

2009 Science Roadmap Preliminary Report



Science Roadmap History



- **FIRST SCIENCE ROADMAP COMPLETED IN 1998-99 AND UPDATED IN 2006 AND 2008**
- **S & T COMMITTEE RECEIVED APPROVAL FROM ESCOP IN MARCH TO PROCEED WITH PROPOSAL TO UTILIZE DELPHI PROCESS**
- **DR. TRAVIS PARK (CORNELL) PREPARED FORMAL PROPOSAL**
- **ESCOP EXEC COMMITTEE APPROVED EXPENDITURE OF UP TO \$5,000 TO SUPPORT CORNELL'S EFFORTS**

Science Roadmap History



- **STEVE PUEPPKE SENT LETTER TO DEANS & DIRECTORS OF RESEARCH, EXTENSION & ACADEMIC PROGRAMS REQUESTING NOMINATIONS**
- **457 INDIVIDUALS WERE NOMINATED FROM BROAD ARRAY OF DISCIPLINES**
- **FIRST ROUND WAS INITIATED ON JUNE 10 & 264 (57.8%) INDIVIDUALS PARTICIPATED**
- **260 (56.9%), 249 (54.5%) AND 246 (53.8%) PARTICIPANTS IN 2ND, 3RD, & 4TH ROUNDS**

Science Roadmap Methodology



- **PARTICIPANTS ASKED TO COMPLETE 4 ROUNDS**
- **QUESTIONS IN ROUND 1 FROM PREVIOUS VERSIONS**
- **IN FIRST 3 ROUNDS, PARTICIPANTS RESPONDED TO PROPOSED RESEARCH PRIORITIES IN RATING SCALE FORMAT OF (5) STRONGLY AGREE TO (1) STRONGLY DISAGREE**

Science Roadmap

Methodology



- **QUESTIONS WITH MEAN RESPONSE > 3.0 & STD. DEV. < 1.0 ACCEPTED & HELD FOR 4TH ROUND**
- **QUESTIONS WITH MEAN RESPONSE < 3.0 DROPPED**
- **PARTICIPANTS HAD OPPORTUNITY TO REWORD OR ADD PRIORITIES**

Science Roadmap Methodology



- **IN 4TH ROUND, PARTICIPANTS ASKED (YES/NO) WHETHER TO INCLUDE PRIORITIES IN NEW ROADMAP**
- **RESEARCH PRIORITIES WITH > 60% CONSENSUS WERE RETAINED**

Science Roadmap

Respondent Demographics

Discipline (*n* = 246)



	<u><i>N</i></u>	<u><i>%</i></u>
ANIMAL SCIENCE	31	12.6
PLANT SCIENCE	27	10.9
AGRIC. ECONOMICS	24	9.8
AGRONOMY & SOIL SCI.	24	9.8
NATURAL RES. & ENVIR. SCI.	18	7.3
FOOD SCI. & NUTRITION	15	6.1
AGRIC. EXTENSION	14	5.7
FAMILY & CONSUMER SCI.	11	4.5
MICROBIOLOGY & BIOCHEM.	11	4.5
ENTOMOLOGY	10	4.1
OTHER/NO RESPONSE	61	24.7

Science Roadmap

Respondent Demographics

Primary Responsibility (*n* = 246)



	<u><i>N</i></u>	<u><i>%</i></u>
ADMINISTRATION	137	55.7
RESEARCH	47	19.1
TEACHING	21	8.6
EXTENSION	5	2.0
OTHER	19	7.7
NO RESPONSE	17	6.9

Science Roadmap

Respondent Demographics

Academic Title ($n = 246$)



	<u><i>N</i></u>	<u><i>%</i></u>
PROVOST	1	0.4
DEAN	17	6.9
DIRECTOR	46	18.7
CHAIR	26	10.6
FACULTY	60	24.4
OTHER	79	32.1
NO RESPONSE	17	6.9

Science Roadmap

Respondent Demographics

Land Grant Institution ($n = 246$)



	<u><i>N</i></u>	<u><i>%</i></u>
1862	196	79.7
1890	28	11.4
1994	5	2.0
NO RESPONSE	17	6.9

Science Roadmap

Respondent Demographics

Geographic Region (*n* = 246)



	<u><i>N</i></u>	<u><i>%</i></u>
SOUTH	79	32.1
WEST	74	30.1
NORTHEAST	45	18.3
CENTRAL	31	12.6
NO RESPONSE	17	6.9

Science Roadmap

Results General



- **OVER 100 “RESEARCH PRIORITIES” WERE SUGGESTED FROM RESPONDENTS DURING 1ST 3 ROUNDS**
- **58 NEW OR REVISED RESEARCH PRIORITIES GARNERED 60% CONSENSUS**
- **OF 28 RESEARCH OBJECTIVES PROPOSED IN 2006, 15 WERE RETAINED**

Science Roadmap

Results

Themes



79.1% Develop renewable energy & biofuel systems

78.2% Manage agricultural water usage

75.0% Develop agricultural systems for a changing global climate

74.4% Develop new plant products, uses, & crop production systems

73.0% Enhance production of safe & abundant food

Science Roadmap

Results Themes



- 72.1% Develop new animal production practices, products & uses
- 71.8% Improve the economic return to agric. Producers
- 71.8% Maintain a sustainable environment
- 71.4% Enhance the uses of biotechnology
- 70.6% Increase public awareness of food, fiber & fuel production

Science Roadmap

Results

Themes



70.1% Improve the productivity of organic & sustainable agriculture

65.4% Develop human capital & capacity in agriculture

64.8% Sustain individual, family, & community resilience

Science Roadmap

Results

“Develop Renewable Energy & Biofuel Systems”



- Develop & implement use of alternative energy sources for agric. purposes incl., but not limited to, wind energy, biofuel, methane production, & small-scale hydroelectric, geothermal, solar, & tidal energy
- Develop agricultural systems that utilize inputs efficiently & create fewer waste products, esp. by converting “traditional” waste products into biomass fuels & by developing secondary uses & markets for current agricultural waste products
- Assess environmental, sociological, & economic impacts from production of biofuels & co-products at local & regional levels to ensure sustainability

Science Roadmap

Results

“Develop Renewable Energy & Biofuel Systems”



- Develop technologies to improve production-processing efficiency of regionally appropriate biomass into by-products (including biofuels)
- Expand biofuel research with respect to non-arable land, algae, pest issues that limit biofuel crop yields, & emissions of alternative fuels
- Investigate opportunity costs of biofuel production from food crops, agricultural waste, & other sources

Science Roadmap

Results

“Manage Agricultural Water Usage”



- Create new &/or modify existing profitable agricultural & natural resource systems that conserve use of & recycle water
- Develop technologies to improve production efficiencies of use distribution & quality of water
- Research effects of global climate change w/ regard to water usage for agricultural production & processing methods
- Evaluate & enhance water recharge value of agricultural & forestry production areas
- Examine the policy & legal issues relating to water use, distribution, & quality

Science Roadmap

Results

“Develop Agricultural Systems for a Changing Global Climate”



- Explore relationships between global climate change, climate variability, invasive species, native species, & crop & livestock responses
- Develop biotechnologies that enable enhanced production of food, adaption of animal & plant food systems to face global climate change, utilization of integrated pest management, & negotiation of socioeconomic challenges to the food system
- Explore production systems that enhance economic viability, improve efficiency, and/or reduce emissions of methane or other greenhouse gasses

Science Roadmap

Results

“Develop Agricultural Systems for a Changing Global Climate”



- Research breeding programs, local practices, & pest & disease management systems that help animal & plant agriculturalists adapt to global climate change
- Analyze impacts of carbon policy on agriculture & the food system & develop strategies to help producers & processors in agriculture, natural resources, & food industries benefit from carbon trading & ecosystem service markets

Science Roadmap Results

“Develop New Plant Products, Uses, & Crop Production Systems”



- Improve crop productivity w/ limited inputs of water & nutrients through enhanced efficiencies, plant biology, innovative management systems
- Develop strategies to enhance energy efficiency in agricultural production systems
- Develop technologies to improve processing efficiency of crop bioproducts
- Investigate interdependency of multiple land use decisions, incl. food, fiber, biofuels, & ecosystem services

Science Roadmap Results

“Develop New Plant Products, Uses, & Crop Production Systems”



- Assess benefits & cost of decreasing the dependency on synthetic, petroleum-based chemicals in the agricultural industry
- Conceive new markets for new plant products & new uses for those crops

Science Roadmap

Results

“Enhance Production of Safe & Abundant Food”



- Develop methods to prevent, detect, monitor, control, & respond to potential food safety hazards in production & processing of food crops & livestock grown under all production systems
- Develop food systems & technologies that improve nutritional values, diversity, & health benefits of food
- Develop strategies to detect & eliminate food-borne illnesses, bioterrorism agents, invasive species, & pathogens affecting plants, humans, & animals
- Decrease dependence on chemicals with harmful effects to people & the environment by optimizing effective crop, weed, pest, & pathogen management strategies

Science Roadmap

Results

“Enhance Production of Safe & Abundant Food”



- Identify plant compounds that prevent human diseases (ex. cancer), & develop & encourage methods to enhance or introduce these plants & compounds into the food system
- Establish plant & animal breeding programs that balance & optimize nutritional value to complement production characteristics
- Examine impact of food supply changes & food transportation relative to preservation practices, safety, & energy efficiency at local & regional scales

Science Roadmap Results

“Develop New Animal Production Practices, Products, & Uses”



- Promote animal health & well-being in all production systems through enhanced nutrition, efficiency, utilization of non-traditional feeds, genetics, & disease reduction
- Develop new & enhanced technologies for the improved efficiency & welfare of animals that are processed for food

Science Roadmap

Results

“Improve the Economic Return to Agric. Producers”



- Develop sustainable production systems that are profitable, productive, & include integration of crop & livestock production systems
- Provide evidence-based recommendations for alternatives to the current price support system that encourage agricultural production
- Explore use of alternative economic models for stimulating farming through use of farmer supports besides price supports
- Support development of marketing infrastructure for crop bioproducts

Science Roadmap Results

“Maintain a Sustainable Environment”



- Develop efficient & sustainable farming & food processing systems that rely on renewable energy systems & decrease the carbon footprint, particularly those systems that convert agricultural wastes into biomass fuels that further improve the efficiency of production
- Develop environmentally friendly crop & livestock production systems that utilize sustainable feeding & pest management strategies
- Develop methods to protect the environment both on & beyond the farm from any negative impacts of agriculture through optimum use of cropping systems including agroforestry, phytoremediation, site-specific management, multicrop polyfarms, & perennial crops

Science Roadmap Results

“Maintain a Sustainable Environment”



- Develop innovative technologies for reducing impact of animal agriculture on the environment
- Develop strategies, ecological & socioeconomic system models, & policy analyses to address conservation, biodiversity, ecological services, recycling, & land use policies
- Develop agricultural systems that create fewer waste products
- Create clear understanding of the principles & facets underlying the concept of sustainability as it relates to urban & rural agriculture

Science Roadmap

Results

“Enhance the Uses of Biotechnology”



- Develop & assess impact of nanotechnology for pathogen & pest identification, detection, & eradication, w/ the overall goal of improving human health
- Assess safety & effectiveness of genetically-engineered organisms on human & environmental health
- Assess safety of nanotechnologies & nanomaterials on human & environmental health
- Integrate nanotechnologies into agricultural & food production practices

Science Roadmap

Results

“Increase Public Awareness of Food, Fiber & Fuel Production”



- Increase public awareness of agricultural production & processing – incl. traditional & organic methods, & the societal & environmental benefits & consequences of agriculture
- Discover effective educational methods to help individuals make informed & healthy food choices
- Understand behavioral & educational dimensions (personal, consumption, & policy) that influence personal & family dietary & health decision-making to reduce public health issues; e.g., obesity
- Conduct research on the relationship between food consumption, portion size, exercise, & obesity, & build extension programs that lead to behavior change regarding eating habits

Science Roadmap

Results

“Improve the Productivity of Organic & Sustainable Agriculture”



- Research feasibility & sustainability of organic & non-organic systems, esp. as related to population growth & future food needs
- Develop improved pest, weed, & disease control and management strategies for organic production
- Examine optimal conservation, environmental, and production outcomes—incl. sustainability, nutrition content, profitability, & energy efficiency—for organically produced agricultural products

Science Roadmap

Results

“Develop Human Capital & Capacity in Agriculture”



- Develop farming systems that increase economic viability, social acceptability, & environmental quality of all participants in the agricultural system
- Identify & assess avenues by which beginning farmers can access necessary education, land, &/or capital to overcome barriers
- Conduct research on retention of existing & development of new human capital in agriculture
- Develop educational programs that build food production capacity & are focused on assistance to ethnic, immigrant, underserved, urban, &/or economically disadvantaged populations interested in entering food production

Science Roadmap

Results

“Sustain Individual, Family, & Community Resilience”



- Determine strategies to enhance well-being of families & individuals, incl. those strategies that ensure access to high-quality food, health care, education, social services, & a clean, healthy environment
- Explore ways to introduce & measure impact of rural & urban agricultural education, natural resources education, & food literacy education in all high schools across the nation
- Increase assistance to 4-H programs, FFA, & private sector youth programs that integrate environmental & agricultural topics into their curriculum

Science Roadmap

Results

“Sustain Individual, Family, & Community Resilience”



- Examine economic impact of entrepreneurship & business development on rural communities, & develop new forms of economic activity built around regional trade associations, rural cooperatives, & local production networks
- Assess strategies for building coalitions among agricultural, environmental, academic, governmental, labor, & community development groups to facilitate scientifically sound social change in rural communities
- Investigate means of enhancing problem-solving capacities of rural communities through developing leadership, implementing action plans which strengthen family & community resilience, & negotiating urban-rural interface issues

Science Roadmap

Results

“Sustain Individual, Family, & Community Resilience”



- Develop strategies for integration of local, regional, national, & global food systems to maximize benefits to both U.S. & global agriculture, particularly in underserved & immigrant populations

Science Roadmap

Next Steps

Review of Survey Results



- **Are there too many themes?**
- **Which can be combined or integrated?**
- **Can the themes be rolled up into true Grand Challenges?**
- **Have any critical research priorities been overlooked?**

Science Roadmap

Next Steps

Development of the Roadmap



Once we have a consensus on the grand challenges and priorities, what are the next steps to develop a roadmap and then how to operationalize the roadmap?

Science Roadmap

Next Steps

Development of the Roadmap



What is the purpose?

- Increase resources
- Increase visibility
- Provide direction to institutions
- Provide input to funding agencies

Science Roadmap

Next Steps

Development of the Roadmap



Who are the audiences?

- Legislators
- Funding agencies
- Research administrators

What should the final product look like?

Science Roadmap

Next Steps

Development of the Roadmap



What are the key elements?

- Grand challenges
- Research priorities
- Potential impacts
- Current gaps in knowledge & resources
- Targets of opportunity
- Future strategies
- Metrics to measure progress

Science Roadmap

Next Steps

Development of the Roadmap



- **What is the process for moving forward?**
- **Who should be the participants in the process?**
 - Science & Technology Committee
 - PBD Emerging Issues Task Force
 - Key experts
 - Research ED's
 - Stakeholders

Science Roadmap

Next Steps

Development of the Roadmap



What is a realistic timeframe?

What approval process should be used?