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At the Annual Meeting of the Association of Public and Land Grant Universities
November 14, 2016

“When you get right down to it, food is practically the whole story every time.”

That’s one of my favorite quotes from Kurt Vonnegut’s novel Galápagos that pretty much sums up my vantage point as well. Humanity and our fragile earth are facing unprecedented challenges. These challenges include producing enough safe and health-promoting food – both in the U.S. and abroad – in the face of emerging diseases of crops and livestock, finite arable land and fresh water, more severe weather, and increased fire and drought. The projected growth in global population expected to surpass 9 billion by mid-century would require us to dramatically increase current agricultural production while simultaneously reducing losses and waste. There’s also a budding bioeconomy in which agriculture holds the promise of providing alternatives to petroleum as agricultural biomass becomes the source of chemical feedstocks for fuel, pharmaceuticals and other industrial products. In discussions about the long-term sustainability of the planet, how to provide health-promoting food in an environmentally sustainable manner emerges as one of the central and most contentious issues.

As we in the Obama administration begin the process of transitioning leadership to the incoming President, it's appropriate to pause and take stock of the current state of the agricultural research and education enterprise that the incoming Under Secretary and Chief Scientist will inherit. Each month this year, Secretary Vilsack has published a chapter in his report of what the Department has accomplished over the last eight years. This month is devoted to research – and I encourage you to read his summary and review the accompanying fact sheet. We've also held a series of forums co-hosted with Land Grant Universities to identify issues the new administration will face like water, land use and tenure, invasive pests and diseases, and climate change.

There are also two just-released reports that give a very good assessment of America's agricultural research and education system. One is a major review of "Innovation, Agricultural Productivity and Sustainability in the United States" conducted by the Organization for Economic Development (OECD). The second is an article in this month's Amber Waves entitled "U.S. Agricultural R&D in an Era of Falling Public Funding." Both reports were issued last Thursday.

The good news is in the OECD report. It finds that "the United States is the world leader in food and agricultural research and innovation." It goes on to point out that "the advances they have made have strengthened US agriculture productivity and benefitted global agriculture. Research has benefited from

international collaboration facilitated by researcher exchanges in US institutions, and various research agreements and partnerships. While public expenditure on agricultural research and development has declined, private expenditure has increased dramatically. This, however, is not a perfect substitute for public research given that the latter focuses at earlier stages of research and covers a broader set of social issues (e.g. environmental protection, food safety) that are generally not addressed by the private sector. Innovative policy mechanisms encourage public-private partnerships in research collaboration benefiting food and agriculture.” The report singles out our unique “public extension services [that] are integrated in the land-grant system together with research and development. They have responded to a wider range of innovation needs, bringing research-driven innovations to the farm level.” And finally, the OECD analysis notes that “growing societal and consumer concerns regarding new technologies, production practices and animal welfare will require new approaches to build public trust in the solutions that innovation may provide.”

All in all, the OECD analysis finds our research and educational innovation ecosystem to be in good health, and the report makes some policy recommendations that are relevant to this audience, especially in light of the ongoing discussions about the next Farm Bill research title. One recommendation is to “assess the relevance and cost-efficiency of secondary education in

agriculture-related areas, and reduce the shortfall of college students needed in the sector.” Several recommendations focus on ways to strengthen the U.S. food and agricultural innovation system, such as:

- Maintain and upgrade public research capacity in food and agriculture
- Review the efficiency of different funding mechanisms to ensure a higher impact.
- Consider greater use of mechanisms that incentivise transdisciplinary and system-based approaches, and wider stakeholder involvement.
- Explore further research collaboration opportunities at the multilateral level and with non-traditional partners.
- Strengthen the mechanisms that facilitate the development of solutions to better manage natural resources and improve resilience to risks.
- Integrate food and agriculture in the climate-change strategy.
- Ensure farmers continue to receive advice that facilitates sustainable management and to adapt to new environmental pressures.
- Continue funding and improving tools to better monitor research investments and results.

The ERS article makes the point that – unlike many other parts of the U.S. economy – the public sector (rather than the private sector) has been the dominant

funder and conductor of agricultural research and development. The U.S. public sector has also been the largest performer of agricultural R&D worldwide.

However, in recent years, the private sector investment has risen rapidly and now surpasses the public investment. The fall in public sector funding and the rising investments that other countries' governments are making (notably China and the EU) have reduced the U.S. share in the global agricultural R&D enterprise. And, while these trends have future negative implications for agricultural productivity growth, at least for the present, the U.S. remains the top producer of agricultural R&D as measured by patents and academic journal articles.

Our buying power in research, education and extension hasn't recovered from the dramatic cuts sustained in 2011, 2012 and 2013, and the ERS analysis points to some long-term negative impacts of the decline in U.S. public investment in agricultural science. Using the examples of emerging pests and diseases and climate stresses, and the fact that private investment builds on rather than substitutes for public R&D, the ERS article paints some clouds on the horizon. The decline in public funding for R&D limits U.S. engagement with the global research community. It limits our ability to quickly respond to outbreaks of new livestock or crop diseases. And it undermines our country's ability to build new businesses that serve our farm economy and provide jobs and overseas markets.

So, it really matters that our inflation-adjusted appropriation is less than what Congress provided to the REE agencies in 2010.

One of the roles that USDA's Chief Scientist plays is to project from current trends, scan the horizon, identify emerging threats that will affect America's food security and then to prepare for them. That preparation entails establishing research priorities to counter the threat, and advocating for funds to support the R&D initiative in the Department's budget proposal, with OMB to make sure the initiative gets in the President's budget and with the appropriators in Congress. For the six years I have served as the department's Chief Scientist, I've raised the clarion call about the historic disinvestment that America is making in agricultural science and what the anticipated outcomes mean for our country's future. Over the last six years, President Obama's budget has contained a number of innovative requests to increase competitive funding. One example in the FY 2017 budget is the first request to fully fund AFRI at its authorized level of \$700 million. A second innovation were proposals in 2015 and 2016 to forge new ways of supporting competitive research through innovation institutes focused on major agricultural research challenges. I regret that these and other good ideas did not garner the support of Congressional appropriators.

I have also advocated the need for a unified message to Congress that will bring together the many factions that are fighting over the allocations of our shrinking

slice of the appropriations pie. I continue to believe that a unified message that has the buy-in of the Land Grant University family, the representatives of commodities, the many food and agricultural business interests and USDA's research agencies is absolutely necessary for success with Congressional appropriators.

When I spoke with you last year, I identified six priorities on the near and medium-term landscape that we would work on with you. Those issues included big data and open data, the interdependence of the extramural and intramural programs, inequities within the partnership and changing societal values related to higher education and agricultural science. Research and education funding and the unified message were also on my list. I'm happy to report that we made progress in each of these issues with a lot of help, support and teamwork from many of you and from the NAREEE Board. Anyone can now access peer-reviewed research publications and the data underlying them that USDA has supported through extramural and intramural funds. And we're leaders in the Global Open Data for Agriculture and Nutrition initiative, the global effort advocating for open data policies and when countries adopt them to prioritize their agricultural and nutrition data. Both ARS and NIFA have coordinated big data initiatives that provide infrastructure for the many diverse agricultural science disciplines. We've worked together to identify our research infrastructure needs and identified the deferred

maintenance in both universities and ARS as a major obstacle to world class research. NIFA has delivered its report to Congress on the 1890's matching funds and NIFA also convened a dialog with the tribal colleges and agreed on a set of strategic actions to address their needs. Recognizing that we must understand society's changing views of agriculture and higher education, NIFA has hired several social scientists to lead a more rigorous program of research and ERS and NASS are collecting data on high priority issues like pollinator health, antibiotic use on farm, and climate change to better inform program and policy decisions.

The mid-term issues I've identified will continue on the agenda of the new administration, along with a few others like improving the rigor and reproducibility of USDA-sponsored research and the Federal role for oversight into how gene editing and synthetic biology research are conducted. All four REE agencies will continue to play important roles in responding to agricultural emergencies like we've experienced in recent years -- highly pathogenic avian influenza, citrus greening disease, the re-emergence of screw worm in Florida, or the drought that's had devastating effects on the western states.

Shaping the new Farm Bill will also occupy the attention of the new administration. Here, I would recommend that serious thought be given to the recommendations from the OECD review. Also, I could caution against re-organizing the REE mission area as is being discussed by some groups. The 2008

Farm Bill created the position of the Chief Scientist and assigned to the Chief Scientist the responsibility for coordinating all USDA research. In implementing that mandate, we now have accomplished the integration of the intra- and extramural programs. They have coordinated program planning and budget development. An annual report is issued from the Office of the Chief Scientist on accomplishments and performance metrics, and the NAREEE Advisory Board plays a key role in evaluation through its annual review of the relevance and adequacy of the intra- and extramural programs. Moving ERS and NASS out from reporting to the Under Secretary Secretary/Chief Scientist to another part of the Department could also do much harm – decreasing research funding in social sciences that flows to universities and opening these statistical agencies to possible political interference.

Today, as we think about the future, we have little information about what the new President's agenda will be for either science or agriculture. There was very little discussion of either topic during the campaign. We don't know the names of the new Secretary of Agriculture or the Under Secretary for REE/Chief Scientist. We don't know what positions they will take on the research title or REE appropriations and other important questions. We don't know whether Congress and the new President will continue the down-sizing of government we've recently experienced. And we don't know whether the strong support from rural America

for the Republican party across the board will result in new programs or higher appropriations for USDA in general, and the research and statistical agencies of REE in particular.

Given the uncertainties, it's all the more important that we have a shared vision for our partnership, a strategy to achieve that vision, and agreement on our message. I've been pleased with the progress that the Riley Memorial Foundation has made in convening discussions among the diverse stakeholders in research, extension and education, and I hope that a unified message will make the case for larger public investment in the programs we all care so deeply about.

In closing, I am confident that we've accomplished the integration of intramural and extramural programs envisioned in the 2008 Farm Bill, established a strong role for the Chief Scientist in national and international science and technology matters, established new ways of working by standing up the Foundation for Food and Agriculture Research and implementing the 2014 Farm Bill provisions on commodity boards, centers of excellence and specialty crops.

So when you get right down to it, food is practically the whole story every time.