A SCIENCE ROADMAP FOR AGRICULTURE

7 *Seven challenges to meeting our nation's agricultural goals*

be competitive in a global economy

add value to our future harvests

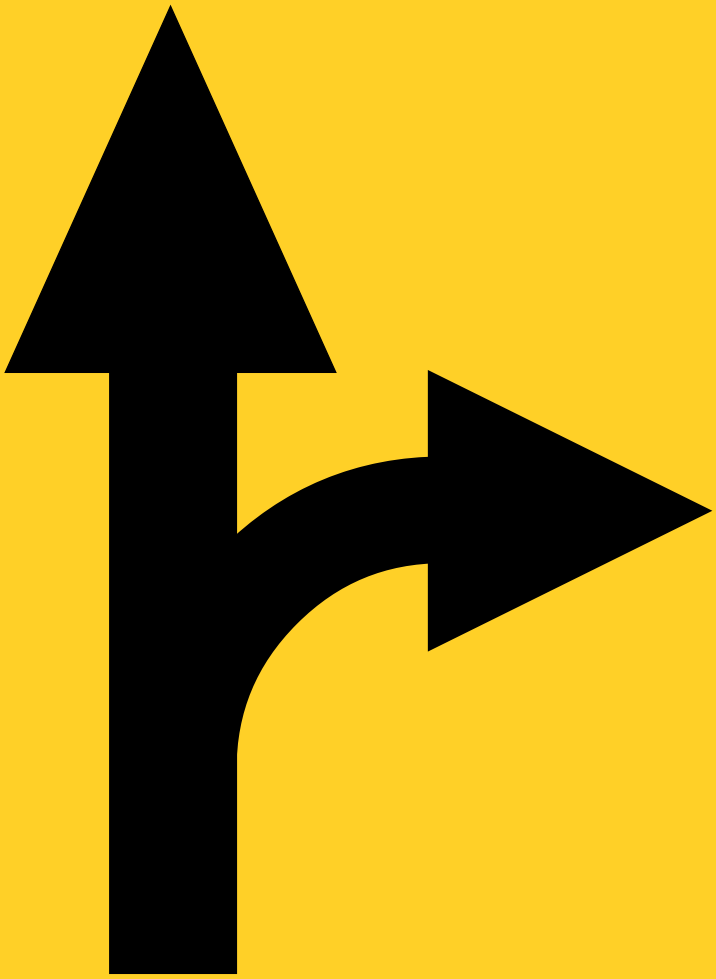
adjust agriculture practices to a changing climate

be good stewards of the environment and natural resources

make our agricultural enterprises profitable

make our families and communities strong

improve foods and processing for better health and safety



How can we meet the needs of diverse stakeholder groups?

Prepared by the
National Association of State Universities and Land Grant Colleges (NASULGC)
Experiment Station Committee on Organization and Policy (ESCOP)

DRAWING THE ROADMAP

Our rapidly evolving world of science and agriculture calls for a new approach in defining the needs and setting the priorities for research and education at both regional and national levels. To that end, the Experiment Station Committee on Organization and Policy (ESCOP) has formulated "A Science Roadmap for Agriculture[1]." The Roadmap sets forth seven challenges, each with under-girding goals on which the agricultural science research community must focus. These challenges relate to developing new products and markets, climate change, the environment and natural resources, profitability and competitiveness, families and communities, and food safety and health. Meeting these challenges and achieving the Roadmap's goals will result in increased success for the U.S. food and agriculture system, and for increased stakeholder and consumer satisfaction.

The Experiment Station Committee on Organization and Policy (ESCOP) developed its Roadmap with support from a task force of nationally recognized scholars that charted the major directions of agricultural science over the next 10 to 20 years. The task force assessed the scientific feasibility of meeting the needs of diverse groups of stakeholders ranging from the food production and processing sectors to consumers and the general public. This effort included prioritizing stakeholder needs; determining the scientific feasibility of solving the most important needs with current scientific methods and tools; and predicting the positive impacts of successful research outcomes. The resulting "Science Roadmap for Agriculture" will assist decision-makers and advocates for the research and education system, as they mobilize and plan the allocation of resources for future program areas.

THE CHALLENGES

New Products and Markets

Challenge 1. *Develop new and more competitive crop products and new uses for diverse crops and novel plant species.* Our science must focus on improving the quantity and quality of crop biomass and the efficiency of agriculture production; conceiving technologies that improve the processing efficiency of bioproducts such as biofuels; developing new products, uses, and markets; and supporting the development of marketing infrastructure for bioproducts.

Challenge 2. *Develop new products and new uses for animals.* Our science must focus on improving existing technologies and developing new ones to improve production efficiency; improving the nutritional value of meats and the value of other animal products for producers and consumers; developing innovative technologies to soften the impact of animal agriculture on the environment; and developing new and enhanced technologies to improve the welfare of animals processed for food.

Climate Change

Challenge 3. *Reduce the risks of local and global climatic change on food, fiber, and fuel production.* Our science must focus on slowing the rate of global climate change by storing more carbon and nitrogen in soil, plants, and plant products; minimizing the effects of climate change on crop and livestock production; integrating weather forecasting, market structure, and crop and livestock management systems to optimize production of food, fiber, and fuel; and developing comprehensive models to assess the social and economic impacts, risks, and opportunities for agriculture of global climate change and extreme weather.

The Environment and Natural Resources

Challenge 4. *Provide the information and knowledge needed to further improve environmental stewardship.* Our science must focus on developing better methods to protect the environment – both on and beyond the farm – with cropping systems that engage agroforestry, phytoremediation, and site-specific management; decreasing our dependence on chemicals that harm people and the environment by adopting effective strategies to manage crops, weeds, pests, and pathogens; finding alternative uses for industrial and agricultural wastes; and developing economic models and incentives that ensure environmental stewardship is encouraged.

[1] *Prepared by the National Association of State Universities and Land-Grant Colleges (NASULGC) Experiment Station Committee on Organization and Policy (ESCOP). November 2001. The roadmap can be found on-line at http://www.nasulgc.org/comm_food.htm*

Profitability and Competitiveness

Challenge 5. *Improve the economic return to the producer.* Our science must focus on designing decision-support systems for farms that employ risk-based management, giving full consideration to small-, medium-, and large-scale enterprises; developing sustainable production systems that yield profits and protect the environment by integrating crop and livestock production; improving our understanding of how local, regional, national, and global economies affect the economic return of U.S. producers; and improving strategies for community-supported food production systems.

Families and Communities

Challenge 6. *Strengthen our families and communities.* Our science must focus on learning how to harness leadership to help rural communities solve problems; finding ways to stimulate entrepreneurship and business development in rural communities, along with finding new forms of economic activity built around regional trade associations, rural cooperatives, and local production networks; formulating strategies for building coalitions among environmental, labor, and community development groups to facilitate democratic social change that ensures families have access to food, healthcare, education, social and human services; and finding strategies that enhance the well being of families and individuals.

Food Safety and Human Health

Challenge 7. *Ensure food safety and health through the entire food-production chain.* Our science must focus on eliminating food-borne illnesses; improving the nutritional value of foods; developing technologies to create health-promoting foods; and fashioning better methods to educate individuals in making informed food choices. The potential threats to our food system from terrorist activities are real and both our animal and plant systems are vulnerable. Science must play a role in both protecting our food system from intentional contaminations as well as develop appropriate responses to minimize the impacts on the food-production chain.

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Increased federal investment in the base programs of the Land Grant University partnership is essential.

A COMMITMENT TO THE FUTURE[1]

To navigate this Science Roadmap, and ensure that the food and agriculture system meets future needs, the national agricultural research system will need to harness significant new resources: nearly 5,200 additional Scientist-Years[3] (see Figure 1) and a total of nearly $6 billion in new funding will be needed to ensure that the existing U. S. food and agriculture system is sustained and expanded to meet future stakeholder and consumer needs.

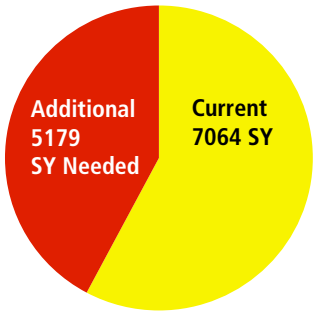
Needed Scientists

Currently there are some 7,064 Scientist-Years located primarily in the land grant universities that sustain the current U.S. food and agricultural system. Critical personnel needs for fulfilling the seven challenges were identified in molecular biology, nutrition and metabolism, engineering, economics, and genetics and breeding. New areas of expertise needed include bioethics, biosystems modeling, logistics and transportation technology, animal behavior, business management, and biomedicine. These needs totaled 5,179 SYs.

Needed Funding

At least $2.1 billion will be needed to support these new scientists. Although these funds would be derived from a variety of sources, a large portion of these resources must come via increased federal investment in base programs of the Land Grant University system.

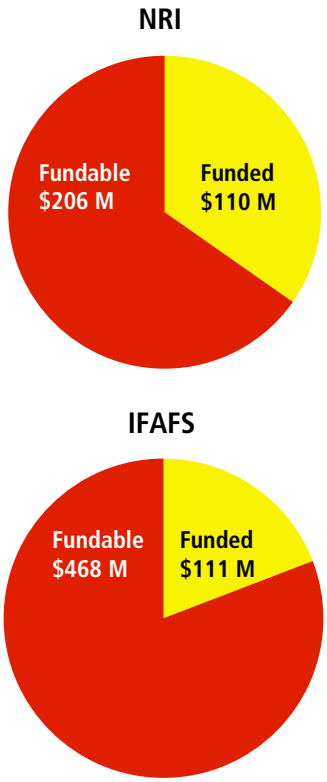
Figure 1. Estimate of Scientist Resources



[2] *This summary, supporting data and analyses can be found at www.escop.msstate.edu/draftdoc.htm under "A Science Roadmap for Agriculture"*

[3] *A Scientist-Year (SY) is a full time person working for one year*

Figure 2. Critical Resource Needs in USDA Competitive Grant Programs. Current status of USDA competitive grants program needs. Total of all high quality proposals funded and those that could be supported if additional resources were available.

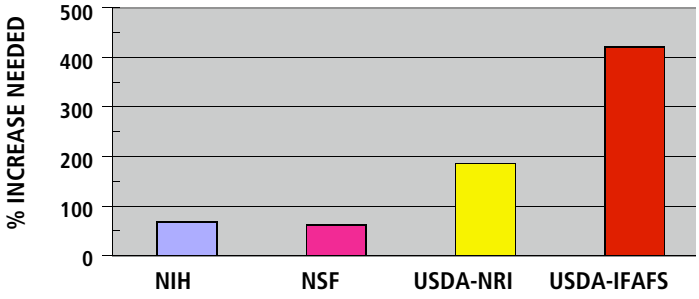


Additional analysis of current funding through competitive grants programs was conducted to see if additional authorities were needed, or if existing programs were simply under funded, *vis-à-vis* the seven challenges of the Science Roadmap. Our analysis revealed that for NIH (non-clinical), NSF, and USDA competitive grant programs there is a critical shortfall of federal investment in high priority research needs (Figures 2 and 3). Even though these programs support some $4.5 billion in competitive research the scientific community currently submits more than $3.5 billion in additional high quality research proposals that would have been supported if funds were available. Moreover within UDSA programs, these shortages are particularly critical. The National Research Initiative (NRI) has the scientific quality capacity to warrant an increase from $110 million to $316 million (a 187% increase). Similarly, The Initiative for Future Agriculture and Food Systems (IFAFS) should increase from $111 million to $579 million (a 421% increase).

Similar data were not available for the Environmental Protection Agency and Department of Energy competitive grant programs. However, it is certain that these agencies also lack resources to support high quality science related to food, agriculture and the environment.

If there is to be a significant increase in the scientific capacity to address the Roadmap's seven challenges, there must be a concomitant and balanced increase in the funds available to support high priority, relevant food and agricultural research. Fundamental to maintaining this balanced portfolio is the need to provide increased base funding to the Land Grant colleges of agriculture.

Figure 3. Comparison of Critical Resource Needs of Several Competitive Grants Programs. Increases (%) in resources required to fund all high quality and meritorious proposals currently submitted.



GETTING RESULTS OUT OF THE LAB

To assure that the fruits of these research investments are realized there will be a need for concomitant investments in technology transfer and adult education. The State Agricultural Experiment Station System's traditional partner in making science accessible to the public is the Cooperative Extension Service. Experience has shown that equal portions of investments are a successful formula for the food and agriculture system.

Task Force Members: Colin Kaltenbach (AZ), Chair, David R. MacKenzie (ED/NE), Vice Chair, R. James Cook (WA), Sam Donald (ED/1890), Terry Etherton (PA), Michael Harrington (ED/W), Bob Heil (ED/W), Tom Helms (ED/S), Donna Hess (SD), Kyle Hoagland (NE), Linda Kinkel (MN), Carol Lammi-Keefe (CT), Brian Larkins (AZ), Daryl Lund (ED/NC), Thomas A. Lyson (NY), James Marsden (KS), John E. Mullet (TX), Sunil K. Pancholy (FL), Joe M. Regenstein (NY), Larry Reynolds (ND), Stephen Rieling (ME), Michael Thompson (IA), Richard D. Vierstra (WI), Robert P. Wilson (MS)

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Overview developed by ESCOP Planning Committee, ESCOP Budget and Legislative Committee, Michael Harrington (ED-W), Tom Helms (ED-S), Richard Jones (FL), Daryl Lund (ED-NC), David MacKenzie (ED-NE), Terry Nipp (AESOP), Jay Ritchie (MS), Eric Young (NC), Tamela Delorme (MD), Miles Hakoda (HI), Ron Daines (UT) and Jody Moore (HI).