2017 University of Tennessee and Tennessee State University Combined Research and Extension Plan of Work

Status: Accepted

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I. Plan Overview

1. Brief Summary about Plan Of Work

Tennessee's two land-grant universities comprise the Tennessee Agricultural Research and Extension System, conducting Research and Extension programs in all 95 counties, serving the state's 6.4 million people. The University of Tennessee Extension (UT Extension) and the Tennessee Agricultural Experiment Station (UT AgResearch) comprise the 1862 institution and the Tennessee State University (TSU) Cooperative Extension Program and the TSU Institute for Food Agriculture and Environmental Research comprise the 1890 institution. This 2017-2021 Plan of Work represents the combined efforts of UT Extension, UT AgResearch, TSU Cooperative Extension Program, and the TSU Institute for Food Agriculture and Environmental Research.

UT Extension conducted a far-reaching strategic planning effort in 2010 to map the future for the next 10 years. The planning process was guided by a diverse leadership team representing a cross-section of employees from across the state, including TSU, and this team was instrumental in collecting and analyzing data. As part of this process, we sought opinions from many Tennesseans, including decision-makers, clientele, partners and volunteers. Nearly 1,000 local Extension stakeholders attended one of 10 area meetings where they discussed Extension priorities and community needs. The planning effort also included an online survey where more than 2,000 Tennesseans shared their opinions. The goal was to give everyone a voice. This extensive strategic planning effort informed this 2017-2021 Plan of Work.

TSU has appointed Program Leaders in family and consumer sciences, 4-H youth development, agricultural sciences and natural resources, and community resource and economic development to provide linkage with program areas between UT and TSU. These appointees also serve on the TSU Extension Programming Council to coordinate integrated and interdisciplinary programming efforts.

Almost one of every five dollars generated in the state is associated with agriculture or an industry that generates projects from a natural resource - more than $60 billion annually. In addition, nearly 300,000 Tennesseans are directly employed by agricultural or natural resource industries, making effective research and Extension programs critical. UT and TSU research foci include supporting the state's nursery industry; developing agronomic crop varieties to meet consumer and farmer needs; improving the reproductive health of our livestock; concerted efforts to ramp-up biomass production and processing to reduce dependence on foreign oil; and expanding the state's important hardwood lumber processing industry. In addition, we seek to continue our leadership in no-till agriculture and soil erosion modeling; become more adept at using beneficial insects to protect ecosystems in the Great Smoky Mountains and beyond; and contribute to the national public policy conversation through our agricultural and natural policy research centers. We will also continue to safeguard the public with important food safety research; promote technologies to minimize wastewater impact, and develop bio-based sensors to more quickly predict disease patterns in the field. TSU research plans to continue to increase our impact through the addition of position in plant biotechnology and food science.

To strengthen our Extension and research for the state's beef cattle producers, this plan continues

our Beef and Forage Center based at the University of Tennessee. This center integrates our research and Extension programs in beef cattle production through applied research, integrated programs, and other joint programming by researchers and Extension personnel.

This plan includes planned programs, stakeholder input, merit/program review, multistate, and integrated research and extension activities. Changes in allocations and FTE assignments between and among planned programs will be made annually to reflect stakeholder input and to reflect the results of statewide needs assessments.

Estimated Number of Professional FTEs/SYs total in the State.

Year	Extension		Research	
	1862	1890	1862	1890
2017	450.0	90.0	330.0	74.0
2018	450.0	90.0	330.0	74.0
2019	450.0	90.0	330.0	74.0
2020	450.0	90.0	330.0	74.0
2021	450.0	0.0	330.0	74.0

II. Merit Review Process

1. The Merit Review Process that will be Employed during the 5-Year POW Cycle

- Internal University Panel
- External University Panel
- Expert Peer Review

2. Brief Explanation

All Extension programs initiated in the state of Tennessee, funded in whole or part from Smith-Lever or NARETPA Section 1444 and 14445 funds, require a merit review process. The criteria for a merit review were submitted to an out-of-state panel of seven Extension administrators, program leaders and scholars for their review. The states represented in the review panel were Arkansas, Kentucky, Mississippi and Texas. The review panel found the criteria to be fair, reliable, consistent with the current research-base, and overall a model for merit review of Extension plans of work. The criteria established includes: needs assessment; networking; appropriate delivery methods; clear implementation steps; plans for evaluation (tools/methods); reaches diverse audience; and outcomes clearly defined. After the criteria were established, UT and TSU pursued a coordinated merit review process for all programs. The planned program proposals are initially prepared by state Extension specialists. The proposals are written in a format called "State Action Agendas" which require that a logic model be established that includes proposed inputs, outputs and outcomes. All program proposals are reviewed by department heads and program leaders (UT) and program coordinators (TSU). This

input is considered by the State Action Agenda Review Team which consists of the three UT State Program Leaders, three TSU State Program Leaders, one UT specialist in program planning and evaluation, and one TSU Administrator. This review team accepts the program as presented, rejects the program, or accepts the program pending changes.

For the 2017-2021 Plan of Work, UT Extension also reviewed the National Outcomes and Indicators established by a panel of experts convened by USDA-NIFA. This review was helpful in validating many of the outcomes we had planned to collect and improving outcome reporting.

All proposed single-state research projects that are funded under the Hatch Act undergo a rigorous review process for merit and scientific soundness. While the details differ slightly by academic department, the review process begins informally with discussions between the project leader, colleagues, and the department head; research center directors (that may be tasked with overseeing field work) are frequently consulted at this stage of project development. After a draft of the research proposal is completed, the department head reviews the proposal. If the department head believes the proposal has potential merit, s(he) either suggests modifications or appoints a panel of scientific peers with expertise and knowledge in the area of the proposed research to review the proposal. The review panel consists of three to five scientists; these scientists are typically from within the researcher's department, but if the department head deems it appropriate, peers from other departments within UT AgResearch, or from other institutions, may also review the proposed research.

The review panel evaluates the proposal to determine if it is editorially appropriate, to determine if the protocol outlined is of sufficient clarity and quality to ensure a sound scientific effort (that should lead to publishable data), and to make a recommendation to the department head about the priority the proposed research should receive relative to the requested resources and the departmental mission. Upon receiving a recommendation from the panel, the department returns the proposal to the author for responses to the reviewer's comments, and, if appropriate, for revision of the proposal. Once peer-review is satisfied, the department head provides further vetting, or signs off. The project then goes to the Dean for review or alteration.

Multi-state projects, drafted by a writing team, are subject to much of the same internal vetting, but the review process is regional, coordinated by an administrative advisor, and subject to a regional review team of seasoned researchers. A new scientist may join an existing multi-state project by documenting their anticipated contribution to the project objectives.

Each component of the TSU research planned programs in this Plan of Work are reviewed by internal research/extension scientist teams as well as research and extension administrators. Discipline-specific focus groups have been formed to serve as a peer-based clearinghouse. Potential research projects are evaluated for relevance to NIFA goals, applicability to stakeholder needs, scientific soundness, and appropriateness of planned outcomes. In addition, select research plans are also reviewed by outside experts. Only those proposed projects that are approved by all parties are developed further for inclusion into our suite of planned programs.

III. Evaluation of Multis & Joint Activities

1. How will the planned programs address the critical issues of strategic importance, including those identified by the stakeholders?

All Planned Programs - For more than 100 years, Extension in Tennessee has been evolving to meet the changing needs of the state. In the future, many significant changes

are expected to occur at an unprecedented rate. The data collected to frame the Extension Strategic Plan indicated six trends that will shape our state. These trends will provide challenges and opportunities for the state, and they will be addressed in the planned programs in this 2017-2021 Plan of Work:

- Increasing urbanization, including a loss of farmland
- Advancing technology in all aspects of Tennesseans' lives
- Rising rate of obesity
- Increasing population and diversity
- Declining economy, including job loss
- Increasing concern for environmental sustainability

Profitable Agriculture - Extension's statewide needs assessment identified marketing and management issues, including new agricultural enterprises, as critical needs for the state's farmers. A major integrated project in organic fruits and vegetable production will continue to be conducted. In partnership with UT AgResearch and the Tennessee Department of Agriculture, research and demonstration will be conducted on Tennessee farms as well as on the University of Tennessee's organic research unit (21 acres) in Knoxville.

Family Economics - In our strategic planning process, stakeholders asked for more Extension resources and programs to utilize technology to a greater degree. We recently launched an entire re-write of our successful On My Own financial simulation for young people. Annually, this program reaches approximately 30,000 Tennessee youth, and stakeholder feedback and program evaluations have determined that this successful program must continue.

Childhood Obesity- Tennessee youth are among the most obese in the nation. The Power U program will target the state's fourth graders and the Healthy Steps program will target the state's preschool students to reverse this trend.

Living Well with Chronic Conditions - Feedback from various key informants, advisory groups, and university researchers has shown that Tennesseans need education and support to pursue daily activities when faced with a chronic health condition. This program will be offered statewide.

UT AgResearch desires to meet pressing needs of both Tennessee and national stakeholders. So, we have long-standing programs targeting, for example, grazing, reproductive optimization, genetic improvement, and mastitis suppression for the Tennessee beef and dairy industries, while also addressing the negative impacts of poor cattle management on stream-dwelling amphibians. We take seriously the natural beauty of our state by addressing hemlock die-off in the Great Smoky Mountains, working to reintroduce the American chestnut, and researching policy affecting ecosystems on public and private lands subject to historical mining or contemporary resource extraction. We are leaders in the move to a bio-based economy, with an emphasis on finding the correct answers for our region, which likely differ in species selection, process and scale, and end-products and by-products from those of other regions.

All research programs in the TSU College of Agriculture, Human and Natural Sciences have an established record of soliciting, establishing, and maintaining direct input concerning research content and direction from stakeholders. The direct relationship we enjoy with our stakeholders and the feedback and oversight they provide us ensures the research we perform addresses issues of strategic importance. An example of stakeholder feedback is in our nursery research programs. In our quest to increase the efficacy of insecticide treatments for the invasive insect, Xylosandrus germanus (Ambrosia Beetle) treatments were developed that had good efficacy, but low residual effects. Our stakeholders communicated that as this insect first emerges during the busy spring shipping season, they were willing to accept a treatment with lower efficacy but a longer residual, to avoid tying up labor with repeated sprays. Alternative treatments are being examined. Also, as in most recent years, a concern

of stakeholders, regardless of area of research, is in the areas of economics and health. Examples of concerns are curtailing expenses, increasing efficiency, finding new markets and, finally, staying in business. Much of our research, regardless of topic or emphasis, addresses these economic themes.

2. How will the planned programs address the needs of under-served and under-represented populations of the State(s)?

Profitable Agriculture - Past Extension and Research programs have not emphasized the needs of small-scale organic fruit and vegetable producers. Our initiative in organics will be shaped and refined to meet the needs of this audience. TSU Extension will conduct a small farmer assistance program to address the needs of limited-resource farmers and landowners. Women are a growing demographic in agriculture and small business, and they need the tools and resources to be successful and effective in their efforts to make a living. The role of women in agriculture will continue to be the focus of "Homefront to Heartland: Empowering Women in Agriculture and Small Business".

Family Economics - Certain programs in Tennessee will be targeted toward clientele of partnering groups to meet the needs of under-served and under-represented clientele. The partnering groups are: Tennessee Housing Development Agency, Tennessee Families First, Tennessee Department of Human Services, Habitat for Humanity and others. We will continue to conduct family economics programs with faith-based organizations to reach ministers who provide counsel to thousands of Tennesseans. A needs assessment of faith-based organizations has informed this programming.

Childhood Obesity - This planned program will target limited resource individuals, particularly with two efforts: the Expanded Food and Nutrition Education Program (EFNEP) and the Tennessee Nutrition and Consumer Education Program (TNCEP). TNCEP is the name of the state's education program for Supplemental Nutrition Assistance Program (SNAP) recipients. Educational materials are available in Spanish and the Food Fiesta curricula targets Hispanic youth. UT Extension has also created the Healthy Steps program to target preschool teachers and youth with healthful eating and physical activity. During 2017-2021, UT and TSU Extension are targeting four West Tennessee counties for obesity prevention programs: Lake, Lauderdale, Haywood, and Humphreys. These four counties were identified by the Centers for Disease Control and Prevention as four of the unhealthiest counties in the United States in terms of obesity, diabetes, heart disease, and stroke. This effort will focus on improving access to healthy foods and physical activity opportunities.

Living Well with Chronic Conditions - This planned program will be offered in locations that provide easy access to under-served and under-represented audiences such as Department of Human Services Offices, local housing authorities, schools, and libraries. Tennessee has many part-time and small-acreage farmers that are perennially under economic pressure. UT AgResearch is always looking for improvements, whether in new biomass crops, high-value specialty crops like grapes or berries, or insuring multiple value streams from our extensive smallholder-owned hardwood stands. Since food security and food safety are issues, both in under-served urban and rural areas, we are active in research on local food production, farmers markets, and the control of a variety of food-borne illnesses. And as Tennessee is a magnet for retired Americans moving to our retirement communities, we address the population dynamics and change related to aging, ethnicity and land-use change in rural areas.

The research goals at TSU are the culmination of a review and prioritization process used to define the scope and direction of the agricultural research programs at Tennessee State University. By virtue of our history and research/extension culture, all of our programs focus on finding solutions to challenges faced by socially and/or economically disadvantaged groups, and contribute to the prosperity of the citizens of Tennessee and the nation. Thus,

each research goal, and subsequently each planned program, is based on a mandate to serve those members of our population that are traditionally classified as being underserved. In addition to focusing on socially and economically disadvantaged groups, our planned research programs also target groups not usually served by mainstream agriculture, i.e., owners of small farms, producers of niche products, limited-resource individuals, etc. Even though some of our programs may develop solutions to challenges faced by mainstream segments of our population, the core of our research emphasis is finding solutions that are acutely applicable to small producers, niche product producers, or persons who are economically or socially disadvantaged.

3. How will the planned programs describe the expected outcomes and impacts?

Profitable Agriculture - UT and TSU Extension are committed to measuring the economic impact of planned programs in animal systems, agronomic crop systems and economic infrastructure and commerce. The recurring economic impact of these programs can be described by increased revenue, increased savings, and one-time capital improvements.

Family Economics - Outcomes and impacts will include increases in savings/investment and reduction in debt. This is an evidence-based program that annually produces an economic benefit to the state of over $5 million in increased savings and reduced debt. The program will be monitored to make sure that the state's neediest families are served.

Childhood Obesity - Participants who receive education in a series of sessions will report changes in attitudes and behaviors using validated instruments.

Living Well with Chronic Conditions - This planned program will be evaluated six months after it is offered. Participants will be interviewed or surveyed to determine their level of healthy food choices, use of positive thinking to control anger and frustration, doctor visits, pain, exercise routine.

For joint programs, many of the measures used to describe expected outcomes and impacts for Extension are also measures of UT AgResearch impact. For example when a producer quantifies the economic value of more reliable cattle reproduction using a technique or product developed by AgResearch, or a lumber mill reduces waste from using process software we developed, those are inherently both an Extension and an AgResearch impact.
This is particularly true for the numerous program areas where we collaborate: agronomic crop systems; animal systems; economic infrastructure and commerce; environmental and water quality impacts; food safety; forestry wildlife, and fisheries; horticultural systems; and sustainable energy. In addition, UT AgResearch publications, patents, intellectual property disclosures, joint ventures, industry licenses, and local, national, and international presentations serve to describe both outcomes and impacts.

4. How will the planned programs result in improved program effectiveness and/or

Extension will implement a review process to assure resources are allocated to high-priority programs. Extension will advance Tennessee through innovative programs using these action steps:

1. Implement a streamlined process for prioritizing programs based on local needs and emerging issues.
2. Coordinate county and state Extension program development and delivery.
3. Designate state-level subject matter expertise and develop curricula for priority programs.
4. Provide expert information technology staff to support innovative technologies for teaching and learning.
5. Ensure effective teaching methods using cutting-edge equipment and software.

6. Enhance and fully utilize Extension's System for University Planning, Evaluation and Reporting (SUPER).

7. Seek input from citizens to ensure Extension programs continue to address local needs.

One area of cooperation between AgResearch and TSU Research is the AgResearch "Faculty Fellows" program designed to get new research faculty up and running quickly. TSU participates in the Fellows program, either in person or remotely by video conference in Fellows events like a hosted grant-writing seminar, or a recent presentation and Q&A session with National Program Leaders in Washington.

In addition, our two sponsored programs offices work closely together on a frequent basis, as TSU researchers involve AgResearch personnel on their proposals and grants, and vice versa. One historical example of particularly close cooperation was a vegetable initiative for Tennessee farmers.

IV. Stakeholder Input

1. Actions taken to seek stakeholder input that encourages their participation

- Targeted invitation to traditional stakeholder groups
- Targeted invitation to traditional stakeholder individuals
- Targeted invitation to non-traditional stakeholder individuals
- Targeted invitation to selected individuals from general public
- Survey of traditional stakeholder groups
- Survey of traditional stakeholder individuals
- Survey specifically with non-traditional groups
- Survey of selected individuals from the general public
- Other (Local and State Advisory Councils)

Brief explanation.

UT and TSU Extension pursued multiple data collections for this Plan of Work.

1. All Extension personnel were surveyed, and asked to rate issues of importance to their county.
2. Nearly 1,000 Tennesseans attended one of ten area meetings held across the state for UT Extension strategic planning. Many were long-time clients of Extension, and others were new to Extension. The area meetings included group discussion and individual opinion polling about critical issues and how Extension should address those issues.
3. More than 2,000 Tennesseans completed an online survey that asked about learning preferences (such as online and face-to-face) and community issues.
4. Focus groups were conducted among the state's 30 leaders of state agencies and statewide organizations to solicit input for the strategic plan. Individuals surveyed included commissioners of state agencies, experts outside the land-grant university system, and leaders in business, industry and human services.

The draft plan was submitted to the State Extension Advisory Council. Council membership is composed of UT and TSU representatives and stakeholders. A modified nominal group technique was used to identify priorities.

Finally, state action agendas were written to address these strategic directions. Our plans are examined annually to determine progress and make needed changes. One of the data points used to examine the Strategic Plan is input from the state's network of local Extension Advisory Committees.

The strategic planning activities were in addition to Extension's ongoing structure for

stakeholder involvement that includes local Extension advisory groups in every Tennessee County. Plans are reviewed and updated during bi-annual meetings of the joint UT-TSU Extension State Advisory Council.

Stakeholder input for UT AgResearch includes the following:

Each of our seven research departments has an advocacy/advisory group, which meets once or more per year. Current research activities and plans for future activities are reviewed at each meeting. Reactions and suggestions from the groups are received and factored into the research agenda-setting process. Membership in each group is by invitation of the department head, and typically consists of industry and regional representatives, scientific peers, alumni, and other relevant stakeholders. Some recent stakeholder input for Animal Science included a request for additional applied research, including additional nutrition and forage analysis, as well as vaccine studies. In Plant Sciences, the advocacy group joined the faculty during their annual planning retreat, and affirmed the department's move into biofuels and a consequent shift of some research positions.

Our ten Research and Education Centers (the regional field laboratories) have advocate groups, similar in function to the department advisory/advocate groups. While the primary function of these groups is local advocacy for the Center involved, some research advising or feedback occurs. Members serve by invitation of the Center director, and include local leaders, commodity group members, and area farmers or business people. They provide local and commodity-focused feedback to the center directors, who then influence research priorities through semi-annual meetings with UT AgResearch administration, immediate communication, and/or individual contact with UT AgResearch faculty conducting research on the centers.

Individual researchers, because of their specialized expertise, are made aware of emerging research needs in the scientific literature and popular press, through attendance and interaction at professional meetings, through RFP's they receive, by their interaction with commodity groups, local associations, through communication with the general public, and in their efforts to continually update coursework (most researchers have a partial teaching appointment; some have a partial Extension appointment).

The UT AgResearch advisory committee consists of a group of senior faculty from various departments with broad, well-developed research backgrounds. This group advises the Dean on research directions and potential areas of interest. One effort underway by this group has been to foster collaborative, cross-disciplinary projects that more closely align with emerging critical real-world issues.

TSU research continues to utilize an increased level of stakeholder input in our hiring processes and areas of research emphasis. For the research activities conducted in the planned programs, community groups, industry associations or individual stakeholders are contacted and solicited for participation. For example, in programs where needs are more commodity-based, trade organizations (i.e. Tennessee Organic Growers Association, Tennessee Nursery and Landscape Association, Professional Grounds Maintenance Association, Tennessee Goat Producers Association, Southern Nursery Association, Guinea Fowl Breeders Association) are routinely utilized for input and direction. In other cases, individuals are contacted and participation is requested. For much of the research in the area of nursery plants, surveys of nursery producers were performed and periodic meetings were held with a Nursery Advisory Group that is maintained by the University. Our research programs relating to forestry work closely with the Nashville Metro Tree Advisory Council, the Forestry Division of the Tennessee Department of Agriculture, and with the Tennessee Urban Forestry Council; those programs examining new sources of feed stock for biofuels utilize the expertise and stakeholder evaluation available in our state Plant Material Advisory Committee and Plant Materials Committee; our environmental programs maintain a close relationship with the Cumberland River Compact, a non-profit organization concerned with the

health and wellbeing of the Cumberland Watershed that encompasses much of Middle Tennessee. A number of different programs maintain an active presence on social media (Facebook, Twitter) and utilize feedback gained from those sources.

2(A). A brief statement of the process that will be used by the recipient institution to identify individuals and groups stakeholders and to collect input from them

1. Method to identify individuals and groups

- Use Advisory Committees
- Open Listening Sessions
- Needs Assessments
- Use Surveys
- Other (See below.)

Brief explanation.

UT and TSU Extension will employ their extensive, statewide network of advisory groups for stakeholder input. The State Extension Advisory Council provides input and direction for statewide initiatives. Tennessee Extension Agents will continue to place special emphasis on involving youth and other under represented groups in needs assessment activities.
In FY 2015, UT and TSU Extension made 5,866 contacts for needs assessment purposes, and 309 (5%) were young people under 18 years of age. Statewide needs assessment methods included:
• 246 advisory committee meetings
• 87 focus group meetings
• 693 interviews with key informants
All of Tennessee's 95 counties have a County Agricultural Committee of seven local stakeholders, nominated by the County Mayor and approved by majority vote of the County Commission. Every County Agriculture Committee meets four times annually, and their duties include input into hiring decisions, local funding, and local programming.

The AgResearch advisory committees and advocates groups are responsible for identifying additional individual and group stakeholders that may depend on the work of a particular research department or research and education center, respectively.
Our methods to identify appropriate stakeholders for TSU research are consistent with those used in previous years. We do not employ a single defined strategy to identify stakeholders, rather they are identified through methods most suitable for a specific program. Our goal is to identify stakeholders in a manner that will provide the most useful and accurate feedback as possible about stakeholder concerns. Groups that serve the stakeholders (community based groups) or groups that represent stakeholders (industry and trade associations) are a primary source of input. Individual stakeholders are utilized where there are no associated groups representing the program area (such as biodiesel producers), or when an opportunity for face-to-face interaction (i.e. at an association meeting, field site visit, or community event) is presented. In these cases, individuals involved the program outputs are identified and queried for input.

2(B). A brief statement of the process that will be used by the recipient institution to identify individuals and groups who are stakeholders and to collect input from them

1. Methods for collecting Stakeholder Input

- Meeting with traditional Stakeholder groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals
- Meeting with the general public (open meeting advertised to all)
- Survey specifically with non-traditional individuals

Brief explanation.

All Tennessee Extension Agents and Specialists receive instruction in selecting needs assessment strategies and in selecting individuals for Advisory Committees. Community leaders selected for Advisory Committees are chosen to represent the diversities (i.e., gender, age, racial/ethnic, socio-economic, political, educational, etc.) of the county or area served. Extension Agents recruit individuals who have participated in past and current Extension programs; and they recruit individuals who have not used Extension to serve on local advisory committees and participate in open listening sessions.

The geographical dispersion of AgResearch and education centers helps in providing a balanced picture of the needs of various populations, regions, and commodity/industry groups. In addition, both our researchers and center administrators conduct informal ongoing needs assessments through literature reviews, monitoring of scientific journals and regional/state news media, attendance at scientific meetings and local conferences, and both solicited and unsolicited communication from the public.

Other stakeholder input, especially for TSU research programs, is collected either in face-to-face discussions or via survey instruments. Each of these methods is effective. The face-to-face discussions are often held in a group setting. This scenario permits questions and answers to direct and stimulate discussion of areas of importance to stakeholders. However, individual discussions are also an important source of input. We have found that some persons are not comfortable speaking out in a group, but are very willing to email opinions and ideas, or to speak one-on-one with scientists. Survey instruments are a useful tool to assess information from broader groups of stakeholders. However, while some stakeholders prefer the anonymity and brevity of a survey instrument (resulting in increased participation), the survey instrument does not allow for discussion of previously unrecognized areas of concern. In addition, audience response 'clickers' and associated software have been purchased and made available to our faculty, permitting them to incorporate opportunities for real-time feedback during group presentations or engagements.

3. A statement of how the input will be considered

- In the Budget Process
- To Identify Emerging Issues
- Redirect Extension Programs
- Redirect Research Programs
- In the Staff Hiring Process

- In the Action Plans
- To Set Priorities

Brief explanation.

All of the input received was used to formulate a State Extension Strategic Plan for 2010-2020. This document, titled Advancing Tennessee, is a guide for identifying emerging issues, redirecting Extension programs, building state action agendas and setting program priorities. Stakeholder input and performance measures at the local, regional and statewide level are used to monitor and adjust deployment of the strategic plan. To illustrate this important process, consider that stakeholder input was used to modify these programs for this 2017-2021 plan, as described below:

• Increasing urbanization and a loss of farmland in the state caused much concern among Tennessee citizens. Our **Nursery, Fruit and Vegetable Production Programs** will place greater emphasis on plant, pest, and soil diagnostic services. We are already seeing results from this change. In FY2015, Tennessee nursery growers realized more than $700,000 in increased revenue or savings as a result of Extension recommendations. Fruit and vegetable programs will stress proper variety selection.

• The **Center for Profitable Agriculture** has conducted educational programs for several years on the state's Agritourism industry. Via surveys and advisory group meetings, 2017-2021 programs will include marketing value-added beef, optimizing farmers' markets, and increasing grants for local food initiatives.

• UT Extension will place greater emphasis on **Living Well with Chronic Conditions Program** based on stakeholder feedback about the health status of Tennessee citizens. Living Well with Chronic Conditions is an evidence-based program that teaches people practical skills to live with anxiety, asthma, chronic bronchitis, heart disease, hypertension, multiple sclerosis, and other chronic conditions.

• To strengthen our Extension and research for the state's beef cattle producers, the **Beef and Forage Center** based at the University of Tennessee will continue to integrate research and Extension efforts in beef cattle. Researchers and Extension personnel will jointly implement research and outreach in hay schools, late gestation nutrition, marketing, forage testing, and stockpiled forages.

• Our **Childhood Obesity Prevention Programs** have demonstrated success at improving physical activity and increasing consumption of fruits and vegetables. Stakeholder input has created local advisory councils specifically to guide our obesity prevention programs in four West Tennessee counties. A new Extension effort, funded by the CDC, will focus in part on family-based approaches to combat obesity, diabetes, heart disease and stroke in four Tennessee counties. The effort will enlist community coalitions to bring about improvements to parks, walkways and greenways as well as to schools and other locally based centers of community activities.

For UT AgResearch, stakeholder input is an active part of setting budget priorities and redirecting allocations as critical needs emerge, are addressed, and wane.Stakeholder input directly impacts hiring patterns, faculty equipment budgets, publicity efforts, forward-looking action plans, and grant-writing directions.

TSU Extension will continue to use extensive stakeholder input to determine what extension faculty positions and extension agent positions are needed for the state of Tennessee. TSU Extension will also continue to partner with UT Extension, county extension offices and extension advisory councils to determine staffing needs, emerging issues and determine priority areas for the State of Tennessee.

The close involvement of Tennessee State University research scientists with stakeholder groups and individuals provides an almost constant feedback about the utility and practicality of the research we conduct and the solutions we pursue. We engage our stakeholders in discussion of all aspects of our research, from planning, to execution, to dissemination of results. As discussed previously, stakeholders are now used in search committees, providing direct influence into the selection and hiring process. Additionally, input at latter stages of the programs is used to ensure we are addressing issues of importance in a manner the stakeholders can readily utilize. The examples of our use of feedback that are presented here have also been cited in Section III-1 of this report.

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

4-H Positive Youth Development

2. Brief summary about Planned Program

According to the Tennessee Department of Education, many students graduate from Tennessee high schools without the skills and attitudes needed to get and hold a job. Tennessee 4-H Youth Development will address this problem by helping youth to attain the life skills of achieving goals and communicating.

A recent National Science Foundation report concluded that most Tennessee 4, 8 and 12 grade students did not demonstrate proficiency in the knowledge and skills taught at their grade level in science and mathematics.

The methods used will vary depending on the local situation and the needs of the target audience, however, clubs, afterschool and school enrichment programs will be emphasized in at least 65 Tennessee counties.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
803	Sociological and Technological Change Affecting Individuals, Families, and Communities	25%	25%	0%	0%
806	Youth Development	75%	75%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Youth in Tennessee need the skills, experience and confidence necessary to meet the demands of the workplace and succeed in a high-performance economy characterized by high-skill, high-wage employment. According to the Tennessee Department of Education, many students graduate from Tennessee high schools without the skills and attitudes needed to get and hold a job. Tennessee 4-H Youth Development will address the development of skills and personal qualities needed for solid job performance. Youth will attain the life skills of achieving goals and communicating, two life skills essential for adult success in a job or careers. Additional emphasis will be placed on improving science literacy among the state's young people through 4-H efforts in science, engineering, and technology.

2. Scope of the Program

- In-State Extension
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Assumption A. It is assumed that Tennessee Extension 4-H Agents and adult volunteer leaders have the necessary skills to collaborate with local school systems for the delivery of afterschool and school enrichment programs.

Assumption B. It is assumed that the logic model concept, applied to youth development program planning, will yield positive results.

2. Ultimate goal(s) of this Program

Tennessee youth will attain the life skills of achieving goals and communicating, two life skills essential for adult success in a job or career. Tennessee youth will possess the skills needed to compete in a diverse and demanding workforce.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	158.0	17.0	0.0	0.0
2018	158.0	17.0	0.0	0.0
2019	158.0	17.0	0.0	0.0
2020	158.0	17.0	0.0	0.0
2021	158.0	17.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

• **Clubs/Project Groups -** At least 65 Tennessee counties will organize over 2,500 4-H clubs where workforce preparation will be the major emphasis. Project work will be emphasized, and the experiential learning model will be used to highlight jobs and careers aligned with 4-H projects. Activity sheets have been developed to emphasize practical skills which align with jobs and careers.

• **School Enrichment -** Various school enrichment programs in at least 50 Tennessee counties will focus on science, engineering and technology. Youth will be exposed to jobs and careers associated with science fields.

• **Mass media** - Mass media will be used to inform parents, participants and stakeholders about program opportunities and achievements.

• **Youth from Under-Served and Limited Resource Families:** For 2016-2021, TSU Extension 4-H

Youth Development programs will place special emphasis on SET programs in clubs, afterschool settings and other venues to reach youth. The ultimate goal is to increase science literacy among the state's young people. TSU Extension will reach under-served and limited resource youth.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● One-on-One Intervention ● Demonstrations	● Newsletters ● TV Media Programs ● Other 1 (Radio Programs) ● Other 2 (Exhibits)

3. Description of targeted audience

Tennessee youth in grades 4-12 will be targeted for this program. To encourage participation of underserved and minority youth, the majority of programs will be organized and taught in public schools.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of volunteers utilized in delivering this program.
- Number of exhibits produced.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Achieving Goals: Number of youth who now put their goal in writing.
2	Achieving Goals: Number of youth who now report they set high goals.
3	Achieving Goals: Number of high school youth who have set a goal for their job or career.
4	Communicating: Number of youth who can express ideas with a poster, exhibit, or other display.
5	Communicating: Number of youth who can use technology to help themselves express ideas.
6	Communicating: Number of youth who have learned at least five jobs in which communication skills are important.
7	Communicating (Public Speaking): Number of youth who can deal with their nervousness when giving a speech or talk.
8	Communicating (Public Speaking): Number of youth who can select a topic for a speech or talk.
9	Communicating (Public Speaking): Number of youth who can speak loudly enough to be heard when giving a speech or talk.
10	Communicating (Public Speaking): Number of youth who feel comfortable sharing their thoughts and feelings in a speech or talk.
11	SET: Number of youth who can design a scientific procedure to answer a question.

Outcome # 1

1. Outcome Target

Achieving Goals: Number of youth who now put their goal in writing.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Achieving Goals: Number of youth who now report they set high goals.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

Achieving Goals: Number of high school youth who have set a goal for their job or career.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Communicating: Number of youth who can express ideas with a poster, exhibit, or other display.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

Communicating: Number of youth who can use technology to help themselves express ideas.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 6

1. Outcome Target

Communicating: Number of youth who have learned at least five jobs in which communication skills are important.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 7

1. Outcome Target

Communicating (Public Speaking): Number of youth who can deal with their nervousness when giving a speech or talk.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 8

1. Outcome Target

Communicating (Public Speaking): Number of youth who can select a topic for a speech or talk.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 9

1. Outcome Target

Communicating (Public Speaking): Number of youth who can speak loudly enough to be heard when giving a speech or talk.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 10

1. Outcome Target

Communicating (Public Speaking): Number of youth who feel comfortable sharing their thoughts and feelings in a speech or talk.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 11

1. Outcome Target

SET: Number of youth who can design a scientific procedure to answer a question.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 803 - Sociological and Technological Change Affecting Individuals, Families, and Communities
- 806 - Youth Development

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities

Description

Much of this program will be delivered in Tennessee public schools to reach the target audience which includes underserved youth. If the program is not available to large numbers of public school youth, the outcome targets will be greatly reduced since additional time and effort is required to reach youth through community-based settings. The delivery of 4-H school-based programs targeting workforce preparation and science literacy has been a priority for Tennessee educational leaders at the local level, but changing accountability demands through standardized testing may alter that priority, and school gatekeepers (i.e. principals, superintendents and local school boards) may have new priorities. This has become especially true as Tennessee was one of the first two states to receive new funding and accountability models as part of the U.S. Department of Education's "Race to the Top" program.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

The Program Evaluation Network will be used to evaluate the 4-H Workforce Preparation program. The after-only or post-program questionnaire is the appropriate method for this program and audience.Instruments have been created and validated for this study. Reliability was established by pilot-tests involving over 1,000 Tennessee youth.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Agronomic Crop Systems

2. Brief summary about Planned Program

This program seeks to increase yield for Tennessee's (and the world's) cotton, corn, soybeans, wheat, and commercial vegetable production. As in the Agronomic Crop Systems planned program for both 2016-2020 and 2017-2021, this plan will also reflect the previous Global Food Security planned program.

We will continue to develop varieties and genetic lines that provide high-yielding, disease-resistant options for producers, and compare these to commercial standards. This will result in unbiased, research-based information to improve the ability of producers to make sound selections for optimum performance and yields. Optimum production systems will be determined through research which will provide producers with best management practices.

Because growth rates and pest and disease resistance and control are critical to the success of farmers, insect and disease control technologies are continually being created by sources within the University system and outside it. We will continue to develop and utilize new Integrated Pest Management technology for control of existing, invasive, new and re-emerging insect and disease pests of cropping systems.

In many cases, agricultural production research develops new technologies and practices to increase yields while ignoring economic tradeoffs. We will seek to use a multidisciplinary approach to evaluate crop systems for economically optimal production of the agricultural commodities produced in Tennessee.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	10%	17%
104	Protect Soil from Harmful Effects of Natural Elements	0%	0%	2%	0%
111	Conservation and Efficient Use of Water	0%	0%	2%	0%
112	Watershed Protection and Management	0%	0%	2%	0%
132	Weather and Climate	0%	0%	1%	0%
133	Pollution Prevention and Mitigation	0%	0%	1%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	12%	13%	25%
202	Plant Genetic Resources	0%	0%	17%	21%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	8%	8%
204	Plant Product Quality and Utility (Preharvest)	0%	0%	2%	4%
205	Plant Management Systems	50%	62%	12%	8%
211	Insects, Mites, and Other Arthropods Affecting Plants	5%	3%	5%	0%
212	Diseases and Nematodes Affecting Plants	5%	16%	10%	17%
213	Weeds Affecting Plants	0%	0%	5%	0%
402	Engineering Systems and Equipment	0%	0%	5%	0%
511	New and Improved Non-Food Products and Processes	0%	0%	3%	0%
601	Economics of Agricultural Production and Farm Management	40%	7%	0%	0%
611	Foreign Policy and Programs	0%	0%	2%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Various needs assessments conducted by Extension specialists show that the following practices are key for Tennessee row crops producers: conservation tillage; planting insect-tolerant crops; planting herbicide-tolerant crops; spraying with foliar fungicide to manage disease; using recommended varieties.

Producers of agronomic crops are challenged each year with high costs of production, relatively low profit margins, and a host of other issues such as plant diseases, weather, and competition from other

countries in world markets. Because farmers often operate with a relatively low profit margin, economic feasibility as well as efficacy of new genetics or technology for pest and disease control is of paramount importance. Farmers need to be aware of the comparative performance of new technologies in order to make appropriate decisions on pest and disease management. Little information exists about the economics of those technologies and systems under differing production conditions.In addition, the economics of systems vary as the combination of system and production environment change, and as relative prices and costs change.

Row crops including corn, soybeans, and wheat are valued at close to $1 billion annually in Tennessee, and are grown on about three million acres in the state. Yield improvements may be obtained with proper variety selection, insect, disease, and weed management, appropriate use of fertilizers and irrigation, and other best management practices. These and other factors directly affect the profitability of crop production and environmental quality. Producers need research-based recommendations to insure maximum production and profitability.

From a research perspective, molecular, marker-assisted and traditional breeding techniques are used to develop genetic lines and varieties of corn, soybeans, and wheat which are adapted, high-yielding, and disease-resistant. Varieties of these crops and cotton are evaluated in replicated field research plots at our Research and Education Centers and with producer cooperators in selected counties. Likewise, cropping systems research addressing tillage systems and rotation schemes are conducted to develop production system information.

We conduct surveillance for exotic and invasive organisms using both conventional and molecular technologies.We research the effects of biological, cultural and chemical control technology for efficacy and effect on productivity of cropping systems under study.We search for new organisms to use in integrated control programs for pests and diseases of those agronomic systems that are predicted to be in danger of severe damage from new, emerging, and re-emerging pests and diseases.

Economic data are developed from field experiments on agricultural experiment stations, through surveys of producers, and through simulation modeling. Data are analyzed using standard methods for estimating yield response functions, budgeting, optimization techniques, risk analysis procedures, simulation modeling, and other methods of economic analysis as appropriate.

Vector-borne diseases of man and animals (zoonotic diseases) and blood-feeding arthropods have a negative impact on human activities and human development. Agricultural production is also decreased when either humans or livestock are affected by an infectious disease agent.

Improved sustainability of agricultural production and enhanced productivity will be obtained by decreasing the amount of inputs required in traditional, organic, and urban agriculture. The increased use of chemicals in agriculture challenges the sustainability of many agricultural enterprises by increasing production costs, polluting the environment and, in many instances, lowering plant quality. Developing systems to reduce chemical inputs and minimize pollutants will improve sustainability.

2. Scope of the Program

- In-State Extension

- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Row crops will continue to be a mainstay of the economy, particularly in the thirty-one West Tennessee counties, for the foreseeable future. The Innovation-Decision Process (Rogers, 1995) is a valid representation of adoption decisions made by Tennessee row crop producers.The level of staff and budget resources for research available from appropriated sources will remain approximately constant. Useable data can be developed from field experiments. Scientists in other disciplines will cooperate in developing and analyzing data. Producers will be willing to adopt technologies and systems that are shown to be economically superior. New pests and diseases will invade the region. Crop genetics will continue to change. Adequate expertise will exist in areas critical to this effort such as molecular, marker-assisted and traditional plant breeding; varietal evaluation, and system development and refinement. The volume and quality of our research work will be increased through substantial extramural funding.

The movement towards increased sustainability will become increasingly prevalent in all social, economic, and environmental aspects of our day-to-day life. Reduced inputs in traditional agriculture will continue to be important in agricultural production and will lead to increased sustainability. Inputs can be reduced via research on novel production practices for crops.

2. Ultimate goal(s) of this Program

The ultimate goal is to improve profitability for Tennessee row crop producers by assisting them to learn and adopt research-based recommendations; by developing and testing technology that will protect commercial agronomic crop systems from existing and invasive pests and disease and provide data in support of new genetics where appropriate; improving the sustainability of agricultural production and by developing and selecting improved crop varieties and production systems.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	4.0	1.0	70.0	13.0
2018	4.0	1.0	70.0	13.0
2019	43.0	1.0	70.0	13.0
2020	43.0	1.0	70.0	13.0
2021	43.0	1.0	70.0	13.0

V(F). Planned Program (Activity)

1. Activity for the Program

The Extension portion of this plan includes cotton, irrigation, entomology, plant pathology and row crops management and marketing issues. It is organized via the Innovation-Decision Process (Rogers, 1995). It is important to organize the agronomic crop systems planned program activity in this way because producers of various row crops, in various locations in the state are in different stages of this process for the array of research-based practices. Based on needs assessments conducted by Extension Specialists, the following practices will be targeted: conservation-tillage; planting insect-tolerant crops; planting herbicide-tolerant crops; spaying crops with foliar fungicide to manage disease; using recommended varieties (based on UT field trial results)

Knowledge: Newspaper articles, radio programs, websites and newsletters will be used to build awareness of UT Extension resources and practices for more profitable production. Mass media will also highlight pests and pesticides in a timely manner.

Persuasion: Farm visits and group meetings will be used to showcase practices.

Decision: Group meetings and classes will be held in which Extension specialists will deliver detailed instruction to producers.

Implementation: On-farm demonstrations will be conducted, particularly in the 31 West Tennessee counties, to highlight research-based practices. To the extent possible, integrated research and extension will be conducted such as result demonstrations and test plots in all 31 West Tennessee counties.

Confirmation: Farm visits and telephone calls will assist producers to continue use of the practices, respond to environmental factors, and realize greater profits.

The research portion of this program will improve disease and insect resistance mechanisms in crops, develop new varieties, increase yields, discover new markets, improve production practices, and reduce production inputs.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site Visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

The primary audience for this program is Tennessee row crop producers, and the secondary audience is the professionals, business owners/cooperatives, and government officials who serve row crop producers.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote awareness and participation in this planned program.
- Number of research-based publications distributed as part of this program.
- Research Fertilizer Efficiency Enhancers (Yin)
- Fight Fungal Pathogens of Snapbean and Soybean (Canaday)
- Develop New Cereal Varieties (West)
- Engineer Drought-Tolerant Bioenergy Crops (Cheng)
- Enhance Bioactive Food Components (Kopsell, Armel, Sams, Deyton)
- Genetically Improve Soybean Yields (Pantalone)
- Address Genetic Resistance to Bt Toxins (Jurat-Fuentes)
- Use Remote Sensing for Variable-rate Nitrogen Application (Gwathmey, Yin)
- Understand Soybean Mosaic Virus Virulence (Hajimorad)
- Evaluate New Crop Varieties (Allen)
- Fact Sheet of recommendations to farmers/producers to grow/manage pigeon pea in Tennessee and surrounding states. (Duseja)
- Investigate Appropriate Use of Unmanned Aircraft Systems (Freeland)
- Evaluate a Foldable Tractor RollOver Protection System (Ayers)
- Evaluate Spent Microbial Biomass for Amending Corn and Fescue (Eash)
- Release High Oleic Soybean to Eliminate Hydrogenation (Pantalone)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Row Crops Production: Number of participants who implemented one or more management practices based on data provided by UT (e.g., conservation tillage, plant population, growth retardants, IPM strategies, disease and weed control).
2	Row Crops Production: Number of producers, farm workers and other ag professionals who received pesticide certification, recertification and pesticide safety training.
3	Row Crops Production: Number of participants who improved their income by following the recommended best management practices for crop production, including plant pest management.
4	Soybeans: Number of producers who learned soybean best management practices that can improve production potential (e.g., conservation tillage, winter covers, plant population, row spacing, planting dates, plant growth regulators, harvest, variety selection, irrigation, fertility).
5	Create Genetic Mapping Populations of Soybean (Pantalone)
6	Investigate Insect Resistance to Biopesticides (Jurat-Fuentes)
7	Identify Molecular and Genomic Plant Defense Mechanisms (Chen, Grant)
8	Explore Nematode and Arthropod Biodiversity (Bernard)
9	Attack the Soybean cyst Nematode (Hewezi, Hajimorad)
10	Precision protocols will be developed for nucleic acid extraction from isolated cotton pollen and microspores towards molecular marker based analyses of cotton lines. (Aziz)
11	Agricultural and Environmental Sciences research knowledge will be enhanced for undergraduate and/or graduate students through laboratory experiential learning. (Aziz)
12	Improve amaranth as an alternative crop and increase profitability of farming in small acreages through the production of alternative crops. (Blair)
13	Increase soybean genetic diversity. (Taheri)
14	Identify vegetable cultivars suitable for organic management system and to improve efficiency of organic farming by proper allocation of inputs. (Nandwani)
15	Research to better understand the bacterial wilt disease process and the role of individual genes in the disease process. (Dumenyo)
16	Define the natural enemy complex for the Brown Marmorated Stink Bug (Moore)
17	Engineer drought-tolerant bioenergy crops (Cheng)

Outcome # 1

1. Outcome Target

Row Crops Production: Number of participants who implemented one or more management practices based on data provided by UT (e.g., conservation tillage, plant population, growth retardants, IPM strategies, disease and weed control).

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Row Crops Production: Number of producers, farm workers and other ag professionals who received pesticide certification, recertification and pesticide safety training.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 3

1. Outcome Target

Row Crops Production: Number of participants who improved their income by following the recommended best management practices for crop production, including plant pest management.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 4

1. Outcome Target

Soybeans: Number of producers who learned soybean best management practices that can improve production potential (e.g., conservation tillage, winter covers, plant population, row spacing, planting dates, plant growth regulators, harvest, variety selection, irrigation, fertility).

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 213 - Weeds Affecting Plants
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 5

1. Outcome Target

Create Genetic Mapping Populations of Soybean (Pantalone)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Investigate Insect Resistance to Biopesticides (Jurat-Fuentes)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Identify Molecular and Genomic Plant Defense Mechanisms (Chen, Grant)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 213 - Weeds Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Explore Nematode and Arthropod Biodiversity (Bernard)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 102 - Soil, Plant, Water, Nutrient Relationships
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 9

1. Outcome Target

Attack the Soybean cyst Nematode (Hewezi, Hajimorad)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 205 - Plant Management Systems
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 10

1. Outcome Target

Precision protocols will be developed for nucleic acid extraction from isolated cotton pollen and microspores towards molecular marker based analyses of cotton lines. (Aziz)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Agricultural and Environmental Sciences research knowledge will be enhanced for undergraduate and/or graduate students through laboratory experiential learning. (Aziz)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1890 Research

Outcome # 12

1. Outcome Target

Improve amaranth as an alternative crop and increase profitability of farming in small acreages through the production of alternative crops. (Blair)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 13

1. Outcome Target

Increase soybean genetic diversity. (Taheri)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 202 - Plant Genetic Resources

4. Associated Institute Type(s)

- 1890 Research

Outcome # 14

1. Outcome Target

Identify vegetable cultivars suitable for organic management system and to improve efficiency of organic farming by proper allocation of inputs. (Nandwani)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 202 - Plant Genetic Resources
- 204 - Plant Product Quality and Utility (Preharvest)

4. Associated Institute Type(s)

- 1890 Research

Outcome # 15

1. Outcome Target

Research to better understand the bacterial wilt disease process and the role of individual genes in the disease process. (Dumenyo)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 16

1. Outcome Target

Define the natural enemy complex for the Brown Marmorated Stink Bug (Moore)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 17

1. Outcome Target

Engineer drought-tolerant bioenergy crops (Cheng)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 132 - Weather and Climate
- 102 - Soil, Plant, Water, Nutrient Relationships
- 111 - Conservation and Efficient Use of Water
- 202 - Plant Genetic Resources
- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Competing Programmatic Challenges

Description

Crop yields are heavily dependent on available moisture. Hot, dry conditions in July can affect pollination and subsequently production for the year. Although some crops such as sorghum are relatively drought tolerant, yields are still dependent on available moisture. Dry conditions in June and July can destroy yield. Corn yields are heavily dependent on available moisture and hot, dry conditions in July can affect pollination and subsequently production for the year. Although sorghum is relatively drought tolerant, yields are still dependent on available moisture. Dry conditions in June and July can destroy yield.

Appropriations changes will greatly affect outcome -- the possible loss of one faculty member may be critical. Policies regarding antibiotic use in animals may change over time and would thus impact the

direction and implications of this research.

The macroeconomics of agriculture may affect the economic environment of specific enterprises and, in turn, affect the applicability of decision-making tools. In addition, Extension and other information providers may have competing demands that prevent effective dissemination of research results. IPM program outcomes will be affected by weather extremes, corporate and academic production of new plant genetics and new chemistries for control.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

- End-of-year follow up survey: Agents make one-on-one contacts to interview producers.
- End-of-program survey: Used at the Grain Conference in Dyersburg, Tennessee.
- Third-Party: Interviews with agri-businesses who sell chemicals and seed (sales records of chemicals and seed varieties used).
- Producers will be surveyed at area crop production meetings to determine the percentage of acres planted to varieties developed/recommended by UT AgResearch, and the percentage which follow cropping system practices based on the results of our research. IPM evaluation information will be acquired from Extension agents, direct contact with growers, and area production meetings, where available.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Animal Systems

2. Brief summary about Planned Program

Our extension and research programs will seek ways to increase the health and productivity of livestock through strategies that reduce disease pathogens and stress factors, optimize livestock nutrition, and increase reproduction.

With 2.17 million cattle and calves in the state, beef cattle remain the number one agricultural enterprise for Tennessee farmers. Cash receipts annually exceed $514 million, representing 20% of the state's total cash receipts from agriculture. UT and TSU Extension will provide producers with in-depth and comprehensive education on production, management, and marketing of beef cattle, and especially feeder cattle, through its Master Beef Producer Program.

To strengthen our Extension and research for the state's beef cattle producers, this plan initiates a new Beef and Forage Center based at the University of Tennessee. This center integrates our research and Extension programs in beef cattle production through applied research, integrated programs, and other joint programming by researchers and Extension personnel.

AgResearch work in disease prevention and therapy of lactating dairy cattle will be conducted using established challenge models, allowing the comparison of treatments. Research to determine genetic factors that impact response to stress and disease as well as those that optimize production in cattle, swine and poultry will constitute a significant component. Additional research will be conducted to find more rapid and reliable identification methods for disease pathogens. Research to determine optimal nutritional regimens and least cost inputs, including byproducts for cattle, swine, and poultry will also be conducted, in the context of modern genetics and current commercial production settings.

AgResearch efforts to determine ways to increase reproductive rates in cattle will constitute another significant component of this program. Identification of physiological factors that impact embryo development and viability, as well as sperm and oocyte longevity will allow for the development of practical and economical techniques that producers can implement at the farm level, which will ultimately result in increased meat and milk production and sustainability of livestock farms. Research for domestic animals includes development of faster disease diagnostic methods for livestock.

Efficiency of animal production by small and/or limited resource producers will also be improved.

Meat goat production in the Southeast will be improved by understanding how animal genetics can be managed to enhance lifetime doe reproductive output. Updated information about the economic viability of production and/or methods to enhance producer income will be delivered to goat producers and individuals contemplating goat production. Hands-on clinics and workshops for value-added products to diversify income streams and increase production management returns will be held.

Research will be conducted to enhance the production efficiency of poultry and Guinea fowl, and to enhance the adoption and profitability of the Guinea fowl as alternative poultry for small scale and limited resource farmers.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	8%	0%
205	Plant Management Systems	0%	0%	8%	0%
301	Reproductive Performance of Animals	15%	16%	8%	0%
302	Nutrient Utilization in Animals	0%	5%	13%	15%
303	Genetic Improvement of Animals	10%	5%	0%	5%
304	Animal Genome	0%	0%	5%	30%
305	Animal Physiological Processes	0%	0%	13%	0%
306	Environmental Stress in Animals	0%	0%	6%	0%
307	Animal Management Systems	60%	57%	5%	25%
311	Animal Diseases	15%	17%	14%	0%
312	External Parasites and Pests of Animals	0%	0%	5%	0%
315	Animal Welfare/Well-Being and Protection	0%	0%	9%	0%
402	Engineering Systems and Equipment	0%	0%	3%	0%
603	Market Economics	0%	0%	0%	25%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	0%	3%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Animal health, efficiency, and performance are critical factors for the profitability and sustainability of livestock systems impacting the ability of farms to remain profitable. Livestock producers and their families are directly impacted economically by these factors and consumers are ultimately affected through costs of food and other farm goods.

The market for beef cattle, like many other agricultural commodities, is becoming increasingly competitive due to consumer demands for safe and wholesome products, international market influences on prices, and escalating energy, fertilizer, and feed prices. Tennessee feeder cattle have been discounted in the past due to perceived inadequacies related to health and management. To ensure future viability of the industry, producers need in-depth and comprehensive education on these priorities: production, management, and marketing of beef cattle, and especially feeder cattle. Such education is not suited for one to two hour county meetings, but rather must be delivered in the form of a multi-week, multi-disciplinary educational program.

Alternative livestock and forage options will enhance the sustainability of small and limited resource producers in the southeast.

Demand for goat products in the US is increasing, in large part, because of increasing ethnic diversity.

Lack of standardized processing techniques and unavailability of goat meat in local stores causes consumer difficulty in obtaining goat meat. Without relevant information, producers are disadvantaged in making informed decisions about production opportunities and marketing options. A need exists to educate the public about the health benefits and qualities associated with goat meat.

Stakeholders have recommended improved outreach activities to communicate marketing, materials/practices, and hands-on demonstrations for value added products.

Goat industry producers have problems maintaining healthy and productive does due to poor genetic-environment combinations, leading to increased production inputs, resulting in low profitability and compromised long-term sustainability. It will benefit producers to maintain herds of mature does that do not require intensive, resource-intense management. Stayability differences between breeds for mature does and indicators of reproductive potential in young doelings within genotypes requires further investigation.

Demand for guinea fowl as alternative poultry continues to increase. This animal is an alternative poultry crop for small scale producers who are unable to compete in the traditional poultry industry. Lack of nutrient requirement recommendations to guide formulation of least-cost rations hampers this industry. Genetic resource information to aid marker assisted selection for important traits is also lacking. Poor feed efficiency and a lack of optimum nutrient requirements results in poor performance, increased production costs, poor quality poultry and poultry products, and environmental pollution from excess nutrients in poultry manure. These constraints can be overcome by determining nutrient requirements of the guinea fowl and generating genetic resource information to aid guinea fowl breeding programs.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

County Extension Agents have the knowledge and skills to collaborate with county livestock associations, cattlemens' associations, local agribusinesses and other local stakeholders to conduct the Master Beef Producer program.Adequate scientific and technical personnel will remain in place so that changes in the research-base will be reflected in the Master Beef Producer curricula and other publications necessary for this program.Research funding will remain static or increase. New vectors and/or diseases will emerge. We will be able to maintain sufficient personnel to continue our research programs.

There is an absence of industry structure for meat goat production in Tennessee. Tennessee remains the second largest producer of meat goats in the country. Additional information concerning goat production and marketing in Tennessee is needed.

Goat management costs are not expected to decrease. Increased demand for chevon is expected to continue. Genetic fitness and longevity are of increased importance because there are few FDA approved pharmaceuticals for goats, and this number is not expected to increase; however, environmental conditions in the Southeast create obstacles to maintaining adequate goat health without elevated management inputs. There are dramatic differences among young straightbred does for reproductive and fitness traits, including retention rates in the herd. Early work has been well received by producer stakeholders and the utilization of TSU-derived research findings and concepts are expected to continue.

Optimum nutrient levels in rations of guinea fowl will improve bird performance. Environmental factors such as temperature and humidity will be controlled successfully and not confound the studies. Improved feeding programs for guinea fowl will minimize feeding cost and enhance success of the guinea fowl production enterprise. Guinea fowl producers will utilize the nutrient recommendations in formulating rations. Genetic resource information generated will be utilized for selection and maintenance of flocks progressing towards optimum fitness and production performance. Such information will be available globally to scientists and the larger poultry industry.

2. Ultimate goal(s) of this Program

Our research and extension efforts will result in information that producers can use to increase animal health, efficiency, and productivity, thus increasing profits of those enterprises.

The Master Beef Producer Program is an educational program designed to educate Tennessee cow-calf producers to help them be the very best in the country, improve their profitability and position the industry to be competitive with other states.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	44.0	5.0	30.0	8.0
2018	44.0	5.0	30.0	8.0
2019	44.0	5.0	30.0	8.0
2020	41.0	5.0	30.0	8.0
2021	41.0	5.0	30.0	8.0

V(F). Planned Program (Activity)

1. Activity for the Program

The Master Beef Producer Program will be led by a team of University of Tennessee Extension specialists and agents, with the support and involvement of representatives of state agencies, businesses and organizations that have an interest in the state's cattle industry. Master Beef Producer programs may

only be taught by agents that have completed the comprehensive training curriculum. During this training, agents are exposed to each session of the program, and are provided on-screen presentations, speaker notes, evaluation instruments, and instructions about the most effective strategies for teaching this curriculum. Industry professionals, veterinarians, and other local industry leaders may be included as a part of the teaching team, provided that they are familiar with the subject matter content included in the Master Beef Producer manual that is related to the subject they will address. The Master Beef Producer Program will:

1. Include a series of 12 educational sessions that focus on cow-calf production and issues facing the beef industry. These are conducted at various off-campus locations accessible to Tennessee beef producers. These sessions include hands-on demonstrations, mini-lectures, discussions, question and answer sessions, etc.

2. Enhance the profitability and competitiveness of cow-calf operations by providing essential, technical information.

3. Provide participants with a beef production reference manual that covers in detail the educational information presented in the sessions.

4. Allow producers to interact with trained facilitators and encourage sharing of ideas with other producers.

Goats are an environmentally adaptive specie of livestock, extremely opportunistic and afford the small limited resource landowner(s) an alternative enterprise. The goat provides food security, high quality protein (for human nutrition), biological land enhancement and many 'value-added' products to increase revenue generated on a holistically sustainable rural farm. With the decrease in planted tobacco acreage and income from this traditional crop, the production of goats becomes a natural alternative. Tennessee continues to rank second in meat goats in the U.S. The total number of meat goats in Tennessee on January 1, 2009 was 133,000 head, up 9,000 head from 2008. Milk goats totaled 5,800 head, unchanged from the previous year (TN Farm Facts, February 4, 2009). Meat goat numbers have been significantly increasing within the United States since the early 1990's but goat meat consumption has surpassed available supply, based on ethnic group statistics. The importation of goat meat (30 pound carcass equivalent) surpassed export in 1994. There is no longer an export value for goat meat; the import value has tripled.

The Tennessee Browsing Academy was established in May 2007 as an extensive four day hands-on training for producers, educators / government agency personnel interested in the biological and environmentally sound practices of vegetative management with small ruminants (specifically goats). This class is taught through lecture and applied practices as the participants learn new techniques.

The most outstanding example of successful outcomes encompassing the work of extension specialists, county extension agents, and clients is the Master Meat Goat Producer Program. The Small Ruminant College has become an annual two-day event covering a different major production theme each year. Along with the two days of both inside lectures and outside hands-on demonstrations, the attendees receive proceedings to complement the topics covered. Work will continue in working with small ruminant farmers as well as with professionals through Heifer International. Presentations and demonstrations in the state are designed for extension agents, government agencies, meat goat organizations, farmer forum initiatives, and 4-H groups.

We conduct applied and basic research in animal health, nutrition, physiology, and genomics to address high priority problems of the livestock industries. We disseminate information gained from these

studies to producers, veterinarians, and others associated with the animal industries through outreach programs and publications.

Surveillance of possible disease vectors is maintained throughout the insect season; suspected vectors are tested for appropriate viruses. Risk factor analysis test results are compared between sites where disease risk is high vs. those where disease risk is low. Mastitis susceptible and resistant dairy cows are used to identify potential genes, immune components, and other factors associated with and responsible for mastitis resistance. A series of trials uses pigs to test various feeding regimens and feed additives to determine effects on the number of antibiotic resistant foodborne pathogens occurring in those animals and their environment. Additional studies are detecting the prevalence of antibiotic resistant bacteria associated with cattle and surrounding environments. These studies should help determine strategies to limit such foodborne risks.

Other Activities:
Conduct research on the longitudinal survival and reproductive output of meat goat does.
Conduct research on nutritional requirements for Guinea fowl.
Perform genome mapping of important production qualities in Guinea fowl.
Conduct focus group meetings to collect information from producers and consumers.
Develop and administer surveys to selected producers and consumers.
Identify selected meat goat consumers/ethnic groups/communities.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class	● Newsletters
● One-on-One Intervention	● TV Media Programs
● Demonstrations	● Other 1 (Newspaper Articles)
● Other 1 (On-Site Visits)	● Other 2 (Radio Programs)

3. Description of targeted audience

Producers, veterinarians, and others associated with the animal industry. Tennessee cattle producers are primarily cow-calf operators. All of the state's cow-calf operators compose the target audience for this planned program.

Dairy and meat goat producers, the national meat goat industry, institutions of meat goat research, ruminant livestock producers, students, public officials, Guinea fowl and poultry industries, small farmers, scientific community.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote awareness of and participation in this planned program.
- Number of research-based publications distributed as part of this program.
- Evaluate Alternative Heating Systems for Broiler Houses (Hawkins)
- Improve Reproductive Efficiency in Cattle (Rispoli)
- Promote Native Grasses in Forage Systems (Keyser)
- Improve nutrient utilization in heat-stressed lactating dairy cows (Ruis)
- Develop novel methods of measuring temperament in bulls (Kattesh)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Extension Economic Impact: The total economic impact of Extension animal systems programs. (The target is expressed in millions of dollars.)
2	Beef Production and Marketing: Number of beef producers who utilized improved sires, artificial insemination or other genetic improvement methods.
3	Beef Production and Marketing: Number of beef producers who improved marketing methods.
4	Beef Production and Marketing: Number of producers who improved forages for livestock by broadleaf weed control, planting clover, stockpiling fescue or planting warm-season grasses.
5	Beef Production and Marketing: The number of calves managed according to Beef Quality Assurance (BQA) guidelines.
6	Goat Production: Number of goat producers who have implemented practices related to genetic improvement, nutrition, health, reproduction and other information as a result of the Master Goat Program.
7	Develop Diagnostic Devices for Animal/Human Diseases (Eda)
8	Supplement Nutrients for Improved Reproduction (Mulliniks)
9	Research to provide new information on the benefit of a new sire breed option (Savannah) and creep feeding on improving the doe output and economic return for commercial meat goat enterprises. (Browning)
10	Efficiency of feed utilization in poultry through knowledge and implementation of optimum nutrient requirements, especially methionine and cysteine. (Nahashon)
11	Genetic resource information for future and rapid selection of well performing animals and those that can transmit superior economic traits to future generations. (Nahashon)
12	Discovery of modes of action of probiotics and new nutrient sensing pathways leading to establishment of precise nutrient requirements of poultry, especially chickens and guinea fowl. (Nahashon)
13	Research to enhance income for meat goat producers through increased consumer knowledge about goat meat and retailer knowledge of goat meat preferences. (Ekanem)
14	Enhanced producer knowledge of marketing information to expand goat meat sales to existing markets. (Ekanem)
15	Efficacy of fat deposition reduction in poultry through genotyping by sequencing approach for analysis of chicken genome. (Wang)
16	Research intestinal microbiota as alternatives to antibiotic growth promoters for food animals and to combat human obesity (Lin)
17	Address S. aureus as causative agent of mastitis (Dego)
18	Develop Non-Antibiotic Strategies for Dairy Cattle Mastitis (Almeida, Prado, Luther)

Outcome # 1

1. Outcome Target

Extension Economic Impact: The total economic impact of Extension animal systems programs. (The target is expressed in millions of dollars.)

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Beef Production and Marketing: Number of beef producers who utilized improved sires, artificial insemination or other genetic improvement methods.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

Beef Production and Marketing: Number of beef producers who improved marketing methods.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Beef Production and Marketing: Number of producers who improved forages for livestock by broadleaf weed control, planting clover, stockpiling fescue or planting warm-season grasses.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

Beef Production and Marketing: The number of calves managed according to Beef Quality Assurance (BQA) guidelines.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 6

1. Outcome Target

Goat Production: Number of goat producers who have implemented practices related to genetic improvement, nutrition, health, reproduction and other information as a result of the Master Goat Program.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals
- 307 - Animal Management Systems
- 311 - Animal Diseases
- 302 - Nutrient Utilization in Animals
- 301 - Reproductive Performance of Animals

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 7

1. Outcome Target

Develop Diagnostic Devices for Animal/Human Diseases (Eda)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 315 - Animal Welfare/Well-Being and Protection

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Supplement Nutrients for Improved Reproduction (Mulliniks)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 305 - Animal Physiological Processes
- 301 - Reproductive Performance of Animals
- 307 - Animal Management Systems
- 302 - Nutrient Utilization in Animals

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 9

1. Outcome Target

Research to provide new information on the benefit of a new sire breed option (Savannah) and creep feeding on improving the doe output and economic return for commercial meat goat enterprises. (Browning)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems

4. Associated Institute Type(s)

- 1890 Research

Outcome # 10

1. Outcome Target

Efficiency of feed utilization in poultry through knowledge and implementation of optimum nutrient requirements, especially methionine and cysteine. (Nahashon)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 304 - Animal Genome
- 303 - Genetic Improvement of Animals
- 302 - Nutrient Utilization in Animals

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Genetic resource information for future and rapid selection of well performing animals and those that can transmit superior economic traits to future generations. (Nahashon)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 304 - Animal Genome
- 303 - Genetic Improvement of Animals
- 302 - Nutrient Utilization in Animals

4. Associated Institute Type(s)

- 1890 Research

Outcome # 12

1. Outcome Target

Discovery of modes of action of probiotics and new nutrient sensing pathways leading to establishment of precise nutrient requirements of poultry, especially chickens and guinea fowl. (Nahashon)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 303 - Genetic Improvement of Animals
- 304 - Animal Genome
- 302 - Nutrient Utilization in Animals

4. Associated Institute Type(s)

- 1890 Research

Outcome # 13

1. Outcome Target

Research to enhance income for meat goat producers through increased consumer knowledge about goat meat and retailer knowledge of goat meat preferences. (Ekanem)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics

4. Associated Institute Type(s)

- 1890 Research

Outcome # 14

1. Outcome Target

Enhanced producer knowledge of marketing information to expand goat meat sales to existing markets. (Ekanem)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics

4. Associated Institute Type(s)

- 1890 Research

Outcome # 15

1. Outcome Target

Efficacy of fat deposition reduction in poultry through genotyping by sequencing approach for analysis of chicken genome. (Wang)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 304 - Animal Genome

4. Associated Institute Type(s)

- 1890 Research

Outcome # 16

1. Outcome Target

Research intestinal microbiota as alternatives to antibiotic growth promoters for food animals and to combat human obesity (Lin)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 302 - Nutrient Utilization in Animals
- 305 - Animal Physiological Processes

4. Associated Institute Type(s)

- 1862 Research

Outcome # 17

1. Outcome Target

Address S. aureus as causative agent of mastitis (Dego)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 311 - Animal Diseases
- 306 - Environmental Stress in Animals

4. Associated Institute Type(s)

- 1862 Research

Outcome # 18

1. Outcome Target

Develop Non-Antibiotic Strategies for Dairy Cattle Mastitis (Almeida, Prado, Luther)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 307 - Animal Management Systems
- 306 - Environmental Stress in Animals
- 311 - Animal Diseases

- 305 - Animal Physiological Processes

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Description

Drought could greatly inhibit the beef program's effectiveness at achieving the stated outcomes. Significant changes in the economic environment or demographics will impact the user adoption of our research efforts.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Before-After: Both pre and post program survey instruments are to be used for each Master Beef Producer participant.

During: In addition, evaluation instruments will be administered for each session of the program, to evaluate the quality of the material presented and the instructor(s). These instruments will assess knowledge gains as a result of the training.

Retrospective: Three years after the completion of the program, participants will be surveyed to determine the extent of the changes in practices that they have adopted. This information will be used to assess the impact of the program on producer behavior.

Ongoing: Disease transmission rates will be monitored by state and regional health officials.

Disease transmission will be monitored by state and regional health officials.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Childhood Obesity

2. Brief summary about Planned Program

Obesity has reached epidemic proportions in Tennessee with two of three adults and four of ten school age children overweight or obese. This program will reduce obesity rates in the state and help Tennesseans live healthier lives. According to the Tennessee Department of Education, Tennessee has the third highest rate of pediatric obesity in the United States and ranks 44th among the 50 states in health outcomes for its adult populace. Since health habits learned during the formative years are crucial to preventing negative health outcomes later in life, early intervention among school-aged youth is necessary and essential in reducing these alarming trends.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
501	New and Improved Food Processing Technologies	0%	10%	0%	0%
502	New and Improved Food Products	0%	5%	0%	34%
701	Nutrient Composition of Food	5%	0%	0%	0%
702	Requirements and Function of Nutrients and Other Food Components	0%	5%	0%	33%
703	Nutrition Education and Behavior	95%	40%	0%	0%
704	Nutrition and Hunger in the Population	0%	0%	0%	23%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%	40%	0%	0%
806	Youth Development	0%	0%	0%	10%
	Total	100%	100%	0%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Obesity has reached epidemic proportions in Tennessee with two of three adults and four of ten school age children overweight or obese. Obesity is the leading risk factor for many chronic diseases such as diabetes, arthritis, heart disease, hypertension, and some types of cancer. The economic and psychosocial costs of obesity and the underlying health issues are impacting all of society. Medical care costs are escalating and creating an economic burden for families, employers, and insurance entities. It is important for Extension to implement programs to reverse this trend.

High rates of obesity also correlate with poverty and race in Tennessee. Excess Risk of Obesity for African American Children trend analyses revealed family poverty status and obesity rates were highly correlated to youth ages 15 to 17 years of age but not for those 12 to 14 years of age. While lower-income children have higher rates of obesity than children from more affluent families regardless of their ethnicity, when ethnicity is included, African American girls are at a higher risk for obesity at the lowest and highest income levels. This dichotomy signifies the reason for higher obesity among African Americans may be substantially influenced by culture.

It is estimated that 11- to 14-year-old children spend about 7 hours daily involved with media including television, video games and computers. Television advertising influences children's purchase requests, food preferences and diets. For every hour of television watched, children consume 167 unneeded calories. Since African American households are reported to watch more television than other Americans, food and beverage marketing may contribute considerably to their disproportionately higher rates of obesity. To increase media literacy among African American children and youth, culturally appropriate media educational material is warranted. This integrated research has implications for contributing to the body of knowledge of: (1) Childhood Obesity Prevention & Treatment; (2) Participatory Action Research; and (3) Adaptive Experimental Design benefiting stakeholders across the nation.

2. Scope of the Program

- In-State Extension
- In-State Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Extension Family and Consumer Sciences Agents have the necessary skills to build partnerships that will engage individuals, families and institutions for community-level change in diet quality. Consumers will use a wide range of outreach programs to provide up to date information that will help them formulate healthier lifestyles. A combination of applied and basic research can address food safety and nutrition issues. Directed funding for this research will remain level or increase.

The culture in which one is raised greatly influences attitudes, beliefs, values, and behaviors. We assert that teaching an appreciation of African culture and reinforcing it on multiple levels (individual, interpersonal, organizational, and community) will empower African American children ages 8 to 14 years to improve their dietary behaviors and practices regarding (1) media literacy knowledge; (2) healthy cooking and food preparation skills; and (3) daily physical activity.

Obesity can also be addressed by the development of new foods with improved dietary and nutritional characteristics.

2. Ultimate goal(s) of this Program

The ultimate goals of this planned program are to:

• reduce obesity among Tennesseans to reduce the prevalence of many chronic diseases such as diabetes, arthritis, heart disease, hypertension, and some types of cancer.

• provide consumers with reliable information to allow them to lead healthier lifestyles.

• Gather data on the use of certain plant flavonoids such as quercetin, genistein and kaempferol to promote healthy eating and nutrition

• Develop dietary fortified foods using various non-traditional agricultural resources as dietary fiber ingredients.

Among 8-14 year old African-American children:

- Increase physical activity
- Limit leisurely TV viewing, internet surfing, and video gaming activities
- Improve dietary practices

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	75.0	9.0	0.0	6.0
2018	75.0	9.0	0.0	6.0
2019	75.0	9.0	0.0	6.0
2020	63.0	9.0	0.0	6.0
2021	63.0	9.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

UT and TSU Extension will use the Power U curriculum in Tennessee schools and afterschool programs. Extension personnel and volunteers will use the curriculum to teach diet quality to young adolescents. The program will be delivered through 10 interactive lessons. Extension obesity prevention programs will emphasize the following:

- how to use MyPlate.gov and following Dietary Guidelines.
- how to use the Healthy Plate Method.
- decreasing consumption of high-fat foods like fried foods, bologna, hot dogs, etc.
- increasing consumption of fruits, vegetables and whole-grains.

The TSU YAMS program will be used to facilitate media literacy research and education Research to develop alternative foods for improved nutrition.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-Site Visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

Tennesseans targeted include consumers and youth. Because of the prevalence of obesity in the state, all consumers are potentially members of the target audience. However, the TNCEP and EFNEP programs will be targeted to the state's limited resource population. In addition, the TSU Food Nutrition Education Program will be targeted to eligible food stamp recipients.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote program awareness and participation.
- Number of research-based publications distributed as part of this program.
- Number of flavonoids examined for reducing oxidative stress in fibroblast cells.
- Number of flavanoids examined for adipocyte differentiate efficiency in fibroblast cells.
- Number of focus groups held to determine perceived benefits, value and needs for relationships by probing habits, needs, preferences, values and lifestyles associated with food and media.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Tennessee Shapes Up: Number of participants who decreased consumption of high-fat foods such as chips, fast food, fried foods, sausage, bacon, bologna, hot dogs, etc.
2	Tennessee Shapes Up: Number of participants who decreased consumption of high-sugar foods and sweetened beverages, such as soft drinks, Kool Aide type beverages, sweetened tea, etc.
3	Tennessee Shapes Up: Number of participants who increased consumption of fruits.
4	Tennessee Shapes Up: Number of participants who increased consumption of vegetables.
5	Tennessee Shapes Up: Number of participants increased consumption of whole grains.
6	Public acceptance of soy fiber fortified breads for increased fiber consumption. (Wu)
7	Establish the fundamental mechanism by which cost-effective, naturally available compounds can promote health and extend lifespan in humans.(Si)

Outcome # 1

1. Outcome Target

Tennessee Shapes Up: Number of participants who decreased consumption of high-fat foods such as chips, fast food, fried foods, sausage, bacon, bologna, hot dogs, etc.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Tennessee Shapes Up: Number of participants who decreased consumption of high-sugar foods and sweetened beverages, such as soft drinks, Kool Aide type beverages, sweetened tea, etc.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

Tennessee Shapes Up: Number of participants who increased consumption of fruits.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Tennessee Shapes Up: Number of participants who increased consumption of vegetables.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

Tennessee Shapes Up: Number of participants increased consumption of whole grains.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 703 - Nutrition Education and Behavior

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 6

1. Outcome Target

Public acceptance of soy fiber fortified breads for increased fiber consumption. (Wu)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products

4. Associated Institute Type(s)

- 1890 Extension
- 1890 Research

Outcome # 7

1. Outcome Target

Establish the fundamental mechanism by which cost-effective, naturally available compounds can promote health and extend lifespan in humans.(Si)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 704 - Nutrition and Hunger in the Population

4. Associated Institute Type(s)

- 1890 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Programmatic Challenges

Description

If Federal formula funds (Smith-Lever, Hatch and NARETPA) are reduced over the next five years, Extension's response to Tennessee's obesity epidemic will be greatly hindered.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Tennessee Shapes Up: After Only (Post-Program): The Tennessee Shapes Up short-term

knowledge gained checklist will be administered to participants at the end of each session. Retrospective (Post-Program): The Tennessee Shapes Up intermediate behavior checklist will be administered at the end of the multi-session program. During the Program: Extension Family and Consumer Sciences Agents will document participant and third-party testimonials and observations.

Impacts from EFNEP adult and youth programs will be reported through the national EFNEP Reporting System.

Evaluation of outreach program events will be conducted to determine baseline knowledge of participants before and after the event. Evaluation of our programs will occur through participant surveys following outreach programs.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Economic Infrastructure and Commerce

2. Brief summary about Planned Program

The economic viability of rural areas is crucial to the welfare of rural residents. Viability is affected by population shifts (e.g., an influx of retirees), economic changes (e.g., transition from tobacco production to other crops or development of a biofuels industry), and other factors.

Research will estimate the impacts that changes in agricultural and forest products industries have on the state's economy and identify growth opportunities for existing and new agri-industry products. Given the severe cost-price squeeze and uncertainties about markets, economic conditions, and agricultural and environmental policies currently facing producers, they need risk, financial, and enterprise management information to help them improve profitability and avoid financial stress. Our research will assess impacts of exogenous changes and will produce management information and decision tools that will help producers develop optimal management strategies for their operations to improve survivability.

We will also investigate food consumer awareness and perceptions regarding safe food choices, factors affecting the consumption of risky foods, and the roles of government programs in improving nutrient intakes and food security. The purpose is to inform public policy decisions about how to influence consumer choices affecting food safety and security.

The production and distribution systems required to provide fruits and vegetables to American consumers are complex. Research will examine trends and identify changes in farm distribution and supplies of fruits and vegetables and measure factors that contribute to the growth of the produce industry, in particular factors associated with market environment and marketing opportunities.

Our Extension planned program will target small and limited resource farmers. A special target will be farmers transitioning from tobacco to other crops.

Another area that the Extension program will focus on is providing leadership development training to limited resource audiences and Extension agents working with these audiences.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
315	Animal Welfare/Well-Being and Protection	0%	0%	12%	0%
601	Economics of Agricultural Production and Farm Management	30%	30%	19%	0%
602	Business Management, Finance, and Taxation	5%	4%	0%	0%
603	Market Economics	5%	4%	6%	40%
604	Marketing and Distribution Practices	30%	26%	5%	0%
605	Natural Resource and Environmental Economics	0%	0%	16%	20%
606	International Trade and Development Economics	5%	0%	5%	0%
607	Consumer Economics	10%	0%	0%	20%
608	Community Resource Planning and Development	15%	16%	15%	0%
609	Economic Theory and Methods	0%	10%	0%	20%
610	Domestic Policy Analysis	0%	10%	10%	0%
901	Program and Project Design, and Statistics	0%	0%	12%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Rural areas do not offer the same potential level of income as more metropolitan areas. This situation can be partially attributed to lack of employment opportunities in agri-business industries and to low returns on resources employed in agriculture. Improvements in income levels can be directly affected by additional agribusiness employment opportunities and by reducing risk and increasing profitability for agricultural enterprises. Agri-businesses also offer markets for local agricultural commodities resulting in increased farm incomes.

For 2017-2021, TSU Extension will place special emphasis on "Small Business Development" for rural and urban areas. The ultimate goal is to increase economic stability for limited resource individuals. TSU Extension will produce and distribute resource materials and educational programs on a variety of topics for interested individuals, young entrepreneurs, and professionals. According to the Small Business Administration Office of Advocacy, small businesses are the heart of Tennessee's economy. Research shows that small businesses create most of the nation's net new jobs, bring innovative ideas, services and products to the marketplace. Tennessee has an estimated total of 531,200 small businesses. The employer firms total 113,900, an increase from previous years. Of this total an estimated 97.2% were small

businesses. TSU Extension will collaborate with the North Mississippi Higher Educational Attainment Center on multi-state efforts to improve entrepreneurship in the two states.

For 2017-2021, TSU Extension will incorporate "global" and "mobile" aspects into its programs. The ultimate goal is to increase access and literacy of technology resources, especially for landowners. Our assessments have found that many Tennessee landowners have never accessed the Internet. TSU Extension will use a mobile computer lab with Internet access to empower these individuals.

TSU Extension is also collaborating with Penn State University as virtual content developers for different aspects of eXtension information technology. One of the projects is the exploration and demonstration of Second Life for educational purposes. TSU Extension will reach under-served and limited resource individuals.

A recent needs assessment by Tennessee State University found that effective community leadership is essential for the development and sustainability of vibrant healthy communities. It assists in developing important relationships, establishing communication and imparting community direction. A recent survey of community leadership programs revealed that the long-term impact of participation in leadership programs can result in the creation of more informally trained leaders through the use of curriculum and methodology obtained from formally trained persons. Researchers have found evidence that leadership programs can produce a multiplier effect by extending program impact beyond the participants who formally participate in the leadership training program. A recent study also found that for every $1 invested, there is a return of $2.86 in net benefits in return on investment (ROI) of the Southern Extension Leadership Development (SELD) Program as implemented at the University of Georgia.

Leadership in the 21st century requires a new vision of management. Many community leaders are often thrust into their role with little or no leadership training. Out-migration by youth and skilled individuals from traditionally rural counties and limited resource communities has resulted in fewer "traditional" leaders. As community demographics shift, more leaders need to be drawn from overlooked "non-traditional" groups or sources. These include leaders who are retirees, youth, women and ethnic or social minorities. Leadership development for these groups or the people working with these leaders needs to be more systematic and intentional. As a result, more training for innovative collaboration, problem-solving, transparent decision making and effective advocacy is needed.

We want to set-up a webinar system for multi-state collaborations among Extension educators to deliver the best, most updated information to our clients. TSU Extension will also provide leadership for the American Distance Education Consortium (ADEC) that has six states involved in a new online venture.

TSU expertise will provide more online visibility. More educators and communities will access our resources, and we believe this program will have local, state, national and international implications.

Small farm research, extension, and education are multi-disciplinary and diverse. They include plant and animal production, farm profitability, marketing, farm and economic sustainability, environmental issues, minority farmer issues, farmland preservation, retaining young farmers, and rural communities.The plight of small and limited resource farmers coupled with their significant economic contributions to Tennessee and the South justifies the need for small farm revitalization and profitability.

Tennessee small-scale and limited resource farmers need education to take advantage of niche markets and consumer demand. Enterprises which hold great promise for increasing profits for the small-scale farmer include goat production and organic farming.

According to the Census of Agriculture, there were 87,595 farms in Tennessee. There were 836

Spanish-origin or Hispanic farmers and 107 Asian farmers operating farms. There were 1,266 African American farmers in Tennessee operating 1,117 farms. Land ownership tied to farming in general has decreased greatly. This is reflected best within the African American communities where the ownership of farm properties has drastically declined. The exodus from the land has been caused by a number of factors, including economic, institutional and legal. Many obstacles have been faced by black farmers in their efforts to remain in farming and to retain ownership of their land. The loss of land points to the need for an intensive educational program that will address estate planning, making wills, getting legal help, and property ownership rights and responsibilities.

One key to a successful business start-up and expansion is the ability to obtain and secure appropriate financing. Raising capital is the most basic of all business activities. But as many new entrepreneurs quickly discover, raising capital may not be easy; in fact, it can be a complex and frustrating process. The process of developing a business plan will help in thinking through some important issues that entrepreneurs may not have yet considered.

Increased demand for fruits and vegetables, volatile energy costs, changes in retail marketing, organic food preferences, sustainable farming and growing consumer and societal awareness of sustainability have made the production and distribution of perishable goods (fruits and vegetables) complex. Research is needed to ensure fruits and vegetables can be produced and distributed as efficiently as possible.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Both UT Extension and TSU Extension have adequate personnel trained in farm financial management. Federal, state and county resources needed for this Extension program will continue over the next five years. Resources available for research will be approximately constant or declining over the life of this research process.

Empirical evidence, insights and knowledge gained from research are needed for informed decision-making, for stakeholders to evaluate needs and opportunities, and to effectively design and implement programs to ensure effective and efficient distribution systems for perishable agricultural products.

Adequate personnel are also needed to provide leadership training to limited resource audiences. Outreach efforts to reach these audiences will be successful.

2. Ultimate goal(s) of this Program

The ultimate goal of the Extension component is to revitalize the economies of Tennessee's rural communities and help small farmers to earn a living wage.

The research component seeks to enhance income in rural areas through agri-business development, to increase incomes to agricultural producers, and to improve public policy regarding food safety, distribution and security.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	32.0	7.0	35.0	2.0
2018	32.0	7.0	35.0	2.0
2019	32.0	7.0	35.0	2.0
2020	18.0	7.0	35.0	2.0
2021	18.0	7.0	35.0	2.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research analysis includes assessment of market potential, market feasibility studies for new agri-industry ventures, buyer and consumer preferences studies, market segmentation analysis and buyer profiling, analysis of new product acceptance, analysis of marketing alternatives, and analysis of valuation of product attributes. To evaluate the impacts of various policies, management strategies, or economic conditions on a farm's bottom line and financial strength, we are developing a set of representative farms that encompass major segments of agriculture in Tennessee. Methods for evaluating risk include risk-based econometric models, risk-based mathematical programming models, generalized stochastic dominance criteria, dynamic optimization, and subjective probability assessment criteria.

The Extension MANAGE program helps families analyze their total farming business so they can make informed decisions regarding their future. Extension staff trained in farm and financial management help families to:

- review their current financial situation
- capitalize on strengths and reduce weaknesses in the farm business
- develop individualized farm and financial plans
- explore alternatives both on and off the farm
- evaluate capital investment opportunities including land and/or machinery purchases
- analyze likely consequences of changing the scope of enterprises
- determine appropriate production practices

In addition to individualized farm and financial planning assistance, Extension is will offer hundreds of workshops to help farmers improve their financial situation. For example, workshops will be offered in improved marketing, goal-setting, and strategic planning.

Although the MANAGE program will not remove uncertainty of the future, it will provide farm families with a clear understanding of their current financial situation and help them evaluate their alternatives for the future. Making informed decisions today may be the best way to prepare for tomorrow's opportunities.

The educational program is offered at no cost to participating farm families in all 95 Tennessee counties.

Land is a great source of wealth in the African-American community. In addition to providing economic stability, land ownership is highly correlated to one's social and economic well-being. Many urban residents who desire to return to the land of their origin find themselves confronted by various obstacles in terms of retaining rightful land ownership. In addition to problems they face of landownership retention are efforts to engage in profitable land use development, and operate viable farming enterprises.

Production inputs have changed over the past two decades. As a result of this, there was a reduction in the number of crops produced. In-service training on "Small Farm Outlook" will continue to be conducted to make landowners aware of resources that are available to them for land retention and crop production. The training will provide information on ways to keep land through estate planning, lessening their property, and legal issues for seniors (the aging population).

Leadership development workshops will focus on leadership, healthy self-esteem, positive risk-taking, achieving goals, ethical decision making, public speaking and responsible citizenship. Extension personnel will also lead, train, recruit and coordinate more volunteers.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-Site Visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

- Limited-resource and small farmers
- Farmers transitioning from tobacco to other crops
- Policy-makers at the state, federal, and municipal level
- Businesses looking to expand or relocate to Tennessee

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote program awareness and participation.
- Number of research-based publications distributed as part of this program.
- Perform economic analyses of various industries and agricultural practices (Jensen)
- Promote local food production and consumption (Hellwinckel)
- Provide forward looking economic analysis for Tennessee (English)
- Evaluate economic resilience of agriculture and water use efficiency (Clark, Lambert)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Land Ownership Information Program: Number of African-American landowners who increased their knowledge of property rights and responsibilities.
2	Land Ownership Information Program: Number of African-American landowners who developed farm management plans.
3	Land Ownership Information Program: Number of African-American landowners who developed estate plans to reduce the financial and legal risks farm family businesses face as they transition between generations.
4	Farm Financial Analysis and Planning: Number of farm families and rural business operators who implemented partial budgeting decisions (examples include sell calves now or later and evaluating equitable leasing arrangements)
5	Farm Financial Analysis and Planning: Number of farm families who developed whole farm plans to improve their farm financial performance.
6	Tennessee Extension Leadership Development: Small businesses or non-profits developed by limited resource leaders.
7	Assess the Local Food System/the Knoxville Foodshed (Hellwinckel)
8	Promote the growth of the Tennessee viticulture industry by determining the impact of production designations (eco-labeling and other certifications) on consumer perception, preference and willingness to pay. (Kar)
9	Evaluate bioenergy economics (Yu, Jensen, Lambert, English)

Outcome # 1

1. Outcome Target

Land Ownership Information Program: Number of African-American landowners who increased their knowledge of property rights and responsibilities.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 2

1. Outcome Target

Land Ownership Information Program: Number of African-American landowners who developed farm management plans.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 3

1. Outcome Target

Land Ownership Information Program: Number of African-American landowners who developed estate plans to reduce the financial and legal risks farm family businesses face as they transition between generations.

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 4

1. Outcome Target

Farm Financial Analysis and Planning: Number of farm families and rural business operators who implemented partial budgeting decisions (examples include sell calves now or later and evaluating equitable leasing arrangements)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 5

1. Outcome Target

Farm Financial Analysis and Planning: Number of farm families who developed whole farm plans to improve their farm financial performance.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 6

1. Outcome Target

Tennessee Extension Leadership Development: Small businesses or non-profits developed by limited resource leaders.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 608 - Community Resource Planning and Development

4. Associated Institute Type(s)

- 1890 Extension

Outcome # 7

1. Outcome Target

Assess the Local Food System/the Knoxville Foodshed (Hellwinckel)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 607 - Consumer Economics
- 605 - Natural Resource and Environmental Economics
- 601 - Economics of Agricultural Production and Farm Management
- 604 - Marketing and Distribution Practices
- 603 - Market Economics

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 8

1. Outcome Target

Promote the growth of the Tennessee viticulture industry by determining the impact of production designations (eco-labeling and other certifications) on consumer perception, preference and willingness to pay. (Kar)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics

4. Associated Institute Type(s)

- 1890 Research

Outcome # 9

1. Outcome Target

Evaluate bioenergy economics (Yu, Jensen, Lambert, English)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics
- 610 - Domestic Policy Analysis
- 604 - Marketing and Distribution Practices
- 608 - Community Resource Planning and Development
- 601 - Economics of Agricultural Production and Farm Management
- 605 - Natural Resource and Environmental Economics

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges

Description

In the event of natural disasters, the program focus will change to assist producers with basic needs. In that event, outcome measures will be changed to measure the success of the recovery effort. Changes in the U.S. economy may affect the number of firms expanding and locating new facilities in rural areas. The general farm economy will affect risk and returns to agricultural enterprises across a broad spectrum.

Research outcomes in this program area are typically cross-cutting by discipline.For this reason, they will largely be reported under other planned program areas (e.g. bioenergy, environmental).

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Before-After questionnaires and time-series evaluations will be used to evaluate adoption/success of economic infrastructure and commerce programs.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Environmental and Water Quality Impacts

2. Brief summary about Planned Program

Our economic and policy research will examine the various ways in which agriculture is affecting, and being affected by, the natural environment, and the implications of this changing relationship for agricultural producers, consumers, and rural communities.

Given the impacts of farm management practices on water quality, we will assess the economic impact of water quality regulations on individual producers and the agricultural industry in Tennessee. Sustained economic growth, coupled with population and income growth, have brought about rapid changes in land use at the rural-urban interface. We will examine development patterns and their estimated effects on natural resource conditions under different policy scenarios to forecast the effects of local policies, including direct land use planning and regulation and indirect land use policies such as provision of public infrastructure or other public services, for land areas in transition in Tennessee.

From an engineering and soils perspective, we will explore various means of reducing the environmental impact of agricultural production and other land uses while not only maintaining but improving water quality. The effectiveness of various best-management practices will be evaluated. New interpretive soil uses will be cataloged as they are added each year to insure proper soil classification and evaluation of landscape position. Studies will be continued to help determine septic systems compatible with the limitations of available soil resources.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	20%	20%	24%	4%
112	Watershed Protection and Management	80%	80%	11%	28%
132	Weather and Climate	0%	0%	0%	20%
133	Pollution Prevention and Mitigation	0%	0%	12%	24%
135	Aquatic and Terrestrial Wildlife	0%	0%	13%	10%
136	Conservation of Biological Diversity	0%	0%	4%	0%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	2%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	3%	0%
205	Plant Management Systems	0%	0%	0%	4%
212	Diseases and Nematodes Affecting Plants	0%	0%	5%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	3%	0%
216	Integrated Pest Management Systems	0%	0%	2%	0%
402	Engineering Systems and Equipment	0%	0%	7%	0%
403	Waste Disposal, Recycling, and Reuse	0%	0%	2%	10%
404	Instrumentation and Control Systems	0%	0%	8%	0%
721	Insects and Other Pests Affecting Humans	0%	0%	4%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Agriculture's effects on the natural environment and the effects of urbanization on surrounding agriculture are becoming more pronounced as both population and per capita wealth grow. Public concern about the impacts of agricultural production practices on water quality continues to increase. Conflicts about land use, odors, and chemical use abound as urban land uses expand into rural areas. Agricultural producers are also constrained by regulation and legal action against production management decisions, thus increasing production costs. Producers, residents of transition land areas, and downstream water users are directly affected by these issues.

Proper soil classification and evaluation of landscape position are crucial to understanding environmental impacts and assessing their effects on water quality. Continuing technical assistance is needed to catalog and communicate the new interpretive uses being added each year.

Tennessee has numerous stream segments that are impaired due (in part) to failing or leaking septic

systems. Systems fail because the design, installation, operation and/or maintenance were not compatible with the limitations of available soil resources.

Manures are a problematic P source. Many soil test extractants do not adequately quantify organic P compounds in soil. This results in underestimating the amount of P available to a growing crop. Elevated phosphorus and potentially hazardous trace element concentrations in biosolid-amended soils pose a risk to human health and the environment through off-site movement. Atrazine (widely used in weed control) is also consequently often detected in environmental media.

The implementation of best-management practices to improve the health of watersheds is widely promoted, but these BMP's are not always effective.

Coal accounts for 42% of the electricity generation in the US. Burning coal to generate electricity produces large amounts of coal combustion wastes, CCW. Nearly sixty percent of CCW generated annually in the US is composed of very fine materials known as fly ash, FA.

Despite their reputation as sources of hazardous chemicals, FAs also contain major and trace elements that are essential for plant growth, and can improve water retention and storage characteristics of soils. Less than 1% of FA in the US is utilized for agronomic purposes.

2. Scope of the Program

- In-State Research
- Multistate Research

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Environmental conflicts and issues will continue to grow in importance. Additional detrimental chemical residues in water supplies will be detected.Urban growth will demand better septic system solutions.There will continue to be a gap between best practice knowledge and best practice application. Resources will be available for our research efforts.

The recognized, biologically based strategies of bioremediation and phytoremediation currently exist for cleaning up a broad range of wastes. Bio- and phytoremediation can be used to clean up fly ash. Issues concerning watershed integrity need to be addressed.

2. Ultimate goal(s) of this Program

We want to provide information to help producers and the public better understand environmental issues and potential solutions, and to enable them to make superior public policy decisions. We plan to develop, improve, and evaluate watershed models; supply more accurate rainfall data for decision-makers; provide technical assistance to soil survey updates in Tennessee; reduce the number of failed onsite wastewater disposal systems; determine available, total, and bioavailable P on P-limited and P-excess sites; develop soil amendments that reduce waste steams from energy production; protect watersheds; enhance hydraulic ecology, and isolate and characterize novel atrazine degrading bacteria from soils and wetland sediments.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	5.0	1.0	35.0	12.0
2018	5.0	1.0	35.0	12.0
2019	5.0	1.0	35.0	12.0
2020	9.0	1.0	35.0	12.0
2021	9.0	1.0	35.0	12.0

V(F). Planned Program (Activity)

1. Activity for the Program

We are developing economic and policy data by accessing existing sources, generating data from computer models, and surveying market participants. This data is analyzed using appropriate statistical and econometric methods. Watershed scale model assessments are conducted utilizing field-level estimates of alternative management practices (AMPs). Changes in water quality in impaired watersheds resulting from the evaluation of AMPs are measured. The cost of meeting different water quality standards at different points within a watershed and the potential impact of different environmental policies on Tennessee's agriculture are evaluated. A model used to project land use change estimates the probability of land development of individual parcels as a function of parcel-level attributes.

Soil research is fundamental to our environmental program.The erosion, sediment transport, and contaminant transport capabilities of the RUSLE2 soil erosion model continue to be refined as the model's use increases nationally and around the world. Soil samples are thoroughly characterized in terms of elemental composition, particle size, mineralogy, and other soil chemical and flow characteristics using standard techniques. New methods for decreasing the expense of measuring soil properties by agricultural producers and fellow researchers are developed.

As new waste treatment approaches are introduced, we provide research-based evaluation of appropriate technologies for Tennessee. Background information on the water quality is collected in various watershed areas, including one where baseline environmental data is being used to evaluate the impact of a dairy production unit on the area.

Research to enhance the protection of watersheds, understand sources of contamination, preserving aquatic ecosystems.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Other 1 (Research-only program)	● Other 1 (Research-only program)

3. Description of targeted audience

This is currently a research-only targeted program, so the target audience is weighted toward basic/applied research clients i.e. agricultural producers, environmental scientists, environmental

regulatory agencies.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of arbuscular mycorrhizal fungi that enhance biomass productivity by cellulosic herbaceous perennials in fly ash-amended soils.
- Leverage the Stormwater Management Center (Buchanan, Ludwig, Tyner, Yoder)
- Relate community health and resilience to gas wells (Lambert)
- Analyze long-term effects of disturbance on soil-dwelling organisms (Bernard)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Increased sustainable biomass production strategies by cellulosic herbaceous perennials in fly ash-amended soil to allow cleanup of toxic materials in the waste product while using the biomass as biofuel feedstock. (Dzantor)
2	Develop practical systems for organic forage production (Butler)
3	Help municipalities evaluate land use and development and related tax structures (Cho)
4	Optimize non-chemical methods of soil disinfestation (Butler)
5	Research to reduce the impact of pharmaceuticals and personal care products in surface water in rural and urbanizing watersheds. (Dennis)
6	Farmers and homeowners will be educated on the impact of pharmaceuticals and personal care products in surface water and the proper ways to dispose of these chemicals (Dennis)
7	Develop a greater understanding of the mechanisms of the studied emerging contaminants for the scientific community to expedite the decision making process in terms of protecting environmental health. (Rakshit)
8	Improve mechanistic understanding of microbial processing of soil decay and its long-term responses to climate warming. (J Li)
9	Research to influence change in understanding of proper management of riparian landscapes. (Sutton)
10	Use biodiversity of aquatic flies to assess environmental resilience (Moulton)
11	Couple chemical fingerprinting with microbial genetic markers for stream sediment source tracing (Essington)
12	Document the role of viruses in shaping soil bacterial community diversity and impacting biogeochemical cycling (Radosevich)

Outcome # 1

1. Outcome Target

Increased sustainable biomass production strategies by cellulosic herbaceous perennials in fly ash-amended soil to allow cleanup of toxic materials in the waste product while using the biomass as biofuel feedstock. (Dzantor)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 205 - Plant Management Systems
- 133 - Pollution Prevention and Mitigation

4. Associated Institute Type(s)

- 1890 Research

Outcome # 2

1. Outcome Target

Develop practical systems for organic forage production (Butler)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 721 - Insects and Other Pests Affecting Humans
- 112 - Watershed Protection and Management
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Help municipalities evaluate land use and development and related tax structures (Cho)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 402 - Engineering Systems and Equipment
- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Optimize non-chemical methods of soil disinfestation (Butler)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 402 - Engineering Systems and Equipment
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Research to reduce the impact of pharmaceuticals and personal care products in surface water in rural and urbanizing watersheds. (Dennis)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 6

1. Outcome Target

Farmers and homeowners will be educated on the impact of pharmaceuticals and personal care products in surface water and the proper ways to dispose of these chemicals (Dennis)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 7

1. Outcome Target

Develop a greater understanding of the mechanisms of the studied emerging contaminants for the scientific community to expedite the decision making process in terms of protecting environmental health. (Rakshit)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1890 Research

Outcome # 8

1. Outcome Target

Improve mechanistic understanding of microbial processing of soil decay and its long-term responses to climate warming. (J Li)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 132 - Weather and Climate

4. Associated Institute Type(s)

- 1890 Research

Outcome # 9

1. Outcome Target

Research to influence change in understanding of proper management of riparian landscapes. (Sutton)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 135 - Aquatic and Terrestrial Wildlife
- 112 - Watershed Protection and Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 10

1. Outcome Target

Use biodiversity of aquatic flies to assess environmental resilience (Moulton)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 403 - Waste Disposal, Recycling, and Reuse
- 136 - Conservation of Biological Diversity
- 135 - Aquatic and Terrestrial Wildlife
- 112 - Watershed Protection and Management
- 133 - Pollution Prevention and Mitigation

4. Associated Institute Type(s)

- 1862 Research

Outcome # 11

1. Outcome Target

Couple chemical fingerprinting with microbial genetic markers for stream sediment source tracing (Essington)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 112 - Watershed Protection and Management
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 135 - Aquatic and Terrestrial Wildlife

4. Associated Institute Type(s)

- 1862 Research

Outcome # 12

1. Outcome Target

Document the role of viruses in shaping soil bacterial community diversity and impacting biogeochemical cycling (Radosevich)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 133 - Pollution Prevention and Mitigation
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Public Policy changes
- Competing Public priorities

Description

Public policies regarding water quality and land use may change, causing the research results to be more or less useful. Changes of public perceptions and concerns about environmental issues and land use would alter the usefulness of results.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

In addition, the effectiveness (success) of the project is being measured by a) workshops in forums such as field days and nursery association expos that educate growers and increase their awareness of surface water quality problems and solutions associated with field nursery crop production; b) heightened local awareness of surface water quality problems and solutions; c) best management practices (BMPs) adopted by growers for individual nursery fields; d) demand by growers for better and more efficient fertilizers that are not prone to excessive surface runoff during storm events and e) better trained students in the environmental protection and enhancement area. As a result, the metrics for evaluating the aforementioned outcomes may include but are not limited to two components: 1) formative assessment throughout the project and 2) summative assessment at the conclusion of the project. The purpose of the formative assessment is to track a) project planning and implementations to ensure that the project activities are being conducted as intended; b) conduct random surveys of nursery crop growers at field day(s) or at nursery trade show(s) to ascertain the knowledge gained by growers as a result of the project, the type and effectiveness of BMPs adopted by growers in the sub-watershed, and the number of growers demanding better and efficient fertilizer formulations, and c) engage both undergraduate and graduate students in the project to gain research experiential training in surface water resources.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Family Economics

2. Brief summary about Planned Program

Because they spend too much and save too little, many Tennesseans will not have enough money to live securely throughout life. This program will help Tennesseans to build and protect wealth, plan for a secure financial future, pay down debt, and protect themselves against financial fraud. This is one of our planned programs because Tennessee is a national leader in personal bankruptcy, and the State Extension Advisory Council and numerous stakeholders have identified financial education as one of the top needs in our state.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
801	Individual and Family Resource Management	100%	100%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Because they spend too much and save too little, many Tennesseans will not have enough money to live securely throughout life. The priority of family economics programs in Tennessee is saving - building wealth throughout the life span. The percentage of retirement-age Tennesseans is expected to almost double over the next 30 years. In addition, they are expected to live 20 years after retirement, in contrast to 15 years after retirement in 1940 (Social Security Administration). During two of the past six years, Tennessee has led the nation in personal bankruptcy (American Bankruptcy Institute).

2. Scope of the Program

- In-State Extension
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

• Assumption A. This program plan assumes that Tennessee's banks and credit unions will continue their support Extension's efforts in family economics education.
• Assumption B. This program plan assumes that existing Tennessee Saves county and regional coalitions will be maintained or strengthened over the next five years.

2. Ultimate goal(s) of this Program

The ultimate goal of this program is that Tennesseans will save the necessary funds to live securely throughout their lives. This will be shown by the state's bankruptcy rate being at or below national levels. Tennesseans will:

- build and protect wealth,
- plan for a secure financial future,
- pay down debt, and
- protect themselves against financial fraud.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	12.0	2.0	0.0	0.0
2018	12.0	2.0	0.0	0.0
2019	12.0	2.0	0.0	0.0
2020	15.0	2.0	0.0	0.0
2021	15.0	2.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Extension will support at least 10 regional and local social marketing campaigns organized by UT and TSU Extension and supported by coalitions of volunteers across Tennessee. The Tennessee toolkit for savings lesson plans and activities for teaching financial and savings education will be used in schools, workplaces, community centers and other locations to teach youth and adults. Extension will maintain a partnership with national Extension "Financial Security in Later Life" initiative and with the "America Saves" national organization and other national and state partners with the TN Jumpstart Coalition. Extension will host a bi-annual partnership training conferences to strengthen the capacity of educators to teach financial and savings education. Extension will deploy its On My Own curriculum and youth TN Saves in over 100 financial education simulations annually throughout the state to reach 30,000 youth with savings and financial education. Additional classes, newsletters, news releases and community events will be conducted for adult audiences.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

Youth and adults will be targeted for this program. UT Extension is a national leader in creating, testing and validating family economic programs for reaching different target audiences, such as youth ages 9-18, young adults, coalition members and consumers.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote program awareness and participation.
- Number of research-based publications distributed as part of this program.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	TN Saves: Number of participants who estimated their retirement income needs.
2	TN Saves: Number of participants identified ways to reduce debt.
3	TN Saves: Number of participants who set financial or retirement goals.
4	Youth Financial Education Simulation: Number of participants who felt more strongly that they needed to get a good education.
5	TN Saves: Number of participants who followed a spending plan.
6	TN Saves: Number of participants who initiated or increased savings.
7	TN Saves: Number of participants who reduced debt.
8	TN Saves: Statewide economic impact from reduced debt, increased savings and increased investment. (This outcome target is expressed in millions of dollars.)

Outcome # 1

1. Outcome Target

TN Saves: Number of participants who estimated their retirement income needs.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

TN Saves: Number of participants identified ways to reduce debt.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

TN Saves: Number of participants who set financial or retirement goals.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Youth Financial Education Simulation: Number of participants who felt more strongly that they needed to get a good education.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

TN Saves: Number of participants who followed a spending plan.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 6

1. Outcome Target

TN Saves: Number of participants who initiated or increased savings.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 7

1. Outcome Target

TN Saves: Number of participants who reduced debt.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 8

1. Outcome Target

TN Saves: Statewide economic impact from reduced debt, increased savings and increased investment. (This outcome target is expressed in millions of dollars.)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 801 - Individual and Family Resource Management

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Competing Programmatic Challenges

Description

Either competing public priorities or competing programs may influence attainment of family economics outcome targets. Programs require local and state resources (volunteers, public funds, private funds, etc.) in addition to Smith-Lever funds, and if local and state resources change, the outcome targets may not be met.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

State Extension Specialists have created 35 instruments to collect data on the outcome indicators. Reliable, validated instruments will be used to collect data on the outcome indicators. The data will be used to report to our funders and other stakeholders as well as to improve the Tennessee Saves effort to help Tennesseans better manage their financial resources.

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food Safety

2. Brief summary about Planned Program

The ultimate goals of this planned program are to:

- improve consumer food handling practices to lower foodborne illnesses.
- provide consumers with reliable information to allow them to lead healthier lifestyles.
- improve food safety to reduce foodborne illness.
- provide opportunities for food processors to produce safe, high quality, shelf-stable food products.
- improve food safety education to child care providers and school children.

- determine the prevalence of antibiotic resistant food borne pathogens in the farm environment and retail fresh produce
- deliver educational programs on safe fresh produce handling practices and judicious use of antibiotics in agriculture

Our microbiological food safety research program seeks to improve detection of, and develop physical and chemical intervention methods for, bacterial and fungal foodborne pathogens. In addition, we want to develop education and monitoring programs for at-risk populations or those who serve food to at-risk populations. Improving food safety is a collaborative effort between scientists in the microbiological food safety and food biopolymer chemistry research groups. Proteins and polysaccharides will be studied for their potential to serve as carriers to help improve the availability of bioactive food antimicrobials and other components in food matrices or in the human gastrointestinal tract, or for their direct antimicrobial effects in packaging, on surfaces or in foods.

We are also active in nutrition-related cancer research. A common mechanism of modifying tumor growth and cancer risk may lie in the ability to alter intracellular calcium levels, and by doing so, we may be able to develop nutritional therapies to combat cancers.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : No

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
125	Agroforestry	0%	0%	3%	0%
311	Animal Diseases	0%	0%	15%	0%
403	Waste Disposal, Recycling, and Reuse	0%	0%	2%	0%
501	New and Improved Food Processing Technologies	0%	0%	11%	33%
502	New and Improved Food Products	0%	0%	7%	0%
503	Quality Maintenance in Storing and Marketing Food Products	10%	10%	0%	0%
504	Home and Commercial Food Service	10%	10%	0%	0%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	10%	0%
703	Nutrition Education and Behavior	0%	0%	2%	0%
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	80%	80%	30%	67%
722	Zoonotic Diseases and Parasites Affecting Humans	0%	0%	7%	0%
901	Program and Project Design, and Statistics	0%	0%	3%	0%
903	Communication, Education, and Information Delivery	0%	0%	10%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The Centers for Disease Control estimates that 76 million people get sick, more than 325,000 are hospitalized, and 5,000 Americans die each year from foodborne illness. This Extension program will improve consumer practices for safe food handling.

The Economic Research Service (ERS) estimated the cost from five bacterial foodborne pathogens as $6.9 billion, which includes medical costs, productivity losses from missed work, and an estimate of the value of premature death.Safety of food products is a primary concern of consumers, and confidence in our agricultural food products is critical for the acceptance of such products and the ultimate well-being of livestock farms and farm families.

Child care providers serve one of the segments of our population which is most vulnerable to foodborne illness. In the US, children under five years of age account for 21% of the cases of food poisoning. Education of child care providers and children may go a long way to reducing foodborne illness.

Nutritional and metabolic disorders, including obesity hypertension, and nutrition-related cancers

impact a large portion of consumers and their families. For example, colorectal cancer is the second leading cause of cancer deaths in the United States.Research-based information to help consumers optimize nutrition and reduce health risks is needed.

Biopolymers, i.e., polysaccharides and proteins, are major components of food products. Improvement of functional properties of biopolymers is important for improving the quality of foods which is of interest to the food industry. Additionally, biopolymers may be used for food, pharmaceutical, agricultural, and biotechnological applications such as carrier-delivery systems for food additives or 'release-on-demand' systems for drugs and other bioactive compounds which would be of benefit to all people.

There has been alarming increase of food borne illnesses associated with fresh produce. When coupled with the trend of increased consumption of vegetables and fruits for health and nutritional benefit, this increase becomes a significant issue. Food borne pathogens in fresh produce indicate a weakness in the nation's fresh produce production system as was demonstrated by recent multi-state outbreaks in produce, including the E. coli OH7:H7 outbreak from spinach that lead to 183 cases of illness, 29 cases of Hemolytic Uremic Syndrome, 95 hospitalizations, and one death. Increasing applications of antimicrobial agents in production systems have resulted in multiple antibiotic-resistant pathogenic and commensal bacteria in human and animal habitats. Research is needed to determine all major sources of food borne pathogens, especially those associated with antibiotic resistance.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Extension Family and Consumer Sciences Agents have the necessary skills to build partnerships that will engage individuals, families and institutions for community-level change in safe food handling practices.

A combination of applied and basic research can address food safety issues. Directed funding for this research will remain level or increase.

The problem of cross-contamination is generally recognized to be complex, involving consumer behaviors and the dynamics of microbial survival and growth, as well as factors that affect bacterial transfer efficiency. Existing research has examined each of these factors independently, but generally fails to examine the problem holistically. It is essential to understand the interaction of specific observed consumer food preparation behaviors with subsequent levels of contamination. Intervention strategies targeting potentially unsafe consumer practices will reduce foodborne illnesses associated with home-prepared foods. Investigating storage practices of refrigerated foods and the likelihood and mechanisms of cross contamination will provide essential information to develop effective intervention strategies.

By improving food handling and storage practices in the home, the risk of foodborne illness will decrease. In another avenue of possible food contamination, the application of raw animal manure as fertilizer can increase the threat of contamination on fruits and vegetables and possibly pass antibiotic-resistant bacteria to humans who consume the contaminated fresh produce. Consumer handling practices and storage of food determines the degree of microbial contamination and the possibility of causing food

contamination.

2. Ultimate goal(s) of this Program

The ultimate goals of this planned program are to:
- improve consumer food handling practices to lower foodborne illnesses.
- provide consumers with reliable information to allow them to lead healthier lifestyles.
- improve food safety to reduce foodborne illness.
- provide opportunities for food processors to produce safe, high quality, shelf-stable food products.
- improve food safety education to child care providers and school children.

- develop new methods to identify and remove contaminants from food.
- deliver educational programs on safe fresh produce handling practices and judicious use of antibiotics in agriculture

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	9.0	1.0	35.0	8.0
2018	9.0	1.0	35.0	8.0
2019	9.0	1.0	35.0	8.0
2020	9.0	1.0	35.0	8.0
2021	9.0	1.0	35.0	8.0

V(F). Planned Program (Activity)

1. Activity for the Program

In the Safe Food for Tennessee initiative, UT and TSU Extension will teach lessons in homes, schools, community centers, churches, and other accessible locations to consumers. The lessons in "Cook's Corner" and "Safe Food for You" are designed to change attitudes, skills and behaviors in regards to safe food handling practices.

Youth participants will receive food safety education using Fight BAC and other curricula through their school classroom, community center, after-school program, or other locations to reach youth. Direct methods (group meetings, classes, demonstrations, and on-site visits) and indirect methods (newsletters, TV media programs, web sites, newspaper articles and radio programs) will emphasize safe food practices:
- using a thermometer to check the internal temperature of food.
- using a thermometer to check the internal temperature of the refrigerator.

We conduct applied and basic research in food-borne risks and nutrition to address high priority issues for consumers of food products. We disseminate information gained from these studies to food

industries and consumers through outreach programs, including workshops and educational events at the county level, and through a variety of publications.

Studies are underway on how non-thermal processing (high pressure, ultrasound, solvents) affect the functional properties of proteins for food and non-food applications. Supercritical carbon dioxide will be used to produce biopolymers encapsulation systems for flavors and nutraceuticals and to modify functional properties of proteins.

Research projects in food safety are multi-pronged in their objectives. A major thrust is characterization of the antimicrobial activity of novel natural (i.e., plant-, animal- or microbial-based) compounds and better targeting through controlled-delivery encapsulation systems and incorporation into nanofibers and packaging films. Encapsulation strategies include micelles, liposomes, chitosans, supercritical carbon dioxide, high pressure homogenization and ultrasound. Novel molecular biology strategies are used to identify stress mechanisms in bacteria that allow them to resist interventions.

Research will also characterize, analyze, and identify pathogenic profiles and patterns of pathogenic microorganisms in fresh produce and farm environments and deliver educational programs to producers and consumers on hygienic agricultural and food handling practices that are needed to improve fresh produce safety. In addition, the program will reduce antibiotic-resistant bacteria in fresh produce and the farm environment; change the behaviors of consumers and farmers to produce safer fresh produce handling practices and judicious use of antibiotics; and train competitive students with relevant skills for employment opportunities in food safety.

Research to develop new methods to identify and reduce contaminants in the food supply.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Workshop	● Newsletters
● Group Discussion	● TV Media Programs
● One-on-One Intervention	● Web sites other than eXtension
● Demonstrations	● Other 1 (Radio Programs)

3. Description of targeted audience

- Consumers
- Employees of Child Care Centers
- SNAP and WIC clients
- Food producers

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote safe food handling practices.
- Number of research-based publications distributed by Extension to educate producers, processors, and consumers.
- Control A. acidoterrestris bacterium in pasteurized fruit juices (Golden)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Safe Food Handling for Consumers: Number of consumers who more often washed their hands with soap and warm running water before preparing food.
2	Safe Food Handling for Consumers: Number of consumers who now separate raw, cooked, and ready-to-eat foods while storing and preparing.
3	Safe Food Handling for Consumers: Number of consumers who now use a thermometer to check the internal temperature of food.
4	Safe Food Handling for Consumers: Number of consumers who canned vegetables following a tested recipe.
5	Inactivate viral pathogens (D'Souza, Davidson)
6	Prevent, rather than responding to, food-borne illness (Buchanan, Critzer, Wszelaki, Lockwood)
7	Target leading foodborne human pathogen C. jejuni (Lin)
8	Research to develop an Immunochemical Fingerprint Analysis method to be specific and sensitive and applicable as a diagnostic assay to identify and differentiate Salmonella isolates from various sources of food contamination. (Chen)
9	Research to develop process innovations and innovative manufacturing technologies providing high quality, novel or modified, healthy products with improved safety profiles using state-of-the-art optical technologies for aflatoxin removal from foods. (Patras)
10	Investigate cell cytotoxicity, cell viability and cytokine analysis using murine macrophage cell line to assess the activity of treated aflatoxins. (Patras)
11	Research to provide logical corridors to mitigate antibiotic-resistance in the Tennessee food system. (Kilonzo Nthenge)
12	Development of science based information on judicious use of antibiotics for agricultural commodity producers. (Kilonzo Nthenge)
13	Produce gluten-free food ingredient from sorghum proteins (Dia)

Outcome # 1

1. Outcome Target

Safe Food Handling for Consumers: Number of consumers who more often washed their hands with soap and warm running water before preparing food.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Safe Food Handling for Consumers: Number of consumers who now separate raw, cooked, and ready-to-eat foods while storing and preparing.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 504 - Home and Commercial Food Service

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

Safe Food Handling for Consumers: Number of consumers who now use a thermometer to check the internal temperature of food.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 504 - Home and Commercial Food Service
- 503 - Quality Maintenance in Storing and Marketing Food Products

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Safe Food Handling for Consumers: Number of consumers who canned vegetables following a tested recipe.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 503 - Quality Maintenance in Storing and Marketing Food Products
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 504 - Home and Commercial Food Service

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

Inactivate viral pathogens (D'Souza, Davidson)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies
- 504 - Home and Commercial Food Service
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Prevent, rather than responding to, food-borne illness (Buchanan, Critzer, Wszelaki, Lockwood)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 504 - Home and Commercial Food Service
- 501 - New and Improved Food Processing Technologies
- 503 - Quality Maintenance in Storing and Marketing Food Products
- 903 - Communication, Education, and Information Delivery

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 7

1. Outcome Target

Target leading foodborne human pathogen C. jejuni (Lin)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins
- 501 - New and Improved Food Processing Technologies
- 311 - Animal Diseases

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Research to develop an Immunochemical Fingerprint Analysis method to be specific and sensitive and applicable as a diagnostic assay to identify and differentiate Salmonella isolates from various sources of food contamination. (Chen)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1890 Research

Outcome # 9

1. Outcome Target

Research to develop process innovations and innovative manufacturing technologies providing high quality, novel or modified, healthy products with improved safety profiles using state-of-the-art optical technologies for aflatoxin removal from foods. (Patras)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies

4. Associated Institute Type(s)

- 1890 Research

Outcome # 10

1. Outcome Target

Investigate cell cytotoxicity, cell viability and cytokine analysis using murine macrophage cell line to assess the activity of treated aflatoxins. (Patras)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 501 - New and Improved Food Processing Technologies

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Research to provide logical corridors to mitigate antibiotic-resistance in the Tennessee food system. (Kilonzo Nthenge)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1890 Research

Outcome # 12

1. Outcome Target

Development of science based information on judicious use of antibiotics for agricultural commodity producers. (Kilonzo Nthenge)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 712 - Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

4. Associated Institute Type(s)

- 1890 Research

Outcome # 13

1. Outcome Target

Produce gluten-free food ingredient from sorghum proteins (Dia)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 502 - New and Improved Food Products

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Competing Programmatic Challenges

Description

Either competing public priorities or competing programs may influence attainment of Extension food safety outcome targets. Programs require local and state resources (volunteers, public funds, private funds, etc.) in addition to Smith-Lever funds, and if local and state resources change, the outcome targets may not be met.

Public priorities for food safety shift somewhat over time, both in the perception of who is most at risk (i.e. day cares, retirees, restaurant patrons, etc.) and in the perceived greatest threat (food contamination, food ingredients, food poisoning, etc.). While our emphasis must be science-based, public sentiment does affect direction and funding.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Safe Food for Tennessee: Adult participants who receive food safety education using lessons in "Cook's Corner" and "Safe Food for You" will complete survey questions on "Your Opinions About Food Safety" (short term attitude/knowledge outcomes) or "Food Handling and Eating Preferences Questionnaire" (intermediate outcomes) before and after education. Impacts from EFNEP adult and youth programs will also be reported through the national EFNEP Reporting System.

Evaluation of outreach program events will be conducted to determine baseline knowledge of participants before and after the event. Evaluation of our programs will occur through participant surveys following outreach programs.

Educational programs will be evaluated by conducting examinations of participants before and after training and at some period following training to evaluate behavior changes.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 9

1. Name of the Planned Program

Forestry, Wildlife, and Fishery Systems

2. Brief summary about Planned Program

The Extension portion of this planned program will encourage and educate Tennesseans to balance productivity and profitability with environmental stewardship, and pass on healthy and sustainable forestry, wildlife and fisheries systems to future generations.

Planned forestry research programs have several principal emphases, including to develop and use data on protecting Eastern Hemlock against the Hemlock Woolly Adelgid, to create innovative tools to characterize key parameters of high-performance composite materials, to establish new statistical methods to advance intelligent manufacturing practices, to develop techniques for increasing re-forestation by establishing genetic variation in nursery and field characteristics of native hardwood and coniferous forest tree species, to identify environmental and physiological factors having the greatest effects on the survival and growth of tree species native to Tennessee, and to develop an objective understanding of innovative forest policy tools and the forest policy environment in Tennessee. Agroforestry research will focus on the mechanisms responsible for soil carbon storage and loss, and test promising management approaches for increased plant productivity and long-term soil carbon sequestration.

Wildlife research includes biology and ecology of non-game bird species, the assessment and evaluation of agricultural crop damage due to wildlife, and the management and distribution of large game species (such as bear and elk) in the Southeast.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	3%	20%
123	Management and Sustainability of Forest Resources	75%	33%	22%	25%
125	Agroforestry	10%	7%	0%	10%
131	Alternative Uses of Land	0%	10%	0%	10%
132	Weather and Climate	0%	0%	0%	10%
133	Pollution Prevention and Mitigation	0%	0%	11%	0%
135	Aquatic and Terrestrial Wildlife	10%	10%	21%	0%
136	Conservation of Biological Diversity	0%	0%	3%	0%
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%	0%	3%	0%
206	Basic Plant Biology	0%	0%	2%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	7%	0%
301	Reproductive Performance of Animals	0%	0%	3%	0%
311	Animal Diseases	0%	28%	2%	0%
312	External Parasites and Pests of Animals	0%	0%	3%	0%
603	Market Economics	0%	2%	0%	25%
605	Natural Resource and Environmental Economics	5%	5%	7%	0%
610	Domestic Policy Analysis	0%	5%	0%	0%
721	Insects and Other Pests Affecting Humans	0%	0%	3%	0%
722	Zoonotic Diseases and Parasites Affecting Humans	0%	0%	3%	0%
903	Communication, Education, and Information Delivery	0%	0%	7%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

In Tennessee the agroforestry complex includes the primary industries of agriculture and forestry, the input supply industry, the value-added subsectors, food and kindred products, apparel and textiles, and

forest products. Tennessee's agriculture and forest products account for 18% of the state's economy and generates more than $60 billion in output.

About 292,000 Tennesseans are employed by the agroforestry complex, with 126,000 employed in agricultural production. Leading value-added industries include food manufacturing, paper manufacturing, beverage and tobacco products manufacturing, furniture and related products manufacturing, and wood products manufacturing. These subsectors account for more than 85% of the value-added to agriculture and forest products.

Agroforestry can be a win-win situation for small wood landowners. It provides opportunities to balance productivity and profitability with environmental stewardship, and pass on healthy and sustainable agricultural systems to future generations. Agroforestry can provide a diversified income and increase farm productivity. Tennessee merchandise exports from agriculture and forestry production and manufacturing, including fishing, hunting and trapping contributed to close to $2 billion, or 17% of the state's total export base of $11.6 billion. Also, agroforestry provides conservation buffer systems against runoff, soil loss, and pollution from heavy rains. Agroforestry can be used to address human needs by improving quality of life, health, comfort, enjoyment, security and recreation.

The Hemlock Woolly Adelgid is an invasive insect pest that first arrived in Tennessee in 2002. The insect has devasted hemlock forests in the northeastern U.S. The U.S. Forest Service and the Great Smoky Mountains National Park are concerned that the loss of major parts of the hemlock forest would permanently damage the local forest ecosystem. Simultaneous urgent needs for release of predatory beetles and studies of the affects of those releases on the adelgid populations go together with studies of non-target effects of chemical controls used on the adelgids and searches for new predators.

We are faced today with unique opportunities to further the effective and efficient use of renewable resources like wood and wood fiber.The elimination of key natural disturbances in TN hardwood forests and the addition of human disturbances have resulted in a lack of oak regeneration needed to replace valuable oak trees.Research is extremely critical at the present time due to the pressures faced by Tennessee's landowners, which include rising demands for timber and recreational opportunities, which calls for policies to enhance environmental services from forests, and increasing land values from non-forest uses.Forest landowners and policy makers often lack information to evaluate the economic returns associated with managing public and private lands for a range of goods and services.

Greenhouse gasses in our atmosphere are increasing, and this phenomenon is expected to increase average global temperature and drought. Forests in the Southeast are particularly vulnerable to decreasing precipitation. A decline in forest health has numerous implications for timber and biomass production, wildlife habitat, and overall ecosystem stability. Micorrhizal fungi form beneficial plant symbioses and are a critical natural resource of healthy forests. Benefits of these symbioses include improved soil structure and, therefore, the ability of soils to support tree root growth and resist erosion; and protection of trees from stresses related to salinity, herbicides, and infection by pathogens. Changes in our atmosphere such as increased greenhouse gasses, elevated temperature and drought can affect mycorrhizal associations. Our ability to predict and react to climate changes, as to their effects on forest health, requires an understanding of how these changes affect mycorrhizal symbioses.

Certain bird species utilize Tennessee habitat during their annual migratory activities; ecosystem habitat alterations may affect their population numbers and distribution along those migratory routes.Interactions of wildlife large game species, both existing and re-introduced, may result in crop damage, ecosystem alterations, or human-animal conflicts.The loss of tobacco as a revenue source in Tennessee has farmers looking for an extra source of income, such as aquaculture.

There is evidence that amphibians serve as wildlife reservoirs for the human pathogen E coli.Human

health implications of this hosting include possible direct human uptake through swimming or open wounds, vegetable contamination water via irrigation water, or indirect transmission via cattle and meat contamination.

Range management sciences can be used to determine the best approaches for long-term carbon storage in soils of tree-based managed ecosystems. Carbon markets can provide incentives for limited resource small farmers and forest woodland owners of Tennessee to modify or diversify their management activities by offsetting initial costs of implementation.

The existing capacity of current forest supply logistics systems in Tennessee are not known. Determining these capacities will help open up opportunities to expand upon existing capacities and to more accurately estimate the capacity of loggers in Tennessee.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

• Tennessee's County Forestry Associations will remain viable organizations over the next five years for the delivery of research-based information on best management practices.
• The resources needed to implement this statewide planned program will be secured as needed.
• External research funding will continue to grow.
• Appropriately skilled staff can be recruited.
• Projected building projects for which private funds exist will be completed.

• Sufficient field research sites will be available.

• Range management and agroforestry systems for carbon storage and timber and ecosystems services will improve sustainability of small land owners
• Determination of the efficiency of the current harvesting technology of forestry products will , provide insight into the efficient utilization of harvesting systems and the exploration of additional feedstock opportunities to sustainably supply emerging forest-based industries

2. Ultimate goal(s) of this Program

We seek to educate and inform Tennesseans to preserve, protect and enhance Tennessee's forestry, wildlife and fisheries systems.

From a forestry research perspective, we want to provide data and technological advances as part of a regional effort to prevent the eradication of hemlock by the Hemlock Woolly Adelgid, predict effects of elevated temperatures/other environmental changes to Tennessee forests by understanding tree physiological mechanisms, re-establish chestnut trees in forest ecosystems, genetically improve selected hardwood/coniferous species, and determine the influence of drought, such as could be expected as a result of global warming, on the beneficial mycorrhizal symbioses in mature temperate forests.

With regard to forest products, we want to understand the role of the wood/polymer interface in composites, develop patentable software for real-time prediction using advanced statistical systems. Help explain existing forest biomass handling and delivery systems in the State of Tennessee.

In the area of wildlife research, we hope to refine methods to evaluate deer damage to agriculture, develop wildlife-based indicators of sustainability to help managers identify forests where sustainability is threatened, evaluate non-intrusive DNA sampling techniques to determine population densities of black bears in the Great Smoky Mountains National Park, and develop faster, more specific tests for fish diseases.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	9.0	2.0	40.0	5.0
2018	9.0	2.0	40.0	5.0
2019	9.0	2.0	40.0	5.0
2020	9.0	2.0	40.0	5.0
2021	9.0	2.0	40.0	5.0

V(F). Planned Program (Activity)

1. Activity for the Program

UT and TSU Extension will partner with the Tennessee Forestry Association to plan and conduct group meetings to inform forest landowners of issues pertaining to forestry and wildlife. Topics will include management and marketing. Volunteers will be recruited and trained to present at group meetings, provide information, demonstrate equipment and provide materials for demonstrations. UT and TSU Extension will provide education at local, regional and statewide events, such as the Tennessee Forest Festival to inform the general public about forest management issues. Demonstrations will be provided for landowners and forestry workers. Extension Agents and Specialists will educate attendees at County Forestry Landowners Association. UT and TSU Extension will work closely with private consultants, Tennessee Wildlife Resources Agency employees, Tennessee Division of Forestry and others in forestry related industries to develop educational programs and activities for professionals and landowners.

UT and TSU Extension will continue one-on-one contacts with landowners throughout the year and use mass media and newsletters to inform the general public on issues and educational opportunities related to natural resources. Both UT and TSU Extension will provide leadership for conducting programs

that target limited resource landowners with TSU providing specialist leadership for this effort.

For Tennessee's forestry sector, UT AgResearch continues biological control of Hemlock Woolly Adelgid by known predators and new species and release technologies.We evaluate methods of increasing seedling success, and techniques for improving reforestation.We exploit genetic variation in nursery and field characteristics of native hardwood and coniferous forest tree species.We try novel strategies to address exotic forest tree pests and corresponding forest restoration. We establish collections of woody plants, including species and cultivars, and plants having potential commercial value as forest species or for landscape development, from which materials may be obtained for breeding/propagation.

For wood products manufacturing, we characterize key parameters associated with the formation of durable, high-performance composite materials, and establish new statistical methods to advance intelligent manufacturing practices. We explore new methods to produce carbon fibers from low-quality raw materials and are developing a process for bonding plastic or polymer to lignocellulosic fibers (using ultrasonic vibration) as a replacement for toxic wood preservatives.

We identify approaches and services to landowners that would enable them to realize a wide range of landownership benefits while fostering stewardship and sustainability of private forest lands in Tennessee. Both qualitative (e.g., personal interviews and focus groups) and quantitative (e.g., survey responses) data are collected and analyzed to better understand landowners understanding of management.

Although manipulative studies of tree seedlings and saplings are cost effective and quick, recent research has shown that they may not allow for valid predictions on mature trees. Therefore, direct experiments on large trees or forested catchments have been developed. Experiments are being conducted on local forest research sites developed by the Department of Energy (DOE). Each are large-scale, multi-year, multi-investigator experiments.

UT AgResearch wildlife and fisheries research evaluates and quantifies the effects of deer on agricultural production and identifies associated land-use patterns and biological and ecological factors that could be used for reducing that impact.We monitor target avian species and relate specific population parameters to factors affecting forest health and sustainability, and develop new forest management prescriptions that promote sustainability.We develop prediction methods and evaluate selected aquatic species in existing and new production systems adapted to Tennessee's climate and geography.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class	● Newsletters
● Workshop	● TV Media Programs
● One-on-One Intervention	● Web sites other than eXtension
● Demonstrations	● Other 1 (Newspaper/Radio)
● Other 1 (On-site Visits)	● Other 2 (Publications)
● Other 2 (Field Days)	

3. Description of targeted audience

The target audiences for this program are forest landowners, the professionals and volunteers who serve them, as well as those who enjoy the state's wildlife resources.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Protect walnut from the walnut twig beetle (Taylor)
- Number of logger preferences examined in emerging forest products industries.
- Develop mobile apps for IPM (Fulcher, Windham, Hale)
- Investigate importance of wildlife to plants (Kwit)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Forest Landowner Education: Number of landowners who now understand the ecology of forest development and succession (using forest management plans or contacting a professional forester.)
2	Assess Biomass Feedstock Availability (Hodges, Young)
3	Address Thousand Cankers Disease on black walnut (Grant, Lambdin, Hadziabdic, Windham)
4	Suppress Emerald Ash Borer (Grant, Wiggins)
5	Establish shortleaf pine (Clatterbuck)
6	Deploy predatory beetles against Hemlock Woolly Adelgid (Lambdin, Grant, Parkman, Wiggins)
7	Protect amphibians from ranavirus (Gray)
8	Research to determine long term site improvement for biofuels production in intercropping systems through increased nutrient pools. (Haile)
9	Optimum switchgrass/pine intercropping combination to enhance soil carbon sequestration and minimize greenhouse gas production. (Haile)
10	Biomass mapping models to help plan a continuous supply of traditional forest products, and help generate revenue, and protect and restore supporting services in the forests in Tennessee. (Pokharel)
11	Optimize oak savannah restoration (Keyser, Kwit)
12	Address tick-borne disease in the Southeast (Hickling)

Outcome # 1

1. Outcome Target

Forest Landowner Education: Number of landowners who now understand the ecology of forest development and succession (using forest management plans or contacting a professional forester.)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Assess Biomass Feedstock Availability (Hodges, Young)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 603 - Market Economics
- 125 - Agroforestry
- 131 - Alternative Uses of Land
- 605 - Natural Resource and Environmental Economics
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Address Thousand Cankers Disease on black walnut (Grant, Lambdin, Hadziabdic, Windham)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 125 - Agroforestry
- 203 - Plant Biological Efficiency and Abiotic Stresses Affecting Plants
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 4

1. Outcome Target

Suppress Emerald Ash Borer (Grant, Wiggins)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 125 - Agroforestry
- 605 - Natural Resource and Environmental Economics
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Establish shortleaf pine (Clatterbuck)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 605 - Natural Resource and Environmental Economics
- 125 - Agroforestry
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Deploy predatory beetles against Hemlock Woolly Adelgid (Lambdin, Grant, Parkman, Wiggins)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 605 - Natural Resource and Environmental Economics

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Protect amphibians from ranavirus (Gray)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 312 - External Parasites and Pests of Animals
- 123 - Management and Sustainability of Forest Resources
- 135 - Aquatic and Terrestrial Wildlife

4. Associated Institute Type(s)

- 1862 Research

Outcome # 8

1. Outcome Target

Research to determine long term site improvement for biofuels production in intercropping systems through increased nutrient pools. (Haile)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 125 - Agroforestry

4. Associated Institute Type(s)

- 1890 Research

Outcome # 9

1. Outcome Target

Optimum switchgrass/pine intercropping combination to enhance soil carbon sequestration and minimize greenhouse gas production. (Haile)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 125 - Agroforestry

4. Associated Institute Type(s)

- 1890 Research

Outcome # 10

1. Outcome Target

Biomass mapping models to help plan a continuous supply of traditional forest products, and help generate revenue, and protect and restore supporting services in the forests in Tennessee. (Pokharel)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 102 - Soil, Plant, Water, Nutrient Relationships

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Optimize oak savannah restoration (Keyser, Kwit)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 136 - Conservation of Biological Diversity
- 135 - Aquatic and Terrestrial Wildlife
- 125 - Agroforestry
- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 12

1. Outcome Target

Address tick-borne disease in the Southeast (Hickling)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 312 - External Parasites and Pests of Animals
- 721 - Insects and Other Pests Affecting Humans

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities

- Competing Programmatic Challenges

Description

A number of environmental factors could change the direction and outcomes of programming in forestry, wildlife and fisheries. These include insect infestation and forest fires.Other natural disasters, such as hurricanes and tornadoes, may significantly alter forested and riverine habitat which ultimately may affect game and non-game population densities.

Outcomes may also be affected by governmental regulations and public policy changes regarding wildlife populations, economic changes affecting the hardwood industry, state and government funding for public lands, government regulations and/or public policy changes that affect forest policy and the sustainability of forest lands research, and possible appropriations changes within DOE.

Natural events such as drought and extreme weather conditions may affect studies designed to identify environmental and physiological factors affecting the survival and growth of tree species native to Tennessee.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

After Only (post program): Post-program questionnaires will be used to ascertain the degree of knowledge and attitude change.

Observation: County Extension Agents will observe landowners before and after programs to determine the level of practice adoption.

Time series as well as comparisons between groups/programs with and without program intervention: Deer damage to agricultural production.

Case study: Bear monitoring using DNA technology.

Comparison between sites where various treatments were made. Tree improvement programs are generally long-term activities with monitoring throughout the study and summary evaluation after a designated period of time; forest policy studies often use the case study approach.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 10

1. Name of the Planned Program

Health and Safety

2. Brief summary about Planned Program

The state of Tennessee spends over 37.5% of its state budget on health care, in part due to the costs incurred by patients who do not understand medical information, chronic disease self-care, the health care system and health provider information. This public health crisis is called low health literacy, which threatens every person in Tennessee, regardless of age, race, education, or income level.Our Extension program will build the health literacy of Tennesseans by helping them to read, understand, and act on health information for personal health decisions. Health literacy affects peoples' ability to: navigate the healthcare system; share personal information, such as health histories with providers; and engage in self care and chronic disease management. At risk are: older adults, racial and ethnic minorities, people with less than an high school degree or GED, people with low income levels, non-native speakers of English and people with compromised health status. Strategies for improving Health Literacy are: usability, evaluation, cultural competence, use plain language, speaking clearly and listen carefully and partner with Health Educators.

Emergency preparedness once only concerned people who lived in areas prone to natural disasters, like earthquakes and tornados. However with man-made, natural disasters, and infectious diseases on the rise, emergency preparedness has become an issue for all Americans. This is particularly true for vulnerable populations, whose access to emergency preparedness information and tools is severely limited. Recent examples, like those affected by Hurricane Katrina, have made awareness of vulnerable populations' emergency needs clear.

Knowing what to do is important in preparing for emergencies. Having the right information and resources can make all the difference when seconds count. Providing these tools to vulnerable populations is critical. Offering them where underserved children and adults live, work, and play is essential. Academic institutions can help with all of these.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
402	Engineering Systems and Equipment	5%	5%	0%	0%
511	New and Improved Non-Food Products and Processes	5%	5%	0%	0%
724	Healthy Lifestyle	70%	70%	0%	0%
805	Community Institutions and Social Services	20%	20%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Health care costs are rising in Tennessee, with the state spending over 37.5% of its state budget on health care. Reasons suggested for the rising health care costs include technological advances, new drug therapies, malpractice costs, and a growing aging population. A reason that is less recognized is the costs incurred by patients who do not understand medical information, chronic disease self-care, the health care system and health provider information. This public health crisis is called low health literacy, which threatens every person in Tennessee , regardless of age, race, education, or income level. Health literacy refers to the ability to read, understand, and act on health information to make personal health decisions. Diabetes is the sixth leading cause of death in Tennessee. One in three Tennesseans have arthritis.

Extension will deliver the Walk Across Tennessee program in over 25 communities in the state. This eight-week walking program organizes teams for walking, jogging, or biking. Instruction is delivered in the prevention of obesity-related diseases such as cancer, diabetes and heart disease. Also, physical activity and weight management are taught.

2. Scope of the Program

- In-State Extension
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The Tennessee Department of Health will continue to its stewardship of 95 County Health Councils in the state, and Extension Family and Consumer Sciences Agents will continue to educate and involve local councils for community health outreach.The resources needed to conduct this program over the next five years will be available as needed.

2. Ultimate goal(s) of this Program

The ultimate goals of this planned program are to improve the health and safety of Tennesseans: To

stabilize or lower health care costs in Tennessee by helping the state's citizens to read, understand, and act on health information to make personal health decisions.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	20.0	1.0	0.0	0.0
2018	20.0	1.0	0.0	0.0
2019	20.0	1.0	0.0	0.0
2020	19.0	1.0	0.0	0.0
2021	19.0	1.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Dining with Diabetes is a three-session course which will be offered throughout the state. This course is taught by Extension Family and Consumer Sciences Agents who coordinate with local health officials to target people with diabetes and/or their caregivers.

Arthritis Self-Help is a program delivered in six sessions. Each session is two-hours in length. Participants are provided with the book, The Arthritis Helpbook, written by Kate Lorig and James Fries. This evidence-based program is designed to increase the self-confidence of participants to manage their arthritis. It will be delivered by Extension, in partnership with the Tennessee Chapter of the Arthritis Foundation, the Tennessee Department of Health's Arthritis Control Program, and the University of Tennessee Medical Center's Department of Family Medicine. Specific efficacy-enhancing strategies used in this program include:

- Contracting: Weekly contracting helps participants master something new.
- Feedback: Opportunity is provided to report and record progress and explore different behaviors.
- Modeling: People learn more and try harder when they are motivated by people whom they perceive to be like themselves. Program participants and the trainer serve as models. The course has an emphasis on modeling.
- Reinterpreting Symptoms and Changing Beliefs: People are pretty rational. They act based on beliefs. If people believe arthritis is a wear and tear disease, then they may not think they can exercise. If they think that nothing can be done for their arthritis, they are probably right. Throughout this program, there is a great emphasis on changing such beliefs.
- Persuasion: By seeing others in the class contract and succeed, even the most reluctant participant will often choose to take part. It is hard not to go along with others. The facilitator urges participants to do a little more than they are doing now, such as walking four blocks instead of two.

Living Well with Chronic Conditions will target citizens living with chronic health issues such as asthma, arthritis, and heart disease. Extension will help these individuals to manage their pain and engage in daily activities.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

The target audience is inclusive of consumers and limited resource individuals and families. The Dining with Diabetes program targets individuals with this chronic disease and the caregivers, health professionals and volunteers who serve them.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits built and displayed to promote program awareness and participation.
- Number of research-based publications distributed as part of this program.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Arthritis Self-Help Course: Number of participants surveyed who have less pain from their arthritis.
2	Arthritis Self-Help Course: Number of participants surveyed who take fewer medications for their arthritis pain.
3	Dining with Diabetes: Number of participants surveyed who reduced weight.
4	Dining with Diabetes: Number of participants surveyed who eat at least five servings of fruits and vegetables each day.
5	Dining with Diabetes: Number of participants surveyed who use spices and other seasonings to cut back on fat, sugar, and salt.
6	Living Well with Chronic Conditions: Number of participants controlling their anger and frustration caused by their condition by using positive thinking techniques six months after completing the program.
7	Living Well with Chronic Conditions: Number of participants making healthy food decisions six months after completing the program.
8	Living with Chronic Conditions: Number of participants who have had fewer doctor visits and/or emergency room visits six months after completing the program.

Outcome # 1

1. Outcome Target

Arthritis Self-Help Course: Number of participants surveyed who have less pain from their arthritis.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 805 - Community Institutions and Social Services
- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Arthritis Self-Help Course: Number of participants surveyed who take fewer medications for their arthritis pain.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

Dining with Diabetes: Number of participants surveyed who reduced weight.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 4

1. Outcome Target

Dining with Diabetes: Number of participants surveyed who eat at least five servings of fruits and vegetables each day.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 5

1. Outcome Target

Dining with Diabetes: Number of participants surveyed who use spices and other seasonings to cut back on fat, sugar, and salt.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 805 - Community Institutions and Social Services
- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 6

1. Outcome Target

Living Well with Chronic Conditions: Number of participants controlling their anger and frustration caused by their condition by using positive thinking techniques six months after completing the program.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle
- 805 - Community Institutions and Social Services

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 7

1. Outcome Target

Living Well with Chronic Conditions: Number of participants making healthy food decisions six months after completing the program.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 8

1. Outcome Target

Living with Chronic Conditions: Number of participants who have had fewer doctor visits and/or emergency room visits six months after completing the program.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 724 - Healthy Lifestyle

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Competing Programmatic Challenges

Description

Public perception, as well as new health and safety crises, may affect governmental policy, priorities, and funding for individual research areas.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

To evaluate the Dining with Diabetes and Arthritis Self-Help Course, surveillance data from Tennessee Department of Health will be employed.Questionnaires will be used with various other health programs including Living Well with Chronic Conditions.

V(A). Planned Program (Summary)

Program # 11

1. Name of the Planned Program

Horticultural Systems

2. Brief summary about Planned Program

Tennessee's horticultural crop industry is an important, growing sector of our agricultural economy. Health conscious consumers are purchasing more fruits and vegetables, and an increasing value is being placed on beautification of residences and businesses via use of annual and perennial plants, many of which are grown in Tennessee. Horticultural production in Tennessee is increasing, partially due to diversification of agronomic crop and beef cattle farms.

Our research involves searching out profitable and marketable products to supplement or replace existing crops. Insect and disease resistant cultivars of ornamental and food plants will be located and tested to determine their ability to contribute to financial improvement in the growing horticultural industry. New Integrated Pest Management technologies will be tested to determine the degree of increased control efficacy they offer.

The U.S. environmental horticulture industry, also known as the "Green Industry", is comprised of wholesale nursery, greenhouse, and sod growers; landscape architects, designers/builders, contractors and maintenance firms; retail garden centers, home centers and mass merchandisers with lawn and garden departments; and marketing intermediaries such as brokers and horticultural distribution centers (re-wholesalers). The Green Industry is one of fastest growing sectors in agriculture. Economic impacts for the U.S. Green Industry have been estimated at $147.8 billion in output, 1,964,339 jobs, $95.1 billion in value added, $64.3 billion in labor income, and $6.9 billion in indirect business taxes. Many challenges face this industry including marketing, integrated pest management, sustainable cultural practices, environmental and human health risks, invasive species, regulations, and profitability.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	10%	0%
205	Plant Management Systems	60%	60%	13%	10%
211	Insects, Mites, and Other Arthropods Affecting Plants	10%	10%	7%	35%
212	Diseases and Nematodes Affecting Plants	10%	10%	41%	25%
213	Weeds Affecting Plants	10%	10%	7%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	4%	0%
216	Integrated Pest Management Systems	10%	10%	0%	10%
601	Economics of Agricultural Production and Farm Management	0%	0%	0%	20%
607	Consumer Economics	0%	0%	4%	0%
702	Requirements and Function of Nutrients and Other Food Components	0%	0%	14%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Many producers are searching for viable and profitable alternative crops. 95% of the vegetables and fruits consumed in-state are imported from other states. Fruits and vegetables also have the potential for considerably more income per acre than row crops.

Greenhouse and horticultural operations in Tennessee need to have technology for control of plant diseases in order to take advantage of state-wide, national and international markets that require healthy plants. There are several ways to improve plant health, including plant genetics, improved pest and disease detection, improved pest control technologies and Integrated Pest Management technology -- strengths of the TAES and TSU programs.

Production and marketing of horticultural crops in Tennessee is a rapidly expanding portion of Tennessee's agricultural income. Part of the reasons for recent expansion and interest in horticultural crop production is the diversification of agronomic crop and beef cattle farms across the state. These "high value" crops are also crops which have relatively high costs of production. It essential that our producers are provided with the research-based information they need to manage their operations for profit. This information includes selection of crops/varieties which will appeal to consumers, and management methods which reduce labor expenses, pest infestations, pesticide use, and risk of frost damage.

2. Scope of the Program

- In-State Extension
- In-State Research

- Multistate Research
- Multistate Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Fruits and vegetables have the potential for considerably more income per acre than row crops. Production information for growers will reduce risk and increase profitability.Infrastructure, expertise, and staffing are appropriate.Extramural funding will remain the same or increase with the addition of competitive grants.

Efficient disease management requires information on the etiology and biology of the pathogen, its winter survival and primary source of infection.

The nursery industry relies heavily on traditional pesticides for pest management with few alternatives available for container and field production systems. Integrated approaches are necessary for increased sustainability of the nursery industry. Other, non-quarantine invasive pests (ambrosia beetles, spotted wing drosophila, etc.) also pose significant threats to the sustainability of the nursery industry. Timely and effective responses to these and other newly introduced pest introductions will reduce the economic impact of new pests on the industry.

2. Ultimate goal(s) of this Program

The overall objective of this planned program is to facilitate the production of the vegetable and ornamental crops that have been identified as feasible for production in Tennessee.We want to prevent plant diseases from damaging plants that are grown for commercial or ornamental purposes, and to develop new plants that will increase Tennessee and mid-south grower profitability.

We want to enhance the sustainability of the nursery industry by developing new plants that will increase Tennessee and mid-south grower profitability, develop environmentally friendly and cost effective procedures for that will achieve increased alternative energy use, control insects and diseases, and meet certification requirements for Japanese beetle and imported fire ants. These new procedures will be cost effective, integrate into current nursery production systems, be environmentally safe, less hazardous to workers, and reduce the utilization of synthetic petroleum-based pesticides and energy sourcesunits.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	36.0	5.0	25.0	10.0
2018	36.0	5.0	25.0	10.0
2019	36.0	5.0	25.0	10.0
2020	45.0	5.0	25.0	10.0
2021	45.0	5.0	25.0	10.0

V(F). Planned Program (Activity)

1. Activity for the Program

Variety evaluation of several different vegetable crops will be conducted to determine suitability to climate, soils and cultural practices for state producers. Yields, quality and market potential will be evaluated to assess potential production by growers seeking additional crops or alternative crops. Crops suitable for greenhouse production in farmers tobacco transplant greenhouses will be evaluated for profitability and product quality with respect to local and state markets.

UT AgResearch efforts determine the effectiveness of various control technologies, develop new genetic cultivars of plants from in-house breeding programs or, in some cases, find naturally resistant populations of plants by searching the southeast U.S. (i.e. for anthracnose resistant dogwoods).

Research is conducted at selected Research and Education Centers across Tennessee, and at several farmer-cooperator locations in key areas of horticultural production in Tennessee. Substantial investments have just been made in construction and renovation of greenhouse facilities on campus and at certain Research and Education Centers. These will be utilized extensively in the conduct of our research.

Research conducted at TSU will:

Identify new pesticide, biopesticide, and treatment methodologies for container and field-grown nursery stock to manage disease and insect problems.
Determine the lowest effective rates for synthetic petroleum-based pesticides and develop new reduced rate insecticide / biopesticide combinations.
Identify new biopesticides that can substitute for synthetic petroleum-based pesticides and reduce worker exposure risk and environmental impact.
Release phorid-decapitating flies in Tennessee to provide imported fire ant biological control.
Provide extension training and literature to producers on imported fire ant and Japanese beetle management and train students in pest management and research techniques.
Provide data to support new treatments in the Domestic Japanese Beetle Harmonization Plan and the Federal Imported Fire Ant Quarantine, as well as data to support new insecticide label amendments.
Conduct assessment of current and future energy use by greenhouse and nursery businesses.
Identify alternative energy sources for the greenhouse and nursery industry.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper articles) ● Other 2 (Radio programs)

3. Description of targeted audience

• Farmers/producers who have traditional livestock and tobacco operations, but are looking to improve income through the Green Industry.

• Master Gardeners who volunteer to provide community service through horticulture.

• Business owners who need research-based information to start, maintain or expand their greenhouse, landscaping, or nursery business.

• Regulatory agencies (e.g., U.S. Environmental Protection Agency, USDA-APHIS, Tennessee Department of Agriculture).
• Agrochemical manufacturers

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Horticultural workshops and conferences.
- Number of exhibits displayed to teach best practices in horticultural systems.
- Number of research-based publications distributed as part of this program.
- Factsheets about alternative methods to control disease and insects in nursery production.
- Develop Drought- and Temperature-Tolerant Grapes (Cheng)
- Employ Nematodes for Biological Pest Control (An)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Consumer Horticulture: Number of consumers who applied fewer fertilizers and pesticides due to a better understanding of landscape best management practices.
2	Consumer Horticulture: Number of consumers who learned about plant selection and proper planting to save money and time in the landscape.
3	New trap designs and strategies for Ambrosia beetle available to growers. (Addesso)
4	Assess and Reintroduce Pityopsis ruthii (Trigiano, Wadl)
5	Enhance Gentic diversity in dogwood cultivars (Windham, Windham, Trigiano, Wadl)
6	Control Downy Mildew (Lamour, Trigiano)
7	Enhance Greenhouse Production (Deyton, Sams)
8	Develop Molecular Markers for Horticultural Traits (Trigiano, Ownley, Wadl)
9	Use Genetics Against Phytophthora Blight (Lamour)
10	Improved understanding of pest management treatment options and reduced-risk pest control options by end-user nursery growers. (Oliver)
11	Development of new treatment options, reduced costs, lower environmental pesticide inputs, or reduced risk from lower rates or new chemistries with less acute toxicity. (Oliver)
12	Research to develop changes to quarantine guidelines for Japanese beetle and imported fire ant. (Oliver)
13	Determine the current labor use by small Tennessee farmers and the degree of off-farm employment by small farmer. (Tegegne)
14	Development of Best Management Practices for labor use by small farmers in Tennessee. (Tegegne)
15	Enhancing sustainable plant health through identification and characterization of microbes with bioactivity against diverse fungal diseases, insects and environmental stress for use as microbial pesticides for pathogens, and in improving plant growth. (Mmbaga)
16	Enhance nursery production efficiency through readily-adopted chemical, biorational and cultural techniques to reduce soil-borne disease. (Baysal-Gurel)
17	Decrease ground and surface water contamination in nursery production through identification of new nursery crop production practices to reduce the use of synthetic pesticides. (Witcher)
18	Develop Bioactive Natural Products for Plant Protection (Gwinn, Chen, Ownley, Bernard)
19	Address Viruses of Grapevine (Hajimorad)

Outcome # 1

1. Outcome Target

Consumer Horticulture: Number of consumers who applied fewer fertilizers and pesticides due to a better understanding of landscape best management practices.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 213 - Weeds Affecting Plants
- 216 - Integrated Pest Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 2

1. Outcome Target

Consumer Horticulture: Number of consumers who learned about plant selection and proper planting to save money and time in the landscape.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 216 - Integrated Pest Management Systems
- 212 - Diseases and Nematodes Affecting Plants
- 205 - Plant Management Systems
- 213 - Weeds Affecting Plants

4. Associated Institute Type(s)

- 1862 Extension
- 1890 Extension

Outcome # 3

1. Outcome Target

New trap designs and strategies for Ambrosia beetle available to growers. (Addesso)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 4

1. Outcome Target

Assess and Reintroduce Pityopsis ruthii (Trigiano, Wadl)

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Enhance Gentic diversity in dogwood cultivars (Windham, Windham, Trigiano, Wadl)

2. Outcome Type : Change in Condition Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 6

1. Outcome Target

Control Downy Mildew (Lamour, Trigiano)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 7

1. Outcome Target

Enhance Greenhouse Production (Deyton, Sams)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 607 - Consumer Economics
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 212 - Diseases and Nematodes Affecting Plants
- 216 - Integrated Pest Management Systems
- 215 - Biological Control of Pests Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 8

1. Outcome Target

Develop Molecular Markers for Horticultural Traits (Trigiano, Ownley, Wadl)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 9

1. Outcome Target

Use Genetics Against Phytophthora Blight (Lamour)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1862 Research

Outcome # 10

1. Outcome Target

Improved understanding of pest management treatment options and reduced-risk pest control options by end-user nursery growers. (Oliver)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Development of new treatment options, reduced costs, lower environmental pesticide inputs, or reduced risk from lower rates or new chemistries with less acute toxicity. (Oliver)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 12

1. Outcome Target

Research to develop changes to quarantine guidelines for Japanese beetle and imported fire ant. (Oliver)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 13

1. Outcome Target

Determine the current labor use by small Tennessee farmers and the degree of off-farm employment by small farmer. (Tegegne)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 14

1. Outcome Target

Development of Best Management Practices for labor use by small farmers in Tennessee. (Tegegne)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 15

1. Outcome Target

Enhancing sustainable plant health through identification and characterization of microbes with bioactivity against diverse fungal diseases, insects and environmental stress for use as microbial pesticides for pathogens, and in improving plant growth. (Mmbaga)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 16

1. Outcome Target

Enhance nursery production efficiency through readily-adopted chemical, biorational and cultural techniques to reduce soil-borne disease. (Baysal-Gurel)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 212 - Diseases and Nematodes Affecting Plants

4. Associated Institute Type(s)

- 1890 Research

Outcome # 17

1. Outcome Target

Decrease ground and surface water contamination in nursery production through identification of new nursery crop production practices to reduce the use of synthetic pesticides. (Witcher)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1890 Research

Outcome # 18

1. Outcome Target

Develop Bioactive Natural Products for Plant Protection (Gwinn, Chen, Ownley, Bernard)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 216 - Integrated Pest Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 19

1. Outcome Target

Address Viruses of Grapevine (Hajimorad)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 216 - Integrated Pest Management Systems
- 212 - Diseases and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Government Regulations
- Competing Programmatic Challenges

Description

Unfavorable weather conditions, unexpected diseases, and natural disasters can affect cultivar evaluations.Changes in the economy may affect grower practices, priorities, and product mixes.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Variety evaluation of several different vegetable crops will be conducted to determine suitability to climate, soils and cultural practices for Tennessee producers.We will evaluate the number of cultivars developed and sold.Yields, quality and market potential will be evaluated to assess potential production by growers seeking additional crops or alternative crops. Crops suitable for greenhouse production in farmers tobacco transplant greenhouses will be evaluated for profitability and product quality with

respect to local and state markets.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.

V(A). Planned Program (Summary)

Program # 12

1. Name of the Planned Program

Human Development

2. Brief summary about Planned Program

Adults, youth and children alike in Tennessee are continuing to have problems with drug abuse, emotional problems, child abuse, juvenile delinquency, divorce, etc. Because many children come from at-risk environments where they do not receive appropriate love and attention, children are not ready for school when they get to kindergarten. Tennessee has one of the highest adult illiteracy rates in the country (21%).

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
802	Human Development and Family Well-Being	100%	100%	0%	0%
	Total	100%	100%	0%	0%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Inadequate parenting and interpersonal skills are associated with family instability which negatively affects child well-being and results in increased costs to individuals, communities, and governments.

• Court-ordered parents: Many courts are requiring parents whose children have been removed to state custody to complete a parent education program. In addition, some agencies will refer parents to classes who are at-risk for having their children removed. Juvenile courts are requiring some parents whose children are in trouble with the law to attend parenting classes as well.

• Relative caregivers: Relative caregivers face not only ambiguous legal status in caring for these children, but they face difficulties in transitioning from their roles as grandparents or other relatives to the role of parent. Children enter these relationships having experienced loss or rejection and often other types of trauma. Relatives may feel overwhelmed by the new responsibilities and fear that they will not be adequate for the task. Providing education and support for these surrogate parents can help ease their stress and provide a refresher or initial training in parenting for those who have never parented or who parented several years ago.

• Teen parents: Fewer than 8% of unwed teen mothers marry the baby's father within one year of giving birth. Teen mothers have a reduced chance of ever marrying and an increased risk of divorce if they

do marry. Unmarried mothers have lower levels of education, lower incomes, and are more likely to receive public assistance than married mothers. Children of unmarried mothers are more likely to have low educational attainment, early sexual activity, and problem behaviors than children of married mothers, and they have lower levels of father involvement in their lives.

• Incarcerated parents: Children of incarcerated parents are at great risk for negative outcomes as adults and face many hardships during their parents' incarceration. Incarcerated parents often lack the skills and self-confidence to maintain a relationship with their children during incarceration which may result in a break in the parent-child relationship.

A recent needs assessment by TSU Extension specialists found numerous studies that there is an increase in the number of individuals who provide care for others in the United States. There are two types of caregiving - formal and informal. The recipients of care include persons with disabilities, aging parents, and underage children and/or grandchildren.

In Tennessee there are 101,510 children living in grandparent-headed households (7.3% of all children in the state). There are another 24,774 children living in households headed by other relatives (1.8% of all children in the state). Of the children living in households headed by grandparents or other relatives in Tennessee, 56,682 are living without the presence of either parent.

The number of Tennessee grandparents reporting having responsibility for their grandchildren who live with them is 61,252. Thirty-one percent are African American; 1% is Hispanic/Latino; and 66% are White. Of these, 42% of these grandparents live in households without the presence of the children's parents. Grandparents under the age of 60 consist of 74%; 20% of them live in poverty.

The person most likely providing care to an older person is an adult child. Other relationships to the older person other than their child are a spouse, other relative or a non-relative. Nearly 25% of caregivers are 65 years of age or older and are likely to be caring for a spouse.

Family caregivers provide the overwhelming majority of long-term-care services in the U.S., which is approximately 80%. Over three-fourths (78%) of adults living in the community and in need of long-term care depend on family and friends as their only source of help; 14% receive a combination of family and hired assistance, and only 8% use paid help only. Over 40% of family caregivers provide some type of nursing care for their loved ones, such as giving medications, changing bandages, managing machinery and monitoring vital signs.

It is reported that 600,000 informal caregivers expend services of 600.4 million caregiving hours per year in the state; with a market value of approximately $5.3 billion. However, providing care for others has its share of shortcomings. For example a significant portion of those in the workforce are providing elder care to family members. Between 25 to 35% of all workers report that they are currently providing or have recently provided care to someone 65 years of age or older. Two-thirds report having to rearrange their work schedule, decrease their hours or take an unpaid leave in order to meet their caregiving responsibilities. Difficulties due to work and caregiving are particularly higher among those caring for someone with dementia. Many employers have no programs or policies in place designed to assist their workers to provide better care.

2. Scope of the Program

- In-State Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Assumption A. Tennessee Extension Family and Consumer Sciences Agents have the necessary relationships to involve and motivate child care providers to access Extension education programs in their communities.

Assumption B. The Tennessee Department of Human Service will continue the enforcement of required training for child care providers.

2. Ultimate goal(s) of this Program

Many Tennessee children are not ready for school when they get to kindergarten. This program will ensure that they are ready for kindergarten and contribute to improved literacy rates in the state. This program will also improve parenting skills, especially for the state's divorced parents and incarcerated parents.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	17.0	2.0	0.0	0.0
2018	17.0	2.0	0.0	0.0
2019	17.0	2.0	0.0	0.0
2020	15.0	2.0	0.0	0.0
2021	15.0	2.0	0.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

This program will involve professionals, parents, child care providers, older adults, and community leaders. The target audiences are child care providers, adolescents, and parents who are divorced or incarcerated, court-ordered parents and relatives as caregivers.

The following will be used to help the target audience gain awareness: Displays, exhibits, community events, newspaper articles, radio programs, TV shows and newsletters. In addition, fact sheets and resource lists for parents, teachers and professionals will be created and dissiminated. Extension FCS Agents in over 60 of Tennessee's 95 counties will offer the four-hour class Parenting Apart: Effective Co-Parenting, an information and skills-based program that utilizes lecture, class discussion, videos, and handouts to inform parents about the potential effects of divorce on their children and provides them with strategies for minimizing those effects. It is expected that approximately 2,000 participants will complete

the Extension class annually.

For 2017-2021, TSU Extension Family and Community Health programs will place special emphasis on "Healthy Aging" for the mind, body and spirit. The ultimate goal is to increase knowledge and education relating to healthy aging. Tennessee is getting older. Various assessments have shown that the percentage of Tennessee's population over the age of 65 will grow to 20% by 2025 (up from about 12% at the beginning of the 21st Century). TSU Extension will produce and distribute resource materials and educational programs on a variety of topics for interested individuals, caregivers, and professionals. Various methods will be employed, including inter-generational connections.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site Visits)	● Newsletters ● TV Media Programs ● eXtension web sites ● Web sites other than eXtension ● Other 1 (Newspaper Articles) ● Other 2 (Radio Programs)

3. Description of targeted audience

The target audiences for this planned program are Tennessee child care providers, parents, and adolescents. While all parents of infants and young children are targeted for literacy programs, parents seeking a divorce are especially targeted for parenting instruction because of the added demands of co-parenting. Tennessee child care providers working full-time are required to have 18 hours and child care center directors are required to have 24 hours of instruction annually. Tennessee parents seeking a divorce are directed by the courts to a four-hour co-parenting class. In many communities in the state, Extension is the only provider of this instruction.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of exhibits displayed to promote program awareness and participation.
- Number of research-based publications distributed as part of this program.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Child Care/Parenting: Number of parents and childcare providers who report using suggested guidance techniques more often.
2	Child Care/Parenting: Number of parents and child care providers who report putting down or blaming their child less.
3	Child Care/Parenting: Number of parents and child care providers who report talking, singing and playing more with their children than before the program.
4	Divorcing Parents: Number of parents who plan to decrease exposure of their children to parental conflict.
5	Caregiving Education: Number of caregivers who report the Extension program helped them to minimize stress.

Outcome # 1

1. Outcome Target

Child Care/Parenting: Number of parents and childcare providers who report using suggested guidance techniques more often.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 2

1. Outcome Target

Child Care/Parenting: Number of parents and child care providers who report putting down or blaming their child less.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 3

1. Outcome Target

Child Care/Parenting: Number of parents and child care providers who report talking, singing and playing more with their children than before the program.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 4

1. Outcome Target

Divorcing Parents: Number of parents who plan to decrease exposure of their children to parental conflict.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1862 Extension

Outcome # 5

1. Outcome Target

Caregiving Education: Number of caregivers who report the Extension program helped them to minimize stress.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 802 - Human Development and Family Well-Being

4. Associated Institute Type(s)

- 1890 Extension

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Government Regulations

Description

If Tennessee law relative to required instructional hours for child care providers changes, the outcomes will likely change. An increase in the number of instructional hours would likely cause an increase in the child care providers reached and the outcomes achieved, provided that the increased demand could be successfully met with current funding levels.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

To evaluate human development programs, post-program questionnaires, pre-tests and post-tests will be used. Typically, participants' knowledge gain is also measured during the actual programs.

V(A). Planned Program (Summary)

Program # 13

1. Name of the Planned Program

Sustainable Energy

2. Brief summary about Planned Program

The focus of this program is the development and improvement of alternative, non-food crop feedstocks for biofuel production and the improvement of the efficiency of alternative energy feedstock production.

Economic research will estimate the capacity of U.S. agriculture to generate a supply of feedstock to sustain a bioenergy and bioproducts industry. Expansion curves for the growth of the bioenergy and bioproducts industries will be developed by estimating a national bioenergy and bioproducts demand for agricultural feedstock, the agricultural resources demanded, and the price and income impacts on the agricultural sector. The economic and land use impacts of alternative sizes of the bioenergy and bioproducts industries and the corresponding economic feasibility to generate feedstock from agricultural sources will also be estimated.

Through the BioWeb project, UT researchers are deploying a dynamic, online, world-class technical resource of peer-reviewed content to support the rapidly changing bioenergy research field.

Engineering research objectives are to develop a knowledge base and/or equipment related to the influence particle size on biomass densification, to identify the most economical ways of size-reducing, separating and transporting biomass feedstocks, and to improve existing approaches and develop new approaches to produce valuable chemical products from common agricultural sources such as seed oils, proteins, and carbohydrates.

Our research-oriented biorefinery is now online to study the full range of processes involved in converting cellulosic biomass to ethanol. Producers are growing the required biomass feedstock for the biorefinery.

UT Extension will continue to conduct needs assessment activities that will influence the biomass utilization research agenda.

3. Program existence : Intermediate (One to five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
101	Appraisal of Soil Resources	0%	0%	6%	0%
102	Soil, Plant, Water, Nutrient Relationships	0%	0%	8%	7%
121	Management of Range Resources	0%	0%	6%	0%
132	Weather and Climate	0%	0%	0%	32%
201	Plant Genome, Genetics, and Genetic Mechanisms	0%	0%	10%	20%
202	Plant Genetic Resources	0%	0%	3%	0%
205	Plant Management Systems	0%	0%	9%	7%
212	Diseases and Nematodes Affecting Plants	0%	0%	4%	0%
215	Biological Control of Pests Affecting Plants	0%	0%	3%	0%
402	Engineering Systems and Equipment	0%	0%	6%	0%
404	Instrumentation and Control Systems	0%	0%	9%	0%
501	New and Improved Food Processing Technologies	0%	0%	4%	0%
511	New and Improved Non-Food Products and Processes	0%	0%	23%	0%
512	Quality Maintenance in Storing and Marketing Non-Food Products	80%	80%	2%	0%
601	Economics of Agricultural Production and Farm Management	0%	0%	2%	34%
603	Market Economics	10%	10%	0%	0%
605	Natural Resource and Environmental Economics	10%	10%	0%	0%
607	Consumer Economics	0%	0%	2%	0%
610	Domestic Policy Analysis	0%	0%	3%	0%
	Total	100%	100%	100%	100%

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

Domestic production of energy in the U.S. lags behind growth in demand, resulting in increasing energy prices. U.S. dependence on imported sources of energy has also created international difficulties for our country including contributing to our large trade deficit. The production of important chemicals from agriculture rather than from petroleum will decrease U.S. dependence upon foreign oil and provide

additional income for U.S. farmers. Government at all levels has endorsed research to identify and develop new domestic sources of energy.

Bioenergy crop production is part of the solution to the global problems of energy security, economic uncertainty and environmental degradation. However, production can be limited by the availability of suitable land that does not compete with land otherwise used for growing food, feed and fiber. Work continues on alternative bioenergy feedstocks and production schemes to meet the need of diversification and production on marginal lands. Complementary alternatives to switchgrass are eastern gamagrass, big bluestem and Indian grass. A major appeal of cellulosic herbaceous perennials (CHPs) as bioenergy feedstock stems from their ability to be produced on marginal and degraded land, thus moderating food-energy debates.

Sound information on the extent of energy production capacity in agriculture, costs per unit, benefits to agricultural producers, and impacts on production of other products and the environment is not readily available. One form of land degradation is soil acidity, which renders up to 30-40% of the world's arable land unproductive. Another form is soil and water pollution from coal-fired power plants. Disposal and management of coal combustion wastes (CCW), in particular fly ash (FA,) is major environmental concern for all coal-based energy producing countries of which the US is third behind India and China. The traditional method for disposal of FA is storage in massive wet ponds or in landfills. Such approaches have become increasingly environmentally and economically unacceptable.

Another area of improved bioenergy availability is in feedstock production. The ability to produce feedstock on marginal lands will improve feedstock availability. Selection for variants/mutants capable of prospering on marginal lands and/or tolerant of herbicides will increase biofuel availability. Once the bioenergy industry becomes more established, feedstock quality will become of great importance and may influence the feedstock price. Therefore, it is important to identify factors that can influence quality, such as harvest timing, for an important feedstock like switchgrass.

While some research has been reported on the handling of forest residue, reported experimental work on collection, transportation, and primary processing of crop residues is scarce. Biomass must generally be fractioned into small droplets or particles prior to use. Atomization of sprayed materials affects spray distribution, and granulation of biomass influences input energy.As an example, corn stover has been suggested as an ideal strategic feedstock for the bioenergy program because of its abundance and proximity to existing grain-to-ethanol conversion facilities. However, corn stover is a low-value product with a high moisture content at the time of grain harvest.As such, it is difficult to handle, spoils readily, is prone to spontaneous combustion, and is a safety hazard when moldy.In addition, the leaf and stalk fractions have different mechanical and chemical properties, affecting size reduction, handling, and ultimate direction of very different feedstocks.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

Fuel consumption will continue to increase and supplies of foreign oil will continue to be a constraint until the US can become self-sufficient in fuel production. Biofuels will remain a viable and important component in the suite of alternative energy options available to fuel producers.

Appropriated and extramural funding and personnel resources will remain adequate to support the

research. Energy prices will remain "relatively high" for the foreseeable future. Agriculture will continue to have excess capacity that will enable it to support energy production. Reported experimental work on collection, transportation, and primary processing of crop residue will continue to be limited. New approaches in atomizing and granulating biomass will be environmentally friendly and energy-efficient.

Agricultural producers will continue to have a financial incentive to pursue feedstock production; alternatives to current standard feedstocks will increase available acreage for feedstock production and decrease competition for food production acreage. Improved feedstock production efficiency will enhance sustainability of biofuel production.

2. Ultimate goal(s) of this Program

This research seeks to provide information that will enable wise private investment and public policy decisions regarding the development of new domestic energy sources from agriculture, to deliver premium quality feedstocks at a low cost to bioconversion facilities, enhance bioenergy production and sustainability through improvement of biomass feedstocks, development of alternative feedstocks, enhanced feedstock production on marginal lands and to improve existing technologies and develop new technologies for cost-effective, inexpensive, and environmentally-friendly downstream purification and processing of lipid and protein feedstocks.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	5.0	1.0	60.0	7.0
2018	5.0	1.0	60.0	7.0
2019	5.0	1.0	60.0	7.0
2020	5.0	1.0	60.0	7.0
2021	5.0	1.0	60.0	7.0

V(F). Planned Program (Activity)

1. Activity for the Program

Disseminate research findings to the scientific community, stakeholders, agricultural, environmental, life science industries. Recruit and train students, incorporating research training into teaching and extension curricula.

Our economic research is developing national ethanol, biodiesel, electric, and bioproduct demand quantities and incorporating them into an existing dynamic agricultural sector econometric simulation model (POLYSYS). Regional feedstock supply curves necessary to meet national bioenergy and bioproduct demand quantities are being estimated by modifying POLYSYS to include cellulosic feedstock in addition to existing agricultural grain and oilseed crops. Regional bioenergy and bioproduct supply curves are being developed using regional feedstock supply curves, representative transportation costs, and representative costs for each feedstock-technology-product combination considered. A national

expansion curve for the bioenergy and bioproduct industry is being estimated. Key indicators of agricultural sector performance including net farm income, agricultural prices, and government cost in meeting national bioenergy and bioproduct demand quantities are being evaluated.

As part of our engineering research, we are documenting drying rates and methods for corn stover, and quantifying the distribution and quality of the above ground biomass.For existing biomass densification systems, we areidentifying relations between particle size, biomass type, final density, compression pressures and energy, and other engineering factors. We are determining optimum particle sizes based on a balance between expended energy, final density, and integrity of compressed pellet or wafer. We are using these optimum particle sizes to identify or invent technologies to achieve the size based on theoretical cutting lengths due to feed speed, cutter speed, and other engineering factors. We are applying the developed technologies in laboratory-scale granulation tests to verify sizes using laser, image analyzer, sieve, and manual methods. We are comparing the developed methods in particle size reduction to existing technologies.

In terms of downstream processing, we are conducting fundamental studies on the fractionation of various free fatty acid (FFA) mixtures to test whether the mathematical modeling approach used by us for rapeseed oil is more widely applicable.Additionally, the food safety of the purified FFA products is being assessed. We will then complete the cost analysis of this fractionation process using results predicted by the mathematical model using chemical plant design software. A bench-scale continuous reactor is being assembled and we will attempt to maintain the same productivity (moles of product per time per mass of enzyme) as achieved for batch-mode experiments from previous experiments.We are also attempting the further development of microemulsion-based protein extraction as a rapid low-cost and scalable means of selectively isolating and purifying proteins of interest from aqueous media.

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class ● One-on-One Intervention ● Demonstrations ● Other 1 (On-site visits)	● Newsletters ● TV Media Programs ● Web sites other than eXtension ● Other 1 (Newspaper articles) ● Other 2 (Radio programs)

3. Description of targeted audience

This planned program is targeted to Tennessee farmers. Secondary audiences include consumers of both basic and applied research and the general public.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts
  - Direct Adult Contacts
  - Indirect Adult Contacts
  - Direct Youth Contacts
  - Indirect Youth Contact
- Number of patents submitted
- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

- Number of research-based publications distributed as part of Extension biofuels programs.
- Number of underrepresented students trained in bioenergy and climate change research
- Develop bio-based agricultural mulches (Hayes)
- Increase control of thermal properties of lignin polymers (Chmely)
- Produce platform chemicals from hemicellulose (Chmely)
- Determine Environmental Fate of Cellulose Nanocrystals (Radosevich)
- Provide Process Analytics for Bio-based Products (Young)

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Address Switchgrass Pathogens and Diseases (Ownley, Zale, Gwinn, Windham)
2	Improve Switchgrass Logistics and Handling (Womac)
3	Develop Lignin-Based Biorefinery Coproducts (Bozell)
4	Use Insects to Help with Biofuel Production (Jurat-Fuentes, Klingeman, Oppert)
5	Deploy Switchgrass Extractives as Bioactive Compounds (Canaday, Gwinn, Labbe, Ownley)
6	Improved understanding of mechanisms of biofuel crop responses to agricultural practices and climate change. (Hui)
7	Improved process-based ecosystem models to forecast biofuel productivity and greenhouse gas emission under future climate conditions. (Hui)
8	Document the growth performance, environmental conditions, and agronomy practices for alternative biomass production in the Southeast. (Illukpitiya)
9	Determine the economic benefits, factors that inhibit adaptation, and cost of short rotation woody biomass crops for bioenergy production. (Illukpitiya)
10	Research to provide insight into factors responsible for regulating stress tolerance traits that are inherited via seeds or genome imprinting in stock plants. (Zhou)
11	Stabilize Bio-oil by Deoxygenation (Chmely)
12	Improve Switchgrass Germination, Yield, and Yield Persistence (Bhandari, Allen)
13	Build and Install the First Synthetic Chloroplast Genome (Liu, Stewart)

Outcome # 1

1. Outcome Target

Address Switchgrass Pathogens and Diseases (Ownley, Zale, Gwinn, Windham)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 212 - Diseases and Nematodes Affecting Plants
- 215 - Biological Control of Pests Affecting Plants

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 2

1. Outcome Target

Improve Switchgrass Logistics and Handling (Womac)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management
- 603 - Market Economics
- 402 - Engineering Systems and Equipment
- 404 - Instrumentation and Control Systems
- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Develop Lignin-Based Biorefinery Coproducts (Bozell)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes
- 605 - Natural Resource and Environmental Economics
- 603 - Market Economics

4. Associated Institute Type(s)

- 1862 Research

Outcome # 4

1. Outcome Target

Use Insects to Help with Biofuel Production (Jurat-Fuentes, Klingeman, Oppert)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Research

Outcome # 5

1. Outcome Target

Deploy Switchgrass Extractives as Bioactive Compounds (Canaday, Gwinn, Labbe, Ownley)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 215 - Biological Control of Pests Affecting Plants
- 601 - Economics of Agricultural Production and Farm Management
- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 6

1. Outcome Target

Improved understanding of mechanisms of biofuel crop responses to agricultural practices and climate change. (Hui)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 132 - Weather and Climate
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1890 Research

Outcome # 7

1. Outcome Target

Improved process-based ecosystem models to forecast biofuel productivity and greenhouse gas emission under future climate conditions. (Hui)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 132 - Weather and Climate
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1890 Research

Outcome # 8

1. Outcome Target

Document the growth performance, environmental conditions, and agronomy practices for alternative biomass production in the Southeast. (Illukpitiya)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 9

1. Outcome Target

Determine the economic benefits, factors that inhibit adaptation, and cost of short rotation woody biomass crops for bioenergy production. (Illukpitiya)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1890 Research

Outcome # 10

1. Outcome Target

Research to provide insight into factors responsible for regulating stress tolerance traits that are inherited via seeds or genome imprinting in stock plants. (Zhou)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 201 - Plant Genome, Genetics, and Genetic Mechanisms

4. Associated Institute Type(s)

- 1890 Research

Outcome # 11

1. Outcome Target

Stabilize Bio-oil by Deoxygenation (Chmely)

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 605 - Natural Resource and Environmental Economics
- 511 - New and Improved Non-Food Products and Processes
- 601 - Economics of Agricultural Production and Farm Management

4. Associated Institute Type(s)

- 1862 Research

Outcome # 12

1. Outcome Target

Improve Switchgrass Germination, Yield, and Yield Persistence (Bhandari, Allen)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 605 - Natural Resource and Environmental Economics
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 13

1. Outcome Target

Build and Install the First Synthetic Chloroplast Genome (Liu, Stewart)

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 202 - Plant Genetic Resources
- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Appropriations changes
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Other (International conflict)

Description

Changes in the relative prices of energy or agricultural commodities beyond those included in the economic modeling may lessen the applicability of research results. International conflicts or energy shortages may intensify usefulness and urgency of the research.Available funding, the success of biomass research, the degree to which conversion processes can be optimized, and the availability of alternate energy sources will greatly affect the rate of increase of cellulosic biomass growers, the market price for resulting products, and the extent to which various processes are scaled-up.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

Some of the anticipated outputs are easily measured research parameters that will be evaluated in the course of conducting the research. In the case of the BioWeb, web content and adoption will be measured using web logs.Outcome evaluation will consist of publicly-available or Extension-generated acreage and grower numbers.

Our research programs are evaluated by acceptance of publications in peer-reviewed, archival journals, grant proposals that receive funding from government, industry, and foundation sources, and our ability to attract promising graduate and post-doctoral students.