Agriculture and Food Research Initiative Competitive Grants Program

03/16/2021 Modifications: All substantive modifications and additional edits appear in red.

Foundational and Applied Science Program

Fiscal Years (FY) 2021 and 2022 Request for Applications

LETTER OF INTENT DEADLINE: Varies by Program Area
APPLICATION DEADLINE: Varies by Program Area

ELIGIBILITY: See Part III, A of this RFA

This RFA solicits applications for two review cycles (2021 and 2022) covering three years of budgets (FY 2021, FY 2022, and FY 2023). Applicants considering applying to the 2022 review cycle should check the AFRI RFA webpage and www.grants.gov after **December 15, 2021** for the 2022 Funding Opportunity Number and Application Kit, as well as for any other changes.



United States Department of Agriculture
National Institute of Food and Agriculture

NATIONAL INSTITUTE OF FOOD AND AGRICULTURE; U.S. DEPARTMENT OF AGRICULTURE

AGRICULTURE AND FOOD RESEARCH INITIATIVE COMPETITIVE GRANTS PROGRAM

FOUNDATIONAL AND APPLIED SCIENCE PROGRAM

INITIAL ANNOUNCEMENT

CATALOG OF FEDERAL DOMESTIC ASSISTANCE: This program is listed in the Assistance Listings under the Catalog of Federal Domestic Assistance number 10.310.

DATES FOR LETTERS OF INTENT AND APPLICATIONS: The Program Area Descriptions section in Part I, C of this RFA identifies the applicability of a Letter of Intent (LOI) and, if applicable, the deadline date for its submission is also found in the same section. If a LOI is required, applicant must submit it by **5:00 p.m. Eastern Time** on the LOI deadline date. This RFA solicits applications for two review cycles (2021 and 2022). Applications for the 2021 review cycle must be received by **5:00 p.m. Eastern Time** on the 2021 deadline dates indicated in Part I, C of this RFA, Program Area Descriptions. Applications for the 2022 review cycle must be received by **5 p.m. Eastern Time** on the 2022 deadline dates indicated in Part I, C of this RFA, Program Area Descriptions.

Applications received after these deadlines will normally not be considered for funding (see Part IV, C of this RFA). Comments regarding this request for applications (RFA) are requested within six (6) months from the issuance of this notice. Comments received after that date will be considered to the extent practicable.

STAKEHOLDER INPUT: We at the National Institute of Food and Agriculture (NIFA) seek your comments about this request for applications (RFA). We will consider your comments when we develop the next RFA for the program, if applicable, and we will use them to meet the requirements of section 103(c)(2) of the Agricultural Research, Extension, and Education Reform Act of 1998 (7 U.S.C. 7613(c)(2)). Submit your written comments by the deadline set forth in the DATES portion of this notice via email to Policy@usda.gov. (This email address is only for receiving comments regarding this RFA and ***not*** for requesting information or forms.) In your comments, please state that you are responding to the Foundational and Applied Science RFA.

Visit the NIFA Centers of Excellence website to access a factsheet on the Centers of Excellence (COE) designation process, including COE criteria, and a list of programs offering COE opportunities.

NIFA solicits proposed topics for Agriculture and Food Research Initiative (AFRI) RFAs from eligible state and national commodity boards on an ongoing basis. Topics must relate to the established AFRI six priority areas. Topics submitted by the commodity boards that align with NIFA priorities are chosen for inclusion in selected program areas of AFRI RFAs. Details on general information and topic submission resources for inclusion in future AFRI RFAs can be found at NIFA's Commodity Board Provision website.

Applicants are encouraged to view the Program Area Descriptions beginning in Part I, C of this RFA for additional details on commodity board-specific priorities and submission of applications relevant to these priorities.

EXECUTIVE SUMMARY: The Agriculture and Food Research Initiative (AFRI) is America's flagship competitive grants program that provides funding for fundamental and applied research, education, and extension projects in the food and agricultural sciences. In this RFA, NIFA requests applications for six AFRI priority areas through the Foundational and Applied Science Program for 2021 and 2022. Applicants considering applying to the second year should check the AFRI RFA webpage and www.grants.gov. The goal of this program is to invest in agricultural production research, education, and extension projects for more sustainable, productive and economically viable plant and animal production systems. The global agricultural output needs to be expanded significantly to meet the food needs of the population expected in 2050; thus, it is imperative to develop innovative, safe and sustainable management strategies for livestock, crops, and critical underlying resources.

In 2021 and 2022, applications are sought in the following priority areas:

1. Plant health and production and plant products;
2. Animal health and production and animal products;
3. Food safety, nutrition, and health;
4. Bioenergy, natural resources, and environment;
5. Agriculture systems and technology; and
6. Agriculture economics and rural communities

The anticipated amount available for new grants for the 2021 deadlines in this Foundational and Applied Science RFA is approximately $290 million. The anticipated amount available for new grants for the 2022 deadlines in this Foundational and Applied Science RFA is approximately $290 million.

This RFA is being released prior to the passage of appropriation acts for FY 2021, FY 2022, and FY 2023. Enactment of additional continuing resolutions or an appropriations act may affect the availability or level of funding for this program.

This RFA solicits Standard Grants, Conference Grants, Coordinated Agricultural Project Grants, and Food and Agricultural Science Enhancement (FASE) Grants, whereas project types solicited in this RFA are Research, Extension and Integrated Research, Education and/or Extension projects. Grant types and project types solicited vary by program area priority and not all grant types are solicited within each program area priority. See Part I, C (Program Area Descriptions) of this RFA for grant and project types solicited by each specific program area priority, and Part II, C of this RFA for a description of each individual grant type and project type.

This notice identifies the objectives for the AFRI Foundational and Applied Science program including program priorities, deadline dates, funding information, eligibility criteria for projects and applicants, and application forms and associated instructions needed to apply for an AFRI Foundational and Applied Science Program grant.

The deadlines under this RFA are summarized as follows:

Priority Area*	Program Area	2021 Review Cycle Deadlines**	2022 Review Cycle Deadlines**
PHPPP	a. Foundational Knowledge of Agricultural Production Systems	June 17, 2021	September 15, 2022
PHPPP	b. Foundational Knowledge of Plant Products	May 20, 2021	August 18, 2022
PHPPP	c. Pests and Beneficial Species in Agricultural Production Systems	May 27, 2021	August 25, 2022
PHPPP	d. Physiology of Agricultural Plants	May 20, 2021	August 18, 2022
PHPPP	e. Plant Breeding for Agricultural Production	May 20, 2021	August 18, 2022
PHPPP	f. Pollinator Health: Research and Application	May 27, 2021	August 25, 2022
PHPPP	g. Conventional Plant Breeding for Cultivar Development	May 20, 2021	August 18, 2022
AHPAP	a. Animal Reproduction	May 6, 2021	August 11, 2022
AHPAP	b. Animal Nutrition, Growth and Lactation	May 6, 2021	August 11, 2022
AHPAP	c. Welfare and Well-being of Agricultural Animals	May 6, 2021	August 11, 2022
AHPAP	d. Diseases of Agricultural Animals	May 6, 2021	August 11, 2022
AHPAP	e. Animal Breeding and Functional Annotation of Genomes	May 6, 2021	August 11, 2022
FSNH	a. Food Safety and Defense	May 27, 2021	August 25, 2022
FSNH	b. Novel Foods and Innovative Manufacturing Technologies	June 10, 2021	September 1, 2022
FSNH	c. Diet, Nutrition and the Prevention of Chronic Diseases	May 27, 2021	August 25, 2022
FSNH	d. Food and Human Health	June 10, 2021	September 1, 2022
FSNH	e. Mitigating Antimicrobial Resistance Across the Food Chain	June 10, 2021	September 1, 2022
BNRE	a. Soil Health	June 10, 2021	September 1, 2022
BNRE	b. Water Quantity and Quality	June 10, 2021	September 1, 2022
BNRE	c. Sustainable Bioeconomy through Biobased Products	June 10, 2021	September 1, 2022
BNRE	d. Sustainable Agroecosystems: Health, Functions, Processes and Management	June 17, 2021	September 15, 2022
AST	a. Engineering for Agricultural Production Systems	July 15, 2021	October 6, 2022
AST	b. Bioprocessing and Bioengineering	July 1, 2021	September 29, 2022
AST	c. Nanotechnology for Agricultural and Food Systems	May 27, 2021	August 25, 2022
AERC	a. Small and Medium-Sized Farms	June 24, 2021	September 22, 2022
AERC	b. Economics, Markets and Trade	July 15, 2021	October 6, 2022
AERC	c. Economic and Social Implications of Food and Agricultural Technologies	July 15, 2021	October 6, 2022
AERC	d. Rural Economic Development	June 17, 2021	September 15, 2022
Crosscutting	a. Agricultural Microbiomes in Plant Systems and Natural Resources	July 15, 2021	October 6, 2022
Crosscutting	b. Critical Agricultural Research and Extension (CARE)	June 17, 2021	September 15, 2022
Crosscutting	c. Data Science for Food and Agricultural Systems (DSFAS)	July 29, 2021	October 20, 2022
Crosscutting	d. Inter-Disciplinary Engagement in Animal Systems (IDEAS)	July 15, 2021	October 6, 2022
Crosscutting	e. Tactical Sciences for Agricultural Biosecurity	July 22, 2021	October 20, 2022

* PHPPP=Plant Health and Production and Plant Products, AHPAP=Animal Health and Production and Animal Products; FSNH=Food Safety, Nutrition, and Health; BNRE=Bioenergy, Natural Resources, and Environment; AST=Agriculture Systems and Technology; AERC=Agriculture Economics and Rural Communities; Crosscutting=Crosscutting Programs

** All applications must be received by 5 p.m. EST on the deadline date.

Beginning in 2021:

- This RFA covers two grant review cycles, one with 2021 deadlines and one with 2022 deadlines. For applications received under the 2021 deadlines, funding from FY 2021 and FY 2022 budgets will be used. For the 2022 review cycle, funding from FY 2022 and FY 2023 budgets will be used.
- All applicants who meet the eligibility requirement as a New Investigator (see Part II, C), will also be eligible to apply for a seed grant, as well as for a New Investigator (standard) grant. While all seed grant applications submitted to a program area priority will be evaluated together, seed grant applications from New Investigators will not compete for funding with applications from strengthening-eligible (see Part II, C) institutions. More information about seed grants is located on the AFRI RFA Resources page ("AFRI Grant Types" in the attachments list).
- Year-round conference grant applications are accepted after submission of the Letter of Intent, see Part I, C of this RFA for more information on which programs accept conference grants. The LOI must be submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.
- The addition of a new program area priority within Plant Health and Production and Plant Products: Conventional Plant Breeding for Cultivar Development program area priority (A1143).

Table of Contents

PART I—FUNDING OPPORTUNITY DESCRIPTION 7
A. Legislative Authority 7
B. Purpose and Priorities 7
C. Program Area Descriptions 9
PART II—AWARD INFORMATION 72
A. Available Funding 72
B. Types of Applications 73
C. Project Types and Grant Types 73
D. Responsible and Ethical Conduct of Research 74
PART III—ELIGIBILITY INFORMATION 75
A. Eligible Applicants 75
B. Request for Determination of Status 76
C. Cost Sharing or Matching 77
D. Centers of Excellence 77
PART IV—APPLICATION AND SUBMISSION INFORMATION 79
A. Letter of Intent 79
B. Electronic Application Package 79
C. Content and Form of Application Submission 80
D. Submission Dates and Times 80
E. Funding Restrictions 82
F. Other Submission Requirements 83
PART V—APPLICATION REVIEW REQUIREMENTS 84
A. General 84
B. Evaluation Criteria 84
C. Conflicts of Interest and Confidentiality 85
D. Organizational Management Information 85
E. Application Disposition 85
PART VI—AWARD ADMINISTRATION 86
A. General 86
B. Award Notice 86
C. Administrative and National Policy Requirements 86
D. Responsible and Ethical Conduct of Research 86
E. Expected Program Outputs and Reporting Requirements 86
PART VII—AGENCY CONTACTS 87
PART VIII—OTHER INFORMATION 89
A. Use of Funds; Changes 89
B. Confidential Aspects of Applications and Awards 89
C. Regulatory Information 90
D. Definitions 90
E. Materials Available on the Internet 91

Table 1: Program Area Priority Contacts 87
Table 2: Administrative/Business Contacts 88

PART I—FUNDING OPPORTUNITY DESCRIPTION

A. Legislative Authority

Section 2(b) of the Competitive, Special, and Facilities Research Grant Act (hereafter referred to as the Act) (7 U.S.C. 3157), as amended, authorizes the Agriculture and Food Research Initiative (AFRI), a competitive grant program to provide funding for fundamental and applied research, education, and extension to address food and agricultural sciences in the following six priority areas:

1. Plant health and production and plant products;
2. Animal health and production and animal products;
3. Food safety, nutrition, and health;
4. Bioenergy, natural resources, and environment;
5. Agriculture systems and technology; and
6. Agriculture economics and rural communities.

To the maximum extent practicable, NIFA, in coordination with the Under Secretary for Research, Education, and Economics (REE), will make grants for high priority research, education, and extension, taking into consideration, when available, the determinations made by the National Agricultural Research, Extension, Education, and Economics Advisory Board (NAREEEAB) pursuant to the Competitive, Special, and Facilities Research Grant Act (7 U.S.C. 3157). The Secretary delegates the authority to the Under Secretary in 7 CFR 2.21, and the Under Secretary delegates that authority to NIFA.

B. Purpose and Priorities

The purpose of AFRI is to support research, education, and extension work by awarding grants to solve key problems of local, regional, national, and global importance in sustaining conventional, organic, and urban agricultural systems. These include farm efficiency, profitability and sustainability; ranching; bioenergy; forestry; aquaculture; rural communities and entrepreneurship; human nutrition; mitigating impacts of biotic and abiotic constraints on food production; food safety; mitigating food waste and food loss; physical and social sciences; home economics and rural human ecology; biotechnology; and classical breeding. Through this support, AFRI advances knowledge in both fundamental and applied sciences important to agriculture. Funding this work also allows AFRI to support education and extension activities that deliver science-based knowledge to end users, allowing them to make informed, practical decisions. This AFRI RFA provides funding for research-only, extension-only, and integrated research, education, and/or extension projects addressing the six priorities identified in Part I, A.

Food and agricultural systems are under the constraints of a growing population; pressure on natural resources; challenges of climate variability and change; and complex demands of ensuring nutritional security and food safety in a global economy. Addressing these challenges requires research, education, extension, and integrated programs in concert with agroecological approaches that increase agricultural and natural resource sustainability. The term "sustainable agriculture" (7 U.S.C. 3103) means a combined system of plant and animal production practice having a site-specific application that will, over the long-term, achieve the following goals: 1) satisfy human food and fiber needs; 2) enhance environmental quality and the natural resource

base upon which the agricultural economy depends; 3) make the most efficient use of nonrenewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; 4) sustain the economic viability of farm operations; and 5) enhance the quality of life for farmers and society as a whole. AFRI encourages projects addressing enhancement of sustainability of agricultural systems.

NIFA supports global engagement that advances U.S. agricultural goals. To attain the agency's goals for U.S. agriculture, global competence of our nation's agricultural workforce, and safe and nutritious food security in a growing world, NIFA recognizes that collaboration with international partners through AFRI can contribute to advances in U.S. agriculture. In an increasingly interconnected world, these U.S. advances may have global importance. Thus, applicants to this RFA may include collaborations with international partners. However, only eligible U.S. institutions may apply. Such applications may include subawards to international partners or other institutions and must clearly demonstrate benefits to the U.S. Additional guidance on including international activities is provided on the AFRI International Partnerships website.

Stakeholder Input
The AFRI Stakeholder Feedback page has information on AFRI-related stakeholder input.

Background
AFRI is NIFA's flagship competitive grants programs for food and agricultural sciences, and funding is offered through the Foundational and Applied Science, Sustainable Agricultural Systems, and Education and Workforce Development Requests for Applications for addressing critical societal issues.

The Foundational and Applied Science RFA program areas address the following priorities as well as all included subpriorities:

A. Plant Health and Production and Plant Products;
B. Animal Health and Production and Animal Products;
C. Food Safety, Nutrition, and Health;
D. Bioenergy, Natural Resources, and Environment;
E. Agriculture Systems and Technology; and
F. Agriculture Economics and Rural Communities.

This AFRI RFA aligns with six USDA strategic goals:

- Strategic Goal 2: Maximize the Ability of American Agricultural Producers To Prosper by Feeding and Clothing the World;
- Strategic Goal 3: Promote American Agricultural Products and Exports;
- Strategic Goal 4: Facilitate Rural Prosperity and Economic Development;
- Strategic Goal 5: Strengthen the Stewardship of Private Lands Through Technology and Research;
- Strategic Goal 6: Ensure Productive and Sustainable Use of Our National Forest System Lands; and
- Strategic Goal 7: Provide All Americans Access to a Safe, Nutritious, and Secure Food Supply

C. Program Area Descriptions

This AFRI RFA includes seven program areas. The program areas and their respective approximate funding amounts for each review cycle include (available funding in millions):

1. Plant health and production and plant products ($66)
2. Animal health and production and animal products ($55)
3. Food safety, nutrition, and health ($39)
4. Bioenergy, natural resources, and environment ($33)
5. Agriculture systems and technology ($29)
6. Agriculture economics and rural communities ($34)
7. Crosscutting programs ($32)

Plant Health and Production and Plant Products

Background

Monumental gains in American crop productivity over the past 60 years are the result of innovations in agricultural production practices, plant breeding, and pest management. The goal of the Plant Health and Production and Plant Products (PHPPP) program area is to ensure continued production gains are achieved through break-through discoveries and the translation of these into plant production and protection practices. The outcomes of these projects are expected to increase production efficiencies and combat persistent threats and new challenges that limit the achievement of dependable yields across variable growing conditions.

Plant-based agriculture is changing with the introduction of new engineering, technology, and information tools. Further improvements to plant agriculture will require a greater understanding of complex, inter-related factors, across a wide range of scales. These include investigations of plant and pest biology at the molecular, cellular, whole-organism, and systems levels to increase performance and provide protection from biotic and abiotic stressors. New traits are being discovered and varieties developed using gene editing and other advanced breeding methods. Optimal integration of production system components is sought to ensure practices and products are safe for consumers and achieved with good stewardship of natural resources and efficient use of human capital. By supporting extension programming **and** training the next generation of scientists, new technologies will be made readily available to end-users and put into practice. This strategy will ensure that the United States continues to be a leader in the agricultural sciences and a reliable source for the expanding domestic and global demand for an abundant and secure supply of food, feed, natural fibers, wood, and other plant-based products.

In addition to the program area priorities described in this section, the **PHPPP** program area also supports the following program area priorities:

1. Agricultural Microbiomes in Plant Systems and Natural Resources (A1402) and Tactical Sciences for Agricultural Biosecurity (A1181) program area priorities are described in Crosscutting Programs.
2. Plant Biotic Interactions will be offered through an interagency program with the National Science Foundation; the NIFA program contact is Dr. Ann Lichens-Park, (202) 445-5483 or ann.park@usda.gov.

Total Program Funds: Approximately **$66** million for each review cycle

Key Information (Applicable to **All** Plant Health and Production and Plant Products Program Area Priorities):

- All applications must adhere to the requirements in Part IV of this RFA.
- Choice of plant species (including crops, trees, and weeds) and objectives must be justified in terms of importance to agricultural food, feed, fiber, ornamental plants (including turf), planted forest, or industrial crop production systems in the United States.
- Applications from and collaborations with minority-serving institutions, small to mid-sized institutions, and/or institutions within the Established Program to Stimulate Competitive Research (EPSCoR) states are encouraged in this program area.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.
- An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be submitted at least **195 days** before the start of the conference. The full Conference Grant application must be submitted, at minimum, **150 days** before the start of the conference.

Program Area Priorities – Each application must address at least **one of the seven** program area priorities listed below. Details about each of the PHPPP program area priorities are provided later in this section.

a. Foundational Knowledge of Agricultural Production Systems
b. Foundational Knowledge of Plant Products
c. Pests and Beneficial Species in Agricultural Production Systems
d. Physiology of Agricultural Plants
e. Plant Breeding for Agricultural Production
f. Pollinator Health: Research and Application
g. Conventional Plant Breeding for Cultivar Development

a. Foundational Knowledge of Agricultural Production Systems

Program Area Priority Code: A1102

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants for research projects must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants for integrated projects must not exceed **$750,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research and Integrated Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: Required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 17, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 15, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** Submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Mathieu Ngouajio, (202) 570-1915 or mathieu.ngouajio@usda.gov
- Dr. John Erickson, (816) 283-6422 or john.erickson@usda.gov

Program Area Priority:

The Foundational Knowledge of Agricultural Production Systems program supports plant research to advance our knowledge for the wide range of agricultural production systems found across the rural-urban continuum, from conventional open-fields to protected built environments. Research will address critical or process-limiting dynamics that occur among and within the various management components of a production system using experimental manipulations of system components, technological interventions, system analyses, modeling, or agro-ecological approaches. Results are expected to lead to the development of innovative sustainable solutions to challenges limiting or threatening the productivity, profitability, and good stewardship of natural resources, environment, and human capital.

Applications must address one or more of the following:

- Investigate how multiple management components of agricultural production systems can be integrated to enhance soil-crop-atmospheric processes or resilience to various biotic and abiotic stressors, and improve product quality and/or productivity;
- Determine how production systems, including regenerative systems, can alter the structure of microbial communities associated with plants, soils, or other growing media; the ways alterations affect functions such as plant nutrient uptake/utilization efficiency; and resilience to weeds, insects, diseases, weather extremes, and other stressors that influence productivity and/or product quality;
- Investigate how changes to cropping systems, including diversification or intensification,

affect crop performance, soil health, and other outcomes beneficial to system resilience; or

- Conduct syntheses and meta-analyses of existing data or develop new or extend existing models to derive general principles about the function, properties, and performance of agricultural production systems.

Program Area Priority Additional Information:

- Projects supported by Foundational Knowledge of Agricultural Production Systems program area priority can serve as building blocks needed for large inter- and trans-disciplinary projects funded by the AFRI Sustainable Agricultural Systems program.
- Appropriate plant-based production systems for study include food, feed, fiber, ornamental plants (including turf), industrial crops; harvested forages and pastures; rangelands; and planted forests. Conventional, organic, and protected systems (including hydroponics, aquaponics, aeroponics, vertical farming, and other controlled environment production systems) are appropriate for study.
- The production system studied could include key management components such as: integrated crop management, soil or other growing media fertility, soil health, agronomic practices, cover cropping, biodiversification, economics, integrated management of target pests (including arthropods, nematodes, pathogens, and weeds), automation, and worker well-being and safety.
- Development of innovative production systems to optimize the production of high-valued plant-based products are encouraged. Plant-based products may include but are not limited to oil, fiber, nutra- and pharmaceuticals, nutrients, proteins, juices, fragrances, resins, and biopesticides.
- Applicants must ensure applications are submitted to the right program or program area priority, for instance:
    1. Applications to study management of pests or beneficial species may be more appropriate for the Pests and Beneficial Species in Agricultural Production Systems program area priority (A1112)
    2. Applications to study microbiome function may be more appropriate for the Agricultural Microbiomes in Plant Systems and Natural Resources program area priority (A1402 in Crosscutting Programs)
    3. Applications to study aquatic animals in aquaponics systems may be more appropriate for the Small and Medium-Sized Farms program area priority (A1601) or the Economics, Markets and Trade program area priority (A1641) described in the Agriculture Economics and Rural Communities program area of this RFA
- The Foundational Knowledge of Agricultural Production Systems program does not support projects focused on livestock. Please refer to the Animal Health and Production and Animal Products program area, described elsewhere in this RFA.

b. Foundational Knowledge of Plant Products

Program Area Priority Code: A1103

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 20, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 18, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Vance Owens, (816) 283-6925 or vance.owens@usda.gov
- Dr. Victoria Finkenstadt, (816) 908-3147 or victoria.finkenstadt@usda.gov

Program Area Priority:

The Foundational Knowledge of Plant Products program supports projects to study the synthesis of plant-derived, high-value chemicals and ingredients for use in foods, pharmaceuticals, and other natural products. Projects must focus on agriculturally-important plants, including native and minor crop plant species and weeds. Molecular, biochemical, whole-plant, agronomic, or eco-physiological approaches may be used to determine the genetic basis of such traits identified through these studies. The intent of this program is for results to be translated into development of varieties that help create or meet emerging and future markets and contribute towards long-term demand for new agriculturally-based industrial and food products.

Applications must address one or more of the following:

- Macronutrients and/or micronutrient synthesis, accumulation, and/or availability that are beneficial to human health and nutrition;
- Primary and secondary metabolism regulating the synthesis of plant metabolites and its chemical ingredients that improve the quality of food and/or feed; or
- Plant-based chemicals that have industrial and/or pharmaceutical relevance.

Program Area Priority Additional Information:

- Applications that address topics related to medicinal studies or alternatively plant defense compounds are not appropriate for this program area priority.

c. Pests and Beneficial Species in Agricultural Production Systems

Program Area Priority Code: A1112

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$750,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Applications exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research-only and Integrated Projects (Research and Extension) only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 27, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 25, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Erica Kistner-Thomas, (816) 894-9283 or erica.kistnerthomas@usda.gov

Program Area Priority:

The goal of the Pests and Beneficial Species in Agricultural Production Systems program is to advance knowledge of invasive or established plant pests and associated beneficial species leading to innovative and biologically-based strategies to manage pests. Appropriate plant-based agricultural production systems for study include food and fiber crops, ornamental plants (including turf), and managed grasslands, rangelands and planted forests. Conventional, organic, and protected systems (including hydroponics, aquaponics, aeroponics, vertical farming, and other controlled environment agricultural systems) are appropriate for study. Pests may include invertebrates, plant pathogens and/or their vectors, nematodes or weeds. Beneficial species in this program will be restricted to biological control agents and microbes that play a role in pest management. Molecular, organismal, population, and/or community approaches are appropriate to this program. Both foundational and translational projects are encouraged.

Applications must address one or more of the following:

- Biotic and abiotic factors, affecting the abundance or spread of agriculturally-important plant pests, disease vectors, or beneficial species relevant to pest management; factors may include (but are not limited to) other plant pests or beneficial species, climate variability, plant compounds, pesticides, or toxins;
- Behavioral attributes of pests and beneficial species, including intra- or interspecies interactions and/or communication systems relevant to pest management;
- Factors that contribute to invasiveness, including (but not limited to) studies using population genetics/genomic approaches or models to predict, prevent or manage

outbreaks, or to pinpoint geographic distribution or origin;

- Movement or dispersal dynamics of pests or beneficial organisms, including pests that vector plant diseases; this could include epidemiological factors that influence disease spread, the influence of agronomic practices on weed populations, and research on aspects of weed biology that impact reproductive biology, seed bank dynamics, and other population-level aspects;
- Mechanisms of pest resistance to pesticides or toxins in genetically-modified plants (e.g., fungicides, herbicides, insecticides, or Bt toxin) and development of strategies to mitigate resistance and/or crop failure; or
- Conference applications that bring together experts in weed biology, plant genomics, herbicide resistance, and data science to better understand how genomic information could lead to novel solutions to manage weeds, how data will be used and maintained, and the underlying molecular mechanisms that contribute to invasiveness.

Program Area Priority Additional Information:

- Applicants must ensure applications are submitted to the right program or program area priority, for instance:
  - Applications that address topics related to pollinators are not appropriate for this program area priority; consider submitting to the Pollinator Health: Research and Application (A1113).
  - Studies involving molecular mechanisms that mediate interactions of plants with their biotic partners may be appropriate for the NSF/NIFA Plant Biotic Interactions program.
  - Applications to study microbiome function may be more appropriate for the Agricultural Microbiomes in Plant Systems and Natural Resources program area priority (A1402 in Crosscutting Programs).
  - Applications to study pests of livestock or humans (e.g., vectors of human diseases or nuisance pests such as flies, bed bugs, cockroaches, and termites) are not appropriate for this program area priority. Instead, consider submitting to the Animal Health and Production and Animal Products program area if you are studying pests of livestock, or to the Crop Protection and Pest Management RFA if your work is focused on nuisance pests in urban or rural systems.
  - Applications for work on big data analytics and tool development to support the development of a data network and cyberinfrastructure for pests and beneficial species should be submitted to the Data Science for Food and Agriculture Systems (DSFAS) program area priority (A1541 in Crosscutting Programs).
  - Projects associated with the initiative to sequence 5,000 arthropod genomes (i5K) are encouraged to link with the National Agricultural Library's i5k workspace.
  - NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Pests and Beneficial Species in Agricultural Production Systems program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]".

d. Physiology of Agricultural Plants

Program Area Priority Code: A1152

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority" described subsequently for opportunity to request **$800,000** for applications that includes specific types of partnerships for this priority only.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 20, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 18, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. John Erickson, (816) 283-6422 or john.erickson@usda.gov
- Dr. Ed Kaleikau, (816) 926-1741 or edward.kaleikau@usda.gov

Program Area Priority:

The Physiology of Agricultural Plants program will support projects to improve productivity or other performance factors of agriculturally-important plants (including weeds) using molecular, biochemical, whole-plant, agronomic, or eco-physiological approaches. The genetic basis of important traits identified through these studies are expected to translate into plant varieties with improved yield or product quality, or growth resilience to adverse environmental conditions.

This program area priority will support research in the following areas:

- Plant growth and developmental processes, including plant architecture, carbon assimilation, and source-sink relationships;
- Mechanisms of plant response to abiotic stresses, including increased water use efficiency; or
- Nutrient uptake, assimilation, and/or utilization, particularly increased plant use efficiency for nitrogen, phosphorus, or other supplemental nutrients.

Program Area Priority Additional Information:

- Relevance to agriculturally-important traits should be clearly justified and specific.
- For studies that involve microbes in plant nutrient utilization or abiotic stress tolerance, consider the Agricultural Microbiomes program area priority (in Crosscutting Programs) or the NSF/NIFA Plant Biotic Interactions program to determine the best fit for the project.

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP**: [full title…]" The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).

e. Plant Breeding for Agricultural Production

Program Area Priority Code: A1141

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants for Plant Breeding Research must not exceed **$650,000** total per project (including indirect costs) for project periods of three to four years. See "Program Area Priority" described subsequently for opportunity to request **$800,000** for applications that includes specific types of partnerships for this priority only.
- Budgets for Coordinated Agricultural Project Grants addressing Innovation in Genomic Technology to Accelerate Breeding Progress must not exceed **$15,000,000** total per project (including indirect costs) for project periods of five years. This program area anticipates making a single CAP award in the 2021 cycle.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research and Integrated Projects; Integrated Projects only for Innovation in Genomic Technology to Accelerate Breeding Progress

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants; Coordinated Agricultural Project and FASE (Strengthening Coordinated Agricultural Project) Grants only for Innovation in Genomic Technology to Accelerate Breeding Progress

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 20, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 18, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Ed Kaleikau, (816) 926-1741 or edward.kaleikau@usda.gov
- Dr. Ann Stapleton, (816) 274-1942 or ann.stapleton@usda.gov

Program Area Priority:

The Plant Breeding for Agricultural Production program will support public breeding efforts to improve crop productivity, efficiency, quality, and performance. Research is encouraged to genetically dissect and then introduce desirable traits that may include, but are not limited to: increased nutrient use efficiency; increased photosynthetic efficiency; tolerance to drought, flood and temperature extremes; resistance to pests and diseases; improved taste, aroma,

nutrition, or food safety; adaptation to vertical agriculture systems; and removal of undesirable traits through the use of both traditional genetic approaches and targeted gene editing.

The Plant Breeding for Agricultural Production program applications must address one of the following:

- **Plant Breeding Research** focused on pre-breeding and germplasm enhancement; participatory breeding; selection theory; applied quantitative genetics; phenomics; or the incorporation of modeling (including crop growth models) in breeding. Explainable artificial intelligence research on ways to leverage parameters and processes that directly relate to theory, genetics and crop models is also encouraged. In addition, applications that address the emerging area of plant breeding for foodborne illness that focus on initiating pre-breeding screening strategies to characterize genetic variability, heritability, and efficacy of target traits or support for breeding objectives where genetic variation and efficacy is established are especially encouraged. Proposed budget requests must not exceed **$650,000** total per project (including indirect costs) for project periods three to four years.
- Opportunity to request **$800,000** for applications that includes specific types of partnerships. A **Plant Breeding Research** application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PLANT BREEDING PARTNERSHIP:** [full title…]" The partnership team MUST BE reflected among the listed Project Director, and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- **CAP for Innovation in Genomic Technology to Accelerate Breeding Progress:** The availability of complete genomes, inexpensive sequencing technologies and editing tools for most major crops as well as advancements in data science and automation have opened possibilities for complementing current public breeding programs with more focused and accelerated approaches to designing optimal gene combinations for changing environments. The CAP Innovation in Genomic Technology to Accelerate Breeding Progress priority supports multiple goals within the USDA Science Blueprint, to catalyze and coordinate research linking genome design and predictive breeding to achieve advances that generate societal and environmental benefits. The **Integrated research and education** CAP priority aims to (1) harness new tools to empower national and international breeding communities to accelerate improvements in crop productivity through innovations in breeding and genomics and (2) to train current and future plant breeders to leverage field and genomics expertise. The ultimate goal is innovation in field evaluation, education, and design of allele incorporation, to enable sustainable crop systems for a changing world.

  Possible focus areas include integration between genotyping and high-throughput phenotyping for source- and sink- related traits, implementation of genomic selection approaches into active public breeding programs and cultivar production, development and testing of new methods, theories, modeling and artificial intelligence for predictive breeding beyond what private industry already does, and functional genomic studies to identify pathways affecting plant productivity and development of ways to incorporate

pathway information into genomic selection. The integrated CAP priority encourages:

- coordination and development of breeding and genomic information in open databases that maximize compatibilities and connectivity to other international databases to include a commitment to the development of tools to facilitate visualization of data and utilization by breeders and researchers;
- international collaborations in research and training with international centers (e.g. CGIAR) or groups from other countries equally committed to public access of germplasm and information;
- incorporation and updating of educational activities based on best practices as supported by bodies of evidence;
- commitment to the many dimensions of diversity including ethnicity, gender, career stages, institutional types, and geographical locations.

Eligible applicants for **Integrated Projects** include a) Colleges and universities; b) 1994 Land-Grant Institutions; and c) Hispanic-serving agricultural colleges and universities. For more information see Part III (Eligibility Information) of this RFA. The integrated application must include a project management plan and a data management plan that covers project intellectual property. Public-private partnerships with letters of support are strongly encouraged. Proposed budget requests must not exceed **$15,000,000** total per project (including indirect costs) for project periods of five years. NIFA anticipates investing in one integrated CAP award in FY2021. Applications that include such integrated research and education must begin their title as "**NIFA CAP for Innovation in Genomic Technology to Accelerate Breeding**: [full title…]"

Program Area Priority Additional Information:

- Choice of plant species and objectives must be justified in terms of importance to agricultural food, feed, fiber, ornamental plants (including turf), or industrial crop production systems in the United States.
- Research that incorporates training of field-based plant breeders is encouraged.
- Relevance to cultivar development should be clearly justified, demonstrable, and specific.
- Data management plan: Use of automated plan builders is encouraged, for example, the DMP Tool; Inclusion of a plan and process for updating the data management plan to incorporate new knowledge on best practices is strongly advised; Incorporation of FAIR best practices is strongly encouraged.
- Release or distribution of plant germplasm and other plant materials: Researchers must consult with the relevant National Plant Germplasm System (NPGS) crop curator to determine whether and how to deposit plant germplasm, plant cultivars, transgenic plants, plant mutants, plant populations, or other kinds of plant materials into the NPGS genebanks and stock centers. Project directors must confer with the relevant crop curators and Crop Germplasm Committees early in the application development process regarding the desirability of submitting the preceding plant materials generated by NIFA funding for deposit into NPGS genebanks and stock centers. More information is available on the NPGS website.
- Applications for work on big data analytics and tool development are solicited to support the development of a plant breeding data network and cyberinfrastructure with the requirement to convert large amounts of data into knowledge and applications through

computer analytics and modeling. Such applications must be submitted to the Data Science for Food and Agriculture Systems (DSFAS) program area priority (A1541 in Crosscutting Programs).

- Applications focused on cultivar development should be submitted to the Conventional Plant Breeding for Cultivar Development program area priority (A1143).

f. Pollinator Health: Research and Applications

Program Area Priority Code: A1113

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$750,000** total per project (including indirect costs) for project periods of three to five years.
- Budgets for Standard Grants, and Strengthening Standard Grants addressing the research coordination network priority below must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. NIFA anticipates a maximum of one award.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Single function Research, Education or Extension only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Requested Grant Types for Research Coordination Networks: Standard and FASE (Strengthening Standard) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 27, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 25, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Erica Kistner-Thomas, (816) 894-9283 or erica.kistnerthomas@usda.gov
- Dr. Megan O'Rourke, (816) 319-8527 or megan.orourke@usda.gov

Program Area Priority:

The Pollinator Health: Research and Application program supports single-function projects (research, extension or education) with the goal of promoting healthy populations of animal pollinators in agricultural systems where reliance of crops on pollinators for pollination services is increasing and where declines of pollinators is evident. The declining health of pollinator populations poses a serious risk to crops that depend on pollinators for the production of marketable commodities and could ultimately impact the nation's food security. Several factors are significantly impacting the health of pollinator populations, including pests, diseases, pesticides, pollutants or toxins, nutritional deficits; effects of climate variability, agricultural production intensification, and habitat loss; reduced species or genetic diversity; and pollinator or crop management practices. Recent research also indicates that changes in bee gut microbial communities could have effects on nutritional health, disease resistance, or susceptibility to

pesticides. However, the mechanisms that underlie these effects on pollinator health need further research. Studies involving ecological, behavioral, genomic, physiological, biophysical, sociological, and/or economic approaches will be considered for funding. Targeted multi-year monitoring of selected species in the context of research is also appropriate.

Applications must address one or more of the following:

- Factors that influence the abundance, diversity and health of pollinators. Examples may include biotic, abiotic as well as social, cultural or economic phenomena.
- Functions of the microbiome associated with pollinators and their role in promoting healthy populations.
- Development and evaluation of innovative tools and management practices that would likely be adopted by stakeholders to ensure healthy pollinators. Examples include, but are not limited to, innovative genetic/genomic and breeding tools, diagnostic techniques, other cutting-edge technologies, alternative chemicals or biologically-based strategies to combat varroa mites or key bee diseases.
- Development, implementation and/or evaluation of management practices of other crop pests/diseases that also ensure protection of pollinators and other beneficial species (i.e., integrated pest and pollinator management). Engagement of extension leaders with one or more types of stakeholders (crop producers, consultants, agribusinesses, non-profit organizations, land managers, bee keepers or others managing native pollinators) is strongly encouraged. Experience working with stakeholders to overcome barriers to adoption of integrated pest and pollinator management practices is recommended. Letters of support or collaboration with stakeholders should be included in the application.
- Education-only that target K-14 level students to advance learning about pollinators in agricultural and associated landscapes. Non-exhaustive examples of educational approaches include curriculum development, experiential learning projects, learning opportunities that increase scientific knowledge, or other creative projects related to pollinators.
- Extension only projects that include informal training, workshops or demonstration projects related to pollinators in agriculture and associated systems.
- Establishment of a Research Coordination Network for a National Native Bee Monitoring Plan. Applications are solicited to foster national-level coordination of efforts to reliably assess the status and trends of agriculturally-important native bee species on a national scale. We will likely only fund one proposal of this type nationally. The purpose is not to fund research itself, but to support broad coordination of ongoing research efforts already funded. Partnerships with existing Federal and state governments and private and non-profit organizations are encouraged. Connections with existing biological inventories or networks should also be emphasized. Network activities may include but are not limited to: training the next generation of scientists in bee taxonomy using traditional and molecular approaches; development of minimum standards and methods for data collection and integration of data sets; plans for long-term data management, data storage, and data sharing; linkages with publicly-accessible databases for collection information, tool development, sampling methods and data curation plans.

Program Area Priority Additional Information:

- A broad range of plant systems are appropriate, such as fruit, vegetable, nut and oil seed crops, habitat in conservation reserve programs, cover crops, hedgerows, rangelands, horticultural crops, prairies, forests, etc. Rural, semi-rural and urban systems are also appropriate.
- Proposals to establish a research coordination network must include a management plan that clearly delineates the specific roles and responsibilities of individuals, agencies or private industries or land managers (e.g., research coordination, leveraging additional funds or other resources, sharing data and information, or citizen engagement).

g. Conventional Plant Breeding for Cultivar Development

Program Area Priority Code: A1143

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$500,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 20, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 18, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Ed Kaleikau, (816) 926-1741 or edward.kaleikau@usda.gov
- Dr. Ann Stapleton, (816) 274-1942 or ann.stapleton@usda.gov

Program Area Priority:

The Conventional Plant Breeding for Cultivar Development program will support public breeding efforts that provide farmers with greater access to locally and regionally adapted cultivars. “Plant breeding is the science driven creative process of developing new plant varieties that goes by various names including cultivar development, crop improvement, and seed improvement. Breeding involves the creation of multi-generation genetically diverse populations on which human selection is practiced to create adapted plants with new combinations of specific desirable traits. The selection process is driven by biological assessment in relevant target environments and knowledge of genes and genomes. Progress is assessed based on gain under selection, which is a function of genetic variation, selection intensity, and time. In general, plant breeding uses principles from a variety of sciences to improve the genetic potential of plants. The process involves combining parental plants to obtain the next generation with the best characteristics. Breeders improve plants by selecting those with the greatest potential based on performance data, pedigree, and more sophisticated genetic

information. Plants are improved for food, feed, fiber, fuel, shelter, landscaping, eco-systems services and a variety of other human activities." (National Association of Plant Breeders).

Applications for research must address later stages of cultivar development focused on testing and evaluation of developed materials in established regional trials with the primary goal of releasing publicly finished cultivars.

Program Area Priority Additional Information:

- Relevance to cultivar development should be clearly justified, demonstrable, and specific.
- Research that incorporates training of field-based plant breeders is encouraged.
- Release or distribution of plant germplasm and other plant materials: Researchers must consult with the relevant National Plant Germplasm System (NPGS) crop curator to determine whether and how to deposit plant germplasm, plant cultivars, transgenic plants, plant mutants, plant populations, or other kinds of plant materials into the NPGS genebanks and stock centers. Project directors must confer with the relevant crop curators and Crop Germplasm Committees early in the application development process regarding the desirability of submitting the preceding plant materials generated by NIFA funding for deposit into NPGS genebanks and stock centers. More information is available on the NPGS website.

Animal Health and Production and Animal Products

Background

Animal health and production play critical roles in the sustainability and competitiveness of U.S. agriculture. Livestock, poultry, equine, and aquaculture species contribute significantly to the nation's economy, global food production, and food security. For U.S. agriculture to remain globally competitive, a better understanding of the critical biological and physiological mechanisms underlying nutrition, growth, reproduction, and health in these species is needed. Basic and applied research at the genetic, genomic, molecular, cellular, microbiome, and organ systems levels is essential to control and prevent animal diseases, reduce animal health and production costs, enhance nutritional quality of animal products, and mitigate environmental impacts. New knowledge gained from this research will lead to better management strategies for both conventional and organic production systems to enhance production efficiency, improve animal health and welfare, and develop high quality animal products for human use. These strategies may include the application of biotechnology, conventional/classical breeding, and breed development. Recent advances in genome modification technologies, such as genome editing, holds promise as a novel tool for understanding the role of specific genes and gene products in animal biology, physiology, and production traits, as well as precision breeding. NIFA is soliciting proposals on genome editing in the programs areas given below as well as in the Inter-Disciplinary Engagement in Animal Systems program are priority (A1261).

Total program funds – Approximately **$55** million for each review cycle

Program Area Key Information applicable to ALL Animal Health and Production and Animal Products Program Area Priorities:

- All applications must adhere to the requirements in Part IV of this RFA.
- Applications from and collaborations with minority-serving institutions, small to mid-sized institutions, and/or institutions within the EPSCoR states are encouraged in this program area.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- Applicants must justify the use of experimental model systems. Applications that primarily use non-agricultural or non-aquaculture species as models (*i.e.*, encompassing greater than 50% of the work proposed) will not be considered.
- When appropriate, applicants must include statistical power analyses and describe the experimental design, experimental unit, replication and sample size for each experimental group.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.
- An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.

Program Area Priorities – Each application must address at least one of the five program area priorities listed below. Details about each of the Animal Health and Production and Animal Products program area priorities are provided later in this section.

a. Animal Reproduction
b. Animal Nutrition, Growth and Lactation
c. Welfare and Well-being of Agricultural Animals
d. Diseases of Agricultural Animals
e. Animal Breeding and Functional Annotation of Genomes

a. Animal Reproduction

Program Area Priority Code: A1211

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **650,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 6, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 11, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Mark Mirando, (202) 445-5575 or mark.mirando@usda.gov

Program Area Priority:

Cellular, molecular, genomic/genetic or whole-animal aspects of animal reproduction relevant to improving reproductive efficiency or enhancing reproductive management, especially focusing on:

- Gonadal function (including production, function, and preservation of gametes);
- Hypothalamic-pituitary axis;
- Embryonic and fetal development (including interaction between the conceptus and its uterine environment); or
- Microbiome of the reproductive tract.

Program Area Priority Additional Information:

- Applications to study effects of nutritional plane on reproductive performance are appropriate for this program area priority (A1211). Applications to study effects of nutritional plane during gestation on subsequent growth performance or lactation of the offspring should be submitted to the Animal Nutrition, Growth and Lactation program area priority (A1231). Applications to study effects of nutritional plane during gestation on immune function or susceptibility to disease of the dam or offspring should be submitted to the Diseases of Agricultural Animals program area priority (A1221).

b. Animal Nutrition, Growth and Lactation

Program Area Priority Code: A1231

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 6, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 11, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Steven Smith, (202) 445-5480 or steven.i.smith@usda.gov

Program Area Priority:

Cellular, molecular, genomic/genetic or whole-animal aspects of nutrition, growth and lactation, especially focusing on:

- Nutrient utilization and efficiency, including influence and impact of the gastrointestinal microbiome;
- Innovative approaches to feed formulation or use of novel alternative feedstuffs;
- Improving the quality and efficiency of producing meat, milk, eggs, and animal fiber; or
- Metabolic disorders and nutritional deficiencies affecting production of meat, milk, eggs, and animal fiber.

Program Area Priority Additional Information:

- Applications focused on the effects of metabolic disorders (e.g., hepatic lipidosis, ketosis, post-parturient hypocalcemia, displaced abomasum, insulin resistance) and nutrient deficiencies on meat, milk and egg production are appropriate for this program area priority (A1231). Applications focused on the effects of metabolic disorders and nutrient deficiencies on immune function or susceptibility to disease should be submitted to the Diseases of Agricultural Animals program area priority (A1221).
- Applications to study effects of nutritional plane during gestation on subsequent growth performance or lactation of the offspring are appropriate for this program area priority (A1231). Applications focused on effects of nutritional plane on reproductive performance should be submitted to the Animal Reproduction program area priority (A1211). Applications to study effects of nutritional plane during gestation on immune function or susceptibility to disease of the dam or offspring should be submitted to the Diseases of Agricultural Animals program area priority (A1221).
- Projects addressing precision animal management, such as resource-smart feeding and monitoring, should consider the Inter-Disciplinary Engagement in Animal Systems (IDEAS) program area priority (A1261 in Crosscutting Programs).
- Applications to study effects of pre-harvest treatments (e.g. nutritional plane) on post-harvest product characteristics are appropriate for this program area priority (A1231). Applications focused exclusively on post-harvest treatments and their effect on our understanding of the chemical, physical, and biological properties of animal products or methods to improve the safety, quality, shelf-life, convenience, nutrient profile or sensory attributes of animal products, should be submitted to the Novel Foods and Innovative Manufacturing Technologies program area priority (A1364). Applications focused exclusively on post-harvest treatments intended to enhance the nutritional value of animal products through improved bioavailability of vitamins, minerals, and bioactive components should be submitted to the Food and Human Health program area priority (A1343).

- NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Animal Nutrition, Growth and Lactation program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]".

c. Welfare and Well-being of Agricultural Animals

Program Area Priority Code: A1251

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for research only applications that include specific types of partnerships.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research or Integrated Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 6, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 11, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Frank Siewerdt, frank.siewerdt@usda.gov
- Dr. Mark Mirando, (202) 445-5575 or mark.mirando@usda.gov

Program Area Priority:

Evaluation (which should include assessment of animal welfare and animal well-being) of current animal agriculture production practices and/or development of new or enhanced management approaches that safeguard both animal welfare and sustainable production efficiency, including but not limited to:

- Advance objective measures of animal welfare and well-being, including the use of emerging methods and metrics for assessment (e.g., functional genomics; epidemiology; automated, noninvasive methods) for outcome based (health and behavior) welfare assessment criteria.
- Alternatives or improvements for painful management procedures; euthanasia and slaughter methods to decrease pain and distress; handling and transportation to decrease injury and distress (including heat stress);
- Understanding the effect of the microbiome on animal welfare and well-being;
- Selection for robustness, behavior, and/or social effects; or

- Development of innovative alternatives to replace or reduce the use of animals in agricultural research.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP**: [full title…]" The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications that address social science aspects of animal welfare or those that focus on precision animal management of animal welfare should be submitted to the Inter-Disciplinary Engagement in Animal Sciences program area priority (A1261).
- Applications that address animal welfare with a significant engineering component such as the design, manufacture, and operation of structures, technologies, machines, processes, and/or systems should be submitted to the Agriculture Systems and Technology program area priority: Engineering for Agricultural Production Systems (A1521).
- Applications that address animal welfare, but work exclusively on prevention, control, or treatment of animal diseases, should be submitted to the Diseases of Agricultural Animals program area priority (A1221).
- NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Welfare and Well-being of Agricultural Animals program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]". **Note: Research applications submitted for U.S.-Ireland Tripartite Collaborative grants are ineligible for U.S. funding above the research program maximum of $650,000.**

d. Diseases of Agricultural Animals

Program Area Priority Code: A1221

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for applications that include specific types of partnerships.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 6, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 11, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Tim Sullivan, (816) 527-5434 or timothy.sullivan@usda.gov
- Dr. Kathe Bjork, kathe.e.bjork@usda.gov

Program Area Priority:

- Cellular, molecular, genomic/genetic or whole-animal aspects of animal health and disease, with emphasis on maintaining healthy agricultural animals to ensure a safe and adequate food supply;
- Maintenance of homeostasis including innate immune responses;
- Disease prevention and control, **including** vaccines; reverse vaccinology; breeding for resistance; management, and diagnostics (for endemic diseases only).
  NOTE: Diagnostics for transboundary/foreign and emerging/re-emerging diseases should be submitted to the Tactical Sciences for Agricultural Biosecurity program area priority (A1181). For diagnostic tests, applicants must provide a validation plan.;
- Therapeutic interventions for disease reduction or treatment, including minor use animal drugs;
- Immune Reagents for Agricultural Animals. Development of publicly-accessible, reasonably-priced immunological reagents for aquaculture (major focus on catfish and salmonids) or Poultry. **Applications addressing reagents for ruminants, swine, or equine species will NOT be accepted in 2021.** NIFA anticipates a maximum of one award in this area. Reagents should be applicable to the study of more than one disease and fill gaps where research is hindered due to a lack of critical reagents. Clearly outline how you will connect with stakeholders and partners to determine the U.S. immunology communities' highest priority needs.
  - The application title should be: "IMMUNE REAGENTS for Aquaculture: Lead Institution Name" or "IMMUNE REAGENTS for Poultry: Lead Institution Name".
  - Describe a strong management and implementation plan that guarantees sustainability and avoids loss of developed reagents.
- Establishment of a "Research Coordination Network for Minor Use Drugs" to advance the timely approval of priority animal health products for minor species of food- and fiber-producing animals, and for minor uses in major animal species (excluding companion animals).
  - The proposal should be titled: "RCN MINOR USE DRUGS: Project Director's First and Last name"; example title = "RCN MINOR USE DRUGS: Joseph Smith".
  - The budget should be divided among 5 years. Projects must address (1) linkages among research institutions, drug manufacturer(s) and the FDA-Center for Veterinary Medicine and other relevant government or private agencies as needed, (2) outreach and communication, (3) selection and prioritization of drug approval needs, (4) sustainability and future funding, and (5) a management plan.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP: [full title…]"** The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications to study effects of nutritional plane during gestation on immune function or susceptibility to disease of the dam or offspring are appropriate for this program area priority (A1221).
- Applications focused on the effects of metabolic disorders (e.g., hepatic lipidosis, ketosis, post-parturient hypocalcemia, displaced abomasum, insulin resistance) and nutrient deficiencies on immune function or susceptibility to disease are appropriate for this program area priority (A1221). Applications focused on the effects of metabolic disorders and nutrient deficiencies on meat, milk and egg production should be submitted to the Animal Nutrition, Growth and Lactation program area priority (A1231).
- NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Diseases of Agricultural Animals program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]". **Note: Research applications submitted for U.S.-Ireland Tripartite Collaborative grants are ineligible for U.S. funding above the research program maximum of $650,000.**

e. Animal Breeding and Functional Annotation of Genomes

Program Area Priority Code: A1201

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Budgets for Standard Grants and Strengthening Standard Grants addressing the USDA Animal Genome Blueprint and USDA Agricultural Innovation Agenda target areas must not exceed **$1,300,000** total per project (including indirect costs) for project periods of four to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 6, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 11, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Frank Siewerdt, frank.siewerdt@usda.gov
- Dr. Mark Mirando, (202) 445-5575 or mark.mirando@usda.gov

Program Area Priority:

Animal genomics research priorities over the next decade were identified from stakeholder inputs and were compiled in a new report. "Genome to Phenome: Improving Animal Health, Production, and Well-Being: A new USDA Blueprint for Animal Genome Research 2018 – 2027" in *Frontier in Genetics*. Some of the research priorities identified in the animal genome blueprint are pan genomes, gene editing, germplasm conservation, functional annotation of animal genomes, precision breeding, high throughput phenotyping, and big data. The USDA Agricultural Innovation Agenda (AIA) identified four innovation clusters for Science Breakthroughs to Advance Food and Agricultural Research by 2030 (i) Genome Design, (ii) Digital/Automation, (iii) Prescriptive Intervention and (iv) Systems based Farm Management. Proposals that align with the animal genome blueprint and AIA goals are highly encouraged to submit to this program area or other program areas within the RFA based on the best alignment with program area priority goals.

- Novel quantitative genetic methods including selection theory and modeling; implementing selection methods that use a systems approach using a combination of genomics, epigenomics, functional genomics, and microbiome data for simultaneous improvement of multiple traits.
- Development of national and regional breeding strategies to address biotic and abiotic stresses (including climate), genetic diversity, germplasm storage and characterization, crossbreeding or genome modifications.
- Development of new phenotypes for improving selection criteria and/or development of high-throughput methods for on-farm recording of traits.

USDA Animal Genome Blueprint Target Areas:

- Genome-wide catalog of functional elements in both coding and non-coding regions of the genome, epigenomics, and chromatin architecture with emphasis on development and application of high-throughput methods for in multiple individuals and across diverse breeds.
- Genome Design using functional genetic or epigenetic variants underlying traits of interest for traditional selection or as candidates for gene editing.
- Development and application of comparative genomics approaches for genetic mapping of traits and understanding the evolution of traits of interest to commercial agriculture.
- Development of gene editing methods for high-throughput functional screening of candidate loci in cells, tissues or organoid systems.

Program Area Priority Additional Information:

- Applications proposing data science projects that leverage data sets across multiple

disciplines and convert large amounts of data into knowledge and applications through computer analytics, modeling and simulations should submit applications to the DSFAS program area priority (A1541 in Crosscutting Programs).

- Applications that propose to use functional genomics and genome editing approaches for understanding animal health or production traits should be submitted to respective program area priorities (A1211 for Animal Reproduction; A1221 for Diseases of Agricultural Animals; A1231 for Animal Nutrition, Growth and Lactation; and A1251 for Welfare and Well-being of Agricultural Animals).
- Applications focused on conventional/classical animal breeding, breed development, or applied quantitative genetics for one or multiple traits are appropriate to this program A1201 (e.g., selecting within a breed for a specific trait of interest).
- Projects should demonstrate strong community support and coordination with domestic and international partners, commodity groups and/or consortia.
- NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Diseases of Agricultural Animals program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]". **Note: Research applications submitted for U.S.-Ireland Tripartite Collaborative grants are ineligible for U.S. funding above the research program maximum of $650,000.**

Food Safety, Nutrition, and Health

Background

Safe, high quality, and nutritious foods are essential for human health and well-being, and their production is critical to the domestic and global competitiveness of American agricultural products, fostering consumer trust and the long-term sustainability of the U.S. agricultural industries. Our nation's population is more diverse than ever and consumers continue to demand foods that are nutritious and safe, including those that have not been common in the typical American diet. Consumer interest in novel foods has risen, and to address this need, industry is responding with novel technologies for engineering, manufacturing, packaging, and delivery of foods and food ingredients. Implementation strategies to address obesity and related chronic diseases include increasing physical activity, improving fruit and vegetable consumption, and strengthening communities with behaviors and policies that encourage healthy lifestyles. As the nation's food systems become more global, vertically integrated and specialized, the use of data science approaches and advanced analytics will be critical to safeguard foods from intentional or accidental contamination. The Food Safety, Nutrition, and Health program area seeks to provide the scientific foundation for addressing public demands for safe and nutritious foods, using a transdisciplinary approach, and to define previously unrealized opportunities for improving food safety, quality and nutrition along the value chain.

Total Program Funds – Approximately **$39** million for each review cycle

Program Area Key Information applicable to ALL Food Safety, Nutrition, and Health Program Area Priories:

- All applications must adhere to the requirements in Part IV of this RFA.

- Applications from and collaborations with minority-serving institutions, small to mid-sized institutions, and/or institutions within the EPSCoR states are welcome in this program area.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- Use of trans-disciplinary teams, including social and behavioral scientists and economists, is encouraged, where appropriate.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.
- An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.

Program Area Priorities – Each application must address at least one of the five program area priorities listed below. Details about each of the Food Safety, Nutrition, and Health program area priorities are provided later in this section.

a. Food Safety and Defense
b. Novel Foods and Innovative Manufacturing Technologies
c. Diet, Nutrition and the Prevention of Chronic Diseases
d. Food and Human Health
e. Mitigating Antimicrobial Resistance across the Food Chain

a. Food Safety and Defense

Program Area Priority Code: A1332

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for applications that include specific types of partnerships for this priority only.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021**: Thursday, May 27, 2021 (5:00 p.m. Eastern Time)
- **2022**: Thursday, August 25, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants**: submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Hongda Chen, (816) 926-2525 or hongda.chen@usda.gov

Program Area Priority:

NIFA requests proposals for basic and applied research that will reduce the risk of intentional or unintentional contamination of foods.

Applications must address one or more of the following:

- Develop microbiological methods for enumerating enteric pathogens, specifically *Salmonella*, *Campylobacter*, and STEC, in large representative food samples designed to represent a food production lot;
- Develop microbiological procedures designed to alleviate the need for enrichment in the detection of very small numbers of pathogens in large food samples collected to represent a food production lot;
- Develop and validate advanced and innovative technologies or processes for food processing, manufacturing, packaging, and cleaning and sanitation to effectively reduce the presence of surviving enteric pathogens, including in low moisture foods and processing facilities; or
- Develop and validate novel strategies for the effective control of persistent reservoirs of foodborne pathogens

Program Area Priority Additional Information:

- The project narrative must include discussion and justification of the foodborne contaminants to be studied as a food safety threat.
- Studies on emerging pathogens or underfunded hazards, such as *Listeria monocytogenes*, are encouraged.
- Control strategies may include plant or animal breeding to improve food safety.
- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP: [full title…]"** The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications addressing antimicrobial resistance should be submitted to the Mitigating Antimicrobial Resistance across the Food Chain program area priority (A1366).
- Projects focused on Nano-based sensing mechanisms and smart sensors for accurate, reliable and cost-effective early and rapid detection of pathogens, allergens, chemicals and contaminants in foods, plant and animal production systems, water and soil and the agricultural production environment should be submitted to the Nanotechnology for Agricultural and Food systems program area priority (A1511).
- Applications to develop or improve advanced data analytical methods or tools for utilizing the emerging science of big data to aid food traceability, safety, quality and nutrition decision making should be submitted to the Data Science for Food and Agricultural Systems (DSFAS) program area priority (A1541 in Crosscutting Programs).

b. Novel Foods and Innovative Manufacturing Technologies

Program Area Priority Code: A1364

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for applications that include specific types of partnerships for this priority only.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Hongda Chen, (816) 926-2525 or hongda.chen@usda.gov

Program Area Priority:

NIFA requests proposals for research that develop risk-based approaches to ensure the quality, safety and nutrition of novel foods and food ingredients, including products from pulses. This priority area also seeks to advance food manufacturing competitiveness to ensure a more sustainable, resilient and healthy food supply.

Applications must address one or more of the following:

- Improve our knowledge and understanding of the chemical, physical, and biological properties of novel foods and food ingredients;
- Improve the safety, quality, shelf-life, convenience, nutrient profile or sensory attributes of novel foods and food ingredients;
- Develop innovative manufacturing technologies that increase productivity, improve food quality and/or nutritional value of foods and food ingredients that are more energy, water and resource efficient; or
- Advance sciences and develop technologies to improve shelf life and minimize food waste and loss throughout the food supply chain including consumer empowering tools.

Program Area Priority Additional Information:

- Novel foods considered for this priority are those foods or food ingredients that can be newly developed, produced or preserved using new technologies or processes.
- Advanced food manufacturing encompasses engineering, processing technologies, packaging, cleaning and sanitation, robotics, high-speed automation, artificial

intelligence, machine learning, data science, nanotechnology, sensors, and quality/safety inspections of food and food products.

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP: [full title…]"** The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications with specific interest in data science, artificial intelligence, machine learning, or integrated or research Coordinated Innovation Networks (CIN) for advanced food manufacturing should be submitted to the Data Science for Food and Agricultural Systems (DSFAS) program area priority (A1541 in Crosscutting Programs).

c. Diet, Nutrition and the Prevention of Chronic Diseases

Program Area Priority Code: A1344

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$1,000,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Integrated Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 27, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 25, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Mallory Koenings, (202) 604-1985 or mallory.koenings@usda.gov
- Dr. Lisa Jahns, (816) 820-9584 or lisa.jahns@usda.gov

Program Area Priority:

NIFA requests proposals for integrated projects that help prevent and manage chronic disease. Applicants must address at least one of the following:

- Develop, implement, and evaluate innovative research, educational, and outreach strategies to improve eating patterns that support the prevention of chronic disease;
- Investigate, assess, and recommend food and nutrition research and program interventions with the goal to improve and sustain health; or
- Improve food security and nutritional health outcomes for low-income people through

an evidence-based approach to healthy eating and active living lifestyle programs, thereby supporting a pathway to self-sufficiency.

Program Area Priority Additional Information:

- Projects must reflect understanding of the multifaceted and interactive nature of research, education, and extension-outreach.
- Projects must also reflect knowledge of food availability and access, healthy lifestyles, and better food and nutrition choices.

d. Food and Human Health

Program Area Priority Code: A1343

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for applications that include specific types of partnerships for this priority only.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Lisa Jahns, (816) 820-9584 or lisa.jahns@usda.gov

Program Area Priority:

NIFA requests proposals that investigates the nutrients and contaminants in food and their impact on the gut microbiota in an effort to improve human health.

Applicants must address at least one of the following:

- Enhance the nutritional value of foods through improved bioavailability of vitamins, minerals, and bioactive components and improved absorption of vitamins, minerals, and bioactive components including nanoscale delivery;
- Investigate the multi-directional impact of food composition and structure (including micro- and nano-structures) on human gut health (i.e., nutrient absorption rates, secondary metabolites, pathogen interaction, physiological indications, sensory signaling, etc.) to assess the safety, quality, and nutritional value of foods; and/or
- Investigate the role of the food components or contaminants on the human gut

microbiome and its metabolites, and the subsequent impact on human health.

Program Area Priority Additional Information:

- Justification must be provided for the relationship of the bioactive component(s) being studied to human health outcomes and/or the health of the human gut microbiome.
- Priority will be given to applications that use a whole food approach or that address health effects of a combination of two or more bioactive components found in food. The whole food approach may also be one that adds enrichment, fortification or micro- and nano-encapsulation to enhance bioavailability of bioactive components in food.
- This program area priority does not support research on the development of dietary supplements, research on dietary therapies for existing disease, or for the establishment, expansion, or maintenance of dietary databases.
- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP: [full title…]"** The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).

e. Mitigating Antimicrobial Resistance Across the Food Chain

Program Area Priority Code: A1366

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$1,000,000** total per project (including indirect costs) for project periods of up to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Integrated Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Steven Smith, (202) 445-5480 or steven.i.smith@usda.gov
- Dr. Kathe Bjork, kathe.e.bjork@usda.gov

Program Area Priority:
Innovative solutions to the complex problem of AMR in food and agriculture are most effectively addressed by inter-disciplinary teams of experts using a systems approach. This systems-based integrated program will empower inter-disciplinary teams to develop, refine, and disseminate science-based knowledge about food and agricultural management and production practices that can mitigate or reduce the risk of antimicrobial resistance along the food chain. Approaches can span AMR knowledge gaps to include but not limited to stewardship and behavioral changes in food and agriculture. The goal is to ensure safe, nutritious and abundant food supply while conserving and protecting responsible use of antimicrobials across the food and agriculture domain.

Applications must address at least one of the following:

- Describe, quantify and assess the risk to human health from the presence of AMR pathogens or genes persisting at various critical control points along the food chain from production through processing to retail, and human consumption;
- Investigate and assess important factors, such as fitness and virulence associated with foodborne AMR pathogens that contribute to AMR development and persistence leading to foodborne illness;
- Identify risk associated with antimicrobial use (AMU) in food animals or crops, AMR development, and public health consequences;
- Assess AMR in food and agriculture: challenges for small-scale or disadvantaged producers; and/or
- Determine improved best management practices and approaches in antibiotic stewardship and trusted resources for communicating and dispensing antibiotic stewardship information and guidance.

Program Area Priority Additional Information:

- Applicants interested in identifying international collaborators or partnerships for the AMR program may refer to the Joint Programming Initiative on Antimicrobial Resistance supported projects website.
- While development of vaccines that prevent certain diseases can be one way to decrease antimicrobial resistance, the AMR program does not support research on the development of vaccines for controlling animal diseases. Applications that address vaccine development for animal diseases should be submitted to the Diseases of Agricultural Animals program area priority (A1221).
- NIFA is partnering with Ireland and Northern Ireland under the U.S.-Ireland Research and Development Partnership to solicit collaborative research applications in the Mitigating Antimicrobial Resistance Across the Food Chain program area priority. For more information including FAQs about this program, visit the NIFA, Ireland, and Northern Ireland partnership page. Applicants submitting to this partnership must select Collaborative as the grant type and their application title should begin as "TRI-PARTITE: [full title]".

Bioenergy, Natural Resources, and Environment

Background
The Bioenergy, Natural Resources, and Environment (BNRE) program area supports foundational and applied research and integrated projects to promote, improve, and maintain healthy agroecosystems and the natural resources that are essential to the sustained long-term production of agricultural goods and services.

Sustainable management of agroecosystems requires the maintenance of the supporting natural resources and ecosystem services. Ecosystem services, defined as the benefits people obtain from ecosystems, fall into four categories of supporting services, provisioning services, regulating services and cultural services, with examples that include genetic resources; water quality; air quality; pollinator, wildlife and fisheries habitats; carbon sequestration; nutrient cycling and recreation.

Development and deployment of sustainable agroecological practices require an understanding of the interactions among physical, chemical, biological, socioeconomic, and human factors and their response to natural and anthropogenic changes. Science-based information that integrates these complex interactions is needed to make decisions that support sustainable expansion of agricultural production while maintaining associated natural resources and ecosystem services, and to avoid critical thresholds of irreversible damage or loss. At the same time, applications to this program area must develop approaches that will contribute to the quantifiable reduction of the overall footprint of agriculture.

USDA-supported agricultural and forest biomass production systems provide raw biomass for transformation into interchangeable feedstock to produce biopower, biofuels, chemicals, and other biobased products. These systems must be integrated into existing agricultural landscapes in ways that enhance or do not degrade the natural resource base or other production systems. Research, development, and outreach to producers, processors, consumers, and the public are needed to build a synthesizable portfolio of agricultural and natural resource research and technologies integrated with sustainable biomass systems.

Total Program Funds – Approximately **$33** million for each review cycle

Program Area Key Information applicable to <u>ALL</u> Bioenergy, Natural Resources and Environment priority areas:

- All applications must adhere to the requirements in Part IV of this RFA.
- Applications from and collaborations with minority-serving institutions, small to mid-sized institutions, and/or institutions within the EPSCoR states are welcome in this program area.
- All applications should justify the choice of the systems under study in terms of importance to sustainability and conservation of agroecosystems.
- Projects with available long-term research data are encouraged to partner with research programs and institutions with existing networks such as the USDA Long-Term Agroecosystem Research Network (LTAR), NSF Long Term Ecological Research (LTER), USDA Forest Service Experimental Forests and Ranges, USDA Forest Service Forest Inventory and Analysis, USDA National Agricultural Library Ag Data Commons,

USDA Climate Hubs, or others.

- Applications may include international collaboration that will help achieve U.S. program objectives. Applicants are welcome to identify potential foreign collaborators using their own networks or contacts, or utilize partnerships that NIFA has developed (see the AFRI International Partnerships webpage).
- Projects focused on data integration for decision making such as organizing and managing large data sets that include sustainability factors, and their interactions to assess risk, valuation of biodiversity and ecosystem services for landscape planning, and management or to make key policy and on farm decisions are encouraged to include reference sources from the Millennium Ecosystem Assessment, LTAR/LTER databanks, USDA Climate Hubs, and/or the USDA Life Cycle Assessment (LCA) Digital Commons.
- Where appropriate, projects may focus on developing, combining and accessing models and approaches for applying adaptive management strategies for more efficient and faster responses to shifting climate and other unforeseen natural or man-made events that affect agriculture and food production.
- The BNRE program area invites applications for conferences and workshops that consider the three pillars of sustainability and interactions among the components. An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.

Program Area Priorities – Each application must address at least one of the four program area priorities listed below. Details about each of the BNRE program area priorities are provided later in this section.

a. Soil Health
b. Water Quantity and Quality
c. Sustainable Bioeconomy through Biobased Products
d. Sustainable Agroecosystems: Health, Functions, Processes and Management

a. Soil Health

Program Area Priority Code: A1401

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$750,000** total per project (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadline:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov

Program Area Priority:

Healthy soils function as a living system and sustain plant and animal productivity while maintaining or enhancing water and air quality and promoting plant, animal and human health. Soils are the foundation of a healthy ecosystem and, hence, it is imperative to improve our understanding of the physical and biogeochemical interactions and processes within and between the soil and the environment. This will lead to the development of tools, practices, techniques and/or innovations for improving soil health and the resilience and sustainability of agricultural production systems and ecosystem services. Practices include soil-based enhancement of nutrient and water efficiencies, reduced inputs, and a reduction in chemicals of environmental concern. The goal of the Soil Health program area priority is to support research projects that will contribute to:

a) foundational and applied research to advance scientific understanding of soil physical and biogeochemical processes and interactions;
b) the assessment, development and adoption of models, decision support tools and new management/conservation practices and/or processes that will lead to improving or maintaining soil health and productivity while maintaining or improving environmental health and sustainability of our natural resource base;
c) a focus on the interactions between the social and human dimensions with environmental and economic dimensions is encouraged. Proposed projects that are primarily fundamental science must explain how a better understanding of the fundamental processes will lead to strategies to improve overall soil health and the resilience and sustainability of agricultural production systems and ecosystem services.

Applications may address one or more of the following:

- Evaluation of the effects of management practices on soil microbial community's function and their contribution to healthy soils and sustainable agroecosystems; or
- Assessment and/or development of innovative and/or appropriate (in the environmental, cultural and economic context) approaches, practices, techniques, tools and technologies that enhance the understanding and/or management of the physical and biogeochemical processes that contribute to soil health and agricultural resilience and sustainability.

Program Area Priority Additional Information:

- Please refer to the USDA Soil Health Technical Note No. NRCS-2018-0006 for recommended soil health indicators and associated laboratory procedures.
- Applications that investigate how changes to cropping systems affect crop performance, soil health and other outcomes beneficial to system resilience should apply to the

Foundational Knowledge of Agricultural Production Systems program area (A1102).

- Applications that involve the interactions between the host, environment, and microbiome with the end-goal of improving and sustaining agricultural productivity and quality in plant systems and associated natural resources should apply to the Agricultural Microbiomes in Plant Systems and Natural Resources program area priority (A1402 in Crosscutting Programs). Research projects interested in only soil microbiomes should apply to the Soil Health program area priority (A1401).
- Applications focused on the development of soil sensors and/or innovative manufacturing processes of sensors for measuring key physical, chemical, and biological components across time and space should consider the Signals in the Soil (SitS) program from NSF. The SitS program is jointly administered by NIFA and NSF.
- Applications that will synthesize or analyze existing data and resources on soil health (e.g., microbiome data, soil health indicators, soil metrics, etc.) should apply to the Data Science for Food and Agricultural Systems (DSFAS) program area priority (A1541 in Crosscutting Programs).

b. Water Quantity and Quality

Program Area Priority Code: A1411

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$750,000** total per project (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov

Program Area Priority:

The U.S. is committed to the proper management of agricultural practices and improved efficiency of agricultural water use to protect water quality and increase water and food security (U.S. Global Water Strategy, 2017). USDA-NIFA will provide competitive support to improve water science, management and technologies, water conservation and water use efficiency; promote common data exchange formats and access to data for decision-making, improve forecasting and model water related systems. Practically, USDA-NIFA seeks applications to:

1) reduce the freshwater demand (both groundwater and surface water) for irrigation and

the nutrient demand for maximum crop production by substituting the use of other technologies, management practices and/or other water sources (recycled wastewater, brackish groundwater, agricultural return flow and produced water from industry) while retaining appropriate soil health (managed salinity, adequate infiltration) and eliminating accelerated erosion from farm fields and

2) improve nutrient management and reduce nutrient load to surface or groundwater.

Applications **MUST** address at least one of the following:

- Reduction of the use of freshwater and improve agricultural resilience/sustainability by innovative approaches, tools and technologies.
- Evaluation of the physical and biogeochemical interactions, fluxes, fate and transport, transformation, and storage of single or multiple nutrients, pathogens or chemicals of environmental concern (CEC) of a variety of sources as it relates to agroecosystem productivity and on associated natural resources and environment. Applications to this priority should include: 1) Predictive and/or hindcasting tools to assess control technologies to mitigate excess nutrient, pathogens, and/or CEC movement; or 2) Improve process-based models to analyze nutrient, and/or CEC life cycles in agroecosystems, rangelands, grasslands and forests.
- Mitigation of soil salinity from the use of lower quality water sources in agriculture through: 1) The application of novel technologies involving plants, animals, soil and/or water; and 2) Improve our knowledge of the benefits and costs of treating water sources for irrigation of crops and other water uses in agriculture.
- Conservation of surface and groundwater quantity through research of agroecosystems. How do we ensure the right crop in the right place with the right water (e.g., availability of nontraditional water sources)? What are the key farming decisions that improve water use under irrigation (e.g., whole farm multipliers, legacy effects and providing a step-change in farm management that manages variable climate risks)?
- Mitigation and/or measurement of soil erodibility and erosion to sustain agroecosystems. Given the demand for greater agricultural production to 2050 coupled with a reduced water footprint, what are the key elements to conserve our natural resource base while farming more marginal landscapes?

Program Area Priority Additional Information:

- Applications focused on engineering devices, technologies for water, and tools to improve agriculturally relevant plant, animal, forestry and natural resource systems should consider applying to the Engineering for Agricultural Production Systems program area priority (A1521).
- Applications involving the development of nanotechnology solutions should consider applying to the Nanotechnology for Agriculture and Food Systems program area priority (A1511).

c. Sustainable Bioeconomy through Biobased Products

Program Area Priority Code: A1414

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$1,000,000** total per project (including indirect costs) for project periods of up to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Integrated (research, and education and/or extension) Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 10, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 1, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Daniel Cassidy, (202) 906-0614 or patrick.cassidy@usda.gov
- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov

Program Area Priority:

This program area priority focuses on developing biomass systems, and producing biobased products or biomass generated power to enable the bioeconomy, and in a manner, which reduces adverse impacts to the environment. The sustainable bioeconomy encompasses the development of bio-based products that promote human health, economic prosperity, energy security, and ecosystem resources. The development of bio-based products can complement existing agricultural production systems and industrialized processes by creating opportunities to improve overall system profitability and productivity. Projects should address one or more of the following:

- New and/or improved strategies to develop bio-based products that improve product functionality, increase potential revenues and/or reduce cost over incumbent products; this includes addressing supply chain challenges for the production systems for feedstock/germplasm improvement, product formulation or end-user market demand;
- Strategies and approaches for scalable biomass systems that provide beneficial ecosystem services, such as improved water availability and quality, improved life cycle emissions, nutrient use reduction, or wildlife and pollinator habitat enhancements; and
- Strategies to alleviate technical, and economic barriers leading to adoption resulting in improved consumer attitudes toward the bioeconomy and strengthening the rural economy through development of new bioproducts and employment opportunities.

Program Area Priority Additional Information:

- Applicants should identify and partner with industry, government, communities and non-government organizations critical for system deployment.

d. Sustainable Agroecosystems: Health, Functions, Processes and Management

Program Area Priority Code: A1451

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 17, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 15, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Megan O'Rourke, (816) 319-8527 or megan.orourke@usda.gov
- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov

Program Area Priority:

This program area priority calls for research projects that focus on improvement of ecosystem health and productivity in managed systems (croplands, forests, grasslands and rangelands) that are currently under stress and at risk from climate, pests, pathogens, invasive plants, and increased environmental pressures. This priority area calls for research projects that will lead to foundational or applied research to advance scientific understanding of processes and interactions, and/or the assessment and development of new management or conservation practices with a focus on ecosystem services. The project should lead to substantial improvements in ecosystem services in extensively managed and agricultural systems by addressing the impacts of changes in management practices on croplands, forest, grasslands, and rangelands at local and landscape scales. Applicants may focus on the interactions between the social and human dimensions with environmental and economic dimensions. Proposed projects that are primarily fundamental science must explain how a better understanding of the fundamental processes will help sustain ecosystem services or help inform actions to achieve improved efficiencies and diminished negative impacts on natural resources.

To enable development and evaluation of innovative management practices and novel systems to maintain or improve productivity while enhancing ecosystem services, applications must address one of the following:

- Connection of ecosystem health to production system functionality, productivity, socioeconomic viability, sustainability, biodiversity and the production of other ecosystem services; or

- New approaches that significantly increase ecosystem health and resilience, along with the output or value of more than one ecosystem service, each compared with the current management system for the region.

Agriculture Systems and Technology

Background
The Agriculture Systems and Technology (AST) program area emphasizes the interrelationships between agricultural systems components to develop the next generation of engineered systems, products, processes, and technologies. AST blends biological, physical, and social sciences, thus, leading to sustainable, competitive, and innovative solutions for United States and global agriculture and food systems, encompassing both conventional and organic production. To the extent possible, applicants are encouraged to incorporate interdisciplinary sciences. By doing so, projects are more likely to incorporate varying dimensions of sustainability (economic, environmental, and social) and have a greater impact on agricultural problems. The broad list of topics encompassed by this program area includes, but is not limited to, new uses and products from traditional and nontraditional crops, animals, mixed animal and plant production systems, byproducts, and natural resources; robotics, automation, precision and geospatial technologies, energy efficiency, computing, and expert systems; new hazard and risk assessment and mitigation measures; and water quality, irrigation, and management.

Total Program Funds – Approximately **$29** million for each review cycle

Program Area Key Information applicable to <u>ALL</u> Agriculture Systems and Technology priority areas:

- All applications must adhere to the requirements in Part IV of this RFA.
- Applications from, and collaborations with, minority-serving institutions, small to mid-sized institutions, and/or institutions within the EPSCoR states are welcome in this program area.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- While this program area encourages conference grant applications on any topic related to the program area priorities below, this program area is particularly interested in conference or workshop applications that bring together stakeholders, researchers, extension specialists, educators, and technology providers to:
  - Create a roadmap for developing and delivering the next generation of agricultural technologies, including but not limited to precision agriculture, cyber-physical systems, information management, and nanotechnology. These technologies should be smarter, more user-friendly, and readily adaptable to a wide variety of crops and producers (including small-scale or limited-resource) and their unique needs (with little modification) in support of sustainable production practices and systems; or
  - Advance the understanding and application of transformative systems approaches to enhance agricultural and food system sustainability. By “transformative systems” we mean those that offer major and synergistic advances toward the multiple goals of sustainability—productivity, profitability, environmental, and social dimensions. A conference or workshop should bring together state-of-the-art knowledge on how to

identify and assess transformative systems, advance the science involved, and produce a summary of its conclusions for publication and other distribution. This program area encourages applicants to draw from knowledge of systems science and transformational change in fields outside of agriculture including the social and policy sciences, law, and humanities, but with a focus on their application to agricultural and food systems.

- Applicants must describe the potential of the proposed work to support or achieve substantial gains in efficiencies of production; the probability that the application of technology will resolve constraints or result in positive impacts; and potential outcomes in terms of expected social and environmental benefits of research (see Part I, B of this RFA). Both transformative and incremental solutions are encouraged.
- Applicants also are encouraged to consider the National Robotics Initiative, the Cyber-Physical Systems, and the Critical Techniques, Technologies and Methodologies for Advancing Foundations and Applications of Big Data Sciences and Engineering (BIGDATA) interagency programs.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.
- An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.

Program Area Priorities – Each application must address at least one of the four program area priorities listed below. Details about each of the AST program area priorities are provided later in this section.

a. Engineering for Agricultural Production Systems
b. Bioprocessing and Bioengineering
c. Nanotechnology for Agricultural and Food Systems

a. Engineering for Agricultural Production Systems

Program Area Priority Code: A1521

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects or Integrated (research, and education and/or extension) Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 15, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 6, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Steven Thomson, (202) 603-1053 or steven.j.thomson@usda.gov
- Dr. Ganesh Bora, (816) 489-0944 or ganesh.bora@usda.gov
- Mr. Brad Rein, (202) 445-5442 or brein@usda.gov

Program Area Priority:

This program area priority focuses on engineered devices, technologies, and tools to improve agriculturally relevant plant, animal, forestry, and natural resource systems. Applications must have a significant engineering component. Engineering is defined as *the application of scientific and mathematical principles to practical ends such as the design, manufacture, and operation of efficient and sustainable structures, technologies, machines, processes, and systems*. Some broad emphasis areas include, but are not limited to:

- Enable engineering, sensing, computing, modeling, automation, and information systems for: forestry and natural resources; plant and animal production and protection; and post-harvest inspection, handling, processing, packaging, and distribution.
- Develop systems for automation and mechanization of labor-intensive tasks in crop and animal production.
- Develop and test the implementation of tools and precision technologies for monitoring, measurement, and detection in agricultural systems that may incorporate both drone and unmanned ground vehicle (UGV) technologies.
- Explore the use or development of advanced computational or engineering methods and technologies for navigation, mining, management, visualization, understanding, and communication of agricultural systems data that enable more effective use of big data.
- Develop and improve engineering technologies that prevent disease spread/pathogens in agricultural systems.
- Develop and test risk assessment and mitigation measures applicable to agriculture (in particular, reduce hazards to agricultural workers that can include assistive technologies).
- For integrated projects that provide engineering solutions for conservation of energy and water resources in irrigation, emphasis areas (that can be combined) include, but are not limited to:
    - Packaged irrigation management solutions using smart sensing and model-based decision support systems that can be readily adopted by farmers on both small and large scales;
    - Variable-rate and deficit irrigation management solutions that provide adaptive prescriptions and consider limitations of the water delivery system;
    - Innovative sensing and control schemes for furrow irrigation;
    - Combined water and nutrient management systems;
    - Micro-irrigation designs and management practices that can be appropriately scaled to site-specific characteristics and end-user capabilities; and/or
    - Decision support tools into easy-to-use irrigation mobile apps that integrate site-specific weather, sensor, and/or model-based data for decision-making.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"Program Name PARTNERSHIP: [full title…]."** The partnership team SHOULD BE reflected among the listed Project Director, and co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications that deal with improving food quality, safety, or nutritional value should be submitted to the Food Safety, Nutrition, and Health program area described in this RFA.
- All applications dealing with nano-scale science and technology should be submitted to the Nanotechnology for Agricultural and Food Systems program area priority (A1511).
- Research-only project applications that focus on improvement of water use under irrigation and that focus on non-traditional water sources used for irrigation (wastewater, etc.) should consider applying to Water Quantity and Quality program area priority (A1411).

b. Bioprocessing and Bioengineering

Program Area Priority Code: A1531

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 1, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 29, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Victoria Finkenstadt, (816) 908-3147 or victoria.finkenstadt@usda.gov
- Mr. Brad Rein, (202) 445-5442 or brein@usda.gov
- Dr. Steven Thomson, (202) 603-1053 or steven.j.thomson@usda.gov

Program Area Priority:

This program area priority focuses on engineered products and processes to improve agriculturally relevant plant, animal, forestry, and natural resource systems. Applications must

have a significant engineering component. Engineering, in the context of this program area priority, is defined as *the application of engineering principles and tools to biological materials or systems to create usable, tangible, economically viable products and processes*. Some broad research emphasis areas include, but are not limited to:

- Improve the production efficiency and capacity of biomass, biofuels, feedstock, bioenergy, and bio-based products;
- Advance or expand utilization of waste and byproducts generated in agricultural and food systems;
- Engineer new or improved products and processes that make use of materials from agricultural origin (including, but are not limited to, bioplastics and biocomposites);
- Refine the long-term sustainability of agricultural and forestry processing systems that balance productivity along with economic, environmental, and social outcomes; and
- Identify the factors that either constrain or encourage the adoption and diffusion of agriculturally relevant engineered products and processes.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $8000,000). Applications that include such partnerships must begin their title as **"Program Name PARTNERSHIP: [full title…]"** The partnership team SHOULD BE reflected among the listed Project Director, and co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Applications that deal with improving food quality, safety, or nutritional value should be submitted to the Food Safety, Nutrition, and Health program area in this RFA.
- All applications dealing with nano-scale science and technology should be submitted to the Nanotechnology for Agricultural and Food Systems program area priority (A1511).
- Applications dealing with feedstock improvements for bioproducts (e.g., improvements to plants for production of bioproducts, including '-omics' approaches) should be submitted to the Plant Health and Production and Plant Products program area of this RFA. Microbial approaches can be submitted to this program area priority (A1531).

c. <u>Nanotechnology for Agricultural and Food Systems</u>

Program Area Priority Code: A1511

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** <u>total per project</u> (including indirect costs) for project periods of three to four years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects <u>only</u>

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants <u>only</u>

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, May 27, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, August 25, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Hongda Chen, (816) 926-2525 or hongda.chen@usda.gov
- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov
- Dr. Ganesh Bora, (816) 489-0944 or ganesh.bora@usda.gov

Program Area Priority:

Nanoscale science, engineering, and technology embrace opportunities in a wide range of critical challenges facing agriculture and food systems. The program encourages applications in the following broad areas: innovative ideas and fundamental sciences to develop nanotechnology enabled solutions for food and nutrition security through improved productivity, quality, and reducing food waste/loss; improved nutritional value of food and feed products, and more effective therapies that significantly impact animal health and wellness; enhanced food safety and biosecurity; increased protection for natural resources, the environment, and agricultural ecosystems; and improved sustainability, health, safety and joy of living. This program area priority includes, but is not limited to:

- Novel uses and high value-added products of nano-biomaterials from agricultural and forest origins for food and non-food applications. Note: Applications primarily addressing packaging, food contact surfaces, food safety, agrochemicals, environment, health, or other aspects of agriculture and food production will be acceptable, whereas applications addressing how engineered nanomaterials affect nutritional or quality attributes of food are not solicited in this program.
- Environmental, health and safety assessments of engineered nanoparticles applied in food and agricultural systems, including detection and quantification of engineered nanoparticles, characterization of hazards, exposure levels, transport and fate of the engineered nanoparticles or nanomaterials in foods, crops, soils (and soil biota), water, and livestock, or to agricultural and allied industry workers. This may also include animal feed formulations and processes that utilize novel nanomaterials or develop new nanostructured materials or nanoparticles that are bio-persistent in digestive pathways.
- Nanotechnology-enabled smart sensors for accurate, reliable and cost-effective early and rapid detection of pathogens, allergens, insects, diseases, chemicals, and contaminants in foods, plant and animal production systems, water, soil and the agricultural production environment. Portable, field-deployable and agriculturally affordable sensors and devices for real-time detection and screening to identify targets requiring no additional laboratory analyses are encouraged.
- Cost-effective distributed sensing networks for intelligent and precise application of agricultural inputs (e.g., fertilizer, water, and chemicals) with the Internet of Agricultural Things (i.e., cyber-physical systems) and the science and tools of big data.
- Monitoring physiological biomarkers for optimal crop or animal productivity and health.
- Discovery and characterization of nanoscale phenomena, processes, and structures

relevant and important to agriculture and food.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"Program Name PARTNERSHIP: [full title…]"** The partnership team SHOULD BE reflected among the listed Project Director, and co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).
- Nanotechnology is defined by the National Nanotechnology Initiative (NNI) as "…the understanding and control of matter at dimensions between approximately 1 and 100 nanometers, where unique phenomena enable applications. Encompassing nanoscale science, engineering and technology, nanotechnology involves imaging, measuring, modeling and manipulating matter at this length scale." Applications should contain a clear statement about how the work proposed uses nanotechnology as defined by the NNI. A proposed study working at the scale of atoms or molecules does not necessarily meet the criteria of nanotechnology. Rather, the work proposed should be based on one or more of the unique phenomena, properties, and processes that occur at the nanoscale and are dimensionally dependent. Typical examples include quantum phenomena (e.g., size quantization of electron states), dominance of surfaces, or self-assembly of atoms or molecules into new materials (e.g., single wall carbon nanotubes, graphene, borophene), or collective phenomena (e.g., plasmons, phonons, because of the material being at the nanoscale). The proposed work should be based on the fundamental differences in physical, chemical, and biological behavior of materials at the nanoscale compared to bulk materials or individual atoms/molecules.
- This program area priority encourages novel platforms of nanotechnology in the area of higher order assembled systems that include the exploitation of bio-nano interfaces, hybrid bio-inorganic systems, systems biology, synthetic biology, and additive manufacturing technology.
- Applications, especially those with potential near-term commercial impact, are encouraged to include socioeconomic analyses of anticipated benefits to agriculture, food, and society and to identify the factors that may contribute to, or hinder, adoption.
- Applications dealing with public deliberation, social acceptability, and risk perception, management, and communication about nanotechnology and nano-based food or non-food products by agricultural stakeholders (including consumers), using appropriate social science tools should be submitted to Economic and Social Implications of Food and Agricultural Technologies program area priority (A1642).

Agriculture Economics and Rural Communities

Background

The Agriculture Economics and Rural Communities (AERC) program area supports rigorous economic and social science research that informs decision making, policy design, and implementation to enhance the sustainability of agricultural production systems and natural resources, promote rural economic development and prosperity, enhance quality of life, and alleviate poverty. Topical issues include, but are not limited to, examining agricultural markets and international trade; social implications of food and agricultural technology; commodity policy, crop insurance, and policy design and impact; market structure and performance in the food system and value chain; interactions between agriculture and the environment; rural economic development and well-being; food security; consumer preferences, behavior and market development; and decision-making under uncertainty. An important topic for this RFA is the effects of COVID-19, especially on domestic and international markets, food supply chain, farmers, youth and rural communities. The AERC program area supports social and behavioral science disciplines. Interdisciplinary efforts involving social, biophysical, and natural science disciplines are also invited. Applicants are encouraged to consult the challenges and research topics defined in the report from the Council on Food, Agriculture and Resource Economics: "Agriculture and Applied Economics Priorities and Solutions."

Total Program Funds: Approximately **$34** million for each review cycle

Program Area Key Information applicable to <u>ALL</u> Agriculture Economics and Rural Communities Program Area Priorities:

- All applications must adhere to the requirements in Part IV of this RFA.
- Applications from, and collaborations with, small to mid-sized institutions, minority-serving institutions, and/or institutions within the EPSCoR states are welcome in this program area.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- Applications must include a section providing a justification for the system studied relevant to improving economic, social, and environmental sustainability of agriculture or rural communities.
- Applications that propose to develop, test, and/or apply decision-support aids or tools are welcome.
- This program area funds the study of entrepreneurship and business development, but it will not fund the development of new business start-ups or the research and development of new technologies and tools for specific businesses to use. The NIFA Small Business Innovation Research (SBIR) program will entertain applications for new technologies and business development.
- Applications with highly complex, large scale, transdisciplinary, and integrated research, education, and extension projects that incorporate foundational knowledge from this program area should be submitted to the AFRI Sustainable Agricultural Systems program (A9201) described in the AFRI SAS RFA.
- An applicant may submit a Conference Grant application anytime during the year. A Letter of Intent (LOI) is required for Conference Grant applications. The LOI must be

submitted at least 195 days before the start of the conference. The full Conference Grant application must be submitted, at minimum, 150 days before the start of the conference.

Program Area Priorities – Each application must address at least one of the four program area priorities listed below. Details about each of the AERC program areas are provided later in this section.

a. Small and Medium-sized Farms
b. Economics, Markets and Trade
c. Economic and Social Implications of Food and Agricultural Technologies
d. Rural Economic Development

a. Small and Medium-Sized Farms

Program Area Priority Code: A1601

- Standard Grants, Strengthening Standard Grants and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects or Integrated (research with education and/or extension) Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, June 24, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 22, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Denis Ebodaghe, (202) 445-5460 or denis.ebodaghe@usda.gov

Program Area Priority:

This program area priority focuses on the development and/or adoption of new models to assist agricultural (farm, forest, or ranch) landowner/manager decision making with respect to appropriate scale management strategies and technologies to enhance economic efficiency and sustainability, including the viability and competitiveness of small and medium-sized dairy, poultry, livestock, crop, forestry, aquaculture, and other operations. The scope of this program area priority includes, but is not limited to projects that:

- Advance the production, profitability and post-harvest handling of specialty crops including high value-niche market crops such as hemp (if approved in your state), medicinal, aromatic, and essential oils.
- Develop effective strategies to aid in the development of research, education and extension/outreach programs to meet the needs of socially disadvantaged small and medium-sized farmers.

- Examine the impacts of COVID-19 on small farm profitability, especially related to new costs related to direct delivery models, new markets and changing demand.
- Identify and develop affordable small farm appropriate digital agriculture tools that improve production, labor management and farm profitability.
- Outreach efforts that create opportunities for entry and farm viability for young, beginning, socially-disadvantaged, veteran, or immigrant farmers and ranchers. Such efforts should address issues such as farm succession, transition, entry, and profitability through tools that ensure that the next generation of small and medium-sized farmers has access to the information and resources they need to operate their farms on a sustainable and profitable basis.
- Examine the varying forms of land tenure, including issues related to heir property, especially among aging and beginning farmers, and identify the opportunities and obstacles to land access and land transfer for younger farmers.
- The feasibility of small to mid-scale processing for fresh fruits and vegetables, frozen fruits and vegetables, value added processing for institutional buyers, or small-scale meat processing. Such efforts could also include direct to consumer markets.
- Develop effective strategies and tools to assist small and medium-sized forest/woodland owners in managing and sustaining their timberland.
- Research and develop effective strategies and tools to assist small and medium-sized farmers in making decisions about participating in livestock or crop production contracts.
- Research and develop effective strategies to aid in the development of efficient local and regional food systems.
- Evaluate and implement strategies to enhance access to markets by small and medium-sized farms.
- Research and outreach efforts that develop new tools to ensure that the next generation of small and medium-sized farmers have access to the information and resources they need to operate their farms on a sustainable and profitable basis.
- Examine the challenges of small and medium-sized farms to increase profitability, sustain farming as a livelihood, and transition to the next generation. Efforts could address issues such as production diversification and sustainability; barriers to markets and effects of social media; farmer savings behavior, financial decision-making and retirement; farm family resource allocation; and intrafamily succession.

Program Area Priority Additional Information:

- Applicants must address the Program Area Priority with a Research Project or an Integrated Project that integrates research with extension and/or education: (NOTE: Refer to Part II, C and Part III, A for Integrated Project definitions and eligibility information)

b. Economics, Markets and Trade

Program Area Priority Code: A1641

Proposed Budget Requests:

- Standard Grants, Strengthening Standard Grants and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years. See "Program Area Priority Additional Information" for opportunity to request **$800,000** for applications that include specific types of partnerships for this priority only.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 15, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 6, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Robbin Shoemaker, robbin.shoemaker@usda.gov

Program Area Priority:

This program area priority supports research on development of theories, methods and applications of agricultural economics. It encourages applications in the following broad areas: agricultural market structure and performance; competitiveness in international trade and domestic markets; agricultural production and resource use; consumer behavior; farm labor and immigration and policy; agricultural policy design and impacts; technology development and adoption; and science and innovation policy. NOTE: This program also addresses topics related to environmental and natural resource economics (ENRE). For proposals addressing an ENRE topic, please provide a lead sentence in your abstract indicating this is an ENRE related proposal.

The program area priority scope includes, but is not limited to:

- Examine the economics of agriculture and food policy, including changes in trade, immigration, crop insurance, price stabilization and income support.
- Factors addressing farm labor shortages, contributing to development and adoption of labor saving or substituting technology; implications for farmer and farm labor economic welfare.
- Economic and behavioral aspects of consumption or savings behavior, consumer financial decision making; agricultural production and technology adoption, and the design and implementation of policy intended to affect those behaviors.
- Examine the causes and consequences of food insecurity.
- Examine the economic implications of big data on agricultural markets, industry

structure, and agricultural and food value chains, how big data informs decision making by agricultural producers, policy makers, and consumers and enhances market efficiency and performance. Development of innovative empirical methods for addressing economic analysis using big data, machine learning, and natural language processing techniques.

- Examine the economics of the bio-economy. Assess the economic and environmental impact of policies and regulations designed to advance the bio-economy. Address issues of acceptance and perception by consumers and producers. Examine the economics and performance of the supply chains that emerge to implement new technologies, how they are affected by various policies, and their competitiveness and trade implications.
- Examine the impact of disasters on food supply chain resilience, agricultural production, and consumer behavior.
- Examine relationships between agriculture, climate change, natural resource conservation, and the environment. Examine the economics of climate mitigation/adaptation and environmental policies and their impact on agriculture and rural communities. Assess the impact of various policies on and the value of ecosystem services.
- The design of policies and incentive mechanisms to promote resource conservation and sustainability. Development of metrics to reflect changes in the value of ecosystem services resulting from the adoption of conservation management practices at various scales.
- Advance the integration of ecological/environmental sciences and economic and other social sciences both in research processes and methods and effective communication of scientific results and knowledge to a broad array of audiences.

Program Area Priority Additional Information:

- Opportunity to request **$800,000** for applications that includes specific types of partnerships. An application that includes significant collaboration with minority-serving institutions, small- to mid-sized institutions, EPSCoR state institutions, and/or international partners will be funded up to $150,000 above the listed budget maximum of $650,000 (i.e., up to $800,000). Applications that include such partnerships must begin their title as **"PARTNERSHIP: [full title…]"** The partnership team MUST BE reflected among the listed Project Director and Co-Project Director(s). A minimum of $150,000 of the budget MUST BE allocated to the institution(s) included as partner(s).

c. <u>Economic and Social Implications of Food and Agricultural Technologies</u>

Program Area Priority Code: A1642

Proposed Budget Requests:

- Standard Grants, Strengthening Standard Grants and New Investigator Grants must not exceed **$650,000** <u>total per project</u> (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects or Integrated (research with education and /or extension) Projects <u>only</u>

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 15, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 6, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Robbin Shoemaker, robbin.shoemaker@usda.gov
- Dr. Ganesh Bora, (816) 489-0944 or ganesh.bora@usda.gov
- Mr. Brad Rein, (202) 445-5442 or brein@usda.gov

Program Area Priority:

Examining the economic and social implications of technology is a form of technology assessment that anticipates the unforeseen and unintended consequences of technological innovation, including cultural, health, welfare, equity, ethical, and environmental impacts. A critical lesson learned from past experiences with the application of scientific discoveries and technological innovations to agricultural production is that public trust in science begins with and requires ongoing transparency and open deliberation. Technologies such as gene drives and genome editing, big data, nanotechnology, autonomous technologies and novel foods have tremendous capability in shaping the future of agriculture, requiring the scientific community to develop effective means of communicating and engaging with the public. The National Academies of Sciences, Engineering, and Medicine recommended that for these innovations to become applicable to agriculture, there should be a dialogue between scientists, legal scholars, bioethicists, social scientists, the public, and other stakeholders to assess the merits and risks of new technologies and scientific discoveries, and pursue an open and effective means to credibly engage with the public about these issues.

Research project applications must address the following:

- Assess the broad social, ethical, cultural, legal, and other potential impacts that a broad range of emerging and disruptive technologies, including breakthrough scientific discoveries, may pose for society, agricultural markets, agricultural communities and rural prosperity, food manufacturing industry, consumer preferences, and other domains and consider models for ameliorating challenge to the technologies; and
- Involve a range of individuals including scientists, legal scholars, bioethicists, social scientists, and researchers from the humanities, the public, and other stakeholders to assess the technology's merits and risks and/or examine issues and modes of communication that can result in open and effective means to involve the public in deliberation over these issues.

Technologies and scientific advancements of interest include:

- Application of gene editing and gene drives in agricultural systems;
- Application of nanotechnology in agriculture and food systems;
- Analysis of big data, and tools and approaches for collecting big data from agricultural

producers; privacy and security implications for the collection, storage, availability and sharing of Big Data on individuals, technologies, businesses, and/or communities;
- Implications of artificial intelligence, machine learning and predictive decision making to society and agriculture and food systems; and
- Implementation of autonomous technologies, the internet of things, artificial intelligence, and systems within the agricultural production, food manufacturing, and supply chains.

Program Area Priority Additional Information:
- Conference applications are encouraged under this program area priority.
- Projects must include trans/multi/interdisciplinary components and/or disciplinary specialists.
- Projects are encouraged to develop new models of collaboration and idea generation to engage in active transdisciplinary exchange and efforts.
- Applications on the adoption and diffusion of agricultural technologies should be submitted to the Engineering for Agricultural Production Systems (A1521 in Agriculture Systems and Technology), Economics, Markets and Trade (A1641), or the Critical Agricultural Research and Extension (CARE, A1701 in Crosscutting Programs) program area priorities.

d. Rural Economic Development

Program Area Priority Code: A1661
- Standard Grants, Strengthening Standard Grants and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects or Integrated (research with education and/or extension) Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:
- **2021:** Thursday, June 17, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 15, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:
- Dr. Robbin Shoemaker, robbin.shoemaker@usda.gov
- Dr. Denis Ebodaghe, (202) 445-5460 or denis.ebodaghe@usda.gov
- Dr. Suzanne Stluka, (816) 908-3305 or suzanne.stluka@usda.gov

Program Area Priority:

This program area priority supports rigorous theoretical and empirical efforts to create and examine innovative approaches for advancing economic opportunities for rural entrepreneurs

and communities, with an aim to promote rural prosperity and well-being. The intent of the program area priority is to improve the understanding of the factors and conditions that enhance economic opportunities for food, agricultural and rural businesses through tools and methods from the various social sciences, (i.e., sociology, demography, economics, geography, etc.). Studies that focus on women, and ethnic and/or racial minority groups are of interest. This RFA will give priority to projects that focus on the impacts of COVID-19 on rural youth, families, communities and entrepreneurs.

Projects can be either integrated (to include extension and/or education, along with research) or research only. Projects may evaluate the institutional, social, or economic factors affecting decision making and policy development to enhance the economic growth and well-being of rural communities.

This program area priority focuses mainly on entrepreneurs, small businesses, and other local-level employers and services who are important sources of employment, and/or on other issues "beyond the farm gate."

The emphasis of this program area priority includes, but are not limited to:

- Examine the impacts of COVID-19 on household and community food security.
- Explore place-making assets, including cultural amenities, performing arts and the aesthetic character of rural communities, and their importance and impacts on rural livability, new resident attraction and retention, and economic development and prosperity.
- Identify strategies for economic growth in regions of persistent extreme poverty that can directly or indirectly impact public-health crises including COVID-19, opioid abuse and suicide.
- Examine the private and public returns to expanding broadband infrastructure into rural areas, the barriers to broadband deployment and adoption and the mechanisms that might ameliorate those factors. Examine the potential relationship between access to broadband and health outcomes, educational attainment, entrepreneurship, and job growth. Examine how broadband availability can directly or indirectly impact public-health crises including COVID-19, opioid abuse and suicide.

Program Area Priority Additional Information:

- Integrated project applications must include research and at least one other function (i.e., education, extension, or both)
- For projects that focus mainly on farms, see the Small and Medium-Sized Farms program area priority (A1601)

Crosscutting Programs

Background
Crosscutting programs address two or more of the following six priority areas:

- Plant health and production and plant products;
- Animal health and production and animal products;
- Food safety, nutrition, and health;
- Bioenergy, natural resources, and environment;
- Agriculture systems and technology; and
- Agriculture economics and rural communities.

Total program funds – Approximately **$32** million for each review cycle

Program Area Key Information:

- For program area priorities soliciting Conference Grant applications (i.e., A1181, A1402, and A1541 only), Conference Grant applications may be submitted any time throughout the year. A Letter of Intent is required for a Conference Grant application, and it must be submitted a minimum of 195 days before conference begins. The full Conference Grant application must be submitted a minimum of 150 days before the conference begins.

Program Area Priorities – Each application must address at least one of the six program area priorities listed below. Details about each of the Crosscutting program area priorities are provided later in this section.

a. Agricultural Microbiomes in Plant Systems and Natural Resources
b. Critical Agricultural Research and Extension (CARE)
c. Data Science for Food and Agriculture Systems (DSFAS)
d. Inter-Disciplinary Engagement in Animal Systems (IDEAS)
e. Tactical Sciences for Agricultural Biosecurity

a. Agricultural Microbiomes in Plant Systems and Natural Resources
Program Area Priority Code: A1402
Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$850,000** total per project (including indirect costs) for project periods of up to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects only
Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only
Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadline:

- **2021:** Thursday, July 15, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 6, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contact:

- Dr. Ann Lichens-Park, (202) 445-5483 or ann.park@usda.gov

Program Area Priority:

Microbiomes have profound impacts on agricultural production systems as well as human, animal, plant, and environmental health. Microbiome research is critical for improving agricultural productivity, sustainability of agricultural ecosystems, safety of the food supply, carbon sequestration in agricultural systems, and meeting the challenge of feeding a rapidly growing world population. Better understanding of microbiomes will help reduce use of chemicals (pesticides, antibiotics, and biocides) in food production, lead to the development of safer alternatives for the management of agriculturally-important pests and diseases, optimize nutrient utilization efficiency, and reduce environmental footprints of agriculture and food systems. Understanding the multipartite interactions among the host, environment, and the microbiome is critical for improving and sustaining agricultural productivity and quality in plant systems, associated natural resources, human nutrition and health. Plant productivity includes biotic factors affecting plant health such as either pests, diseases or vectors as well as abiotic factors (water, soil health). Research supported by this program area priority will help fill major knowledge gaps in characterizing agricultural microbiomes and microbiome functions across agricultural production systems, and natural resources through crosscutting projects. Projects focusing on microbiomes associated with livestock, aquacultured animal species, or any animals other than vectors (e.g., insect or nematode) of plant-associated microbes are beyond the scope of this program area priority. Also, beyond the scope of this program are studies that do not have a strong focus on the **community of microorganisms** associated with the plant, such as studies of interactions between a single microbial species and its plant host. This research will capitalize on the convergence of low-cost sequencing and "omics" technologies, manipulation of microbiome composition and of phage and microbial genes (transposons, integrons), genome editing tools, and other novel tools for studying microbiota's structure and function. Development of tools to expand the use of gene editing in agriculturally relevant microbes is encouraged.

Applications must address one of the following:

- Characterize molecular mechanisms and signal exchange involved in microbiome assembly and interactions in various environments or physiological states such as stress, diseases, or growth stages.
- Functionally characterize microbiomes and microbiome metabolites in conferring specific host phenotypes (such as disease resistance or drought tolerance), optimization of environmental processes (such as water uptake, nutrient cycling or carbon sequestration), and/or host-microbiome interactions (such as host influences on microbiome composition).
- Define genomic elements that shape functional diversity, virulence and resistance to sanitation and/or antimicrobial treatment of foodborne pathogens associated with plant foods

Program Area Priority Additional Information:
Projects focusing on microbiomes associated with livestock or aquacultured food-fish should be submitted to the most relevant program area priority within the Animal Health and Production and Animal Products program area in this RFA.

b. Critical Agricultural Research and Extension (CARE)
Program Area Priority Code: A1701
Program Area Code Name: Critical Agricultural Research and Extension
Proposed Budget Requests:

- Standard Grants, Strengthening Standard Grants and New Investigator Grants must not exceed **$300,000** total per project (including indirect costs) for project periods of one to three years and are not renewable.
- FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding the budgetary guidelines will not be reviewed.

Requested Project Types: Integrated (research and extension) Projects only
Requested Grant Types: Standard and FASE (Strengthening Standard and New Investigator) Grants only
Application Deadline:

- **2021:** Thursday, June 17, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, September 15, 2022 (5:00 p.m. Eastern Time)

Program Area Priority Contacts:

- Dr. James Dobrowolski, (202) 420-8918 or james.dobrowolski@usda.gov
- Dr. Andres Cibils, andres.cibils@usda.gov
- Dr. Vijay Nandula, (816) 894-7229 or vijay.nandula@usda.gov

Program Area Priority:
This program area addresses critical challenges and opportunities that research and extension, together, can address to improve our nation's agricultural and food systems. Despite prior investments in basic and applied research, critical problems continue to impede the efficient production of agriculturally-important plants and animals, for producing safe and nutritious foods, and to meet environmental challenges for agriculture. These problems may be local, regional, or national, and may call for work focused on one or more scientific disciplines. However, all need immediate attention to meet producer and consumer needs. Finding and implementing solutions to these critical problems require partnership and close coordination among researchers, extension experts, and practitioners in food and agricultural enterprises. Funded projects are expected to produce results that lead to practices, tools, and technologies that are rapidly adopted by end-users.

This program area priority is designed to support integrated activities based on rigorous research combined with effective extension and involvement of stakeholders to develop and rapidly apply new knowledge or practices resulting in improved well-being of the people, communities, plants, and animals involved in, and affected by, agriculture and food-production systems.

The program area priority seeks applications that:

- Focus on a clear, time-sensitive, stakeholder-identified need or problem for agriculture;
- Explain the magnitude (e.g., unexpected losses of income or employment, acres affected, estimated or actual economic costs to specified agricultural or food system, private industry, land owners, rural communities, adverse effects on the environment, risk of disease or illnesses) of the problem and the rationale for targeting it;
- Describe a meaningful approach for blending research and extension expertise and other outreach and implementation approaches throughout the project to address principal objectives;
- Provide evidence that the project is aligned to priorities listed above;
- State expected solutions or improvements and how these will be assessed and measured;
- Address the potential cost of a proposed solution and describe how it can be scaled to be sustainable in the short term and long term; and
- Explain how the project will strengthen agricultural and food-production systems and how results will be adopted or applied at a local, regional, or national level.

Each application must address one or more of the six priorities for AFRI**:**

A. Plant health and Production and Plant Products;
B. Animal Health and Production and Animal Products;
C. Food Safety, Nutrition, and Health;
D. Bioenergy, Natural Resources, and Environment;
E. Agriculture Systems and Technology; and
F. Agriculture Economics and Rural Communities.

Program Area Priority Additional Information:

- All applications must adhere to the requirements in Part IV of this RFA. If submitting an integrated Research and Extension application, please refer to specific content requirements for integrated applications. Applications that do not adhere to these requirements will not be reviewed.
- A justification of how the project addresses a critical stakeholder need must be included in the Project Narrative of the full application.
- Strict focus on short- to medium-term application of results is a requirement of this program area priority.
- Applications must demonstrate that outcomes of the project period can be implemented within 2 years after the grant ends.
- Applications from and collaborations with minority serving institutions, small to mid-sized institutions, and/or institutions within the EPSCoR states are welcome in this program area priority.
- Applications that include collaborations with international partners may also be submitted. The AFRI International Partnerships webpage contains additional information on international partnerships.
- In the full application, a letter of support must be included from the stakeholder(s) which details their role and their degree of interest in implementing projected outcomes.

c. Data Science for Food and Agricultural Systems (DSFAS)

Program Area Priority Code: A1541

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project (including indirect costs) for project periods of three to five years.
- Budgets for Standard Grants, and Strengthening Standard Grants addressing the coordination innovation networks priority below must not exceed **$1,000,000** total per project (including indirect costs) for project periods of up to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research Projects or Integrated (research, education and /or extension) Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Requested Grant Types for Coordination Networks: Standard and FASE (Strengthening Standard) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 29, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 20, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Application Title: The title of the DSFAS project applications must begin with "DSFAS: [full title…]"

Program Area Priority Contacts:

- Dr. Ann Stapleton, (816) 274-1942 or NIFA-DSFAS@usda.gov
- Dr. Ganesh Bora, (816) 489-0944
- Dr. Hongda Chen, (816) 926-2525
- Dr. Steven Thomson, (202) 603-1053

Program Area Priority:

This program area priority focuses on data science to enable systems and communities to effectively utilize data, improve resource management, and integrate new technologies and approaches to further U.S. food and agriculture enterprises. The program encourages university-based research as well as public and private partnerships.

Many challenges are associated with data in agriculture and food production and processing systems. NIFA stakeholders identified at least a dozen issues that are critical to address including: data infrastructure and management; applications and use of data; entities affected by data; creation, collection, provenance, and characteristics of data; training, programs, student, and knowledge needs around data; principles and protocols associated with data; team, community, and public/private aspects of data; data producers, engineers, scientists, and researchers of data; roles of public, corporate, and commercial entities in data; privacy, security,

confidentiality, and quality data; biological and interoperable data systems; bibliometrics, altmetrics, text and data mining; and data sharing, repositories, and analysis.

This program area priority will support projects that examine the value of data for small and large farmers, as well as the agricultural and food industries, and gain an understanding of how data can impact the agricultural and food supply chain, reduce food waste and loss, improve consumer health, environmental and natural resource management, affect the structure of U.S. food and agriculture sectors, and increase U.S. competitiveness. The most competitive proposals will be equally well grounded in agricultural science and data science.

Applications for research and integrated research projects must address one or more of the following data science priorities in relation to food and agricultural systems:

- Analysis of Agricultural Data
    - Develop data-integration and data-quality algorithms and tools to improve analytic capability.
    - Design, validate and implement new algorithms and methods for depicting and leveraging massive data.
- Connect Multi-scale, Multi-domain or Multi-format Agricultural Data
    - Bridge real-time distributed and parallel data systems;
    - Create new methodologies and frameworks for tracking and processing data; and/or
    - Identify new approaches to data archiving and sharing that support Findable, Accessible, Interoperable, and Re-usable (FAIR) standards.
- Agricultural Applications and Human-Technology-Data Interactions
    - Examine new scientific implications and practical aspects of how agricultural data and computer systems are accessed, designed, and used to improve human-human, human-technology, and human-decision experiences;
    - Integrate visualization with statistical methods and other analytic techniques in order to support discovery and analysis;
    - Engage students and professionals, teams, universities, and the public and private sectors; and /or
    - Develop decision-support tools that use diverse data sources and Big Data analytics modeling of short-term impacts of various factors to create best value to the U. S. agricultural enterprise.

Within the project description, all applications must include a sustainability plan explaining how project products and services will be accessible during and after the funding period. Projects that include development of tools and platforms are strongly encouraged to provide a detailed software development plan and build upon existing tools and platforms such as R/Python and the national cyberinfrastructure (e.g. XSEDE, Science Gateways). Proposals that include development of tools and platforms should include details of software development practices such as testing and validation plans, and plans for governance, development and support of user and developer communities. Implementation of innovative and effective methods for participation of stakeholders in tools and platform development priority-setting and testing is strongly encouraged.

Artificial Intelligence (AI) for Precision Agriculture: In support of the Executive Order on Maintaining American Leadership in Artificial Intelligence, USDA Science Blueprint, and

USDA Agriculture Innovation Agenda, the DSFAS program area priority is particularly seeking projects that apply artificial intelligence and machine learning for monitoring, analytics, and automation in precision crop agriculture, precision livestock farming, and advanced food manufacturing. Such projects should start their titles as "DSFAS-AI: [full title…]" and address research in one or more of the following topic areas:

- Facilitate real-time decision making.
- Provide solutions to AI challenges including testing, validation and effective implementation in agricultural applications.
- Incorporate new testing methods to reduce bias in machine learning methods.
- Develop and scale open-source platforms to improve affordability, adoption and penetration of AI tools and technologies among producers.
- Incorporate new testing methods to reduce bias in machine learning methods.

Applications for integrated or research Coordinated Innovation Networks (CIN) should start their titles as "DSFAS-CIN: [full title…]" and must address at least one of the priorities listed immediately above and the following:

- Synergy: There should be a demonstrable benefit to the existence of a multidisciplinary, multi-sector, or multifunctional CIN that would not otherwise be possible by the participating entities and individuals operating independently.
- Contribution: Each participating individual or entity should have a unique, meaningful, and active contribution to the network that is critical to the network's functioning, performance, and success in addressing bottlenecks in critical areas.
- Continuity: There should be a sustainability plan for network persistence beyond the duration of initial grant support (e.g., identification of additional funding sources and/or more formal organizational arrangements).
- Management: There should be a plan for coordination and oversight including, but not limited to, communication, leadership, advisory boards, milestones, and evolution over time (e.g., new objectives or new participants).

Program Area Priority Additional Information:

- For additional resources on DSFAS including frequently asked questions, see the DSFAS webpage.

d. Inter-Disciplinary Engagement in Animal Systems (IDEAS)

Program Area Priority Code: A1261

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$1,000,000** total per project (including indirect costs) for project periods of up to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Integrated Projects (Research and Extension or Education) only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Application Deadlines:

- **2021:** Thursday, July 15, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 6, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Steven Smith, (202) 445-5480 or steven.i.smith@usda.gov
- Dr. Ganesh Bora, (816) 489-0944 or ganesh.bora@usda.gov
- Dr. Andres Cibils, andres.cibils@usda.gov

Program Area Priority:

This program priority area seeks to bridge traditional disciplinary divides and address complex issues in animal agriculture and aquaculture. This will require new interdisciplinary work anchored in animal and veterinary medical sciences to support food and agriculture production. Interdisciplinary is defined as integrating knowledge and methods, using a real synthesis of approaches that bring together diverse backgrounds and disciplines as well as diverse sources of data (information) in novel, integrative ways to solve pressing issues. Given the complexity of social, cultural, environmental, economic, and technologic challenges facing the food and agriculture system in the United States today, broader views at the intersection among multiple disciplines are essential to spur creativity, inspire innovation, and develop solutions.

This program area priority encourages university-based research as well as public and private partnerships. With animal and veterinary medical science at the core, some broad emphasis areas to be supported by this program area priority include, but are not limited to:

- Precision animal management
  - Developing methods and technologies to enhance animal production and increase productivity: use of spatial and temporal resources; resource-smart feeding and monitoring, breeding, and management; and animal health and animal products to ensure and enhance economic viability.
  - Optimizing animal management for improved product quality, animal health and human health.
- Environmental synergies of animal production
  - Managing emissions to the atmosphere and hydrosphere in various production systems to achieve synergy between animal production and environmental quality.
  - Recycling, reusing co-products of animal agriculture (e.g., manure management for efficient nutrient use).
  - Optimizing animal management for environmental health.
- Societal aspects of animal welfare
  - Identifying and resolving factors that influence building trust around animal agriculture across a diversity of communities such as consumers and producers to improve animal welfare and well-being.
  - Examining consumer life experiences and other factors (e.g., profession, culture, and environment) that influence perceptions of agricultural animal well-being and preferences for how production systems should respond.
  - Exploring opportunities for greater and meaningful public engagement in the policy

and practices of animal agriculture for improved animal welfare.

e. Tactical Sciences for Agricultural Biosecurity

Program Area Priority Code: A1181

Proposed Budget Requests:

- Budgets for Standard Grants, Strengthening Standard Grants, and New Investigator Grants must not exceed **$650,000** total per project for single function projects and **$1,000,000** total per project for integrated projects (including indirect costs) for project periods of three to five years.
- Conference and FASE Grants must adhere to the guidelines outlined in Part II, C(2) of this RFA.
- Requests exceeding budgetary guidelines will not be reviewed.

Requested Project Types: Research, Extension, and Integrated Projects only

Requested Grant Types: Standard, Conference, and FASE (Strengthening Standard, New Investigator, Strengthening Conference, Seed, Equipment, and Sabbatical) Grants only

Letter of Intent: required only for Conference Grant applications. The LOI must be submitted a minimum of 195 days before the conference begins.

Program Area E-mail Address for Submission of Letter of Intent: biosecurity@usda.gov

Application Deadlines:

- **2021:** Thursday, July 22, 2021 (5:00 p.m. Eastern Time)
- **2022:** Thursday, October 20, 2022 (5:00 p.m. Eastern Time)
- **Conference Grants:** submitted after LOI decision response and a minimum of 150 days before the conference begins

Program Area Priority Contacts:

- Dr. Amer Fayad, (816) 894-7228 or amer.fayad@usda.gov
- Dr. Tim Sullivan, (816) 527-5434 or timothy.sullivan@usda.gov

Program Area Priority:

This program area priority focuses on increasing our national capacity to prevent, rapidly detect, and respond to biological threats to the U.S. agriculture and food supply. Supported activities will be aimed at increasing agricultural biosecurity at the regional and national levels, and across the public and private sectors. A well-designed agricultural biosecurity system is supported by resource management, relevant research, balanced regulations, and effective collaboration among scientific experts, policy-makers, and consumers. Addressing the vulnerabilities of our nation's food and agricultural system requires a concerted effort, sustained investment, and a coordinated strategy that protects the U.S. food and agriculture system against threats from pests, diseases, contaminants, and disasters.

Applications must address one or more of the following:

- Detection and diagnostics of transboundary and emerging pests and diseases associated with animal production systems and/or emerging, re-emerging and invasive diseases, insects and weeds associated with plant production systems. Non-traditional detection methodologies such as syndromic surveillance, predictive analysis of satellite imagery, etc. will also be considered; or
- Rapid response to, and recovery from, pests and diseases that pose large-scale biosecurity threats to plant and animal production, including existing and imminent

threats to U.S. agricultural production systems.

Program Area Priority Additional Information:

- Projects focusing on specific pests and/or diseases will be restricted to transboundary and emerging pests and diseases associated with animal production systems and/or emerging, re-emerging and invasive diseases, insects and weeds associated with plant production systems.
- Developing early-stage research methods to reduce the impact of pests and diseases that pose a biosecurity concern is encouraged. Activities associated with the commercialization of patented research are not suitable for this program. Consider applying to the Small Business Innovation Research (SBIR) program if your project is focused on development or commercialization of instrumentation.
- Proposals must include metrics to justify the project's importance to agricultural biosecurity and identify at least one significant impact that could result from the work being proposed.
- Collaboration with existing national biosecurity framework components including diagnostic and biological containment laboratories such as the National Plant Diagnostic Network (NPDN) and the National Animal Health Laboratory Network (NAHLN), regional IPM centers, IR-4 laboratories, regulatory agencies, and industry (livestock, biopharmaceuticals, and crop protection) is highly encouraged.
- Proposals that address common threats to agricultural biosecurity in both animal and plant systems are encouraged.
- International collaborations that enhance our ability to manage threats and reduce losses to U.S. agriculture are encouraged.
- Inclusion of experiential learning opportunities for students on applied aspects of agricultural biosecurity as part of the proposed extension or research activities is encouraged.
- For Integrated Projects including education, the educational component should not constitute more than one-third of the project budget.
- Applications for projects on foodborne pathogen/contaminant detection should be submitted to the Food Safety and Defense program area priority (A1332).

PART II—AWARD INFORMATION

A. Available Funding

This RFA solicits applications for two review cycles; one in 2021 and one in 2022. For 2021, funding from FY 2021 and FY 2022 appropriations will be used. For 2022, funding from FY 2022 and FY 2023 appropriations will be used. The anticipated amount available to support the AFRI program is approximately $435 million for FY 2021, $435 million for FY 2022, and $435 million for FY 2023. NIFA anticipates approximately $202 million will be available to support program areas in this AFRI RFA in each fiscal year's budget. Since the RFA invites applications in two review cycles, NIFA anticipates approximately $303 million available in each of the two review cycles.

This RFA is being released prior to the passage of an appropriations act for FY 2021, FY 2022, and FY 2023. Enactment of additional continuing resolutions or an appropriations act may affect the availability or level of funding for this program in FY 2021, FY 2022, and FY 2023.

Of the total amount available to make awards for the AFRI program, no less than 30 percent will be made available to fund integrated research, education, and extension projects. Of the AFRI funds allocated to research activities, no less than 60 percent will be directed toward grants for fundamental (or basic) research and 40 percent toward grants for applied research. Of the AFRI funds allocated to fundamental research, not less than 30 percent will be directed toward research by multidisciplinary teams. It is expected that no less than 15 percent of the funds will be made available for Food and Agricultural Science Enhancement (FASE) Grants, and no more than two percent of the funds available for fundamental research will be made available for Equipment Grants (see Part II, C of this RFA for information about FASE Grants including Equipment Grants).

Of the anticipated approximately $193 million available for each fiscal year FY 2021, FY 2022 and FY 2023 to support the program areas in this RFA, no less than 11.25% will be made available for Strengthening grant types under the FASE program.

The funds will be awarded through a grant for performance periods of up to five years. NIFA may choose to issue a grant on a continuation basis. A continuation award is an award instrument by which NIFA agrees to support a specified level of effort for a predetermined period of time with a statement of intention to provide additional support at a future date, provided that performance has been satisfactory, appropriations are available for this purpose, and continued support would be in the best interest of the federal government and the public. There is no commitment by NIFA to fund any particular application or to make a specific number of awards.

The Automated Standard Applications for Payment System (ASAP), operated by the Department of Treasury's Bureau of the Fiscal Service, is the designated payment system for awards resulting from this RFA. For more information see the ASAP website.

B. Types of Applications

In 2021 and 2022, you may submit applications to one of the program areas in this RFA as one of the three types of requests: (1) New Application; (2) Renewal Application; or (3) Resubmitted Application.

(1) **New application**. This is a project application that has not been previously submitted to NIFA. We will review all new applications to ensure they meet administrative requirements and all applications will be competitively evaluated by a review panel using criteria and selection processes described in Part V of this RFA — Application Review Requirements.

(2) **Renewal application**. This is a project application that requests additional funding for a project beyond the period that was approved in an original or amended award. Applications for renewed funding must contain the same information as required for new applications; they also must contain a Progress Report (see Project Narrative, Part IV. C of this RFA). We must receive the renewal applications by the relevant due dates. We will evaluate renewal applications in competition with other pending applications in the program area priority to which they are assigned, and they will be reviewed according to the same evaluation criteria (Part V, B of this RFA) as new applications. If you are submitting renewal application, enter the NIFA-assigned award number of the previously-funded application in the Federal Identifier (Field 4.a. of the SF 424 (R&R) form).

(3) **Resubmitted application**. This is an application that was submitted previously to NIFA but not funded. Project Directors (PDs) must respond to the previous review panel summary (see Response to Previous Review, Part IV, C of this RFA). We must receive resubmitted applications by the relevant due dates. We will evaluate resubmitted applications in competition with other pending applications in the appropriate program priority area to which they are assigned, and they will be reviewed according to the same evaluation criteria (Part V, B of this RFA) as new applications. A renewal application that was submitted previously but not funded and is being resubmitted is also considered as Resubmitted application; however, PDs must include a Progress Report (see "renewal application" above) and a Response to Previous Review. If you are resubmitting an application, enter the NIFA-assigned proposal number of the previously-submitted application in the Federal Identifier (Field 4.a. of the SF 424 (R&R) form).

C. Project Types and Grant Types

1. **Project Types**. Applicants must propose one of the AFRI project types specified within the relevant program area descriptions in Part I, C of this RFA. Only project types specifically solicited under each program area or program area priority described in Part I, C of this RFA will be considered for review. A detailed description of the project types (Research, Education, Extension, and Integrated Research, Education and/or Extension) available across AFRI is located on the AFRI RFA Resources page ("AFRI Project Types" in the attachments list).

2. **Grant Types.** Applicants must select the appropriate AFRI grant type specified within the relevant Program Area Descriptions in Part I, C of this RFA. Only grant types specifically solicited under each program area or program area priority described in Part I, C of this RFA will be considered for review. A detailed description of the grant types (Standard Grants, Coordinated Agricultural Projects, Conference Grants, Collaborative Grants, and FASE Grants) available across AFRI is located on the AFRI RFA Resources page ("AFRI Grant Types" in the attachments list).

D. Responsible and Ethical Conduct of Research

In accordance with sections 2, 3, and 8 of 2 CFR Part 422, institutions that conduct USDA-funded extramural research must foster an atmosphere conducive to research integrity, bear primary responsibility for prevention and detection of research misconduct, and maintain and effectively communicate and train their staff regarding policies and procedures. In the event an application to NIFA results in an award, the Authorized Representative (AR) assures, through acceptance of the award that the institution will comply with the above requirements. Award recipients shall, upon request, make available to NIFA the policies, procedures, and documentation to support the conduct of the training. See NIFA's Responsible and Ethical Conduct of Research page for further information.

PART III—ELIGIBILITY INFORMATION

A. Eligible Applicants

Applications may only be submitted by eligible entities. Failure to meet an eligibility criterion by the application deadline may result in the application being excluded from consideration or, even though an application may be reviewed, will preclude NIFA from making an award.

Eligibility is linked to the project type as specified below.

1. **Research, Education or Extension Projects**
   Eligible applicants for single-function Research, Education or Extension Projects include:
   a) State Agricultural Experiment Station;
   b) colleges and universities (including junior colleges offering associate degrees or higher);
   c) university research foundations;
   d) other research institutions and organizations;
   e) Federal agencies;
   f) national laboratories;
   g) private organizations or corporations;
   h) individuals who are U.S. citizens, nationals, or permanent residents; and
   i) any group consisting of two or more entities identified in a) through h).

   Eligible institutions do not include foreign and international organizations.

2. **Integrated Projects**
   Eligible applicants for Integrated Projects include:
   a) colleges and universities;
   b) 1994 Land-Grant Institutions; and
   c) Hispanic-serving agricultural colleges and universities (see NIFA's Hispanic-Serving Agricultural Colleges and Universities page).

   For item a) under Integrated Projects, the terms "college" and "university" mean an educational institution in any state which
   i) admits as regular students only persons having a certificate of graduation from a school providing secondary education, or the recognized equivalent of such a certificate;
   ii) is legally authorized within such state to provide a program of education beyond secondary education;
   iii) provides an educational program for which a bachelor's degree or any other higher degree is awarded;
   iv) is a public or other nonprofit institution; and
   v) is accredited by a nationally recognized accrediting agency or association.

   A research foundation maintained by a college or university is eligible to receive an award under this program.

3. **Food and Agricultural Science Enhancement Grants**
   Part II, C(2) of this RFA contains the eligibility details for Food and Agricultural Science

Enhancement (FASE) Grants. Note that under FASE program, New Investigator, Strengthening Standard, Strengthening Conference, Seed, Equipment and Sabbatical Grants are solicited in this RFA.

Applicants must respond to the program area priorities and deadlines found in Part I, C of this RFA. Grant recipients may subcontract to organizations not eligible to apply provided such organizations are necessary for the conduct of the project. Failure to meet an eligibility criterion by the application deadline may result in the application being excluded from consideration or, even though an application may be reviewed, will preclude NIFA from making an award (see Part III, B of this RFA).

B. Request for Determination of Status

1. Minority-Serving Institution

If an institution is applying for a Strengthening Grant (see Part II, C(2) of this RFA) and wants the Secretary to consider a group, beyond one included in the minority definition (see Part VIII, D of this RFA), then documentation (see below) must be submitted as part of the requestor's LOI (if required) and the full application package (Part IV, C of this RFA) by the applicable program area or program area priority deadline. The Secretary of Agriculture (or designated individual) will use the information in the documentation to determine whether the group or groups identified are qualified as a minority group for the purpose of receiving a Strengthening Grant under the FASE program (for Strengthening Grants information, refer to the AFRI RFA Resources page, "AFRI Grant Types" in the attachments list).

Documentation for the request for determination as a minority-serving institution must include the following and be provided in the order specified below:

a. A description of each minority group being submitted for determination;
b. Data or studies supporting this group's designation as a minority group; and
c. Data indicating that enrollment of the minority group(s) exceeds 50 percent of the total enrollment at the academic institution, including graduate and undergraduate and full-and part-time students.

2. Multi-Campus Institution

All institutions grouped under one main campus as listed in Table 1 following Part VIII of this RFA, unless located in an Established Program to Stimulate Competitive Research (EPSCoR) state (listed in Part II, C(2) of this RFA), are excluded from eligibility for all strengthening funds. However, if any campus within a multi-campus listing can provide information demonstrating that it is administratively independent or has an independent accreditation, then the institution may petition for an exemption to this rule and request eligibility for strengthening funds. The LOI (if required) and the application must include a letter indicating how the institution is independent of the main campus, either through accreditation or administration, how the institution is eligible as a small and mid-sized or minority-serving institution due to enrollment, and total federal funds received for science and engineering research and development. The letter must be signed by the Authorized Representative (AR).

C. Cost Sharing or Matching

Matching funds requirements for AFRI programs included in this RFA may be found at 7 U.S.C. 3157 (b)(9)(a-C). If an applied **Research** (see Part VIII, D of this RFA) **or Integrated Project** with an applied research component, is commodity-specific and not of national scope, the grant recipient is required to match the USDA funds awarded on a dollar-for-dollar basis from non-federal sources with cash and/or in-kind contributions.

NIFA may waive the matching funds requirement based on submitted document (see Part IV, C(6) of this RFA), for a grant if we determine that:

a. The results of the project, while of particular benefit to a specific agricultural commodity, are likely to be applicable to agricultural commodities generally; or
b. The project involves a minor commodity, the project deals with scientifically important research, and the grant recipient is unable to satisfy the matching funds requirement.

For Equipment Grants: The amount of Federal funds provided may not exceed 50 percent of the cost of the equipment acquired using funds from the grant, or $50,000, whichever is less. Grantees are required to match 100 percent of Federal funds awarded from non-Federal sources. NIFA may waive all or part of the matching requirement if all three of the following criteria are met:

1. application is from a college, university, or research foundation maintained by a college or university that ranks in the lowest one third of such colleges, universities, and research foundations on the basis of Federal research funds received (see AFRI RFA Resources page "Table 2 Least Successful Institutions" in the attachments list, for more information);
2. the equipment to be acquired costs no more than $25,000; and
3. the equipment has multiple uses within a single research project or is usable in more than one research project. To be considered for this waiver, the budget justification (see Part IV, C(6) of this RFA) must include a letter signed by the institution's AR addressing the noted criteria.

D. Centers of Excellence

Pursuant to Section 7214 of the Agricultural Act of 2014 (Pub. L. 113-79), NIFA will recognize and provide priority in the receipt of funding to applications from "centers of excellence" that carry out research, extension, and education activities that relate to the food and agricultural sciences. NIFA held listening sessions in July 2014 and accepted written comments from stakeholders to inform NIFA's implementation of the COE provision. Information on COE provision, and frequently asked questions are available at the NIFA COE website.

A COE is composed of one or more of the following entities that provide financial or in-kind support to the COE.

a) State agricultural experiment stations;
b) Colleges and universities;
c) University research foundations;
d) Other research institutions and organizations;

e) Federal agencies;
f) National laboratories;
g) Private organizations, foundations, or corporations;
h) Individuals; or
i) Any group consisting of two or more of the entities described in a) through h).

COE designation is available only for the **standard grant** and the **Coordinated Agricultural Project (CAP) grant** applications submitted to the program areas or program area priorities in the Foundational and Applied Science and Sustainable Agricultural Systems RFAs. If applicable, Part IV, C of this RFA contains additional requirements for COE consideration.

PART IV—APPLICATION AND SUBMISSION INFORMATION

A. Letter of Intent

If a program area or program area priority within this RFA requires a LOI (LOI), then a LOI is a prerequisite for submission of an application. Refer to the Program Area Descriptions beginning in Part I, C of this RFA for LOI deadlines for a specific program area or program area priority. For detailed guidance on LOI submission, see the AFRI RFA Resources page ("AFRI Letter of Intent Instructions" in the attachments list).

B. Electronic Application Package

Only electronic applications may be submitted via Grants.gov to NIFA in response to this RFA. We urge you to submit early to the Grants.gov system. For information about the pre-award phase of the grant lifecycle see the Grants.gov Pre-Award Phase page.

New Users of Grants.gov
Prior to preparing an application, we recommend that the Project Director/Principal Investigator (PD/PI) first contact an AR to determine if the organization is prepared to submit electronic applications through Grants.gov. If not (e.g., the institution/organization is new to the electronic grant application process through Grants.gov), then the one-time registration process must be completed **PRIOR** to submitting an application. It can take as long as two weeks to complete the registration process so it is critical to begin as soon as possible. In such situations, the AR should go to **"Register," in the top right corner of the Grants.gov web page (or go to https://www.grants.gov/web/grants/register.html), for information on registering the institution/organization with Grants.gov.** Part II, 1 of the NIFA Grants.gov Application Guide contains detailed information regarding the registration process. Refer to item 2, below, to locate the "NIFA Grants.gov Application Guide."

Steps to Obtain Application Package Materials
To receive application materials, do the following:

a. Download and install a version of Adobe Reader compatible with Grants.gov to access, complete, and submit applications. For basic system requirements and download instructions, see https://www.grants.gov/web/grants/applicants/adobe-software-compatibility.html. Grants.gov has a test package that will help you determine whether your current version of Adobe Reader is compatible.

b. To obtain the application package from Grants.gov, go to https://www.grants.gov/web/grants/applicants/search-opportunity-package.html and enter the funding opportunity number where appropriate

   Funding Opportunity Number for 2021: USDA-NIFA-AFRI-007692
   Funding Opportunity Number for 2022: Applicants considering applying to the 2022 review cycle should check the AFRI Foundational Program RFA webpage and www.grants.gov after **December 15, 2021** for the 2022 Funding Opportunity Number and Application Kit, as well as for any programmatic change.

Click “Search”. On the displayed page, click the corresponding link to continue. A Grant Application Package is tied to a particular funding opportunity. You may move the forms amongst different Grant Application Packages, but you may ONLY submit an application to the particular funding opportunity to which the Grant Application Package is associated.

Contained within the application package is the “NIFA Grants.gov Application Guide.” This guide contains an introduction and general Grants.gov instructions, information about how to use a Grant Application Package in Grants.gov, and instructions on how to complete the application forms.

If you require assistance to access the application package (e.g., downloading or navigating Adobe forms) **or submitting the application,** refer to resources available on the Grants.gov website (https://www.grants.gov/web/grants/support.html). Grants.gov assistance is also available at:

Grants.gov customer support (https://www.grants.gov/web/grants/support.html)
800-518-4726 Toll-Free or 606-545-5035
Business Hours: 24 hours a day, 7 days a week. Closed on federal holidays.
Email: support@grants.gov
Grants.gov iPortal (see https://grants-portal.psc.gov/Welcome.aspx?pt=Grants):
Top 10 requested help topics (FAQs), Searchable knowledge base, self-service ticketing and ticket status, and live web chat (available 7:00 a.m. – 9:00 p.m. Eastern Time).
Have the following information available when contacting Grants.gov:

i. Funding Opportunity Number (FON)
ii. Name of agency you are applying to
iii. Specific area of concern

C. Content and Form of Application Submission

Application and submission information including page limits and narrative font sizes for AFRI Foundational and Applied Science RFA applications are available at AFRI RFA Resources page (“2021-2022 Foundational and Applied Science RFA Additional Information for Part IV, C” in the attachments list).

D. Submission Dates and Times

A table with the LOI and application deadlines for all 2021 and 2022 program area priorities is available on the AFRI Deadlines page.

a. Letter of Intent

The LOI if applicable, must be received at NIFA by **5:00 p.m. Eastern Time on the dates indicated in the Program Area Descriptions beginning in Part I, C** of this RFA and in the format specified in Part IV, A of this RFA. The LOI (if applicable) is a prerequisite for the submission of a full application.

b. Full Application

Applications for the 2021 and 2022 review cycles must be received by Grants.gov by 5 p.m. Eastern Time on **the dates indicated in the Program Area Descriptions beginning in Part I, C** of this RFA. Applications received after this deadline will normally not be considered for funding.

We recommend that you conduct an administrative review of the application before submission of it via Grants.gov to ensure that it complies with all preparation instructions.

An application checklist is included in Part VII of the NIFA Grants.gov Application Guide to assist with this review.

You should check the application for completeness. The application should be checked for the following required items, which must include:

- Project Summary/Abstract
- Project Narrative
- Bibliography & References Cited
- Logic Model for Integrated Projects (if applicable)
- Management Plan for Integrated Projects (if applicable)
- Data Management Plan
- Facilities & Other Resources
- Curriculum Vitae
- Conflict of Interest Lists
- Current and Pending Support
- Budget
- Budget Justification
- Felony and Tax Certification Form (if applicable)

This is not an exhaustive list of required items; it only serves to highlight items that may be overlooked. **Failure to include any of the three critical required documents of Project Summary/Abstract, Project Narrative, or Bibliography & References Cited sections as PDF attachment will result in the application not being reviewed or considered for funding by NIFA.**

Instructions for submitting an application are included in Part IV, Section 1.5 of the NIFA Grants.gov Application Guide.

If you have trouble submitting an application to Grants.gov, you should FIRST contact the Grants.gov Help Desk to resolve any problems. Keep a record of any such correspondence. See Part IV, B of this RFA for Grants.gov contact information.

We send email correspondence to the AR regarding the status of submitted applications. We strongly encourage you to provide accurate email addresses, where designated, on the SF-424 R&R Application for Federal Assistance.

If the AR has not received correspondence **from NIFA** regarding a submitted application within

30 days of the established deadline, contact the Agency Contact identified in Part VII of this RFA and request the proposal number assigned to the application. **Failure to do so may result in the application not being considered for funding by the peer review panel. Once the application has been assigned a proposal number, you should cite this number on all future correspondence.**

E. Funding Restrictions

7 U.S.C. § 3310 limits indirect costs for the overall award to 30 percent of Total Federal Funds Awarded (TFFA) under a research, education, or extension grant. The maximum indirect cost rate allowed under the award is determined by calculating the amount of indirect costs using:

1) the sum of an institution's negotiated indirect cost rate and the indirect cost rate charged by subawardees, if any; or
2) 30 percent of TFFA (TFFA = Field K., Total Costs and Fee, on SF-424 R&R Budget).

The maximum allowable indirect cost rate under the award, including the indirect costs charged by the subawardee(s), if any, is the lesser of the two rates.

If the results of 1), is the lesser of the two, the grant recipient is allowed to charge the negotiated indirect cost rate on the prime award and the subaward(s), if any. Any subawards would be subject to the subawardee's negotiated indirect cost rate. The subawardee may charge its negotiated indirect cost rate on its portion of the award, provided the sum of the indirect cost rate charged under the award by the prime awardee and the subawardee(s) does not exceed 30 percent of the TFFA.

If the result of 2), is the lesser of the two, then the maximum indirect cost rate allowed for the overall award, including any subaward(s), is limited to 30 percent of the TFFA. That is, the indirect costs of the prime awardee plus the sum of the indirect costs charged by the subawardee(s), if any, may not exceed 30 percent of the TFFA.

In the event of an award, the prime awardee is responsible for ensuring the maximum indirect cost allowed for the award is not exceeded when combining indirect costs for the Federal portion (i.e., prime and subawardee(s)) and any applicable cost-sharing (see 7 CFR 3430.52(b)). Amounts exceeding the maximum allowable indirect cost is considered unallowable and will be handled accordingly. See sections 408 and 410 of 2 CFR 200.

Indirect costs are not allowed for equipment or conference grants.

See Part V, section 7.9 of the NIFA Grants.gov Application Guide for further indirect cost information.

You may not use grant funds awarded under this authority to renovate or refurbish research, education, or extension space; purchase or install fixed equipment in such place; or the plan, repair, rehabilitate, acquire, or construction of buildings or facilities.

F. Other Submission Requirements

You should follow the submission requirements noted in Part IV, Section 1.5 in the document entitled "NIFA Grants.gov Application Guide."

For information about the **status of a submitted application**, see Part III, Section 6 of the NIFA Grants.gov Application Guide.

Multiple submissions

In accordance with Part III, Section 5 of NIFA Grants.gov Application Guide, duplicate, essentially duplicate or predominantly overlapping applications submitted to one or more program areas within AFRI (including FASE Grants) in any one fiscal year will not be reviewed. In addition, applicants may not submit to AFRI an application that is considered duplicate, essentially duplicate, or predominantly overlapping with an application submitted to another NIFA program in the same fiscal year.

PART V—APPLICATION REVIEW REQUIREMENTS

A. General

NIFA evaluates each application in a two-part process. First, we screen each application to ensure that it meets the administrative requirements as set forth in this RFA. Second, a scientific peer-review process will be used to technically evaluate applications that meet the administrative requirements using a review panel (see NIFA Peer Review Process).

Scientific Peer Review Process:
NIFA selects reviewers for the review panel based upon their training and experience in relevant scientific, extension, or education fields, taking into account the following factors:

- the level of relevant formal scientific, technical education, or extension experience of the individual, as well as the extent to which an individual is engaged in relevant research, education, or extension activities;
- the need to include experts from various areas of specialization within relevant scientific, education, or extension fields;
- the need to include other experts (e.g., producers, range or forest managers/operators, and consumers) who can assess relevance of the applications to targeted audiences and to program needs;
- the need to include experts from a variety of organizational types (e.g., colleges, universities, industry, state and Federal agencies, and private profit and non-profit organizations) and geographic locations;
- the need to maintain a balanced composition with regard to minority and female representation and an equitable age distribution; and
- the need to include reviewers who can judge the effective usefulness of each application to producers and the general public.

After each peer review panel has completed its deliberations, the responsible program staff of NIFA will recommend that your project is either approved for support from currently available funds or declined due to insufficient funds or unfavorable review.

NIFA reserves the right to negotiate with the PD/PI and/or the submitting organization or institution regarding project revisions (e.g., reductions in the scope of work, funding level, period, or method of support) prior to recommending any AFRI project for funding.

After the review process has been completed, NIFA sends copies of reviews, *not* including the identity of reviewers, and a summary (if applicable) of the review panel comments to the PD.

B. Evaluation Criteria

A reviewer's written evaluation entails two levels of assessment. First, the reviewer summarizes how well the application addressed each evaluation criterion. After the application has been assessed for strengths and weaknesses of each criterion, the reviewer then evaluates the overall likelihood that the project will have significant outcome and impact. The written reviews are used to begin panel discussions with other reviewers serving on the peer review panel. Through these

discussions, peer review panelists come to consensus on the final ranking of the applications. A complete description of NIFA's peer review process can be found at the NIFA Peer Review Process for Competitive Grant Applications page.

Detailed evaluation criteria for each project type, grant type, and centers of excellence are found at the AFRI RFA Resources page ("AFRI Review Criteria" in the attachments list). We will use the appropriate evaluation criteria to review applications submitted in response to this RFA.

C. Conflicts of Interest and Confidentiality

During the peer evaluation process, we take extreme care to prevent any actual or perceived conflicts of interest that may impact review or evaluation. See the NIFA Peer Review Process for Competitive Grant Applications page for further information about conflicts of interest and confidentiality as related to the peer review process.

D. Organizational Management Information

Specific management information relating to an applicant shall be submitted one-time, with updates on an as-needed basis. This requirement is part of the responsibility determined prior to the award of a grant identified under this RFA, if such information has not been provided previously under this or another NIFA program. We will provide you copies of forms recommended for use in fulfilling these requirements as part of the pre-award process. Although an applicant may be eligible based on its status as one of these entities, there are factors that may exclude an applicant from receiving federal financial and nonfinancial assistance and benefits under this program (e.g., debarment or suspension of an individual involved or a determination that an applicant is not responsible based on submitted organizational management information).

E. Application Disposition

An application may be withdrawn at any time before a final funding decision is made regarding the application. Each application that is not selected for funding, including those that are withdrawn, will be retained by the agency for a period of three years.

PART VI—AWARD ADMINISTRATION

A. General

Within the limit of funds available for such purpose, the NIFA awarding official shall make grants to those responsible, eligible applicants whose applications are judged most meritorious under the procedures set forth in this RFA. The date specified by the NIFA awarding official as the effective date of the grant shall be no later than September 30 of the federal fiscal year in which the project is approved for support and funds are appropriated for such purpose, unless otherwise permitted by law. The project need not be initiated on the grant effective date, but as soon thereafter as practical so that project goals may be attained within the funded project period. All funds granted by NIFA under this RFA may be used only for the purpose for which they are granted in accordance with the approved application and budget, regulations, terms and conditions of the award, applicable federal cost principles, USDA assistance regulations, and NIFA General Awards Administration Provisions at 7 CFR part 3430, subparts A through E.

B. Award Notice

The award document will provide pertinent instructions and information including, at a minimum, the information described in 2 CFR 200.211

See NIFA's Terms and Conditions page to view current NIFA award terms and conditions.

C. Administrative and National Policy Requirements

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 NIFA's Federal Regulations 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—is available at NIFA's Policy Guide page.

D. Responsible and Ethical Conduct of Research

Refer to Part II, D of this RFA for more information.

E. Expected Program Outputs and Reporting Requirements

The output and reporting requirements are included in the award terms and conditions (see NIFA's Terms and Conditions page for information about NIFA award terms). If there are any program or award-specific award terms, they will be identified in the award.

PART VII—AGENCY CONTACTS

For general questions related to the AFRI Programs, applicants and other interested parties are encouraged to contact:

AFRI Program Office:
Dr. Parag Chitnis, Associate Director, National Institute of Food and Agriculture
Dr. Debora Hamernik, Deputy Director, Institute of Food Production and Sustainability
Dr. Timothy Conner, Acting Deputy Director, Institute of Food Safety and Nutrition
Dr. Suresh Sureshwaran, Acting Deputy Director, Institute of Youth, Family, and Community
Dr. Timothy Conner, Acting Deputy Director, Institute of Bioenergy, Climate, and Environment
Telephone: (816) 926-1604
E-mail: AFRI@usda.gov

Specific questions pertaining to technical matters may be directed to the appropriate Program Area Priority Contacts:

Table 1: Program Area Priority Contacts

Program Area	Program Area Contacts
Plant Health and Production and Plant Products	John Erickson (816) 283-6422; john.erickson@usda.gov Victoria Finkenstadt (816) 908-3147; victoria.finkenstadt@usda.gov Ed Kaleikau (816) 926-1741; edward.kaleikau@usda.gov Erica Kistner-Thomas (816) 894-9283, erica.kistnerthomas@usda.gov Mathieu Ngouajio (202) 570-1915; mathieu.ngouajio@usda.gov Megan O'Rourke (816) 319-8527; megan.orourke@usda.gov Vance Owens (816) 283-6925; vance.owens@usda.gov Ann Stapleton (816) 274-1942; ann.stapleton@usda.gov
Animal Health and Production and Animal Products	Kathe Bjork; kathe.e.bjork@usda.gov Mark Mirando (202) 445-5575; mark.mirando@usda.gov Frank Siewerdt; frank.siewerdt@usda.gov Steven Smith (202) 445-5480; steven.i.smith@usda.gov Tim Sullivan (816) 527-5434; timothy.sullivan@usda.gov
Food Safety, Nutrition, and Health	Kathe Bjork; kathe.e.bjork@usda.gov Hongda Chen (816) 926-2525; hongda.chen@usda.gov Helen Chipman (202) 701-3524; helen.chipman@usda.gov Lisa Jahns (816) 820-9584; lisa.jahns@usda.gov Mallory Koenings (202) 604-1985; mallory.koenings@usda.gov Steven Smith (202) 445-5480; steven.i.smith@usda.gov
Bioenergy, Natural Resources, and Environment	Daniel Cassidy (202) 906-0614; patrick.cassidy@usda.gov James Dobrowolski (202) 420-8918; james.dobrowolski@usda.gov Megan O'Rourke (816) 319-8527; megan.orourke@usda.gov
Agriculture Systems and Technology	Ganesh Bora (816) 489-0944; ganesh.bora@usda.gov Hongda Chen (816) 926-2525; hongda.chen@usda.gov James Dobrowolski (202) 420-8918; james.dobrowolski@usda.gov

	Victoria Finkenstadt (816) 908-3147; victoria.finkenstadt@usda.gov Brad Rein (202) 445-5442; brein@usda.gov Steven Thomson (202) 603-1053; steven.j.thomson@usda.gov
Agriculture Economics and Rural Communities	Ganesh Bora (816) 489-0944; ganesh.bora@usda.gov Denis Ebodaghe (202) 445-5460; denis.ebodaghe@usda.gov Brad Rein (202) 445-5442; brein@usda.gov Robbin Shoemaker; robbin.shoemaker@usda.gov Suzanne Stluka (816) 908-3305; suzanne.stluka@usda.gov Steven Thomson (202) 603-1053; steven.j.thomson@usda.gov
Crosscutting Programs	Ganesh Bora (816) 489-0944; ganesh.bora@usda.gov Hongda Chen (816) 926-2525; hongda.chen@usda.gov Andres Cibils; andres.cibils@usda.gov James Dobrowolski (202) 420-8918; james.dobrowolski@usda.gov Amer Fayad (816) 894-7228; amer.fayad@usda.gov Ann Lichens-Park (202) 445-5483; ann.park@usda.gov Vijay Nandula (816) 894-7229; vijay.nandula@usda.gov Steven Smith (202) 445-5480; steven.i.smith@usda.gov Ann Stapleton (816) 274-1942; ann.stapleton@usda.gov Tim Sullivan (816) 527-5434; timothy.sullivan@usda.gov Steven Thomson (202) 603-1053; steven.j.thomson@usda.gov

Table 2: Administrative/Business Contacts

For administrative questions related to

- Grants.gov, see Part IV of this RFA
- Other RFA or application questions, please email policy@usda.gov
- Awards under this RFA, please email awards@usda.gov

- **U.S. Postal Mailing Address:**
  National Institute of Food and Agriculture
  U.S. Department of Agriculture
  P.O. Box 419205, MS 10000
  Kansas City, MO 64141-6205

- **Courier/Package Delivery Address:**
  National Institute of Food and Agriculture
  United States Department of Agriculture
  2312 East Bannister Road, MS 10000
  Kansas City, MO 64141-3061

PART VIII—OTHER INFORMATION

A. Use of Funds; Changes

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 sub-awarding, transferring or contracting out of any work under a federal award, including fixed amount sub-awards as described in §200.33**3** Fixed amount sub-awards. 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 NIFA's Terms and Conditions page for information about NIFA award terms.

B. Confidential Aspects of Applications and Awards

When an application results in an award, it becomes a part of the record of NIFA transactions, available to the public upon specific request. Information that the Secretary of Agriculture determines to be of a confidential, privileged, or proprietary nature will be held in confidence to the extent permitted by law. Therefore, any information that the applicant wishes to have considered as confidential, privileged, or proprietary should be clearly marked within the application. We will retain for three years a copy of an application that does not result in an award. Such an application will be released only with the consent of the applicant or to the

extent required by law. An application may be withdrawn at any time prior to the final action thereon.

C. Regulatory Information

This program is not subject to the provisions of the Executive Order 12372, which requires intergovernmental consultation with state and local officials.

Under the provisions of the Paperwork Reduction Act of 1995 (44 U.S.C. Chapter 35), the collection of information requirements contained in this notice have been approved under OMB Document No. 0524-0039.

D. Definitions

Please refer to 7 CFR 3430, Competitive and Noncompetitive Non-formula Financial Assistance Programs--General Award Administrative Provisions, for applicable definitions for this NIFA grant program.

For the purpose of this program, the following additional definitions are applicable:

Applied Research means research that includes expansion of the findings of fundamental research to uncover practical ways in which new knowledge can be advanced to benefit individuals and society.

Food and Agricultural Science Enhancement (FASE) Grants mean funding awarded to eligible applicants to strengthen science capabilities of Project Directors, to help institutions develop competitive scientific programs, and to attract new scientists into careers in high-priority areas of National need in agriculture, food, and environmental sciences. FASE awards may apply to any of the three agricultural knowledge components (i.e., research, education, and extension). FASE awards include Pre- and Postdoctoral Fellowships, New Investigator grants, and Strengthening grants.

Limited institutional success means institutions that are not among the most successful universities and colleges for receiving Federal funds for science and engineering research. A list of successful institutions is provided on AFRI RFA Resources page ("Table 2 Least Successful Institutions" in the attachments list).

Minority-serving institution means an accredited academic institution whose enrollment of a single minority or a combination of minorities exceeds fifty percent of the total enrollment, including graduate and undergraduate and full- and part-time students. An institution in this instance is an organization that is independently accredited as determined by reference to the current version of the *Higher Education Directory*, published by Higher Education Publications, Inc., 6400 Arlington Boulevard, Suite 648, Falls Church, Virginia 22042 (703-532-2300).

Minority means Alaskan Native, American Indian, Asian-American, African-American, Hispanic American, Native Hawaiian, or Pacific Islander. The Secretary will determine on a case-by-case basis whether additional groups qualify under this definition, either at the Secretary

of Agriculture's initiative, or in response to a written request with supporting explanation.

Multidisciplinary project means a project on which investigators from two or more disciplines collaborate to address a common problem. These collaborations, where appropriate, may integrate the biological, physical, chemical, or social sciences.

Small and mid-sized institutions are academic institutions with a current total enrollment of 17,500 or less including graduate and undergraduate and full- and part-time students. An institution, in this instance, is an organization that possesses a significant degree of autonomy. Significant degree of autonomy is defined by being independently accredited as determined by reference to the current version of the *Higher Education Directory*, published by Higher Education Publications, Inc., 6400 Arlington Boulevard, Suite 648, Falls Church, Virginia 22042 (703-532-2300).

Strengthening Grants mean funds awarded to institutions eligible for FASE Grants to enhance institutional capacity, with the goal of leading to future funding in the project area, as well as strengthening the competitiveness of the investigator's research, education, and/or extension activities. Strengthening grants consist of Standard, Coordinated Agricultural Project and Conference Grant types as well as Seed Grants, Equipment Grants, and Sabbatical Grants.

Transdisciplinary Team is composed of investigators from multiple disciplines that cross boundaries using holistic approaches to address complex challenges that cannot be solved using single-disciplinary approaches.

USDA EPSCoR States (Established Program to Stimulate Competitive Research) mean States which have been less successful in receiving funding from AFRI, having a funding level no higher than the 38th percentile of all States based on a 3-year average of AFRI funding levels, excluding FASE Strengthening funds granted to state agricultural experiment stations and degree-granting institutions in EPSCoR States and small, mid-sized, and minority-serving degree-granting institutions. The most recent list of USDA EPSCoR States is provided at AFRI RFA Resources page ("AFRI Grant Types" in the attachments list).

E. Materials Available on the Internet

AFRI program information will be made available on the NIFA AFRI website. The following are among the materials available on the NIFA website:

1. Stakeholder Input
2. Requests for Applications
3. AFRI Abstracts of Funded Projects
4. AFRI Annual Synopsis
5. Frequently Asked Questions
6. Interagency Programs

Most Successful Universities and Colleges
Any institution listed on this list, Most Successful Universities and Colleges Receiving Federals Funds, is not eligible for Strengthening Grants from the FASE program unless they are located in an EPSCoR state. See the AFRI RFA Resources page, "Table 1 Most Successful Institutions" in the attachments list.

Lowest One Third of Universities and Colleges Receiving Federal Funds
The lowest one third of universities and colleges receiving Federal funds is used to determine eligibility for possible waiver of matching funds requirement for Equipment Grants (see the AFRI RFA Resources page, "Table 2 Least Successful Institutions" in the attachments list).

Flow Chart for Strengthening Grant Eligibility
The Flow Chart for Strengthening Grant Eligibility will help to determine your eligibility to apply for strengthening grants (see the AFRI RFA Resources page, "FASE Strengthening Grant Eligibility Flow Chart" in the attachments list).

List of AFRI Deadlines
A table with the LOI and application deadlines for all 2021 and 2022 program area priorities is available on the AFRI Deadlines page.