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As the Administrator of the U.S. Department of Agriculture's extra-mural science and education granting agency, the Cooperative State Research, Education and Extension Service, I will discuss the promise of science and education for assuring the long-term sustainability of agriculture.

There are many strategies to attain sustainability in natural resource-based endeavors such as agriculture including: addressing land tenure issues, so that farmers have a long-term, vested interest in sustainable production; fostering cooperatives to give farmers collective power to influence markets; stabilizing financial systems used in the agricultural system; and expanding knowledge and application of ever-evolving scientific advances in production, processing, distribution, and use of agricultural products. I believe the last of these is fundamental to the long-term, world-wide sustainability of agricultural systems.

A critical mission at USDA is to advance knowledge for agriculture, the environment, human health and well-being, and communities. We provide national leadership and support for programs in plant and animal sciences, natural resources and environment, economic and community systems, food and nutrition, and family and youth development.

Much of this support goes to university research, education, and extension programs found in colleges of agriculture through a cooperative partnership with over 100 land-grant universities and colleges, and over 3000 county offices across the U.S. This partnership with the Land-Grant University System began in 1862 and has underpinned the growth and success of American agriculture for almost 150 years.

Approaches to assure sustainable agriculture -

We can accelerate sustainability through science and education in two ways—1) development and implementation of “integrated programming” which spans from fundamental science, to education, to application and demonstration, leading to adoption and diffusion of best practices;

and 2) use of communication technology for global access and sharing of relevant research findings and practical applications.

Many nations engage in research and development supporting sustainability. We are committed to research and development as well. Beyond that approach, however, we emphasize “integrated programs” that bring the three components of the agricultural knowledge system (research, teaching, and extension) to bear on a problem area, through multi-disciplinary and collaborative work.

The challenges of sustainable research and development are how to: 1) focus the continuing discoveries from basic research on current critical issues, and 2) quickly translate applied research into practices that can be adopted by producers and general public in cost-effective ways. Integration of activities and partnerships are the keys to success.

The U.S. Economic Research Service estimates agricultural research annually returns 7 to 30 percent. And, funds are highly leveraged across partners; for example, U.S. States match Federal Extension investments 3 to 1. Contributions of expertise and commitment, as well as funding, by partners in both domestic and international programs help to ensure the sustainability of investments, and the breadth of benefits.

The scientific challenges -

Humans are an integral part of most every ecosystem--not only are we agents of change, we are consumers of ecosystem goods and services. We are inextricably linked to the sustainable use and management of agroecosystems. The fundamental purpose of agriculture is to manage ecological structures, functions, and processes to meet essential human needs.

Most sustainability questions are not specific to a given country or bounded by national borders, and we all hold the surrounding oceans and atmosphere, and in many cases contiguous land masses, in common. Critical issues for agriculture research include: land management practices and changes in land use; improved sustainability and management, including tillage practices; animal manure management; forest and rangeland fuel management; conservation corridors and buffer strips; invasive species; landscape scale changes, such as fire, wind, and urban development; harvesting; pathogen and disease infestations; drought and flooding; climate change; watershed and air shed protection; and landscape fragmentation. The concept of “agroecosystem management” allows for achieving the traditional agricultural goal of production while balancing the goals of conservation and protection of natural resources, mitigation of environmental impacts, maintenance of ecosystem services, and rural community viability.

Research and education which supports sustainable development establishes frameworks which integrate global and local perspectives to shape a “place-based” understanding of the interactions between environment and society. About 20 years ago, we initiated the Sustainable Agricultural

Research and Education (SARE) program which supports farm-based research and demonstration projects which encourage peer learning and technology use and improvement.

Finally, sustainability requires better utilization of existing tools and processes for linking knowledge to action in pursuit of a transition to sustainability. We need to accommodate an expected doubling to tripling of the urban system in a habitable, efficient, and environmentally friendly manner; reverse declining trends in agricultural production in Africa; sustain historic trends elsewhere; accelerate improvement in the use of energy and bio-based materials; restore degraded ecosystems while conserving biodiversity elsewhere; and integrate approaches to research and actions at the regional scale related to water, atmosphere and climate, species and ecosystems, and desertification.

An example of a grand challenge facing all of us is management of nitrogen in agriculture. Nitrogen has provided a bountiful food supply around the world, but the inputs have to be more carefully managed by every nation if we are to keep our waterways and ocean ecosystems functioning for food production.

Rapidly moving knowledge to application requires the use of new technology. Earlier this spring, the U.S. Department of Agriculture and its university partners launched eXtension (www.extension.org), a web-based educational system designed to speed research-based guidance related to an expanding range of issues from pest management to food safety. This program will make US Extension information, and the expertise of land-grant university researchers and experts, available globally. Our US AID has a related program for resource land management solutions.

The long-term future of agricultural productivity depends on our ability to make use of the Earth's renewable natural resources without depleting them. Understanding both at the global and local levels how agricultural practices affect all types of ecosystems is critical to achieving sustainable production. Managing expectations and helping consumers understand the implications of food, fiber, and fuel choices will help us achieve this goal.

All of these actions will require us to initiate and support partnerships across sectors, nations, and cultures to continuously develop and rapidly utilize the best knowledge available to assure the sustainability of agriculture.