

National Agricultural Research, Extension, Education and Economics Advisory Board

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REPORT AND RECOMMENDATIONS OF THE AGRICULTURAL EXPERIMENT STATION WORKING GROUP OF THE NATIONAL AGRICULTURAL RESEARCH, EXTENSION, EDUCATION AND ECONOMICS (NAREEE) ADVISORY BOARD

Developed from Presentations and Discussions at the Spring 2014 Meeting of the NAREEE
Advisory Board

Executive Summary

The NAREEE Board wants to first recognize the energy and effectiveness of USDA REE leadership in increasing awareness and securing additional research resources for the food and agriculture sector (government, academia, industry and NGOs). This allows us to frame recommendations that challenge U.S. policymakers to recognize and invest in the research, education and extension activities that will maintain a world-class agriculture and food sector.

The Agriculture Experiment Station (AES) system was the focus of the spring 2014 NAREEE Advisory Board meeting, and this report summarizes observations and discussions from the Board during that visit, as well as recommendations that were catalyzed after considering other reports on research capacity, needs and priorities.

Recommendation 1a: USDA REE and the AES Directors should actively lead the effort to establish, facilitate, and strengthen additional research partnerships among the entire Land Grant University system (1862, 1890, 1894 and Hispanic-serving institutions) and within USDA agencies to enhance coordination of the research portfolio.

Recommendation 1b: USDA REE should actively lead the effort to establish and facilitate additional research partnerships with other federal departments and agencies, as well as non-Land Grant agricultural, food and natural resource-focused Universities, industry stakeholders, nonprofits and nongovernmental organizations to leverage the resources USDA can commit to addressing the research needs of complex problems.

Recommendation 2a: USDA REE should consider the research funding and investments in AES, a key component of the NIFA, relative to its entire research portfolio including its agencies and extramural partner. NIFA should be directed to allocate more strategically between both competitive AFRI funds, as well as formula and competitive funding, to AES, its personnel and partners so that REE can continue to expand and improve the impact and returns to investment

that has been commonly documented for food and agricultural research through the AES. There should be particular attention to maintaining the correct balance of Formula and Competitive Funding because of the synergy of benefits from capacity building and infrastructure that come from formula funding and the innovation that stems from competitive funding. Both are essential to maintain the vitality, evolution and relevance of the AES system.

Action Item: USDA REE should encourage the ERS, in its new program to evaluate existing administrative data, to compile data on the portfolio of ARS, ERS, NASS and NIFA data, with particular attention to Formula (Hatch, McIntire Stennis, Evans-Allen) and AFRI competitive research funding with decomposition of priority areas, integrated activities and recipients.

Recommendation 2b: As part of its realignment, AFRI should focus primarily on investigator driven research relevant to the priority areas and eliminate the more prescriptive Challenge-Area Program (This recommendation is supported by a forthcoming NRC report¹ as well).

Recommendation 3a: USDA/REE should ensure that AES system, by design, have a strong focus on foundational issues to support and reinforce the translational research using NIFA Institutes and Centers of Excellence, including Food Production and Sustainability; Bioenergy, Climate, and Environment; Food Safety and Nutrition; and Youth, Family, and Community.

Recommendation 3b: USDA/REE should promote the fundamental linkages between the AES and Extension system, allowing the impacts of applied research and translational outreach to be greater and more effective.

Action Item: USDA REE should continue to prioritize integrated activities within the AFRI competitive research funding programs, and better analyze and compile information on how AES formula dollars are committed to integrated projects and activities.

¹ NRC Committee on a Review of the USDA Agriculture and Food Research Initiative. Spurring Innovation in Food and Agriculture: A Review of the USDA Agriculture and Food Research Initiative Program. National Academies Press, Washington, DC. 2014.

Introduction

The Agriculture Experiment Station (AES) system was the focus of the spring 2014 NAREEE Advisory Board meeting. The original need for organized research and its application to animal and plant production, the environment, natural resources, households and rural life led to the formation of AES organizations, initially in California and Connecticut, and subsequently in the establishment of a federally-funded system of more than 50 AES through the Hatch Act of 1887. From its inception, the clear intent of the Hatch Act was to ensure effective partnerships among the federal and state governments and the land-grant universities to the benefit of the states and nation through the continuum of research discovery to adoption of relevant research.

The evolution of the AES system and the increasing complexity of the problems facing domestic and global agri-systems, environment, and human health require strong and effective partnerships with the traditional federal, state, land-grant partners, and increasingly, integrates industry and more complex interdisciplinary and system research approaches. The system allows for flexible and rapid research responses to local agricultural needs as well as coordinated and integrated cooperative research to address national and even global needs. The AES has been remarkably successful as indicated by the forthcoming National Research Council (NRC) report² that estimated the AES return on investment across its individual state units ranges from 10:1 to 69:1. The NRC committee also comments on the, “persistent underinvestment ..and forgoe opportunities,” despite the clear success and benefit of the ASE system to the agri-system. The very success of the research through AES, in partnership with the Agricultural Research Service (ARS), in enhancing agricultural productivity and pioneering the application of technology to the agri-system has also contributed to the evolution of the complexity of the current research needs and the greater need for interdisciplinarity across a wider array of disciplines than those traditionally identified as ‘agricultural’ fields. The challenge for the AES system and REE and the AES directors in leading it, is to meet these evolving and increasingly complex societal needs in the face of aging research infrastructure and constrained resources.

Across the AES system, its research scientists address the five priority challenges established by the REE’s competitive funding arm, the National Institute for Food and Agriculture (NIFA): childhood obesity prevention, climate change, food safety, global food security and sustainable bioenergy. The challenge areas are focused on five societal challenges determined by NIFA, and the foundation priority areas follow the six outlined priorities that are authorized in the 2008 Farm Bill. The challenge areas are prescriptive and focus on specific problems of interest (such as climate change), which were predetermined at the inception of the program in 2010. For that reason, the challenge areas have been perceived by the committee and many in the scientific community as lacking sufficient flexibility to address newly emerging problems and to incorporate rapid advances in science and technology. That is in contrast with the foundation priority areas (such as plant health and production and plant products) that are categorized by disciplines that span food and agriculture.

In addition, the power of the AES located in each state, the District of Columbia and local

² NRC Committee on a Review of the USDA Agriculture and Food Research Initiative. *Spurring Innovation in Food and Agriculture: A Review of the USDA Agriculture and Food Research Initiative Program*. National Academies Press, Washington, DC. 2014.

territories enables the investment in local emergent priorities, such as water scarcity and watershed management in Western AES, and more specifically, that led by the Oregon AES.

The Ohio Agricultural Research and Development Center and the USDA Agricultural Research Service (ARS), Wooster, OH, hosted sessions and tours that exemplified the fundamental and translational research partnerships with each other, the Ohio State University (the land-grant university) and private partners in the agribusiness sector. Thus, the Ohio Agricultural Research and Development Center served as an informative model of how the integration of AES into the USDA REE broader system may necessitate effective partnerships to address current and emerging issues in agriculture, agribusiness and the food system through its linkage with human health.

Recommendation 1a: USDA REE and the AES Directors should actively lead the effort to establish, facilitate, and strengthen additional research partnerships among the entire Land Grant University system (1862, 1890, 1894 and Hispanic-serving institutions) and within USDA agencies to enhance coordination of the research portfolio.

As discussed in the Relevancy and Adequacy report, many current high level policy discussions related to food and agricultural issues suggest that coordination will be key to REE's future success. We reiterate that report's recommendation that USDA REE updates its focus on: research partnerships among federal and state agencies, private sector, and universities; the incentivization, support, and evaluation of its integration of education and formal Extension activities as well as broader outreach efforts with research; the data management tools to be used in support of research, education and Extension; and, the design of a communications, engagement and outreach plan addressing a broad array of stakeholders.

The Board recommends that USDA and the AES Directors continue to pursue creative new partnerships. Two new initiatives have emerged that represent key first steps to pursue this recommendation; the proposed Centers for Excellence³ designation and the establishment of the Foundation for Food and Agriculture Research.⁴ These concepts could both be crucial links to leveraging USDA's resources to support the AES system and further expand the mission's funding impact while increasing the efficacy and efficiency across interdisciplinary and multi-institutional programs. Of particular note is the current language encouraging Centers of Excellence to integrate government partners (including ARS) and industry organizations in programming within those institutes.

Beginning in October of 2014, the new Farm Bill requires that NIFA prioritize Centers of Excellence established for purposes of food and agricultural research, extension, and education activities when selecting recipients of grants from any of the Agency's research or extension competitive grant programs. A Center of Excellence is composed of one or more of the following entities that provide financial or in-kind support to the Center of Excellence:

1. State agricultural experiment stations

³ http://www.nifa.usda.gov/about/offices/legis/farm_bill_2014_ex_prov.html

⁴ <http://www.usda.gov/wps/portal/usda/usdahome?contentidonly=true&contentid=2014/07/0156.xml>

2. Colleges and universities
3. University research foundations
4. Other research institutions and organizations
5. Federal agencies; national laboratories
6. Private organizations or corporations, as well as individuals

The Farm Bill delineates criteria for being recognized as a Center of Excellence, such as:

- Coordination and cost effectiveness improvements
- Leveraging of resources using public-private partnerships
- The ability to increase economic returns to rural communities,

NIFA is currently compiling feedback from key stakeholders and the broader community about what the scope of a Center of Excellence should be, as well as the strengths and weaknesses of some of the models that are used by other federal agencies. This committee applauds the development of criteria for Centers of Excellence that incentivize and ensure an increase in the economic returns to rural communities through coordination and joint identification of high-priority agricultural issues by multi-faceted partnerships. Given the convergence of needs of rural and urban populations and the interconnectedness of the food system, environment and health across rural and urban areas, we also encourage REE to consider the intersection of rural and urban food and agricultural needs as it sets these priorities for the Centers of Excellence. High visibility issues that could be more effectively addressed in this way may include: food access and obesity; the intersection between animal and human health; and the key role of water management in food systems (among others).

Similarly, the Foundation for Food and Agriculture Research intends to raise \$200 million of matching funding for research from non-governmental stakeholders, with no strings attached, to target at priority topics with the potential to have the greatest impact on our food and ag systems. This matching for federal funding of \$200 million again reflects the long-standing philosophy and practice of forging partnerships that underlies the AES system. USDA REE leadership has *ex officio* seats in this new foundation, but we recommend the USDA NAREEE board has a liaison to that organization as well, given the overall mission and its relationship to the NAREEE's mission and charge.

Recommendation 1b: USDA REE should actively lead the effort to establish and facilitate additional research partnerships with other federal departments and agencies, as well as non-Land Grant agricultural, food and natural resource-focused Universities, industry stakeholders, nonprofits and nongovernmental organizations to leverage the resources USDA can commit to addressing the research needs of complex problems.

The power of partnerships cannot be underscored because the best partnerships are mutually beneficial and driven by necessity, in some instances, due to limited resources. As a result, partnerships facilitate the maximization of available resources, which is critical during periods of uncertainty, like the one recently experienced as land-grant universities awaited passage of the Farm Bill. The USDA REE is in a powerful position to incent and support such partnerships through the existing infrastructure of the AES and ARS, its federal formula funding for AES and its competitive

funding through NIFA. The committee applauds REE for its strategic and focused approach that has already lead to powerful impact from such partnership, several of which we highlight below.

OARDC and ARS highlighted the impact of their work on wheat quality on advancing foundational breeding research at the national level, while accommodating project based work of specific benefit to industry millers and bakers. Another highlight focused on partnerships with private farmers to develop new large-scale production of algae for harvesting of nutrients such as omega-3 fatty acids and other bioactive components. In cooperation with a company focused on biofuel generation, a pilot project now provides 33% of the electricity for the AES and ARS facilities in Wooster. A sustained partnership with a food processing company on food product development exemplified the effective and mutually beneficial application of AES research. Such industry partnership to enhance agricultural productivity to meet future food system, health and bioenergy needs exist throughout the AES systems. Research, Extension and technology transfer focused on a targeted tree sprayer was also demonstrated for the committee, and showcased how industry needs, and a new focus on more sustainable production methods were squarely addressed with work at the Center.

Public-sector agriculture and food R&D is conducted by scientists in AES and associated universities and by scientists in federal USDA laboratories. Some U.S. government funding (\$78.9 million in 2009) also supports agricultural R&D conducted by the international research centers that constitute the Consultative Group on International Agricultural Research. Of the \$3.6 billion spent by state-affiliated institutions (the AES and other cooperating institutions) in 2009, 38.0% came from federal sources, 38.3% from state governments, 8.2% from industry grants and contracts, and 15.5% from income earned from sales, royalties, and various other sources⁵. Although the monies from industry partnerships have grown slightly in absolute terms between 2009 and 2012 (from \$230.7 million to \$250.6 million), the relative proportion of such funding to the total AES funding appears to change little even with increased efforts to secure cost share investments when grants primarily benefit a specific sector.

So, perhaps it is important to focus on projects that have been relatively successful in leveraging federal dollars to consider “best practices” that may be more actively encouraged in the culture of all AES programs.

At the national level, the NC219 study yielded outcomes that addressed health promotion priorities of USDA and other agencies such as NIH. Researchers with this multi-state study were successful in leveraging grant funding, including an Initiative for Future Agriculture and Food Systems (IFAFS) grant and two National Research Initiative (NRI) grants. As a result, they developed significant depth in the understanding of young adult food choice behavior because they were provided access to a wider variety of young adults than possible at a single institution. According to researchers, “our collaborative relationship permits development of a much larger and more intricate project than possible within any one state alone.”

Other examples of successful collaborations include the Healthy Homes Partnership, which is over

⁵ National Institute of Food and Agriculture, REEport
<http://portal.nifa.usda.gov/portal/front/login?service=http%3A%2F%2Fportal.nifa.usda.gov%2Fportal%2F>

10 years old. The Healthy Homes Partnership is an interagency partnership between the United States Department of Housing and Urban Development (HUD) and the United States Department of Agriculture (USDA) and, “is an outstanding example of interagency teamwork.” Since the program began, \$2.7 million has been distributed to 34 states, resulting in radon testing for more than 16,000 homes, installation of carbon monoxide alarms for 9,000 residents, and installation of 619 smoke detectors, in 2010 alone. “This Partnership improves individual and family health and reduces health care cost for families, communities, and the nation.”

In July of the current year, USDA, along with other organizations, partnered with the Consumer Financial Protection Bureau (CFPB) to train social service agencies in the use of the Your Money, Your Goals financial education curriculum. Feedback from CFPB’s pilot of their curriculum in 21 states revealed that most of the case managers who were trained are using the information and tools with their clients and feel more confident talking about these financial topics. “As a result, their clients are feeling empowered to take on challenges like paying down debt and building a spending plan to have more control of their financial lives.” Beyond these highlighted programs, there exist innumerable other excellent examples of effective partnerships.

REE and the AES Directors are encouraged to incent more partnerships by AES with less traditional partners. In some AES, when the relevant supporting academic discipline with its research capacity and expertise is not administered through the related agricultural academic unit, the partnership with the academic discipline is weak or not apparent. This may lead to limitations in some AES portfolios relative to national or local priority foundational or translational research. A relevant example comes from linkages with nutrition. At some Land Grant Universities, nutrition academic programs are administered through agricultural colleges or units leading to robust partnerships in critical areas of food and nutrition with AES, whereas at others the academic nutrition is administered elsewhere resulting for whatever reason in limited interaction and a weakened linkage of food production-oriented AES programming with the discipline. Similar administrative challenges and barriers may be encountered for other relevant and important disciplines such as; natural resources, business management, consumer behavior and community development.

Further, as the complexity of the research needs and problems facing food and agriculture grow, partnerships with non-traditional and emerging disciplines such as informational science will be needed. The committee recommends that REE consider how it can incentivize stronger interdisciplinary and cross-disciplinary partnerships across AES irrespective of the specifics of academic administration on a particular campus. Examples do exist in the system such as the campus-wide approach to engaging a wide range of academic partners and Extension professionals in Water Systems research and Food Systems programming at the Colorado Agricultural Experiment Station. Finding ways to facilitate more effective cross-disciplinary programs are critical for the integrated research approaches and projects required to solve the problems facing the agri-system today and, no doubt, in the future.

Recommendation 2a: USDA REE should consider the research funding and investments in AES, a key component of the NIFA, relative to its entire research portfolio including its agencies and extramural partner. NIFA should be directed to allocate more strategically between both competitive AFRI funds, as well as formula and competitive funding, to AES, its personnel and partners so that REE can continue to expand and improve the impact and returns to investment

that has been commonly documented for food and agricultural research through the AES. There should be particular attention to maintaining the correct balance of Formula and Competitive Funding because of the synergy of benefits from capacity building and infrastructure that come from formula funding and the innovation that stems from competitive funding. Both are essential to maintain the vitality, evolution and relevance of the AES system.

Recommendation 2b: As part of its realignment, AFRI should focus primarily on investigator driven research relevant to the priority areas and eliminate the more prescriptive Challenge-Area Program (This recommendation is supported by a forthcoming NRC report⁶ as well).

The Science Road Map for Food and Agriculture, prepared by the Association of Public Land Grant Universities provided a strong case for increased funding, concluding that the recent decline in agricultural productivity gains is at least in part due to declining public investments in agricultural research. However, new funding will be met with increased scrutiny of returns to those investments. Along with leveraging USDA dollars with monies spent by partner agencies, industry partners and organizations (discussed in Recommendation 1), changing the perception of some that monies are targeted and invested in a way that follows some outcome-based metrics may also be key. We recommend this perception may change most markedly with transparent and metric based information on outcomes from research funding to formula and competitive research pools.

Some key principles to consider when rebalancing the portfolio of funding include:

- a) balanced use of both capacity and competitive funding to support maintenance of a basic cadre of professionals to do the work of the AES system ensuring it can respond to unforeseen challenges, while encouraging development of innovative ideas formulated across the AES, and extramural expertise;
- b) leveraging of federal and state funding with that of the NGO and private sectors; and,
- c) the integration of research, education and outreach across the work of the AES and partnering units of the agency.

There have been continued arguments by the APLU that a balanced use of both formula/capacity and competitive funding is key to the USDA's successful support of food and agricultural research. Yet, there is no formal analysis of what proportions of each type of funding make sense, if those proportions vary by foundational programs, and if there is some time horizon where an emerging, current issue may mature into a field of study that warrants long term capacity funding. This evolution of priority, current issues into long-term research needs could also be a way to engage state funding partners in their role in supporting foundational research needs of their constituencies through their AES. And, the integration of research, education and outreach can be incentivized through competitive funding priorities and funding, but it is likely the AES-based capacity funding of more permanent personnel lines will be required to influence the curriculum and work teams that will address those classroom and outreach needs in the long term. These issues should be addressed in future USDA REE strategic plans.

⁶ NRC Committee on a Review of the USDA Agriculture and Food Research Initiative. Spurring Innovation in Food and Agriculture: A Review of the USDA Agriculture and Food Research Initiative Program. National Academies Press, Washington, DC. 2014.

The Board continues to prioritize a timely critique of how the whole portfolio of funding for the AES system is evaluated. In addition to past calls for a full evaluation of how NIFA and ARS conduct peer reviews of competitive grant applications, the new Centers for Excellence concept may provide a catalyst for reconsidering how reviews of capacity among institutions or broad sets of partnerships in the AES system may facilitate more streamlined evaluation of how formula/capacity and competitive funding complement one another. There may also be opportunities to evaluate how the use of data collected by NASS, analysis performed by the ERS, and cooperative agreements between ERS and partners throughout the US are helping to leverage fixed program funding in the AES system as well. This priority was validated in one recommendation from the draft of an upcoming National Research Council report:

NRC Report's Recommendation 4-D: NIFA should develop the capability to regularly evaluate AFRI projects in terms of their outcomes, which would allow assessment of the economic and social impacts of the research that AFRI supports.

Recommendation 3a: USDA/REE should ensure that AES system, by design, have a strong focus on foundational issues to support and reinforce the translational research using NIFA Institutes and Centers of Excellence, including Food Production and Sustainability; Bioenergy, Climate, and Environment; Food Safety and Nutrition; and Youth, Family, and Community.

Recommendation 3b: USDA/REE should promote the fundamental linkages between the AES and Extension system, allowing the impacts of applied research and translational outreach to be greater and more effective.

The first round of newly oriented AFRI grants has been an achievement. At the same time, there is concern among some USDA NAREEE Board members that recent AFRI grants have shifted a large amount of competitive funding toward “megaprojects,” leaving less funding to distribute to “smaller scale” research projects. The development of the Centers of Excellence designation may be perceived as having similar implications, given one proposed mechanism to gain designation is through a competitive grants process. And, because there is an increased presence of educational and Extension activities through Integrated competitive grants programs, the Centers for Excellence may further strengthen linkages among those functions. For this reason, this committee believes this recommendation may be addressed at the same time that a process for Centers of Excellence designation is developed.

Following recommendations from the Relevancy and Adequacy report, a stronger emphasis on metrics and intended outcomes within the REE Action Plan will assure that foundational issues are connected to prioritized impacts expected of the AES and other USDA programs. Moreover, those same metrics and intended outcomes will be paramount to selection of Centers for Excellence.

The Science Roadmap argues that Land Grant Universities have a long tradition of solving societal problems related to the issues listed above by balancing strong science with benefits and consequences to society. It can do so because it has the broad disciplinary expertise to address both the bench-science and human dimensions of issues. The authors of the Roadmap argue that sustained funding of foundational programs capitalizes on this capacity, while also directing some of the investments into translational research. The translational research is integrated with teaching and outreach through the REE and its partner Land Grant University to effectively address societal needs.

Concluding Points

The AES system has a long, sustained and successful history of effective partnerships with formula and competitive funding from USDA REE, augmented by competitive funding from other federal agencies, state government, and increasingly, private organizations and the industry sector. REE has a key and pivotal leadership role in incentivizing strategically prioritized foundational and translational research through the AES system to address the central challenges for the nation in terms of its global food security, agriculture, environment and nutritional health. To ensure the continued vitality and effectiveness of the AES system, REE needs to facilitate partnerships to leverage these foundational investments, openly address the appropriate balance of formula funds for capacity and infrastructure and competitive funds to ensure excellence and strategic impact, and effective foundational and translational research. Each of these investments require more attention to documentable impact and outcomes to clearly demonstrate to the nation the return on its investment in the AES system.

**Report Developed by the Cooperative Agricultural Experiment Station
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