

2012 Academy of Nutrition and Dietetics (AND)
Food & Nutrition Conference & Expo President's Lecture

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Research, Education, and Economics

“A Research Agenda for Solving the Global Food and Agriculture Grand
Challenges”

Sunday, October 7, 2012

Philadelphia, Pennsylvania

Good afternoon. Thank you Dr. (Glenna) McCollum for that kind introduction. I am honored to have been asked to deliver this year's 2012 President's Lecture. Today I'd like to discuss the current role and the potential role of public research in nutrition, and how the convergence of the food, agricultural and natural resource challenges we're facing is going to require a coordination and intensification of our research efforts.

I am USDA's Chief Scientist and Under Secretary for Research, Education, and Economics. I am also a dietitian and received my Ph.D. in human nutrition.

With USDA's broad portfolio of expertise in agriculture, food, and nutrition, we are committed to continuing to produce the research to make sure our agricultural and food systems are meeting our needs – now and into the future.

At USDA we are focused on addressing the grand societal challenges of food security, food safety, bioenergy, climate change and nutrition. These are the driving priorities in the research done through both our intramural and extramural agencies, and are each complex challenges that require multi-faceted approaches.

Nutrition research is an essential part of the service our agency provides. In my role at USDA, I place a high priority on our nutrition research, not only because of my own academic and professional affiliation, but because of how vital it is for our nation.

USDA's commitment to nutrition research stems from the fact that the U.S. diet is the functional outcome of U.S. agriculture; a health-promoting diet and healthy population are the ultimate measures of agriculture's success. Understanding the

composition of foods and using that information to analyze what Americans are eating helps us determine the healthfulness of the U.S. food supply.

USDA is also the only agency with research components in both U.S. food production and human nutrition, thus the only agency that fully studies the connection and nuances of the food supply and human health outcomes.

This relationship underscores the complexity of nutrition in relation to public policy. Though they've always been interrelated, in a rapidly shrinking world with a rapidly growing population, we're seeing a clear convergence of many health-, food- and natural resource-related issues. The connection is agriculture – our primary interface with the natural environment as we work to feed ourselves.

The air we breathe, the water and food we ingest are essential for life. Healthy, safe and nutritious food and clean and plentiful water depend on healthy and safe agricultural systems. And in a shrinking, interconnected world, serious challenges to this system show up at an ever faster rate.

Our top priority is to stay ahead of this curve. This accelerating convergence is going to require a coordination and intensification of our research efforts across all sectors and internationally as well.

The foundational principle of our efforts is supporting a sustainable and science-based intensification of agriculture, fostering food systems that promote lifelong health for people and long-term sustainable agroecosystems.

The U.S. has been immensely fortunate to have some of the lowest-cost, safest food in the world, and a wide variety of food to choose from. Though we do import many products, when it comes down to it, we're actually one of the few countries in the world able to raise enough food to feed ourselves. Most years we are likewise blessed with abundant water resources that fuel our diverse economy. The impact of this year's drought is still not fully known, but it will have effects here and globally. But American agriculture's success in most years isn't a lucky accident – it's the result of hard working farmers and ranchers, innovative research and technology transfer, and the right policies to support it.

But keeping this system going is going to require adaptation. As I'm sure many of you are aware, the U.N. now projects world population to surpass 9 billion by mid-century. Producing food for these additional two billion people will be a challenge in and of itself. Adding to that challenge, a recent U.N. assessment of global land resources found a quarter of all land "highly degraded," placing additional strain on existing resources.

We also know that 60-75 percent of emerging human disease outbreaks of the past 60 years have come from infectious diseases that have jumped from animals to humans.

And with 70 percent of freshwater used for irrigation, by 2025, 1.8 billion people could be living in regions with absolute water scarcity, with two-thirds of the world population potentially under stress conditions.

The short story here is that our planet has a serious food and water crisis on the horizon – projected demand substantially outpacing supply. FAO estimates that farmers will need to increase production by 70 percent by 2050 to meet demand.

Given this, it's becoming increasingly evident that agriculture and natural resources are squarely at the crossroads of the world's most critical problems: sustainable food production, water availability, growing energy demand, and human health. And we all know the serious effects that climate change is already beginning to have.

Overall, we're headed in the right direction: over the past three decades new production practices have contributed to a nearly 50 percent increase in ag production, while reducing the total inputs used. Farming today requires fewer labor hours and less land than 30 years ago.

The fact is, agriculture relies more heavily on improvements in technology as a source of growth than almost any other sector of the economy. So not only is there much success to talk about – there's much opportunity for further growth with less environmental disruption. This opportunity is where we should be focused.

But we can't afford growth at the cost of food safety and nutrition. Our research agencies are hard at work to ensure Americans continue to have sufficient, safe, and nutritious diets. But there is a lot of work to be done.

As recent studies have shown, most Americans' diets do not meet Federal dietary recommendations. Our social scientists at the Economic Research Service are working to find out why. The common explanation is that healthier foods are simply more expensive than less healthy foods. However, as demonstrated in a recent ERS report entitled *Are Healthy Foods Really More Expensive?*, when comparing prices of healthy and less healthy foods according to food energy (\$/calorie), edible weight (\$/100 edible grams), and average portion (\$/average portion), for all metrics except the price of food energy, healthy foods actually cost less than less-healthy foods.

This type of analysis is valuable intelligence for smart policymaking, and it is one quick example of the kinds of work we do. There are a lot of myths out there about the food environment, and well developed studies can help improve our understanding of the real picture.

At USDA, we our planning efforts have been focused on questions like this, and undertaking the science and social science to help shape federal policy. Within the REE mission area, we have developed an Action Plan to define and help coordinate research agendas across our various agencies.

Nutrition is one of five priorities (along with food security, food safety, bioproducts, and climate change). Within the nutrition priority, we've articulated four strategic goals:

- Linking food systems to human health outcomes;
- Conducting nutrition monitoring of the American population and evaluating policies influencing nutritional health;
- Building the scientific basis for dietary guidance for health promotion and disease prevention; and
- Developing and extending approaches to preventing obesity and related diseases.

Our planning efforts recognize the importance of leveraging our work in this area by coordinating closely among REE agencies and through strategic federal and public-private partnerships.

I believe our multi-agency, cross-departmental approach to nutrition research is an effective one. To illustrate this point, I want to briefly highlight some of the complementary work going on at the three research agencies in the REE mission area.

Across its research portfolio, ERS conducts research on a wide range of topics including anticipatory research on food policy issues impacting food safety, food choice, food assistance, and human nutrition.

ERS conducts research on the economic, regulatory, programmatic, and market forces influencing consumer food choices and the effect of these choices on nutritional, obesity, and health outcomes -- including efforts to understand the complex determinants of food choices, food purchases, food program participation, food prices, nutrition knowledge, and consumer psychology.

Supporting USDA food assistance programs, ERS conducts economic analysis on the immediate and long-term consequences of alternative policies and programs aimed at ensuring access by children and adults to safe and nutritious food.

Research findings are used by policy makers, program managers, and those shaping efforts to promote access to affordable and healthful food.

Food safety and nutrition are also priorities for the Agricultural Research Service.

ARS has two nutrition monitoring research groups: The Nutrient Data Lab that compiles and maintains nutrient and bioactive food composition databases, and the Food Surveys Research Group that partners with CDC to conduct the dietary survey portion of the National Health and Nutrition Examination Survey (NHANES). These unique USDA resources are recognized as the ‘gold standards’ nationally and internationally.

We have six nutrition centers that specialize in various aspects of human nutrition research. Thus USDA is the only agency that fully studies the connection and nuances of the food supply and human health outcomes. The databases and survey research are good examples of what I sometimes call “uniquely federal responsibilities.” They require long-term commitments, uniquely trained scientists, and form an asset that underpins epidemiological research, food safety risk assessment and program planning and evaluation efforts.

The National Institute of Food and Agriculture supports our extramural program of nutrition research through several competitive grants programs.

The largest of these are within the Agriculture and Food Research Initiative (AFRI), including foundational programs in Food Safety, Nutrition and Health. AFRI also supports substantial nutrition research through its Childhood Obesity Prevention Challenge Area. NIFA sponsors additional nutrition-related activities through its Institute of Youth, Family, and Community, while NIFA's Small Business Innovation Research Program includes a topic area focused on Food Science and Nutrition. I'd like to mention the Rural Health and Safety Education (RHSE) Competitive Grants Program. This program seeks to enhance the quality of life in rural communities by supporting health promotion activities for rural Americans.

Our nutrition research is tuned into a constantly changing food environment. There have been numerous changes to the U.S. food system over the past 75 years, some beneficial, some undesirable. These changes make a strong case for maintaining an adaptable nutrition research system in the U.S.

In the case of nutrition monitoring, for example, current efforts focus only on what is consumed. Expanding monitoring to cover the “food system” will require expanding our scope, capturing data from food production and as well as consumption. Changes to the U.S. food system begin with production. We are often accustomed to treating this information as outside of the realm of nutrition. Going forward, as these issues continue to converge, these connections will become more apparent.

Agricultural research has contributed to more than a doubling of productivity over the past 60 years, contributing to the reduction in food costs from about 24% of income to less than 9% today. This change contributed in no small way to the continuous economic expansion since the end of World War II by allowing consumers to spend a large portion of their earnings on consumer goods other than food.

A major factor in these changes has been the increase in the share of agricultural products coming from very large farms. Small to medium size commercial farms (<\$250,000 sales) accounted for 41% of sales in 1982 but only 14% in 2007. The largest farms, selling more than \$1 million annually, rose from 24% in 1982 to 59%

in 2007. The shift to production by the largest farms primarily reflects consolidation resulting from technological advances in production of cattle, hogs, poultry, and milk leading to more edible product per animal. Larger and faster farm equipment extended this consolidation to crop production. Another major factor in consolidation of farms is the ability of larger farms to pay full-time labor while smaller ones cannot, often depending heavily on off-farm income.

Consolidation has similarly occurred throughout the food and beverage processing industry, with the biggest concentrations being in the meat and milk processing segments. Accompanying concentration is vertical coordination. While this may decrease the variability in types of foods available in the marketplace, it increases efficiency and economy of production, offering more affordable foods to consumers. Most American consumers now prefer their food products to be less variable in appearance, taste, and availability. We see this in national brands of foods sold across the country and chain restaurants displacing single owner businesses, particularly in the low and medium price ranges.

Americans are buying their food differently as well. In the early 20th century direct sales from farmers accounted for almost 10% of total food, but are now

around 1%. Traditional grocery stores are playing a much smaller role in the market, while the rapid rise of supermarkets following World War II until the late 1970's has shifted today to the growth of big box and convenience stores. At the same time we're seeing a continued reduction of specialty stores such as butchers, bakeries, fruit and vegetable markets, and so on.

So Americans have changed where they shop. They've also changed, and are constantly changing, what they buy. It is estimated the typical supermarket has 40,000 food products on its shelves. You can appreciate the high proportion of new products introduced annually. Many of these are withdrawn quickly if they don't make their sales projections.

Because the food business experiences little growth, companies introduce products that offer a new experience for people. That generally means foods with lower nutritional value, such as candy, snacks and drinks. These tend to have a higher profit margin than foods with greater nutritional density. As the degree of food processing increases, in general the nutrient density decreases and the cost of ingredients contributes a smaller fraction to the price of the product.

Despite the popularity of introducing foods in the candy and beverage category, the USDA food category that contributes the most calories on our diet is grain-based desserts, which includes cookies, cakes, doughnuts, and similar items. This one category supplies about 13% of calories in the most recent What We Eat in America (WWEIA)/NHANES, national dietary survey (conducted in collaboration with the DHHS National Center for Health Statistics data), which also shows we snack twice as often compared with 30 years ago, with most Americans snacking two or more times daily and that snacking behaviors do not differ by body weight. Snacks provide about one-fourth of all calories in the American diet and supply lower nutrients than other foods.

New products mean new marketing. Since the 1990s, the most frequently made nutrient claim on new food product introductions is about fat: low-fat, no fat, or reduced-fat. Other common claims highlight products that contain lower levels of cholesterol and sugar. Beginning in the early 2000s, “no trans-fats” claims began to appear and equaled those of low/no/reduced fats in 2009-2010.

Tallying the number of new product introductions, shows that breakfast cereal and bread were the products that changed most rapidly, offering consumers

healthier choices. A likely reason for the change is that both the 2000 and 2005 Dietary Guidelines emphasized the importance of whole grains.

Increases in the number of whole-grain new product introductions was especially rapid around the 2005 Dietary Guidelines, which was unique in suggesting a quantitative target for consumers: whole-grains ought to be half of their grain consumption. This, along with a clear definition of whole-grain products likely incited competition among food manufacturers to offer whole-grain products.

Of course, some of these changes are driven by socio-economic factors outside of the food system. Changes in the role of women in society, for example, have led to less time for food preparation, adolescents and men more involved with food shopping/preparation, and young children receiving one/two meals at day care.

Americans spend only half as much time (33 minutes) in food preparation and cleanup per day as in 1965 (65 minutes). 73 percent of women report that they are the usual grocery shopper and meal preparer for their households; 32 percent of men report being the usual grocery shopper, and 30 percent report being usual

meal preparer.

Higher-income individuals who report being the household's usual meal preparer appear to "outsource" children's meals—those whose children obtained meals at school spent more time in paid work than those whose children did not obtain meals at school. School meals provide a time savings for these households.

Food expenditure data from ERS show that the share of food dollars spent away from home has been gradually increasing from around 40% in the late 1970s to almost 50% in 2010. The effects of the recent recession have slowed the trend somewhat. But the food intake data from WWEIA/NHANES show that the proportion of calories from food away from home has increased through the mid 2000s. The latest data available show that one-third of calories come from food eaten away from home, and more than one-tenth is from fast food outlets.

Research in the 1990s showed that food consumed away from home is often less healthful than food consumed at home. Recently, ERS has updated that research using the newest available data from WWEIA/NHANES. This research shows that a meal eaten away from home adds 134 calories to adults' diets, as compared to a

meal eaten at home; 144 calories to the diets of children 13-18 years old; and 65 calories to the diets of children 6-12 years old. In general a meal eaten away from home also has less fruits and vegetables and whole grains, and so is often of lower nutritional value as well.

Most ready to eat foods purchased from restaurants, concessions, or other food outlets have increased in size since their introductions. It is well established that serving larger portions leads to more consumption.

If we want to change the food supply to influence trends in obesity, we need to understand where the money for food goes. Less than 12% goes to farmers.

Because of the large increases in food away-from-home, more than one-third of all food dollars now go to food services. Energy use by consumers, driving to stores and home refrigeration, actually use as much energy as the entire food production chain.

Little of the value goes to farmers and this has not changed over the past 40 years. For more highly processed foods, the commodity cost bears little relation

to the retail price. This fact is important in understanding that changing farm policy will have minimal impact on the cost of many foods.

One trend in apparent contradiction to those of consolidation, processing, and convenience is the recent sharp increase in consumer interest in “buying local.”

In a 2011 poll by the National Grocers Association, over 85 percent said they chose a grocery store based in part on whether or not it stocked food from regional producers. Agricultural census data collected by NASS show that direct-to-consumer sales in the U.S. (while very small as I’ve said) grew more than twice as fast as all agricultural sales from 1997-2007.

Support for local and regional food systems is coordinated at USDA through the Know Your Farmer, Know Your Food initiative, which leverages many programs and activities across the Department through a task force led by Deputy Secretary Merrigan. The work of the initiative is summarized in a web-based document and interactive map of projects, the Know Your Farmer, Know Your Food “Compass.”

Over 250 research, education and extension projects funded by several NIFA programs are on the map, among the nearly 2,000 USDA projects, with more to come later this week when the newest data are added to the map.

USDA's long-term investments in capturing food supply and consumption data make this data and these kinds of projects possible. This information is some of the best intelligence we have on our food system, and it also wouldn't have been possible without the tireless work of our researchers at ARS, ERS, and NASS, and the established research programs that have been collecting this data for decades.

But support for this research is not as strong as it needs to be. Current budgetary concerns are part of a larger trend in the wrong direction in support of agricultural research. Historically, over much of the life of our 150-year old public research system, the United States has been the leader in food and ag research. That dedication has recently fallen off. This trend doesn't bode well for our country, its health, the health of our economy, or our challenge to feed a growing population. We know that other countries, most notably China, recognize this importance and are ramping up their investments in ag research just as the United States is cutting back.

With the convergence we're seeing today of many of the major challenges we face, the importance of this research is only growing. Now more than ever, we need to reinforce our commitment to food and ag research.

But it's a difficult time to try to predict what lies ahead, with today's appropriations and authorization climate hazy at best.

Many current USDA programs and policies were authorized under the 2008 Farm Bill through September 30, 2012. These include a great number of critical programs impacting millions of Americans, including programs for farm commodity and price support, conservation, research, nutrition, food safety, and agricultural trade.

Unfortunately, Congress has not acted on a new Food, Farm and Jobs Bill. As of October 1, USDA's authority or funding to deliver many of these programs has expired, leaving USDA with far fewer tools to help strengthen American agriculture. Additional programs will expire in the coming months.

We will continue to work hard on behalf of food producers and consumers, while continuing to urge Congress to act on multi-year, comprehensive Food, Farm and Jobs legislation that would provide additional certainty for producers.

As far as the budget is concerned, in February 2012 the President released the Administration's proposed budget for FY 2013. As you might know, to date Congress has not passed any full year appropriations bills that fund Federal agencies for FY 2013. However, on September 22, the Senate approved a Continuing Resolution previously passed by the House which provides funding for the Federal government through March 27, 2013. The President signed it on September 28. The CR provides funding for most Department programs to continue at a level that is equivalent to 0.6 percent above the amount provided for in FY 2012. Entitlement programs, including the Supplemental Nutrition Assistance Program, are funded under the CR at a rate that maintains current program levels.

Despite enactment of the CR, there is a significant level of uncertainty surrounding funding levels that will ultimately be provided for the Department's activities during FY 2013. This is due in part to the potential for an across-the-

board reduction, known as a sequestration, under terms of the Budget Control Act of 2011. Absent further Congressional action, a sequestration will occur on January 2, 2013. It is estimated that a sequestration would reduce the Department's budget by more than \$3 billion in FY 2013 alone.

We'll have a better sense of how this will turn out soon enough, and we're working hard to reverse the overall trend of ag research funding. But there is a lot of work to be done. Given all of these uncertainties, we are also working internationally to create the global platforms that will ensure our science continues to progress.

A major part of this effort is ensuring access to scientific information. The food and ag challenges we face today are global in nature, and so too must be the solutions. We live in a time when technology makes the prospect of a globalized "open science" a reality, and we must take advantage of that. Open science means collaboration. Open science means coordination. Open science means sharing resources to maximize research productivity and effectiveness. And it means sharing the tools to help people help themselves. Because publicly funded ag research occurs in a precompetitive space (what economists call "public goods

research”), reflecting our continued commitment to the protection of intellectual property in the marketplace – we know that expanding access to it only enhances productivity and innovation.

There is a lot that can and should be done to make global food and ag R&D better coordinated, more efficient and more effective. Fortunately, the world’s attention is beginning to turn towards these issues. Greater direction on priorities and targets and increased transparency in global agricultural research and investment can catalyze growth and support the long-term sustainability of ag systems and natural resources.

So far, there are promising pockets of international collaboration for specific initiatives. But we can do much more to coordinate all global ag research to strengthen research planning, encourage knowledge sharing, and foster necessary productivity gains. This is all the more critical given that the economic situation in the E.U. and the U.S. has led to reductions in government funding of ag research.

In 2011, both the G-20 Ag Ministers Group and the G-20 Development Working Group recognized the need for increased cooperation on international agricultural

research and development as critical to achieving increased and sustainable global ag productivity. This year, at the recent G-20 meeting in Mexico, ag research was high on the agenda, as it was in May at the G-8 summit.

Through the G-8 and G-20, we're working to develop what we see as strategic platforms to achieve sustainable food security: 1) open access to genomic data; 2) open access to government sponsored research; 3) open access to germplasm collections; 4) technology transfer; 5) coordinated ag statistics; 6) regular meetings of the ag chief scientists. These platforms, once established, will be the fundamental building blocks for fostering the research to reinvent global agriculture, as it's been reinvented over and over again in the past, this time using all the tools in our toolbox to meet the needs of a changing world.

This past month I traveled to Guadalajara, Mexico for the first meeting of agricultural chief scientists. Agricultural research leaders from the G-20 countries, with participation from non profits, NGOs and the private sector, worked to identify global agricultural research and development (Ag R&D) priorities and define targets needed to sustainably increase agricultural productivity.

Achieving the necessary increase in food production will require deliberate, long term commitments to Ag R&D from all nations, as well as a partnership and a coordinated research effort across these nations, including both the public and the private sector. In meeting with the G-20 Agricultural Chief Scientists (MACS), we deliberated on establishing MACS Global Research Collaboration Platforms and agreed to consider their inclusion within our own national agricultural research and development strategies. We also reviewed the status and progress of Global Research Initiatives endorsed by the G20 and ongoing funding and collaborative mechanisms, and agreed to hold MACS annually, with the goal of building agreement on agricultural R&D priorities and targets, monitoring progress, and establishing policies to support GRCP's. The next meeting will be scheduled once the next Presidency of the G20 has defined its priorities.

Open science and open data will ultimately help decision-makers, companies, researchers and – most importantly – farmers, access and effectively use new forms of critical agricultural knowledge, information and technology. These new resources are essential for achieving the growth needed to ensure future food security, the availability of nutritious food, and help the bioeconomy grow.

Between now and 2050, today's college students will be doing the research, producing new products, and making the policy decisions that will determine whether the world will surmount the challenge. We need the leadership today to set the stage for this work to begin. Open science can be a big part of this.

At every turn, in every partnership, USDA science agencies are delivering on their mission to help ensure a healthy, productive, safe and sustainable food and agricultural system, while protecting our precious natural and human resources. Our research has a proven track record of success – now more than ever, policy needs to be as scientific as our science: evidence- and performance-based. A robust public food and ag research system is our best resource for ensuring that our food system delivers the healthy diet we want and expect.

People are thinking more about food these days. This interest is a great opportunity, one we in the food and ag science community can't afford to pass up. We need to nurture and inform this interest with a clear and focused vision of where we need to get to, and how we can get there.

And we need to continue to stress the vital importance of this research, and emphasize the benefits it brings to society. As active players in these issues, I hope all of you will consider the roles, and potential roles, that your institutions can play in supporting food and ag science, and training our next generation of dietitians, nutritionists, and food scientists.

As awareness grows, sustained support for food and ag research will follow, and as support for food and ag research grows, we'll see just how effective it can be at finding solutions to the serious challenges we are facing. Many of you are leaders in these efforts and I look forward to continuing to work with many of you here today to strengthen the ability of food and agricultural science to keep our food system healthy, safe and secure.