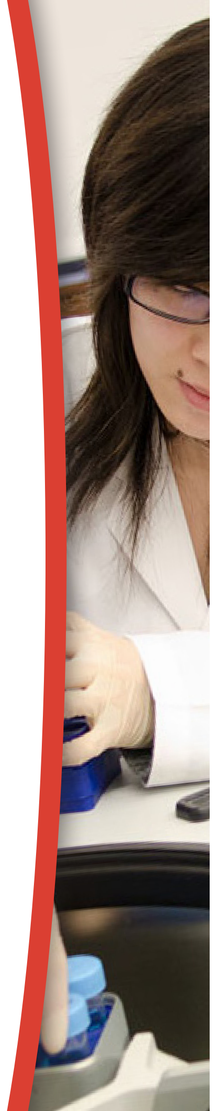
Strategic Investments

These challenges won't be solved by fragmented policies tailored to specific commodities, regions, or sectors of the economy. They require new approaches in policy and research that consider the entire framework of systems that produce food and deliver it to grocery stores

Systematic, decisive planning and partnerships among government, universities, and the private sector are the only way to meet these challenges. But we find ourselves facing the perfect storm: An intensifying set of challenges coupled with decreasing state and federal investment in agriculture, energy, and environmental research.

The American Association of Public and Land Grant Universities and the U.S. Agricultural Experiment Stations are eminently suited to solve the urgent issues of food safety, security, and abundance. To extend cutting-edge research to solve critical problems for the public good will require strategic government and private investments now in the following crucial areas:

- Technologies and breeding programs that maximize the genomic potential of plant and animal productivity, nutritional value, and drought tolerance.
- Robust local food systems that benefit large and small growers as well as vulnerable, low-income consumers.
- Technologies to prevent, detect, and respond to food safety hazards, including bioterrorism and chemical contaminants.
- Prevention and treatment of chronic diseases through nutrition and application of human genome data to identify key triggers and processes.
- Prevention of obesity though community-appropriate methods including physical activity, social interaction, and access to healthy foods.
- Efficient production systems and processing technologies for crop bioproducts, including biofuels, pharmaceuticals, and functional foods.
- Development of mutually beneficial rural-urban market linkages and other components of regional economic development that support rural families.
- Tools to help producers and municipalities identify where and when adaptation of new practices to cope with extreme weather will be beneficial and financially viable.
- Agricultural systems that utilize inputs such as water and energy efficiently, create fewer waste products, and increase producers' profits.



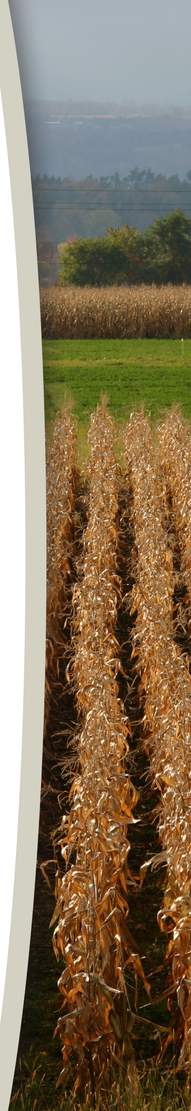
The full Science Roadmap is available at www.nera.umd.edu.

EXPERIMENT STATION COMMITTEE ON ORGANIZATION AND POLICY

Experiment Station Section
The Board on Agriculture Assembly
National Association of State Universities and Land-Grant Colleges

A Science Roadmap for Food and Agriculture

In 2010, more than 250 research administrators and land grant university scientists from a wide range of disciplines and institutions participated in a process to identify global societal issues and develop a systematic and detailed Science Roadmap for Food and Agriculture to address them. The Roadmap identifies research priorities needed to tackle these challenges into the next decade and guides strategic public investments in research.



Meeting 21st Century Challenges with Science and Technology

By 2050 there will be nine billion people on Earth. Demographic trends indicate that this global population will be more urbanized and more concentrated in coastal communities, which are more vulnerable to severe weather, rising sea levels, and a lack of fresh water. At the same time, per capita incomes will continue to grow in many parts of the world and with them the demand for nutritious food, energy, water, and sanitation. Meanwhile, urban population growth will continue to move water away from agricultural use, increasing vulnerability to drought and famine around the world.

In the United States, the population is predicted to increase 40 percent by 2050, which will drastically increase demand for services, food, and natural resources-especially fresh water. Without drastic reductions in greenhouse gas emissions, temperatures across most of the U.S. are predicted to increase by between 3 and 6°F by 2050, rainfall patterns will change, and increases in storm intensity may bring more frequent crop failures and migrations of affected populations. As a result, the U.S. will face significant challenges to food security, human health, economic growth, job creation, and sustainable environmental and natural resources.

The challenges we face as a nation will be multiplied across our interconnected world. How will we safeguard our quality of life-including affordable food, energy security, economic opportunity, a healthy environment, and economically and socially viable communities? Guided by principles of sustainability and stewardship, the American Association of Public and Land Grant Universities and State Agricultural Experiment Stations have identified the key challenges and management strategies needed to address them. Strategic investments now will position the U.S. for resilience in the decades to come.

The Challenges

While the Science Roadmap describes seven specific Grand Challenges, they can be divided into three strategic issues:

1. Food Security and Human Health
2. Economic Growth and Job Creation
3. Sustainable Environmental and Natural Resources

1 Food Security and Human Health

Today the average American spends only 10 percent of their total expenditures on food. This affordability was built on the country's abundant natural resources and science-based land grant programs that increased the efficiency of agricultural production, food processing, and food distribution. Food will become less affordable as production costs rise—whether from rising fuel costs, crop failures, high water prices, or insecure global food systems. Agricultural scientists and engineers must develop new technologies to meet these challenges.

> Our prosperity depends on our ability to maintain safe, affordable, and stable food supplies.

These scientists and engineers must also tackle human health and nutrition-related chronic diseases such as heart disease, stroke, cancer, diabetes, and arthritis, which are among the most common, costly, and preventable of all health problems in the U.S., accounting for 83 percent of all health care spending. Additional food-related risks include preventable outbreaks of food-borne illnesses and ingredients sourced from countries with less rigorous food safety standards. Our prosperity depends on our ability to maintain safe, affordable, and stable food supplies.

2 Economic Growth and Job Creation

The challenges ahead also provide opportunities to diversify U.S. food and agricultural production systems through the development of new industries. One such opportunity is in the development of renewable energy and biofuels in particular. Commercial-scale methods for the production of fuel from grasses, feedstock, farm waste streams including manure, and woody plants would strengthen our nation's renewable energy portfolio, provide new crops for growers, and utilize marginal lands. The outcomes would include reduced greenhouse gas emissions and dependence on imported fossil fuels as well as buffering of food prices from global petroleum demand.

In addition to biofuels, plants can be used to produce bio-based fabrics with new properties; polymers such biodegradable plastics, films, and industrial chemicals at a commercial scale; as well as pharmaceuticals and functional foods. These products could reinvigorate factories, mills, and industrial parks that now stand empty. Because climate change is bringing warmer summers and longer growing seasons to high latitude states, new areas will be suitable for crop production. These new economic prospects will create new job and employment opportunities. The land grant university system must be ready to prepare an increasingly diverse population with 21st century job skills for an economy very different from that of the present. Social science-based research—from communications to economic geography—is needed to position individuals, families, and communities for success.

> New areas will be suitable for crop production, creating new job and employment opportunities.

3 Sustainable Environmental and Natural Resources

Water, the source of life, will become a limiting factor for economic productivity and quality of life in the next century. For communities, water is a natural resource for sanitation, factories, recreation, and beautification. In many areas, climate change is predicted to lead to higher average temperatures and less rainfall. At the same time, urban population growth will alter water consumption patterns and policies, driving water—and therefore food—prices higher. Irrigation of crops may be the most invisible use of water in our society, but food production accounts for more than 80 percent of the U.S.'s use of fresh water in lakes, rivers, streams, and underground aquifers. Additionally, most western high-value agriculture depends on irrigation provided by snowmelt, which will be less available due to warmer winters and springs, affecting food prices around the country. The challenge we face by 2050 is how to double food production for a larger population—nationally and globally—using the same land area but with vastly less irrigation water.

> We need agricultural practices that provide not only food, feed, and fiber but also maximize the 'services' provided by the land.

Farming practices impact the local, regional, and global environment. We need agricultural practices that provide not only food, feed, and fiber but also maximize the 'services' provided by the land, including producing food and forest products, preventing soil erosion, buffering weather fluctuations such as excess storm water, keeping nutrients out of waterways, maintaining water quality, and managing pest populations. Long-term sustainability means decreasing inputs, decreasing waste, and optimizing yield.