2025-2035 agInnovation Research Roadmap

Who We Are:

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agInnovation is the nationwide system of agricultural research and state agricultural experiment stations at our nation's land-grant universities. These scientific research centers support highly trained and dedicated scientists who work with farmers, ranchers, suppliers, and processors involved in food production and other agriculturally related activities. Scientists develop and apply science-based solutions for improving the nation's agricultural systems, environment, public health, economy, and overall quality of life of its citizens. Roughly 70% of the publicly funded research and development is conducted by universities and other nonfederal institutions, and the impacts deliver $20 to the nation for every $1 invested.[1] These centers also have a critical role in training the next generation of scientists and skilled leaders who'll work in the food, agriculture, forestry, natural resource, and environmental sectors. For more information, visit www.aginnovation.info.

An "Outcomes-Driven" Research Roadmap for the Nation:

In 2023-2024, the agInnovation chair launched a transformative initiative to craft and implement a focused, 10-year platform for agricultural research. agInnovation leaders worked to develop a plan that sets forth clear goals and ambitious research outcomes aimed at tackling our most critical challenges — such as combatting climate change, improving water resilience, and ensuring sustainable food systems. Grounded in the foundations of national security and an aim to cultivate the next generation of experts, the roadmap outlines bold and measurable objectives achievable through strategic investment. To ensure accountability and maximize impact, the agInnovation leadership team devised an implementation strategy that includes regular progress updates and innovative funding approaches that harness agInnovation's expertise and partnerships.

"A world where people and the planet thrive through agInnovation and discovery"
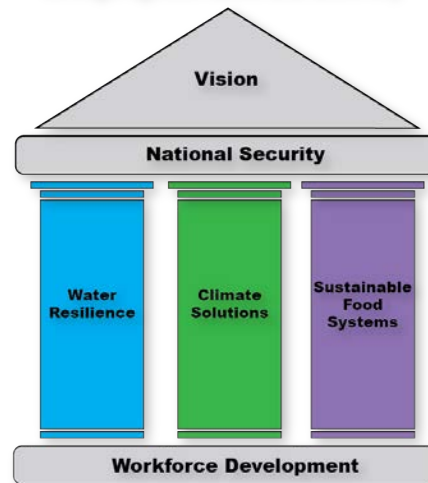
A National Imperative: Increased Investment in Agricultural Research:

Our nation faces a critical imperative: increasing investment in agricultural research. The outcomes outlined in our strategy are vital to national security, yet current funding levels jeopardize their achievement. Despite every $1 invested yielding $20 in economic benefits, federal support has declined, hindering our competitiveness against global leaders such as China, the current top investor in agricultural research and development.[1]

> **To realize our ambitious 10-year goals, an additional $1.9 billion per year in federal research funding is needed over the next decade, equivalent to only 1% of the total federal research and development investment.**

To realize our ambitious 10-year goals, federal research funding support for land-grant universities urgently requires an increased annual investment of $1.9 billion — or $19 billion over the next decade — equivalent to just 1% of the fiscal year 2023 total federal research and development budget. This includes bolstering core capacity and competitive grant programs at the U.S. Department of Agriculture's National Institute of Food and Agriculture, alongside aligned initiatives at the National Science Foundation, National Institutes of Health, National Oceanic and Atmospheric Administration, NASA, U.S. Department of Energy, U.S. Environmental Protection Agency, and other federal funding agencies. Securing this enhanced support is essential to advancing transformative research and safeguarding our nation's future prosperity.

[1] Nelson, K. P., & Fuglie, K. (2022, June 6). *Investment in U.S. public agricultural research and development has fallen by a third over past two decades, lags major trade competitors.* https://www.ers.usda.gov/amber-waves/2022/june/investment-in-u-s-public-agricultural-research-and-development-has-fallen-by-a-third-over-past-two-decades-lags-major-trade-competitors/

Water Resilience

Overview:

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Safe and readily available water is critical to agricultural production, public health, and our environment. Research on water resiliency is needed to advance agricultural resilience and conservation efforts to secure the long-term sustainability of water sources for agriculture, communities, and the environment. Research is also needed to develop practices and technologies that ensure water resiliency and conservation amid a changing climate with more frequent and extreme climatic events, such as floods and droughts.

Outcome Goals and Impacts:

- Increase water use efficiency by 50% across food and agriculture systems (i.e., production and processing).
- Enhance the health and U.S. Environmental Protection Agency compliance of our rivers, lakes, streams, groundwater, and coastal waters by reducing water quality impairment within agricultural watersheds by 40%.
- Enhance agricultural system resilience by reducing agricultural production losses to waterlogging, flooding, and drought by 50%.
- *Cross-cutting outcome:* Annually train an additional 20,000 students in food, agriculture, and renewable natural resources, addressing the growing demand for a skilled workforce in these sectors. Students will be recruited with diverse backgrounds and experiences reflective of the U.S. population.

Funding Requirement:

To achieve our water resilience goals and address other societal challenges in the U.S., it's critical to allocate an additional $1.9 billion annually in federal research funding to land-grant universities over the next decade. This annual increase is equivalent to just 1% of the total federal research and development budget.

Research Opportunities:

- Develop and deploy an effective multi-year strategy that prioritizes water monitoring and data collection, innovative practices and technologies, and policy interventions that improves agricultural water use efficiency, flood tolerance and mitigation, water reuse, crop and livestock productivity, profitability, and climate change resiliency.
- Develop water-efficient and flood- and drought-resistant crops.
- Develop and implement AI-driven irrigation systems.
- Develop best management practices for water conservation, reuse, and quality.

Risk of Not Taking Action:

- Less water will be available for drinking and home use in rural and urban communities, as well as for agricultural production. Water levels in streams and lakes will further decline and negatively impact wildlife and recreation.
- Increased withdrawal of groundwater will exacerbate land subsidence that damages community infrastructure (e.g., roads, bridges, water wells, buildings, levees), leading to a heavy financial burden on communities, loss of flooding protection, and the decreased capacity of aquifers to store water.
- The quality of water used for drinking, irrigation and recreation will significantly decline, resulting in negative public health consequences.

Climate Solutions

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LAND-GRANT UNIVERSITY RESEARCH

Overview:

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As a global leader in agricultural production, the United States must enhance the resilience of our agriculture and natural resources to withstand increasingly variable weather conditions and extreme weather events. This requires moving beyond traditional efficiency metrics. It is essential to prioritize productivity that regenerates soil, sustains water resources, and enhances biodiversity and community resilience. Embracing climate-smart practices, soil health principles, and advanced technologies will protect our natural resources and propel U.S. agriculture forward, thereby improving resilience and national food security.

Outcome Goals and Impacts:

- Improve yield stability and soil health through increased soil carbon sequestration, higher soil moisture content, and a 40% reduction in agriculture's carbon footprint.
- Improve nitrogen fertilizer use efficiency, minimize nutrient runoff, and enhance recycling while reducing costs of production for farmers and related greenhouse gas emissions by 35%.
- Foster new forestry land management, land cover, and harvesting approaches that promote healthy forests resilient to fire and extreme weather events, and aid in the uptake of 30% of economy-wide carbon dioxide emissions annually.
- Improve adoption of climate-smart practices and enhance resilience of agriculture, rangeland, and forest ecosystems, optimizing production amid variable, changing weather conditions and extreme weather events. Doing so can help reduce annual federal crop insurance payments by 25%, or $3.5 billion annually.
- *Cross-cutting outcome:* Annually train an additional 20,000 students in food, agriculture, and renewable natural resources, addressing the growing demand for a skilled workforce in these sectors. Students will be recruited with diverse backgrounds and experiences reflective of the U.S. population.

Research Opportunities:

- Identify climate-smart practices that improve nitrogen use efficiency, soil fertility, structure, and resilience, enhancing our understanding of soil composition and processes.
- Reduce barriers to collaboration among farmers, communities, researchers, and policymakers to drive adoption of grassroots innovations for climate adaptation and resilience.
- Develop accurate metrics for quantifying greenhouse gas emissions, carbon sequestration, water usage, and biodiversity. Integrate climate modeling and scenario simulations to enhance the resilience of agriculture and natural resource systems.
- Apply gene-editing techniques to produce climate resilient crops and animals (e.g., improved water use efficiency, drought tolerance, heat tolerance). Develop feeds that reduce methane emissions from livestock.

Funding Requirement:

To achieve our climate solutions goals and address other societal challenges in the U.S., it's critical to allocate an additional $1.9 billion annually in federal research funding to land-grant universities over the next decade. This annual increase is equivalent to just 1% of the total federal research and development budget.

Risk of Not Taking Action:

- From increased wildfires to water-caused crop failures, agriculture is already experiencing the impacts of variable, changing weather conditions and extreme weather events. If we fail to adapt, these challenges will exacerbate, leading to reduced crop yields and increased harm to livestock, forests, and fisheries. Biodiversity will suffer as resistant weeds, pests, diseases, and wildfires become more prevalent, disrupting ecosystems and agricultural productivity. The degradation of water, air, and soil quality will intensify and cause severe consequences for food security, human and animal health, and environmental sustainability. Immediate action is needed to safeguard agriculture systems and the health of our planet.

Sustainable Food Systems

agInnovation
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LAND-GRANT UNIVERSITY RESEARCH

Overview:

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Agricultural research is crucial for safeguarding both food and national security in the U.S. It delivers transformative innovations that ensure a sustainable and resilient food system across the country that's economically viable, socially just, and environmentally sound. Resiliency requires diversity of production, processing, and distribution scales and locations for supply chains across all agriculture and food sectors. Research is essential for a sustainable and resilient food system to meet the needs of current and future generations.

Outcome Goals and Impacts:

- Achieve national and food security by producing 95% of our food domestically, increasing local and regional farm net incomes by 20%, and reducing food waste by 50%.
- Bolster supply chain resilience of food systems by strengthening local and regional markets to meet between 15% to 25% of the local demand, while reducing the carbon footprint of food transportation by 25%.
- Reduce food insecurity and decrease diet-related diseases by 40%.
- Increase the nutritional value of foods and safeguard food supply through the prevention of foodborne contaminants, plant and animal disease outbreaks, and pests during food production, processing, transportation, and retail.
- *Cross-cutting outcome:* Annually train an additional 20,000 students in food, agriculture, and renewable natural resources, addressing the growing demand for a skilled workforce in these sectors. Students will be recruited with diverse backgrounds and experiences reflective of the U.S. population.

Funding Requirement:

To achieve our sustainable food systems goals and address other societal challenges in the U.S., it's critical to allocate an additional $1.9 billion annually in federal research funding to land-grant universities over the next decade. This annual increase is equivalent to just 1% of the total federal research and development budget.

Research Opportunities:

- Identify ways to repurpose agricultural byproducts and extend shelf life to minimize waste and enhance food security.
- Increase access to affordable, nutritious, and safe food, and develop science-based approaches to help individuals adopt healthier lifestyles.
- Conduct cost-benefit analyses, life-cycle analyses, environmental impact evaluations, and social cost-benefit analyses to track improvement of local and regional food system sustainability.
- Develop new surveillance tools and approaches for early detection of pests and diseases across the food chain.
- Develop diverse crops and livestock genetics that increase nutritional value and resistance to diseases and pests, including deploying new biotechnologies, information technologies, and other innovations that take advantage of new and changing environments.

Risk of Not Taking Action:

- Food system failures and disruptions caused by global conflicts, pandemics, economic downturns, geopolitical turmoil, and climate change will significantly threaten national security and lead to increased food supply interruptions, food spoilage and waste, food insecurity and hunger, diet-related chronic and foodborne diseases, environmental degradation, economic instability, and mass migration of people across the globe.