. Additionally, overweight and obesity is increasingly reported in very young children. Evidence shows these overweight and obese children tend to grow up to become obese adults.

Obesity and Health Disparities

Although all races and ethnicities are subject to the obesity epidemic, it presents a particular burden to racial/ethnic minorities and low-income population groups. Obesity rates are significantly higher in Latino and black population groups than in their white counterparts, for both males and females, and ranging from preschoolers to adolescents. Current evidence suggest that obesity results from a complex interplay between genetic, behavioral and environmental risk factors, however, the rapid rise of the obesity epidemic in specific populations underscores the significant influence of environmental factors. New approaches are needed to effectively address obesity disparities, approaches that take into consideration individual, intrapersonal and systemic barriers and constraints.

Life Course Model: Action plan for MCH

Life course theory (LCT) has recently emerged as an important organizing framework for addressing persistent maternal and child health issues, such as overweight/obesity, poor nutrition and health inequities. LCT posits that social, economic and environmental dynamics are significant drivers of persistent health inequities over a life-time, and across populations and generations. Applying LCT within this context reveals the need for early detection of risk factors combined with early interventions.

Justification for the Program Relative to Stakeholder Needs and Potential for Sustained External Funding

Traditional approaches to addressing economic and racial/ethnic disparities in MCH obesity have had limited success. This is partly due to strategies and initiatives that segment MCH programming into discrete components, rather than integrative programs that incorporate individual health within the larger context of community and environmental systems, across the lifespan. We propose that obesity disparities, which are significant drivers of poor health outcomes in MCH population groups, can be effectively addressed through applying LCT within a comprehensive framework that includes integrated research, education development and Extension.

Stakeholder Needs

Stakeholders who provide MCH services have a critical need for evidence-based interventions that are effective in promoting lifelong healthy development among vulnerable population groups and to increase health equity. Our team aims to meet stakeholder needs using a new organizing framework (i.e. LCT) that approaches the issue from a more holistic and systems perspective, and is positioned to be more effective in addressing MCH health trajectories.

We propose the development of a Northeastern regional network, comprised of a cross-disciplinary team of researchers and Extension professionals, focused on generating evidence-based, integrated research and education programming. This regional network of scholars and experts would facilitate collaborations across states and programs to propose, test, implement and evaluate new integrated projects and programs designed to improve the health and well-being of vulnerable MCH population groups. More specifically, the proposed **integrated research, education and Extension** activities will help generate much needed knowledge and evidence through the translation of LCT into scholarship and educational programming, such as targeted curricula, material that is currently lacking in the field.

Uniqueness and Innovation of Team

Our team, consisting of researchers and Extension professionals representing five northeastern states (CT, MA, ME, NY, WV), is uniquely positioned to develop, implement and evaluate obesity prevention programs guided by the LCT framework.

The composition of our team allows for critical expansion of traditional MCH foci (perinatal period, newborn and young child), to *incorporate adolescent girls,* thereby providing a more complete understanding of the reproductive life stages often missed in MCH initiatives. An additional concern regarding the current body of MCH research is the absence of paternal perspectives. The expertise of our team will allow for the opportunity to *gather data that includes male participation*. Also unique in our team composition is the capacity to *conduct economic analysis of programs*, an important factor given that estimates indicate that close to one third of direct medical expenditures of racial and ethnic minorities were excess costs associated with health inequities.

As a regional network we will create a focused forum that facilitates effective feedback coordination between research and program design and implementation, thereby strengthening the integrative principals of the team. The planning grant will provide an opportunity for a consolidation of ideas and development of grant proposals targeting the NIFA AFRI funding stream, such as the Childhood Obesity Prevention Challenge program. AFRI grants emphasize applied research that integrates education and Extension, providing critical evidence and knowledge for program development aimed at obesity prevention and promotion of healthy behavior and wellbeing. Additionally, our regional network will target the NIH's Institute on Minority Health and Health Disparities (NIMHD) and NICHD, as funding mechanisms to respond to their interest in research focused on women, children and families vulnerable to health inequities. Proposals can also be targeted to private foundations such as Robert Wood Johnson Foundation (RWJF) that has a particular interest in the prevention of childhood obesity in minority and low-income populations.

Activities to be Engaged in by Team Members Towards a More Complete Definition of the Program

This proposed regional network is comprised of an interdisciplinary team of research and Extension experts, who will collaborate to generate knowledge and develop efficacious MCH interventions, which will be disseminated widely for program development. Additionally, research outcomes will include important measures and indicators used to test programs relying on evidence-based curricula. Outputs of this work can be shared locally, regionally and nationally in other settings targeting obesity disparities.

The purpose of the planning grant submission is to facilitate a face-to-face meeting for team members to collectively discuss stakeholder needs, feasibility and regional capacity, and to develop collaborative grant proposals. Through these structured discussions, the team can identify key research questions to guide grant proposal development and submissions. Overall, the meeting will accomplish the following: (i) review team members' previous and current MCH research, education and extension activities; (ii) articulate stakeholder needs and brainstorm how to meet needs through network activities; (iii) identify additional collaborators to enhance the network (i.e. behaviorists, systems analyst, biostatistician); (iv) develop a strategic vision of

regional collaboration activities; (v) define scope of action, prioritize focus areas, funding opportunities, targets and timelines; (vi) establish grants subcommittee, to initiate draft of proposal(also set timelines for proposal feedback/input, deadlines and logistics for grant submissions); (vii) establish procedures and logistics for ongoing communication plan through video conferencing/conference calls.

Explanation of Roles of Team Members

L. Sibeko will assume responsibility as the project leader and draw on the support of a strong team of research and Extension educators with extensive knowledge and experience in implementing programs and interventions that reach low- income populations and racial and ethnic minorities (see Appendix II for specifics on expertise of team members).

The UMass members of the team (L.Sibeko & L.Cordeiro) will take a lead in organizing the planning meeting, to be hosted at UMass Amherst. The planning meeting will begin with a comprehensive review and discussion of programs currently offered by members of the network, identifying commonalities and divergences as well as gaps in programming. Using LCT as a framework, team members will breakout into discussions groups to brainstorm areas of development in three focused areas: (a) prenatal health, b) infant and young child health and c) adolescent health. By the conclusion of the meeting, a priority integrated research, education and extension project will be identified that provides continuity of education and environmental policies/systems that promote and support healthy outcomes for the target population, spanning from the prenatal period, through infancy/childhood and adolescence life stages.

Timetable for Completion of Planning Activities and Preparation of a Competitive Proposal

Date	Activity
November/December 2016	Establish organizing sub-committee and organize meeting logistics.
January 2017	Hold **two (2)** day meeting (UMass): establish working groups and grant writing sub-committee; identify research/education priority and timelines for grants.
Jan/Mar 2017	Grant proposal committee drafts and circulates proposal to team for input (via dropbox).
April/May 2017	Grant sub-committee finalize and submit proposal to AFRI.
June/July 2017	Prepare proposal for NIH submission.
September/October 2017	Finalize and submit NIH grant.
November/December 2017	Prepare, circulate, finalize and submit proposal to RWJF.

Budget for Planning Activities (travel, meeting expenses, etc.)

Expense	Amount
TRAVEL: 3 x 250.00(drive), 5x $500 (flight)	$3250.00
LODGING: 2 night accommodation @ 390.40 per room	$3125.00
MEETING SPACE, FOOD FOR BREAKS X 2 DAYS; SUPPLIES.	$2000.00
3 MEALS FOR 10 X 2 DAYS	$1625.00
TOTAL REQUEST	$10,000.00

Leveraging Resources

Each person will receive a maximum stipend of $250.00 if driving to meeting site, and $500 if flying. In some cases indirect resources will be leveraged for this planning grant.

APPENDIX

Lindiwe Sibeko, PhD, IBCLC
Curriculum Vitae
(Abbreviated)

PERSONAL STATEMENT

As the Extension assistant professor of nutrition at the University of Massachusetts Amherst, my research and Extension work centers on maternal and child health, focused on socially and economically vulnerable and underserved populations. My research uses community-based participatory approaches to address health inequities among racial/ethnic minorities and low-income women, newborns and children, with a special interest in the area of breastfeeding, and obesity prevention.

LEADERSHIP

As a new investigator my emerging research agenda addresses the intersection of nutrition and health disparities of low income and racial/ethnic minority families, with the intention of producing scholarship that can direct education and extension health promotion programs targeted at women and their families. I am PI of an integrative school-based research project aimed at the promotion of increased fruit and vegetable consumption among multicultural adolescents (and their household members), attending a middle school with a 87% free and reduced lunch subscription rate, in the city of Worcester MA. In 2015/16 I was selected as a research scholar in the prestigious program of the Center for Family Research (UMass), in support of my research development in the area of breastfeeding disparities in the African American (AA) population. I also am Co-PI of a study aimed at identifying levels of food insecurity, health outcomes and nutrition intervention needs of low-income Cambodian women in Massachusetts. Our state SNAP-Ed program recently received funding to carry out policy, systems and environmental (PSE) initiatives with community partners, my role in this new initiative is to lead the evaluation of the integration of PSE into community programs.

ACADEMIC AND PROFESSIONAL EXPERIENCE

2013-present	Extension Assistant Professor of Nutrition, University of Massachusetts. Amherst. MA
2008-11	Post-doctoral Fellow**:** Division of Social and Transcultural Psychiatry. McGill University: Montreal. Canada
1999-2008	Teaching Assistant and Research Assistant positions at McGill University, Montreal Canada
1988-98	Community Nutritionist: North Kingston Community Health Center. Kingston Ontario. Canada
TEACHING:	Community Nutrition NUTR 572(service Learning course): Spring semester. Nutrition Education in Practice NUTR 397B: Fall semester. ***Developing graduate course in Maternal and Child Health (for 2017)***

SERVICE:

2014-present **REGIONAL:**

- Northeast Regional Nutrition Education Center of Excellence (NE NECE): Stakeholders Advisory Committee

2015-present **NATIONAL:**

- Chair of Community and Public Health Nutrition Symposium: Health Disparities and Promoting Health in Diverse Populations: ASN *Experimental Biology* conference: San Diego; April 2016.
- Ad-Hoc grant reviewer: North Central Nutrition Education Center of Excellence (NC NECE-Perdue University).

2015-present **UNIVERSITY:**

- Provost's Committee on Service-Learning (PCSL)

2014-present **SCHOOL LEVEL:**

- School of Public Health and Health Sciences Diversity Committee

FELLOWSHIPS

2015-2016 Center For Research on Families Scholar program
2014-2015 Civic Engagement, Service Learning Faculty Fellow

EDUCATION AND LICENSURE

2008 Ph.D. (Human Nutrition). McGill University; Montreal, Canada.
2002 M.Sc. (Human Nutrition). McGill University; Montreal, Canada.
1987 Graduate Clinical Dietetic Internship. (KGH) Kingston, Ontario. Canada.
1986 BSc (Dietetics). Mount Saint Vincent University; Halifax. Canada.

LICENSURE

2011 International Board Certified Lactation consultant
1987 Certified Dietitian

RESEARCH ACTIVITY

Funding: USDA/NIFA.
05/2014 - 05/2019
Integrating Urban Agriculture and Nutrition Promotion to Increase Consumption of Fruits and Vegetables: A Focus on Worcester, Massachusetts.
Role: PI

Funding: Integrated Research and Extension Project, Center for Agriculture/USDA.
10/2012 – 09/2015
Food Security, Health Outcomes, and Nutrition Education Among Cambodian Women in Massachusetts.
Role: Co-PI.

Selected Publications/Presentations
Emily Harrington*, Frank Mangan, Lisa Sullivan Werner, Zoraia Barros, **Lindiwe Sibeko**. Attitudes, Beliefs and Promotion of Fruits and Vegetables by Multicultural Students from an Urban Middle School in Worcester, MA. (Abstract) Experimental Biology 2016. * my graduate student.

Nelson-Peterman J, **Sibeko, L** & Cordeiro L. A Research Framework for Understanding Nutrition Across Refugee Generations. North American Refugee Health Conference. Toronto, Ontario, Canada. June 4-6, 2015.

Danielle Groleau, **Lindiwe Sibeko**. Breastfeeding in the Margins: navigating through the conflicts of social and moral order (2012). In: Beyond Health, Beyond Choice. Eds. Hall Smith,P., Hausman B & Labbok M; pp. 203-211. Rutgers University Press.

Lindiwe Sibeko, Anna Coutsoudis, Sphindile Nzuza, Katherine Gray-Donald (2009). Mothers' Infant Feeding Experiences: constraints and supports for optimal feeding in an HIV-impacted urban community in South Africa. Public Health Nutrition;12(11), 1983-1990.

II TEAM EXPERTISE

The proposed MCH network is comprised of researchers (senior and junior levels) and extension professionals with extensive experience. I am well supported to lead this network of Research and Extension specialists.

Tatiana Andreyeva PhD
As an economist, Tatiana's expertise in health care research centers on cost-effectiveness/cost-benefit analysis of child nutrition programs. In her work with WIC, she has evaluated the effects of the WIC food package revisions on food access (through stocking inventories and interviews in 300 CT stores) and food purchases (using food purchase data from a large grocery chain).
Lorraine Cordeiro PhD, MPH is a food security and adolescent health expert, whose community-engaged research addresses health and nutritional disparities. She has worked extensively on behalf of women and children in underserved populations. Her emerging research integrates adolescence as a fundamental component of the Maternal and Child Health Life Course Model.
Gina Wood MPH, RD, LD,; Gina Taylor MAT,; Kristine McCartney MPH, RD, LD: WVU Extension.
The WVU Extension Service Family Nutrition Program (FNP) provides evidence-based nutrition education and obesity prevention interventions to limited-resource adults and youth in over 50 counties in West Virginia with the support of the Supplemental Nutrition Assistance Program (SNAP-Ed) and the Expanded Food and Nutrition Education Program (EFNEP). Current efforts in the area of maternal and child health include providing education (using the Nutrition Education Aimed at Toddlers (NEAT) curriculum) to caregivers and parents of preschool aged children to assist in the development of healthy eating habits, healthy mealtime environments and positive adult-child interaction. Technical assistance (via the NAP-SACC program) is also provided to administrators and staff of early childcare and education settings to assist them in improving their nutrition and physical activity practices.
Amy R. Mobley, PhD, RD her expert area is related to nutrition education and obesity prevention. Currently, she is focusing on parental influences on childhood obesity especially low-income fathers of preschool age children. She also has a current grant to develop evidence-based messages for childhood obesity prevention targeted to parents and caregivers of children ages 0 to 24 months of age. She has conducted research with SNAP-Ed and EFNEP programs seeking to evaluate web-based nutrition education, dietary guidance messages for low-income consumers and, childhood obesity prevention for preschool age children.

Kathleen Savoie MS, RD her expertise is in breastfeeding promotion and policy work. She has a particular interest in MCH programming related to adherence with Dietary Guidelines for Americans to increase fish consumption. Previous research efforts include evaluating the role of nutrition education on prenatal folic acid consumption, sustainability of local food systems, food safety and nutrition education within the EFNEP sector.

Pamela Weisberg Shapiro PhD is interested in using a CBPR approach to gain a better understanding of food and nutrition issues experienced by low-resource families. Pamela's current work focuses primarily on the "urban" Black/African American population and rural population in the Ithaca community. Her research takes an intergenerational, life course approach to improving women's health and nutritional status with the premise improved maternal wellbeing will improve the entire family's health. Pamela is interested in developing sustainable programs that promote academic and community/stakeholder participation at all levels of program development and implementation.

Kate Yerxa MS, RD conducts integrative research and extension education projects focusing on evaluation of Extension education program that addresses promotion of healthy lifestyle, and obesity prevention in low-income populations throughout the state of Maine. Kate is the UMaine Extension state Expanded Food and Nutrition Education Program (EFNEP) coordinator.

Proposal # 16-11
2016 NERA Planning Grants Program

Investigating the adaptive potential of a forest indicator species to climate change predictions in Northeastern forest ecosystems.

Team Member	Discipline	Institution/Agency	State
Chris Sutherland	Population Ecology	UMass-Amherst* Cornell University*	MA NY
Evan Grant	Population Ecology; Wildlife Management	USGS – Patuxent Wildlife Research Center; University of Maryland*	MD
Sean Sterrett	Wildlife Ecology and Management	USGS – Conte	MA
Danika Tyminski	Elementary education	Swift River Elementary School	MA
Amanda Hyde	Environmental Education	Greenfield Community College	MA
Catherine Devlin	Environmental Education	Greenfield Community College	MA
Lena Fletcher	Environmental Education	UMass-Amherst*	MA
Paola Dolcemascolo	Environmental Education	NJ School of Conservation	NJ
David Miller	Population Ecology	Pennsylvania State University*	PA
David Munoz	Population Ecology	Pennsylvania State University*	PA
Elise Zipkin	Population and Community Ecology	Michigan State University	MI
Alexa Warwick	Environmental Education; Population Genetics	Beacon Ctr for the Study of Evolution in Action; Michigan State University	MI
Nancy Karraker	Herpetology Conservation	University of Rhode Island*	RI
Stephen Morreale	Herpetology Conservation; Outreach & Extension	Cornell University*	NY

***** Northeastern experiment station institute (five in total)

Team Leader Contact Information
Chris Sutherland, Rm 118 Holdsworth Hall, 160 Holdsworth Way, Amherst, MA

Project mission

Our objective is to **increase our understanding, valuation, and management responses for the Red-backed salamander (RBS), in response to projected changes in climate at the scale of the species' range.** To achieve this, we propose developing an intellectually and geographically distributed network, the Salamander Population and Adaptation Research Coordination network (SPARCnet), that aims to facilitate and integrate scientific inquiry, education and public engagement to address pressing ecological questions related to species' distribution and range dynamics. Specifically, the network aims to:

1. Integrate multi-disciplinary scientific inquiry across multiple spatial scales to understand the controls and constraints on species' range dynamics.
2. Integrate research, education and public engagement to provide authentic learning experiences and develop associated curriculum and assessment tools for environmental education aimed at multiple ages while simultaneously generating data sources useful for objective (1).
3. Facilitate information flow among and between researchers, educators, citizens and managers to foster full participation in ecosystem understanding and stewardship.

Project outline

Predicting and mitigating the impacts of large-scale global change is an enduring challenge in applied ecology (Mace 2013) and is a research goal shared across a broad range of disciplines (Botkin et al. 2007). While discipline-specific progress has been made independently, it is clear that understanding species and community responses to climate change requires approaches that integrate research across many disciplines and geographic scales (Fraser et al. 2013). Therefore, rather than research being coordinated among small collaborator groups, the development of coordinated, diverse research networks is required (e.g., Weltzin et al. 2003, Wright et al. 2004, Adler et al. 2011). This proposal seeks to develop such a network, with the goal of developing a robust model system for understanding climate responses of the RBS (*Plethodon cinereus*), a forest ecosystem indicator species, across the Northeastern USA and SE Canada.

Red-backed salamanders are an important component of forest ecosystems and their broad distribution, high density, and sensitivity to environmental change and habitat disturbance have made them a model system for understanding species interactions and community ecology (Hairston 1987), behavior (Jaeger et al. 2016), physiology (Spotila 1972, Feder 1983), and evolution and speciation (Kozak and Wiens 2006, Wake 2009). RBS are considered a sensitive indicator species for local forest habitat condition (Welsh and Droege 2001; Homyack et al. 2011) and are promoted as ideal target species for long-term monitoring of forest ecosystems (Welsh et al. 2006), that can be useful for forest management assessment.

SPARCnet will consist of a set of replicated study sites distributed within forest patches across forested landscapes in the Northeast. While sites will be managed locally, all data collection will conform to a standardized design: at each site, there are six replicate plots spaced at least 20 m apart. Each plot is comprised of a 5 m x 10 m artificial cover object array that contains 50 wooden cover boards, each spaced 1 m apart. In order to gain detailed information about salamander population dynamics, these core study plots gather capture-mark-recapture (CMR) data, using visual implant elastomer to mark individuals, providing detailed demographic information (e.g. Sutherland et al 2016, Muñoz et al. 2016). Within each replicate, half of the

plots are assigned as control and half are experimental plots in which snow removal experiments will be conducted to simulate predicted reductions in snowfall. This basic sampling structure offers participants the flexibility to answer questions of local relevance, while also providing standardized information across a large part of the salamander distribution (i.e., NE USA).

In addition to the research activities of network participants, a key objective of SPARCnet is to strengthen the link between research and education by providing authentic scientific experiences for students of different ages and levels of education, and the general public. This will be accomplished using place-based educator-mediated citizen science efforts which collect locally relevant data on salamanders, develop key lessons that will aid students in interpreting and analyzing data thereby training them in the core scientific process of defending claims from evidence, with the ultimate goal of promoting climate change literacy and training a new generation of ecologically-informed citizens.

Project Justification

In Massachusetts, we have developed a working model for integrating classroom/community engagement, management and research objectives (see current MA team members). We have recruited researchers and educators from 5 other states across the RBS range, including from four NE State Agricultural Experiment Station institutions (see team member list), to serve on the SPARCnet steering committee. The primary focus now, is to share the progress made in MA so that the model can be expanded throughout the Northeast. The focus of this planning project is to bring together this diverse group of educators, managers, and researchers to build the capacity for growing the network and in doing so, better meet local and regional education, management and research objectives. We seek funding for two knowledge exchange (KE) events to foster the development of the network and specifically to (1) identify regional and local forest ecosystems research priorities and the role of salamanders as a model system and (2) identify and integrate local education and learning opportunities with scientific inquiry that contributes to the broader network objectives.

Team member activities and roles

The SPARCnet Research and Citizen Science Handbook (v.1.2; Appendix 2) acts as a comprehensive guiding document describing the network objectives, vision for future network development and provides a network management structure for participant roles and responsibilities of data collection and education curricula initiatives. All identified team members, designated as either educators or researchers (see team member disciplines), will serve on the network steering committee.

Educators will facilitate learning by providing students and community members with genuine and engaging research opportunities while collecting useable and valuable data on salamander populations. In the planning phase proposed here, educators will identify links between research objectives and recently developed Next Generation Science Standards (NGSS Lead States 2013) and generate interest from local schools, colleges, and nature centers. This includes working with educators to develop activities directly relevant to specific curriculum goals, including the use of 'Data Nuggets', an innovative approach to course activities that brings real data into the classroom (Schultheis and Kjelvik 2015). These activities will be developed to align with the overall network learning objectives:

1. developing an appreciation for hidden biological diversity.

2. promoting basic scientific literacy.
3. promoting quantitative skills to all audiences.

Researchers are directly involved with implementing long-term standardized research protocols across the network. Researchers will establish local sampling plots that conform to network sampling protocol. Research participants will identify local, discipline-specific research objectives (keeping in mind the regional research objectives), and develop knowledge transfer mechanisms to facilitate KE and collaboration. In this planning stage, researchers will develop a conceptual modeling framework for integrating local data for regional inference and identify available data and potential 'proof-of-concept' analyses, both of which will strengthen future funding applications.

All steering group members (educators and researchers) will be required to seek funding to maintain local research activities while also contributing towards writing larger grants to coordinate the network and fund range-wide research projects that take advantage of the diverse skillset offered by network facilitated collaborations.

Timetable

We propose two 3-day 'knowledge exchange' meetings that will bring together current and prospective network participants. The first meeting, hosted at UMass-Amherst, will take place within 2 months of the beginning of the grant period. The second will take place 6 months after the beginning of the grant period at another participating institution. We have identified two substantial funding sources that the proposed project would be appropriate for: the first to fund network coordination and data management (National Science Foundation – Research Coordination Network), and the second to fund network wide research activities focused on the adaptive potential of salamanders to climate change (National Science Foundation – Division of Environmental Biology). Preparation of at least one of these proposals will be the ultimate goal of this planning grant.

Budget for planning activities (total request $10,000)

Based on the current average airfare (approx. $400) and the average hotel costs (approx. $100 per night), we request $8,000 ($4,000 per KE event) to provide travel and accommodation assistance to participants attending the two 3-day knowledge exchange and grant development meetings. The requested amount will be used to subsidize out-of-state participant via eight $500 travel grants per meeting (additional costs will be covered by participants). The first meeting will be hosted by UMass-Amherst where room hire will be provided free of charge. The location of the second meeting will be confirmed at the first event but will be hosted without charge at a participating institution.

We request a further $1,500 ($750 per KE event) to cover meeting refreshments ($50 per day for three days) and contributions towards participant meals (~$33 per person per event). Finally, we request $500 for demonstration materials which will be used as a recruitment tool during meetings and outreach events during the grant period to demonstrate the standardized establishment and data collection procedures (these materials will not be used for research).

Appendix 1 – Sutherland CV

CURRICULUM VITAE

Chris Sutherland, Assistant Professor
Department of Environmental Conservation
University of Massachusetts-Amherst
160 Holdsworth Way

OFFICE: (413) 545-1770
E-MAIL: csutherland@umass.edu

EDUCATION

Univ. Brighton, United Kingdom	B.S., Biological Sciences	2005-2008
Univ. Aberdeen, United Kingdom	M.Res., Ecology & Sustainability	2009-2010
Univ. Aberdeen, United Kingdom	PhD, Ecology & Statistics	2010-2013

PROFESSIONAL APPOINTMENTS

Assistant Professor. Dept. of Environmental Conservation. Univ. Massachusetts. 2015 – Present
Postdoctoral Research Associate. Cornell University. Dept. of Natural Resources. 2013-2015

FIVE MOST RELEVANT PUBLICATIONS

Muñoz, D. J., Miller, D. A., Sutherland, C., & Grant, E. H. C. (2016). Using spatial capture-recapture to elucidate population processes and space-use in herpetological studies. Journal of Herpetology. (*In Press*)

Sutherland, C., Muñoz, D. J., Miller, D. A., & Grant, E. H. C. (2016). Spatial Capture-Recapture: A Promising Method for Analyzing Data Collected Using Artificial Cover Objects. Herpetologica, 72(1), 6-12.

Sutherland, C., Brambilla, M., Pedrini, P., Tenan, S. 2016. A multi-region community model for inference about geographic variation in species richness. Methods in Ecology & Evolution, 7 (7), 783-791.

Royle, JA, Fuller, A., Sutherland, C. 2016. Spatial capture–recapture models allowing Markovian transience or dispersal. Population Ecology, 58 (1): 53-62.

Sutherland, C., Elston, D.A. & Lambin, X. 2014. A Demographic, Spatially Explicit Occupancy Model for Describing and Predicting Metapopulation Dynamics and Persistence. Ecology, 95 (11): 3149-3160.

FIVE ADDITIONAL PUBLICATIONS

Fuller, A. K., Sutherland, C. S., Royle, J. A., & Hare, M. P. (2016). Estimating population density and connectivity of American mink using spatial capture–recapture. Ecological Applications, 26(4), 1125-1135.

Royle, JA, Sutherland, C., Fuller, A., Sun, C. 2015. Likelihood Analysis of Spatial Capture-Recapture Models for Stratified or Class Structured Populations. Ecosphere, 6 (2) art22.

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SYNERGISTIC ACTIVITIES

- **Invited Contributor -** National Socio-Environmental Synthesis Center (SESYNC) Workshop – *Socio-Spatial Ecology of the Bed Bug and its Control.*

- **Invited Contributor -** The National Oceanic and Atmospheric Administration (NOAA) workshop – *North Atlantic Right Whale Visual and Passive Acoustic Data Integration Modeling Workshop.*

- **Software contributor and developer** – main developer of the freely available R package '*oSCR*', statistical for analyzing spatial encounter history data and estimating abundance. In addition, I contribute to the development and maintenance '*unmarked*', winner of the 2014 outstanding contributions to spatial ecology from The Wildlife Society Spatial Ecology and Telemetry Group.

- **Member** – New York State Moose working group – A moose conservation and management steering group that coordinates and integrates the scientific research and management need of the State.

- **Peer review** – Reviewer of >30 peer reviewed journal articles, for >10 journals and an internal reviewer for U.S. Geological Survey.

Appendix 2 – SPARCnet Handbook

A copy of the SPARCnet handbook can be found here: http://bit.ly/2bHesHk

Appendix 2 - References

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Proposal # 16-12

2016 NERA Planning Grants Program

Project Title: Poor maternal nutrition and its impact on neonatal outcomes

Team Members

Name	Discipline	Institution/Agency/Other
Steven Zinn	Endocrinology	CT Exp. Stat.
Kristen Govoni	Growth Biology	CT Exp. Stat.
Sarah Reed	Muscle Biology	CT Exp. Stat.
Sabrina Greenwood	Metabolism	VT Exp. Stat.
Ryan Arsenault	Signal Transduction	DE Exp. Stat.
Carol Bagnell	Neonatal Development	NJ Exp. Stat.
Kim Vonnahme	Fetal Programming	ND Exp. Stat.
Joel Caton	Developmental Programming	ND Exp. Stat.
Larry Reynolds	Placental Physiology	ND Exp. Stat.
Caleb Lemley	Placental Development	MS Exp. Stat.
Derris Burnett	Muscle Biology	MS Exp. Stat.
Ryan Ashley	Placental Development	NM Exp. Stat.
Min Du	Muscle Biology	WA Exp. Stat.
Guoyao Wu	Amino Acid Metabolism	TX Exp. Stat.
Stephen Ford	Fetal Programming	WY Exp. Stat.
Sean Limesand	Metabolic Endocrinology	AZ Exp. Stat.
Stephanie (Thorn) Wesoloski	Fetal Metabolism	Univ. Colorado School of Medicine (CO)
Rachael Gately	Ultrasound/Fetal Development	Tufts Cummings Veterinary School (TVM)

(Attach an additional sheet if more space is needed.)

Team Leader Contact Information:

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Rationale. With the global population approaching 9.5 billion by 2050 (FAOSTAT, 2015), there is a critical need to produce an adequate supply of high quality animal protein, to feed the growing population. In addition, management systems must maintain animal health and production efficiency. In livestock, exposure to poor maternal nutrition, resulting from restricted and over-feeding, during gestation alters prenatal and postnatal growth of the offspring. Specifically, these animals exhibit undesirable changes to body composition (increased fat, reduced muscle), metabolic disorders, and organ dysfunction (Ford et al., 2007; Long et al., 2009, 2011; Hoffman et al., 2016a). Consequently, these changes can lead to poor health, poor reproductive status, reduced production efficiency, and reduced quantity and quality of meat and milk products (Wu et al., 2006; Reynolds et al., 2010). Therefore, the effects of poor maternal nutrition during gestation on offspring development are detrimental to animal agriculture and ultimately food security. Poor maternal nutrition can be caused by nutrient restriction or overfeeding, with negative phenotypic outcomes observed in the offspring. Importantly, these negative effects can persist into adulthood (Yan et al., 2011; Huang et al., 2012) and can be multi-generational (Dunn et al, 2009; Ford et al., 2012). To date, several studies have demonstrated the connection between poor maternal nutrition and persistent negative effects in the offspring. However, the mechanisms mediating the long-term and multigenerational implications on health, growth, and development are not well characterized (Grandjean et al., 2015). Furthermore, evaluation of therapeutic agents or management regimens that mitigate the negative effects of poor maternal nutrition are limited. Identifying strategies is critical to provide opportunities to improve production practices, which will further improve the health and well-being, production efficiency and food security.

Significance to the Northeast (NE). Controlling maternal diet during gestation can be challenging due to various management, environmental and economic factors. For example, the management practice of flushing or increasing nutrient intake to increase the number of (oocytes) ovulated (Shad et al., 2011) can result in over-feeding of the dam during early and mid-gestation. In addition, the pasture-based management systems used in the NE (Steinberg and Comerford, 2009) can also contribute to poor maternal nutrition during gestation, primarily because quality and quantity of pasture varies greatly throughout an average year with spring and summer months exhibiting the greatest quality and quantity. However, by late summer and early fall this tends to decrease with pasture reaching the poorest quality in the fall. This period of decreasing pasture quality and quantity corresponds to the gestation period for many agricultural species used in the NE (e.g., beef cattle, sheep and goats). Further variations with year, season, temperature and rainfall exacerbate this problem when pasture quality and quantity are limited. Therefore, under current management practices used within the NE, many offspring are born to dams that were poorly nourished (restricted or over-fed) during gestation which impacts offspring health, development and growth, thereby reducing the sustainability and profitability of NE livestock operations.

Introduction. Maternal restricted and over-nutrition results in reduced lean-to-fat ratio (Zhu et al., 2006), reduced muscle cross-sectional area (Bayol et al., 2005; Reed et al., 2014), and increased fat deposition (Bee, 2004; Reed et al., 2014) in the offspring. Nutrient restriction during early or late gestation results in fewer muscle fibers in lambs (Costello et al., 2008) and an increased number of glycolytic myofibers (Zhu et al., 2006). Moreover, fetal muscle in lambs from obese ewes had decreased diameter of primary muscle fibers and increased collagen content (Huang et al., 2010; Yan et al., 2011) which can negatively impact meat tenderness (Oury et al., 2009; Kang et al., 2011). These alterations to body composition are persistent into adulthood (Yan et al., 2011; Huang et al., 2012). In addition to changes in muscle, fat and connective tissue, maternal nutrient restriction and overfeeding alters concentrations of key circulating factors (eg; insulin, IGFI, IGFBP3, and leptin; Ford et al., 2007; Long et al., 2011; Hoffman et al., 2014, 2016a) that are critical for regulating animal growth and

metabolism. Poor maternal nutrition during gestation can have long-term negative effects on the metabolism of the offspring as determined by reduced insulin sensitivity (Ford et al., 2007), altered cellular metabolism (Thorn et al., 2011, 2013), and increased expression of pro-inflammatory mediators (Yan et al., 2011; Ge et al., 2013). In an effort to understand what factors may be mediating these observed phenotypic changes in muscle, our research group using next generation sequencing, determined that genes involved in cell proliferation, cellular metabolism and signal transduction are reduced in the muscle tissue of offspring born to restricted and over-fed dams (Hoffman et al., 2016b). Furthermore, we were able to identify that despite a common phenotype (Reed et al., 2014) the mechanisms by which the muscle tissue development was altered appear to be different (Hoffman et al., 2016b). While these findings are novel, additional research is needed to better understand how poor maternal nutrition causes the physical changes observed in the offspring and the molecular mechanisms mediating these changes. In turn, this information can be used to develop effective intervention strategies to address the problem that poor maternal nutrition poses to animal agriculture and food security.

This group of scientists from these 11 experiment stations, University of Colorado Medical School (UCO) and Tufts Cummings School of Veterinary Medicine (TVM) have developed experimental models using livestock (primarily sheep) that focus on molecular, cellular, and whole animal response to poor maternal nutrition during gestation both in the dam and in the offspring during pre-, peri-, and post-natal periods of development, with additional expertise in high throughput peptide analyses, next-generation sequencing, metabolism, and signal transduction. Thus, the participants in this planning grant bring diverse expertise to the field of poor maternal nutrition and its impact on neonatal outcomes with major areas of focus on the dam and the offspring.

Areas of research focusing on the dam include development of the placenta (MS, ND, NM, WY) and maternal blood supply (ND) to the fetus, alterations in the endocrine system (AZ, CT, UCO) and inflammatory status (CT, WY), as well as potential management tools to mitigate the negative effects to the offspring (MS, ND).

Areas of research focus in the offspring include developmental and metabolic changes in muscle, satellite cells, bone, adipose, liver, pancreas and mesenchymal stem cells (AZ, CT, DE, NJ, VT, TX, UC, WA) as well as changes in pre- and postnatal changes in body weight and body composition (CT, MS, ND, NJ, NM, TX, WY, TVM).

Scientists from NE experiment stations have specific expertise in muscle and bone physiology next-generation sequencing, endocrinology and growth biology (CT), high throughput peptide analyses and signal transduction (DE), developmental biology and peri-natal growth (NJ), and ruminant metabolism and nutrition (VT). Therefore, given their specific areas of expertise, these scientists will have a central role in the implementation of this planning grant.

Overall, this group of scientists is uniquely qualified to investigate mechanisms that contribute to poor growth and development of offspring as a result of poor maternal nutrition at the molecular, cellular and whole animal level, as well as evaluate therapeutic intervention strategies that mitigate the negative effects of poor maternal nutrition. Importantly, the collaboration established with this planning grant will increase the opportunities to collaborate on specific experiments, apply for regional and federal grants, and therefore utilize animal resources more efficiently.

The overall goals of this planning committee proposal are:

1. To bring together scientists from NE Experiment Stations (CT, DE, NJ, VT) and veterinarians (TVM) with scientists from experiment stations outside the NE (AZ, MS, ND, NM, TX, WA and WY) and UCO that have diverse expertise to foster multi-institutional collaborations to address research questions focused on addressing the effects of poor maternal nutrition on offspring growth and metabolism.

2. To develop cross disciplinary multi-state research proposals that integrate a variety of expertise to enhance our understanding of the mechanisms by which poor maternal nutrition during gestation alters multi-generational growth and development that will provide opportunities to improve production practices and identify therapeutic interventions that mitigates the negative effects of poor maternal nutrition.

Achieving these goals will result in 1) the identification of the mechanisms that cause the negative phenotypic changes in offspring born to poorly nourished dams and 2) allow for the development of new management tools to improve livestock production efficiency, product quality and to enhance sustainability of livestock production systems in the NE. Collaboration with Cooperative Extension System (CES) specialists and teaching faculty throughout the NE and the country will provide outreach opportunities to disseminate new technologies and management tools to current and future producers. Moreover, including scientists from UCO and TVM will provide a medical and veterinary perspective to the project and provide additional outreach and educational opportunities at their institutions and in the communities they serve.

Use of the Planning Committee Grant. The first step to address the goals of the project is to organize a meeting for scientists from the NE and other participating experiment stations and associated institutions. CT would serve as the host institution for a 1.5 day meeting. Each Experiment Station would present their experimental approach(es), data, potential for shared samples, and future plans (~45 minutes each). Ample opportunity for discussion around each presentation will be scheduled. The meeting will conclude with a discussion about preparing integrative grant proposals to appropriate agencies (eg., USDA-NIFA, NIH, NSF, USDA-NIH Dual purpose grants, SARE).

The primary products of the Planning Committee will be 1) the integration of scientists from the NE with other scientists from the United States, using their experience and expertise to address an issue that has significant relevance to producers in the NE; 2) the development and publication of a review article updating the 'state of the field' since reviews by Wu et al. (2006) and Du et al. (2010); and 3) the development and submission of grant proposal(s) to fund collaborative projects with participating investigators to identify key mechanisms and develop intervention strategies tailored to NE livestock production systems.

The request for the planning committee grant is $10,000 which will be used to offset costs of scientists to attend. The grant will cover transportation ($100 to $700 per station; $6,000) and meals at the meeting ($2,000) with the up to $2,000 to assist with lodging. Each Experiment Station/PI will be responsible for any additional housing costs and a portion of the travel costs if multiple scientists from a single station participate. The UConn Animal Science Department will match $1,000 towards meeting rooms, any AV requirements, food, and shuttles from the airport to campus. In addition, the CT Station will match $1,000 towards costs of the meeting (see letter Appendix 3). If needed, publication charges will be requested from the authors if a manuscript is accepted for publication.

Appendix 1: References

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Appendix 2: Zinn Bio Sketch

BIOGRAPHICAL SKETCH

Steven Zinn Department of Animal Science Unit 4040 University of Connecticut (UConn) Storrs, CT 06268	POSITION TITLE: Head and Professor Department of Animal Science, UConn

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	YEAR(s)	FIELD
Cornell University, Ithaca, NY	BS	1978	Animal Science
Michigan State University, E. Lansing, MI	MS	1984	Animal Science
Michigan State University, E. Lansing, MI	PhD	1989	Animal Science
Worcester Foundation, Shrewsbury, MA	Post Doc	1989-1990	Molecular Biology

Research Experience:
2005-present – Professor, Department of Animal Science, UConn
1996-2005 - Associate Professor, Department of Animal Science, University of Connecticut
1990-1996 - Assistant Professor, Department of Animal Science, University of Connecticut
1989-1990 - Postdoctoral Associate, Worcester Foundation for Exp. Biology, Shrewsbury, MA
1980-1989 - Graduate Assistant, Department of Animal Science, Michigan State University

Research Interests: The effects of maternal nutrition in growth and development.

Selected Research Awards (Selected awards since 2000):

2000-2003: Novel delivery systems of porcine somatotropin to stimulate growth rate, feed efficiency and carcass composition in growing pigs. Connecticut Innovations, Inc., $175,393 plus $35,000 from Drug Smart, Inc.

2000-2003: Effects of zinc on nuclear actions of thyroid hormone. USDA NRI Competitive Research Grants Program, Co-PI with Hedley Freake, direct cost, $ 109,323.

2004-2006 Physiological and genetic factors contributing to differences between two genetic lines of IGF-I divergent cattle. University of Connecticut Research Foundation, $25,102.

2005-2010 STRONG-CT: Science and Technology, Reaching Out to New Generations in Connecticut. NSF, Steven A Zinn, Co-PI H. Freake D. Khan, M. Philion, M. Jehnings, direct cost, $1,999,995.

2007-2009 Using the somatotropic axis as a model to predict nutritional status in free-ranging Steller sea lions. University of Connecticut Research Foundation. $12, 953.

2013: Evaluation of the Antigenicity of Novel DNA-based Foot and Mouth Disease Virus Vaccines in Swine, Inovio Pharmaceuticals, Co-PI with K. Govoni, direct cost $19,000.

2014-2016: Effects of intrauterine growth retardation (IUGR) on fetal development in sheep. USDA-NIFA AFRI Foundational Nutrition, Growth and Lactation Program, direct cost $110,555.

2015-2017: Effects of poor maternal nutrition on muscle progenitor cell function and metabolism. USDA-NIFA AFRI Foundational Nutrition, Growth and Lactation Program, Co- with S. Reed, K. Govoni, direct cost, $150,000.

Awards (Selected awards since 2008):
2016 American Society of Animal Science (ASAS) President Elect
2016 University of Connecticut Teaching Fellow
2015 Fellow of the American Society of Animal Science
2014 H. Allen Tucker H. Allen Tucker Lactation & Endocrinology Award, ASAS
2008-2013 Editor-in-Chief, *Journal of Animal Science*
2011-2014 Editor-in-Chief, *Animal Frontiers*

B. Publications: (selected publications since 2010):

Richmond, J.P., T. Norris, S.A. Zinn. 2010. Re-alimentation in harbor seal pups: Effects on the somatotropic axis and growth rate. Gen. Comp. Endocrinol. 165: 286-292.

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Glynn E.R., A.L. Sanchez, S.A. Zinn, T.A. Hoagland, and K.E. Govoni. 2013 Culture conditions for equine bone marrow mesenchymal stem cells and expression of key transcription factors during their differentiation into osteoblasts. J. Anim. Sci. Biotech. 4:40 (DOI: 10.1186/2049-1891-4-40).

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Zinn, S.A. and A.M. Beck. 2014. The human-animal bond and domestication: Through the ages…animals in our lives. Animal Frontiers 4 (issue 3): 5-6.

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Zinn, A.T., M.D. Foreman, L. Griffin Masso, D.T. Ouimette and S.A. Zinn. 2014. Learning Communities: Animal Science at the University of Connecticut. Natural Sci. Education. 44: 6-10. doi: 10.2134/nse2014.09.0021.

Zinn, S.A. 2015 H. Allen Tucker Lactation and Endocrinology Award: Graduate Education: Lessons from my mentor. J. Anim. Sci. 93: 12: 5594-5596. doi: 10.2527/jas2015-8869

Jones, A.K., R.E. Gately, K.K. McFadden, S.A. Zinn, K.E. Govoni, and S.A. Reed. 2016. Transabdominal ultrasound for detection of pregnancy, fetal and placental landmarks, and fetal age before day 45 of gestation in the sheep. Theriogenology 10.1016/j.theriogenology.2015.11.002.

Hoffman, M.L., K.N. Peck, M.E. Forella, A.R. Fox, K.E. Govoni, and S.A. Zinn. 2016. The effects of poor maternal nutrition during gestation on postnatal growth and development of lambs J. Anim. Sci. 94: 2: 789-79910.2527/jas2015-9933.

Raja, J.S., M. L. Hoffman, K. E. Govoni, S. A. Zinn, and S. A. Reed. 2016. Restricted maternal nutrition alters myogenic regulatory factor expression in satellite cells of ovine offspring. Animal 10.1017/S1751731116000070.

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UCONN
UNIVERSITY OF CONNECTICUT

College of Agriculture, Health and Natural Resources
Ratcliffe Hicks School of Agriculture
Office of Academic Programs

August 25, 2016

To: Steven Zinn
Head, Animal Science Department

From: Cameron Faustman
Associate Dean/Director

This is to follow up our recent discussion regarding your 2016 NERA Planning Grant proposal entitled, “Poor maternal nutrition and its impact on neonatal outcomes”. The purpose of this memo is to formally confirm that the CAHNR research office will provide you with a match of 10% of the approved budget, up to a total of $1,000, should your proposal be selected for funding. Best wishes for success!

Cc: L. Grabowski

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Agenda

NORTHEAST MULTISTATE ACTIVITIES COMMITTEE MEETING

September 15, 2016
3:00 pm to 4:00 pm

Chair, Fred Servello (ME)

Members: Tim Phipps (WV), Gary Thompson (PA), Cameron Faustman (CT-S), Pat Vittum (MA/NEED), Dennis Calvin (PA/NEED)
NERA: Rick Rhodes and Judy Palmer (Recorder)

1. Multistate Project Proposals:
    - Request to approve multistate proposal, NE_TEMP1010 Improving Forage and Bioenergy Crops for Better Adaptation, Resilience, and Flexibility (10/01/2017 - 10/01/2022)

2. NRSPs:
    - No actions required

3. Advisor assignments
    - NE 1640: Plant-Parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems [10/2016-09/2021]

4. Other Business
    - 2016/17 NERA Planning Grant Decisions
        - 12 proposals
        - Rank and make recommendation for funding

5. For information only:
    - NE 1640 (formerly NE_TEMP1640 and NE 1040): Plant-Parasitic Nematode Management as a Component of Sustainable Soil Health Programs in Horticultural and Field Crop Production Systems [10/2016-09/2021] pending approval by NIFA

Current MAC members:

- Fred Servello, ME (2015-2018) – Chair
- Cameron Faustman, CT-S (2014-2017)
- Tim Phipps, WV (2013-2016)
- Gary Thompson, PA (2015-2018)
- Pat Vittum, MA/NEED (2014-2017)
- Dennis Calvin, PA/NEED (2017-2020)

NE_TEMP1010: Improving Forage and Bioenergy Crops for Better Adaptation, Resilience, and Flexibility

Status: Draft Project

Duration 10/01/2017 to 10/01/2022
Admin Advisors:
NIFA Reps:

Statement of Issues and Justification

The economics of producing food, fiber, and energy products is a major issue in providing food security in the region and in all of North America. Forage crops are the foundation of livestock and dairy enterprises in the USA and Canada. Breeding of perennial forage crops has resulted in improved cultivars that make livestock, dairy, and energy production more economical by reducing inputs and increasing outputs. Compared to other types of crop species, perennial forage species enable more sustainable agricultural systems. Leguminous forages reduce or eliminate N fertilization due to fixation of atmospheric N, thus reducing inputs and the risk of environmental contamination from fertilizer usage. Forage grass species have fibrous roots that reduce soil erosion and capture environmental contaminants. All of these perennial species reduce land disturbance that could lead to soil erosion. In addition, they sequester carbon and reduce greenhouse gas emissions.

Improved forage cultivars translate to benefits to agricultural producers of animal and energy products. The seed industry benefits from production and marketing of improved cultivars. All Americans benefit by reducing costs of food and energy and by protecting the environment by reducing use of pesticides, herbicides, and fertilizers.

Continuing the trend across the last few decades, the number of forage breeders in North America is decreasing. The number of forage researchers in the USA has decreased by 60% between 1984 and 2009. The number of extension workers declined by 30% (Rouquette et al., 2009). In some state experiment stations, as a forage scientist has retired or left their position for another, often they are not replaced. For example, in the last 15 years, forage breeding positions have been lost at Iowa State University, Oklahoma State University, and Kansas State University. The number of forage scientists at USDA-ARS also has declined. When the forage breeder at USDA-ARS in Mandan, ND, retired, his position was not replaced. At state agricultural experiment stations, alfalfa breeding research is being done in only three states and agronomic research in six states (Undersander, 2014). In FY 2012 USDA expenditures for alfalfa research were $3.7M among 9.9 scientist years, compared to more than $42M and more than 95 scientist years each for corn, cotton, and wheat (Samac, 2014).

The number of private breeding companies is few and have been reduced through consolidations. These companies work on few perennial forage species, mostly alfalfa and a few of the grass species. Many forage species are receiving no attention by private breeders.

As budgets and the number of scientists have been reduced, the need for cooperative research is more essential than ever. Most forage breeders work on more than one forage species, thus diluting efforts on individual species. Because these forage species are perennial, establishing fields is less frequent than with annual crops. Therefore, seed is sold less frequently per unit land area compared to that of annual crops. Unless forage cultivars are broadly adapted for use across a large range of environments, the seed industry is not interested in new cultivars because of the economic limitation. All of these factors

point to the need for cooperative research to accomplish significant advances in developing improved forage cultivars adapted to a wide range of environments. Although forage scientists are few in number and individual efforts on some forage species are small, the cumulative efforts among forage scientists through cooperative research is significant. The current NE-1010 project fosters the interactions necessary to achieve goals with diminishing resources without unnecessary duplication.

This multistate cooperative research project addresses most of the NIFA priority focus areas, as explained below.

1) Global food security and hunger: Breeding crops with higher forage yield, improved forage quality for livestock production, longevity, and resistance or tolerance to biotic and abiotic stress conditions will provide more economical food production.

2) Climate change: Because of global warming, forage crops need to be developed that will be productive under abiotic stresses, including drought, flooding, cold and warm temperatures, and soil salinity.

3) Sustainable bioenergy: Several of the researchers in the current NE-1010 multistate research project have been working on various grass and legumes species (for example, switchgrass, big bluestem, and alfalfa) for bioenergy uses. The bioenergy industry is not likely to use these perennial forage species until they become more economical to produce. Cooperative research is needed for developing cultivars with improved biomass and quality, while protecting these crops from biotic and abiotic stress conditions. Research needs to be done on stand establishment (improved seed germination and seedling vigor), biomass production, disease and insect resistance, etc., across multiple environments, especially on marginal soils where these species are likely to be used without competing with food crops.

4) Food safety: Improving the yield, nutritional quality, and storability of forage crops will ensure an ample supply of good quality feed to animals and an essential step in securing the food chain to the consumer through the reduction of feeding of rendered slaughterhouse waste to livestock, which spreads mad cow disease and reduces feeding of poultry litter that can lead to the spread of diseases such as salmonella, E. coli, and botulism, and increase the risk of contamination of food supply.

Without cooperative research through the multistate project, these priorities would not be accomplished for most of the perennial forage species. The impact on providing feed for the livestock industries, especially for beef and dairy production, would be huge. Research outputs would be minimal, and cultivars would be narrowly adapted. In 2013 more than 35 M acres of hay and haylage were harvested, valued at $22.8 trillion (USDA National Agricultural Statistics Service). These figures are conservative estimates of forage production since significant acreage is devoted to pastures and rangelands. Farmers have relied on forage breeders to improve productivity of these crops, especially when new diseases, insects, and other problems have arisen.

Impacts of the proposed research will vary. Germplasm with new traits will be available to private and other public breeders to use in their programs for developing improved cultivars. Improved forage cultivars directly released from NE-1010 scientists will make seed and forage production more economical for farmers and seed companies. Development of breeding methods, both traditional and molecular methods, will enhance efficiencies and effectiveness of improving forages for traits of low

heritability or from unadapted genetic backgrounds. Data from forage yield trials across multiple locations and years will be available for breeders to use for selecting experimental populations for release as cultivars, for the seed industry in advertising seed of the cultivars, and for extension educators and farmers when selecting cultivars for their locations. Development of forage species as feedstocks for the biofuel industry ultimately will contribute toward more secure and sustainable energy production. The overall impact will be more economical food and energy production while reducing negative environmental impacts in the agricultural systems.

The scientists cooperating in this project have the ability to accomplish the proposed research. The current NE-1010 project consists of most of the forage breeders from North America, who have cooperated in research for several years. In addition to scientists at state agricultural experiment stations, NE-1010 has evolved over the years to include more scientists from USDA-ARS, Agriculture and Agri-Food Canada, and the Noble Foundation. These forage breeders and scientists of other disciplines have extensive experience in research on forages. Many accomplishments already have been realized in the form of release of improved germplasm and cultivars, information on breeding methods for improving forage yield, and data on forage yield of multiple species for use by breeders, the seed industry, farmers, and extension educators. Extension presentations and information on the web have informed various stakeholders of the new information and cultivars developed by this project. Other scientists have been informed of the research results through professional publications and presentations at professional conferences. Regarding the continued or new project, the scientists have the major equipment along with field, greenhouse, and laboratory facilities to accomplish the proposed work.

Because of the long-term nature of research on perennial forage species, some of the research that was begun in the last few years will continue into the next project period. Most of the research, however, will be new as a result of the collaborative efforts and discussions during our technical committee meetings. The current project has evolved from focusing almost exclusively on traditional breeding to initiating research on new molecular genetic technologies. The cooperative multistate research project being proposed will increase the emphasis on integrating molecular technologies with traditional breeding efforts to improve forage species. Another emphasis will be on plant adaptation and resilience to changing environments due to climate change and other factors. In addition, emphasis will increase in cooperative research on plant species for biofuel use as well as use for the livestock industry.

Funding for these collaborative efforts would be only partially covered by the multistate-Hatch funding. Much of the funding would be from other sources such as the seed industry, royalties from seed sales of cultivars, private sources, and various public funding sources at the state and federal levels (primarily competitive grants). In the past, the existence of the NE-1010 project has been a key factor in helping to secure other grant funds for accomplishing the research goals.

Related, Current and Previous Work

This proposal continues a long-term regional research project that has provided multilocation interactions to a number of breeding projects. The current project, NE1010, which ends in 2017, has grown to include forage breeders throughout the US and Canada. This breadth of geographical dispersion enables us to design experiments that cannot be accomplished by each breeder individually but that have relevance across North America. The participants of this proposal individually have research projects narrowly focused on their regions, species adapted to those regions, and the needs of producers at their locations. Our goal with this multi-location research project is to identify several major objectives that complement each location’s individual research projects but that, through the

collaborative arrangements provided by this project, provide a larger geographical context.

In this project, we have developed projects related to the three major forage-bioenergy crop groups,*viz*., legumes (alfalfa, birdsfoot trefoil), cool-season grasses (tall fescue, orchardgrass, meadow bromegrass), and warm-season grasses (switchgrass). While numerous other forage crops are of importance, particularly in certain regions or specific niches, these crops represent major species of interest across broad regions of the continent. Therefore, we focus on these projects which require multi-location collaboration.

As funding methods have changed over time, most of the collaborators, even those at state AES, do not receive funding for this regional research. Consequently, these projects are ones that complement existing research and can reasonably be tied with ongoing goals each collaborator has at his/her location. This also means that expensive objectives (e.g., those involving large scale genotyping or DNA sequencing) cannot be proposed within these research projects. However, by combining our programs, we can develop a framework to ask interesting questions about topics of broad interest, e.g., genotype × environment interaction, that we can then use to attract external funding. By having this regional project in place, the opportunities to attract external funding increase, and thus, this project is a key leverage point to get further funding to forage- and/or bioenergy- based projects.

Previous research results from this project (NE1010)

- Selection methods for increased yield in alfalfa are currently under multiple site evaluation.
- Genomic selection model for biomass yield shown to be effective in alfalfa.
- A potato leafhopper resistant alfalfa cultivar has been developed for the Northeast USA and will be commercialized.
- An acid tolerant alfalfa cultivar (AAC Meadowview) was developed and released for commercial production.
- A salt tolerant alfalfa cultivar (AAC Bridgeview) was released.
- A new sanfoin cultivar (AAC Mountainview) was released. This cultivar was bred for ability to survive when grown in alfalfa stands.
- An alfalfa snout beetle tolerant alfalfa cultivar (Seedway 9558 SBR) was released and is now in commercial production. Continued selection has improved resistance further.
- New birdsfoot trefoil germplasm bred for forage yield and persistence has been evaluated for potential release.
- Birdsfoot trefoil populations with higher rhizome production and vigor are being developed to enhance productivity and longevity of the crop
- Birdsfoot trefoil bred with grass companion crops has better performance in mixtures with grass than germplasm bred without companion crops.
- Comparison of selection methods for biomass yield is almost complete in multiple location trials.
- Populations were selected using a genomic prediction model. These will be increased in 2016 and tested in field trials in 2017.
- Seed of red clover populations with improved persistence, general adaptation, and biofuel use are being increased for evaluation. Marker-assisted selection strategy for red clover improvement is now in use.
- Selection of meadow and hybrid bromegrass continue to be under multiple site evaluation.

- A model to identify desirable reed canarygrass cultivars for biofuel use was developed.
- Mixture trials documented the value of including legumes with grasses.
- Multiple species of cool and warm season perennial forages were evaluated annually for forage yield, persistence, and other agronomic traits at multiple locations in North America to provide data on new cultivars and experimental populations to plant breeders, seed companies, extension educators, and growers. Legume/grass mixture trials are being evaluated for use as feedstocks for biofuels and livestock feed.
- Alfalfa cultivars with multiple disease resistance and with improved forage yield and quality have been developed and are currently in use by dairy and other livestock producers to make those operations more economical. The most recent cultivar that was released is N-R-Gee, the first alfalfa cultivar bred for higher pectin concentration for increasing milk production in cows.
- Comparisons of breeding methods on alfalfa have been completed or are underway.
- Alfalfa association mapping with replicated clones has been completed and published.

Relevant background for research planned in this project

Alfalfa Germplasm Enhancement. Over 3000 alfalfa (*Medicago sativa* L.) germplasm accessions are in the U.S. National Plant Germplasm System (NPGS). Over the decades this collection has been a rich resource for North American alfalfa breeders, particularly as sources of disease or insect resistances. However, virtually no work has been expended in prebreeding the germplasm in this collection to develop new sources of variation for quantitative traits, such as yield and adaptation. Prebreeding can be defined as the process of converting a large number of germplasm accessions into a few adapted breeding pools that could be incorporated into commercial breeding programs. That intermediate step of making initial selections to synthesize new germplasm breeding populations is rarely done, leaving much of the collection unexplored for commercial potential.

Given the possibility for a rapid change in climate across the globe, prebreeding offers the potential of providing breeders with new, semi-improved populations to incorporate into their programs in order to counter these expected changes. At its 2010 meeting, the North American Alfalfa Improvement Conference (NAAIC, an international organization of public and private alfalfa researchers) made the systematic germplasm improvement program one of the highest priority research projects. This project is direct response to that priority setting exercise by NAAIC. Past examples using non-North American alfalfa germplasm to enhance elite alfalfa germplasm pools include the development of leafhopper resistant alfalfa (Elden and McCaslin, 1997), lodging tolerant alfalfa (Lamb et al., 1997), disease resistance (Elgin et. al, 1988). Numerous studies have also show that genetically distinct alfalfa germplasm could be used as the basis for obtaining yield heterosis in hybrid or semi-hybrid alfalfa breeding schemes (Dudley and Davis, 1966; Busbice and Rawlings, 1974; Riday and Brummer, 2002; Bhandari et al., 2007). Over the past decade, a program to pre-breed pure yellow flowered alfalfa germplasm (subsp. *falcata*) has been underway (Riday and Wagner, 2012), including several breeding and evaluation projects within the NE1010 regional project).

Historically, alfalfa germplasm was classified into pools based on region of origin, most notably the synthesis by Barnes et al. (1977). However, defining pools of extant breeding germplasm in 2016 is more difficult, given the extensive mixing that has occurred over the past century; if anything, cultivars appear to be structured according to fall dormancy classification (Li et al., 2013), possibly reflecting past introgression of *falcata* germplasm. A number of molecular marker analyses have been conducted in

various alfalfa germplasm (reviewed in Li and Brummer, 2011), and several more recent analyses have focused on putatively wild diploid (Şakiroğlu et al., 2010) and tetraploid accessions (Ilhan et al., 2016). Across all these experiments, the differentiation of yellow and purple flowered taxa is well established. Among tetraploids, however, a clear gradation is obvious with the hybrid subsp. x*varia* falling intermediate between the two ends, effectively creating a continuum between true *sativa* and true *falcata* types. Alfalfa germplasm most likely follows a diversity 'cline' subject largely to isolation by distance based on continental geography. More fully understanding overall genetic variation, would be useful in helping to structure future breeding programs and to preserve and incorporate germplasm resources.

For all these reasons this project is desirable and necessary to more fully exploit the NPGS germplasm system to pre-breed alfalfa to be utilized by North American alfalfa breeders in a systematic way. Work is already fully underway to develop a 'falcata' (yellow flowered alfalfa subsp. falcata pool). This project would seek to emulate and expand this work by developing multiple geographic based germplasm pools in the subsp. *sativa* ranges.

Switchgrass disease research. Switchgrass (*Panicum virgatum* L.) is a native warm-season C_4 perennial range grass that is now a target feedstock for U.S. production of sustainable cellulosic biofuels (Schmer et al., 2008). The principal, on-going objective of switchgrass breeding programs is to select for and develop cultivars with higher biomass production (Parrish et al., 2012). Maintenance of high biomass and biofuel yields will depend on the cultivar's ability to tolerate environmental and biotic stressors. One major challenge for scaling-up bioenergy feedstock production is that yield loss due to pathogens will become more prevalent with large monoculture plantings (Crouch et al., 2009; Uppalapati et al., 2013; Zhu et al., 2013; Stewart and Cromey, 2011). Phytopathogenic fungi with explosive disease potential will likely become more prevalent and economically damaging as switchgrass plantings expand (Casler et al., 2011; Aguirre et al., 2012; Casler and Vogel, 2014; Kenaley et al. 2016). Substantial yield loss attributable to fungal pathogens has already been demonstrated (Gravert et al., 2000; Thomsen et al., 2008; Fajolu, 2012; Sykes et al., 2016). For example, rust infection of switchgrass has recently been demonstrated to reduce ethanol yield up to 55% (Sykes et al., 2016) and three species of rust fungi have been determined to affect commercially important switchgrass cultivars throughout the north-central and eastern U.S. (Kenaley et al., 2016).

The success of switchgrass as a bioenergy crop requires identification of genetic variation for disease resistance that can be used by breeders to prevent yield losses. At present, however, there is only a limited understanding of the genetics of switchgrass resistance to the multiple microbial pathogens that infect it (Gustafson et al., 2003; Schrotenboer et al., 2011; Uppalapati et al., 2013; Serba et al., 2015). Switchgrass harbors substantial natural genetic variation for many traits, and that variation appears to extend to disease resistance. Much of the natural genetic variation within switchgrass is partitioned between upland and lowland ecotypes, driven by adaptation to habitats differing in soil water availability and other factors (Porter et al., 1966; Lowry et al., 2014). In addition, many genetically-based abiotic stress responses and phenological traits vary clinally by latitude (McMillan, 1964; Aspinwall et al., 2013; Lowry et al., 2014). Genetic variation in switchgrass disease resistance likewise differs both between ecotypes and with latitude (Gustafson et al., 2003; Uppalapati et al., 2013; Serba et al., 2015). Recent studies have shown that the southern lowland ecotype is generally more resistant to fungal diseases – including anthracnose, Bipolaris leaf spot, rust, and head smut – than the northern upland ecotype. Our work will identify this divergence in disease resistance between the southern lowland and northern upland ecotypes as well determine regional adapted germplasm tolerant to pathogenic microbes of switchgrass.

More than 150 fungal species have been found to infect switchgrass including anthracnose

(*Colletotrichum navitas*), leaf spot (*Bipolaris oryzae*), smut (*Tilletia maclaganii*), and rust (*Puccinia emaculata* and *Uromyces graminicola*) fungi (Farr and Rossman, 2016). However, the latter fungi – rusts – are particularly acute and recurrent threats to biofuel production from switchgrass (Cornelius and Johnston, 1941; Uppalapati et al., 2013; Sykes et al., 2016). Because of their high evolutionary and explosive disease potential, rust fungi historically are among the most serious and damaging pathogens of agricultural crops worldwide (Strange and Scott, 2005). Four species of rust fungi reportedly cause disease in switchgrass: *P. emaculata*, *P. graminis*, *P. huberi*, and *U. graminicola* (Burrill, 1884; Arthur, 1934; Ramachar and Cummins, 1963, 1965; Anonymous, 1970; Cummins, 1971). *Puccinia emaculata* has received most of the attention as it is reportedly distributed across the eastern two-thirds of North America (Ramachar and Cummins, 1965; Lenne, 1990; Farr and Rossman, 2016) and has caused recurrent outbreaks on cultivated switchgrass in the central and eastern U.S. (Gravert and Munkvold, 2002; Gustafson et al., 2003; Zale et al., 2008; Hirsch et al., 2010; Gilley and Tomaso, 2011; Frazier et al., 2013; Uppalapati et al., 2013; Kenaley et al., 2016). However, the geographic distribution and presence of *P. graminis*, *P. huberi*, and *U. graminicola* – either alone or in combination with *P. emaculata* – on switchgrass remains unknown. Moreover, the monophyly of *P. emaculata* is questionable as its purported biology likely suggests that this taxon is a compound species consisting of two or more morphologically convergent taxa (e.g., *P. emaculata* sensu stricto, *P. pammelii*, and/or *P. panici*) (Arthur, 1934; Kenaley et al., 2016). Thus, rust resistant cultivars/germplasm will require breeding programs that select for and integrate not only yield-defining agronomic/horticultural traits but also multiple sources (genes) for rust resistance. The majority of disease resistance genes reported to date in agricultural crops are specific to the causal organism (Ellis et al., 2014; Hulbert and Pumphrey, 2014; Mundt, 2014). Thus, determining which fungi infect switchgrass across a large geographic area is critical in attaining durable resistance as well as identifying cultivars and germplasm that likely possess the genes conferring resistance.

One of the primary reasons that southern lowland cultivars have greater disease resistance is because they are exposed annually and persistently to a greater diversity of pathogens – strong selective and evolutionary forces. In general, biological diversity is correlated with latitude. Likewise, pathogen diversity often increases at lower latitudes where pathogen populations are less likely to experience local extinction and recolonization events. However, no previous study has evaluated pathogen diversity across geographically distinct switchgrass populations at the national scale proposed herein. Thus, our research presents an unparalleled opportunity to determine pathogen diversity and host-pathogen combinations as well as evaluate germplasm for resistance to these disease agents. Moreover, given that pathogen diversity differs by region, the success of the proposed work will necessitate multistate collaboration.

Cool-season grass breeding. Cool-season (C_3) grasses comprise a major forage source in both the United States and Canada. Production includes both monoculture and mixed-legume management for grazing, hay, and/or silage production. The increased consumer demand for grass-fed and organic animal products and producer needs for increased sustainability necessitate further advances in the improvement of cool-season grasses for North American production. To maintain or expand the seeded acreages of the grasses, it is critical to develop new cultivars with broader adaptation or cultivars with novel traits. Meadow bromegrass (*Bromus riparius* Rehm.), tall fescue (*Festuca arundinacea* Schreb.) and orchardgrass (*Dactylis glomerata* L.) are three important cool-season grasses used in temperate region of North America. Meadow bromegrass is now recommended across Canada (Knowles et al., 1993), and is receiving increasing interest in the U.S. with cultivars being developed in Montana and Utah. The previous NE1010 project developed a meadow bromegrass breeding line by crossing superior plants selected at four locations across North America. However, this material has not been tested at multiple locations. Tall fescue is recommended across North America; however, its relatively lower palatability and nutritive value compared to other cool-season grasses limits its use. New soft-leaf tall

fescue populations developed in Utah need to be tested at multiple locations to determine their adaptation and palatability as well as the expression of the trait. Orchardgrass is cultivated in the northern regions of United States and in all Canadian provinces. In Europe, increased concentrations of cool-season grass water soluble carbohydrates (WSC) provide increased animal production and decreased environmental impacts (Miller et al., 2001; Lee et al., 2001). Additionally, there is evidence that increased WSC also buffers plants against various abiotic stresses including drought and freezing (Volaire and Thomas, 1995; Sanada et al., 2007). While there is interest in higher WSC forages in North America, to this point there are no North American cultivars specifically developed with this trait, nor is there evidence documenting its value under North American management systems and climate. The development of cultivars with increased levels of WSC is a new breeding objective of forage grass breeding programs in recent years.

Bioactive compounds in birdsfoot trefoil. Condensed tannins (CT) from tanniniferous plants have the potential to improve environmental performance of ruminants by increasing the N-use efficiency and animal productivity in forage-fed ruminants (Waghorn and McNabb, 2003). Research into the impact of bioactive forages on nematodes that are parasitic to livestock has indicated variable impacts on levels of infection, possibly a result of variable levels of bioactive compounds in the forages due to genetic variability in both gross bioactive content and specific bioactive compounds between plant species and cultivars (Hoste et al., 2006). The bioactive compounds in the forages appear to affect the parasites both in the animal (Marley et al., 2005) and in the manure and soil (Marley et al., 2006).

Relation to other CRIS/REEIS research

Several of these projects are also part of other CRIS projects. Many CRIS/REEIS reports were identified for alfalfa germplasm development, but they involved developing specific traits in elite germplasm in plant breeding programs. The new NE multistate project would enhance adaptation of alfalfa germplasm developed mostly from plant introductions that have not previously been used in plant breeding programs. This enhanced germplasm would to provide new germplasm for future cultivar development by alfalfa breeders in North America. A few CRIS/REEIS reports are about research on switchgrass diseases, but none of these reports described surveys of switchgrass diseases across North America. CRIS/REEIS reports indicate that research has been done on gastrointestinal parasites that affect health and performance of small ruminants. Much of the research has focused on animals and hence is not relevant to our project. Of the research focused on birdsfoot trefoil, most of it has been done at the University of Rhode Island by K. Petersson and others. One of our multistate project researchers (Rebecca Brown) is now located there. We plan to expand on this research by sampling birdsfoot trefoil cultivars in experimental field trials across multiple locations in the USA and Canada.

Objectives

1. Developing broadly adapted, climate resilient forages for sustainable cropping systems.
   Comments: This objective has four sub-objectives. 1.1. Regionally adapted, resilient alfalfa germplasm pool development. Cooperating locations: AES: Cornell Univ., South Dakota State Univ., and Univ. California, Davis [co-lead]; USDA-ARS: Logan, UT and Madison, WI [co-lead]; AAFC: Québec, QC, Saskatoon, SK, and Truro, NS; Noble Foundation, Ardmore OK. 1.2. Switchgrass phenotypic variation to fungal pathogens across space and time. Cooperating locations: AES: Cornell Univ. [lead], Mississippi State Univ., Rutgers Univ., South Dakota State Univ.; USDA-ARS: Madison, WI. 1.3. Resilient cool-season grasses adapted to variable climatic conditions. Cooperating locations: AES: Cornell Univ.; South Dakota State Univ.; Univ. California, Davis; Univ. Kentucky, and Univ. Minnesota; USDA-ARS: Logan, UT [co-lead] and Madison, WI; AAFC: Québec, QC and Saskatoon, SK [co-lead]. 1.4. Birdsfoot trefoil germplasm with bioactive components to control parasitic nematodes. Cooperating locations: AES: Cornell Univ., Univ. Rhode Island; USDA-ARS: Logan, UT and Madison, WI; AAFC: Truro, NS [lead].

2. Understanding genotype by environment interactions across multiple forage species
   Comments: Cooperating locations: AES: Auburn Univ., Cornell Univ., Mississippi State Univ., Rutgers Univ., South Dakota State Univ., Univ. California, Davis, Univ. Florida, Univ. Georgia, Univ. Kentucky, Univ. Minnesota, Univ. Rhode Island, Univ. Tennessee; USDA-ARS: Logan, UT and Madison, WI; AAFC, Lethbridge, AB, Québec, QC, Saskatoon, SK, and Truro, NS; Noble Foundation, Ardmore OK.
3.

Methods

1.0. Developing broadly adapted, climate resilient forages for sustainable cropping systems.

1.1. Regionally adapted, resilient alfalfa germplasm pool development

The overarching goal of this project is to use the NPGS alfalfa germplasm collection to enhance genetic diversity in elite North American alfalfa breeding pools. Selection from the NPGS pools will be organized into region of origin germplasm pools that can be useful for long-term genetic improvement of alfalfa and potentially valuable for the creation of heterotic groups and hybrid cultivars. The project consists of a series of related experiments that by nature are collaborative across multiple North American locations. This objective is an outgrowth of a long-term discussion at the North American Alfalfa Improvement Conference (NAAIC) on using the germplasm collection for long-term improvement.

- *Germplasm pool development*. Based largely on accessions that are documented as landraces or cultivars from regions outside North America, we will develop pools based on Northern (fall dormancy levels from 1-5) and Southern adaptation (fall dormancy 5-12). Populations will be developed that derive from discrete ecogeographic regions. We propose to have four Northern and four Southern pools. Northern pools: include Siberia/Mongolia, Central Asia, Balkans-Turkey-Black Sea Region, and North Eastern Europe to the Ural Mountains; Southern pools from South America, North Africa, Southern Asia (India, Iran), and the Arabian Peninsula. In conjunction with those regional pools, we plan to develop two broadly based populations by pooling the four regional pools.

- *Evaluation/selection within new germplasm pools for broad adaptation*. We expect that multiple cycles of selection will be necessary for these pools to be both broadly adaptable to North American climates and useful in commercial breeding programs. Therefore, we will undertake multi-location breeding nurseries to select plants within populations to develop improved versions of these germplasms. In addition to scientists involved at the outset of this project, we will also invite other breeders to participate either by becoming members of the regional project itself of by conducting evaluation trials.

- *Diversity evaluation of germplasm pool*. In order to validate our germplasm pool approach we will conduct DNA marker based diversity studies of developing pools using falcata as outgroup to determine how distinctive the eco-geographic regional germplasm pools are in relationship to the North American elite alfalfa germplasm pool. This analysis could help us also define less utilized regional germplasm sources and guide further enhancement efforts.

- *Seed increases and yield/performance trials of new germplasm pools* Seed of the germplasm pools will be increased to provide sufficient seed quantities for yield evaluation at multiple locations. New germplasms are expected as part of this project that will be freely available to commercial alfalfa breeding interests through the NPGS system.

- *Characterization of pools for various biotic and abiotic stresses in conjunction with on-going research projects of participants* Including reference cultivars and using standard test procedures where available (NAAIC standard tests), we will characterize the new pools for various traits, including (but not limited to) fall dormancy, insect/disease resistance, salinity, winter hardiness, and waterlogging tolerance. Where appropriate, we will select from these populations to develop new germplasm that is enhanced for these traits. We will work with other US alfalfa scientists in the public and private sectors to evaluate key insect and disease resistances of most importance nationally and within specific regions.

- *Release of germplasm to the public* All populations developed through this project will be made publicly available through the National Plant Germplasm System, accessable through the Germplasm Resources Information Network, and also through individual scientists involved in the project.

1.2. Switchgrass phenotypic variation to fungal pathogens across space and time

No previous study has evaluated pathogen diversity across geographically distinct switchgrass populations at the national scale proposed herein. Thus, our research presents an unparalleled opportunity to determine pathogen diversity and host-pathogen combinations as well as evaluate germplasm for resistance to these disease agents. Moreover, given that pathogen diversity differs by region, the success of the proposed work will necessitate multistate collaboration.

Quantify the patterns of important switchgrass pathogens across geographic space. We will characterize the geographic distribution and severity of economically important/yield-reducing diseases caused by phytopathogenic fungi in the north-central, eastern, and south-eastern United States through surveys of common cultivars and breeding lines. Fungi can result in a range of mild to severe disease in plant hosts. However, disease symptoms or signs of phytopathogenic fungus may not immediately reveal the specific identity of a pathogen. Therefore, quantification of diseases in switchgrass requires both field assessments of disease severity and analytical laboratory procedures to identify the specific pathogens. Thus, we will first quantify the severity of fungal diseases in switchgrass with annual survey (2017-2020) of all commercially important and promising new lines of switchgrass in yield trials and nurseries in Mississippi (Mississippi State University), New Jersey (Rutgers University), New York State (Cornell University), South Dakota (South Dakota State University), and Wisconsin (USDA). Disease surveys will focus on determining the severity of four diseases: 1) rust (*Puccinia emaculata* and *Uromyces graminicola*); 2) anthracnose (*Colletotrichum navitas*); 3) *Bipolaris* leaf spot; and, 4) head smut (*Tilletia* species). For each survey, collaborators will score only promising new lines and commercially important cultivars for infection using established, standardized visual disease severity rating systems (e.g., for rust, 0-9 *Puccinia emaculata* system). Because different pathogens are detectable at different times, surveys for smut will be executed in summer (July or early August) during or shortly after flowering whereas surveys for rust and the other foliar disease will be conducted during peak infection late in the growing season (mid-September). From these surveys, we will establish how disease severity varies by geographic location as well as between northern upland and southern lowland genotypes.

Identify and quantify specific host-pathogen relationships. We will identify patterns of phenotypic variation for switchgrass resistance and, hence, susceptibility to fungal pathogens across common cultivars, breeding lines, and field sites. We have noted previously that varying fertilization regimes (nitrogen loading per acre) and summer rainfall can significantly influence the incidence and severity of switchgrass disease, particularly anthracnose and head smut (S.C. Kenaley, Cornell Univ. unpub. data). Thus, we predict that the extent and severity of pathogen infection will differ by site and be influenced significantly by local environmental factors. To identify environmental factors associated with the severity of disease(s), we will compile a set of environmental covariates for each field site including: (i) 2017-2020 weather data, obtained from PRISM; (ii) soil fertility (established by collaborators); (iii) proximity of

alternate hosts for foliar pathogens of switchgrass; and (iv) extent of vegetation types within 1 km, as determined from field observation and the USDA National Agricultural Statistics Service Cropland Data Layer. To determine how landscape features predict genotype-specific disease severity, we will conduct stepwise general linear model fitting. Here, the response variable will be disease severity and the landscape environmental factors will be predictor variables. Model comparison using Akaike information criterion (AIC) will be executed to identify best-fit models using the statistical software R.

Pathogen resistance in switchgrass. We will quantify pathogens across common cultivars and breeding lines to identify switchgrass germplasm possessing tolerance and resistance to regional phytopathogenic fungi. We will compare results among field sites to identify regionally adapted switchgrass plants for possible scale-up and downstream genetic analyses. Elucidating the geographic distribution of fungi requires careful morphological and molecular analyses. We will collect fungi with switchgrass leaves annually in mid-summer to early fall 2017-2020 at all sites. Morphologic identification will be executed on culturable fungi whereas for rust and smut fungi, we will use teliospore measurements and DNA data. Using the latter data, we will conduct phylogenetic and phylogeographic analyses as well. We will determine phylogenetic relationships among sampled taxa using single-locus or multilocus sequence data and three separate phylogenetic approaches (maximum-likelihood, maximum parsimony, and Bayesian inference of phylogeny). We will conduct phylogeographic analyses to understand how species diversity is distributed across our field sites. Drs. Shawn Kenaley and Gary Bergstrom (Cornell Univ.) have conducted the only morphological and phylogenetic analyses of switchgrass rust fungi to date and, hence, have the expertise and procedures to successfully complete the aforementioned molecular and morphometric analyses. Pathogen identification will be critical for understanding patterns in host-pathogen combination(s) and why some cultivars/breeding lies express disease resistance at some sites but not others.

1.3. Resilient cool-season grasses adapted to variable climatic conditions

This project will characterize cultivars and breeding lines of important cool-season grasses (meadow bromegrass, tall fescue, and orchardgrass) across multiple North American locations.

- Evaluate and select meadow bromegrass breeding lines to understand the G x E interaction, and to develop adapted cultivars
- Evaluate soft-leaf tall fescue populations to select adapted populations.
- Quantify water-soluble carbohydrate expression and cell wall digestibility of tall fescue and orchardgrass at different growth environments to understand the underlying genetic basis.
- Select individual genotypes from new orchardgrass populations to develop populations with improved winter hardiness.

Five populations of meadow bromegrass will be characterized for biomass production, nutritive value,

survival, and seed production at Logan, UT; Saskatoon, SK; Québec, QC; and Madison, WI for three production years. Biomass and nutritive value will be collected during the first two production years, and seed production will be collected during the third production year. Survival data will be collected each year. The experimental design at each location will be a randomized complete block design consisting of four complete blocks. Each population will be represented in each block by a plot consisting of forty genotypes. Based on the data collected from each location, the best genotypes will be identified and selected for the development of four new meadow bromegrass germplasms.

Five populations of tall fescue and fifty half-sib families of orchardgrass will be evaluated for winter injury, survival, water-soluble carbohydrate content, and cell wall digestibility at Logan, UT; Panguitch, UT; Saskatoon, SK; St. Paul, MN; Quebec City, QC; and Normandin, QC field sites. Data will be collected for three production years at each location to determine the relationship between water-soluble carbohydrate expression with winter injury, digestibility, and survival under varying precipitation levels. The experimental design at each location will be a randomized complete block design with four complete blocks. Plots will be 1 x 2 m seeded sward plots. Based on the data collected from each location, the best families will be selected for development of an improved orchardgrass germplasm based on multi-location selection.

1.4. Birdsfoot trefoil germplasm with bioactive components to control parasitic nematodes.

Assess the varied profile and contents of isoflavones in birdsfoot trefoil across diverse climatic conditions in the northern latitudes.

This investigation will be initiated by establishing small, replicated plots of birdsfoot trefoil cultivars and elite lines in regions where the investigators are located. In 2019 and 2020, the plots will be assessed for development stage, and forage from 0.25 m^2 will be hand clipped from each plot and flash frozen, freeze dried, and shipped to Dr. Papadopoulos. After sampling the plots, they will be harvested to assess herbage yield.

2.0. Understanding genotype by environment interactions across multiple forage species

To provide multilocation evaluation data for broadly adapted as well as location specific germplasm developed by members of the NE1010 committee either jointly or independently.

Cooperating locations where testing will be conducted will be identified for each species and an individual from one of the locations will act as the coordinator. Seed of each entry will submitted by each cooperating location to the coordinator of the trial, entries will typically not exceed four to six entries. For each species a core set of check cultivars will be included for testing. Seed from each cooperating location and the core set of cultivars will be distributed by the coordinator to each cooperating location. These will then be established following local practices in small plot trials and will be maintained for two to three years following the establishment year. Each location will collect a core set of data: Seedling vigor and plant stand in the establishment year, forage yield from a minimum of one harvest in the two to three years following establishment, forage quality data where the local cooperator has that capability and persistence following the last harvest in the second year following establishment. Each location will collect data unique to the biotic and abiotic stresses for their specific environment. Individual locations may choose to include additional check cultivars when a test is specific to their location.

At the conclusion of the final harvest year, raw/rep data will be sent from each cooperating location to the coordinator of that crop. This should occur no later than mid November. The coordinator for that crop will analyze and summarize the data, reporting GXE interactions for establishment, forage yield, and persistent. All data, including that unique to specific locations, will be summarized in mean tables, which will then be distributed to all cooperators.

Measurement of Progress and Results

Outputs

- Ten new alfalfa germplasm populations.
- Agronomic data on the new alfalfa populations across North American testing locations
- Analysis of alfalfa genetic diversity using genetic markers
- Incorporation of alfalfa data generated from this project into the Alfalfa Breeders' Toolbox developed at the Noble Foundation and integration with other alfalfa databases, including the alfalfa genome sequence and gene expression atlas.
- Documentation of the severity of fungal diseases among switchgrass ecotypes across time and space.
- Identification of environmental factors that are most predictive of disease severity by region.
- In-depth analyses of switchgrass pathogen diversity.
- Identification of disease resistant switchgrass germplasm for selection and gene mining.
- Assessment of geographic distribution of fungal pathogens affecting upland and lowland ecotypes in temperate region of U.S.
- Determination of unique host-pathogen relationships across the U.S.
- Deposition of DNA sequence data for rust and smut fungi in public genetic databases (e.g., GenBank).
- Four improved meadow bromegrass germplasms.
- An improved tall fescue germplasm.
- An improved orchardgrass germplasm.
- Understanding of the relationship between water-soluble carbohydrate expression and abiotic stress and the underlying quantitative genetics of these traits in orchardgrass and tall fescue.
- Identification of the magnitudes of genotype by environment interaction of bioactives in trefoil.
- Understanding of genotype by environment interactions across North America for major forage species.
- Adaptation data useful for breeders in making cultivar release decisions.
- Data for seed dealers and extension specialists in making cultivar recommendations, and forage producers in choosing cultivars that meet their needs.
- Scientific publications for each of the objectives.
- Scientific and extension presentations to disseminate results to the scientific community and to producers.

Outcomes or Projected Impacts

- New, adapted alfalfa germplasm that will be available to breeders in North America to develop improved cultivars more resilient and better adapted to climate stress in the future.
- Improved cultivars will enhance the economics of livestock producers.
- Journal papers will discuss the genetic structure of alfalfa germplasm and identify priorities for use and improvement of new germplasm pools.
- Collectively, survey data will be leveraged to pursue funding for QTL mapping and marker development for resistance to switchgrass pathogens.
- Disease resistance markers would accelerate greatly selective breeding programs nationwide as well as provide opportunities to develop new cultivars adapted to regional abiotic stressors and pathogen communities.
- Establishing the geographic distributions of pathogen communities and species diversity will also yield opportunities for in depth study of the epidemiological factors contributing to their spread and intensification in switchgrass cultures.
- Data will establish which pathogens are recurrent threats to switchgrass yields in different regions, providing producers with options for planting and harvesting to optimize production..
- Improved germplasm will be provide material for further breeding and/or immediate commercialization of grass cultivars with improved adaptation and resilience for production and persistence under pasture and hay production systems.
- Journal papers will document genetic control of phenotypes and genotype-by-environment effects, making future improvement more successful.
- Use of birdsfoot trefoil cultivars that will inhibit growth of parasites will result in enhanced productivity of animals, thus increasing economic viability of these operations.
- Use of cultivars with high forage yield and quality will result in enhanced economic vitality of forage and livestock production operations.

Milestones

(**2017**):Evaluate establish nurseries containing germplasm from the first version of the four northern pools (collectively N1.0). Evaluate existing NPGS germplasm nurseries from southern pools (NPGS-S-2016). Screen additional germplasm from NPGS for inclusion in northern pools (NPGS-N-2017) and southern germplasm pools (NPGS-S-2017). Evaluate, analyze and summarize general patterns of

diseases – and their causal fungi - across field sites. Collect landscape level data – weather, prevalence of alternate host(s), soil fertility, and vegetation type neighboring fields. Establish grass evaluation nurseries Establish birdsfoot trefoil research plots Establish GxE evaluation trials

(**2018**):Final evaluation year of N1.0 make selections to form N2.0. Select out of NPGS-S-2016 to from S1.0 (collectively southern germplasm pools).Continue to evaluate NPGS-N-2017 and NPGS-S-2107. Re-execute disease surveys and fungal species identification. Analyze two-year data sets to assist in the identification of switchgrass cultivars and breeding lines expressing phenotypically differing levels of disease resistance and severity (i.e., unique host-pathogen combinations) Collect phenotypic data from grass trials. Obtain herbage samples for the assessment of isoflavone content, as well as evaluate plant persistence and herbage yield. Continue harvesting GxE evaluation trials

(**2019**):Final evaluation year of NPGS-N-2017 and NPGS-S-2107 make selections to form N1.1 and S1.1. Conduct a larger seed increase of S1.0 and N2.0. Begin registration process of N1.0 populations as germplasm for inclusion in NPGS. Begin multi location-testing of S1.0. Conduct disease and pathogen surveys. Analyze three-year data and conduct phylogenetic analyzes for rust and smut fungi. Submit fungal DNA data to public genetic databases. Continue phenotypic evaluations for grass trials for a second year. Obtain herbage samples for the assessment of isoflavone content, as well as evaluate plant persistence and herbage yield for a second year. Plant additional GxE trials and continue harvesting existing trials.

(**2020**):Begin evaluation nursery testing of N1.1, S1.1. Germplasm characterization testing of N2.0. Continue evaluating S1.0. Execute final surveys for diseases and pathogens. Integrate survey and landscape level data to examine predictive environmental variables contributing to the severity of individual switchgrass diseases. Determine switchgrass plants with resistance to one or more diseases and mark them for vegetative propagation. Create crossing blocks to develop improved grass germplasm populations. Complete statistical analysis for trefoil study and discuss project results. Analyze data of evaluation trials. Continue to establish new trials and harvest existing trials.

(**2021**):Final year evaluation of S1.0 make selections to form S2.0. Continue evaluation of N1.1 and S1.1. Continue N2.0 characterization testing. Summarize project results and prepare manuscript for publication in a peer-reviewed journal. Utilize these data as leverage in procuring additional funding for quantitative trait loci analyses of resistant germplasm and, thereafter, the development of molecular markers in switchgrass for the identification of genes conferring resistance to one or more diseases. Seed production of grass germplasms. Data analysis, writing, and publication of journal papers for all projects (likely begins in previous years) Investigate relationships among species for GxE.

Outreach Plan

All members of the technical committee are involved in outreach to the scientific community, the seed industry, and the farm community in their region. The primary means of outreach to the scientific community include publications in peer reviewed journals and presentations at conferences. Many of the members of the technical committee have active breeding programs that release cultivars, and these members typically have connections with seed companies to market their cultivars. The technical committee will work to enhance communication between scientists and industry colleagues to more effectively transfer results to industry and also to ensure research is being conducted on topics of relevance to the industry. In the current proposal, the alfalfa germplasm project already has S&W Seeds as a collaborating member and will involve other alfalfa companies as the project continues. Similar efforts will be made for the other objectives. Finally, all members of the committee routinely speak at extension or grower meetings in their respective locations and work to ensure that extension personnel know about and are conversant on their research programs.

Throughout the life of the project, we will regularly invite other forage breeders, pathologists, entomologists, physiologists, and agronomists in the public and private sectors to collaborate on aspects of the projects, as needed. Any of these participants are also welcome to join the project as official members. Our goal is to be as inclusive as we can be to ensure we reach our objectives.

Organization/Governance

This project is organized by objective, with each objective having one or more lead scientists. Like the current NE1010 project, the lead scientists will prepare annual summaries of research in their objective (or sub-objective) and lead the discussion at the annual meeting. All other participants contribute

updates on their work.

The annual meetings have a chair and a secretary, who typically rotates to chair the succeeding year. The secretary for the next meeting is elected by the membership each year.

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Land Grant Participating States/Institutions

NY,CA,RI,GA,MN

Non Land Grant Participating States/Institutions

Participation

Participant	Is Head	Station	Objective	Research						Extension	
				KA	SOI	FOS	SY	PY	TY	FTE	KA

Combined Participation

Combination of KA, SOI and FOS	Total SY	Total PY	Total TY
201-1620-1081	0.03	0.2	0.5
202-1621-1081	0.03	0.2	0.5
212-1640-1081	0.03	0.2	0.5
212-1641-1081	0.03	0.2	0.5
212-1620-1160	0.01	0	0
212-4020-1160	0.01	0	0
212-1620-1160	0.05	0	0
212-4020-1160	0.05	0	0
202-1640-1081	0.1	0.2	0
202-1699-1081	0.1	0.2	0
202-1641-1081	0.1	0	0
201-1621-1080	0.03	0	0
202-1631-1081	0.03	0	0
203-1640-1081	0.03	0	0
212-1649-1081	0.03	0	0
204-1621-1081	0.1	0	0.1
Grand Total:	**0.71**	**0.40**	**0.60**

Program/KA	Total FTE
0	0
212	0
212	0.03
0	0
0	0
0	0
0	0
Grand FTE Total:	**0.11**

View Participant Information

Project Number: NE_TEMP1010 Improving Forage and Bioenergy Crops for Better Adapta

Part 1: Participant List | **Part 2: Research Summary** | **Part 3: Extension Summary**

Participant	Is Head	Station	Objective No.	Research								Extension	Options
				KA	SOI	FOS	SY	PY	TY	FTE	Program/KA		
Viands, Donald R. drv3@cornell.edu		New York -Ithaca : Cornell University	1,2	201 202 212 212	1620 1621 1640 1641	1081 1081 1081 1081	0.10	0.20	0.50	0	0		Edit (http://www.nimss.or
Bergstrom, Gary C. gcb3@cornell.edu		New York -Ithaca : Cornell University	1,2	212 212	1620 4020	1160 1160	0.01	0.00	0.00	0.01	212		Edit (http://www.nimss.or
Kenaley, Shawn sck26@cornell.edu		New York -Ithaca : Cornell University	1,2	212 212	1620 4020	1160 1160	0.10	0.00	0.00	0.1	212		Edit (http://www.nimss.or
Brummer, Edward C ecbrummer@ucdavis.edu		California -Davis : University of California, Davis	1,2	202 202	1640 1699	1081 1081	0.20	0.20	0.00	0	0		Edit (http://www.nimss.or
Missaoui, Ali M cssamm@uga.edu	Yes	Georgia - University of Georgia	1,2	201 202 203 212	1621 1631 1640 1649	1080 1081 1081 1081	0.10	0.00	0.00	0	0		Edit (http://www.nimss.or
Ehlke, Nancy J nancy@umn.edu	Yes	Minnesota - University of Minnesota	1,2	204	1621	1081	0.10	0.00	0.10	0	0		Edit (http://www.nimss.or

Add Participant (http://www.nimss.org/appendix_e/create/17116)

Report a Bug

Appendix G: Peer Review (Submitted)

Status: Complete

Project ID/Title: NE_TEMP1010: Improving Forage and Bioenergy Crops for Better Adaptation, Resilience, and Flexibility

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Excellent
3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Excellent
Comments
The project plan is very well written and straight forward. The project has excellent objectives and the plan of work should be achievable with the planned cooperative work. This work would not be possible without having this type of cooperative project. The leaders of the project may want to make an effort to expand the project by inviting some forage breeders who are not involved in the project to join in the cooperative effort. This could enable additional testing locations to be included in the evaluation work. The only criticism is that the term "pre-breeding" is not defined or characterized. This can be easily corrected.
Your Recommendation:
Approve/continue project

Appendix G: Peer Review (Submitted)

Status: Complete

Project ID/Title: NE_TEMP1010: Improving Forage and Bioenergy Crops for Better Adaptation, Resilience, and Flexibility

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Good
3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Excellent
5. Overall technical merit:
Good
Comments
Overall, the project is ambitious but meets the needs of the forage community and uses the multistate locations of cooperators well. This project has two objectives. The first objective has four parts and it has a sufficient amount of detail to evaluate the feasibility and potential impact of completing the project. In the milestones, it would be helpful to list which objective and sub-objective is being met. Otherwise, it is difficult to determine which milestone corresponds to which subobjective. Specific concerns for two subobjectives are detailed below.

The goal of Objective 1.1 is to develop germplasm pools for Northern and Southern areas from plant introductions in the NPGS system. I suggest that the investigators identify partners to assist in evaluation of biotic stresses. By assessing only the fungal diseases, responses to the most important pathogens of alfalfa (bacterial and oomycete pathogens) will be missed, particularly Clavibacter michiganensis subsp. insidiosus (bacterial wilt), Phytophthora medicaginis (Phytophthora root rot), Aphanomyces root rot (Aphanomyces euteiches) and Pythium species causing seed rot and damping off. It would also be useful to have the locations listed where evaluations will be made to judge the feasibility of attaining the objective.

The second sub-objective is to evaluate resistance of switchgrass to major fungal pathogens and measure diversity within the pathogens. This sub-objective is very ambitious and it is unclear if the investigators have sufficient personnel and resources to complete it. Field assessments of disease severity will be done twice a year for an unstated number of years and apparently each plant in the trial will be scored. The number of locations of the yield trials and nurseries was not given, but for even a moderate number of sites, this could be very laborious. The investigators state that they will quantify the pathogens, which is impossible to do. They likely mean they will quantify disease incidence and severity. It is important that all collaborators use the same assessment methods for each disease otherwise efforts will not be able to be compared among sites. The methods proposed to assess the environmental factors affecting disease will likely not yield useful results. Bipolaris leaf spot is affected by the amount of infected crop residue in the vicinity. Local weather and fertility may be useful in identifying conditions leading to disease. However, rust and smut diseases are strongly impacted by the amount of inoculum arriving from other regions each year. Local weather and soil fertility will have little impact on the amount of disease observed. Patterns will be difficult to impossible to identify on such a short-term basis. Additionally, the alternate host of the major rust pathogen, P. emaculata, has not been identified and multilocus genetic analysis is not straightforward for this pathogen. I suggest that the investigators partner with scientists who have worked previously on identification and genetic diversity in this pathogen so that methods can be modified to ensure completion of the objectives.
Your Recommendation:
Approve/continue project

Appendix G: Peer Review (Submitted)

Status: Complete

Project ID/Title: NE_TEMP1010: Improving Forage and Bioenergy Crops for Better Adaptation, Resilience, and Flexibility

Rate the technical merit of the project:

1. Sound Scientific approach:
Approve/continue project
2. Achievable goals/objectives:
Good
3. Appropriate scope of activity to accomplish objectives:
Excellent
4. Potential for significant outputs(products) and outcomes and/or impacts:
Good
5. Overall technical merit:
Excellent
Comments
This project is well-written and covers a broad range of very important plant breeding activities in forage and bioenergy crops. The planning for cooperative research is commendable.

I did not see a plan for the eventual distribution of the improved germplasm pools/ genetic lines/ etc. This should be addressed in this document and I assume will consist of depositing these improved lines back into NPGS/GRIN. This will assure some form of public availability.

This is a great example of truly cooperative research and this project should be approved.
Your Recommendation:
Approve/continue project

NERA Best Practices Session Topics

September 14, 2016

Previous

- Hatch Project Management; i.e., Project Development & Review, Reporting, and Budget Distribution Mechanisms (NERA 3/07)
- Effecting Change, Keeping Institutions Agile, Replacing Unproductive Tenured Staff (NERA 7/07)
- Allocation of Space; i.e., Office, Lab, Greenhouse, Field, etc. (ESS 9/07)
- Re-Directing Non-Productive or Unnecessary Faculty Research Programs (Re-Treading/Re-Training). (ESS 9/07)
- Estimating Costs of Raising and Managing Research Animals and Implementing Per Diem Charges; Decision Processes, Transition, Oversight, etc. (NERA 3/08)
- Budgeting for New Faculty Hires (Including Start-Up and Spousal Hires); Unique Start-Up Packages, Inter-College Spousal Hiring, Funding Start-Ups, etc. (NERA 7/08)
- Managing Significant Budget Reductions; i.e., Selective vs. Across-the-Board, Prioritization, Creative Funding Mechanisms, etc. (NERA 3/09; ESS 9/08)
- Relationships with State Departments of Agriculture (NERA 7/09)
- Institutional and Regional Responses to Budget Reductions (NERA 9/09)
- Managing High Cost Agricultural Research Facilities (ESS 9/09)
- Positioning NERA Institutions and Scientists for the New AFRI RFP (NERA 3/10)
- Adoption of a *"Culture Of Sustainability"* in Our Institutions (NERA 3/10)
- Encouraging Collaborations (NERA 7/10)
- Coordinated Regional Research on Invasive Plants (NERA 9/10)
- Documenting Impacts, How and Why (ESS 9/10)
- How Do We Want to Handle Dairy Support in the Region? (NERA 3/11)
- Intellectual Property: How It is Handled and the Role of Experiment Stations (NERA 3/11)
- Sustainable Campus Operations (ESS 9/11)
- Structuring University-Wide Centers and Institutes; Issues and Solutions (ESS 9/11)
- Program Evaluation in Plans-of-Work and Annual Reports (NERA 3/12)
- Forming, Managing and Benefitting from AES External Advisory and Advocacy Committees; What Works and What Doesn't (NERA 3/12)
- Encouraging Leadership Development for Faculty and Staff – LEAD 21 or campus-based programs (NERA 3/12)
- Future of Animal Research Programs (ESS 9/12)
- Small Farms Viability (ESS9/12)
- Resources/Faculty Sharing (NERA 3/13)
- Establishment of a Grant Support Unit in the Experiment Station, College or University Level (NERA 3/13)
- Resource Use in Our Experiment Station/Research Centers/Facilities (NERA 3/13 and 7/13)
- Northeast Faculty Hiring Decisions (NERA 7/13)
- New Budget/Management Strategies for Dealing with Austerity (ESS 9/13)
- Emerging Needs for Agricultural Engineering Research or Tech Transfer in the NE (NERA 10/14)

- Open Architecture Laboratory Management (NERA 7/15)
- Identifying Gaps in Our Research and Extension Expertise for 21st Century Problems (NE 7/15)
- Meeting the Need for Future Leadership in Teaching, Research and Extension. (NE 7/15)
- An Experiment Station's Role in Helping to Drive Economic Development (NERA 3/16)
- Communications for Telling Our Research Story (NERA 3/16)

Potential

- Flexible budget and resource allocation methods; i.e., historical, competitive, programmatic, etc.
- How we handle funds
- Hiring and supporting mid-level administrative leadership; i.e., department heads, research center directors, etc.
- State-level leadership in major research program areas; i.e., identifying & supporting faculty leaders, relationship with department heads & college administration, degree of administrative load, etc.
- Pesticide and toxic waste management on outlying research stations; i.e., compliance, disposal, personnel training, etc.
- Indirect cost recovery; i.e., commodity groups and state agency grants, use of college portion, etc.
- Developing integrated, interdisciplinary "centers of excellence"; i.e., establishment & funding, leadership, member vs. non-member, etc.
- Research faculty technical support; i.e., appropriate level, sharing technicians, partial salary, etc.
- Developing true multi-state partnerships in research
- Working with our commodity groups for funding research
- Encouraging a culture of publishing in peer-reviewed journals
- Ensuring research stands behind the extension recommendations, especially when the recommendations are referred to in state rules and policy
- Research websites and tying R, T, and E together
- Leading the local experiment station to actively initiate and engage in new initiatives
- Flexible research support for departments/units; i.e., new funding models, department/unit leaders help develop model
- Faculty performance expectations; i.e., publications, grants, teaching, etc.
- Hatch, McIntire-Stennis, and internal competitive project review processes; i.e., new/renewed Hatch & M-S project review, internal RFPs, decision processes, etc.
- Ensuring laboratory security in university settings; i.e., compliance policies, access, oversight, etc.
- Decommissioning outlying stations; i.e., decision process, local public relations, stakeholder communication, faculty/staff reassignment, etc.
- Estimating the costs of managing and supporting greenhouse research and implementing greenhouse or bench charges; decision processes, transition, oversight, etc.
- Purchasing, maintaining and managing shared equipment; oversight, use scheduling, cost sharing, etc.
- Graduate student and post doc costs
- Open access and federal mandate for data archiving – who is doing what?
- Framing the NE region's position in likely future USDA water initiatives

- Crowd-funding as a means to raise money for research et all
- Aligning faculty hires with applied research and extension needs that experiment station directors identify
- Leading university-wide initiatives that complement station activities
- Engagement and collaboration of 1862's and 1890's
- Tapping the source: new, novel streams of funding for agricultural research