



CSREES Administrator's Report to the Partnership

Fall 2008

The mission of the Cooperative State Research, Education, and Extension Service (CSREES) is to advance knowledge for agriculture, the environment, human health and well-being, and communities.



The Next Big Thing

What does the future hold for agriculture science and education?

In this climate of change, it's more important than ever to look ahead. CSREES Administrator Dr. Colien Hefferan asked the Agency's national program leaders (NPL) to identify the next big ideas in agricultural science and education. Specifically, she asked the NPLs to define what research, education, and extension priorities they saw as critical for the next 5 years to serve the needs of the food and agricultural system, natural resources and the environment, human health and nutrition, and communities well into the next decades. *see pg. 4*

LOOKING AHEAD TO AGRICULTURE IN THE 21ST CENTURY

Change is the byword of the season in America. Although it is the currency of politics, we appear to have a love/hate relationship with change. We love the concept, but seldom much like the details. And, while we certainly like change in others, few welcome it for ourselves. We often think of change as a solution, rather than as a process.

The change we have sought and won for the concept of federal support for agricultural research, education, and extension is to establish the National Institute of Food and Agriculture. We now face a truly challenging question: How do we change the whole, when the parts do not want to change, elect not to see value in change, and do not feel they have to change much anyway? Without a long-term view that envisions the creation of the National Institute as a process leading us to clarify the importance of agricultural science, elevate its stature, and ultimately grow support for research, education, and extension, a critical opportunity will be lost. If the National Institute is to succeed, it must be more than the sum of its parts.

The Food, Conservation, and Energy Act of 2008 (FCEA), the Farm Bill, calls for the establishment of the National Institute of Food and Agriculture by October 1, 2009. At the same time, FCEA reauthorizes all the currently funded programs underlying extramural support for research, education, and extension, with only limited changes. In fact, where there are changes in currently funded authorities, those changes have been far from wholly embraced.

In addition, FCEA adds new program authorities supported through mandatory funds and others yet to be funded through the Congressional appropriations process. While this sustained and potential expansion of funding authorities may offer valuable new opportunities, it also risks further fragmentation and continued Balkanization of programs in an organization already plagued with too many moving parts. When funded entities and the specific interests they serve care more passionately and actively about parts—however small—than they do about the whole program, they stymie growth. Recognizing this very real, political fact of life has been essential to the success of advocates who have supported growth in the budget of the National Institutes of Health. The success of the National Institute of Food and Agriculture will depend on our collective understanding of and commitment to the idea that the agricultural knowledge system, including discovery, education, and engagement, across a broad range of issues, is our strength and our comparative advantage.

How do we move from a confederation of parts to a cohesive whole? First, we focus on the principles underlying the rationale, design, and implementation of the National Institute. We have worked with policy makers, beginning with Congress and the guidance they provided in the Farm Bill, then with Departmental officials, to synthesize and explicate the purposes and goals to which the National Institute will be directed. These include advancing knowledge for agriculture, assuring relevance through continuous stakeholder involvement, promoting science for the public interest and in the public sector, using protocols for funding decisions that promote the best quality science, providing accessibility to and assuring usefulness of science, and ensuring transparency in processes, resulting

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in enhancing the stature of agricultural science. These principles will drive the way the National Institute of Food and Agriculture is built, operates, and is promoted.

Second, we must identify the issues we need to address and the problems we can solve through extramural science and education. At CSREES, a critical step in planning for the transition to the National Institute of Food and Agriculture was to ask, "What are the next, big issues on the horizon where support for agricultural and related science and education can make a difference?" Some of the answers focus on new tools for science or teaching, others on opportunities for collaborations, and many on the integration, application, adoption and diffusion of knowledge "almost there" to solve problems in water use, new biofuels, nutrient absorption, trade barriers, and countless other challenges. The issues we will address and the problems we hope to solve are the key attributes of the National Institute that our constituents want and need to understand.

Finally, within the Agency, we are looking across programs for new ways to manage our efforts to address ongoing issues and new opportunities, and show results. We have asked specific questions such as, "How does the Specialty Crop Research Initiative influence the way we configure the Request for Applications for the Agriculture and Food Research Initiative (AFRI) opportunities?" We also have sought to better understand broad program interrelationships such as the role of formula-allocated funds, including those appropriated through the Hatch and Smith-Lever authorities, to the design of new competitive opportunities, such as the Beginning Farmers and Ranchers Program. In this discussion of management, it is essential that we define current and potential partnerships with organizations with whom we share missions, relationships with the communities who perform the work we fund, and ongoing guidance from those we hope will benefit from the investments the National Institute makes.

These are important and exciting times for agricultural research, education, and extension. We have been entrusted to build a new foundation from which to help solve some of the most important issues and opportunities facing our planet and its people—assuring adequate food, fiber, feed, fuel, and flowers in an environmentally stressed, economically linked, and health challenged world. By embracing this opportunity for change, I am confident that a cohesive, well-designed National Institute of Food and Agriculture, working in partnership with all of those who share its mission, will move us toward a sustainable and productive future.



Transformative Graduate Education in Natural Resources and Environment

It has been said that the real world has problems and opportunities, but universities have disciplines. The indictment in this oft-cited reference is clear: The ways in which universities have organized knowledge don't fully recognize the multi-faceted nature of a complex world with increasingly complex problems. Addressing complex problems requires the integration and synthesis of knowledge from different locations, and the capacity to analyze and think across borders.

Over the past two to three decades, graduate education in natural resources and environment has shifted from single-discipline-focused efforts to multi-disciplinary, interdisciplinary, and, ultimately, trans-disciplinary programs (Klein, J. T., 1990, p. 56, 65-66, 196)*. This shift has seen the development of programs that recognize the linkages between biophysical processes and human social, economic, and behavioral sciences.

Funding agencies, in particular the Cooperative State Research, Education, and Extension Service (CSREES), have supported this transition from discipline-focused programs to multi-disciplinary or trans-disciplinary educational programs through a host of competitive grant programs. CSREES supports this work through Higher Education grants (e.g., Multicultural Scholars Program and the Food and Agricultural Sciences National Needs Graduate and Postgraduate Fellowship Grants Program) and through topical issue-focused grant programs in natural resources (e.g., CSREES' NRI Invasive Species Program, Water and Watersheds Program, Air Quality Program, Ecosystems Program, and Integrated Water Quality Program). These efforts have succeeded in expanding graduate curricula to include coursework that spans biophysical, social, and behavioral sciences. However, it is not clear whether this approach has been sufficient in leading to a greater capacity for solving many of today's environmental issues.

Current challenges facing graduate programs in natural resources and the environment include serving an increasingly diverse student body – that learns differently and expects education to fit their model of learning, including extensive social networks using a variety of electronic media – institutional structures that do not support interdisciplinary programming, and an upcoming wave of retirements in all relevant sectors, including the professoriate. Opportunities include increased national interest and attention on issues related to the environment, as well as increased support for and recognition of interdisciplinary programming in higher education as a means to address the complex problems of the day.

It is apparent that we need a new transformative model for graduate education that goes beyond students being exposed

to multi-disciplinary knowledge from biophysical, social, and behavioral sciences to one that fully immerses students into the knowledge base, thinking process, and culture of these disparate disciplines. In essence, students must understand not only the questions asked by individuals from different disciplines, but also the rationale for asking those questions. In addition to a strong core discipline focus, future graduates will require the added perspective of working in cross-disciplinary (cross functional) teams to solve complex environmental issues from a variety of perspectives. Many institutions now prepare for this by exposing students nearing graduation to internships, capstone courses, or to case studies involving student teams comprised of several related disciplines. These students are asked to solve real world problems by synthesizing their collective knowledge in group settings that simulate actual job situations where issues are addressed under realistic deadlines from a variety of perspectives (disciplines). Often the final exam involves a face-to-face formal presentation made to the actual stakeholders (land owners, environmental groups, and/or resource stewards) where students are encouraged to defend their strategies and positions.

Too often, our vision of graduate school is restricted to discovery in the research phase of a project. We need to transform graduate education so that students are presented with opportunities to participate in the outreach component of a project – meeting and dealing with citizens affected by environmental or land use change issues. This transformation will lead to graduates who understand – and apply – social science, economic, and behavioral knowledge to key environmental issues. It will call on them to understand the biophysical processes at work as well as the human constraints to finding solutions.

Students completing graduate programs will need to meet the changing expectations of future employers who require skills in allocating and managing time, money, materials, space, and staff. Graduates will be expected to work on teams, teaching others and serving customers, particularly when dealing with people from culturally diverse backgrounds in the rapidly changing global environment. Employers will expect graduates to use technology to gather and process information but also understand social and organizational systems to meet organizational goals.

We have an opportunity to reinvigorate the tripartite mission of land-grant institutions with graduate education programs that combine strong training within a discipline with an appreciation for the types of problem solving approaches used by other disciplines. How can CSREES help to meet this challenge through its existing funding programs? First, we must engage the most innovative thinkers of transformative education to guide our program development. Second, we must clearly define expectations for the transformative edu-

cation process. These expectations should form the basis of evaluation criteria in grant programs. Finally, we must continue to understand and value the needs of students entering graduate programs in natural resources and environment and make them partners in this endeavor.

For more information, contact Mike O'Neill, national program leader in the Natural Resources and Environment Unit, at 202-205-5952 or at moneill@csrees.usda.gov.

*Klein, J. T., (1990). *Interdisciplinarity: History, theory and practice*. Detroit: Wayne State University Press.

Expanding Education to Support Sustainable Agriculture

Sustainable agriculture – a growing field of science and practice over the past 20 years – is now exploding on the national scene. For example:

- The nation's largest food retailer (Walmart) and largest food distributor (Sysco) are implementing sustainability measures across their supply chains.
- A controversial American National Standards Institute (ANSI) standard for sustainable agriculture has been proposed.
- The National Research Council is revisiting its landmark report, *Alternative Agriculture*, under the title "21st Century Systems Agriculture."
- The United Nations' Commission on Sustainable Development has a 2-year focus on agriculture, rural development, and related topics.

CSREES and its partners are preparing the workforce to lead this wave. Education for sustainable agriculture – for both current educators and future scientists and practitioners – must combine technical disciplinary expertise with a wider holistic perspective that encompasses the multiple dimensions of sustainability: economic, environmental, and social. It must consider the entire lifespan of a product or process, from "field to fork." And, it must do so in a way that combines scientific principles with site-specific knowledge gained from applying those principles in a real-world setting. Doing so often requires new partners who have expertise in complementary disciplines or settings.

The Professional Development Program (PDP) of CSREES' Sustainable Agriculture Research and Education (SARE) program provides that kind of continuing education to extension educators and other agricultural professionals. SARE-PDP competitive grants, together with state and regional programs, support workshops, farm visits, online courses, mentoring, and other learning opportunities in both basic and advanced topics. They address long-standing priorities such as intensive grazing, soil quality, and ecological pest management, as well as emerging issues, such as local food systems, energy efficiency, and renewable energy. Many educators

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When asked about the future of agriculture, CSREES National Program Leaders identify:

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The following ideas are just a few of the dozens provided by CSREES' NPLs. These visions about research, education, and extension priorities will guide program development, potential budget initiatives, discussion with partners, and both reflect and lead the stakeholder input process.

"Plant Genomics"

Ed Kaliekau
National program leader
for Plant Genomics
Competitive Programs Unit

A grand challenge in plant genomics, genetics, and breeding is to identify those gene combinations that lead to significant innovation in agriculture and the production of raw materials for food, feed, fiber, and fuel.

Integration of advances in biotechnology, genomic research, and molecular marker applications with conventional plant breeding practices can create the foundation for molecular plant breeding, an interdisciplinary science that could revolutionize 21st century plant improvement. An effective approach to

accelerate such efforts is to better integrate the different research disciplines and activities that form core components of molecular plant breeding. This integration would require new knowledge of genome structure and function, statistical approaches to estimate genetic effects, experience in both laboratory molecular methods and field-based breeding practice, and the ability to manage large datasets with diverse data types. A combination of molecular markers and high-throughput genome sequencing efforts would dramatically increase knowledge of and ability to characterize genetic diversity in the germplasm pool.

- Expand molecular marker selection tools to create high-resolution genetic maps that can exploit linkage between markers and agronomic traits to include marker assisted selection, quantitative trait locus discovery, positional cloning, and comparative genomics. These resources should be developed to translate and integrate

basic research endeavors with applied plant improvement outcomes.

- Expand structural genomic research to develop or improve the physical maps of economically important plants and to utilize next generation sequencing technologies to advance knowledge of the gene space.
- Expand functional genomics research to increase understanding of the biological role of genomic sequence, including coding, regulatory and repeated sequences, and to link these sequences to physiological function.
- Expand bioinformatic tools to enable breeder-centric high-throughput data management and visualization tools and platforms necessary to integrate genome sequence information with other data types, and breeder-centric views of map and trait data that best serve their needs. ✨

Invasive species constitute one of the most serious economic, social, and environmental threats of the 21st century. Nearly every terrestrial, wetland, and aquatic ecosystem in the United States has been invaded by non-native species, with economic losses estimated at \$137 billion per year. Detections of invasive species are increasing annually and highly damaging species are rapidly extending their range across the country. Global climate change could continue to further exacerbate the spread of invasive species.

The CSREES Invasive Species Working Group prioritized research, education, and extension activities identified in the 2008-2012 National Invasive Species Management Plan (<http://www.invasivespeciesinfo.gov/council/mpdraft07.pdf>) that would strengthen the agency's efforts to address invasive species on a more comprehensive front. These activities include

- improving and supporting recruitment and training of volunteers for early detection

and rapid response efforts at the local level, utilizing existing programs and infrastructure (e.g., Master Gardeners, Master Naturalists, National Wildlife Refuge "Friends" Groups, 4-H Groups, National Park Support Groups);

- engaging risk assessment experts to provide authoritative and timely assessments of current or potential invasions;
- developing and evaluating the use of predictive models to forecast the spread of specific invasive species;
- improving economic modeling of control and management actions to determine their costs and benefits;
- developing and providing portal and reference information, as well as public access to federal research information, as appropriate and consistent with applicable law;
- working with existing educational organizations to enhance invasive species information delivery to primary and secondary educators; and

"Invasive Species"

Robert Nowierski
National program leader
for Bio-Based
Pest Management
Plant and Animal Systems Unit

- improving federal research capacity and coordination to address a broader array of invasive species issues. The magnitude of the problem and ever increasing threats of invasive species to the economic, social, and environmental well-being of U.S. agriculture, human/animal health, and natural resources necessitates that CSREES increase its investment in research, education and extension activities in the future relative to invasive species. ✨

“Education”

Greg Smith

National program leader
for Science and Education
Resources Development Unit

As the National Institute of Food and Agriculture takes the place of CSREES, so will the next generation of food and agricultural scientists and professionals replace the existing workforce. Will these graduates possess requisite skills, knowledge and abilities that define a new economy driven by consumer demands for sustainable agricultural systems, renewable fuels, and a safe and abundant supply of food? Through programs that build research capacity and ensure outreach to communities, the National Institute must also ensure these efforts are built upon a strong educational foundation.

The National Institute must address many issues and assumptions, including demands and demographics. To meet these needs, the National Institute should commission an Education Benchmark Team (EBT). The EBT, with representatives from all Research, Education, and Extension Office (REEO) units, will develop recommendations to address the need for

- increased coordination (funding, networking, and employment of graduates) among the National Institute partnership;
- increased impacts resulting from all of our newly coordinated integrated funding opportunities;
- increased dialogue with other federal and state agencies, and private foundations, to better coordinate and effectively deliver our assistance programs; and
- increased attention to developing coordinated state and regional K-12 educational programs that move agricultural sciences education from traditional fields to training for emerging technologies, and from ‘agricultural literacy’ to ‘formal academic content.’

A veritable cornucopia of unexplored science is about to be tapped and new knowledge to be pursued, directly or indirectly relating to virtually every CSREES program area, through the new National Institute for Mathematical and Biological Synthesis (NIMBioS).

NIMBioS is a new \$16 million partnership involving CSREES, the National Science Foundation (\$11 million) and the Department of Homeland Security (\$5 million). Created through a grant by our land-grant university partner, the University of Tennessee, NIMBioS links mathematical approaches to problems across biology to develop modeling decision tools.

Animal infectious disease modeling became a logical focus of NIMBioS, in fact it was the only specific discipline area mentioned specifically in the RFA. That said, this institute must also embrace a much broader landscape of subjects and problems at the interface of mathematics and biology.

This multidisciplinary approach will bring together the biological, physical, economic, and social sciences to support food and agricultural sustainability. Just as sophisticated modeling now gives us ample warning and threat assessment for hurricanes, math-bio modeling will play critical roles in developing improved understanding and predictability in such diverse subject areas as plant and animal physiologic/production systems, agro-economics, natural resources and environment, and global climate change. Even sociology is slated to be within the purview of NIMBioS, which may, in turn, prove important to CSREES units such as Families, 4-H and Nutrition, and Economic and Community Systems.

Project awards from a Mathematical Biology Initiative for Food and Agriculture that partners with NIMBioS resources would lead to more robust predictive models for complex biologic problems.

“Mathematical Biology Initiative”

Gary Sherman

National program leader (NPL)
for Veterinary Science and acting
NPL for Veterinary Clinical Medicine
and Population Health
Plant and Animal Systems Unit

Peter Johnson

NPL for animal health
Competitive Programs Unit

“Microbial Research”

Ann Lichens-Park

National program leader
for Microbial Genomics
Competitive Programs Unit

By supporting research aimed at understanding microbe-microbe and microbe-host interactions, we have a great opportunity to advance knowledge and translate that knowledge into practical applications that address numerous high priority issues in agriculture. With microbial genome sequence data, we can greatly accelerate our understanding of how microbial populations contribute to the following:

- Food safety
- Bioenergy/biofuels
- Plant and animal disease
- Plant and animal productivity
- Human nutrition
- Improving or sustaining environmental quality (e.g., soil or water)
- Biological control of plant and animal disease

Microbial genome sequence data greatly accelerates the identification of microbial proteins or secondary metabolites that interact with/enter host or other microbial cells. Once such a set of proteins or secondary metabolites are identified, computational analyses and biological approaches can be used to better understand the effect that they are having on host cells. By combining genome data, computational analyses, and biological knowledge we can begin to answer questions that we would not have even been able to formulate before the age of genomics. We are headed for an “explosion” of new knowledge and technology and on the brink of tremendous advances.

Research in this area is appropriate for interagency partnerships because it is likely that there will be links between the mechanisms used by microbes to cause disease on plants, animals, and humans. Likewise, there will be links between the ways that microbes protect against diseases of plants, animals, and humans or the ways that they improve nutrient utilization in plants, animals, and humans.

gain further experiential knowledge conducting on-farm research with producers in SARE Farmer/Rancher grants and in teams with other scientists and producers in SARE Research and Education grants. SARE has partnered with USDA's National Agroforestry Center to support producer grants and professional training in agroforestry, and with Regional Rural Development Centers to provide expertise and support for sustainable community development.

Colleges and universities are expanding their coursework in sustainable agriculture and related fields. A few examples:

- The 15-year-old Sustainable Development Institute at the College of the Menominee Nation offers coursework in sustainable development and sustainable timber harvesting.
- The graduate program in Sustainable Agriculture of Iowa State University's (ISU) College of Agriculture collaborates with the ISU College of Business on a sustainable agriculture minor in the MBA program.
- Colorado State University, Washington State University, and the University of Florida have all begun offering majors in organic agriculture.

SARE competitive grants for graduate student projects – over 180 awards since Southern SARE pioneered this program in 2000 – provide experiential learning for students in applying for grants and conducting participatory on-farm research with farmers and ranchers.

In 2005, CSREES' Food and Agricultural Sciences National Needs Graduate and Postgraduate Fellowship (NNF) grants program began funding a targeted expertise shortage area in sustainable sciences. In 3 years, 14 NNF awards totaling over \$2.75 million have been made to train 39 masters students, 20 doctoral students, and 6 International Research and Thesis/Dissertation Travel opportunities. The Higher Education Multicultural Scholars Program recently added a program area of emphasis in Natural Resources Science, which includes transdisciplinary training in sciences for food and agricultural sustainability.

For more information, contact Jill Auburn, national program leader (NPL) for Sustainable Agriculture in the Economic and Community Systems Unit, at jauburn@csrees.usda.gov, or (202) 720-5384; or Audrey A. Trotman, NPL in the Science and Education Resources Development Unit, at Audrey.Trotman@usda.gov, or 202-720-1973

The American Competitive Initiative: Responding to a Climate of Change and Challenge

Over the last 10 years, several reports have noted the decline in our country's K-12 educational performance relative to other developed countries. The most recognized report, "Rising Above the Gathering Storm," was published by the National Academies in 2006. The committee that authored the report included "presidents of major universities, Nobel

laureates, CEO's of Fortune 100 corporations, and former presidential appointees."

Among other things, the report found that "fewer than one-third of U.S. 4th and 8th grade students performed at or above a level called 'proficient' in mathematics, about one-third of the 4th and one fifth of the 8th graders lacked the competence to perform even basic mathematical computations, and U.S. 12th graders performed below the international average for 21 countries on a test of general knowledge in mathematics and science." In the globalized economy, this concern has translated into a focus upon the future capacity of American competitiveness.

The report concludes with four recommendations accompanied by 20 specific actions to implement them. The committee recommends we

- increase America's talent pool by vastly improving K-12 science and mathematics education;
- sustain and strengthen the nation's traditional commitment to long-term basic research that has the potential to be transformational to maintain the flow of new ideas that fuel the economy, provide security, and enhance the quality of life;
- make the United States the most attractive setting in which to study and perform research so that we can develop, recruit, and retain the best and brightest students, scientists, and engineers from within the United States and throughout the world; and
- ensure that the United States is the premier place in the world to innovate; invest in downstream activities, such as manufacturing and marketing; and create high-paying jobs based on innovation by such actions as modernizing the patent system, realigning tax policies to encourage innovation, and ensuring affordable broadband access.

The report has precipitated considerable administrative and Congressional focus.

The administration has proposed the American Competitiveness Initiative "...which commits \$5.9 billion to increase investments in research and development, strengthen education, and encourage entrepreneurship—doubling in 10 years the collective budgets for the U.S. Department of Energy Office of Science, the National Science Foundation, and the research programs of the National Institute of Standards and Technology." Congress has increased appropriations in these areas but has not been able to reach the levels proposed by the White House.

In retrospect, the decline with our country's educational performance strikes deeply for those devoted to teaching—particularly in an era when our nation faces increasingly complex challenges. Many universities enroll large proportions of freshman students in remedial math and there is a growing concern with students' basic capacity in writing and composition skills. Although some data indicate that we are making

progress in slowing this declining trend in educational performance, the reality is that the generation coming into the workforce is one that the educational system failed.

At CSREES, we have focused on our programs that support educational activities by developing an education portfolio. This enables the Agency to perform a concentrated self study of our education programs which will be reviewed by a panel of distinguished experts early in 2009. The panel's recommendations will serve as a significant source of guidance for us as we look forward to updating our priorities for educational programs in order to most effectively navigate through this climate of change and challenge.

For more information, contact Franklin E. Boteler, Deputy Administrator for Economic and Community Systems and Interim Deputy Administrator for Science and Education Resources Development, at fboteler@csrees.usda.gov, or 202-720-7947.

Coming Soon: Academic Summit Report

The economic engine of the country is in crisis mode. With developing case studies, faculty and others are engaging students and colleagues in the opportunities that are burgeoning into novel territory.

The food, fiber, flowers, and renewable fuel sector is pivotal in this economic environment. Relevant, translational education – specifically higher education – for entry into the workforce is critical to ensuring that the United States remains highly competitive in the food systems domain, within the global knowledge economy. The Board on Agriculture and Natural Resources and the National Academies, with CSREES sponsorship, convened a leadership summit in October 2006 that addressed teaching and learning in undergraduate education. More than 300 people who participated in deliberations and dialogue at the Academic Summit remain engaged and share information through the AGEDU-SUMMIT listserv. One Academic Summit attendee described the benefit from her participation as, “...exactly what I needed at this time to fully engage my students in their learning outcomes.”

Academic Summit participants reached the consensus that the information was transformational for undergraduate education. Contacts made were intrinsic to advances in their teaching. Many connections made at the Academic Summit have become integral to multi-institutional curricula development and information delivery. Challenges presented by diverse institutional cultures have been transcended to create higher value through jointly-delivered educational activities.

In 2007, the Academic Summit was followed with a meeting at Texas A&M University, “From Dialog to Action – Reinventing Teaching and Learning: First Steps from Summit,” that allowed Academic Summit participants and others to exchange vision and guidance for innovative teaching, learning, and management in undergraduate education.

Much information was shared about what approaches worked within given settings. The more than 100 participants of that meeting were re-energized to adapt teaching and learning approaches to enable students/learners to advance with enhanced competencies in agriculture and life sciences.

Participants are looking forward to the soon to-be-released report on the Academic Summit that will provide information about new developments in education; provide ways to respond to the new marketplace of higher education; address the demand for quality assessment of education; and make new instructional modalities and pedagogies work in trans-generational academic settings to effect change in undergraduate education. There is high interest in the report for information about global engagement, social equity, public policy, diversity, and change leadership in undergraduate education, among others.

CSREES is committed to engaging in collaborative leadership strategies to advance teaching and learning for enhanced human capital development within the food and agricultural systems domain.

For more information, contact Audrey A. Trotman, national education program leader in the Science and Education Resources Development Unit, at Audrey.Trotman@usda.gov, or 202-720-1973.

CSREES Leadership for Global Change and Climate Research, Education, and Extension

Climate plays an important role in shaping the environment, natural resources, infrastructure, economy, and other aspects of life. Current scientific evidence indicates that most of the variations in climate experienced over the past decades can be attributed to human activities, including agriculture, and that human influence on the climate system is expected to increase. Variations in climate result in global and regional changes that have substantial environmental and socioeconomic implications. It is essential for society to have the best possible knowledge of climate variability and global change so that people may exercise responsible stewardship for the environment and lessen the potential for negative climate impacts.

The vision of CSREES, with respect to Global Change and Climate, is resilient and sustainable ecosystems and human communities for the production of agricultural goods and services, which optimize mitigation potentials and adaptive capacities under a changing climate and environment. The CSREES capacity for dealing with climate change is based on its network of scientific and educational partners, highly skilled and experienced extension professionals, and a body of information for developing responses to climate change.

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“Sustainable Agriculture”

Jill Auburn

National program leader for Sustainable Agriculture and director of Sustainable Agriculture Research Education Economic and Community Systems Unit

Sustainable systems should be the grand, over-arching theme for CSREES and USDA's Research, Education, and Economics mission area over the next 5 years.

The concept has been around for some time and CSREES has made a significant

investment in a number of programs and projects, but it is far short of both our capacity and the need. All the critical sectors are coming together around this theme: the scientific community (professional societies, the National Research Council's 21st Century Systems Agriculture study), ag/food industry (Sysco, Unilever, Walmart, commodity groups/keystone process), government, media, and society.

It's time to work sustainability explicitly into the mission statement of the Agency.

We need to invest in more crosscutting, systems science, for example:

- Energy, climate change, and land stewardship considered together due to their multiple interactions.
- Food systems – locavores (people who advocate eating locally grown food, growing

their own food, and promote sustainable, environmentally-friendly farming) have captured the media's attention. However, we don't even have a good systems map of the interacting factors (nutrition, energy, economics, food safety, culture, etc.), let alone the knowledge/data that are needed to inform either individual consumer decisions or policy decisions.

With sustainability bubbling up on university campus agendas – often at much higher levels than colleges of agriculture – we should help our land-grant leaders be a visible part of that huge wave by helping them institutionalize sustainability into ag/food/resource/community research, education, and extension. With the new 10-year authority and bigger thinking, we can achieve institutional change, not just project-by-project outcomes. ✨

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The complex interplay between agriculture and natural vulnerabilities, risks, and opportunities requires CSREES to take the lead in discovery, learning, and outreach to arrive at socially sustainable and economically viable solutions. The strategy is to build strong partnerships with communities to develop and provide cutting-edge research programs, advance novel ideas to manage risk and benefit from new opportunities, and create innovative tools for communication and education to provide information that people and communities can use in their daily lives.

To address the complex issues of climate change for agricultural research, education, and extension, CSREES has developed the Environment and Natural Resources (enr) Enterprise. The enr Enterprise seeks a more integrated understanding of the complex interactions among human societies, ecosystems of working lands, and natural areas. The enr goal is to change the way working lands are managed. The enr strategy to achieve this goal is to use our understanding of coupled human-natural systems to enable people to be better informed in their personal and professional endeavors about working lands and ecosystems. This brings together natural sciences, engineering, mathematics, business, social and political sciences, economics, and education to achieve a system science view of agricultural and forestry production and sustainability.

Natural and engineering science approaches to climate change need to be complemented by studies on sociological impacts; economic and environmental evaluations of alternative energy options; issues of environmental justice; impacts of government policies and regulations; sustainable urban development strategies; health and community issues; integrated resource planning; and the politics and economics of disasters among others. Advancing research on climate change must be accompanied by equally advancing education programs at school-based programs. Extension programs must be equally conducted in a sustainable manner that provides public knowledge of CSREES programs credibly and effectively and making information and products easily available to a diverse set of audiences. CSREES is working with all its stakeholders and partners to provide leadership and support for this grand challenge.

For more information, contact Luis M. Tupas, National Program Leader for Global Change and Climate in CSREES' Natural Resources and Environmental Unit, at 202-401-4926 or ltupas@csrees.usda.gov.