

The Economic and Functional Impact of University of Illinois Extension



I ILLINOIS EXTENSION

COLLEGE OF AGRICULTURAL, CONSUMER
& ENVIRONMENTAL SCIENCES

Prepared for: University of Illinois Extension
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TEconomy Partners, LLC is a global leader in research, analysis, and strategy for innovation-based economic development. Today, we're helping nations, states, regions, universities, and industries blueprint their future and translate knowledge into prosperity.

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Executive Summary

Knowledge—The Driver of Economic and Societal Progress

In today's economy, complexity is the defining characteristic of the world in which people live. Complex global supply chains, wide-ranging social and business networks, rapidly expanding data resources, web-enabled real-time information access, the ongoing march of technological advancement, and a wide variety of additional factors each contribute to a seemingly overwhelmingly complicated economic and societal environment.

At a time when knowledge is ever more critical to advanced economies, sources of information are rapidly expanding. Today, there are nearly 2 billion websites on the Internet, expanding at a pace exceeding two new websites per second. Google is used to perform over 3.3 billion searches each day, or over 38,000 searches per second. As a result, having access to trusted, validated sources of reliable information and know-how is extraordinarily important and valuable.

Against such a background of rapid and dramatic change, can the Cooperative Extension Service (Extension) model, established over 100 years ago, be relevant? The answer is that Extension may well be more necessary and relevant today than ever before.

The Mission of Extension—To Deploy Knowledge

All of Illinois' universities engage in research and teaching; but, the University of Illinois at Urbana-Champaign (UIUC), as one of the nation's premier land-grant universities, has a third critical mission—Extension. "Extension" means "reaching out," and UIUC "extends" its academic and research resources, solving public needs with university-based intellectual capital through a myriad of activities. University of Illinois Extension (Illinois Extension) has the pragmatic, purposefully designed mission to ensure that research-based knowledge is not confined to academic circles but is deliberately and professionally provided to individuals and organizations, enabling them to solve problems, adapt to changes and new opportunities, make informed decisions, develop new skills, and carry innovations forward into practice.

Today, Illinois Extension serves as the following:

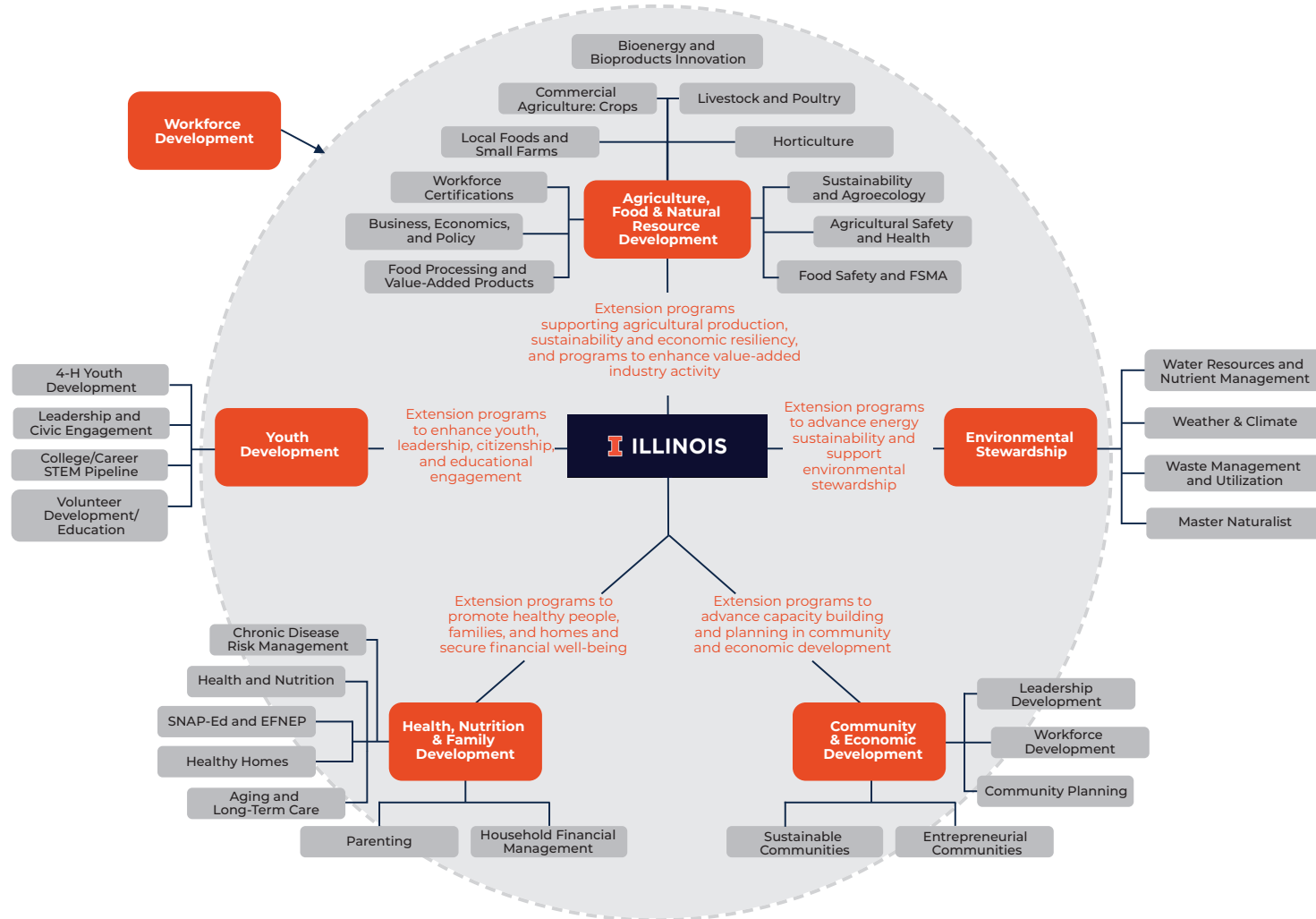
- An **innovation engine**, relaying needs and challenges from the field to university researchers and research teams; and testing new practices, technologies, and innovations to sustain and advance the economy, social progress, and individual capacity.
- A **transformational educator** working to provide continuous, noncredit education to audiences statewide—education that improves recipients' personal and working lives. Illinois Extension is a teaching organization that works to significantly enhance human capital, generate well-prepared practitioners, and promote lifelong learning across the State of Illinois.

- A **regional network**—with a presence in every Illinois county—linking communities, businesses, and the general population to the intensive research and development and technical resources of the university and its partners.
- A **transdisciplinary entity** able to adopt holistic, integrated approaches to tackle complex problems in scientific, economic, technological, and social areas of importance to the citizens of the state.
- A **catalyst** for the improvement of natural resource management practices, enhancing the environment, and sustaining Illinois' quality of place, ensuring the attractiveness of the state and its communities for human capital, new ventures, and industry retention and expansion.
- A **deliverer** of research, teaching, and Extension efforts to bolster food safety, ensure a secure food supply, and protect and promote the health of the state's citizens.
- A **strengthenener** of the quality of life of individuals and families, thereby contributing to community sustainability and vitality.
- A **provider** of 4-H Youth Development and leadership services, helping to provide the next generation of workers, leaders, and responsible citizens.

The Functional Impacts of Illinois Extension

The work of Illinois Extension can be understood as taking place under five major thematic areas, which are highlighted in Figure ES-1.

FIGURE ES-1: KEY THEMES FOR ILLINOIS EXTENSION PROGRAMMING AND ACTIVITIES



Source: TEconomy Partners, LLC.

WORKFORCE DEVELOPMENT— A CROSSCUTTING THEME FOR EXTENSION

In today's workplace, the pace of change dictates a need for ongoing learning and professional development. The reality is that few careers are static, and most require lifelong learning to stay abreast of change and to maintain personal productivity, competitiveness, and effectiveness.

As industries and professions evolve, continuing education is required for workers to stay current with the latest skills, knowledge, and new technologies required within their field. To help meet this need, Illinois Extension Educators work to deploy knowledge to those who utilize this know-how through a myriad of professions across the State of Illinois.

Illinois Extension's workforce development programs and initiatives span its five thematic programmatic areas, creating a sixth crosscutting functional thematic impact area—workforce development. Illinois Extension activities that serve workforce development needs are diverse and include the following:

- Career exploration and work readiness for youth—providing 4-H participants with skills in communication, leadership, teamwork, and problem-solving and introducing them to career pathways in science, technology, engineering, and mathematics (STEM) and other high-demand opportunity areas.
- Job skills for frontline workers—improving productivity in agriculture through provision of new knowledge, skills, and best practices for the agricultural production workforce, and frontline customer service skills in other industry sectors.
- Provision of formal training programs—serving workers who require specific training courses and certifications to perform their work (e.g., pesticide applicator training, Food Safety Modernization Act training, etc.).
- Building work skills for at-risk populations (e.g., horticulture and green industry training for persons in the Illinois correctional system) and helping workers to adjust to health or disability challenges (e.g., AgrAbility).
- Leadership and management training (e.g., Livestock Management Training, Farm Business Management Training, Local Government leadership training, etc.).
- Building the volunteer workforce—using a train-the-trainer approach to build widespread volunteer capacity across Illinois (e.g., Master Urban Farmers, Master Gardeners, and Master Naturalists).

Through these varied programs, Illinois Extension is helping Illinois residents become ready for work, qualified to work, and more skilled in their work. Workforce development programs meet multiple individual and societal needs, and hold numerous advantages for participants:

- Ensuring individual capabilities keep pace with the current standards of others in the same field.
- Providing a competitive edge for career advancement, job mobility, and increased earnings.
- Increasing job security, with higher levels of education tending to link to better job security, and credentials earned staying with individuals for life.
- Enhancing confidence and satisfaction in the workplace.

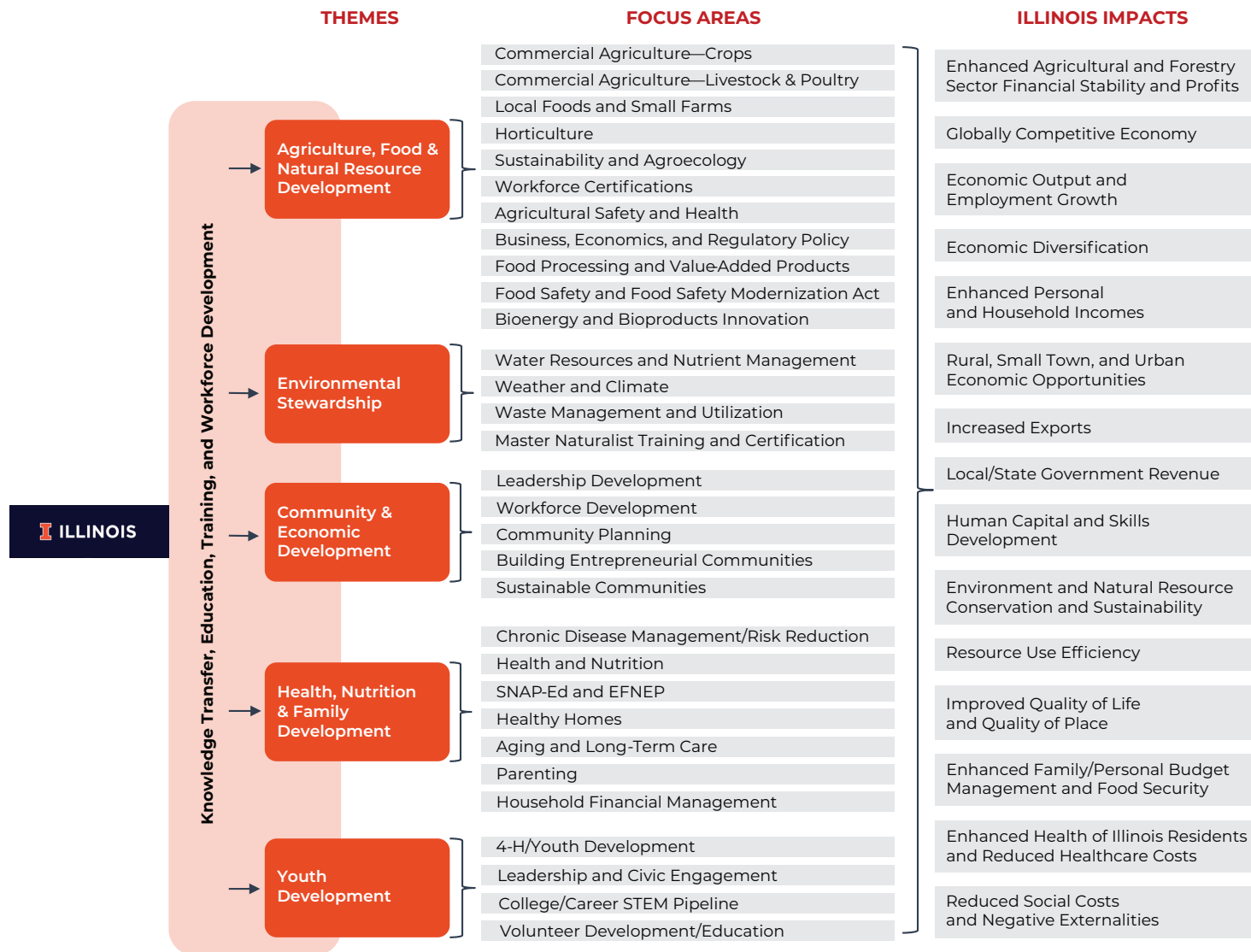
The impacts that are generated from the programs and initiatives delivered by Illinois Extension are categorized as “forward-linkage impacts” or “functional impacts” and are related to institutional mission and function. The forward-linkage impacts of Illinois Extension are delivered through five primary functional areas of service:

- Agriculture, food, and natural resource development
- Environmental stewardship
- Economic and community development
- Health, nutrition, and family development
- Youth development.

In addition, incorporated across all five of these functional areas is a sixth theme—workforce development (see text box). As industries and professions evolve, continuing education is required for workers to stay current with the latest skills, knowledge, and new technologies required within their field. To help meet this need, Illinois Extension Educators work to deploy knowledge to those who utilize this know-how through a myriad of professions across the State of Illinois.

Each of these primary areas of activity contain multiple programs and initiatives that build and sustain Illinois’ economic and social well-being. Services and programs under these Illinois Extension themes reach across all 102 Illinois counties. They are made available by Illinois Extension to Illinoisans young and old, in rural and urban environments, and at home and in the workplace. The principal functions and associated impact benefits of each of the themes are illustrated in Figure ES-2 and are discussed in detail in the report that follows.

FIGURE ES-2: ILLINOIS EXTENSION FUNCTIONAL (FORWARD-LINKAGE) IMPACTS



Source: TEconomy Partners, LLC.

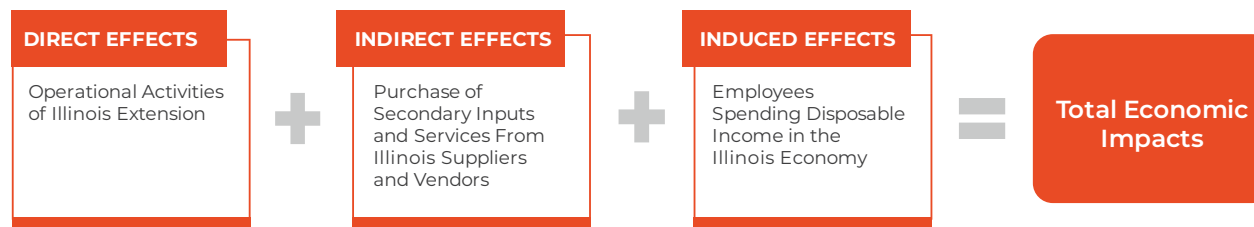
The Expenditure-Based Economic Impacts of Illinois Extension

In addition to the mission-based functional impacts of Illinois Extension, there are additional economic impacts generated via the operational expenditures of Illinois Extension.

While Illinois Extension does not exist to simply generate economic stimulus through its expenditures, given its total operating expenditures of \$60.9 million and direct employment of 655 full-time equivalents (FTE) employed across all 102 counties of Illinois, the stimulus effect is not insignificant.

To measure the impact of Illinois Extension expenditures, TEconomy Partners LLC used input/output (I/O) analysis. The analysis calculates the direct, indirect, and induced impacts as shown in Figure ES-3.

FIGURE ES-3: COMPONENTS OF EXPENDITURE-BASED (BACKWARD-LINKAGE) ECONOMIC IMPACTS



Source: TEconomy Partners, LLC.

The results of the I/O analysis of Illinois Extension operational expenditures are shown in Table ES 1. The analysis finds that the expenditures generated a total output impact of \$126 million in the Illinois economy and supported 1,058 jobs with labor income totaling \$65.4 million. Because Illinois Extension is found across all 102 counties, these impacts are distributed across the entire State of Illinois.

TABLE ES-1: EXPENDITURE-BASED ECONOMIC IMPACT OF ILLINOIS EXTENSION

Impact Category	Employment (FTEs)	Labor Income (\$ millions)	Output (\$ millions)	State/Local Tax Revenue (\$ millions)
Direct Effect	655.0	\$43.1	\$60.9	\$1.0
Indirect Effect	97.3	\$6.1	\$18.0	\$0.9
Induced Effect	306.1	\$16.1	\$47.1	\$2.8
Total Impacts	1,058.5	\$65.4	\$126.0	\$4.8
Multiplier	1.62	1.51	2.07	N/A

Source: TEconomy analysis using data provided by the University of Illinois, College of Agricultural, Consumer, and Environmental Sciences and an IMPLAN State of Illinois Impact Model.

Conclusion

Illinois Extension is a significant economic catalyst for the State of Illinois. Simply in terms of expenditure impacts, Illinois Extension generates a total output impact of \$126 million in the Illinois economy on an annual basis. These expenditure impacts are, however, eclipsed in their importance by the benefits accruing to the state through the wide array of services provided through Illinois Extension's network of programs and initiatives. As Figure ES-4 highlights, case studies and estimations used to assess the functional impact find positive benefits for the Illinois economy that total \$477.3 million on an annual basis.

FIGURE ES-4: EXAMPLES OF ILLINOIS EXTENSION'S FUNCTIONAL IMPACTS



Source: TEconomy Partners, LLC.

Overall, the funding for Illinois Extension clearly provides strong benefits and positive impacts in return for the investment. For an annual total investment of \$60.9 million (all sources of funding in fiscal year 2019), Illinois Extension programs are generating wide-ranging returns. The total output impacts of Extension expenditures (\$126 million), when combined with just the agricultural output support, cost savings, and income benefits examples shown on Figure ES-4, combine for \$603.3 million (both expenditure impacts and functional impacts combined) in an average year, an amount nearly tenfold higher than annual investment in the system.

Introduction

Knowledge—The Driver of Economic and Societal Progress

In today's modern economy, complexity is the defining characteristic of the world in which people now live. Complex global supply chains, wide-ranging social and business networks, rapidly expanding data resources, web-enabled real-time information access, the ongoing march of technological advancement, and a wide variety of additional factors each contribute to a seemingly overwhelming, complex, economic and societal environment.

As a result, the ability to decipher the ever-growing deluge of information in order to possess value-added knowledge has become even more important for economic growth and development than the possession of physical resources. Less than 50 years ago, traditional comparative advantage factors included natural resources, low-cost labor, and capital. Today, comparative advantage is no longer measured by tangible assets, but rather in terms of ease of access and timely control of knowledge-intensive, value-added capabilities to produce leading-edge, next-generation discoveries, breakthroughs, and systems.

At a time when knowledge is ever more critical to advanced economies, sources of information are rapidly expanding—but this is not always a positive development. Today, there are nearly 2 billion websites on the Internet, expanding at a pace exceeding two new websites per second. Google is used to perform over 3.3 billion searches each day, or over 38,000 searches per second. Negotiating this complex modern reality requires not only information, but, more importantly, the knowledge and skills that allow people to access, process, and make sense of the information they receive and discern what to trust and what to discard. As a result, having access to trusted, validated sources of reliable information and know-how is extraordinarily important and valuable.

The ability of a society to discern, disseminate, and deploy evidence-based knowledge is fundamentally important for its economic well-being. The deployment of knowledge, the growth of an economy, and the material and immaterial well-being of a society is explicitly linked. Societies that are unable to harness the power of the knowledge economy are declining in both national and global competitiveness as well as different aspects of the well-being of their citizens.

Against such a background of rapid and dramatic change, can the Cooperative Extension Service (Extension) model, established over 100 years ago, be relevant? The answer is that Extension may well be more necessary and relevant today than ever before.

The Mission of Extension—To Deploy Knowledge

All of Illinois' universities engage in research and teaching; but, the University of Illinois at Urbana-Champaign (UIUC), as one of the nation's premier land-grant universities, has a third critical mission—Extension. “Extension” means “reaching out,” and UIUC “extends” its academic and research resources, solving public needs with university-based intellectual capital through a myriad of activities. University of Illinois Extension (Illinois Extension) has the pragmatic, purposefully designed mission to ensure that research-based knowledge is not confined to academic circles but is deliberately and professionally provided to individuals and organizations, enabling them to solve problems, adapt to changes and new opportunities, make informed decisions, and carry innovations forward into practice. This third mission is shown in Figure 1.

FIGURE 1: LAND-GRANT UNIVERSITIES AND THE ADDITIONAL MISSION OF EXTENSION



Source: TEconomy Partners, LLC.

Congress created the Extension System just over a century ago to address exclusively rural, agricultural issues. At that time, more than 50 percent of the U.S. population lived in rural areas, and 30 percent of the workforce was engaged in farming. Extension's engagement with rural America helped make possible the national agricultural revolution, which dramatically increased farm productivity. For example:

- In 1866, the first year the United States Department of Agriculture (USDA) began to publish corn yield estimates, 1 acre of land produced on average about 26 bushels of corn a year.

- Rapid adoption of double-cross hybrid corn by growers began in the late 1930s, and by 1955, that same acre of land produced on average about 40 bushels of corn a year.
- A second significant improvement in the annual rate of yield gain began in the mid-1950s in response to continued improvement in crop genetics, increased adoption of fertilizer and chemical pesticides, and increased utilization of agricultural mechanization so that by 1985, 1 acre of land was producing 100 bushels of corn.
- A third significant improvement in the annual rate of yield gain came about in part due to the advent and adoption of transgenic hybrid traits beginning in the mid-1990s so that by 2016, that same acre of land was producing more than 170 bushels of corn annually.¹

While often recognized for advancing American progress in agriculture (and rightfully so), Extension has a much wider range of focus and influence. Extension has evolved to embrace an expansive mission, seeking to advance not only improvements in specific sectors of the economy but also provide knowledge to empower societal, family, and individual capacity to thrive in the economy and socio-cultural fabric of the United States.

Extension represents a visionary system (see sidebar), purpose-designed by an Act of Congress to bring research-based, land-grant developed innovations, advancements, and education to a diverse range of populations.

¹ <https://www.agry.purdue.edu/ext/corn/news/timeless/YieldTrends.html>.

A VISIONARY SYSTEM FOR AMERICAN PROGRESS

Land-grant universities have their historic roots in the Morrill Land-Grant Act of 1862, which provided grants of land to the states that could then be sold to finance and support institutions to teach agriculture, mechanics and military tactics, without forgoing classical studies.

These institutions particularly focused on providing a practical education suited to the demands of the expanding American economy. The original Morrill Act gave rise to, and supported, a series of colleges and universities that have grown to become many of this nation's most prestigious and research-intensive institutions. The subsequent Hatch Act of 1887 further built upon the Morrill Act's foundation by authorizing federal grant funds to each state for the establishment of an agricultural experiment station connected to each state's land-grant institution. These experiment stations were then funded by ongoing federal funds leveraged with state matching dollars.

The Smith-Lever Act of 1914 created a Cooperative Extension Service associated with each land-grant institution. The "Cooperative" part of the Extension Service name references the unique partnership between the federal (USDA), state (land-grant colleges), and local (county) entities that enables the pragmatic and crucially important work of translating and disseminating the latest know-how, information, and innovations that result from the research of the land-grant colleges and their experiment stations.

It is a testament to Representative Justin Smith Morrill of Vermont (for whom the Morrill Act is named), and each successive administration and congress, that this integrated system of land-grant universities, Experiment Station Systems, and Cooperative Extension Services, providing R&D-based solutions and pragmatic knowledge transfer, has grown and thrived for more than 150 years.

Simon Tripp, et al., 2017. National Evaluation of Capacity Programs. TEconomy Partners LLC for the National Institute of Food and Agriculture.

As noted by the USDA:

Extension provides non-formal education and learning activities to people throughout the country—to farmers and other residents of rural communities as well as to people living in urban areas. It emphasizes taking knowledge gained through research and education and bringing it directly to the people to create positive changes... The hallmarks of the extension program—openness, accessibility, and service—illuminate how cooperative extension brings evidence-based science and modern technologies to farmers, consumers, and families. Through extension, land-grant institutions reach out to offer their resources to address public needs. By educating farmers on business operations and on modern agricultural science and technologies, extension contributes to the success of countless farms, ranches, and rural business. Further, these services improve the lives of consumers and families through nutrition education, food safety training, and youth leadership development.²

Today, Illinois Extension focuses on a wide array of critical issues affecting people's daily lives and the state's future. Illinois Extension's efforts empower people and communities to solve problems and improve their lives. Specifically, Illinois Extension works to improve the quality of life for all Illinois citizens by helping to accomplish the following:

- Ensure a safe, secure, and abundant food supply
- Improve agricultural and natural resource profitability and productivity
- Protect animal and plant health
- Increase effective decision-making regarding environmental stewardship
- Promote sound human nutrition and health
- Strengthen individuals and families
- Foster the development of youth
- Provide opportunities for career exploration and work readiness
- Promote a strong local economy and workforce
- Empower connected, engaged communities and leaders.

Through these activities, Illinois Extension personnel work every day to deploy fact-based knowledge to Illinois' agricultural and natural resource producers, agribusinesses, community leaders, families, and youth.

² <https://nifa.usda.gov/extension>.

Study Goals: Evaluating the Economic and Functional Impacts of Illinois Extension

Recognizing a need to communicate the value, modern relevance, importance, and impact of Illinois Extension, the University of Illinois System engaged TEconomy Partners, LLC (TEconomy) to conduct an independent study on economic and functional impacts across its key mission areas. TEconomy has performed national program evaluation for the USDA's National Institute of Food and Agriculture (NIFA), undertaken assessments of the role and functions of experiment stations and extension services throughout the North Central and Southern Regions of the United States, and has been engaged on multiple impact assessments for individual land-grant universities across the nation. TEconomy, thus, has the in-depth knowledge of the structure and function of Cooperative Extension Service activities to undertake an in-depth independent assessment for the University of Illinois System.

This report seeks to provide the following:

- Measures of the quantitative impact of Illinois Extension operational expenditures on key economic metrics such as Illinois business volume, personal incomes, and employment.
- An understanding of the broad range of functional, social, and community benefits afforded by Illinois Extension's activities across the State of Illinois.
- Specific illustrations of the range of positive functional impacts generated in Illinois because of Illinois Extension's activities.

From an economic perspective, the impacts of Illinois Extension are best viewed as comprising two distinct pathways. The presence and operations of Illinois Extension generates “economic stimulus” or **expenditure impacts** across the Illinois economy including all 102 individual counties in which Illinois Extension maintains a physical footprint. This “stimulus” occurs via the direct expenditures of Illinois Extension and the expenditures of its personnel. The direct and indirect economic impacts on Illinois' business volume (output), employment, and personal incomes generated by Illinois Extension expenditures are typically termed “backward-linkage impacts.” While Illinois Extension obviously does not exist simply to create economic stimulus through expenditures, it is important to note that this impact is not insignificant for Illinois—primarily because a significant portion of Illinois Extension funding comes from external (federal) funding sources that then are spent in operations across the State of Illinois.

However, the primary, and most important pathway comprises the functional impacts. These **functional impacts** are the reason Illinois Extension exists and are driven by the core programmatic missions on which Illinois Extension focuses in order to help Illinois' agricultural economy, workforce, communities, families, and youth prosper. Regional economists and economic development professionals typically term these functional, mission-focused impacts as “forward-linkage impacts.” Through its extensive programmatic activities, Illinois Extension has a substantial track record in contributing to Illinois' overall quality of life and positively impacting the state's economy. As knowledge becomes the foremost driver of modern economies, it is likely that university extension activities will grow

in their central importance to economic progress. Strengthening the lives and communities of Illinois through research-based educational programming (activities at the core of Illinois Extension's mission) are keys to the long-term competitive sustainability of Illinois' standard of living. The degree to which Illinois Extension's work has, and is, contributing to the economic progress in the State of Illinois is the subject of this report.

Expenditure-Based Economic Impacts of Illinois Extension

Introduction to Expenditure Impacts

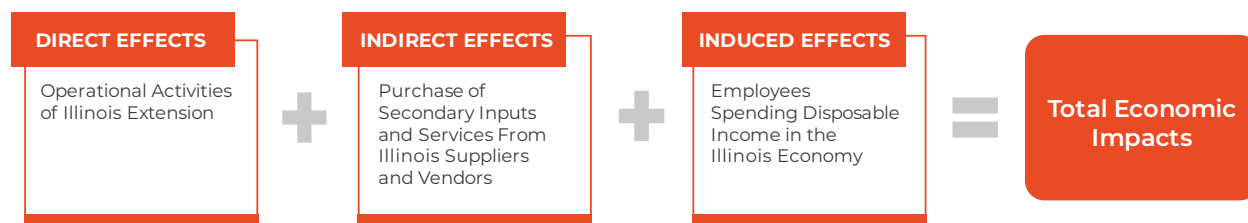
The main impact of Illinois Extension is created and obtained through the activities that Extension faculty and staff are engaged in throughout the State of Illinois as they work to fulfill Illinois Extension's mission (functional impacts). Every day across Illinois, Extension professionals are engaged with farmers, value-added processing industries, communities, families, youth, and other key stakeholders providing knowledge and innovations to advance the Illinois economy and improve the quality of life of Illinois residents. These functional impacts, central to the mission of Illinois Extension, are addressed in the following chapters.

While the generation of functional benefits for Illinois is the reason for the existence and programs of Extension, from a traditional economic perspective, there is a subsidiary benefit generated in the state through Illinois Extension's budget expenditures. Illinois Extension is a large operation with a substantial budget, and its expenditures in Illinois generate a measurable stimulus effect within the Illinois economy. Significant financial support for Illinois Extension comes each year from outside of the state, largely via federal government formula funding. This federal funding represents a fresh inflow of funds into the state that then are spent by Illinois Extension inside the state. The economic impacts that are generated through the direct operational expenditures of Illinois Extension and through the expenditures of Extension personnel and service providers constitute "backward-linkage" economic impacts.

Expenditure Impact Modeling

Estimation of the expenditure-based economic impacts herein is accomplished using an IMPLAN input-output (I-O) model. The I-O model examines and quantifies the interrelationships and transactions between economic sectors. The model uses I-O multipliers that are quantitative representations of the flow of commodities that occur between industries, consumers, and institutions within the economy. At the heart of I-O analysis is a matrix representation that allows the effects of a change in one economic sector to be evaluated for the effects it generates in all other sectors of the economy. The findings reported in this chapter are derived from using the latest Illinois-specific I-O model developed by IMPLAN. The IMPLAN model is the most widely used model in the nation and is based on the U.S. Bureau of Economic Analysis (BEA) national accounts data, supplemented with state-level employment data from the U.S. Bureau of Labor Statistics (BLS) and other economic data from the U.S. Bureau of the Census. The use of I-O analysis provides measures for the categories of impacts shown in Figure 2.

FIGURE 2: COMPONENTS OF EXPENDITURE-BASED (BACKWARD-LINKAGE) ECONOMIC IMPACTS



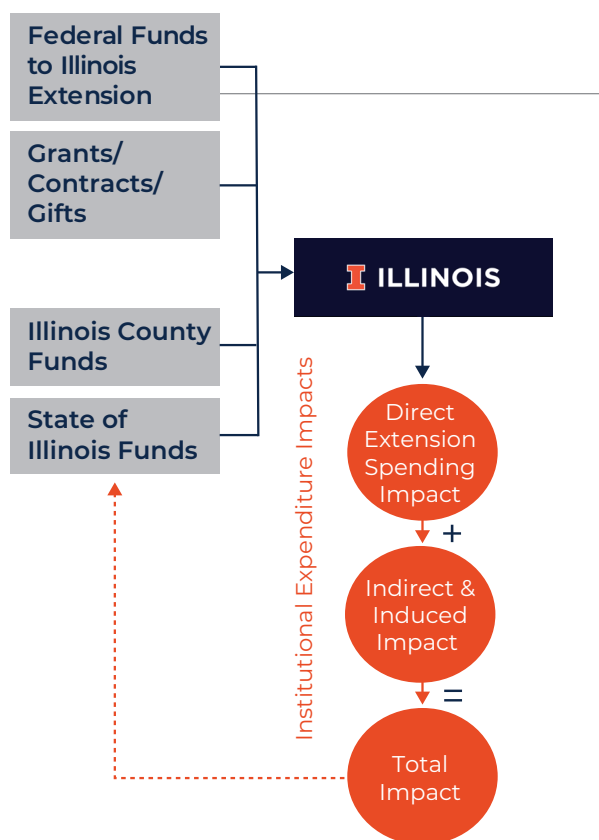
Source: TEconomy Partners, LLC.

I-O analysis effectively models the “ripple effect” (also known as the multiplier effect) that originates from the Illinois Extension operations. These expenditures are funded from a variety of sources, including significant federal funds as well as support by Illinois’ counties (Figure 3).

The IMPLAN I-O model generates estimates for four primary classes of impact:

- **Output** (also known as production, sales, or business volume) is the total value of the goods and services produced in the economy. For public/nonprofit organizations, including Extension, “expenditures” are the most appropriate base measure of this economic activity.
- **Employment** is the total number of jobs created and includes the direct employment of Illinois Extension and also the indirect and induced employment impacts associated with expenditures.
- **Labor Income** is the total amount of income, including salaries, wages, and benefits, received by Illinois Extension employees and others in the associated supply chain.
- **Government Revenues** includes estimates of revenues generated for federal and state/local governments through the direct and indirect economic activity that is generated in the state.

FIGURE 3: THE EXPENDITURE IMPACT COMPONENT OF THE ILLINOIS EXTENSION IMPACT ROADMAP



Source: TEconomy Partners, LLC.

Expenditure Impacts of Illinois Extension

Table 1 details revenue sources for Illinois Extension by primary category, indicating that for fiscal year (FY) 2019 Illinois Extension operated with a total revenue base of \$60.88 million.

TABLE 1: OPERATIONAL REVENUE SOURCES FOR THE ILLINOIS EXTENSION OPERATIONS (FY2019)

Funding Source	\$ millions
State of Illinois (direct funding)	\$2.22
State of Illinois (state employee fringe benefits payments)	\$2.38
University of Illinois (other institutional funding)	\$6.81
USDA NIFA Cooperative Extension	\$22.39
Additional County-Based Resources (e.g., direct funding and in-kind support)	\$12.16
Grants, Contracts, Fees, and Other Self-Generated Resources	\$8.87
Operating Reserves (from prior years)	\$6.05
Total FY2019 Funding	\$60.88

Source: FY2019 Operational Data University of Illinois, College of Agricultural, Consumer and Environmental Sciences.

The above operational revenues are used to fund compensation for Illinois Extension's 655 FTE personnel and for all other non-personnel operational expenditures. Table 2 summarizes these macro expenditure categories for FY2019.

TABLE 2: ILLINOIS EXTENSION OPERATIONAL EXPENDITURES (FY2019)

Expenditures	\$ millions
Personnel compensation expenditures	\$43.13
Non-personnel operating expenditures	\$17.75
Total Expenditures for Higher Education Operations (academics)	\$60.88
Total FTEs	655

Source: FY2019 Operational Data University of Illinois, College of Agricultural, Consumer and Environmental Sciences.

The expenditures and employment highlighted in Table 2 combine to generate the expenditure-based economic impacts for Illinois Extension shown in Table 3. For FY2019, Illinois Extension generated a total expenditure-based economic impact for Illinois (as measured by output) of \$126 million and generated a total of 1,058.5 FTE jobs in the state with labor income totaling \$65.4 million (equivalent to average compensation³ of \$61,785 per FTE).

TABLE 3: EXPENDITURE-BASED ECONOMIC IMPACT OF ILLINOIS EXTENSION

Impact Category	Employment (FTEs)	Labor Income (\$ millions)	Output (\$ millions)	State/Local Tax Revenue (\$ millions)
Direct Effect	655.0	\$43.1	\$60.9	\$1.0
Indirect Effect	97.3	\$6.1	\$18.0	\$0.9
Induced Effect	306.1	\$16.1	\$47.1	\$2.8
Total Impacts	1,058.5	\$65.4	\$126.0	\$4.8
Multiplier	1.62	1.51	2.07	N/A

Source: TEconomy analysis using data provided by the University of Illinois, College of Agricultural, Consumer and Environmental Sciences and an IMPLAN State of Illinois Impact Model.

Again, it must be noted that these impacts are based only on the expenditures of the Illinois Extension. Functional impacts in Illinois that are generated through the actual programs and activities of Illinois Extension are not included in these numbers and are addressed separately in this report.

Conclusions

The expenditure impacts of Illinois Extension are significant, supporting approximately 1,058 FTE jobs. These jobs support comparatively high levels of employment compensation, averaging \$61,785 per supported job. The overall impact on the economy of Illinois is significant, with \$126 million in total economic activity generated through the expenditures of Extension in FY2019. The impacts being generated are particularly notable given that a significant portion of the base funds supporting operations are derived from outside of the state, in the form of capacity funds and competitive grant funding provided to Illinois Extension by the federal government (primarily through USDA NIFA). Overall, the total expenditure-based impacts for the economy of Illinois, at \$126 million, stand at 7.5 times the total state and county funding received by Illinois Extension (\$16.76 million)⁴ for FY2019.

³ Comprises total compensation including benefits.

⁴ Sum of: State of Illinois (direct funding) of \$2.22 million + State of Illinois (state employee fringe benefits payments) of \$2.38 million + Additional County-Based Resources (e.g., direct funding and in-kind support) of \$12.16 million.

The Functional Impacts of Illinois Extension

The Illinois Extension Delivery System

Illinois Extension is the flagship outreach effort of UIUC. Based in the College of Agricultural, Consumer and Environmental Sciences (ACES) and working with all colleges and units of UIUC, Illinois Extension is an organization specifically dedicated to putting knowledge to work. As part of the U.S. Cooperative Extension System, Illinois Extension translates “research into action: bringing cutting-edge discoveries from research laboratories to those who can put knowledge into practice.”⁵ Illinois Extension empowers agricultural and natural resource industries, communities, families, and individuals in all 102 Illinois counties to meet the challenges and opportunities they face through access to best-practice, evidence-based knowledge, technologies, and innovations.

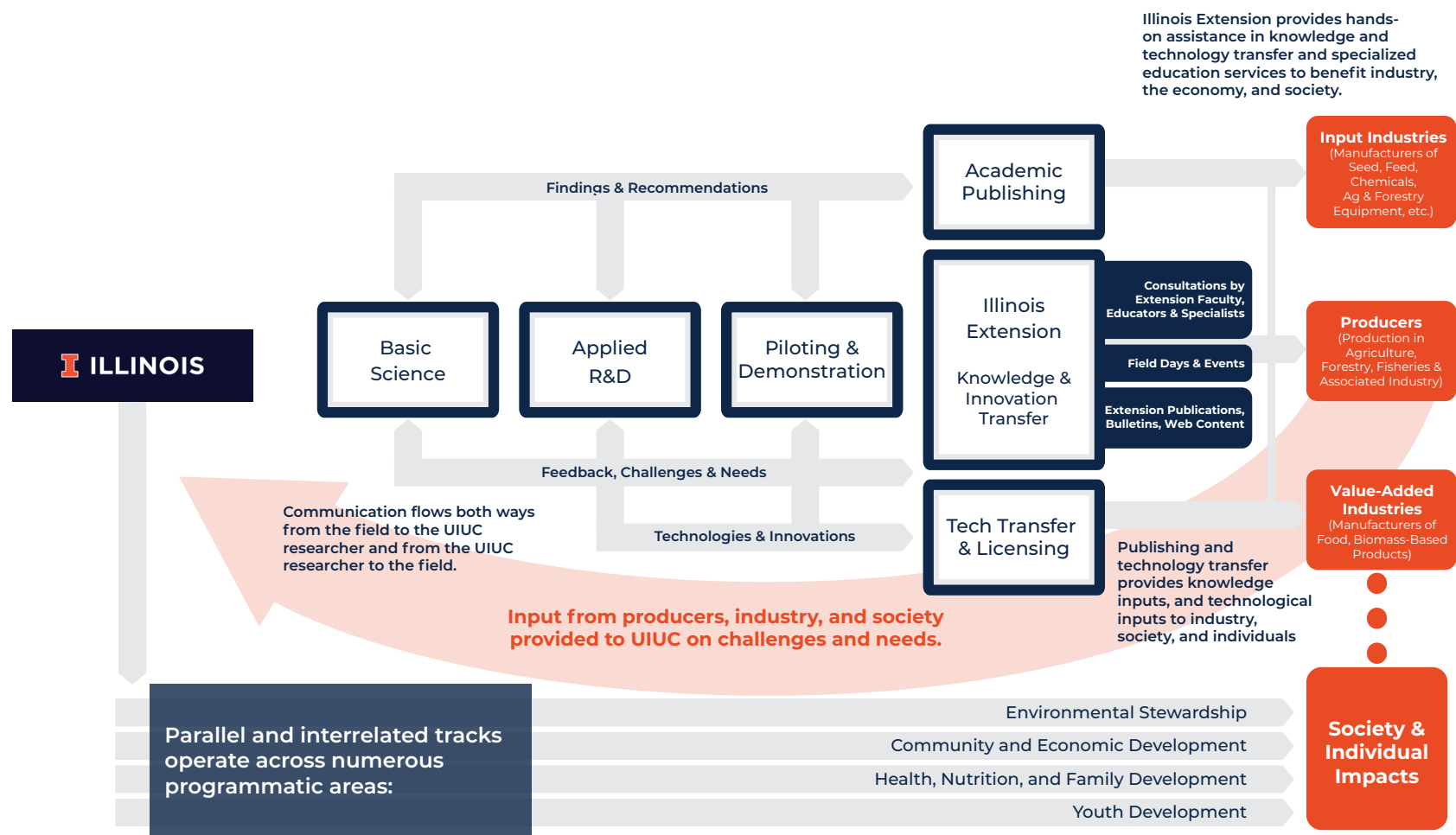
Illinois Extension operates a system of county centers located across all 102 Illinois counties. These Illinois Extension offices house Extension Educators and staff who know their home county and communities. They meet with agricultural producers and other key constituencies; respond to questions posed by the public; conduct proactive workshops and other educational events; and provide answers to commonly encountered problems through educational materials, web-based information, the telephone, and individual consultations. These local operations are supported by Extension Specialists who are University of Illinois faculty and staff with deep subject matter expertise. Illinois Extension operates as a two-way system, providing an entrance point to the university for field-identified needs and challenges, and as a portal for the transfer of university knowledge and recommendations to those in the field able to put knowledge to work.

Illinois Extension works across such a diversity of impact domains as a result of a sophisticated delivery system that is empowered by a two-way flow of information/innovation and needs identification. In one direction, Illinois Extension works to disseminate the research-based innovations and knowledge produced by faculty and staff based on campus and at research stations to those in Illinois who can best benefit from the information and put knowledge to work for the betterment of the Illinois economy, society, and individuals. The system is particularly effective because it also works in the reverse direction, with local Extension personnel, in the field and interacting with their local communities, to identify issues and needs for which the universities’ researchers can find solutions. In effect, Illinois Extension is operating as an “ecosystem” dedicated to researching solutions to needs and then transferring knowledge that will boost the Illinois economy and ensure the well-being of Illinois communities, families, and individuals. Figure 4 shows the general structure of the Extension ecosystem, illustrating the bi-directional flows of information from the field regarding needs and questions and from the universities providing answers to questions and providing new knowledge, innovations, and practice recommendations.

5 United States Department of Agriculture, National Institute of Food and Agriculture. “Cooperative Extension System.” Accessed online: <https://nifa.usda.gov/cooperative-extension-system>.

In Figure 4, the central chain of activity illustrates the work of Illinois Extension in supporting the agricultural production system, while the arrows across the bottom of the graphic illustrate the other themes operated in parallel by Illinois Extension, covering diverse areas in community and economic development, family and youth development, and community and individual health and well-being.

FIGURE 4: ILLINOIS EXTENSION ECOSYSTEM: A TWO-WAY SYSTEM FOR ENHANCING ECONOMIC AND SOCIAL WELL-BEING



Source: TEconomy Partners, LLC. Adapted from original figure in Simon Tripp, et al., 2017. National Evaluation of Capacity Programs. TEconomy Partners LLC for the National Institute of Food and Agriculture.

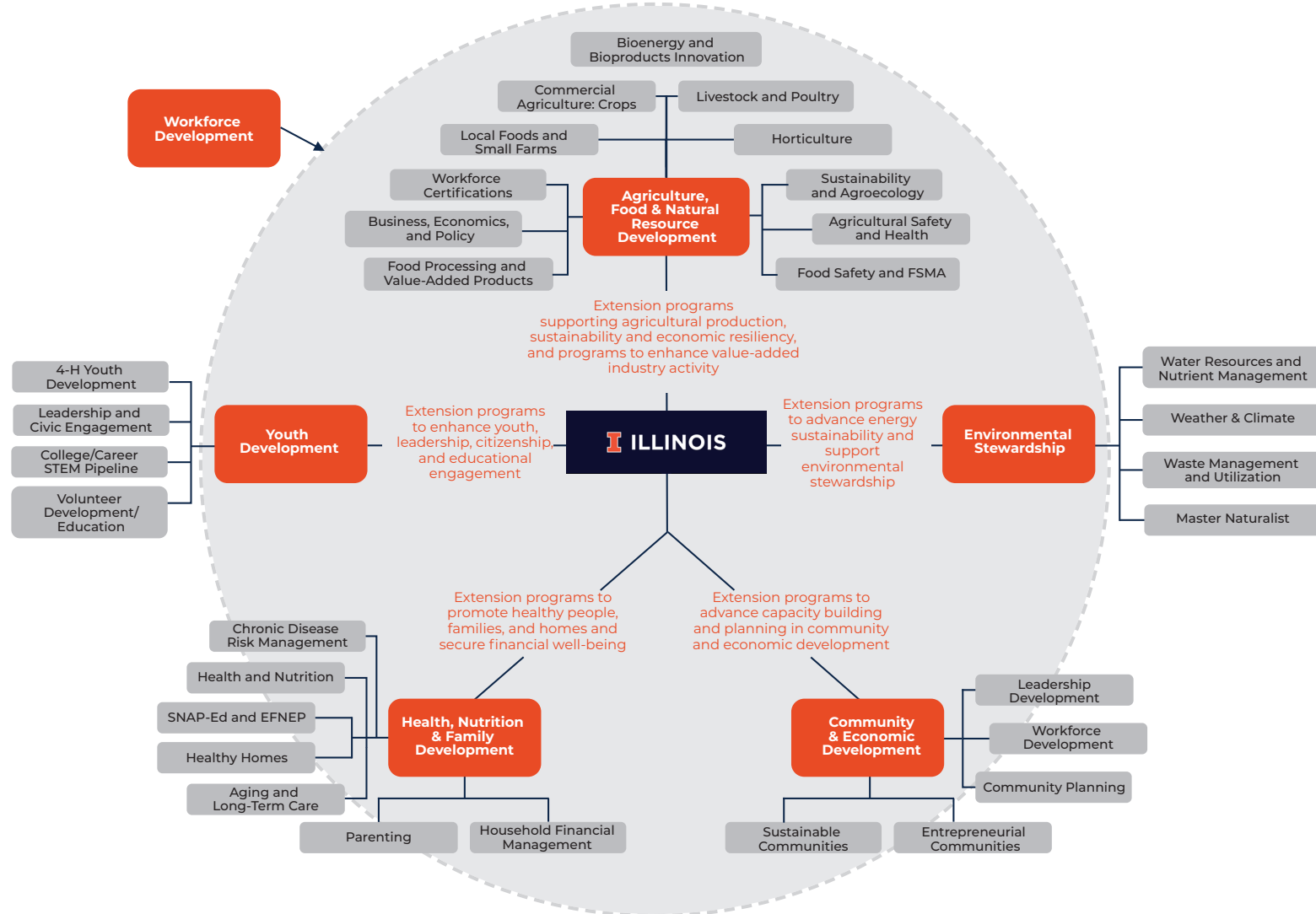
An Overview of the Functional Impacts of Illinois Extension

Being able to compete in the global economy requires constant innovation, practice improvement, new technology introduction, skills enhancement, and global intelligence—exactly the competitive factors that land-grant universities and CES were created to enhance, develop, and support. Since the Smith-Lever Act of 1914, the UIUC has maintained the continuous operations of Extension programs and activities dedicated to supporting Illinoisans with research, analysis, information, and practical advice designed to improve the economy, society, communities, and families. Given the exponential increase in knowledge, and the impact of knowledge on economic and social well-being, Illinois Extension, despite being more than 100 years old, is a highly relevant and necessary institution providing valuable statewide services. Today, Illinois Extension is serving as the following:

- An **innovation engine**, relaying needs and challenges from the field to university researchers and research teams; and testing new practices, technologies, and innovations to sustain and advance the economy, social progress, and individual capacity.
- A **transformational educator** working to provide continuous, noncredit education to audiences statewide—education that improves recipients' personal and working lives. Illinois Extension is a teaching organization that works to significantly enhance human capital, generate well-prepared practitioners, and promote lifelong learning across the State of Illinois.
- A **regional network**—with a presence in every Illinois county—linking communities, businesses, and the general population to the intensive research and development (R&D) and technical resources of the university and its partners.
- A **transdisciplinary entity** able to adopt holistic, integrated approaches to tackle complex problems in scientific, economic, technological, and social areas of importance to the citizens of the state.
- A **catalyst** for the improvement of natural resource management practices, enhancing the environment, and sustaining Illinois' quality of place, ensuring the attractiveness of the state and its communities for human capital, new ventures, and industry retention and expansion.
- A **deliverer** of research, teaching, and Extension efforts to bolster food safety, ensure a secure food supply, and protect and promote the health of the state's citizens.
- A **strengthenener** of the quality of life of individuals and families, thereby contributing to community sustainability and vitality.
- A **provider** of 4-H Youth Development and leadership services, helping to provide the next generation of workers, leaders, and responsible citizens.

Illinois Extension is a diverse organization with a broad mission directed at serving the needs of Illinois. The work of Illinois Extension can be understood as taking place under five major thematic areas, which are highlighted in Figure 5. The activities conducted by Illinois Extension and the results obtained through it are termed “functional impacts.”

FIGURE 5: KEY THEMES FOR ILLINOIS EXTENSION PROGRAMMING AND ACTIVITIES



Source: TEconomy Partners, LLC.

WORKFORCE DEVELOPMENT— A CROSSCUTTING THEME FOR EXTENSION

In today's workplace, the pace of change dictates a need for ongoing learning and professional development. The reality is that few careers are static, and most require lifelong learning to stay abreast of change and to maintain personal productivity, competitiveness, and effectiveness.

As industries and professions evolve, continuing education is required for workers to stay current with the latest skills, knowledge, and new technologies required within their field. To help meet this need, Illinois Extension Educators work to deploy knowledge to those who utilize this know-how through a myriad of professions across the State of Illinois.

Illinois Extension's workforce development programs and initiatives span its five thematic programmatic areas, creating a sixth crosscutting functional thematic impact area—workforce development. Illinois Extension activities that serve workforce development needs are diverse and include the following:

- Career exploration and work readiness for youth—providing 4-H participants with skills in communication, leadership, teamwork, and problem-solving and introducing them to career pathways in science, technology, engineering, and mathematics (STEM) and other high-demand opportunity areas.
- Job skills for frontline workers—improving productivity in agriculture through provision of new knowledge, skills, and best practices for the agricultural production workforce, and frontline customer service skills in other industry sectors.
- Provision of formal training programs—serving workers who require specific training courses and certifications to perform their work (e.g., pesticide applicator training, Food Safety Modernization Act training, etc.).
- Building work skills for at-risk populations (e.g., horticulture and green industry training for persons in the Illinois correctional system) and helping workers to adjust to health or disability challenges (e.g., AgrAbility).
- Leadership and management training (e.g., Livestock Management Training, Farm Business Management Training, Local Government leadership training, etc.).
- Building the volunteer workforce—using a train-the-trainer approach to build widespread volunteer capacity across Illinois (e.g., Master Urban Farmers, Master Gardeners, and Master Naturalists).

Through these varied programs, Illinois Extension is helping Illinois residents become ready for work, qualified to work, and more skilled in their work. Workforce development programs meet multiple individual and societal needs, and hold numerous advantages for participants:

- Ensuring individual capabilities keep pace with the current standards of others in the same field.
- Providing a competitive edge for career advancement, job mobility, and increased earnings.
- Increasing job security, with higher levels of education tending to link to better job security, and credentials earned staying with individuals for life.
- Enhancing confidence and satisfaction in the workplace.

These impacts are categorized as “forward-linkage impacts” or “functional impacts,” which are related to institutional mission and function, rather than being related to institutional spending. These are the impacts that Congress envisioned as benefits to be provided through the formation of the state extension programs. As will be discussed in this chapter, they constitute a broad and multifaceted array of positive economic and social impacts for Illinois.

As a service supported by the public sector, Extension must fulfill economic and social needs that would not otherwise be adequately met by private sector activity. It was public need that led to the initiation of the Extension program in 1914; and today, the same holds true. Table 4 provides some of the primary benefits of Extension, in economic terms, as revealed by research.⁶

TABLE 4: NEEDS FULFILLED BY PUBLIC SECTOR PROVISION OF EXTENSION SERVICES

Economic Terms	Explanation	Free Market Outcome	Selected Extension Examples
Imperfect Information	When information available to consumers is poor or inadequate, the government provides information (a service) so that consumers can make better choices.	Consumers cannot make the best choices for themselves because they are inadequately informed about the products they purchase.	• Soil management education for agricultural producers • Master Gardener training • Pesticide applicator training • Home-based processing/microprocessing training • Economic development strategies best suited for a community
Distribution of Resources	The government provides goods or services that address crucial concerns about fairness or justice.	Society as a whole could be better off if certain private goods were available to everyone at some minimal level, regardless of their ability to pay.	• Healthcare education • Youth development programs in underserved communities • Nutrition education for low-income families • Ensuring adequate access to food, housing, and health-care
External Benefits (costs) from Consumption	The use of a good or service confers benefits (costs) on someone other than those directly involved in the transaction.	The consumer fails to fully consider the external benefit (cost) and consumes less (more) of the good than society desires.	• Erosion control • Wastewater treatment • Municipal waste management • Conflict resolution training
External Benefits (costs) from Production	The production of a good or service confers benefits (costs) on someone other than those directly involved in the transaction.	The producer fails to fully consider the external benefit (cost) and produces less (more) of the good than society desires.	• Development of non-fossil fuels • Agricultural product development

6 Laura Kalambokidis. “Identifying the Public Value in Extension Programs.” *Journal of Extension*. 42(2).

Economic Terms	Explanation	Free Market Outcome	Selected Extension Examples
Public Good	When it is costly (or impossible) to exclude non-payers from benefiting from a good or service and one person's enjoyment of the good or service does not detract from anyone else's.	Too few citizens pay, not enough funds are collected, not enough of the good or service is produced.	• Disease prevention and control (through home food safety for high-risk individuals and food safety training for food service industry) • Main Street revitalization • After-school programs for children • Financial literacy programs • Retirement or investment planning • Creation of shared public spaces accessible to everyone
Natural Monopoly	The more of a good or service is produced, the lower is the cost per unit to produce it.	A single company may build the infrastructure and act as a monopoly supplier.	• Knowledge generation at a research university.

Source: TEconomy Partners, LLC.

As Table 4 indicates, extension services fulfill important public needs that would not be fulfilled, or would be inadequately fulfilled, if left completely to market forces. The fulfillment of these public needs is provided through the forward-linkage functions of Extension.

The forward-linkage impacts of Illinois Extension are delivered through five primary functional areas of service:

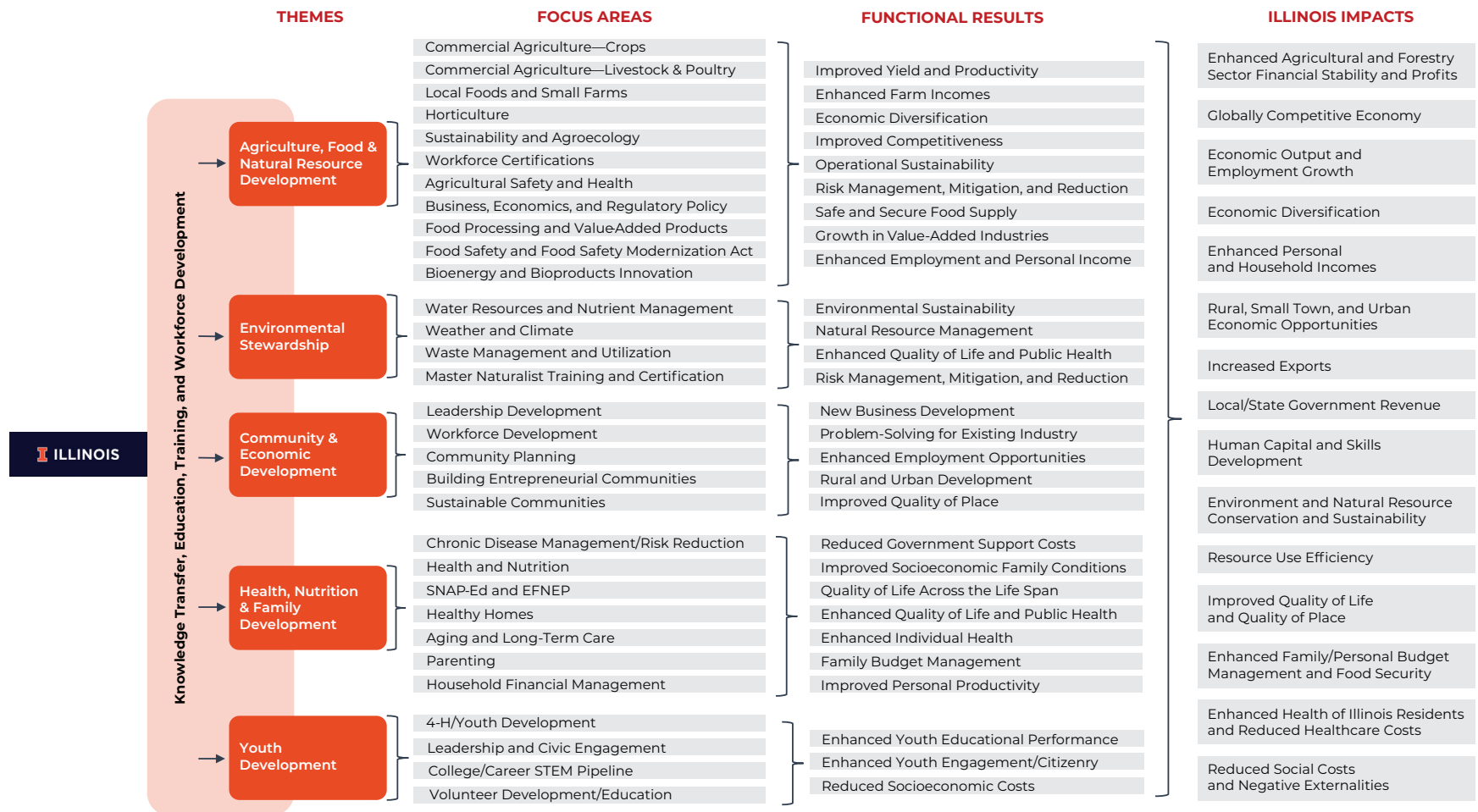
- Agriculture, food, and natural resource development
- Environmental stewardship
- Economic and community development
- Health, nutrition, and family development
- Youth development.

In addition, incorporated across all five of these functional areas is a sixth theme—workforce development (see text box). As industries and professions evolve, continuing education is required for workers to stay current with the latest skills, knowledge, and new technologies required within their field. To help meet this need, Illinois Extension Educators work to deploy knowledge to those who utilize this know-how through a myriad of professions across the State of Illinois.

Each of these primary areas of activity contain multiple programs and initiatives that build and sustain Illinois' economic and social well-being. Services and programs under these Illinois Extension themes reach across all 102 Illinois counties. They are made available by Illinois Extension to Illinoisans young and old, in rural and urban environments, and at home and in the workplace.

The principal functions and associated impact benefits of each of the five themes are illustrated in Figure 6 and discussed further in the narrative detail that follows. For each program theme, TEconomy provides a description of the program area, outlines the tangible needs being addressed in Illinois, and provides specific examples and case studies of Illinois Extension in action and the positive impacts being generated.

FIGURE 6: ILLINOIS EXTENSION FUNCTIONAL IMPACT ROADMAP



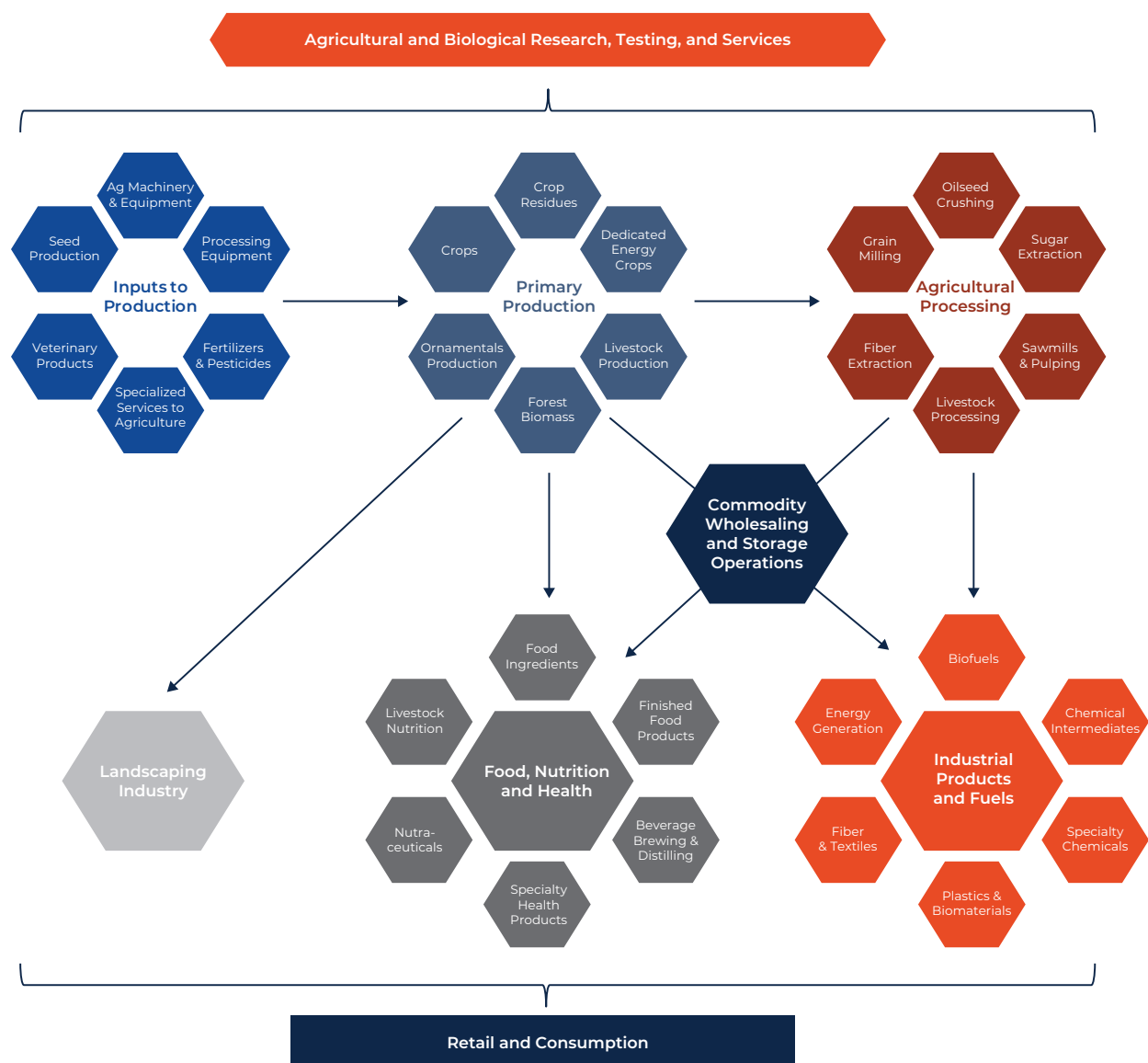
Source: TEconomy Partners, LLC.

Functional Impacts Generated from Agriculture, Food, and Natural Resource Development

DESCRIPTION

Primary agriculture is part of a complex ecosystem of economic activities that spans a complete value-chain in Illinois, from R&D and the development of agricultural inputs, through on-farm production, and onward into downstream value-added processing, packaging, and distribution industries. Figure 7 provides a basic overview of key elements in the complex food, fiber, and fuel value-chain that emanates from and connects to Illinois' agriculture and forestry production.

FIGURE 7: OVERVIEW OF KEY AGRICULTURAL VALUE-CHAIN ELEMENTS



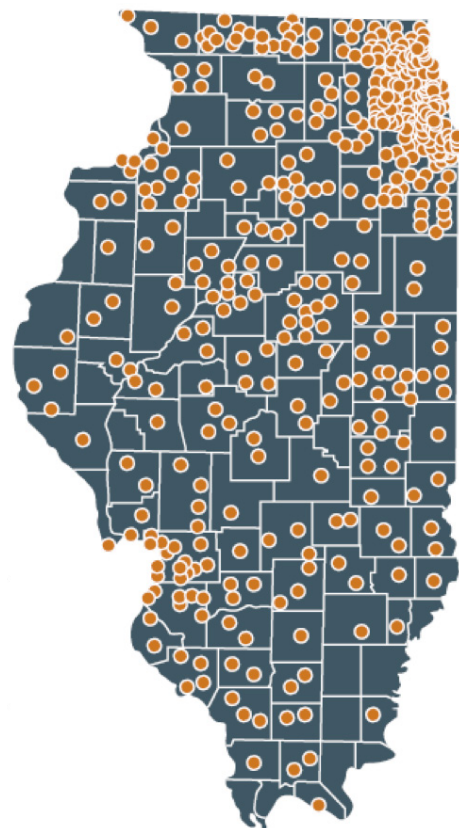
Source: TEconomy Partners, LLC.

Illinois has a rich history of development and major industry presence across the entire value-chain. The state is home to pioneering companies in agricultural equipment (e.g., John Deere and Caterpillar), crop varieties and seed (DeKalb/Bayer), major processing multinationals (e.g., ADM and ConAgra), onward into innovative manufacturers of packaged food and other products for final consumers. In this latter case, Intersect Illinois reports that Illinois is ranked first in the nation in processed food sales and contains over 2,600 food manufacturing companies employing more than 130,000 personnel.⁷ The livestock industry and meat processing also have a rich history in Illinois; and the state is home to the Chicago Board of Trade, the U.S. pioneer in agricultural commodity trading.

Not surprisingly, the agriculture sector in the state generates large-scale economic impacts. A 2015 report placed the total output impact⁸ of agriculture and ag-related industries in Illinois at \$120.9 billion, comprising 9.6 percent of the total output across the state economy.⁹ The study placed employment allocable to agriculture and associated industries at over 432,000 jobs.

Importantly, the agriculture value-chain creates jobs statewide in Illinois with a presence in every Illinois county. Each county in the state has agricultural production taking place, and the food processing industry in Illinois is also highly distributed (Figure 8).¹⁰ Farming as a land-use comprises 75 percent of Illinois' land area,¹¹ with over 72,000 farms operating on over 27 million acres of land.¹² What the value-chain in Illinois creates is a widely distributed production and value-added economic development ecosystem that benefits every county and has a positive impact on the economy of urban, suburban, small town, and rural Illinois.

FIGURE 8: FOOD PROCESSING FIRMS IN ILLINOIS



Source: *intersectillinois.org*.

7 intersectillinois.org. "Illinois' Unrivaled Food Industry." Fact Sheet accessed online at: <https://intersectillinois.org/wp-content/uploads/2018/03/Agribusiness-Industry-Profile-Download.pdf>.

8 Calculated as direct + indirect + induced economic impact quantified through IMPLAN I-O analysis.

9 Decision Innovation Solution. "Illinois Agriculture Economic Contribution Study." February 2015.

10 intersectillinois.org. Op. cit.

11 Illinois Department of Agriculture. <https://www.nasda.org/organizations/illinois-department-of-agriculture>.

12 USDA National Agricultural Statistics Service (NASS) 2018 State Agriculture Overview for Illinois.

THE NEED FOR EXTENSION

In most industries, the research that improves products and productivity is conducted by the industry itself. In aerospace, the automotive sector, metals, software, electronics, etc., industry research **that is conducted by the producers themselves** dominates. This is not the case in agriculture. As noted in a report by TEconomy for the USDA:

“Unlike most other manufacturing or technology industry sectors, agriculture is almost entirely composed of small and midsize business enterprises in terms of primary production. Whereas the global automobile industry, for example, comprises circa two dozen or so major manufacturers, agricultural output in the United States alone stems from the work of 2.1 million individual farms. The national U.S. agricultural industry’s output is the net result of literally hundreds of millions of individual decisions made by farmers across their growing seasons, with those decisions having to take into account an exceptional number of variables (weather, soil fertility, pathogens, pests, commodity prices, global competition, etc.) and the potential deployment of multiple technologies and solutions (such as specific crop varieties and cultivars to use, livestock health products to employ, type of tillage to deploy, and capital investments in new farming equipment, to name just some). The fact that American farmers and the R&D system that supports these farmers have together achieved [large scale] productivity increases in the face of the variable production environment and multivariate decision-making environment in which farmers operate is a splendid American success story, but one that goes under recognized and underappreciated... Importantly, unlike many other industries, the primary production sector in agriculture, being made up of millions of small and midsize enterprises, has only a limited internal R&D capacity. Instead, innovations and productivity increases predominantly depend on R&D and knowledge transfer from agricultural inputs suppliers, the United States Department of Agriculture (USDA) Agricultural Research Service (ARS), and America’s unique system of Land-Grant universities and Cooperative Extension Services.”¹³

While Illinois contains some quite large and sophisticated farming operations (with 228 farms having sales in 2017 greater than \$5 million), the majority of farms in the state are “small” by USDA standards, with annual sales of less than \$250,000. Indeed, out of the total of 72,651 Illinois farms recorded in the 2017 Census of Agriculture, 48,941 (67.4 percent) had sales below \$100,000.¹⁴ Only 12.8 percent of farms in Illinois are in the largest category, having in excess of \$500,000 in annual sales (Table 5).

13 S. Tripp, et al. 2017. National Evaluation of Capacity Programs. TEconomy Partners, LLC. Prepared for the National Institute of Food and Agriculture (NIFA).

14 USDA, National Agricultural Statistics Service. “Economic Class of Farms by Market Value of Agricultural Products Sold and Government Payments: 2017 and 2012.” 2017 Census of Agriculture—Illinois State Data. Accessed online at: https://www.nass.usda.gov/Publications/AgCensus/2017/Full_Report/Volume_1,_Chapter_1_State_Level/Illinois/st17_1_0003_0003.pdf.

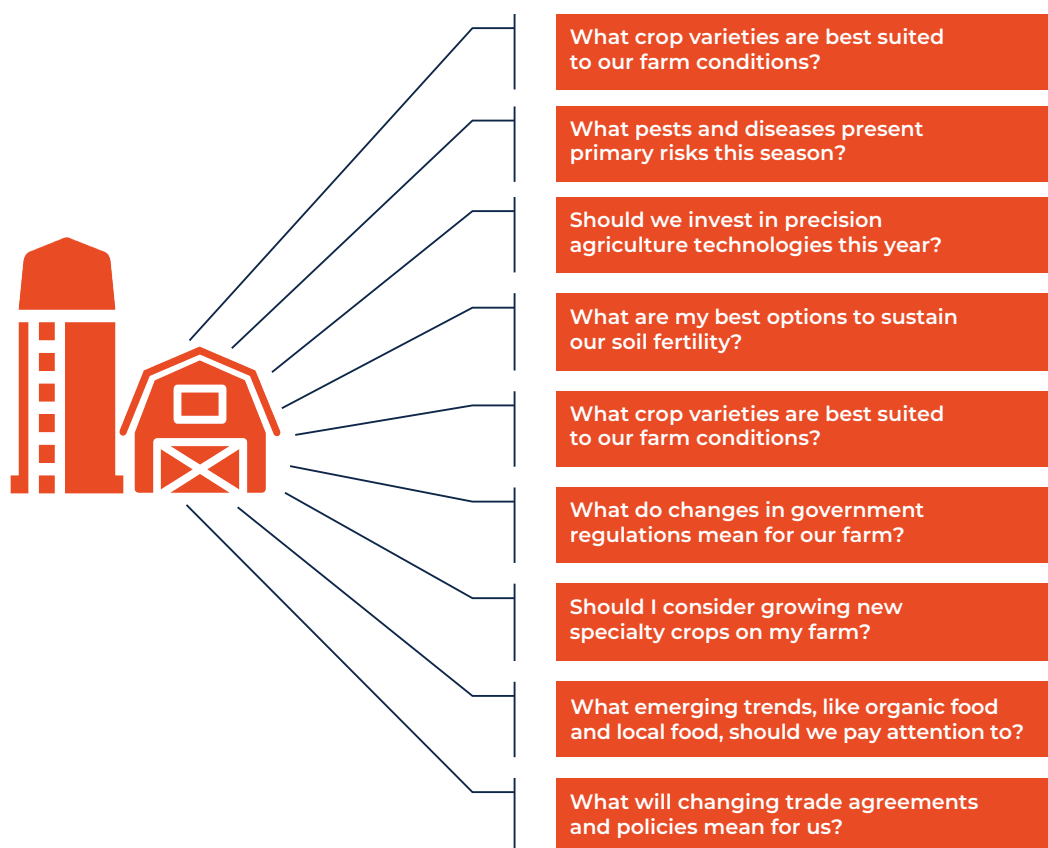
TABLE 5: NUMBER OF FARMS IN ILLINOIS, CLASSIFIED BY VALUE OF SALES IN 2017

2017 Value of Sales	Number of Illinois Farms	Percent of Illinois Farms
Less than \$2,500	23,276	32.0%
\$2,500 to \$4,999	4,185	5.8%
\$5,000 to \$9,999	4,989	6.9%
\$10,000 to \$24,999	5,848	8.0%
\$25,000 to \$49,999	4,919	6.8%
\$50,000 to \$99,999	5,724	7.9%
\$100,000 to \$499,999	14,392	19.8%
\$500,000 or more	9,318	12.8%
Totals	72,651	100.0%

Source: USDA, National Agricultural Statistics Service.

The reality is that Illinois farms, given their size, do not have R&D budgets of their own. So, they absolutely depend on the R&D performed by others to solve challenges and to sustain their productivity in the face of changing field conditions, technologies, competition, and market forces. UIUC is the de facto go-to “research arm” for Illinois’ farms; and Illinois Extension is the conduit for that research, working directly with producers in transferring research knowledge and relaying producers’ concerns and challenges from the field to UIUC researchers. Extension provides a uniquely powerful two-way information exchange and a critically important system of support for agricultural producers and other business operations in the value-chain. Extension is called upon to help farmers and others deal with a uniquely complex set of annual questions and decision-making events (Figure 9). Because every farm is different, with varying soils, topography, crop rotation history, available equipment, budgetary resources, proximity to markets, etc., there is no one-size-fits-all approach. Extension has to tailor its recommendations and solutions not just to the type of challenge presented, but also to the specifics of the location where solution implementation will occur and to the characteristics of the implementer. Extension maintains a statewide presence of Extension field staff to provide the necessary local access, knowledge, and connections to deliver effective solutions and identify specific needs.

FIGURE 9: EXAMPLES OF COMPLEX FARM QUESTIONS AND CHALLENGES



Source: TEconomy Partners, LLC.

UIUC, through its Agricultural Experiment Station and Extension system, works to develop practice recommendations, crop varieties, technology innovations, etc., of its own design and also serves a very important role as trusted independent evaluator of research-based products produced by industry (such as crop varieties, agricultural chemicals, livestock health products, and agricultural equipment). Farmers are presented with an extremely large portfolio of agricultural inputs and equipment options for consideration on their farms, and Extension is able to help cut through the marketing noise and provide reliable evidence-based information to facilitate farmer decision-making.

While Illinois Extension is an organizational entity in its own right, it is important to note that it is functionally intertwined with the university's research enterprise. The work of Extension, the University Experiment Station System, and its associated research community is symbiotic, and each side informs the activities of the other. Extension staff in the field can often provide a solution on the spot grounded in their own knowledge and experience, but they also have the full expertise and research resources of the university to turn-to when more complex or unusual questions or challenges are presented. Faculty performing research may also serve as Extension Specialists, while Extension Educators in the field may be engaged in and supporting faculty research projects. It should also be noted that

the advice, recommendations, and solutions that Illinois Extension provides in Illinois are not solely originated through UIUC research. Illinois Extension is part of a rich nationwide resource of interconnected land-grant universities and is thus able to draw from best-practices and programming developed at other peer institutions. In this regard, Illinois Extension plays an important role for Illinois as a gateway to the entire nationwide land-grant university system and its incredibly broad base of evidence-based solutions, proven programming and expertise.

The amount of research performed at UIUC in agricultural sciences, natural resources, and associated life science areas is substantial. National Science Foundation data show the UIUC with \$122.8 million in “agricultural sciences, natural resources and conservation, and other life sciences” research expenditures in 2018, an increase over 2017’s \$121.6 million. These dollars fund a basic through applied research continuum across a broad variety of disciplines and subject matter areas. TEconomy analyzed Clarivate Analytics “Web of Science” data on publications at UIUC for 2015 through 2019. For disciplines in and related to agricultural and environmental sciences, a total of 8,549 publications with UIUC authors are identified in disciplines related to agricultural sciences and environment and natural resources—this represents 30.7 percent of all UIUC-authored publications (27,831) over the time period analyzed (Table 6). Peer-reviewed publications (as measured in the data) represent the gold standard for academic research, and the data shown on Table 6 help to illustrate the intense levels of expertise and subject matter coverage provided by UIUC faculty and research personnel.

TABLE 6: PUBLICATIONS BY UIUC AUTHORS IN AGRICULTURAL SCIENCE AND ENVIRONMENT AND NATURAL RESOURCE SUBJECTS (2015–2019)

Web of Science Categories	Number of Publications	Percent of UIUC Publications	Publications Quotient ¹⁵
Environmental Sciences	1,024	3.68	1.24
Biochemistry Molecular Biology	870	3.13	0.85
Ecology	711	2.56	1.50
Plant Sciences	566	2.03	1.82
Biotechnology Applied Microbiology	564	2.03	1.56
Veterinary Sciences	554	1.99	2.48
Food Science Technology	514	1.85	2.22
Agriculture Dairy Animal Science	500	1.80	5.24
Genetics Heredity	440	1.58	0.92
Water Resources	380	1.37	1.58
Zoology	341	1.23	1.57
Agronomy	337	1.21	2.54
Nutrition Dietetics	320	1.15	1.43
Biodiversity Conservation	216	0.78	1.52
Entomology	201	0.72	1.66
Green Sustainable Science and Technology	183	0.66	1.12
Materials Science Biomaterials	148	0.53	1.17
Agricultural Engineering	117	0.42	2.87
Agriculture Multidisciplinary	109	0.39	2.01
Soil Science	108	0.39	1.69
Virology	99	0.36	0.61
Horticulture	65	0.23	1.10
Forestry	62	0.22	0.73
Agricultural Economics Policy	59	0.21	2.19
Infectious Diseases	58	0.21	0.17
Materials Science Paper Wood	3	0.01	0.18
	8,549	30.72	–

15 Publications quotient formula: (UIUC Publications in Discipline/UIUC Total Research Publications)/(U.S. Publications in Discipline/U.S. Total Publications). A high publications quotient in agricultural sciences and associated disciplines is to be expected at a land-grant university given these institutions' unique legislated access to federal capacity (formula) funding and the fact that they were originally founded with an agricultural science mission.

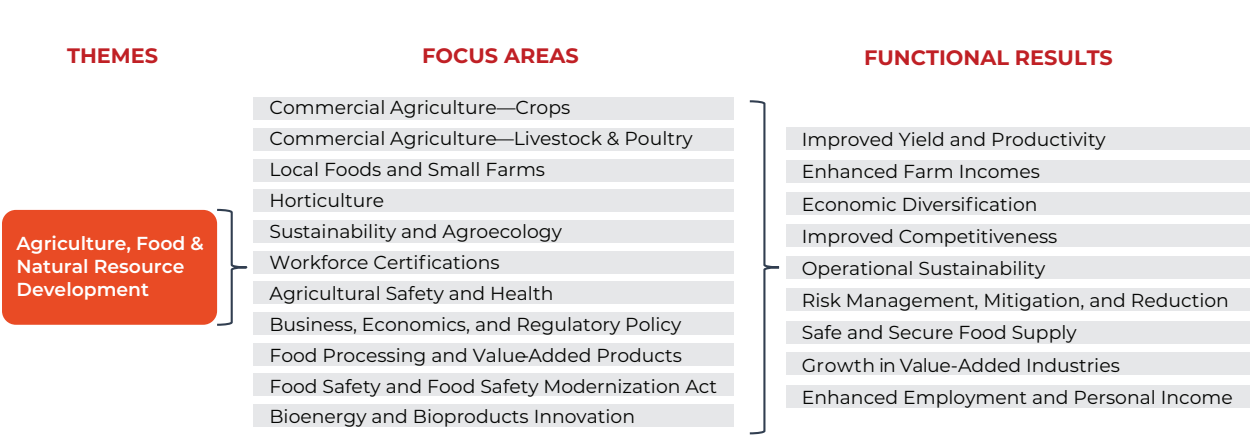
What is unique about Extension is that it ensures that the findings, discoveries, innovations, and practice advancements elucidated in the research on Table 6 do not only reside in the pages of academic journals—rather Illinois Extension is purpose-designed to translate research findings into pragmatic information and recommendations and transfer the knowledge therein to farmers, foresters, and others who can put that knowledge to work.

Illinois Extension has served its role as a highly valued independent information and solution provider for the agricultural and natural resources value-chain in Illinois for more than 100 years. Over that time span, the intense increases that have occurred in agricultural yields, sustainable production practices, livestock nutrition and health, food safety, and other innovative areas have not occurred by serendipity—rather Illinois Extension has been there every step of the way, working alongside and in collaboration with farmers and leaders across the value-chain to make sure the latest research and best practices are relayed to farmers and put to work for the betterment of Illinois’ agricultural industry and the people and families that depend upon it.

HOW ILLINOIS EXTENSION GENERATES IMPACT WITHIN THE AGRICULTURE, FOOD, AND NATURAL RESOURCE DEVELOPMENT THEMATIC AREA

In support of agriculture, food, and natural resource industries, Illinois Extension has to work across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Illinois and its citizens. Figure 10 captures the primary focus areas for Extension’s work in agriculture, food, and natural resource development and the broad categorizations of functional impacts that result from work across these areas.

FIGURE 10: ILLINOIS EXTENSION FUNCTIONAL IMPACT THEMES IN AGRICULTURE, FOOD, AND NATURAL RESOURCE DEVELOPMENT



Source: TEconomy Partners, LLC.

Evident within the focus areas is the fact that Illinois Extension is working across the full value-chain, providing services and support not only to farmers but also in service to the green industry and downstream value-added industries in food, bioenergy, and other

bioproducts. In production agriculture, Extension support is provided for farms of all scales, from midsize and large farms with significant row crop acreage and sophisticated livestock operations, down to small farms, greenhouse operators, niche specialty crop producers, and urban farmers. Extension is also supporting important workforce development and credentialing processes, helping to ensure availability of personnel needed for specialized agricultural value-chain jobs.

FUNCTIONAL IMPACT EXAMPLES FOR ILLINOIS EXTENSION IN AGRICULTURE, FOOD, AND NATURAL RESOURCE DEVELOPMENT

Discussing every program and activity undertaken by Illinois Extension in the area of agriculture, food, and natural resources would lead to an excessively long and complex report. Rather than attempting to produce a list of each and every activity, TEconomy in this (and other functional impact discussion areas) draws upon program examples to illustrate the types and range of important functional impacts generated by Illinois Extension programming. The following examples help to illustrate the type of high-impact work taking place.

Extension Work with Commercial Agriculture in Primary Crops

Illinois is a major production state for major commercial row crops. The production of corn and soybeans is particularly extensive. In 2018 corn was planted on 11 million acres of Illinois agricultural land, producing output with a market value of over \$8.2 billion. Soybeans were planted on a similar acreage (10.8 million acres), producing a direct economic output of \$6.25 billion. While corn and soybeans represent the “big guns” in Illinois commodities, other crops are grown, and so Extension has to be ready to provide production recommendations and solve challenges across many major crop types. Additional row crops grown in Illinois in 2018 included wheat, sweet corn, oats, and sorghum. There is also a significant crop of hay grown in the state in support of the livestock industry.

The characteristics of Illinois commercial crop agriculture means that Illinois Extension needs to be very much current and ready to respond to issues in the big crops of corn and soybean (because such a large part of Illinois’ agricultural economy depends upon them having a successful growing season). It also requires that Extension sustain broad knowledge and expertise across a diversity of crops because much more than just corn and soybeans are grown. Being ready to respond to the needs and issues pertaining to a broad variety of crops also means that Extension needs expertise across the full scope of disciplines and areas of agricultural science that may have relevance in any given year—this requires expertise and access to specialist knowledge in areas such as the following:

- Plant breeding, crop development, crop genetics, and variety trials
- Crop protection, requiring comprehensive coverage of plant pathology, entomology, and weed science, together with integrated pest management and access to diagnostic laboratory services
- Soil science and soil analysis
- Agronomy practices and farming equipment
- Harvesting and postharvest storage
- Conservation and sustainable land and natural resource practices
- Agricultural economics, farm financial management, and risk mitigation.

There is no other organization—commercial, governmental, or otherwise—that farmers can turn to for such comprehensive capabilities and advice. [Illinois Extension is it](#). Even in some specific areas where larger operators may use commercial “crop consultants” to cover some content, for the most part those crop consultants were educated at UIUC (or another land-grant university) and they sustain their knowledge and credentials through working with the university and accessing Extension programming and events.

Program Area: Agriculture, Food, and Natural Resource Development

Example 1: Crop Management

“Crop management” is a collective term that encompasses the agronomic practices that are used to promote high-productivity growth of field crops. Producers have to consider a broad range of variables in their crop management decision-making, considering factors such as soil tillage, rotation strategies, fertilizer applications, seed timing and seeding rates, integrated pest management practices, irrigation strategies, harvest timing, etc. Producers are supported in this complex crop management decision-making by Extension Educators and also by commercial Certified Crop Advisors (CCAs). Illinois Extension provides important educational opportunities and professionally delivered content that supports farmers directly and upgrades the knowledge and skills of CCAs. An important component of Extension’s delivery of this education are a series of Crop Management Conferences (CMCs) that Illinois Extension holds in four different locations across Illinois. CMCs are delivered by Extension Specialists, Educators, and faculty and are attended by both producers and CCAs. At the conferences, Extension distributes the latest results and recommendations from research and trials activities, providing evidence-based advice for optimizing crop management across Illinois’ diverse production environments.

In 2018, the Illinois Extension CMCs were attended by 364 participants, who farm, manage, or advise over 8.2 million acres of Illinois cropland. Extension performs follow-up with attendees to gauge their use of CMC-imparted knowledge, and results obtained in 2018 suggest strong impacts being generated. Ninety-five percent of participants in the conferences reported “knowledge increase,” and nearly two-thirds of the participants reported that they would be implementing the new crop management techniques and practices that they learned at the Extension events. Some of the areas where new recommendations were being adopted as a result of the Extension education included the following:

- Adoption of herbicide-mixing recommendations that help to prevent the buildup of herbicide resistance in weeds
- Adoption of revised fertilizer use recommendations
- Adoption of new strategies for selecting soybean varieties that will reduce the incidence of soybean sudden death syndrome (SDS).

Based on input received from attendees (via post-event surveying) on their adoption of recommendations, it is estimated that the value of their implementation of recommended practices would be approximately \$1 million across the 364 attendees and the acres they farm, manage, or advise for 2018.

It should be noted that the CMCs represent just one facet or a multifaceted Extension approach to delivering crop management value. Extension also provides multiple local meetings and workshops across Illinois and delivers online education for CCAs together with publishing a broad range of information resources available on the Extension website. Extension professionals also provide hands-on expert assistance on specific crop management issues and needs as well as input to university researchers regarding the need for research on current and emerging issues.

Key Impacts:

- Improved weed and pest control (reduced losses)
- Improved crop yields
- Enhanced farm financial performance

Program Area: Agriculture, Food, and Natural Resource Development

Example 2: Crop Protection

Operating largely in open-field environments, agricultural production has the potential to be negatively impacted annually by a broad range of biotic factors that can reduce yield, reduce crop value (through damage to crop quality), and potentially destroy entire crops. Plant diseases (caused by fungi, bacterial, and viral pathogens) and insect pests, both together and individually, can have devastating effects on producer profitability. Similarly, weeds can crowd out the growth of crops and reduce the availability of soil nutrients needed by crops. It is fair to say that crop protection specialists are in a constant war with biotic factors that wax and wane with field conditions and the influence of abiotic factors, which have the ability to evolve resistance to existing methods of control, and with new emerging or invasive pests, diseases, and weeds that can impact Illinois crops. Illinois Extension is alongside farmers on the front lines in fighting this war.

Extension provides evidence-based resources and advisory services that cover integrated pest management practices, identification of pests and diagnosis of plant diseases and causative pathogens and vectors, recommendations for pesticide and herbicide use, and training in the safe application of these crop protection chemicals.

One of the signature programs supported by Illinois Extension is the operation of the Plant Clinic, an invaluable resource for early diagnosis of diseases, pathogens, pests, and weeds. Farmers directly, and Extension field staff, submit samples (and, in some cases, photographs) to the Plant Clinic, which is equipped with the specialized personnel and equipment to provide accurate diagnosis. Demand for the services of the Plant Clinic is high. In 2018, the clinic performed 4,315 individual diagnoses and performed analysis of 3,121 samples from the field. The clinic also provides phytosanitary analysis services, which for 2018 covered 424 fields with a combined acreage of 11,854 acres. Assessment of the value of seed for export covered by the clinic's phytosanitary services show it helped to certify an estimated \$40 million in seed exports. Services in 2018 included advanced molecular analysis of 336 samples to evaluate the herbicide resistance of weeds and the presence of palmer amaranth seeds, together with 1,228 soil and nematology samples.

The Plant Clinic uses standard lab testing and diagnosis techniques but is also active in pioneering new tests and methodologies. An important example of this has been the clinic's contribution to the development of a novel molecular assay that can detect palmer amaranth in mixed seed samples. Contamination of seed with palmer amaranth has been a significant challenge for U.S. agriculture, and the Plant Clinic's development work helps to ensure that farmers will not see the production challenges and control costs that infestation with this weed would generate. The clinic has also been performing specialized assays to determine herbicide resistance in samples of both palmer amaranth and waterhemp. Identification of herbicide-resistant varieties helps farmers avoid the cost of ineffective herbicide applications, the potential environmental impacts of these applications, and lets them put in place alternative weed management techniques. In addition to serving Illinois, the plant expertise of the Plant Clinic is also called upon by other states. In 2018, 163 field samples from nine states representing approximately 650 waterhemp and palmer amaranth plants were tested for herbicide resistance.

Another area where Illinois Extension is engaged is in addressing the use of dicamba. Dicamba is a broad-spectrum herbicide that is effective in control of a variety of annual and perennial broadleaf weeds. The National Pesticide Information Center reports that dicamba is currently incorporated as an active ingredient in more than 1,100 herbicide products. Dicamba resistance has been genetically engineered into key crops similar to glyphosate. One of the challenges of dicamba is that it is more chemically volatile and becomes more readily airborne and subject to drift—which is then a challenge for farmers in adjacent fields who may be growing crops that are not resistant to the herbicide. Illinois Extension has been active in providing response to producer concerns and information to producers regarding new regulations governing the use of the product. In addition, Extension has been proactive in addressing the subject in its pesticide applicator and pesticide safety training programs.

Program Area: Agriculture, Food, and Natural Resource Development

Example 2: Crop Protection

Key Impacts:

- Accurate diagnosis of factors affecting crop performance, thereby helping to enhance yields
- Reduced costs associated with application of crop protection chemicals unsuited to particular field conditions and challenges
- Reduced drift issues with volatile herbicides
- Enhanced farm financial performance

Program Area: Agriculture, Food, and Natural Resource Development

Example 3: Soil Health, Conservation, and Nutrient Loss Reduction

Illinois contains more than 600 different kinds of soils and soil series,¹⁶ and healthy soils with optimized nutrient and mineral content for crop health are crucial for achieving high-yield and high-quality crops. Illinois Extension performs a range of work that is focused on conserving and improving Illinois soils to improve agricultural results in the state.

One of the activities performed by Extension is the delivery of the Advanced Soil Health (ASH) training program. ASH is a comparatively new educational program that is designed to provide in-depth training to producers. Delivered over the course of 18 months, the program provides detailed coverage of soil health and management for producers who are then encouraged to further help with peer-to-peer outreach in their region. Extension also provides less-intensive Soil Fertility Workshops and online training sessions.

Illinois Extension is also working to address challenges associated with nutrient loss from farm fields. Multiple groups from Extension's Commercial Agriculture, Local Foods and Small Farms, and Energy and Environmental Stewardship teams are working to address nutrient loss, while transdisciplinary work is occurring in support of the Illinois Nutrient Loss Reduction Strategy. One of the newer programs involves education and outreach on best management practices in four high-priority Illinois watersheds. Extension is helping to form watershed groups and outreach associates who can work at a local level and is supporting these groups with grant-writing and technical assistance. One outcome of the work has been a Nutrient Loss Reduction podcast, with 17 episodes that have been accessed 2,700 times.

Key Impacts:

- Improved crop yields through enhanced soil performance
- Reductions in the loss of soil nutrients, and its associated costs and environmental impacts
- Enhanced farm financial performance

¹⁶ USDA and the Illinois Soil Classifiers Association. "Illinois: Understanding Soil." Accessed online at: http://www.coloenvirothon.org/uploads/4/6/2/6/46261801/understanding_soils_final2.pdf.

Program Area: Agriculture, Food, and Natural Resource Development

Example 4: Introducing New Crops and Supporting Specialty Crops for Commercial Production

Industrial hemp is a multiuse crop that may be grown for fiber, biomass, food and feed purposes, and as a source of valuable phytochemicals including cannabidiol (CBD). Now that the 2018 Farm Bill has authorized the production of hemp in the United States, there has been considerable interest in the crop from farmers and potential processors nationwide. While there has been somewhat of a “gold rush” mentality at play, the fact is that hemp has been an understudied crop in the United States. It is not particularly easy to grow well, nor has it seen much work on variety development suited to specific growing conditions. Markets for the crop are still developing, and it presents challenges for producers in terms of finding buyers and processors for their harvest.

Because of interest in the crop, and its potential as a specialty crop for some producers, Illinois Extension has been active in providing hemp consultations and advisory services. To date, Illinois Extension has held five workshops across the state, attended by over 500 individuals. The workshops have been designed to introduce attendees to options for hemp production in Illinois for CBD, legislation, production of hemp for grain, and aspects of small business development needed for hemp processing. Extension has also developed a webinar series, information resources, and publications and videos to help meet demand for information. Based on input from Extension, university researchers are now conducting research on hemp for Illinois production.

While hemp is gaining attention, it is only one of many specialty crops for which Illinois Extension is providing support. Fruits and vegetables are another area of emphasis; and Extension engages in multiple state and regional workshops and events covering options with these crops, including the Specialty Crops Conference and the Southern Illinois Fruit and Vegetable School. Extension also publishes the Illinois Fruit and Vegetable newsletter. Since 2014, Illinois Extension has conducted an innovative program in southern Illinois called the “Summer Twilight Series,” which provides demonstration programs on farms that are attended by other producers, beginning farmers, and even home gardeners. The events cover production and management practices, market development, and other issues important for potential growers to understand. Since 2014, a total of 23 face-to-face Summer Twilight Series events have occurred with attendance by 603 participants. Results from post-event evaluations show positive results being achieved, with 72.9 percent of participants rating the overall usefulness of the information presented as “excellent” and 59.6 percent rating information on marketing as “excellent.”

Another example of Illinois Extension work in support of specialty crops is the Pumpkin Field Day program. Held in 2014, 2016, and 2018, the field days have taken place at the Ewing Demonstration Center and have been attended by over 300 growers. Extension reports and demonstrates the results from its field trials; provides information on variety selection; and provides information on agronomic best practices for the crop, such as pest management. Event information is distributed more widely through online informational resources hosted by Extension and via Extension newsletters. In addition to field day participants, additional work by Extension is estimated to have reached a further 400 growers. Some of the key benefits reported by Extension through the program include supporting the adoption of new, more productive and marketable pumpkin varieties; introduction of no-tillage production practices that help avoid soil and nutrient loss; and the registration of a new herbicide.

Key Impacts:

- Introduction of new crops to diversify agricultural production in Illinois
- Development of management practices and production recommendations to ensure production success
- Reduced environmental impacts associated with new crop agronomy
- Enhanced farm financial performance

Program Area: Agriculture, Food, and Natural Resource Development

Example 5: Responding to Critical Events

No matter what the underlying reason, it does appear that the agricultural community has been experiencing a series of challenging critical events in recent years. Challenges related to abiotic stress events such as flooding, drought, late frosts, extreme heat events, etc., can create critical conditions that have profound negative effects on agricultural production. Illinois Extension is “always there” ready with local personnel on the ground and the full research and outreach resources of a world-class research university, to quickly respond to extreme events. Extension is proactive in developing research, analysis, and outreach to support critical and emerging issues, and this was very much in evidence across Illinois in 2019 where flooding caused the USDA to declare an “agriculture disaster” in all 102 Illinois counties. Illinois Extension was there to provide guidance to farmers on their options regarding late planting and on other issues such as access to federal funds to aid recovery efforts. Extension provided webinars and information that addressed the following:

- Insurance and government market facilitation payments related to different planting strategies, and documentation of “agricultural expert” agronomic recommendation required to establish eligibility for crop insurance payments
- Options for growing cover crops for forage, as an alternative for producers unable to plant corn or soybeans
- Advice and counseling for dealing with farm stress and financial difficulties.

This aspect of Illinois Extension’s work comes very much into focus when one considers the profound impact that critical events can have on the farming community and individual farmers. Declining commodity prices, very poor weather conditions, and international tariffs on agricultural commodities created unprecedented stress on farm families in 2019. Farm loan delinquencies, foreclosures, and bankruptcies rose to a 6-year high in the nation; and the resulting stress has been cited as causing mental health crises to spike across farm country.¹⁷ Having Illinois Extension to turn to as a resource that is always there for evidence-based sound advice and proactive guidance is no doubt extremely important and comforting when hard times hit producers.

Key Impacts:

- Rapid response to critical events and disasters
- Evidence-based strategies and practices for recovery and alternative production
- Support for farmers and farm families in crisis

¹⁷ Chuck Jones. “Amid Trump Tariffs, Farm Bankruptcies and Suicides Rise.” Forbes. Aug 30, 2019. Accessed online at: <https://www.forbes.com/sites/chuckjones/2019/08/30/amid-trump-tariffs-farm-bankruptcies-and-suicides-rise/#632174082bc8>.

Extension Work with Commercial Agriculture in Livestock

As home to the historic Chicago Stock Yards, Illinois has a long history of contributions in the livestock sector. The most recent USDA NASS report for Illinois shows the state having a sizable livestock sector. Hogs represent the largest sector in terms of total inventory, recording an inventory of 5.4 million in January of 2018. Cattle are also an important species, with an Illinois beef inventory of 405,000 cows in January 2018, 85,000 dairy cows, and overall, almost 1.2 million cattle in the state (including calves). Small ruminants have also been increasing in sheep and goat production. The net effect of the livestock sector in Illinois is quite significant. An economic impact study entitled “The Economic Impact of Illinois' Livestock Industry,”¹⁸ cited a \$1.94 billion direct output impact in Illinois from livestock products and a total economic impact of \$3.17 billion. The study noted that the state's 326 meat and dairy processing firms added an additional \$10.07 billion in direct output products and \$19.72 billion in total economic impact. Together, the study reported the livestock production and value-added processing and dairy sectors being responsible for 119,538 full-time jobs across Illinois.

UIUC contributes to the success of the livestock industry in Illinois in multiple ways. Home to the College of Veterinary Medicine, the university is the education center for large-animal veterinary medicine in Illinois that serves the needs of the livestock sector. The college also sustains active programs in research and operates the Veterinary Medicine Research Farm and an active Veterinary Diagnostic Laboratory. Within the College of Agricultural, Consumer and Environmental Sciences (ACES), the Department of Animal Sciences is the key hub for higher education and research related to livestock. Illinois Extension, in turn, has access to the expertise and resources contained across the university and is able to be fully responsive to needs in the industry pertaining to food animal nutrition; animal health; animal housing and well-being; animal reproduction; and downstream value-added areas in processing and food safety.

18 Illinois ACES Animal Sciences. Online article titled “Livestock Industry Impacts State's Economy” reporting on impact study by Professor Peter Goldsmith. Accessed online at: <https://ansc.illinois.edu/news/livestock-industry-impacts-states-economy-0>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 6: Extension Work to Sustain Animal Health

In recent interviews with major livestock companies, TEconomy was told that animal health is the issue that “keeps us up at night.” With livestock exposed to biological pressures in field conditions or when kept in close proximity to one another in more intensive confined operations, the risk of events that may impact animal health requires constant vigilance. The current outbreak of African Swine Fever in China illustrates the potential risk (although Chinese production is not to the standard of care exercised in the United States). The Chinese outbreak has resulted in a year-on-year decline of 26 percent in its pig herd (according to official Chinese Government statistics), but some independent analysts estimate that the decline may be closer to 40 percent. In some instances, a livestock disease outbreak (especially if it has crossover effects into human health, either real or perceived) can be so significant that long-term declines in product demand may occur (as occurred in the United Kingdom [UK] with the bovine spongiform encephalopathy [BSE] outbreak of the late 1980s, which precipitated long-term beef demand reductions approaching 25 percent of their original value across Europe).¹⁹ In a meta-analysis of livestock disease impact studies, researchers note that “the U.S. Food and Drug Administration (FDA) estimates a loss of \$15 billion in sales revenue, resulting from a 24 percent decline in domestic beef sales and an 80 percent decline in beef and live cattle exports if a U.S. [BSE] outbreak were to occur. Slaughter and disposal costs of at-risk cattle would be at least \$12 billion.”²⁰

Because so much economic value is at risk, Illinois Extension is proactive in engaging with the livestock sector in issues pertaining to animal health. An example of this work is Extension’s work on the issue of anaplasmosis in cattle. Anaplasmosis is a vector-borne (primarily tick-borne) infectious blood disease in cattle caused by the parasites *Anaplasma marginale* and *Anaplasma centrale*. The parasite infects red blood cells, causing severe anemia leading to substantial weight loss and potentially cattle death. One study placed the economic impact of the disease in U.S. cattle at \$300 million annually.²¹

Recent research at Illinois Extension finds that *A. marginale* prevalence is significantly higher in southern Illinois than was previously thought to be the case. Preliminary data identified that 60 percent of tested beef cows and 93 percent of herds tested positive for the parasite. Ongoing Extension research is documenting prevalence in other Illinois counties, and is examining options for protective management practices. In addition to facilitating the research, Illinois Extension delivered a series of presentations across nine counties on the increased prevalence of the *A. marginale* parasite and outlined recommended practices for limiting transmission.

Another Illinois Extension program is focusing on the problems associated with predatory behavior of the black vulture, with the bird being cited as responsible for predation of the soft tissue (especially eyeballs and anal tissue) of young calves. The damage done to a calf can be deadly, either directly or because a calf must be euthanized for humane reasons. Illinois Extension is providing advice to producers concerned with the issue and the challenges of dealing with black vultures, which are protected under the Migratory Bird Treaty Act.

Key Impacts:

- Helping producers reduce the risk of yield-reducing livestock health events
- Enhanced farm financial performance

19 W. Thompson and G. Tallard. “Consumption versus Demand-Recovery after BSE?” EuroChoices. Spring 2003.

20 James Pritchett, Dawn Thilmany, and Kamina Johnson. “Animal Disease Economic Impacts: A Survey of Literature and Typology of Research Approaches.” International Food and Agribusiness Management Review. 2005; 8(1).

21 Greg Henderson. “Risk of Contracting Anaplasmosis Grows.” Drovers. May 9, 2018. Accessed online at: <https://www.drovers.com/article/risk-contracting-anaplasmosis-grows>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 7: Enhancing Beef Production, Quality, and Value

Illinois is home to a complete value-chain in beef. Because Illinois is home to cow/calf operations; backgrounder and stocker operations; and feedlot, slaughter, and meat processing and packaging operations, beef represents an important component of the state's food and agriculture sector. Illinois Extension supports this value-chain through a variety of programmatic activities—ranging from support for producers in areas such as reproduction, nutrition, and livestock health, onward into processing and food safety.

One of the signature programs of Illinois Extension with beef cattle is the Beef Quality Assurance (BQA) program. The program educates producers in production strategies proven to maintain and improve beef quality. Quality beef commands higher market prices, providing a very real return to producers who are able to raise their product quality. Increasingly, buyers are requiring that producers have BQA training and are certified; so, Extension fulfills an important need in the beef value-chain through its development and delivery of these training and certification programs. A 2019 study by Colorado State University demonstrated that cattle with BQA listed in their lot description command a premium of \$16.80 per head.²² Such premiums can add up quickly given the total Illinois beef cattle inventory numbers cited earlier in this report of 405,000 head. Were all these cattle to be produced under BQA practices, the net result could be \$6.8 million in increased value.

Another Illinois Extension program is the Illinois Performance Tested Bull Sale. This sale incentivizes the production of bulls that meet specific criteria associated with high beef quality. Extension facilitates this sale, providing producers following production criteria with a well-marketed outlet where they can gain premium prices for their high-quality bulls. The 2018 Illinois Performance Tested Bull Sale realized sales of \$193,650 for participating producers who sold 50 bulls. The economic impact of the sale, however, extends beyond the direct sale of the bulls. The key value is in raising the quality profile of beef cattle herds in the state that are sired by the purchased bulls. Producers have been noting whole herd increases in reproductive efficiency and improved weight gain on feed for the progeny of Illinois performance tested bulls.

Illinois Extension also providing valuable research-based advice to producers on winter feeding strategies for cattle. Work in this regard has centered on strategies for extending the grazing season and using cover crops, the use of alternative feeds and processing by-products, and feeding equipment design improvements.

Key Impacts:

- Enhanced quality of beef, increasing the ability of Illinois beef to command market price premiums
- Improved reproduction and progeny production performance through performance tested bulls
- Enhanced livestock performance in the winter
- Enhanced farm financial performance

22 National Cattlemen's Beef Association. "Study Shows Premium in Cattle from BQA Certified Producers." <https://www.bqa.org/Media/BQA/Docs/research-shows-premiums-from-bqa-certified-cattle.pdf>.

Extension Work with Small Farms, Local Foods, and Urban Agriculture

As highlighted earlier (Table 6), the preponderance of Illinois farms are small. The USDA reports that, of the 72,651 farms in Illinois, 23,276 recorded 2017 sales of less than \$2,500. An additional 9,174 Illinois farms had sales of between \$2,500 and \$9,999. The Illinois Farm Bureau reports that 34.1 percent of Illinois farms are sized in the 1–49 acres category.²³ Often operated by part-time farmers, first-time farmers, or “hobby farmers,” small farm operations can place high demands on the expertise, support, and hands-on assistance that Illinois Extension provides.

Small farm operations can make important contributions to the economic and social fabric across rural and small town Illinois, but there is also a trend in the emergence of small urban farming operations. Driven by interest in, and demand for, local foods, together with the availability of vacant or underutilized urban land, urban farming operations represent an expanding opportunity for small business operations. Urban farming is a quite innovative sector too, occupying not only surface-level outdoor land, but also occupying rooftops and, in some instances, operated inside of buildings (e.g., hydroponic operations and indoor aquaculture).

Illinois Extension’s Local Foods and Small Farms Team is very much engaged across a full spectrum of small farms, urban farms, and local food development operations. As might be expected, given the diversity of crops, livestock, ornamentals, and other products that can be produced in diverse small operator settings, there is a wide variety of Extension programming in the space.

Program Area: Agriculture, Food, and Natural Resource Development

Example 8: Chicago Safe Soils

Covering 227.63 square miles and home to a population of 2,695,598 people, Chicago is the third-largest city in the United States. The City of Chicago was incorporated in 1837 and, for several decades, was the world's fastest-growing city. Growing rapidly and heavily industrialized, Chicago grew unrestrained; and decades of unplanned and often unregulated growth and industrial activity led to large areas of the city being contaminated with industrial pollutants and other contaminants. Changing economic fortunes, manufacturing declines, and changing housing preferences have left large areas of former industrial or home sites derelict, vacant, or underutilized. Now, however, enterprising individuals and community groups are looking to these sites as potential opportunities for the production of food or other agricultural products. Located in the heart of a huge metropolitan area, with a big population as a captive market, local food production presents opportunities to revitalize space, green-up communities, and provide healthy fresh produce for community members.

This opportunity cannot be realized, however, if a site contemplated for urban agriculture is contaminated with heavy metals, toxic chemicals, or other legacy pollutants from past activities. Recognizing a need to ensure that urban agriculture is performed safely, Illinois Extension is engaged in the Chicago Safe Soils Initiative. This Extension program is working to develop tools to identify and mitigate soil heavy metal risks and provide these tools to urban stakeholders for site evaluation. The project provides active soil testing services and is also leveraging the power of citizen-scientists to help identify and manage soils with lead contamination. The program is working to develop a publicly available mapping tool showing sites of heavy metal soil and lead contamination across Chicago.

23 Catherine Lawry. Illinois Farm Facts. Illinois Farm Bureau Information Research Center. Accessed online at: <https://www.ilfb.org/media/3136/2018faff.pdf>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 8: Chicago Safe Soils

Key Impacts:

- Public health protection
- Expanded opportunities for urban farming and local food availability in Chicago
- Improved community aesthetics and green space
- Opportunities for Chicago residents to expand their incomes and produce homegrown food

Program Area: Agriculture, Food, and Natural Resource Development

Example 9: Master Urban Farmer Training Program

Most urban farmers are going to be new farmers—coming to their farming venture with limited or no prior experience in agricultural production and farm business operations and management. It is in the State of Illinois' interest to see these small business and entrepreneurial urban food ventures succeed, and Illinois Extension has stepped-forward to develop specific programs to support urban farmer education and training. One of the Extension initiatives is the Master Urban Farmer Training Program (MUFTP), which has first been rolled out in Chicago. The program uses 11 education sessions that provide beginning urban farmers with the knowledge and skills they need to get started with an urban farm. Started in 2016, the MUFTP has now trained four cohorts of beginning farmers comprising a total of 112 participants.

One year after the first training, follow-up research was conducted. Twenty-two participants responded to the evaluation, with seven saying they were now engaged in active farming and five reporting that they had created a new urban farm. Over time, as success builds and the Chicago urban farming movement builds, it is anticipated that Extension will expand the program into other urban locations across Illinois.

Illinois Extension's support for urban farming is being significantly enhanced with the opening of the South Suburban Cook County Urban Ag Demo Farm. Deliberately small, to mimic the type of operations occurring in urban farming, the 0.2-acre site demonstrates season extension structures, raised-bed systems, in-ground bed systems, and storage. It has been located at the Matteson Area Center as a part of Prairie State College and is designed to serve as a training asset for the MUFTP and site for other urban farm training and education sessions. Produce grown on the Urban Ag Demo Farm will be used within the Prairie State College culinary arts program with excess donated to food pantries.

Key Impacts:

- Increasing the knowledge and skills of Illinois residents seeking to start new urban farming operations

Program Area: Agriculture, Food, and Natural Resource Development

Example 10: Community Gardens

Another Illinois Extension initiative targeting small food production operations is the Community Garden program. Community gardens are supported through Extension's Master Gardener program, and the initiative is helping schools and communities establish operational gardens in multiple locations. The program has multiple elements to it, but its primary goals can be captured under two themes:

Program Area: Agriculture, Food, and Natural Resource Development

Example 10: Community Gardens

1.The produce that is grown at the community gardens helps to bring fresh produce to schools, food pantries, and food-insecure parties—providing access to nutritious healthy foods.

2.The community gardens are designed to be demonstration (as well as production) sites, to facilitate education, and to serve as training sites for their communities. They present an opportunity to introduce agricultural and green industry opportunities to youth and community members while instructing participants in environmental stewardship and food production skills.

The extent of the program is significant, with Extension supporting nearly 300 community gardens in 2019. Extension reports that these gardens donate over 80,000 pounds of fresh produce annually, with an estimated value of \$117,000.

Key Impacts:

- Increasing the knowledge and skills of Illinois residents
- Expanded local food production and donation of food to in-need populations
- Healthy school meals using local fresh produce.

Program Area: Agriculture, Food, and Natural Resource Development

Example 11: Small Farm Programming and Research

Illinois Extension conducts a broad variety of activities focused on opportunities and solutions for small farming operations in the state. Some recent examples of research activities include the following:

- Variety trials, for asparagus, tomatoes, cucumbers, potatoes, and peppers
- Evaluation of comparative production methods for specialty crops
- Evaluation of cover crops and no-till production practices for fresh market tomatoes and peppers
- Weed management for crops including tomatoes and zucchini
- Exposure risks of pathogens and disinfection by-products from on-site treated rainwater and drainage water used for irrigation
- Testing reduction of dairy financial risk through grazing and insurance.

Extension translates the findings of its research through its website, publications, webinars, and other event programming; demonstration and field days; and via direct interactions between Extension Educators and producers. Because of increasing demand for local food programming and associated small farming operations, Illinois Extension recently set up two new sites for research, demonstration, and education in previously underserved areas within southern Illinois and southern Cook County. These new locations join the existing sites with a focus on local foods and small farms (e.g., the Ewing Demonstration Center, the Jackson County Extension Research and Demonstration Fields, and the Dixon Springs Agricultural Center). Dixon Springs was reopened as a site for fruit and vegetable research and for conducting high tunnel demonstrations.

Key Impacts:

- Increase diversity of production and local food availability
- Enhanced farm financial performance

Program Area: Agriculture, Food, and Natural Resource Development

Example 12: Food Safety and Modernization Act Training

According to data from the Centers for Disease Control and Prevention (CDC), approximately 48 million people in the United States (1 in 6) get sick, 128,000 are hospitalized, and 3,000 die each year from foodborne diseases. In response to the issue, Congress enacted the Food Safety Modernization Act (FSMA) in 2011 to further the prevention of foodborne illness. FSMA has given the FDA new authorities to regulate the way foods are grown, harvested, and processed.

In part, the FSMA is a federal response to the increasing globalization of the food supply system, but it also aims to enhance procedures within domestic food production. FSMA recognizes that even domestic procedures can be improved to reduce the public health and personal challenges associated with foodborne illnesses. Illinois Extension has a long history of work in food safety, covering the value-chain from farms all the way to final safe food preparation and serving in the home. Illinois does have a very safe food system, and Illinois Extension has been a significant contributor to that safety. Now that FSMA is part of the equation, Illinois Extension has been responsive in terms of developing training, including in-person training, for those whose business operations are impacted by the legislation.

FSMA is quite complex, comprising seven individual rules that cover different aspects of food safety. The rules impact the entire food production and supply chain and generated significant demand for information on the rule requirements, best practices for addressing those requirements, and adaptation of current practices and processes to fit with FSMA rules. Illinois Extension Educators are directly involved in delivering FSMA training. Part of the work involves Produce Safety Rule Grower Trainings, whereby Extension Educators teach Good Agricultural Practices, FSMA Produce Safety Rule requirements, and details on how to develop a farm food safety plan. The program includes mandatory training modules covering worker health and hygiene, soil amendments, wildlife, domesticated animals and land use, agriculture water (both production water and postharvest water), postharvest handling and sanitation, and farm food safety plan development.

Key Impacts:

- Ensuring that farmers of produce are able to comply with FSMA rules
- Enhanced food safety

Extension Work with Horticultural Operations and the Green Industry

The Merriam-Webster dictionary defines horticulture as “the science and art of growing fruits, vegetables, flowers, or ornamental plants.”²⁴ Illinois Extension experts in horticulture work with both food and ornamental applications of horticulture.

On the food side, Extension supports commercial horticultural production in Illinois via multiple activities and programs. Chief among these are the following:

- Conferences and workshop events. Examples include the Specialty Growers, Agritourism, and Organic conference, the Horseradish Growers conference, the Commercial Tree Fruit School, and the Southern Illinois Fruit and Vegetable School.
- Crop-specific meetings and demonstrations.
- Development and provision of educational materials, website-based information, and videos.
- Expert assistance and consultations provided by Extension Educators and Extension Specialists.

²⁴ <https://www.merriam-webster.com/dictionary/horticulture>.

The green industry and ornamental component of horticulture is also an important industry within Illinois. While the study is somewhat dated, a 2005 analysis of the industry within the United States and individual states²⁵ indicated that green industry primary production economic output in Illinois (direct, indirect, and induced) totaled \$958 million and 4,666 jobs were supported in the state by green industry production. This is just the primary production of the plants and does not include all the service jobs associated with landscaping, retail, etc.

Program Area: Agriculture, Food, and Natural Resource Development

Example 13: Plant Protection in the Horticulture Sector

As with commercial row crop agriculture, the horticulture sector faces variable biotic and abiotic stress events that may significantly impact production. The challenge of plant protection is particularly acute in the horticulture sector because of the wide variety of plants grown for ornamental and landscaping purposes—with this variety meaning that a large range of plant diseases, pests, and other biotic challenges need to be addressed.

One of the recent challenges for the industry in Illinois has been the emergence of boxwood blight. Boxwood is a common landscape planting, and boxwood blight is a fungal disease that can kill boxwood trees and shrubs. Because of the potential impact of the disease, the Illinois Department of Agriculture (IDA) has declared it a state-regulated disease. Illinois Extension has been a key partner with the IDA working to develop a management plan for boxwood blight and strategies to contain an outbreak and limit environmental and economic losses.

Another example of Illinois Extension work in the green sector is the Mastering Urban Tree Health and Identification (MUTHI) program. Individual trees and urban woodland beautify the environment and provide ecosystem services as well as psychological and health benefits for community residents. Through the MUTHI program, Extension uses a train-the-trainer model, leveraging and supporting its large network of Master Gardeners and Master Naturalists to monitor tree health and address identified issues across their communities. Extension Specialists are available to provide diagnostic services and management approaches for issues identified.

Key Impacts:

- Accurate diagnosis of factors affecting plant performance, thereby helping to enhance yields
- Reduced costs associated with application of crop protection chemicals unsuited to particular conditions and challenges.
- Enhanced producer financial performance

25 C. Hall, A. Hodges, and J. Haydu. 2005. "The Economic Impact of the Green Industry in the United States." Selected paper prepared for presentation at the Southern Agricultural Economics Association Annual Meeting, Orlando, Florida, February 5–8, 2006.

Program Area: Agriculture, Food, and Natural Resource Development

Example 14: Master Gardener Program

Volunteers are integral to the work of Extension. The extra hands and minds provided by volunteers are especially important to addressing needs relevant to the green industry and ornamental horticulture because of the huge numbers of home gardens, landscape plantings, and community plantings distributed across the entire state. Consider, for example, that, just in terms of residential demands, Illinois contains 4,591,779 households, and each may have questions and needs whether they have home gardens or indoor plants. Illinois Extension is able to respond to this potential demand through its Master Gardener program.

The Master Gardener program trains volunteers who then are available to enhance and support their communities across Illinois through gardening outreach activities. Master Gardeners receive 60 hours of face-to-face or web-based training, and, as of 2018, there were 2,622 active Illinois Master Gardeners providing service to communities. In 2018, Extension trained 402 new Master Gardeners. The hours of service contributed by the Master Gardeners are tracked by Illinois Extension, and, in 2018, 219,272 hours of volunteer time was provided. Independent Sector is a national membership organization that serves nonprofits and foundations, and the organization produces an important annual analysis of the national and state-by-state value of volunteer hours.²⁶ For Illinois in 2018, Independent Sector places the economic value of a volunteer hour at \$26.89. Applying this hourly value to the 219,272 hours of volunteered Illinois Master Gardener time in 2018 results in a total provided value of \$5,896,224.

Illinois Extension Educators develop and prepare educational presentations and materials that the Master Gardeners are able to use within their communities. Webinars are also provided by Extension, and videos of webinars are archived and made available online for ongoing use. In addition to responding to individual challenges and needs that come to them, the Master Gardeners are also proactive speakers at events; and, for 2018, 411 Master Gardener Speakers Bureau presentations were made throughout Illinois. The diversity of activities supported by the Master Gardener program is quite broad. Examples of activities include manning information hotlines; hosting community workshops and plant clinics; and providing advice to institutions, schools, and organizations in regard to community gardening, therapeutic gardening, and other special applications.

Key Impacts:

- Improved communities and quality of life
- Enhanced local food production

26 Independent Sector. "Value of Volunteer Time: 2018." <https://independentsector.org/value-of-volunteer-time-2018/>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 15: Sustainable Landscaping

Landscaping beautifies homes, neighborhoods, and communities and provides tangible benefits in terms of increasing the value of property and enhancing quality of life and well-being of residents. However, landscaping, if not installed with an eye toward sustainability, can also contribute unwanted environmental issues. Some examples of such challenges include runoff of chemicals applied to lawns, overspray of herbicides, inadvertent planting of plants that can be invasive, etc. Done right, landscapes provide the aesthetic benefits previously described, but they can also be designed to serve environmentally beneficial functions such as the interception and retention of water runoff in urban environments. Illinois Extension experts in horticulture are able to offer advice on these issues and opportunities statewide.

One example of Extension work in this area is the Conservation@Home for Schools program. Begun in 2018 in Cook County, the program works with public schools and other organizations (e.g., churches and nonprofit groups) to provide advice in sustainable landscaping. The program also provides a formal recognition program to help celebrate successful sustainable landscape work. The program, founded on the Conservation@Home program, was initially piloted in 2018 and was broadened in 2019 to 10 schools.

Key Impacts:

- Improved environment and reduction of negative externalities
- Improved communities and quality of life

Extension Work with Agricultural Workforce Training, Certifications, and Safety

Much of the work in agricultural production and associated value-added industries requires specialized skills development and educational training. Workers in the agricultural sector deal with heavy machinery and equipment, hazardous agricultural chemicals, large animals, and general outdoor environmental hazards—making training on proper operations and hazard mitigation important. The industry is also supplying products for human consumption, and therefore specific processes have to be followed to make sure production and manufacturing processes do not allow pathogens or other food contaminants to make their way to consumers. It is in the public interest to make sure that the agricultural value-chain has access to education and training resources that ensure workforce skills. In a number of instances, specific training is mandated by government regulations in areas such as pesticide application and safe food manufacturing practices.

Illinois Extension is, at its heart, an education-provision organization. While much of what it provides is education that is not mandated legislatively (but nonetheless critically important), it also plays an important role in delivering specific certification courses and other educational programming that meets the requirements of regulatory bodies. By providing these services, Illinois Extension helps to ensure that the agricultural value-chain has access to the skilled and certified workforce needed for its daily operations. It also helps Illinois workers find jobs in the industry, by providing accessible education and training programs giving them competitive job skills.

Program Area: Agriculture, Food, and Natural Resource Development

Example 16: Pesticide Applicator Training

Pesticides are an important tool in the plant protection arsenal of modern agriculture. The Genetic Literacy Project notes that pesticide products prevent the loss of crop yields globally by protecting them “from more than 10,000 species of pests, 30,000 species of weeds and countless diseases.”²⁷ The UN FAO has estimated that, on average, 26–40 percent of crop yields are lost to weeds, pests, and diseases and that without pesticides losses could double. Sustaining the high yields obtained by modern agriculture requires the use of pesticides across many crops, and such is the case in Illinois. While pesticides are an important production tool, they also present hazards if used or applied inappropriately. Overuse or inefficient application can lead to pesticide runoff into water resources, pesticide drift can impact adjacent fields of unprotected crops, and misuse can promote the development of pesticide-tolerant pests (disease organisms, insects, or weeds). Furthermore, chemicals in pesticides can present health risks to applicators and others.

Illinois Extension is a key partner in providing pesticide safety education in Illinois. The Extension Pesticide Safety Education Program (PSEP) provides producers and professional pesticide applicators with specific training required for the safe and effective handling and application of pesticides. Testing for certification of pesticide applicators is conducted by the IDA. Illinois Extension provides the education and training for applicators needed to pass the test. Demand for these training services is high, with 2018 seeing Extension conducting 89 training clinics containing a total of 13,035 participants, including 6,322 unique commercial operators and applicators. Based on ZipRecruiter data for Illinois, certified commercial pesticide applicators have an average annual salary in Illinois of \$32,977 a year.²⁸ Extrapolating this average salary to the 4,653 commercial operators and applicators certified, based on current test pass rates, indicates that Extension is helping to support Illinoisans earning over \$153 million in combined annual pay through pesticide applicator jobs.

The training provided by Illinois Extension helps to keep applicators up-to-date on new developments in both chemical and nonchemical pest control methods and is designed to specifically help prepare applicants to pass the state certification examinations required for obtaining either operator or applicator licenses. Extension staff also support the industry with newsletters and online articles on current pesticide topics and developments within the agricultural sector. The Extension team also provides additional value in the state by providing informational resources covering home and garden pest issues.

Key Impacts:

- Enhanced workforce and job opportunities
- Improved environment and reduction of negative externalities

27 Genetic Literacy Project, republished article from Farming UK. 2019. “Farming without pesticides could double crop losses, boost global food prices, UK economist warns.”

28 As of February 2020, the average annual pay for the Commercial Pesticide Applicator jobs category in Illinois is \$32,977 a year. ZipRecruiter notes it sees Illinois annual salaries as high as \$43,723 and as low as \$19,675, with the majority of salaries within the Commercial Pesticide Applicator jobs category currently ranging between \$28,420 (25th percentile) to \$38,476 (75th percentile) in Illinois.

Program Area: Agriculture, Food, and Natural Resource Development

Example 17: AgrAbility—Keeping Farmers Farming

Injuries or health problems present challenges for many in the agricultural sector. Agricultural production is a physically challenging job, requiring physical functionality and mental acuity to operate heavy equipment, interact with large animals, and generally conduct a diversity of daily tasks. When farmers or farm workers have injuries, disabilities, or health issues, their ability to conduct their work can be compromised and their safety further imperiled. Just in terms of injuries alone, estimates indicate that each year in Illinois “more than 200 farm workers sustain injuries which result in physical disabilities that affect their future income, and ... beyond that, health related impairments such as arthritis, stroke, or respiratory ailments can have a similar impact, and are evident in all agriculture occupations.”²⁹

AgrAbility Unlimited, a joint program of the Illinois Cooperative Extension Services and the Illinois Easter Seals Society, is supported by funding from the USDA (authorized under the 1990 Farm Bill). Currently, Illinois is one of 14 states participating in the program. In Illinois, the AgrAbility Unlimited program provides “assistance to individuals and their families engaged in farming or a farm related activity and who have been affected by a disability.”³⁰ Services provided are individualized on a case-by-case basis. Ideally, AgrAbility Unlimited services seek to help those who are disabled continue to farm through implementation of evidence-based assistive technologies or techniques. In some instances, though, help may need to be provided to direct individuals to alternative employment or income opportunities. The main types of assistance provided include on-site assessments to determine adaptive requirements, equipment or work site modifications consultation, job task restructuring, stress management and counseling, and safety and secondary injury awareness.

Key Impacts:

- Sustained employment/income for farmers and farm workers
- Lower potential use of state social welfare programs

Program Area: Agriculture, Food, and Natural Resource Development

Example 18: Training At-Risk Populations to Enter Agriculture

Many activities in agriculture and green industries are labor intensive, and the demanding nature of the work can make it challenging for employers to always find a supply of trained workers to fill their job openings. Today’s more restrictive immigration environment is also contributing to the challenge, reducing flows of migrant labor into the sector across the United States. Work in agriculture, horticulture, and associated industries can provide rewarding and stable work; but gaining access to those jobs does require that an applicant have either experience or training that equips them for the tasks they will face.

Through a training program taking place in the Illinois correctional system, Illinois Extension is addressing demand for workers and providing opportunities for persons who may typically find the job market hard to access. The program operates under the name “From Orange to Green” and is being piloted with offenders at the Vienna Correctional Center in Johnson County. The program is designed to provide introductory programming on plant propagation and care, urban crop protection methods, and small farm entrepreneurship. The 11-month program draws upon Extension’s well-proven Master Gardener curriculum. Hands-on experience is provided through dedicated field resources at the correctional facility, and the produce grown has the added benefit of providing fresh produce for the facility’s population. Forty residents enrolled in the program through its first two years.

29 University of Illinois Extension. “Fact Sheet: Disability Services for Farm Families in Illinois.” Accessed online at: <https://web.extension.illinois.edu/agsafety/factsheets/disable.cfm>.

30 Ibid.

Program Area: Agriculture, Food, and Natural Resource Development

Example 18: Training At-Risk Populations to Enter Agriculture

Key Impacts:

- Enhanced workforce and job opportunities
- Local food for correctional facility population

Program Area: Agriculture, Food, and Natural Resource Development

Example 19: Livestock Management Training

In 1996, the Illinois legislature passed the Livestock Management Facilities Act, which mandates livestock producers or managers with 300 or more Animal Units to complete a formal certification process. Re-certification is required every three years. A key goal of the program is to impart management practices that limit the negative impacts of livestock operations in Illinois air and water quality. Illinois Extension delivers the training that enables livestock producers and managers to achieve their certification. In 2018, the workshops provided by Extension resulted in 426 producers and managers achieving their certifications (with those 426 certifications covering an inventory of 750,000 animal units).

Key Impacts:

- Ability of producers to be certified to operate
- Improved environment and reduction of negative externalities

Extension Work in Agricultural Economics, Farm Management, and Public Policy

With so much attention paid to the practice and science of farming, it is easy to forget that every farm is a business and that, in addition to their production needs, farmers have to manage a full range of marketing, sales, finance, tax, insurance, property management, regulation, and personnel management issues. Illinois Extension works on the business and public policy side of farm operations and agriculture through work performed by agricultural economics, business specialists, and community and economic development experts.

Program Area: Agriculture, Food, and Natural Resource Development

Example 20: Integrated Information for Farm Business Management—*farmdoc*

Operating with 20 professionals, the *farmdoc* team at Illinois Extension provides “U.S. Corn Belt crop and livestock producers with constant access to integrated information and expertise to better manage their farm businesses.”³¹ Originated in 1999, *farmdoc* now has more than a 20-year history of providing producers with access to decision support tools; information on agricultural finance, law and taxation, farm management, and agricultural policy; and coverage of other agricultural business subject matter. The team has always used information and communications technology (ICT) platforms to facilitate widespread access to content, and this has meant evolving with the times as ICTs have changes. Today, the ubiquitous use of mobile platforms and associated apps, together with online access to web-based resources, is built in to the way *farmdoc* operates and is accessed; and *farmdoc* sustains a substantial social media presence being accessible through Facebook, Twitter, LinkedIn, Instagram, and YouTube. The *farmdoc* team also keeps producers engaged on a daily basis through *farmdocDAILY* online, making sure to publish “one new article of research-based analysis each business day.”³² “In 2016, the Farm Policy News site was added to the *farmdoc* family of websites in order to provide updates on current developments relating to the farm economy and U.S. farm policy.”³³

Among the many distinctive elements of *farmdoc* is the provision of a large portfolio of online tools and apps available for use by farmers in managing and planning their farm operations and finances. Table 7 lists 44 of these tools, which provide wide-ranging applications for helping producers with farm management, financial and investment analysis, marketing, and risk management.

However, *farmdoc* has become a trusted go-to resource not only for Illinois farmers. It is accessed daily from throughout major production states in the United States and internationally. Perhaps the best indicator of the utility of *farmdoc* is the fact that, in the last year, the three *farmdoc* websites (*farmdoc*, *farmdocDAILY*, and *Farm Policy News*) collectively received over 3 million unique visitors. All active grain farms in Illinois are users of the system.

Key Impacts:

- Enhanced farm financial performance

31 Illinois Extension. “The *farmdoc* Story.” <https://farmdoc.illinois.edu/about>.

32 Ibid.

33 Ibid.

TABLE 7: TOOLS FOR FARMERS ON THE FARMDOC SYSTEM

FARM MANAGEMENT TOOLS	
Farm Projection Tool	This program calculates per-acre budgets for different crops and a whole farm budget and includes break-evens.
Planting Decision Model	With this program, the user can: (1) estimate the costs of planting corn and soybeans by planting date, (2) estimate the net returns from replanting, (3) prevented planting payments, and (4) compare crop rotations.
Grain Farm Budget and Projection Tool	This program calculates per-acre budgets for different crops and a whole farm budget and includes break-evens. Projected financial statements and return sensitivities are available. The effects of farm level crop insurance and hedging can be analyzed.
Biomass Crop Budget Tool—Corn Stover	The corn stover budget tool provides estimates of the breakeven price of that the producer would need to receive to cover the costs associated with the harvesting, collection, and storage of the stover.
Cash Rent with Bonus Worksheet	Contains a worksheet that allows setting of parameters of cash rent with bonus leasing arrangements. The worksheet then calculates cash rents under alternative prices and yields.
Machinery Economics	Analyzes the cost of completing fieldwork and generates machinery costs.
Biomass Crop Budget Tool—Miscanthus and Switchgrass	The miscanthus and switchgrass budget tool provides estimates of the breakeven price of biomass that the producer would need to receive each year to match the returns earned under their current land use.
Specialty Commodity Breakeven Analysis	With this program, the user can enter budgets and calculate breakeven levels for a set of specialty commodities.
Farmland Lease Analysis	Calculates revenues, costs, and returns for share rent, cash rent, and dry bushel farmland leases.
Enterprise Allocation and Analysis	Estimates costs of production across farm enterprises.
FINANCIAL ANALYSIS TOOLS	
Quick Cash Flow Projections	Prepares a quarterly cash flow projection and performs sensitivity analysis.
Cash Flow Planning	Prepares monthly pro-forma cash flows for an operation.
Balance Sheet & Historical Financial Statements	Prepares financial statements for a farm based on beginning and ending balance sheets and revenue and expense items.
Personal Financial Statements	Prepares a family budget that produces a balance sheet and an income statement.
Repayment Capacity Analysis	The user can estimate the cash needs required to meet living, debt and investment payments.
New Company Simulator	With this program, the user can project earnings, financial conditions, and breakeven levels and prices.

Ethanol Plant Simulator	Simulate the performance of a dry mill ethanol plant over a 7-year period.
Net Worth Allocation	Provides an estimate of the separation of earned net worth and valuation of market valuation equity.
Estimation of Deferred Taxes	Estimates deferred taxes for financial statement preparation.
Cash to Accrual Income Approximation	Approximates accrual income from schedule F.
Appraisal of Current Financial Position	Evaluates the potential operating loan needs of a farm business by taking a forward look at the business—income, expenses, and cash flow requirements.
GRAIN MARKETING AND MANAGEMENT TOOLS	
Grain Inventory Management	Inventory accounting system to track grain inventory from harvest to sale.
Corn & Soybean Basis Tool	The user can calculate, monitor, and evaluate the nearby basis, as well as cash and nearby futures prices for corn and soybeans in a given year.
Grain Pricing Tool	Enables the user to: (1) estimate the future distributions of corn and soybean, (2) calculate breakeven prices for storage and compare to projections, and (3) compare net returns of delivering grain to alternative locations and/or months.
INVESTMENT ANALYSIS TOOLS	
Time Value Tools	Computes interest rate factors and solves basic time value of money problems.
Savings Calculator	Calculates how savings accumulates over time and the amount of savings needed to achieve specific targets.
Machinery Financing	Calculates annualized cash flows for different methods of financing machinery acquisitions.
MACRS Calculator	Calculates tax depreciation schedules for depreciable items.
Lease vs. Purchase	Compares lease vs. purchase alternatives and calculates the terms to make the options equivalent in net present value.
Land Purchase Analysis	Calculates maximum bid prices for farmland and sensitivity to terms.
Grain Bin Analysis	Evaluates the feasibility of purchasing a grain bin.
Capital Budgeting	Worksheet to compute net present value, compare price and terms, evaluate internal rate of return and modified internal rate of return for basic capital budgeting/investment analysis programs.
LIVESTOCK MANAGEMENT TOOLS	
Dairy Profitability Model	Calculates breakeven prices for a dairy operation including group feed cost summaries. A net income summary on a per cwt, per cow, and per farm basis after all costs is also generated.

Cost of Feedstuffs Calculator	With this program, the user can calculate the per unit cost of energy and crude protein with the cost of the feed ingredients on an as-fed basis.
Beef Tool	Calculates the cost of feed rations for beef cattle, as well as net income produced per cwt, per cow, and per farm after all costs.
LOAN ANALYSIS	
Revolving Loan Calculator	Calculates principal and interest balances for revolving loans.
Loan Amortization	Simple loan amortization program calculating principal, interest and outstanding balance.
Loan Comparison	Compares terms across different loans and evaluates the benefits of refinancing.
RISK MANAGEMENT TOOLS	
2018 Farm Bill What-If Tool	This program calculates Agricultural Risk Coverage for County Coverage (ARC-CO) and Price Loss Coverage (PLC) payments.
Crop Insurance Decision Tool—2020 Spring (updated each year in spring and fall)	Calculates premiums, evaluates insurance payments, and provides historical data useful when making crop insurance decisions for multiple crops. Estimates are for crops in states that are harvested in 2020.
Farm Rent Evaluator	Compares the risks and returns of different leases.
Marketing and Crop Insurance Risk Model	With this program, the user can estimate the impact alternative risk management strategies have on gross revenue distributions.
YIELD AND LAND DATABASE	
Crop Yield Database	Used to access historic crop yield data for corn, soybeans, and wheat; sortable by state total, county level, and NASS crop reporting district.
Illinois Soil Productivity Index Utilities	Designed to assist with common computations related to the Illinois Soil Productivity measures and associated predicted yields.

Source: <https://farmdoc.illinois.edu/fast>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 21: Illinois Farm Business Farm Management (FBFM)

Another example of Illinois Extension operating intensive hands-on programs in support of farm business management and operations is Illinois FBFM. FBFM is an independent organization, but its work and operations are closely aligned with and supported by Illinois Extension. FBFM has farmer members across the state for whom FBFM provides educational service programs focused on management decision-making. The program is hands-on in terms of having specialists who meet regularly with member farmers (called “cooperators”) throughout the year, with counseling provided on business record keeping and FBFM providing interpretive analytics to help guide efficient management and identify and solve challenges.

Through its work with FBFM, agricultural economists at UIUC have access to an incredibly rich data resource that helps advance research and provide insight that can lead to actionable recommendations for member farmers. The Illinois FBFM website also links its users to resources provided by the university and Illinois Extension.

Key Impacts:

- Improved management and financial performance for Illinois farms

Extension Work with the Value-Added Processing Sector

Illinois is an important hub for the food processing industry, and the industry has a statewide footprint. A 2012 report in the publication *Farm Flavor*³⁴ noted as follows:

Food processing, Illinois’ leading manufacturing activity, contributes more than \$13 billion to the value of raw agricultural products. Illinois is home to more than 2,514 food manufacturing companies. While many of the foods processed in state are sold locally, much of it makes its way to other states and international markets. Illinois is the sixth-leading processed foods exporting state in the country, with annual exports of more than \$2.7 billion.

Illinois Extension, as detailed below, actively supports the food processing industry in the state with specialized training—specifically as it pertains to food safety practices. The university also has pilot plant facilities available for work with outside parties and industry on food process development, process demonstration, and problem-solving.

Value-added opportunities for agriculture in Illinois also extend beyond food, with active university programs focused on advancing renewable bioenergy and biobased products.

34 Kirby Smith. “Illinois Leads the U.S. in Processed Foods Sales.” *Farm Flavor*. July 20, 2012. Accessed online at: <https://www.farmflavor.com/illinois/illinois-agribusiness/illinois-food-processing-industry/>.

Program Area: Agriculture, Food, and Natural Resource Development

Example 22: Development and Testing of Food Production Processes

Illinois Extension Educators in agriculture, food, and natural resource development and in community and economic development are called upon to work across the value-chain, including working with entrepreneurs and existing businesses in food processing. Among the key assets able to assist industry is the university's newly renovated Food Science and Human Nutrition Pilot Processing Plant. This is a modern facility equipped to serve a three-part mission in terms of being a resource for (1) educating students on equipment they are likely to encounter in industry, (2) helping university researchers, and (3) serving needs for the food industry in Illinois and beyond. The facility includes a product development kitchen, space for new product and process development, and the ability to perform small-scale food production.

Key Impacts:

- Access to specialized resources and expertise for food product and process development

Program Area: Agriculture, Food, and Natural Resource Development

Example 23: Advancing the Bioenergy and Biobased Products Sectors

The output of farming does not only move into the food supply chain. Recent years have seen growth in the application of biomass produced on farms to industrial uses in the production of liquid fuels (e.g., ethanol and biodiesel), biobased chemicals and materials, and use of biomass directly for the production of energy (via direct combustion or gasification).

Illinois Extension is able to advise the agricultural sector regarding production of biomass for nonfood applications and consult on business opportunities and practices within the sector (indeed, one of the *farmdoc* tools listed on Table 7 is an Ethanol Plant Simulator). Extension is also able to direct its stakeholders to several unique UIUC assets able to advance product development and work on production processes and associated issues. The university's Integrated Bioprocessing Research Laboratory (IBRL) is one such facility that contains advanced laboratory and pilot-scale equipment able to help users bridge the gap from basic discovery to commercialization of bioproducts. IBRL notes as follows:

The facility serves as an invaluable asset to bioenergy and bioprocessing companies by partnering them with the human and equipment capabilities of the university. Faculty and researchers affiliated with the IBRL have the expertise needed to improve efficiencies, reduce water usage, and increase biofuel production in the corn ethanol industry. IBRL provides a lab and pilot plant for innovative research to market application and commercial products for industry partners. Researchers are also developing and improving technologies for next-generation biofuels and value-added products derived from biomass.³⁵

Another signature asset is the university's "Energy Farm," which is a 320-acre operational farm and demonstration site for biomass crop development, field trials, and the testing of equipment. It serves both the university research community and external collaborators. In addition to its field plots, the farm is equipped with growth chambers, greenhouse facilities, biomass processing equipment, and laboratories to facilitate research. Energy Farm is located at the Urbana campus' South Farms.

Key Impacts:

- Access to specialized resources and expertise development and processing of biomass and bioenergy crops
- Access to specialized resources and expertise for biofuel and biobased product and process development

35 <https://ibrl.aces.illinois.edu/>

The Economic Impact of Agriculture Output in Illinois

As highlighted in just the examples above, Illinois Extension is engaged in very broad activities that are focused on improving agricultural yields, enhancing agricultural product quality, ensuring ongoing sustainability in agricultural production, working with producers on their farm business operations, and guiding the development of value-added processes. Because of the expertise contained within Illinois Extension, individuals working in agriculture and related industries in Illinois have access to the latest evidence-based information and innovations in agricultural research, education, and training. The work of Illinois Extension Educators and Specialists in agriculture is focused directly on improving the economic performance and sustainability of agriculture and associated industries throughout the entire state.

As noted earlier, this report does not attempt a complete inventory or accounting of each and every Illinois Extension activity. There are literally hundreds of ongoing programs and tens of thousands of individual interactions occurring through Extension each year, and Extension's information resources (including, but not limited to, the Extension website) are accessed constantly. The examples covered above show a range of programmatic impacts being generated by Extension in agriculture, and they are clearly wide ranging and significant. To give at least some potential scale to this impact in agriculture, TEconomy analyzed the effect that every 1 percent of total agricultural production in Illinois has on the overall economy in the state. Given the extensive range of programs provided by Illinois Extension to the agriculture sector in the state, it is highly likely that Extension's programs serve to support and sustain more than 1 percent of agricultural output on an annual basis—however, the use of a conservative 1 percent estimate shows how even just 1 percent of a major industry sector supports extremely large-scale impacts for the state.³⁶ The impacts generated through the 1 percent model are detailed below.

³⁶ It should be noted that measuring impacts of Illinois Extension on agriculture cannot solely be examined by referring to output. While Extension plays an important role in helping to grow agricultural output in the state (by providing best practice information to producers, data on best performing crop varieties, etc.), Extension is also working hard to prevent negative events (e.g., plant diseases, animal health challenges, nutrient loss, etc.). It is obviously very hard to measure the effect of something that did not happen (due to prevention work).

The Economic Impact of Agricultural Output in Illinois

Use of the IMPLAN I-O model for Illinois enables TEconomy to quantify the total effect on the state's economic output, employment, and other variables of agricultural output (dollar value). The analysis performed by TEconomy details the impact of each 1 percent of output for the agricultural sector overall, and subsectors comprising the livestock, crop, and forestry production. In terms of total agricultural production, 1 percent of agricultural production generates the following impacts:

- \$323.5 million in total Illinois economic output, comprising direct, indirect, and induced impact components
- \$134.6 million in value-added within the Illinois economy
- 1,605 jobs supported
- \$70.4 million annually in labor income for Illinois residents.

Examining the crop production industry subsector, 1 percent of output in Illinois generates the following:

- \$277.1 million increase in economic output
- \$110.9 million in value-added within the state economy
- 1,230 jobs
- \$59.5 million in labor income.

For livestock and poultry production, 1 percent of output generates the following:

- \$45.7 million in state economic output
- \$23.4 million in value-added
- 361 jobs
- \$10.7 million in labor income.

For forestry production, 1 percent of direct output generates the following:

- \$0.68 million in Illinois economic output
- \$0.31 million in value-added
- 13 jobs
- \$0.20 million in labor income.

It also should be noted that the agricultural sector benefits every county in the state. Agriculture and associated processing industries are distributed across all 102 Illinois counties; and, therefore, the direct and indirect effects of the sector are felt much more widely than would be the case with narrower, more geographically focused sectors.

Functional Impacts Generated from Environmental Stewardship

DESCRIPTION

The landscape of Illinois has been actively shaped by human activity. Agriculture occupies the largest land area, changing the natural ecology, working the land with equipment, and introducing agricultural chemicals into the landscape to sustain yields. Roads and urban development make a checkerboard of the landscape, with their hard surfaces and drainage systems restructuring natural water flows and human activities consuming natural resources. Human use and reshaping of the landscape generate profound impacts on ecosystems and biodiversity, on natural resource availability, landscape aesthetics, water quality, water flows, and shorelines. Global movement of goods and people has resulted in the redistribution of natural organisms and introduced invasive species that can dramatically impact native species.

Individually, the harm that humans cause to the environment is limited. But collectively, with 7.8 billion people worldwide supported by extensive industrial supply chains and with wealth and consumption increasing, people generate an enormous impact. There is now little doubt that the release of fossil carbon into the atmosphere is reshaping the global climate, while on land and in seas and lakes, microplastics are ubiquitous.

As a species, there is no doubt that humans accomplish great things. But when these activities are unchecked and unrestrained, the impact on the environment and the global biosphere becomes a global grand challenge that must be addressed.

Stewardship of the environment is required at a local level. People can be concerned, and engaged, in global issues; but it is at home, at work, in their communities and home states where daily impacts and improvements can be achieved. With a population of approximately 12.7 million people; major population centers; and extensive industrial, agricultural, and other commercial activity, the landscape, ecology, and natural resources of Illinois are under pressure daily.

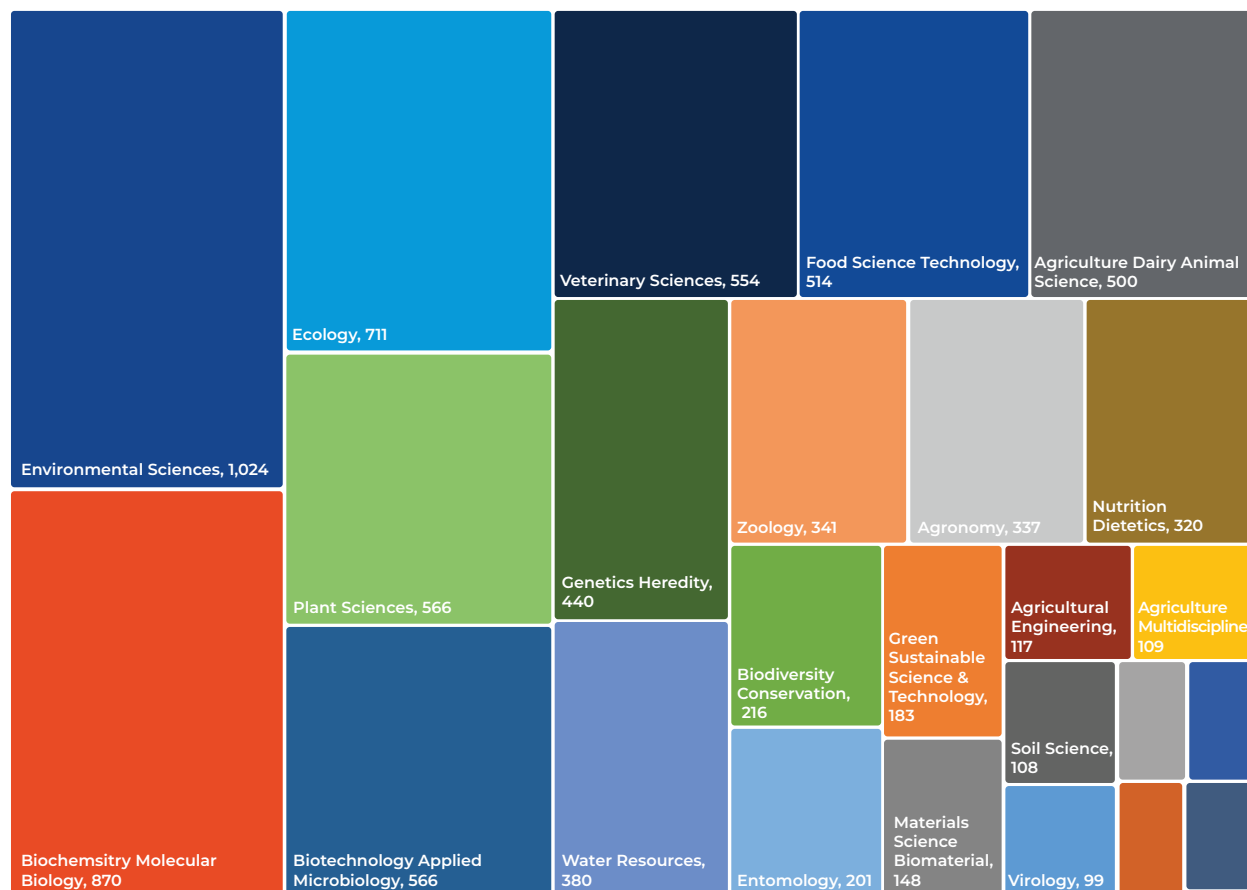
THE NEED

Long-term, the one permanent asset that Illinois has is the land it occupies. Covering 57,915 square miles, Illinois' land is home to present-day Illinoisans but also held in trust for generations to come. To better protect and sustain this invaluable asset, work is required to understand the ways in which human activities impact the environment, and to find better ways to accomplish those activities with more limited impacts and to mitigate the negative impacts that have already occurred. Understanding and paying attention to environmental impacts and natural resource sustainability increases the ability to stop land degradation, depletion of resources, loss of ecosystem services, and generation of pollutants that impact health and quality of life.

UIUC is a key hub for research and education in environmental science and natural resource management. Figure 11, which is based on the data previously shown in Table 6, shows the “landscape” of research publications generated by the UICU between 2015 and 2019 in agricultural science and environment and natural resource subjects. Evident in this landscape is research expertise directed toward intensive work in environmental sciences,

ecology, water resources, biodiversity conservation, and green sustainable science and technology. Taken together, these five areas of research at UIUC generated 2,514 publications (29.4 percent of all publications listed in Figure 11).

FIGURE 11: PEER-REVIEWED PUBLICATIONS BY UIUC AUTHORS IN AGRICULTURAL SCIENCE AND ENVIRONMENT AND NATURAL RESOURCE SUBJECTS (2015–2019)



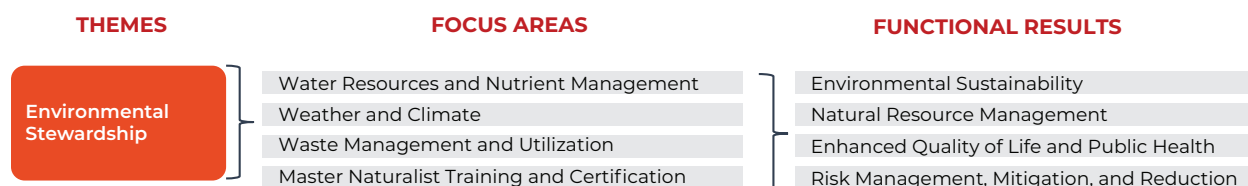
Source: TEconomy Partners, LLC.

Illinois Extension is able to carry forward the knowledge, best practice innovations, and recommendations emanating from research in environmental science and natural resource stewardship to individuals and organizations across Illinois who can put this information to work to protect and sustain the environment and natural resources. It should also be noted that Extension professionals, working in communities across the state, observe or have presented to them challenges occurring relating to the environment and natural resources that need solutions. Extension relays these needs to the university research community to address through applied research programs. Extension effectively works as the key interface between the knowledge contained and produced within the academic research community and public and private landowners, resource managers, and private citizens who need fact-based information and knowledge to sustain resources and be good environmental stewards.

HOW ILLINOIS EXTENSION GENERATES IMPACT WITHIN THE ENVIRONMENTAL STEWARDSHIP THEMATIC AREA

In support of environmental stewardship, Illinois Extension works across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Illinois and its citizens (Figure 12).

FIGURE 12: ILLINOIS EXTENSION FUNCTIONAL IMPACT THEMES IN ENVIRONMENTAL STEWARDSHIP



Source: TEconomy Partners, LLC.

FUNCTIONAL IMPACT EXAMPLES FOR ILLINOIS EXTENSION IN ENVIRONMENTAL STEWARDSHIP

In the case of Illinois Extension’s work in environmental stewardship, some examples below are illustrative of the high impact work taking place.

Program Area: Environmental Stewardship
Example 1: Master Naturalist Program
The Master Gardener program has established an excellent track record in Illinois for leveraging the power of volunteers, combined with the knowledge of the university, to provide robust statewide subject matter expertise and responsiveness to needs. This same model has been adapted to form the Illinois Master Naturalist program, which educates and trains adult volunteers to provide evidence-based natural resource information and best practices to the public and other land stewards to assist with conservation restoration activities in their community and across the assets they manage. As noted by Extension, Master Naturalists are available to provide a range of important services across the state:³⁷ • Assisting in the management of local natural areas • Completing natural resource–related office work with special interest groups or not-for-profit agencies • Teaching adults or children about natural areas • Giving demonstrations and presentations to local groups • Serving as a liaison between natural resource agencies and the public • Serving as a resource person to groups in need of natural resource assistance. For 2018, the 887 active Illinois Master Naturalists donated over 83,000 hours of education and service time. As noted previously in the discussion of Master Gardeners, Independent Sector places the economic value of a volunteer hour in Illinois at \$26.89 for 2018.³⁸ Applying this hourly value to the 83,000 hours of volunteered Illinois Master Naturalist time in 2018 results in a total provided value of \$2,231,870.

³⁷ <https://web.extension.illinois.edu/mn/who.cfm>.

³⁸ Independent Sector. “Value of Volunteer Time: 2018.” <https://independentsector.org/value-of-volunteer-time-2018/>.

Program Area: Environmental Stewardship

Example 1: Master Naturalist Program

Key Impacts:

- Enhanced Illinois environmental stewardship and natural resource conservation
- Improved communities and quality of life

Program Area: Environmental Stewardship

Example 2: Energy Strategies for Illinois

The production and consumption of energy, particularly fossil-based energy, stand among the most significant contributors to pollution in general and to carbon dioxide and other emissions into the atmosphere. While energy use is fundamental to the functioning of the economy and society, there are options available for generating energy sustainably, reducing energy-related atmospheric emissions, and reducing energy consumption through use efficiencies.

In the latter case of energy efficiency, Illinois Extension has been working to produce and disseminate consumer education materials focused on the electric Smart Grid. As smart meters have been introduced in Illinois, education has been required to inform consumers of their options for using this equipment to monitor and reduce their energy consumption. A particular focus of the work has been delivery of educational programming and informational materials and workshops to hard-to-reach populations, consisting of rural residents, senior citizens, and low-income audiences. Because of the wide geographic coverage of Extension and its existing work in communities with in-need populations, Illinois Extension has been ideally placed to deliver. In addition, Extension's deep experience in the development and delivery of programs for youth has also been engaged, working to enhance knowledge of efficient electricity use with the next generation of utility users.

Key Impacts:

- Enhancing knowledge of the Smart Grid and associated energy efficiencies
- Reduced energy consumption and environmental footprint of electric energy generation

Program Area: Environmental Stewardship

Example 3: Water Quality

People depend on water to live; but, there is no escaping the fact that human activities have put considerable strain on water resources, caused the entry of significant pollutants into water resources that impact water quality, and facilitated the introduction of invasive species into waterways and lakes.

The Illinois-Indiana Sea Grant is an affiliated Extension program that is working to improve water quality and protect water resources through multiple programs. Initiatives have focused on a diversity of issues such as water supply planning, reduction of nutrient losses from fields and landscapes, prevention of agricultural chemicals entering water resources, strategies for addressing invasive species, stormwater control, and general literacy pertaining to water and issues in the Great Lakes region.

An emerging area of concern has been the introduction of pharmaceutical molecules into water. Careless disposal of unwanted or expired medicines can lead to their ingredients and compounds entering water supplies. Medicines that are flushed down drains enter municipal wastewater treatment systems or septic systems, but these treatment systems have a limited ability to remove medical compounds. Some medicines, e.g., hormones and antidepressants, can contain endocrine-disrupting compounds that, once they enter the environment, may negatively impact the reproductive cycle and growth of fish and other aquatic and amphibious species. Extension has been helping communities establish medicine collection programs to help address the issue. With financial and technical support from the Illinois-Indiana Sea Grant, Extension has access to informational toolkits and resources that are helping communities understand the issue and implement mitigation strategies. Since 2008, this work in Illinois has led to programs collecting over 200,000 pounds (100 tons) of medicine that have then been appropriately disposed. With aging populations, increasing healthcare access, and introduction of new pharmaceuticals, the challenge is ongoing. Extension reports that, in 2018, the programs it has worked with collected 22,370 pounds (11.2 tons) of unwanted medicines, and 52 permanent collection programs have been established.

Some of the other programs through the Illinois-Indiana Sea Grant are equally impactful. Examples include the following:

- The Great Lakes Literacy Project is a train-the-trainer initiative whereby Extension Educators work with schoolteachers to provide resources and knowledge that help them communicate the value of water quality and the preservation of the Great Lakes and their watersheds. Data from the program show 117 Illinois teachers have received training so far, and they have introduced Great lakes literacy subject matter to more than 15,000 students.
- Extension has been working with the Chicago Metropolitan Agency for Planning (CMAP) to produce water resources strategy recommendations for the Chicago region. As a result, the region's ON TO 2050 regional comprehensive plan has integrated evidence-based strategies for water, wastewater, and stormwater management. More than 8 million Illinois residents live within the area impacted by the plan.
- Microplastics represent an area of pollution that is causing rising levels of concern, and there is much research still required to understand the impact of plastic particles on water resources and aquatic ecosystems. The U.S. Geological Survey reports that "microplastics are prevalent in many rivers that flow into the Great Lakes ... are harmful to animal and possibly human health [and] will continue to accumulate in the Great Lakes well into the future."³⁹ The Illinois-Indiana Sea Grant has funded research that is working to assess microplastics pollution in Lake Michigan and other Illinois bodies of water. Extension is starting the process of raising awareness of this growing issue and potential strategies for reducing plastic pollution.

Key Impacts:

- Strategies and actions that are preventing water pollution and raising awareness of the issue

39 United States Geological Survey. 2016. "Widespread Plastic Pollution Found in Great Lakes Tributaries." Accessed online at: <https://www.usgs.gov/news/widespread-plastic-pollution-found-great-lakes-tributaries>.

Program Area: Environmental Stewardship

Example 4: Protecting Illinois from Invasive Species

Invasive species (e.g., invasive plants, insects, and animals) can cause substantial ecological, economic, and social impacts across terrestrial and aquatic domains. Invasive species bring wide-ranging challenges, e.g., threatening agricultural and forest production, impacting urban greenery and property values, clogging water intakes and damaging public utilities, and reducing stocks of native species. A widely cited 2005 study estimated that the economic damages associated with invasive species in the United States approximated \$120 billion⁴⁰ (equivalent to \$158 billion in 2020 dollars).

Illinois Extension is engaged on multiple fronts in work to address invasive species issues and challenges. The first level of activities performed are in knowledge enhancement, education, and awareness building—working to inform the public and key stakeholders through the annual Illinois Invasive Species Symposium and the Illinois Indigenous Plant Symposium annually and via creation of outreach materials and programs addressing critical and emerging invasive species issues. A second core set of activities revolves around surveillance and diagnostics—with Extension professionals and its volunteer Master Naturalists and Master Gardeners in the field making observations and responding to issues brought to them by the public. Backing up this front line are Extension Specialists and the faculty at UIUC with expertise in plant sciences, plant pathology, entomology, zoology, microbiology, and other areas of domain expertise able to identify invasive organisms, determine the threat they pose, and design strategies for mitigating threats.

Key Impacts:

- Safeguarding biodiversity, reducing losses from forestry and agriculture, and improving ecosystem health

Program Area: Environmental Stewardship

Example 5: Developing Sustainable Residential Landscapes

There are approximately 5.4 million housing units in Illinois, with approximately two-thirds of these owner occupied. While not all have yards, the majority do, and how these yards are planted and managed can have a significant impact on the environment and ecosystems. Yards can be designed to capture water and avoid runoff, native plants can be chosen that benefit the natural ecology of the state, plantings with potential to become invasive can be avoided, and plants can be selected to be attractive to and supportive of important pollinator species.

Illinois Extension provides education and advice relating to home gardens through informational materials, Extension Educators, and Master Gardener volunteers. A particularly intensive program has been developed for highly populated Cook County called Conservation@Home, which specifically trains home gardeners in the following:

- Sustainable landscape design
- Methods for reducing reliance on fertilizers, pesticides, and irrigation/watering
- Techniques for avoiding soil erosion and runoff
- Selection and use of Illinois native plants
- Methods for removal of invasive species and avoiding their introduction
- Creation of wildlife habitat.

Through the Conservation@Home program, participants can achieve certification and receive a certification sign for their yard. To date, more than 70 Cook County residents have been certified.

Key Impacts:

- Strategies and actions for improving residential garden sustainability and ecosystem benefits

40 D. Pimentel, R. Zuniga, and D. Morrison. 2005. "Update on the environmental and economic costs associated with alien-invasive species in the United States." *Ecological Economics*. February 15, 2005; 52(3): 273–288.

Functional Impacts Generated from Community and Economic Development

DESCRIPTION

Achieving effective government in Illinois, and efficiently and professionally managing the state's 102 counties, 1,299 incorporated municipalities, and thousands of other public and quasi-public entities (schools, public agencies, authorities, special districts, etc.) is very much in the community and economic interest of Illinois and all Illinoisans. The U.S. system of government and public administration encourages local self-determination, and the ethos that "local people know what's best for local people" has shaped the way community and economic development is undertaken across the nation and in Illinois. Illinois Extension very much fits within this structure, operating statewide, with county support and local extension presence. As such, Illinois Extension can operate as both a trusted "community member" and also as an independent provider of research and information from the flagship university of the state. Through Extension, everyone has a portal to the university for addressing topics and needs, and an approachable local presence to facilitate this access.

THE NEED

Across Illinois, all counties and municipalities have interest in community development. Sustaining a high quality of life and livability in communities is part of this interest, as is ensuring fair, well-managed, and efficient public administration and delivery of services. Economic development is similarly a high priority. Whether in big cities, small towns, or rural areas, households need to earn a living and a healthy economy is needed to support the tax base that supports education and community services.

HOW ILLINOIS EXTENSION GENERATES IMPACT WITHIN THE COMMUNITY AND ECONOMIC DEVELOPMENT THEMATIC AREA

Illinois Extension has a long-standing history of working to advance community and economic development in Illinois. It advances community and economic development interests along multiple pathways and through multifaceted programs, with key themes evident in the following:

- Education for local government and community leaders
- Facilitation of inclusive and participatory community plans
- Technical assistance for economic development and workforce development
- Programs to encourage small businesses development, entrepreneurship, and business growth
- Disaster planning.

In support of community and economic development, Illinois Extension's work engenders a variety of positive functional benefits (results) for Illinois and its citizens (Figure 13). Overall, Illinois Extension offered more than 400 educational program sessions in fiscal year 2019, reaching more than 16,000 community leaders and residents.

FIGURE 13: ILLINOIS EXTENSION FUNCTIONAL IMPACT THEMES IN COMMUNITY AND ECONOMIC DEVELOPMENT



Source: TEconomy Partners, LLC.

FUNCTIONAL IMPACT EXAMPLES FOR ILLINOIS EXTENSION IN COMMUNITY AND ECONOMIC DEVELOPMENT

In the case of Illinois Extension’s work in community and economic development, examples below serve to show the breadth of programs and the high impact work that is taking place.

Program Area: Community and Economic Development
Example 1: Local Government Education
Elected officials will often enter their positions of administration and authority with little or no prior experience with government work. Facing new duties, operating in the public eye, and being responsive to governing laws and regulations can be daunting. Officials may face challenges and emerging issues that they have not encountered before and have to make important decisions that will affect their communities, institutions, and members of the public, often quite significantly. Illinois Extension provides a series of programs designed to help local government officials navigate challenges and effectively serve their constituents. Two of the main programs delivered by Extension in this area include the following: • The University of Illinois/United Counties Council of Illinois (UCCI) Leadership Academy. This program in leadership skills development for county officials was developed by Illinois Extension in collaboration with UCCI. The academy has a formal curriculum that teaches participants practical skills and methods for addressing challenges, issues, and opportunities in their jurisdiction. It uses five interactive sessions, facilitated by Extension, that provides at least 25 county officials each year the opportunity to share and learn from their peers and build support and advisory networks.

Program Area: Community and Economic Development

Example 1: Local Government Education

- The Local Government Education (LGE) Webinar Series is a regular series of trainings that provide coverage of multiple topics of concern to county and municipal officials. These “E-Institutes” are provided in several formats (video recordings, audio recordings, recorded presentations, and webinars) to facilitate access, depending on the topic. Illinois Extension offered 13 webinars in the series in 2019, reaching more than 1,200 participants. Some examples of E-Institute content can serve to show the diversity of topics covered:
 - Ready to Diversify: Lessons Learned from Coal Communities Across the Country
 - Raising the Minimum Wage in Illinois
 - Counting for Dollars: Census 2020
 - Economic Development Implications for Rural Youth Population Decline for our Region
 - Developing a Creative Economy
 - State Legislative Update
 - Opportunity Zones
 - Tax Increment Financing in Illinois
 - Rural Community Water: Understanding Public and Private Sources
 - The Opioid Crisis: Community Strategies for Treatment and Recovery
 - Illinois Broadband: Federal Policy Framework
 - Illinois Local Government: How do you make essential services more effective and efficient?
 - In total, 75 e-Institute modules are listed on the Local Government Education Illinois Extension website.

Key Impacts:

- Improved government decision-making and responsiveness to constituent needs
- More efficient and effective government and public administration

Program Area: Community and Economic Development

Example 2: Participatory Community Planning

An individual leader may think they alone know more than all the assembled parties in a situation room, but it is rather doubtful. One person using their “gut” or intuition, or even past relevant experience, to develop a plan is unlikely to produce the type of effective results that can be developed by an assembled group of experts who can bring a diversity of knowledge and perspectives. Good plans result from considering different options and angles, understanding the needs of different affected constituencies, and balancing goals with the reality of available resources and available time. Participatory planning recognizes the power of multiple minds and experiences brought together to tackle an issue. In addition to gaining multiple perspectives, participatory planning has other benefits:

- Resulting plans evolve through consensus and are more likely to sustain community support.
- When people participate in a planning process, they have a higher propensity to be committed to the plan and its implementation.
- Engaging those who will implement a plan in the planning process helps them to better understand the plan and the “why” of its contents.

Illinois Extension is a proactive facilitator of participatory planning processes in Illinois for community planning. Working as a trusted, third-party facilitator, Extension professionals are able to do the following:

- Identify and convene key stakeholders
- Provide background data and demographics and assist with primary data collection
- Professionally facilitate planning meetings
- Capture and synthesize discussions to inform preparation of plan documents.

Extension’s expertise in providing these services has been called upon in a variety of planning projects, with examples including hazard mitigation plans, economic development plans, and organizational strategic plans. In 2019, Illinois Extension provided 55 structured participatory planning sessions with 234 participants to strategically address locally defined community development needs.

Example Program—“Mercer County: Better Together”

Additional perspective can be provided by examining a specific example of how Extension leadership in participatory planning has come together to benefit one particular county. In Mercer County, Extension became engaged in a community planning process in 2015 and has stayed engaged with ongoing supporting services. The overall program, called “Mercer County: Better Together,” has been working to improve organizational development in the county and civic engagement. To date, 11 community forums have been organized with participation by 800 county residents. Community volunteers helped facilitate meetings, raise funds, promote the process, analyze data, and collect stories from residents about their history in Mercer County. They also connected with residents through online surveys, a Facebook page, and a new website. Extension notes as follows:

Through these efforts, Mercer County residents shared their perspectives on potential projects, strategies and goals that Mercer County: Better Together (MCBT) could pursue.⁴¹

To help formalize plan implementation and facilitate access to funding resources, Illinois Extension helped design and establish a 501c(3) structure for MCBT, develop the organization’s bylaws, and structure an effective board of directors. Extension also assisted with planning organizational finances to ensure its sustainability. As a result of the program and its formal organizational structuring, the MCBT project has leveraged \$1,169,000 in additional funding for the planning process and for supporting county projects that are in the plan. Projects underway include technology upgrades for two school districts, parks and recreation improvements, and a grant to the health department to provide mental health programming.

41 <https://www.canr.msu.edu/ncrcrd/uploads/NC%202017%20Impact%20Report.pdf>.

Program Area: Community and Economic Development

Example 2: Participatory Community Planning

Key Impacts:

- Community plans with community buy-in and a diversity of perspectives
- Plans with a high likelihood of achieving implementation
- Plans supported by evidence and data, supported through Extension resources
- Leveraged funding secured through having a formal plan

Program Area: Community and Economic Development

Example 3: Technical Assistance for Economic Development

In addition to helping to facilitate community planning processes, Extension also provides technical support and research services that support economic development planning. Modern economic development is far more than simply trying to recruit companies to move into a community. Economic development as a practice now makes use of sophisticated data analysis, understanding of innovation-drivers, competitive analysis, and consideration of the importance of placemaking in the development process. Practitioners have to assess the presence and status of an economic development ecosystem and key elements of capital availability (early stage and growth capital), talent access and workforce development, entrepreneurship, business incubation and acceleration, R&D capacities and core competencies, and many other factors. Large counties and cities may have the resources to recruit and retain talented economic development professionals and business cluster experts, but typically such expertise is hard to secure in smaller communities and for rural economies. While expert consultants may be brought in, good ones with a successful track record in strategy development and program implementation are scarce and expensive.

Illinois Extension is able to fulfill the need for technical assistance for Illinois communities in economic development in a variety of ways. Having the resources of the university, Extension has access to researchers and professional staff with experience in economic data analytics. Extension is able to compile, analyze, and synthesize data that let communities understand their economy, their business base, development trends, commuting patterns, demographics, innovation drivers, and other important factors. For specific envisioned projects, such as downtown development or industrial site development, Extension can provide technical assistance with the market analysis necessary to determine project feasibility. Extension survey research experts are also available to support economic development planning, providing access to the Extension Community Survey Tool. In 2019, Extension Educators and Specialists responded to nearly 300 requests for individualized technical assistance.

Key Impacts:

Development of effective and technically sophisticated economic development plans for Illinois communities

Program Area: Community and Economic Development

Example 4: Workforce Development

UIUC makes broad and deep contributions to workforce development in Illinois through its for-credit higher education programs providing undergraduate and graduate certificates, undergraduate degrees, and graduate and professional degrees. For-credit education is a strong contributor to providing highly educated personnel equipped with the lifelong learning skills needed to thrive in the evolving workplace. Illinois Extension, on the other hand, fulfills another important need for noncredit education and skills training across the state. Most jobs are evolving to some degree as automation, the Internet of Things, artificial intelligence, online marketplaces, global competition, etc., reshape commerce. Change is a given for the future; and Illinoisans need access to specialized education, skills development, and skills upgrading and retraining options. Illinois Extension is part of the solution to this workforce education challenge.

Extension has a varied portfolio of programs it is operating in this space. One set of program examples revolves around helping to evaluate strengths, aptitude in the workplace, and ensure that workers understand and accept differences. Examples include the following:

- **Real Colors**—This is a personality inventory process that helps to increase understanding of employees' working styles and strengths.
- **Age Matters**—This program is designed to increase awareness and sensitivity around generational differences in working styles.
- **iDREAM**—This program helps students use dreaming and goal-setting to navigate career and life goals.

Programs can also address development of particular workforce skills. A key example of Illinois Extension's work in this regard is its Customer Service Training program. This program focuses on improving the competitiveness of Illinois businesses through enhancing their skills in customer-facing services. Titled "On the Front Line: Skills for Excellent Customer Service in your Community," the Extension training program has been widely deployed to benefit economic development in multiple Illinois communities. It is a particularly thorough program using a series of 10 learning sessions that cover the following:

1. Customer Service for Common Good
2. Definition of Customer Service
3. Understanding Customers (diversity, culture)
4. Demonstrating Good Customer Service
5. In-person communication (verbal/nonverbal)
6. Telephone Technique
7. Delivering Customer Service Online
8. Unhappy Customers
9. Keeping Customers Happy
10. Looking back and looking ahead.

A key benefit for communities and businesses participating is development of an in-depth understanding of how excellence in customer service and customer interactions can lead to enhanced customer loyalty in communities and more sustainability for local businesses in the face of growing online competition. For small communities, the interactions between customers and small businesses are also part of the social fabric of the community; and the impact goes beyond the financial bottom line to help set the tone for how community members, neighbors, and visitors feel about the community. At a time when small towns and rural communities are seeking to retain their populations and attract back those who have left, this community customer service approach is a novel pathway to a partial solution. Illinois Extension Educators in community and economic development offered more than 150 workforce development training sessions in 2019, reaching nearly 10,000 participants.

Key Impacts:

- Improved workforce readiness and job preparation
- Enhanced community and economic development through improved customer service

Program Area: Community and Economic Development

Example 5: “Buy Local” Programming and Small Business Development

Illinois Extension's small business development programming does not duplicate the programs offered by the Small Business Administration. Rather, it is focused on enhancing the environment in communities under which multiple small businesses can thrive collectively. This can take the form of working to secure an enhanced operating environment (such as improved broadband access), training local business leaders in the use of current and emerging social media platforms to promote their businesses and raise awareness, programs to encourage youth to consider entrepreneurship or small business careers, and raising awareness of issues in succession planning for small and family-owned businesses that are important to communities.

A prime example of Illinois Extension work in collective small business development is its “Buy Local” program. The concept of the multiplier effect shows how retention and recirculation (responding) of money in a community (as opposed to the leakage of money to purchases made outside of the community) creates increased demand and sparks economic development. The “Buy Local” program does just what its name suggests, it promotes the positive impact of spending dollars locally to help combat and address economic challenges. “Buy Local” programming helps community members and businesses understand the importance of spending dollars locally by teaching people about the economic multiplier effect and tax revenue implications of their purchasing behavior. It also encourages communities to establish “Buy Local” marketing campaigns.

Key Impacts:

- Retained income in communities through local purchasing and prevention of monetary leakages.
- Economic expansion via the multiplier effect or the responding of retained income

Program Area: Community and Economic Development

Example 6: Disaster Planning

Unfortunately, disasters (whether natural or human caused) do occur. A natural disaster is a major adverse event resulting from natural Earth system processes—with examples that may affect Illinois including tornadoes, major winter storms and ice events, floods, heat waves and drought, and earthquakes (near the New Madrid zone). Biological events may also be sources of substantial threats—with infestations or disease epidemics possible via domestic or exotic insect pests and pathogens. In addition to natural disasters, accidental human-caused disasters may occur (e.g., a train derails carrying toxic chemicals, a large pipeline leaks, or an industrial plant explodes). There is also the unfortunate modern reality that preparation is needed in case of deliberate acts of terror or sabotage. Recognizing the reality of these threats, society must prepare (particularly public entities) and develop strategies and action plans that mitigate damages, evacuate people from harm's way, and speed recovery in the event that disasters do occur.

Illinois Extension teams are helping communities and businesses prepare for all phases of a disaster event including mitigation, response, and recovery. One of the key activities Extension helps with is development of Multi-Jurisdictional Hazard Mitigation Plans. Here Extension assists the community with applications for the planning grant, facilitates the planning process, and works with the community in producing the final plan and plan updates. Multi-Jurisdictional Hazard Mitigation Plans are usually designed for a single county with all or most municipalities within the county participating and officially adopting the plan. Hazard mitigation plans once developed are submitted to the Federal Emergency Management Agency (FEMA) for official approval. Once approved, communities have the benefit of being eligible for financial assistance during a disaster declaration that is higher than would be provided without an approved plan. Illinois Extension Educators convened disaster planning and educational sessions in 2019 across the state, enabling nearly 200 local officials to improve access to federal disaster funds for response and recovery.

Program Area: Community and Economic Development

Key Impacts:

- FEMA-approved disaster plans for Illinois counties and communities
- Access to additional federal disaster funds for response and recovery

Program Area: Community and Economic Development

Example 7: Poverty Simulation

Empathy and understanding of the daily life situations of others is a desirable characteristic for public officials and others whose work and decisions impact the public. One of the extreme challenges facing many Illinoisans is poverty, with 1,509,247 Illinois residents falling below the poverty line in 2019. Statistics for 2019 show a 12.1 percent poverty incidence rate overall in Illinois, and 15.9 percent for children.⁴²

Illinois Extension is proactively working to raise the level of understanding of the challenges people face trying to live with poverty-level income. Extension's "Poverty Simulation" program uses group role-play in which participants get to simulate the experience that those with limited resources face in securing food, shelter, and daily necessities. The program effectively sensitizes decision makers and employees in organizations (such as government agencies, schools, nonprofits, etc.) that interface or work with Illinoisans who may be living in poverty. Accommodating up to 88 participants, the Extension program simulates a month in poverty through four 15-minute "weeks." The participants interact with simulated community institutions and resource providers with the goal of meeting two objectives—providing the necessities for their family and maintaining shelter. The program is able to simulate interaction across a range of organizations including community healthcare providers, action agencies, interfaith services, daycare, banks, utility companies, department of social services, police, schools, employers, and quick-cash lenders.

The program is seeing significant participation rates, with 50 or more training sessions having been held. More than 2,000 participants have been through the program. Results have been heartening, with participants not only gaining understanding of poverty challenges, but also brainstorming ways to help. A group of school-teachers, for example, recognized a need for clean clothing for some of their students and installed a washing machine and clothing closet at their school. A regional healthcare organization developed a strategy to assist with transportation to healthcare centers. To help expand the reach of the program, a video training module has been developed and a professional development tool for teachers.

Key Impacts:

- Better understanding of people with low income and improved services for clients with low income
- Pathways to lessen bureaucratic obstacles for clients
- Increased awareness about institutional obstacles for people with low income
- Stimulation of innovations and approaches to making life better for persons facing poverty

⁴² <https://talkpoverty.org/state-year-report/illinois-2019-report/>.

Functional Impacts Generated from Health, Nutrition, and Family Development

DESCRIPTION

One of the core elements of Cooperative Extension Services envisioned in the original Smith-Lever Act was the “development of practical applications of research knowledge and giving of instruction and practical demonstrations of existing or improved practices or technologies in ... home economics ... and subjects relating thereto.”⁴³ Extension was conceived not only as a technological and educational institution for agricultural practitioners, but also a provider of resources that would strengthen American family life and communities. Today, that original vision of Extension as a supporter of families is very much alive.

At Illinois Extension, specialists within Family and Consumer Sciences have developed and are delivering a wide range of programs aimed at supporting and improving life across the full range of Illinois’ rural and urban communities. In addition, recognizing some of the unique challenges represented within dense urban settings, Illinois Extension Cook County, through a partnership with the University of Illinois Chicago, has developed and is delivering unique Community Health programming, targeting their efforts and outreach to underserved and underrepresented populations. Programs that support the family unit and the environments in which they reside are used to help Illinoisans address a range of issues, including building stronger families, managing family budgets and financial resources, and addressing some of Illinois’ most pressing societal issues of the day centered on health and nutrition.

THE NEED

A report for Cooperative Extension’s North Central Region noted as follows:

*While the United States provides its people with many opportunities and represents the largest and most diverse economy among nations, there is no hiding the fact that it is also a country where tens of millions of residents face significant problems and challenges. Over 45 million Americans presently live in poverty, and U.S. life expectancy is just 42nd among all nations... Over 87 million in the nation are worried about having enough money each month to pay their regular monthly bills, and 17.6 million U.S. households are food insecure.*⁴⁴

These and similar issues are felt acutely in Illinois, where persistent poverty, food insecurity, chronic disease, and other socioeconomic challenges affect large numbers of Illinoisans. The need for solutions to these human challenges is significant because of the following:

- 12.1 percent of Illinoisans live in poverty—more than 1.5 million people⁴⁵—with
 - 16 percent of Illinoisan children living below the poverty level and
 - 25 percent, or one in four, African Americans living in poverty.

43 <https://www.agriculture.senate.gov/imo/media/doc/Smith-lever%20Act.pdf>.

44 Battelle Memorial Institute, Technology Partnership Practice. 2015. Analysis of the Value of Family & Consumer Sciences Extension in the North Central Region. Produced for Directors of Cooperative Extension in the North Central Region. http://www.nccea.org/app/download/7241418760/Battelle_FCS_Executive_Summary_11-2015.pdf.

45 <https://talkpoverty.org/state-year-report/illinois-2019-report/>.

- Nearly 1.4 million Illinoisans struggle with hunger, and of them 453,260 are children, leaving 1 in 6 children to face food insecurity.⁴⁶
 - 11 percent of Illinoisans households are food insecure, meaning at some point during the year, they experienced difficulty providing enough food due to a lack of money or resources.⁴⁷
- Poor nutrition and lack of physical activity are primary lifestyle risks that lead to chronic disease:
 - More than 1 million people in Illinois, or 10.4 percent of the adult population, have diabetes.⁴⁸
 - An additional 296,000 have diabetes but don't know it, greatly increasing their health risk.
 - There are nearly 3.4 million people in Illinois, 34 percent of the adult population, that have prediabetes with blood glucose levels higher than normal but not yet high enough to be diagnosed as diabetes.
 - Every year, an estimated 65,000 people in Illinois are diagnosed with diabetes.
 - People with diabetes have medical expenses approximately 2.3 times higher than those who do not:
- Total direct medical expenses for those diagnosed with diabetes in Illinois was estimated at \$8.7 billion in 2017
- Another \$3.2 billion was spent on indirect costs from loss of productivity due to diabetes.
 - Heart disease is the leading cause of death in Illinois and stroke is the third cause of death, ranking Illinois as 19th in the nation for the highest death rate from cardiovascular disease.⁴⁹
 - Nearly one-third (31.8 percent) of Illinois' adult population is classified as obese.⁵⁰
 - This is up from 20.4 percent in 2000 and from 12.1 percent in 1990.
- Financial conditions and family dynamics can lead to hardships:
 - 34 percent of children in Illinois are being raised in single-parent households.⁵¹
 - 25 percent of children in Illinois have parents who lack secure employment.
 - While family income is one factor of financial security, the cost of basic expenses also matters. 29 percent of children in Illinois are living in households with a high housing cost burden.

Illinois Extension works to understand the key social and behavioral factors that impact quality of life and to provide the skills that contribute to positive lifestyle choices across an individual's life span. It also works to identify the community and societal factors that

46 <https://www.feedingamerica.org/hunger-in-america/illinois>.

47 <https://talkpoverty.org/state-year-report/illinois-2019-report/>.

48 American Diabetes Association. "The Burden of Diabetes in Illinois." State Fact Sheets. http://main.diabetes.org/dorg/docs/state-fact-sheets/ADV_2020_State_Fact_sheets_IL.pdf.

49 Based on total number of deaths in 2017. Centers for Disease Control and Prevention. WISQARS Leading Cause of Death Reports, 2017. <https://www.heart.org/-/media/files/about-us/policy-research/fact-sheets/quality-systems-of-care/quality-systems-of-care-illinois.pdf?la=en&hash=C42227FD161F185B4680A49C77B5B574CAA84D8B>.

50 <https://www.stateofobesity.org/states/il/>.

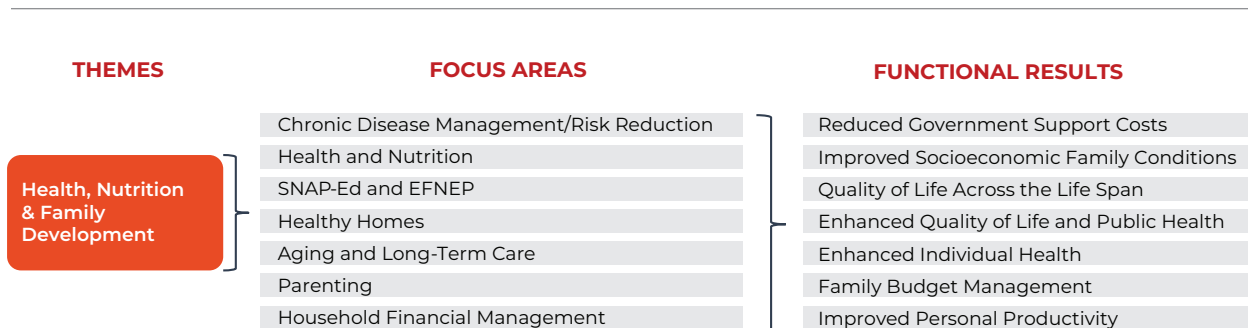
51 <https://datacenter.kidscount.org/data>.

facilitate or inhibit positive or negative lifestyle choices and to address these through programs targeted at behavior influencers.

HOW ILLINOIS EXTENSION GENERATES IMPACT WITHIN THE HEALTH, NUTRITION, AND FAMILY DEVELOPMENT THEMATIC AREA

In support of health, nutrition, and family development, Illinois Extension works across a diverse range of focus areas—and these, in turn, engender a variety of positive functional benefits (results) for Illinois and its citizens (Figure 14).

FIGURE 14: ILLINOIS EXTENSION FUNCTIONAL IMPACT THEMES IN HEALTH, NUTRITION, AND FAMILY DEVELOPMENT



Source: TEconomy Partners, LLC.

Family and Consumer Science programs can be classified under three broad subcategories:

- Health and Nutrition
- Workforce Development
- Family Development, and
- Consumer Economics

Illinois Extension works to understand the key social and behavioral factors that impact health and nutrition with efforts focused on major questions and issues such as the following:

- What are the underlying causes of unhealthy decisions?
- What tools and information do people need to help them make healthy decisions?
- How can children be encouraged to develop healthy eating and physical activity patterns that will persist across their life span?
- What do recipients of food assistance programs need in order for them to make wise food purchase decisions and stretch their food dollars?
- What actions should individuals take to avoid the development of preventable chronic diseases and the associated physical and cost burdens?
- How can public policy impact access to healthy food and improve food security?

Illinois Extension's efforts also support the development of families that focus on major questions and issues such as the following:

- What are the underlying causes of family strife and how can quality of life be enhanced through improved family situations?
- How can quality of life be improved across every segment of one's life span?
- What tools and information do people need to improve personal productivity which in turn improves quality of life?

Finally, Illinois Extension's efforts support the education and knowledge of Illinoisans around issues concerning consumer economics/financial management. According to statistics from the American Bankruptcy Institute, as of January 2020, Illinois ranked 6th out of 50 states for the greatest per capita personal bankruptcy filing rate.⁵² Illinois Extension efforts in financial literacy focus on major questions and issues such as the following:

- What are the underlying issues that cause individuals to make poor financial decisions?
- What tools and information do people need to help them make sound financial decisions?
- How can improved socioeconomic family conditions through improved management of family financials enhance personal and household incomes and decrease debt?

FUNCTIONAL IMPACT EXAMPLES FOR ILLINOIS EXTENSION IN HEALTH, NUTRITION, AND FAMILY DEVELOPMENT

Illinois Extension's programmatic efforts influence key social and behavioral factors resulting in improved quality of life for citizens in all 102 counties of the state. Discussing every program and activity undertaken by Illinois Extension to improve the health, nutrition, and family development of Illinoisans is not feasible. Rather than attempting to produce a laundry list of activities, TEconomy draws upon program examples to illustrate the types and range of functional impacts generated by Illinois Extension programming. The following examples help to illustrate the type of high-impact work taking place.

Health and Nutrition

Program Area: Health, Nutrition, and Family Development

Example 1: SNAP-Ed: Eat, Move, Save

Illinois Extension's largest nutrition education program is the Supplemental Nutrition Assistance Program Education (SNAP-Ed), which is funded by the federal government to help SNAP recipients make informed, healthy, food choices. The nonpartisan Center on Budget and Policy Priorities (CBPP) notes that "SNAP is heavily focused on the poor. About 93 percent of SNAP benefits go to households with incomes below the poverty line, and 58 percent go to households below half of the poverty line. Families with the greatest need receive the largest benefits. These features make SNAP a powerful antipoverty tool."⁵³

⁵² <https://www.abi.org/newsroom/bankruptcy-statistics>.

⁵³ Reported in SNAP-Ed FY2015: Supplemental Nutrition Assistance Program Education through the Land-Grant University System. A Retrospective Review of Land-Grant University SNAP-Ed Programs and Impacts. Prepared by TEconomy Partners LLC for Cooperative Extension Service Directors/Administrators through the National Land-Grant University SNAP-Ed Assessment. September 2016. Available online at: https://www.researchgate.net/publication/326327939_SNAP-Ed_FY2015_Supplemental_Nutrition_Assistance_Program_Education_Through_the_Land-Grant_University_System_A_Retrospective_Review_of_Land-Grant_University_SNAP-Ed_Programs_and_Impacts/link/5b4620f8a6fdccadaebfdcca/download.

Program Area: Health, Nutrition, and Family Development

Illinois Extension SNAP-Ed provides hands-on education so that SNAP recipients can learn the basic skills necessary to raise healthy families on limited incomes. It is well understood that no single intervention or program can affect the type of change in knowledge, attitudes, and behaviors needed to promote healthy lifestyle choices. Rather, Illinois Extension has developed a series of activity and action domains that address four areas of critical importance to SNAP-Ed:

- Educating SNAP-Ed recipients on dietary quality and nutrition choices
- Teaching about effective shopping behavior and food resource management
- Addressing food access and food security issues
- Enhancing understanding of the need for physical activity and the avoidance of a sedentary lifestyle

In FY2018, Illinois Extension taught nearly 21,500 lessons to nearly 720,000 SNAP participants. In FY2019, Illinois Extension taught nearly 180,000 people through face-to-face programs at approximately 34,500 educational sessions, totaling more than 577,000 educational contacts. By focusing on educating participants on the value of nutrition and physical activity, Illinois Extension helps improve public health, thereby reducing the incidence of obesity, diabetes, and other diet-related chronic health problems in Illinois' low-income populations and reducing the economic burden created by health consequences arising from those diseases (see case study at the end of this section).

Key Impacts:

- Improved use of SNAP benefits by recipients across Illinois
- Healthier diet and physical activity behaviors among SNAP recipients and SNAP-eligible individuals, resulting in better health and ability to perform effectively at school and at work
- Reduced costs for the state in terms of chronic healthcare costs associated with improper diet and lack of sufficient exercise

Program Area: Health, Nutrition, and Family Development

Example 2: Expanded Food and Nutrition Education Program (EFNEP)

The Expanded Food and Nutrition Education Program (EFNEP) is a federally funded nutrition education program that serves low-income youth and families with children to help improve their dietary intake and physical activity, increase food resource management skills, improve food safety and preparation skills, and reduce food insecurity. EFNEP serves limited-resource families with young children, school-age youth, and pregnant teens. Participants learn how to do the following:

- Make wise food choices
- Increase daily physical activity
- Manage food resources
- Practice food safety.

In 2019, 3,289 families participated in Illinois Extension's EFNEP educational programming, reaching 11,888 total family participants. Graduates of the program learned new skills to help them make changes to improve their overall health.

Program Area: Health, Nutrition, and Family Development

Example 2: Expanded Food and Nutrition Education Program (EFNEP)

- 93 percent of adult participants improved in one or more nutrition practices (i.e., making healthy food choices, preparing food without salt, reading nutrition labels);
- 77 percent of adult participants improved in one or more food resource management practices (i.e., meal planning, resource management); and
- 78 percent of adult participants increased their home food safety practices.

Graduates of the program learned new skills to help them make changes to improve their overall health (see case study at the end of this section).

Key Impacts:

- Healthier diet and physical activity behaviors among participants, resulting in better health and ability to perform effectively at school and at work
- Reduction in food costs per month thereby helping to reduce levels of food insecurity
- Reduced costs for the state in terms of chronic healthcare costs associated with improper diet and lack of sufficient exercise

Program Area: Health, Nutrition, and Family Development

Example 3: Nutrition Environment Food Pantry Assessment Tool (NEFPAT)

Food access/food insecurity have huge implications on a population's nutritional choices. As previously noted, 11 percent of Illinoisans' households are food insecure, meaning at some point during the year they experience difficulty providing enough food due to a lack of money or resources. Recognizing the need to help develop educational programming to help those facing food insecurity make the best nutritional choices they can, Illinois Extension created the Nutrition Environment Food Pantry Assessment Tool (NEFPAT) to work with food pantries across the state in helping them impact healthy changes in the pantries' offerings. Illinois Extension collaborates with pantry personnel to customize intervention plans to help move pantry clients toward healthier food choices. Intervention plans range from adding healthy signage to adopting nutrition policies for purchased/donated foods. Food pantries who adopt suggested practices create a space that makes the healthy choice, the easy choice, and promote dignity and inclusivity.

Buy-in and support for NEFPAT and healthy pantry interventions in Illinois is growing. Since 2018, SNAP-Ed has engaged in 92 emergency food partnerships and 20 multisector emergency food coalitions. Four of these coalitions were started by Illinois Extension Educators to strengthen local pantry networks and offer a space for the exchange of ideas, resources, and best practices.

Since October 2018, Illinois SNAP-Ed staff have implemented a total of 132 promotional, system, environmental, and policy changes with food pantry partners. In that same time, overall NEFPAT pre-assessment to post-assessment scoring has seen an average increase of 32.8 percent statewide. Public health approaches, like the NEFPAT and its interventions, take time to demonstrate impact on health outcomes. In the short term, these interventions can improve pantry guests' selection, preparation, and consumption of healthier foods by reinforcing nutrition education topics via strategic nutrition signage and marketing of healthful pantry products. These efforts are focused to meet individual pantry needs and readiness to change.

As healthy food pantry initiatives continue with existing partners, and new food pantries take interest in the process, Illinois Extension will be able to further impact the well-being of Illinoisans facing food insecurity. Tools developed promote healthy choices in food pantries and shed light on the need to move away from simply filling bellies, to instead address health inequities and nutrition deficiencies that food insecure families face every day.

Program Area: Health, Nutrition, and Family Development

Example 3: Nutrition Environment Food Pantry Assessment Tool (NEFPAT)

Key Impacts:

- Healthier diet behaviors, resulting in better health and ability to perform effectively at school and at work
- Reduced costs for the state in terms of chronic healthcare costs associated with improper diet

Program Area: Health, Nutrition, and Family Development

Example 4: U and I Aware of Breast Cancer

Studies examining economic, racial, and ethnic disparities in breast cancer have found that women in high-poverty areas are at substantially greater risk for late-stage diagnosis. Additional research has found that low-income women are less likely to receive a mammogram than higher-income women. Furthermore, African American women with breast cancer are more likely to die from the disease than their white female counterparts. African American women are diagnosed with later-stage cancer at a younger age. Finally, while Latinas have lower rates of breast cancer compared with non-Hispanic white women or African American women, breast cancer is the leading cause of cancer deaths among Latinas. Latinas utilize screening services at lower rates due to lack of insurance, low education, barriers related to language and culture, limited access to health-care, and lack of awareness of breast cancer risks.

To help combat these issues, the Illinois Extension office in Cook County, through additional grant funding secured for Community Health initiatives in partnership with the University of Illinois Chicago, have developed the U and I Aware of Breast Cancer (UIABC) program. UIABC is not meant to diagnose breast cancer, rather it promotes participants' breast self-awareness and gives them the tools to detect a change in their own breast tissue and follow up by getting checked by a health provider. Participants learn the difference between a lump and nodularity, normal breast tissue that can often be mistaken as a lump because of the way it presents itself. They also learn about risk factors for developing breast cancer; many cancer cases could potentially be prevented with the adoption of healthier lifestyles. Early detection is key, so these methods are discussed with special emphasis on breast self-exam following the MammaCare® method and using tactually accurate breast models to teach participants what to feel for during a breast self-exam in between clinical breast exams and mammograms. It is also important to highlight that this program is offered in English and in Spanish to reach as much of the underserved/underrepresented part of the population as possible.

Breast cancer is the most common type of cancer diagnosed in women; however, most forms of breast cancer are highly treatable, and the sooner the cancer is diagnosed the more effective the treatment will be. In February 2019, a study in *Cancer*, a journal of the American Cancer Society, found that women who undertake regular screening have a 60 percent lower risk of death within 10 years following their breast cancer diagnosis and a 47 percent lower risk of death within 20 years after breast cancer diagnosis.⁵⁴ In addition, detection at early stages of breast cancer have significant healthcare cost savings (see case study at the end of this section).

Key Impacts:

- Earlier detection of breast cancer thereby enhancing personal health and quality of life
- Reduced cost of healthcare expenses

54 <https://acsjournals.onlinelibrary.wiley.com/toc/10970142/2019/125/4>.

Workforce/Professional Development

Program Area: Health, Nutrition, and Family Development

Example 5: Professional Development—The ABCs of School Nutrition

Illinois Extension serves as an information resource and education provider for a number of professionals working in areas of family development, including senior adult care providers, healthcare professionals, and early childcare professionals. Educational topics include the following:

- Real Colors Training to understand interpersonal dynamics among coworkers and improve workplace relationships
- Being Mindful in a Busy World
- Building Resiliency in Yourself and the Workplace
- Older Adult/Senior Bullying
- Better Brain Health
- Better Brains for Babies.

One unique professional development program that was created, and leverages many of the nutrition expertise referenced previously, is the ABCs of School Nutrition targeted at school food-service professionals. The ABCs of School Nutrition is a partnership with the Illinois State Board of Education. Recognizing that school food-service professionals can benefit from training that helps them understand ways to make the cafeteria environment more appealing to encourage healthy eating and reduce waste, the ABCs of School Nutrition program was created by Illinois Extension.

In 2018, Extension Educators provided training and technical assistance to 1,734 school nutrition professionals through 175 on-site trainings and completed 185 Smarter Lunchrooms assessments in schools. School nutrition staff were trained on menu planning, school wellness, offering smart snacks and beverages, nutrition, food production and serving food, federal meal pattern guidance, food safety, and communications and marketing. In addition, Illinois Extension hosts an active website that features 23 minicourses that were completed by 1,472 learners and received 77,127 page views in 2018.

Key Impacts:

- Healthier diet behaviors, resulting in better health and ability to perform effectively at school
- Reduced costs for the schools by reducing food waste

Family Development

Program Area: Health, Nutrition, and Family Development
Example 6: Brain Health
One in 10 Illinoisans experience subjective cognitive decline. With continuing growth in this country's aging population, concerns about maintaining one's memory as well as recognizing and managing brain disease are issues of great interest to the aging and their families in maintaining their quality of life. The Brain Health series includes programs such as FIT WITS, Hold that Thought, Wits Fitness, Two Heads are Better than One, and Head Strong. Workshops are designed to increase knowledge and self-efficacy to take actions that actively address brain health. For a number of the programs, the intent/purpose is to provide opportunities for older adults to engage intellectually and to increase their socialization through ongoing group participation. Based on research, intellectual challenge and social connectedness are two important factors that contribute to brain health throughout life. In many locations, participants have the option to attend multiple workshops. Illinois Extension implemented a total of 117 workshops with 2,506 participants across Illinois in 2018. Participants reported high levels of impact as a result of the workshop content and activities. Of the 245 participants responding to an end-of-program evaluation, 87 percent reported an increase in knowledge of how lifestyle choices can contribute to brain health or increase in awareness of the strategies and techniques to improve memory. Additionally, 78 percent indicated they felt more confident in their ability to use recommended techniques to promote brain health.
Key Impacts: • Enhanced quality of life and individual health across the life span • Improved personal productivity

Consumer Economics

Program Area: Health, Nutrition, and Family Development
Example 7: Financial Education—All My Money
People spend a great deal of time working to earn an income, but research shows most Americans paying only limited attention to managing income, family budgets, and financial planning for the future. A research paper published by the National Bureau of Economic Research notes as follows: <i>Increasingly, individuals are in charge of their own financial security and are confronted with ever more complex financial instruments. However, there is evidence that many individuals are not well-equipped to make sound saving decisions. This paper demonstrates widespread financial illiteracy among the U.S. population, particularly among specific demographic groups. Those with low education, women, African-Americans, and Hispanics display particularly low levels of literacy. Financial literacy impacts financial decision-making. Failure to plan for retirement, lack of participation in the stock market, and poor borrowing behavior can all be linked to ignorance of basic financial concepts.⁵⁵</i>

55 Annamaria Lusardi. 2008. "Financial Literacy: An Essential Tool for Informed Consumer Choice?" NBER Working Paper No. 14084. Issued in June 2008.

Program Area: Health, Nutrition, and Family Development

Low levels of “financial literacy” are an issue for many Illinoisans. In recognition of this, Illinois Extension operates a range of programs targeting several key aspects of personal finance that have a large impact on family incomes and budgets. One example of this work is the program All My Money.

The All My Money program is a train-the-trainer financial management curriculum for individuals working with limited-resource audiences. The curriculum is designed in a way that agency staff, social workers, and other educators can teach financial literacy topics, even if they do not personally have expertise in financial management. A total of 77 participants completed the training in 2018.

Key Impacts:

- Improved financial literacy for individuals and families across Illinois
- Enhanced family incomes through improved budgeting and financial planning
- Improved family well-being and stress reduction associated with financial challenges

Program Area: Health, Nutrition, and Family Development

Example 8: Financial Education—Financial Planning for Young Adults

According to research at the University of Illinois, about a third of young adults are considered “financially precarious,” meaning they have few money management skills and little income stability. Another third is considered financially “at risk” because they are expected to have a drop in income within the year and have no savings to support themselves. They also don’t have enough to pay for a \$2,000 emergency. These young adults are struggling with money management, such as budgeting and credit-card usage, and often put their health in jeopardy by avoiding doctor visits and prescriptions because of costs. The findings highlight how many young people are leaving high school and college without a basic understanding of how to handle their money and starting their first jobs without little idea of what to do with their paychecks.

In response, Illinois Extension has created a number of programs to address these educational needs. For example, Illinois Extension has partnered with the University of Illinois University Student Financial Services and Cashier Operations (USFSCO) Student Money Management Center (SMMC) in support of the **University of Illinois Saves (UISAVES) Campaign**. UISAVES strives to promote a culture of saving among students, faculty, and staff throughout the University of Illinois System. Over the course of the 6-week campaign in 2018, 10 educational events were delivered, and 1,055 people were reached online through digitally delivered information and 2 webinars. Online events allowed participants to digitally share their saving goals and learn new saving tips.

Key Impacts:

- Improved financial literacy for young adults across Illinois
- Enhanced quality of life across the life span
- Improved personal well-being and stress reduction associated with financial challenges

The Economic Impact of Illinois Extension's Work to Enhance the Nutrition of Illinoisans, thereby Reducing the Rate of Chronic Disease

The work of Illinois Extension in assisting people with the management of chronic diseases, prevention of the effects on health related to obesity and poor nutrition, improving physical activity levels, and other related efforts reaches tens of thousands of participants across the state each year. Improving the nutrition of Illinoisans has an obvious benefit for the quality of life of people across the state, but it also generates tangible savings in terms of reducing healthcare costs.

To illustrate the potential impact of healthcare improvement, TEconomy used an analysis of medical cost data to model the economic effect on Illinois of a reduction in several diseases and health disorders associated with diet and exercise. The scenario models the impact of a decrease in the total number of hospital inpatient visits for 25 selected conditions related to diet and exercise and derives a dollar savings estimated from data on the mean cost of visits. Data are derived from state statistics from the Healthcare Cost and Utilization Project (HCUP) State Inpatient Databases [2014],⁵⁶ recorded by the Agency for Healthcare Research and Quality (AHRQ). Recognizing that healthcare costs and patient volumes have likely risen since 2014, these data represent a conservative benchmark in assessing the potential medical costs avoided due to preventative effects of extension-related programs and services.

Based on the analysis, TEconomy finds that a **3 percent decrease in hospital inpatient visits in Illinois (for diseases that are associated with poor diet and/or lack of exercise) would conservatively result in \$99.6 million in cost savings annually to the state.** This estimate results in the question of whether 3 percent is high, low, or approximately correct in terms of the potential impact of Illinois Extension nutrition programs. Based on EFNEP and SNAP-Ed program contacts by Illinois Extension alone, a 3 percent estimate for impacts is likely conservative. Illinois has a population of 12.67 million and an average household size of 2.59 (U.S. Bureau of the Census data). In FY2019, nearly 183,260 Illinois families participated in either an EFNEP or SNAP-Ed program. If it is assumed that the changed behavior of one member of the household also influences others, then use of the 2.59 average household size can be used to calculate the influenced population, which would be 474,643 Illinoisans. By dividing 474,643 by 12.67 million, it is evident that approximately 3.75 percent of Illinoisans are reached each year by just these two programs, which does not take into account all of the graduates of the program from prior years who may continue to practice what they learned as they pursue a healthier life. Furthermore, Illinois Extension reaches many more citizens through its many other programs, with health and nutrition educational content being a significant component of numerous other programs and initiatives—including chronic disease self-management programs; youth programs such as Health Jam, Health Rocks!, and Illinois Junior Chef; and efforts to connect community gardens and farmers markets to underserved populations, thereby increasing their access to healthier nutritional choices.

56 Due to the transition from ICD-9-CM to ICD-10-CM in October 2015, 2015 statistics were calculated using only quarter 1–3 data, and the statistics available are limited. In addition, only rates of discharges are displayed and not the number of discharges. As a result, 2014 data represent the best available data for state inpatient costs using high-level Clinical Classifications Software (CCS) categories, a tool for clustering patient diagnoses and procedures into a manageable number of clinically meaningful categories.

These diverse programs are likely having a significant impact on hospitalizations for diseases that are related to poor diet and/or lack of exercise.

Ultimately, the work of Illinois Extension in support of nutrition education across all 102 counties produces a series of desired functional benefits:

- Enhanced individual health of Illinois citizens, thereby improving the quality of life and reducing healthcare costs for Illinoisans.
- Enhanced public health and well-being, thereby improving overall productivity and decreasing the costs of healthcare.
- Improved management of family food budgets, thereby enhancing personal and household incomes and decreasing food insecurity.
- Improved personal productivity, generating the opportunity to increase personal and household incomes, leading to an improved quality of life.

The Economic Impact of Illinois Extension's Breast Cancer Awareness and Early-Detection Programs

The Illinois Extension Cook County Community Health team has developed breast cancer awareness and early-detection program (UIABC) to educate Illinoisans on the signs and symptoms of the disease and provide information on how to assess personal risk factors. The deployment of this knowledge, particularly to socioeconomically disadvantaged groups that often do not receive preventative care, increases the rate of early detection, thereby reducing overall healthcare costs and increasing survivorship rates.

To estimate the potential economic impact from increased awareness and education programs targeted at breast cancer, TEConomy leveraged data on the incidence rates of breast cancer as well as studies on the staging and costs of breast cancer treatment in the first year after diagnosis. In addition to influencing health outcomes for the affected patients, being diagnosed with later-stage cancer is associated with a higher cost of treatment; earlier detection and diagnosis have the potential to realize significant avoided expenditures. The CDC's U.S. Cancer Statistics Working Group publishes state-level incidence rates for breast cancer,⁵⁷ which, in conjunction with population data from Cook County, can be used to derive the approximate number of new cases of breast cancer diagnosed per year. To determine estimates of the rates at which breast cancer is staged at diagnosis, data from a study of the Surveillance, Epidemiology, and End Results (SEER) database⁵⁸ of the National Cancer Institute (NCI) were used to apportion an approximate number of breast cancer incidences to each clinical staging type (1–4), with stage 1 indicating a relatively smaller, isolated tumor through stage 4, indicating a tumor that has metastasized to regional or distant organ

57 U.S. Cancer Statistics Working Group. U.S. Cancer Statistics Data Visualizations Tool, based on November 2018 submission data (1999–2016): U.S. Department of Health and Human Services, CDC, and National Cancer Institute.

58 J. Iqbal, O. Ginsburg, P.A. Rochon, P. Sun, and S.A. Narod. "Differences in Breast Cancer Stage at Diagnosis and Cancer-Specific Survival by Race and Ethnicity in the United States." JAMA. 2015; 313(2):165–173.

systems. Most cases are diagnosed at earlier stages due to improvements in diagnostic screening technologies, with an estimated 82.6 percent of new cases in the analyzed SEER data characterized as being stages 1–2. Another study from 2016 leveraged retrospective claims data from commercially insured individuals in the United States to determine costs of treatment by stage in the first 12 months after diagnosis with breast cancer.⁵⁹ Using these data and prevalence estimates for Cook County derived by breast cancer stage at diagnosis, a total estimated cost for individuals in the county in the first 12 months after diagnosis associated with the current incidence rates across all stages is approximately \$624.7 million.

An important goal of public health education efforts is to shift patient populations toward more positive clinical outcomes through prevention and earlier detection of disease, which has the additional impact of creating cost savings in the form of avoided healthcare expenditures. To estimate the potential short-term economic implications of achieving these impacts, TEconomy analyzed a hypothetical scenario where current proportions of the cases diagnosed at later stages (3 and 4) are reduced and instead diagnosed at earlier stages (1 and 2), resulting in improved prognosis and lower expenditures. As an example of potential program impact, TEconomy assumed 5 percent of cases diagnosed at stage 3 and 5 percent of cases diagnosed at stage 4 (representing an estimated total of 61 new cases at these later stages) would instead be diagnosed at stages 1–2 as a result of improved education and awareness in the public as a result of Illinois Extension programs. This new scenario of the population of Cook County would be associated with a total estimated cost in the first 12 months after diagnosis of approximately \$621.7 million, **reflecting an avoided cost of \$2.9 million due to the earlier diagnosis.** This estimate does not reflect ongoing costs associated with treatment after the first 12 months of treatment or spillover impacts on other types of ongoing healthcare expenses, which are also likely to be significantly reduced as a result of earlier diagnosis, making this a very conservative estimate of overall economic impact of program activities. Finally, this was also modeled only for Cook County. The educational materials are available online and can be accessed by Educators in other counties as well as by individuals living anywhere in the state. As a result, the potential impact extends beyond Cook County to the entire state and could potentially result in far more significant cost savings.

The Economic Impact of Illinois Extension's Smoking Cessation Program

The Illinois Extension Cook County Community Health team has developed a smoking cessation program to educate Illinoisans on the risk factors associated with smoking and help prevent and reduce the chances of negative health outcomes by providing educational programming and access to tools to help them quit smoking.

To estimate the potential economic impact from changes to smoking behavior, TEconomy leveraged data on smoking-attributable expenses on a per-individual-smoker basis created by the CDC as a part of its Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) system of models.⁶⁰ These models used econometric analyses of healthcare outcomes and medical expenditure survey data to derive the portion of personal healthcare expenditures that could be avoided by eliminating smoking across the population of U.S.

59 Helen Blumen, et al. "Comparison of Treatment Costs for Breast Cancer, by Tumor Stage and Type of Service." *American Health & Drug Benefits*. 2016; 9(1): 23–32.

60 Centers for Disease Control and Prevention, SAMMEC—Smoking-Attributable Mortality, Morbidity, and Economic Costs, 2005–2009.

adults ages 19 and older. The estimates of smoking-attributable expenditures include ambulatory, hospital, prescription drugs, nursing home, and other assorted home healthcare, medical equipment, and services costs related to excess healthcare costs experienced by smokers relative to nonsmokers. The latest available state-level data on expenditures for Illinois was from 2009 and was adjusted for inflation to current (2020) dollar levels using the BLS Consumer Price Index (CPI) series for costs associated with medical care services and commodities.⁶¹ In conjunction with estimates of the current population⁶² and the proportion of smokers in the state and Cook County,⁶³ approximated at 16 percent of the state population and 18 percent for the overall county population (including Chicago), these data were used to estimate the total population of smokers at the state and county level as well as the total per-smoker attributable expenses for the state.

One of the key desired outcomes of smoking cessation programs is to encourage current smokers to end the practice and realize future savings in the form of healthcare costs avoided due to mortality and morbidity risks of associated chronic illnesses. As a conservative estimate of the impact of smoking cessation programs, TEconomy estimated the impact of a hypothetical 1 percent decline in the current population of smokers in Cook County. **The decline in smoking behavior as a result of educational and interventional programs would result in the change of approximately 9,300 current smokers to former smokers in Cook County, which, in turn, would realize an estimated total savings from avoided smoking-attributable expenses of \$34.8 million dollars.**

Although the program was created through the Cook County Extension Office, the material is available online and can be accessed by Educators in other counties as well as by individuals living anywhere in the state. As a result, the potential impact extends beyond Cook County to the entire state and could potentially result in far more significant impacts in smoking cessation behavior. If this same 1 percent reduction in current smokers was realized across the entire state of Illinois, it would result in broader impacts encompassing an estimated \$76.1 million in smoking-attributable expenses avoided.

61 BLS CPI index for medical care in U.S. city average (medical care services + commodities), all urban consumers, not seasonally adjusted.

62 Economic Modeling Specialists International (EMSI) 2019.2 demographic data.

63 County Health Rankings and Roadmaps: Suburban Cook County Equivalent Measures 2018, Cook County Public Health Community Epidemiology and Health Planning Unit.

Functional Impacts Generated from Youth Development

DESCRIPTION

Illinois Extension's youth development efforts are delivered primarily through 4-H programs. 4-H provides education and development programs through experiential learning models where young people learn by doing through the mentorship of a caring adult. The national 4-H organization described its efforts in the following manner:

Kids complete hands-on projects in areas like health, science, agriculture, and civic engagement, in a positive environment where they receive guidance from adult mentors and are encouraged to take on proactive leadership roles. Kids experience 4-H in every county and parish in the country through in-school and after-school programs, school, and community clubs, and 4-H camps.⁶⁴

With over 6 million members, 4-H is the largest youth development organization in the United States and is focused on helping young people thrive. 4-H programs seek to instill integrity, service, leadership, a sense of duty, and personal growth in the youth they serve. It is through these efforts that 4-H programs can be seen to build a basis for positive personal and societal economic impacts. Specific activities designed to develop life skills are built into 4-H projects, activities, and events with the goal of helping youth become contributing, productive, self-directed members of society. However, what makes 4-H truly unique is that the programs are delivered by adults who strive to develop meaningful mentorship relationships with the youth whom they serve. Research shows that, through these relationships, youth achieve important developmental outcomes, like personal responsibility, academic motivation, confidence, and high personal standards.

THE NEED

It is important to note that Illinois Extension differs from social service organizations in that it targets prevention education before significant problems arise or just as difficulties emerge, whereas "social service organizations typically provide intervention services to those who have been clearly identified as having that need. Preventing problems before they happen, through education, is more effective and more economical than intervention or remediation after unhealthy behaviors have become entrenched."⁶⁵

According to the National Center for School Engagement, "at-risk youth" are youth who are exposed to factors that may increase their tendency to engage in problem behaviors such as delinquency.⁶⁶ This definition covers self-destructive behavior, as well as costs to society related to crime and antisocial behavior. Sadly, with the rise in opiate and other drug addictions, peer influences, and broken homes, the number of at-risk youth is increasing across the nation, including in Illinois.

64 National 4-H Council Website. "What is 4-H." <https://4-h.org/about/what-is-4-h/>.

65 Battelle Memorial Institute, Technology Partnership Practice. 2015. Analysis of the Value of Family & Consumer Sciences Extension in the North Central Region. Produced for Directors of Cooperative Extension in the North Central Region. http://www.nccea.org/app/download/7241418760/Battelle_FCS_Executive_Summary_11-2015.pdf.

66 <http://schoolengagement.org/school-engagement-services/at-risk-youth/>.

Over the years, 4-H Youth Development programs have been found to have a positive impact on the nation's youngest citizens. Research conducted at Kansas State University, with oversight by a National Impact Project Steering Group,⁶⁷ found that participation in 4-H Youth Development programs impact youth in the following ways:

- The opportunity to value and practice service for others
- An opportunity for self-determination
- A positive relationship with a caring adult
- A physically and emotionally safe environment
- An inclusive environment
- Engagement in learning
- Opportunity for mastery
- An opportunity to see oneself as an active participant in the future.

Research shows convincing evidence that participation in 4-H Youth Development programs engenders positive self-esteem, personal responsibility, and an engagement with and responsibility toward community. Participants from at-risk backgrounds who achieve such positive outcomes through 4-H Youth Development programs are, of course, less likely to succumb to external peer pressures and the low self-esteem issues that so often lead to antisocial and self-destructive behavior.

Richard M. and Jacqueline V. Lerner at Tufts University lead a team that has conducted the preeminent research on the youth development impacts of 4-H Youth Development programs nationwide. The 4-H Study of Positive Youth Development (PYD) is a longitudinal study repeated annually from 2002 to 2010 that surveyed more than 7,000 adolescents across 42 states in grades 5–12. Findings from the 2016 study, which examined youth development across all eight waves, suggest that 4-H youth are four times more likely to make contributions to their communities in grades 7–12 than youth participating in other out-of-school activities. The same study also finds that 4-H youth are about twice as likely to be civically active.⁶⁸ Therefore, the role that 4-H Youth Development programs play, in both encouraging community service and discouraging risk behaviors, through its programming and activities positively impact the economy of Illinois over the long term.

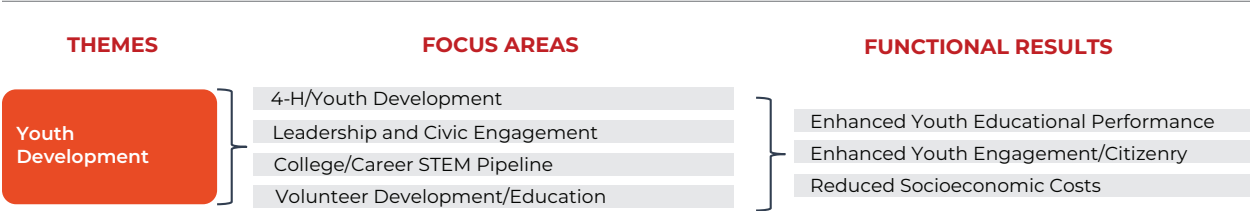
⁶⁷ Prepared and Engaged Youth Serving American Communities: National 4-H Impact Assessment Project, <https://ucanr.edu/sites/UC4-H/files/13698.pdf>.

⁶⁸ <https://4-h.org/wp-content/uploads/2016/02/4-H-Study-of-Positive-Youth-Development-Full-Report.pdf>.

HOW ILLINOIS EXTENSION GENERATES IMPACT WITHIN THE YOUTH DEVELOPMENT THEMATIC AREA

In support of youth development, Illinois Extension delivers youth-specific programming across the state—and these initiatives, in turn, engender a variety of positive functional benefits (results) for Illinois and its citizens (Figure 15).

FIGURE 15: ILLINOIS EXTENSION FUNCTIONAL IMPACT THEMES IN YOUTH DEVELOPMENT



Source: TEconomy Partners, LLC.

While 4-H provides important programming across the entire state of Illinois, its efforts may be especially vital to rural and urban students whose schools have limited funding to provide an abundance of extracurricular opportunities. Research finds that structured and collaborative extracurricular activities promote good mental health, build positive skills and values, and reduce the potential for youth to engage in negative behaviors.⁶⁹ For some students, 4-H Youth Development programs may be the most important source, if not the only source, of structured extracurricular activities that promote positive development.

There are many paths to a 4-H experience. Youth become involved in 4-H through participation in the following:

- Multiproject clubs
- Special interest clubs
- 4-H Camps
- Educational programming in partnership with schools and afterschool partner organizations.

In 2019, 137,311 children across all 102 Illinois counties experienced the benefits of 4-H through 228,299 program-participant experiences and 27,975 club project experiences.

Programming was made available, in part, as a result of the 15,615 volunteers who dedicated their time to mentoring youth in 2018.

69 <http://onlinelibrary.wiley.com/doi/10.1002/pits.10136/abstract>.

FUNCTIONAL IMPACT EXAMPLES FOR ILLINOIS EXTENSION IN YOUTH DEVELOPMENT

Examples below are illustrative of the high impact work taking place through Illinois Extension's 4-H Youth Development programs.

Program Area: Youth Development
Example 1: 4-H Clubs—Preparing Youth to be Consumers, Producers, and Entrepreneurs of Illinois' Agricultural Products
With each passing generation, more people in society are further removed from agricultural production, and as a result, are further disconnected from understanding where food comes from. This lack of knowledge is increasingly becoming more and more problematic as agricultural communication competes with various other sources of misinformation regarding issues related to the food supply. The Illinois Extension 4-H Club programs engages 4-H members in a variety of hands-on activities and experiences that cultivate an increased understanding and appreciation for agriculture. A wide variety of county- and state-level 4-H agricultural programs are offered across Illinois, in areas including, but not limited to, livestock, horses, small animals, and gardening clubs. Through these efforts, Illinois 4-H is providing first-time agricultural experiences to youth who are far removed from the source of the food they eat. In 2018, nearly 95,000 individual project enrollments were related to livestock production and the care of animals where youth learn management practices to produce safe food for the growing population. Youth also participated in livestock judging and livestock ambassador programs. In addition, Illinois 4-H delivers a school embryology program throughout Illinois' educational systems. The course is designed to provide elementary and high school teachers with knowledge on the chicken's egg, its importance to man, and its role in reproduction of the species. Course content is oriented to train teachers to conduct classroom incubation and embryonic development projects. The hands-on project is designed to provide students the opportunity to hatch chicks in their own classroom. During the 21-day incubation period, students learn to prepare eggs, set up an incubator, record progress, turn eggs, and test eggs for fertility. The project aligns with state learning standards. In 2018, 5,492 youth participated in the school embryology program.
Key Impacts: • Instilling agricultural knowledge/communication • Fostering youth motivation and performance • Promoting career readiness/exploration

Program Area: Youth Development

Example 2: Instilling Healthy Decision Making

Recent statistics confirm what parents, teachers, and other concerned adults suspect—children and teens continue to use tobacco, alcohol, and drugs in significant numbers. According to the 2018 Illinois Youth Survey, 27 percent of 8th graders and 40 percent of 10th graders have used alcohol in the past year, and 20 percent of 10th graders have used some form of tobacco or vaping product. Early drug education is essential for addressing risky beliefs and attitudes that research has shown to be important contributing factors to youth substance abuse.

To help meet this growing need, Illinois 4-H is empowering youth through the Health Rocks! healthy living initiative to make wise decisions when confronted with risky behaviors such as substance abuse. 4-H Health Rocks! helps build life skills that lead to healthy lifestyle choices. The program focuses on helping young people understand the consequences of tobacco, drugs, and alcohol use so that they have all the information they need to make wise choices. Part of decision-making is learning to deal with peer pressure. 4-H Health Rocks! uses interactive and team activities to get the message across and involves teens as teachers and mentors for their peers.

In 2018, a total of 2,041 youth participants completed the full 10 hours of required training. Health Rocks! was successful in changing beliefs and attitudes that are research-based contributing factors to substance abuse among youth.

- 87 percent reported a favorable change in one or more drug- or life skills-related beliefs, comparing beliefs after the program with before the program.
- On average, 6 of the 13 beliefs addressed in the program changed for participants in a favorable direction.
- 97 percent agreed that they learned a significant amount of helpful information as a result of completing the course.

In addition to Health Rocks!, Illinois 4-H provides robust programming focused on instilling healthy decision making through sound nutrition and meal preparation skills to youth through organized cooking clubs and programs such as Health Jam, Illinois 4-H Food Challenge, and Cooking 101 programs. In 2018, 10,430 participant affiliations were reached through health and nutrition programs in 21,419 projects or programs.

Key Impacts:

- Fostering youth motivation and performance
- Building enhanced social capital and capacity
- Reducing social/economic cost

Program Area: Youth Development

Example 3: Career Readiness

Workforce preparation is a major concern in the global economy. Employers across Illinois are reporting that young workers lack communication, leadership, teamwork, and problem-solving skills necessary in today's workplace. Illinois 4-H has addressed these concerns by providing intentional workforce preparation experiences including education, experience, and reflection through a variety of 4-H programs impacting youth at all age levels.

Illinois 4-H works to create pathways to successful careers by exposing youth to project areas of interest and mentors who can guide that development. Through these pathways, 4-H members learn life skills, such as communicating, decision-making, and goal-setting. Programs include the following:

Program Area: Youth Development

Example 3: Career Readiness

- Ready4Life Challenge, which are clubs that are created to help middle and high school students and their families gain the skills and knowledge needed to achieve success through high school graduation, pursuit of postsecondary education, and sustained employment.
- Juntos 4-H is the name given to Ready4Life Challenge clubs designed for Spanish-speaking youth and families.
- Illini Summer Academies in which participants attend academy sessions led by university professors and enjoy a variety of engaging activities that provide a taste college life.

Another example of a career readiness program delivered by Illinois 4-H is the Welcome to the Real World program. Welcome to the Real World provides training and curriculum materials for teachers and a simulation for their middle and high school students that allow them to explore careers and money management in adult life. The simulation allows students to start with a monthly income and visit various booths to spend their income on items typically found in a family budget such as housing, utilities, food, transportation, insurance, and childcare. In 2018, 3,385 youth participated in the Welcome to the Real World training across 26 counties in Illinois.

Key Impacts:

- Fostering youth motivation and performance
- Promoting career readiness/exploration
- Building enhanced social capital and capacity

Program Area: Youth Development

Example 4: STEM—Inspiring Innovation

Agricultural Science is a STEM discipline that integrates life science, physical science, engineering, economics, and other disciplines. It is an applied field that very much helps students understand STEM content in the context of something real that they can associate with and understand. Illinois 4-H programs leverage the power of agricultural science to improve the performance of Illinois' educational offerings for children and youth through partnerships with local school systems to deliver 4-H club and school enrichment opportunities.

Illinois 4-H is empowering youth to be the inventors, makers, scientists, and engineers needed for an ever-growing STEM world. 4-H youth use science and technology to solve problems and incorporate what they learn from 4-H STEM projects in their everyday life. Programs include the following:

- 4-H Robotics is a program in which students learn to design, build, and program robots through hands-on projects.
- 4-H Tech Wizards is a program that offers small-group mentoring experiences with a focus on STEM skills. In addition to building positive relationships with their mentors, young people learn about STEM topics such as video editing and rocketry. Mentors help young people build positive relationships with a caring adult, providing the potential of lasting impact on how youth view college and careers they may never have considered alone.
- Emerging Technologies is a program where projects are added that spark the imagination in fields such as 3-D printing and drones.
- National Youth Science Day is a program in which youth across Illinois all do the same Science Experiment.

The total STEM-related project affiliations was 37,444 in 2018.

Program Area: Youth Development

Example 4: STEM—Inspiring Innovation

Key Impacts:

- Instilling knowledge/skills
- Fostering youth motivation and performance
- Promoting career readiness/exploration

Program Area: Youth Development

Example 5: Leadership and Civic Engagement

Illinois 4-H believes that all youth should have opportunities for positive youth leadership and civic development. While all 4-H programs have leadership as a component of the program design's objective, Illinois 4-H has developed specific efforts to provide youth from across the state with the opportunity to develop leadership skills. These opportunities empower youth to be leaders in a global society by deepening their cultural awareness and respect for difference. Programs include 4-H Teen Leadership, 4-H Teen Teachers, Illinois State 4-H Youth Leadership Team, and the Speaking for Illinois 4-H.

One unique example of how Illinois 4-H is combining leadership development with civic engagement is the way in which youth are working together on the hunger/food insecurity challenge facing their communities. Originally working to respond to the needs faced by food deserts within their communities, volunteers worked to organize mobile markets to fill gaps. In 2018, 370 volunteers devoted 5,640 hours to benefit 4,740 individuals with mobile food markets in Illinois. The 4-H efforts to help solve these food deserts resulted in 88,000 pounds of food distributed, including produce and other healthy shelf-stable products. More importantly, these 4-H members taught other youth in their community how to garden and partnered with developmental centers to engage developmentally disabled youth in gardening activities with their resulting harvest being donated.

Another example is the Teen Teacher Training program, a program in which teen are trained to deliver programs to younger peers. In 2018, the Teen Teacher training was offered to 562 high-school-age youth throughout the state, who attended one or more of the 147 educational sessions offered. Once trained, Teen Teachers then volunteered to teach/facilitate numerous educational programs across the state for other youth, including Illinois Junior Chefs, Health Jam, and Health Rocks! where the near-peer social influence resonates with their younger peers when learning about how to make healthy choices and avoid risky ones.

Key Impacts:

- Fostering youth motivation and performance
- Building enhanced social capital and capacity

4-H Impact on Educational Attainment and Future Earnings

By working to keep youth feeling positive about themselves and their abilities and instilling a desire to learn and improve, 4-H can lead to greater personal and societal economic success. Research has proven that there are increasing personal returns from educational attainment, with greater levels of education being rewarded with higher median earnings (and benefiting society through higher taxation receipts).

Therefore, even under the most conservative of estimates, it is reasonable to assume a portion of the 137,311 youth (ages 8–18) involved in 4-H in Illinois in 2019 develop the personal abilities that lead them to be more likely to pursue higher education opportunities. While some of these children certainly would have pursued higher education even if they had not been involved in 4-H, research has shown that children involved in 4-H programs are five times more likely to graduate from college. With ages being 8 to 18, the cadre of 137,311 youth engaged with 4-H takes approximately a decade to pass through the system to their high school graduation. Put another way, approximately 10 percent of the 137,311 youth can be considered as candidates to go to college in any given year (13,731). Using just a very conservative assumption that 5 percent of these Illinois 4-Hers were encouraged by their 4-H educational experience to enter higher education and achieve a bachelor's degree, rather than ending their formal education after receiving their high school diploma, this would equate to 687 additional bachelor's degrees being granted. At a median earnings differential of an additional \$23,972⁷⁰ per year for a bachelor's degree over and above a high school diploma, **this equates to increased annual earnings for this group of \$16.5 million, or more than \$660 million in increased earnings over the course of their careers.**

The 4-H experience also may keep students from dropping out of high school. Again, if 5 percent of Illinois 4-Hers stayed and received their high school diploma, rather than dropping out of high school, this group's annual personal earnings gain would be \$6.9 million.

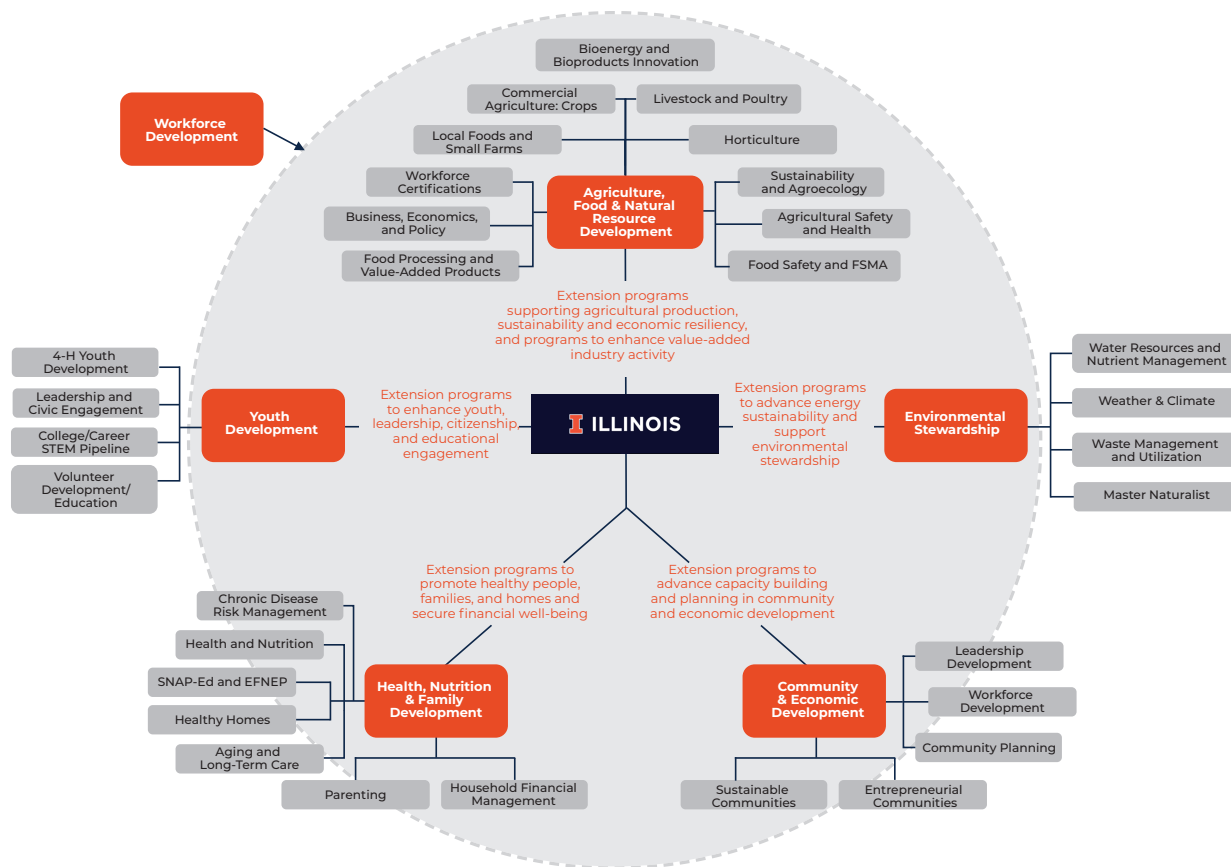
These increases in lifelong earning potential not only impact personal incomes, but also the quality of life of Illinois families and the state's tax base for those graduates who live and work in the state after graduation.

⁷⁰ <https://www.bls.gov/careeroutlook/2018/data-on-display/education-pays.htm>.

Conclusion

Illinois Extension is a significant economic catalyst for the state of Illinois. Simply in terms of expenditure impacts, Illinois Extension generates a total output impact of \$126 million in the Illinois economy on an annual basis and supports 1,058 jobs with labor income totaling \$65.4 million. These expenditure impacts are, however, eclipsed in their importance by the benefits accruing to the state through the wide array of services provided through Illinois Extension's network of programs and initiatives. The work of Illinois Extension can be understood as taking place under five major thematic areas that are highlighted in Figure 16 and detailed in the previous chapter.

FIGURE 16: KEY THEMES FOR ILLINOIS EXTENSION PROGRAMMING AND ACTIVITIES



Source: TEconomy Partners, LLC.

These impacts are categorized by economists as “forward-linkage impacts,” which, rather than being related to institutional spending, are related to institutional mission and function. It is these impacts that are making a difference in the everyday lives of Illinoisans in every county across the state. Figure 17 highlights just some of the case studies and estimations used in this report to assess the functional impacts across the thematic areas and find positive benefits for the Illinois economy that are extremely large.

FIGURE 17: EXAMPLES OF ILLINOIS EXTENSION'S FUNCTIONAL IMPACTS



Source: TEconomy Partners, LLC.

Overall, the funding for Illinois Extension clearly provides strong benefits and positive impacts in return for the investment. For an annual total investment of \$60.9 million (all sources of funding in fiscal year 2019), Illinois Extension programs are generating wide-ranging returns. The total output impacts of Extension expenditures (\$126 million), when combined with just the agricultural output support, cost savings, and income benefits examples shown on Figure 17, combine for \$603.3 million (both expenditure impacts and functional impacts combined) in an average year, an amount nearly tenfold higher than annual investment in the system.

