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on

2018 Farm Bill – Research, Education, and Extension

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Subcommittee on Biotechnology, Horticulture, and Research
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Introduction

Chairman Davis, Ranking Member Lujan Grisham, and Members of the Subcommittee, I am Jay Akridge, Dean of the College of Agriculture at Purdue University in Indiana, and I appreciate the opportunity to testify as you begin discussions for the next Farm Bill. I am here today to represent the Board on Agriculture Assembly (BAA) of the Association of Public and Land-grant Universities (APLU) and serve as Chair of the Policy Board of Directors of the BAA.

APLU is a research, policy, and advocacy organization that is dedicated to strengthening and advancing the work of public universities across the nation. Annually, APLU's 238 member institutions enroll 4.8 million undergraduate students and 1.3 million graduate students, while employing over 1.2 million faculty and staff. Each year, 1.2 million degrees are awarded, and institutions conduct $43.5 billion in university-based research.

The purpose of the BAA is promotion and support of agriculture in all of its phases (agriculture, food/nutrition, natural resources, environment, veterinary medicine, forestry, international) and all three missions (research, education, and Extension) in the land-grant and agricultural colleges in all 50 states, the District of Columbia, the Commonwealth of Puerto Rico, the territories of the Pacific, and the U. S. Virgin Islands. The APLU BAA includes the deans of agriculture, and the leadership of academic programs, Cooperative Extension, experiment stations, and international agriculture in land-grant and non-land-grant colleges of agriculture[1].

The BAA has held several meetings on the Farm Bill beginning in mid-2016 to discuss proposals submitted by BAA members and to identify system priorities. This process is on-going. As a result of this inclusive process, the Agriculture Committees can trust that the APLU BAA priorities for the next Farm Bill will reflect a comprehensive cross-section of agricultural research, education, and Extension stakeholders.

While public support for agricultural research and education comes from a variety of sources, my comments today will focus primarily on the extramural funds provided by USDA through the National Institute of Food and Agriculture (NIFA) and authorized in the Farm Bill. These extramural funds take two general forms: capacity funds (primarily Hatch, Smith-Lever, McIntire Stennis, Evans-Allen, and 1890s Extension) and competitive funds (Agriculture and Food Research Initiative - AFRI).

Agricultural Research: Driving Competitiveness in a Global Economy

A Changing Agriculture

The agriculture of the 21st century will be as different from the 20th century as 20th century agriculture was different from the 19th century. Over the 20th century, advances in genetics, machine power, and chemical fertilizers and pesticides promoted staggering increases in agricultural productivity. As an example, U.S. corn yields of 30 bushels per acre in the 1930s,

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[1] A land-grant college or university is an institution that has been designated by its state legislature or Congress to receive the benefits of the Morrill Acts of 1862, 1890, and 1994. Non-land-grant colleges of agriculture (about 60) are public colleges and universities that offer baccalaureate or higher degrees in agriculture, food, and renewable resource education.

were nearly 140 bushels per acre by 2000. The population of the world soared from 1.5 billion in 1900 to 6 billion in 2000. While forecasts of mass starvation did not materialize, more than 826 million were food insecure in 2000, despite the profound increases in agricultural productivity[2].

Looking forward, agriculture still faces a fundamental question – how to feed a growing world? But, that question has become much more complex in the new century. More variable weather has brought new challenges to the world's farmers. Access to new, arable land is limited. Availability of and competition for water is increasingly an issue. The environmental implications of farming practices are being questioned globally. Farmers are finding new opportunities to produce for non-food markets. Some consumers have demonstrated much deeper interest in how and where food is produced, and societal acceptance of new technology cannot be taken for granted. Obesity is a global public health issue and not just in the high income countries. The average age of the U.S. farmer is nearing 60 years old and questions are being raised about where the next generation of farmers will come from.

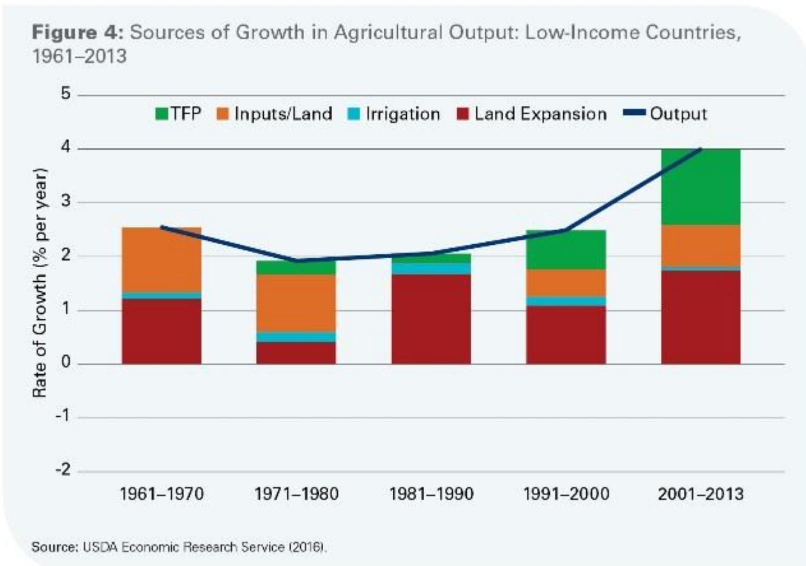
What set of technologies and investments in human talent will drive the type of agriculture needed to address our 21st century challenges?[3] The science of the 21st century agriculture will be about precision: precise editing of genes to drive plant improvement, precise use of inputs to give plants and animals exactly what they need, precise management of resources to mitigate environmental impacts. This precision will be built on data collected in ways and volumes unprecedented in our history. The word 'convergence' will characterize agricultural technology as biology, data analytics, and automation combine to provide the productivity increases we need to address the challenges defined above. Technology will also help enable an even more consumer-responsive agriculture. Note this 21st century technology revolution is not just about large scale agriculture, producers of all sizes will ultimately have access to many of these technologies in some form as they build their farm businesses around the markets they serve. At the same time, the next century will not be ours alone as other nations are investing heavily in agricultural research and U.S. agricultural competiveness will be a key issue.

Land-grant universities and colleges of agriculture have answered the call for the research and education needed by our industry in the past, and can in the future. We are prepared to play our role in conducting the research required and the education needed to drive U.S. agricultural competitiveness. Continued public investment in agricultural research and Extension is fundamental to addressing the challenges outlined above, and ultimately supports the global competitiveness of the U.S. agricultural sector. We have certainly appreciated your support in the past, and look forward to your support in the future.

[2] "The State of Food Insecurity in the World". FAO, http://www.fao.org/docrep/x8200e/x8200e00.htm
[3] See Woodson, R. "The Role of U.S. Research Universities in Meeting the Global Food Security Challenge." 2016 AAAS Charles Valentine Memorial Lecture, for an overview of some of these emerging technologies.

Feeding a Growing World

According to the U.S. Census Bureau, the United States gains one new person every 16 seconds; the world gains a new person about every half a second[4]. At present rates, the global population will reach 9.6 billion by 2050, and experts believe that agricultural productivity must increase 25 – 100% from current levels to feed a global population of that magnitude[5]. The challenge here is more than producing calories, it is about providing proper nutrition for a growing population[6]. And, this challenge is more than a food security issue, it is a national security issue as food insecurity and political instability are tightly linked[7]. This task is also made more challenging by a variety of factors: limited land and water resources, increasingly variable weather, natural response to modern farming practices (pests and weeds resistant to insecticides and herbicides, for example), societal attitudes toward science and technology, and barriers to adoption of improved farming practices globally.[8,9]

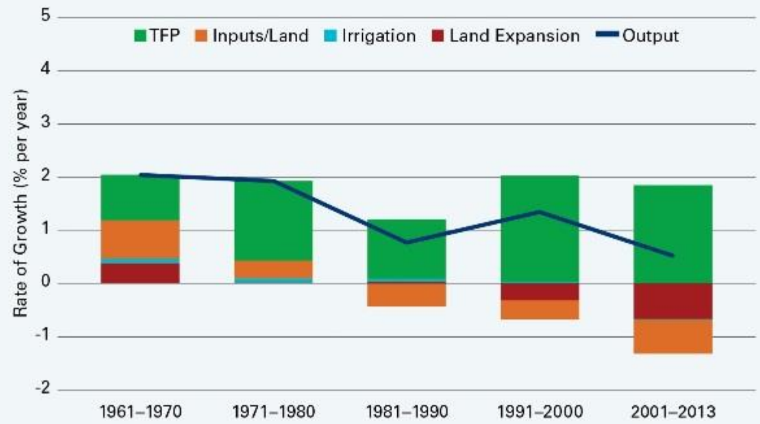


The Global Harvest Initiative (GHI) has worked to quantify the challenge of feeding a growing world and measuring the current status of our ability to meet that challenge. The charts above and below are from the GHI's *2016 Global Agricultural Productivity Report* and demonstrate the

[4] https://www.census.gov/popclock/
[5] Hunter, M.C, R.G. Smith, M.E. Schipanski, L.W. Atwood, D.A. Mortensen. "Agriculture in 2050: Recalibrating Targets for Sustainable Intensification." *BioScience*, February 22, 2017.
[6] Jones, A.D. and G. Ejeta. "A New Global Agenda for Nutrition and Health: The Importance of Agriculture and Food Systems". *Bulletin of the World Health Organization*. 2015-94:228-229.
[7] Ejeta, G. "Revitalizing Agricultural Research for Global Food Security". *Food Security,* Volume 1, No. 4 (2009).
[8] Glickman, D. "A Food and Agricultural Research Agenda to Deal with the Asteroids of the Future". 2014 Charles Valentine Riley Memorial Lecture, June 4, 2014
[9] Baldos, U.L.C and T.W. Hertel. "Global Food Security in 2050: The Role of Agricultural Productivity and Climate Change." *Agricultural and Resource Economics*. 58:2014.

profound difference that Total Factor Productivity (TFP) has made in the developed world over the past 50 years. TFP is the ratio of agricultural outputs (gross crop and livestock output) to inputs (land, labor, fertilizer, machinery and livestock). When TFP rises, more output can be produced from a fixed amount of inputs. TFP growth can result from increased effectiveness of inputs, more precise use of inputs, or adoption of improved production practices.[10]

Figure 5: Sources of Growth in Agricultural Output: High-Income Countries, 1961–2013



Source: USDA Economic Research Service (2016).

GHI reports that TFP must grow by 1.75% annually for the world to double agricultural output through productivity gains by 2050.Investment in agricultural research will be a fundamental determinant of whether or not this level of productivity growth is achieved.

According to the GHI's 2016 Global Agricultural Productivity Report, "Agriculture research and development (R&D) and extension programs are essential public goods and the principal drivers of TFP. Along with private sector and collaborative research, public R&D in agriculture plays an essential role in fostering agricultural innovation systems." The report goes on to state that publicly funded agricultural research generates technologies and innovation that enhance farmer productivity and competitiveness, reduce waste in the food value chain, and ultimately benefit consumers through lower prices and improved access to safe and nutritious food.

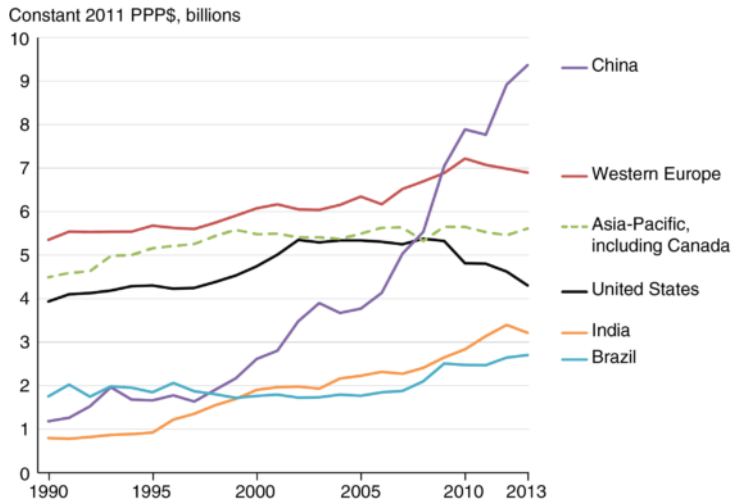
Investment Strategies of U.S. Competitors

Who will produce the food needed for a growing world and who will bring the next generation of agricultural technologies to the market are important questions. The U.S. is being quickly outpaced by other countries in public agricultural research and development spending. The chart below from USDA's Economic Research Service shows that China has dramatically increased its investment in agricultural research at the same time that U.S. public investment in agricultural

[10] 2016 GAP Report: http://www.globalharvestinitiative.org/GAP/2016_GAP_Report.pdf

research stagnated. Between 1990 and 2013, the U.S. share of spending among nations with major public agricultural research and development investments fell from 22.5 percent to 13.4 percent, largely driven by a decline in U.S. investment and rising spending from developing countries such as China and India.[11]

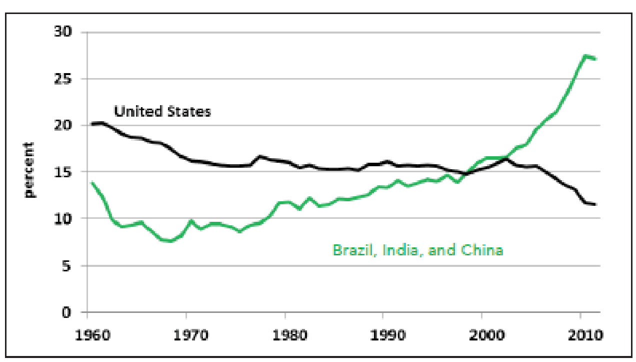
U.S. public sector funding for agricultural R&D falls as spending by China and India rises



PPP = purchasing power parity.
Source: USDA, Economic Research Service and Agricultural Science and Technology Indicators (ASTI), Organisation for Economic Cooperation and Development.

The chart below shows the shares of global public agricultural research and development spending for the U.S. and Brazil, India, and China. Pardey and Beddow note that "key middle-income countries with agricultural sectors (specifically Brazil, India, and China) collectively overtook the United States in 1998. As of 2011, for every dollar the United States invested in public agricultural R&D, those countries invested $2.15."

Shifting Global Public Share of Food and Agricultural R&D, 1960-2011



Source: Pardey, P.G. and J.M. Beddow, "Revitalizing Agricultural Research and Development to Sustain U.S. Competitiveness." Farm Journal Foundation, InSTePP R&D accounts version 3.8

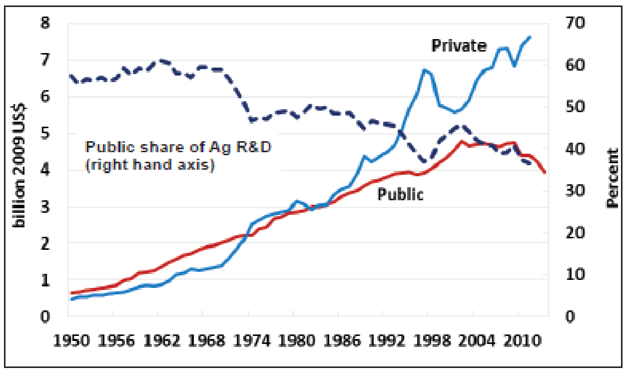
This shift in research and development spending has occurred despite the consistent evidence of the large and pervasive societal return on investment from U.S. public investment in agricultural

[11] https://www.ers.usda.gov/amber-waves/2016/november/us-agricultural-rd-in-an-era-of-falling-public-funding/

research. Pardey and Alston summarize much of this work and report that "surveys of hundreds of studies quantifying the returns from agricultural research suggest that rates of return in the range of 40-60 percent per year. The most recent, comprehensive work by Alston, et al. reconfirms that U.S. public investment in agricultural research has paid off handsomely, with benefit-cost ratios of 20:1 or higher."[12] [13]

Public and Private Sector Research: A Needed Partnership

Addressing the global challenges outlined above will require both increased levels of public investment as well as more private investment in agricultural research. Over the past 50 years, there has been a pronounced shift toward private funding of agricultural research in the U.S. In 1950, public spending on agricultural research was about 65% of the total investment, by 2010 that figure had declined to about 35%.



Source: Pardey, P.G. and J.M. Beddow. "Revitalizing Agricultural Research and Development to Sustain US Competitiveness". Farm Journal Foundation, February 2017.

Despite increased levels of investment by private firms in agricultural R&D, public investment is still much needed. Private sector investment will rightly follow opportunities for short-term return on the research investment. Public sector investment is needed to pursue questions/areas where the pay-off will ultimately happen, just over a longer period of time than private investors would be satisfied with. Examples include work on understanding the ways that plants respond to environmental stress such as drought or heat at the most fundamental level. Such work is typically deemed too exploratory and hence too risky to be the focus of private sector research. But, unless such basic research questions are answered, it is impossible to breed better plants. In addition, some critical questions are more applied and/or have immediate societal payoffs, even if short-run returns to an individual or a private firm are modest. Examples here would include research on farming practices that enhance water quality. Such research may well have no immediate commercial value, but the value of clean water to a community, a state, or our nation is obvious.

[12] Pardey, P.G. and J.M. Alston. "For Want of a Nail: The Case for Increased Agricultural R&D Spending". American Enterprise Institute.
[13] Alston, J.M., M.A. Anderson, J.S. James, P.G. Pardey. *Persistence Pays: U.S. Agricultural Productivity Growth and the Benefits from Public R&D Spending.* Springer, 2010.

Importantly, public and private investment in agricultural research is not an 'either/or' situation, and private investment in university agricultural research now accounts for about 23-24% of the total funding.[14] [15] Such public-private partnerships will in all likelihood be even more important in the future.

Cooperative Extension: Providing Research-based Insights

Cooperative Extension is the unique pillar of the three that make up the land-grant system (research, education, Extension). Reaching the more than 3,000 counties in the U.S. with research-based insights, the stakeholder connections provided by Extension help insure relevancy of the land-grant system's applied research and education activities. In rural counties, Extension provides a lifeline to unbiased insights on agricultural, health, and community development questions. In urban areas, increasing interest in urban agriculture as well as health and wellness issues are addressed through ExtensionAs stakeholders have evolved, so has Extension with the traditional county-based Extension Educator or Agent, complemented by direct access to campus-based Extension Specialists and a wide variety of e-learning tools. More on the impact of Extension can be found here:

https://extension.org/

Recent research has quantified the societal returns to investments in agricultural Extension and finds the payback is both large (returns on investment of over 100%) and quick (in many cases a year or less given the fact that Extension influences current decision making)[16].

Building Human Talent

The land-grant system and our non-land grant colleges of agriculture have a fundamental role in training the next generation of talent for the food and agricultural industry. The most recent data (2013) show more than 175,000 students (BS, MS, Ph.D.) enrolled at land-grant and non-land-grant colleges of agriculture,and demand for that talent remains strong. A recent study by Purdue and NIFA reported an annual demand for 57,900 BS and higher degree graduates per year through 2020 in the areas of food, agriculture, renewable natural resources, or the environment[17]. While enrollments at colleges of agriculture have been growing, the total supply of agriculture graduates is expected to be 35,400 annually – leaving a gap (39%) to be filled by graduates with other degrees. Beyond the supply and demand situation, the fact that these students enrolled in colleges of agriculture are being trained by individuals who have research or Extension appointments (or both) brings state of the art science and/or stakeholder relevance to students in a unique way, enhancing their educational experience.

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[14] Monke, J. "Agricultural Research: Background and Issues." Congressional Research Service, October 6, 2016.
[15] Clancy, M. K.O. Fuglie, P.W. Heisey. "U.S. Agricultural R&D in an Era of Falling Public Funding." *Amber Waves*, ERS-USDA, Vol. 14, Issue 10, November 2016.
[16] Huffman, W.E. "New Insights on the Impacts of Public Agricultural Research and Extension". *Choices*, 1st Quarter 2016 (31):1.
[17] "Employment Opportunities for College Graduates in Food, Agriculture, Renewable Natural Resources, and the Environment, United States, 2015-2020." USDA and Purdue University, 2015.

Extension also has a fundamental role in developing human talent and the 4-H program provides an important example. 4-H is the largest youth development program in the U.S., reaching nearly 6 million youth annually, who are supported by 500,000 volunteers, and 3,500 4-H professionals. 4-H has a well-documented impact building life-skills in youth[18][19]. Importantly, 4-H members pursue higher education at a higher rate than do high school students in general[20]. While traditional 4-H projects remain a fundamental part of 4-H, new Science, Technology, Engineering, and Math (STEM) programming is taking the proven 4-H volunteer-led, research-based model into an exciting new areas. In Indiana, the fastest growing 4-H clubs are in urban centers such as Gary and Indianapolis. We now have more than 70 counties with robotics 4-H clubs in Indiana.

The Land-Grant System: Leveraging Resources

It is essential to understand the leverage that federal funding for research and Cooperative Extension enjoys as a result of the network of land-grant and non-land-grant Colleges of Agriculture that exists. We are part of a national system that knits together more than 107 land-grant colleges and universities and 60 non-land-grant universities. This network allows us to share best practices, collaborate on research and Extension initiatives, avoid duplication in our efforts, and at the same time drill down to address local needs. In fact, 25% of our federal capacity fund investments in agricultural research programs must be spent on projects that span multiple states. In addition, competitive funds drive multi-institution collaboration as researchers build the most competitive teams they can to put the best possible case forward for limited available funding.

The total public investment in agricultural research and Extension is a partnership between federal, state, and county sources – with a mandatory match of the federal funds dollar for dollar with state funds required (for most states, the match is much higher).[21] Without federal support, this partnership collapses, and stressed state budgets will simply not be able to support even current levels of investment, much less what is needed.

As pointed out earlier, public investment in agricultural research is also leveraged with private sector investment – in 2013, for every dollar the federal government invested in university research, the private sector invested 49 cents[22]. Again, without federal investment in capacity and competitive funds, these private sector investments in agricultural research at universities do not happen at this level.

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[18] Mulroy, M., Kraimer-Rickaby, L. "The Impact and Sustainability of 4-H Youth Development Programs: A Synthesis Report" University of Connecticut Center for Applied Research, 2006.
[19] 4-H Study of Positive Youth Development: http://3t61of1t6u3x3af7ir2y91ib.wpengine.netdna-cdn.com/wp-content/uploads/2016/02/4-H-Study-of-Positive-Youth-Development-Full-Report.pdf
[20] Ratkos, J. "4-H Makes a Difference in Post-secondary Education Enrollment." http://msue.anr.msu.edu/news/4_h_makes_a_difference_in_post_secondary_education_enrollment Posted December 19, 2014.
[21] Clancy, M., K.O. Fuglie, P.W. Heisey.
[22] Clancy, M., K.O. Fuglie, P.W. Heisey.

An Indiana Example

I will provide an Indiana example of the importance of federal funding for agricultural research that demonstrates the critical role of partnerships and the leverage of available federal funding. Purdue University made a $20 million commitment to a new Plant Sciences Institute based in our College of Agriculture, one of only 2 research investments made as part of a set of 10 university level strategic initiatives called Purdue Moves. The focus of this Institute is improved plants – plants that yield more, plants that are more tolerant of drought, plants that use nutrients more effectively, and plants that have improved nutritional profiles. This investment was made because our President and Trustees recognized the importance of plant agriculture as we look to the future, for all of the reasons highlighted above. However, beyond the importance of the problem, the University also invested because our College had deep strength in plant agriculture research and Extension, which was built on and supported by federal capacity funding.

This University investment included new faculty positions, some new facilities and equipment, a focus on bringing discoveries to the marketplace, and new student training initiatives. The $20 million was intended to be platform investment, to help attract others to invest - and, that is happening. Our Indiana corn and soybean farmers through their check-off funds have supported the construction of a new field scale plant phenotyping facility to help us both drive plant improvement and take the idea of precision agriculture to an entirely new level through sensor development and new data analytics. Other industry partners, including firms far outside of agriculture such as Verizon and IBM, have joined us as well. Multiple start-up companies have been launched since the University made the commitment in 2014. In addition, we have launched a pre-college educational experience in the summer to help attract young men and women to plant agriculture, as well as an undergraduate research fellows program for students on campus.

None of this would have happened without the federal capacity funding that supported the salaries and research of our plant scientists.Bringing this full circle, one of our soybean breeders recently received a large AFRI grant to put the new phenotyping facility to work in improving soybean genetics. Looking forward, it will take enhanced levels of federal capacity and competitive funds, leveraged with farmer, industry, foundation, and state funds, to drive the kind of research and education program we need to feed a growing world.

Looking Forward: Opportunities and Issues

Funding Levels

Advances in food, agricultural, and environmental sciences depend upon research through the USDA NIFA. However, current USDA funding for food and agricultural research at $2.4 billion per annum, is not sufficient to address the challenges outlined earlier. In fact, Federal funding for agricultural research has been stagnant over the past decade, and has declined in real terms.[23]

[23] *Pursuing a Unifying Message: Elevating Food, Agricultural, and Natural Resources Research as a National Priority*. Charles Valentine Riley Memorial Foundation, November 2014.

From 2005 to 2012, USDA funding for agricultural research declined by 16% in real terms, falling from $2.9 billion to $2.4 billion in constant 2014 dollars.

Like agriculture, modern advances in health care depend upon research advances from the public sector, supported with investments of more than $32 billion per annum directed through the National Institutes of Health. Much of this research takes place at public universities, and depends upon state of the art facilities for conducting research, and is enhanced by funding from private sector interests. Over the 1990-2012 period, funding for NIH increased 135% while USDA funding increased 21% over that same period.[24] There is no doubt that medical research addressing health issues in our country is a national priority, but one can question the relative investment in research addressing the security of our food supply.

Another instructive trend is the split of federal and state support for agricultural research and development. Since 1950, the share of publicly funded research and development carried out by state-based land-grant universities and other agencies has increased from 61 percent in 1950 to 73 percent in 2013 – leading to more dependence on state-funding and facilities, an increasingly tenuous position given the status of state budgets.

Capacity and Competitive Funding Are Equally Important

Federal support for both capacity (Hatch, Smith-Lever, McIntire Stennis, Evans-Allen, and 1890s Extension) and competitive funding (Agriculture and Food Research Initiative - AFRI) is essential. Federal capacity funds provide land-grant universities with the human talent and support needed to address local research and extension needs, provide timely response in emergency situations such as a disease or pest outbreak or weather event, and ultimately the capacity to pursue research supported by other funding sources including competitive federal funds, foundation funding, and private funding. AFRI is NIFA's flagship competitive funding program, but has never been funded at its authorized level of $700 million. As a result, many research proposals, deemed both important and deserving of funding, are not funded. In fiscal 2015, more than 2,600 proposals were submitted for AFRI funding, requesting almost $1.8 billion. Through a rigorous peer-review process, over 1,400 were recommended for funding, but only 569 could be supported with the funds available.

Infrastructure Challenges

Another significant challenge faced by our land-grant universities is the state of our research and education infrastructure. In 2015, the APLU BAA commissioned a study into deferred maintenance[25] which estimates that the land-grant system faces a deferred maintenance backlog of $8.4 billion. The study delivered three key findings:

1. The level of deferred maintenance identified is significant and conditions exist for it to grow.

[24] Charles Valentine Riley Memorial Foundation.
[25] http://www.aplu.org/news-and-media/News/2015/10/15/sightlinesaplu-study-finds-84-billion-in-deferred-maintenance-at-schools-of-agriculture-in-us

2. There are three main areas identified that are contributing to the growth of deferred maintenance:
    a. The majority of space was constructed during a period of rapid, poor quality construction.
    b. Most buildings have received insufficient capital investments as they have aged.
    c. 80% of campuses are investing at such a low level that deferred maintenance will grow annually.
3. These conditions are consistent across the country.

A major driver of deferred maintenance at land-grant institutions is the age profile of buildings. Of the 15,596 buildings included in the study, containing 87 million gross square feet of space, 53% were built between 1951 and 1990, the period when buildings were built "quickly and with lower quality standards and materials." Facilities built in this time period account for 68% of the total $8.4 billion in deferred maintenance costs across the system. The replacement cost of all research and education space in the system is estimated at $29 billion.

The study also found that the capital investment needed to renovate these buildings is also falling well short. "Over 80% of the schools of agriculture were spending at levels that meant they are deferring projects on an annual basis" the study said. The average capital spending per year at schools of agriculture was $1.82 per gross square foot, compared to $4.40 per gross square foot for the broad database of U.S. colleges and institutions – significantly lower.

As just one example of this issue at Purdue University, we recently completed a study of infrastructure needs at our 8 research farms strategically located around Indiana. The 2014 study showed that more than $25 million is needed by 2020 to address the backlog of deferred maintenance and to equip the farms to do the contemporary applied research needed by farmers in our state.

<u>Efforts to Unify under a Common Message for Research</u>

Purdue and other land-grant universities, along with partners at non-land-grant schools, research societies, agricultural organizations and many others, have actively been engaged in national discussions on how we take a different approach to ensure a sustainable future in food, agricultural and natural resources. Led by the Charles Valentine Riley Memorial Foundation, this effort envisions the opportunity for a convergence of efforts that result in development of a unified message - one that calls for making public investment in food, agricultural and natural resources research a higher national priority. A common thread of these dialogues has been exploring the formation of a broad coalition committed to develop the compelling case for enhanced investment in research. The times call for an inspiring vision, bold action and a heightened sense of purpose. We believe these continuing discussions underscore the need to think differently about how agriculture speaks out on the need to fund research at the priority it deserves — by speaking together on the benefits made possible for the public good and our common future.

<u>Challenge of Change Commission</u>

To advance the goal of feeding the world, the APLU has established the Challenge of Change Commission[26], which aims to examine challenges to food security and make recommendations on the actions required by public research universities to meet global food needs by 2050. The commission's charge is three-fold:

1. Identify and prioritize the key challenges that our public universities can successfully address that will advance food security in North America and the world.
2. Recommend how our public universities can align their resources to address the challenges identified by the Commission.
3. Determine the resources required for our public universities to address the challenges identified by the Commission.

There is an obvious synergy among the land-grant system's research, education, and Extension mandate and the agriculture industry's charge to feed the growing population. APLU is ready to lead the discussion and address the challenge with the direction and support of Congress.

Closing Comments

<u>Up for the Challenge…</u>

Despite these challenges, the nation's land-grant universities and agricultural colleges remain the world's premier source of research, education, and Extension programs benefiting the agricultural industry from producer to consumer. The recent QS World University Rankings provide evidence of this fact with 10 of the top 15 agricultural and forestry universities globally located in the U.S.[27] With a proven record of impact, and with appropriate levels of federal investment, APLU members stand ready to address the challenges of feeding a growing world.

Thank you for this opportunity to share the nature of the food security challenge in front of us, the reasons public investments in agricultural research and Extension are important, and some of our system's successes and challenges. Thank you for your past support of agricultural research and Extension. The Association of Public and Land-grant Universities is available to assist the Agriculture Committee, and the broader industry, in any way possible, and we look forward to the culmination of the next Farm Bill.

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[26] http://www.aplu.org/projects-and-initiatives/international-programs/challenge-of-change/ChallengeofChangeCharge.pdf
[27] https://www.topuniversities.com/university-rankings/university-subject-rankings/2017/agriculture-forestry