

NEBRASKA RESEARCH

POSITIONED TO DEFEND AMERICA'S FOOD, AGRICULTURE, ENVIRONMENT

PROCEEDINGS

Food, Agriculture & Environment Security Workshop
Lincoln, Nebraska, USA | March 8, 2023



**NATIONAL STRATEGIC
RESEARCH INSTITUTE**
at the University of Nebraska

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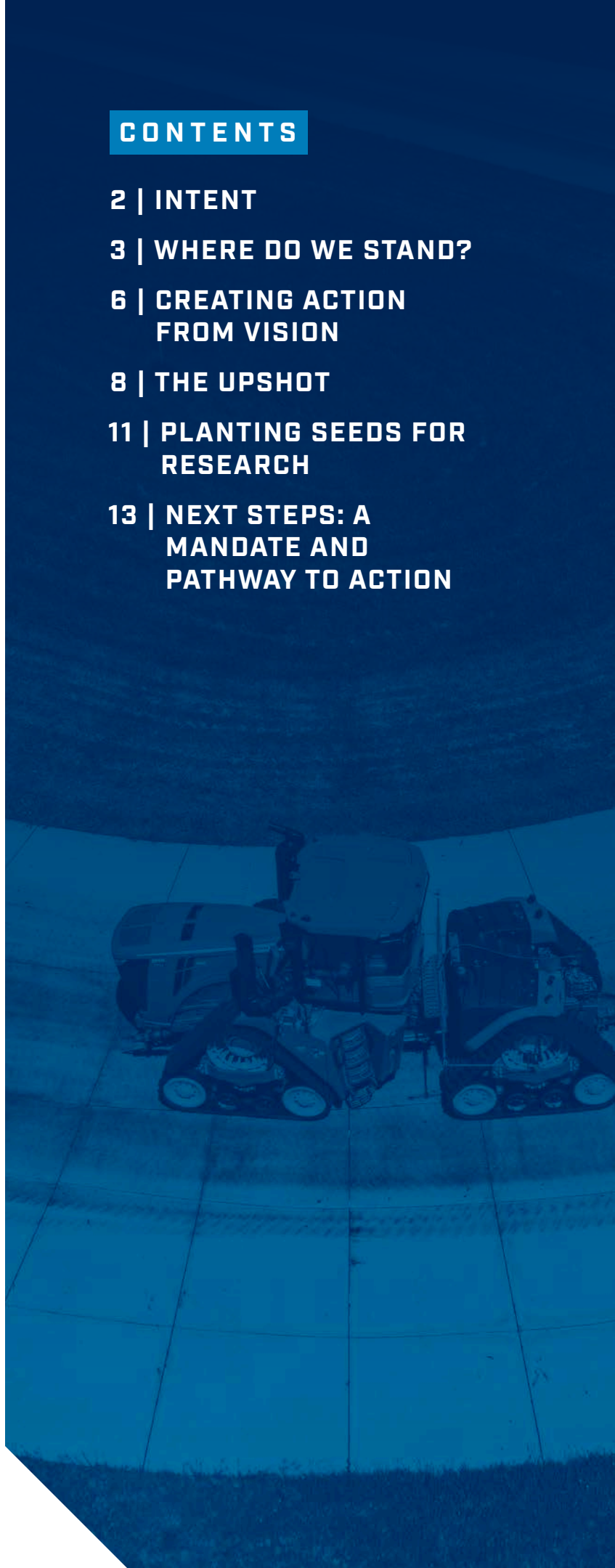
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NSRI MISSION STATEMENT

***ENABLE DETERRENCE OF,
PREPAREDNESS FOR
AND RESPONSE TO
STRATEGIC NATIONAL
SECURITY THREATS ACROSS
MULTIPLE DOMAINS THROUGH
RESEARCH AND SUPPORT.***



INTENT

In November 2022 U.S. President Joe Biden published National Security Memorandum 16 (NSM-16) on Strengthening the Security and Resilience of U.S. Food and Agriculture. NSM-16 underscored the importance of developing an initiative within the National Strategic Research Institute (NSRI) at the University of Nebraska and the University of Nebraska–Lincoln (UNL) Institute of Agriculture and Natural Resources (IANR). For nearly 18 months, the institutes had been strategizing the introduction of a new focus area within NSRI's respected national security research portfolio — Food, Agriculture and Environment Security (FAES).

The intent: Help America's leaders determine how to best protect the nation's food supply chains, agricultural systems and the environment from attack, adulteration and disease.

NSRI is uniquely positioned to integrate existing and new research into this area of defense.

- ▶ As the DOD-designated University Affiliated Research Center (UARC) sponsored by U.S. Strategic Command (USSTRATCOM) and the University of Nebraska System, NSRI is a trusted agent of the federal government.
- ▶ NSRI's UARC status and pre-competed contract vehicle provides researchers with a direct funding opportunity to support DOD and other federal agencies.
- ▶ NSRI has established and potential collaborations across the four campuses of the University of Nebraska System.

Strategically aligned with the more than 150 years of agriculture research prowess from NU and IANR, it is time to connect Nebraska's researchers to DOD and national security challenges in this space and solve them.

The research focus area opens exciting new opportunities for researchers to serve the nation and receive funding and support in many different disciplines.

On March 8, 2023, in a conference room at the UNL East Campus Union, NSRI and IANR hosted the inaugural gathering of NU researchers and other stakeholders in food, agriculture and the environment to help answer this question: What role could — and should — NU research and resources play in defending America's food production system?



WHERE DO WE STAND?

Every project mankind undertakes requires ready access to food — whether it is the meals that power our bodies for simple day-to-day living or the food warfighters use to fuel their bodies during battle.

A significant attack on our environment or food production infrastructure could cripple the nation's food chain and cause chaos in the lives of millions of Americans in many different ways.

In the last decade, a number of events underscore the need for the U.S. to turn its attention to new types of domestic defense. Most recently:

- ▶ 2020 — COVID-19 pandemic exposed our vulnerability to biological events, natural or intentional.
- ▶ 2021 — ransomware cyberattack stopped production at one of the largest U.S. meat suppliers.
- ▶ 2022 — Russian's invasion of Ukraine, a global grain producer, threw markets into chaos and emphasized the defensive role food can play in warfare.
- ▶ 2023 — Avian Flu spread across poultry farms, wreaking havoc on production and substantially raising the price of poultry and eggs.

Presenters and attendees at the Food, Agriculture & Environment Security Workshop on March 8, 2023, raised other concerns as well, such as the U.S. agricultural systems' increasing vulnerability to cyberattacks, as farmers and livestock producers adopt more and more advanced technology for food production.



Maj. Gen., USAF (Ret.) Rick Evans, NSRI executive director

OPPORTUNITIES TO SEARCH FOR RESEARCH SOLUTIONS

Opening the March 2023 workshop for more than 60 NU researchers in attendance, Maj. Gen., USAF (Ret.) Rick Evans, NSRI executive director, described NSRI’s goals for the new Food, Agriculture & Environment Security focus area within its role as a DOD-designated University Affiliated Research Center (UARC). Established in 2012, NSRI carries the UARC designation on behalf of the University of Nebraska (NU) System and is sponsored by U.S. Strategic Command. It positions NU capabilities to serve federal government agencies within the mission areas of strategic deterrence and countering weapons of mass destruction (CWMD).

“There are only 15 UARCs in the country — that’s prestigious company, and we’re lucky to have one here in Nebraska,” he said. “The university’s and NSRI’s core competencies as well as our existing research and development infrastructure fit nicely into addressing concerns of food, agriculture and environmental security.”

“This room has the energy, expertise, knowledge and access to the assets and resources of the university that are needed to address current and future national security challenges.”
— Rick Evans, NSRI Executive Director

Food, agriculture and the environment could be targets for strategic attack. Building resilience in these areas could aid efforts in strategic deterrence. NSRI is seeking expertise in areas relating directly or indirectly to preparing for chemical, biological, radiological, nuclear (CBRN) and cyber threats to our nation’s environment and food supply. This includes not only the production, storage and transport of food, but also threats to the overall condition of our environment, as well as intertwined issues such as public health.

The institute is also looking for a director to lead the charge, collaborate with internal and external stakeholders and enhance national resilience to this segment of the nation’s critical infrastructure.



Dr. Mike Boehm, NU vice president and Harlan Vice Chancellor for UNL IANR

TRUSTED AGENT, EFFICIENT CONTRACTS

Dr. Mike Boehm, NU vice president and Harlan Vice Chancellor for IANR, spoke to workshop attendees about the unique advantages of the relationship between NSRI and NU, as well as the institute's connection to its DOD sponsor, U.S. Strategic Command.

He provided more information about the pre-competed funding available through NSRI. In addition to already having done the legwork to build relationships with defense customers, the institute has received three coveted indefinite delivery/indefinite quantity (IDIQ) contract vehicles, the latest in September 2020 for \$92 million.

"When the DOD calls and says, 'We have a problem,' NSRI can efficiently mobilize funding in a non-competitive way using the IDIQ contract vehicle," Dr. Boehm said.

"Let's tightly dial in IANR and the university and fulfill our role as a trusted agent of the federal government — deliver essential research and engineering products to the DOD and federal government agencies working tenaciously in this space."

— Dr. Mike Boehm, IANR Vice Chancellor



Dr. Derek McLean, dean of the IANR Agricultural Research Division (ARD)

HISTORY OF INNOVATION

Dr. Derek McLean, dean of the IANR Agricultural Research Division (ARD), spoke about UNL's capabilities and how work within the new focus area might move forward.

"The one big question I want to ask is, 'How do we fit into this mission?'" he said. "I've been looking forward to this meeting. We have the opportunity to move into that domain today. Let's reset and start thinking about this in a new way."

He challenged researchers to put their ideas to work and help lead NSRI and the university to a premiere role in carrying out the calls to action outlined in President Biden's memorandum.

"All of you are innovators, and Nebraska has a long history of innovation. After this meeting, we want to hear from you. We need to build a roadmap so we can develop your ideas. What is the next step?"

— Dr. Derek McLean, ARD Dean



Dr. Neal Woollen, NSRI associate executive director of CWMD allied programs

CREATING ACTION FROM VISION

Dr. Neal Woollen, NSRI associate executive director for CWMD allied programs, provided more detail about research opportunities and the advent and intent of the new focus area. He said the effort dates back to a meeting with a previous Assistant Secretary of the U.S. Department of Homeland Security for CWMD during which the discussion focused on the impact the pandemic was having on the supply chain and the availability of food.

At that time, food had not been specifically tied to CBRN threats, and it was a stretch to discuss it as such — but that has changed, Dr. Woollen said. NSM-16 specifically codifies CBRN threats to food and agriculture and provides a linkage to NSRI's designated core competencies.

The next question is — what will this new program look like? Dr. Woollen suggested NSRI and the university begin identifying needs, links from capabilities to opportunities and engagement strategies to support national efforts.

**“So how do we achieve success?
It falls down to two things:
identifying opportunities and
leveraging assets we have to bring
to bear on solving these problems.”
— Dr. Neal Woollen, NSRI associate
executive director**



UNL Veterinary Diagnostic Center



UNO NCITE



UNMC Global Center for Health Security



UNK Wildlife Biology



UNL NIMBUS Lab



UNL IANR



Nebraska Drug Discovery & Development Pipline



UNMC College of Public Health

Some of the many capabilities, facilities and centers from across the University of Nebraska System ready to contribute to the food, agriculture and environment security focus area. Visit nsri.nebraska.edu/faes for the growing list.

1. IDENTIFY OPPORTUNITIES

Dr. Woollen listed examples of the federal roles and responsibilities implied by NSM-16’s declaration, which ultimately could lead to organizations that become NSRI customers, sources of funding and partners with NU scientists such as:

- ▶ U.S. Food and Drug Administration (FDA)
- ▶ U.S. Department of Homeland Security (DHS)
- ▶ U.S. Department of Agriculture (USDA)
- ▶ U.S. Department of Defense (DOD)
- ▶ State, Local, Tribal and Territorial Partners
- ▶ Food and Agriculture Industry and Consumer Groups

For example, DHS has named several potential high-priority projects based on existing needs: decontamination, de-composting, slurry pits, disinfection, operation resilience, swine fever and surrogate pathogens.

“We might start by looking at resilience of the country and Nebraska during a significant disruptive event,” Dr. Woollen suggested. “How would such an event impact resilience and what are contributors to a lack of resilience?”

2. LEVERAGE NU ASSETS

“We don’t plan to duplicate capabilities that are already in existence,” Dr. Woollen said. “We want to leverage those and add to them. This new focus area is a resource for all NU scientists. We aim to match you with a group who needs the resources you can provide to those efforts.”

He then went on to explain how it could be challenging for a federal program to solve food, agriculture and environment security problems due to the privately owned and operated components of the industry. Decreasing the impact of a CBRN incident on the private sector will require a multidisciplinary approach. For that reason, he said, a broad array of university researchers must look at NSM-16 and finds ways their areas of expertise could deliver within the area of focus.

Several collaborators are already identified in the drafted strategic plan for the NSRI food, agriculture and environment security area, but Dr. Woollen insisted that the list is not yet comprehensive.

Complete our momentum survey to be added to the expanding FAES capabilities map. nsri.nebraska.edu/faesmomentum

THE UPSHOT

Regardless of research emphasis, it is possible nearly every NU researcher could contribute to this effort. There is a need for natural scientists in areas like biology, epidemiology and agriculture — but there also will be a need for research in disciplines that might not immediately be associated with food and agriculture security such as sociology, cyber science, political science and more.

“With NSRI, researchers can access the support and resources they need to accomplish the work that is critical to the security of the nation,” Dr. Woollen said. “We have a unique position as a trusted agent through our special UARC status and with the support of USSTRATCOM.”

Faculty presenters at the workshop were asked to review NSM-16 and analyze their own research to present how existing research could apply to the food, agriculture and environment focus area. Each speaker was given 20 minutes and each approached their analysis of NSM-16 within the context of very different areas of expertise.

Dr. Scott McVey, director of the UNL school of veterinary medicine and biomedical sciences, featured the current and potential contributions of UNL laboratories for animal agricultural security such as disease surveillance, diagnostic testing for disease outbreaks of all species and tumor biopsy diagnostics. He emphasized the importance of solidifying the university’s contribution in this space given total livestock cash receipts in the U.S. are nearly \$10 billion annually.

Dr. Loren Giesler, head of the UNL plant pathology department, outlined several crop diseases, including Philippine downy mildew, maize lethal necrosis and wheat stem rust, before moving into a discussion of the effects of climate change, which emerged as a theme across presenters.

Dr. Andrea Bianchini Huebner, associate professor in UNL food science and technology department, discussed how to safeguard the food supply chain, walking through the FDA’s food defense plan and highlighting UNL research across the disciplines of

training, disease modeling, crop sorting innovation, robotic technology and more.

Dr. Elizabeth VanWormer, associate professor in the UNL school of veterinary medicine and biomedical sciences, presented an outline of the UNL One Health Initiative she directs. Through visual representations of different ecosystems and species, she depicted how humans, animals and the environment are linked across several levels, and explained some of the benefits and costs of these linkages.

Dr. Michelle Black, director of workforce and education for the UNO National Counterterrorism Innovation, Technology, and Education Center (NCITE), brought forward research that explores several states and stakeholders that have a vested interest in agriculture, establishing the potential perceptions of bad actors. For example, certain perceptions within Russia and China suggest that the use of agriculture could positively affect the countries’ global status. Russian perceptions support weaponizing food exports to gain independence or to impose bargaining power over the West.

Dr. George Grispos, assistant professor with the UNO school of interdisciplinary informatics, showcased the capabilities of NebraskaCYBR to counter cyber threats to agriculture. For example, he, his colleagues and students can provide engineering adaptive, secure, forensic-ready agricultural software systems; malware detection, analysis and mitigation for agricultural components; and incident response.

However different their area of focus, three specific themes emerged from the presentations.

THREAT OF CLIMATE CHANGE

The pressures climate change might apply to U.S. food production include a harsher climate to grow food in, less consistent rainfall and proliferation of viral and fungal diseases that affect crops and livestock.

Dr. Giesler explained how the changing climate affects the development and spread of plant disease.

“Changing temperatures, high levels of moisture, drought — all of these are factors stressing the

system, and those changing conditions are ideal for disease,” he explained.

Climate change can affect the spread of disease in ways not usually expected. Dr. Bianchini Huebner demonstrated how changing temperatures may actually shift the regions in which crops can be grown, which could lead to the expanding range of some fungal threats.

“Historically you see occurrences of certain mycotoxins in tropical areas and others in a moderate climate,” she said. “Increasing temperatures may lead to temperatures too high to produce certain crops. Those crops will start moving and expanding that area of production — the issue is that the contamination also moves, and the amount of aflatoxin may be moving with it.”

Understanding and mitigating these threats can help prevent vulnerabilities that leave America exposed.

DEFENDING AGAINST BAD ACTORS

Another concern exposed by multiple presenters was the vulnerability of the U.S. food production to bad actors.

Dr. Black focused on ways to keep at bay various threats to agricultural production. Foreign governments, religious extremists, cybercriminals and criminal organizations could be kept at bay through principles of deterrence, but she showed how agriculture is lacking some protections.

“Bad actors do fear prosecution, but many factors are at play and not all actors are adversaries,” she said. “Understanding and mitigating the complex risks can be challenging. For example, agriculture is not a highly monitored space. That in itself can add to vulnerability.”

Dr. Grispos pointed out that agriculture’s rising reliance on technology has made it increasingly vulnerable to cyberattacks, and he demonstrated how easy it would be to interfere.

“We are throwing a lot of tech at individuals that is effectively rife with opportunities for malicious actors to exploit,” he said. “A lot of manufacturers



DR. LOREN GIESLER



DR. ANDREIA BIANCHINI HUEBNER



DR. MICHELLE BLACK



DR. GEORGE GRISPOS

are pushing out tech that's rushed to market before security can be tightened up as much as it probably should before release."

The nature of agriculture means we might not even know we have been hacked. Dr. Grispos explained that when we see an attack on a hospital or a bank, we see the effect quickly. But crop producers could be hit by cyberattacks during planting and not see effects until months later when they realize yield was cut in half. Even if they determine the problem, by that time the hackers are long gone.

INTERDISCIPLINARY APPROACH

It is clear that solving many food, agriculture and environment security challenges will require expertise in more than one area, where individuals with varied expertise can identify problem areas together, make connections and get the work done.

Dr. McVey spoke about the need for a multidisciplinary team to treat vesicular stomatitis in livestock, one of his past projects.

"These are complex diseases," he said. "You have mammalian hosts which means veterinarians, infectious agents which means virologists, insect vectors which requires entomologists. For our project, we looked at genetics, virology, immunology and regulatory factors."

Dr. VanWormer looked at threats from a One Health perspective — the health of humans, animals and the environment is an interconnected system and for that reason there is a need to find solutions through a multidisciplinary approach.

"It's very hard for any one discipline to navigate this system," she said. "That's especially true when we consider global forces like landscape or climate changes."

Dr. VanWormer also highlighted potential contributions from scientists outside of natural science.

"A lot of times we focus on the natural science partnerships, and we leave out the social scientists," she said. "We need to bring sociologists, economists and others to the team."



DR. SCOTT MCVEY



DR. ELIZABETH VANWORMER

PLANTING SEEDS FOR RESEARCH

Dr. Tala Awada, IANR ARD associate dean and physiological plant ecologist, has served as a co-leader for the development of the NSRI Food, Agriculture & Environment Security focus area. In this role, Dr. Awada has worked alongside Dr. Neal Woollen to shape the drafted strategic plan, develop the NSRI director position and guide engagement strategies with researchers, partners and stakeholders.

To conclude the workshop, an open discussion was held with all presenters serving as panelists and Dr. Awada facilitating. Many ideas were discussed during the panel, and submissions to the FAES momentum survey provided additional insight. The following questions have surfaced as compelling seeds of future research and collaboration.

- ▶ How can we supply troops with food and move them quickly in response to urgent needs while minimizing disease exposure?
- ▶ How can we overcome the lack of integrated policies to ensure desired outcomes needed, including data sharing and security? The U.S. has no federal cyber security guidelines, for example, and the need is immediate.
- ▶ How can we reduce the cost and improve our ability to actively monitor the spread of crop and livestock disease? Surveillance is expensive and can be politically sensitive.
- ▶ How do we form research teams and align different areas of research for success? NSRI has relationships and resources in place to help with this.
- ▶ Farms and other agricultural facilities are highly vulnerable compared to other critical infrastructure. How can we improve security in these locations?
- ▶ How can we quickly take solutions from pure concept to a pilot level? Venture capital dollars are slim in Nebraska.
- ▶ How do we work with private enterprise to ensure wide adoption of solutions?
- ▶ How can NSRI projects help accelerate commercial efforts in agriculture, including training people to more rapidly produce food and reduce risk?
- ▶ A citizen science approach has been successful in some of the disciplines discussed. How can we engage with communities across Nebraska?
- ▶ How can we prepare organizations like FEMA for a potential FAES disaster? They may lack experience or adequate tools to respond to agricultural and environmental attacks.
- ▶ How can we tap new opportunities synthetic biology offers to help us stay ahead of threats?
- ▶ What is Nebraska doing locally that could be extrapolated onto the world stage? University researchers have already done a great deal of this in the area of irrigation.
- ▶ Future research may come from intersecting CBRN areas. A lot was said about natural biological threats — what potential radiological, chemical and nuclear threats were not considered?

NSM-16 PRIORITIES, REQUIREMENTS & PRIMARY AGENCIES

This table provides the list of requirements and prioritized efforts with responsible agencies identified within the National Security Memorandum on Strengthening the Security and Resilience of U.S. Food and Agriculture.

NSM-16 PRIORITIES OR REQUIREMENTS	PRIMARY AGENCIES
Federal Risk Mitigation Strategy; annually	AG, DHS*
Vulnerability Assessment of the Food and Agriculture Sector (FAS); update criteria are defined	USDA, HHS*
Comprehensive Risk Assessment for the FAS; reviewed/updated annually	DHS, AG, USDA, HHS*
Strategy and Action Plan; reviewed/revised biennially	USDA, HHS*
Interim Risk Review; within 120 days	USDA, HHS, DHS*
Protect and prepare the FAS for threats that may result in high consequence and catastrophic incidents	USDA, HHS
Provide strategic guidance, promote a national unity of effort, integrate FAS efforts into National efforts	DHS, AG, USDA, HHS*
Provide support domestically and globally to strengthen security and resilience of FAS	DoS, DoD, DoI, DoC, DHS*
Risk-informed and coordinated domestic and global surveillance and monitoring systems	DoI, USDA, DoC, HHS, DHS, DoS, DoD, AG*
Systems that track specific animals, plants, food, and other commodities	
Coordinated nationwide laboratory networks	
Maintain and enhance a National Veterinary Stockpile: vaccines, diagnostics, and therapeutics	USDA, HHS*
Maintain and enhance a National Plant Disease Recovery System: details provided	
Share information on available funding to help SLTT and private sector prepare, mitigate, respond, and recover	USDA, HHS, AG, DoC, DHS
Cybersecurity technical assistance efforts	DHS
Program to exercise and train Federal, SLTT, private sector, and NGOs for threat/incident response	DHS
Higher education for protecting FAS: degrees, certifications, vocational, and other training	
Professional development and specialized training in food, agriculture, biorisk management, and env. protection	USDA, HHS, DHS*
Training for FAS professionals: webinars, workshops, exercises	
Symposia, conferences, meetings, and other engagements to enhance preparedness and resilience	
Information sharing to inform interdiction, inspection, and identification of suspect items	AG, USDA, HHS, DHS, DoD, DoI*
Information sharing to enhance threat assessments and dissemination of actionable information	
Expand R&D of current and new capabilities to enhance security and resilience of FAS	USDA, HHS, DHS, EPA*
Refine and promote the identification of and guidance for essential FAS workers during incidents	DHS, USDA, DoL, HHS*
Enhance capabilities to detect, characterize, mitigate, respond to, recover from threat-related incidents	
Conduct response actions in accordance with the National Response Framework	DHS, DoS, AG, USDA, DoC, HHS, EPA, DNI*
Conduct recovery actions in accordance with the National Disaster Recovery Framework	
Enhance international engagement with foreign governments and international organizations	
Oversee university-based, DHS-funded centers of excellence in agriculture and food defense	DHS, USDA, HHS
Maintain an FAS risk assessment and conduct annual outreach with SLTT and private sector for implementation	DHS, AG, USDA, HHS*
Lead threat response (AG) and national asset response (DHS) for Federal cyber incident response for FAS	AG, DHS
Increase the volume, timeliness, and quality of cyber threat information sharing for FAS	
Support USDA, HHS, and DHS* in the preparedness, protection, defense, and resilience of the FAS	DoD
Provide support to civil authorities for security and resilience of FAS	
Develop, maintain, and enhance biocontainment capabilities to develop veterinary countermeasures	DoD, DoI, USDA, HHS, DHS
Request budget requirements for the continued implementation of NSM-16	AG, USDA, HHS, DHS*

* Other relevant agencies.

Acronyms: AG=Attorney General, DHS=Department of Homeland Security, USDA=Department of Agriculture, HHS=Health and Human Services, DoS=Department of State, DoD=Department of Defense, DoI=Department of Interior, DoC=Department of Commerce, EPA=Environmental Protection Agency, DNI=Director, National Intelligence.

NEXT STEPS: A MANDATE AND PATHWAY TO ACTION

NSM-16 was a clear mandate to defense professionals, researchers and other stakeholders to study the need, ask the right questions, connect people and resources, establish concrete goals and begin working urgently toward solutions to protect our food production system, environment and public health.

Together, we can mobilize the rich agricultural resources and innovative research platforms Nebraska is known for to strengthen the country's defense of food, agriculture, environment and public health, as we have through other NSRI focus areas.

Everything in our daily lives and our future hinges on being able to protect what we have built and our nation's citizens, who represent the best part of the American experiment that began more than 200 years ago.

Defense of food is essential to continuing our way of life. There is no more worthy cause.

1. NSRI & IANR TO HIRE DIRECTOR

A new position for a NSRI director for food, agriculture & environment security will be posted soon. This position will facilitate communication across all areas of interest and involvement. For example, the position will assist in the meshing of military and academic needs and contributions.

2. FINALIZE & ELICIT FEEDBACK ON STRATEGIC PLAN

NSRI and IANR leaders will move ahead with more specific workshops and conversations as well as outreach to individual researchers. They will study opportunities in greater detail and hone in on the most relevant threats and solutions based on input of defense partners and researchers.

3. COMPLETE THE MOMENTUM SURVEY

What could you contribute? Think about these challenges in the context of your area of expertise and submit to our momentum survey at nsri.nebraska.edu/faesmomentum.



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