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

Contents

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

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. Accessible to all NRSP12 participants and partners, the Hub 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 this NRSP pertain to 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 agInnovation

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 and 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 urban-derived historical health disparities and environmental injustices.

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 [21] [22] [23] [24]. For example, different production systems have different attributes and shortcomings that complicate their suitability and functionality [25] [26]. CEA and vertical farms enable year-round production but rely on high energy and infrastructure inputs [27]. 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 [26] [9]. Exploring these interactions, while standardizing data collection metrics, is an emerging and urgent research priority [28]. 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 [32] [33] [34] [35].

These soils are frequently used to support urban food production and green infrastructure initiatives; however, their properties in this regard remain poorly understood [36] 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]
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> 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:

A. Objectives and Projected Outcomes:

Objectives:

O1: 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.

- 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.

O2: 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.

- 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.

O3: 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.

- 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.

O4: Communicating Outcomes. A nationwide network requires nimble, timely, and thoughtful sharing of information, news, and opportunities across a wide audience of interested members.

- 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

Given the scope and goals of the NRSP12, we anticipate a diversity of high-impact outcomes that make major scientific advancements in the field of urban agricultural-ecosystem research that benefit both academia and our nation's cities.

- Establishment of robust, national networks of researchers that are collaborating to solve pressing urban challenges across disciplines and scales.
    - 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.
    - 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.
    - 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.
    - 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.
    - [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.

B. 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

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. Cronan has contributed extensively to major national and international research initiatives. He has served as Co-PI on the UNESCO-funded CABN–FABN Atlas of Climate and Environmental Change, where he led atlas architecture and production to support climate-informed decision-making across biosphere reserves. His work also includes co-leading a MetLife Foundation and Lender Center project with Syracuse University and SUNY-ESF in which he directed the production of digital twins to advance placemaking and community engagement.

His ongoing scholarship builds on significant NSF-funded projects, including leading an EPSCoR GEM3 Large Seed project that coupled stakeholder-informed and biophysical scenarios to address uncertainty in socio-ecological systems. He also played a central role in the NSF INFEWS ATLAS initiative, where he guided scenario modeling, GeoDesign workflows, representational strategies, and stakeholder facilitation to create actionable land-use projections for food-energy-water systems resilience. Earlier, as a Geodesign and Representation Team Lead for the NSF GEM3 "Genes by Environment" program, he contributed integrative visualizations and scenario-based planning tools for a $20 million research effort examining climate–ecosystem interactions. Cronan's work advances scenario-based, stakeholder-driven futures that guide community planning and provide frameworks for resilient development in complex socio-ecological systems, particularly food systems in both urban and rural contexts.

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.

C. Integration and Documentation of Research Support

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.

D. 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 information (PII), including data subject to HIPAA or FERPA regulation, will be housed in the Map Room.

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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Appendices

Appendix 1: Letters of Commitment

GREEN CITY GROWERS

Thursday, November 20, 2025

Dr Gaolach,

My name is Christopher Grallert and I am CEO of Green City Growers based in Somerville, Massachusetts. We are a major force in the industry sector referred to as Farming as a Service. Currently, GCG manages over 180 active farms and gardens in New England and beyond, including at public schools, at corporate office parks, at hospitals, senior centers, and residential complexes. We build the infrastructure as well as maintain and programmatically activate each location, teaching agricultural literacy and food systems capacity building. Green City Growers is an employee owned, certified Benefit Corporation.

The proposed project, Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities, has a breadth of support services that would help our organization in supporting the expansion of a localized, short supply chain food systems. If funded, we would actively participate in and benefit from.

- Participating in national Integrated Research Networks (IRNs) that connect 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.
- Use a data archiving and sharing platform that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to a Urban Research Repository that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- Participate in professional development and training in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- Participate in Research Synthesis and Acceleration Activities, including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Christopher P. Grallert
CEO

LANDSCAPE ARCHITECTURE FOUNDATION

1200 17th St NW, Suite 210
Washington, DC 20036

November 24, 2025

Dear Dr. Gaolach,

The Landscape Architecture Foundation (LAF) is a nonprofit organization based in Washington, DC and its mission is to support the preservation, improvement and enhancement of the environment. LAF does this by investing in research, scholarship, and leadership to increase the collective capacity of landscape architects and other designers of the built environment to achieve sustainability.

Our primary research focus is on landscape performance: the evaluation and documentation of quantified environmental, social, and economic benefits of sustainable landscape solutions. Our award-winning *Landscape Performance Series* is an online set of resources to help designers, agencies, and advocates evaluate performance, share best practices, and make the case for sustainable landscape solutions. The database of over 210 Case Study Briefs of built projects with quantified performance benefits, 215 Fast Facts from published research, and over 30 tools and calculators to estimate performance is visited by over one hundred thousand users per year. This includes research and data on a wide range of nature-based solutions as well as information pertaining to urban agriculture and food systems and green infrastructure.

This proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* has a breadth of support services that would help my organization in disseminating high quality research related to urban resiliency that would be of great value to our audience of landscape architects and others interested in the sustainability of the exterior built environment. If funded, LAF would participate in and benefit from:

- **Participating in national Integrated Research Networks (IRNs)** that connect researchers, Extension professionals, and urban stakeholders like my organization 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.

- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of this application and the ability to start participating in the activities of this project.

Sincerely,

Megan Barnes
Sr. Program Manager
Landscape Architecture Foundation

SCHOLARS
STRATEGY NETWORK

Dear Dr. Brad Gaolach,

I am writing on behalf of the Scholars Strategy Network (SSN), a national membership organization made up of college- and university-based researchers interested in using research to improve public policy in the United States. Over the past 14 years, SSN has grown into a network of over 2,000 researchers in 47 states. SSN members organize themselves into state and regional chapters, working to advance the use of research wherever policy decisions are made. Our scholars regularly contribute their research to inform debates related to public health, food systems, and urban ecosystems.

Your proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* offers a breadth of support services that would help SSN members conduct high quality research related to urban resiliency and then share those findings with key practitioners and policymakers. If funded, SSN members would actively participate in the project in a number of ways, including:

- Participating in national Integrated Research Networks (IRNs) that connect researchers, Extension professionals, and urban stakeholders across key topic areas outlined in the application
- Participating in Research Synthesis and Acceleration Activities, including working groups to address knowledge gaps between policy actors, practitioners, and scholars and workshops to facilitate acceleration of research to action on emerging ideas

In addition to the participation of SSN members with the project, the SSN national staff would offer public engagement training for participants. The training program emphasizes generalizable and repeatable skills that help participants communicate their research and its significance to policy, media, and practitioner audiences. The final training options will ultimately depend on the participants, but will include:

- Policy-focused sessions that help participants identify how to move from scholarly research to policy recommendations, how to identify relevant policymakers and build a relationship with them, and how to write persuasively for policy audiences
- Media-focused workshops that equip participants with the skills necessary to share their research with reporters through media interviews and how to disseminate their findings by successfully writing and pitching op-eds

SCHOLARS
STRATEGY NETWORK

By pairing the research support described in the project with policy and media professional development opportunities, the project as a whole promises to boost the capacity of researchers to build meaningful relationships with diverse stakeholders, conduct more relevant research, and share that research with a range of audiences so that it has an impact.

I look forward to the success of your application and working on this project together.

Sincerely,

Andrew Pope, PhD
Director of Policy, Scholars Strategy Network

November 25, 2025

Dear Dr. Gaolach,

I am writing to confirm my support and enthusiasm for the proposed NRSP project entitled "*Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities."* I serve as Associate Director of Healthy Living for the Institute for Advancing Health Through Agriculture (IHA) at Texas A&M AgriLife Research.

The IHA is the world's first academic institute to bring together precision nutrition, responsive agriculture, and social and behavioral healthy living research. Uniquely, the Healthy Living arm of IHA encompasses expertise in community engagement, Extension and outreach, and clinical-community partnerships in research. This project is well-matched to our focus areas as it relates to urban agriculture and food systems, nature-based solutions (NbS), and urban ecosystem services. If funded, I would actively participate in activities related to urban resiliency. In particular, I would be involved in:

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Using a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and using and contributing to an Urban Research Repository that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Supporting professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.

I look forward to the opportunity to participate in the activities of this project.

Sincerely,

Rebecca A. Seguin-Fowler, PhD, RDN, LD, CSCS

***Rebecca A. Seguin-Fowler**, PhD, RDN, LD, CSCS, Associate Director, Institute for Advancing Health Through Agriculture (IHA)*
Texas A&M AgriLife Research, Norman E. Borlaug Building, 498 Olsen Blvd, College Station, TX 77843

November 18, 2025

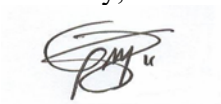
Dear Dr. Gaolach:

I am pleased to write this support letter for the proposed NRSP project entitled "*Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities."* This project is a good match to ongoing efforts at the Human Behavior Lab in collaboration with colleagues in the School of Public Health and the Institute for Advancing Health through Agriculture. If funded, I would actively participate in activities related to human behavior. More specifically, I would be involved in:

- **National Integrated Research Networks (IRNs)** that connect 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.
- **Professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,



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November 21, 2025

Dear Dr. Gaolach,

My name is Dr. Edward Martin, Associate Vice President and Director of the University of Arizona Cooperative Extension. Although Extension addresses many issues, one of our key topics is urban agriculture. In fact, this year, UA Cooperative Extension established a new Center for Urban Smart Agriculture at the Maricopa County Cooperative Extension Office. Serving the fourth-largest populated county in the United States, the new center focuses on issues related to the establishment and success of small and beginning urban food systems, including business plans and production practices in urban-center populations.

The proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* has a breadth of support services that would help me/my lab/my organization in conducting high quality research related to urban resiliency. If funded, I/we would actively participate in and benefit from.

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to a **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Edward C. Martin, Ph.D.
Associate Vice President and Director
UArizona Cooperative Extension
Division of Agriculture, Life, & Veterinary Sciences, and Cooperative Extension

WASHINGTON STATE UNIVERSITY
PULLMAN

Department of Crop and Soil Sciences
COLLEGE OF AGRICULTURAL, HUMAN, AND NATURAL RESOURCE SCIENCES

November 19, 2025

Dr Gaolach,

My name is Holly Henning and I am an Associate Professor in the Department of Crop and Soil Sciences at Washington State University. Prior to my time at WSU, I worked two presidential commissions focused on public-private partnerships to advance sustainability. I currently teach undergraduate students in Agriculture and Food Systems about systems thinking while connecting them to the research and Extension resources of our Land Grant University to develop more resilient and sustainable food systems.

The proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* has a breadth of support services that would help me and my organization in conducting high quality research related to urban resiliency. If funded, I would actively participate in and benefit from:

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to a **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Contribute to and participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address

PO Box 646420, 379 Clark Hall, Pullman, WA 99164-6420
509-335-3475 http://css.wsu.edu

knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Holly Henning
Associate Professor, Crop and Soil Sciences
Swantz Distinguished Professor of Teaching and Learning
College of Agriculture, Human and Natural Resource Sciences
Washington State University

THE UNIVERSITY OF ARIZON
Agriculture, L
Veterinary Sc

Dawn H. Gouge Ph.D.
Professor – Medical Entomologist & IPM Specialist
Extension Interim Associate Director of Agriculture & Natural Resources
University of Arizona, Department of Entomology
MAC Experiment Station, 37860 West Smith-Enke Road, Maricopa, AZ 85138
Office Tel. (520) 374-6223; Fax. (520) 374-6394; Mobil (602) 418-5202
dhgouge@arizona.edu

November 21, 2025

Re. Letter of Support for National Research Support Project Grant - Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities

Dear Dr. Gaolach,

Please accept this letter of support for the National Urban Research & Extension Center National Research Support Project grant application. I am an entomologist with over 25 years of experience both conducting research in urban communities and evaluating science-based operational solutions to real-time challenges in cities. I see great value in activities that support urban research. There is a critical need for an Integrated Research Network and platform support for urban research initiatives.

Hired in 2000 as an Urban Entomologist for the University of Arizona I am based at an Experiment Station site between our two largest metropolitan areas (Phoenix and Tucson). I have been acutely aware of the many unique issues generated by urban living, with zoonotic and vector-borne disease issues central to my own field of research.

The University of Arizona has a number of entomologists, plant scientists and engineers working in urban agriculture, horticulture, and nature-based solutions addressing climate adaptation needs.

Formation of Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities would provide an exceedingly valuable array of

support services that would benefit my own research ability and those I collaborate with across the nation, allowing the expansion of quality research related to urban resiliency. A warming desert climate brings both agricultural opportunities for year-round, urban production and food access improvements, but comes with extreme heat and water scarcity challenges. Research opportunities abound, but collaboration and support systems are needed.

If funded, I would actively participate in and benefit from:

- Participating in national Integrated Research Networks that connect researchers, Extension professionals, and urban stakeholders across key fields of science including urban agriculture and food systems, nature-based solutions and urban ecosystem services (with an emphasis on soil health and green infrastructure) to co-create research agendas.
- Using a data archiving and sharing platform that includes an interactive “Urban Map Room” that hosts spatial data to support developing research projects and would use and contribute to a Urban Research Repository that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- Participating in professional development and training in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- Participating in Research Synthesis and Acceleration Activities, including year-long synthesis working groups to address knowledge gaps, research needs, and proposal development workshops to facilitate acceleration of emerging needs and novel science initiatives.

I look forward to participating in these activities, all of which are urgently needed. Please contact me if you have any questions or would like additional information.

Sincerely,

Dawn H. Gouge
Medical Entomology Professor & Integrated Pest Management Specialist
Department of Entomology,
University of Arizona

Department of Horticulture
Oregon State University
4017 Agricultural and
Life Sciences Building
Corvallis, Oregon, 97331

P 541-737-5175 | **F** 541-737-3479
gail.langellotto@oregonstate.edu

11/25/2025

Dr Gaolach,

My Gail Langellotto, and I am a Professor of Horticulture at Oregon State University, where I also Direct the BioResource Research (BRR) Program and serve as Principal Investigator for the Garden Ecology Lab.

BRR is a unique undergraduate major, where students complete 600-800 hours of research, write an undergraduate thesis, and present and defend their research to a faculty committee. Because of the hands-on, highly mentored nature of our program, our students go on to great success upon graduation, including enrollment in highly selective M.D./Ph.D. programs and selection for highly competitive graduate fellowships (e.g. NSF, NIH). Unlike other undergraduate research programs at OSU, BRR is open and accessible to all: we do not require a minimum GPA or payment of additional fees in order to participate.

The Garden Ecology Lab studies garden habitats as a socio-ecological system, with relevance to nature-based solutions, urban ecosystem services, and urban agriculture and food systems. We have several studies of urban soils, microbes, plants, and invertebrates published or in process, with a focus on how garden-level biodiversity translates to ecosystem services and urban resiliency.

Your proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* has a breadth of support services that would help me in conducting high quality research related to urban resiliency. If funded, I/we would actively participate in and benefit from:

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to a **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Gail A. Langellotto, Ph.D.
Professor of Horticulture

Department of Horticulture
Oregon State University
4017 Agricultural and
Life Sciences Building
Corvallis, Oregon, 97331

November 17, 2025

Dear Dr Gaolach,

I am an Associate Professor of Pollinator Health Extension in the Department of Horticulture at Oregon State University. I was the first Pollinator Health Extension Specialist in the United States. While there have traditionally been Apiculture Extension programs that primarily serve a rural agricultural clientele (e.g., beekeepers and growers of crops that rent bees for pollination), my position came out of pesticide poisonings in a primarily urban context. Since being hired in 2016, there has been an explosion of interest and need in creating habitat for managed and wild bees in urban landscapes. There has been a commensurate growth in the literature around creating habitat, but much of it is disconnected and difficult to interpret across contexts.

The proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities*, would fill a gap among researchers working on bee conservation in cities, providing a much needed structure to synergize research and put it into practice on the ground. If funded, my lab would actively participate in and benefit from

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to a **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Andony Melathopoulos
Associate Professor
Andony.Melathopoulos@oregonstate.edu
541 452 3038

UNIVERSITY OF MINNESOTA

Crookston • Duluth • Morris • Rochester • Twin Cities

Department of Horticultural Science
College of Food, Agricultural and Natural Resource Sciences

305 Alderman Hall
1970 Folwell Avenue
St. Paul, MN 55108

612-624-4742
Fax: 612-624-4941
http://horticulture.umn.edu

November 21, 2025

Dear Dr. Gaolach,

As associate professor in the Dept. of Horticultural Science at the University of Minnesota, my responsibilities include teaching, research, and Extension. In my education role, I serve as the Director of Undergraduate Studies for the Sustainable Agriculture and Food Systems program teach both the introductory course and capstone course for this program. This program emphasizes community engagement and experiential learning and supports green infrastructure in the Twin Cities metropolitan area via collective action. In my research role, I am currently exploring the effect of invasive swede midge insects on brassica crops in urban agriculture, a new pest that is constraining local production of high-quality vegetables here. My Extension program is focused on urban agriculture, specifically working with community partners to practice sustainable integrated pest management. These practices are largely preventative and take a holistic approach, including weed management and maintaining soil health and fertility.

The proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities,* has a breadth of support services that would contribute to my team's ability to conduct high quality research related to urban resiliency. If funded, I would actively participate in and benefit from these activities:

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Mary Rogers, Ph.D.

Associate Professor
Sustainable & Organic Horticultural Food Production Systems
612-624-8871

THE UNIVERSITY OF ARIZONA
Cooperative Extension
Maricopa County

THE UNIVERSITY OF ARIZONA
COOPERATIVE EXTENSION
Center for Urban
Smart Agriculture

Office of the Director

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http://extension.arizona.edu/maricopa - https://extension.arizona.edu/center-urban-smart-agriculture

November 29, 2025

TO: Dr. Brad Gaolach

FROM: Dr. Ayman Mostafa

SUBJECT Letter/Memo of Collaboration as Co-Principal Investigator

Dear Dr. Gaolach,

As Director of **Maricopa County Cooperative Extension (MCCE)** and **the University of Arizona Center for Urban Smart Agriculture (UA-CUSA)**, I lead these two Departments with a vision to advocate for and support the development, adoption, and implementation of science-based solutions to the unique challenges facing agriculture and food production in urban areas of Arizona and beyond. The UA-CUSA and MCCE facilitate a process to identify environmental, socioeconomic, and political challenges and opportunities that shape the development of urban smart agriculture in Arizona. We engage stakeholders by providing opportunities for applied research and education in urban smart agriculture tailored to their needs and challenges, facilitating collaborations, and increasing the adoption of sustainable, nature-based practices and solutions in the Sonoran Desert. We are collaborating with the University of Arizona faculty and institutions to find science-based solutions to client-identified issues. The two departments are reaching out to thousands of urban agriculture, small-scale, and beginning farmer communities, relevant academic and professional collaborators, government and industry representatives, and graduate and undergraduate students interested in this area.

The proposed project, ***Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities***, includes a wide range of support services to assist the teams at UA-CUSA and MCCE in conducting high-quality research on urban resiliency. If funded, I/we would actively participate in and benefit from:

- **Participating in national Integrated Research Networks (IRNs)** that connect researchers, extension professionals, and urban stakeholders across key areas—including urban agriculture and food systems, nature-based solutions (NbS), and urban ecosystem services—with a focus on urban soils and green infrastructure to develop research agendas and share best practices.

THE UNIVERSITY OF ARIZONA
Cooperative Extension
Maricopa County

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4341 E. Broadway Road - Phoenix AZ 85040-8807 - Phone: 602-827-8200 - Fax: 602-827-8292
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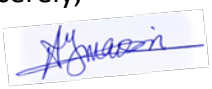
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to an **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency. UA-CUSA has built a substantial needs-assessment database over the past four years, highlighting issues of significant concern to the relevant community in Arizona. These needs assessment surveys could help identify research topics and connect them with appropriate researchers.
- **Participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities,** including year-long synthesis working groups to address knowledge gaps and research needs, and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to begin participating in this project's activities.

Sincerely,



Ayman M. Mostafa, Ph.D.

HORTICULTURE AND LANDSCAPE ARCHITECTURE
COLORADO STATE UNIVERSITY

College of Agricultural Sciences
Horticulture and Landscape Architecture
Fort Collins, Colorado 80523-1173
agsci.colostate.edu

December 1, 2025

Dr Gaolach,

My name is Jennifer Bousselot, an Associate Professor of Horticulture at Colorado State University (CSU). I lead the Green Roof and Urban Agriculture research team at the Metropolitan Agricultural Research Center at the CSU Spur campus in Denver, Colorado. We study green roof plant-pollinator interactions, green roof system stormwater capture, rooftop agriculture, and the integration of solar panels on green roofs, also known as rooftop agrivoltaics.

The proposed project, *Building Integrated Research Networks to Advance the Conduct and Application of Science with Urban Communities*, has a breadth of support services that would help my team in conducting high quality research related to urban resiliency. If funded, we would actively participate in and benefit from the following four network/activities:

- **Participating in national Integrated Research Networks (IRNs)** that connect 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.
- **Use a data archiving and sharing platform** that includes an interactive "Urban Map Room" that hosts a breadth of urban spatial data to support developing research projects and would use and contribute to an **Urban Research Repository** that assembles, stores, and disseminates research outputs, methods, and resources related to urban resiliency.
- **Participate in professional development and training** in systems thinking, resilience planning, team science, and community-driven research approaches tailored to urban contexts.
- **Participate in Research Synthesis and Acceleration Activities**, including year-long synthesis working groups to address knowledge gaps and research needs and proposal development workshops to facilitate acceleration of emerging ideas

I look forward to the success of your application and the ability to start participating in the activities of this project.

Sincerely,

Best- Jen

Jennifer Bousselot, Ph.D.
Associate Professor, Department of Horticulture and Landscape Architecture,
College of Agricultural Sciences, Colorado State University
Jennifer.Bousselot@colostate.edu

Appendix 2: Interviews with Researchers

Dr. Anand Jayakaran

Professor, Green Stormwater Infrastructure Specialist, Biological Systems Engineering, College of Agricultural, Human, and Natural Resource Sciences, Puyallup Research and Extension Center, Washington State University. Past-President American Ecological Engineering Society.

Urban Resilience Through Nature-Based Solutions

Ani discussed nature-based solutions for urban resilience, emphasizing trees as the first intervention due to their stormwater management and co-benefits. He identified three key research areas: the role of plants in stormwater systems, the intersection of social sciences with nature-based solutions, and incorporating climate science projections into design. Ani also highlighted the need for better integration of arborist knowledge with engineering and the importance of understanding community needs and building trust in underserved areas.

Affordable Sensor Technology for Monitoring

Ani discussed the need for more affordable and reliable sensor technology for monitoring various environmental parameters, such as bacterial contamination and harmful algal blooms, which are currently expensive and difficult to deploy. He emphasized the importance of post-construction monitoring and the development of low-cost asset management systems for nature-based solutions like trees and bioretention systems. Brad suggested the possibility of sensors that could trigger human intervention for maintenance, allowing for better resource allocation.

Synthesis Centers for Research Collaboration

Brad and Ani discussed establishing synthesis centers for researchers to collaborate and develop research questions beyond specific disciplines. Ani emphasized the importance of in-person collaboration, incentives like funding opportunities, and the prestige of being part of a curated cohort. They considered the potential outcomes of the project, including building a network of researchers, writing grants, and publishing a manuscript in a journal. Ani highlighted the value of the process itself, including rigorous thinking and writing, even if the final product is not published.

5-Year Project Outcomes and Metrics

Ani discussed the desired outcomes for a 5-year project, including securing a grant, graduating students, and measuring tangible impacts such as increased awareness and behavior change. He emphasized the importance of developing standardized metrics to assess the project's success and highlighted the challenge of balancing case studies with broader data synthesis. Ani expressed willingness to contribute his research to a shared repository, noting the potential benefits of standardized data for AI-driven research and the value of documenting both successes and failures in nature-based solutions.

Mapping Hub for Nature-Based Research

Brad and Ani discussed the development of a mapping and reporting hub for researchers, focusing on the utility of map-based data for Ani's field-based research. Ani emphasized the importance of soil, climate, and plant data for nature-based solutions, highlighting the need to understand regional applicability and sustainability. They explored how such data could support research by providing insights into similar ecosystems and informing the design of nature-based solutions across different regions.

Dr. Jeff Hattey

Professor, School of Environment and Natural Resources, The Ohio State University

Interests & Expertise: Soil Management; Soil Science Education; Animal Waste Management; Urban soil;Urban agriculture

Nature-Based Urban Resilience Grant

Brad and Jeff discussed a grant proposal focused on nature-based solutions to increase the resilience of cities. Jeff emphasized the importance of addressing community infrastructure, particularly stormwater management, to align with municipal budgets and resident concerns. He highlighted soil health as a key area for research, considering both contamination issues and soil compaction in urban areas. Jeff also stressed the role of carbon management in improving soil structure and reducing stormwater runoff.

Urban Land Management Challenges

Jeff and Brad discussed the challenges and opportunities in urban land management, focusing on soil health, land utilization, and reconnecting urban dwellers with the land. Jeff highlighted the contrast between engineering goals for construction and biological goals for land enhancement, emphasizing the need for a patchwork approach to urban development that balances ecological and social needs. They also touched on the historical conversion of prime farmland to urban areas and the potential for nature-based solutions to address environmental challenges in cities.

Synthesis Centers for Research Collaboration

Brad and Jeff discussed establishing synthesis centers for researchers to collaborate and develop interdisciplinary research questions. They agreed that bringing people together in person, like at the National League of Cities meeting, is valuable for exchanging ideas and building relationships. Jeff emphasized the importance of having a mix of researchers, practitioners, and city planners to inform research questions and facilitate funding opportunities. They also discussed the need to incentivize researcher participation, including financial support and the promise of future funding opportunities.

Nature-Based Solutions Impact Assessment

Jeff outlined the key objectives for a 5-year project focused on nature-based solutions for urban challenges. He emphasized the need for documents that can communicate the project's value at federal, state, and local levels, highlighting its relevance to urban and peri-urban populations. After two years, Jeff wants to see a tangible document showcasing the project's impact, while

after five years, he envisions a multi-state assessment of the project's nationwide impact, including cost-benefit analyses and co-benefits of nature-based solutions.

Urban Advocacy and Research Funding

Jeff and Brad discussed the challenges of advocating for urban issues compared to agricultural interests, highlighting the lack of a dedicated commodity group for urban concerns. Jeff emphasized the importance of presenting clear metrics to justify the value of investments in research and education, such as securing external funding and supporting state legislators. They agreed on the need to demonstrate the impact of NSRPs in terms of securing grants, training students, and publishing research to justify their renewal.

Research Repository Collaboration Initiative

Brad discussed creating a research repository to promote discovery and collaboration, sharing documents, results, and tools for integrating data and maps. Jeff expressed support for sharing research results, emphasizing that much of his work is publicly accessible, especially if funded by taxpayers. He suggested using such a tool for background information when working in unfamiliar areas or for general data comparisons across regions. Brad proposed a mapping tool with thousands of data layers, and Jeff confirmed this would be useful for his work. No major concerns were raised about the project's viability, and Jeff expressed his support for the initiative.

Urban Agriculture and Ecological Solutions

Jeff and Brad discussed the challenges of urban agriculture and ecological solutions in densely populated areas. Jeff emphasized the need to balance ecological ideals with practical realities, noting that organic farming alone cannot feed the world's population due to insufficient natural resources. They agreed that while urban agriculture cannot meet city food demands, it can contribute to broader benefits like economic streams and co-benefits beyond food production.

Dr. Eleni Pliakoni

Professor, Urban Food Production, Postharvest Handling, Department of Horticulture and Natural Resources; Director of the Urban Food Systems Initiative, Kansas St Univ, Olathe Campus

Grant Planning for Research Support

Brad and Eleni discussed a grant aimed at supporting research activities rather than conducting research directly. Brad explained that the grant would help make certain activities useful for researchers like Eleni, and he sought her input on what activities would be most beneficial. He compared the grant to an NSF collaborative network, emphasizing that it is still in the planning stages and they are gathering diverse perspectives to inform its development.

Urban Agriculture for Resilience

Brad and Eleni discussed nature-based solutions for urban resilience, with Eleni focusing on urban agriculture as a key area. They explored how urban agriculture could contribute to water storage, food security, and education, while also addressing challenges such as transportation efficiency and cost-effectiveness. Eleni identified three main research areas: defining urban

resilience, improving food transportation within cities, and evaluating the economic viability of urban agriculture for both producers and consumers.

Synthesis Centers for Research Collaboration

Brad and Eleni discussed establishing synthesis centers for researchers to collaborate on research questions beyond specific disciplines. Eleni emphasized the importance of a shared vision, funding, and support for grant submissions to bring people together. They explored potential outcomes for a 2-year project, including preliminary data for larger grants and identifying correct team members. For a 5-year grant renewal, Eleni suggested measuring success through return on investment, successful proposals, and adapting to new funding agents. Both agreed that metrics for renewal would likely include money and publications.

Research Impact and Data Accessibility

Eleni and Brad discussed the importance of identifying and measuring impact in research, including changes in knowledge, behavior, and situations. They explored the potential of a research repository to promote discovery and collaboration, with Eleni emphasizing the need for user-friendly organization and accessibility. Brad inquired about Eleni's anticipated use of geographically referenced data layers, to which Eleni responded that usage would depend on the message she wishes to convey. Eleni expressed interest in having baseline data on food losses, highlighting the difficulty in accurately measuring this metric, and suggested the need for standardized methods to assess contributions in research.

Urban Agriculture Engagement Strategies

Eleni and Brad discussed the challenges of engaging a diverse group of people in discussions about urban agriculture and post-harvest physiology. They explored the possibility of using horizon scans as a mechanism to gather input from a core group while allowing for digital engagement from others. Eleni expressed concern about the viability of projects based on nature-based solutions in cities, citing the need to align priorities with the current administration's funding priorities.

Appendix 3: Evaluation Plan Overview

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.

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

***Outcomes**:*

1. Increase national and/or cross-institutional research collaboration and training efforts
2. Improve the quality and accessibility of data related to urban ecosystem and agriculture research and research products (e.g., de-silo the current fragmented state of urban data systems)
3. Increase the amount and speed at which high quality research is developed, implemented, and disseminated

Process evaluation 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. Hubspot will also house data to be utilized as a sampling frame for annual surveys, listening sessions, and/or case studies for mid-year and long-term outcomes.

Summative evaluation 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.

Evaluation Activities

Outcome	Activity	Process Evaluation (ongoing)	Summative Evaluation (mid-term and final reports)
Increase national and/or cross-institutional research collaboration and training efforts	Building and facilitating National Integrated Research Networks (IRNs) that will convene experts across key topic areas to generate research agendas and share best practices	Rates of participation by participant and organizational characteristics (e.g., tenure status, LGU type, expertise); 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 IPN frameworks key stakeholders overall and by U.S. region Rates of best practices utilization in research publications or products # of funded research projects within research agenda topical areas # of publications in 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
Improve the quality and accessibility of data related to urban ecosystem and agriculture research and research products (e.g., de-silo the current fragmented state of urban data systems)	Developing and maintaining an Urban Data Hub that will house data from research projects, research outputs, and make accessible urban data sets nationwide. Products include a Research repository and Urban Map Room to facilitate sharing of	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	# 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)

Outcome	Activity	Process Evaluation (ongoing)	Summative Evaluation (mid-term and final reports)
	data and data visualization Increase the quality and utilization of standardized metrics of urban nature-based solutions	(LGU/org type; researcher type/tenure) #/% of cross-institutional research projects using Hub # of standardized metrics developed and utilized overall, by IRN area, and by service user characteristics Annual survey and/or listening sessions to identify needs and service gaps	
Increase the amount and speed at which high quality research is developed, implemented, and disseminated	Providing professional development and training in multiple modalities including in-person skill building, online and/or hybrid training opportunities, and resource dissemination	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

Data Sources:

Data Hub and Repository Analytics. These data will be used to understand evaluate changes in the availability, and utilization, of data by stakeholders and by topical area.

Event participation. Hubspot is a CRM that will be used to track event registration, participation, and engagement with the myriad resources disseminated throughout the life of the project. It will also be used as a sampling frame for annual surveys, listening sessions, case studies, and other evaluation-related activities.

Annual surveys. Surveys will be conducted annually with stakeholders and event participants to understand changes in adoption of research products, frameworks, as well as gaps in services. This will also allow for comparisons in research development outcomes to by a variety of characteristics, including high vs. low service users; organizational characteristics; IRN topic areas; regional differences; and the potential mediating or moderating effects of services on the development and dissemination of high-quality research.

Interviews, listening sessions, and/or case studies. These data sources will be used to identify gaps in services and to evaluation the extent to which IRNs, Data Hub, and professional development activities are influencing the project outcomes.

Appendix 4: MOU between NLC and NUREC

We agree that:
Both Parties share the common goal of building and strengthening the relationship between NLC members and their Extension resources so that municipal leaders understand and have access to the skills and scholarship provided by NUREC and NUREC has opportunities to share its innovations directly with municipal leaders.

Both Parties are interested in pursuing partnerships with networks, organizations, and other institutions that share the same mission to enhance the effectiveness and sustainability of their respective efforts and commit to cooperate as follows:

To this end we have a systematic approach to engaging NLC members, they are laid out in the approach both parties agree is most effective:

1. **Synthesis and acceleration**: Catalyze rigorous understanding of innovative programs. NLC has dozens of cohorts active in municipalities across the country. These cohorts encourage and support municipal leaders in promising, transformative and innovative practices across a wide range of subject areas. Cohorts range from 4 cities exploring how to better connect their workforce and education institutions to supporting 50 cities in economic mobility programming and 10 cities in implementing smart surface policies for their infrastructure needs.

   Many of these practices expand on existing theory where there is little scientific evidence of their impact or return-on-investment (ROI). There is so little research on many of these practices due to three key factors a) the academic/scientific field is often unaware of projects in incubation, b) even with awareness trust between researchers and practitioners is key to successful evaluations of promising practices – something difficult to build for a single project and c) scholarly research often relies on funding to execute.

   By capitalizing on already existing relationships with funders who invest in technical assistance at NLC, from start-to-finish, an evaluation process by which we provide added value to all involved, from municipalities, to funders, to the scholarly field can easily be integrated into NLC's work. NLC is uniquely trusted by municipal leaders allowing it access to the implementation of these practices so as to capture the necessary evidence to understand their potential for scale. Despite this status, NLC has limited capacity to be deeply embedded in its work as an R&D arm. However, NUREC provides unique opportunities to engage scholars in relevant fields early in the cohorts to ensure rigorous evaluation of these new and innovative practices as well as to inform them with scientific guidance throughout the implementation. This work would allow us to expand beyond "innovative" into "best" practices leading to the next phase.

2. **Best Practices and Expansion**: NLC has a unique position from which it can inform the broader fields of municipal research, policy and practice. NLC is

often leading the scaling of these innovative practices making it well-aware of innovations in the field before many others are. NLC members trust NLC to provide evidence on promising practices and will be eager for support in learning when, how and for whom promising practices provide impact or return-on-investment. Extension can partner with NLC to take best practices and support expansion of programming beyond the initial cohort (innovators) through the waves of adoption difusion theory (early adopters, early majority, late majority) while also supporting both local adaption and data and impact collection for common metrics of change and impact.

To achieve these goals we aim to do the below:

1. **Durable Educational materials** targeted to audiences of both parties, co-produced and branded by both parties (e.g., fact sheets, research reports, policy briefs, etc).
2. **Learning opportunities** to connect the audiences from both parties to each other (e.g., webinars, podcasts, professional / workforce development trainings and micro-credentialling) including, but not limited to, NLCU Executive Education course sequences and free learning opportunities. To facilitate this engagement and its potential continuation both Parties agree to discuss a potential master services agreement for NLC from Washington State University (organizational home of NUREC), revenue share on NLCU courses and badging and credentialing from these courses.
3. **Technical Assistance cohorts and Scaled Models of Practice.** Pursue opportunities to leverage each party's expertise and audience/members to co-create, support, and scale the development and / or translation of knowledge into practice.
    a. In the long-term we will use these cohorts to explore a program evaluation component that includes evaluation of baseline and outcome metrics as well as collection of core program data to identify key outcomes of innovative programming. Capitalizing on the unique network of academics and scholars present in NUREC we will be able to provide municipal

governments with the capacity to rigorously understand these programs and their impacts. This allows for opportunities to scale rigorous programs through dissemination of efective programs through new TA cohorts as well as through informing the field of scholarship on these programs in collaboration with scholars engaged in the work throughout the programming of the cohort.