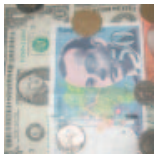
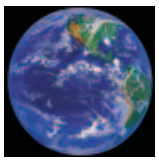
A SCIENCE ROADMAP FOR AGRICULTURE

UPDATE 2006





Prepared by the
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Experiment Station Committee on Organization and Policy (ESCOP)

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INTRODUCTION

In November 2001, the Experiment Station Section of NASULGC published *A Science Roadmap for Agriculture* (http://www.cals.ncsu.edu:8050/escop/roadmap2.pdf). This road mapping effort framed seven challenge statements that describe research priorities over the next 10-20 years; however, there was no consideration given at that time to relative importance or ranking. Although these challenges still exist, many changes have occurred in the past five years that may have affected their relative significance. In addition, the need for additional research capacity to meet these challenges remains large, but the most limiting discipline areas may have changed.

This update prioritizes the original seven challenge areas presented in the Roadmap, provides minor modifications to some challenge areas, and prioritizes the supporting objectives. Also provided is updated information on the faculty expertise needed to meet the Roadmap's challenge areas as well as perceived drivers of priorities within experiment stations.

The METHODOLOGY: In November 2004, an on-line survey was constructed to determine the relative importance of the seven original Roadmap challenge areas as well as assess new challenges in order to provide the experiment station system a basis for moving forward with or altering these priorities. The questionnaire dealt with three major areas. Section I focused on the level of priority for each of the seven challenges and their respective objectives and on the relative allocation of resources over the next 5 years. This section also asked for new challenges and objectives. Section II addressed disciplines where the current capacity has most restricted research progress. Finally, Section III asked which institutions or groups were currently the most or least influential in prioritizing experiment station efforts in the Fall of 2004 and then how that might change for 2010.

SURVEY SAMPLE: A sample was drawn through the emailing lists of members of research, extension, and academic program directors at land-grant universities across the US. Of the 300 potential respondents, 95 completed the on-line survey representing a 31.7% response rate. The average age of the respondent was 54 years. The sample was primarily male (89.2%). Almost half of the sample had an affiliation with research (48.4%) with the remaining respondents affiliated with extension (29.5%) or academic programs (22.1%). The average years of affiliation was 19.1 years. A detailed report on the survey results may be obtained at (http://www.cals.ncsu.edu:8050/escop/Roadmap%20Survey%20Report.pdf).

Priority of Importance and Allocation of Resources for the Major Challenge Areas

Table 1 reports the relative priority based on importance and allocation of resources for each of the major seven original challenge areas. Paired t-tests were performed to note significant differences among the challenges in both priority and resource allocation. Challenges with the same color bar are not significantly different ($p<.01$) for both importance and resource allocation.

Table 1. Rank Order of Priority and Allocation Means of the Major Challenges

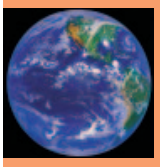
Original Roadmap Challenge	Priority Mean		Allocation Mean
We can ensure improved food safety & health through agricultural & food systems	4.5		4.2
We can provide the information & knowledge needed to further improve environmental stewardship	4.4		4.1
We can improve economic return to agricultural producers	4.2		3.9
We can strengthen our communities & families	4.1		3.9
We can develop new & more competitive crop products & new uses for diverse crops & novel plant species	4.0		3.7
We can lessen risks of local & global climatic change on food, fiber, and fuel production	3.7		3.3
We can develop new products & new uses for animals	3.4		3.2

The challenges related to food safety & health and to environmental stewardship received the highest priority for both need and funding.

In both priority for importance and level of funding, the challenges took on a similar ranking. The challenges related to food safety & health and to environmental stewardship received the highest priority for both need and funding. Challenges related to economic return, families & communities, and new crop products followed these. The survey also indicated the need to add certain components to some challenges, including: production aspects to the new crop products and new animal products challenges; sustainable management, environmental stewardship, ecological and sociological components to the environmental stewardship challenge; an international consumer component to the economic return challenge; and securing agriculture from intentional and unintentional attacks to the food safety & health challenge.

The need for these new dimensions to be included suggested a need to revise the challenge areas and objectives, in addition to prioritizing them. Table 2 shows the updated challenges and objectives revised and prioritized based on the survey results.

Table 2. Updated Challenge Areas and Objectives

Rank	Challenges / Objectives
 1	**We can ensure food safety and health through agricultural and food systems.** • Eliminate food borne illnesses. • Develop technologies to improve the nutritional value of food and create health-promoting foods. • Understand the behavioral dimensions (personal, consumption, and policy) that influence personal and family dietary and health decision-making to reduce public health issues, such as obesity. • Develop policy and strategies to address agro-security, bioterrorism, and invasive species to protect producers and consumers.
 2	**We can provide the information and knowledge needed to further improve environmental stewardship.** • Develop better methods to protect the environment both on and beyond the farm from any negative impacts of agriculture through optimum use of cropping systems including agroforestry, phytoremediation, and site-specific management. • Find alternative uses for the wastes generated by agriculture. • Develop more environmentally friendly crop and livestock production systems that utilize sustainable weed, insect, and pathogen management strategies, along with feeding strategies that promote environmental stewardship. • Develop better strategies, ecological and socioeconomic systems models and policy analysis to address soil, water, air and energy conservation, biodiversity, ecological services, recycling, and land use policies.
 3	**We can improve the economic return to agricultural producers.** • Develop sustainable production systems that are profitable and protective of the environment, including finding ways to optimize the integration of crop and livestock production systems. • Develop strategies for integration of local, regional, national, and global food systems to maximize the benefits to both U.S. agriculture producers and consumers throughout the world. • Design improved decision support systems for risk-based management of farms, ranches, and forests/ woodlots. • Find ways to improve on strategies for community-supported food and fiber production systems.
 4	**We can strengthen our communities and families.** • Stimulate entrepreneurship and business development in rural communities and new forms of economic activity built around regional trade associations, rural cooperatives, and local production networks. • Build coalitions among environmental, labor, and community development groups to facilitate democratic social change to ensure that families have access to food, health care, education, and welfare services • Enhance the problem solving capacities of rural communities through leadership development • Determine strategies to enhance the well-being of families and individuals.
 5	**We can develop new and more competitive crop production practices and products and new uses for diverse crops and novel plant species.** • Conceive new markets for new plant products, and new uses for those crops. • Develop technologies to improve processing efficiency of crop bioproducts. • Support the development of marketing infrastructure for crop bioproducts. • Improve crop biomass quantities, qualities and agricultural production efficiencies.
 6	**We can lessen the risks of local and global climatic change on food, fiber, and fuel production.** • Diminish the rate of long-term global climatic change by increasing the storage of carbon and nitrogen in soil, plants, and plant products. • Create broad-based, comprehensive models to assess the socioeconomic impacts, risks, and opportunities associated with global climate change and extreme climate events on agriculture and natural resources. • Integrate long-term weather forecasting, market infrastructures, and cropping and livestock management systems to rapidly optimize domestic food, fiber, and fuel production in response to global climatic changes. • Minimize the effects of long-term global climatic changes on production of crops, livestock, forests, and other natural resource systems.
 7	**We can develop new and more competitive animal production practices and products and new uses for animals.** • Develop innovative technologies for reducing the impact of animal agriculture on the environment. • Enhance the value of food and other animal products for both the producer and consumer by using conventional and newly developed technologies that are socially and ethically acceptable. • Develop new and enhanced technologies for the improved efficiency and welfare of animals that are processed for food. • Improve conventional technologies as well as developing new technologies to improve the efficiency of animal production.

Discipline Capacity Needed by the Major Challenge Areas

Table 3 reports the percentages of those respondents who think additional capacity in these specific disciplines is needed to adequately address the challenge areas. The disciplines shown were all identified by 30% or more of the respondents as having limiting capacity.

Table 3. Percent Respondents who Identified a Need for Additional Discipline Capacity for each Challenge Area

	CHALLENGES						
DISCIPLINES	Food Safety & Health	Environmental Stewardship	Economic Return	Families & Communities	New Crop Products	Climate Change	New Animal Products
Economics		32%	47%	42%	30%		
Nutrition- Metabolism	46%						
Ecology		46%					
Information-Communication	37%	41%	31%	45%			
Sociology				44%			
Education	34%	34%		43%			
Molecular biology					42%		35%
Hydrology		40%					
Meteorology-Climatology						36%	
Biochemistry-Biophysics					35%		
Genetics (breeding)					34%		33%
Bacteriology	34%						
Engineering		34%					
Management			33%				
Statistics-Econometrics-Biometrics			31%				
Cellular biology						31%	
Biology (whole systems)		30%					

Table 4. Ranking of Institutions and Groups in 2004 and Projected Changes in 2010

Institutions or Groups	2004 Rank	Projected 2010 Rank (change)
Commodity groups	1	5 (-4)
Farmers & rancher groups	2	7 (-5)
State Legislature	3	1 (+2)
USDA	4	10 (-6)
Agribusinesses	5	3 (+2)
Congress	6	6 (0)
Environmental groups	7	2 (+5)
Public trade policy	8	8 (0)
Food safety groups	9	4 (+5)
Urban consumers	10	9 (+1)
Rural development groups	11	11 (0)
University Presidents	12	14 (-2)
Middle class consumers	13	12 (+1)
Food Retailers	14	13 (+1)
Poorer consumers	15	15 (0)

There is a relatively high need for increased capacity in the fields of Economics, Information-Communication, and Education, each limiting three or four challenges. For the highest priority challenge, food safety & health, the disciplines of Nutrition, Information-Communication, Education, and Bacteriology are seen as the greatest needs. The second highest priority challenge, environmental stewardship, has the greatest diversity of needs across seven disciplines. The fields of Ecology, Information Technology, Hydrology, Engineering, Education, Economics, and Biology all have relatively high need. It is also interesting to note that the two lowest priority challenges also have fewer disciplines where capacity is limiting success.

External Groups' Influence in Prioritizing Experiment Station Research Activities

Table 4 shows the rank ordering of the influence of various institutions and groups on research activities in 2004 and how its rank is projected to change by 2010. Groups gaining the most influence were Food Safety and Environmental. Institutions and groups losing the most influence were USDA, Farmers & Ranchers, and Commodities. All other groups either remained the same rank or changed by only 1 or 2 positions. State Legislatures, Environmental Groups and Agribusinesses were predicted to be the top 3 most influential groups in 2010.