

Innovations at the Nexus of Food, Energy and Water Systems (INFEWS)

PROGRAM SOLICITATION

NSF 18-545

REPLACES DOCUMENT(S):

NSF 17-530



National Science Foundation

Directorate for Geosciences

Directorate for Engineering

Directorate for Social, Behavioral & Economic Sciences

Office of International Science and Engineering

Office of Integrative Activities



National Institute of Food and Agriculture

Full Proposal Deadline(s) (due by 5 p.m. submitter's local time):

September 26, 2018

IMPORTANT INFORMATION AND REVISION NOTES

The Participating Directorates have changed. This modifies the options for the required three disciplines to be integrated. Additional disciplines integrated into project are allowed as the "fourth discipline".

An INFEWS-RCN track has been added.

The Cyber-Human-Physical Track (formerly Track 2) has been removed and those concepts may be pursued as a "fourth" discipline within the current tracks (Track 1, Social-Physical Modelling of FEW systems; Track 2, Research to Enable Innovative Solutions; and Track 3, INFEWS Research Coordination Networks (INFEWS-RCN), or as short-titles: Track 1, modelling; Track 2, solutions; and Track 3, RCN).

Provisions for international collaborations have been updated and clarified. Detailed instructions are provided in the solicitation.

The program description has been slightly revised, principally for clarity.

Specific instructions on necessary components and preparation have been clarified and expanded.

Any proposal submitted in response to this solicitation should be submitted in accordance with the revised *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) ([NSF 18-1](#)), which is effective for proposals submitted, or due, on or after January 29, 2018.

SUMMARY OF PROGRAM REQUIREMENTS

General Information

Program Title:

Innovations at the Nexus of Food, Energy and Water Systems (INFEWS)

Synopsis of Program:

Humanity depends upon the Earth's physical resources and natural systems for food, energy, and water (FEW).

However, both the physical resources and the FEW systems are under increasing stress. It is becoming imperative that we determine how society can best integrate social, ecological, physical and built environments to provide for growing demand for food, energy and water in the short term while also maintaining appropriate ecosystem services for the future. Known stressors in FEW systems include governance challenges, population growth and migration, land use change, climate variability, and uneven resource distribution. The interconnections and interdependencies associated with the FEW Nexus pose research grand challenges. To meet these grand challenges, there is a critical need for research that enables new means of adapting societal use of FEW systems.

The INFEWS program seeks to support research that conceptualizes FEW systems broadly and inclusively, incorporating social and behavioral processes (such as decision making and governance), physical processes (such as built infrastructure and new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrologic cycles), biological processes (such as agroecosystem structure and productivity), and cyber-components (such as sensing, networking, computation and visualization for decision-making and assessment). Investigations of these complex systems may produce discoveries that cannot emerge from research on food or energy or water systems alone. It is the synergy among these components in the context of sustainability that will open innovative science and engineering pathways to produce new knowledge, novel technologies, and innovative predictive capabilities.

The overarching goal of the INFEWS program is to catalyze well-integrated, convergent research to transform understanding of the FEW Nexus as integrated social, engineering, physical, and natural systems in order to improve system function and management, address system stress, increase resilience, and ensure sustainability. The NSF INFEWS activity is designed specifically to attain the following goals:

1. Significantly advance our understanding of the food-energy-water system of systems through quantitative, predictive and computational modeling, including support for relevant cyberinfrastructure;
2. Develop real-time, cyber-enabled interfaces that improve understanding of the behavior of FEW systems and increase decision support capability;
3. Enable research that will lead to innovative and integrated social, engineering, physical, and natural systems solutions to critical FEW systems problems;
4. Grow the scientific workforce capable of studying and managing the FEW system of systems, through education and other professional development opportunities.

This initiative enables interagency cooperation on one of the most pressing problems of the millennium - understanding interactions across the FEW nexus - how dynamics of the FEW Nexus are likely to affect our world, and how we can proactively plan for consequences. This solicitation allows the partner agencies - National Science Foundation (NSF) and the United States Department of Agriculture National Institute of Food and Agriculture (USDA/NIFA) - to combine resources to identify and fund the most meritorious and highest-impact projects that support their respective missions, while eliminating duplication of effort and fostering collaboration between agencies and the investigators they support.

In addition, NSF and USDA/NIFA promote international cooperation that links scientists and engineers from a range of disciplines and organizations to solve the significant global challenges at the nexus of FEW systems. Proposals including international collaboration are encouraged when those efforts enhance the merit of the proposed work by incorporating unique resources, expertise, facilities or sites of international partners. The U.S. team's international counterparts generally should have support or obtain funding through non-NSF sources. To facilitate coordinating research activities between US and international partners, specific collaborative funding opportunities have been developed involving some international partners: [list of international opportunities](#).

All questions regarding proposal submissions should be directed to INFEWSquestions@NSF.GOV or the program officers listed below.

Cognizant Program Officer(s):

Please note that the following information is current at the time of publishing. See program website for any updates to the points of contact.

- Thomas Torgersen, Co-Chair, Directorate for Geosciences, telephone: (703) 292-4738, email: ttorgers@nsf.gov
- James W. Jones, Co-Chair, Directorate for Engineering, telephone: (703) 292-4458, email: jwjones@nsf.gov
- Deborah Winslow, telephone: (703) 292-7315, email: dwinslow@nsf.gov
- Rachel Melnick, USDA/NIFA, telephone: (202) 401-4980, email: rmelnick@nifa.usda.gov
- Lara Campbell, Office of International Science and Engineering, telephone: (703) 292-7049, email: lcampbel@nsf.gov
- Timothy VanReken, Office of Integrative Activities, telephone: (703) 292-7378, email: tvandreke@nsf.gov

Applicable Catalog of Federal Domestic Assistance (CFDA) Number(s):

- 10.310 --- USDA-NIFA Agriculture and Food Research Initiative
- 47.041 --- Engineering
- 47.050 --- Geosciences
- 47.075 --- Social Behavioral and Economic Sciences
- 47.079 --- Office of International Science and Engineering
- 47.083 --- Office of Integrative Activities (OIA)

Award Information

Anticipated Type of Award: Standard Grant or Continuing Grant

Estimated Number of Awards: 15 to 30

Projects submitted to Tracks 1-2 (Track 1, modelling; Track 2, solutions) will request three to five years of support with a total budget less than or equal to \$2,500,000 per project.

Projects submitted to Track 3 (Track 3, RCN) will request four or five years of support with a total budget less than or equal to \$750,000 per project.

Estimated Number of Awards:

Track 1: 5 to 10 awards; Track 2: 5 to 10 awards; Track 3: 5 to 10 awards

Both NSF and USDA/NIFA funds will be used to support Tracks 1-3. NSF will share all submitted materials with USDA/NIFA. Some projects and/or subawards may be funded directly by USDA/NIFA as determined by a joint NSF/USDA decision. If a submitted proposal is determined by NSF and USDA/NIFA to be funded by USDA/NIFA, the lead PI/institution or subawardee will be instructed to update those portions of the proposal that must conform to differing USDA/NIFA guidelines. Subsequent grant administration procedures will be in accordance with the individual policies of the awarding agency.

Anticipated Funding Amount: \$34,000,000

The total amount available for this solicitation is \$34,000,000. Of this amount, NSF anticipates contributing approximately \$29,000,000 and USDA/NIFA anticipates contributing approximately \$5,000,000. This plan is subject to the availability of funds. This program solicitation is being released prior to the passage of the relevant appropriations. Enactment of additional continuing resolutions or an appropriations act may affect the availability of funds or level of funding for this program.

Projects submitted to Tracks 1 and 2 will request three to five years of support with a total budget less than or equal to \$2,500,000. If any Track 1 or 2 proposal exceeds \$2,500,000, it will result in "Return Without Review."

Projects submitted to Track 3 will request four to five years of support with a total budget less than or equal to \$750,000. If any Track 3 proposal exceeds \$750,000 it will result in "Return Without Review."

Funding requests from international partners on this solicitation are independent of and not included in the total request (Link to [Budget requirements for international partners](#)).

This is an interagency partnership between NSF and USDA/NIFA; therefore meritorious proposals may be funded by one or more agencies at the option of the agencies, not the proposer. Both agencies will contribute to and participate in a common review process. All proposals MUST conform to NSF budgetary and proposal submission guidelines by the due dates.

Eligibility Information

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For proposals to be considered for funding under USDA/NIFA: (1) State agricultural experiment stations; (2) colleges and universities (including junior colleges offering associate degrees or higher); (3) university research foundations; (4) other research organizations; (5) Federal agencies, (6) national laboratories; (7) private organizations or corporations; (8) individuals who are U.S. citizens, nationals, or permanent residents; and (9) any group consisting of 2 or more entities identified in (1) through (8). Eligible organizations do not include foreign and international organizations. Award recipients may subcontract to organizations not eligible to apply provided such organizations are necessary for the conduct of the project.

Who May Serve as PI:

There are no restrictions or limits for the allowable organizations listed above. To be considered as an NSF proposal, federal agencies and federally funded research and development centers (FFRDCs) can participate only as subawardees or unpaid collaborators. FFRDC and federal agency scientists cannot serve as lead PI to be eligible for NSF funding. Non-NSF sponsored FFRDCs are required to provide a letter of support from their agency.

Limit on Number of Proposals per Organization:

There is no limit on the number of proposals per organization. However, there is a limitation on the number of submissions per PI as noted below.

Limit on Number of Proposals per PI or Co-PI:

An individual may be lead PI, co-PI, Senior Personnel, or Consultant on: Any individual currently leading an INFEWS

(16-524 and/or 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal.

- Any individual currently leading an INFEWS (16-524 and/or 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal.
- For any individual who is a lead-PI, co-PI or Senior Personnel on an active/funded INFEWS award (16-524 and/or 17-530), s/he may be involved in only one proposal associated with this solicitation (NSF 18-xyz) in any capacity other than an external advisory committee member.
- No more than two INFEWS proposals and
- No more than one proposal per track.
- If an individual is on 2 proposals in any of these positions, s/he may be a lead PI on ONLY ONE of the two proposals.

These limitations include PIs, Co-PIs, and Senior Personnel listed on the lead organization or any subaward submitted as part of the proposal.

Please be advised that violations of these rules will result in "return without review" for ALL proposals submitted that include the individual in violation of these rules.

Please note: All materials should be submitted to NSF and must conform to NSF PAPPG guidelines (including budgetary/overhead considerations) at the time of submission. NSF will share all submitted materials with USDA/NIFA. If all or a portion of a submitted proposal is determined by NSF and USDA/NIFA to be funded by USDA-NIFA, the lead PI/organization or subawardee will be instructed to update those portions of the proposal that must conform to differing USDA guidelines. Subsequent grant administration procedures will be in accordance with the individual policies of the awarding agency.

Proposal Preparation and Submission Instructions

A. Proposal Preparation Instructions

- **Letters of Intent:** Not required
- **Preliminary Proposal Submission:** Not required
- **Full Proposals:**
 - Full Proposals submitted via FastLane: *NSF Proposal and Award Policies and Procedures Guide (PAPPG)* guidelines apply. The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.
 - Full Proposals submitted via Grants.gov: *NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov* guidelines apply (Note: The *NSF Grants.gov Application Guide* is available on the Grants.gov website and on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide).

B. Budgetary Information

- **Cost Sharing Requirements:**

Inclusion of voluntary committed cost sharing is prohibited.
- **Indirect Cost (F&A) Limitations:**

In accordance with NSF policy, the applicable US Federally negotiated indirect cost rate(s) must be used in computing indirect costs for the proposal. If a proposal or part of a proposal is selected for funding by USDA/NIFA, PIs will receive further instruction. For awards made by USDA/NIFA see information and instructions regarding indirect costs, refer to Part V, section 7.9 of the NIFA Grants.gov Application Guide.
- **Other Budgetary Limitations:**

Other budgetary limitations apply. Please see the full text of this solicitation for further information.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

September 26, 2018

Proposal Review Information Criteria

Merit Review Criteria:

National Science Board approved criteria. Additional merit review considerations apply. Please see the full text of this solicitation for further information.

Award Administration Information

Award Conditions:

Additional award conditions apply. Please see the full text of this solicitation for further information.

Reporting Requirements:

Additional reporting requirements apply. Please see the full text of this solicitation for further information.

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I. INTRODUCTION

Humanity depends upon the Earth's physical resources and natural systems for food, energy, and water (FEW). However, both the physical resources and the FEW systems are under increasing stress. It is becoming imperative that we determine how society can best integrate social, ecological, physical and built environments to provide for growing demand for food, energy and water in the short term while also maintaining appropriate ecosystem services for the future. Known stressors in FEW systems include governance challenges, population growth and migration, land use change, climate variability, and uneven resource distribution. The interconnections and interdependencies associated with the FEW Nexus pose research grand challenges. To meet these grand challenges, there is a critical need for research that enables new means of adapting societal use of FEW systems.

The INFEWS program seeks to support research that conceptualizes FEW systems broadly and inclusively, incorporating social and behavioral processes (such as decision making and governance), physical processes (such as built infrastructure and new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrologic cycles), biological processes (such as agroecosystem structure and productivity), and cyber-components (such as sensing, networking, computation and visualization for decision-making and assessment). Investigations of these complex systems may produce discoveries that cannot emerge from research on food or energy or water systems alone. It is the synergy among these components in the context of sustainability that will open innovative science and engineering pathways to produce new knowledge, novel technologies, and innovative predictive capabilities.

The overarching goal of the INFEWS program is to catalyze well-integrated, convergent research to transform understanding of the FEW Nexus as integrated social, engineering, physical, and natural systems in order to improve system function and management, address system stress, increase resilience, and ensure sustainability. The NSF INFEWS initiative is designed specifically to attain the following goals:

1. Significantly advance our understanding of the food-energy-water system of systems through quantitative, predictive and computational modeling, including support for relevant cyberinfrastructure;
2. Develop real-time, cyber-enabled interfaces that improve understanding of the behavior of FEW systems and increase decision support capability;
3. Enable research that will lead to innovative and integrated social, engineering, physical, and natural systems solutions to

- critical FEW systems problems;
4. Grow the scientific workforce capable of studying and managing the FEW system of systems, through education and other professional development opportunities.

This initiative enables interagency cooperation on one of the most pressing problems of the millennium - understanding interactions across the FEW Nexus - how dynamics of the FEW Nexus are likely to affect our world, and how we can proactively plan for consequences. This solicitation allows the partner agencies - National Science Foundation (NSF) and the United States Department of Agriculture National Institute of Food and Agriculture (USDA/NIFA) and others - to combine resources to identify and fund the most meritorious and highest-impact projects that support their respective missions, while eliminating duplication of effort and fostering collaboration between agencies and the investigators they support.

In addition, NSF and USDA/NIFA are promoting international cooperation that links scientists and engineers from a range of disciplines and organizations to solve the significant global challenges at the nexus of FEW systems. Proposals including international collaboration are encouraged when those efforts enhance the merit of the proposed work by incorporating unique resources, expertise, facilities or sites of international partners. The U.S. team's international counterparts generally should have support or obtain funding through non-NSF sources. To facilitate coordinating research activities between US and international partners, specific collaborative funding opportunities have been developed involving some international partners. These opportunities are listed on the [INFEWS international opportunities website](#).

II. PROGRAM DESCRIPTION

General Requirements

Systems Approach: The INFEWS program defines food and energy and water (FEW) systems as inclusive of social and behavioral processes (such as decision making and governance), physical processes (such as built infrastructure and new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrological cycles), agricultural and biological processes (such as agroecosystem structure and productivity), and cyber-components (such as sensor networking, computation, visualization of decision-making and assessment). The INFEWS program also recognizes that FEW systems may appropriately be defined at a wide range of temporal and spatial scales; locally to globally.

Although each proposal does not need to examine all processes listed in the previous paragraph, **proposals submitted to the INFEWS solicitation must define (especially in the project description and the context statement) the FEW systems intended for study.** The FEW systems description should identify the various system boundaries and the primary food and energy and water components that make up the integrated FEW system(s) of the study. Each of the three FEW components must be important and significant in the research proposed from an integrated systems perspective. **Proposals that conduct integrated research on two of the three components, while inadequately integrating the third component or treating the third component in a non-research mode (i.e. applying what you already know) will be returned without review.** Successful proposals will define appropriate feedback mechanisms and dynamics among the FEW systems components to be studied. Proposals should also identify how the research will account for exogenous inputs to the system, where relevant. PIs should justify their approach in the proposal.

Integration across Disciplines: Proposals submitted to the INFEWS program must demonstrate meaningful integration across disciplines to address the principal objectives outlined below and should go beyond existing approaches that can be addressed within the individual disciplines and usual core-program co-funded research opportunities at NSF and USDA/NIFA. Although many disciplinary challenges remain in FEW systems research, this solicitation intends to bridge significant existing gaps between disciplinary foci, and to foster new lines of research that emerge only in a convergent science context. (See [Convergence Research at NSF](#) and the [Dear Colleague Letter: Growing Convergence Research at NSF](#) March 2017).

Proposals must document that the proposed research is truly interdisciplinary, that the respective components are fully integrated, necessary, and important for the successful execution of the proposed project, and that the research team contains sufficient expertise to carry out all dimensions of the research plan to enable fully convergent science. Plans for integration of the respective research components must be fully outlined in the proposal.

INFEWS proposals must integrate and engage the disciplinary science from three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA. USDA/NIFA may be invoked as a "discipline" if the research focus represents a topical area that is uniquely distinct from disciplines typically supported by participating NSF Directorates (ENG, GEO, SBE). Additional disciplines may be added from participating or non-participating Directorates provided the three required disciplines are in place. **The FEW Context Statement should carefully elaborate the three specific disciplines as well as the relevant differences between NSF and USDA/NIFA "disciplines".** **Proposals that conduct integrated research on two of the three disciplines, while inadequately integrating the third discipline and/or proposing research that integrates the third discipline only tangentially, will be returned without review.** See also Frequently Asked Questions at the end of the solicitation.

Leverage existing investments: Multiple agencies and universities have established data collections and measurement programs that provide a significant background of information on many potential FEW systems studies. An INFEWS project should utilize such data sources when appropriate and propose the measurement and collection of new data only if they are critical to the FEW systems under study.

General Options

Cyber Elements: Pursuing INFEWS research topics may require that novel capabilities be added to new and existing cyberinfrastructure to be successful. Cyber-Human-Physical Systems can be integrated for decision making at multiple spatial and temporal scales with sensing, computation, and networking measurements of the social, natural, physical, and built worlds. This solicitation encourages investments that would introduce new capabilities, advanced computation and novel cyberinfrastructure approaches, especially with respect to (1) fully engaging stakeholders and public outreach, (2) addressing the computational challenges, and (3) data integration challenges inherent in INFEWS research, leading to previously unattainable results. Given that

INFEWS proposals require three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA, **these cyber options will need to be included as a “fourth” discipline but may positively benefit the overall project by providing a higher degree of integration.**

Partnerships: INFEWS research has natural linkages to federal agencies and a wide spectrum of other stakeholders. Whenever appropriate, **partnerships are encouraged among universities, research centers, federal agencies, national labs, state, local, and tribal governments, private organizations as well as businesses and industries.** Such partnerships should be considered for improved definition of underlying scientific problems such that effective and impactful approaches may be developed.

International Cooperation: NSF and USDA/NIFA promote international cooperation that links scientists and engineers from a range of disciplines and organizations to solve significant global challenges at the nexus of FEW systems. Proposals including international collaboration are encouraged (but not required) when those efforts enhance the merit of the proposed work by incorporating unique resources, expertise, facilities or sites of international partners. Research may involve any country/countries, but the U.S. team's international counterparts generally should have support or obtain funding through non-NSF sources. More information is provided below under “**Proposal Preparation Instructions**”. For budget requirements for international partners, link to the In are discussed at [INFEWS International Opportunities website](#).

INFEWS Tracks

This solicitation outlines three tracks of research (numbering differs from previous years): Track 1: Social-Physical Modelling of FEW Systems; Track 2: Research to Enable Innovative Solutions; and Track 3: INFEWS Research Coordination Networks (INFEWS-RCN). A proposal may be submitted to ONLY ONE track per competition. Proposals submitted to more than one track or proposals that fail to specify a track in the title will be returned without review.

Track 1: Social-Physical Modelling of FEW Systems Track 1 aims to significantly advance understanding of FEW systems with advanced modeling that investigates the functioning of coupled social, physical, biotic, abiotic, and engineered systems. The goal is to define and understand the couplings/linkages, feedback mechanisms and processes among the FEW systems components and to elucidate the factors that influence resilience, thresholds and criticalities. Track 1 projects should articulate clear hypotheses and/or describe what anticipated theoretical advancements will likely emerge from the systems modeling efforts. These projects should enable innovative perspectives and advances in understanding and modeling complex systems processes. Development of advanced computational methods and effective means for incorporation of large quantities of disparate data, as implemented in new and novel software and tools, is also appropriate.

Projects might use a wide variety of different systems analyses and modeling approaches to explore the functional dynamics of FEW systems. Some projects might integrate across models from multiple disciplinary domains, including, but not limited to the agricultural, political, social, behavioral, computational, cultural, ecological, economic, energy, engineering, geospatial, hydrological, and mathematical domains. Projects might also explore disparate types of datasets to develop new understandings of FEW relationships, systems and their dynamics. Some of the proposed projects may address additional cyberinfrastructure capabilities that could include advanced computational infrastructure supporting advanced modeling, data integration across multiple scales (including the possibility of real-time sensing) or more fully engaging stakeholders, and public outreach.

Systems chosen for study must be examined to define/quantify spatially heterogeneous FEW systems responses to various internal and external driving factors that occur on both short and long timescales. FEW systems operations must be investigated under the influence of single and multiple driving factors. FEW models should allow for investigation of system(s) resiliency, attempt to identify thresholds, and explore system(s) response to variability among critical parameters singly, in combination, or at extreme values.

INFEWS research topics and projects may also require novel capabilities of existing shared cyberinfrastructure to be successful. Track 1 projects may introduce new capabilities and novel computing cyberinfrastructure and data integration approaches to address the scientific challenges and the engagement and outreach to stakeholders. Here, the emphasis would be upon extending existing, shared cyberinfrastructure resources (at the campus, regional, or national level) to specifically address the computational cyberinfrastructure challenges associated with the proposed INFEWS research.

Proposed Track 1 projects/models must be designed to assess (a) the model's generalizability through either site-to-site comparisons or within site comparisons at multiple time/space scales, or (b) the model's ability to evaluate minimization-of-risk with respect to FEW services, the components/couplings that define threshold and resilient FEW systems behavior and the impact of mitigation and adaptation with respect to minimization-of-risk. Alternately, projects where advanced cyberinfrastructure is the focus, must assess performance and strategic potential of the new cyberinfrastructure, as well as its ability to enable INFEWS research advances.

Track 2: Research to Enable Innovative System Solutions

FEW systems are facing multiple stresses, including, but not limited to, shifting social, economic and governance norms, increasing global populations, rapid land use change, and escalating climate variability. Heterogeneous resource distribution and access, increasing resource scarcity, degraded resource quality, and diminished ecosystem services also challenge long-term FEW systems sustainability. Track 2 projects will develop and examine innovative solutions that address specific FEW system challenges and aim to enhance FEW systems' resilience and sustainability. Research on innovative institutional, behavioral, and technological solutions – and the coupled-combinations of solutions – is needed. Track 2 research might explore sustainable management solutions, examine the drivers of resource consumption, and study the means of extending resources via methods such as reducing, recycling, recovery, and reuse, among other topics.

Track 2 projects must take a systems approach when researching potential solutions. A project that addresses the three components (food, energy, and water) separately, rather than integrating all three in a single system simultaneously, is not appropriate for the INFEWS solicitation. Projects should demonstrate how the envisioned solution will contribute to system-wide improvements across sectors and places accounting for appropriate variabilities across temporal and spatial scales. Solutions may increase stress at certain scales, or during an initial adjustment period, but may prove to reduce key stressors in a broader context or over longer time horizons. Proposers should be cognizant that solutions often imply increased resource investments across differing cultural and legal contexts, and, therefore have the potential to increase systems level stresses and other unintended consequences. Hence, the proposed approaches must identify solutions in a broad systems context beyond the specific proposed solution.

Specific areas of interest include, but are not limited to:

- **Governance:** Research on the cultural, behavioral, institutional, legal, organizational, political, social, and technological innovations that improve the sustainability, efficiency, equity, and resiliency of FEW systems is needed. Managerial, social, and policy innovations may involve intergovernmental relations as well as formal and informal governance structures. The effectiveness of innovations in one domain may depend on complementary innovations in other domains.
- **Efficient Use of Resources:** One goal of INFEWS is to address production, consumption and waste. Scientific, engineering, institutional, social, and behavioral solutions to improve FEW systems efficiencies should be coupled with new knowledge of how economic, social, ecological and physical systems interact. Projects can address production, consumption, and waste as well as how these aspects of FEW systems interact with each other in technical and non-technical domains to minimize resource consumption and waste at a systems level.
- **Conversion and/or Reuse of Waste Materials:** New devices, sensors, catalysts, nanomaterials, smart filters, and processes may be required to detect, remove, destroy or convert compounds of concern from waste streams, or to turn waste constituents into valuable primary or secondary products. A FEW systems approach to these problems may also reveal uses for 'waste' that do not require complete reversion back to pristine conditions. Proposals should either demonstrate or include plans to examine the expected effects of wide-spread adoption of the proposed innovation on the FEW systems. Projects may also consider the social, cultural, economic and other incentives and obstacles to deployment of such solutions.
- **Systems Sustainability:** INFEWS aims to enable research on innovative strategies for appropriate management of social, and physical systems. Questions of use, access, and governance will likely be important in this context. Spatial incongruities between the natural and political boundaries of the various component systems and temporal mismatches between decision-making timeframes and systems response and dynamics may also need to be addressed.

Implementation of a Track 2 project may benefit from novel capabilities added to new and existing cyberinfrastructure. This track encourages investments that would introduce new capabilities, advanced computation and novel cyberinfrastructure approaches, especially with respect to (1) fully engaging stakeholders and public outreach, (2) addressing the computational challenges, and (3) data integration challenges inherent in INFEWS research, leading to previously unattainable results. Given that INFEWS proposals require three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA, **these cyber options will need to be included as a "fourth" discipline but may positively benefit the overall project by providing a higher degree of integration.**

Track 3: INFEWS Research Coordination Networks (INFEWS-RCN)

This track supports the establishment of new networks of interdisciplinary researchers from multiple organizations who will collectively and significantly advance INFEWS concepts, knowledge and new directions through active exchange of ideas, development of new directions in fundamental research and education, and other approaches. Each INFEWS-RCN proposal will request four or five years of support at a level not to exceed \$750,000 for the total budget.

An INFEWS-RCN should be designed to identify and address an ambitious, nationally, and/or internationally important theme across INFEWS systems that requires the scale, breadth, facilities, and integration across disciplines and sectors made possible by a large and diverse network.

INFEWS-RCN awards are not meant to support the existing activities of established collaborations/projects, nor should they support the planning or performance of individual or group research projects. Funds from this program may not support independent, individual research projects of the participants; nor are they to be used as a mechanism for a mini-grant awarding program. Rather, an INFEWS-RCN should engage in activities that will facilitate (1) the advancement of fundamental INFEWS research ideas across diverse research communities; (2) building of coordinated, new and novel networks of innovation that go beyond the scope of funded activities conducted by the members of the INFEWS-RCN; and (3) communication with stakeholders on INFEWS concepts and research.

INFEWS-RCN areas of interest may include, but are not limited to, novel participant networking strategies, collaborative technologies for interdisciplinary or distributed work, and the development/discussion of research community standards for data and meta-data. The ultimate goal of an INFEWS-RCN is to nurture and grow the INFEWS research and education ecosystem, cultivate new research directions in this area, and/or otherwise advance the field through effective communication and sharing of ideas between the academic community and affected businesses, communities, and industries.

Implementation of a Track 3 INFEWS-RCN project may benefit from novel capabilities added to new and existing cyberinfrastructure. This track encourages investments that would introduce new capabilities, advanced computation, and novel cyberinfrastructure approaches. These new methods and approaches should be targeted to (1) fully engaging stakeholders and public outreach, (2) addressing the computational challenges, and (3) data integration challenges inherent in INFEWS research, leading to previously unattainable results. **These cyber options (to be included as a "fourth" discipline) may positively benefit the overall project by providing a higher degree of integration.**

International INFEWS-RCNs: This INFEWS Track will also consider RCNs with international participants. NSF encourages international collaboration, and anticipates that RCN projects may include participants, including leadership committee members, from outside the US. International collaborations that clearly strengthen the proposed network activities should be included. As NSF funding is intended to support US participants, network participants from organizations outside the US should seek support from their respective funding organizations. Some opportunities for support of researchers and networks based outside the US are described on the [INFEWS international opportunities website](#).

ADDITIONAL REQUIRED CHARACTERISTICS OF INFEWS-RCNs

General information about the RCN concept and mechanism can be found at [NSF 17-594](#). However, given the special nature of this INFEWS program solicitation, applicants must follow the instructions and guidance in this INFEWS solicitation to prepare an INFEWS-RCN application. Specifically, an INFEWS-RCN proposal will need to address integrated food and energy and water research and education with engagement of researchers from communities served by the three participating NSF directorates (ENG, GEO, SBE) or two participating Directorates and USDA-NIFA. There is no penalty nor special consideration given to projects that include the disciplinary science of more than the three participating Directorates.

1. **Convergent Research:** An INFEWS-RCN will transcend traditional disciplinary boundaries and bring together social and

physical scientists, engineers, educators, managers, and other stakeholders from a range of disciplines, businesses, organizations, and backgrounds. These different groups will, through the proposed network, help to better define both the FEW Nexus problems as well as appropriate approaches to solutions to the defined problems. From the outset, the RCN should promote integration and collaboration with resource managers, policymakers, end-users, and other stakeholders in the private and public sectors through direct involvement. The INFEWS-RCN should be designed to adapt and grow as new opportunities arise. Together, this convergent research network team will foster new knowledge, and tools that significantly advance this network of integration, coordination, and innovation and the [convergent science](#) of INFEWS systems.

2. **Community Engagement:** In addition to the disciplinary research communities defined by the (at least) 3 participating NSF Directorates (or 2 participating Directorates and USDA-NIFA), an INFEWS-RCN should include interactions with lead and other organizations as well as individuals and organizations in the public, private and/or non-profit sectors. Here, community engagement refers to substantive interaction with individuals, institutions, and other organizations in target communities such as community partner organizations and organizations in the public, private, and not-for profit sectors; these organizations include but are not limited to governments, government departments/agencies, schools, libraries, health and social service providers, non-profits, cultural organizations, and businesses/industries. Researchers and community partners will work closely to develop and evaluate creative approaches to achieving meaningful engagement and solutions for mutual benefit across the INFEWS-RCN focal topic.
3. **Support for education, outreach, and diversity:** The INFEWS-RCN should include a strong program of linked education and outreach activities that support the goals of the INFEWS initiative, increase stakeholder and public engagement, and train the next generation of researchers and the future FEW workforce. The INFEWS-RCN is expected to include a range of research and education training opportunities and promote the development of a diverse, internationally-competitive, and globally-engaged workforce that is well-prepared for a variety of career paths related to FEW Systems sustainability. An INFEWS-RCN is also expected to maintain a significant web-presence in support of convergence science discussions.
4. **Growing the INFEWS-RCN:** The initial network of participants should be identified in the proposal along with the Executive team comprised of PI, co-PI(s), and Senior Personnel. Additionally, there should be clearly developed mechanisms to maintain openness, ensure access, and actively promote participation by interested parties outside of the initial participants in the proposed network.

SPECIFIC REQUIREMENTS for INFEWS-RCNs

In addition to the general eligibility rules:

- Any individual currently leading an INFEWS (16-524 and/or 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal.
- For any individual who is a lead-PI, co-PI or Senior Personnel on an active/funded INFEWS award (16-524 and/or 17-530), s/he may be involved in only one proposal associated with this solicitation (NSF 18-xyz) in any capacity other than an external advisory committee member.

These limitations include PIs, Co-PIs, and Senior Personnel listed on the lead organization or any subaward submitted as part of the proposal.

Management Plan for Track 3 INFEWS-RCNs:

The management plan is part of the 15-page project description for the INFEWS-RCN track (for Tracks 1 and 2, the Management Plan is a separate document and not part of the 15-page project description). The INFEWS-RCN management plan should:

- Describe plans and procedures for the development and assessment of the proposed activity.
- Include formal mechanisms to ensure fair and equitable allocation of group resources.
- Clearly define the responsibilities for leadership and the role of the PI and the steering committee.
- Delineate the procedures used for the selection of initial network participants, the plans for maintaining an appropriate degree of openness, and for continually encouraging the involvement of additional interested parties.
- Describe means for self-evaluation of progress toward the network goals.
- Describe the plans for coordination and cooperation among the relevant networks, groups, and/or international partners.

Project Personnel Table; Collaborators and Other Affiliations Requirements:

An INFEWS-RCN must define their core member participants in the Project Personnel Table (members of the leadership committee); listed as PI, co-PI(s), or Senior Personnel). As such, each of their biographical sketches must also be provided as per the submission instructions in section "V" below.

Members of the RCN's (optional) external advisory committee (if already formed) must be named in the Project Personnel Table for purposes of managing reviewer selection (but do not include a biographical sketch) and listed in the Collaborators and Other Affiliations Information spreadsheet; information specified on the ["Collaborators and Other Affiliations" website](#).

III. AWARD INFORMATION

Anticipated Type of Award: Continuing Grant or Standard Grant

Estimated Number of Awards: 15 to 30

Anticipated Funding Amount: \$34,000,000

The total amount available for this solicitation is \$34,000,000. Of this amount, NSF anticipates contributing approximately \$29,000,000 and USDA/NIFA anticipates contributing approximately \$5,000,000. This plan is subject to the availability of funds. This program solicitation is being released prior to the passage of the relevant appropriations. Enactment of additional continuing resolutions or an appropriations act may affect the availability of funds or level of funding for this program.

Projects submitted to Tracks 1 and 2 will request three to five years of support with a total budget less than or equal to \$2,500,000. If any Track 1 or 2 proposal exceeds \$2,500,000, it will result in "Return Without Review."

Projects submitted to Track 3 will request four to five years of support with a total budget less than or equal to \$750,000. If any Track 3 proposal exceeds \$750,000 it will result in "Return Without Review."

Funding requests from international partners on this solicitation are independent of and not included in the total request (Link to [Budget requirements for international partners](#)).

This is an interagency partnership between NSF and USDA/NIFA; therefore meritorious proposals may be funded by one or more agencies at the option of the agencies, not the proposer. Both agencies will contribute to and participate in a common review process. All proposals MUST conform to NSF budgetary and proposal submission guidelines by the due dates.

IV. ELIGIBILITY INFORMATION

Who May Submit Proposals:

Proposals may only be submitted by the following:

- Institutions of Higher Education (IHEs) - Two- and four-year IHEs (including community colleges) accredited in, and having a campus located in the US, acting on behalf of their faculty members. Special Instructions for International Branch Campuses of US IHEs: If the proposal includes funding to be provided to an international branch campus of a US institution of higher education (including through use of subawards and consultant arrangements), the proposer must explain the benefit(s) to the project of performance at the international branch campus, and justify why the project activities cannot be performed at the US campus.
- Non-profit, non-academic organizations: Independent museums, observatories, research labs, professional societies and similar organizations in the U.S. associated with educational or research activities.
- For proposals to be considered for funding under USDA/NIFA: (1) State agricultural experiment stations; (2) colleges and universities (including junior colleges offering associate degrees or higher); (3) university research foundations; (4) other research organizations; (5) Federal agencies, (6) national laboratories; (7) private organizations or corporations; (8) individuals who are U.S. citizens, nationals, or permanent residents; and (9) any group consisting of 2 or more entities identified in (1) through (8). Eligible organizations do not include foreign and international organizations. Award recipients may subcontract to organizations not eligible to apply provided such organizations are necessary for the conduct of the project.

Who May Serve as PI:

There are no restrictions or limits for the allowable organizations listed above. To be considered as an NSF proposal, federal agencies and federally funded research and development centers (FFRDCs) can participate only as subawardees or unpaid collaborators. FFRDC and federal agency scientists cannot serve as lead PI to be eligible for NSF funding. Non-NSF sponsored FFRDCs are required to provide a letter of support from their agency.

Limit on Number of Proposals per Organization:

There is no limit on the number of proposals per organization. However, there is a limitation on the number of submissions per PI as noted below.

Limit on Number of Proposals per PI or Co-PI:

An individual may be lead PI, co-PI, Senior Personnel, or Consultant on: Any individual currently leading an INFEWS (16-524 and/or 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal.

- Any individual currently leading an INFEWS (16-524 and/or 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal.
- For any individual who is a lead-PI, co-PI or Senior Personnel on an active/funded INFEWS award (16-524 and/or 17-530), s/he may be involved in only one proposal associated with this solicitation (NSF 18-xyz) in any capacity other than an external advisory committee member.
- No more than two INFEWS proposals and
- No more than one proposal per track.
- If an individual is on 2 proposals in any of these positions, s/he may be a lead PI on ONLY ONE of the two proposals.

These limitations include PIs, Co-PIs, and Senior Personnel listed on the lead organization or any subaward submitted as part of the proposal.

Please be advised that violations of these rules will result in "return without review" for ALL proposals submitted that include the individual in violation of these rules.

Please note: All materials should be submitted to NSF and must conform to NSF PAPPG guidelines (including budgetary/overhead considerations) at the time of submission. NSF will share all submitted materials with USDA/NIFA. If all or a portion of a submitted proposal is determined by NSF and USDA/NIFA to be funded by USDA-NIFA, the lead PI/organization or subawardee will be instructed to update those portions of the proposal that must conform to differing USDA guidelines. Subsequent grant administration procedures will be in accordance with the individual policies of the awarding agency.

Additional Eligibility Info:

If one participating unit constitutes an FFRDC and/or another US government agency, expenses associated with participation of those scientists should be consolidated into a single subaward (for each agency). Should the proposal be successful, the full FFRDC financial commitment must be met by the FFRDC or agency; therefore FFRDC and agency submissions should be cleared in advance with the relevant agency and the submission should be supported by an email or letter of commitment from that agency (provided in Supplementary Documents).

Projects involving federal agencies or national laboratories will only be considered for co-funding by NSF if they are cooperative efforts that involve non-federally funded organizations. Proposals from FFRDCs must obey NSF budget guidelines and may not include costs already covered by federal funds. To facilitate possible interagency funding of such collaborations, an organization other than the federal agency or national laboratory must serve as the lead organization.

Projects which end up being funded by USDA/NIFA will follow normal operational USDA/NIFA guidelines for agencies and FFRDCs; projects funded under this solicitation by NSF will follow normal operational NSF guidelines for agencies and national laboratories (PAPPG Chapter I.E.7). Under exceptional circumstances, research or education projects at other Federal agencies or FFRDCs that can make unique contributions to the needs of researchers elsewhere or to other specific NSF objectives may receive NSF support. This generally means that other federal agencies and/or FFRDCs should not be the lead organization and specific budgetary restrictions apply per NSF.

V. PROPOSAL PREPARATION AND SUBMISSION INSTRUCTIONS

A. Proposal Preparation Instructions

Full Proposal Preparation Instructions: Proposers may opt to submit proposals in response to this Program Solicitation via Grants.gov or via the NSF FastLane system.

- Full proposals submitted via FastLane: Proposals submitted in response to this program solicitation should be prepared and submitted in accordance with the general guidelines contained in the NSF Proposal & Award Policies & Procedures Guide (PAPPG). The complete text of the PAPPG is available electronically on the NSF website at: https://www.nsf.gov/publications/pub_summ.jsp?ods_key=papppg. Paper copies of the PAPPG may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov. Proposers are reminded to identify this program solicitation number in the program solicitation block on the NSF Cover Sheet For Proposal to the National Science Foundation. Compliance with this requirement is critical to determining the relevant proposal processing guidelines. Failure to submit this information may delay processing.
- Full proposals submitted via Grants.gov: Proposals submitted in response to this program solicitation via Grants.gov should be prepared and submitted in accordance with the NSF Grants.gov Application Guide: A Guide for the Preparation and Submission of NSF Applications via Grants.gov. The complete text of the NSF Grants.gov Application Guide is available on the Grants.gov website and on the NSF website at: (https://www.nsf.gov/publications/pub_summ.jsp?ods_key=grantsgovguide). To obtain copies of the Application Guide and Application Forms Package, click on the Apply tab on the Grants.gov site, then click on the Apply Step 1: Download a Grant Application Package and Application Instructions link and enter the funding opportunity number, (the program solicitation number without the NSF prefix) and press the Download Package button. Paper copies of the Grants.gov Application Guide also may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

See Chapter II.C.2 of the [PAPPG](#) for guidance on the required sections of a full research proposal submitted to NSF. Please note that the proposal preparation instructions provided in this program solicitation may deviate from the PAPPG instructions.

The following instructions supplement or deviate from the guidance in the PAPPG and NSF Grants.gov Application Guide.

Please note: All materials should be submitted to NSF. NSF will share all submitted materials with USDA/NIFA and other participating agencies.

There are specific instructions regarding Multi-Organizational Proposals, title of Proposal, Co-Review, preparation of "Biographical Sketches", "Results from Prior NSF Support" and "Collaborators and Other Affiliations".

There are also specific instructions for Supplementary Documents regarding preparation of "Data Management Plan", "Postdoctoral Researcher Mentoring Plan", "Project Personnel Table", "Results from Prior NSF Support", "Management Plan", "Letters of Collaboration", and the "FEW Context Statement".

There are additional specific instructions for Track 3 (INFEWS-RCN) in addition to those for Tracks 1 and 2.

Failure to follow these instructions can result in a proposal being returned without review (RWR).

Special Instructions regarding International Collaboration

Proposals that choose to involve international collaboration should clearly describe the work that will be accomplished by the entire team, including the international partners, and how the international partners' efforts will be or are already supported.

NSF is developing collaborations with international partner funding organizations to coordinate research activities between US researchers and those in other countries. Funding opportunities relevant to researchers outside the US who would like to cooperate with US researchers on INFEWS proposals are listed at the [INFEWS international opportunities website](#). This list includes both

general funding opportunities related to INFEWS (listed as “**General Opportunities**”) and any specific coordinated funding opportunities that have been developed (listed as “**INFEWS International Partnerships**”). Support for research collaborators outside the US should be sought from non-NSF sources wherever possible, and the proposal should state how the international partners will pursue research funding support or what relevant support they already have.

There are two possible modes of international collaboration:

- Collaboration with researchers in countries listed under [INFEWS International Partnerships](#), in which a partner funding agency may provide the funds required by the international research collaborator. More details are available at the link listed above, including details on the documents to include in your proposal and budget limits for international partners set by their funding agency(s).

Where coordinated agreements have been developed, partner funding agencies may send an observer to attend review/panel meetings, and may fully participate in the decision-making process for proposals that do include researchers from their country. In addition, partner funding agencies may recommend reviewers who may be selected to serve as panelists or ad hoc reviewers. Proposals submitted to NSF under INFEWS International Partnerships may be shared with the funding agency(s) from the relevant country(s), along with reviews, supplementary documents and other materials needed to reach a funding decision.

- Collaboration with non-US researchers whose **countries are not listed** or are only listed under **General Opportunities** on the [INFEWS International Partnerships](#) website. Many international research collaborators, especially in developed countries, have opportunities for support from their own funding agencies even if they are not partners on this solicitation. A partial list of potentially relevant opportunities is provided.

Developing country collaborators who are working with NSF-funded researchers may be eligible to submit proposals to the [Partnerships for Enhanced Engagement in Research \(PEER\)](#) program, which is funded by USAID and managed by the US National Academies. Support should be sought from non-NSF sources wherever possible and the proposal should state how the international partners will pursue support or what relevant research support they already have. The NSF budget may include limited funds for services provided by non-US-based persons only if those services are essential to the success of the project, and if they could not be provided by a US-based person or organization.

Additional guidance is provided on the [INFEWS international opportunities website](#).

Special Instructions (Tracks 1, 2, and 3) for the following:

1. Cover Sheet
2. Multi-Organizational Proposals
3. Title of Proposal
4. Co-Review
5. Biographical sketches
6. Results from Prior NSF Support
7. Supplementary Documents
8. Single Copy Documents - “Collaborators and Other Affiliations”
9. Additional Instructions for Track 3 INFEWS RCNs

Cover Sheet: No co-review allowed; Title must include Track number to which the proposal is directed. For proposals with an international dimension, the country or countries involved should be reported on the cover sheet.

Multi-Organizational Proposals: Any proposals involving multiple organizations must be submitted by the lead institution with all other organizations included via subawards. Simultaneous submission of the same proposal from multiple organizations (as described under PAPPG Chapter II.D.3) will **NOT** be accepted.

Title of Proposal: Submissions will have a title beginning with “INFEWS/T1”, “INFEWS/T2”, or “INFEWS/T3 RCN” depending upon the specific track to which the proposal is submitted (proposals may be submitted to only one track). These lead characters should be followed by any other indicators if appropriate. The title should state clearly and succinctly the focus of the project.

Co-Review: **PIs may not request co-review by other tracks or programs at NSF.** International partners from the countries and organizations listed on the [INFEWS international opportunities website](#) will review discussions of any proposals submitted to this competition involving their country(s) and will participate in the decision-making process for proposals involving their country(s).

Biographical Sketches: Biographical Sketches of all PIs, co-PIs, senior personnel, and consultants (that define the scientific team listed in the Project Personnel Table) should be provided in the “Biographical Sketches” section and must adhere to NSF guidelines (refer to PAPPG Chapter II.C.2.f for detailed Biographical Sketch preparation instructions). Additionally, **Biographical Sketches** for international collaborators should be included. The easiest way is to have the Biographical Sketches appear in the same order as in the Project Personnel Table is to list them in alphabetical order by last name in the table. If your submission runs into problems because you need to upload too many Biographical Sketches, please consolidate any remaining Biographical Sketches and upload them as a single document in **Supplementary Documents**.

Results from Prior NSF Support : Note that this should be uploaded as described below. It should **NOT** be part of the 15-page description as is indicated in the PAPPG. Please note that this section is only for reporting prior NSF support (no other federal agencies or other organizations are required to be listed in this section). “Results from Prior NSF Support” is not required for international partners unless they have received NSF funding. Reporting of “Results from Prior NSF Support” supported by USDA/NIFA is optional and may be included if it is contained within the 4 allotted pages.

For INFEWS-RCNs ONLY, “Results from Prior NSF Support” need not be submitted unless the proposed activity is clearly a logical extension of an activity supported by NSF, in which case the prior activity and how it relates to the proposed activity should be described.

Supplementary Documents: These Documents, discussed below, should be provided in the following order:

Document 1: Data Management Plan (up to 2 pages): The "Data Management Plan" should describe how the project will use and contribute to centralized efforts for data management including model-run output where applicable. The "Data Management Plan" must be submitted under the specific tab indicated in Supplementary Materials. The "Data Management Plan" is considered an integral part of the project and therefore subject to reviewer, panel, and program evaluation. Successful proposers will be expected to address data management issues in annual and final project reports. The following information should be addressed (as appropriate) for Tracks 1, 2 and 3:

- The types of data, samples, physical collections, software, and other materials to be produced over the course of the project;
- The standards to be used for data and metadata format and content (where existing standards are absent or deemed inadequate, this should be documented along with any proposed solutions or remedies); in all cases existing publicly accessible data bases should be utilized wherever it is appropriate;
- Policies for access and sharing including provisions for appropriate protection of privacy, confidentiality, security, intellectual property, or other rights or requirements;
- Policies and provisions for re-use, re-distribution, and the production of derivatives;
- Plans for archiving data, samples, and other research products, and for preservation of access to them;

Data Management Plan for Track 3 INFEWS RCN Proposals: Although collection of new data is not supported in RCN projects, this plan should describe issues related to information exchange, intellectual property rights, derived products, databases, software, model output, and materials sharing. For example, if the proposed activity is expected to result in community resources (such as databases or collections of materials and samples), the "Data Management Plan" should present a clear plan for sharing of these resources not only among the network participants but with the scientific community at large. The "Data Management Plan" should also address plans for determining authorship or proper attribution of credit for peer-reviewed or other publications, internet resources, etc. that may be expected to result from the activity.

Document 2: Postdoctoral Researcher Mentoring Plan (PRMP) (if Applicable) (up to 1 page): Proposals that request funding to support postdoctoral researchers at any of the participating organizations must include a description of the disciplinary and cross-disciplinary mentoring activities that will be provided for such individuals. Only one single-page PRMP is allowed per proposal even if multiple postdoctoral researchers from different organizations are involved. Thus, the postdoctoral researcher mentoring plan will be an additional means of providing cross-disciplinary mentoring across organizations and the project as a whole.

The Postdoctoral Researcher Mentoring Plan must be submitted under the specific tab indicated in Supplementary Materials.

Document 3: Other Supplementary Documents (one PDF containing the five documents, preferably in this order; descriptions listed below):

1. "Project Personnel Table" (Solicitation Addition to the PAPPG requirements).
2. "Results from Prior NSF Support" (up to four pages, Change in placement from the PAPPG requirements).
3. "Management Plan" (up to three pages, Solicitation Addition to the PAPPG requirements) for Tracks 1 and 2. For Track 3, the Management Plan should be included in the 15-page project description.
4. "Letters of Collaboration"
5. FEW Context Statement (one page, Solicitation Addition to the PAPPG requirements)

Project Personnel Table (PPT): The "Project Personnel Table" should specifically list PIs, co-PIs, senior personnel, and consultants) for the proposal. The purpose of the "Project Personnel Table" is to provide both NSF staff and reviewers information on the roles of each person for these large research groups. It also indicates who should have a biographical sketch, and who should be included in the "Results from Prior NSF Support" section.

Members of the project's (optional) external advisory committee (if already formed) must be named in the "Project Personnel Table" to provide both NSF staff and reviewers information on the roles of each person for these large research groups. Biographical sketches do not need to be included. The committee members also must be listed in the Collaborators and Other Affiliations Information spreadsheet (see ["Collaborators and Other Affiliations website."](#))

For Track 3, INFEWS-RCN, proposals must define their core member participants in the "Project Personnel Table" (members of the leadership team; listed as PI, co-PI, or Senior Personnel). As such, biographical sketches must also be provided for each.

Each proposal should submit ONE "Project Personnel Table" for their PROJECT. These individuals should be identified as to their responsibility in the Management Plan and should have an NSF-style biographical sketch included within the "Biographical Sketches" portion of the proposal. The table should include the names of all individuals associated (named) with the project including international participants according to the following template (use landscape layout if needed).

- Column A: PI, co-PI, Senior Personnel, consultant, or external advisory member on project (last name, first name).
- Column B: Organization of PI, co-PI, senior personnel, consultant, or external advisory member on project.
- Column C: project role, e.g. lead PI, co-PI, senior personnel (leadership team members of an RCN should be a PI, a co-PI or senior personnel in this table), consultant, or advisory board member.

The Project Personnel Table should be created as a spreadsheet and then be prepared and uploaded as a character recognizable pdf.

1. **Results from Prior NSF Support (up to 4 pages):** "Results from Prior NSF Support" must be provided (preferably in the order of the "Project Personnel Table") for all named participating PI/co-PI's (those appearing in the "Project Personnel Table") as a single document of **up to four pages and is to be included in Supplementary Documents**. Thus, "Results from Prior NSF Support" should NOT be placed into the 15-page project description. "Results of Prior NSF Support" is a requirement of all NSF submitted proposals (except for the INFEWS-RCNs, see below). Instructions for what is to be included in "Results from Prior NSF Support" are provided in the PAPPG. For some project personnel, the phrase "not applicable" may be appropriate. Please note that this section is only for reporting prior NSF support (no other federal agencies or other organizations are required to be listed in this section). "Results from Prior NSF Support" supported by USDA/NIFA is optional and may be included if it is contained within the 4 allotted pages. Results from prior support is not required for international partners unless they have received NSF

funding.

For INFEWS-RCNs ONLY, "Results from Prior NSF Support" need not be included unless the proposed activity is clearly a logical extension of an activity supported by NSF, in which case the prior activity and how it relates to the proposed activity should be described.

2. **Management Plan: (up to 3 pages; submit as a Supplementary Document for Tracks 1 and 2 ONLY):** The "Management Plan" should describe the management, communication, and administrative structure with sufficient detail to demonstrate the capability for conducting the proposed work. The "Management Plan" is a key document used in the review of the proposals. It should identify the roles and responsibilities of all individuals named in the "Project Personnel Table" and should include an appropriate Gantt Plot describing how the tasks will be integrated over the course of the project. Please note that the **"Management Plan" for Track 3 RCN Proposals should be a major portion of the 15-page project description** and should not be additionally uploaded as a supplementary document. Please see the description of Track 3 above (Section II: Program Description) to see the requirements of the INFEWS RCN management plan in the 15-page project description.
3. **Letters of Collaboration:** Proposers needing to document collaborative arrangements (confirmatory of cooperation on the project) or other types of commitments must submit letters of collaboration (as Supplementary Documents). All letters of collaboration must be included at the time of the proposal submission. Letters should confirm that the organization/individual agrees to the responsibilities identified in the project description and the "Management Plan". Letters of Collaboration that convey an excessive sense of enthusiasm for the project or highlight research team qualifications are not permitted. It should NOT be a letter of endorsement but rather a commitment to the participation as defined in the project description. Submission of a letter of collaboration is not the same as submitting a separately submitted collaborative proposal (which is NOT ALLOWED under this solicitation).
4. **FEW Context Statement (up to one page, placed in the Supplementary Documents):** The FEW Context Statement is an important component of the submission and review process. It is not a project summary or a synopsis; it is a critical document specifically addressing the points noted below. Proposals that do not contain a FEW Context Statement with the appropriate information will be returned without review. This FEW Context statement may be used for reviewer selection as well as to determine the appropriateness of the proposal to the solicitation.

The context statement will briefly summarize key elements of the proposal and must contain the following information:

- o An explanation and definition of the food and energy and water systems the project is addressing, and why that overall FEW systems to be studied is of importance.
- o For Tracks 1 and 2: The persuasive reasons why the research is to be undertaken, and how the work will significantly enhance knowledge of FEW systems.
- o For Track 3, why the research coordination network is needed around that specific FEW topic, and how the network will significantly enhance the FEW community.
- o The specifically named and defined (at least) three disciplines that will be engaged and integrated in the project. The three or more intellectually distinct disciplines must represent at least 3 scientific areas typically supported (one each) by the three participating NSF Directorates (ENG, GEO, SBE), or two (or more) participating NSF Directorates and USDA/NIFA. (USDA/NIFA may be invoked as a "discipline" if the research focus represents a topical area that is uniquely distinct from disciplines typically supported by participating NSF Directorates ENG, GEO, and SBE. The FEW Context Statement should carefully elaborate the specific disciplines as well as the relevant differences between NSF and a USDA/NIFA "discipline"). See also Frequently Asked Questions at the end of the solicitation.

Budget Request from International Partner Agency(s). For proposals involving international collaborators from countries listed on the [INFEWS international opportunities website](#), the budget request to the partner funding agency to support personnel and/or research in that country should be provided as a supplementary document. Further details on materials to submit are at the website above. The \$2,500,000 cap applies ONLY to the budget request for this solicitation. Budget limitations and requirements for international partners whose funding agencies are participating as INFEWS International Partners in this call are described on the [INFEWS international opportunities website](#). International research collaborators may instead obtain support from their country's funding agency through funding opportunities that are not linked to this solicitation. These potential opportunities for support are listed under **General Opportunities** at the website above. Collaborators from these countries are not required to provide the budget request to their country as a supplemental document. However, in order to evaluate the full scope of research that the team would do, the proposal should describe how the international partners will contribute to the proposed research and how their efforts would be supported or are already supported.

Other Considerations: Where appropriate, investigators are encouraged to work in association with existing projects, observational networks, experimental watersheds, long-term ecological research sites, long terms agricultural research sites (LTAR, ARS) or research centers, or testing and evaluation facilities, whether supported by NSF or other agencies, such as USEPA, USGS, USDA/NIFA, USDA/ARS or NOAA. In such proposals, the project description should make clear how the proposed work differs from and augments activities already supported. A letter stating the specifics of cooperation or support from the ongoing activity for the proposed project should be included as Supplementary Documents.

Single Copy Documents

Collaborators and Other Affiliations Information: Proposers should follow the guidance specified in [Chapter II.C.1.e](#) of the NSF PAPPG. Grants.gov Users: The COA information must be provided through use of the COA template and uploaded as a PDF attachment.

INFEWS Proposal Checklist

1. Cover Sheet (See PAPPG): no co-review allowed; Title must include Track number to which the proposal is directed. For proposals with an international dimension, the country or countries involved should be reported on the cover sheet.
2. Project Description (See PAPPG – **Note change:** "Results from Prior NSF Support" is NOT included in the 15-page limit for this solicitation). Please note that the "Management Plan" description for Track 3 INFEWS RCN proposals should be a major portion of the project description. For Tracks 1, and 2, the "Management Plan" has specific

- parameters and should be placed in the Supplementary Documents section.
3. Biographical Sketch(es) (See PAPPG): **Please load them in the same order as they appear in the Project Personnel Table - alphabetical order by last name is the suggested way to accomplish this.**
 4. Proposal Budget (See PAPPG). Please note that all proposal budgets MUST comply with NSF policy at the due date). Note also that Budgets submitted must include AT LEAST one person-trip per year to the Washington D.C. area over the lifetime of the project to represent the project at the annual INFEWS PI meeting. Budget for more than one PI meeting trip or travel by more than one project participant is allowed. Note that specific tracks have differing budget limitations.
 5. Current and Pending Support (for all PIs, Co-PIs, and Senior Personnel) at a US organization. For international collaborators, only current and pending support from US organizations is required (See PAPPG).
 6. Supplementary Documents
 - Data Management Plan (See PAPPG) – Please note the different requirements of Track 3 compared to Tracks 1, and 2 for the Data Management Plan.
 - Postdoctoral Researcher Mentoring Plan (if applicable – see PAPPG)
 7. **Other Supplementary Documents (in order each part should appear)**
 - A. **Project Personnel Table** (addition for this solicitation) submitted as a character recognizable pdf file.
 - B. **Results from Prior NSF Support** (Previously this was in the Project Description – it has been moved to this section for this solicitation only).
 - C. **Management Plan** (addition for this solicitation) – please note the different requirements of Track 3 when compared to Tracks 1, and 2 for the Management Plan. The Management Plan for Track 3 proposals should be part of the 15-page project description, as noted earlier.
 - D. **Letters of Collaboration**
 - E. **FEW Context Statement**
 - F. For projects that will include a request for funds from an international partner described on the [INFEWS international opportunities website](#), the budget request from that international partner should be included as a supplementary document.
 8. Single Copy Documents:
 - Collaborators & Other Affiliations (COA)

B. Budgetary Information

Cost Sharing:

Inclusion of voluntary committed cost sharing is prohibited.

Indirect Cost (F&A) Limitations:

In accordance with NSF policy, the applicable US Federally negotiated indirect cost rate(s) must be used in computing indirect costs for the proposal. If a proposal or part of a proposal is selected for funding by USDA/NIFA, PIs will receive further instruction. For awards made by USDA/NIFA see information and instructions regarding indirect costs, refer to Part V, section 7.9 of the NIFA Grants.gov Application Guide.

Other Budgetary Limitations:

Tracks have differing maximum budget allowances: Projects submitted to Track 1 and 2 will request three to five years of support with a total budget less than or equal to \$2,500,000. If any Track 1 or 2 proposal exceeds \$2,500,000, it will result in "Return Without Review."

Projects submitted to Track 3 will request four to five years of support with a total budget less than or equal to \$750,000. If any Track 3 proposal exceeds \$750,000, it will be "Returned Without Review."

Budget Preparation Instructions:

If one participating unit constitutes an FFRDC and/or another US government agency, expenses associated with participation of those scientists should be consolidated into a single subaward (for each agency). Should the proposal be successful, the full FFRDC financial commitment is to be met by the FFRDC agency. It is thus necessary that FFRDC submissions should be cleared in advance with the relevant agency and the submission should be supported by an email confirmation from that agency (in the Supplementary Documents section).

Budgets submitted must **include AT LEAST one person-trip per year to the Washington D.C. area over the lifetime of the project** to represent the project at the annual INFEWS PI meeting. Budgeting for more than one PI meeting trip or travel by more than one project participant is allowed.

C. Due Dates

- **Full Proposal Deadline(s)** (due by 5 p.m. submitter's local time):

September 26, 2018

D. FastLane / Grants.gov Requirements

For Proposals Submitted Via FastLane:

To prepare and submit a proposal via FastLane, see detailed technical instructions available at: <https://www.fastlane.nsf.gov/a1/newstan.htm>. For FastLane user support, call the FastLane Help Desk at 1-800-673-

6188 or e-mail fastlane@nsf.gov. The FastLane Help Desk answers general technical questions related to the use of the FastLane system. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this funding opportunity.

For Proposals Submitted Via Grants.gov:

Before using Grants.gov for the first time, each organization must register to create an institutional profile. Once registered, the applicant's organization can then apply for any federal grant on the Grants.gov website. Comprehensive information about using Grants.gov is available on the Grants.gov Applicant Resources webpage: <http://www.grants.gov/web/grants/applicants.html>. In addition, the NSF Grants.gov Application Guide (see link in Section V.A) provides instructions regarding the technical preparation of proposals via Grants.gov. For Grants.gov user support, contact the Grants.gov Contact Center at 1-800-518-4726 or by email: support@grants.gov. The Grants.gov Contact Center answers general technical questions related to the use of Grants.gov. Specific questions related to this program solicitation should be referred to the NSF program staff contact(s) listed in Section VIII of this solicitation.

Submitting the Proposal: Once all documents have been completed, the Authorized Organizational Representative (AOR) must submit the application to Grants.gov and verify the desired funding opportunity and agency to which the application is submitted. The AOR must then sign and submit the application to Grants.gov. The completed application will be transferred to the NSF FastLane system for further processing.

Proposers that submitted via FastLane are strongly encouraged to use FastLane to verify the status of their submission to NSF. For proposers that submitted via Grants.gov, until an application has been received and validated by NSF, the Authorized Organizational Representative may check the status of an application on Grants.gov. After proposers have received an e-mail notification from NSF, Research.gov should be used to check the status of an application.

VI. NSF PROPOSAL PROCESSING AND REVIEW PROCEDURES

Proposals received by NSF are assigned to the appropriate NSF program for acknowledgement and, if they meet NSF requirements, for review. All proposals are carefully reviewed by a scientist, engineer, or educator serving as an NSF Program Officer, and usually by three to ten other persons outside NSF either as *ad hoc* reviewers, panelists, or both, who are experts in the particular fields represented by the proposal. These reviewers are selected by Program Officers charged with oversight of the review process. Proposers are invited to suggest names of persons they believe are especially well qualified to review the proposal and/or persons they would prefer not review the proposal. These suggestions may serve as one source in the reviewer selection process at the Program Officer's discretion. Submission of such names, however, is optional. Care is taken to ensure that reviewers have no conflicts of interest with the proposal. In addition, Program Officers may obtain comments from site visits before recommending final action on proposals. Senior NSF staff further review recommendations for awards. A flowchart that depicts the entire NSF proposal and award process (and associated timeline) is included in PAPPG Exhibit III-1.

A comprehensive description of the Foundation's merit review process is available on the NSF website at: https://www.nsf.gov/bfa/dias/policy/merit_review/.

Proposers should also be aware of core strategies that are essential to the fulfillment of NSF's mission, as articulated in *Investing in Science, Engineering, and Education for the Nation's Future: NSF Strategic Plan for 2014-2018*. These strategies are integrated in the program planning and implementation process, of which proposal review is one part. NSF's mission is particularly well-implemented through the integration of research and education and broadening participation in NSF programs, projects, and activities.

One of the strategic objectives in support of NSF's mission is to foster integration of research and education through the programs, projects, and activities it supports at academic and research institutions. These institutions must recruit, train, and prepare a diverse STEM workforce to advance the frontiers of science and participate in the U.S. technology-based economy. NSF's contribution to the national innovation ecosystem is to provide cutting-edge research under the guidance of the Nation's most creative scientists and engineers. NSF also supports development of a strong science, technology, engineering, and mathematics (STEM) workforce by investing in building the knowledge that informs improvements in STEM teaching and learning.

NSF's mission calls for the broadening of opportunities and expanding participation of groups, institutions, and geographic regions that are underrepresented in STEM disciplines, which is essential to the health and vitality of science and engineering. NSF is committed to this principle of diversity and deems it central to the programs, projects, and activities it considers and supports.

A. Merit Review Principles and Criteria

The National Science Foundation strives to invest in a robust and diverse portfolio of projects that creates new knowledge and enables breakthroughs in understanding across all areas of science and engineering research and education. To identify which projects to support, NSF relies on a merit review process that incorporates consideration of both the technical aspects of a proposed project and its potential to contribute more broadly to advancing NSF's mission "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense; and for other purposes." NSF makes every effort to conduct a fair, competitive, transparent merit review process for the selection of projects.

1. Merit Review Principles

These principles are to be given due diligence by PIs and organizations when preparing proposals and managing projects, by reviewers when reading and evaluating proposals, and by NSF program staff when determining whether or not to recommend proposals for funding and while overseeing awards. Given that NSF is the primary federal agency charged with nurturing and supporting excellence

in basic research and education, the following three principles apply:

- All NSF projects should be of the highest quality and have the potential to advance, if not transform, the frontiers of knowledge.
- NSF projects, in the aggregate, should contribute more broadly to achieving societal goals. These "Broader Impacts" may be accomplished through the research itself, through activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. The project activities may be based on previously established and/or innovative methods and approaches, but in either case must be well justified.
- Meaningful assessment and evaluation of NSF funded projects should be based on appropriate metrics, keeping in mind the likely correlation between the effect of broader impacts and the resources provided to implement projects. If the size of the activity is limited, evaluation of that activity in isolation is not likely to be meaningful. Thus, assessing the effectiveness of these activities may best be done at a higher, more aggregated, level than the individual project.

With respect to the third principle, even if assessment of Broader Impacts outcomes for particular projects is done at an aggregated level, PIs are expected to be accountable for carrying out the activities described in the funded project. Thus, individual projects should include clearly stated goals, specific descriptions of the activities that the PI intends to do, and a plan in place to document the outputs of those activities.

These three merit review principles provide the basis for the merit review criteria, as well as a context within which the users of the criteria can better understand their intent.

2. Merit Review Criteria

All NSF proposals are evaluated through use of the two National Science Board approved merit review criteria. In some instances, however, NSF will employ additional criteria as required to highlight the specific objectives of certain programs and activities.

The two merit review criteria are listed below. **Both** criteria are to be given **full consideration** during the review and decision-making processes; each criterion is necessary but neither, by itself, is sufficient. Therefore, proposers must fully address both criteria. (PAPPG Chapter II.C.2.d(i). contains additional information for use by proposers in development of the Project Description section of the proposal). Reviewers are strongly encouraged to review the criteria, including PAPPG Chapter II.C.2.d(i), prior to the review of a proposal.

When evaluating NSF proposals, reviewers will be asked to consider what the proposers want to do, why they want to do it, how they plan to do it, how they will know if they succeed, and what benefits could accrue if the project is successful. These issues apply both to the technical aspects of the proposal and the way in which the project may make broader contributions. To that end, reviewers will be asked to evaluate all proposals against two criteria:

- **Intellectual Merit:** The Intellectual Merit criterion encompasses the potential to advance knowledge; and
- **Broader Impacts:** The Broader Impacts criterion encompasses the potential to benefit society and contribute to the achievement of specific, desired societal outcomes.

The following elements should be considered in the review for both criteria:

1. What is the potential for the proposed activity to
 - a. Advance knowledge and understanding within its own field or across different fields (Intellectual Merit); and
 - b. Benefit society or advance desired societal outcomes (Broader Impacts)?
2. To what extent do the proposed activities suggest and explore creative, original, or potentially transformative concepts?
3. Is the plan for carrying out the proposed activities well-reasoned, well-organized, and based on a sound rationale? Does the plan incorporate a mechanism to assess success?
4. How well qualified is the individual, team, or organization to conduct the proposed activities?
5. Are there adequate resources available to the PI (either at the home organization or through collaborations) to carry out the proposed activities?

Broader impacts may be accomplished through the research itself, through the activities that are directly related to specific research projects, or through activities that are supported by, but are complementary to, the project. NSF values the advancement of scientific knowledge and activities that contribute to achievement of societally relevant outcomes. Such outcomes include, but are not limited to: full participation of women, persons with disabilities, and underrepresented minorities in science, technology, engineering, and mathematics (STEM); improved STEM education and educator development at any level; increased public scientific literacy and public engagement with science and technology; improved well-being of individuals in society; development of a diverse, globally competitive STEM workforce; increased partnerships between academia, industry, and others; improved national security; increased economic competitiveness of the United States; and enhanced infrastructure for research and education.

Proposers are reminded that reviewers will also be asked to review the Data Management Plan and the Postdoctoral Researcher Mentoring Plan, as appropriate.

Additional Solicitation Specific Review Criteria

In addition to the National Science Board merit review criteria, reviewers will be asked to apply the following program-specific criteria when reviewing INFEWS proposals.

- **Systems Approach:** How well does the proposal incorporate and integrate across food, water, and energy systems? Are the proposed study systems appropriately defined?
- **Interdisciplinary Integration:** How well do the proposed research activities integrate across at least three or more intellectually distinct disciplines that, in aggregate, represent scientific areas supported (one each) by the three participating NSF Directorates (ENG, GEO, SBE) or two participating Directorates and USDA/NIFA. (USDA/NIFA may be invoked as a "discipline" if the research focus represents a topical area that is uniquely distinct from disciplines typically supported by participating NSF Directorates. See also Frequently Asked Questions (FAQ) at the end of the solicitation.

B. Review and Selection Process

Proposals submitted in response to this program solicitation will be reviewed by Panel Review.

Reviewers will be asked to evaluate proposals using two National Science Board approved merit review criteria and, if applicable, additional program specific criteria. A summary rating and accompanying narrative will be completed and submitted by each reviewer. The Program Officer assigned to manage the proposal's review will consider the advice of reviewers and will formulate a recommendation.

The program may implement a two-stage panel review process, depending on the number and breadth of proposals received. During a first review stage, groups of thematically similar proposals would undergo panel review. The program's management team would consider the panels' advice and, if warranted, select proposals to move on to a second stage of review. Proposals not selected for further consideration may be declined at this point.

After scientific, technical and programmatic review and consideration of appropriate factors, the NSF Program Officer recommends to the cognizant Division Director whether the proposal should be declined or recommended for award. NSF strives to be able to tell applicants whether their proposals have been declined or recommended for funding within six months. Large or particularly complex proposals or proposals from new awardees may require additional review and processing time. The time interval begins on the deadline or target date, or receipt date, whichever is later. The interval ends when the Division Director acts upon the Program Officer's recommendation.

After programmatic approval has been obtained, the proposals recommended for funding will be forwarded to the Division of Grants and Agreements for review of business, financial, and policy implications. After an administrative review has occurred, Grants and Agreements Officers perform the processing and issuance of a grant or other agreement. Proposers are cautioned that only a Grants and Agreements Officer may make commitments, obligations or awards on behalf of NSF or authorize the expenditure of funds. No commitment on the part of NSF should be inferred from technical or budgetary discussions with a NSF Program Officer. A Principal Investigator or organization that makes financial or personnel commitments in the absence of a grant or cooperative agreement signed by the NSF Grants and Agreements Officer does so at their own risk.

Once an award or declination decision has been made, Principal Investigators are provided feedback about their proposals. In all cases, reviews are treated as confidential documents. Verbatim copies of reviews, excluding the names of the reviewers or any reviewer-identifying information, are sent to the Principal Investigator/Project Director by the Program Officer. In addition, the proposer will receive an explanation of the decision to award or decline funding.

USDA/NIFA

Applicants selected for funding by USDA/NIFA will be required to provide additional information in accordance with policies and procedures of the [Agriculture and Food Research Initiative](#) (AFRI) program. Applications selected for funding by NIFA will be forwarded to the USDA/NIFA Awards Management Division for award processing in accordance with the USDA/NIFA procedures.

VII. AWARD ADMINISTRATION INFORMATION

A. Notification of the Award

NSF: Notification of the award is made to *the submitting organization* by a Grants Officer in the Division of Grants and Agreements. Organizations whose proposals are declined will be advised as promptly as possible by the cognizant NSF Program administering the program. Verbatim copies of reviews, not including the identity of the reviewer, will be provided automatically to the Principal Investigator. (See Section VI.B. for additional information on the review process.)

USDA/NIFA

The award document will provide pertinent instructions and information including, at a minimum, the information described in [2 CFR 200.210](#).

See <http://www.nifa.usda.gov/business/awards/awardterms.html> to view current NIFA award terms and conditions

B. Award Conditions

An NSF award consists of: (1) the award notice, which includes any special provisions applicable to the award and any numbered amendments thereto; (2) the budget, which indicates the amounts, by categories of expense, on which NSF has based its support (or otherwise communicates any specific approvals or disapprovals of proposed expenditures); (3) the proposal referenced in the award notice; (4) the applicable award conditions, such as Grant General Conditions (GC-1)*; or Research Terms and Conditions* and (5) any announcement or other NSF issuance that may be incorporated by reference in the award notice. Cooperative agreements also are administered in accordance with NSF Cooperative Agreement Financial and Administrative Terms and Conditions (CA-FATC) and the applicable Programmatic Terms and Conditions. NSF awards are electronically signed by an NSF Grants and Agreements Officer and transmitted electronically to the organization via e-mail.

*These documents may be accessed electronically on NSF's Website at https://www.nsf.gov/awards/managing/award_conditions.jsp?org=NSF. Paper copies may be obtained from the NSF Publications Clearinghouse, telephone (703) 292-7827 or by e-mail from nsfpubs@nsf.gov.

More comprehensive information on NSF Award Conditions and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide* (PAPPG) Chapter VII, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

Special Award Conditions:

Awardees may be required to participate in program-level evaluation by which NSF can assess implementation processes and progress toward outcomes overall. NSF or a NSF contractor on behalf of NSF, may periodically conduct program evaluations or special projects that necessitate access to project level staff and data. This may occur at any time during the grant period and could occur after the grant has ended. Project-level participation includes limited burden—responding to inquiries, interviews and other methods of common data collection and/or aggregation across individual grants. In addition, PIs may be asked to assist in developing a program evaluation that will mutually benefit the agency and program participants.

USDA/NIFA

Awards issued as a result of this solicitation will have designated the Automated Standard Applications for Payment System (ASAP), operated by the Department of Treasury's Bureau of the Fiscal Service, as the payment system for funds. For more information, see [Award List](#).

Several federal statutes and regulations apply to grant applications considered for review and to project grants awarded under this program. These may include, but are not limited to, the ones listed on the [NIFA web page](#).

[NIFA Federal Assistance Policy Guide](#)— a compendium of basic NIFA policies and procedures that apply to all NIFA awards, unless there are statutory, regulatory, or award-specific requirements to the contrary .

Other Requirements

USDA/NIFA:

1. Delegation of Fiscal Responsibility

Unless the terms and conditions of the award state otherwise, awardees may not in whole or in part delegate or transfer to another person, institution, or organization the responsibility for use or expenditure of award funds.

2. Changes in Budget or Project Plans

In accordance with [2 CFR 200.308](#), awardees must request prior approval from NIFA for the following program or budget-related reasons:

- i. Change in the scope or the objective of the project or program (even if there is no associated budget revision requiring prior written approval).
- ii. Change in a key person specified in the application or the federal award.
- iii. The disengagement from the project for more than three months, or a 25 percent reduction in time devoted to the project, by the approved project director or principal investigator.
- iv. The inclusion, unless waived by the federal awarding agency, of costs that require prior approval in accordance with 2 CFR 200 Subpart E—Cost Principles of this part or 45 CFR Part 75 Appendix IX, "Principles for Determining Costs Applicable to Research and Development under Awards and Contracts with Hospitals," or 48 CFR Part 31, "Contract Cost Principles and Procedures," as applicable.
- v. The transfer of funds budgeted for participant support costs as defined in §200.75 Participant support costs to other categories of expense.
- vi. Unless described in the application and funded in the approved federal awards, the subawarding, transferring or contracting out of any work under a federal award, including fixed amount subawards as described in §200.332 Fixed amount subawards. This provision does not apply to the acquisition of supplies, material, equipment, or general support services.
- vii. Changes in the approved cost-sharing or matching provided by the non-federal entity.
- viii. The need arises for additional federal funds to complete the project.

The awardee will be subject to the terms and conditions identified in the award. See [link to information about NIFA award terms](#).

C. Reporting Requirements

For all multi-year grants (including both standard and continuing grants), the Principal Investigator must submit an annual project report to the cognizant Program Officer no later than 90 days prior to the end of the current budget period. (Some programs or awards require submission of more frequent project reports). No later than 120 days following expiration of a grant, the PI also is required to submit a final project report, and a project outcomes report for the general public.

Failure to provide the required annual or final project reports, or the project outcomes report, will delay NSF review and processing of any future funding increments as well as any pending proposals for all identified PIs and co-PIs on a given award. PIs should examine the formats of the required reports in advance to assure availability of required data.

PIs are required to use NSF's electronic project-reporting system, available through Research.gov, for preparation and submission of annual and final project reports. Such reports provide information on accomplishments, project participants (individual and organizational), publications, and other specific products and impacts of the project. Submission of the report via Research.gov constitutes certification by the PI that the contents of the report are accurate and complete. The project outcomes report also must be prepared and submitted using Research.gov. This report serves as a brief summary, prepared specifically for the public, of the nature and outcomes of the project. This report will be posted on the NSF website exactly as it is submitted by the PI.

More comprehensive information on NSF Reporting Requirements and other important information on the administration of NSF awards is contained in the *NSF Proposal & Award Policies & Procedures Guide*, available electronically on the NSF Website at https://www.nsf.gov/publications/pub_summ.jsp?ods_key=pappg.

USDA/NIFA:

The output and reporting requirements are included in the award terms and conditions (see <http://www.nifa.usda.gov/business/awards/awardterms.html> for information about NIFA award terms). If there are any program or award-specific award terms, those, if any, will be identified in the award.

Additional Reporting Requirements

- For awards funded by NSF, PIs will be required to include descriptions of their project milestones and their data management activities in their annual reports. Data reporting should conform to current NSF data policy guidelines; PIs should consult with the PAPPG.
- For awards funded by USDA/NIFA, reporting requirements for awards funded will conform to those specified by USDA/NIFA.
- For projects that are funded by NSF and USDA/NIFA, the annual report of the lead project in the collaborative must be resident at NSF and must include a description of the activities and milestones of the parts of the project that are funded by the other agencies.
- When a project is funded by both agencies, the NSF-lead organizations should submit a unified annual report and the USDA/NIFA funded portion of the project should include the NSF-unified annual report as part of its USDA/NIFA annual report (see also FAQ).

VIII. AGENCY CONTACTS

Please note that the program contact information is current at the time of publishing. See program website for any updates to the points of contact.

General inquiries regarding this program should be made to:

- Thomas Torgersen, Co-Chair, Directorate for Geosciences, telephone: (703) 292-4738, email: ttorgers@nsf.gov
- James W. Jones, Co-Chair, Directorate for Engineering, telephone: (703) 292-4458, email: jwjones@nsf.gov
- Deborah Winslow, telephone: (703) 292-7315, email: dwinslow@nsf.gov
- Rachel Melnick, USDA/NIFA, telephone: (202) 401-4980, email: rmelnick@nifa.usda.gov
- Lara Campbell, Office of International Science and Engineering, telephone: (703) 292-7049, email: lcampbel@nsf.gov
- Timothy VanReken, Office of Integrative Activities, telephone: (703) 292-7378, email: tvandreke@nsf.gov

For questions related to the use of FastLane, contact:

- FastLane Help Desk, telephone: 1-800-673-6188; e-mail: fastlane@nsf.gov.

For questions relating to Grants.gov contact:

- Grants.gov Contact Center: If the Authorized Organizational Representatives (AOR) has not received a confirmation message from Grants.gov within 48 hours of submission of application, please contact via telephone: 1-800-518-4726; e-mail: support@grants.gov.

All questions regarding proposal submissions should be directed to INFEWSquestions@NSF.GOV

IX. OTHER INFORMATION

The NSF website provides the most comprehensive source of information on NSF Directorates (including contact information), programs and funding opportunities. Use of this website by potential proposers is strongly encouraged. In addition, "NSF Update" is an information-delivery system designed to keep potential proposers and other interested parties apprised of new NSF funding opportunities and publications, important changes in proposal and award policies and procedures, and upcoming NSF [Grants Conferences](#). Subscribers are informed through e-mail or the user's Web browser each time new publications are issued that match their identified interests. "NSF Update" also is available on [NSF's website](#).

Grants.gov provides an additional electronic capability to search for Federal government-wide grant opportunities. NSF funding opportunities may be accessed via this mechanism. Further information on Grants.gov may be obtained at <http://www.grants.gov>.

USDA-NIFA requires a Felony Convictions or Tax Delinquent Status certification. Additional information will be provided prior to award if selected for funding.

Responsible and Ethical Conduct of Research: For information, link to [Responsible and Ethical Conduct of Research](#).

The USDA-NIFA authority for this solicitation is contained in section 2(b) of the Competitive, Special, and Facilities Research Grant Act (7 U.S.C. 450i(b)), of the Agriculture and Food Research Initiative (AFRI). AFRI authorizes the Secretary of Agriculture to award competitive grants for fundamental and applied research, extension, and education to address food and agricultural sciences. AFRI awards are subject to the NIFA regulations found at 7 CFR Part

3430. NIFA's authority to participate in the issuance of a joint RFA is 7 U.S.C. § 3319b.

ABOUT THE NATIONAL SCIENCE FOUNDATION

The National Science Foundation (NSF) is an independent Federal agency created by the National Science Foundation Act of 1950, as amended (42 USC 1861-75). The Act states the purpose of the NSF is "to promote the progress of science; [and] to advance the national health, prosperity, and welfare by supporting research and education in all fields of science and engineering."

NSF funds research and education in most fields of science and engineering. It does this through grants and cooperative agreements to more than 2,000 colleges, universities, K-12 school systems, businesses, informal science organizations and other research organizations throughout the US. The Foundation accounts for about one-fourth of Federal support to academic institutions for basic research.

NSF receives approximately 55,000 proposals each year for research, education and training projects, of which approximately 11,000 are funded. In addition, the Foundation receives several thousand applications for graduate and postdoctoral fellowships. The agency operates no laboratories itself but does support National Research Centers, user facilities, certain oceanographic vessels and Arctic and Antarctic research stations. The Foundation also supports cooperative research between universities and industry, US participation in international scientific and engineering efforts, and educational activities at every academic level.

Facilitation Awards for Scientists and Engineers with Disabilities provide funding for special assistance or equipment to enable persons with disabilities to work on NSF-supported projects. See Grant Proposal Guide Chapter II, Section D.2 for instructions regarding preparation of these types of proposals.

The National Science Foundation has Telephonic Device for the Deaf (TDD) and Federal Information Relay Service (FIRS) capabilities that enable individuals with hearing impairments to communicate with the Foundation about NSF programs, employment or general information. TDD may be accessed at (703) 292-5090 and (800) 281-8749, FIRS at (800) 877-8339.

The National Science Foundation Information Center may be reached at (703) 292-5111.

About the National Institute of Food and Agriculture

The National Institute of Food and Agriculture (NIFA) is an agency within the U.S. Department of Agriculture (USDA), part of the executive branch of the Federal Government. Congress created NIFA through the Food, Conservation, and Energy Act of 2008. NIFA replaced the former Cooperative State Research, Education, and Extension Service (CSREES), which had been in existence since 1994. NIFA's unique mission is to advance knowledge for agriculture, the environment, human health and well-being, and communities by supporting research, education, and extension programs in the Land-Grant University System and other partner organizations. NIFA doesn't perform actual research, education, and extension but rather helps fund it at the state and local level and provides program leadership in these areas. Through grants offered by NIFA, the USDA enables researchers throughout the United States to solve problems critical to our farmers, consumers, and communities. NIFA is the USDA's major extramural research agency, funding individuals, institutions, and public, private, and non-profit organizations. NIFA's education programs supports and promotes teaching excellence, enhances academic quality, and develops tomorrow's scientific and professional workforce. In cooperation with public institutions, private sector partners, and the Land-Grant University System, NIFA provides national leadership to address critical educational issues. NIFA's extension projects deliver science-based knowledge and informal educational programs to people, enabling them to make practical decisions.

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PRIVACY ACT AND PUBLIC BURDEN STATEMENTS

The information requested on proposal forms and project reports is solicited under the authority of the National Science Foundation Act of 1950, as amended. The information on proposal forms will be used in connection with the selection of qualified proposals; and project reports submitted by awardees will be used for program evaluation and reporting within the Executive Branch and to Congress. The information requested may be disclosed to qualified reviewers and staff assistants as part of the proposal review process; to proposer institutions/grantees to provide or obtain data regarding the proposal review process, award decisions, or the administration of awards; to government contractors, experts, volunteers and researchers and educators as necessary to complete assigned work; to other government agencies or other entities needing information regarding applicants or nominees as part of a joint application review process, or in order to coordinate programs or policy; and to another Federal agency, court, or party in a court or Federal administrative proceeding if the government is a party. Information about Principal Investigators may be added to the Reviewer file and used to select potential candidates to serve as peer reviewers or advisory committee members. See Systems of Records, [NSF-50](#), "Principal Investigator/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004), and [NSF-51](#), "Reviewer/Proposal File and Associated Records," 69 Federal Register 26410 (May 12, 2004). Submission of the information is voluntary. Failure to provide full and complete information, however, may reduce the possibility of receiving an award.

An agency may not conduct or sponsor, and a person is not required to respond to, an information collection unless it displays a valid Office of Management and Budget (OMB) control number. The OMB control number for this collection is 3145-0058. Public reporting burden for this collection of information is estimated to average 120 hours per response, including the time for reviewing instructions. Send comments regarding the burden estimate and any other aspect of this collection of information, including suggestions for reducing this burden, to:

Suzanne H. Plimpton
Reports Clearance Officer
Office of the General Counsel
National Science Foundation
Alexandria, VA 22314

X. APPENDIX

INFEWS Frequently Asked Questions (FAQs)

FAQs are organized under distinct headers.

1. *About Disciplinary Requirements*
2. *About the Scope of Research*
3. *About the Team*
4. *About the Submission Process*
5. *About INFEWS-RCN Proposals*

About Disciplinary Requirements

1-1. What is meant by interdisciplinary INFEWS research?

Proposals are expected to document that the proposed research is truly interdisciplinary and that the respective components are fully integrated and of high relevance for the successful execution of the proposed project. Plans for integration of the respective research components must be clearly described in the proposal and reinforced within the management plan. In order to ensure a sufficiently broad interdisciplinary approach, **INFEWS proposals must integrate and engage the disciplinary science from three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA.** (USDA/NIFA may be invoked as a "discipline" if the research focus represents a topical area that is uniquely distinct from disciplines typically supported by participating NSF Directorates (ENG, GEO, SBE). The FEW Context Statement should carefully elaborate the specific disciplines as well as the relevant differences between NSF and USDA/NIFA "discipline". See also Frequently Asked Questions at the end of the solicitation. The scope of the project problem must include important and governing components of the FEW systems under study and not just token three components that satisfy the "F and E and W" rule. **Proposals that conduct integrated research on two of the three components (F and E and W), while inadequately integrating the third component in a non-research mode (i.e., applying what you already know) will be returned without review. Additionally, proposals that conduct integrated research on two of the three defined disciplines while inadequately integrating the third discipline and/or proposing research that integrates the third discipline only tangentially, will be returned without review.** Successful proposals will define appropriate feedback

mechanisms and dynamics among the FEW systems components to be studied. Proposals should also identify how the research will account for exogenous inputs to the systems, where relevant. Proposals should justify their approach. The FEW Context Statement (see below) should carefully elaborate on the specific differences between an NSF and USDA/NIFA "discipline". INFEWS-RCNs must also include disciplinary science from three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA.

1-2. My proposal encompasses agricultural research that is relevant to USDA/NIFA. Can I use USDA/NIFA supported research to satisfy the interdisciplinary requirement?

Yes; research supported by USDA/NIFA can count as one of the three required disciplines. However, it is important that each of the disciplines included in the proposal are distinctly different. For example, if you are focusing on agricultural engineering research, then you can consider the ENG Directorate as one of the disciplines and then you will need to incorporate research from at least two other participating directorates (GEO, SBE, USDA/NIFA). You would not be able to count agricultural engineering as both an ENG discipline and a NIFA discipline. Additionally, because the BIO Directorate is not a participant in this solicitation, all "biological" disciplinarity must be satisfied by use of an appropriate USDA/NIFA programmatic area (see [NIFA list](#)).

1-3. To cover the disciplinary requirements, can I include more than three disciplines in my proposal?

Yes. You may include as many disciplines as needed to address the key science questions posed by your FEW systems research project. At a minimum, the research needs to reflect scientific areas that are unique to (one each) the three participating NSF Directorates or two participating Directorates and one USDA/NIFA science. You may also incorporate science from other disciplines not supported by the participating directorates, as long as it is the "fourth" discipline.

1-4. If the research and methodologies described in my proposal integrate three very different intellectual fields that are classified under one or two NSF Directorates, can this still satisfy the disciplinary requirements?

No. You need to incorporate three distinct disciplines that fall under the scope of (one each) the three participating Directorates (ENG, GEO, SBE) (or two participating Directorates and USDA/NIFA as explained above) to ensure compliance with the solicitation requirements.

For example, if your proposed research includes ethnographic methods (by a cultural anthropologist), game theoretic work (from an economist), fluid mechanics (by an ENG discipline), and policy analysis across different third-world countries (by a political scientist), it would be considered under the purview of two NSF Directorates: ENG (fluid mechanics) and SBE (economics, cultural anthropology, and political science). To satisfy the disciplinary requirements, a third discipline that falls under the scope of another Directorate (i.e. GEO or USDA/NIFA) must be integrated into the proposed research.

1-5. My proposal includes a significant educational component. Can I count this as one of the three disciplines needed to satisfy the interdisciplinary requirement?

No. The Directorate of Education and Human Resources (EHR) is not participating in this solicitation and thus cannot be used to satisfy one of the "three disciplines".

1-6. I see the Office of International Science and Engineering is participating in this solicitation. Can I count the international component of my proposal as one of the three disciplines needed to satisfy the interdisciplinary requirement?

No. While the Office of International Science and Engineering and the Office of Integrative Activities are participating in this solicitation, these offices are not research directorates. Proposals that address the interests of these offices are welcome, but such components cannot be counted as one of the three scientific disciplines needed to satisfy the interdisciplinary requirement.

1-7. What is the preferred contribution level that should be provided by each project participant/discipline?

There are no specific requirements for the relative distribution of disciplinary expertise yet each component should be included at a level commensurate with the problem scope. However, the disciplinary science should be significant and of high relevance to the FEW systems under study and should not appear as token participation. Each discipline must be an active and integrated aspect of the project. **Proposals that conduct integrated research on two of the three disciplines, while inadequately integrating the third discipline and/or proposing research that integrates the third discipline only tangentially, will not review well, and may be returned without review.** For example, (1) a simple switch of crop-for-food vs crop-as-biofuels may not represent well the controlling components of the system; (2) irrigation certainly uses power but merely including that energy expense does not necessarily define its overall role in the FEW systems. For biofuels, a significant economic and production constraint is location of the crop relative to the biofuels production facility. This controls economic feasibility and farmer choice.

The project team should be developed in accordance with the specific project objectives. Strong and well-defined interdisciplinary integration is an important element of the INFEWS program. Multidisciplinary integrative research requires multidisciplinary expertise. The appropriateness of the research team's disciplinary composition and expertise will be factors in the merit review of the proposals. See Additional Review Criteria Section for more information.

About the Scope of Research

2-1. I noticed that throughout the solicitation, FEW systems are described in plural (i.e. systems versus system). Does this mean my project must study more than one system or can I focus on a single system?

The solicitation is written using "systems" as a plural noun because all proposals submitted to the INFEWS program must outline plans to examine the intersections of food and energy and water systems. It is important to define the specific food and energy and water systems as well as the system of systems that will be addressed by the project and why this system of systems is important in the understanding of the FEW Nexus.

2-2. Can my FEW systems research be place-based, location-specific, or context-dependent?

Yes. However, the generalizability of models, solutions and results is an important consideration of the INFEWS program. While studies of the interactions among food and energy and water systems at a single location are within the scope of the solicitation, proposals

should articulate how the results and outcomes of such a project will be applicable or generalizable in a much broader context.

2-3. Should proposals be focused exclusively on FEW systems or can proposals investigate more comprehensive topics, like Sustainable Development, where FEW systems might represent a sub-focus that is critical to the project's success?

For this solicitation, proposals must focus on food and energy and water systems. Sustainability research could qualify if it is multi-disciplinary (i.e. it includes three or more participating scientific disciplines as stated in the solicitation) and is targeted towards the complex role of FEW systems within a broader context.

2-4. I would like to study the health dimensions of FEW systems. Is this feasible under the INFEWS program?

You will need to make sure that the project meets NSF and the extra INFEWS solicitation requirements. For example, the NSF supports research that examines the social, behavioral, and/or physical and engineering dimensions of systems that cause adverse health outcomes. USDA/BIFA supports research addressing food safety. However, clinical research cannot be supported by NSF or USDA/NIFA and thus "health science" cannot be specifically identified as one of the three requisite "disciplines". INFEWS could support a project that includes a sociologist or an epidemiologist who plans to quantify adverse health outcomes of people within a FEW system(s). Similarly, INFEWS could support a project that incorporates plans to examine the hydrological, ecological, or behavioral processes that spread human pathogens or other contaminants (e.g. chemicals, nanoparticles, microplastics) within FEW systems. See PAPPG for further guidance.

2-5. I want to use FEW systems modeling (Track 1) to explore an innovative systems solution (Track 2). How should I decide whether to submit to Track 1 or to Track 2?

Intellectually and with respect to the FEW Nexus, there is a degree of overlap across the various tracks. This is the nature of the problem. The best approach is to review the solicitation carefully and determine which track is the most appropriate fit for your research; i.e., the track that applies to the project's more impactful science. It is specifically necessary to identify the track (in the title and justified elsewhere) for which the proposal is most competitive. Please note that proposals cannot be submitted to or reviewed by more than one track.

2-6. Is Track 2 limited to research on new and innovative solutions, or is it possible to develop advances that build upon existing approaches and technologies?

Track 2 proposals may lead to advances in existing systems, develop new solutions, or explore alternative or novel applications for the current state-of-the-art. It is important that Track 2 proposals adopt a systems approach that incorporates foundational or transformative research related to at least three participating directorates. In preparing your proposal, bear in mind that it will be reviewed using NSF's intellectual merit review criteria. Therefore, proposals must advance knowledge (element 1) and should be creative, original, and/or potentially transformative (element 2). While Track 2 proposals may certainly develop or use approaches that build upon existing methods, strategies, and/or technologies, proposals should clearly demonstrate how the project is novel and will advance knowledge.

2-7. If a project explores social, behavioral, or economic solutions and/or linkages among food and energy and water systems, does it meet the requirements of this solicitation?

Yes, so long as it includes research from two other participating directorates (or one other participating directorate and USDA/NIFA). INFEWS defines FEW systems very broadly, incorporating physical processes (such as built infrastructure and new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrologic cycles), biological processes (such as agroecosystem structure and productivity), and social and behavioral processes (such as decision making and governance). Therefore, proposals that examine social, behavioral, or economic solutions and/or linkages among FEW systems are encouraged – as long as the projects sufficiently integrate across disciplines (one each) from the participating Directorates (ENG, GEO, SBE) or two participating directorates and USDA/NIFA.

2-8. I am interested in proposing advanced cyberinfrastructure enabling research in Food and Energy, and Water. Can you provide insights into the cyberinfrastructure emphasis in the solicitation?

This solicitation encourages investments within Tracks 1, 2 and 3 that would introduce new capabilities, advanced computation and novel cyberinfrastructure approaches, especially with respect to (a) fully engaging stakeholders and public outreach, (b) addressing the computational challenges, and (c) data integration challenges inherent in INFEWS research, leading to previously unattainable results. Given that INFEWS proposals require three or more intellectually distinct disciplines that represent scientific areas typically supported (one each) by the three participating NSF directorates (ENG, GEO, SBE) or two (or more) participating directorates and USDA/NIFA, **these cyber options will need to be included as a "fourth" discipline but may positively benefit the overall project by more effectively integrating resources and stakeholders.**

2-9. The solicitation provides guidance on leveraging existing investments. Does this mean I have to use previously published or publicly available data?

No, but given the funds that will be available to any one project, leveraging your project plan off existing data sources may increase the scope and breadth of the research that can be undertaken. Multiple agencies and universities have established data collection and measurement programs that provide significant background information to many potential FEW Nexus studies. Your project should use such relevant data sources and propose the measurement and collection of new data only if they are critical to the FEW systems under study.

2-10. What project duration is allowable for project submitted under this solicitation?

For projects submitted under this solicitation, 3-5 year durations are required for Tracks 1 and 2. Track 3 projects are required to be 4-5 years. In all cases the project duration should be consistent with the scope of work.

About the Team

3-1. Is there a limit to how large my team can be? Likewise, is there a minimum size?

The team size depends on the overall scope of the project, in addition to the project's budgetary and practical constraints. There are no

specific limits on the minimum or maximum number of participants yet there is a difference between projects that are allowable and projects that are highly competitive.

3-2. How many proposal submissions can I be on? For example, is it feasible to serve as the PI on one proposal, a co-PI on a second proposal, and an unpaid consultant on a third proposal?

Any individual currently leading an INFEWS (16-524; 17-530) award (the lead PI) may not be the lead PI on a Track 3 INFEWS-RCN proposal; and for any individual who is a lead-PI, coPI or Senior Personnel on an active/funded INFEWS award (16-524 and/or 17-530), s/he may be involved in only one proposal associated with this solicitation (NSF 18-xyz) in any capacity other than an external advisory committee member. An individual can be an external advisory committee member on ANY number of proposals. This limitation includes proposals submitted by a lead organization or any subaward submitted as part of a proposal.

For this solicitation, an individual may be PI, coPI, Senior Personnel, or Consultant on no more than two proposals per competition (this solicitation) and no more than 1 proposal per track. If an individual is on 2 proposals in any of these positions (lead PI, co-PI, Senior Personnel, or Consultant) s/he may be a lead PI on only one of those two proposals. Additionally, for any individual who is a lead-PI, coPI or Senior Personnel on an active/funded INFEWS award from previous INFEWS solicitations (16-524 or 17-530), s/he may be involved in only one proposal associated with this solicitation (NSF 18-xyz).

3-3. I am a researcher at a Federally Funded Research and Development Center (FFRDC) (or a federal agency). May I submit a proposal or serve as a co-PI?

To be eligible for NSF funding or co-funding, you can only participate on a proposal only as part of a sub-award or via a letter of collaboration. If you submit a proposal as a PI, you are only eligible for the portion of funding that USDA/NIFA is contributing.

3-4. Are PIs from the National Center for Atmospheric Research (NCAR), an NSF-sponsored FFRDC, permitted to submit proposals to INFEWS?

NCAR scientists are not permitted to submit proposals to INFEWS. NCAR participation can only be as a subaward (or via a letter of collaboration) and is subject to two conditions: (1) NCAR's participation must be consistent with the NCAR mission, (2) NCAR's participation is expected to be in partnership with non-FFRDC organizations with NCAR participation as a subaward. As an NSF-sponsored FFRDC, the letter of NSF commitment is not required.

3-5. Can an INFEWS project involve international research and/or involve international collaborators?

INFEWS projects can involve international research. The challenges and complexities of FEW systems are global, therefore international collaborations are encouraged where appropriate. International collaborators, however, should seek support from non-NSF sources. Funding guidelines for involving international collaborators (see Budgetary Information section of the INFEWS solicitation) allow only the following expenses to be included in the NSF budget: 1) Travel expenses for U.S. scientists and students participating in travel integral to the project; 2) Limited project-related expenses for international partners to engage in research activities while in the United States as project participants; 3) costs for specific services provided by an international partner that are essential to the success of the project and cannot be provided by a U.S. person or organization; and 4) project-related expenses for U.S. participants to engage in research activities while abroad. Although services listed under (3) above could be provided by a researcher from a developed country with its own sources of research funding, such a request that includes more than minimal and truly essential expenses is unlikely to review well.

3-6. Are there opportunities for private sector participation in this solicitation?

This solicitation strongly encourages engagement with the private sector. However, in order to be eligible for NSF funding, private sector businesses or individuals can only participate as subawardees or consultants on projects; they cannot serve as the lead organization. If a proposal is submitted with a business or individual as the lead-PI, you are still subject to the disciplinary requirements of the solicitation and are only eligible for the smaller portion of funding that USDA/NIFA is contributing.

3-7. I would like to include undergraduate students in my project. How do I incorporate a Research Experiences for Undergraduates (REU) experience within my proposal?

Incorporation of an REU experience within a proposal is an effective mechanism to integrate undergraduate educational activities into a research project. The Research Experiences for Undergraduates (REU) solicitation ([NSF 13-542](#)) notes that support for undergraduate students involved in carrying out research under NSF awards should be included as part of the research proposal itself instead of as a post-award supplement to the research proposal. Please consult the REU solicitation for further details.

3-8. I would like to propose work with an international collaborator. Can I include funds for my international partner in my NSF budget?

If your international collaborator is based at an organization in a country listed under [INFEWS International Partnerships](#), s/he can request funds from her/his own funding agency(s) as described in the link to partnerships above. The US funding limit is \$2.5M for Tracks 1 and 2. The funding limits for the work supported by the international partner(s) is subject to limitations of their funding agency described on the [INFEWS International Partnerships website](#). The proposal should describe the work that the entire team, US and international, will accomplish together. The budget request to the international partner should be provided as a supplementary document.

If your international collaborator is listed under [INFEWS International Partnerships](#), or is not listed, s/he should request funding support, separately from this solicitation, from his/her own domestic funding agency or potentially through the US Agency for International Development's [Partnerships for Enhanced Engagement in Research \(PEER\) program](#), managed by the National Academies of Science.

The NSF proposal may include limited funds for services that are essential to the success of the research project, only if those services could not be provided by a US-based person or organization. "Limited" is not specifically defined, but remember that NSF is not an aid agency and your proposal will be reviewed in competition with entirely domestic proposals. Your proposal can include requests for essential services that would be provided by a researcher from a developed country with its own sources of research funding; however, such requests tend not to review as well.

3-9. My international collaborator is applying for funding from her/his own country's research funding agency. How will this affect the success of my proposal?

International collaborations are encouraged and we appreciate that it is hard to synchronize funding with the limited opportunities for co-funding available through **INFEWS International Partnerships**. You should describe the research that your collaborator would do and how it improves the intellectual merit and broader impacts of your proposed efforts. However, since your collaborator's funding is not guaranteed, it would be best to ensure that her research effort is not essential for your project to be successful. For instance, it may be preferable to rely on her existing data or analyses that she can do without additional funding. You should explain that if she does receive funding your collaborative efforts would go further, even though your efforts would not be fully integrated. If her efforts are required for your research to be successful and she does not already have funding, your proposal is unlikely to review well.

About the Submission Process

4-1. This seems to be a very complicated solicitation with many required parts and pieces. Is there a checklist to ensure I have submitted all the necessary parts?

Yes. We recommend starting the upload and submission process early and referring to the checklist provided below.

The checklist for submission is discussed in detail "Proposal Preparation Instructions" given in section V of this solicitation.

INFEWS Proposal Checklist

1. Cover Sheet; no co-review allowed; title must include Track number to which proposal is directed. For proposals with an international dimension, the country or countries involved should be reported on the cover sheet.
2. Project Description (See PAPPG – **Note change**: "Results from Prior NSF Support" is NOT included in the 15-page limit for this solicitation). Please note that the "Management Plan" description for Track 3 INFEWS RCN proposals should be a major portion of the project description. For Tracks 1, and 2, the "Management Plan" has specific parameters and should be placed in the Supplementary Documents section.
3. Biographical Sketch(es) (See PAPPG. **Please load them in the same order as they appear in the Project Personnel Table - alphabetical order by last name is the suggested way to accomplish this.**)
4. Proposal Budget (See PAPPG. Please note that all proposal budgets MUST comply with NSF policy at the due date). Note also that Budgets submitted must include AT LEAST one person-trip per year to the Washington D.C. area over the lifetime of the project to represent the project at the annual INFEWS PI meeting. Budget for more than one PI meeting trip or travel by more than one project participant is allowed. Note that specific tracks have differing budget limitations.
5. Current and Pending Support (for all PIs, Co-PIs, and Senior Personnel) at a US organization. For international collaborators, only current and pending support from US organizations is required – See PAPPG).
6. Supplementary Documents
 - o Data Management Plan (See PAPPG) – Please note the different requirements of Track 3 compared to Tracks 1, and 2 for the Data Management Plan.
 - o Postdoctoral Researcher Mentoring Plan (if applicable – see PAPPG)
7. **Other Supplementary Documents (in order each part should appear)**
 - A. **Project Personnel Table** (addition for this solicitation) submitted as a character recognizable pdf file.
 - B. **Results from Prior NSF Support** (Previously this was in the Project Description – it has been moved to this section for this solicitation only).
 - C. **Management Plan** (addition for this solicitation) – please note the different requirements of Track 3 when compared to Tracks 1, and 2 for the Management Plan. The Management Plan for Track 3 proposals should be part of the 15-page project description, as noted earlier.
 - D. **Letters of Collaboration**
 - E. **FEW Context Statement**
 - F. **For projects that will include a request for funds from an international partner described on the [INFEWS International Partnerships website](#), the budget request from that international partner should be included as a supplementary document.**
8. Single Copy Documents (1 separate PDF file):

Collaborators & Other Affiliations (COA) information specified in the PAPPG should be submitted using the instructions and spreadsheet template found on the [Collaborators and Other Affiliations Information website](#). Please note that *proposers using the COA template for more than 10 senior project personnel will encounter proposal print preview issues. Please see the COA website for updated guidance.*

4-2. I see a deadline for submission is indicated in this solicitation. Does this deadline mean I can submit to any of the three tracks up until 5 pm (local time) on that date?

Yes. You are only able to submit proposals up to the deadline. Please note that proposals will not be accepted after the deadline. Starting the submission process early is strongly encouraged to ensure that you meet the deadline.

4-3 I am an engineer and I see that I have to submit my Track 1 project to the GEO Directorate. Is that correct?

Yes. For administrative purposes only, Tracks 1 and 3 are being directed to GEO and Track 2 is being directed to ENG. ALL PROPOSALS will be subject to review, evaluation, and assessment by ALL participating NSF Directorates and USDA/NIFA.

4-4. Can I submit the same proposal to INFEWS and other programs or solicitations at NSF?

No. NSF prohibits PIs from submitting the same proposal to more than one program or solicitation at NSF. Please be aware that submission of duplicate or substantially similar proposals concurrently for review by more than one program at NSF without prior NSF approval will result in the return of the redundant proposals.

4-5. I work in an NSF/EPSCoR jurisdiction and I noticed that there was a recent solicitation for the Research Infrastructure Improvement (RII) Track-2 Focused EPSCoR Collaborations (FEC) programs that encourages INFEWS research. Can I submit an identical proposal on this topic to EPSCoR and to INFEWS?

No. NSF prohibits PIs from submitting the same proposal to more than one program or solicitation. You will need to decide which solicitation is more aligned with your research interests and collaboration plans. Please check the EPSCoR website to determine RII Track-2 eligibility requirements and topics.

4-6. Can I obtain a waiver of the page limitation for the project description if my project is large and complex, or if my project includes multiple organizations?

No. All proposals must adhere to the page limit given in the solicitation. Note that "Results from Prior NSF Support" has been moved to "Supplementary Documents" for this solicitation.

4-7. Do all proposals require a Data Management Plan?

All proposals submitted to Tracks 1-3 are required to have a Data Management Plan (Supplementary Document). The proposal must include a section that describes data and model sharing plans (in the Data Management Plan). Please note that the supplemental documents should not repeat the information in the body of the proposal, but provide concise information as defined in the NSF Grant Proposal Guide and in the Proposal Preparation Instructions section of the INFEWS solicitation. If you anticipate that your proposed project would not generate data or samples that require management and/or sharing, please state that in your Data Management Plan. Please note that this statement will be subject to merit review.

4-8. Do all proposals require a Management Plan?

Yes. All proposals submitted to Tracks 1-3 are required to have a Management Plan, but the placement of the plan differs depending on which Track the proposal is submitted to. Proposals submitted to Track 3 require a Management Plan that is included as part of the project description, not a supplemental file. The Supplementary Documents section in Tracks 1 and 2 proposals must include a Management Plan which is also described in the Proposal Preparation Instructions section of the INFEWS solicitation. The quality and appropriateness of the Management (and Integration) Plan is an important review criterion for INFEWS proposals as outlined in the NSF Merit Review Criteria section of the solicitation.

4-9. The solicitation requires a Collaborators and Other Affiliations (COA) information as well as a spreadsheet that lists participating project personnel. These seem redundant. Why are they all necessary?

Both lists are necessary because they are used for different purposes. The COA is seen by NSF and is used for review purposes. The Project Personnel Table is seen by ad hoc reviewers and panelists for project evaluation. The Project Personnel Table should be created as a separate spreadsheet according to the instructions provided in the solicitation and submitted as a **character recognizable PDF file**. The **Project Personnel Table** should be placed within "Supplementary Documents". Collaborators & Other Affiliations (COA) information specified in the PAPPG should be submitted using the instructions and spreadsheet template found on the [Collaborators and Other Affiliations Information](#) website. Please note that proposers using the COA template for more than 10 senior project personnel will encounter proposal print preview issues. Please see the COA website for updated guidance.

4-10. What other resources can I read for more information regarding NSF and USDA's involvement in this initiative?

There is a growing body of literature on topics relevant to the INFEWS initiative. During FY2015, NSF funded a series of workshops related to food and water and energy systems. Please visit this site for more information on these workshops: <https://foodenergywater.wordpress.com/>. Please consult the NSF award database and other bibliographic search engines for current information.

4-11. I submitted my proposal to NSF and part, or all, of my project was chosen for funding by NIFA. What will I need to do to get my award?

For proposals selected for funding by NIFA, PIs will be asked to withdraw their proposal from NSF and resubmit it to NIFA in accordance with instructions given by the cognizant NIFA Program Officer. You will be personally contacted by this program office and provided with detailed instructions on how to resubmit your proposal to NIFA. Your proposal will not need to compete again, as it has already been reviewed through the joint NSF/NIFA INFEWS process detailed in this solicitation. Project funds will be dispersed to your organization through the Automated Standard Applications for Payment Systems (ASAP), operated by the Department of Treasury's Financial Management Service. For more information see http://www.nifa.usda.gov/business/method_of_payment.html.

Post award management will be done jointly with NSF. All PI meetings will be held jointly by NSF and NIFA. All projects funded by NIFA will need to submit their project reports through the NIFA reporting system. When projects are jointly funded through NSF and NIFA, they should submit a unified annual report that is a summary of the outcomes, impacts, and progress of the entire project. Reports should be drafted by the team, but will need to be submitted to both NSF and NIFA to meet the federal grant reporting standards of each agency. A similar report can be submitted to the reporting systems of both agencies to present a unified annual report.

5. About INFEWS-RCN Proposals

5.1. I am developing a proposal for an INFEWS-RCN (Track 3 in this solicitation). Do I need to write a Context Statement for my proposal in this Track?

Yes. A Context Statement is needed that designates your INFEWS-RCN's focus. There are many types of FEWS Systems, and it is important for you to clearly identify the system or systems that will be the focus of your INFEWS-RCN. The statement must also include a description of which scientific disciplinary communities will be involved in the RCN that correspond to the 3 participating NSF directorates (ENG, GEO, and SBE) or 2 of these directorates and USDA-NIFA. If there are extra disciplinary interests in addition to the required 3, they should also be noted in the context statement. These communities can be part of existing networks, but the proposed INFEWS-RCN should NOT fund an existing network that is already in place. Rather, the focus should be on creating new collaborations for a new network.

5.2. Is it appropriate to directly involve the private sector in an INFEWS-RCN proposal for Track 3?

Yes. It is important to involve both public and private sector entities in INFEWS-RCNs. There may be many possible ways of doing this,

and it is up to the PIs to determine the most appropriate mechanisms for involving the private sector in their FEW Systems domain. If the private sector is involved, the proposal should clearly specify their roles and how their participation might contribute to broader impacts of the INFEWS-RCN.

5.3. Is it possible to create an INFEWS-RCN that involves researchers in other countries?

Yes. Researchers in other countries can be involved when their participation contributes to the development of science and engineering convergence across disciplines and it contributes to our national interests. In general, NSF funding can facilitate travel by US-based personnel and limited travel by non-US persons whose participation is essential to the success of a meeting or other effort. NSF funding should not be used for travel by non-US-based personnel merely engaging as participants. Therefore, in order to engage with international networks, it is generally best to have US-based personnel travel to international meetings/events.

5.4. Do we need to include all three components (food and energy and water) in an INFEWS-RCN proposal?

Yes. The INFEWS-RCN must address FEW Systems that include all three components and their interactions. In contrast to research proposals in Tracks 1 and 2, however, the INFEWS-RCN will not conduct research, but instead have objectives and activities that lead to greater cooperation among researchers across all three components.

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