

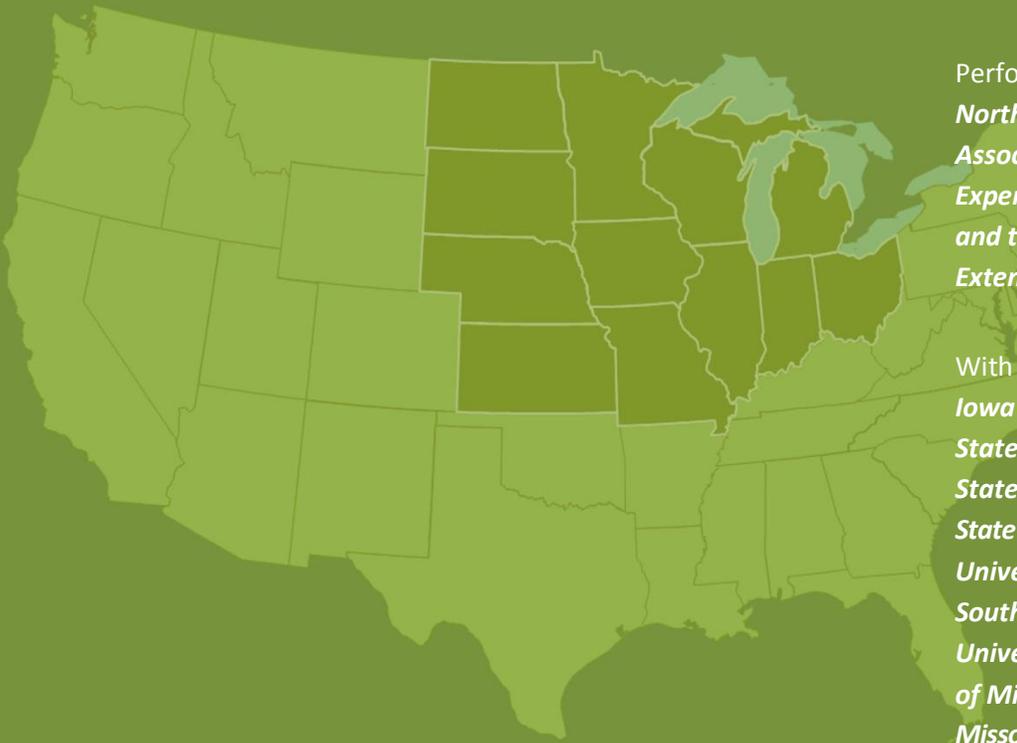


EXECUTIVE SUMMARY

POWER & PROMISE:

Agbioscience in the North Central United States

*The Importance of North Central Experiment Stations,
Extension Services and their Land-grant Universities
in the Global Bioscience Economy*



Performed For:
*North Central Regional
Association of State Agricultural
Experiment Station Directors
and the North Central Cooperative
Extension Association*

With Sponsorship By:
*Iowa State University • Kansas
State University • Michigan
State University • North Dakota
State University • The Ohio State
University • Purdue University •
South Dakota State University •
University of Illinois • University
of Minnesota • University of
Missouri • University of Nebraska
• University of Wisconsin*

Performed By:
Battelle
**Technology Partnership Practice
and BioDimensions**

2011

Battelle

The Business of Innovation

Battelle does not engage in research for advertising, sales promotion, or endorsement of our clients' interests including raising investment capital or recommending investments decisions, or other publicity purposes, or for any use in litigation.

Battelle endeavors at all times to produce work of the highest quality, consistent with our contract commitments. However, because of the research and/or experimental nature of this work the client undertakes the sole responsibility for the consequence of any use or misuse of, or inability to use, any information, apparatus, process or result obtained from Battelle, and Battelle, its employees, officers, or Trustees have no legal liability for the accuracy, adequacy, or efficacy thereof.

ABSTRACT

The North Central Region's Agricultural Extension Services and Experiment Stations are a foundation on which the \$125 billion, 2.4 million job agriculture-driven industry in the region is built. This industry is already the most sophisticated and productive agriculture, forestry and value-added products system ever created, and it is poised to expand significantly with new markets such as novel health, specialty crops, biofuels and biobased products. Using just biobased products as an example, it is estimated that there is a potential to replace up to two-thirds of petro-based chemicals with agricultural-based materials, representing 50,000 different products—a \$1 trillion global market.¹ There are similar opportunities with novel health, food safety, biofuels, and environmental technologies, each of which has potential to create thousands of new jobs and knowledge-based companies across the North Central region and the United States. Sustaining and protecting current agricultural value-chain production, while realizing the potential of exciting new economic opportunities, requires support for the fundamental scientific research and translational support mechanisms contained within land-grant agricultural experiment stations and extension services. The land-grant system has played a central role in the rise of American agriculture to global preeminence, but the scale of opportunities contained in a fast-expanding bio-based 21st century economy warrant considerably more attention be paid to these core institutions.

Sustained or expanded federal, state and local support will help this important land-grant, experiment station and extension service system to continue to perform its multi-faceted functions in cutting edge research for commercialization, education of knowledge workers for industry across the value chain, supply of unbiased information and support for farmers, and pursuit of opportunities for new collaborations and networks to grow the industry.

Through the 12 member institutions in the North Central Cooperative Extension Association (NCCEA), county extension agents are providing education to farmers serving as the primary unbiased link between the farm and new technologies and production practices. On the R&D front the 12 member institutions in the North Central Regional Association (NCRA) of State Agricultural Experiment Station Directors and the NCCEA are working to produce and disseminate agbioscience solutions to pressing economic and social needs. Collectively these thousands of knowledge-workers are driving a system that is providing for a safe, competitive, and healthy agbioscience based economy for the United States, while generating the knowledge and research support required to expand the sector in the future as a foundation for new and enhanced sustainable industries in food, feed, health, materials, chemicals and energy. Without ongoing public support for land-grant agbioscience research and extension activities national and regional agbioscience industries will not be able to realize their competitive potential. Indeed, at a national and state level, expanded support for agbioscience research and extension activities should ideally be pursued because the economic development opportunities are so large, the issues addressed strategic to the U.S., and funding support critical to maintaining and expanding U.S. leadership.

Agbioscience holds the key to a bright future for the U.S. and the North Central region in what has been termed the BioCentury. It is a base of economic power for the region and the nation, but moreover it holds great promise as a central driver of a successful economic and societal future.

¹ Jarrell, K.A., *"Synthetic Biology and Sustainable Chemistry Revolution."* Industrial Biotechnology. Winter 2009.

EXECUTIVE SUMMARY

There is no other arena of economic activity, or field of science and innovation, that so directly addresses human survival and quality of life, global economic development, and prospects for an environmentally sustainable future as agriculture and agbioscience.

Land-grant universities, through their experiment stations and extension services, are on the frontline of sustaining and securing America's leadership and competitiveness in what is and will be the key macroeconomic sector of our time.

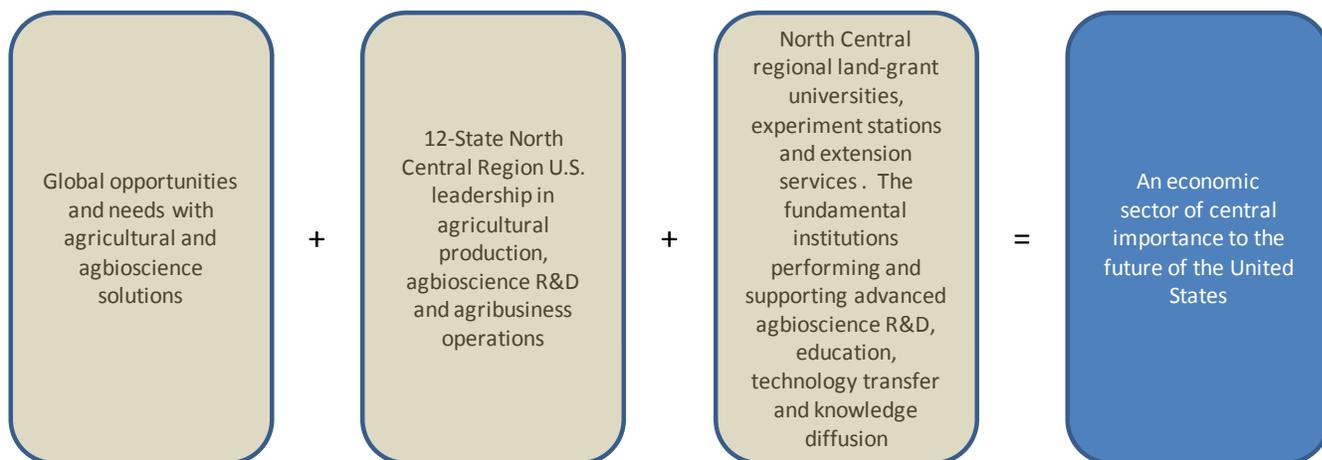
This report highlights the fact that agriculture and modern agbiosciences represent a scientific and economic sector of central importance to the future of the United States. Agriculture and agbioscience are directly relevant to finding solutions to key challenges facing the U.S. and the world—*economic growth, food security, human health, and environmental sustainability*. Within agbioscience the U.S. is a global R&D and production leader, working from a position of great strength. The U.S. is at the forefront in innovating and leveraging advanced technologies and bioscience knowledge advancements to enhance productivity and sustainability in food production and to create expanding economic opportunities in new advanced biobased products for fuels, chemicals, materials, healthcare products and a broad range of additional applications.

While agriculture is an economic sector present and important in every state, the twelve-state North Central region of the U.S. stands as a premiere location for agbioscience R&D, high-volume and high-efficiency agricultural production, and for agribusiness generating value-added products for domestic consumption and export.

Of central importance to progress in North Central regional agbiosciences are the presence and operations of land-grant universities, their experiment stations and extension services. These institutions undertake the fundamental and applied research leading to innovation in agbioscience. These institutions provide the testing, piloting and scale-up infrastructure and expertise to propel new innovations and technologies to market reality. These institutions provide support services in R&D, process improvement and the development of solutions to problems for industry. These institutions translate new knowledge, techniques and tools into the field through the translational activities of extension. And, these institutions educate the scientists, engineers and other skilled human capital required to sustain U.S. and North Central global leadership in agbiosciences.

In the “BioCentury” that is the 21st Century, land-grant universities, and their experiment stations and extension services, are on the frontline of sustaining and securing America’s leadership and competitiveness in what is, and will be, the key macroeconomic sector of our time. As this report shows, sustaining these institutions, further investing in them, and addressing their challenges is of central importance to a sustainable economic future for the United States. The North Central region’s agbioscience assets are part of an agricultural “equation for progress” (Figure ES-1):

Figure ES-1: Agriculture and Agbiosciences, an Equation for Sustainable U.S. Economic Progress



It is America’s land-grant universities that uniquely engage across the full-spectrum of agbiosciences—from the most basic scientific enquiry through to practical services in support of producers, manufacturers and society provided via extension services.

By directly addressing key challenges and opportunities associated with agriculture and agbioscience the North Central regional land grant universities are playing a central role in U.S. progress across a range of fronts (Figure ES-2).

The importance and relevance of agriculture and agbiosciences to major challenges facing states, the nation and the globe are further documented in a recent report entitled “A Science Roadmap for Food and Agriculture” which highlights the direct impact of land-grant institutions on seven identified “grand challenges”.²

- *Enhancing the sustainability, competitiveness, and profitability of U.S. food and agricultural systems*
- *Adapting to and mitigating the impacts of climate change on food, feed, fiber, and fuel systems in the United States*
- *Supporting the energy security and the development of the bioeconomy from renewable natural resources in the United States*
- *Playing a global leadership role to ensure a safe, secure, and abundant food supply for the United States and the world*
- *Improving human health, nutrition, and wellness of the U.S. population*
- *Heightening environmental stewardship through the development of sustainable management practices*
- *Strengthening individual, family, and community development and resilience.*

² Association of Public and Land-grant Universities, Experiment Station Committee on Organization and Policy – Science and Technology Committee, “A Science Roadmap for Food and Agriculture.” November 2010.

Figure ES-2: Global Challenges with Agricultural and Agbioscience Solutions



Developments in agbioscience are also creating new markets for crops and crop residues as renewable, bio-based feedstocks for a number of key industries, including clean energy, chemicals, plastics and health products.

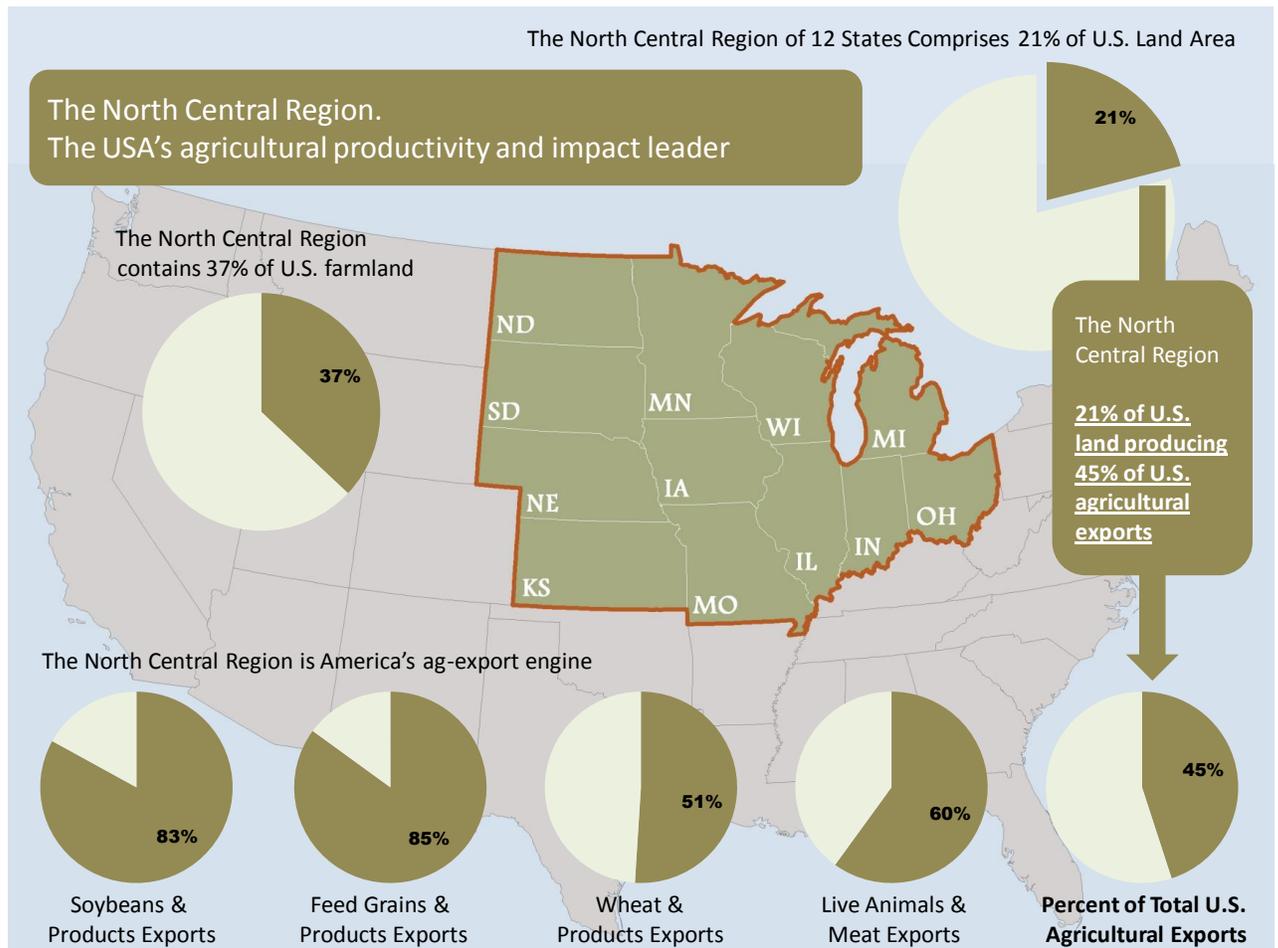
Battelle’s work leads us to concur with the relevance of modern agriculture and agbiosciences to these grand challenges. Agbiosciences represent a unique field of science and applied R&D generating widespread innovations, technologies and solutions to tangible real-world needs.

Agbioscience practitioners, the research community sustaining America’s leadership in agbioscience innovation, and the extension professionals translating advancements into the field, have a critical role to play in supporting a sustainable global future—economically, socially and environmentally.

The North Central Region

As noted above, the North Central region is a high performance center for agriculture, agbioscience R&D and educational activity. Its leading position in agricultural production is illustrated by Figure ES-3:

Figure ES-3: The North Central Region – The U.S. Leader in Agricultural Production



This agricultural and biomass-based economy is supported by an extensive network of land-grant assets. Underpinning the region’s leadership in agriculture and agri-business, and its promise for the future, is an intensive

North Central regional extension and experiment station assets focused on agricultural inputs development, agricultural production, ag-processing, ag-equipment development, and downstream value-added food, fiber and industrial products manufacturing comprise an “agbioscience innovation ecosystem” —an environment in which agbioscience business development is thriving.

cluster of institutions, organizations and businesses engaged in agbiosciences research and associated R&D activities. Taken together, North Central regional assets in agricultural inputs development, agricultural production, ag-processing, ag-equipment development, and downstream value-added food, fiber and industrial products manufacturing comprise an “agbioscience innovation ecosystem”—an environment in which agbioscience business development is thriving.

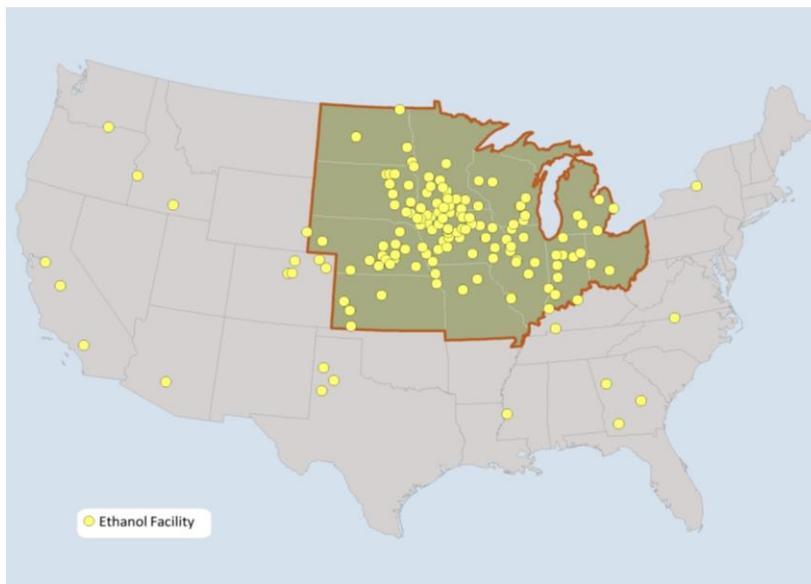
The North Central’s academic agbioscience community is performing well. In 2009, colleges and universities in the North Central region attracted \$3.6 billion in funding for academic R&D in agbiosciences and related disciplines. Likewise, the region is also a hub of major agbioscience-based industry multinationals that are active in R&D and technological innovation, for example:

- Ten of the top 25 U.S. food manufacturers have their HQ operations in the North Central Region (Kraft, Anheuser-Busch, General Mills, ConAgra, Kellogg, Sara Lee, Hormel, Cargill, SABMiller and Chiquita Brands).
- Two of the top five seed companies in the World are based in the North Central U.S. region (Monsanto and Land O’Lakes).
- Two of the world’s preeminent agricultural equipment manufacturers are based in the region (John Deere in Illinois, the World’s largest, and #2 ranked Case New Holland’s North American HQ in Illinois).
- The North Central region is the hub for the U.S. animal health products industry, with operations of leading companies such as Fort Dodge Animal Health (Kansas), Abbott Animal Health (Illinois), Boehringer Ingelheim Vetmedica (Missouri), Novartis Animal Health (Iowa) and Pfizer Animal Genetics (Michigan).

Taken together this uniquely active system of agricultural production and advanced value-added manufacturing makes the North Central region the global leader in both traditional agricultural economic activity and the leading emerging areas of the modern bioeconomy. The degree of leadership shown by the region in the emerging bioeconomy is well documented and illustrated by the example of the distribution of first-generation renewable biofuels production plants (shown in Figure ES-4).

The renewable fuels sector, however, represents just one part of a multi-faceted emerging bioeconomy for the North Central region. The significant chemicals, polymers and materials industry in the region is proactively investigating the use of biobased feedstocks as substitutes for current environmentally unfriendly and price volatile fossil-resource based feedstocks (primarily petroleum). Similarly food and health product manufacturers in the region are on the frontier of developing and manufacturing advanced foods, functional foods, nutraceutical products and other health enhancing agriculture-based products.

Figure ES-4: Clustering of Renewable Biofuels Operations Evident in the North Central Region. Ethanol Manufacturing Facilities in the United States



Land Grants and their Experiment Stations and Extension Services: Of Central Importance to Agbioscience Power and Promise

The North Central region’s leadership in agricultural production, agricultural processing and value-added manufacturing is advanced and supported by continuous innovation in agricultural and biological sciences, and within associated disciplines (such as engineering). Helping to drive scientific discovery, innovation and the deployment of new technologies and innovations to enhance industry productivity is a uniquely American

The twelve 1862 Land-grant universities in the North Central region include:

- **Iowa State University**
- **Kansas State University**
- **Michigan State University**
- **North Dakota State University**
- **The Ohio State University**
- **Purdue University**
- **South Dakota State University**
- **University of Illinois**
- **University of Minnesota**
- **University of Missouri**
- **University of Nebraska**
- **University of Wisconsin**

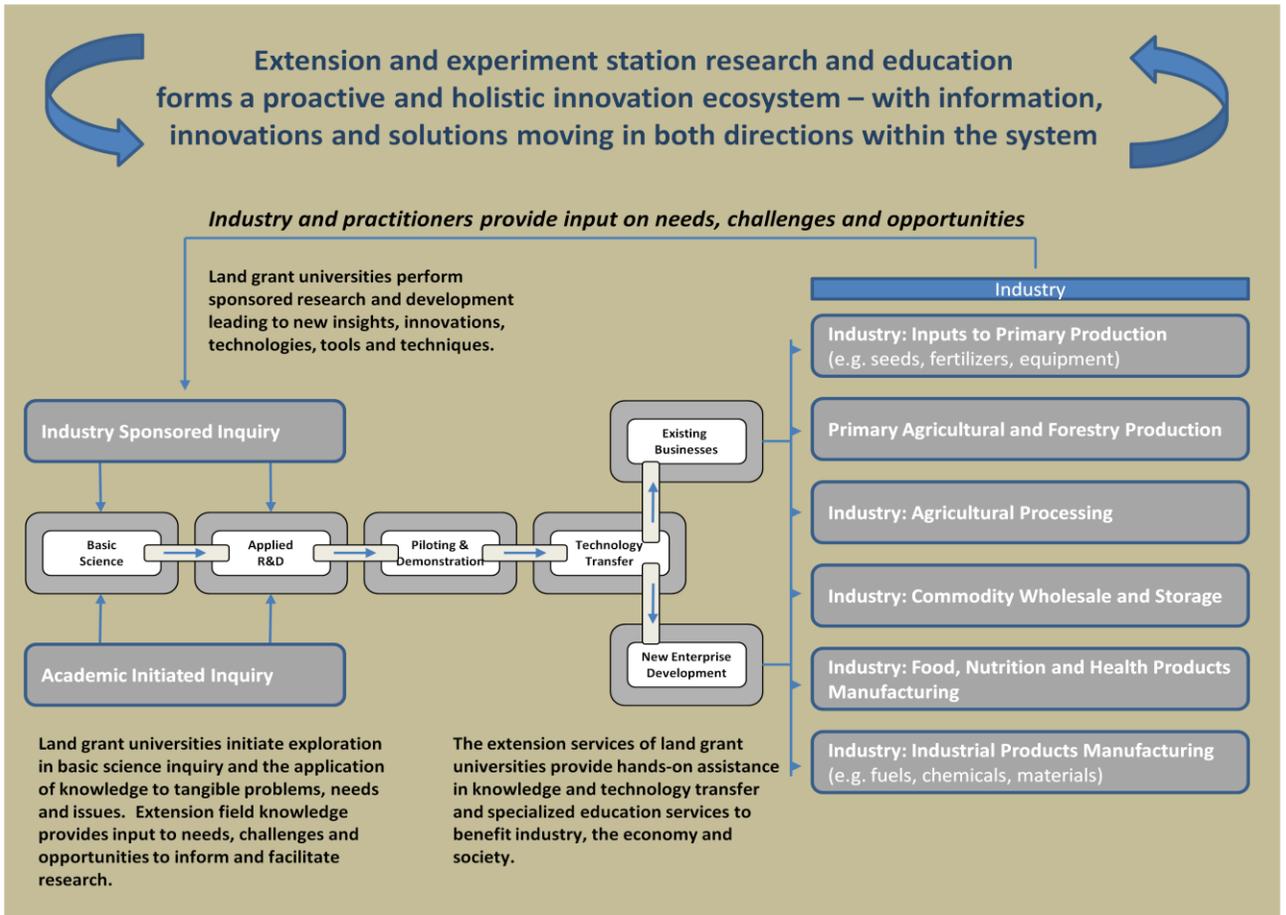
system developed by visionaries in the late 1800’s—the Land-grant University. “Land-grant University” is the term used to identify a public university in each state that was originally established as a land-grant college of agriculture pursuant to the Morrill Act of 1862. In most states (including all of the North Central states) the original agricultural colleges grew over time into full-fledged comprehensive public universities by adding other colleges (e.g., arts and sciences, medicine, law, etc.). Today these universities stand among the world’s premier research institutions.

Providing a comprehensive and integrated system of education, research, and knowledge and advanced practice diffusion—the North Central region’s land-grant universities provide the skilled human capital needed by the agbiosciences sector and they advance the basic and applied knowledge base that underpins agbioscience advancement. Unlike other academic-based disciplines, the agbiosciences at land-grant universities are deliberately leveraged for the good of agricultural producers, industry and society through the operations of a purpose-built extension system. This highly pragmatic system provides science and technology development and implementation services that keep U.S. agriculture, agribusiness and associated business sectors at the forefront of innovation, productivity and competitiveness.

Through a systematic pipeline of research and education (see Figure ES-5), comprising experiment station and extension service programs, these institutions are leading the way in agbioscience R&D, in new knowledge dissemination, and in technology transfer and commercialization of technologies for the agricultural production and processing sectors. Under this system, colleges of agriculture and their experiment stations conduct basic and

applied R&D in the agricultural and agbio industries through their laboratories, research farms and testing facilities. From basic science in molecular biology, biochemistry and genetics through to highly applied work in plant breeding, plant transgenics, agricultural engineering and biomaterials, this research work is helping to develop new crops, technologies, processes and value-added products for the American agricultural and agbio industries.

Figure ES-5: Land-grant Universities and their Experiment Stations and Extension Services – A Unique System for Agbioscience Research, Development, and Innovation Diffusion



As Figure ES-5 shows, in this land-grant innovation ecosystem research inquiries in basic and applied sciences (sponsored by federal grants, state support, foundation funding, industry sponsorship and other typically extramural sources) generate technologies, innovations and practice examples that are tested and piloted through the unique infrastructure contained in agricultural colleges, associated university departments and the experiment station system. Via licensing, new business formation, knowledge-diffusion and other technology transfer activities, the land-grants (often through the extension service) proactively move innovations, technologies and practice advancements into use within the agbioscience industry value-chain. As a result of this land-grant system new products, enhanced products, process

The proximity of the North Central Land-grant universities to distinctive clusters of plant bioscience and animal bioscience companies makes the North Central region a particularly vibrant center for realizing America's agbioscience industry opportunity.

improvements and other advancements in agbioscience knowledge and practice are transferred into commercial sectors—keeping them competitive and helping to drive U.S. economic growth.

Within the North Central region, thousands of projects are undertaken annually by the 12-university regional land-grant system and it would be impossible to illustrate the impacts of each and every one. However, the broad variety of positive impacts engendered by this system can be, in part, illustrated by referencing specific impact examples recorded by the North Central Regional Association of State Agricultural Experiment Station Directors. Figure ES-6, on the following page, classifies the many core categories of impacts generated by this unique system—illustrating the broad suite of impact categories addressed by the land-grant/experiment station/extension system.

Advances in agbioscience depend on the quality of the technology developed as well as the successful translation of that technology into commercial utilization by producers and processors. Extension Service Programs at each of the universities comprise a network of specialists (typically in each and every county) providing a wide variety of information, technical knowledge and education services for individuals and companies in the community. Extension service providers work closely with farmers, ranchers, foresters, business persons and other members of the local community to provide timely, and unbiased advice on issues like the introduction of new crop varieties and production requirements, agricultural marketing opportunities, disease and pest management tools, animal and livestock health products, agricultural equipment, irrigation technologies, and agricultural processing technologies.

The land-grant university, experiment station and extension service system is clearly a unique asset for the U.S. and represents a system of extreme relevance to the needs of a modern U.S. economy so dependent on innovation, knowledge and technological advancement to maintain its competitive edge.

Table ES-1 serves to illustrate a number of the key issues being addressed through the land-grant/experiment station/extension service system:

Figure ES-6: Examples of Impact Categories Within the North Central Region

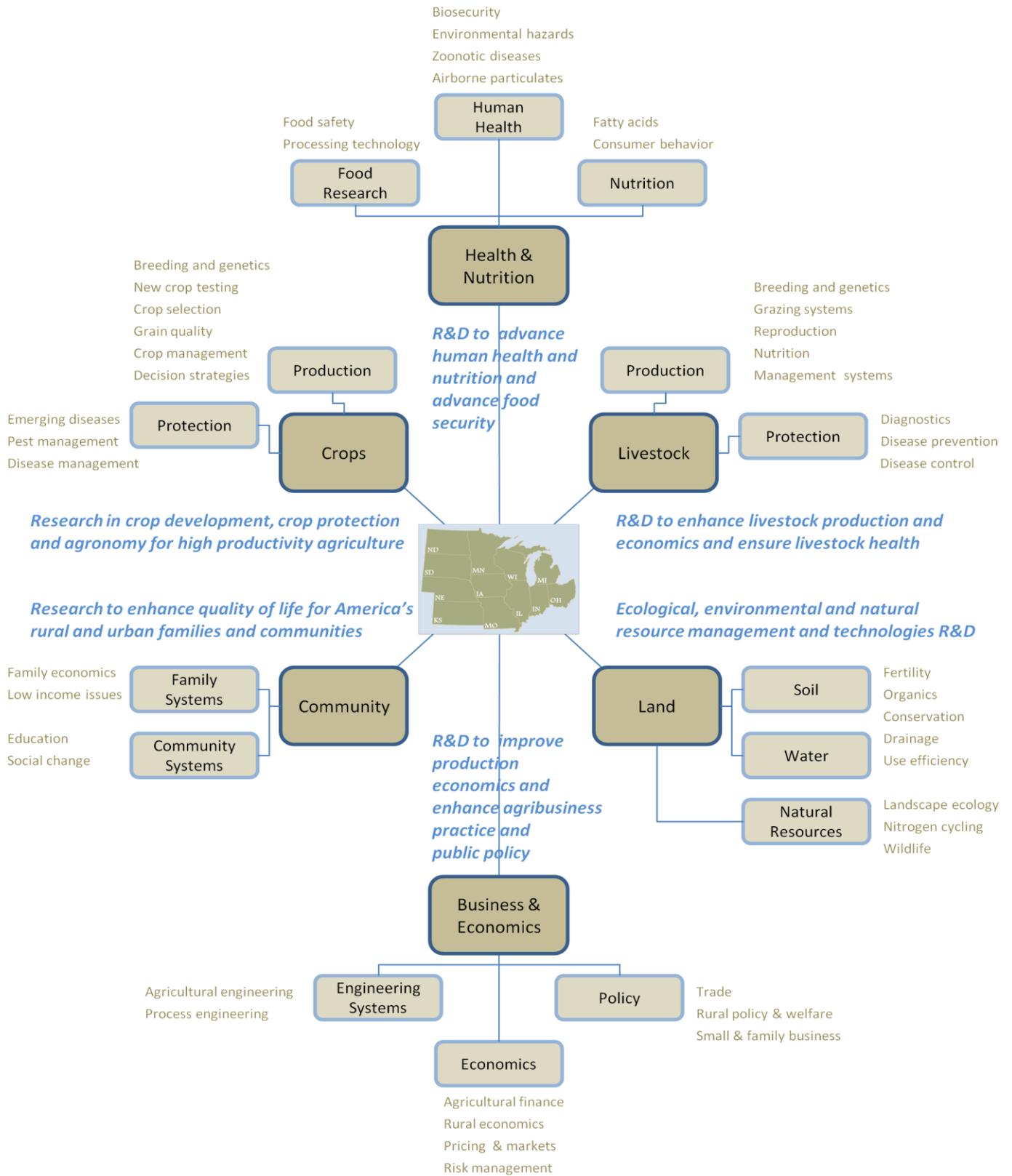


Table ES-1: Experiment Stations and Extension Services –Relevance to Major Issues and Challenges

Issues	Research Relevance	Extension Education Relevance
National economic competitiveness	<p>Innovations to enhance agricultural and forest productivity.</p> <p>Innovations to enhance the productivity and competitiveness of value-adding industry.</p> <p>Field trials, testing and scale-up of new technologies.</p> <p>Facilitation of research in specific soils, climatic and agronomic zones.</p> <p>Specialized testing and R&D services for industry</p> <p>New products and technology innovations for commercialization.</p> <p>Business and new technology incubation services.</p> <p>Adding value to domestic, home-grown resources.</p> <p>Development of products for export.</p>	<p>Demonstration and field testing</p> <p>Education in new technologies and practices for producers.</p> <p>Education and technology transfer for industry.</p> <p>Direct consultation with producers on tools, techniques, products and markets to enhance competitiveness.</p> <p>Advisory services in new business development and commercialization.</p>
Homeland security	<p>Protecting the U.S. from plant, animal and zoonotic diseases.</p> <p>Specialized research infrastructure for specific crops, animals and associated threats.</p> <p>Reducing dependency on foreign imports and fossil fuel resources.</p>	<p>Widespread on the ground monitoring and observation network.</p> <p>Tangible, hands-on assistance and advice to producers and processors.</p> <p>Specific food safety and handling education.</p>
Environmental sustainability	<p>Innovations in production inputs use efficiency, and plant transformation to reduce agricultural inputs.</p> <p>Technologies for reducing waste streams and waste stream impacts, and for converting waste to value-added products e.g., energy.</p> <p>Production scale test sites for evaluation of environmental impacts and technologies.</p> <p>Demonstration facilities for environmentally sustainable practices, tools and technologies.</p>	<p>Widespread on the ground monitoring and observation network.</p> <p>Tangible, hands-on education and advice to producers and processors.</p> <p>Education of practitioners, community members and youth regarding environmental sustainability.</p> <p>Water, energy and resource conservation advisory services.</p> <p>Demonstration and field testing</p>
Education, skilled human capital and workforce development	<p>Direct education of undergraduate and graduate students.</p> <p>Continuing education courses.</p> <p>Development of new knowledge and know-how for diffusion into practice.</p> <p>Facilitation of regional access to expertise and development resources.</p> <p>Facilitation of field research in regional crops, specific agronomic zones, etc.</p>	<p>Knowledge and know-how diffusion.</p> <p>Continuing education for adult and youth audiences.</p> <p>K-12 programs and STEM (Science, technology, Engineering and Math) education support.</p> <p>4-H educational and youth development programs.</p> <p>Development of web and distance learning systems and educational materials</p>
Societal welfare	<p>Economics research and policy analysis</p> <p>Policy analysis</p> <p>Community, urban and rural development research</p> <p>Education and extension operations research</p> <p>Research on the American family, youth development and other key social issues</p>	<p>4-H programs extending learning hours and reaching “at risk” youth.</p> <p>Tangible services in urban and rural economic development.</p> <p>Hands-on support and coaching for families, community groups and civic leaders.</p> <p>Promote public and individual health for adults, children and youth.</p>

The North Central region's experiment stations and extension service programs provide an integrated system to research, develop, pilot, demonstrate, and disseminate new innovations to benefit practitioners and industry.

As highlighted above, the North Central region's experiment stations and extension service programs provide an integrated system to research, develop, pilot, demonstrate, and disseminate new innovations to benefit practitioners and industry. This system is providing innovative systems for improving the profitability of agricultural producers and processors, creating new businesses and new economic opportunity, protecting food sources from toxins and pathogens, and ensuring the sustainability of the environment for the next generation and beyond. Importantly, this is also a system that is well-structured to support U.S. economic development in the BioCentury—leveraging biobased resources to expand our economy and enhance economic, societal and environmental sustainability.

A System at Risk

While agriculture and agbioscience have great relevance to human health, economic and social progress, and environmental sustainability in the 21st Century, the core institutions that are supporting advancements in these fields—America's land-grant universities, colleges of agriculture, experiment stations and extension services—face considerable challenges.

Table ES-2 highlights some of the diverse challenges and issues facing experiment stations, extension services and land-grant universities, and it is evident that the challenges come from multiple quarters. Fundamentally, the importance of agbiosciences is expanding due to its relevance to global needs and challenges—BUT, this is occurring at a time of budget crises within federal, state and local funding agencies and within private industry. There is, therefore, a fundamental tension between meeting expanding needs and opportunities while attempting to operate within a budget crisis environment.

America's land-grant universities, their colleges of agriculture, experiment stations and extension services face considerable challenges.

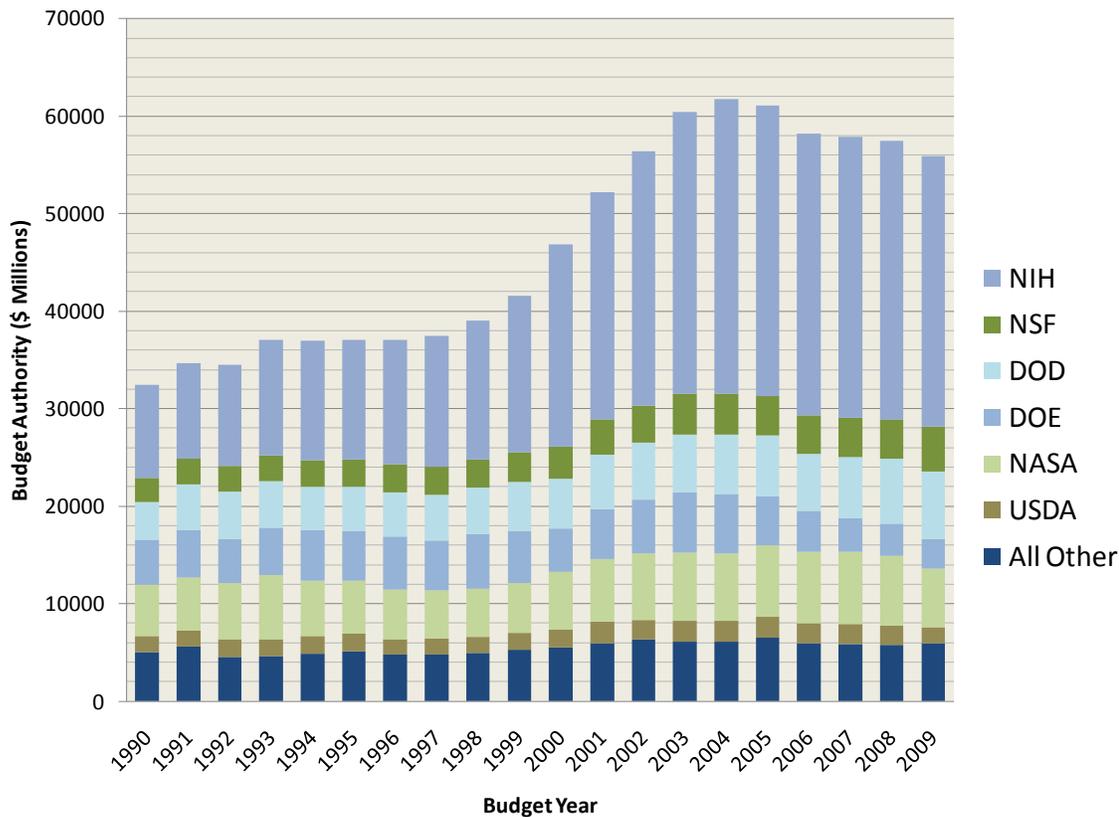
Table ES-2: Challenges to Agbioscience Institutions in the Current Environment

Challenges and Issues	
Federal	<ul style="list-style-type: none">• Decline of federal formula funding.• A need to increase funding for agbioscience related R&D, via NIFA, if land-grants are to fully address the major issues and opportunities.
State	<ul style="list-style-type: none">• Rising tide of state fiscal crises limiting support to state universities, experiment stations and extension.• Fiscal problems for U.S. counties limiting traditional local support for extension.
General Public	<ul style="list-style-type: none">• Lack of communications regarding the growing importance of agriculture and agbioscience to global issues and development opportunities.• Need for those benefiting from programs to voice their impact and appreciation with key decision makers.• Need to communicate the “public value” of programs• Need to better connect the message of <i>agriculture = food = nutrition = health</i>

Perhaps chief among the challenges faced is an uncertain funding environment for agbioscience R&D and associated extension activities. While funding for the USDA and NIFA has been relatively steady, cuts are proposed in forthcoming budgets: cuts that will ripple through a system that leverages federal funding with state and local matching financial support.

As discussed in this report, agbiosciences are critically important to tackling many of the most pressing issues facing the nation and globe—yet, as a collective suite of disciplines, agbiosciences receive comparatively low levels of funding attention in the national R&D funding scheme. Figure ES-7 illustrates this funding situation, showing the level of funding provided via USDA versus other agencies. Ideally, recognition of the large-scale market opportunities in the agbioscience space should spur increased investment in NIFA because without such expanded investment it will be difficult to sustain U.S. R&D leadership in the sector, realize economic development gains from the development of R&D based agbioscience innovations to meet growing market needs, and reap the strategic benefits of a sustainable domestic biobased economy.

Figure ES-7: Federal Funding by Major Agency – 1990 through 2009 (in 2008 constant dollars)
 (Source: American Association for the Advancement of Science - <http://www.aaas.org/spp/rd/guihist.htm>)



Not Just a Federal Issue

Constrained NIFA research funding represents an issue, but it is not the only financial challenge facing experiment stations and extension services. Extension is funded by the USDA at the federal level, with federal funding matched and highly leveraged by state and local (county) partners. Current budgetary challenges are impacting each of these three legs of the funding stool (noted by land-grant college of agriculture deans to be a “perfect storm”)

There is a fundamental tension between meeting expanding needs and opportunities while attempting to operate within a budget crisis environment.

In addition, general budget crises in many states are leading state governors and legislatures to consider substantial cuts to funding of what they see as “discretionary programs” such as agricultural research and extension (even though these are actually core drivers of future economic growth potential).

The risk of not having agbioscience as a priority for the nation and states is potentially an erosion of financial support for land-grants, experiment stations and extension and, therefore, a reduction in our ability to compete effectively in global agriculture and agbioscience. The federal government and individual states are clearly in an era of budget crises and many programs appear to be at risk for funding cut-backs. Work performed by land-grant institutions in agbioscience though can provide a high return for funders -- giving back to

government more than is put-in. Independent research performed by Battelle in Nebraska and in Oklahoma found that the land-grant agbioscience complex in these states generated between a 15 to 1 and 25 to 1 return on investment for state resources³.

Standing Still is Not an Option

The United States is not alone in the pursuit of frontier science as a driver of economic and societal development. Traditional competitors in Europe are being joined by fast developing economies such as India, China and Korea that see the benefits of investing in scientific research and applied development projects—including agbioscience projects.

At stake is leadership in the areas of science and technology development, and technical education, most relevant to key global challenges—and, therefore, most likely to generate high demand and economic opportunities.

The National Academies⁴ has sounded warning bells regarding U.S. funding for science and the preparedness of our education system to sustain a leadership position. With funding challenges coming across multiple fronts we have a system at risk—a system in which the U.S. currently has a leading position and tremendous potential opportunities, but one that can be rapidly eroded by foreign competitors if the U.S. fails to support the system and its key institutions.

In Conclusion

Agbiosciences represent an opportunity for the United States—an opportunity to expand on U.S. leadership in a biobased, sustainable resource-driven economy with wide ranging innovation and technology-based development opportunities. Within the U.S. the North Central region is a clear leader in agbiosciences and production within the agricultural value-chain, a position that is supported by the R&D and education activities of agricultural experiment stations, extension systems and their twelve land-grant universities. These institutions should be considered priorities for further strategic investment and development given their importance in realizing the intrinsic growth potential of agbiosciences for the U.S. and regional economies.

³ Battelle Technology Partnership Practice research reports:

“The Oklahoma State University Division of Agricultural Sciences and Natural Resources Agbiosciences Activities Deliver Positive Economic Benefits for Oklahoma”. March 2007

“The University of Nebraska Institute of Agriculture and Natural Resources: A Generator of Positive Economic Impacts for Nebraska”. February 2007.

⁴ National Academies. July 2008. *“Rising Above the Gathering Storm, Revisited: Rapidly Approaching a Category Five.”* National Academies Press.

POWER & PROMISE:
Agbioscience in the North Central United States

***The Importance of North Central Experiment Stations, Extension Services
and their Land-grant Universities in the Global Bioscience Economy***
