Report and Recommendations
NORTHEAST MULTISTATE ACTIVITIES COMMITTEE
For the March 17, 2026
agInnovation Northeast Meeting

Members: Puneet Srivastava (Maryland-Chair), Beth Gugino (Pennsylvania), Chris Smart (New York-Geneva), Lee Hecker (Maine), Bill Miller (Massachusetts/NEED), Ali Dunigan (NEED) [Non-voting, ex officio: Rick Rhodes (agInnovation Northeast), David Leibovitz (agInnovation Northeast)]

Review of National Research Support Project (NRSP) Materials

- NRSP_TEMP12: *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities* [New NRSP, Northeast AA: Bill Miller – Massachusetts] – proposal, reviews, response to review, and budget attached

Review of Nominations for the 2026 Northeast Excellence in Multistate Research Award (call for nominations)

- NE2231: *Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US* (two nominations; Anton Bekkerman-AA and Lee Hecker)
- NE2501: *Harnessing Chemical Ecology to Address Agricultural Pest and Pollinator Priorities* (one nomination from AA Blair Siegfried and proposed AA Toni DiTommaso)

Administrative Adviser Assignments

- NE2501: *Harnessing Chemical Ecology to Address Agricultural Pest and Pollinator Priorities*
  - Blair Siegfried (Pennsylvania) is retiring, and Toni DiTommaso (New York-Ithaca) was nominated to serve as the new AA.
- Open AA positions to be filled:
  - NECC2202: Formal Structure for the Minor Use Animal Drug Program (formerly Margaret Smith)
  - NECC29: Corn Improvement Conference (formerly Margaret Smith)

Informational Items

- agInnovation Northeast activities ending 09/30/2026
  - NECC2103: High tunnel specialty crop production [AA: Anton Bekkerman] (**in revision post-peer review as multistate research project NE_TEMP2603**)
  - NE2140: Sustainable Management of Nematodes in Plant and Soil Health Systems [AA: Anton Bekkerman] (**in revision post-peer review as NE_TEMP2640**)

DRAFT

    - NEERA2104: Northeast Region Technical Committee on Integrated Pest Management [AA: Beth Gugino] (**interest in renewal TBD**)
    - NE2101: Eastern White Pine Health and Responses to Environmental Changes [AA: Lee Hecker] (**elected to not renew**)
- New multistate activities with anticipated start 10/1/2026
    - NE_TEMP2650: Building a Resilient Equine Economy: Sustainable Pathways for Horses and Communities [AA: Lee Hecker] (**finishing up peer review)**
- Northeast selection for 2026 Multistate Research Fund Impacts writing workshop
    - NE9: Conservation and Utilization of Plant Genetic Resources [AA: Chris Smart]
- Regional and National Award Nomination Opportunities
    - Excellence in Leadership Award (call for nominations)
    - Agricultural Research Innovation Award of Excellence (separate awards for Early, Mid-Career, and Life-Time Career) (call for nominations)

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NRSP_TEMP_12: Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities

Status: Submitted As Final

Duration	10/01/2026 to 09/30/2031
Admin Advisors:	[George Smith] [William A. Miller] [Graham (Cliff) Lamb] [Brent D Hales]
NIFA Reps:	

Non-Technical Summary

The land-grant university (LGU) system was established when most U.S. residents lived in rural areas. Today, over 80% of the population lives in metropolitan regions, meaning the LGU research and Extension enterprise must evolve to meet urban needs in the 21st century. **NRSP12** will address this need by focusing on urban systems using collaborative research. By building a national network and data infrastructure, NRSP12 will align research outputs with municipal decision-making needs and facilitate comparative studies across cities.

Specifically, this project will:

- **Create and support national network of Integrated Research Nodes (IRNs)** connecting researchers, Extension professionals, and urban stakeholders across key topic areas – including urban agriculture and food systems, nature-based solutions (NbS) and urban ecosystem services (with an emphasis on urban soils and green infrastructure) – to co-create research agendas and share best practices.
- **Develop data archiving and sharing infrastructure** that includes an interactive “Urban Map Room” that hosts a breadth of urban spatial data and an **Urban Research Repository** to assemble, store, and disseminate research outputs, methods, and resources related to urban resiliency.
- **Provide professional development and training** for scientists and Extension agents in systems thinking, resilience planning, and community-driven research approaches tailored to urban contexts.

Housed within the National Urban Research and Extension Center (NUREC) at WSU, this NRSP will leverage NUREC’s established Extension networks to ensure that knowledge is co-created with communities and translated into practice. Ultimately, **NRSP12 will reinforce productive connections between public universities and urban communities**, positioning the LGU system to deliver science-based solutions for complex urban challenges.

Statement of Issues and Justification

Issues and Justifications

This National Research Support Project (NRSP) is rooted in the fundamental mission of the LGU system by integrating research and extension to advance science as well as support communities. The focus of NRSP12 is on urban areas, which present unique and urgent knowledge gaps in the development of evidence-based solutions for climate resilience, food security, and public well-being for millions of people across the US.

Urbanization has long been focused on excluding the natural world, leaning on man-made infrastructure, technology, and ingenuity to create an optimal space for humans to gather, create, and thrive. However, the near total exclusion of green spaces, food production, and non-human habitat have introduced fundamental, systematic weaknesses into cities that urbanites are now seeking to address. Over the last two decades, interest in urban ecosystem service initiatives have proliferated in cities nationwide and are viewed as promising pathways for shrinking food deserts, increasing local and regional biodiversity, and buffering negative impacts from changing patterns in regional temperature and precipitation. Yet, many of these perceived ecosystem service benefits cities use to justify investments and structural changes are derived from assumptions based on non-urban ecosystem and agricultural systems, or on urban-based findings from a specific location, neither of which may adequately capture the benefits and trade-offs of urban ecosystem investments when translated to different locations. In response, new research foci and methodologies aimed at addressing these problems have exploded across the US, making major headway in our understanding of urban ecosystem services. New knowledge is being generated in hundreds of urban locations, but efforts to align evaluation metrics to better compare results across locations and build nationwide research networks to tackle challenging issues and synthesize findings for advancing the field of urban ecosystem services are currently lacking [1] [2]. These research gaps are confirmed by stakeholder input highlighting that fragmented data systems and lack of cross-city knowledge synthesis are major barriers to effective decision-making and long-term planning.

NRSP12 is conceived as a research coordination and acceleration network. It will directly address the gaps and barriers identified above by focusing on urban research problem areas and providing supporting infrastructure for collaboration and synthesis. In the sections below, we outline the major research priority areas that structure this project, followed by the plan of work detailing how integrated research networks and a NRSP data hub will be created and managed to synthesize and accelerate our understanding of urban ecosystem services, and how we intend to track and evaluate the success of our network activities and outcomes. This integrated approach is justified by the breadth of urban challenges: urban areas are diverse, complex, and vary greatly from one another, and interdisciplinary approaches are needed to tackle issues like urban climate resilience or food security. By pooling resources and expertise across the national LGU network, NRSP12 will *accelerate* our understanding and knowledge of urban systems by *synthesizing* existing information and encouraging *collaboration* to address promising new research areas to inform our *practical capacity* to improve urban quality of life, in alignment with the LGU system’s mission to serve all communities.

Prerequisite Criteria

How is the NRSP consistent with the mission?

The goal of NRSP12 is to coordinate and advance research efforts across the US to better understand the benefits and trade-offs of investments in urban ecosystem services. This goal will be accomplished through a research network framework designed to facilitate nationwide coordination of research agendas and best practices, support the incubation of new and innovative projects, and synthesize existing information to help generalize findings and understand the impacts and benefits of urban ecosystem services at regional and national scales, allowing us to match the NRSP mission directly.

Research Hub Structure

NRSP12 does not propose a single, hypothesis-driven research study. Rather, it is a structured research network framework for connecting researchers, curating existing information, supporting new research initiatives, and communicating findings through shared, new technologies across three scales of key urban agricultural-focused ecosystem service research: Urban Food-Energy-Water (FEW) nexuses; Nature-Based Solutions; and Urban Soils. Each of these three research areas will serve as an Integrated Research Node (IRN) within the NRSP12 research network further linking new knowledge and practical benefits across regional, local, and hyper-local areas of study.

Connecting Researchers: Each IRN is envisioned as a **national network of peers** who collaborate regularly to rapidly identify and address a broad set of interrelated urban challenges across scales and disciplines. We will recruit researchers nationally to engage in Research Synthesis and Acceleration Activities (RSAAs) and create opportunities for them to learn, connect, and work together through topical webinars for sharing disciplinary, topical, and practical expertise widely across the NRSP network, and monthly “Link & Learn” virtual events aimed at nurturing interdisciplinary team development. Each IRN will have a **Program Leader** to coordinate that research community. These leaders will be responsible for facilitating communication and collaboration around thematically relevant data synthesis and accelerating new research efforts between researchers, and with stakeholders. They will also help steer the broader NRSP12 effort, assisting leadership in identifying cross-cutting themes, emerging issues, and in addressing unforeseen challenges.

Synthesizing Information and Supporting New Research: While the IRNs support thematic work, the broader goals of the research network also include the facilitation and acceleration of research along and between the IRNs. To support these broader goals, NRSP12 includes an innovative set of Research Synthesis and Acceleration Activities (RSAAs) that work within each IRN to build and grow expertise and knowledge to tackle broader urban challenges. Led by the Toolbox Dialogue Initiative (TDI) Center from Michigan State University and the Center for Environmental Research, Education, and Outreach (CEREO) from Washington State University, the RSAAs focus on 1) providing NRSP participants with the necessary background and skills to successfully collaborate and engage in interdisciplinary research activities, 2) facilitating **Synthesis Working Groups** (SWGs), and 3) hosting Proposal Development Workshops. **Interdisciplinary skill building** will occur through webinars and workshops designed to increase shared understanding in heterogeneous teams and make it easier to establish collaborations among groups with different experiences, goals, cultures, and values. SWGs are year-long efforts within each IRN that explicitly seek to synthesize existing knowledge and data, address knowledge gaps and research needs using interdisciplinary approaches as the foundation for collaboration. SWGs would be topically focused and are expected to yield high-profile outcomes. **Proposal Development Workshops** (PDWs) facilitate the acceleration of emerging ideas across our IRNs and SWG activities. These workshops are designed to help participants form interdisciplinary teams, refine research questions, and craft compelling grant proposals over a two-month timeline. This structure builds on successful similar workshops our leadership team have led in the past (e.g. GROW Urban Agriculture workshop).

Enabling Technologies for Communicating Findings: Addressing complex urban issues and advancing new areas of science benefits from a flexible **data infrastructure** that supports deep integration and synthesis across disciplines, locations, and time. Currently, the data required to achieve these research goals exists in **fragmented and inaccessible data streams**. These datasets are often collected by different entities who use different units, scales of measurement, nomenclature, and data repositories. This means there is often no single-entry point for researchers exploring interdisciplinary questions, such as the interplay of tree canopy, air quality, and asthma rates in various cities. The **Urban Data Hub**, including an **Urban Map Room** and **Research Repository**, would serve as a national, open, standards-based data platform that collects, assembles, stores, curates, and distributes urban datasets (incl., soils, green infrastructure performance, FEW indicators, socio-demographics) alongside methods, instruments, and protocols so that nuance and results from different cities and studies can be compared consistently. This will further ensure consistency and accuracy in the research process, facilitating the comparison of results across different studies and regions; thus, enabling synthesis, meta-analysis, and evidence-based practice.ub will provide discovery, visualization, download, and contribution workflows with robust metadata and data templates to ensure national comparability and interoperability, thereby reducing barriers for teams to launch comparative and multi-site studies.

Complementarity and non-duplication

As designed, NRSP12 complements, rather than duplicates, existing multistate projects by supplying the core and foundational services (data, methods, collaboration venues, training, evaluation) that those projects can leverage. Housed within WSU’s National Urban Research and Extension Center (NUREC) and governed by a multi-region steering committee with SAES and Extension representation, NRSP12 links research and Extension from the outset, ensuring that research support activities are mission-aligned with the land-grant system’s obligation to deliver public benefit. Where appropriate, NRSP12 will coordinate with related efforts (e.g., urban agriculture (NE2401) and green infrastructure (NE2206), initiatives) to host their datasets, align metrics, and amplify dissemination.

Long-term Planning

An important outcome of building these IRNs is the creation of a sustainable national network that persists beyond the NRSP's funding period. To support ongoing collaboration and mutual benefit, each IRN will develop a sustainability plan – for instance, identifying long-term host institutions or integrating into existing national networks (such as NUREC, the National Urban Extension Leaders for the Extension side, or professional societies for researchers). By the end of the project, we anticipate that these IRNs will become largely self-sufficient communities that continue to drive urban research and innovation. In summary, the IRN approach enables continuous, structured collaboration across institutions, which is essential for tackling the multifaceted problems outlined in our research priorities.

How does the NRSP pertain as a national issue?

Why This Matters Nationally

Urbanization is a defining demographic and environmental trend in the United States. Urban communities face complex and interlinked challenges from climate change impacts, degraded soils, food and water insecurity, public health inequities, aging infrastructure, and limited access to nature and nature-based benefits. These issues are not confined to a single region; they affect cities in every state and across all land-grant university regions. As such, they represent a truly national challenge requiring coordinated support through shared infrastructure, robust research networks, and the translation of science to action through the integration of research, Extension, and stakeholder communities. NRSP12 offers a research network structure that coordinates researchers across three pressing research themes and across multiple scales. Through its innovative approaches it will increase research quality and comparability, accelerate new research efforts by providing real support to team building and proposal generation, strengthen Extension translation, and leave a lasting legacy of open data, shared methods, and a trained, connected community. This fulfills the NRSP mission to support, enable, and facilitate high-priority research across the LGU system.

Addressing National Issues

Urban Agriculture and Food–Energy–Water (FEW) Systems

Urban agriculture (UA) has re-emerged as a multifaceted strategy for urban sustainability and resilience, integrating food production directly into city systems. Studies show that UA can provide numerous benefits—ranging from improved food security to enhanced ecosystem services and social well-being—while still facing practical constraints [3] [4] [5].

A growing body of work emphasizes examining UA through the food–energy–water systems (FEWS) nexus to better manage resource trade-offs and synergies in a holistic way [6]. In practice, however, most cities continue to address food, water, and energy in isolation because of institutional silos [7]. Yet the ecological and social conditions in which UA operates present a unique opportunity to evaluate it through a FEWS lens and align it with the Sustainable Development Goals [3] [8].

Within this broader perspective on food production in cities, several national-scale issues are emerging. First, many new technological innovations—such as vertical farming and controlled-environment agriculture have not yet been evaluated for long-term sustainability, particularly in relation to the Sustainable Development Goals [8]. Second, traditional in-ground, uncontrolled environment urban agriculture systems differ substantially in both form and function from rural agroecosystems [9] [5]. Specifically in the context of urban soils and fragmented urban ecosystems [10] [11]. These differences highlight the need to reinvest in foundational agricultural research, especially on soil fertility management and integrated pest management specific to urban environments [5] [12].

Beyond these biophysical needs, additional research is required on urban food-system components such as supply chains, post-harvest processing, appropriate technologies, and innovation pathways [3]. Such work is necessary for urban agriculture to mature into an integrated part of the urban food system and to be effectively incorporated into urban planning [3].

Nature-Based Solutions and Ecosystem Services

Nature-based solutions (NbS) go hand-in-hand with urban agriculture efforts to leverage ecosystems and green infrastructure to address urban challenges, providing services like stormwater management, urban cooling, carbon sequestration, and public health benefits. NbS have gained prominence as multi-benefit strategies for urban sustainability and climate resilience [13]. Studies show that well-designed NbS can reduce flooding, mitigate heat islands, support biodiversity, and enhance human well-being. However, key debates center on their effectiveness and equitable implementation. Poorly planned projects may reinforce social inequities such as green gentrification, underscoring the need for community-engaged planning [14].

Another challenge is the gap between research and practice in deploying NbS at scale. Many cities pilot NbS projects but mainstreaming them into policy and infrastructure investment remains slow [1] [2]. Obstacles include fragmented governance, lack of long-term monitoring, and design approaches that do not account for local ecological conditions [15] [1] [2]. To overcome these barriers, scholars recommend developing global knowledge networks for sharing NbS best practices, innovating financing models that value ecosystem services, and creating regionally adapted implementation strategies [15]. Interdisciplinary collaboration is likewise critical, integrating ecology, urban planning, engineering, and social sciences to fully quantify NbS benefits and optimize co-benefits [13] [14].

Urban Soils and Anthropogenic Landscapes

Urban soils, often heavily altered by construction, pollution, and other human activities, form the foundation of urban green infrastructure and urban agriculture. Although frequently overlooked, recent research shows that these soils provide essential ecosystem services, including carbon storage, stormwater regulation, nutrient cycling, and support for vegetation that improves air quality, reduces urban heat, and enables food production [16] [17].

A major recurring issue in urban soil science is contamination. Many city soils contain legacy pollutants such as lead from old paints and gasoline, posing health risks and constraining the growth of urban agriculture [18] [19]. Toxic metals and other contaminants often necessitate soil testing, remediation, or the use of clean substrates in raised beds to ensure food safety [18]. Identifying effective strategies to manage contamination—especially in-situ techniques—is an increasingly important focus of current research [20].

However, while contamination receives considerable attention, the physical and biological properties of urban soils remain comparatively understudied. These properties influence soil structure, water retention, microbial activity, and plant growth, yet they are rarely integrated into planning decisions [17]. For cities to effectively incorporate soil considerations into urban planning and design—particularly for NbS and urban agriculture—interdisciplinary approaches are required. Collaboration among soil scientists, ecologists, engineers, and public health researchers is essential for developing strategies that address contamination while also improving soil function [16].

Strengthening the condition and understanding of urban soils enhances the performance of both urban agriculture and nature-based solutions. Ultimately, improving urban soils is a key step toward building sustainable, healthy, and climate-resilient cities.

Conclusion

Across these three themes, a common thread is the need for integrated, interdisciplinary approaches to urban sustainability. Urban agriculture, nature-based solutions, and urban soil management all contribute to the resilience and livability of cities, yet their full potential is realized only when viewed as interconnected components of an urban system. Programs like NRSP12 can play a vital role by uniting agronomists, ecologists, soil scientists, urban planners, and policymakers around shared sustainability goals that not only span disciplinary, but spatial, boundaries. By fostering collaborative research networks similar to global initiatives for NbS, NRSP12 can advance holistic strategies that connect FEW innovations with green infrastructure and soil remediation. Such coordination will generate co-benefits for climate adaptation, public health, and resource security. The literature underscores that sustainable urban systems must integrate food systems, ecological infrastructure, and soil health rather than address them in isolation.

Leveraging the Best Minds and Resources

Urban sustainability and resilience cannot be addressed by individual institutions acting alone. NRSP12 draws on expertise across the SAES system and beyond, integrating soil scientists, ecologists, engineers, social scientists, planners, and Extension professionals into coordinated IRNs. These networks provide platforms for cross-pollination of ideas, avoiding duplication of effort and enabling more rapid progress. Importantly, the project also plans to encourage researchers to work with municipalities, NGOs, and federal agencies, to ensure that science is co-produced with those responsible for implementation.

Support Activities Relative to Other NRSPs

NRSP12 is complementary to other NRSPs by providing support services that enable multistate research. While other NRSPs focus on specific agricultural production systems or specific components of production systems, NRSP12 focuses on the **urban interface,** a space that is often underrepresented but critically important for national sustainability. Its role is to provide opportunities for multi-state researcher networking, curation of existing information, support of new research initiatives, and mechanisms for communicating findings through shared, new technologies. By filling this gap, NRSP12 ensures that urban issues are fully integrated into the national agricultural experiment station and Extension agenda.

Logical Progression and Building on Past Work

This proposal builds directly on the increasing recognition of urban systems as a national priority for the land-grant system. Initiatives like NUREC, the National Urban Extension Leaders (NUEL) network and recent USDA investments in urban agriculture, urban forestry, and heat health highlight the continuing need. NRSP12, and its integration with NUREC, provides a logical progression by offering a durable support framework to institutionalize and scale this work. Rather than a temporary project, it embeds the NRSP12 framework into existing, well-known institutions, enhancing our existing ability to support a wide array of multistate research and Extension efforts for years to come.

Rationale

Priority Established by ESCOP/ESS

This project aligns directly with national priorities identified by agInnovation and the ESCOP Science and Technology Committee (STC). The ESCOP Science Roadmap highlights the need for research support activities that advance agricultural science by addressing cross-cutting challenges such as sustainable production, resilient ecosystems, climate adaptation, water and soil stewardship, and stakeholder engagement. NRSP12 IRNs address issues related to Climate Change and Resilient Ecosystems (P1), Water Resilience (P2), Sustainable Food Systems (P3), Resilient Lands (P4), and Human Health and Nutrition (P5) through their focus on urban agricultural systems and the urban ecosystem, which serve as critical frontlines for food, energy, and water systems.

IRN Research Priority Areas

This research network focuses on three interconnected research priority areas that are critical for urban systems science and well suited for a collaborative, multi-state approach. Each IRN addresses a recognized knowledge gap and opportunity where a national effort can accelerate discovery and application across scales within the ESCOP Science Roadmap framework.

1. Urban Agriculture adn Food-Energy-Water (FEW) Systems

The broadest scale of assessment in this NRSP, the urban Food-Energy-Water (FEW) nexus, represents a complex set of interconnected linkages between external resources (e.g. water/energy inputs) and markets with internal production and community impact. The structure and function of the urban FEW determines how well communities can support and sustain community gardens, rooftop and Building-Integrated Agriculture (BIA), hydroponic and aquaponic systems, other forms of Controlled Environment Agriculture (CEA), etc. that are believed to alleviate .

However, our understanding of urban FEW dynamics and trade-offs in cities is still in its infancy, despite the concept of urban agriculture having expanded rapidly across cities in response to increased need for food production and food security. Significant questions remain about scalability, appropriateness of the technologies, resource efficiency, societal impact, and the ecology of these systems in the built environment [22] [23] [24] [25]. For example, different production systems have different attributes and shortcomings that complicate their suitability and functionality [26] [27]. CEA and vertical farms enable year-round production but rely on high energy and infrastructure inputs [28]. In contrast, soil-based systems provide social and nutritional benefits but are space-limited, often encounter contaminated soil, and are restricted by lack of infrastructure and technical support [27] [9]. Exploring these interactions, while standardizing data collection metrics, is an emerging and urgent research priority [29]. Examples of Roadmap related research in this area include work that explores:

FEW trade-offs (P1, P3, P4, P5): Quantifying energy, water, labor, and yield trade-offs among indoor, rooftop, agrivoltaics, soil-based, and other types of urban agriculture systems; and analyzing the connections between urban food production and regional agriculture systems to enhance resilience under climate and supply-chain stress.

Resource Efficiency (P2, P3, P4): How can urban agriculture systems be designed to optimize water reuse, renewable energy integration, and nutrient cycling without compromising food safety and economic viability?

Climate Resilience (P1, P4, P5): How do different urban agriculture models (e.g., rooftop farms, vertical farming, CEA, community gardens) influence the resilience of FEW systems under climate extremes, and what role can smart technologies and novel governance frameworks play in enhancing adaptive capacity and supporting equitable access to benefits?

2. Nature-Based Solutions (NbS) and Ecosystem Services

Cities worldwide are turning to non-agricultural nature-based solutions (NbS) – such as green roofs, street tree plantings, rain gardens, bioswales, urban wetlands, and pocket parks – to address challenges like flooding, extreme heat, air and water pollution, and declining biodiversity [13] [29] [30] [31]. These solutions leverage natural processes to provide ecosystem services in urban environments.

While NbS hold great promise for urban resilience, their adoption and effectiveness in U.S. cities are not yet well understood in a systematic way. Performance data on urban NbS (e.g., stormwater retention, temperature reduction, air quality improvement, or human health benefits) are often inconsistent or localized, making it difficult for planners to predict outcomes in new contexts [1] [2]. Governance of NbS can be fragmented – for example, responsibilities may be split between public works and parks departments, or between city and homeowner actions – which complicates maintenance and long-term success. There is also a need to examine trade-offs and unintended consequences. At present, much of the evidence for NbS benefits in urban areas remains anecdotal or site-specific. A coordinated research effort can help move from isolated case studies to a generalizable understanding of what works, where, and why in deploying NbS across different urban contexts. Examples of Roadmap related research in this area include work exploring:

The role and function of ecosystem services (P1, P2, P3, P4): Understanding how urban agriculture and other NbS can mitigate heat stress, manage stormwater, increase biodiversity to support pollination and nutrient cycling and improve urban environmental health.

Decentralized vs. centralized solutions (P1, P2, P3, P4). Comparing the effectiveness and cost-benefit of decentralized green infrastructure versus traditional centralized infrastructure. This includes analyzing how different urban density or land-use contexts influence which approach performs better.

Unintended consequences and trade-offs (P1, P2, P4, P5). Developing cross-site protocols to study potential unintended impacts of urban greening (e.g., does installing bioswales in a community lead to any displacement (gentrification) effects?) to maximize societal benefits and minimize inequities.

3. Urban Soils and Anthropogenic Landscapes

At the most local scale, NRSP12 explores how novel urban soils—often disturbed or manufactured, composed of fill, construction debris, and legacy contamination—affect our urban community's health, infrastructure, agricultural, and ecosystem security [30] [31] [32] [33]. These soils are frequently used to support urban food production and green infrastructure initiatives; however, their properties in this regard remain poorly understood [34] Understanding and improving these soils is crucial for maintaining environmental health, sustaining food production, and promoting sustainable urban design.

Addressing questions of urban soil ecology and research gaps necessitates interdisciplinary collaboration among researchers. NRSP12 will coordinate multi-city and state efforts to study and improve urban soils as a foundation for resilient cities, including questions of nutrient cycling and leaching, legacy contamination (e.g., heavy metals, PFAS, microplastics) and impacts on community health, physical properties (i.e., infiltration and structure) that affect urban design and infrastructure, and biophysical properties such as microbial communities that are key to preserving ecosystem services. The complex and heterogenous nature of these soils must be explored in the context of suitability for a variety of green infrastructure activities in the built environment. Examples of Roadmap related research in this area include work exploring:

Soil Contamination and Community Health (P3, P4, P5): How do legacy pollutants and emerging contaminants in urban soils influence crop nutrient quality and human health risks, and what remediation strategies can balance food production with soil ecosystem integrity? The advancement of soil remediation techniques and technologies to mitigate and adapt to urban soil contamination, along with improving our understanding of the ecology and behavior of specific contaminants (e.g. lead, PFAS, and microplastics).

Soil-Ecosystem Links (P1, P3, P4, P5): How does soil microbial diversity in urban agricultural sites affect nutrient cycling, carbon sequestration, and resilience to climate stressors, and what design interventions can enhance these ecosystem services?

Soil-Structure Interactions (P2, P3, P4): In what ways can urban soil management practices (e.g., compaction reduction, organic amendments) improve stormwater infiltration and structural stability of green infrastructure while supporting productive and profitable urban agriculture?

Relevance to Stakeholders

Identification of Stakeholders and Related Needs

The project is designed with a wide stakeholder base that spans the research, Extension, policy, and community landscape. Primary stakeholders include:

Land-Grant University (LGU) Researchers and Experiment Stations: Faculty, postdoctoral researchers, and graduate students across SAES institutions, including ecologists, biologists, soil scientists, hydrologists, engineers, urban planners and social scientists will be engaged to develop standardized evaluation frameworks and to synthesize knowledge across cities, thereby accelerating the smart implementation of NRSP12 outcomes. NRSP12 will offer researchers unique opportunities to collaborate at broader scales and across disciplines and leverage the Urban Data Hub which should lower barriers to entry for urban research, provide standardized datasets, and enable cross-site comparisons. See interviews with selected researchers ([37], uploaded as an attachment), letters of support ([38], uploaded as an attachment) [39]

Extension Professionals: County and urban Extension agents, NUEL (National Urban Extension Leaders) members, and program leaders who serve as translators of research to communities who can help translate research for managers interested in ensuring land and water resiliency for urban agricultural and ecological systems in the face of climate change and urbanization pressures. NRSP12 will allow Extension to access new research results, connect communities with research teams, and be more proactive in responding to urban agricultural and ecosystem challenges more easily (see attached letter of commitment from NUEL)

Government Agencies: Including local level city planners and sustainability offices [2] and state public health, environmental and agricultural departments who require credible science-based outputs to inform policy and decision-making as well as federal agencies (e.g. USDA, EPA, HUD, NOAA) that support urban sustainability and require national datasets and methods to inform programs and investments. NRSP12 will provide managers and policy-makers with access to a centralized, reliable platform for urban data that complements and extends existing datasets (e.g., USDA urban agriculture toolkit, EPA green infrastructure guidance).

Community-Based Organizations and NGOs: In addition to urban Extension professionals, urban agriculture groups, neighborhood associations, food justice coalitions, and nonprofits often provide frontline services to urban communities and would benefit from research-based information to build local programming from. Additionally, NRSP12 would provide benefits in the form of data sets and standardized metrics of ecosystems services provided by NbS ([38] see: Landscape Architecture Foundation) [1].

Industry and Private Sector Partners: As interest in NbS and urban agriculture grow, companies working in in green infrastructure, urban technology, consulting, and engineering fields need a reliable research base and open datasets from which to build their businesses around as well as the development of standardized metrics to evaluate performance against [38], see Green City Growers.

Stakeholder Involvement in Project Development and Activities

Stakeholders and participants have been actively engaged in shaping NRSP12 since its inception [39] [1] [37] (see Appendix 1: Letters of Commitment and Appendix 2: Interviews with Researchers). During the concept-building stage, municipal officials, Extension leaders, and community-based organizations have participated in several NUREC activities, listening sessions and webinars, including

Building Collaborative Research and Extension Networks to Advance the Application of Science with Urban Communities. In July 2024 NUREC and the National League of Cities, co-convened a by-invitation summit with 43 individuals representing federal agencies, local governments, non-profits/membership organizations, land-grant universities, and a non-land-grant urban serving university to identify research priorities and potential educational/Extension programs in the issue areas of: 1) urban agriculture and food systems, 2) health and wellness, and 3) the built environment. [40]

Generating Research Opportunities Workshop (GROW) for Urban Agriculture. This workshop was a virtual event designed to engage potential research, extension, education, industry, and community collaborators from across the nation in integrated urban agriculture proposal development. During this conference, interdisciplinary teams collaborated to develop creative and effective proposals rather than spend resources competing against one another. (https://sites.google.com/msu.edu/grow-uaconf/home).

Leading Edge Dialogues: In 2019, NUREC (formerly WCMER) hosted the National Urban Extension Conference (NUEC) and launched the Leading Edge Dialogues, a series of 90-minute interactive workshops which explored critical issues facing our cities and our universities and developed recommendations and opportunities for collaboration [41].

Urban, Indoor, and Emerging Agriculture: During May 2020, NUREC, in conjunction with NUEL and several urban Farm Bureau county organizations, conducted 4 on-line listening sessions to solicit, collect, and submit responses from the broad group of stakeholders to inform NIFA's development of Urban, Indoor, and Emerging Agriculture program [42].

Sustainable Urban Systems: NUREC brought together a select group of 40 scientists and practitioners across an array of disciplines, sectors, and locations as part of the National Science Foundation's development of their Sustainable Regional Systems program. Publications developed include a guide for city planners, a guide for developing community outreach and engagement for researchers, and a project report – all available at: https://nurec.extension.org/portfolio-item/sustainable-urban-systems/.

Urban Green Infrastructure: In early 2018, NUREC hosted a summit to connect scientists, Extension professionals, practitioners, and community leaders to share existing resources; inform education and research priorities; and build new collaborative, problem-solving networks program. [43]

Promoting Urban Food, Energy and Water Resource Resilience via the Regional Food System. This summit built on 27 key-informant interviews and convened researchers, Extension professionals, urban food producers and policy makers to understand how food, energy, and water are interdependent in the context of changing environmental pressures and policies. [24].

Built Environment Rx Series. NUREC launched the Built Environment Rx Series [44] to explore how urban design, planning, landscape architecture, and construction practices can improve human and ecological well-being across U.S. communities. This ongoing series brings together scholars, practitioners, and community partners to examine "living systems" in the built environment including water, vegetation, soil, and the city itself and to highlight emerging research, metrics, and collaborative approaches for healthier, climate-adaptive urban systems. Sessions feature national experts and foster dialogue across universities, agencies, and community organizations. https://nurec.extension.org/portfolio-item/built-environment-rx-series/

This input directly shaped our Research Network structure and focus. To ensure that our network stays relevant to urban issues, each IRN will have mechanisms to involve community stakeholders and end-users in meaningful ways. This will build off the Memorandum of Understanding between NUREC and the National League of Cities and their support leeter (both attached) to include a municipal representative or community organization leader as a co-chair of the IRN, hosting listening sessions or "urban needs" panels at IRN meetings and stakeholder meetings (e.g. the National League of Cities annual City Summit), and partnering with Extension in each state to connect research teams with local stakeholder groups to co-design research agendas, contribute datasets, and participate in case studies. This engagement ensures that the research conducted addresses real-world needs and that outreach pathways are built in from the start.

Involvement in Review and Management Plans

NRSP12 governance includes an Advisory Committee with stakeholder representation across SAES, Extension, and partner organizations. The Steering Committee will help to guide project priorities, facilitate partnerships for pilot projects, and provide feedback on overall network structure and achievements, ensuring that activities respond to real-world needs rather than academic abstraction. This ensures balanced oversight and responsiveness to community and practitioner needs. Members of the Steering Committee will also contribute through annual advisory forums, where they can review progress, assess outputs, and suggest course corrections.

Relationship of Stakeholders with Research Support

Stakeholders are not passive recipients but active partners. By embedding Extension educators and municipal representatives within leadership structures, NRSP12 ensures that research support activities are continually informed by practice. The Urban Data Hub will provide stakeholders with access to open, standardized datasets and visualization tools, reducing reliance on fragmented or proprietary information. In turn, stakeholders will contribute local data, knowledge, and feedback, creating a reciprocal relationship between research support and application.

Mechanism for Assessing Stakeholder Use of Outputs

NRSP12 incorporates a comprehensive evaluation and assessment framework that includes:

- Usage Analytics: Tracking downloads, dataset contributions, and visualizations accessed from the Urban Data Hub.
- Surveys and Feedback Loops: Periodic surveys of Extension professionals, municipal staff, and community organizations to measure adoption, satisfaction, and impact of tools.
- Advisory Forums: Annual convenings where stakeholders review outputs, share use cases, and recommend adjustments.
- External Evaluation: A mid-term independent review that includes stakeholder interviews and case studies of use.
- Outcome Indicators: Metrics such as number of municipalities adopting standardized NbS metrics, number of Extension programs using urban soil curricula, or new policies informed by project outputs.

See Appendix 3: Evaluation Plan Overview for more details.

By establishing robust mechanisms for tracking stakeholder use and producing policy-relevant outcomes, NRSP12 ensures that its research support activities will directly inform decision-making, advance national priorities, and strengthen the land-grant system's public value.

Implementation

Objectives

1. Building Networks- Each IRN is envisioned as a national network of peers focused on a specific urban issue domain, who collaborate regularly to share knowledge, co-design multi-site projects, and implement methods, procedures and practices that result in more successful research programs and more effective applications of research findings. Comments: Year 1 will focus on recruitment and networking through webinars, synthesis working groups, and other workshops in addition to Urban Data Hub development of a comprehensive geospatial data library for IRN use. Years 2-5 networking activities and Hub use will continue but will focus more explicitly on research acceleration leveraging synthesis working group findings, and through team-building for proposal development and seed grant opportunities.
2. Synthesizing Knowledge- Curating, organizing, and understanding the vast swath of urban agricultural and environmental data that currently exist is crucial for informing where future research efforts should be developed Comments: Each IRN will explore a pressing topical issue through SWG activities over the course of a year. Three SWGs will run each year (Years 1-5) to identify, curate, and assess existing data to fill standing knowledge gaps and research needs. The Urban Data Hub will be key to research synthesis, providing rapid access to, and manipulation of, existing data. The Hub will serve as a platform analogous to the data systems in place for long-term agricultural research (LTAR) sites.
3. Accelerate New Research- A structured synthesis approach (SWGs, Urban Data Hub development) to understanding the state-of-the-science within our three IRNs will set the stage for NRSP12 participants to rapidly identify multiple novel research areas and collaborate to tackle pressing issues across the urban agricultural and ecosystem domain. Comments: Proposal workshops will run in Years 2-5 and will support the formation of interdisciplinary teams in the creation of competitive proposals using platforms and facilitation strategies previously proven to be successful in the urban agriculture domain. All NRSP12 participants will have opportunities to apply for internal funding for research acceleration. Travel Grants (four per year, for up to $2,500 each) will help support in-person meetings for dedicated ideation and writing time and an annual seed grant competition (five, $10k awards per year) will fund particularly innovative and relevant NRSP research.
4. Communicating Outcomes. A nationwide network requires nimble, timely, and thoughtful sharing of information, news, and opportunities across a wide audience of interested members.
   Comments: We will develop a web presence within the existing NUREC website to provide a readily known and trusted entry point to the NRSP12 including its goals, opportunities and activities, Data Hub & Repository, and news and updates. In addition to NRSP12 activities and results being disseminated through disciplinary channels and AES networks, we will also leverage our partnership with NUEL, NLC, NACo and others to get information, data, and outputs into the hands of decision makers and practitioners. The Urban Data Hub platform will allow users to register free-of-charge and will offer regular training on upload and access to scholarly products, policy documents, and presentations, and in how to use customized tools for academic and non-academic needs. User activity will be tracked project evaluation.

Projected Outcomes

- Establishment of robust, national networks of researchers that are collaborating to solve pressing urban challenges across disciplines and scales. Comments: Our vibrant online presence through our website, social media, virtual networking, and Urban Data Hub will create a rich and robust network from which researchers, decision-makers, and practitioners can learn, engage, share, and connect across pressing urban agricultural-ecosystem issues. The thematic focus areas- Urban FEW, NbS, and Urban Soils- are linked by the common thread of the urban ecosystem and provide a structured approach for building insights across disciplinary domains and scales of interest to strategically link regional, local, and hyper-local work that leverages disciplinary expertise and local knowledge towards interdisciplinary solutions to complex challenges at the national scale.
- A new national cohort of researchers who have been trained in interdisciplinary best practices and have experience leading research teams in research synthesis and acceleration. Comments: By focusing on both synthesis and research acceleration, the NRSP12 positions participants to serve as national and global research leaders as SWGs provide the structure and support to rapidly make new connections across existing knowledge, and our proposal development and support (i.e., workshops, seed grants, travel grants, networking) provide the resources to help launch novel ideas into scientific successes and applied solutions to real-world challenges. This research network will capitalize on the decades of experience our PIs bring related to team science, interdisciplinary skills building, convergence science, and proposal development. The core structure of the NRSP12 is based on building and sustaining strong, collaborative, innovative teams of researchers through novel, engaging, and incentive-based opportunities (i.e. RSAAs). Our approach includes opportunities for faculty to continually develop and hone their interdisciplinary and collaborative soft skills and is structured to build a Train-the-Trainers approach so researchers involved in the NRSP12 can apply what they have learned beyond this research network at their home institutions.
- A high-visibility, easily accessible data platform for housing a diversity of urban data. Comments: The Urban Data Hub and Repository offer a unique service for centralizing and maintaining access to a breadth of interrelated urban data. The results of the archiving, visualizing, and training efforts funded here will support research efforts for decades to come.
- A viable plan for sustaining the NRSP12 network beyond the lifetime of this project. Comments: o Our efforts for building strong networks, training teams to conduct deep interdisciplinary research, curating and sharing urban data will create deep roots in our participant’s home organizations, institutionalizing core pieces of our network through a distributed support system. o By integrating NRSP12 within NUREC, a long-term sustainability plan is envisioned from the beginning which will ensure that OTT funds invested in NRSP12 will have a lasting impact on AES research and the land-grant university system. NUREC’s business plan to transition into a Research and Extension Consortium in consistent with this plan.

Management, Budget and Business Plan

Management and Organizational Structure

Steering Committee: NRSP12 will be managed by a steering comprised of the two IRN leads (Dr Dan Cronan and Dr Joshua Arnold), Data hub leadership (Chris Barnett), professional development leadership (Dr Julie Padowski and Dr Edgar Cardenas) and project director (Dr Brad Gaolach). The steering committee will meet virtually monthly for the first six months of the project, every other month for the balance of year 1, and then quarterly during years 2-5 of the project. The steering committee, advisory committee and external reviewer will meet in person annually. The steering committee will review progress and ensure that activities remain aligned with project goals and stakeholder needs. This committee also plays a role in evaluation oversight and in planning for sustainability (e.g., identifying opportunities to institutionalize parts of the project into existing national programs).

Advisory Committee: In addition to the AAs and NIFA representative, it will include representatives from research (Bret Hess, Executive Director AgInnovations – West); Extension (designee of the National Urban Extension Leaders, see Appendix 1: Letters of Commitment); Extension Foundation (TBN); National League of Cities (Dr. Chistine Baker-Smith, Director of Research, see Appendix 1: Letters of Commitment); National Association of Counties Large Urban County Caucus (TBN); and a representative from a non LGU urban serving university (TN). They will provide strategic guidance for the NRSP, review performance of the NRSP, provide a feedback loop to ESCOP, ECOP, and USDA and identify further action and /or communication needed to be shared with constituents and stakeholders. They will meet annually with the steering committee.

External Evaluation: We will employ an external evaluator throughout the project to measure the overall outcomes, successes, and challenges of the NRSP and identify areas for improvement. The evaluator will use qualitative, quantitative, and mixed methods; employing focus groups and individual in-depth interviews to collect primary data. Additional data will also be collected from the documents and other outputs developed as part of the NRSP activities. They will provide summative reviews in years 2 and 5. They will meet annually with the steering and advisory committees at a minimum and more frequently (virtually) as needed

Executive Team: NRSP12 will be administered within the National Urban Research and Extension Center (NUREC), which has been hosted by Washington State University since inception. This will allow integration with and leveraging of NURECs established research, Extension, and stakeholder connections. WSU currently provides fiscal administration of NUREC as well as overall organizational support for the Director (Brad Gaolach), operational management (Martha Aitken), an urban extension specialist and a project specialist. NRSP12 will have access to WSU's resources such as communications hosting and document repositories. The executive team, consisting of the project director, operations director and assistant, will meet weekly as part of NUREC's standing operations meeting to ensure smooth operation of the NRSP, that all milestones are being met, and support to all aspects of the NRSP are being provided.

Budget Justification

University of Massachusetts is requesting salary and benefits for 0.167 FTE annually for Dr Josh Arnold to provide leadership for the Urban Agriculture and Soils IRNs and annual travel to the in-person steering committee ($1,771). Dr Arnold is an agroecologist who combines research, Extension, and teaching to impact the health of cities and increase food security. Joshua specializes in integrated pest management, soils, and the social-ecological factors that influence and create urban agroecosystems. Total five-year salary requested for Dr. Arnold: $81,245 plus $25,430 benefits

Michigan State University is requesting salary and benefits 4 staff (cumulative 0.33 FTE) from the Toolbox Dialogue Initiative (TDI) to support the Research Synthesis and Acceleration (RSA) activities and travel for 1 person to the annual in-person steering committee meeting ($1,771). Total five-year salary requested: $182,243 plus $68,515 benefits

TDI has developed and provide training similar to the RSA activities to National Science Foundation projects (AceelNet, Convergence Accelerator, Growing Convergence Research Programs, EPSCoR and BEACON programs), NASA, the Swiss National Science Foundation, and 6 US based Institutions (5 LGUs).

Dr. Edgar Cardenas will lead activities focused on interdisciplinary training. He will contribute to the design and delivery of quarterly team science and research synthesis webinars, Link & Learn events focused on networking and idea cross-pollination, team science and participatory research capacity building activities, and office hours. He will also co-lead the development and management of Synthesis Working Groups (SWG) and serve as a reviewer for evaluating travel grant and seed grant competition applications. Dr. Cardenas will serve as the institutional lead for Michigan State University.

Dr. Michael O'Rourke will support Dr. Cardenas in designing interdisciplinary activities, co-managing SWGs, and in overseeing MSU contributions.

A Project Senior Specialist (TBN) will support Dr. Cardenas in designing and delivering all interdisciplinary training activities, including quarterly team science and research synthesis webinars, Link & Learn events focused on networking and idea cross-pollination, Team science and participatory research capacity building activities, and office hours. They will also participate in supporting the development of SWGs.

A Project Manager (TBN) will support Dr. Cardenas by scheduling and running planning meetings, scheduling events, coordinating with NRSP staff, and running budget and personnel reports and will coordinate with the NRSP project assistant.

University of Missouri is requesting funds to support 6 staff (cumulative 0.46 FTE annually) from the Center for Applied Research and Engagement Systems (CARES); travel for 1 person to the annual in-person steering committee meeting ($1,771; software licensing ($4,500 in years 1 and 3-5 and $6,500 in year 2); and $9,000 for additional computer storage in year 1. Total five-year salary requested: $182,402 plus $70,775 benefits.

CARES will provide leadership for the Urban Data Hub. CARES develops and hosts web-based resources that support access to thousands of geographic data sets, supports tools that provide tailored insight into data impacting local condition, and provides information and tools with the goal of helping communities obtain and understand how to use data to better support decision making. Over the last three decades, CARES has worked with state and federal agencies, researchers and non-profits, and local communities and organizations, to better visualize and communicate issues in a manner that supports informed decision-making. https://extension.missouri.edu/programs/cares/. Since 1992, CARES has collaborated on projects with support from several foundations, non-profit organizations, government agencies, and partnering university researchers. Selected funders include Robert Wood Johnson Foundation, WK Kellogg Foundation, Kaiser Permanente, National Science Foundation, US Department of Agriculture, Environmental Protection Agency, US News, Missouri Department of Economic Development, and the Missouri Department of Natural Resources. Through these collaborations, CARES has developed a significant portfolio for data collection and management, web-based content delivery, and spatial analysis.

Chris Barnett, CARES Director, will direct implementation of the Urban Data Hub and Urban Research Repository, collaborate with project partners, oversee CARES staff assignments and budget allocations, and contribute to project evaluation and distribution of results.

Project Coordinator (TBN) will support the CARES Director on management of the project, oversee daily project operations, coordinate with project partners on project issues and milestones, and assist with project reporting and evaluation.

Data and Database (TBN)staff will identify and integrate the data supporting the project systems, design and support an optimal database structure, implement and maintain map and report content, and manage data-related website content.

Programmer and website developer (TBN) staff will design and implement project system web interfaces, ensure compliance with digital accessibility and other applicable standards, develop programs supporting Urban Data Hub tools, and collaborate with broader project staff on Hub review and modifications.

Fiscal and systems administer (TBN) staff will ensure project systems are current and compliant with standards, set up required data storage and management systems, and collaborate with project management and University of Missouri fiscal officers on project expenditures and fiscal reporting.

Communications staff will be responsible for website content development, supporting communications events, and preparing reports and user support documents.

Washington State University is requesting funds to support:

Personnel:

- 5 staff (cumulative 0.97 FTE annually (1.01 in year 1) Total five-year salary requested: $499,415 plus $196,422 benefits.
- $407,776 ($77,772 annually) for 2 Synthesis Working Group Fellows (graduate RAs)

Travel

- $50,000 ($10,000 annually) in travel grants for researchers to participate in RSA activities
- $281,000 (56,200 annually) to host (all expenses covered) 25 persons to attend Synthesis Working Group workshops (conference rooms, travel, lodging, meals)
- 11 persons to travel to annual in-person meetings (including evaluator and advisory committee members). ($19,481 annually)

Other

- $200,000 for seed grants ($50,000 in years 2-5; 5 per year, $10,000 each)
- $9,000 annually for open access publication fees;
- $4,932 average annually for an external evaluator:
- $3,000 single time for purchase of Owls for video conferences (year 1);
- $2,000 in years 2-5 for virtual conference platform (Gather.Town):
- $3,000 annually for HubSpot CRM software;
- $288 annually for data cloud storage;

Personnel details

Dr. Dan Cronan, Assistant Professor in the School of Design and Landscape Architecture at WSU. He is providing leadership for the Built Environment IRN. Dr. Cronan's research interests include Landscape Planning and Landscape Architecture with an emphasis: Food, Energy, and Water Systems (FEWS); Alternative Futures Landscape Analysis (GeoDesign Scenario Planning); Agricultural and Stormwater Best Management Practices (BMP) siting, sizing, and implementation; Urban Sustainability; Urban Ecology; Landscape Planning and Site Planning; and Sustainable construction practices for Landscape Architects; Landscape Planning and Systems suitability analysis and geospatial analytical tools; and Landscape Architecture pedagogical evaluation tools. He was a team lead and member on an NSF INFEWS grant (# 1639529), contributing scenario modeling and planning to align stakeholder perspectives and researcher-based trajectories of change. The scenario-based land use projections are intended to provide guidance for community planning and a framework for future development in socio-ecological systems, specifically food systems within the urban and rural context.

Dr. Julie Padowski will coordinate all RSAA activities. She will support MSU in interdisciplinary training, co-design Link & Learn events focused on networking and idea cross-pollination and co-lead the development and management of Synthesis Working Groups (SWG). She will oversee the travel grant and seed grant competition process.

Padowski serves as the Director for WSU's Center for Environmental Research, Education, and Outreach (CEREO) https://cereo.wsu.edu/about_us/, and is a Research Associate Professor with the School of the Environment. Through her work with CEREO, Padowski brings a decade of experience working with students, faculty, staff, administrators, and community partners in advancing interdisciplinary, environmental scholarship and engagement through grant-funded projects. She specializes in approaches that use **systems thinking** and **community engaged scholarship strategies** to develop flexible, collaborative structures that bring thought leadership, convene and support multi-, inter-, and transdisciplinary research projects, and will leverage this expertise to build integrated opportunities for research, education, and outreach through the NRSP. She has been a PI or Co-PI on 23 grants since 2017 that have collectively brought in $21M in grant-related funding. Notable projects of Padowski's include an NSF Sustainable Regional Systems Research Network grant entitled" Transforming Rural-Urban Systems: Trajectories for Sustainability in the Intermountain West (#2115169); an NSF Research Experiences for Undergraduates program entitled "**Stakeholder Informed Modeling of Innovations in the Food, Energy, and Water (FEW) Nexus** "(#1950877) ; and an NSF INFEWS/T1 grant entitled **Increasing regional to global-scale resilience in Food-Energy-Water systems through coordinated management, technology, and institutions (#**1639458), and a NSF NRT graduate training program award entitled, Rivers, Watersheds and Communities: **Training an Innovative, Cross-Sector Workforce for Equitable, Multi-Scale Decision-Making Towards Human and Ecosystem Health (#**2125758**)**.

Dr Brad Gaolach will serve as the project director. He is the founding director of the National Urban Research and Extension Center (NUREC) and WSU's Metropolitan Center for Applied Research and Extension both focusing on bridging the gap between research and community through extramurally funded project, NSF and USDA funded workshops, and listening sessions.

Dr Gaolach is trained as a population biologist and community ecologist; he is recognized for bringing systems and sustainability-based approaches to community-based applied research and education programs. Dr. Gaolach utilizes his training as a research scientist and ecologist to bridge the world of academia with community-based applications. He provides leadership on Center projects related to environmental stewardship, systems thinking, and organizational development. He has additionally conducted applied research and developed extension programs relating to water quality, climate change, agriculture, food systems, and community and economic development.

Martha Aitken will support operations of the NRSP across all universities; ensuring successful operational and administrative collaboration amongst all project partners and subcontractors, including primary oversight over fiscal and contract matters related to the NRSP. Ms. Aitken has performed these activities for over 20 years with WSU.

Maggie Anderson will provide broad-based support to the project, supporting the IRN leads in scheduling meetings, events, and coordination with RSA activity participants. Ms Anderson currently performs these activities on NUREC projects, including their Knowledge and Practice Networks and grant-funded projects.

Business Plan

NRSP12 will be **hosted by Washington State University (WSU)**, within NUREC. WSU is providing significant in-kind support (staff time, fiscal management, integration into WSU operational and management systems, office space, etc.) to ensure the success of NUREC and NRSP12, reflecting a strong institutional commitment to this initiative. NRSP12 Director (Dr. Gaolach) will oversee day-to-day operations, coordination among teams, and serve as the primary liaison to the NRSP governing bodies.

With long-term sustainability in mind, financially, NRSP12 will operate within the NUREC business plan which currently includes Smith-Lever funding, NUREC membership dues ($70,000 in annual), external grants, and in-kind contributions. While NUREC is currently modest in size (0.6 FTE) and fiscal revenue (membership dues plus active grant projects), it is organizing as a Research and Extension Consortium to increase its capacity to develop fiscal resources from corporate and philanthropic sources. The synergistic activities of NUREC and NRSP12 will provide a strong foundation to build a research and extension consortium from. NUREC's goal is to grow LGU institutional memberships from the current 14 to over 25, with a target of at least 5 institutions from each of the 4 geographic regions of AgInnovations / ECOP (west, south, northeast, and north central) as well as membership from non-LGU urbans serving universities. NUREC's business plan also includes working through our USDA federal partnership to facilitate fiscal opportunities with other federal agencies (e.g. HUD, EPA, NOAA) to support existing and developing new IRNs.

NUREC has established an MOU with the National League of Cities around core pillars of synthesis **and acceleration** and **best practices development and expansion**. This MOU will be used to mutually develop revenue streams to conduct research and extension projects to augment NRSP12 and base NUREC funding – either through joint funding opportunities (e.g. grants) or direct funding from NLC to NUREC to complete targeted research projects (see Appendix 4: MOU between NLC and NUREC). NUREC's business plan is to develop this fiscal and programmatic (research and extension) model with NLC and then replicate it in similar ways with the National Association of Counties' Large Urban County Caucus as near-term growth opportunities.

Integration

Integration with Extension is a core design feature of NRSP12, ensuring that research results translate into on-the-ground impact. The project's housing within **NUREC (National Urban Research and Extension Center)** provides a structural link to Extension from the start, as NUREC's mission is explicitly to bridge research and practice in urban areas. We will leverage NUREC's existing networks and partnerships (such with the National Urban Extension Leaders (NUEL) and National League of Cities (NLC)) to disseminate NRSP12 insights widely. The goal is that every research activity also has an outreach pathway, and every Extension activity is informed by current research.

Key strategies for Extension integration include:

- **Extension Representation in Leadership and IRNs:** Extension professionals are part of the leadership team and Advisory Committee of NRSP12 and are actively involved in each Integration Research Node. For example, each IRN's core committee will include at least one Extension specialist or agent from a land-grant institution. This ensures Extension perspectives (such as the feasibility of applying research recommendations in community programs) shape the research from the beginning. Extension members also act as liaisons to state and local Extension networks, communicating needs and findings in both directions.
- **Urban Extension Program Development:** Applied research projects undertaken through NRSP12 will be connected to urban Extension programming from the outset. If a research team is, say, developing a new soil testing protocol for urban gardens, we will coordinate with Extension educators to pilot that protocol in urban gardening programs and gather feedback. Similarly, if research identifies a successful intervention (e.g., a particularly effective design for a community cooling center or a high-yield rooftop farming technique), NRSP12 and / or NUREC will help package those findings into **Extension curricula, toolkits, or demonstration projects** that can be delivered by Extension in cities nationwide. By weaving research and Extension together, we accelerate the adoption of innovations.
- **National Urban Extension Leaders (NUEL) Partnership:** We will maintain a close partnership with NUEL, which is a network of 1,300+ urban-focused Extension professionals across the country. The NRSP12 Director (who is also NUREC Director) sits on the NUEL Steering Committee, which facilitates ongoing exchange of information. Through NUEL, we will share NRSP12 outputs (datasets, case studies, policy briefs) with Extension leadership in all Extension regions. NUEL's biannual National Urban Extension Conference and other forums will be used to showcase NRSP12 projects and glean input on emerging urban issues that research should address. NUEL has agreed to have an urban research track in the conference to highlight research from the NRSP
- **Community Outreach and Engagement:** The project will follow best practices for community engagement, emphasizing respect, mutual benefit, and transparency. We will promote and support the use tools like **community advisory boards** for certain research projects, and create accessible outreach materials (such as fact sheets or neighborhood workshops) to share results in non-technical language. Extension personnel will be crucial in translating scientific findings into culturally relevant outreach and education materials. The Urban Data Hub will also have a public-facing component that allows community users to access information (for example, a community group could use the map room to visualize conditions in their neighborhood). In this way, the Hub supports outreach by serving as a data resource for the public, facilitated by Extension.
- **Feedback Loop from Practice to Research:** Integration with Extension not only helps push research out, but also pulls community needs in. Through Extension's on-the-ground connections, NRSP12 will stay attuned to the evolving needs and questions that urban communities have. For example, if Extension agents report increasing inquiries about urban pollinator conservation or safe techniques for rooftop gardening, the NRSP can respond by encouraging research in those areas. This responsiveness to community-voiced issues helps keep the NRSP relevant and demand-driven.

Overall, Extension integration ensures that NRSP12 remains **firmly grounded in application**. Success will be measured not just by academic outputs, but by evidence of use – city agencies using data from the Hub to make decisions, community gardens adopting new practices from our research, or new Extension programs (like urban soil health workshops) launched as a result of NRSP12 findings. By embedding Extension throughout the project, we will bridge the notorious gap between research and practice, fulfilling the "extension" of knowledge that is the hallmark of the LGU system.

Outreach, Communications and Assessment

Intended Audiences

Our target audiences include:

- The scientific community at land-grant universities; urban serving universities; local, state, federal, and tribal governmental agencies. This would include graduate students and postdoctoral researchers and fellows.
- Policy makers at local, state, federal agencies and their associated organizations such as the National League of Cities as a conduit to their members nationally and tribal governmental agencies.
- Extension and other non-governmental organizations / practitioners at local, state, and national levels.

In addition to fostering high quality urban research, this NRSP complements the mission of NUREC to bridge the gap between community and research and support the translation and application of that research by Extension.

Stakeholder Engagement

Primary stakeholder engagement will be through participation in the NRSP12 activities (e.g. research synthesis and acceleration activities (RSAAs), professional development activities, integrated research networks, and the data hub). The IRN leads will engage the research community through existing professional connections, the researchers who have provided letters of commitment in Appendix 2, through relevant professional societies and their meetings (e.g. American Ecological Engineering Society) as well as through regional AES networks. We will leverage our practitioner connections (e.g. National Urban Extension Leaders, National League of Cities, Landscape Architecture Foundation) to incorporate them into IRNs and project activities; thereby connecting researchers and communities to identify and prioritize research that is important to both, and then elevate those issues for collaborative problem solving, program development and dissemination of results and products. This approach will ensure an on-going feedback loop of evaluating NRSP activities, how they are being used by stakeholders, and how they are supporting researchers' needs.

NUREC has established Knowledge and Practice Networks for the Built Environment and Urban Agriculture and Food Systems with established engagement with relevant stakeholders (e.g. the Built Environment Rx: web series [44] engaged 285 individuals during the first 4 events: https://nurec.extension.org/portfolio-item/built-environment-rx-series/). NUREC will leverage these existing engagement activities to promote NRSP12 opportunities and track engagement

NUREC has established a customer relationship management (CRM) system with currently over 1,700 researchers, policy makers, practitioners, industry members and use it to actively engage with and track engagement in activities. NUREC will use this CRM to build and track stakeholder engagement with NRSP activities. NUREC will incorporate NRS12 into their website (http://nurec.extension.org), directly connect to the Data Hub elements housed on the CARE website in a seamless fashion, and showcase NRSP activities, products, and accomplishments.

Measuring Accomplishments and Impacts

Evaluation and accountability: NRSP12 will bring a holistic evaluation framework to bear that supports integrated tracking (participation, datasets contributed or used, collaborations formed, outputs, stakeholder use cases) and a mid-term external review to ensure the support functions are effective and responsive. The evaluation plan is designed to monitor progress toward three primary outcomes: fostering national and cross-institutional research collaboration, improving the quality and accessibility of urban ecosystem and agriculture data, and accelerating the development and dissemination of high-quality research. See Appendix 3: Evaluation Plan Overview for additional detail

To measure these outcomes, the plan integrates process evaluation (ongoing monitoring) and summative evaluation (mid-term and final assessments).

Process evaluation

We will include assessing the extent to which project activities (IRN development and activities; Data Hub development and utilization; and professional development offerings) are advancing toward the goals. IRN development and collaborative work will be assessed using meeting agendas, minutes, and a description of the IRN composition, deliverables (e.g., standardized metrics developed) and incubation projects supported. The Data Hub and Repository will create a data and research project inventory to establish a baseline rate of utilization overall and by key stakeholder characteristics. Utilization of the Data Hub and repository by stakeholder characteristics will also be assessed using database analytics. Professional development offerings will be assessed using rates of registration, participation, satisfaction, and pre/post assessments of knowledge, self-efficacy, and intention to implement skills. Annual surveys, listening sessions, and/or case studies will be used to understand needs and utilization of IRN, Data Hub, and professional development offerings. Hubspot will be used to track participation in IRN and professional development offerings and will house data to be utilized as a sampling frame for annual surveys, listening sessions, and/or case studies for mid-project and long-term outcomes.

Summative evaluation

We will assess long-term impact through indicators such as adoption of IRN frameworks by stakeholder groups, utilization of IRN-developed best practices, number of developed and funded research projects, and publications in high-impact journals among those participating in professional development offerings and/or using Data Hub resources. Comparative analyses will examine differences in research development and dissemination (e.g., acceptance rates by journals and impact factors) overall and by stakeholder type, region, and utilization of the project's resources (high vs. low) levels, as well as against publications rates identified in the peer-reviewed literature. Case studies and interviews will provide deeper insights into how IRNs, the Data Hub, and training activities influence the longer-term outcomes. Annual surveys, listening sessions, and/or case studies will also be used to understand how the IRNs, Data Hub, and professional development offerings supported the development of research, adoption of best practices or IRN frameworks, and the faster dissemination of research to peer-review.

Specific Metrics include:

- Rates of participation by participant and organizational characteristics (e.g., tenure status, LGU type, expertise, state, EAS region); stakeholder type
- # of incubation projects identified and/or supported overall and by IRN areas and by stakeholder type
- Research agenda and best practices development by meeting agenda, minutes, action items completed; # of RFAs responded to within research agenda topical areas; # of and type of best practice offerings developed and disseminated
- Annual survey and/or listening sessions to identify research gaps and support needs of stakeholders
- #, %, rates of change related to adoption/implementation of IRN frameworks key stakeholders overall and by AES region
- Rates of best practices utilization in research publications or products
- # of submitted and funded research projects within research agenda topical areas
- # of publications by type (e.g., technical bulletins, policy briefs, high impact factor journals) and response of journal (e.g., desk acceptance, major revision, minor revision)
- Annual surveys, case studies, and/or interviews with stakeholders to assess the extent to which goals were achieved
- Create an inventory of research projects
- #/% changes in products available to researchers and stakeholders (type, topic area)
- Rates of product utilization and by user characteristics (LGU/org type; researcher type/tenure). For example, the Data Hub will include features to help track performance and products by loggin key metrics such as the number of datasets contributed, the usage statistics of the platform, the collaborative projects and proposals that emerge, and policy or community applications informed by Hub data.
- #/% of cross-institutional research projects using Hub
- # of standardized metrics developed and utilized overall, by IRN area, and by service user characteristics
- # of funded research projects using Data Hub products
- # of publications or funded proposals using Data Hub products
- # of publications in high impact factor journals and response of journal (e.g., desk acceptance, major revision, minor revision)
- Changes in rates of participation with professional development offerings overall and by stakeholder type
- Participant characteristics (e.g., LGU type, tenure status); stakeholder type
- Pre/Post tests to examine changes in knowledge, beliefs, and behavior intention
- Participant satisfaction ratings
- Identification of needs through interviews or listening sessions
- Annual needs assessment and service utilization survey
- # and rate of research proposals development overall and by high and low-service user
- # and rate of publications in high impact factor journals compared to national averages identified in the peer reviewed literature
- # and rate of publications in high impact factor journals overall and by high and low service user
- # of abstracts submitted, accepted, or invited overall and by high and low service users

Stakeholder Advisory Feedback: In addition to formal evaluation, we will maintain an **Advisory Committee** (including representatives from participating SAES institutions, Extension, and external urban stakeholders) that meets at least annually to review progress. They will examine data such as the usage of the Data Hub, participation stats, and examples of research or extension success, and provide feedback and guidance. Having this external perspective built-in will keep us accountable to the broader community and help flag any issues early.

Strategic Plan and Methodology

This NRSP will operate as a **research synthesis and acceleration network**, structured to generate tangible outputs within the first two years while building capacity for long-term research coordination. The strategic plan is organized around three interrelated components: (1) formation of Integrated Research Nodes (IRNs), (2) research synthesis and acceleration activities, and (3) professional development and seed grant mechanisms that catalyze collaborative research.

Formation of Integrated Research Nodes (IRNs)

Strategy:
We will establish three thematic IRNs focused on (a) Urban Soils, (b) Nature-Based Solutions (NbS) and Ecosystem Services, and (c) Urban Agriculture and Food-Energy-Water (FEW) Systems. Each IRN will be co-led by faculty from land-grant universities and supported by Extension professionals and external partners (e.g., National League of Cities, NACo).

Methodology:

- Convene IRN launch workshops in Year 1 to identify shared research questions, knowledge gaps, and priority metrics.
- Develop governance frameworks for each IRN, including leadership roles, decision-making processes, and annual work plans.
- Expand IRN membership by Year 2 to include at least 30 researchers across six or more LGUs, ensuring disciplinary diversity and institutional buy-in.

Synthesis and Data Integration

Strategy:
We will employ a research coordination model modeled on NSF Research Coordination Networks and synthesis centers. The Urban Data Hub will serve as the integrative platform for sharing, synthesizing, and visualizing research data.

Methodology:

- **Phase 1 (Year 1):** Launch a beta version of the Hub prioritizing up to 10 key topics to promote with maps, data, and resources around the priority themes (urban soils, NbS, urban agriculture). In this initial phase, we will focus on assembling readily available, high-value datasets (for example, a nationwide urban soil lead contamination dataset, a tree canopy cover dataset for several cities, USDA urban ag census data, etc.) and building the core mapping interface. Users will be able to visualize data layers, overlay their own local data points, and generate basic reports (charts, maps) to support research planning. Feedback from beta users will be gathered to improve functionality. We will also work with the Synthesis Working Group to visualize and archive outcomes from the group's efforts. We anticipate this will include merging and rescaling of existing data, and the generation of new data based on the results generated by the in-person workshop.
- **Phase 2 (Year 2):** Expand the Hub's content and capabilities. By the end of Year 2, we aim to support data and resources for at least 25 key topics spanning additional cities and variables, and to implement robust metadata standards for all data (using, for example, Dublin Core or ISO standards for geospatial data). A key feature introduced in Phase 2 will be the **Urban Research Repository** to house **user data contributions**. Researchers will be able to upload their own datasets (e.g., results from a multi-state urban soil experiment) through a guided submission process ensuring standardized formatting and documentation. The Repository will accommodate data in a variety of formats, including spatial, and will support integration with other Hub components. We will also initiate **training workshops** and tutorials to promote the Hub's use – showing the community how to find data, add data, and use the mapping tools in their research and Extension work. Participants will get NRSP credits for contributing datasets (see Research Synthesis and Acceleration Activities Section), accumulated credits are used to weight applications for seed grant and travel grant opportunities. In addition, these efforts will drive adoption so that the Hub becomes an active, living resource.
- **Synthesis Workshops:** Each IRN will convene annual workshops to synthesize existing knowledge, identify common indicators, and draft white papers.
- **National Symposium (Year 2):** Convene a cross-IRN synthesis meeting to integrate findings and define standardized metrics for urban soils, NbS, and urban agriculture.
- **Outputs:** By the end of Year 2, the network will produce at least three white papers (one per IRN), submitted as peer-reviewed technical reports or journal articles.

Professional Development and Seed Grants

Strategy:
Capacity-building will be delivered through training programs led by the Toolbox Dialogue Initiative (MSU) and CEREO (WSU), paired with a competitive seed grants program that funds pilot research aligned with NRSP objectives.

Methodology:

- **Training:** Offer professional development workshops and webinars on systems thinking, resilience frameworks, team science, scenario planning, and community-based research methods.
- **Seed Grants (Year 2):** Allocate $50,000–$75,000 annually to support 6 pilot projects across the three IRNs. Pilot projects will generate preliminary data, methods, or partnerships that can feed into competitive external proposals.
- **Evaluation:** Year 1 will establish baseline metrics; Year 2 will assess outputs such as publications, data hub adoption, and grant submissions.

Two-Year Milestones and Deliverables

Year 1:

- Milestones: Establish 3 Research IRNs; Launch beta Data Hub; Host professional development workshops
- Deliverables: 3 IRN launch workshops; draft outlines for 3 white papers; beta Data Hub with ≥10 datasets; training modules and proceedings

Year 2:

- Milestones: Convene national synthesis symposium; Publish white papers; Expand Data Hub; Launch seed grants
- Deliverables: 3 white papers submitted; ≥25 datasets in Data Hub; 6 seed projects funded; ≥5 competitive grant proposals submitted; symposium proceedings published; 100+ registered Data Hub users; documented institutional buy-in through letters of support, co-funding, and in-kind contributions

Communication Pieces

We will produce an annual report that provides a comprehensive accounting of NRSP12 activities, accomplishments, outcomes, and impacts along with 1-page overviews for each of the IRNs, seed-grant projects, and data hub elements. These will be provided to the Review Committee, NIFA, SAES and ARD directors and shared through the NIMSS system, with the all members of the NRSP, on the NRSP webpage and with regional executive directors for both AgInnovations and Extension, other stakeholders, and to use as recruitment and engagement mechanisms for new participants.
Where possible, we will also publish or present on our evaluation approach and lessons learned (e.g., sharing how the IRN model worked, through venues like the Journal of Extension or at the AEA conference for evaluators). This contributes to the knowledge base on how to effectively evaluate transdisciplinary, networked projects

Data Management Plan

The Urban Data Hub will be developed and housed on University of Missouri (MU) Center for Applied Research and Engagement Systems (CARES) supported systems. The Urban Data Hub will consist of an Urban Map Room and a Research Repository.

The Urban Map Room will leverage existing national data repositories at CARES consisting of thousands of mappable data layers. The data layers comprise geographic information stored in ESRI geodatabases, SQL Server, and MySQL databases or accessed via standard data sharing protocols (open map services, APIs, etc.). These data are based on common data resources, such the American Community Survey, and include current and (limited) historical data. A complete listing of data layers can be found at https://allthingsmissouri.org/atm-map-data-list/.

The data will be maintained by CARES staff, who will integrate updated information on a regular basis, including acquisition and integration of new data, preparation of map symbolization, documentation of new data, and development of map services. CARES will be responsible for ensuring data security and backup and will collaborate to identify and integrate information directly supporting urban research. No personally identifiable

The Map Room will also support integration of local data developed by researchers. The supported formats for this information include standard geographic data formats (shapefiles, KML/KMZ files, or geojson data), spreadsheet data that can be associated with common geographic features (e.g. counties) based on a standard geographic identification code, and geocodable address data. Researchers submitting data will be required to participate in a short training event, certify that the information they are providing does not include PII, enter basic metadata for each dataset uploaded, provide citation and sharing permissions, and develop mapping symbology for their data set. Tools and assistance for the latter will be provided. All data submissions will be conducted using a secure, permissions-based interface and will be reviewed for content before being made publicly accessible in the Map Room.

All mapping data will be publicly accessible through a mapping interface that allows for discovery, display, and interaction with available map layers. The interface will include tools for overlay of multiple data layers, data query and selection, discovery of metadata, generation of map outputs (JPG, GIF, PNG, and PDF formats), and map sharing (via email or social media). Logged in users will be able to save maps and retrieve maps previously constructed within the Map Room.

A chief component of the Map Room will be the reporting tools, which will provide indicator-based reports for an identified geographic area. A list of supported indicators will be developed for Map Room users to select and build custom reports and logged in users will be able to generate and save reports on the system. All users will be able to download reports in PDF or Microsoft Word formats.

The Research Repository (RR) will be designed to include systems for submitting and documenting urban research, storing and cataloging submitted research, and allowing user discovery and retrieval of research documentation.

Research descriptions will be collected through a standardized, login only, WordPress-based interface and stored in a MySQL database. Researchers will be asked to provide standard information about their research, including (but not limited to) information on subject, sponsors, methods, findings and publications. A standard taxonomy related to research description will be developed to aid data entry and facilitate data query. Researchers will also supply citation information and use permissions and will be able to update the information submitted. Researchers will have the ability to provide links to research websites and online publications related to their projects. Optionally, researchers can submit a photograph related to their research for inclusion in search results. The information submitted to the RR will be immediately available for user discovery, but CARES staff will exercise the ability to remove or block public access to submitted data as warranted.

User discovery tools will consist of an interface allowing users to search, filter, and sort information within the RR. Information will be displayed as an array of tiles with basic information that can be selected by the user for display of the complete information related to the urban research project. The user will have the option to mark a particular project as research of interest. It is anticipated that users will select multiple research projects of interest, or even all results of their query, for further action. The user will then be able to generate and download a formatted report (PDF or similar) of all projects of interest with basic research information included.

An optional login for the user discovery tools will be designed and implemented. Logged in users will be able to save and return to their queries, so that as more research is added to the RR over time, their results will automatically update. In addition, these logged in users will be able to save their search results reports and use them in the future to link directly to the full research project description stored in RR.

User support and training materials will be developed and made available within the RR. Regular backup of the systems and data will be supported, and systems security scans and compliance will be provided in collaboration with the University of Missouri Division of Information Technology.

Distribution of Results

The primary mechanism for distributing results will be through NRSP12 and the project website on the NUREC website, which will include access to the RR. Outreach and engagement efforts will drive traffic to the website so it will be seen as the primary portal to engage with and from which to access results. We will also present the results at scientific discipline related professional meetings and annual meetings of stakeholders. We are intentionally choosing not to host our own NRSP12 related annual meetings of stakeholders as we feel there are enough existing venues. Instead of competing for participation, we think that resources could be better, and more effectively, spent by engaging stakeholders at their respective meetings and demonstrating how we support their work and missions (e.g. the National League of Cities annual City Summit and the National Urban Extension Conference).

We will engage with and distribute materials to appropriate organizations and committees within the land-grant system, to include the Executive Director for each of the regional AgInnovations and Extension Directors associations, for dissemination across the research and Extension networks; appropriate APLU committees; Extension Committee on Organization and Policy (ECOP); and the National Urban Extension Leaders.

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Outreach Plan

Intended Audiences

Our target audiences include:

- The scientific community at land-grant universities; urban serving universities; local, state, federal, and tribal governmental agencies. This would include graduate students and postdoctoral researchers and fellows.
- Policy makers at local, state, federal agencies and their associated organizations such as the National League of Cities as a conduit to their members nationally and tribal governmental agencies.
- Extension and other non-governmental organizations / practitioners at local, state, and national levels.

In addition to fostering high quality urban research, this NRSP complements the mission of NUREC to bridge the gap between community and research and support the translation and application of that research by Extension.

Stakeholder Engagement

Primary stakeholder engagement will be through participation in the NRSP12 activities (e.g. research synthesis and acceleration activities (RSAAs), professional development activities, integrated research networks, and the data hub). The IRN leads will engage the research community through existing professional connections, the researchers who have provided letters of commitment in Appendix 2, through relevant professional societies and their meetings (e.g. American Ecological Engineering Society) as well as through regional AES networks. We will leverage our practitioner connections (e.g. National Urban Extension Leaders, National League of Cities, Landscape Architecture Foundation) to incorporate them into IRNs and project activities; thereby connecting researchers and communities to identify and prioritize research that is important to both, and then elevate those issues for collaborative problem solving, program development and dissemination of results and products. This approach will ensure an on-going feedback loop of evaluating NRSP activities, how they are being used by stakeholders, and how they are supporting researchers' needs.

NUREC has established Knowledge and Practice Networks for the Built Environment and Urban Agriculture and Food Systems with established engagement with relevant stakeholders (e.g. the Built Environment Rx: web series [44] engaged 285 individuals during the first 4 events: https://nurec.extension.org/portfolio-item/built-environment-rx-series/). NUREC will leverage these existing engagement activities to promote NRSP12 opportunities and track engagement

NUREC has established a customer relationship management (CRM) system with currently over 1,700 researchers, policy makers, practitioners, industry members and use it to actively engage with and track engagement in activities. NUREC will use this CRM to build and track stakeholder engagement with NRSP activities. NUREC will incorporate NRS12 into their website (http://nurec.extension.org), directly connect to the Data Hub elements housed on the CARE website in a seamless fashion, and showcase NRSP activities, products, and accomplishments.

Measuring Accomplishments and Impacts

Evaluation and accountability: NRSP12 will bring a holistic evaluation framework to bear that supports integrated tracking (participation, datasets contributed or used, collaborations formed, outputs, stakeholder use cases) and a mid-term external review to ensure the support functions are effective and responsive. The evaluation plan is designed to monitor progress toward three primary outcomes: fostering national and cross-institutional research collaboration, improving the quality and accessibility of urban ecosystem and agriculture data, and accelerating the development and dissemination of high-quality research. See Appendix 3: Evaluation Plan Overview for additional detail

To measure these outcomes, the plan integrates process evaluation (ongoing monitoring) and summative evaluation (mid-term and final assessments).

Process evaluation

We will include assessing the extent to which project activities (IRN development and activities; Data Hub development and utilization; and professional development offerings) are advancing toward the goals. IRN development and collaborative work will be assessed using meeting agendas, minutes, and a description of the IRN composition, deliverables (e.g., standardized metrics developed) and incubation projects supported. The Data Hub and Repository will create a data and research project inventory to establish a baseline rate of utilization overall and by key stakeholder characteristics. Utilization of the Data Hub and repository by stakeholder characteristics will also be assessed using database analytics. Professional development offerings will be assessed using rates of registration, participation, satisfaction, and pre/post assessments of knowledge, self-efficacy, and intention to implement skills. Annual surveys, listening sessions, and/or case studies will be used to understand needs and utilization of IRN, Data Hub, and professional development offerings. Hubspot will be used to track participation in IRN and professional development offerings and will house data to be utilized as a sampling frame for annual surveys, listening sessions, and/or case studies for mid-project and long-term outcomes.

Summative evaluation

We will assess long-term impact through indicators such as adoption of IRN frameworks by stakeholder groups, utilization of IRN-developed best practices, number of developed and funded research projects, and publications in high-impact journals among those participating in professional development offerings and/or using Data Hub resources. Comparative analyses will examine differences in research development and dissemination (e.g., acceptance rates by journals and impact factors) overall and by stakeholder type, region, and utilization of the project's resources (high vs. low) levels, as well as against publications rates identified in the peer-reviewed literature. Case studies and interviews will provide deeper insights into how IRNs, the Data Hub, and training activities influence the longer-term outcomes. Annual surveys, listening sessions, and/or case studies will also be used to understand how the IRNs, Data Hub, and professional development offerings supported the development of research, adoption of best practices or IRN frameworks, and the faster dissemination of research to peer-review.

Specific Metrics include:

- Rates of participation by participant and organizational characteristics (e.g., tenure status, LGU type, expertise, state, EAS region); stakeholder type
- # of incubation projects identified and/or supported overall and by IRN areas and by stakeholder type
- Research agenda and best practices development by meeting agenda, minutes, action items completed; # of RFAs responded to within research agenda topical areas; # of and type of best practice offerings developed and disseminated
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We will establish three thematic IRNs focused on (a) Urban Soils, (b) Nature-Based Solutions (NbS) and Ecosystem Services, and (c) Urban Agriculture and Food-Energy-Water (FEW) Systems. Each IRN will be co-led by faculty from land-grant universities and supported by Extension professionals and external partners (e.g., National League of Cities, NACo).

Methodology:

- Convene IRN launch workshops in Year 1 to identify shared research questions, knowledge gaps, and priority metrics.
- Develop governance frameworks for each IRN, including leadership roles, decision-making processes, and annual work plans.
- Expand IRN membership by Year 2 to include at least 30 researchers across six or more LGUs, ensuring disciplinary diversity and institutional buy-in.

Synthesis and Data Integration

Strategy:
We will employ a research coordination model modeled on NSF Research Coordination Networks and synthesis centers. The Urban Data Hub will serve as the integrative platform for sharing, synthesizing, and visualizing research data.

Methodology:

- **Phase 1 (Year 1):** Launch a beta version of the Hub prioritizing up to 10 key topics to promote with maps, data, and resources around the priority themes (urban soils, NbS, urban agriculture). In this initial phase, we will focus on assembling readily available, high-value datasets (for example, a nationwide urban soil lead contamination dataset, a tree canopy cover dataset for several cities, USDA urban ag census data, etc.) and building the core mapping interface. Users will be able to visualize data layers, overlay their own local data points, and generate basic reports (charts, maps) to support research planning. Feedback from beta users will be gathered to improve functionality. We will also work with the Synthesis Working Group to visualize and archive outcomes from the group's efforts. We anticipate this will include merging and rescaling of existing data, and the generation of new data based on the results generated by the in-person workshop.
- **Phase 2 (Year 2):** Expand the Hub's content and capabilities. By the end of Year 2, we aim to support data and resources for at least 25 key topics spanning additional cities and variables, and to implement robust metadata standards for all data (using, for example, Dublin Core or ISO standards for geospatial data). A key feature introduced in Phase 2 will be the **Urban Research Repository** to house **user data contributions**. Researchers will be able to upload their own datasets (e.g., results from a multi-state urban soil experiment) through a guided submission process ensuring standardized formatting and documentation. The Repository will accommodate data in a variety of formats, including spatial, and will support integration with other Hub components. We will also initiate **training workshops** and tutorials to promote the Hub's use – showing the community how to find data, add data, and use the mapping tools in their research and Extension work. Participants will get NRSP credits for contributing datasets (see Research Synthesis and Acceleration Activities Section), accumulated credits are used to weight applications for seed grant and travel grant opportunities. In addition, these efforts will drive adoption so that the Hub becomes an active, living resource.
- **Synthesis Workshops:** Each IRN will convene annual workshops to synthesize existing knowledge, identify common indicators, and draft white papers.
- **National Symposium (Year 2):** Convene a cross-IRN synthesis meeting to integrate findings and define standardized metrics for urban soils, NbS, and urban agriculture.
- **Outputs:** By the end of Year 2, the network will produce at least three white papers (one per IRN), submitted as peer-reviewed technical reports or journal articles.

Professional Development and Seed Grants

Strategy:
Capacity-building will be delivered through training programs led by the Toolbox Dialogue Initiative (MSU) and CEREO (WSU), paired with a competitive seed grants program that funds pilot research aligned with NRSP objectives.

Methodology:

- **Training:** Offer professional development workshops and webinars on systems thinking, resilience frameworks, team science, scenario planning, and community-based research methods.
- **Seed Grants (Year 2):** Allocate $50,000–$75,000 annually to support 6 pilot projects across the three IRNs. Pilot projects will generate preliminary data, methods, or partnerships that can feed into competitive external proposals.
- **Evaluation:** Year 1 will establish baseline metrics; Year 2 will assess outputs such as publications, data hub adoption, and grant submissions.

Two-Year Milestones and Deliverables

Year 1:

- Milestones: Establish 3 Research IRNs; Launch beta Data Hub; Host professional development workshops
- Deliverables: 3 IRN launch workshops; draft outlines for 3 white papers; beta Data Hub with ≥10 datasets; training modules and proceedings

Year 2:

- Milestones: Convene national synthesis symposium; Publish white papers; Expand Data Hub; Launch seed grants
- Deliverables: 3 white papers submitted; ≥25 datasets in Data Hub; 6 seed projects funded; ≥5 competitive grant proposals submitted; symposium proceedings published; 100+ registered Data Hub users; documented institutional buy-in through letters of support, co-funding, and in-kind contributions

Communication Pieces

We will produce an annual report that provides a comprehensive accounting of NRSP12 activities, accomplishments, outcomes, and impacts along with 1-page overviews for each of the IRNs, seed-grant projects, and data hub elements. These will be provided to the Review Committee, NIFA, SAES and ARD directors and shared through the NIMSS system, with the all members of the NRSP, on the NRSP webpage and with regional executive directors for both AgInnovations and Extension, other stakeholders, and to use as recruitment and engagement mechanisms for new participants.
Where possible, we will also publish or present on our evaluation approach and lessons learned (e.g., sharing how the IRN model worked, through venues like the Journal of Extension or at the AEA conference for evaluators). This contributes to the knowledge base on how to effectively evaluate transdisciplinary, networked projects

Data Management Plan

The Urban Data Hub will be developed and housed on University of Missouri (MU) Center for Applied Research and Engagement Systems (CARES) supported systems. The Urban Data Hub will consist of an Urban Map Room and a Research Repository.

The Urban Map Room will leverage existing national data repositories at CARES consisting of thousands of mappable data layers. The data layers comprise geographic information stored in ESRI geodatabases, SQL Server, and MySQL databases or accessed via standard data sharing protocols (open map services, APIs, etc.). These data are based on common data resources, such the American Community Survey, and include current and (limited) historical data. A complete listing of data layers can be found at https://allthingsmissouri.org/atm-map-data-list/.

The data will be maintained by CARES staff, who will integrate updated information on a regular basis, including acquisition and integration of new data, preparation of map symbolization, documentation of new data, and development of map services. CARES will be responsible for ensuring data security and backup and will collaborate to identify and integrate information directly supporting urban research. No personally identifiable

The Map Room will also support integration of local data developed by researchers. The supported formats for this information include standard geographic data formats (shapefiles, KML/KMZ files, or geojson data), spreadsheet data that can be associated with common geographic features (e.g. counties) based on a standard geographic identification code, and geocodable address data. Researchers submitting data will be required to participate in a short training event, certify that the information they are providing does not include PII, enter basic metadata for each dataset uploaded, provide citation and sharing permissions, and develop mapping symbology for their data set. Tools and assistance for the latter will be provided. All data submissions will be conducted using a secure, permissions-based interface and will be reviewed for content before being made publicly accessible in the Map Room.

All mapping data will be publicly accessible through a mapping interface that allows for discovery, display, and interaction with available map layers. The interface will include tools for overlay of multiple data layers, data query and selection, discovery of metadata, generation of map outputs (JPG, GIF, PNG, and PDF formats), and map sharing (via email or social media). Logged in users will be able to save maps and retrieve maps previously constructed within the Map Room.

A chief component of the Map Room will be the reporting tools, which will provide indicator-based reports for an identified geographic area. A list of supported indicators will be developed for Map Room users to select and build custom reports and logged in users will be able to generate and save reports on the system. All users will be able to download reports in PDF or Microsoft Word formats.

The Research Repository (RR) will be designed to include systems for submitting and documenting urban research, storing and cataloging submitted research, and allowing user discovery and retrieval of research documentation.

Research descriptions will be collected through a standardized, login only, WordPress-based interface and stored in a MySQL database. Researchers will be asked to provide standard information about their research, including (but not limited to) information on subject, sponsors, methods, findings and publications. A standard taxonomy related to research description will be developed to aid data entry and facilitate data query. Researchers will also supply citation information and use permissions and will be able to update the information submitted. Researchers will have the ability to provide links to research websites and online publications related to their projects. Optionally, researchers can submit a photograph related to their research for inclusion in search results. The information submitted to the RR will be immediately available for user discovery, but CARES staff will exercise the ability to remove or block public access to submitted data as warranted.

User discovery tools will consist of an interface allowing users to search, filter, and sort information within the RR. Information will be displayed as an array of tiles with basic information that can be selected by the user for display of the complete information related to the urban research project. The user will have the option to mark a particular project as research of interest. It is anticipated that users will select multiple research projects of interest, or even all results of their query, for further action. The user will then be able to generate and download a formatted report (PDF or similar) of all projects of interest with basic research information included.

An optional login for the user discovery tools will be designed and implemented. Logged in users will be able to save and return to their queries, so that as more research is added to the RR over time, their results will automatically update. In addition, these logged in users will be able to save their search results reports and use them in the future to link directly to the full research project description stored in RR.

User support and training materials will be developed and made available within the RR. Regular backup of the systems and data will be supported, and systems security scans and compliance will be provided in collaboration with the University of Missouri Division of Information Technology.

Distribution of Results

The primary mechanism for distributing results will be through NRSP12 and the project website on the NUREC website, which will include access to the RR. Outreach and engagement efforts will drive traffic to the website so it will be seen as the primary portal to engage with and from which to access results. We will also present the results at scientific discipline related professional meetings and annual meetings of stakeholders. We are intentionally choosing not to host our own NRSP12 related annual meetings of stakeholders as we feel there are enough existing venues. Instead of competing for participation, we think that resources could be better, and more effectively, spent by engaging stakeholders at their respective meetings and demonstrating how we support their work and missions (e.g. the National League of Cities annual City Summit and the National Urban Extension Conference).

We will engage with and distribute materials to appropriate organizations and committees within the land-grant system, to include the Executive Director for each of the regional AgInnovations and Extension Directors associations, for dissemination across the research and Extension networks; appropriate APLU committees; Extension Committee on Organization and Policy (ECOP); and the National Urban Extension Leaders.

Organization/Governance

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Land Grant Participating States/Institutions

AZ,WA,MA,TX,MI

Non Land Grant Participating States/Institutions

Washington State University

Participation

Participant	Is Head	Station	Objective	Research			Extension
				KA	SOI	FOS	KA

Budgets

MRF Funding 2025

Description	Dollars	FTE
Salaries	252938.00	3.00
Fringe Benefits	83525.00	0.00
Wages	0.00	0.00
Travel	22105.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	9000.00	0.00
Other	95818.00	0.00
Totals	**463386**	**3**

Comments

Washington St Univ (WSU; Gaolach; gaolach@wsu.edu): $320,279 Michigan St Univ (MSU; Cardinas; carden61@msu.edu) $49,000 Univ of Missouri (UM; Barnett, barnettc@missouri.edu) $72,640 Univ of Massachusetts (UMass; Arnold, joshuaarnold@umass.edu) $21,446

Other Funding 2025

Description	Dollars	FTE
Salaries	31592.00	0.25
Fringe Benefits	9733.00	0.00
Wages	0.00	0.00
Travel	0.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	19590.00	0.00
Totals	60915	0.25
Comments		

MRF Funding 2026

Description	Dollars	FTE
Salaries	248197.00	3.00
Fringe Benefits	81612.00	0.00
Wages	0.00	0.00
Travel	14169.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	156716.00	0.00
Totals	**500694**	**3**

Comments

WSU: 372,169 MSU 50,470 UM: 55,853 UMass 22,254

Other Funding 2026

Description	Dollars	FTE
Salaries	32856.00	0.25
Fringe Benefits	10122.00	0.00
Wages	0.00	0.00
Travel	0.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	19590.00	0.00
Totals	62568	0.25
Comments		

MRF Funding 2027

Description	Dollars	FTE
Salaries	253607.00	3.00
Fringe Benefits	83673.00	0.00
Wages	0.00	0.00
Travel	22105.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	139920.00	0.00
Totals	**499305**	**3**

Comments

WSU 370,597 MSU 51,879 UM 53,756 UMass 23,073

Other Funding 2027

Description	Dollars	FTE
Salaries	34170.00	0.25
Fringe Benefits	10527.00	0.00
Wages	0.00	0.00
Travel	0.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	19590.00	0.00
Totals	64287	0.25
Comments		

MRF Funding 2028

Description	Dollars	FTE
Salaries	263387.00	3.00
Fringe Benefits	86884.00	0.00
Wages	0.00	0.00
Travel	14169.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	139920.00	0.00
Totals	**504360**	**3**

Comments

WSU 371,397 MSU 54,931 UM 55,655 UMass 23,925

Other Funding 2028

Description	Dollars	FTE
Salaries	35536.00	0.25
Fringe Benefits	10947.00	0.00
Wages	0.00	0.00
Travel	0.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	19590.00	0.00
Totals	66073	0.25
Comments		

MRF Funding 2029

Description	Dollars	FTE
Salaries	270712.00	3.00
Fringe Benefits	89688.00	0.00
Wages	0.00	0.00
Travel	22105.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	154716.00	0.00
Totals	**537221**	**3**

Comments

WSU 399,848 MSU 54,931 UM 57,630 UMass 24,812

Other Funding 2029

Description	Dollars	FTE
Salaries	36958.00	0.25
Fringe Benefits	11386.00	0.00
Wages	0.00	0.00
Travel	0.00	0.00
Supplies	0.00	0.00
Maintenance	0.00	0.00
Equipment / Capital Improvement	0.00	0.00
Other	19590.00	0.00
Totals	67934	0.25
Comments		

NRSP Review (Submitted)

Project:
Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities
Dates Covered:
10/01/2026 - 09/30/2031

The following statement defines the mission of the National Research Support Projects (NRSP's):

NRSP Mission: National Research Support Projects (NRSPs) focus on the development of enabling and critical technologies (e.g., databases, cyberinfrastructure, on-line toolkits, reagents), support activities (e.g., collect, assemble, store, and distribute materials, data, resources or information) or the sharing of facilities (e.g., analytical equipment, lab, field) needed to accomplish high priority research.

Based on this mission, please rate the proposed NRSP using the following criteria.

Mission:	
Consistency with the NRSP mission	**Satisfactory**
Relevance:	
Addresses and supports a high priority national issue	**Satisfactory**
Demonstrates clear and tangible benefits to the scientific community as a whole	**Satisfactory**
Clearly identified sponsoring beneficiary stakeholders	**Satisfactory**
Stakeholder involvement in project development, project activities, review, and/or management plans	**Satisfactory**
Technical Merit:	
Overall technical merit (sound scientific approach, achievable objectives, review, and/or management plans)	**Satisfactory**
Potential for significant outputs (products) and outcomes with impacts	**Satisfactory**
Implementation Plan:	
Benchmarks for success clearly identified	**Satisfactory**
Management structure that adequately coordinates efforts of multiple participants	**Satisfactory**
Well-developed business plan that captures multiple sources of funding and leverages OTT MRF	**Satisfactory**
Funding plan that develops alternative funding sources to reduce OTT MRF in future years	**Satisfactory**
Efforts integrated with Extension, academic, or international programs	**Satisfactory**
Outreach, communications and assessment plan that communicates the program goals, accomplishments, and outcomes, and impacts	**Satisfactory**

Comments (Please add general and specific comments on strengths and weaknesses of the proposal, including specific revisions that would improve the proposal):

This is a valuable proposal that addresses an important need. The proposed structure is well-aligned with national conversations around urban sustainability. I recommend approving it following revision to address two concerns. First, my primary concern about the proposed project is the way urban agriculture (UA) is represented within the broader focus areas. While UA is identified as a key topic, its treatment within the FEW nexus and alongside ecosystem services and urban soils positions it more as an environmental concern rather than recognizing the importance, research needs, challenges, and value of urban food production on its own. My experience with existing UA literature in this domain (the FEW nexus or ecosystem services) is that it ends up being fundamentally disconnected from the reason that many people are interested in it: the production of food to address issues with food access or food security or for the purposes of commercial/economic benefit. While the proposal mentions food deserts, the proposal, in my reading of it, fails to discuss UA as a value in its own right (for public health benefits, food security, or supporting livelihoods), but it appears to only looks at it in terms of tradeoffs or ecosystems benefits. For example, it appears to suggest that urban agriculture's urban ecosystem services are a way to address food deserts. In my experience, the mere existence of an urban farm, even one that is very robust and successful, can utterly fail to address food access issues and can even exacerbate issues of food insecurity. The proposal's focus on UA through this lens seems to be a result of the expertise of the project team and affiliated researchers, which appear to have expertise in environmental, ecosystems, built environment and similar domains, but lack expertise in community-based food systems, public health nutrition, horticulture, or other areas that focus more directly on the food production and distribution aspects of UA and its nutritional impact on communities. The absence of this perspective risks reinforcing a persistent gap I have seen in existing research and Extension in urban agriculture. Particularly in Extension, urban agriculture for food production purposes is systematically overlooked. There are urban gardens and programs for hobbyists, and there are programs for ecosystems services, but the real programming focused on food production is seen to be under the purview of agricultural Extension, which sees its focus and clientele as being more rural. In part, this is a result of the fact that Extension (rightly) flows from research, and research tends to fail to look at urban food production specifically for food production's sake (i.e., what crops are grown? At what yields? What is most profitable or nutritious?). The other concern I have is with the budget. In the big picture, the budget seems quite large for the work that is being proposed, particularly given that the project does not involve conducting actual research, but instead synthesizing others' research and coordinating researchers. It seems to be quite a lot of FTE and individuals involved with not a whole lot of work or outputs. In particular, I would like more clarity and explanation of what two graduate fellows would be doing to warrant over $400,000 on the project. The second budget concern I have is with the size of the seed funding grants that are proposed. In my experience, it is difficult to do anything for less than $75,000. As I read the budget, they intend to allocate that amount of funding in total for 6 pilot projects, rather than $50,00-$75,000 each. As I look at the budget, reallocating the annual $77,000 designated for graduate fellows toward seed funding could generate more substantial engagement from the research community and support more robust research in this area. I am supportive of this proposal and recommend approval pending revision. With clearer attention to the role of food production in urban agriculture and a more strategic use of project funds (or a more detailed justification of the current budget), the proposal will be even better positioned to advance this important work.

Overall Recommendation:
Approve with Revision

NRSP Review (Submitted)

Project:
Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities
Dates Covered:
10/01/2026 - 09/30/2031

The following statement defines the mission of the National Research Support Projects (NRSP's):

NRSP Mission: National Research Support Projects (NRSPs) focus on the development of enabling and critical technologies (e.g., databases, cyberinfrastructure, on-line toolkits, reagents), support activities (e.g., collect, assemble, store, and distribute materials, data, resources or information) or the sharing of facilities (e.g., analytical equipment, lab, field) needed to accomplish high priority research.

Based on this mission, please rate the proposed NRSP using the following criteria.

Mission:	
Consistency with the NRSP mission	**Satisfactory**
Relevance:	
Addresses and supports a high priority national issue	**Satisfactory**
Demonstrates clear and tangible benefits to the scientific community as a whole	**Satisfactory**
Clearly identified sponsoring beneficiary stakeholders	**Satisfactory**
Stakeholder involvement in project development, project activities, review, and/or management plans	**Satisfactory**
Technical Merit:	
Overall technical merit (sound scientific approach, achievable objectives, review, and/or management plans)	**Satisfactory**
Potential for significant outputs (products) and outcomes with impacts	**Satisfactory**
Implementation Plan:	
Benchmarks for success clearly identified	**Satisfactory**
Management structure that adequately coordinates efforts of multiple participants	**Satisfactory**
Well-developed business plan that captures multiple sources of funding and leverages OTT MRF	**Satisfactory**
Funding plan that develops alternative funding sources to reduce OTT MRF in future years	**Unsatisfactory**
Efforts integrated with Extension, academic, or international programs	**Satisfactory**
Outreach, communications and assessment plan that communicates the program goals, accomplishments, and outcomes, and impacts	**Satisfactory**

Comments (Please add general and specific comments on strengths and weaknesses of the proposal, including specific revisions that would improve the proposal):

This is a well-developed proposal that addresses current needs to integrate applied research and extension to meet the needs of urban population centers. Most of the U.S. population is in urban, suburban or peri urban areas however the applied research and extension infrastructure is not as well developed as it is for rural population areas for production of adequate healthy foods. The PI's have addressed major national needs however there is a lack of involvement from urban centers in the southeast and southwest U.S. Urban centers in these regions have significant growing population in hot-humid or hot-arid climates which pose unique climate resilience and food production needs in the urban landscape. A significant portion of the project is related to developing leadership and the data hub. How will this translate into an incentive program that brings research scientists and extension specialists together to create and extend knowledge for urban centers? More thought as to how funding will be solicited and secured from stakeholders, and federal or state governments for long-term sustainability.

Overall Recommendation:
Approve

NRSP Review (Submitted)

Project:
Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities
Dates Covered:
10/01/2026 - 09/30/2031

The following statement defines the mission of the National Research Support Projects (NRSP's):

NRSP Mission: National Research Support Projects (NRSPs) focus on the development of enabling and critical technologies (e.g., databases, cyberinfrastructure, on-line toolkits, reagents), support activities (e.g., collect, assemble, store, and distribute materials, data, resources or information) or the sharing of facilities (e.g., analytical equipment, lab, field) needed to accomplish high priority research.

Based on this mission, please rate the proposed NRSP using the following criteria.

Mission:	
Consistency with the NRSP mission	**Satisfactory**
Relevance:	
Addresses and supports a high priority national issue	**Satisfactory**
Demonstrates clear and tangible benefits to the scientific community as a whole	**Satisfactory**
Clearly identified sponsoring beneficiary stakeholders	**Satisfactory**
Stakeholder involvement in project development, project activities, review, and/or management plans	**Satisfactory**
Technical Merit:	
Overall technical merit (sound scientific approach, achievable objectives, review, and/or management plans)	**Satisfactory**
Potential for significant outputs (products) and outcomes with impacts	**Satisfactory**
Implementation Plan:	
Benchmarks for success clearly identified	**Satisfactory**
Management structure that adequately coordinates efforts of multiple participants	**Satisfactory**
Well-developed business plan that captures multiple sources of funding and leverages OTT MRF	**Satisfactory**
Funding plan that develops alternative funding sources to reduce OTT MRF in future years	**Satisfactory**
Efforts integrated with Extension, academic, or international programs	**Satisfactory**
Outreach, communications and assessment plan that communicates the program goals, accomplishments, and outcomes, and impacts	**Satisfactory**

Comments (Please add general and specific comments on strengths and weaknesses of the proposal, including specific revisions that would improve the proposal):

Proposal is clear and overall technical merits are sound. Priority issues are illustrated. The main element I find unclear is regarding membership. Membership into NUREC appears to be exclusive so it's hard to understand how membership will be utilized to achieve the project goals. The proposal states the methodology to expand IRN membership to include at least 30 researchers in Year 2. How was this determined as the target number? Perhaps the PIs are being very conservative but that number seems very low. Or perhaps a small number of members is desired.

Overall Recommendation:
Approve

NOTE: Below are the narratives from the three peer reviewers (designated A-C based on the date of submittal to NIMSS, A being the first). Their narrative is in *italics*, our response is in **bold** font.

Peer Reviewer A: Accept with Revision

This is a valuable proposal that addresses an important need. The proposed structure is well-aligned with national conversations around urban sustainability. I recommend approving it following revision to address two concerns.

First, my primary concern about the proposed project is the way urban agriculture (UA) is represented within the broader focus areas. While UA is identified as a key topic, its treatment within the FEW nexus and alongside ecosystem services and urban soils positions it more as an environmental concern rather than recognizing the importance, research needs, challenges, and value of urban food production on its own. My experience with existing UA literature in this domain (the FEW nexus or ecosystem services) is that it ends up being fundamentally disconnected from the reason that many people are interested in it: the production of food to address issues with food access or food security or for the purposes of commercial/economic benefit.

While the proposal mentions food deserts, the proposal, in my reading of it, fails to discuss UA as a value in its own right (for public health benefits, food security, or supporting livelihoods), but it appears to only looks at it in terms of tradeoffs or ecosystems benefits. For example, it appears to suggest that urban agriculture's urban ecosystem services are a way to address food deserts. In my experience, the mere existence of an urban farm, even one that is very robust and successful, can utterly fail to address food access issues and can even exacerbate issues of food insecurity.

The proposal's focus on UA through this lens seems to be a result of the expertise of the project team and affiliated researchers, which appear to have expertise in environmental, ecosystems, built environment and similar domains, but lack expertise in community-based food systems, public health nutrition, horticulture, or other areas that focus more directly on the food production and distribution aspects of UA and its nutritional impact on communities. The absence of this perspective risks reinforcing a persistent gap I have seen in existing research and Extension in urban agriculture. Particularly in Extension, urban agriculture for food production purposes is systematically overlooked. There are urban gardens and programs for hobbyists, and there are programs for ecosystems services, but the real programming focused on food production is seen to be under the purview of agricultural Extension, which sees its focus and clientele as being more rural. In part, this is a result of the fact that Extension (rightly) flows from research, and research tends to fail

to look at urban food production specifically for food production's sake (i.e., what crops are grown? At what yields? What is most profitable or nutritious?).

We appreciate the reviewer's thoughtful and constructive feedback. We agree that urban agriculture (UA) must be recognized not only for its environmental and ecosystem service contributions, but also as a food-producing sector with distinct research, public health, and economic importance. We acknowledge that the original proposal did not make this sufficiently explicit, and we have revised it to clarify this emphasis.

First, we want to state clearly that we view food production, food access, food security, public health, and livelihood generation as core dimensions of UA, not secondary outcomes of ecosystem service provision. We agree that positioning UA primarily within the FEW nexus and ecosystem services framing risks, reinforcing a pattern in which food production itself becomes underexamined. In response, we have strengthened language throughout the proposal to explicitly articulate UA as a production system that requires distinct research and technical support. Second, our revised language avoids implying that ecosystem services alone can resolve food inequities. Instead, we now explicitly emphasize the need for research that integrates production capacity, distribution systems, and economic viability.

Third, we agree that urban food production requires specialized research that acknowledges the distinct constraints of urban environments. We have strengthened the proposal to identify research pathways that directly address:

- Scaled nutrient management strategies
- Urban-adapted Integrated pest management (IPM)
- Appropriate technologies for rooftop, in-ground, controlled environment agriculture (CEA), and other urban typologies
- Economic feasibility and market integration for urban growers

We also explicitly acknowledge the Extension gap described by the reviewer. We agree that urban production-focused UA has often fallen between traditional agricultural Extension (which primarily serves rural producers) and urban-focused programs (which may emphasize gardening or ecosystem services). In the revised proposal, we clarify that a key goal is to strengthen research–Extension linkages specifically including our reference to alignment of datasets synthesized by the Long-term Argroecosystem Research (LTAR) (see Implementation: Objective 2).

Finally, while we retain the FEW nexus framing, we have revised the proposal to ensure that food production is not subsumed within environmental tradeoff discussions. Instead, we present production-oriented research as foundational, with environmental and ecosystem dimensions understood as interacting components rather than dominant lenses.

In summary, we have revised the proposal to:

1. Explicitly center food production, food security, and livelihoods as primary UA outcomes.
2. Clarify that ecosystem services are complementary, not substitutive, to production goals.
3. Identify concrete research priorities focused on urban-adapted agronomic practices, yields, profitability, and distribution.
4. Strengthen the commitment to production-focused Extension engagement in urban contexts.

We appreciate the reviewer's insight and believe these revisions strengthen the proposal by treating urban agriculture as a food-producing system with intrinsic value and distinct research needs.

The other concern I have is with the budget. In the big picture, the budget seems quite large for the work that is being proposed, particularly given that the project does not involve conducting actual research, but instead synthesizing others' research and coordinating researchers. It seems to be quite a lot of FTE and individuals involved with not a whole lot of work or outputs.

We appreciate the feedback on our budget and justification. Our approach towards coordinating, synthesizing, and accelerating urban research uses a multi-faceted approach that funds research efforts in a variety of ways.

Part of our approach through this NRSP is to support synthesis-focused research. This line of research generates new findings, and does so by leveraging the vast amount of existing data across the nation to help build a stronger conceptual understanding of how urban ecosystem science scales across space and time. We have done a more thorough job explaining this research area in our proposal, clarifying that it is not a glorified literature review- rather it will be an opportunity for dozens of researchers to bring together similar, yet previously unaggregated datasets, to explore urban ecosystem questions at scales that

have to date been ignored. We believe this work is incredibly important, and will help fill a fundamental gap in our understanding of urban ecosystem services.

In addition to supporting synthesis-focused research, we also encourage foundational and applied research. Our seed grant competitions and travel grants ($360,000 total) will directly fund researchers interested in advancing science related to our IRNs. Based on your feedback, we've reflected on what a useful seed grant allowance could be. Based on similar competitions at our existing universities, we have modified our seed grant program to support ~2 seed grants per year at $30,000, reducing the number of grants, but doubling the funding available each year.

In addition to directly funding research, part of our budget goes towards supporting virtual proposal development workshops (run by personnel at WSU and MSU). While not providing dollars to researchers directly, we leverage personnel time and experience to bring hundreds of people together each year to learn more about relevant work within each IRN, build competitive research teams, and apply for external funding (beyond our NRSP, which explicitly is about supporting research, but not directly funding research) which we think is a valuable use of resources.

In particular, I would like more clarity and explanation of what two graduate fellows would be doing to warrant over $400,000 on the project. The second budget concern I have is with the size of the seed funding grants that are proposed. In my experience, it is difficult to do anything for less than $75,000. As I read the budget, they intend to allocate that amount of funding in total for 6 pilot projects, rather than $50,00-$75,000 each. As I look at the budget, reallocating the annual $77,000 designated for graduate fellows toward seed funding could generate more substantial engagement from the research community and support more robust research in this area.

With a particular emphasis placed on synthesis-focused research, we recognize that curating data and framing appropriate research questions takes leadership. We have envisioned this as an excellent opportunity to both bring established researchers together to explore their data in new ways, while meaningfully engaging early career scientists who are interested in interdisciplinary urban research. To this end, we are providing a 9-month Research Assistantship for 12 graduate students between Years 1-4. Each year, three SWG Fellows will be recruited from across our IRN networks, and will each help lead one SWG effort. These fellows will take the lead on synthesizing where existing research and data could be used to answer questions at broader spatial or temporal scales, and would be supported through regular engagement with a Planning Committee of approximately 4-8 faculty who have related expertise to the chosen SWG theme. With the Fellow leading, the team would work to identify relevant knowledge gaps and answer low-hanging fruit

research questions. We anticipate these efforts would not only lead to at least two peer-reviewed publications per SWG that produce new science, but would also identify target areas where the NRSP can support additional efforts to address urban challenges. Fellows will be expected to use these experiences to also support their own research, and will benefit from the networking and interdisciplinary training that accompanies these roles. In total, we are devoting ~$80,000 per year to support these three Fellows, which equates to a little over 15% of our anticipated budget each year. We believe this investment will both support new research directly via the Fellow's engagement and indirectly by helping us target our focused seed grant competition each year.

I am supportive of this proposal and recommend approval pending revision. With clearer attention to the role of food production in urban agriculture and a more strategic use of project funds (or a more detailed justification of the current budget), the proposal will be even better positioned to advance this important work.

Peer Reviewer B: Accept

This is a well-developed proposal that addresses current needs to integrate applied research and extension to meet the needs of urban population centers. Most of the U.S. population is in urban, suburban or peri urban areas however the applied research and extension infrastructure is not as well developed as it is for rural population areas for production of adequate healthy foods.

The PI's have addressed major national needs however there is a lack of involvement from urban centers in the southeast and southwest U.S. Urban centers in these regions have significant growing population in hot-humid or hot-arid climates which pose unique climate resilience and food production needs in the urban landscape.

We agree with the importance of the southeast and southwest regions. While we do not members from these regions as part of the current proposal development team, we have engaged them and letters of intentions to engage with the project if funded from the following (see Appendix 2 for the letter of intentions – see the bookmarks to easily navigate through the Appendix):

- Texas A&M's Institute for Advancing Health Through Agriculture
- Texas A&M's Human Behavior Laboratory
- University of Georgia's Center for Urban Agriculture
- University of Arizona: Extension, Center for Urban Smart Agriculture, and Institute for Resilience
- Dr. Dawn Gouge, Urban IPM specialist at Univ of Arizona

- Dr. Most Tahera Naznin, Assistant Professor of Urban and Indoor Agriculture at University of Nevada Reno

We have also added references to these letters in the Relevance to Stakeholders: Identification of Stakeholders and Related Needs and Stakeholder Involvement in Project Development and Activities sections of the proposal.

A significant portion of the project is related to developing leadership and the data hub. How will this translate into an incentive program that brings research scientists and extension specialists together to create and extend knowledge for urban centers?

We appreciate the opportunity to clarify how our NRSP supports research advancement. Our combined approach of targeted programs that support synthesis-focused research, direct funding of conceptual and applied research, and team building and targeted proposal development brings a diverse range of opportunities to NRSP participants-whether they are research scientists or extension specialists. For more information, please see our responses to Reviewer A and C.

More thought as to how funding will be solicited and secured from stakeholders, and federal or state governments for long-term sustainability.

The overall business plan for institutionalizing the core activities and goals of this NRSP is the integration with the National Urban Research and Extension Center (NUREC) in that NUREC is currently working with the Washington State University Office of Research to evolve NUREC into a Research and Extension Consortium. The consortium will provide the structure by which to engage external partners and funders (e.g. foundations, industry, philanthropic organizations, and sponsored projects). The core objectives and supporting activities of the NRSP of building integrated research networks, synthesizing knowledge, accelerating new research, and communicating results will be integrated into NUREC as it focuses on its mission of bridging the gap between research and community. This long-term business model will accompany NUREC's evolution from a state-membership model to a broader, nation-wide consortium.

Additionally, our response to Reviewer A's question about budget better articulates how the SWG, SWG Fellows, travel grants, and pilot project funding work together to create and support teams to more effectively secure external funding.

Peer Review C: Accept

Proposal is clear and overall technical merits are sound. Priority issues are illustrated.

The main element I find unclear is regarding membership. Membership into NUREC appears to be exclusive so it's hard to understand how membership will be utilized to achieve the project goals.

We appreciate the opportunity to clarify how this NRSP and NUREC fit into a collaborative short and long-term approach to advancing urban research. Currently, NUREC is an institutionally-based membership organization that started with 6 members in 2015. It now has 17 members, adding 3 new members in 2026. As discussed in the response to Reviewer B's question, NUREC is evolving into a broader-based consortium that will increase impacts. As a membership-based organization there is some need to return value to its members; however, NUREC members also see a value in advancing the entire LGU system's ability to engage better in urban communities.

Therefore, NUREC's structure allows for targeted synergistic work that supports the nationally available NRSP activities – basically NUREC can serve as an external funder who has geographic priority areas and is able to directly fund research as well as Extension and research-Extension activities, which the NRSP is not supposed to do. Additionally, while NUREC, as an external funding organization may prioritize work in certain geographic areas, it will also support research and extension activities that are national or regional in scale. In this way it not only supports the NRSP project goals, but it also acts as a synergistic organization to leverage the activities, outputs, and outcomes from the NRSP towards larger outcomes that support the tri-part mission of the LGU system to generate, disseminate, and apply knowledge.

The proposal states the methodology to expand IRN membership to include at least 30 researchers in Year 2. How was this determined as the target number? Perhaps the PIs are being very conservative but that number seems very low. Or perhaps a small number of members is desired.

Thank you for pointing this number out. We had intended to indicate that researchers from at least 30 INSTITUTIONS would be engaged by year 2. As to the number of individuals engaged by year 2, we would anticipate at least 300 individuals would be engaged across the connected activities of the NRSP based on our previous experience leading elements similar to what we propose here. Our NRSP is designed to engage researchers in multiple ways based on different, yet connected, goals.

For example, our Research Synthesis and Acceleration Activities seek to provide opportunities across topical interests, time commitments, and career pathways. Participants can experience anything from listening to a webinar on how to integrate team science principles into their own research strategy (MSU workshops tend to draw ~30

people per event), to presenting to the NRSP community on an IRN-related theme (NUREC presentations have drawn upwards of 100 people per event), to leading a Synthesis Working Group (similar activities support by WSU engage ~30 people per SWG, so estimating 90 people per year across three SWG events), to meeting new researchers and crafting new proposal ideas during our Proposal Development Workshops (WSU and MSU have co-led similar workshops drawing 200 participants in the past).

We also anticipate that additional IRN related activities, opportunities, and events will draw additional engagement at the national scale.

Based on our previous experience, we are confident that the defined breadth and depth of our NRSP provide numerous ways for researchers to engage and be supported in developing national networks to further high-quality research to address current and emerging issues across our nation's urban landscape.

MRF Funding Budget values must be entered without $ or commas

NRSP_TEMP_12 Budget at-a-glance

Description	Budget FFY2026	Budget FFY2027	Budget FFY2028	Budget FFY2029	Budget FFY2030	Total
	Dollars	Dollars	Dollars	Dollars	Dollars	
Salaries / Wages	252938	248197	253607	263387	270712	$1288841
Fringe	83525	81612	83673	86884	89688	$425382
Total FTE	3	3	3	3	3	15
Travel	22105	14169	22105	14169	22105	$94653
Equipment / Capital Improvement	9000	0	0	0	0	$9000
Other[2]	95818	156716	139920	139920	154716	$687090
Totals	463386	500694	499305	504360	537221	$2504966
Comments For each year, please clearly indicate here how much each recipient institution should receive, along with the respective investigator name and email address. NRSP budgets may not be approved if this information is missing.	Washington St Univ (WSU; Gaolach; gaolach@wsu.edu): $320,279 Michigan St Univ (MSU; Cardinas; carden61@msu.edu) $49,000 Univ of Missouri (UM; Barnett, barnettc@missouri.edu) $72,640	WSU: 372,169 MSU 50,470 UM: 55,853 UMass 22,254	WSU 370,597 MSU 51,879 UM 53,756 UMass 23,073	WSU 371,397 MSU 54,931 UM 55,655 UMass 23,925	WSU 399,848 MSU 54,931 UM 57,630 UMass 24,812	

[2]Other (materials and supplies, publications, consultants, computer services, subawards/ consortium/ contractual, rental/user fees)

Add New Budget Source

Other Funding

Source: Source Not Stated

Edit Source Title

Description	Budget FFY2026	Budget FFY2027	Budget FFY2028	Budget FFY2029	Budget FFY2030	Total
	Dollars	Dollars	Dollars	Dollars	Dollars	
Salaries / Wages	31592.00	32856.00	34170.00	35536.00	36958.00	$171112
Fringe	9733.00	10122.00	10527.00	10947.00	11386.00	$52715
Total FTE	0.25	0.25	0.25	0.25	0.25	$1.25
Travel	0.00	0.00	0.00	0.00	0.00	$0
Equipment / Capital Improvement	0.00	0.00	0.00	0.00	0.00	$0
Other[2]	19590.00	19590.00	19590.00	19590.00	19590.00	$97950
Totals	$60915	$62568	$64287	$66073	$67934	$321777

Nomination Region: Northeast (NE)
Nominator: Anton Bekkerman (anton.bekkerman@unh.edu)
Project: NE2231: Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US.
Technical committee Chair: Mario Andrade (mario.murad@maine.edu); Paul Collins (paul.collins@usda.gov)
Administrative Advisor: Anton Bekkerman (anton.bekkerman@unh.edu)

Issue, problem or situation in context of Grand Challenge(s) addressed: Potatoes are among the most economically and nutritionally important crops, annually contributing over $100 billion to the U.S. economy (nearly $11 billion of which to the agricultural sector) and exporting approximately 20% of production to the global market. However, northeast producers are particularly vulnerable to not continuing to benefit from these markets due to rapid climate change, shifting pest and disease issues, changing demographic and consumer preferences, and immense development pressure on farmland—all of which can adversely affect high yields and quality, overall production, and the ability to meet consumer needs. In response to these vulnerabilities, new variety development is consistently ranked among the top priorities by potato growers and industry stakeholders, as existing varieties often lack adaptation to new management practices and environments. Moreover, in the Eastern states, where potatoes rank among the top vegetable crops in FL, ME, NC, NY, OH, PA, and VA, and where ME and NY represent substantial seed potato industries, the economic importance of continuous variety improvement cannot be overstated. But easily meeting this need—which must accommodate the significantly different in Eastern states' geographic, climatic, and processing environments from ME to FL, and ensure that farmers meet distinct consumer markets (for example, NY, FL, PA, and NC, contribute significantly to chip production, while about 60% of Maine's crop is used for French fries)—cannot be done without a truly coordinated effort. NE2231's leadership in such an effort has led to the breeding and release of high-yielding, high-quality, disease-resistant potato cultivars that have been key to sustainable, profitable potato production in the region. Research and innovations from NE2231 scientists are at the heart of meeting two USDA Grand Challenges: Increasing Profitability of Farmers and Ranchers; and Expanding Markets and Creating New Uses of U.S. Agricultural Products.

Objectives: The NE2231 project's overall goals are to develop new, attractive, high-yielding, disease-resistant potato varieties for fresh, processing (French fries and chips), and specialty potato markets, serving potato growers in the Eastern U.S. The specific objectives are: 1) Conduct multidisciplinary conventional and marker-assisted breeding, germplasm enhancement, and early-generation selection research to improve potato productivity and quality for important Eastern U.S. markets; 2) Use novel and improved potato germplasm to reduce the impact of economically important potato pests and abiotic stress in the Eastern U.S.; 3) Evaluate yield, quality, pest resistance, and abiotic stress tolerance of preliminary and advanced potato breeding lines in experimental- and commercial-scale trials at multiple Eastern locations to aid industry adoption of new varieties; 4) Provide timely and relevant information to stakeholders through various means including the maintenance of a project website and a web-based potato variety performance database for use by researchers, extension, potato growers, and allied industry members. This collaboration has spanned multiple multistate projects and has served U.S. potato

growers for decades by engaging scientists from diverse fields, expediting the breeding process, and facilitating the commercialization of new varieties.

Accomplishments: The multidisciplinary NE2231 team maintains a strong publication record, including more than 30 peer-reviewed journal articles in the past three years, annual state-level germplasm evaluation reports (18), multiple extension bulletins, and numerous outreach activities with growers actively participating in field days and related events (10). A defining achievement of the NE2231 project is the generation and screening of approximately 100,000 new potato clones annually across the five eastern breeding programs. Newly screened germplasm undergoes successive generations of selection to confirm superiority in tuber yield, quality, and disease resistance. Advanced selections are incorporated into new crosses or released as cultivars. Over the past 20 years, the NE2231 project has released 15 new potato varieties that, nationwide, have demonstrated a substantial economic impact beyond the eastern U.S. region. In 2025, project-derived varieties were grown on 10,070 seed acres, representing approximately 10% of all seed potatoes produced in the United States, with an estimated seed value of $35.2 million. Varieties introduced through the group's work over the last 20 years account for about 30% of total seed acreage. This seed crop supports planting on approximately 100,700 acres, with a retail value of approximately $327.3 million. These figures illustrate both the program's economic contribution and the strong market demand for its varieties. Indeed, seven cultivars released through the collective effort over the past two decades rank among the top 50 most widely grown potato varieties in the U.S., including Lamoka, Caribou Russet, Waneta, Lady Liberty, Hamlin Russet, Bliss, and Lehigh.

Selected Short-term outcomes:

- Generation of improved germplasm each year - ~100,000 new potato clones.
- Submission of new breeding clones to National Chip and National Fry Processing Trials for grower and processor feedback each year - ~60 new entries from our group per year.
- Creation and maintenance of a website with the trials results, readily available potato variety production information to growers, processors, and consumers.

Selected Medium-term outcomes:

- Improved germplasm from our breeding programs that are used for new crosses; Germplasm screened and selected for key potato pest including PVY, golden nematode, common scab, potato wart, late blight, and early blight.
- Evaluations of new potential varieties under commercial storage conditions with grower and processor feedback.
- Development of genomic tools, including advanced phenotyping procedures, development of marker-assisted selection assays, and genomic selection models, to modernize the breeding pipeline.

Selected Long-term outcomes:

- Varieties released by this project, including: Lamoka, Caribou Russet, Hamlin Russet, Lady Liberty, Upstate Abundance, and Pinto Gold, are now a vital part of the potato industry in the Eastern U.S. and other regions.

- Based on 2025 seed production acreage, the retail value of varieties developed by this program will total $295.5 million in 2026.

Impacts: Historically, the multistate NE regional breeding and variety development efforts have had a substantial impact on local and national growers, processors, and consumers. Varieties released by the program have been widely adopted due to their high yield and quality. A key component of our work is rigorous screening for major diseases to ensure we address the real challenges growers face. Potato production costs can exceed $3,000 per acre, and devastating diseases such as soft rot, pink rot, and late blight can result in severe crop losses. Pest-resistant varieties, therefore, contribute to increased profitability, improved worker safety, and reduced pesticide use and environmental impact. One clear indicator of the program's direct impact on the potato industry is the seed acreage planted with our released varieties. During the 2025 season, varieties developed by the Eastern group accounted for approximately 10% of the total acreage planted to seed potatoes. Varieties from the Eastern group are consistently highlighted in national trials conducted by Potatoes USA (PUSA). In both the National Chip Trial and the National Fry Processor Trial, Eastern varieties consistently account for a significant share of entries and are frequently ranked among the top performers. This performance reflects the quality of our varieties, as PUSA trials are coordinated by industry partners and growers.

Added Value and Synergistic Activities: Potato breeding is inherently multidisciplinary. The NE2231 project integrates applied breeding, molecular biology, bioinformatics and statistics, plant pathology, entomology, food science, agricultural engineering, field evaluation, and extension. A central example of this collaboration is the coordinated multi-location trial network conducted annually across seven U.S. states and two Canadian provinces. Advanced clones are exchanged among participating programs and evaluated under diverse agroecological conditions, generating shared datasets that inform parent selection, advancement decisions, and regional adaptability. These data are reported back to breeders and disseminated to industry partners to guide commercial decisions. NE2231 members have also collaborated on cross-state extension programming. Annual field days are held in multiple states (ME, FL, NY, PA), where breeders and other professionals jointly present trial results and performance data on new clones and varieties to growers, seed producers, and industry representatives. In addition, breeding programs routinely share pre-commercial seed with industry partners for on-farm testing under commercial conditions. Up to ten industry collaborators annually evaluate advanced clones in their own production systems, strengthening the feedback loop between breeding programs and end users.

Multi-functional integrated activities: The NE2231 project operates in a highly coordinated manner rather than as isolated breeding programs. Participating institutions integrate early-generation selection, disease screening, multi-location trials, processing quality evaluation, and commercial-scale validation within a unified regional framework. This structure enables efficient advancement of germplasm from initial crosses to national processing trials and on-farm evaluations while ensuring that research outputs align with growers' needs and industry priorities. A clear example of this coordination is the systematic exchange of breeding materials among programs. The Maine breeding program annually sends approximately 200 early-generation clones to Florida and North Carolina for heat tolerance screening under southern production conditions. In addition, breeding programs collectively submit approximately 60 advanced clones each year to Penn State for screening against early blight and late blight. These

coordinated evaluations speed up the selection decisions and allow efficient assessment of traits such as disease resistance and abiotic stress tolerance across environments. Our program also includes the active participation of graduate and undergraduate students who are being trained to become plant scientists. These students are closely engaged in our research and outreach initiatives, helping develop a workforce truly engaged with the agricultural community.

Additional partnerships, associations or collaborations: In addition to project members, we have successfully partnered with researchers from USDA-ARS, Agriculture and Agri-Food Canada, and the New Brunswick Department of Agriculture, Aquaculture, and Fisheries. A vital strength of our group is its close relationship with stakeholders. Highlighting the close collaboration with the potato breeding program at USDA-ARS, which serves as an active and permanent member of the group. USDA-ARS contributes through germplasm exchange, coordinated trials, and shared decision-making, integrating USDA-ARS scientists, research stations, and faculty in a highly collaborative effort. In every eastern state where we operate, we have an active, engaged potato association that supports our breeding programs. In addition, we have established highly successful and informative on-farm trials in partnership with growers and industry collaborators, ensuring that research activities are addressing real production systems. We distribute approximately 100 breeding clones annually for testing to industry partners, including McCain Foods, Lamb Weston, Black Gold Farms, Masser, AIS, Cavendish Farms (US and Canada), LaPatate (Quebec), and others, as well as to other industry and government partners through the Potatoes USA National Trials. Project goals are developed through close consultations with multiple industry stakeholders to directly address their needs.

Multi-institutional and Leveraged Funding: Members of the NE2231 project have actively pursued and secured funding to support their research. In recent years, the group collectively received $3.2 million from the USDA-NIFA Potato Breeding Research program (2023-2027) to strengthen public potato breeding efforts. NE2231 institutions collaborated on the development and submission of this proposal, reflecting the project's coordinated, integrated nature. This shared investment supports multi-state breeding activities, disease screening, multi-location evaluations, and the training of future plant scientists. Additionally, breeding programs received direct funding from growers' associations and other stakeholders. This continued financial support demonstrates strong industry support for the NE2231 collaborative framework and serves as a clear indicator of growers' and the industry's recognition of the group's collective efforts and impact.

Summary of Participating Institutions and Units: The seven states and their institutions that cooperate on the NE2231 project are: Maine – University of Maine; New York – Cornell; Penn State – Pennsylvania; Ohio – Ohio State; Virginia – Virginia Tech; North Carolina – North Carolina State University; Florida – University of Florida; USDA-ARS – Maryland and Maine. **Industry Collaborators include**: McCain Foods, Lamb Weston, Cavendish Farms, Black Gold Farms, La Patate, AIS, Masser, Johnny's Selected Seeds, Utz, Cape Cod, Herrs. **Other institutions**: USDA-ARS Idaho, Agriculture and Agri-Food Canada, and the New Brunswick Department of Agriculture, Aquaculture, and Fisheries.

Nominating Region: Northeast **Nominator**: Lee Hecker **Email**: lee.hecker@maine.edu
Project or Committee Number and Title: NE2231: Collaborative Potato Breeding and Variety Development Activities to Enhance Farm
Technical Committee Chair: Walter De Jong **Email**: wsd2@cornell.edu
Administrative Advisor: Anton Bekkerman **Email**: Anton.Bekkerman@unh.edu
Issue, problem or situation in context of Grand Challenge(s) addressed: The Multi-state project "Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US" (NE2231) serves as a vital safeguard for the sustainability and profitability of the American food supply. Potatoes rank among the top three vegetable crops in Florida, Maine, North Carolina, New York, Ohio, Pennsylvania, and Virginia, making their economic health synonymous with regional stability. With annual cash farm receipts for totaling approximately $500 million and a significant multiplier effect on state economies, pressure to maintain productivity is immense (GC 7). The industry faces a daunting geographic distribution, requiring varieties that can thrive in the summer conditions of southern Florida and the truncated growing season of the Northeast. Further, researchers must develop varieties to meet the needs of large international processing companies as well as direct-to-consumer sales of specialty varieties (GC 1&4). This span of conditions creates a tremendous diversity of needs. Research aiding the Eastern potato industry impacts markets associated with over half of the US population. Potato growers face high production costs (>$3,000 per acre) and devastating diseases like pink rot or late blight that can destroy an entire crop. To address these needs and mitigate risks for potato growers, NE2231 researchers work collaboratively to develop new economically viable varieties (GC 1, GC 4) and have genetic resistance to pests and pathogens.
Objectives: The research of NE2231, Collaborative Potato Breeding and Variety Development Activities to Enhance Farm Sustainability in the Eastern US, is focused around four core objectives: 1) Conduct multidisciplinary conventional and marker-assisted breeding, germplasm enhancement, and early-generation selection research to improve potato productivity and quality for important Eastern U.S. markets. 2) Use novel and improved potato germplasm to reduce the impact of economically important potato pests and abiotic stress in the Eastern US. 3) Evaluate yield, quality, pest resistance, and abiotic stress tolerance of preliminary and advanced potato breeding lines in experimental- and commercial-scale trials at multiple Eastern locations to aid industry adoption of new varieties. 4) Provide timely and relevant information to stakeholders through various means including maintenance of a project website and web-based potato variety performance. database for use by researchers, extension, potato growers, and industry members.
Accomplishments: NE2231and its predecessors have a proven track record of producing new and commercially viable potato varieties. In the last 5 years the eastern breeding program has released 13 varieties that have made the top 100 list of US certified seed production with five varieties making significant impact in 2024. (Lamoka #7, Caribou Russet #10, Lady Liberty #29, Hamlin Russet #36, and Bliss #58). Additionally, specialty varieties like Adirondack Blue, Adirondack Red, Peter Wilcox, Pinto Gold, and Strawberry Paw provide very high net returns for small-scale growers with direct sales to consumers. In 2024 alone, potato varieties released

by the NE2231 group were grown on 3,869 seed acres in Maine and New York, with a seed potato value of approximately $11.9 million. Additionally, the Caribou Russet variety developed under NE2231 was the most popular potato seed variety in Maine in 2023. This seed crop has the potential to plant 33,990 acres in 2025, with a ware value estimated at $110.5 million. The most recent release (Titus, 2024) is a promising variety for the short growing seasons of the northeast exhibiting resistance to common diseases. Its economic impact will be clearer in coming years.

Selected Short-term outcomes: The transition from lab-bench science to real-world application is captured in the project's robust "Impact Pipeline." The group has provided a steady stream of technical and practical knowledge to peer groups and stakeholders. To facilitate adoption, they maintain the Variety Data Management (VDM) platform, a sophisticated digital tool that allows stakeholders to generate data summaries and perform side-by-side comparative analyses of potato clones. This technological leap has significantly heightened industry awareness and helped researchers identify specific clones worthy of expensive commercialization trials.

Selected Medium-term outcomes: The medium outcome of this work represents a fundamental shift in agricultural behavior and environmental conditions. Farmers are increasingly moving away from high-input, older varieties in favor of NE2231 releases that offer innate resistance to pests like Potato Virus Y (PVY). Several areas in NY could not produce potatoes without the golden nematode resistant varieties developed as part of this research project.

Selected Long-term Outcomes: Efforts of the NE2231 Multistate research group have fundamentally changed the landscape of the potato industry, specifically that of the northeast. In Maine and New York alone, project varieties grew on 3,869 seed acres recently, resulting in seed potatoes worth $11.9 million. These seed crops have the potential to plant nearly 34,000 acres, resulting in a downstream potato crop value of approximately $110.5 million. The development of genomic selection models is a promising new method to significantly accelerate breeding programs. Over 750 clones have been genotyped and phenotype and preliminary training of models has resulted in promising marketable yield and specific gravity.

Impacts: Nationally, the varieties released by this project since 2007 represent an approximate seed value of $24.1 million, with a potential 2024 production value estimated at $223.7 million. By providing varieties that can thrive in quarantined areas or withstand devastating diseases like pink rot and late blight, this project has secured the livelihoods of thousands of families and ensures that the U.S. potato industry remains sustainable, profitable, and productive. The advanced clones and releases from the Eastern project continue to be commercially evaluated and adopted by farmers and our industry stakeholders.

Added Value and Synergistic Activities: The core strength of NE2231 lies in its "cooperate-to-minimize-redundancy" model, an integrated framework where the success of the whole relies on the unique specializations of individual Experiment Stations. This group is highly interactive and coordinated, capitalizing on the existence of varying diseases, insect, and abiotic stresses across the eastern US and beyond to allow for the rigorous screening of potential varieties against both existing and emerging production threats. Each participating breeding program incorporates novel genetic materials and employs the latest genetic, genomic, and phenotyping technologies

to develop new germplasm that feeds into this massive testing network. While the University of Maine manages the central regional seed nursery, field trials span throughout the eastern US. Advanced clones are distributed to seven states and two Canadian Provinces with other institutions such as USDA-ARS providing specialized screening. By working collaboratively, the eastern breeding program can provide specialized screening that no single program could sustain alone. For example, promising varieties are simultaneously being screened for Golden Nematode (Cornell), Late Blight and Common Scab resistance (Penn State) and heat tolerance (NC State). This "hub-and-spoke" model ensures that varieties released have been "stress-tested" across environmental variables that no individual scientist could replicate in a single location.

Multi-functional integrated activities: Participants in NE2231 regularly disseminate knowledge through presentations at regional, national and international conferences for growers and/or the scientific community. These presentations reflect the team's collective expertise in genetics, pest and disease management, and product development. Collaborating with Extension partners at various institutions also helps to promote the applied nature of research directly to members of the growing community. Further, direct communication with industry partners has allowed NE2231 researchers to communicate outcomes in a timely manner and reach markets faster, promoting the researcher's practical relevance.

Additional partnerships, associations, or collaborations: These efforts are further amplified by deep partnerships that extend far beyond land-grant universities. The broad stakeholder support is significantly enhanced by our participation in Potatoes USA SNAC chipping trials, national chip (NCPT) and fry processing (NFPT) trials, as well as several USDA-NIFA-SCRI-funded projects, each of which have annual project meetings that bring researchers and industry stakeholders together in a structured format to share recent results, review progress and discuss ongoing short- and long-term industry needs. By integrating their research with Potatoes USA and the SNAC chipping trials, they ensure that breeding targets are aligned with the actual needs of the global marketplace. Interactions with local organizations like the Maine Potato Board, Empire State Potato Growers, Pennsylvania Potato Growers, and North Carolina Potato Association allows NE2231 researchers to receive direct input from local industry members. This collaborative framework allows the NE2231 researcher to seek real-time feedback from growers, and producers alike. The collective output ensures that the sum of the research group's work far exceeds what could be accomplished through individual efforts.

Multi-institutional and leveraged funding: The sustained success of this multi-state project is supported by a robust portfolio of leveraged funding from diverse sources. In addition to core institutional support, the project draws heavily from competitive federal grants such as the USDA-NIFA Specialty Crop Research Initiative (SCRI). Specialty Crop Grants have been utilized to explore genomic selection, virus microbiology, and targeted diploid breeding. These funds are further bolstered by industry-specific investments from Potatoes USA and state-level grower commissions, which provide the resources necessary for national fry processing and chipping trials. The inclusion of international partners further demonstrates the high level of institutional leveraging and shared responsibility that defines NE2231.

Summary of Participating Institutions:

- **Cornell University**
    - Dr. Walter De Jong, College of Agriculture and Life Science
- **North Carolina State University**
    - Dr. Craig Yencho, College of Agriculture and Life Sciences
- **Ohio State University**
    - Dr. Matthew Kleinhenz, Department of Horticulture and Crop Science
- **Pennsylvania State University**
    - Dr. Francesco Di Gioia, Department of Plant Sciences
    - Dr. Xinshun Qu, Department of Plant Pathology and Environmental Microbiology
- **University of Maine**
    - Dr. Andrei Alyokhin and Dr. Ek Han Tan, School of Biology and Ecology
    - Dr. Mary Ellen Camire, and Dr. Mario Murad Leite Andrade, School of Food and Agriculture

Former Participating Institutions: University of Florida, Virginia Polytechnic Institute and State University (VA Tech)
Frequent Collaborators: USDA-ARS MD, ME, and NY; Agriculture and Agri-Food Canada; New Brunswick Dept. Agriculture, and Fisheries; Medius Ag; Potatoes USA; Maine Potato Board; NC Potato Association; PA Cooperative Growers; McCain Foods; McCain Produce

Nominating Region: Northeast
Nominator: Toni DiTommaso ad97@cornell.edu and Blair Siegfried bds313@psu.edu
NE2501: *Harnessing Chemical Ecology to Address Agricultural Pest and Pollinator Priorities*
Technical Committee Chair: Jennifer Thaler jst37@cornell.edu
Administrative Advisors: Toni DiTommaso ad97@cornell.edu (formerly Blair Siegfried)

Issue, problem and situation in context of Grand Challenges

Agriculture in the Northeast and across the U.S. must balance controlling pests while minimizing the impact to beneficial species such as pollinators and natural enemies to remain profitable and to ensure a safe, abundant food supply. Yet many cropping systems still rely heavily on non-selective pesticides that can harm beneficial insects, contaminate the environment, and enhance pest resistance, resulting in increasing constraints. This multistate project advances chemical ecology—the study of chemical signals that mediate interactions among crops, pests, natural enemies, pollinators, and microbes—to deliver practical, science-based strategies that reduce pesticide reliance while sustaining yields. The project directly supports Grand Challenges by improving sustainability and profitability of agriculture, strengthening resilience to changing environments and pests, and safeguarding ecosystem services that underpin food security. The project's stakeholder-driven rationale is clear: growers need effective alternatives to insecticides, IPM and organic systems need novel tools, and society needs management that protects pollinators and human health. The group addresses these needs by combining discovery (identifying mechanisms), measurement (quantifying residues), and implementation (field validation, recommendations, outreach). The efforts of NE2501 have provided significant advances through regional and national cooperation and information exchange, scientific publications and science-based recommendations to growers.

Objectives: **1)** Develop tools and knowledge in sustainable pest management across cropping systems while maintaining pollinator, predator, and soil function. **2)** Quantify how local and landscape variability across regional landscapes shapes chemically mediated pest–crop–beneficial interactions. **3)** Minimize environmental impacts of pesticide use and resistance evolution, and identify reduced-risk tactics that minimize impacts to non-target organisms. **4)** Use domestication and breeding history to deploy crop resilience strategies informed by defensive chemistry, physiological tradeoffs, and cross-tolerance. **5)** Explore microbe mediation of interactions (bacteria, fungi, nematodes) to enable biological control and resilience. **6)** Operate and broaden utilization of shared analytical facilities and educate the next generation of scientists. **7)** Ensure delivery of science-based recommendations through Extension and Outreach to promote adoption and awareness of chemical-ecology-based IPM to improve environmental quality, human health, and welfare.

Accomplishments (past five years): Scholarly products and knowledge synthesis: Hundreds of high quality peer-reviewed publications have emerged from this distinguished group of participants over the past 5 years (including papers in the most visible applied and general scientific journals: *Science*, *Nature* and *PNAS*). Participants specifically reported ~117 peer-reviewed publications directly relevant to this project, along with many technical talks, invited presentations, and syntheses. As well, we have made very strong connections to industry as well as government agencies, as outlined on page four of this nomination packet.

Shared analytical infrastructure (a regional enabling output): facilities provide GC–MS and LC–MS/M capacity for targeted residues, plant hormones, and plant metabolites, VOC collection/analysis. The facilities support method development, protocols, and training.
Decision-relevant measurement: We quantify pesticide residues and metabolites, enabling cross-site comparison and linking exposure levels to risks for non-targets. Pesticide analyses are also offered in an extension capacity to ~20 beekeepers and farmers (all states may participate).
Method development for pest management: members optimized pheromone trapping systems and lure performance (e.g., corn earworm traps). Multiple teams developed and tested behavior-based tactics including repellents, attract-and-kill, and push–pull strategies for several key pests. Results shared with and projects co-developed with industry partners (see page 4).
Breeding and diversification enabling datasets: collaborative trials assessed crop varieties and breeding pools for resistance and evaluated how cover crops and intercropping shift plant chemistry and resistance through plant-to-plant signals and plant–soil feedbacks.
Multi-state Group projects: consortium-wide field deployments (e.g., testing methyl salicylate/PredaLure as a predator attractant across multiple crops and states) and planned meta-analyses that generate guidance beyond single-site studies; many students trained.
Extension and outreach: webinars, presentations, factsheets, online resources, and stakeholder engagement embedded in multiple member programs. A highlighted eOrganic webinar on pest-suppressive microbiomes engaged 120+ attendees from 36 U.S. states.
Policy and regulatory engagement: the committee jointly articulated barriers to semiochemical registration and communicated science-based recommendations to regulators, including a productive meeting with EPA staff (following from the annual meeting and industry partners).

Short-term outcomes: 1, meetings and symposia disseminated findings and a shared understanding of which mechanisms are ready for translation (semiochemical and behavioral control, induced defense, microbe-mediated resistance). 2, analytical facilities expanded what can be measured reliably (residues, hormones, VOCs) and trained personnel, increasing the region's capacity. 3, outreach and stakeholder engagement improved understanding among growers, beekeepers, and agricultural professionals of how management choices influence risk.

Medium-term outcomes: Findings are being translated into improved decisions and practices. Grower-facing recommendations and outreach support reduction of pesticide risk to bees and other non-target species and promote adoption of alternative tactics (behavior-based tools, diversification and soil practices, and improved monitoring). Industry-facing collaborations are growing and supporting more practical and durable monitoring tools. The annual reports also document rapid changes in commercial hive management practices following evidence that orchard deployments can create ecological traps for wild queens, illustrating research-to-practice translation. In addition, routine use of shared residue and metabolomics services by multiple institutions lowered the barrier to incorporate chemical measurement into applied IPM programs, enabling feedback loops between research, extension, and on-farm decisions.

Long-term outcomes: While relatively young (the project is only 10 years old), we are building scalable alternatives that reduce pesticide reliance while maintaining yields: (i) semiochemical and behavior-based control; (ii) diversification and companion-cropping mechanisms that alter plant chemistry and pest pressure; (iii) microbe-enabled resilience and novel biocontrol approaches; and (iv) breeding targets informed by plant resistance. The enduring condition

change is a strengthened regional innovation ecosystem—trained personnel, standardized methods, shared infrastructure.

Impacts: Environmental impacts include reduced risk from pesticide use and conservation of pollinators and natural enemies. Economic impacts accrue through reduced crop loss and improved resilience to pest outbreaks and resistance, especially in high-value specialty crops. Ecological impacts include protecting pollinators and advancing management that integrates above- and belowground processes. Scientific impacts include national leadership in translating chemical ecology, implementable IPM tools, decision-relevant measurement and training.

Added value and synergistic activities across mission areas: The group integrates entomology, chemistry, plant biology, soil ecology, and data science. This breadth is essential: identifying candidate metabolites, verifying organismal perception, quantifying residues and metabolites, and validating outcomes in replicated field trials.

Multi-disciplinary activities: We multiply Chemistry × engineering × entomology: NE2501 teams co-develop IPM tools by pairing pheromones with trap engineering and field work. We use plant science × microbiology × metabolomics to find practical pest/pollinator outcomes.

Multi-functional integrated activities: The project is structured as research, shared infrastructure, and extension/outreach. Annual meetings catalyze new collaborations, coordinate projects, standardize protocols, and accelerate co-authored products. The analytical facilities support both research and extension while serving as training platforms, strengthening the translation pipeline from discovery to adoption. Interactions with industry participants and Extension personnel, both within and outside the annual technical committee meetings, ensure timely communication of new research findings, allowing the industry to integrate the latest science into crop protection strategies, enhancing NE2501's practical application and relevance.

Partnerships beyond land-grant universities: The committee engages partners including USDA scientists and programs, regulatory stakeholders concerned with semiochemical products, and private-sector entities involved in lures, traps, and product development. Public-facing analytical services for beekeepers and growers further extend the project's reach and relevance.

***What the committee did together that could not be accomplished individually*:** 1) Maintained analytical infrastructure that overcomes the barrier of instrumentation. 2) Multi-state field evaluations, producing regional recommendations. 3) Built interdisciplinary community, including training across institutions, and synthesis products and joint proposals. 4) Connected research to decision-making through a feedback that is difficult within a single program.

***Evidence of multi-institutional and leveraged funding*:** The multistate framework has leveraged substantial external funding and proposal activity. Participants report that as a direct result of multi-state activities over the past few years, $7 million in grants have been obtained from diverse sources (including USDA-NIFA, NIH and other competitive mechanisms) and continue larger-scale proposal submissions. The shared facilities and coordinated projects increase competitiveness, multi-location datasets, and integrated outreach plans. We note that this does not include many grants held by participants that are not directly related to project goals.

No. of participants	State	Institution
2	California	University of California, Davis
1	Connecticut	Connecticut Agricultural Experiment Station
2	Delaware	University of Delaware
1	Delaware	Delaware Cooperative Extension
1	Illinois	University of Illinois
1	Indiana	Purdue University
1	Louisiana	Louisiana State University
2	Massachusetts	University of Massachusetts
1	Massachusetts	Elms College
1	Michigan	Michigan State University
1	Minnesota	University of Minnesota
1	Mississippi	Mississippi State University
1	Nebraska	University of Nebraska
1	New Hampshire	University of New Hampshire
1	New Jersey	Rutgers University
1	New York	Cooperative extension
4	New York	Cornell University - Geneva
7	New York	Cornell University - Ithaca
1	North Carolina	North Carolina Cooperative Extension
8	Pennsylvania	Pennsylvania State
1	Vermont	University of Vermont
1	Virginia	Virginia Polytechnic Institute and State University

The PIs in this group are widely interacting with industry relating to IMP and Agricultural Innovation, and these relationships are both individual and joint across PIs and states:

ISCA Technologies (semiochemicals)
Aromatic Plants Research Center
Trécé, Inc. (Semiochemicals and traps)
Scentry Biologicals, Inc. (Semiochemicals)
Hercon Environmental (Semiochemicals)
Suterra (Semiochemicals and traps)
VOC Health (Electronic noise)
Thermo Scientific (chromatography)
Mott's, Inc (fruit processing)
Keurig/Dr. Pepper (beverage company)
Andermatt AG CH-6146
Sterling International, Inc.
Shin-Etsu Chemical Company (Japan)
ChemTica Internacional, Costa Rica
BASF SE (Germany) pheromone
Mitsui & Company (Japan)
U.S. Environmental Protection Agency
The Savanna Institute (non-profit)
Many commercial apple farms
Many small beekeeping companies

International collaborations are far and wide, amplifying this work, including the following: Germany (University of Hamburg), Japan (Kyoto University, Ryukoku University, Kyushu University), Finland (University of Eastern Finland, Switzerland (Neuchâtel University)