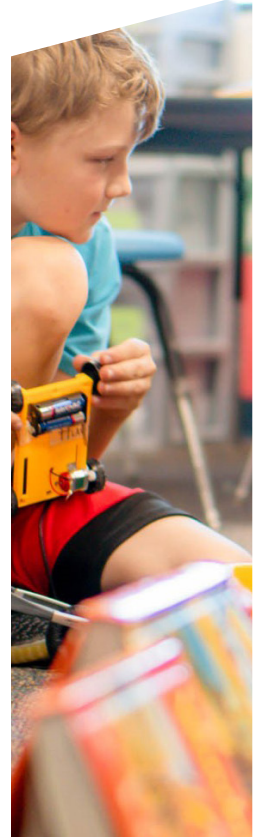
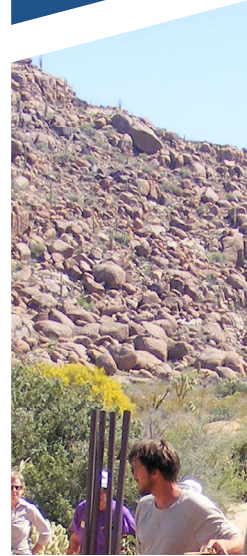
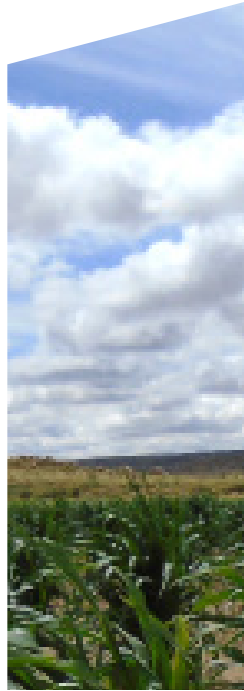
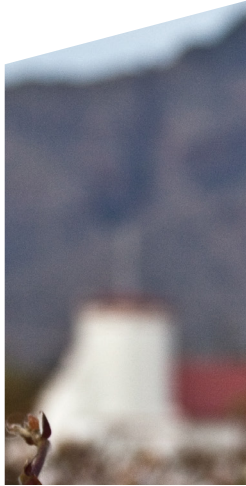
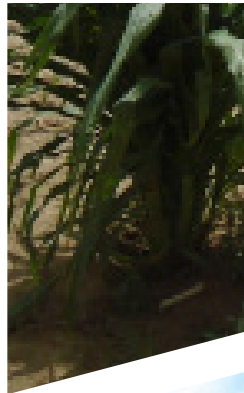
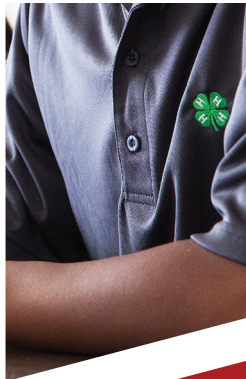




THE UNIVERSITY OF ARIZONA
Cooperative Extension



THE ECONOMIC AND FUNCTIONAL IMPACT OF ARIZONA EXTENSION



Performed For:
University of Arizona
Cooperative Extension

Performed By:
TEconomy Partners, LLC

May 2022



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TEConomy Partners, LLC is a global leader in research, analysis, and strategy for innovation-driven economic development. Today, we're helping nations, states, regions, universities, and industries blueprint their future and translate knowledge into prosperity.



Contents

EXECUTIVE SUMMARY	i
Knowledge—The Driver of Economic and Societal Progress.....	i
The Mission of Extension—To Disseminate Knowledge	ii
Expenditure-Based Economic Impacts of AZ Extension.....	iii
The Functional Impacts of AZ Extension.....	v
Conclusion.....	vii
INTRODUCTION	1
Knowledge Dissemination Drives Progress	1
Land-Grant Universities: Centers of Knowledge Creation and Dissemination	2
The Mission of Extension—To Disseminate Knowledge	3
Study Goals: Evaluating the Economic and Functional Impacts of Arizona Extension	5
EXPENDITURE-BASED ECONOMIC IMPACTS OF AZ EXTENSION	6
Measuring Expenditure-Based Economic Impacts—Methodology	6
AZ Extension’s Employment and Expenditures	8
Economic Impact of AZ Extension Expenditures	9
Summary	11
FUNCTIONAL IMPACTS OF AZ EXTENSION	12
Agricultural Production	18
Natural Resources and Environmental Stewardship	35
4-H Youth Development and Education	44
Community and Business Development	66
Tribal Nations/FRTEP	73
CONCLUSION	77
APPENDIX A: COUNTY AND TRIBAL EXTENSION ECONOMIC IMPACT PROFILES.....	79



EXECUTIVE SUMMARY

Abstract

University of Arizona Cooperative Extension (AZ Extension) is a trusted source of critical, research-based information that it disseminates to a diverse array of audiences across the State of Arizona, thereby serving as a significant economic catalyst.

The \$14.2 million annual investment from the State of Arizona enables AZ Extension to:

- Leverage \$18.4 in federal and other competitive sources of funds
- Employ 637 part-time and full-time positions across the state
- Produce a total expenditure output impact of \$69.4 million in the Arizona economy
- Generate an ROI of \$4.87 for every \$1 of state investment, and
- Improve economic productivity annually by \$138.5 million through its programs and initiatives.

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 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 of approximately 175 new websites every minute. Google is used to perform over 5.6 billion searches each day, or over 63,000 searches per second. As a result, having access to trusted, validated sources of reliable information and know-how is extraordinarily important and valuable.

The issue at hand is that so much knowledge is transferred through diffusion—a practice that requires a person to have the knowledge and skills to access, process, and make sense of the information they receive and discern what to trust and what to discard. By comparison, knowledge dissemination focuses on communicating information by targeting and tailoring the findings and the message to a particular target audience. The ability of a society to discern, disseminate, and deploy evidence-based knowledge is fundamentally essential for its economic well-being.

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 Disseminate Knowledge

The University of Arizona was established in 1885 as Arizona’s land-grant university. In 1914, with the passage of the Smith-Lever Act, Cooperative Extension was organized in Arizona. Since its creation, University of Arizona Cooperative Extension (AZ Extension) has worked to bring research-based innovations, advancements, and education to a diverse range of populations. “Extension” means “reaching out,” and the University of Arizona “extends” its academic and research resources, solving public needs with university-based intellectual capital through a myriad of activities. AZ 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, AZ 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 education to audiences statewide—education that improves recipients’ personal and working lives. AZ Extension is a teaching organization that works to significantly enhance human capital, generate well-prepared practitioners, and promote lifelong learning across the State of Arizona.
- A **regional network**—with a presence in every Arizona county and across tribal lands—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 Arizona’s quality of place.
- A **strengtheners** 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.

This report seeks to:

- Measure the quantitative impact of AZ Extension operational expenditures.
- Describe the broad range of functional, social, and community benefits delivered by AZ Extension’s activities across the State of Arizona.
- Provide specific illustrations of the range of positive functional impacts generated in Arizona because of AZ Extension’s activities.

From an economic perspective, the impacts of AZ Extension are best viewed as comprising two distinct pathways. The presence and operations of AZ Extension generate “economic stimulus” or **expenditure impacts** across the Arizona economy, including all 15 individual counties and tribal lands where AZ Extension maintains a physical footprint. This “stimulus” occurs via the direct expenditures of AZ Extension and the expenditures of its personnel. While AZ Extension obviously does not exist simply to create economic stimulus through expenditures, it is important to note that this impact is not insignificant for Arizona—primarily because a significant portion of AZ Extension funding comes from external (federal) funding sources that then are spent in operations across the State of Arizona.

However, the **functional impacts** generated are the reason AZ Extension exists. AZ Extension’s functional impacts are driven by the core programmatic missions on which AZ Extension focuses in order to help Arizona’s agricultural economy, workforce, communities, families, and youth prosper. Through its extensive programmatic activities, AZ Extension has a substantial track record in contributing to Arizona’s overall quality of life and positively impacting the state’s economy. As knowledge becomes the foremost driver of modern economies, university Extension activities will likely grow in their crucial importance to economic progress. Strengthening the lives and communities of Arizona through the dissemination of research-based knowledge (activities at the core of AZ Extension’s mission) are keys to the long-term, competitive sustainability of Arizona’s standard of living. The degree to which AZ Extension’s work has, and is, contributing to the economic progress in the State of Arizona is the subject of this report.

Expenditure-Based Economic Impacts of AZ Extension

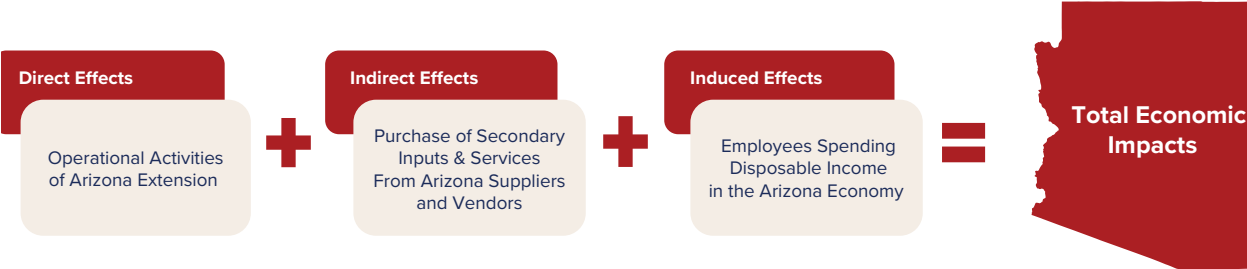
The main impact of AZ Extension is created and obtained through the activities that AZ Extension faculty and staff are engaged in throughout the State of Arizona (functional impacts). These activities improve the character and quality of life of thousands of Arizona residents in both rural and urban settings and improve economic performance through the dissemination of knowledge, technologies, and practices.

From a traditional economic perspective, however, AZ Extension also has an “economic impact” on the State of Arizona through its direct operational expenditures and, ultimately, the expenditures of its Extension faculty, other staff, and service providers. In addition, many of these expenditures are then recirculated within the state economy as recipients of the first round of income spend a portion of this income with other businesses and individuals within the subject economy. This spending is termed the multiplier effect (incorporating both indirect and induced economic impacts).

Therefore, while AZ Extension does not exist to simply generate economic stimulus through its expenditures, given its total operating expenditures of \$32.6 million (\$14.2 million of which is provided by the State of Arizona through direct funding) and direct employment of 637 full- and part-time faculty and staff employed across all 15 counties of Arizona, the stimulus effect is not insignificant.

To measure the impact of AZ 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-1.

Figure ES-1: Components of Expenditure-Based (Backward-Linkage) Economic Impacts of AZ Extension



Source: TEconomy Partners, LLC

The results of the I-O analysis of AZ Extension operational expenditures are shown in Table ES 1. The analysis finds that the expenditures generated a total output impact of \$69.4 million in the Arizona economy and supported 859 jobs with



labor income totaling \$36.7 million. Because AZ Extension is found across all 15 counties, these impacts are distributed across the entire State of Arizona.

Table ES-1: Statewide Economic Impact of AZ Extension Expenditures, FY 2021

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	637.0	\$24,649,087	\$32,753,515	\$428,828	\$798,876
Indirect Effect	68.2	\$3,803,637	\$11,740,663	\$195,582	\$260,722
Induced Effect	153.6	\$8,281,018	\$24,915,526	\$787,607	\$939,915
Total Impacts	858.8	\$36,733,742	\$69,409,704	\$1,412,017	\$1,999,512
Multiplier	1.35	1.49	2.12		

Source: TEconomy analysis, 2020 State of Arizona IMPLAN Model

From a state perspective, AZ Extension significantly leverages the State of Arizona's direct Extension funding. For every \$1.00 of direct state funding, AZ Extension generates an additional \$1.63 of funding from other sources. Furthermore, from a total economic impact perspective, the Return on Investment (ROI) is even greater. The operational expenditures of AZ Extension generate a total economic impact of more than \$69.4 million. In terms of generating economic activity in the state, this constitutes an ROI of \$4.87 for every \$1 of state investment.

So, while the expenditure-based economic impacts of the AZ Extension do not measure the overall importance and value of Extension programming and initiatives to the residents and communities of Arizona, as a generator and supporter of economic activity in the state, the expenditure impact of AZ Extension is significant.

The Functional Impacts of AZ Extension

AZ Extension is a diverse organization with a broad mission directed at serving the needs of Arizona. While perhaps best known for work in support of crop and animal production and associated rural development, AZ Extension's work and influence are felt considerably more broadly. AZ Extension has evolved to embrace an expansive mission, seeking to advance not only improvements in specific sectors of the economy but also to provide knowledge to empower societal, family, and individual capacity to thrive in the economic and socio-cultural fabric of Arizona.

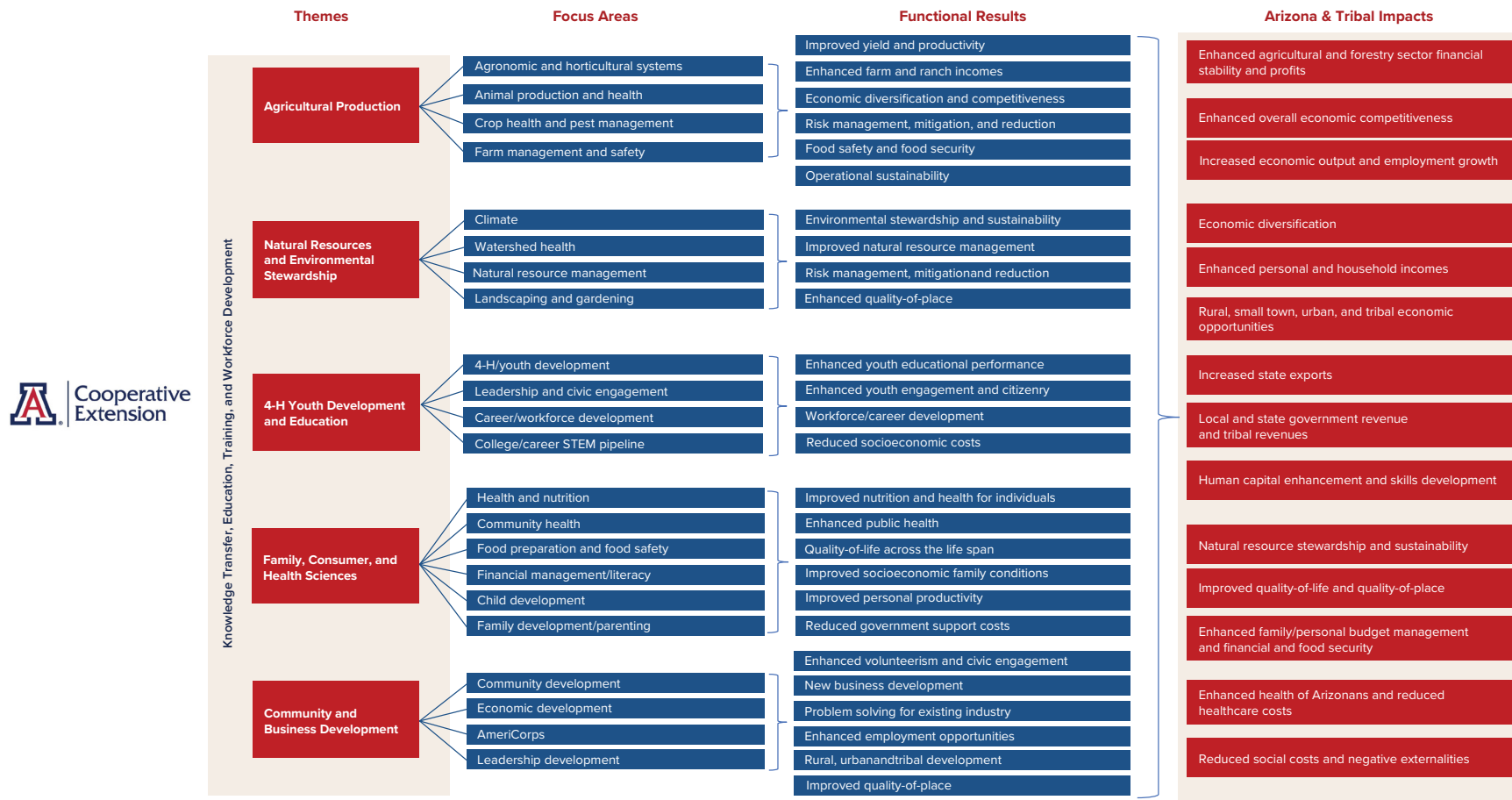
As described in this report, the work of AZ Extension can be segmented across five thematic focus areas:

1. **Agricultural Production** – comprising Extension work focused on enhancing and sustaining Arizona's commercial crop and livestock production.
2. **Natural Resources and Environmental Stewardship** – comprising Extension work to help assure resiliency and sustainability in land and natural resources assets that sustain Arizona's economy and quality of life.
3. **4-H Youth Development and Education** – comprising Extension working to bring research-based, knowledge and programming to youth that enhances educational and personal development outcomes, personal productivity, employability, financial security, and quality of life.
4. **Family, Consumer, and Health Sciences** – where Extension works to empower individuals with the knowledge and skills to make informed decisions regarding their health and nutrition, food preparation and food safety, financial management/literacy, family development, child development, and parenting.
5. **Community and Business Development** – whereby Extension works to provide knowledge and programs that assist both rural and urban communities in their ongoing development.

Each of these primary areas of activity contain multiple programs and initiatives that build and sustain Arizona's economic and social well-being. Services and programs under these AZ Extension themes reach across all 15 Arizona counties and tribal lands. They are made available by AZ Extension to Arizonans 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.



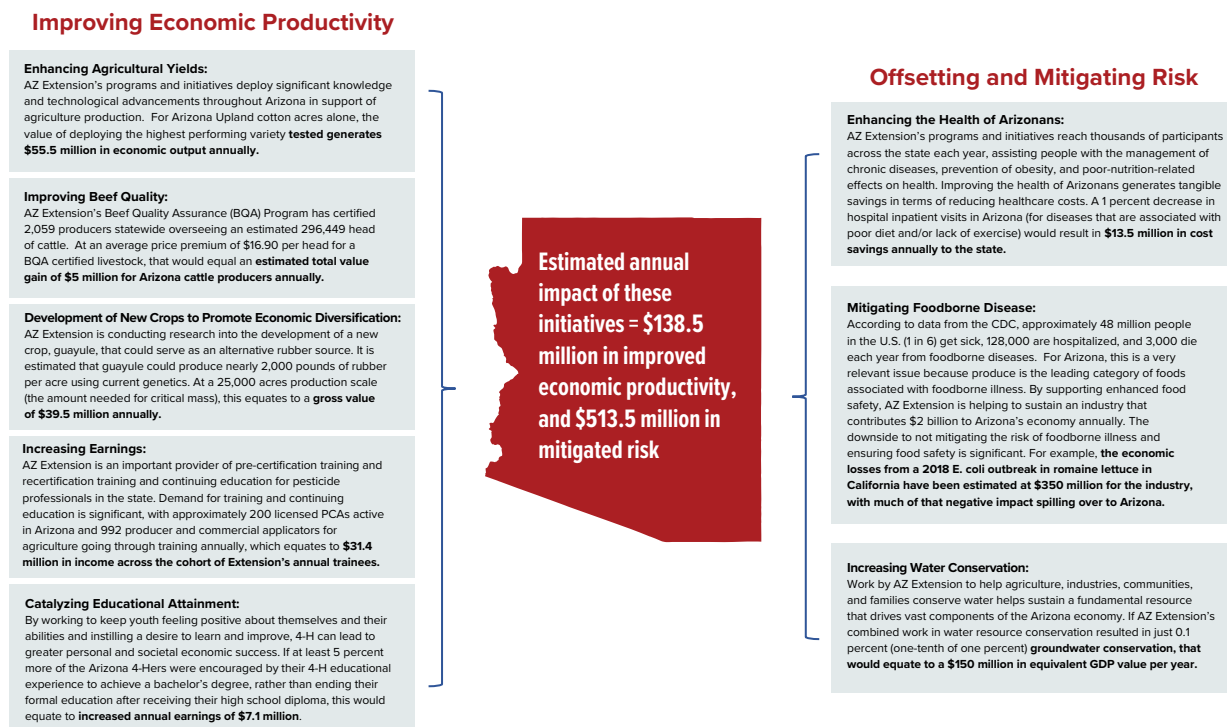
Figure ES-2: AZ Extension Functional (Forward-Linkage) Impacts



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 every day in the lives of Arizonans across the state. As Figure ES-3 illustrates, case studies and estimations used to assess the functional impact of these thematic areas find significant positive benefits for the Arizona economy on an annual basis.

Figure ES-3: Examples of AZ Extension's Impact



Source: TEconomy Partners, LLC.

As Figure ES-3 illustrates, the functional benefits of AZ Extension occur along two pathways. The first is education and programming that leads to improvements in economic and personal productivity, which can be measured in terms of return on investment. The second is more complicated to quantify in that Extension works to prevent large-scale, expensive, negative events from happening. In effect, Extension tangibly prevents financial losses by addressing potential negative events, such as plant, animal, and human diseases, pests, natural resource depletion, etc. In reviewing a handful of examples, one quickly sees the magnitude of the threats that Extension addresses in Arizona.

Conclusion

Overall, the investment in AZ Extension clearly provides a very strong return on investment for the state. For an annual total direct investment of \$14.2 million, AZ Extension initiatives are improving economic productivity annually by \$138.5 million, a nearly ten-fold return. This is in addition to generating a total annual output impact of \$69.4 million through its expenditure of federal, state, local, and private sources, a nearly five-fold return.

As a result, it is clear that AZ Extension is a trusted source of critical, research-based information that it disseminates to a diverse array of audiences across the State of Arizona, thereby serving as a significant economic catalyst for the State of Arizona.



INTRODUCTION

Knowledge Dissemination Drives Progress

Today, ever-increasing complexity is the defining characteristic of the world in which we live. This increase in complexity is directly related to wide-ranging social and business networks, rapidly expanding data resources, web-enabled real-time information access, and the ongoing march of technological advancement that each contributes to a seemingly overwhelming, complex, economic, and societal environment.

As a result, the ability to manage and make decisions within this complex environment has become increasingly more important for economic growth and development. 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. Thirty years ago, the first-ever website was published on the World Wide Web. Fittingly, the site was about the World Wide Web project, describing the Web and how to use it. Today, there are nearly 2 billion websites on the internet, expanding at a pace of approximately 175 new websites every minute. Google is used to perform over 5.6 billion searches each day, or over 63,000 searches per second.

The issue at hand is that so much of knowledge is transferred through diffusion—efforts that are passive and largely unplanned, uncontrolled, and often via unvetted sources. In knowledge diffusion, the onus is on the potential adopter to be able to formulate a question that they may have, know how and where to search for the relevant knowledge that may answer their question, access knowledge when they identify it, critically appraise it, and then apply it to their issue or problem. Negotiating this complex barrage of data 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.

By comparison, knowledge diffusion focuses on communicating information by targeting and tailoring the findings and the message to a particular target audience. 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 are 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 various aspects of the well-being of their citizens.

Against such a background of rapid and dramatic change, can the Cooperative 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.

Land-Grant Universities: Centers of Knowledge Creation and Dissemination

A number of modern economies have a history of investing in higher education and research. However, unique to the United States is an especially important investment that has been made in higher education capacity through the creation and continued support of land-grant universities. The Morrill Act of 1862 provided public lands to states and/or territories that financed the creation of colleges to teach agriculture and mechanical arts. The resulting land-grant colleges provided a path for ordinary citizens to gain the higher education needed to advance their work, their communities, and the economy. Research became embedded in the land-grants through the passage of the Hatch Act in 1887 supporting research and innovation activity. This legislation funded the system of state Agricultural Experiment Stations, which were predominantly set up under the land-grant colleges, providing assets for both general and location-specific research aimed at improving agricultural productivity and the economic value-chain dependent on it.

In 1914, the success of the land-grant colleges was further enhanced through far-sighted legislation forming the Cooperative Extension System to ensure that the expertise and research findings of the land-grant colleges and their experiment station systems were translated into action on the farm and in communities. Extension is paired with the word “cooperative” because it operates as a collaboration between the federal government, state governments, and county governments in supporting knowledge dissemination.

Land-grant universities undertake research and teaching activities similar to their research university peers across the nation, but they add a deliberately organized function that works to proactively carry, or “extend,” university knowledge, recommendations, practice advancements, and technological innovations to audiences outside of the academic environment. Extension, at U.S. land-grant universities, is a dedicated organization and delivery system that has the pragmatic, purposefully designed mission to assure that research-based knowledge is not confined to academic circles but is also deliberately and professionally provided to individuals and organizations across the economy and society who can put knowledge to work. Extension provides outreach and education to individuals and organizations who will benefit from advanced information and knowledge that will enable 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

The Mission of Extension—To Disseminate Knowledge

The University of Arizona was established in 1885 as Arizona's land-grant university. In 1914, with the passage of the Smith-Lever Act, Cooperative Extension was organized in Arizona. Since its creation, University of Arizona Cooperative Extension (AZ Extension) has worked to bring research-based, land-grant developed innovations, advancements, and education to a diverse range of populations.

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 modern agricultural science and technologies, extension contributes to the success of countless farms, ranches, and rural businesses. Further, these services improve the lives of consumers and families through nutrition education, food safety training, and youth leadership development.¹

As the descriptions of Extension suggest, AZ Extension has a diverse and far-reaching mission. Although perhaps best known for work in support of crop and animal production and associated rural development, AZ Extension's work and influence are felt considerably more broadly. AZ Extension has evolved to embrace an expansive mission, seeking to advance not only improvements in specific sectors of the economy but also to provide knowledge to empower societal, family, and individual capacity to thrive in the economy and socio-cultural fabric of Arizona.

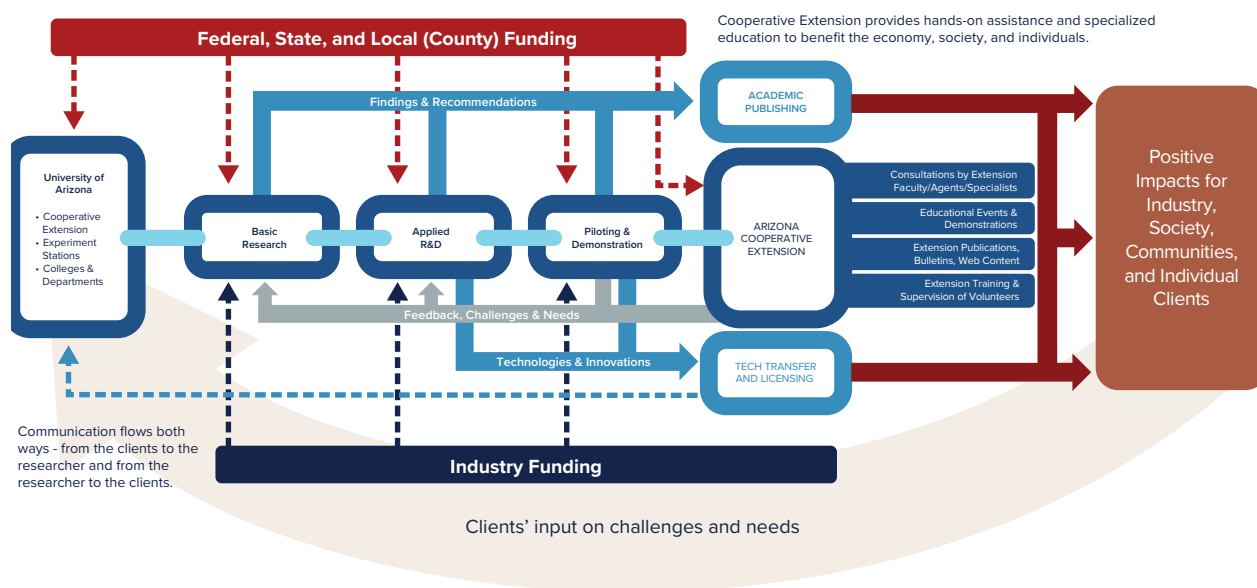
As described in this report, the work of AZ Extension can be segmented across five principal domains of focus:

1. **Agricultural Production** – comprising Extension work focused on enhancing and sustaining Arizona's commercial crop and livestock production.
2. **Natural Resources and Environmental Stewardship** – comprising Extension work to help assure resiliency and sustainability in land and natural resources assets that sustain Arizona's economy and quality of life.
3. **4-H Youth Development and Education** – comprising Extension working to bring research-based knowledge and programming to youth that enhances educational and personal development outcomes, personal productivity, employability, financial security, and quality of life.
4. **Family, Consumer, and Health Sciences** – where Extension works to empower individuals with the knowledge and skills to make informed decisions regarding their health and nutrition, food preparation and food safety, financial management/literacy, family development, child development, and parenting.
5. **Community and Business Development** – whereby Extension works to provide knowledge and programs that assist both rural and urban communities in their ongoing development.

1 <https://nifa.usda.gov/extension>

AZ Extension works across this breadth of focus areas through a sophisticated delivery system that is empowered by a two-way flow of information/innovation and needs identification. In one direction, AZ Extension works to disseminate the research-based innovations and knowledge produced by campus, county, and research station-based faculty and staff to those in Arizona who can best benefit from the information and put knowledge to work for the betterment of the Arizona economy, society, and individuals. The system is particularly effective because it also works in the reverse direction, with county Extension personnel and clientele, in the field and interacting with their local communities, identifying issues and needs for which the university's researchers can work to find solutions. In effect, AZ Extension is operating as an “ecosystem” dedicated to researching solutions to needs and then disseminating knowledge that boosts the Arizona economy and assures the well-being of Arizona communities, families, and individuals. Figure 2 illustrates the general structure of the Extension ecosystem, illustrating the bidirectional 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.

Figure 2: The AZ Extension Ecosystem: A Two-Way System for Enhancing Economic and Social Well-Being



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

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

Recognizing a need to communicate the value, modern relevance, importance, and impact of AZ Extension, the University of Arizona 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 activities to undertake an in-depth independent assessment for the University of Arizona.

This report seeks to provide the following:

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

From an economic perspective, the impacts of AZ Extension are best viewed as comprising two distinct pathways. The presence and operations of AZ Extension generate "economic stimulus" or **expenditure impacts** across the Arizona economy, including all 15 individual counties and tribal lands in which AZ Extension maintains a physical footprint. This "stimulus" occurs via the direct expenditures of AZ Extension and the expenditures of its personnel. The direct and indirect economic impacts on Arizona's business volume (output), employment, and personal incomes generated by AZ Extension expenditures are typically termed "backward-linkage impacts." While AZ Extension obviously does not exist simply to create economic stimulus through expenditures, it is important to note that this impact is not insignificant for Arizona—primarily because a significant portion of AZ Extension funding comes from external (federal) funding sources that then are spent in operations across the State of Arizona.

However, the primary and most important pathway comprises the functional impacts. These **functional impacts** are the reason AZ Extension exists and are driven by the core programmatic missions on which AZ Extension focuses in order to help Arizona's 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, AZ Extension has a substantial track record in contributing to Arizona's overall quality of life and positively impacting the state's economy. As knowledge becomes the foremost driver of modern economies, university Extension activities will likely grow in their crucial importance to economic progress. Strengthening the lives and communities of Arizona through the dissemination of research-based knowledge (activities at the core of AZ Extension's mission) are keys to the long-term competitive sustainability of Arizona's standard of living. The degree to which AZ Extension's work has, and is, contributing to the economic progress in the State of Arizona is the subject of this report.



EXPENDITURE-BASED ECONOMIC IMPACTS OF AZ EXTENSION

The main impact of AZ Extension is created and obtained through the activities that AZ Extension faculty and staff are engaged in throughout the State of Arizona (functional impacts). These activities improve the character and quality of life of thousands of Arizona residents in both rural and urban settings and improve economic performance through the dissemination of knowledge, technologies, and practices.

From a traditional economic perspective, however, AZ Extension also has an “economic impact” on the State of Arizona through its direct operational expenditures and, ultimately, the expenditures of its Extension faculty, other staff, and service providers. In addition, many of these expenditures are then recirculated within the state economy as recipients of the first round of income spend a portion of this income with other businesses and individuals within the subject economy. This spending is termed the multiplier effect (incorporating both indirect and induced economic impacts).

AZ Extension receives support from the federal government, county-based resources, self-generated funds, and allocations from the State of Arizona—and it invests these funds in human capital, resources, and infrastructure to benefit the state. In turn, the expenditures of AZ Extension and its faculty and staff employed within all 15 Arizona counties generate significant economic impact.

This chapter describes the data and methods used to estimate expenditure impacts (known as backward-linkage effects), together with a description of the results and findings of the analysis. The expenditure-based economic impact of AZ Extension on each county and tribal lands can be found in Appendix A.

Measuring Expenditure-Based Economic Impacts—Methodology

The standard analytical technique for the quantification of expenditure impacts is input-output (I-O) analysis. I-O analysis, the technique deployed for impact measurement herein, uses a matrix representation of an economy that quantifies the impact of spending by one sector of the economy on all other sectors, consumers, and government. TEconomy uses software and data systems developed by IMPLAN for the application of I-O analysis. The IMPLAN models are the most widely used in the nation and are based on a number of federal datasets, including data from the U.S. Bureau of Economic Analysis (BEA) and the U.S. Bureau of Labor Statistics.² The I-O methodology allows TEconomy to calculate the expenditure impacts of AZ Extension across multiple measures, including the following:

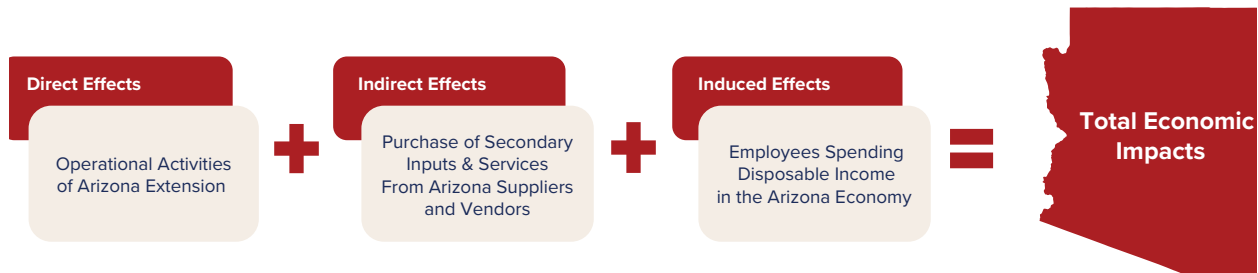
- **Output**, also known as business volume, is the total value of goods and services produced in an economy and represents the typical measure expressed as “economic impact” in a standard economic impact study. For public/nonprofit organizations, including Extension, “expenditures” are the most appropriate base measure of this economic activity.

2 This analysis uses the 2020 State of Arizona model from IMPLAN.

- **Employment** includes both direct employment at AZ Extension (including mission-specific contractors) and the jobs within the economy supported by AZ Extension expenditures (indirect and induced employment).
- **Labor Income** is the total amount of compensation received by labor in the economy because of the presence and operations of AZ Extension via AZ Extension payrolls, contractor payments, and the compensation of other supported employment.
- **Government Revenues** include estimates of revenues generated for county/local and state governments through the direct and indirect economic activity that is generated in the state.

Impact analysis makes use of an I-O model to represent the interrelationships among economic sectors. I-O data show the flow of commodities to industries from producers and institutional consumers for any given geography. The data also show consumption activities by workers, owners of capital, and imports from outside the geography. These trade flows built into the model permit estimating the impacts of one sector on other sectors. These impacts consist of three types: direct effects (the specific impact of the institution and/or sector[s] in question), indirect effects (the impact on suppliers to the focus industry or institution), and induced effects (the additional economic impact of the spending of these suppliers and employees in the overall economy). These three effects combined are considered the total impacts (Figure 3).

Figure 3: Components of Expenditure-Based (Backward-Linkage) Economic Impacts of AZ Extension



Source: TEconomy Partners, LLC

The estimated impacts of AZ Extension operations were calculated using an I-O model from IMPLAN of the State of Arizona (that is, a statewide model).

Each IMPLAN model uses detailed state- and sector-specific information to estimate outcomes and gauge potential impacts. The model incorporates details of 536 individual industry and economic sectors that cover the entire state economy. With these sector possibilities, TEconomy can more precisely model the operations of AZ Extension by aggregating the operational characteristics and production functions of the various aspects of AZ Extension operations.

This economic-impact assessment provides a results table that presents the **direct-effect** values driving the model (based on the employment and operational data provided by AZ Extension), additional estimated **indirect** and **induced effects** capturing the **ripple effect** of the impacts of AZ Extension employment and expenditures on the state economy, and the **total impacts**. An impact **multiplier** is also provided for three model components (**employment, labor income, and output**)—for every single (job or dollar) of direct effect, the multiplier number will equal the total (including the direct effect) number of jobs or dollars created in the state economy. Thus, for example, an employment multiplier of 1.5 would indicate that, for every 1 direct job, an additional 0.5 indirect and induced job is created in the state’s economy.

Finally, the IMPLAN model provides an estimate of county/local and state tax revenues generated by the AZ Extension operations, controlled for issues related to public and nonprofit status and Arizona-specific taxation policies.

AZ Extension’s Employment and Expenditures

Three data metrics are used to drive the economic interactions within the models: **employment** (headcount basis of Extension employees); **labor income** (also called total compensation, including salaries, wages, and the full cost of benefits); and output, which is typically measured for public sector or nonprofit organizations such as AZ Extension as **total expenditures** as they are a truer measure of total direct output than revenues.

Data were obtained from AZ Extension regarding employment and detailed operational expenditures. Additionally, data were captured to reflect the county-level resources involved in operating the county field agent infrastructure (including both additional staffing and expenditures not captured by direct AZ Extension financial reporting).

As shown in Table 1, total funding for AZ Extension reached more than \$37 million in Fiscal Year 2021 (FY 2021). The largest single funding source is direct state funding at \$14.2 million or 38 percent of AZ Extension funding. Core capacity funding for AZ Extension from USDA accounts for an additional 11 percent or more than \$3.9 million in FY 2021. Resources from the county partners provide an additional 7 percent to overall funding reaching nearly \$2.6 million in FY 2021.

Uniquely, among Cooperative Extension programs in the U.S., AZ Extension can significantly leverage its state direct funding with additional grants, contracts, and other sources of self-generated funding. **This additional funding reached nearly \$16.7 million in FY 2021, representing 45 percent of total AZ Extension funding.** The sources of this additional funding ranged from state grants and other locally generated funding/fees (accounting for 67 percent of the additional funding) to competitive federal grants (20 percent), non-profit and philanthropic grants (11 percent), and industry (2 percent). While about half of this additional funding was garnered to support statewide Extension activities, many individual county Extension operations also supplemented their resources with additional external grants and funding.

Table 1: Arizona Extension FY 2021 Operational Funding Sources

Funding Source	Value
State of Arizona (Direct Funding)	\$14,239,660
USDA NIFA Cooperative Extension Capacity Funds	\$3,936,862
Additional County-Based Resources (e.g., direct funds, in-kind)	\$2,575,698
Grants, Contracts, Fees, and Other Self-Generated Resources	\$16,692,361
Total FY 2021 Arizona Extension Operational Funds	\$37,444,581

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

Although the funding sources for AZ Extension provide a picture of their recent operations from a fund-raising perspective, from an economic impact perspective, only actual expenditures that occurred in FY 2021 are examined and modeled. Table 2 provides key parameters included within the economic impact modeling. Across all of AZ Extension, fully 637 individuals are engaged in providing at least some Extension-related Services, while the total number of FTEs is roughly half that amount (about 317 FTEs). Combined, these workers received over \$24.6 million in total compensation (i.e., salaries, wages, all benefits). Beyond personnel expenditures, AZ Extension spent over \$10 million on operational expenditures and annual capital expenditures in FY 2021. The excess funding received in

FY 2021 of roughly \$4.7 million is carried forward to fund efforts in FY 2022 and perhaps beyond. These key inputs of headcount, compensation expenditures, and total operational expenditures become the key drivers of the AZ Extension economic impact analysis.

Table 2: Arizona Extension FY 2021 Headcount and Operational Expenditures

Operational Input Type	Value
Total Headcount (FTE)	637 (316.63)
Total Compensation Expenditures	\$24,649,087
Total Non-Personnel Operational Expenditures	\$7,777,825
Total Capital Expenditures	\$326,603
Total FY 2021 Arizona Extension Operational Expenditures	\$32,753,515

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

Economic Impact of AZ Extension Expenditures

Using these input values, the expenditure-based economic impacts are estimated for AZ Extension's FY 2021 statewide operations (Table 3). The three key driver inputs are all shown in the Direct Effects line of Table 3.

The FY 2021 employment and operations of AZ Extension generated a total economic (output) impact of \$69.4 million. With an output multiplier of 2.12, for every \$1.00 of AZ Extension spending, an additional \$1.12 was generated in the State of Arizona's economy.

The level of this output, consisting of AZ Extension spending, supplier (indirect) spending, and the spending of all-related employment (induced spending) within the Arizona economy generates and supports an additional 221 workers in the state (indirect and induced combined). These workers, in turn, received compensation of nearly \$13 million.

Table 3: Statewide Economic Impact of AZ Extension Expenditures, FY 2021

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	637.0	\$24,649,087	\$32,753,515	\$428,828	\$798,876
Indirect Effect	68.2	\$3,803,637	\$11,740,663	\$195,582	\$260,722
Induced Effect	153.6	\$8,281,018	\$24,915,526	\$787,607	\$939,915
Total Impacts	858.8	\$36,733,742	\$69,409,704	\$1,412,017	\$1,999,512
Multiplier	1.35	1.49	2.12		

Source: TEconomy analysis, 2020 State of Arizona IMPLAN Model

Table 4 extends and summarizes the expenditure-based economic impact analysis down to the county level as well as the six-county Tribal Lands region used for an assessment of the impacts of Tribal Region Extension. While the

presence of AZ Extension statewide operations headquarters can be seen in the total impacts shown for Pima County, fully nine of the 15 counties receive an economic (output) impact exceeding \$1 million.³

Table 4: Summary Economic Impacts of AZ Extension, FY 2021 – Statewide, County, and Tribal Extension

Arizona Region	Direct Operations				Total Impacts		
	Head-count	Total Expenditures	Employment	Labor Income	Output	County/Local Tax Revenue	State Tax Revenue
Statewide	637	\$32,753,515	858.8	\$36,733,742	\$69,409,704	\$1,412,017	\$1,999,512
Apache	13	\$528,687	15.0	\$452,625	\$833,856	\$10,275	\$22,179
Cochise	38	\$1,937,190	47.0	\$1,883,709	\$3,273,004	\$66,404	\$104,085
Coconino	10	\$448,336	12.9	\$540,066	\$916,618	\$19,118	\$26,620
Gila	18	\$873,843	22.1	\$825,836	\$1,477,069	\$28,812	\$38,358
Graham	19	\$957,228	22.5	\$710,166	\$1,468,072	\$29,279	\$53,239
Greenlee	9	\$290,926	9.7	\$290,448	\$424,200	\$4,919	\$6,474
La Paz	7	\$251,331	7.5	\$251,109	\$349,078	\$4,106	\$10,235
Maricopa	70	\$3,900,386	108.4	\$5,694,346	\$11,107,316	\$187,503	\$311,015
Mohave	14	\$430,392	17.0	\$489,128	\$899,331	\$17,506	\$30,469
Navajo	12	\$407,035	14.0	\$416,892	\$707,497	\$13,411	\$23,142
Pima*	282	\$15,820,071	408.0	\$18,319,319	\$36,439,747	\$797,621	\$1,036,721
Pinal	59	\$2,566,532	67.7	\$2,492,402	\$3,947,321	\$76,433	\$101,083
Santa Cruz	41	\$901,257	43.8	\$753,312	\$1,331,872	\$24,024	\$44,020
Yavapai	15	\$998,350	22.0	\$1,060,497	\$2,020,805	\$46,761	\$65,407
Yuma	21	\$1,725,269	28.2	\$1,811,293	\$2,868,427	\$59,844	\$81,859
Tribal (6 County)	9	\$716,682	13.0	\$742,592	\$1,345,491	\$26,002	\$44,606

Source: TEconomy analysis, 2020 IMPLAN Model.

Notes: *Includes Pima County Extension activities as well as University of Arizona Main Campus Extension activities.

Table 5 further examines the economic value of AZ Extension and its impacts. From a state perspective, AZ Extension significantly leverages the State of Arizona’s direct Extension funding. For every \$1.00 of direct state funding, AZ Extension generates an additional \$1.63 of funding from other sources. Throughout the state and in nearly every county, Extension operations generate at least a one-to-one match on their direct state funding.

Furthermore, from a total economic impact perspective, the Return on Investment (ROI) is even greater. The operational expenditures of AZ Extension generate a total economic impact of more than \$69.4 million. In terms of generating economic activity in the state, this constitutes an ROI of \$4.87 for every \$1 of state investment, with ROIs ranging from \$1.83 to \$98.58 in the unique circumstances of Tribal Region Extension.

3 Data on the individual counties’ funding, expenditures, and impacts are provided in Appendix A.

Table 5: Funding Leverage and ROI for AZ Extension, FY 2021 – Statewide, County, and Tribal Extension

Arizona Region	Extension Funding			Total Output Impact	State-Level Economic Activity ROI**
	State Funding	Total Funding	Leverage*		
Statewide	\$14,239,660	\$37,444,581	\$1.63	\$69,409,704	4.87
Apache	\$205,026	\$746,781	\$2.64	\$833,856	4.07
Cochise	\$697,668	\$1,830,557	\$1.62	\$3,273,004	4.69
Coconino	\$300,315	\$581,975	\$0.94	\$916,618	3.05
Gila	\$409,171	\$977,377	\$1.39	\$1,477,069	3.61
Graham	\$303,460	\$1,015,485	\$2.35	\$1,468,072	4.84
Greenlee	\$167,533	\$359,532	\$1.15	\$424,200	2.53
La Paz	\$191,216	\$394,891	\$1.07	\$349,078	1.83
Maricopa	\$1,077,420	\$4,105,386	\$2.81	\$11,107,316	10.31
Mohave	\$154,383	\$986,816	\$5.39	\$899,331	5.83
Navajo	\$167,779	\$776,522	\$3.63	\$707,497	4.22
Pima***	\$7,615,553	\$18,140,883	\$1.38	\$36,439,747	4.78
Pinal	\$1,421,284	\$2,605,197	\$0.83	\$3,947,321	2.78
Santa Cruz	\$172,684	\$1,124,204	\$5.51	\$1,331,872	7.71
Yavapai	\$503,306	\$1,207,482	\$1.40	\$2,020,805	4.02
Yuma	\$839,213	\$1,858,532	\$1.21	\$2,868,427	3.42
Tribal (6 County)	\$13,649	\$732,961	\$52.70	\$1,345,491	98.58

Source: TEconomy analysis, 2020 IMPLAN Model.

Notes: *Leverage = Additional amount generated by AZ Extension for every \$1.00 of State Funding

**State-Level ROI = Total Output Impact/State Funding for Extension.

***Includes Pima County Extension activities as well as University of Arizona Main Campus Extension activities.

Summary

As discussed, the expenditure-based economic impacts of the AZ Extension do not measure the overall importance and value of Extension programming and initiatives to the residents and communities of Arizona. Yet, as a generator and supporter of economic activity in the state, it is worth understanding the extent to which AZ Extension impacts the economy. With total economic impacts exceeding \$69 million and spread throughout the state, AZ Extension indeed drives and leverages funding to allow the AZ Extension faculty and staff to deliver the true value to the state through Extension’s functional impacts.



FUNCTIONAL IMPACTS OF AZ EXTENSION

Extension was founded and is sustained to meet the goals laid out in the original Smith-Lever Act of 1914, as follows:

Cooperative agricultural extension work shall consist of the development of practical applications of research knowledge and giving of instruction and practical demonstrations of existing or improved practices or technologies in agriculture, home economics, and rural energy, and subjects relating thereto to persons not attending or resident in said colleges in the several communities, and imparting information on said subjects through demonstrations, publications, and otherwise and for the necessary printing and distribution of information in connection with the foregoing; and this work shall be carried on in such manner as may be mutually agreed upon by the Secretary of Agriculture and the State agricultural college or colleges or Territory or possession receiving the benefits of this Act.⁴

As the Act makes clear, AZ Extension is a pragmatic organization dedicated to diffusion of evidence-based knowledge and practical training and skills development for Arizonans. Thus, Extension is **purposely designed to produce positive economic and social impacts** for the State of Arizona—impacts that include the following:

- Enhanced productivity and profitability for Arizona agricultural enterprises
- Protected environment and the promotion of sustainability in the state
- Enhanced state and local government revenues through expansion of the Arizona economy
- Improved social conditions and quality of life for residents of Arizona by helping to nurture families, secure financial stability, and promote healthy lifestyles
- Prepared youth who will become the leaders of tomorrow
- Education and promotion regarding the health and nutrition of Arizonans, and
- Engaged and informed citizenry.

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

As an educational system 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 6 provides some of the primary benefits of Extension, in economic terms, as revealed by research.⁵

⁴ Smith-Lever Act. 1914. Section 2.

⁵ Laura Kalambokidis. 2004. “Identifying the Public Value in Extension Programs.” *Journal of Extension*: Volume 42, Number 2.

Table 6: Needs Fulfilled by Public Sector Provision of Extension Efforts

Economic Terms	Explanation	Free Market Outcome	Selected Extension Examples
Imperfect Information	When information available to consumers is poor or inadequate, the government provides information 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.	<ul style="list-style-type: none"> • Soil management education for agricultural producers • Master Gardener training • Pesticide applicator training
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.	<ul style="list-style-type: none"> • Healthcare education • Youth development programs in underserved communities • Nutrition education for low-income families
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.	<ul style="list-style-type: none"> • Erosion control • Wastewater treatment • Youth development • Municipal waste management
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.	<ul style="list-style-type: none"> • Development of non-fossil fuels • Agricultural product development
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.	<ul style="list-style-type: none"> • Disease prevention and control (through nutrition education and food safety training) • After-school programs for children • Financial literacy programs
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.	<ul style="list-style-type: none"> • Knowledge generation at a research university



As Table 1 indicates, AZ Extension fulfills an important public need 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.

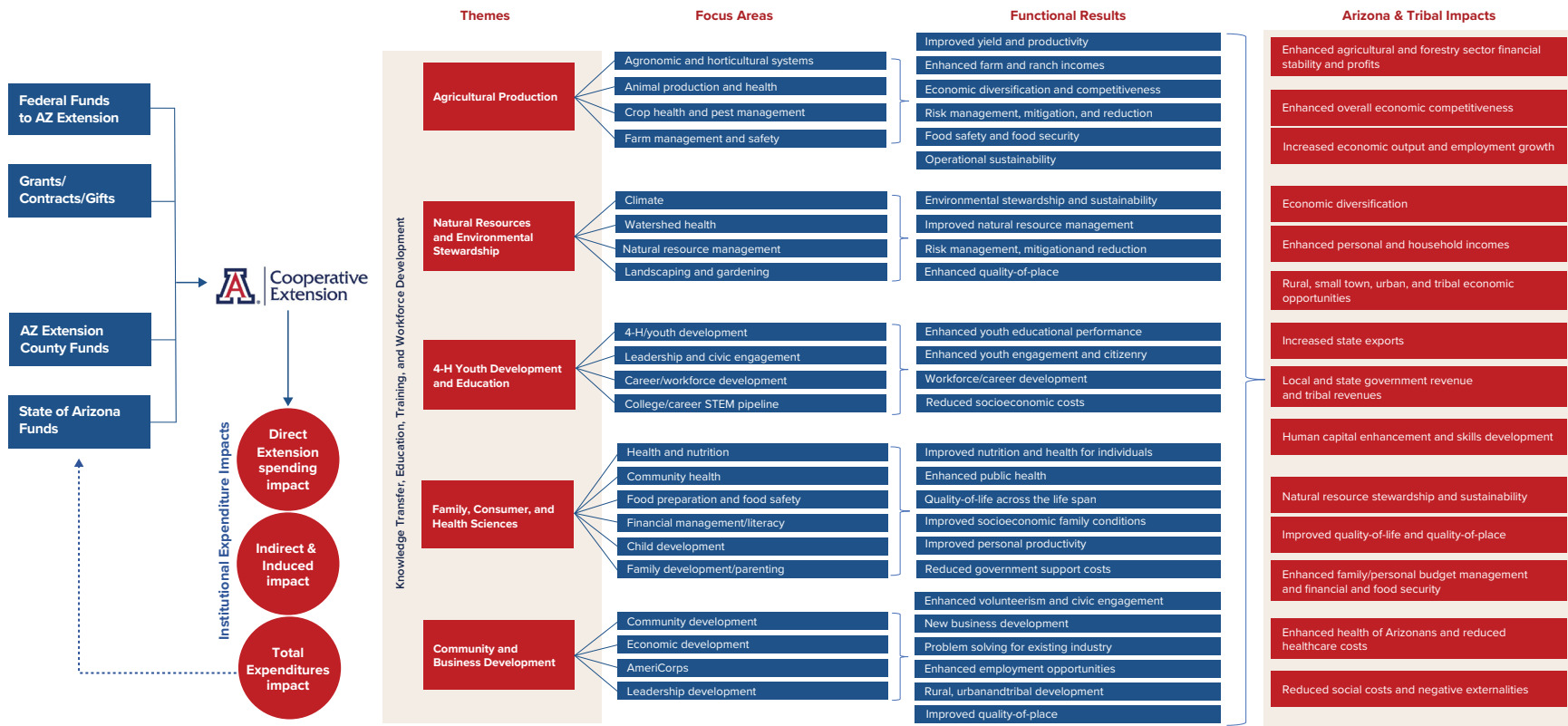
The forward-linkage impacts of AZ Extension are delivered through five primary functional areas:

1. Agricultural Production
2. Natural Resources and Environmental Stewardship
3. 4-H Youth Development and Education
4. Family, Consumer, and Health Sciences, and
5. Community and Business Development.

Each of these five primary areas of activity contain multiple programs and initiatives that build and sustain Arizona's economic and social well-being. Educational programs and initiatives under these AZ Extension themes reach across all 15 Arizona counties and sovereign tribal lands. They are made available by AZ Extension to Arizonans 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 4 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 Arizona, and provides specific examples and case studies of AZ Extension in action and the positive impacts being generated.

Figure 4: AZ Extension Impact Roadmap



Source: TEconomy Partners, LLC.

A key contributor to the effectiveness of Extension is the systems functionality in translating research findings into information useful to many stakeholders (farmers, communities, families, etc.). Extension helps to “put knowledge to work,” providing access to, and proactive transfer of, applied research that improves the economy and society. AZ Extension is very much integrated with the research mission of the University of Arizona, providing knowledge from the field regarding challenges that need to be addressed through research, and performing knowledge transfer to those who need to know, understand, and use applied research information. AZ

Extension benefits from the broad and intensive research activity at the University of Arizona, especially within the Division of Agriculture, Life and Veterinary Sciences, and Cooperative Extension (ALVSCE).

The volume of research performed within ALVSCE in agricultural sciences, natural resources, veterinary science, and associated life science, social science, and engineering disciplines is substantial. National Science Foundation data show the University having \$63.8 million in “agricultural sciences, natural resources and conservation, and other life sciences” research expenditures in 2020, an increase of nearly 17 percent over 2017’s \$54.7 million.⁶ 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 (WoS) data on publications at the University of Arizona for 2017 through 2021.⁷ For disciplines relevant to ALVSCE and the work of Extension, a total of 6,030 publications with University of Arizona authors are evident in disciplines related to ALVSCE’s work—this represents 27 percent of all University-authored publications over the time period analyzed (Table 7). Peer-reviewed publications (as measured in the WoS data) represent the gold standard for academic research, and the data shown on Table 7 help to illustrate the intense levels of expertise and subject matter coverage provided by ALVSCE faculty and research personnel. It should be noted that ALVSCE faculty and Extension staff often publish in WoS categories distinct from departmental and core ALVSCE disciplines. For example, ALVSCE faculty have also published in journals connected to family studies, meteorology, pediatrics, public health, and sports science over this 2017-2021 period.

Table 7: Publications by U. Arizona Authors in ALVSCE–associated Fields (2017–2021)

Web of Science Categories	Number of Publications	Percent of U. Arizona Publications	Publications Quotient ⁸
Environmental Sciences	1,203	5.37	1.46
Ecology	780	3.48	1.95
Water Resources	500	2.23	2.46
Genetics Heredity	374	1.67	1.06
Plant Sciences	370	1.65	1.47
Microbiology	314	1.40	0.90
Biotechnology Applied Microbiology	181	0.81	0.71
Biodiversity Conservation	179	0.80	1.41
Zoology	169	0.75	0.90
Infectious Diseases	168	0.75	0.59
Remote Sensing	166	0.74	1.14
Environmental Studies	161	0.72	1.27
Food Science Technology	158	0.71	0.82
Entomology	155	0.69	1.53
Agronomy	135	0.60	1.14

6 National Science Foundation—Higher Education Research and Development (HERD) Survey, 2020.

7 The Web of Science database maps journals by title and conference proceedings to approximately 250 different discipline-oriented categories ranging from Acoustics to Linguistics to Zoology. The categories captured in Table 7 reflect TEconomy’s experience with core extension-related disciplines.

8 Publications quotient formula: (UA Publications in Discipline/UA 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. A publications quotient higher than 1.0 (in bold type) means that this subject area is more concentrated in the University of Arizona’s volume of research than it is across the universe of U.S. higher education institutions.

Web of Science Categories	Number of Publications	Percent of U. Arizona Publications	Publications Quotient ⁸
Nutrition Dietetics	134	0.60	0.75
Forestry	121	0.54	1.58
Virology	121	0.54	1.00
Green Sustainable Science Technology	107	0.48	0.64
Soil Science	99	0.44	1.82
Limnology	89	0.40	2.16
Veterinary Sciences	74	0.33	0.38
Parasitology	52	0.23	0.63
Horticulture	40	0.18	0.86
Agriculture Multidisciplinary	37	0.17	0.84
Agricultural Economics Policy	34	0.15	1.28
Agriculture Dairy Animal Science	31	0.14	0.35
Materials Science Biomaterials	31	0.14	0.32
Agricultural Engineering	28	0.13	0.94
Mycology	19	0.09	1.10
Totals	6,030	26.93	-

Figure 5 helps to visualize the distribution of research activity, by volume, across various subject matter areas.

Figure 5: Number of Publications by Field in Extension-Relevant Areas at the University of Arizona (2017-2021)



The central, functional characteristics of AZ Extension is that it ensures that the findings, discoveries, innovations, and practice advancements elucidated in the research on Table 7 and Figure 5 do not only reside in the pages of academic journals—rather, Extension is purpose-designed to translate the research findings into pragmatic information and recommendations and transfer the knowledge therein to farmers, ranchers, natural resource professionals, community leaders, public health professionals, families, and others who can put that knowledge to work.

Agricultural Production

Description

Agriculture is, and always has been, a key component of the Arizona economy. Present in every Arizona county, agriculture generated \$3.86 billion in cash receipts in 2020 through the operations of 19,000 farms covering 26.2 million acres (36 percent of Arizona’s land area)⁹. Agriculture within Arizona is quite diverse, with the top products including milk from dairy operations (\$790 million), lettuce (\$725 million), cattle and calves (\$673 million), hay (494 million), spinach (\$114 million), cotton (\$102 million), and melons (\$92 million).¹⁰ The sector is also a generator of income for Arizona through exports, with top exported commodities including vegetables (fresh and processed), leafy greens, cotton, and dairy products.

Primary agricultural commodity sales comprise one component of a far larger economic footprint for agriculture in Arizona. Farms and ranches are part of a multi-faceted value chain that includes the manufacturing and sales of inputs to production agriculture (such as seed, fertilizer, irrigation equipment, etc.); production agriculture itself; and then post-farm gate processing and the manufacturing of food, feed, and biobased products and their distribution. Examining the complete value chain enables the full importance of agriculture within Arizona’s economy to be understood. Detailed analysis performed by the University of Arizona’s Department of Agriculture and Resource Economics found that the total impact of the sector writ large on Arizona’s economy was \$23.3 billion (2014 data), and agribusiness directly and indirectly supported more than 138,000 full- and part-time jobs in the state.

Diverse and benefiting the economy of the entire state and every county, agriculture and the value chain it supports has an outsized impact upon Arizona and Arizonans.

The Need

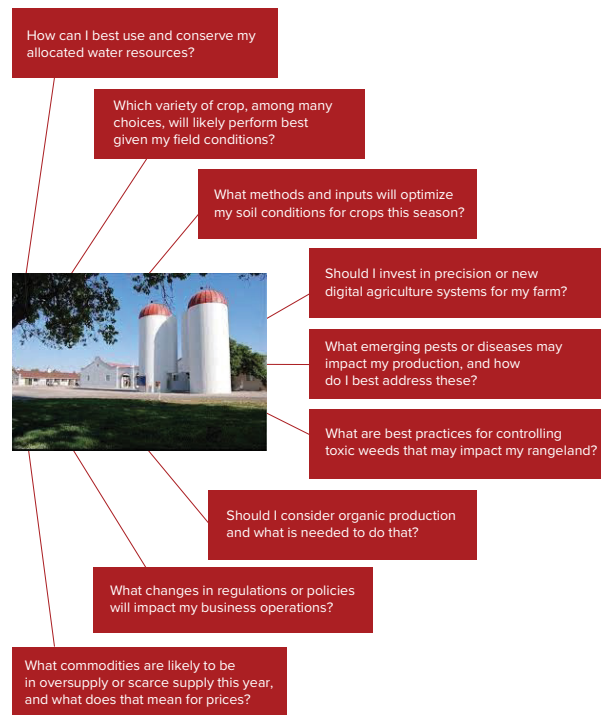
Farmers and ranchers have an exceedingly challenging job. The sector comprises thousands of small and midsize businesses across Arizona—businesses that have generated high levels of productivity within a uniquely variable and challenging production environment. Unlike producers of typical manufactured products, agricultural producers have to work within a dynamic production environment that contains great geographic variety and year-to-year variability, uncertainties, and risks. Unlike other production sectors (such as automobile manufacturing, aerospace, information technology, chemicals, etc.) the industry does not comprise a few large corporations with substantial R&D budgets, but rather comprises thousands of smaller entities that have to rely on R&D, information, and advice produced by external parties. It is a unique industry.

9 https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=ARIZONA

10 <https://economic-impact-of-ag.uada.edu/arizona/> and https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=ARIZONA

For agriculture to thrive and sustain competitiveness, it is imperative that Arizona producers be equipped with the specialized knowledge, skills, tools, and inputs required to produce quality products at competitive prices. Because products take time to grow and process, farmers also have to understand and anticipate changing market preferences and demands, often within a global commodity supply context. To be successful in this dynamic production environment, a producer needs to make informed decisions across a broad range of variables. Indeed, farmers and ranchers face an almost overwhelming series of decisions each year that may make or break their bottom line (some examples are illustrated in Figure 6). It is fair to say that no other category of business faces such a variable and risky production environment and series of decisions that must be made and repeated year after year. There is thus an intense need for producers to access knowledge on best farm management and operation practices, new and emerging technologies, market developments, regulatory requirements, etc. They need access to reliable, research-based solutions that can help them sustain productivity and profitability for their farms and ranches.

Figure 6: Examples of the complex questions that producers consider each growing season.



How AZ Extension Impacts Agricultural Production

Having access to reliable decision-support information and advice is crucial to making informed decisions. AZ Extension serves as an independent, objective provider of research-based information and solutions for Arizona farmers, ranchers, and associated industry professionals. Present in every Arizona county, Extension professionals are indispensable key access points for the information needs of agricultural and natural resource producers, and they are backed up by the full research and knowledge resources of the University of Arizona and its world class Division of Agriculture, Life and Veterinary Sciences, and Cooperative Extension (ALVSCE).

The University of Arizona has been serving the role of trusted advisor to Arizona producers for well over a century. The University began “farmer institutes” in 1901 to advance farming practices, and the Arizona legislature made appropriations to support university work with producers in 1905. In 1915 the legislature empowered Arizona county governments to appropriate funds to support these activities. Together with the federal Smith-Lever Act of 1914, which created Extension operations associated with each land-grant institution, Arizona was able to grow Cooperative Extension at the University of Arizona, incorporating cooperative financial support from the federal government, state government, and county governments. Today’s high productivity, high-impact agricultural sector in Arizona has benefitted every step of the way through professional research, intelligence, expertise, and rigorous advisory and educational programs provided by AZ Extension.

AZ Extension has a particularly challenging responsibility because of the unique demands imposed by the desert environment of its Southwest United States location, and the diversity of the agricultural economy in the state. Among the most diverse states in terms of the agricultural commodities it produces, Arizona sees intensive operations in livestock ranching, dairy production, field crops, and an extremely broad variety of fresh vegetable, leafy green, fruit, and nut

production. Compared to many big agricultural states in the Midwest United States where just two or three crops dominate, Extension in Arizona has to possess expertise and address specific needs and challenges across a broad range of agricultural products. Each commodity and product are different, requiring specialized knowledge of best performing varieties and cultivars, soil and plant nutrient requirements, pest and disease management practices, farming equipment and agronomy and range management procedures.

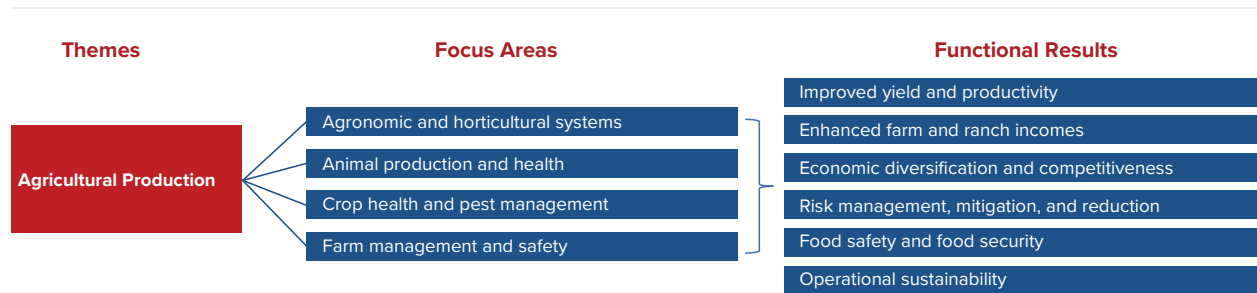
Arizona Cooperative Extension has offices in all 15 Arizona counties and on 5 tribal reservations

Intensifying the challenge for Extension is the huge and varied geography of the state and the individual production systems across this geography. Extension has to understand the varying conditions across the state and the limits and advantages that local production characteristics impart.

Extension is very well-structured to address the diverse needs of Arizona because it is designed to provide a two-way flow of communications and dialog between agricultural producers and Extension personnel. Producers and Extension professionals work to identify needs and opportunities in the field. Extension then relays these to research specialists and faculty at the University of Arizona to investigate solutions and develop research-based innovations. In addition, ALVSCE faculty and scientists, leveraging their resources at the main campus in Tucson and in the University's special network of field (experiment) stations and county offices, pursue novel research projects that provide discoveries and practice innovations that can be applied within Arizona's farms, ranches, and natural resource industries. It is an elegant system, informed by on-the-ground Extension faculty and staff in counties, communities, and tribal lands who have local knowledge and relationships, together with access to Extension Specialists who provide in-depth coverage of specific topic areas in science, technology, agricultural production, economics, and more.

In reviewing the Extension system at the University of Arizona in support of crop and livestock production industries, it is evident that five core themes capture the majority of Extension activities for agriculture. These, in turn, engender a variety of positive functional benefits (results) for Arizona and its citizens (Figure 7).

Figure 7: AZ Extension Functional Impact Themes in Agricultural Production



Source: TEconomy Partners, LLC.

Functional Impact Examples for AZ Extension on Agriculture Production

Discussing every program and activity undertaken by AZ Extension in support of agricultural production would lead to an excessively long and complex report. Rather than attempting to produce a lengthy laundry list of all activities, TEconomy in this (and other functional impact discussions) draws upon selected program examples to illustrate the types and range of functional impacts generated by Extension programming. In the case of Extension work in this theme area, the following examples illustrate the diverse high-impact work taking place. It should be noted that the discussion of work and impacts may blur somewhat the distinction between ALVSCE research (and the associated experiment station system) and AZ Extension because, although there are organizational boundaries, in effect it is an integrated system with Extension faculty and staff often leading or involved in the research. One supports and informs the other, and it is a two-way system of needs identification and information provision (as discussed previously).

Programs focused upon **agronomic and horticultural systems** span a broad variety of activities that provide integrated solutions to cropland management, selection and application of production inputs, approaches to addressing crop stressors (heat, drought, pests, etc.), and farming systems. At their core, these programs are focused on helping farmers maximize their economic returns via enhanced yield, improved product quality, and reductions in the costs of their farming operations.

Program Area: Agricultural Production—Agronomic and Horticultural Systems

Example: Extension Programs in Support of Arizona Vegetable and Leafy Greens Production

Identified Need: There has been an evolution in the types of crops grown over time in Arizona, and no place in the state epitomizes this more than Yuma County. In the past 100 years, agriculture in Yuma has changed significantly:

“The number of acres planted to vegetables has increased nearly seven-fold over the past 100 years while acreage committed to the perennial and full season crops such as citrus, cotton, sorghum and alfalfa has declined by roughly 50 percent.”¹¹

Blessed with a mild winter climate and secure water resources from the Colorado River, Yuma today anchors the winter vegetable production system (along with Maricopa County) and stands as one of the most productive agricultural hubs in the nation. Most of the cropland in Yuma County is now deployed in a multi-crop production system, whereby winter vegetable crops (such as lettuce and spinach) are followed by durum wheat, melons, short-season cotton, or Sudan grass.¹² Yuma County is thus a complex and sophisticated agricultural environment where decision-making comes with high financial stakes. Given the value of the production, Yuma is a location where innovative technologies (physical, digital, and biological) can see early testing and adoption, and where producers have particularly complex decisions to make regarding areas such as variety choice, timing of operations, pest management strategies, new tech adoption, irrigation management, food safety regulations, etc. It is thus an environment with high demand for the expertise and support that AZ Extension provides.

Description of Program: The Yuma Cooperative Extension office has 17 faculty and staff in the county and, as with all Extension County offices, has access to the Extension Specialist faculty at ALVSCE in Tucson and the various Experiment Stations (including two in Yuma County—Yuma Valley and Yuma Mesa, collectively termed the Yuma Agricultural Center). It is a sophisticated operation providing broad coverage of the varied agricultural and horticultural issues specific to the Yuma production complex. Focused Yuma Extension programs are directed towards, for example: plant pathology, weed control, integrated pest management, soil health, water/irrigation resource management, equipment and technology evaluation, on-farm food safety practices, and crop variety testing. The office also sustains programs in focused agricultural education for children, youth, and adults. Extension is very much integrated within the work of the Yuma Agricultural Center, which performs highly applied research of direct relevance to the Yuma agricultural production systems.

11 <http://southwestlivingyuma.yumawebteam.com/industry/history-of-crop-production/>

12 Ibid.

Program Area: Agricultural Production—Agronomic and Horticultural Systems

The Center has nine faculty, and a total of circa 40 personnel, covering plant physiology, crop protection, entomology, plant pathology, weed ecology, soil and water management, fate and transport of environmental contaminants, food safety, and agricultural mechanization. (Further information relevant to work in Yuma agricultural production is also contained in the case study on integrated pest management).

Key Impacts:

- Enhanced agricultural sector financial stability and profits
- Increased economic output and employment
- Economic diversification and resilience
- Rural, small town and urban economic activities
- Increased exports
- Local and state government revenue

Program Area: Agricultural Production—Agronomic and Horticultural Systems

Example: Enhancing and Protecting Arizona Cotton Yield

Identified Need: Cotton is one of Arizona’s leading crops, grown on 129,000 acres of farmland in the state (2020). Producing primarily Upland cotton, with more limited production of Pima cotton, Arizona is also an important producer and exporter of cotton seed. The 2021 USDA State Agricultural Overview for Arizona shows direct value of production for 2020 of \$101.5 million for “Cotton, Upland” and \$42.2 million for “Cottonseed.”

Every growing season, farmers face a key decision in terms of which cotton variety, among many options on the market, they should select for their farm conditions. With margins typically tight in agricultural production, selecting the “right” variety can be a make-or-break decision for producers, as there can be large variation in production yield and realized price (based on quality) between the best performing and least-well performing varieties for any given production environment. Growers thus have a critical need for reliable, independent, research-based information to help inform their decisions on the varieties of cotton to plant on their farms.

Once a high-performance variety is selected and planted, Arizona cotton producers also have to keep their crop healthy and protected from pests. To meet that critical need they require access to research-based solutions for dealing with established and emerging pests.

Description of Program: Cotton Variety Testing

For Upland cotton, AZ Extension’s Upland Cotton Variety Testing Program is the critical trusted resource for growers—providing objective, field-based research results from trials on farms in key cotton production areas of the state. The 2020 trials are reported for six field locations covering prime cotton regions in Yuma, Pinal, Pima, and Graham counties. The trials in each location evaluated the lint yield and various measures of quality (resulting in a price premium in cents per pound) for each variety, ultimately deriving a value of the production per acre for each variety. This latter value measure provides a means to evaluate the potential economic impact of this important research and Extension program. TEconomy has taken the lowest, median, and highest variety value-per-acre metrics for each of the six sites to derive an estimate of the potential return to producers from using the variety trial data. **Averaging across the six locations, the value of deploying the highest performing variety versus the lowest would be \$30,003,470 for 2020’s 119,000 harvested Arizona Upland cotton acres, while the difference between the median and highest performance variety would be \$14,575,120.** Either of these are clearly significant differences in production value, particularly for comparatively low-margin crop, and represent a high return on investment for this program. Using these direct output differentials, estimates of the total potential economic impact effect of this work on the Arizona economy can be calculated using Input-Output analysis. **The results of the I-O analysis are shown in Table 8, indicating that the differential total economic impact potential of the highest versus the lowest performing variety would be \$55.5 million in economic output within Arizona and \$36.5 million in value added in Arizona (contribution to GDP).** For the highest versus median performing varieties, the differential economic impact is approximately halved.

By identifying the top performing varieties and distributing the findings to cotton growers across the state, this Extension program generates significant economic benefits for the producers and the state and represents a resource for ongoing selection of high-performing varieties into the future.

Description of Program: Integrated Pest Management in Cotton

In the 1990's the silverleaf whitefly (*B. argentifolii*) emerged as a break-out challenge for Arizona's important cotton production industry.¹³ The silverleaf whitefly (SWF) is particularly challenging because not only does it deplete phloem supply to the plant, it also secretes a viscous liquid which contaminates lint surfaces with sugars that harbor sooty molds and seriously hamper the downstream processing of lint on high speed milling equipment.¹⁴ The challenge for processors was such that they simply avoided purchasing lint from production regions with SWF, seriously harming the market for affected region producers. The net result was serious reduction in realized prices for Arizona cotton, a reality that persisted even after SWF came under control. The economic costs of SWF to growers in Arizona were well in excess of \$10 million per year¹⁵, and producers were performing heavy, repeated spraying of expensive insecticides in hopes of controlling the pest (with upwards of 12 sprayings a year).

Work by ALVSCE researchers and Extension faculty and staff, through what became known as the Arizona Plan, produced effective IPM approaches for SWF that reduced spraying to "just under 2 foliar sprays required for all pests"¹⁶ representing a 25-year low in pesticide application in 1999. It was noted in Integrated Management of Whiteflies in Arizona, "using 5-year averages pre- and post- introduction of the current IPM plan, cotton growers alone have saved over \$100 million just in SWF control costs."¹⁷ The approaches also worked for vegetable and melon crops also impacted by SWF, increasing horticultural production options for producers in southwest Arizona.

Key Impacts:

- Increased economic output and value-added in the Arizona economy
- Enhanced agricultural sector financial stability and profits
- Sustaining cotton yield in the face of biotic stress
- Increased exports

13 Peter Ellsworth and Steven Naranjo. Integrated Management of Whiteflies in Arizona. <https://cals.arizona.edu/crop/presentations/ellsworthperuwf2002.pdf>

14 Ibid.

15 Ibid.

16 Ibid.

17 Ibid.

Table 8: Results of Economic Impact Analysis for Upland Cotton Production Using Highest Performance AZ Research and Extension Cotton Field Trial Varieties Versus Lowest and Median Performance Varieties.

Differential Economic Impact Via Growth of Highest Performance Versus Lowest Performance Trial Variety

Impact	Output	Value Added
Direct	\$30,003,470.00	\$21,808,941.58
Indirect	\$8,409,021.75	\$4,676,505.66
Induced	\$17,121,577.11	\$10,003,819.45
Total	\$55,534,068.86	\$36,489,266.69

Differential Economic Impact Via Growth of Highest Performance Versus Median Performance Trial Variety

Impact	Output	Value Added
Direct	\$14,575,120.00	\$10,594,372.60
Indirect	\$4,084,944.21	\$2,271,758.27
Induced	\$8,317,339.33	\$4,859,666.86
Total	\$26,977,403.54	\$17,725,797.74

Source: TEconomy use of IMPLAN Input-Output analysis of AZ Research and Extension 2020 cotton trials data.

Program Area: Agricultural Production—Agronomic and Horticultural Systems

Example: Evaluating New Crops to Diversify Arizona Agriculture—Guayule as a New Crop

Identified Need: For much of Arizona, water is a scarce and highly valuable resource. The dry climate of the desert Southwest means that most agricultural crops require significant irrigation to yield a viable crop. Water allocations for parts of Arizona have declined, with further cuts happening, and concerns over depleting aquifers have placed an imperative on developing more water-efficient options for farmers. There is a distinct need to develop new crop alternatives that require lower water inputs while still maintaining economic viability.

Guayule (*Parthenium argentatum*) is a low-water-input shrub native to the arid southwestern U.S.—a plant naturally well adapted to growth in water limited areas. Of course, to be a viable crop, there has to be a use and demand for the crop. Guayule’s key economic value is that it comprises 3 to 5 percent natural rubber (cis-1,4-polyisoprene). The rubber has similar characteristics to the natural rubber sourced from the *Hevea brasiliensis* rubber trees of Southwest Asia. Tire companies and other commercial users of natural rubber have long sought to have their critical supply chain diversified. For the U.S., a domestic supply of natural rubber holds both commercial and strategic appeal. Two major tire companies, Bridgestone, and Cooper Tire & Rubber[®], are pursuing significant programs to develop a guayule rubber industry. Both have a focus in Arizona for their work. As a novel crop there is significant work to be done in developing agronomics, harvesting, and processing practices for guayule. R&D is needed to develop not only extraction and use of the natural rubber, but also potential use of terpene resins (approximately 6 to 7 percent of the plant) and the woody biomass material (the bulk of the plant), known as bagasse, which ideally needs to find economic use (with palletization for biofuels or integration into fiberboard for construction being examined). Potential producers of a guayule crop will have many questions that need to be answered, and AZ Extension will play a significant role in this—helping to develop what could become a significant new industry for Arizona.

18 <https://cen.acs.org/articles/93/i16/Guayule-Rubber-Ready-Hit-Road.html>

Program Area: Agricultural Production—Agronomic and Horticultural Systems

Description of Program: ALVSCE research and AZ Extension is engaged in the project, with large-scale funding provided by USDA to a partnership of Bridgestone with the University of Arizona, Colorado State University, Colorado School of Mines, and New Mexico State University. The University of Arizona is leading research work in relation to genetics refinement and breeding, water use in guayule production, and optimization of irrigation engineering. Bridgestone is engaged with the University's work directly and as an advisor.

A key potential impact of the development of guayule agriculture is that it presents an opportunity for making use of large-scale tracts of agricultural land in Arizona that are currently kept fallow because of a lack of adequate water resources for other crops. In discussion with Extension staff, it was noted that there are some 60,000 acres of land that used to be allocated 4-acre feet of water, that now are only allocated 1.75-acre feet, with more land likely to be added to this water-challenged category. Developing guayule as an alternative crop provides a potential pathway to bringing these lands back into economic production with a new crop that uses circa half the water than other key crops, such as cotton. The commitment of Bridgestone to R&D for this fledgling industry is particularly significant (in addition to the USDA funding), with a \$100 million investment which is, in part, being used to pay farmers to establish the crop. As farmers look to participate, AZ Extension is now providing field days, with more than 200 participants attending so far. Providing basic education on the crop and guidelines for its production, Extension forms a vital component of the ecosystem developing around this novel crop. Current plans for production acreage show a significant anticipated ramp-up within Arizona. For 2022 it is anticipated that between 500-700 acres of guayule will have been established, rising to more than 1,000 acres in 2023, 10,000 acres in 2024, and 25,000 acres by 2026. At the 2026 level of production, volumes produced would be sufficient for a major commercial processing plant to come online.

The production value at the farm gate could be significant. It is estimated that guayule would produce circa 2,000lb of rubber per acre using current genetics.¹⁹ For 2020 the average price of natural rubber per lb. on the Singapore Commodity Exchange (SICOM) was \$0.79 per lb. (\$1.73 per kilogram).²⁰ It can be extrapolated that, at a 25,000-acre production scale, with a 2,000lb per acre yield, and a \$0.79 per lb. value, this equates to gross value of \$39.5 million (\$1,580 acre). It should be noted however, that the extraction process for natural rubber from guayule is more complex and expensive than that for traditional rubber trees, and that will impact the price paid for the guayule crop. Offsetting this somewhat could be development of processes and markets for utilization of the guayule resins and bagasse. These figures (while rough estimates) suggest that guayule as a crop may have the potential to be competitive with a crop like cotton on a realized price-per-acre basis²¹ while having a benefit of using half the water and utilizing land that is currently fallow. To get started, Bridgestone has made a major commitment to establishing guayule as a crop for Arizona producers by paying a guaranteed \$250 per acre over whatever the production costs are for a grower.

Key Impacts:

- Economic diversification and resilience
- Increased economic output and employment
- Unproductive land brought back into production
- Development of value-added processing industries
- Rural, small town and urban economic activities
- Increased exports
- Local and state government revenue

19 Source: <https://www.azcentral.com/story/money/business/2014/10/04/arizona-rubber-plant/16748521/> and <https://www.farmprogress.com/miscellaneous/guayule-future-cropping-option-west-southwest>

20 <https://www.statista.com/statistics/653796/price-of-rubber-per-pound/>

21 In 2020 Upland cotton was harvested on 119,000 acres in Arizona with a reported value of production of \$101,530,000. Source: USDA NASS. This equates to an average value per acre of \$853.19.

Example: Growing Traditional Foods

Identified Need: For centuries, native communities have existed on the natural terrain of Arizona, using farming and knowledge of their land for survival. Today, native culture remains dependent on this knowledge passed down from their elders. For example, participation in traditional life requires traditional foods, which are a healthier alternative to modern processed foods. By merging traditional growing methods with modern science education, Arizona Extension agents play a vital role in helping tribal communities overcome dual crises of both climate change and a broken food system.

Description of Program: Hopi Reservation Extension works with Hopi Tribal Government partners such as the Office of Range Management and the Hopi Office of Youth Affairs, and with non-governmental partners such as the Hopi Pu'tavi Project and the Natwani Coalition, to improve community capacities in the areas of natural resource management, community development, youth education and improved nutrition for disease prevention.²² Extension supports Hopi livestock production, traditional farming, home gardening and youth education.

Example of activities explored by Hopi Reservation and Extension staff include:

- Using traditional growing methods (things like “dry farming,” where crops are grown without irrigation) alongside a modern, science-based education.
- Using “diversity, rotation and rest” practices with livestock that were used successfully by indigenous communities as ways of hunting, gathering and growing food in the area.
- Limiting the number of cows and livestock on the land and rotating them frequently.
- Managing animal grazing habits to improve soil and keep grass in vegetative states.

In the San Carlos Apache Reservation, FRTEP programs support education on native traditional planting, gardening basics, seed saving, farm-to-school policy, food preservation, adapting resources and curricula into the Apache language, and youth activities exploring agriculture and natural resource careers. Extension helped start a small hoop-house and have since begun re-introducing foods through programs where participants learn how to plant crops such as traditional Apache squashes and corns using old techniques, as presented by community leaders during gardening sessions.

Key Impacts:

- Increased food sovereignty and access to fresh and preserved local foods using local resources
- Increased use of traditional growing methods
- Improved soil, air, water, and environmental quality
- Enhanced connections between younger and older Tribal residents

22 <https://tribalexextension.org/project/hopi/>

Example: Beef Quality Assurance

Identified Need: The grazing and herding of cattle has been a signature component of agriculture in the Southwest U.S. since the 1800's. The production of beef cattle, and cow/calf operations, continue to contribute to the Arizona economy through continuation of a long ranching tradition. The USDA National Agricultural Statistical Service (NASS) data for Arizona show that on the 1st of January 2022, Arizona had a total of 960,000 cattle, including calves, in the state.

Key to successful ranching and cow/calf operations is realizing a good price for the cattle reared. Buyers will pay a premium for high quality cattle—cattle reared under robust quality standards to assure a high-quality product. To provide assurance of quality beef production practices, the Beef Quality Assurance (BQA) certification program was developed as a national program funded by Beef Checkoff dollars and designed to “help beef producers market their cattle, demonstrate commitment to food safety and quality and emphasize the importance of responsible cattle management, care and animal handling.”²³ A research study titled, “Effect of Mentioning BQA in Lot Descriptions of Beef Calves and Feeder Cattle Sold Through Video-based Auctions on Sale Price,” conducted by researchers at Colorado State University (CSU) “undertook to determine if sale prices of beef calves and feeder cattle marketed through video auction companies were influenced by the mention of BQA in the lot description. Partnering with Western Video Market, CSU reviewed data from 8,815 video lot records of steers (steers, steer calves and weaned steers) and heifers (heifers, heifer calves and weaned heifers) sold in nine western states from 2010 to 2017.”²⁴ The results of the CSU study revealed a significant premium of \$16.80 per head for cattle that had BQA listed in the lot description compared to no mention and holding other factors constant.

Description of Program: AZ Extension has been a participant in the Beef Quality Assurance (BQA) program working to proactively educate producers in the production strategies proven to maintain and improve beef quality. Because quality beef commands higher market prices, there is a demonstrable return to producers who are able to raise their product quality. Increasingly, buyers are seeking producers having BQA certification, and Extension is fulfilling a vital role for AZ ranchers in its development and delivery of these training and certification programs. As noted above, the 2019 study by Colorado State University demonstrated that cattle with BQA listed in their lot description command a premium of \$16.80 per head.

AZ Extension reports that 2,059 producers have been certified under the Beef Quality Assurance program statewide. If we assume that one person will achieve the certification to cover a farm's operations under the program, that would represent 29.2% of the farms in Arizona that have a cattle/calf inventory (there were 7,057 farms with a cattle/calf inventory in Arizona reported in detailed USDA NASS statistics for 2017). With a total number of 1,015,237 head of cattle in the state, proportionately this gives an estimate of 296,449 head of cattle likely produced on a farm with Beef Quality Assurance certification. At an average price premium of \$16.90 per head for a BQA certified livestock, that would equal an estimated total value gain of \$4.98 million for Arizona cattle producers through the program.

Key Impacts:

- Enhanced quality of beef, increasing the ability of Arizona beef to command market price premiums
- Increased economic output and value-added in the Arizona economy

23 “BQA Study: Effect of Mentioning BQA in Lot Descriptions of Beef Calves and Feeder Cattle Sold Through Video-based Auctions on Sale Price.” Colorado State University.

24 Ibid.

Example: The Navajo Beef Program

Identified Need: Historically speaking, agriculture and livestock have always been essential to the development of the Navajo Nation's society and economy.²⁵ Many ranchers in the Navajo Nation have herds of cattle, but their management practices vary greatly. Furthermore, many ranchers may struggle to gain premium pricing for their cattle due to inconsistent range, livestock management, and issues created by complex land ownership and access.

Description of Program: Since 2012, the Navajo Beef Program has been a cornerstone of the University of Arizona FRTEP program. Each year, Extension staff recruits, educates, and certifies producers for the program using established guidelines on Beef Quality Assurance (BQA), record keeping, marketing and range management.²⁶ This process allows native ranchers to uphold traditional practices to produce premium, quality beef that is both tender and flavorful: all Navajo Certified Beef is Choice grade or better and aged 21 days.²⁷ The program also works with Future Farmers of America (FFA) programs at high schools, with a focus on helping students whose parents are ranchers learn about improving beef quality, the importance of vaccination, herd genetics and other best practices.

The meat is bought directly from a Texas-based food distributor called Labatt Food Service who pays well over the market price, plus a premium for animals that reach premium grades. In the fall, Navajo cattle are picked up and taken to feed yards in Nebraska, where they are fed a diet mainly comprised of grass so they can be marketed as grass fed beef. The cattle are then processed in Colorado, followed by transportation to New Mexico for further processing and butchering. The primary customer for Navajo Beef is restaurants and casinos, who purchase these high-quality cuts of meat for a considerable premium. Navajo Beef is served at the Firerock, Northern Edge, and Twin Arrows casinos, as well as restaurants across Dallas-Ft. Worth, Albuquerque, San Antonio, and some grocery stores.

As of 2021, 80 Navajo Nation producers are participating in the program, with 1,200 total head of cattle.²⁸ Previously, the average Navajo producer was receiving \$500 per cow. However, after the Navajo Beef Program intervention, the average participant receives \$1,000 per head of cattle. This suggests that the total revenue from the Navajo Beef program is \$1.2 million, spread across 80 producers. This amounts to \$15,000 per producer, and an additional \$7,500 more per producer than prior to the program.

Key Impacts:

- Enhanced quality of beef, increasing the ability of Navajo beef to command market price premiums
- Increased economic output and value-added in the economy

25 <https://www.agriculture.navajo-nsn.gov/>

26 Interview with Extension Staff

27 <https://web.labattfood.com/articles/23-million-for-navajo-ranchers-through-beef-program>

28 Interview with Extension Staff

Example: Arizona Livestock Incident Response Team (ALIRT)

Identified Need: A series of common diseases impact livestock herds, including beef cattle. Typically, ranchers are able to identify the most common and then address them directly or with their veterinarian. There are also, however, uncommon diseases, some of which have the potential to be devastating to U.S. livestock production—diseases such as Anthrax and bovine spongiform encephalopathy (BSE), for example.

The goal, in both common and uncommon diseases, is to identify disease early, before it spreads through an entire herd and causes significant economic losses. To address this need, livestock producers need access to expertise in livestock infectious diseases, toxicology, and other fields necessary to quickly identify causative agents in unexplained livestock deaths.

Description of Program: The Arizona Livestock Incident Response Team (ALIRT) is a collaborative program developed to advance the rapid diagnosis of unexplained livestock deaths. The program is a partnership between AZ Extension, the Arizona Department of Agriculture, Arizona Cattlemen's Association, and the USDA. Ranchers who find deceased livestock for which there is not a readily apparent cause of death can reach out to their Arizona County Cooperative Extension Office, an ALIRT-certified veterinarian, or their local Arizona Department of Agriculture Livestock Office (if they are unable to have their own veterinarian rapidly respond). Under ALIRT, a trained expert will visit a ranch to examine an unusual livestock event and conduct an investigation, including collection and analysis of laboratory samples if needed. Depending on the suspected cause of death, other Extension expertise can then be tapped, such as poisonous weed or environmental toxicology experts.

In a best-case scenario, ALIRT will never have to address an outbreak of high economic or public health concern such as foot-and-mouth disease, BSE, or other foreign invasive diseases reportable to the USDA Animal and Plant Health Inspection Service (APHIS). However, in the rare event that does occur, ALIRT is in place and ready to intercept the challenge as early as possible. A fast response can mean the difference between a contained disease in a handful of animals and the destruction of entire herds. The economic impact of an averted outbreak can be extremely costly. During the BSE outbreak in the 1990's in the United Kingdom, over 4 million cattle had to be killed (equivalent to more than 23 times the entire beef cattle inventory in Arizona). A study by Kansas State University examined the negative impacts associated with a BSE outbreak after a single dairy cow in Washington State tested positive for BSE on December 23, 2003.²⁹ The study found that within days, 51 countries had banned U.S. produced beef (with exports accounting for 9.6 percent of beef production), and domestic beef prices declined by 16 percent in just a week. Outbreaks can have a long-term impact on consumer confidence in a product, causing sustained suppression of the market.

Key Impacts:

- Enhanced biosecurity for Arizona's livestock production industry
- Reduced economic losses associated with spreading mortality or morbidity events

29 Brian Coffey, et al. 2005. The Economic Impact of BSE on the U.S. Beef Industry: Product Value Losses, Regulatory Costs, and Consumer Reactions. Kansas State University Agricultural Experiment Station and Cooperative Extension Service. <https://krex.k-state.edu/dspace/bitstream/handle/2097/12460/EconomicImpactofBSE.pdf?sequence=1&isAllowed=y>

Example: Integrated Pest Management (IPM)

Identified Need: Operating largely in open field environments, agricultural and horticultural production is negatively impacted by a host 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, bacteria, and viral pathogens) and insect pests, individually and together, can have devastating effects on producer profitability. The challenge of integrated pest management in Arizona is particularly significant, because in a number of large production sectors in Arizona agriculture (most notably horticultural production of vegetables and fruit), consumers have almost zero tolerance for visible pest damage to produce or insect residuals on the crop after treatment.

Description of Program: AZ Extension is on the front lines with producers to combat diseases, pests, and weeds—working to provide research-based, scientific information on technologies and best practices to inform producer decision-making. AZ Extension faculty and staff are available to diagnose issues brought to them by producers and are backed-up by Extension Specialists with expertise in integrated pest management (IPM), entomology, plant pathology, weed science, and associated disciplinary skills.

The high value of Arizona's horticultural crops (vegetables and fruits) can lead producers to overspray pesticides in hopes of avoiding insect damage. Extension works to better inform pesticide use and application practices to avoid the cost and environmental impacts of overuse, and the risks of pests developing resistance to overused pesticides. This is a complex task, as the leafy greens farming sector alone comprises some 30 crops impacted by a broad range of pests such as aphids, thrips, caterpillars, and flies. In addition, multiple plant pathogens and weeds must be controlled in the Arizona production environment. As noted by the University of Arizona IPM team: "Vegetable IPM programs in Arizona have resulted almost exclusively through the efforts of several University of AZ Extension specialists and agents who have developed research-based information on pest biology, ecology, and management."³⁰

An example of Extension's work in IPM serves to illustrate the program's positive impacts. The Bagrada bug (*Bagrada hilaris*) is a pest insect native to Africa and south-central Asia. An invasive pest, it was first found in California in June of 2008, identified in Yuma, Arizona in September 2009, and then subsequently found in other parts of Arizona. Nymph and adult Bagrada bugs use piecing mouth parts and damage the leaves and growing points of plants. Researchers found the pest causing damage to Arizona broccoflower, broccoli, cabbage, cauliflower, Chinese cabbage, kale, radish, rutabaga, collards, arugula, turnip and mustard.³¹ Furthermore, adult bugs were reported on lettuce, spinach, cantaloupes, sugarbeets, and watermelons. At the time of first infestation in Arizona, little was known about the pest's biology or plant preferences, and detailed study had to be performed by the University to rapidly characterize the pest and to develop management strategies for it. AZ Extension has been able to provide pesticide and cultural practice recommendations for control of the Bagrada bug. With producers finding 15-35 percent yield loss in some crops such as cabbage, cauliflower, and broccoli³² due to Bagrada bug damage, the work of Extension to control this invasive pest holds substantial economic value. In 2020, for example, Arizona production of cabbage was valued at \$56.1 million, cauliflower at \$76.9 million, and broccoli at \$87.5 million (\$220.5 million combined). At a low range loss of 15 percent of the crop, the value saved through control of Bagrada bug equates to \$33.1 million, and a level of 35 percent loss would equate to \$77.2 million.

Many other examples of University of Arizona IPM work sustaining the economics of Arizona agriculture are evident. In 2016/17, for example, the diamondback moth (*Plutella xylostella*), a global pest, emerged as a new pest impacting Arizona's vegetable industry (with almost all cruciferous vegetable crops susceptible to the pest, including broccoli, Brussels sprouts, cabbage, Chinese cabbage, cauliflower, collard, kale, kohlrabi, mustard, radish, turnip, and watercress). Extension and ALVSCE researchers worked to identify the cause of its emergence in Arizona, examined pesticide options and cultural practice options for its control, and after rolling out formal recommendations to producers, the pest was controlled.

30 <https://vegetableipmupdates.arizona.edu/>

31 https://cals.arizona.edu/crops/vegetables/advisories/docs/Bagrada_bug_2010_Palumbo.pdf

32 Ibid.

Program Area: Agricultural Production—Crop Health and Pest Management

It should be noted that IPM for vegetables is a prime example of the role of the University of Arizona’s integrated system of research, experiment station and Extension capabilities. Experimentation cannot be performed on active farms, where experimental sprays or practices may cause production challenges. Having the Yuma Agricultural Center and laboratory resources provides a means for ALVSCE to develop and test solutions specific to the needs of regional producers without impacting their daily production. This resource also allows the university to work on practices for emerging growth areas in the industry, such as organic production, which require novel approaches to IPM.

Key Impacts:

- Large-scale economic and environmental benefits
- Enhanced agricultural sector financial stability and profits
- Increased/protected economic output and employment

Program Area: Agricultural Production – Crop Health and Pest Management

Example: Pesticide Use and Application Training

Identified Need: Combatting pests, especially at a commercial level, often requires appropriate application of pesticides. Typically, pesticides are chemical compounds specifically formulated to target a specific pest or provide a broad spectrum of control. Nearly all comprise a complex mix of active and inert ingredients, with the pesticide designed for efficacy via specific recommendations for application technique, dose, timing, storage, and disposal. Federal regulations require labeling of the product that specifies their allowable use. Pesticides are an effective tool for controlling pests but, with over \$1 billion pounds of pesticides used in the United States each year, there is significant risk of their misuse or mishandling, potentially harming the environment and human health. Acute exposure to certain pesticides may result in poisoning, leading to serious health issues for those exposed, and long-term exposures may have chronic health impacts and create increased risk for developing cancers. Because of these risks, particularly for those in farming or the commercial application of pesticides (those with the potential to be exposed at scale), professional training in safe handling, use, and application procedures is crucial—and often mandated under law, which requires initial training leading to certification as an applicator and ongoing continuing education to sustain certification status.

Arizona and California have specific rules and regulations governing the use of agricultural chemicals, including pesticides. In effect, the application of pesticides is governed by a “prescription” program whereby the type, volume, and application of a pesticide has to be approved by a Pest Control Advisor (PCA). A PCA is a licensed, professional production consultant serving agricultural and horticultural producers in Arizona (and similarly in California). PCAs provide written pest management recommendations that enable producers to then use the necessary chemicals. In addition to the PCA professionals, a second group of certified professionals in Arizona may then apply the prescribed pesticide. Whether an agricultural producer doing their own applications, or a commercial pesticide applicator, formal certification requirements have to be met through testing.

Description of Program: AZ Extension is an important provider of pre-certification training, recertification training, and continuing education for pesticide professionals in the state. Demand for training and continuing education is significant: Annually, in Arizona, approximately 200 licensed, active PCAs and 992 producer and commercial applicators for agriculture complete training. ZipRecruiter data indicate pesticide applicators earn on average \$31,655 per year in Arizona (March 2022 data)³³, so 992 applicators receiving training equates to income potentials of \$31.4 million across the cohort of Extension’s annual trainees.

Key Impacts:

- Enhanced public health and safety
- Environmental sustainability
- Enhanced agricultural sector financial stability and profits
- Increased economic output and employment

33 <https://www.ziprecruiter.com/Salaries/Pesticide-Applicator-Salary--in-Arizona>

Example: Food Safety

Identified Need: According to data from the Centers for Disease Control and Prevention (CDC), approximately 48 million people in the U.S. (1 in 6) get sick, 128,000 are hospitalized, and 3,000 die each year from foodborne diseases.³⁴ For Arizona, food safety is a very relevant issue, because produce is the leading category of foods associated with foodborne illness (involved in 46 percent of cases, according to CDC studies).³⁵

In 2011, seeking improvement to food safety, Congress enacted the Food Safety Modernization Act (FSMA). In part, the FSMA is a response to the increasing globalization of the food supply system, but it also aims to enhance procedures within domestic food production. AZ Extension has long been engaged in activities focused on food safety across the production supply chain—from farm production all the way through to final safe food preparation in home, institutional, and commercial kitchens. Arizona has a safe food system (and Extension has contributed to that safety), but FSMA recognizes the reality of global supply chains and foreign produced food entering our system, and that even domestic procedures can be improved to reduce the public health burden associated with foodborne illnesses.

The Food Safety Modernization Act is quite complex, comprising seven individual rules that cover different aspects of food safety. The large-scale legislated rule changes under FSMA, effectively impacting the entire food production and supply chain, created substantial demand for information on rule requirements, best practices in effectively addressing the requirements and in adapting current practices, compliance issues, etc. AZ Extension has responded with reliable education, information, and hands-on guidance.

Description of Program: A key component in Arizona's compliance with FSMA is participation of producers in an On-Farm Readiness Review (OFRR). The OFRR is a non-regulatory, confidential assessment of a farm's readiness for compliance with the FSMA Produce Safety Rule. Through participating in the program, which is delivered jointly by representatives of AZ Extension and the Arizona Department of Agriculture, producers are assisted in determining areas of risk they can address with an on-farm review performed walking through pre-harvest, harvest, and post-harvest activities to review procedures and practices and identify areas in need of mitigation or further attention. This program helps producers prepare for formal inspection by the Food and Drug Administration (FDA) and avoid downtime and other challenges associated with inspection issues.

AZ Extension also operates a Microbiology Food Safety course custom-designed for the food safety community in the food value chain across the state. A prime, but not sole, focus of its work is on the intensive fresh produce production industry in Maricopa and Yuma counties. The Maricopa Agricultural Center and Yuma Agriculture Center collaborated to develop a customized curriculum to educate their regional food safety communities on "basic microbiology concepts, pathogenic contamination and current food safety research."³⁶ This Extension program covers two main modules: the first, an "Introduction to Microbiology," covers key topics that include bacterial classification, factors in bacterial growth, and specific bacterial pathogens; the second, "Intermediate Microbiology," focuses on human pathogens.

Specific to produce production, FSMA's Produce Safety Rule (PSR) requires farmers to set an initial Microbial Water Quality Profile (MWQP) for each untreated surface water and/or ground water source that is used to provide a direct water application on covered produce (other than sprouts). "Growers must also conduct annual surveys for each water source in subsequent years to develop a rolling geometric mean and determine continued PSR compliance."³⁷ Extension has helped address the MWQP requirement through development of several tools for grower use. The tools also explain PSR requirements in detail, help assess current compliance, and "offer guidance on mitigation steps, and offer guidance on the application of die-off days to assist growers with making food safety management decisions if a water source does not meet PSR requirements."³⁸ Tools developed include a "Ag Water App," a FSMA Produce Safety Rule Online Calculator, and Microsoft Excel calculators for untreated surface waters and ground waters.

34 <https://www.cdc.gov/foodborneburden/index.html>

35 <https://www.cdc.gov/foodborneburden/attribution/attribution-1998-2008.html>

36 <https://www.cals.arizona.edu/fps/node/57>

37 Ibid.

38 Ibid.

Program Area: Agricultural Production—Farm Management and Safety

By supporting enhanced food safety, AZ Extension is helping sustain an industry that contributes \$2 billion to Arizona's economy annually.³⁹ The downside to not assuring food safety can significantly impact the industry, and the economic losses from a 2018 E. coli outbreak in romaine lettuce in California have been estimated at \$350 million for the industry, with much of that negative impact spilling over to Arizona.

Key Impacts:

- Human capital and skills development
- Enhanced human health and reduced healthcare costs
- Reduced negative economic costs, social costs, and externalities

THE FUNCTIONAL ECONOMIC IMPACT OF AZ EXTENSION IN AGRICULTURE: EXAMPLE OF THE ECONOMIC IMPACT ASSOCIATED WITH EACH ONE-PERCENT INCREASE IN PRODUCTION IN ARIZONA.

As seen above, AZ Extension is sustaining and enhancing agriculture and agriculture-related economic activity in Arizona. Via Extension, individuals working in agriculture and related industries have access to high quality and unbiased research, education, and training. This access helps producers introduce new production practices, new products, and production technologies. It directly improves farm and ranch business performance and sustainability in the state. The long-standing work of AZ Extension in the agriculture sector, and the dedicated resources of Extension and the University of Arizona research enterprise, applied to improving and growing the agriculture and associated agribusiness sectors of the state economy, mean that Extension's work has an annual impact on state economic performance.

To identify a potential scale of this impact, TEconomy analyzed the effect that each 1 percent increase in total agricultural production would have on the economy of Arizona. Given the wide range of programs provided by Extension to the agriculture sector in Arizona, it is highly likely that Extension's educational programs and initiatives generate more than a 1 percent benefit in terms of agricultural output in the state on an annual basis—however, the use of a conservative 1 percent estimate serves as a baseline for considering the significant impacts of improving agricultural sector performance within the Arizona economy. The impact of a 1 percent agricultural production increase in the state is discussed in detail in the textbox.

39 Heather van Blokland. "FDA Releases E. Coli Report on Romaine Lettuce Contamination." KJZZ.org. June 1, 2020.



The Economic Impact of a 1 Percent Increase in Agricultural Output in Arizona

Use of the IMPLAN Arizona Input-Output models enables TEconomy to quantify the total effect on Arizona's economic output, employment, and other variables of an increase in agricultural output (dollar value). The analysis performed by TEconomy details the impact of a 1 percent increase in output for the agricultural sector overall, and sub-sectors comprising the crop and livestock components of the industry.

In terms of total agricultural production, a 1 percent increase would generate the following impacts:

- **\$68.8 million increase in total Arizona economic output, comprising direct, indirect, and induced impact components.**
- **\$36.2 million increase in value-added within the Arizona economy (contribution to State GDP).**
- **504 jobs created and supported.**
- **\$23.7 million annually in additional labor income for Arizonans.**

Examining the **animal production** industry subsector shows the potential impact of a 1 percent increase in this subsector. The impact of a 1 percent increase in the livestock industry would be:

- \$29.6 million increase in Arizona economic output.
- \$13.9 million in value added within the Arizona economy.
- 134 jobs created and supported.
- \$8.5 million in additional labor income.

For **crop production** the impact of a 1 percent increase in direct production output would be:

- \$39.2 million increase in Arizona economic output.
- \$22.3 million in value added within the Arizona economy.
- 370 jobs created and supported.
- \$15.2 million in additional labor income.

Natural Resources and Environmental Stewardship

Description

Technologies change, the economy cycles, and people come and go, but the one fixed and permanent asset that Arizona possesses is its land. Covering 114,000 square miles, Arizona is the 6th largest state by surface area in the U.S. This land is diverse in its topography, climate, and ecosystems—spanning from the desert and desert grasslands of its southern region, through to rising uplands in the central area of the state and the Colorado Plateau and significant mountainous high country in the Northwest region. The landscape and its flora and fauna change significantly as the state is traversed. Indicative of the unique diversity and significance of Arizona’s natural landscape and ecosystems, there are 24 National Park Service sites in the state, including three National Parks (Grand Canyon, Saguaro, and the Petrified Forest). This unique landscape and its natural resources require careful consideration in terms of its use and the consumption of its resources. Soils require careful management to avoid degradation, niche ecosystems can be delicate and easy to unbalance, and precious water resources have to be very carefully managed, for example.

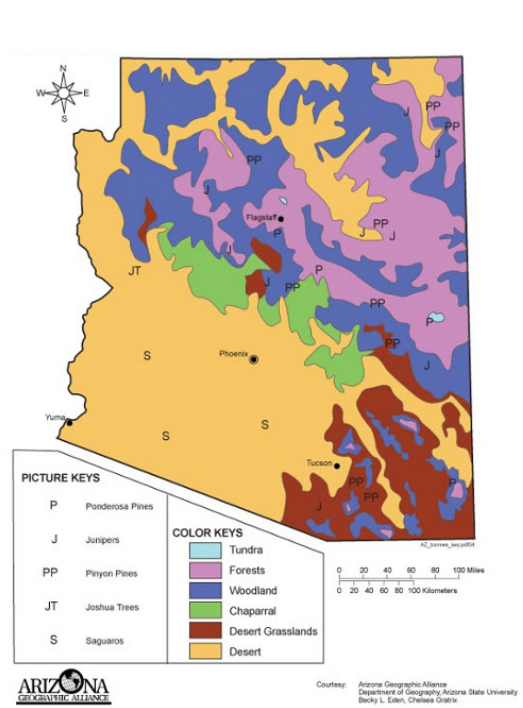
The Need

Sustained drought conditions, extreme heat stresses, invasive species, and human instigated changes to the landscape can be particularly harsh to delicate ecosystems and natural resources across Arizona. Understanding natural and human associated challenges to Arizona’s natural resources and their impact on environmental resiliency is critical if the state is to achieve sustainability and pass-on its special quality-of-place and quality-of-life to future generations of Arizonans. Most members of the population are not environmental scientists, and while each of us may have a desire to conserve natural resources and protect the beauty of the land, few have the in-depth, specialized knowledge required to make truly informed decisions regarding actions that may impact the environment and associated natural resource resiliency. Whether homeowners making home landscaping decisions, gardeners trying to address pests, farmers seeking a production edge, or simply concerned citizens trying to understand their environment, there is a distinct need for reliable, fact-based, research-derived information to inform personal, public, and private sector decisions that may positively or negatively impacts Arizona’s special environment.

“Arizona contains arid deserts and canyonlands, semiarid shrub- and grass-covered plains, woodland- and shrubland-covered hills, lava fields and volcanic plateaus, forested mountains, glaciated peaks, and river alluvial floodplains. Ecological diversity is remarkably high.”

Ecoregions of Arizona. U.S. Geological Survey.

Figure 8: Arizona Biomes



In addition to environmental science as a component of understanding environmental and natural resource resiliency, there is also a need to contextualize the special ownership characteristics of these resources in Arizona. Unlike most states to the east of the Rockies, most of Arizona’s land is not in private ownership. Much of the state’s landscape comprises public lands (federal and state) and 27 percent of Arizona is tribal reservation land. Research and development for environmental and natural resource management and sustainability options for Arizona must therefore consider political, economic, and social science perspectives.

Arizona Land Ownership

- *There are 72.9 million acres of land in Arizona. The USDA Cooperative Extension System, through the University of Arizona, provides educational programs throughout the state in land management.*
- *Approximately 12.9 million acres, or 18 percent, in Arizona are privately owned.*
- *Approximately 9.6 million acres in Arizona, or 13 percent, are managed by the State of Arizona. The Arizona State Land Department is responsible for the management of the state trust land.*
- *Approximately 20.1 million acres in Arizona, or 27 percent, are held in trust by the United State Government for native Americans. The Tribal governments and the USDI Bureau of Indian Affairs are responsible for the management of rangelands on reservations.*
- *Approximately 30.3 million acres in Arizona, or 42 percent, are owned by the citizens of the United States. These public lands are managed by the USDA Forest Service, the National Park Service, military organizations, and USDI Bureau of Land Management.*

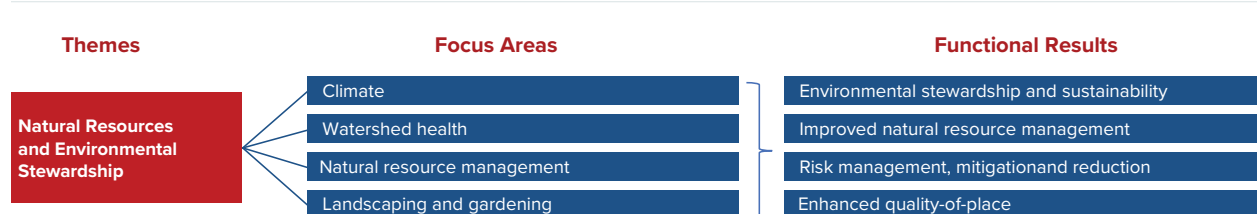
Rocky Mountain Research Station. Managing Semi-Arid Watersheds: Watershed Basics—Public Land Management and Land Ownership in Arizona. USDA and U.S. Forest Service.

How AZ Extension Impacts Natural Resources and Environmental Stewardship

AZ Extension is able to leverage distinctive strengths across the University of Arizona in diverse fields—in areas such as climatology and meteorology, hydrology and limnology, ecology, geosciences, environmental chemistry, soil science, ornamental horticulture, turf management, social sciences, and a range of other specialized areas. This breadth and depth of knowledge, in combination with research resources, is able to both inform decision makers and the public regarding best practices for environmental resiliency as well as develop and disseminate research-based findings to address natural resources and environmental management challenges.

In support of natural resource and environmental sustainability and resiliency practices, AZ Extension works across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Arizona and its citizens (Figure 9).

Figure 9: AZ Extension Functional Impact Themes in Natural Resources and Environmental Stewardship



Source: TEconomy Partners, LLC.

Functional Impact Examples for AZ Extension on Natural Resources and Environmental Stewardship

Water is a key area—water and commercial agriculture, water, and industrial uses (e.g., copper mining), household and landscaping water use.

Program Area: Natural Resources and Environmental Stewardship—Climate

Example: The Arizona Meteorological Network (AZMET) and the Climate Assessment for the Southwest (CLIMAS) program.

Identified Need: At the most macro-level, three physiographic regions span Arizona – the dryland Basin and Range in the south and far west of the state, the Transition Zone of the Central Highlands, and the Colorado Plateau in the northeast. While topography and elevation change, and there can be considerable local variability, each of these regions are generally arid or semi-arid in their climate characteristics. Climate is, in many regards, the defining feature that has shaped the landscape, the flora and fauna upon it, and the use of the land by humans. For agriculture in Arizona, water is a key determinant of what to grow and when to grow it, and similarly is key to the vegetation on rangelands and their carrying capacity for livestock. Industries, such as Arizona’s copper mining industry, need access to water resources, and an expanding human population places pressure on natural resources including water. Clearly both climate (the average meteorological characteristics occurring over a long time span) and weather (real-time and near-term meteorological conditions) hold a particularly deterministic power over life and economic activities in Arizona. For effective planning for the sustainability and resiliency of Arizona’s natural environment, its economy, and way of life it is imperative that decision makers have access to reliable, research-based information on climate trends, weather patterns, and their effect on resources (most crucially, but not exclusively, water availability).

Description of Program: AZ Extension and the University of Arizona ALVSCE play a particularly important role in research and data provision for both weather and climate. Understanding of weather and climate impacts is, of course, integrated across much of the multi-disciplinary work of Extension with agriculture because of its impact on crop selection, crop growth, soil conditions, pest pressures, and livestock health. In addition, Extension, and ALVSCE more broadly, have developed specific initiatives focused on providing detailed measurement, data provision, and analysis focused on weather across the state and long-term climate trends.

Weather: For weather and agriculture, the signature Extension program is the Arizona Meteorological Network (AZMET), which “provides meteorological data and weather-based information to agricultural and horticultural interests operating in southern and central Arizona.”⁴⁰ AZMET collects data from a distributed network of automated weather stations that are located in both rural and urban production settings. As noted by AXMET:

Meteorological data collected by AZMET include temperature (air and soil), humidity, solar radiation, wind (speed and direction), and precipitation. AZMET also provides a variety of computed variables, including heat units (degree-days), chill hours, and reference crop evapotranspiration (ET_o).⁴¹

The usefulness of AZMET information for agriculture can be demonstrated in reference to cotton. The heat units (aka: degree days) that AZMET calculates are used by farmers and researchers to predict the stages of development of their cotton plants. The data also help to predict risk for the outbreak of pests allowing producers to optimize their application of pesticides.

Twenty-seven weather stations and a distributed network of rain gauges provide AZMET with coverage of meteorological conditions, and information provided by AZMET guides decision making for planting, irrigation application, pesticide need and application, harvesting timing, and other important agricultural decisions. The information is also used by municipalities, golf course operators, and other turf professionals for planning and decision-making purposes. AZMET began operations in 1987, and its historic records now provide valuable, high-resolution information for studying meteorological trends over recent decades.

40 <https://ag.arizona.edu/azmet/az-about.htm>

41 Ibid.

Climate: As noted by the United Nations (UN):

Climate change refers to long-term shifts in temperatures and weather patterns. These shifts may be natural, such as through variations in the solar cycle. But since the 1800s, human activities have been the main driver of climate change, primarily due to burning fossil fuels like coal, oil, and gas... The Earth is now about 1.1°C warmer than it was in the late 1800s. The last decade (2011-2020) was the warmest on record.⁴²

As the climate changes, there will be significant impacts. As the UN notes: “The consequences of climate change now include, among others, intense droughts, water scarcity, severe fires, rising sea levels, flooding, melting polar ice, catastrophic storms and declining biodiversity.”⁴³ For Arizona, where >100 degrees Fahrenheit days are a regular feature, and a long-term drought has been experienced for the past 27 years⁴⁴, climate science is crucial to understand.

A key component of the work of the University of Arizona’s in climate science is the Climate Assessment for the Southwest (CLIMAS) program. The program was established in 1998 as part of the National Oceanic and Atmospheric Administration’s (NOAA) Regional Integrated Sciences and Assessments program. Housed at the University of Arizona’s (UA) Institute of the Environment, CLIMAS is a collaboration between the University of Arizona and New Mexico State University. As noted by the University: “The CLIMAS team is made up of experts from a variety of social, physical, and natural sciences who all work with partners across the Southwest to develop sustainable answers to regional climate challenges.”⁴⁵ The work of the CLIMAS team is focused on six areas:

- Decision-relevant questions about the physical climate of the region
- Planning for regional water sustainability in the face of persistent drought and warming
- The effects of climate on human health
- Economic trade-offs and opportunities that arise from the impacts of climate on water security in a warming and drying Southwest
- Building adaptive capacity in socially vulnerable populations, and
- Regional climate educational options to support communities working to adapt to climate change.

Key Impacts:

- Enhanced agricultural production through improved forecasting and decision-making
- Long-term sustainability of agricultural economy via appropriate planning measures

42 <https://www.un.org/en/climatechange/what-is-climate-change>

43 Ibid.

44 <https://azclimate.asu.edu/drought>

45 <https://climas.arizona.edu/about>

Example: Water Resources Research Center

Identified Need: Informed decision-making, by definition, relies on information. With water resource availability impacting so many aspects of life and economic activity in Arizona, there is a distinct need for provision of reliable, research-based information to key decision makers and the general public throughout the state. Having a neutral and trusted party that aggregates information and develops informational resources and programmatic materials serves an important function for informed decision-making and public policy relevant to water. Recognizing this need, the federal government enacted the Water Resources Research Act in 1984 that developed the National Institutes for Water Resources (NIWR) comprising Institutes in each state, located at the land-grant universities.

Description of Program: The University of Arizona's Water Resources Research Center (WRRC) is Arizona's NIWR institute. It serves as the central coordinating resource for agglomerating water research and key findings relevant to water resource management and key policy decisions impacting the state. It then works to proactively disseminate information and knowledge to those in the state able to put the knowledge to work to advance intelligent water resource management. The Center actually pre-dates the NIWR creation, having been established in 1964 as an AZ Extension center and a research unit in ALVSCE under the 1964 Federal Water Resources Research Act.

The work conducted by the WRRC is diverse. As the Center notes, it works to transfer "water research results and information to other researchers, water managers, policy makers, and the wider public through publications, conferences, lectures, seminars, and workshops."⁴⁶ The Center also provides "water news and information ... to the academic community, water professionals, elected and appointed officials, students and the public."⁴⁷

A series of important projects and programmatic initiatives focused on Arizona water resources fall under the WRRC, including:

- **Water RAPIDS** (Water Research and Planning Innovations for Dryland Systems) performs various programs focused on helping communities balance water demands and water resource availability.
- **Transboundary Aquifer Assessment Program** (TAAP) focuses on aquifer resource management for aquifers spanning the Arizona/Mexico border region.
- **Conserve2Enhance** (C2E) helps consumers track water use and investigate options to reduce water consumption. Resulting water savings are then used to support community-led enhancement projects.
- **Desert Water Harvesting Initiative** provides informational resources and networking to promote rainwater and storm-water capture (harvesting). Demonstration Sites, online resources, and workshops are provided.
- **Middle East Water**, an international collaboration, shares knowledge and best practices between Arizona and similar water-challenged regions in the Middle East.

These combined initiatives and programs are leveraged by a large number of Arizona organizations and individuals. The 2020 WRRC reports 886 partners and collaborators with their programs and 609 individuals registered for the 2020 Annual Conference. The Weekly Wave e-News Digest had 2,847 subscribers in 2020, and 6,028 people received the annual Arroyo publication via email and a further 1,486 by mail. Water RAPIDS interfaced with 412 stakeholders across Arizona, and the WRRC gave 53 presentations to various audiences in the state. This prominent level of Extension activity is indicative of the importance of reliable water resource information for all in Arizona.

It is, of course, extremely challenging to place an economic value on knowledge and information, even though it may lead to better management of scarce or critical natural resources. However, an interesting impact study was conducted at Arizona State University's L. William Seidman Research Institute that aimed to quantify the economic impacts in the state associated just with groundwater resources (which supply 40 percent of state water used).⁴⁸ The ASU study, which used IMPLAN Input-Output analysis, examined the economic activity for five Active Management Areas (AMAs) dependent on having access to groundwater. Given that other water resources (for example, surface waters) are all fully allocated in the state (and thus substitutions for groundwater are not readily available), the ASU study effectively shows the amount of economic activity "at risk" if groundwater resources become depleted and unavailable. The findings show that:

46 <https://wrrc.arizona.edu/about>

47 Ibid.

48 Tim James, et al. 2020. *The Economic Importance of Groundwater in Arizona, 2010-2018*. L. William Seidman Research Institute, W. P. Carey School of Business, Arizona State University.

Program Area: Natural Resources and Environmental Stewardship—Watershed Health

- “In total... groundwater supplied to municipal, industrial, and agricultural customers in the five AMAs was cumulatively responsible for approximately \$1.2 trillion (2018 \$) in State GDP between 2010 and 2018.”⁴⁹ That equates to approximately \$150 billion a year in state GDP.
- Groundwater availability effectively underpins “42.2 percent to 44.3 percent of the State’s total annual GDP, dependent on the year in question.”⁵⁰

Work by AZ Extension to help agriculture, industries, communities, and families conserve water can thus be seen to be working towards sustaining a fundamental resource vital to vast components of the Arizona economy. With agriculture comprising 72 percent of total water consumption⁵¹ in Arizona, the importance of Extension’s work is clear. Based on the study cited above, if AZ Extension’s combined work in water resource conservation resulted in just 0.1 percent (one-tenth of one percent) groundwater conservation, that would equate to a \$150 million in equivalent GDP value per year.

Key Impacts:

- Conservation of statewide water resources
- Long-term sustainability of agricultural economy via appropriate planning measures

Program Area: Natural Resources and Environmental Stewardship—Watershed Health

Example: Arizona Project WET

Identified Need: Knowledge regarding the importance of water resources and options and practices for water conservation and stewardship is important for all people. Developing a base of awareness and knowledge is best achieved when we are young, building a foundation of knowledge and interest that will serve across the lifespan. Teachers need readily-accessible, validated, and proven resources and programs to help support the important goal of building water resource awareness in Arizona children and youth.

Description of Program: Arizona Project WET is an initiative of AZ Extension that is designed to support in-school education program for K-12 students focused on water. As noted by the organization:

Arizona Project WET develops water stewardship and STEM literacy by providing teacher professional development that evolves instructional practice and deepens content knowledge, direct student outreach that delivers or extends classroom learning, and community engagement that connects members to K-12 students in meaningful ways. We deliver our programs in-person, online, and in blended learning formats.

The work of Arizona Project WET is reported by Extension to be accessed by a considerable volume of students and stakeholders in the education system on an annual basis. For the most recent year, it is reported that 1,390 educators, 39,540 students, and 5,147 community members were served through the project through 258 workshops, presentations, training sessions, and events conducted in 2020 by Arizona Project WET.⁵²

Key Impacts:

- Improved knowledge of water issues, use and conservation among the Arizona population
- Conservation of statewide water resources

49 Ibid.

50 Ibid.

51 <https://www.arizonawaterfacts.com/water-your-facts>

52 WRRRC 2020 Annual Report

Example: Informing the Sustainable Use of Public Lands

Identified Need: A significant component of the economic value of land in much of Arizona is tied to the use of public lands (which comprise a majority of land in Arizona) for the grazing of livestock. Arizona contains 33.8 million acres of rangeland.⁵³ The federal Bureau of Land Management (BLM) alone manages 11.5 million acres of rangeland that are available for livestock grazing.⁵⁴ These rangelands hold value from multiple perspectives, via their ecosystem services, their recreational use, their natural beauty, their cultural significance for indigenous tribes, and as home for grazing livestock.

The beef cattle industry in Arizona supported by this rangeland is large-scale with robust economic impacts for the state. Analysis by University of Arizona researchers found, for example, that in 2011 “the estimated contribution of the beef industry to total economic output in the state of Arizona was \$1.7 billion” and supported 8,758 jobs in the state with a total labor income of \$240 million.⁵⁵ Sustaining the productivity of Arizona’s rangeland and maintaining healthy livestock operations on the land is of significant importance to the state economy.

Description of Program: AZ Extension provides a broad range of educational programs focused on supporting the productive and sustainable use of Arizona rangeland for cattle ranching operations. Work is conducted by AZ Extension faculty and staff in areas such as rangeland management, native plants, water resources, livestock nutrition, animal health, livestock reproduction, ecology, and multiple other fields. Extension serves as an important informational resource, problem solver, and interface between Arizona’s ranching community and public land holders such as the state and federal government.

AZ Extension Rangeland Monitoring programs assist in collecting important data that are fundamental in making informed land management decisions. A multidisciplinary Extension team works with ranchers and public land management staff to support collaborative drought planning and through development of drought information tools and guides to monitor drought. Extension maintains data resources and guides covering range plants and plant toxicology, and leverages expertise in livestock nutrition to help with planning of nutrition supplementation required for grazing cattle and calves based on the quality of rangeland. The work of Extension in grazing and cattle ranching is, by design, diverse and has a statewide footprint with cattle ranching operations present in every county in the state and having an important presence on tribal reservations.

One of the University’s innovative programs for addressing the special status of public lands and rangeland utilization in Arizona is the Natural Resource Users Law and Policy Center (NRULPC), which operates as a partnership between AZ Extension and the University’s James E. Rogers College of Law. The use of public land for private economic activity, such as cattle grazing, leads to special needs in relation to sustainable resource management and law. The NRULPC is a unique collaboration that performs research and educational activities so that public policy can be informed by well-researched information and solutions. The Center also serves as a neutral ground for various public and private stakeholders to discuss complex natural resource law and policy matters.

Key Impacts:

- Enhanced agricultural sector financial stability and profits
- Increased economic output and employment
- Economic diversification

53 <https://farmlandinfo.org/statistics/arizona-statistics/>

54 <https://www.blm.gov/programs/natural-resources/rangeland-and-grazing/rangeland-health/arizona#:~:text=Arizona%20Rangeland%20Management%20and%20Grazing,and%20leases%20on%20841%20allotments.>

55 Ashley Kerna, et al. 2014. *The Contribution of the Beef Industry to Arizona’s Economy: State and County Profiles*. Cooperative Extension, Department of Agricultural and Resource Economics, The University of Arizona.

Example: Smartscape

Identified Need: The Arizona Department of Water Resources reports that:

The largest use of potable water in Arizona is for landscaping and as much as 70 percent of residential water use is outdoors. Millions of gallons are used annually to irrigate non-residential landscapes such as parks, golf courses, sport fields and resorts.⁵⁶

Both residential and non-residential landscapes and turfgrass areas for decorative and recreational uses are clearly significant users of Arizona water resources. As such, there is a need to develop awareness of practices and landscaping options that can optimize water-use efficiency and reduce consumption of this critical state resource. As the Department of Water Resources notes, “Water use in all landscapes can be significantly reduced by using efficient and regionally-appropriate designs, plant selection, and irrigation practices.”⁵⁷ Programs to encourage water resource conservation in landscaping are thus a high-priority need for Arizona.

Description of Program: AZ Extension has collaboratively developed a program called Smartscape, in partnership with Tucson Water, the Arizona Municipal Water Users Association, the Arizona Nursery Association, the Arizona Landscape Contractors Association, and industry representatives. Smartscape, launched in the high-density Tucson and Phoenix metropolitan areas in 1994, is a training program developed for landscape and irrigation professional instruction. The training covers fundamentals related to the “design, installation, irrigation, and maintenance of desert-adapted landscapes.”⁵⁸ Extension notes that “Smartscape has provided foundational training for thousands of professionals and influenced landscape choices and outdoor water use in the Phoenix and Tucson areas for more than 25 years.”⁵⁹ Landscape professionals can leverage their training to market themselves as having the expertise in water efficient landscaping to their customers.

Through the program website, Smartscape.org, interested commercial or residential customers can access a database of trained landscaping professionals and check credentials. All individuals listed in the directory have completed the core classes of the Smartscape Program, with many having completed Advanced Smartscape training or participating in additional specialized classes within the program. The website for the program is a deep informational resource, providing information focused on appropriate plants, landscape design ideas, and high-efficiency irrigation.

Smartscape operates with a core of 21 instructors and personnel, providing intensive support for Maricopa and Pima counties in particular. Interested parties statewide, however, can access the informational resources contained on the website. Much of the educational material is available in English and Spanish. Key benefits for the state, businesses, and individuals include conservation of water resources, reduced water bills for landscape maintenance, increased property values through enhanced high-quality landscaping, and increased revenues for certified landscaping professionals.

Key Impacts:

- Improved knowledge of water issues, use and conservation among the Arizona population and landscaping professionals
- Conservation of statewide water resources

56 <https://new.azwater.gov/conservation/landscaping#:~:text=Landscaping%20%2D%20Residential%20%26%20professional,courses%2C%20sport%20fields%20and%20resorts.>

57 Ibid.

58 <https://smartscape.org/about/>

59 Ibid.

Example: Master Gardener Program

Identified Need: Home gardening can provide multiple benefits—improving property values, generating aesthetic pleasure and enhanced quality of life, providing outdoor recreation space, and providing a means for homegrown healthy vegetables, leafy greens, and other produce. Gardening is a rewarding activity, but to do it well requires knowledge—knowledge of plants suited for Arizona’s varying environments, knowledge of plant health and pest control, knowledge of timing for planting, irrigation management, soil health, and many other factors. Having a trusted resource to turn to for reliable, best-practice gardening advice is highly beneficial.

Description of Program: AZ Extension has a purpose-designed initiative, called the Master Gardeners program, that trains volunteers as gardening experts to help home gardeners make informed decisions. As Extension notes:

Arizona Master Gardeners are university-trained volunteers who serve as community educators. They work with the University of Arizona providing research-based information on environmentally responsible gardening and landscaping to the public. After completing a semester long course, concentrating on gardening and the environment, Master Gardeners Associates volunteer to serve their communities.

In effect, the Master Gardener program is a train-the-trainer program, training volunteers as Master Gardener who then are able to provide research-based horticultural education, guidance, and resources in their local communities statewide.

The scope of the program in Arizona is significant. In 2021, Extension reports that a total of 1,590 Arizona Master Gardeners were active participants in the program, serving as Extension volunteers in nine counties the state. The Master Gardener curriculum is intensive, providing Arizona-specific instruction in:

- Botany
- Cacti and succulents
- Citrus
- Composting
- Desert-adapted plants
- Entomology
- Irrigation and landscape watering
- Landscape design
- Pest management
- Plant problems diagnosis
- Soils and fertilizers
- Tree and shrub pruning
- Turf
- Vegetable and herbs

Master Gardener volunteers provide a substantial monetary value equivalent through the many thousands of volunteer hours contributed across the state. Across the 1,590 Master Gardeners in the 2021 AZ Extension program, a total of 92,339 hours of volunteer time were contributed, for an average of 49 hours per volunteer. At a value of \$26.84 per volunteer hour,⁶⁰ **this equates to direct economic value of \$2.5 million in services provided to Arizonans.**

Key Impacts:

- Landscape beautification and enhanced quality of life in Arizona
- Reduced negative environmental impacts from suboptimal landscape management
- Promotion of water efficient landscapes and water conservation

60 Independent Sector. “The Value of Volunteer Time—Arizona Statistics.” <https://www.independentsector.org/resource/the-value-of-volunteer-time/>.

4-H Youth Development and Education

Description

AZ Extension's area of focus in youth development and education is delivered primarily through 4-H programs. 4-H provides education and development programs through experiential learning models where young people learn by doing. The national 4-H organization noted as follows:

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.⁶¹

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 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. 4-H Youth Development projects are designed to be in-depth learning experiences for 4-H members.

The Need

It is important to note that AZ 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.”⁶²

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.⁶³ 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 unstable home environments, the number of at-risk youth is increasing across the nation, including in Arizona.

Over the years, 4-H Youth Development programs have been found to have a positive impact on youth. Research conducted at Kansas State University, with oversight by a National Impact Project Steering Group,⁶⁴ found that participation in 4-H Youth Development programs provide opportunities for 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

61 National 4-H Council Website. (n.d.) What is 4-H. <https://4-h.org/about/what-is-4-h/>.

62 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.ncea.org/app/download/7241418760/Battelle_FCS_Executive_Summary_11-2015.pdf.

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

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



- Opportunity for mastery, and
- An opportunity to see oneself as an active participant in the future.

Tufts 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.⁶⁵ Therefore, the role that 4-H Youth Development programs play, in both encouraging community service and discouraging risk behaviors, positively impacts the economy of Arizona over the long term.

Research also suggests that participation in 4-H Youth Development programs boosts academic achievement and college readiness. The Tufts study also found the following:

- 4-Hers have higher academic competence in grades 7, 9, 11, and 12.
- 4-Hers are nearly twice as likely to participate in science, technology, engineering, and mathematics (STEM) programs during out-of-school time compared with students in other out-of-school activities.
- Importantly, the latter effect is even more pronounced for girls, which is significant given that girls' interest and participation in STEM fields tend to decrease compared with that of boys at every stage of education.⁶⁶

Furthermore, 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.

AZ Extension's 4-H programs engage youth 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 Arizona, in areas including, but not limited to, livestock, gardening, and other agricultural

⁶⁵ <https://4-h.org/wp-content/uploads/2016/02/4-H-Study-of-Positive-Youth-Development-Full-Report.pdf>

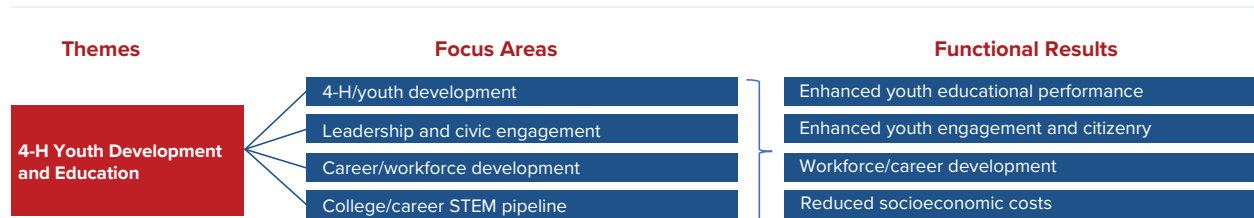
⁶⁶ Ibid.

literacy efforts. Through these efforts, AZ Extension is providing agricultural experiences to youth who may be far removed from the source of the food they eat. This creates not only greater agricultural literacy but also begins to develop a future workforce pipeline for Arizona’s agricultural and related agbioscience industry sectors.

How AZ Extension Impacts 4-H Youth Development and Education

In support of developing Arizonans’ youth, AZ Extension provides programming to approximately 113,000 youth each year. AZ Extension works across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Arizona and its future (Figure 10).

Figure 10: AZ Extension Functional Impact Themes in 4-H Youth Development and Education



Source: TEconomy Partners, LLC.

While 4-H provides important programming across the entire State of Arizona, its efforts may be especially vital to both 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.⁶⁷ For some students, 4-H Youth Development programs may be the most important, if not the only, source of structured extracurricular activities that promote positive development. 4-H programs seek to connect with youth from across the State of Arizona by engaging with them through eight different pathways: agriculture, camping, civic engagement, community service, cultural understanding, healthy living, leadership, and STEM programs.

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

Functional Impact Examples for 4-H Youth Development and Education

Building more self-confident, responsible, educated, and community-focused children and youth in Arizona represents a core investment in the future human potential of the state. The following examples provide an illustration of the breadth and scope of work.

Program Area: 4-H Youth Development and Education—4-H/Youth Development

Example: 4-H Club Programs

Identified Need: 4-H empowers young people with the skills to lead for a lifetime. It's a research-based experience that includes a mentor, a hands-on project, and a meaningful leadership opportunity. Mentoring, at its core, helps to guarantee a young person that there is someone who cares about them, assures them they are not alone in dealing with day-to-day challenges, and makes them feel like they matter. Research confirms that quality mentoring relationships have powerful positive effects on young people in a variety of personal, academic, and professional situations. Ultimately, mentoring connects a young person to personal growth and development, and social and economic opportunity. Yet one in three young people will grow up without this critical asset.⁶⁸

Description of Program: The 4-H club program is a positive youth development program that creates developmental experiences for youth so that they become personally resilient, professionally competent, and contributing citizens to Arizona communities. The goal of 4-H clubs is to support youth thriving through community participation with caring mentors who support youth curiosity.

Youth members start their participation in 4-H clubs at the county or tribal level. AZ Extension 4-H professionals provide leadership and support to the county 4-H program. AZ Extension certifies authorized 4-H adults (aka., volunteers) to create safe inclusive spaces and deliver subject matter expertise and facilitate a positive youth development experience through volunteer-led clubs.

A wide variety of agricultural club programs are offered across the state, in areas including, but not limited to, livestock, horses, small animals, veterinary sciences, consumer knowledge, food nutrition, food preservation, sewing and textiles, entomology, gardening, shooting sports, and sport fishing.

In 4-H Year 2021 (2020-2021), 5,927 Arizona youth participated in a 4-H Club, which was made possible by the 1,184 adult volunteers who led the youth development programs.

Key Impacts:

- Improved understanding of traditional practices
- Exposure to new experiences and careers
- Enhanced life skills (e.g., generosity, responsibility, resilience)

68 <https://www.mentoring.org/mentoring-impact/>

Example: 4-H Programming in Tribal Communities

Identified Need: Across the nation, youth populations on tribal reservations remain underserved due to their remote location, a shortage of mentors, the emotional or behavioral challenges of the targeted population, or other situations identified by the federally recognized tribes.⁶⁹

A unique element of Tribal Extension is the ability for faculty and staff to incorporate native culture into their programming. One area where this is especially prevalent is in 4-H, where educational programming is provided across a range of areas, including nutrition, diabetes, traditional foods, gardening, health, and 4-H projects.

Description of Program: The goal of the FRTEP Extension programs is to help youth on Arizona's reservations develop positive skills, aspirations, attitudes, and behaviors through programs in gardening, nutrition, 4-H, range management, and livestock. Across these reservations, Extension faculty and staff engage with young people and teach life skills such as responsibility, generosity, and entrepreneurship. Extension faculty and staff on tribal reservations use both a hands-on and classroom approach to motivate young people and encourage them to adopt positive attitudes about growing their own food, raising their own animals, learning archery, and engaging in arts and crafts. Importantly, the values of traditional native cultures are intertwined across these activities.

Examples of 4-H activities offered through Arizona FRTEP include:

- The San Carlos 4-H Program offers experiences in arts and crafts, archery and hunting, gardening, horses, and steer, with an average of 30 youth participating each year. The 4-H program provides nutritional training and family fun night nutrition and exercise programs. They also participate in the Natural Resource Practicum, a summer camp designed to introduce high school students to natural resource careers.
- The Navajo Nation 4-H and FFA Show and Sale encourages youth to enter, display, and vie for top honors in their respective class and categories. Producing animals for show and sale creates opportunities for participants to build character, become more patient and enduring, exhibit leadership, and earn cash awards. Although the 2021 show was relatively small, were approximately 60 youth still participated, with a considerable amount of support from the Navajo Nation, the Gaming Commission, and small businesses. Prior to the pandemic, the Show and Sale reached nearly \$100,000 in revenue.
- In the Hualapai region, the 4-H program works with schools and a local detention center on topics such as hand crafts, entomology, natural resources, hunting safety, and meat science. A new initiative, Science in the Classroom, works with schools and the Head Start program to teach kids science through nature.
- The 4-H program on the CRIT Reservation includes projects related to livestock, small stock and poultry raising, where participants learn to raise animals for food. Other projects include shooting sports, sport fishing, and a summer camp for students to learn about concepts like robotics, solar energy, and STEM. All 4-H participants are also required to complete an indoor project, which helps develop their writing and communication skills.
- Hopi Extension is launching a 4-H program to provide additional opportunities for tribal youth to learn life skills, gain knowledge on agriculture and natural resources, have fun, engage with their community, and earn leadership experience.

Key Impacts:

- Improved understanding of traditional practices
- Exposure to new experiences and careers
- Enhanced life skills (e.g., generosity, responsibility, resilience)

69 <https://ojdp.ojp.gov/funding/awards/2011-ty-fx-0031>

Example: Teaching Healthy Living at the Tucson Village Farm

Identified Need: Access to nutrition information, ability to combat chronic illness, and ensuring food security are all persistent societal problems across the U.S.; and AZ Extension is working on multiple fronts, including through 4-H Youth Development programming, to combat the problems by helping to ensure that youth and their parents are able to connect to a healthy food system in order to live an active, healthy life.

Description of Program: In January 2010, an empty lot of land near River and Campbell in Tucson was the definition of untapped potential. Breaking ground with the use of borrowed tools, packets of donated seeds, and a dream of growing an urban farm, the Tucson Village Farm is an unconventional youth garden with three goals in mind: to encourage children to experience nature, regardless of where they attend school; to give children a place to stay busy; and to reconnect children to a healthy food system.⁷⁰

Today, Tucson Village Farm (TVF) is a working urban farm built by and for the youth of the Tucson community. As a program of AZ Extension, TVF is intentionally designed to reconnect Tucson's youth to a healthy food system. Notable activities include not only teaching students how to grow and prepare fresh food, but also empowering them to make healthy life choices. TVF offers an array of year-round, instructional, hands-on programs for youth of all ages. In particular, TVF seeks to include urban youth from all ethnic and socio-economic backgrounds.

The farm offers a safe, urban location where youth can engage in outdoor physical activities and contribute to local food production, preparation, and consumption. Students learn about a wide variety of agricultural elements, such as building soil, integrated pest management (IPM), managing weeds, rotating crops, and growing food in an herbicide- and pesticide-free manner. As a true community-based program, TVF has partnered with over one hundred community organizations, businesses, schools, and governments since its inception.

In 2019, TVF⁷¹:

- Reached a total of 15,030 youth and adults (11,053 youth and 3,977 adults), delivering 62,117 hours of educational programming
- Utilized 7,000 volunteer hours, and
- Cultivated seven acres of crops with 253 varieties of vegetables produced.

Key Impacts:

- Improved student nutrition
- Improved student understanding of food systems
- Increased interest in gardening and agriculture

70 National Young Farmers Coalition. 2012. "A Farm by and For Youth in Tucson, Arizona." <https://www.youngfarmers.org/2012/04/a-farm-by-and-for-youth-in-tucson-arizona/>

71 https://tucson.com/news/local/tucson-village-farm-celebrates-10th-anniversary-moves-to-new-digs/article_9ac897ab-9755-5702-a6e7-fde1a9254520.html

Example: 4-H Camping—Building Life Skills and Memories

Identified Need: 4-H was founded on the belief that when kids are empowered to pursue their passions and chart their own courses, their skills grow and take shape, helping them to become true leaders in their lives, careers, and communities. 4-H Camp experiences provide the full benefits of a 4-H experience coupled with the fun and wonder of camping in the great outdoors.

Description of Program: AZ Extension operates a statewide facility, the Harold and Mitzie James 4-H Camp & Outdoor Learning Center, which is an American Camping Association-accredited 4-H camping facility. The 100-bed camp, located on 55 acres on Mingus Mountain, offers modern facilities that can accommodate a variety of programmatic and participant needs. 4-H Camping is focused on cooperative group living in a natural environment that focuses on hands-on learning and developing life skills by providing a framework for mentoring and role modeling. At camp, youth learn how to take care of themselves and become more independent while enjoying a variety of classes and socializing with peers, teen leaders, and adults from differing backgrounds.

In addition to the James 4-H Camp, numerous other county-based camping programs are available to youth from across the state. AZ Extension 4-H Camping programs have the unique opportunity to reach a variety of audiences, bringing together those from limited-income backgrounds, underserved families, and those with access to a variety of services; youth living in both urban and rural areas; and youth who already participate in other aspects of 4-H in a club or school enrichment activity.

Key Impacts:

- Increased youth motivation and performance
- Enhanced social capital and capacity

Example: Youth Leadership and Civic Development

Identified Need: Leadership and civic development programs empower young people to be well-informed citizens who are actively engaged in their communities and the world. When youth learn about civic affairs, build decision-making skills, and develop a sense of understanding and confidence in relating and connecting to other people, they are becoming tomorrow's leaders.

4-H is an innovator in developing youth leadership and decision-making skills to prepare young people for the future. Arizona's 4-H leadership and civic engagement programs engage youth in programs, organizations, and communities where they share a voice, influence, and decision-making authority. 4-H leadership and civic engagement programs equip young people with confidence and leadership skills to be leaders today and tomorrow.

Description of Program: Arizona 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, 4-H has developed additional specific efforts to provide youth from across the state with the opportunity to develop leadership skills. These programs include:

AZ 4-H Summit is a youth conference focused on campus experience, career exploration, and community engagement. At AZ 4-H Summit, the goal is to help provide teens with an environment in which they can explore what they are passionate about and how to take the next steps to create a future around that passion. Summit is an experience for Arizona 4-H teens to build problem-solving skills, practice putting innovative ideas into action, and to explore future careers.

Journey of Opportunities for Leaders of Tomorrow (JOLT) is an annual summer camp experience for Arizona 4-H Teens. Young leaders from around the State of Arizona gather at the James 4-H Camp to develop life and leadership skills. The mission of JOLT is to create an environment where Arizona teens can learn how to empower personal leadership, home in on creativity, and encourage positive social change in their own community by upholding the tradition of making the best better.

The State 4-H Ambassador Program provides a select group of 4-H teen leaders with the opportunity to advocate for 4-H youth, represent Arizona 4-H, and develop as generational leaders. Ambassadors serve in a variety of leadership positions.

The 4-H Tech Changemakers Program empowers young people to close the digital divide by providing the education and tools they need to teach "teens as teachers" digital skills to adults in their communities. The combination of inadequate internet access and limited digital skills has created a digital divide, impacting future opportunities for young people and adults. 4-H Tech Changemakers uses the "teens as teachers" model for experiential learning by putting teens at the forefront of increasing digital inclusion in their communities through collaboration with corporate partners, local elected officials, nonprofits, educators, and businesses.

The 4-H STEM YOUiversity Ambassador Program enables youth with an interest in STEM to share their STEM skills and enthusiasm with others while developing new STEM activities and gaining leadership and civic engagement skills.

Key Impacts:

- Improved youth motivation and performance
- Enhanced social capital and capacity

Example: Fab Labs Spurring Career Aspirations and Early Training

Identified Need: Because many Arizona-advanced manufacturing industries have shed traditional processes for automated, digital workflows, the demand for engineering and manufacturing technology education has skyrocketed. This requires a drastic transformation in how we expose youth to career opportunities.

A fab lab (fabrication laboratory) is a small-scale workshop typically equipped with an array of flexible, computer-controlled tools that cover several different length scales and various materials, with the aim to make "almost anything". This includes technology-enabled products generally perceived as limited to mass production.

Although many students may have an interest in science, technology, engineering, arts, and math (STEAM), the ability to turn this interest into a passion or a career varies greatly by area. In Arizona's rural communities—especially those located on Tribal Reservations—the ability to access high-quality applied education related to STEAM can be difficult. To overcome these challenges, AZ Extension is partnering with local schools and other community stakeholders to develop Fab Labs: an open-door, open-source, educational resource designed for STEAM.

Description of Program: Arizona's Fab Labs are home to collections of digital fabrication equipment and electronics platforms. Beyond room to accommodate a lab, AZ Extension also provides equipment to encourage learning, including an engraver and a 3-D printer. Engravers can engrave on wood, metals, and plastics, while 3-D printers allow students the ability to produce a wide variety of items.

In Pima County, as part of the Extension office, a fully-equipped Fab Lab has been created. 4-H clubs can create banners, contest awards, and come in to teach youth CAD skills on provided computers. 4-H volunteers are trained to use of the Fab Lab machines in order to expose youth to STEM opportunities.

On the Hopi Reservation, the Fab Lab is operated in partnership with Pima County 4-H. First opening in November 2021, this Fab Lab is fully equipped with a laser cutter, a 3D printer, a large color banner maker, a large vinyl cutter, and a podcasting studio. Through the help of AmeriCorps members, the lab is now ready for outside groups to use and reserve. This is especially beneficial to 4-H clubs, who can create banners, contest awards, and teach youth CAD skills on provided computers.

In CRIT, FRTEP partnered with Le Pera Elementary School on a mini-Fab Lab project. The school provides space to house the Fab Lab and develops a curriculum to educate students on STEAM concepts and practical applications for the equipment. Through a grant funded by the AZ Extension, FRTEP provides the state-of-the-art equipment for the Fab Labs.

Navajo County 4-H and the Blue Ridge Unified School District operate a Fab Lab located in Pinetop. The facility is an open door, open-source educational resource that includes several classrooms designed for STEAM (Science, Technology, Engineering, Art, and Math) work. The Fab Lab is home to a collection of digital fabrication equipment and electronics platforms.

Key Impacts:

- Exposure to STEAM concepts and careers
- Improved confidence, teamwork, and leadership ability
- Enhanced educational outcomes

Example: 4-H STEM YOUiversity

Identified Need: 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. Arizona 4-H programs are leveraging the power of agricultural science to improve the performance of Arizona’s educational offerings for children and youth through partnerships with local school systems to deliver 4-H club and school enrichment opportunities.

Description of Program: Arizona’s 4-H STEM (Science, Technology, Engineering, Mathematics) Program aims to provide:

- Hands-on, problem-based learning activities that foster a collaborative, inclusive, nurturing environment for youth to thrive and explore STEM.
- Collaborations with the 4-H state office leadership, county 4-H agents/coordinators, 4-H STEM leaders/volunteers, school teachers, and AmeriCorps members.
- Unique opportunities for youth from across the state to discover STEM in meaningful, culturally relevant, engaging, hands-on, problem-based learning STEM activities that promote team building and communication skills, as well as cultivate confidence in our youth.
- Encouragement and inspiration to our diverse youth to pursue STEM careers they find fulfilling while contributing to Arizona’s and Americas STEM workforce.

Arizona’s 4-H STEM Program focuses on three major areas:

- Infusing STEM into 4-H, FCHS, FRTEP Programs, and into the community
- Native American STEM Outreach, and
- Preparing the next generation of STEM Innovators.

Programming delivered through Arizona 4-H STEM YOUiversity includes:

The Cross Reality (XR) Floating Farm Project is a hands-on, computer science, software-based activity that engages and guides 4-H members through the world of augmented reality (AR). Youth explore and learn the basics of AR and learn to create a virtual farm using free online software (Tinkercad, Vuforia, and Unity) incorporating their cultural perspectives. Youth are able to build their confidence in computer science while working collaboratively in small groups, building relationships with friends and peers, and opening their eyes to careers in STEM.

The Greenhouse Sustainable Energy Engineering Design (SEED) Project is a multidisciplinary project in which youth build a sustainable green energy greenhouse through a hands-on, problem-based learning approach. The curriculum has several modules that take students through a 60-hour, 10-week journey of exploration in building a model scale greenhouse. They make use of innovative ideas learned through 3D modeling, architectural and engineering design, circuitry, and sustainable green energies (solar, wind, and hydro).

In addition, AZ Extension offer programs in robotics, underwater robotics, and space-related projects.

Key Impacts:

- Exposure to STEM concepts
- Exposure to agriculture and agbioscience-related careers
- Improved confidence, teamwork, and leadership ability
- Enhanced educational outcomes



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). Furthermore, research has shown that children involved in 4-H programs are five times more likely to graduate from college.

Therefore, even under the most conservative estimates, it is reasonable to assume a portion of the 5,927 youth actively involved in 4-H Clubs in Arizona in 4-H Year 2021 developed the personal abilities that would lead them to pursue advanced education opportunities. While some of these children certainly would have pursued higher education even if they had not been involved in 4-H, research shows that children involved in 4-H programs are five times more likely to graduate from college; therefore, it is reasonable to assume that at least 5 percent more of the Arizona 4-Hers were encouraged by their 4-H educational experience to achieve a bachelor's degree, rather than ending their formal education after receiving their high school diploma. This assumption equates to 296 additional bachelor's degrees granted. At a median earnings differential of an additional \$24,100⁷² per year for the degree over and above a high school diploma, **this equates to increased annual earnings for this group of \$7.1 million, or more than \$275 million in increased earnings over the course of their careers.**

These increases in life-long earning potential not only impact personal incomes, but also the quality of life of Arizona families and the state's tax base.

72 Anthony P. Carnevale, et al. 2011. *The College Payoff: Education, Occupation, Lifetime Earnings*. The Georgetown University Center on Education and the Workforce.

Family, Consumer, and Health Sciences

Description

A defining feature of 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.”⁷³ Beyond the provision of education for agricultural practitioners, Extension has long played a role in American families and communities. As noted by Virginia Tech researchers in the *Journal of Public Health Management and Practice*:

*Extension’s rich history has paved a firm foundation to impact the lives of Americans. This national system was designed for, and has been shown to be successful at, disseminating and facilitating behavior change for more than a century...Taken together, Extension’s mission aligns with the overall objective of health promotion researchers and practitioners across the world: to disseminate and implement evidence-based research to improve the health of communities.*⁷⁴

Today, support for family, consumer, and health sciences (FCHS) is a pillar of the AZ Extension’s programs. AZ Extension’s FCHS programs focus on developing strong families, strong minds, and strong bodies. To accomplish this, AZ Extension’s FCHS personnel and programs deliver community-specific programs across Arizona, centered around seven focus areas: health and nutrition, community health, food preparation and food safety, diabetes prevention, financial management and literacy, child development and safety, and family development and parenting.

The Need

Throughout communities in Arizona and across the nation, a plethora of social problems impact the day-to-day quality of life of individuals: poverty and economic hardships, environmental quality, race and class conflict, safety and well-being of children, food security, and poor health and wellness. To overcome these challenges, an essential feature of AZ Extension is to help more people build capacity to shape their lives, communities, and their collective futures.

The ability for Extension professionals to use their unique experiences and understanding of local circumstances and specific issues is a critical part of helping more people share their perspectives. As noted in a 2019 *Journal of Family & Consumer Sciences*, “Extension agents help guide conversations about participants’ values regarding an issue, sort through the costs and benefits of alternative courses of action and come to common ground that leads to positive change.”⁷⁵ These authors later note that the services of Extension professionals can be especially helpful at bridging challenges related to social issues, a condition that can be particularly prevalent in areas where there are long distances between homes and communities, limited transportation, and few opportunities for engagement. Extension professionals can use their contacts, creativity, and deliberative skill set to develop committed, caring, and engaged citizens.⁷⁶

73 <https://www.law.cornell.edu/uscode/text/7/342>

74 Thomas E Strayer, et al. 2019. Partnering for Successful Dissemination. *Journal of Public Health Management and Practice*. DOI: <http://dx.doi.org/10.1097/PHH.0000000000001025>

75 https://www.researchgate.net/profile/Bonnie-Braun/publication/331677412_Loneliness_and_Social_Isolation-A_Private_Problem_A_Public_Issue/links/5c92445d92851cf0ae8a037d/Loneliness-and-Social-Isolation-A-Private-Problem-A-Public-Issue.pdf

76 https://www.researchgate.net/profile/Bonnie-Braun/publication/331677412_Loneliness_and_Social_Isolation-A_Private_Problem_A_Public_Issue/links/5c92445d92851cf0ae8a037d/Loneliness-and-Social-Isolation-A-Private-Problem-A-Public-Issue.pdf

How AZ Extension Impacts Family, Consumer, and Health Sciences

In support of improving social conditions and quality of life for residents of Arizona by helping to nurture families, secure financial stability, and promote healthy lifestyles, AZ Extension works across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Arizona and its future (Figure 11).

Figure 11: AZ Extension Functional Impact Themes in Family, Consumer, and Health Sciences



Source: TEconomy Partners, LLC.

Notably, each of these focus areas helps generate strong, positive, functional impacts for the state of Arizona and its tribal communities. Examples of these impacts include improved nutrition and health for individuals, enhanced public health, quality of life across the lifespan, improved socioeconomic family conditions, improved personal productivity, and reduced government support costs.

Functional Impact Examples for Family, Consumer, and Health Sciences

Family, Consumer, and Health Science Extension faculty and staff provide critical services across large and populated geographies. Thirteen of Arizona’s fifteen counties rank within the top 85 largest counties by geographic area across the U.S., including three of the top six (Coconino, Mohave, and Apache). In addition, Arizona is home to the fourth most populous county in the U.S. (Maricopa).

Programs delivered by AZ Extension address a multitude of issues, from human nutrition and food safety, to strengthening families, to enhancing wellness and personal health, to offering support with family budgets or other personal finances. A primary focus of AZ Extension is the administration of two federal programs: The SNAP-Ed program and the EFNEP Program. These programs are essential at helping individuals and families from across Arizona and its tribal communities to acquire the necessary skills, attitudes, information, and changed behaviors that can lead to healthier, more fulfilling lives.

It is necessary to position the work of Family, Consumer, Health Sciences programs against the backdrop of today’s chaotic, post-pandemic environment. Facing the wide array of social challenges, threats to the family, and urban and rural poverty continue to reduce the ability of many Americans to reach their full potential. For Arizona, it is crucial that the state’s population has the social networks, human capital, and support services needed to live a stable life. This platform, which encourages personal progress across an individual’s lifetime, is an important part of this stability. There is a considerable amount of untapped potential across the American population, whether it is single parents struggling to make ends meet, individuals with critical skills but less formalized educations or criminal records, youth who are at risk or facing adverse childhood experiences, or those exhibiting self-destructive behavior. Instead of becoming costly to society, there are significant opportunities to help these populations flourish.

Example: Supplemental Nutrition Assistance Program—Education (SNAP-Ed)

Identified Need: Many individuals are interested in living a healthier lifestyle but may struggle to know where to begin. For the roughly 39 million people across the nation receiving SNAP benefits – including nearly 800,000 Arizonans – ensuring that individuals are making positive nutritional decisions and living a healthier life is of the utmost importance.⁷⁷

Recent data suggests that many Arizonans struggle to put food on the table: 11.7 percent of households were considered “food insecure,” or otherwise struggled to afford a healthy diet.⁷⁸ SNAP participants represent 1/9 of the population for both Arizona and the nation, according to FY 2019 data. Roughly 69 percent of SNAP recipients are children between the ages of 5 and 17 years of age, 29 percent are in families with members who are elderly or have disabilities, and more than 43 percent are in working families. Approximately 86 percent of participants had household incomes at or below the poverty line.

Description of Program: The Supplemental Nutrition Assistance Program—Education (SNAP-Ed) is a nationwide program that offers educational services related to nutrition education and obesity prevention. Funded by the United States Department of Agriculture Food and Nutrition Service, SNAP-Ed activities engage low-income individuals and families who receive or are eligible to receive SNAP benefits.

In Arizona, the SNAP-Ed program is administered by the Arizona Department of Health Services’ AZ Health Zone. This public-private-partnership operates throughout the state to implement community nutrition education programs and policy, systems, and environmental change interventions. SNAP-Ed programs encourage healthy eating, increase physical activity, and maintain appropriate caloric balance for healthy body weights.

The School of Nutritional Sciences and Wellness partners with AZ Extension and the Family, Consumer, and Health Sciences Cooperative Extension faculty and staff in 13 Counties to implement the SNAP-Ed programs at the University of Arizona. The focus areas behind the direct education services offered to adults and youth include active living, childhood development, and food systems.

A critical component of AZ Extension SNAP-Ed’s work revolves around Policy, Systems, and Environmental (PSE) changes with nutrition education to create strong behavioral changes. Working across sites, neighborhoods, school districts, and populations, each PSE intervention with each partner is unique and based on their needs, strengths, and capacity.

The community partners for AZ Extension SNAP-Ed programs are as diverse as the clients they seek to serve, and include food banks, early childcare centers, schools, after-school programs, Dept. of Economic Security, WIC, health departments, Indigenous tribes, municipal governments, non-profits, low-income and senior Housing, rehabilitation programs, farmers’ markets, food pantries, job skills programs, government agencies, and neighborhood communities.

Ultimately, the overall goal of the AZ Extension SNAP-Ed is to improve individuals and families by:

- Encouraging positive behavior change to know how to shop, prepare, and eat more healthy foods and exercise more.
- Providing cost-savings tips at the grocery store and stretching their food budget.
- Engaging in PSEs that create positive change at the population/community level.
- Empowering community members through community engagement, giving the community the power to provide feedback so that UA SNAP-Ed can improve what and how programs are offered based on the needs of the community.

According to the AZ Extension Statewide EARS Report for FY 2021, notable activity metrics related to AZ Extension SNAP-Ed’s performance include:⁷⁹

- 46,532 materials distributed
- 5,440 people at meetings
- 798 people at trainings
- 13,225 people at events, and
- 3,412 unduplicated people at food demos.

77 https://www.cbpp.org/sites/default/files/atoms/files/snap_factsheet_arizona.pdf

78 https://www.cbpp.org/sites/default/files/atoms/files/snap_factsheet_arizona.pdf

79 UA Statewide EARS Report by Agency data

Program Area: Family, Consumer, and Health Sciences—Health and Nutrition

Using a similar input-output methodology described earlier in this document, researchers from the University of Arizona quantified the economic impacts of AZ Extension SNAP-Ed program as recently as 2018. According to 2016 data, the AZ Extension SNAP-Ed program was awarded and spent \$5.4 million in competitive grant funds, accounting for approximately 41 percent of all AZ Health Zone’s federally awarded funds from the USDA–FNS. Accounting for multiplier effects, spending by the AZ Extension SNAP-Ed in 2016 supported the following:

- 109 full-time equivalent (FTE) jobs
- \$5.0 million in labor income
- \$6.3 million in value added (GDP), and
- \$11.5 million in economic output.

Key Impacts:

- Improved use of SNAP benefits by Arizona recipients
- Healthier diets among SNAP-recipients and SNAP-eligible individuals
- Improved physical activity among SNAP-recipients and SNAP-eligible individuals
- Reduced costs for the state due to reduced costs of chronic healthcare associated with poor physical health and nutrition

Program Area: Family, Consumer, and Health Sciences—Health and Nutrition

Example: Expanded Food and Nutrition Education Program (EFNEP)

Identified Need: Considering the disproportionate impacts on America’s most vulnerable populations, a significant health concern facing the nation today relates to “nutrition insecurity,” as reflected by poor nutrition, limited physical activity, unsafe food practices, and food insecurity.⁸⁰

Nutrition insecurity is especially prevalent in Arizona. For example, research from Feeding America finds that 918,940 people in Arizona are facing hunger—a third of whom are children.⁸¹ By using education to support efforts toward self-sufficiency and nutritional health and well-being, there are opportunities to support low-income youth and families and other vulnerable populations by reducing food insecurity and encouraging positive health behaviors related to nutrition, food safety, and physical activity.

Description of Program: The NIFA’s Expanded Food and Nutrition Education Program (EFNEP) is a unique program that currently operates in all states across the nation, including Arizona. With educational activities that promote nutrition, food safety, healthy lifestyles, and resource management, EFNEP targets low-income adults and older youth who care for young children.

By focusing on assisting audiences with limited resources, the EFNEP program helps participants acquire the necessary skills, attitudes, know-how, and other behavioral changes for a more nutritionally sound diet. This positively contributes to the participant’s personal development, improves the diet of them and their families, and enhances overall well-being.

In Arizona, the EFNEP program helps adults to select more nutritional foods and gain skills in food production, preparation, storage, safety, and sanitation. The program operates in six counties, with a heavy emphasis on paraprofessional educators. Each part-time paraprofessional educator is expected to conduct 75 trainings per year. For each participant, there are eight sessions, and each is 90 minutes long. In FY 2021, Arizona’s EFNEP Programs reached 1,036 and 2,238 other family members, for a total of 3,274 participants.

80 <https://nifa.usda.gov/sites/default/files/2020%20EFNEP%20National%20Data%20Reports.pdf>

81 <https://www.feedingamerica.org/hunger-in-america/arizona>

Importantly, Arizona EFNEP recruits heavily from the communities they are trying to reach. This is vitally important because of the need for native Spanish speakers. EFNEP staff are culturally competent and both aware of and sensitive to potential hardships facing participants. To address topics such as food access and security, recipes are able to be modified and custom fit at the county level.

Through Arizona EFNEP programs, adults also learn new methods to manage their food budgets, including resources such as SNAP (Food Stamps). For children and families alike, EFNEP programs help participants learn skills across holistic health topics. Examples of classes offered by AZ Extension include:⁸²

- Cleaning fresh fruits and vegetables safely
- Starting an indoor herb garden
- Transplanting a seedling
- Using fresh herbs in the kitchen, and
- Cooking healthy and flavorful dishes.

In FY 2021, EFNEP surveyed adults who had gone through the program and found:

- 88 percent reported improvements in at least one aspect of their diet during FY 2021
- 62 percent made one positive change in their positive activity
- 74 percent made positive changes in food resource management, and
- 64 percent showed improvement in one or more food safety practices.

Key Impacts:

- Improved nutrition through class attendance
- Improved hydration levels and water consumption
- Learned to prepare healthy foods
- Learned to read and understand nutrition labels
- Learned to balance food proportions
- Learned basics of food science (e.g., added sugars, carbohydrates, fats)
- Altered eating habits
- Improved shopping habits

82 <https://extension.arizona.edu/cochise-efnep>

Example: Diabetes Prevention Program

Identified Need: Approximately 600,000 adults in Arizona have been diagnosed with diabetes, or 10.1 percent of the Arizona adult population.⁸³ However, these statistics do not include people who have not yet been diagnosed, which means that the prevalence of diabetes could be much greater. Reducing the risk for type 2 diabetes (T2D) is an urgent need in Arizona.

While 1 in 10 Arizonans have T2D, roughly 1 in 3 adults have prediabetes—and most struggle with managing their illnesses. For many individuals with prediabetes, there are little to no symptoms. However, these individuals can delay or prevent the onset of T2D by engaging in additional physical activity, adopting healthy eating habits, and changing other unhealthy behaviors. Diabetes is an extremely costly disease for Arizona and for the United States as a whole.

In the United States, direct and indirect costs (including medical costs and loss of work productivity) are \$245 billion yearly.⁸⁴ The annual medical costs for people who have diabetes can be up to 2 times greater than those who do not have diabetes. In 2013 in Arizona, approximately \$3.1 billion was spent on direct costs and \$5 billion on indirect costs of diabetes, for a total cost of over \$8 billion.

Description of Program: The National Diabetes Prevention Program (DPP) is a lifestyle-based intervention offered nationwide in a concerted effort to reduce the risk of developing T2D.⁸⁵ Since 2018, AZ Extension has offered DPP across the state, providing effective, accessible, and free diabetes prevention programming to our communities.

The DPP is a year-long endeavor, meeting for one hour 26 times per year. Key components of the program include CDC-approved lessons and other resources to help participants make healthy changes; specially trained lifestyle coaches to help participants learn new skills, set and meet goals, and keep them motivated; and support groups of people with similar goals and challenges.

The program promotes a 5-7 percent reduction in body weight by increasing exercise to 150 minutes a week and adopting healthy eating habits.⁸⁶ These changes can lower the risk of developing T2D by as much as 58 percent.

Key Impacts:

- Reduced body weight and increased exercise
- Adopted healthier eating habits
- Reduced risk for developing T2D
- Improved personal responsibility and motivation

83 <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1790-2019.pdf>

84 <https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1790-2019.pdf>

85 University of Arizona Extension (2019): nccd.cdc.gov/Toolkit/DiabetesBurden/Home/Economic

86 [az1790-2019.pdf](https://extension.arizona.edu/sites/extension.arizona.edu/files/pubs/az1790-2019.pdf) (arizona.edu)

Example: Certified Professional Food Manager

Identified Need: Research from the CDC finds that in 2017, reported foodborne disease outbreaks resulted in 14,481 illnesses, 827 hospitalizations, 20 deaths, and recalls of 14 food products.⁸⁷ Importantly, restaurants were linked to outbreaks more often than any other place where food was prepared, accounting for 64 percent of outbreaks that had a single location where food was prepared. In 2018 dollars, the economic burden of these pathogens was about \$17.6 billion, an increase of about \$2 billion, or 13 percent, over the 2013 ERS estimate of \$15.5 billion.⁸⁸ Educating restaurant workers about the importance of food safety yields benefits not only for health and wellness, but also for economic development.

Description of Program: In 2001, Yavapai County adopted a change to its health code that requires all food establishments that handle open and potentially hazardous foods to have at least one person available during all hours of operation who has undergone extensive food service training and has obtained manager certification.

AZ Extension in Yavapai County is an approved agency for providing training for the Certified Professional Food Manager (CPFM) Exam.⁸⁹ AZ Extension offers the Certified Professional Food Manager (CPFM) class virtually and refers participants to take the exam through Prometric's ProProctor service. Examples of courses offered by AZ Extension include cleaning refrigerators after a food recall, cooking in altitudes above 3,000 feet, and baking, canning, and cooking at high-elevations.

In 2021, 231 Yavapai County food establishments have earned the "Golden Plate Award." This is the sixteenth year of the award, and to be eligible, an owner or operator needs to meet three criteria:

- Operate throughout the entire calendar year without a cited priority or priority foundation (critical) food handling violation.
- Have an approved and implemented food safety plan.
- Have a person-in-charge with an accepted and current manager-level food safety certificate through-out the year.

Key Impacts:

- Increased health and wellbeing of citizens
- Reduced economic costs due to foodborne illnesses
- Fewer unsanitary restaurants

87 <https://www.cdc.gov/foodsafety/newsletter/new-report-foodborne-disease-outbreaks-9-20-19.html>

88 <https://www.ers.usda.gov/data-products/cost-estimates-of-foodborne-illnesses/>

89 <https://extension.arizona.edu/yavapai-food-safety-preservation>

Example: Take Charge America institute

Identified Need: Across Arizona, many adults and families are considered financially vulnerable. According to a recent study by the nonprofit research group Prosperity Now, Arizona ranks 42nd among states across a range of measures to assess financial vulnerability, including low/volatile incomes, low credit scores, a reliance on high-cost lenders, and heavy household debts.⁹⁰ One reason why many Arizonans may struggle with financial management is due to a lack of education and mentorship. As a result, there are numerous opportunities for AZ Extension to support a more financially literate populous.

Description of Program: As part of the University of Arizona’s Norton School of Family and Consumer Sciences, The Take Charge America Institute creates research-based educational outreach programs that improve financial literacy and empower consumers to make informed financial choices. Working closely with local Cooperative Extension offices, the Institute conducts a range of workshops and outreach programs across Arizona’s communities. Notable examples include:

- The Institute’s “Take Charge Cats” program recruits and trains university students to be financial education ambassadors. These students then present dozens of financial education seminars each semester on campus and in high schools and middle schools across the university community. An annual personal finance case study competition also brings hundreds of students to the university’s campus to analyze true-to-life cases of household financial distress.
- Building Financial Security is a 4-part series that takes an in-depth look at managing money. Offered through AZ Extension, the course’s weekly 2-hour classes discuss four major questions: Why do I spend money the way I do? How do I prepare for emergency costs? What are the costs of borrowing money? And, how do I read my credit report and score?
- The Early Childhood Financial Literacy Lending Library is a portable kit with children’s books and tip sheets for parents. Located at select Early Childhood Education Centers across the state, this library seeks to help parents of young children (ages 3 to 5) instill an understanding of financial literacy at young ages.
- As a single session class, the *Where Does Your Money Go?* course helps participants develop a spending-savings plan create SMART financial goals—those that are specific, measurable, achievable, relevant, and time-based.
- The four-part series *Building Financial Security for Self, Family, and Community* offers additional tools for participants to take control of finances.

These financial literacy programs have been successful in garnering outside funding to support their operations. For example, the Marley Foundation has provided a generous two-year gift (\$400K) to support parenting and financial literacy programming. Take Charge America, Inc. funded the TCAI original endowment (\$5.5M). Wells Fargo Foundation has provided \$25K. Other partners include the United Way of Southern Arizona Financial Wellness Partnership, which provides networking, and the Financial Planners Association of Greater Phoenix, which offers advocacy and financial support of financial literacy education.

In the future, Extension staff are working on a new financial literacy curriculum/programming to reach the 18–24-year-old population. Other activities include an expansion of peer-educators to help deliver programming, and piloting two-generation financial literacy programming that includes classes for parents and teens and classes for young parents and preschoolers. AZ Extension is also planning expanded financial literacy in tribal areas with use of AmeriCorps members to deliver programming.

A survey of 111 adult participants in 2021 found that 78 percent reported specific “spending leaks” over the course of one year, averaging \$3,395 annually or \$65 per week. In total, this represents \$293,939 in annual spending leaks identified across the surveyed participants.

Key Impacts:

- Reduced poverty
- Improved decision making via spending plans
- Avoided financial emergencies and crises by preparing for emergency costs
- Improved understanding of debt, credit scores, and other financial reports

90 <https://scorecard.prosperitynow.org/data-by-location#state/az>

Program Area: Family, Consumer, Health Sciences—Financial Management/Literacy

Example: Financial Literacy Training in Tribal Nations

Identified Need: Individuals and their families across Arizona’s underserved rural and tribal communities can struggle with financial management and literacy. In partnership with the Take Charge America Institute, Arizona Federally Recognized Tribal Extension Program (FRTEP) helped to develop and deliver financial literacy education programs.

Description of Program: These educational offerings leverage pre-existing programs, namely the *Building Financial Security for Self, Family, and Community* program and the *Where Does Your Money Go?* curriculum. The target audience for these programs are adult participants with limited resources. These efforts aim to increase financial literacy and help individuals practice responsible financial behaviors, such as paying bills on time, maintaining emergency funds, saving for retirement, lowering the likelihood of engaging in negative financial behaviors such as debt accumulation and high-cost borrowing.

Key Impacts:

- Increased competencies in financial literacy skills
- Awareness of personal values and choices pertaining to finances
- Increased intentions to make behavioral changes pertaining to personal financial practices

Program Area: Family, Consumer, and Health Sciences—Child Development

Example: Developmental and Sensory Screening Programs

Identified Need: In the United States, about 1 in 6 children aged 3 to 17 years have one or more developmental or behavioral disabilities, such as autism, a learning disorder, or attention-deficit/hyperactivity disorder.⁹¹ Meanwhile, a child’s first few years are when their brain develops the most, with 90 percent of brain development happening by the time a child enters kindergarten.⁹²

Regular hearing, vision, and developmental milestone screenings ensure a child’s development is on track. Screenings can also identify challenges early so a child can get the help they need to reach their full potential. Early screening allows for early detection, diagnosis, and treatment of children with hearing and vision problems.

Description of Program: The Developmental and Sensory Screening (DSS) program, supported by First Things First, provides educational resources and free hearing, vision, and developmental milestone screenings to help encourage a child’s health and development. These screenings are offered in Gila and Pinal County, and with the San Carlos Apache Tribe.

In Pinal County, for example, hearing and vision staff screen young children (ages 1–5) to identify potential hearing or vision problems that may impact their development. This program provides education on the importance of screenings, provides free hearing and vision screenings, and promotes awareness of early detection and interventions. To accomplish this, staff not only offer free screenings, but also provide age-appropriate activities for children and families to do at home. Virtual options are also available for developmental milestone screenings.

Key Impacts:

- Advanced speech/communication
- Enhanced physical and socio-emotional development
- Improved behavior later in life
- Increased school readiness

91 <https://www.cdc.gov/ncbddd/childdevelopment/screening.html>

92 <https://extension.arizona.edu/developmental-sensory-screening>

Example: Positively Engaging Families and Building Positive Experiences

Identified Need: Research from Youth.Gov finds a slew of evidence that highlights the positive impacts associated with family engagement and youth outcomes. For example, studies show that strong family engagement is a necessary component in improving outcomes for children and youth. These family engagement strategies can help inform education, child welfare, juvenile justice, health, mental health, and behavioral health systems.⁹³

Description of Program: AZ Extension conducts a range of family engagement programs, including parent education workshops and Family Resource Centers. These centers offer tools that help parents be more involved in and intentional about their child's development. Notable classes cover topics such as brain development, positive discipline, critical thinking, and building healthy eaters. Many classes also involve children together with their parents.

AZ Extension programs are intentional about meeting parents and families where they are to deliver services in a meaningful, targeted, and culturally competent manner. For example, Pima County Cooperative Extension runs the Family Engagement Program at the Arizona State Prison Complex—Tucson.⁹⁴ Conducting three parenting classes weekly, the Family Engagement Program provides incarcerated parents with courses to understand the stages of their child's development, ways to manage everyday child behavior, and tactics to recognize and avoid family tensions and conflicts.

Family development programs help parents engage in their child's physical and social development in a safe and fun environment. Notable programs offered by AZ Extension include:

- Support groups, where parents learn self-care techniques to reduce the stress of parenting.
- Diverti2, a class that teaches parents to connect with their two-year-old in a fun, interactive way.
- Keys for 3's, a class that teaches the seven essential life skills every child needs to succeed in school through discovery activities.
- Abriendo Puertas, a unique class on cultural strengths and values with topics that range from early childhood development to leadership and advocacy.
- Fine Arts is for 3's, a class where parents of 3-year-olds can explore with their child the world around them through art.
- Kinder Literature, a literature class for parents of 4- and 5-year-olds to create a love for books.
- Healthy for Life, an evidence-based community nutrition and well-being program that empowers people to make healthy food and nutrition choices.
- A partnership with the Diaper Bank of Southern Arizona Partnership to increase access to essential household items.

Key Impacts:

- Greater self-discipline, responsibility, cooperation, and problem-solving skills
- Bridged communication gaps
- Defused power struggles
- Enhanced communication focused on love
- Increased self-efficacy
- Increased cooperation at home and school

93 <https://youth.gov/youth-topics/impact-family-engagement>

94 <https://www.firstthingsfirst.org/region-stories/parenting-class-at-state-prison-complex-in-tucson-helps-create-positive-learning-environment-for-young-kids/>

THE FUNCTIONAL ECONOMIC IMPACT OF AZ EXTENSION: EXAMPLE OF THE ECONOMIC IMPACT ASSOCIATED WITH 1-PERCENT DECREASE IN CHRONIC DISEASE INCIDENCE

Ultimately, AZ Extension is sustaining and enhancing the health of individuals and families across the state. Extension staff play an important role in assisting individuals to better manage chronic diseases, prevent obesity and poor-nutrition, and improve physical activity. Each year, this work and other related efforts reach thousands of participants across Arizona. While there are obvious quality-of-life benefits related to improving the health of Arizonans, there are also tangible savings in terms of healthcare costs.

TEconomy analyzed the effect that a one-percent reduction in 25 diseases and health disorders associated with diet and exercise would have on the Arizona economy. It is likely that Extension's educational programs and initiatives generate more than a 1-percent benefit in terms of public health cost-saving, but this estimate acts as a conservative baseline to better understand Extension's impacts. The economic impact of a 1-percent reduction in chronic diseases associated with diet and exercise can be found below:

The Economic Impact of a 1-Percent Reduction in Chronic Disease Incidence

To highlight the potential economic impacts of healthcare improvement, TEconomy used input-output analysis to model the effect on Arizona of a reduction in several diseases and health disorders associated with diet and exercise. This modeled scenario estimates the impact of a 1-percent decrease in the total number of hospital inpatient visits for 25 selected conditions related to diet and exercise and derives 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 [2017], recorded by the Agency for Healthcare Research and Quality (AHRQ).

Based on the analysis, TEconomy finds that a 1-percent decrease in hospital inpatient visits in Arizona (for diseases that are associated with poor diet and/or lack of exercise) would result in \$13,530,545 in cost savings to the state. This estimate results in the question of whether 1 percent is high, low, or in the ballpark in terms of the potential impact of AZ Extension health and nutrition programs targeting population and individual health benefits. Based on EFNEP and SNAP-Ed program contacts by Extension alone, a 1-percent estimate for impacts is likely conservative.

Arizona has approximately 7.3 million citizens. In FY 2021, a year heavily impacted by COVID-19, Arizona's EFNEP Programs were still able to reach a total of 4,435 individuals (0.06 percent of Arizona's population). If it is assumed that the changed behavior of one member of the household also influences others, then use of the Arizona average household size (2.65) can be used to calculate the influenced population, which is 0.16 percent of Arizonans. As detailed herein, Extension's SNAP-Ed programing reaches considerably more people than EFNEP (13,225 people in 2021). Thus, a 1-percent impact on health nutrition and health behaviors through this deep reach into the Arizona population is likely a conservative figure.

Community and Business Development

Description

Arizona is a land of dualities, with a sizable portion of its population living in metropolitan areas, but a significant portion of its land is dedicated to non-commercial uses. For communities in urban and rural areas alike, AZ Extension offers a range of critical research, programs, and initiatives to help address challenges related to development and sustainability. AZ Extension works collaboratively with communities to foster economic development and create capacity for resilient communities, engaging communities in their food system, and encouraging leadership development, community decision-making, community emergency preparedness, and inclusive communities. From Arizona's largest cities to its smallest rural communities, AZ Extension plays an active role in delivering applied service and assistance.

The Need

Although most Arizonans—an estimated 90 percent of the population—live in metropolitan areas, there is no one-size-fits all approach to community and economic development. For example, the metropolitan areas of Phoenix and Tucson, which comprise the majority of the state's population and its growth, are themselves comprised of small and mid-sized communities, each with their own distinct needs. As noted in research by the Morrison Institute for Public Policy, "In recent years, some small towns in Arizona's fast-growing metropolitan areas have experienced rapid growth in population, while others in more isolated rural areas have lost population or have been barely able to hold on to what they had. In rural Arizona, one finds localities with struggling "one crop" economies based on farming, ranching, or mining hoping to find a way to improve their attractiveness to companies looking to expand or relocate. But the quest for development is difficult."⁹⁵

In order to build sustainable communities and economies across Arizona, there is a need for supportive capacity-building to help communities and organizations increase volunteerism; nonprofit, private and public investment; and efficiency to create sustained economic value and development.

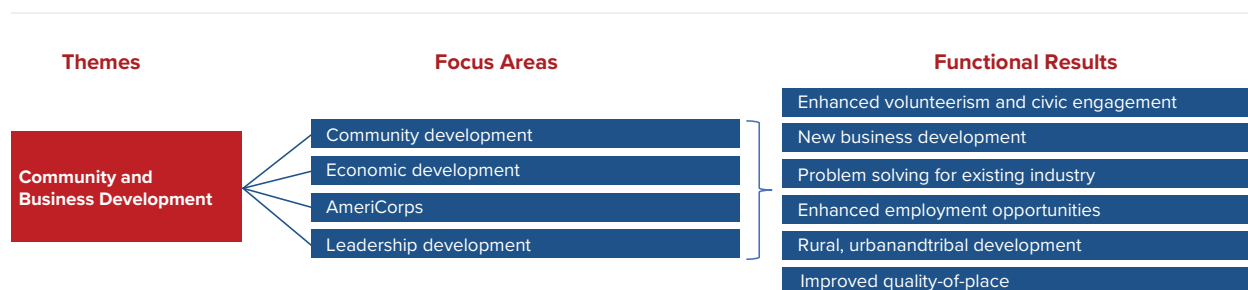
Across Arizona, a case can be made that many community leaders, local elected officials and volunteers do not fully comprehend the array of factors that influence their communities and their economies. As a result, there is a need for increased knowledge and collaboration around potential strategies to encourage community and economic development by helping individuals across Arizona learn about their communities, build leadership skills, and positively affect systems change.

How AZ Extension Impacts Community and Business Development

In support of improving social conditions and quality of life for residents of Arizona by helping to nurture families, secure financial stability, and promote healthy lifestyles, AZ Extension works across a diverse range of themes—and these, in turn, engender a variety of positive functional benefits (results) for Arizona and its future (Figure 12).

95 https://morrisoninstitute.asu.edu/sites/default/files/urban-rural_relationship.pdf

Figure 12: AZ Extension Functional Impact Themes in Community and Business Development



Source: TEconomy Partners, LLC.

Functional Impact Examples for Community and Business Development

In the case of AZ Extension’s Community and Business Development programs, several examples illustrate the high-impact work taking place.

Program Area: Community and Business Development—Community Development

Example: Community Gardens and the CRIT Reservation

Identified Need: Covering an area of close to 300,000 (including 80,000 that are arable), the Colorado River Indian Tribes (CRIT) reservation was established in 1865 and is located in the Southwestern part of Arizona, with a portion of the reservation on the California side.⁹⁶ The Mohave, Chemehuevi, Hopi, and Navajo are four distinct tribes that comprise the CRIT.

Unlike many tribal reservations, CRIT contains an abundance of water, a fertile valley, and other resources to support agriculture. The primary crops produced by CRIT farmers include alfalfa and cotton, as well as others such as specialty potatoes, durum wheat, sorghum, and Bermuda and Sudan grass.

Despite the longstanding relationship between CRIT and agriculture, there is a distinct need for an even greater number of CRIT residents, especially students, to feel a connection to their food system.

Description of Program: In collaboration with Le Pera Elementary School, FRTEP established a learning garden for students in grades K-8 to better understand how plants grow and to gain an appreciation for farming activities. Not only does this garden offer opportunities for students to learn about agriculture in a hands-on manner, but it also serves as an outdoor classroom where students use gardening to learn applied science and math concepts.⁹⁷

The school garden includes both a vegetable area and a fruit grove. Students in the vegetable area focus on land preparation, learning about weather and climate, irrigation and water conservation using a drip system and mulching, care, maintenance, and harvesting. Meanwhile, students in the fruit grove focus on fertilizing, pruning, and removing weeds under the tree canopy. Importantly, this garden gives students a break from the potentially mundane school day and offers an opportunity for engaging, outdoors, physical activity.

FRTEP also partners with the CRIT-DHS Food Distribution Program on a community garden project to encourage more individuals to grow vegetables. By providing a season-long learning opportunity that enables participants to learn gardening from preparing the soil to harvesting, participants are also encouraged to grow their own garden at home. In partnership with AZ Health Zone, FRTEP also offered the Seed-to-Supper online vegetable gardening program, a six-week gardening class covering topics from planning a home garden to harvesting.

Key Impacts:

- Increased understanding of and connectivity with local food systems
- Improved physical activity and nutrition

⁹⁶ <https://tribalexextension.org/project/colorado-river-indian-tribes/>

⁹⁷ Ibid.

Example: Tucson Garden Kitchen

Identified Need: As noted in Tucson Foodie, “It can be tough for some residents of the 1.1-square-mile City of South Tucson to balance all the tasks necessary to achieve health. Many work several part-time jobs or struggle to find one. They might lack health insurance and reliable transportation, and struggle to pay for their basic necessities.”⁹⁸ Indeed, research from the University of Arizona finds that South Tucson is among the many census tracts in the area defined as a “food desert,” a geographically isolated location where the population struggles to find access to healthy, affordable foods, especially fresh produce like fruits and vegetables.⁹⁹

Description of Program: With a focus on teaching community residents’ low cost, healthy cooking—with an emphasis on gardening—the Tucson Garden Kitchen was created as a partnership between the University of Arizona, Pima County Cooperative Extension, Pima County, and the city of South Tucson. Located in a former Mexican restaurant that closed in 2009, Pima County purchased the site for \$225,000 with neighborhood reinvestment money, followed by more than \$450,000 in other improvements and renovations.¹⁰⁰

Examples of Community Garden programs and Garden Kitchen events include:¹⁰¹

- **Community Gardens:** Offering free garden installations, gardening classes, and technical assistance to qualifying partners in Pima County.
- **Early Childhood Centers:** Building capacity and providing resources for qualifying Early Childhood Centers, especially as it relates to gardening, nutrition, and physical activity.
- **Partners in Policy, Systems & Environmental Change:** Working with partners to modify policy, and create systems and environmental change, in order to make healthy choices practical and available to all.
- **Fit First Saturdays:** Held monthly, these free events include a physical activity class, a food demonstration, and a gardening class.
- **Taste of the Desert Festival:** An annual free Fall celebration featuring delicious and healthy recipes using ingredients that have been harvested locally for centuries.
- **Culinary Classes:** Hands-on courses that offer a fun and interactive environment to learn new kitchen skills and techniques.
- **Gardening Hour:** Open to the community every Thursday, this time provides an opportunity for locals to learn more about home gardening and allows them to harvest produce from the community garden.

Since 2012, The Garden Kitchen has reached more than 250,000 Pima County residents and has been an integral part of revitalization work along South Fourth Avenue.¹⁰²

Key Impacts:

- Increased family food security
- Increased availability of healthy foods
- Increased opportunities for physical activity

98 <https://tucsonfoodie.com/2018/08/21/the-garden-kitchen/>

99 <https://mapazdashboard.arizona.edu/comprehensive-food-access-analysis-tucson>

100 https://tucson.com/news/local/free-event-at-the-garden-kitchen-saturday/article_6d2c30ed-fb10-5dd8-8d82-7990ce5baf13.html

101 <https://thegardenkitchen.org/about-us/>

102 https://tucson.com/news/local/free-event-at-the-garden-kitchen-saturday/article_6d2c30ed-fb10-5dd8-8d82-7990ce5baf13.html

Example: Cochise County's Healthy Cochise Initiative and Leadership Academy

Identified Need: Located in the Southeast corner of the state along both the Mexican and New Mexican borders, Cochise County is a unique county filled with a range of diverse neighborhoods, towns, and communities. However, like many counties in rural Arizona, Cochise County residents face a variety of health challenges: 9 percent of adults live with diabetes, nearly one-third (32 percent) live with obesity, and more than one in five children (21 percent) experience food insecurity.¹⁰³ By focusing on the health, social, and economic factors most relevant to each unique community and its residents, there are opportunities to improve both the lives of people and the places they live.

Description of Program: The Healthy Cochise Initiative addresses health issues in Cochise County utilizing the Collective Impact model. This program focuses on using social determinants of health to make policy, systems, and environmental (PSE) changes.

Across the County, health issues are addressed by developing community-based solutions through school health advisory committee's (K-12 and Higher-Ed), healthy community committees, and individuals and groups that participate in the Cochise Leadership Academy. The collaborative process prioritizes three areas of focus: mental health and alcohol substance abuse; good jobs and a healthy economy; and healthy eating, obesity, and diabetes.

There are 11 Healthy Community Committees (HCCs) in Cochise County: Healthy Huachuca City, Winchester Heights, Bisbee Healthy Community, Benson Community Resource Council, Be Healthy Sierra Vista, Growing Healthy Willcox, Step Up Douglas, Healthy Tombstone, Bowie Community Meeting, Ft. Huachuca Community Ready and Resilient Council, Healthy Elfrida. The HCCs are transitioning into 501c3's to be able to write for grants and be sustainable in their communities.

The Healthy Cochise Initiative's imprint also includes six district School Health Advisory Committees that receive direct support, 26 districts in collaboration, and 64 individual schools (public, charter, and private) with a total of just under 20,000 students K-12 (public, charter, and private). The initiative has also developed new partnerships with Cochise Community College in the areas of food security, student mental health support, community development and community health promotion, and STEM related to agriculture and nutrition science.

School gardens play a key role in the initiative, including The Garden Tower Project, which has awarded 21 garden towers to schools and non-profits in the County. The award includes 3-tier, 4-tier, and 5-tier garden towers, as well as potting soil, seeds, and gardening information. School gardens provide a variety of educational topics that can reinforce students learning about nature, science, math, and reading and writing skills.

An essential element of the Healthy Cochise Initiative is leadership development. Cochise County's leaders are developed through "Community Leadership Academies," where they develop PSE projects of particular interest to the participant. The Healthy Cochise Initiative team has developed a dynamic curriculum based on recognized leadership skills, tailors the curriculum and training with cutting-edge information, provides program logistics, and executes an outstanding training that builds upon itself. Ultimately, the training is designed to develop leadership from within communities to focus on their emerging needs, and ultimately, produce PSE changes or other significant outcomes.

To date, the Leadership Academy has graduated leaders who consisted of public service workers, school administration, and various citizens with diverse interests and backgrounds. Everyone is welcome to participate, regardless of their background. Topics of the Leadership Academy are varied, and include Servant Leadership, Discovering Your Leadership Type, Community Engagement, Building Consensus, Communication, Conflict Resolution, Strategic Planning, Equity and Diversity, Empowerment, Delegation Strategies, and Public Speaking.

The data sharing and collection in partnership with the University of Arizona Community Research Evaluation Data Team has helped develop extensive insights through Ripple Effects Mapping. This research indicates that collective impact projects where AZ Extension serves as the backbone organization have the ability to positively impact community health and economic development through policy, systems, and environmental change.

Program Area: Community & Business Development—Community Development

The Cochise Community Leadership Academy has had five cohorts, producing over 60 graduates. These emergent leaders self-select a project to work on depending on their specific issue or passion. Many projects led by graduates are ongoing and continue to make an impact on their communities. Others are morphing to meet the ever-changing needs of the people they seek to serve. Examples of projects culminating from the Leadership Academy include:

- Creating a website to promote a local artist cooperative gallery
- Educating the public on the health benefits associated with a plant-based lifestyle
- Collaborating with rural fire departments and schools from across Cochise County to train people in Compression Only CPR
- Increasing volunteerism to provide transportation services to help seniors age in place
- Improving transparency in prescription drug costs
- Increasing healthy food access
- Creating school-age curriculum to build cultural awareness and self-esteem
- Improving local emergency response systems
- Bringing a youth recreation center to a high-need area, and
- Development of parent education curriculum.

Key Impacts:

- Increasing food distribution in the county
- Increasing water consumption in schools
- Conducting PSE initiatives through the leadership academy
- Connecting and providing food locally through farmers and ranchers
- Identifying community needs in functional groups and working on PSE to make changes

Program Area: Community and Business Development—Economic Development

Example: Rural Economic Development Programming

Identified Need: Arizona is one of the nation's fastest growing states, buoyed by robust growth in the urban centers of Phoenix and Tucson. Because Arizona is largely an urban state, state-level statistics fail to capture the nuances of the state's rural economies, including the role of agriculture and the larger food system, the impacts of outdoor recreation and tourism, and the importance of other natural resource-based industries. As a result, there is a need for county-level information that speaks to the unique challenges and opportunities facing Arizona's rural communities.

Description of Program: AZ Extension personnel deliver a range of programs to encourage rural economic development across the state. For example, The Extension Regional Economic Analysis Program (EREAP) conducts research and participates in economic development projects relevant to Arizona's rural county economies. Extension serves as a trusted source of information for decision makers to help drive data-driven policies across the state's smaller, rural communities.

Elsewhere in the state, AZ Extension faculty develop farm budgets and tools/templates to assist farmers and ranchers with budgeting and decision-making. These faculty also support farmers and ranchers with information resources on marketing of products and services, as well as best practices in ranch and farm management to enhance the productivity, profitability, and access to markets for farming enterprises.

Other programs offered by the University of Arizona related to rural economic and community development include rural tax education, resources for small acreage landowners, and aiding counties, cities, and towns in developing sound land use policies for siting solar energy facilities.

Key Impacts:

- Informed decision-making for rural communities
- Increased attention on rural communities
- Improved profitability for farmers and ranchers

Program Area: 4-H Youth Development and Education—Economic Development

Example: Workforce Development

Identified Need: Agriculture is one of Arizona’s most important industries, and yet the average age of an Arizona farmer is 61 and 93 percent of farmers are 35 years or older.¹⁰⁴ At the same time, the sustainability of family farms cannot rely solely on family succession planning because fewer family farms are passed down to the next generation. It is critical that young farmers and ranchers be provided education and training to help ensure the economic viability of agricultural production across the state. Internships and apprenticeships are a recognized way to build talent and a career pipeline.

Description of Program: AZ Extension is partnering with Painted Desert Demonstration Projects, Inc. (known as the STAR School), Apex Applied Technology, Inc. (AATech), and Arizona farmers and nursery/landscape businesses to deliver the Veterans Ag Education and Apprenticeship Program (VAEAP). VAEAP seeks to increase the number of military veterans pursuing careers in food, agricultural, and green industry sectors through a comprehensive, hands-on, and immersive training program. Hands-on and immersive training experience has been identified as a critical strategy to help returning military Veterans enter into and sustain successful careers in agriculture. The VAEAP Bootcamp Framework provides program on-boarding, online classes, experiential training, and mentorship.

Expanding upon this program, AZ Extension, in partnership with the Agriculture Workforce Development Coalition, is helping to guide the design and implementation of the Arizona Agriculture Workforce Development Program that was passed by the Arizona Legislature in 2021 (SB1150). This first-ever, state-sponsored agriculture apprenticeship program is a 2-year pilot program, administered by AZ Extension, that will provide paid apprenticeships for new and beginning farmers and ranchers.

Key Impacts:

- Human capital enhancement and skills development
- Increased economic output and employment growth
- Enhanced agricultural sector economic stability
- Workforce/talent diversification
- Enhanced personal and household incomes

Program Area: Community and Business Development—AmeriCorps

Example: AmeriCorps (UA Wildcat Corps)

Identified Need: Many college graduates are unaware of the opportunities available to them after completing their degree – especially those that allow them to make a difference in a community and apply their skills and ideals in a meaningful way. At the same time, numerous communities across Arizona and the nation need some youthful perspective, exuberance, and optimism.

Description of Program: As a program operated through AZ Extension, the UA Wildcat Corps improves lives and communities by serving as a statewide network that provides all Arizonans with lifelong educational programs.¹⁰⁵ As AmeriCorps Members, participants prioritize education by providing experiential learning opportunities. These experiences help address community needs through educational programs that strengthen the capacity of individuals to increase educational attainment and foster positive development.

For the 2021-2022 Service Year, AZ Extension is recruiting for 70 AmeriCorps members in 10 Arizona counties and 3 tribal communities. Overall, members serve 300 to 900 hours. Participants are provided with a living allowance ranging from \$2,652 to \$6,600 and an educational award from \$1,289 to \$3,047. Educational awards can be used for future education or past student loans.

104 <https://static1.squarespace.com/static/5d435f1eae8ff80001247373/t/5e420141b76b490661ebb5cc/1581384002221/SB1206+Combined+Info.pdf>

105 <https://extension.arizona.edu/about-ameri-corps>

Program Area: Community and Business Development—AmeriCorps

Key Impacts:

- Improved civic engagement and capacity
- Increased community connectivity
- Enhanced knowledge about problems facing communities

Program Area: Community and Business Development—Leadership Development

Example: Center for Rural Leadership (Project CENTRL)

Identified Need: Across Arizona, there are individuals living within our communities who are recognized for their potential, but not typically labeled as leaders. These individuals have a strong ability to build on their strengths to advocate for community change. However, while these individuals may display signs of leadership potential, they often lack the resources required to take their leadership potential to the next level.

Description of Program: The Center for Rural Leadership (Project CENTRL) helps cultivate and educate passionate leaders who serve and provide a critical voice for Arizona’s rural communities. Project CENTRL is a twelve-month, competitively selected and tuition-free leadership development program for 16 individuals connected to rural Arizona.¹⁰⁶ Over the course of nine seminars across Arizona, Washington, DC, and Sonora, Mexico, the program helps participants build personal leadership skills, connect with leaders and experts, and learn tools to address the issues facing rural Arizona.

Project CENTRL was originally developed by AZ Extension under a seed grant from the W. K. Kellogg Foundation. Today, Project CENTRL is a 501(C)3 organization that continues to operate in close partnership with the University of Arizona.

Key Impacts:

- Strengthened and expanded personal leadership skills
- Accelerated lifelong learning
- Improved abilities to problem-solve on complex contemporary issues
- Enhanced capacity to address challenges facing rural Arizona
- Creation of a statewide network with over 650 alumni, working at the grassroots, local, county, state, and national level to improve the quality of life in rural Arizona

¹⁰⁶ <https://centrl.org/About>

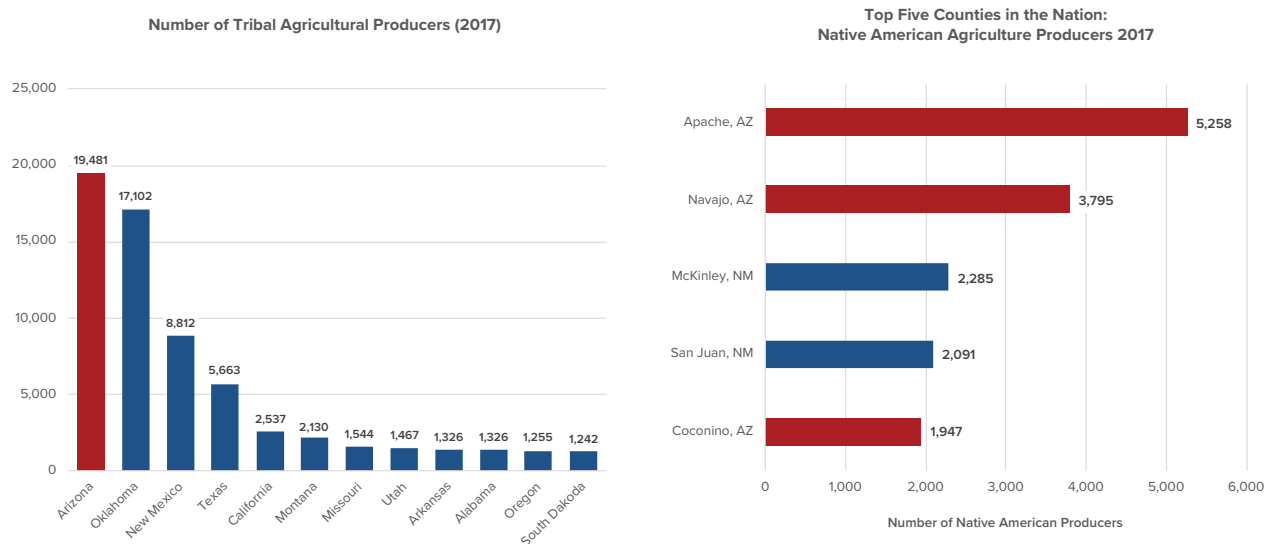
Tribal Nations/FRTEP

About Arizona FRTEP

The Federally Recognized Tribes Extension Program (FRTEP) is a competitive grant program funded by the USDA specifically for Extension programs to focus on Indian Reservations and Tribal jurisdictions. FRTEP funds are used to pay the salary of an Extension agent to liaise with other USDA programs, provide training in farm and ranch business management, supervise 4-H and youth development activities, and coordinate special training programs. **The FRTEP program is an essential conduit between tribes, tribal communities, and university resources in solving critical issues.**

There are 22 Tribes and 21 reservations in Arizona, and Tribal Lands account for more than 30 percent of the land base in the state.¹⁰⁷ FRTEP's expertise in rural agriculture is of critical importance to these tribal communities. With nearly 20,000 Tribal Agricultural Producers as of 2017, Arizona is among the nation's leaders in indigenous agriculture (Figure 13). Arizona is also home to three of the top five counties in the nation with the most tribal agricultural producers.

Figure 13: Top States and Counties for Native American Agriculture Producers (2017)¹⁰⁸



Currently, there are 8.75 FRTEP FTE's working on 17.5 million acres and serving 362,587 tribal community members. Approximately 47 Cooperative Extension FTEs are working in Arizona's Indian Country. Across programs like 4-H, First Things First, Snap Education and agricultural conferences, Arizona's FRTEP agents reach approximately 2,000 to 3,000 Tribal youth per year.

AZ Extension works directly through its Tribal Extension Program with five of the Native American Nations through its Tribal Extension offices:

- **Hopi Tribe:** Based in Kykotsmovi, AZ Extension's primary programs include 4-H and Master Gardener. Examples of notable successes include workshops for beginning ranchers and farmers, community and school gardens and courses, workshops on fruit tree planting, and Hopi Farmers Markets.

¹⁰⁷ Arizona Extension "Tribal Full FRTEP Review 2020"

¹⁰⁸ Arizona Extension "Tribal Full FRTEP Review 2020"

- **Hualapai Nation:** Based in Peach Springs, primary program areas include 4-H, horses, and gardening for youth. Notable successes include 26 years of the “Buck-and-Doe” 4-H Club, the revitalization of community gardens, and natural resources youth field trips and summer camp programs.
- **Navajo Nation:**
 - In Shiprock, AZ Extension’s program areas include agriculture and natural resources, and youth development and leadership. Examples of notable successes included the establishment of a nonprofit with an agricultural emphasis, events such as Shiprock Agricultural Days and Livestock Days, and a collaboration with New Mexico State University on a Native American Producers Sustainability project.
 - In Window Rock, AZ Extension’s notable program areas include support for agriculture, natural resources, and 4-H youth development. Examples of successes include updating and prioritizing the program’s objectives with Tribal officials, offering certified Beef Quality Assurance programming, and delivering early language and literacy development education in Native Communities. Window Rock has seen a 45 percent increase in native 4-H youth participation (with a considerable increase in Navajo Nation employment), hosted 12 youth summer camps, and its first-ever Jr. Horse Show Series. The Navajo Nation Fair Jr. Livestock Show had 140 exhibitors and 25 volunteer leaders. Extension also helped launch the first-ever Navajo Nation 4-H Committee.
 - In Tuba City and Kayenta, notable successes include the Navajo Beef Project, which provides Beef Quality Assurance and assistance with marketing and record keeping. AZ Extension also supports youth horsemanship, junior rodeos, community and school gardens, and unique camps like Song of the Horse Camp and Vet Camp.
- **San Carlos Apache Tribe:** In San Carlos, AZ Extension’s main program areas include 4-H Youth Development and Agriculture and Natural Resources. Notable successes by San Carlos Apache Extension include horse management workshops, 4-H programs related to STEM, archery, horses, and horticulture, and community gardening projects. Extension also supports Rural Business Development projects as well as collaborative range and livestock workshops.
- **Colorado River Indian Tribes:** In Parker, AZ Extension’s primary program areas include 4-H Youth Development, horticulture and school gardens, and agricultural production. Nearly one-fourth of the 200+ 4-H members are tribal members or of Native American descent, with programs related to shooting sports, fishing, and summer youth camps. AZ Extension also supports school and community garden projects, the Master Gardner program, farmer workshops with continuing education credits, and field evaluation of various herbicides in alfalfa and wheat.

Throughout this report, a range of examples illustrate the functional impacts of AZ Extension’s work in the tribal nations. Arizona’s FRTEP Activities include a wide range of topics relevant to Tribal Communities:

- Traditional Foods
- Native Rancher Short Course
- Native Beef Program
- 4-H Youth Development
- Youth Equine Camps
- Range Management
- Horticulture: youth and adult programming
- Community Development
- Forestry
- Farmer Markets
- Business and Marketing Management
- Science in the Classrooms
- Irrigation Trainings
- Beginning Farmer
- Entomology
- Community and Youth Gardens
- Alternative Energy
- Water Quality

The Economic and Functional Benefits of Arizona FRTEP

According to an input-output analysis using similar methodologies found in Chapter 2, the inflow of funds through the FRTEP program increases economic output in Arizona by nearly \$1 million per year (Table 9).¹⁰⁹

Table 9: Economic Impacts of Arizona’s FRTEP Program (2016)¹¹⁰

Impact Type	Employment	Labor Income	Value Added	Output
Direct Effects	8.0	\$371,784	\$371,784	\$527,823
Multiplier Effects	3.5	\$152,724	\$262,567	\$466,350
Indirect Effect	0.7	\$27,149	\$44,880	\$83,288
Induced Effect	2.8	\$125,575	\$217,687	\$383,062
Total Direct and Multiplier Effects	11.5	\$524,508	\$634,351	\$994,173

Source: Dari Duval, 2016.

Similarly, volunteers play an important part of delivering FRTEP educational programs and initiatives. Although estimating volunteer hours is difficult due to restrictions by several tribes on data collection, on average, each of the 7 offices interacts with about 20 volunteers at 10 hours or more per year. This results in an estimated 1,400 volunteer hours per year.

Beyond these economic impacts, a range of functional impacts can be attributed to the FRTEP Program. As identified by Warner & Sero in their 2018 findings on FRTEP, examples of these functional impacts are illustrated in Figure 14:¹¹¹

Figure 14: Functional Impacts of FRTEP Programs



Source: J. Warner & R. Sero. 2018. FRTEP Findings.

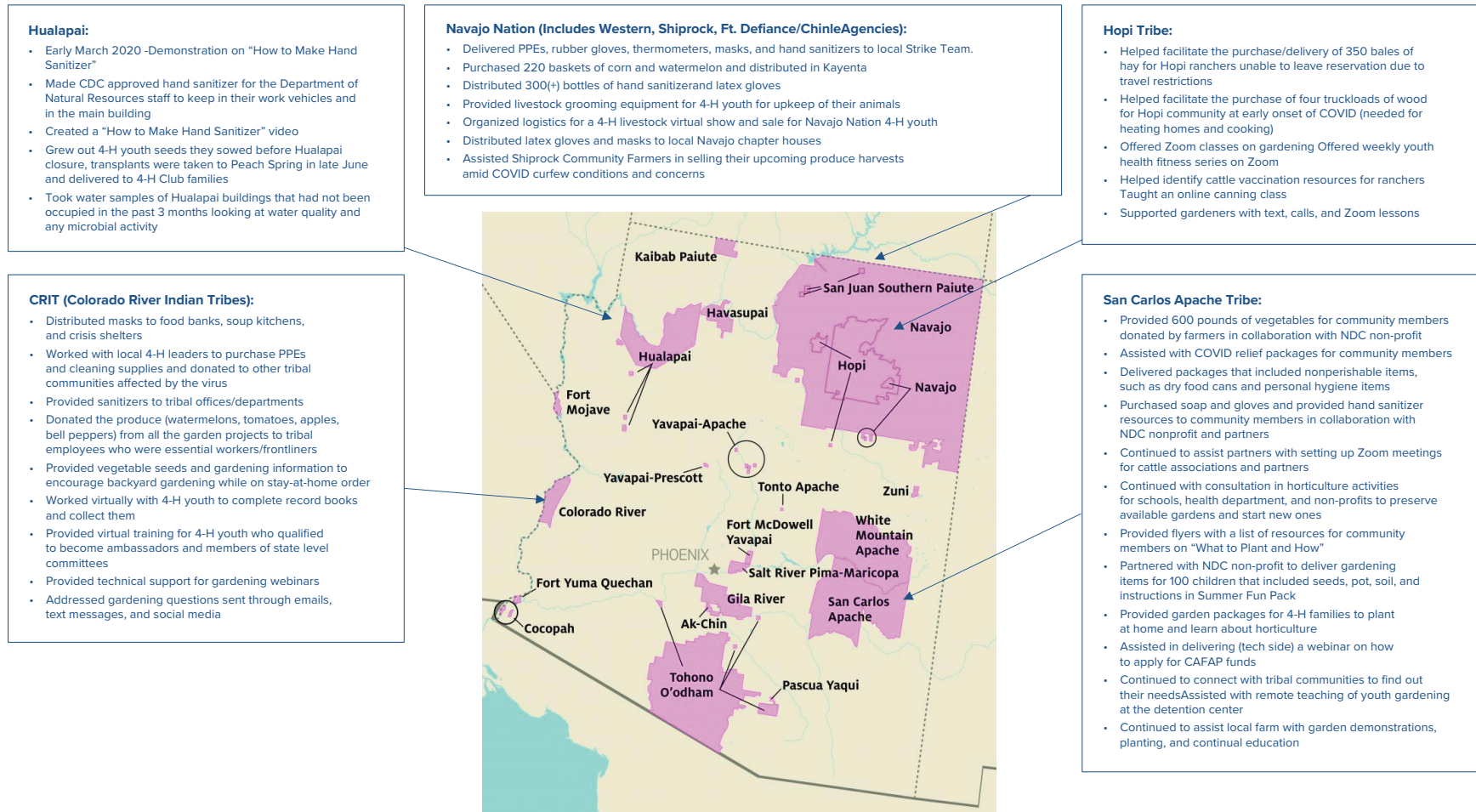
¹⁰⁹ Dari Duval. 2016. Economics Impacts Generated by University of Arizona Cooperative Extension Federally Recognized Tribal Extension Program.

¹¹⁰ Ibid.

¹¹¹ J. Warner & R. Sero. 2018. FRTEP Findings.

While these functional impacts are certainly worthy of celebration, the ability for AZ Extension FRTEP Agents to serve as valuable conduits for their communities during the COVID-19 Pandemic is equally laudable. As noted in Figure 15, these FRTEP staff made important, meaningful, and timely contributions to their communities when they were needed most.

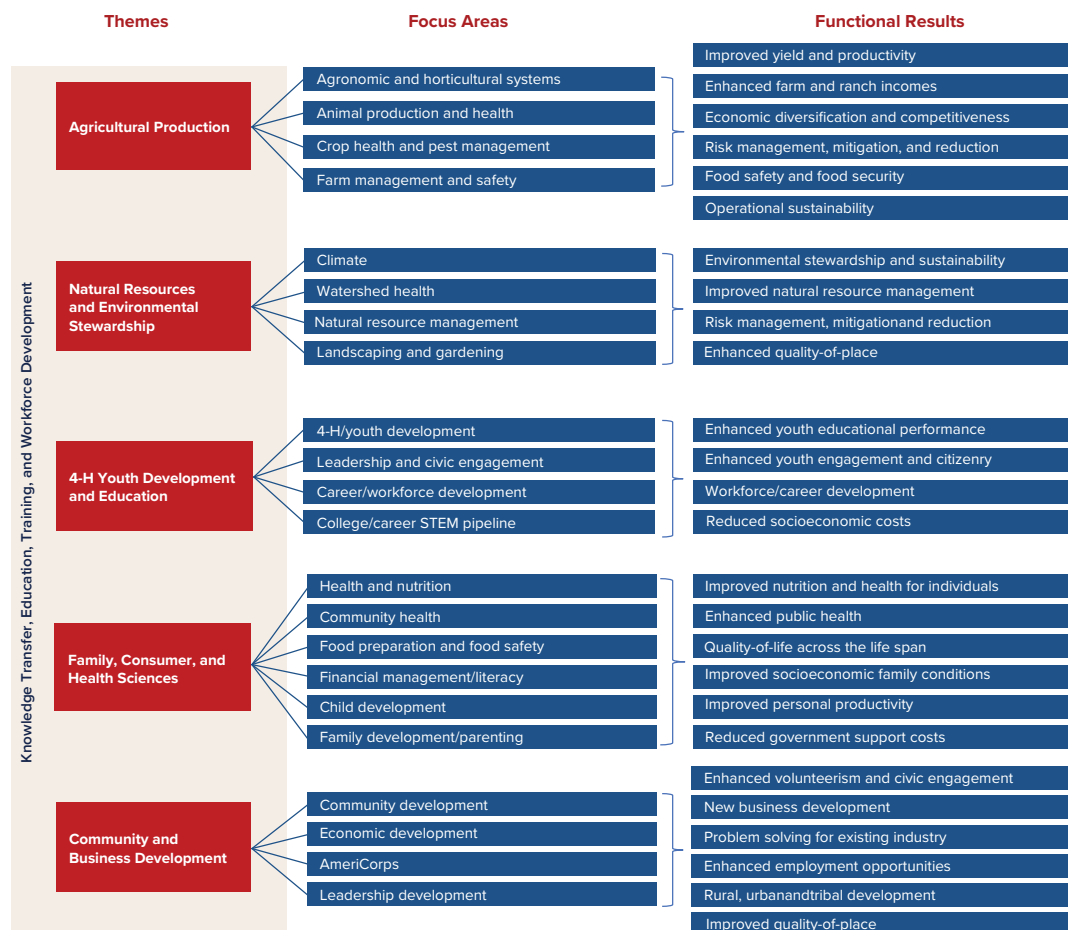
Figure 15: Highlights of Arizona FRTEP COVID Response



CONCLUSION

AZ Extension is a significant economic catalyst for the State of Arizona. Simply in terms of expenditure impacts, AZ Extension generates a total output impact of \$69.4 million in the Arizona economy and supports 859 jobs with labor income totaling \$36.7 million. These expenditure impacts are, however, overshadowed in their importance by the benefits accruing to the state through the wide array of services provided through AZ Extension's numerous programs and initiatives. The work of AZ Extension is taking place under five major thematic areas that are highlighted in Figure 16 and detailed in the previous chapter.

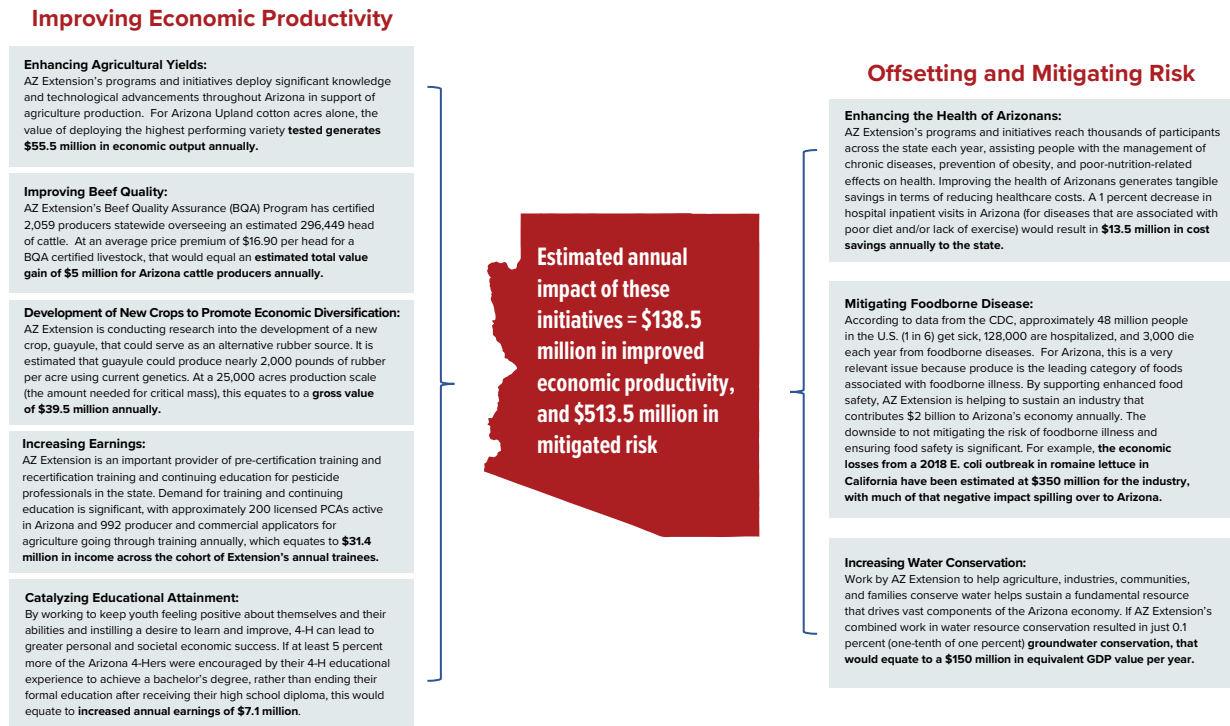
Figure 16: Key Themes for AZ Extension Programming and Activities



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 every day in the lives of Arizonans across the state. As Figure 17 illustrates, case studies and estimations used to assess the functional impact of these thematic areas find positive benefits for the Arizona economy.

Figure 11: Examples of AZ Extension’s Impact



Source: TEconomy Partners, LLC.

As Figure 11 illustrates, the benefits of AZ Extension occur along two pathways. The first is education and programming that leads to improvements in economic and personal productivity, which can be measured in terms of return on investment. The second is more complicated to quantify in that Extension works to prevent large-scale, expensive, negative events from happening. In effect, Extension tangibly prevents financial losses by addressing potential negative events, such as plant, animal, and human diseases, pests, natural resource depletion, etc. In reviewing a handful of examples, one quickly sees the magnitude of the threats that Extension addresses in Arizona.

Overall, the investment in AZ Extension clearly provides a very strong return on investment for the state. For an annual total direct investment of \$14.2 million, AZ Extension initiatives are improving economic productivity annually by \$138.5 million, a nearly ten-fold return. This is in addition to generating a total annual output impact of \$69.4 million through its expenditure of federal, state, local, and private sources, a nearly five-fold return.

As a result, it is clear that AZ Extension is a trusted source of critical, research-based information that it disseminates to a diverse array of audiences across the State of Arizona, thereby serving as a significant economic catalyst for the State of Arizona.

APPENDIX A: County and Tribal Extension Economic Impact Profiles

Apache County Extension

Table A details revenue sources for Arizona Extension allocated to Apache County. In FY 2021, Apache County generated nearly \$747,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Apache County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$205,026
USDA NIFA Cooperative Extension Capacity Funds	\$29,798
Additional County-Based Resources (e.g., direct funds, in-kind)	\$111,680
Grants, Contracts, Fees, and Other Self-Generated Resources	\$400,277
Total FY 2021 Arizona Extension Operational Funds	\$746,781

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension’s 13 personnel and for all other non-personnel operational expenditures for Apache County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Apache County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	13 (9.75)
Total Compensation Expenditures	\$381,416
Total Non-Personnel Operational Expenditures	\$147,271
Total Capital Expenditures	\$0
Total Extension Expenditures	\$528,687

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Apache County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Apache County:

- Total expenditure-based economic impact (as measured by output) of nearly \$834,000
- 15 total jobs supported in the County, receiving nearly \$453,000 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Apache County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	13.0	\$381,416	\$528,687	\$5,776	\$14,127
Indirect Effect	1.0	\$32,314	\$154,121	\$1,330	\$2,599
Induced Effect	1.0	\$38,894	\$151,048	\$3,169	\$5,453
Total Impacts	15.0	\$452,625	\$833,856	\$10,275	\$22,179
Multiplier	1.15	1.19	1.58		

Source: TEconomy analysis, 2020 IMPLAN Model

Cochise County Extension

Table A details revenue sources for Arizona Extension allocated to Cochise County. In FY 2021, Cochise County generated more than \$1.8 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Cochise County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$697,668
USDA NIFA Cooperative Extension Capacity Funds	\$316,753
Additional County-Based Resources (e.g., direct funds, in-kind)	\$139,960
Grants, Contracts, Fees, and Other Self-Generated Resources	\$676,176
Total FY 2021 Arizona Extension Operational Funds	\$1,830,557

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 38 personnel and for all other non-personnel operational expenditures for Cochise County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21 and in some instances prior year funding was spent in FY 2021.

Table B: Arizona Extension Headcount and Operational Expenditures in Cochise County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	38 (21.75)
Total Compensation Expenditures	\$1,438,666
Total Non-Personnel Operational Expenditures	\$427,581
Total Capital Expenditures	\$70,943
Total Extension Expenditures	\$1,937,190

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Cochise County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Cochise County:

- Total expenditure-based economic impact (as measured by output) of over \$3.27 million
- 47 total jobs supported in the County, receiving more than \$1.88 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Apache County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	38.0	\$1,438,666	\$1,937,190	\$22,499	\$49,366
Indirect Effect	2.5	\$142,390	\$374,021	\$5,349	\$7,977
Induced Effect	6.4	\$302,653	\$961,794	\$38,556	\$46,742
Total Impacts	47.0	\$1,883,709	\$3,273,004	\$66,404	\$104,085
Multiplier	1.24	1.31	1.69		

Source: TEconomy analysis, 2020 IMPLAN Model

Coconino County Extension

Table A details revenue sources for Arizona Extension allocated to Coconino County. In FY 2021, Coconino County generated more than \$580,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Coconino County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$300,315
USDA NIFA Cooperative Extension Capacity Funds	\$33,964
Additional County-Based Resources (e.g., direct funds, in-kind)	\$103,149
Grants, Contracts, Fees, and Other Self-Generated Resources	\$144,547
Total FY 2021 Arizona Extension Operational Funds	\$581,975

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 10 personnel and for all other non-personnel operational expenditures for Coconino County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Coconino County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	10 (5.66)
Total Compensation Expenditures	\$379,588
Total Non-Personnel Operational Expenditures	\$64,953
Total Capital Expenditures	\$3,795
Total Extension Expenditures	\$448,336

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Coconino County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Coconino County:

- Total expenditure-based economic impact (as measured by output) of nearly \$917,000
- 12.9 total jobs supported in the County, receiving more than \$540,000 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Coconino County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	10.0	\$379,588	\$448,336	\$3,923	\$8,952
Indirect Effect	0.9	\$48,554	\$147,544	\$3,855	\$4,559
Induced Effect	2.0	\$111,924	\$320,738	\$11,341	\$13,110
Total Impacts	12.9	\$540,066	\$916,618	\$19,118	\$26,620
Multiplier	1.29	1.42	2.04		

Source: TEconomy analysis, 2020 IMPLAN Model

Gila County Extension

Table A details revenue sources for Arizona Extension allocated to Gila County. In FY 2021, Gila County generated more than \$977,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Gila County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$409,171
USDA NIFA Cooperative Extension Capacity Funds	\$106,789
Additional County-Based Resources (e.g., direct funds, in-kind)	\$85,680
Grants, Contracts, Fees, and Other Self-Generated Resources	\$375,737
Total FY 2021 Arizona Extension Operational Funds	\$977,377

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 10 personnel and for all other non-personnel operational expenditures for Gila County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Gila County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	18 (15.46)
Total Compensation Expenditures	\$674,831
Total Non-Personnel Operational Expenditures	\$199,012
Total Capital Expenditures	\$0
Total Extension Expenditures	\$873,843

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Gila County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Gila County:

- Total expenditure-based economic impact (as measured by output) of nearly \$1.48 million
- 22.1 total jobs supported in the County, receiving more than \$825,000 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Gila County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	18.0	\$674,831	\$873,843	\$9,616	\$20,200
Indirect Effect	1.9	\$64,793	\$273,075	\$4,321	\$4,540
Induced Effect	2.2	\$86,212	\$330,151	\$14,875	\$13,618
Total Impacts	22.1	\$825,836	\$1,477,069	\$28,812	\$38,358
Multiplier	1.23	1.22	1.69		

Source: TEconomy analysis, 2020 IMPLAN Model

Graham County Extension

Table A details revenue sources for Arizona Extension allocated to Graham County. In FY 2021, Graham County generated more than \$1.0 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Graham County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$303,460
USDA NIFA Cooperative Extension Capacity Funds	\$22,205
Additional County-Based Resources (e.g., direct funds, in-kind)	\$33,500
Grants, Contracts, Fees, and Other Self-Generated Resources	\$656,320
Total FY 2021 Arizona Extension Operational Funds	\$1,015,485

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 19 personnel and for all other non-personnel operational expenditures for Graham County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Graham County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	19 (9.26)
Total Compensation Expenditures	\$562,418
Total Non-Personnel Operational Expenditures	\$339,636
Total Capital Expenditures	\$55,174
Total Extension Expenditures	\$957,228

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Graham County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Graham County:

- Total expenditure-based economic impact (as measured by output) of nearly \$1.48 million
- 22.5 total jobs supported in the County, receiving more than \$825,000 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Graham County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	19.0	\$562,418	\$957,228	\$14,166	\$30,476
Indirect Effect	0.9	\$38,719	\$128,613	\$3,569	\$5,352
Induced Effect	2.6	\$109,030	\$382,231	\$11,544	\$17,410
Total Impacts	22.5	\$710,166	\$1,468,072	\$29,279	\$53,239
Multiplier	1.18	1.26	1.53		

Source: TEconomy analysis, 2020 IMPLAN Model

Greenlee County Extension

Table A details revenue sources for Arizona Extension allocated to Greenlee County. In FY 2021, Greenlee County generated nearly \$360,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Greenlee County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$167,533
USDA NIFA Cooperative Extension Capacity Funds	\$28,915
Additional County-Based Resources (e.g., direct funds, in-kind)	\$52,887
Grants, Contracts, Fees, and Other Self-Generated Resources	\$110,197
Total FY 2021 Arizona Extension Operational Funds	\$359,532

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 9 personnel and for all other non-personnel operational expenditures for Greenlee County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Greenlee County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	9 (4.25)
Total Compensation Expenditures	\$257,784
Total Non-Personnel Operational Expenditures	\$33,142
Total Capital Expenditures	\$0
Total Extension Expenditures	\$290,926

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Greenlee County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Greenlee County:

- Total expenditure-based economic impact (as measured by output) of more than \$424,000
- 9.7 total jobs supported in the County, receiving more than \$290,000 in total compensation

Table C. Economic Impact of AZ Extension Expenditures in Greenlee County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	9.0	\$257,784	\$290,926	\$1,376	\$3,907
Indirect Effect	0.4	\$19,406	\$75,515	\$772	\$703
Induced Effect	0.3	\$13,258	\$57,760	\$2,771	\$1,864
Total Impacts	9.7	\$290,448	\$424,200	\$4,919	\$6,474
Multiplier	1.08	1.13	1.46		

Source: TEconomy analysis, 2020 IMPLAN Model

La Paz County Extension

Table A details revenue sources for Arizona Extension allocated to La Paz County. In FY 2021, La Paz County received generated nearly \$395,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in La Paz County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$191,216
USDA NIFA Cooperative Extension Capacity Funds	\$0
Additional County-Based Resources (e.g., direct funds, in-kind)	\$48,700
Grants, Contracts, Fees, and Other Self-Generated Resources	\$154,975
Total FY 2021 Arizona Extension Operational Funds	\$394,891

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 7 personnel and for all other non-personnel operational expenditures for La Paz County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in La Paz County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	7 (3.55)
Total Compensation Expenditures	\$226,268
Total Non-Personnel Operational Expenditures	\$25,063
Total Capital Expenditures	\$0
Total Extension Expenditures	\$251,331

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to La Paz County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in La Paz County:

- Total expenditure-based economic impact (as measured by output) of nearly \$350,000
- 7.5 total jobs supported in the County, receiving more than \$251,000 in total compensation

Table C: Economic Impact of AZ Extension Expenditures in La Paz County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	7.0	\$226,268	\$251,331	\$1,000	\$4,432
Indirect Effect	0.0	\$622	\$2,384	\$19	\$42
Induced Effect	0.5	\$24,219	\$95,363	\$3,087	\$5,761
Total Impacts	7.5	\$251,109	\$349,078	\$4,106	\$10,235
Multiplier	1.07	1.11	1.39		

Source: TEconomy analysis, 2020 IMPLAN Model

Maricopa County Extension

Table A details revenue sources for Arizona Extension allocated to Maricopa County. In FY 2021, Maricopa County received more than \$4.1 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Maricopa County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$1,077,420
USDA NIFA Cooperative Extension Capacity Funds	\$396,111
Additional County-Based Resources (e.g., direct funds, in-kind)	\$589,769
Grants, Contracts, Fees, and Other Self-Generated Resources	\$2,042,086
Total FY 2021 Arizona Extension Operational Funds	\$4,105,386

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension’s 70 personnel and for all other non-personnel operational expenditures for Maricopa County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Maricopa County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	70 (42.50)
Total Compensation Expenditures	\$3,140,893
Total Non-Personnel Operational Expenditures	\$759,493
Total Capital Expenditures	\$0
Total Extension Expenditures	\$3,900,386

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Maricopa County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Maricopa County:

- Total expenditure-based economic impact (as measured by output) of more than \$11.1 million
- 108.4 total jobs supported in the County, receiving nearly \$5.7 million in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Maricopa County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	70.0	\$3,140,893	\$3,900,386	\$38,139	\$84,342
Indirect Effect	10.7	\$780,277	\$2,204,071	\$30,846	\$50,354
Induced Effect	27.7	\$1,773,176	\$5,002,859	\$118,519	\$176,319
Total Impacts	108.4	\$5,694,346	\$11,107,316	\$187,503	\$311,015
Multiplier	1.55	1.81	2.85		

Source: TEconomy analysis, 2020 IMPLAN Model

Mohave County Extension

Table A details revenue sources for Arizona Extension allocated to Mohave County. In FY 2021, Mohave County generated nearly \$987,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Mohave County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$154,383
USDA NIFA Cooperative Extension Capacity Funds	\$28,405
Additional County-Based Resources (e.g., direct funds, in-kind)	\$254,180
Grants, Contracts, Fees, and Other Self-Generated Resources	\$549,848
Total FY 2021 Arizona Extension Operational Funds	\$986,816

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension’s 14 personnel and for all other non-personnel operational expenditures for Mohave County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Mohave County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	14 (9.25)
Total Compensation Expenditures	\$345,809
Total Non-Personnel Operational Expenditures	\$81,383
Total Capital Expenditures	\$3,200
Total Extension Expenditures	\$430,392

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Mohave County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Mohave County:

- Total expenditure-based economic impact (as measured by output) of nearly \$900,000
- 17 total jobs supported in the County, receiving nearly \$490,000 in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Mohave County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	14.0	\$345,809	\$430,392	\$2,842	\$9,816
Indirect Effect	0.9	\$38,664	\$140,341	\$3,716	\$5,215
Induced Effect	2.1	\$104,655	\$328,598	\$10,948	\$15,439
Total Impacts	17.0	\$489,128	\$899,331	\$17,506	\$30,469
Multiplier	1.21	1.41	2.09		

Source: TEconomy analysis, 2020 IMPLAN Model

Navajo County Extension

Table A details revenue sources for Arizona Extension allocated to Navajo County. In FY 2021, Navajo County generated more than \$776,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Navajo County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$167,779
USDA NIFA Cooperative Extension Capacity Funds	\$33,304
Additional County-Based Resources (e.g., direct funds, in-kind)	\$251,698
Grants, Contracts, Fees, and Other Self-Generated Resources	\$323,741
Total FY 2021 Arizona Extension Operational Funds	\$776,522

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 12 personnel and for all other non-personnel operational expenditures for Navajo County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Navajo County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	12 (6.70)
Total Compensation Expenditures	\$329,312
Total Non-Personnel Operational Expenditures	\$77,723
Total Capital Expenditures	\$0
Total Extension Expenditures	\$407,035

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Navajo County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Navajo County:

- Total expenditure-based economic impact (as measured by output) of nearly \$708,000
- 14 total jobs supported in the County, receiving nearly \$417,000 in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Navajo County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	12.0	\$329,312	\$407,035	\$3,215	\$9,308
Indirect Effect	0.5	\$20,732	\$75,702	\$2,314	\$3,116
Induced Effect	1.5	\$66,848	\$224,760	\$7,882	\$10,718
Total Impacts	14.0	\$416,892	\$707,497	\$13,411	\$23,142
Multiplier	1.16	1.27	1.74		

Source: TEconomy analysis, 2020 IMPLAN Model

Pima County Extension

Table A details revenue sources for Arizona Extension allocated to Pima County. In FY 2021, Pima County received and generated more than \$18.1 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Pima County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$7,615,553
USDA NIFA Cooperative Extension Capacity Funds	\$2,429,042
Additional County-Based Resources (e.g., direct funds, in-kind)	\$257,100
Grants, Contracts, Fees, and Other Self-Generated Resources	\$7,839,188
Total FY 2021 Arizona Extension Operational Funds	\$18,140,883

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 282 personnel and for all other non-personnel operational expenditures for Pima County and Statewide Extension operations. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Pima County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	282 (110.3)
Total Compensation Expenditures	\$11,425,181
Total Non-Personnel Operational Expenditures	\$4,335,513
Total Capital Expenditures	\$59,377
Total Extension Expenditures	\$15,820,071

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Pima County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Pima County:

- Total expenditure-based economic impact (as measured by output) of more than \$36.4 million
- 408 total jobs supported in the County, receiving over \$18.3 million in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Pima County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	282.0	\$11,425,181	\$15,820,071	\$252,446	\$409,123
Indirect Effect	39.9	\$2,266,692	\$6,881,343	\$116,836	\$146,635
Induced Effect	86.1	\$4,627,446	\$13,738,333	\$428,338	\$480,962
Total Impacts	408.0	\$18,319,319	\$36,439,747	\$797,621	\$1,036,721
Multiplier	1.16	1.27	1.74		

Source: TEconomy analysis, 2020 IMPLAN Model; * Includes Pima County and statewide extension activities

Pinal County Extension

Table A details revenue sources for Arizona Extension allocated to Pinal County. In FY 2021, Pinal County generated more than \$2.6 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Pinal County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$1,421,284
USDA NIFA Cooperative Extension Capacity Funds	\$223,669
Additional County-Based Resources (e.g., direct funds, in-kind)	\$158,865
Grants, Contracts, Fees, and Other Self-Generated Resources	\$801,379
Total FY 2021 Arizona Extension Operational Funds	\$2,605,197

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 59 personnel and for all other non-personnel operational expenditures for Pinal County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Pinal County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	59 (26.28)
Total Compensation Expenditures	\$2,138,797
Total Non-Personnel Operational Expenditures	\$427,735
Total Capital Expenditures	\$0
Total Extension Expenditures	\$2,566,532

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Pinal County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Pinal County:

- Total expenditure-based economic impact (as measured by output) of more than \$3.9 million
- 67.7 total jobs supported in the County, receiving nearly \$2.5 million in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Pinal County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	59.0	\$2,138,797	\$2,566,532	\$25,456	\$49,441
Indirect Effect	3.6	\$142,684	\$526,002	\$4,073	\$5,758
Induced Effect	5.1	\$210,921	\$854,786	\$46,905	\$45,883
Total Impacts	67.7	\$2,492,402	\$3,947,321	\$76,433	\$101,083
Multiplier	1.15	1.17	1.54		

Source: TEconomy analysis, 2020 IMPLAN Model

Santa Cruz County Extension

Table A details revenue sources for Arizona Extension allocated to Santa Cruz County. In FY 2021, Santa Cruz County generated more than \$1.1 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Santa Cruz County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$172,684
USDA NIFA Cooperative Extension Capacity Funds	\$92,238
Additional County-Based Resources (e.g., direct funds, in-kind)	\$26,250
Grants, Contracts, Fees, and Other Self-Generated Resources	\$833,032
Total FY 2021 Arizona Extension Operational Funds	\$1,124,204

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 41 personnel and for all other non-personnel operational expenditures for Santa Cruz County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Santa Cruz County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	41 (15.12)
Total Compensation Expenditures	\$628,606
Total Non-Personnel Operational Expenditures	\$272,651
Total Capital Expenditures	\$0
Total Extension Expenditures	\$901,257

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Santa Cruz County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY 2021, Arizona Extension generated the following economic impacts in Santa Cruz County:

- Total expenditure-based economic impact (as measured by output) of more than \$1.33 million
- 43.8 total jobs supported in the County, receiving more than \$753,000 in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Santa Cruz County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	41.0	\$628,606	\$901,257	\$11,287	\$23,199
Indirect Effect	0.8	\$33,533	\$125,831	\$2,553	\$4,240
Induced Effect	2.1	\$91,173	\$304,784	\$10,183	\$16,581
Total Impacts	43.8	\$753,312	\$1,331,872	\$24,024	\$44,020
Multiplier	1.07	1.20	1.48		

Source: TEconomy analysis, 2020 IMPLAN Model

Yavapai County Extension

Table A details revenue sources for Arizona Extension allocated to Yavapai County. In FY 2021, Yavapai County generated more than \$1.2 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Yavapai County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$503,306
USDA NIFA Cooperative Extension Capacity Funds	\$90,851
Additional County-Based Resources (e.g., direct funds, in-kind)	\$275,840
Grants, Contracts, Fees, and Other Self-Generated Resources	\$337,485
Total FY 2021 Arizona Extension Operational Funds	\$1,207,482

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 15 personnel and for all other non-personnel operational expenditures for Yavapai County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Yavapai County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	15 (11.12)
Total Compensation Expenditures	\$759,407
Total Non-Personnel Operational Expenditures	\$121,217
Total Capital Expenditures	\$117,726
Total Extension Expenditures	\$998,350

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Yavapai County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Yavapai County:

- Total expenditure-based economic impact (as measured by output) of more than \$2.02 million
- 22 total jobs supported in the County, receiving more than \$1.06 million in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Yavapai County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	15.0	\$759,407	\$998,350	\$12,084	\$24,238
Indirect Effect	2.3	\$90,019	\$348,926	\$9,297	\$11,087
Induced Effect	4.7	\$211,072	\$673,528	\$25,380	\$30,082
Total Impacts	22.0	\$1,060,497	\$2,020,805	\$46,761	\$65,407
Multiplier	1.46	1.40	2.02		

Source: TEconomy analysis, 2020 IMPLAN Model

Yuma County Extension

Table A details revenue sources for Arizona Extension allocated to Yuma County. In FY 2021, Yuma County generated more than \$1.8 million in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Extension in Yuma County (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$839,213
USDA NIFA Cooperative Extension Capacity Funds	\$104,818
Additional County-Based Resources (e.g., direct funds, in-kind)	\$186,440
Grants, Contracts, Fees, and Other Self-Generated Resources	\$728,061
Total FY 2021 Arizona Extension Operational Funds	\$1,858,532

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

The above operational revenues are used to fund compensation for Arizona Extension's 21 personnel and for all other non-personnel operational expenditures for Yuma County. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures in Yuma County (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	21 (18.43)
Total Compensation Expenditures	\$1,410,781
Total Non-Personnel Operational Expenditures	\$298,100
Total Capital Expenditures	\$16,388
Total Extension Expenditures	\$1,725,269

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Yuma County in FY2021, the expenditure-based economic impacts within the County are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Yuma County:

- Total expenditure-based economic impact (as measured by output) of nearly \$2.87 million
- 28.2 total jobs supported in the County, receiving more than \$1.8 million in total compensation

Table C: Economic Impact of AZ Extension Expenditures in Yuma County (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	21.0	\$1,410,781	\$1,725,269	\$17,793	\$38,547
Indirect Effect	0.5	\$29,916	\$90,944	\$2,185	\$2,376
Induced Effect	6.7	\$370,595	\$1,052,214	\$39,866	\$40,935
Total Impacts	28.2	\$1,811,293	\$2,868,427	\$59,844	\$81,859
Multiplier	1.34	1.28	1.66		

Source: TEconomy analysis, 2020 IMPLAN Model

Tribal Region Extension*

Table A details revenue sources for Arizona Extension allocated to Tribal Region Extension. In FY 2021, Tribal Region Extension generated nearly \$733,000 in total funding from a variety of sources.

Table A: Operational Revenue Sources for Arizona Tribal Region Extension (FY 2021)

Funding Source	Value
State of Arizona (Direct Funding)	\$13,649
USDA NIFA Cooperative Extension Capacity Funds	\$0
Additional County-Based Resources (e.g., direct funds, in-kind)	\$0
Grants, Contracts, Fees, and Other Self-Generated Resources*	\$719,312
Total FY 2021 Arizona Extension Operational Funds	\$732,961

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

* **Note:** These funds include competitive NIFA FRTEP grants.

The above operational revenues are used to fund compensation for Arizona Extension's 9 personnel and for all other non-personnel operational expenditures for Tribal Region Extension. Table B summarizes these macro expenditure categories for FY 2021. Please note, not all funds received in FY 21 were expended in FY 21.

Table B: Arizona Extension Headcount and Operational Expenditures for Tribal Region Extension (FY 2021)

Operational Input Type	Value
Total Headcount (FTE)	9 (7.25)
Total Compensation Expenditures	\$549,330
Total Non-Personnel Operational Expenditures	\$167,352
Total Capital Expenditures	\$0
Total Extension Expenditures	\$716,682

***Note:** An economic impact model for Tribal Region Extension was developed by integrating the IMPLAN models of the six counties of Arizona in which the greatest level of Tribal Extension activity occurs (Apache, Coconino, Gila, La Paz, Mohave, and Navajo).

Source: FY 2021 Operational Data University of Arizona, Arizona Cooperative Extension

As a result of the expenditures and employment highlighted in Table B that Arizona Extension dedicated to Tribal Region Extension in FY2021, the expenditure-based economic impacts are shown in Table C. For FY2021, Arizona Extension generated the following economic impacts in Tribal Region Extension:

- Total expenditure-based economic impact (as measured by output) of nearly \$1.35 million
- 13 total jobs supported in the Region, receiving nearly \$743,000 in total compensation

Table C: Economic Impact of AZ Extension Expenditures for Tribal Region Extension (FY 2021)

Impact Type	Employment (Headcount)	Labor Income	Output	County/ Local Tax Revenue	State Tax Revenue
Direct Effect	9.0	\$549,330	\$716,682	\$7,211	\$19,401
Indirect Effect	1.2	\$54,322	\$192,228	\$4,547	\$6,169
Induced Effect	2.7	\$138,941	\$436,580	\$14,243	\$19,036
Total Impacts	13.0	\$742,592	\$1,345,491	\$26,002	\$44,606
Multiplier	1.44	1.35	1.88		

Source: TEconomy analysis, 2020 IMPLAN Model

