

2010 West Virginia University Research Plan of Work

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I. Plan Overview

1. Brief Summary about Plan Of Work

The West Virginia Agricultural and Forestry Experiment Station is administered within the Davis College of Agriculture, Forestry and Consumer Sciences at West Virginia University. The College is relatively broad in academic and research discipline areas, including within the College, Divisions of Design and Merchandizing (formally Family and Consumer Sciences; includes programs in Interior Design as well as Textiles and Fashion Merchandising) and Forestry and Natural Resources (includes Forest Resource Management, Wood Science, Parks and Recreation and Wildlife Management) in addition to the more typical Divisions of Animal and Nutritional Sciences (includes Agriculture, Animal and Veterinary Sciences, Biochemistry, and Human Nutrition and Foods), Plant and Soil Sciences (Agronomy, Horticulture, Basic Sciences), and Resource Management (Environmental and Natural Resource Economics, Agricultural and Extension Education and Landscape Architecture).

The Experiment Station supports approximately 40 FTE research faculty positions distributed across slightly more than twice that number of individual scientists. The Station also supports approximately 25 FTE technical positions, 35 clerical and farm/forest worker positions and 40 professional support positions (mostly graduate students). The West Virginia Experiment Station operates seven farms and two forests which support faculty research. Four of the farms (Animal and Nutritional Sciences farms in Morgantown and Reedsville, Horticultural and Agronomy farms in Morgantown) and the University Forest are sufficiently close to the University campus to be used extensively to support academic programs in addition to research. Outlying farms include the Reymann Memorial Farm (beef, sheep, aquaculture, agronomic crops and bull testing station) and Kearneysville Tree Fruit Research Farm (primarily apples and peaches) in northeastern West Virginia; the Willow Bend Farm in the southeast (pasture raised and finished beef cooperative project with ARS); and the Tagart Valley Forest (mostly oak regeneration and disease control research) in east-central West Virginia. All but Tagart Valley Forest serve as extension as well as research centers.

The focus of research programs in the West Virginia Station over the planning period 2010 – 2014 will be on economic activities for which West Virginia conditions provide some degree of competitive advantage for state producers, or on problems having particular impact on families and communities within the state. Advantages to West Virginia producers/entrepreneurs include proximity to large urban population centers of potential demand for specialty or niche market products; an expanse of exceptional hardwood forests; a topography, soil and climate well suited to the production of forages and/or pasture-reared livestock; a rich history, scenic beauty, abundant wildlife and varied recreational opportunities which are highly attractive to tourists; and extensive water resources well suited to the production of cool and cold water fish for food and recreation. Additionally, there is a clearly recognized need to protect the natural resources which enable many of the economic activities within the state.

The most common problems impacting families and communities in West Virginia include a state population which is decreasing in size and aging as well due to a disproportionate loss of younger citizens; a largely rural population with limited access to health and nutritional information and a consequent tendency towards poorly balanced, calorie-dense diets; and an extreme need for environmentally friendly and sustainable economic development which will provide jobs to replace the many which have been lost in coal and timber harvesting industries.

As in the past, research programs of the West Virginia Experiment Station are coordinated with and supported by research programs at West Virginia State University and by educational outreach programs of both West Virginia State and West Virginia University Extension. Supporting research at West Virginia State includes plant genetic work to improve yield, disease resistance and organoleptic properties of pepper, watermelon and greenhouse tomatoes, investigation of procedures to bind water soluble metals and carbon in CO₂, and determining feasibility of utilizing in fish diets, protein recovered from anaerobic digestion of poultry litter.

Supporting outreach programs are conducted by West Virginia University Extension for all Station research programs except Fundamental Plant and Animal Systems and Wildlife Management. Interactions are extensive and vital to technology transfer and implementation of programs involving production agriculture and forestry, economic development and quality of life in rural communities, human nutrition and health and assuring a safe, high quality food supply.

West Virginia University and West Virginia State University entered into a voluntary agreement in 1997 to create the West Virginia Association of Land-Grant Institutions; a collaboration of the state's two land-grant institutions committed to providing education that would help the citizens of West Virginia improve their lives and communities. More recently (in 2005), triggered by an USDA-CSREES mandate, the two Universities developed a Comprehensive Plan for the State which superseded the former

agreement. This plan assures appropriate coordination between the two institutions to avoid duplication of efforts, as it relates to their research and extension programming, and thus an efficient investment of human and financial resources within the State. Program Administrative teams and Directors from both institutions meet annually prior to POW submission to plan for collaboration and avoid duplication.

Modifications of the West Virginia plan for 2010-2014 are minor excepting the elimination of the planned program in Wildlife Management and the addition of a new research program in the development and evaluation of sustainable, bio-based energy systems.

In 2009, the College/Experiment Station will hire an additional 1.3 FTE research positions made available by the University. Faculty in these positions will possess expertise in the area of renewable, bio-based production of energy, chemicals and other products and, will direct research programs which focus on either production/conversion processes or situation/consequence evaluation. We also anticipate a rejuvenation of College research to produce liquid fuels and / or other carbon-based products from animal waste, research which has languished somewhat following the death of the project's PI. Principle knowledge areas for these projects will be KA 133, 403, 511, 605 and 610. These areas of research will compliment research involving thermophilic anaerobic digestion of poultry and poultry litter at West Virginia State University.

Research related to production/conversion processes will develop new technology for the production of biofuels, fuel additives, pharmaceutical products and/or industrial chemicals, using agricultural and forest products and byproducts as primary feedstock materials. Feedstock examples include cultivated biomass crops, inedible crop residues and food wastes, livestock manure and bedding, energy feedstock-dedicated trees, material currently discarded during timber harvest, wood manufacture, and wood construction, etc. Specific research programs will focus in areas such as physiology and management of biomass production, altering chemical composition of plant materials, identifying and quantifying waste streams as potential sources of feedstock, biochemistry of energy conversion to various fuels or of chemical conversion to useful products, methods and economics of crop and timber feedstock harvest, integration of production processes, etc.

Situation/consequence evaluation research will emphasize analysis of economic, marketing, and market demand situations, will answer questions involving environmental sustainability, and will explore various public policy issues and concerns. Emphasis will center on analysis of profit, loss and risk associated with alternative enterprises in a biobased economic sector; on understanding sector impact on carbon sequestration, CO₂ production, soil erosion, and water supplies; on developing accurate assessments of consequences of sector growth on food and housing costs in addition to farm and forest incomes; on conducting a thorough analysis of market demand and market clearing prices; and on assessing requirements to either provide incentives for sector enterprises or assign true costs to competing alternatives of process or input.

Research programs in human nutrition (KA 702, 703) and in food safety and quality (KA 712) will continue to show increases in outputs, relative to those cited in previous work plans, partly from enhanced maturity and recognition of existing programs, and partly from modest reallocations of resources from selected areas of the planned program in production agriculture (KA 205, 307). Research programs in human nutrition will continue to work cooperatively with educational efforts of West Virginia University Extension Service (Family Nutrition, Diabetes, 4-H Youth and others). Finally, we anticipate modest increases in research programs related to organic production of vegetables, fruits and small animal products with consequent small reductions in research dealing with plant and animal management systems.

Although the quantity and variety of wildlife in West Virginia are extremely important to the economy, quality of life and character of the state, the very little of the work in this program has been supported by federal formula funding. For the most part, research in the wildlife management program has been cooperative with and supported by the West Virginia Division of Natural Resources, USGS, US Fish and Wildlife Service and the Wildlife Management Institute. There have been very few formula funded projects directly supported by formula funds over the last several years (currently two projects). Wildlife Management therefore will be discontinued as a separate, formula funded research program area with specific projects henceforth included in programs focused on Economic Development and Quality of Life in Rural Communities, Environmental Quality and Stewardship, or others as appropriate.

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

Year	Extension		Research	
	1862	1890	1862	1890
2010	0.0	0.0	39.8	0.0
2011	0.0	0.0	39.8	0.0
2012	0.0	0.0	40.9	0.0
2013	0.0	0.0	40.9	0.0
2014	0.0	0.0	41.1	0.0

II. Merit Review Process

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

- Internal University Panel
- Expert Peer Review

2. Brief Explanation

Prior to the initiation of any research project to be supported wholly or in part by federal formula funding or by a special research grant, the Director of WVAFES (or his/her designee) calls for a peer review of the proposed research activities. A minimum of three peer scientists qualified by their status in the same discipline, or closely related field of science, will be solicited by the Division Director of the lead investigator to read and provide written comments on the proposed activities. Peer review scientists may be selected from the same campus or from another institution.

Reviewers focus their attention on questions of the quality of the proposed science, technical feasibility of the research, the validity of the scientific approach, and likelihood for completing the stated objectives. Additional comments may be requested on a project’s relevance to a station’s (or a region’s, or national) priorities, the degree of integration with extension (as appropriate), responsiveness to stakeholder needs, and the accuracy of any claims for multi-disciplinary and multi-state collaboration. Reviewers will be asked to present their findings in writing, and records of the reviewers’ comments will be preserved for the life of the project, or for a period of three years in the event that a project is not initiated.

Peer review of proposed projects is expected to provide:

- increased quality of science funded by the federal-state partnership,
- greater relevance to institutional priorities and mission,
- enhanced responsiveness to stakeholder needs, and
- additional opportunities to partner with other states, federal research agencies, and our Cooperative Extension counterparts.

Additional information can be found at: http://www.cafcs.wvu.edu/wvafes/policies_peer.htm

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?

West Virginia Experiment Station faculty will participate in multistate research projects and partner with specialists from West Virginia University Extension to develop and deliver new knowledge and provide technical support to those industries of agriculture and forestry for which West Virginia enterprises have potential competitive advantage. Additionally, multistate research and outreach efforts will focus on preserving state natural resources, enhancing rural economic development and improving the health, nutrition and lifestyle choices for citizens in rural Appalachian communities.

Resources from multiple universities will be applied through multistate research projects to improve yield and efficiency of production methods for forages and grazing livestock; to increase profitability of organic production; to develop sustainable management systems for, and new products from, Appalachian hardwoods; to minimize negative effects on state natural resources from economic activity; to better understand the impacts of natural resource policy and assessment measures on

environmental and economic well-being; and to define habitat requirements and management systems required to maintain West Virginia plant and animal wildlife populations.

Station faculty will partner with West Virginia University Extension specialists to assure timely technology transfer and industry adoption of research results as appropriate to the maturity of the technology. Programs initially receiving particular emphasis in educational outreach efforts will include cool water aquaculture, production and optimum use of Appalachian hardwoods, organic production of vegetables and fruits, economic growth through development of outdoor recreation and tourism opportunities, and reducing obesity and osteoporosis in rural West Virginia communities.

Stakeholder input has been and will continue to be of critical importance in determining priority research and outreach programs for the West Virginia Station. A majority of stakeholder input is gathered in conjunction with West Virginia University Extension from attendees at regular meetings of organizations of stakeholders (Farm Bureau, Forestry Association, Grasslands Steering Committee, Organic Research Project, Aquaculture Forum, Beef Cattle Association annual meeting, Farmer's Market Association annual meeting, etc.). Additionally, input is obtained from groups having interest in specific programs within the college - groups such as the Appalachian Hardwood Council, West Virginia Shepherds Association, Organic Research Project Steering Committee - and from specifically established advisory bodies such as the Davis College of Agriculture, Forestry and Consumer Sciences Visiting Committee and the West Virginia Agricultural and Forestry Experiment Station Advisory Board.

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

West Virginia has a relatively high proportion of limited income, rural and typically underserved citizens for whom issues related to economic opportunity and quality of life tend to be of highest priority. Station faculty will work cooperatively with colleagues in the West Virginia University Extension Service, West Virginia State University Land Grant Programs, and West Virginia University Health Sciences Center Department of Community Medicine to deliver information and technical support most needed by these citizens.

Research and outreach programs in production agriculture and forestry will be conducted jointly with West Virginia University Extension and will focus on the often underserved, smaller, family owned operations which are typical in West Virginia. Similarly, programs in food quality, food safety, and human nutrition and health will be directed largely at concerns and situations characteristic of smaller, less affluent, rural communities, again those typically underserved. Additionally, Station programs supporting economic development, quality of life and protection of natural environments will be directed toward developing ways in which smaller, rural communities can capitalize on existing resources to enhance economic development and improve quality of life in the community. Station faculty will be supported and strongly encouraged to participate in cooperative, multi-state projects which address these issues.

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

Most joint research-extension programs in West Virginia share a common goal of contributing to economic growth by developing technology dependent upon resources which are relatively unique to West Virginia and readily accessible to state citizens, in order to produce competitive advantage for state entrepreneurs. Other joint programs focus on development and delivery of solutions to state-wide problems, including human nutrition (osteoporosis, obesity, cardiovascular disease, etc.), and on natural resource conservation. Expected outcomes and impacts from these programs will be described in terms of economic growth and industry expansion (aquaculture, pasture finished livestock, hardwood utilization, etc.), improved public health demographics for citizens in rural communities in West Virginia (healthier diets, reduced incidence of obesity, diabetes and cardiovascular disease, fewer cases of osteoporosis, etc.) and enhanced soil and water quality (quality assessment for increased proportion of state soil and water resources, reduction in the extent of impaired state waterways, fewer acid mine drainage sites, and recovery of declining species of crustaceans, amphibians, etc.).

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

Multistate research and joint research-extension efforts are critical to the success of programs conducted by the West Virginia Agricultural and Forestry Experiment Station. The West Virginia Station lacks the critical mass of scientists needed to achieve reasonable progress in the development of technology to support economic development and improved quality of life for state citizens. Joint research programs involving scientists from other states and from West Virginia State University, are therefore necessary to meet expectations for technology development. Likewise, Station efforts to enhance state-wide economic development and improve quality of life require joint research-extension programs to develop and deliver outreach programs which will achieve the understanding and adoption of new technology, improved management systems, steps to healthier lifestyles, more informed personal choices, etc.

IV. Stakeholder Input

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

- Survey of traditional stakeholder groups
- Targeted invitation to traditional stakeholder groups
- Survey specifically with non-traditional groups
- Targeted invitation to traditional stakeholder individuals

Brief explanation.

Collect survey information from, and interact personally with, attendees at annual meetings of traditional and new stakeholder organizations plus solicit input from advisory boards (one each, associated with the College and Experiment Station; two associated with College Divisions) of selected individuals representing a wide range of stakeholders.

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 Internal Focus Groups
- Use Advisory Committees
- Use External Focus Groups

Brief explanation.

Suggested by representatives from organizations traditionally associated with the College and others with more recent ties to College programs (e.g., organic producers); suggestions from College administrators, faculty, students and alumni. A significant number are suggested by representatives rotating off one of the advisory groups.

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
- Meeting specifically with non-traditional groups
- Survey of traditional Stakeholder groups
- Meeting with traditional Stakeholder individuals

Brief explanation

Surveys are distributed at annual meetings for numerous organizations having interest in College program areas (related to agriculture, forestry, landscape architecture, interior design, human nutrition, etc.) to provide input. Division Directors, College faculty and advisory groups are queried regularly and routinely to identify industries, groups or subject matter areas needing representation in the College input stream and for specific individuals to fill these roles. For example, a representative from coal mining / energy production has recently been added to the Advisory Board for the Experiment Station even though this industry has not been a traditional stakeholder.

3. A statement of how the input will be considered

- To Identify Emerging Issues
- To Set Priorities
- In the Budget Process
- Redirect Research Programs
- In the Staff Hiring Process
- In the Action Plans

Brief explanation.

Stakeholder input as it relates to the College/Station research portfolio is discussed regularly with College advisory groups

and within College administrative groups, particularly when work plans are being prepared or when staffing decisions are pending.

V. Planned Program Table of Content

S. NO.	PROGRAM NAME
1	Economic Development and Quality of Life in Rural Communities
2	Environmental Quality and Stewardship
3	Fundamental Plant and Animal Systems
4	Human Nutrition and Health with an Adequate, Safe, and High Quality Food Supply
5	Production Agriculture
6	Production Forestry - Timber Management and Wood Utilization
7	Systems for Energy Production from Renewable, Bio-based Feedstocks

V(A). Planned Program (Summary)

Program #1

1. Name of the Planned Program

Economic Development and Quality of Life in Rural Communities

2. Brief summary about Planned Program

The emphasis of research in this program is on economic development and quality of life issues facing citizens and small businesses in other than large metropolitan areas. Opportunities to develop environmentally sensitive and sustainable activities which are related to tourism and outdoor recreation will be especially important.

Research will examine factors which affect levels of employment, poverty, welfare, and food assistance in order to characterize patterns of income distribution, land use, and the potential for economic development from recreational and tourism activities. Additional work will examine economic potential to direct market local and niche foods, develop and test techniques to support clonal nursery production, and evaluate public policy which supports and nurtures biobased production of energy and products.

Quality of life issues to be examined focus on rural citizens and communities and include education and leadership development, personal appearance and self esteem as well as suitability of constructed environments at home and in the workplace. We also are evaluating ways to alter national park programs and infrastructure to better attract and appeal to minority and disabled citizens, and to best use our national park system in supporting national goals for environmental education and fitness enhancement.

West Virginia University Extension has an extensive number of related educational outreach programs in community resource and economic development. Those involving business development and retention, community design for sustainable economic growth, and forest heritage tourism are most closely related to College research programs.

3. Program existence : Mature (More than 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
131	Alternative Uses of Land			15%	
511	New and Improved Non-Food Products and Processes			10%	
605	Natural Resource and Environmental Economics			15%	
608	Community Resource Planning and Development			20%	
704	Nutrition and Hunger in the Population			10%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			15%	
806	Youth Development			15%	
	Total			100%	

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

1. Situation and priorities

Stagnant or declining per capita income, population outflow tending toward younger ages, and growing unemployment, are chronic problems in some areas of West Virginia. Research to develop technologies and management systems which promote economic development consequently represents a high priority in the West Virginia Station. Additionally, research which supports improvements in factors which affect quality of life independent of income may be equally important in stemming outflows of human capital.

The predominantly rural character of West Virginia dictates that Station research will focus on economic development and quality of life issues that occur primarily in rural communities having agricultural or forest-based or other land-based economies. During the planning period, the West Virginia Station will continue to focus on research to determine keys to successfully increasing direct consumer sales of agricultural products (retail rather than wholesale) – with integrated, birth to market production methods for livestock where beneficial; to develop systems of treating water from abandoned mines which allow useage in the production of cool water fish; to devise protocols for the efficient propagation of native plant species; to institute programs which assist community-based efforts to establish recreation and/or tourism industries which capitalize on local historical, forest or wildlife resources; to construct decision tools which assist in choosing among easement and land use alternatives; to develop methods to evaluate economic feasibility of niche or specialty markets through analysis of risk and profit potential; to formulate and implement procedures which compare alternative courses for economic development in terms of potential profit and degree of risk; to devise models predicting restorative, stress reducing capacity of various nature related recreational activities and assess relationships between interpretation and level of tourism activity.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Opportunities exist to offer controlled and sustainable economic growth to rural communities in ways which will not destroy the essence and character of the communities involved.

2. Ultimate goal(s) of this Program

To assist rural West Virginia communities in developing diverse and robust local economies which provide sufficient opportunities for gainful employment while preserving the natural resources and character of each community.

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
2010	0.0	0.0	6.1	0.0
2011	0.0	0.0	5.5	0.0
2012	0.0	0.0	5.5	0.0
2013	0.0	0.0	5.5	0.0
2014	0.0	0.0	5.5	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research; publish results in scientific journals and popular press; make presentations at scientific and professional meetings; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Community managers, planners, policy makers, consultants, local development committees or groups.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	4	0	0
2011	4	0	0
2012	4	0	0
2013	4	0	0
2014	4	0	0

V(H). State Defined Outputs

1. Output Target

- Presentations on reserach at professional meetings

2010 9 2011 10 2012 :8 2013 6 2014 6

- Team consultations with, and reports to assist, community action groups focused on improving local economic development and quality of life.

2010 2 2011 3 2012 :3 2013 4 2014 4

- Completed graduate degree programs

2010 4 2011 4 2012 :4 2013 4 2014 4

- Popular press reports.

2010 2 2011 2 2012 :3 2013 3 2014 3

V(I). State Defined Outcome

O. No	Outcome Name
1	Expansion of economic activity in targeted state industries as indicated by annual increases in weighted indices of economic activity involving the production of pasture raised beef and sheep; broilers, turkeys and eggs; trout; organic vegetables; tourism and outdoor recreational activities; ornamental horticulture; timber and wood products etc. - % annual growth
2	Customized designs for enhanced economic development prepared for, and adopted by, state rural communities (#)

Outcome #1**1. Outcome Target**

Expansion of economic activity in targeted state industries as indicated by annual increases in weighted indices of economic activity involving the production of pasture raised beef and sheep; broilers, turkeys and eggs; trout; organic vegetables; tourism and outdoor recreational activities; ornamental horticulture; timber and wood products etc. - % annual growth

2. Outcome Type : Change in Condition Outcome Measure

2010 2	2011 : 3	2012 : 3	2013 3	2014 :2
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3. Associated Institute Type(s)

- 1862 Research

4. Associated Knowledge Area(s)

- 131 - Alternative Uses of Land
- 511 - New and Improved Non-Food Products and Processes
- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 804 - Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures
- 806 - Youth Development

Outcome #2**1. Outcome Target**

Customized designs for enhanced economic development prepared for, and adopted by, state rural communities (#)

2. Outcome Type : Change in Condition Outcome Measure

2010 2	2011 : 3	2012 : 2	2013 2	2014 :3
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3. Associated Institute Type(s)

- 1862 Research

4. Associated Knowledge Area(s)

- 605 - Natural Resource and Environmental Economics
- 608 - Community Resource Planning and Development
- 804 - Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

V(J). Planned Program (External Factors)**1. External Factors which may affect Outcomes**

- Economy
- Appropriations changes

Description

Changes in appropriations which reduce or eliminate support for this program could significantly alter the timing of outcomes.

V(K). Planned Program (Evaluation Studies and Data Collection)**1. Evaluation Studies Planned**

- During (during program)
- Before-After (before and after program)

Description

State agricultural, forestry, environmental and public health statistics are available to monitor selected industries. Efforts to work with economic development in local communities always involve follow-up contacts and visits.

2. Data Collection Methods

- Sampling
- On-Site
- Mail
- Whole population
- Case Study
- Observation
- Structured

Description

Economic statistics are collected by others. Work with local communities involves in-person, on-phone and by-mail interviews and surveys.

V(A). Planned Program (Summary)

Program #2

1. Name of the Planned Program

Environmental Quality and Stewardship

2. Brief summary about Planned Program

The majority of research in this program will examine the impact of human activity on soil and/or water quality. Specific emphasis will be on proper handling of animal wastes, environmentally sensitive management of pests (insects, diseases, nematodes, weeds and invasive plants), determining cost and value of programs to prevent and remediate pollution, developing methods to increase the success of created wetlands, setting restoration priorities, minimizing negative environmental impacts from agricultural, forestry and mining activities and developing opportunities for state participation in rapidly growing biobased sectors of the economy. Also examined will be organic production of vegetable, small animals and eggs, soil properties best supporting pasture productivity, and the efficacy of current mitigation practices in aiding recovery of lost aquatic ecosystem function on reclaimed mine sites.

Related research at West Virginia State University will examine the utilization of metal ion complexation technology in the remediation of metal contaminated water and will develop a heterogeneous carbon dioxide reduction photocatalyst. The former will investigate the synthesis of water-soluble multidentate phosphine ligands attached to an insoluble solid support for metal ion removal and will determine the efficiency of removing silver, iron, copper, zinc, lead, cadmium, and manganese from water.

West Virginia University Extension conducts related educational outreach programs in sustainable agriculture and forestry, watershed management, pesticide safety and integrated pest management.

3. Program existence : Mature (More than 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			20%	
102	Soil, Plant, Water, Nutrient Relationships			15%	
133	Pollution Prevention and Mitigation			30%	
403	Waste Disposal, Recycling, and Reuse			20%	
605	Natural Resource and Environmental Economics			15%	
	Total			100%	

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

1. Situation and priorities

Research supporting preservation of West Virginia’s soil, water, forest and wildlife resources has high priority in the West Virginia Agricultural and Forestry Experiment Station. Key research themes over the period 2010-2014 will include protecting soil and water quality by developing economically effective and environmentally sustainable management practices for agriculture and forestry and at other points of interaction between man and environment. Contamination of soil and eventually ground water with acid drainage from abandoned mines, and from more recent surface mining, is a growing state concern. Most acid mine drainage sites involve complex mixtures of contaminants. Efforts to define the nature and scope of the contamination have used both actual mine drainage sites and simulated drainage situations. Examples of the former include comparing wetlands impacted by the release of metal-laden sediments from acid mine drainage and those not so impacted. Research with simulated mine drainage is measuring, under laboratory conditions, impacts of sulfate, neutralizing cation action and endpoint pH on acid mine drainage neutralization with the goal of designing more efficient acid mine drainage treatment systems.

Research to develop environmentally sustainable practices for managing farms and forests is an important component of overall Station goals to position state producers/entrepreneurs to compete more effectively in organic or "green" markets and to preserve West Virginia land, forest, wildlife, soil and water resources for future generations. Example projects include the development of soft chemical and mating disruption programs to minimize insect damage to tree fruit orchards, efforts to document and correct as necessary, impacts on non-target species from efforts to control gypsy moth defoliation of state forest lands, development of TMDL planning and assessment tools, use of composted poultry litter in turfgrass management, and developing methods to objectively assess economic value of environmentally sustainable practices.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Activities conducted without thought to environmental consequences are rarely sustainable. Research can lead to significant improvement in the sustainability of agricultural and forest industries in West Virginia and long-run, cost effective environmental decisions.

2. Ultimate goal(s) of this Program

Make significant contributions to both the environmental sensitivity and profitability of land-based economic activities in West Virginia.

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
2010	0.0	0.0	7.9	0.0
2011	0.0	0.0	8.0	0.0
2012	0.0	0.0	8.0	0.0
2013	0.0	0.0	8.0	0.0
2014	0.0	0.0	8.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research; publish/present results; contribute to educational and outreach programs; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Commercial producers and foresters, managers, consultants, policy makers, governmental regulators.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	5	0	0
2011	5	0	0
2012	4	0	0
2013	5	0	0
2014	6	0	0

V(H). State Defined Outputs

1. Output Target

- Presentations on research at professional meetings

2010 8 2011 10 2012 8 2013 8 2014 6

- Popular press articles on research

2010 2	2011 3	2012 2	2013 4	2014 2
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- Completed graduate degree programs

2010 2	2011 3	2012 3	2013 3	2014 4
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V(I). State Defined Outcome

O. No	Outcome Name
1	Reduce the percentage of West Virginia streams classified as 'impaired' (%).
2	Reduce percentage of state streams classified as impaired by agricultural and forestry activities (%).

Outcome #1

1. Outcome Target

Reduce the percentage of West Virginia streams classified as 'impaired' (%).

2. Outcome Type : Change in Condition Outcome Measure

2010 :15 **2011** : 15 **2012** : 12 **2013** :10 **2014** :9

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 102 - Soil, Plant, Water, Nutrient Relationships
- 133 - Pollution Prevention and Mitigation
- 403 - Waste Disposal, Recycling, and Reuse
- 605 - Natural Resource and Environmental Economics

Outcome #2

1. Outcome Target

Reduce percentage of state streams classified as impaired by agricultural and forestry activities (%).

2. Outcome Type : Change in Condition Outcome Measure

2010 :4 **2011** : 4 **2012** : 3 **2013** : 3 **2014** :3

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 403 - Waste Disposal, Recycling, and Reuse
- 605 - Natural Resource and Environmental Economics

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Economy
- Appropriations changes

Description

Loss or significant reduction in funding would impact timing of outcomes; change in state legislation supporting transportation of poultry litter from area of heavy concentration.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)

Description

State surveys as available; personal surveys as needed

2. Data Collection Methods

- Sampling
- Mail
- Tests

Description

Data are collected and published by the State Department of Environmental Protection.

V(A). Planned Program (Summary)

Program #3

1. Name of the Planned Program

Fundamental Plant and Animal Systems

2. Brief summary about Planned Program

Research involving fundamental systems in animals is to increase our understanding of reproductive, nutritional, genetic and general physiological systems and processes. Practical problems impacted will include embryonic mortality in sheep and cattle, limiting amino acids in animal rations, health and disease resistance in poultry, nature and function of novel oocyte expressed genes, and genome mapping in domestic livestock.

In plants, program emphasis will vary from determining the function of ubiquitin and other polypeptide tags, to understanding fundamental mechanisms of flower senescence, to combating the impacts of phytophthora and Chestnut blight, to defining and eliminating negative effects on grazing animals of ergot alkaloids produced by fungi symbiotic with pasture grasses. Work also is directed toward characterizing public health significance of Enterobacter species, understanding the extensive impact of plant interactions with mycorrhizal fungi, and establishing cell callus lines of American Ginseng. Related research at West Virginia State University will develop improved varieties of peppers, watermelons and tomatoes while enhancing our fundamental knowledge of genomic function and variation in these plants.

3. Program existence : Mature (More than 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
201	Plant Genome, Genetics, and Genetic Mechanisms			25%	
206	Basic Plant Biology			15%	
301	Reproductive Performance of Animals			25%	
302	Nutrient Utilization in Animals			15%	
304	Animal Genome			10%	
305	Animal Physiological Processes			10%	
	Total			100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

Efficiency in the production of plant and animal products is enhanced by a thorough understanding of the ways in which biological systems interact with environmental conditions, including conditions which define habitat for wildlife, natural settings for recreational activities or alternative schemes for the management of domestic plants and animals. A primary goal of research involving fundamental plant and animal systems at the West Virginia Station will be to support components of production agriculture, forestry and other land-based economic activities which are profitable under West Virginia conditions. Examples of supporting research include basic nutrition and physiology of poultry; genetic mapping and functional genomics for cool water fish species; reproduction and nutrient utilization of pasture raised livestock; basic growth and physiology of forage plant species as well as livestock-forage interactions; physiological processes controlling growth, cold tolerance, flower production, etc. of ornamental plants; mechanisms of disease and pest resistance for organically produced crops; etc.

2. Scope of the Program

- Multistate Research
- In-State Research

V(D). Planned Program (Assumptions and Goals)**1. Assumptions made for the Program**

Natural variation exists in the efficiency of numerous physiological processes which characterize plant and animal species. Greater process control and efficiency of production generally result from a more complete understanding of the basic mechanisms which underlie a productive process.

2. Ultimate goal(s) of this Program

To develop greater understanding of usable variations in fundamental physiological processes of plants and animals which lead to increased returns to industries for which state producers/entrepreneurs have competitive advantage or to improved life quality for West Virginia families and communities.

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
2010	0.0	0.0	4.0	0.0
2011	0.0	0.0	4.0	0.0
2012	0.0	0.0	4.0	0.0
2013	0.0	0.0	4.0	0.0
2014	0.0	0.0	4.2	0.0

V(F). Planned Program (Activity)**1. Activity for the Program**

Conduct research; publish/present results in refereed journals/professional meetings; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Primarily researchers; professional practioners, regulators, some producers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :1

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	6	0	6
2011	7	0	7
2012	7	0	7
2013	6	0	6
2014	5	0	5

V(H). State Defined Outputs

1. Output Target

- Presentation on research at professional meetings

2010 7 2011 7 2012 :8 2013 8 2014 7

- Completed graduate degree programs

2010 2

2011 2

2012 2

2013 3

2014 3

V(I). State Defined Outcome

O. No	Outcome Name
1	Identify and map genes affecting flower senescence - # new genes
2	Develop ergot alkaloid deficient grasses at or near wild-type vigor - # new cultivars
3	Successfully develop and employ strategies using hypovirus as a biological control agent for Chestnut blight - # new strategies employed
4	Identify ovarian-specific gene expression affecting reproductive success - # new genes identified

Outcome #1**1. Outcome Target**

Identify and map genes affecting flower senescence - # new genes

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1	2011 : 1	2012 : 0	2013 0	2014 :0
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 206 - Basic Plant Biology

Outcome #2**1. Outcome Target**

Develop ergot alkaloid deficient grasses at or near wild-type vigor - # new cultivars

2. Outcome Type : Change in Condition Outcome Measure

2010 :1	2011 : 0	2012 : 0	2013 :1	2014 :0
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 206 - Basic Plant Biology

Outcome #3**1. Outcome Target**

Successfully develop and employ strategies using hypovirus as a biological control agent for Chestnut blight - # new strategies employed

2. Outcome Type : Change in Condition Outcome Measure

2010 0	2011 : 0	2012 : 1	2013 :1	2014 :1
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 201 - Plant Genome, Genetics, and Genetic Mechanisms
- 206 - Basic Plant Biology

Outcome #4**1. Outcome Target**

Identify ovarian-specific gene expression affecting reproductive success - # new genes identified

2. Outcome Type : Change in Knowledge Outcome Measure

2010 :1	2011 : 1	2012 : 0	2013 :1	2014 :0
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 301 - Reproductive Performance of Animals
- 304 - Animal Genome
- 305 - Animal Physiological Processes

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Reduction in funding for fundamental research could have a significant impact on timing of outcomes

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- Time series (multiple points before and after program)

Description

Existence of technology where none existed previously; as appropriate use of state-wide industry statistics.

2. Data Collection Methods

- Sampling
- Other (NASS)
- Observation

Description

V(A). Planned Program (Summary)**Program #4****1. Name of the Planned Program**

Human Nutrition and Health with an Adequate, Safe, and High Quality Food Supply

2. Brief summary about Planned Program

Research related to human nutrition will determine the impact of diet, nutritional education and dietary intervention on obesity and obesity related conditions (diabetes, elevated cholesterol and plasma lipids, heart attack, stroke, and some cancers); will test the efficacy and safety of alternatives to estrogen replacement therapy for controlling osteoporosis in post-menopausal women; and will develop Omega-3 DHA enhanced diets along with educational programs to promote their use.

Research related to an adequate, safe, high quality food supply will focus on processing and cryopreservation of fish, muscle foods, and vegetables, development of methods to more productively use fish processing wastes, on assessing the efficacy and safety of bioactive components in foods, and on the use of electron beam treatment to control bacterial growth on foods, especially those not amenable to heat treatment.

Complementary educational programs directed by West Virginia University Extension include food safety education, family nutrition, dietary planning with diabetes, and cardiac nutrition.

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
501	New and Improved Food Processing Technologies			10%	
502	New and Improved Food Products			10%	
702	Requirements and Function of Nutrients and Other Food Components			20%	
703	Nutrition Education and Behavior			30%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			30%	
	Total			100%	

V(C). Planned Program (Situation and Scope)**1. Situation and priorities**

West Virginia is one of the most overweight of US states with both adults and youth impacted. Dietary patterns formed in childhood often persist into adolescence and influence the risk of developing chronic health problems. For example, overweight children and teens are more likely to be obese as adults and have greater chance of developing type 2 diabetes, high blood pressure, abnormal blood lipid profiles, and orthopedic problems.

Knowledge regarding relationships among familial factors, dietary patterns and body mass index of young children, will allow us to better address the serious and growing problem of childhood obesity in West Virginia. Planned research will provide information about these relationships in rural, Appalachian children that will allow us to design culturally sensitive, effective outreach and education programs.

State median population age and occurrence of osteopenia or osteoporosis likewise exceed national averages in West Virginia. In fact, the National Osteoporosis Foundation estimates that by the year 2020, more than 300,000 women in West Virginia will suffer from osteoporosis unless corrective action is taken. Estrogen replacement therapy has been used successfully to prevent bone loss in postmenopausal women but has several undesirable side effects. Ongoing research is examining the efficacy of exercise and treatment with non-steroidal plant estrogens (phytoestrogens) as an alternative to estrogen replacement therapy in preventing bone loss.

Omega-3 polyunsaturated fatty acids, particularly docosahexaenoic acid (DHA) have been shown to reduce cardiovascular disease, inflammatory disorders, autoimmune disorders, Crohn’s disease and certain cancers. Additionally, infants born from mothers with high plasma DHA exhibit characteristics that are indicative of greater central nervous system maturity at comparable points in time. Research will be undertaken to develop sensory – acceptable methods of fortifying foods with DHA which avoid problems of short chain fatty acid oxidation, and of providing a reliable source of DHA using the heterotrophic marine alga, *Cryptocodinium cohnii*.

Planned research also will address problems related to food quality, food safety, and efficiency of food processing. Because fish proteins are especially susceptible to freeze and freeze-thaw cycle induced denaturation, one research focus will be on developing superior (measured by product quality and safety) methods of cryopreservation for fish fillet and restructured fish products. Additionally, research is being instituted to evaluate and develop non-thermal electron beam treatment as a critical control point to minimize microbial contamination, particularly in leafy green vegetables and ground meat products. A recently instituted and related area of research involves developing improved methods for protein and lipid recovery from trout processing by-products.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Dietary modifications can be developed which will significantly improve the health of West Virginia citizens. Research can lead to increased food quality and safety while increasing efficiency of food processing.

2. Ultimate goal(s) of this Program

To provide citizens of West Virginia with an abundant, safe, high quality food supply and the information needed to make healthful dietary choices.

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
2010	0.0	0.0	2.5	0.0
2011	0.0	0.0	2.5	0.0
2012	0.0	0.0	3.0	0.0
2013	0.0	0.0	3.0	0.0
2014	0.0	0.0	3.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research; publish results in scientific, peer reviewed research journals and popular press; make presentations to colleagues at professional meetings; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Families, dieticians, consultants, policy makers, researchers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :1 2012 :0 2013 :0 2014 :1

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	3	0	3
2011	3	0	3
2012	3	0	3
2013	4	0	4
2014	5	0	5

V(H). State Defined Outputs

1. Output Target

- Presentations on research at scientific meetings

2010 :3	2011 :4	2012 :4	2013 :4	2014 :4
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- Popular press articles on research

2010 :2	2011 :2	2012 :2	2013 :3	2014 :3
----------------	----------------	----------------	----------------	----------------

- Completed graduate degree programs

2010 :1	2011 :1	2012 :1	2013 :1	2014 :1
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V(I). State Defined Outcome

O. No	Outcome Name
1	Annual reduction in state incidence of overweight and obesity and obesity related health problems (diabetes, cardiovascular disease, hypertension, etc.)-% reduction
2	Reduction in state incidence of osteoperosis and similar or related disorders - % reduction

Outcome #1

1. Outcome Target

Annual reduction in state incidence of overweight and obesity and obesity related health problems (diabetes, cardiovascular disease, hypertension, etc.)-% reduction

2. Outcome Type : Change in Condition Outcome Measure

2010 3 **2011** : 3 **2012** : 2 **2013** 2 **2014** :2

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

Outcome #2

1. Outcome Target

Reduction in state incidence of osteoporosis and similar or related disorders - % reduction

2. Outcome Type : Change in Condition Outcome Measure

2010 3 **2011** : 2 **2012** : 2 **2013** 2 **2014** :1

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 702 - Requirements and Function of Nutrients and Other Food Components
- 703 - Nutrition Education and Behavior

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Appropriations changes
- Economy

Description

Reduced or eliminated funding would significantly impact timing of outcomes.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Use of state statistics; generation of additional to augment as necessary

2. Data Collection Methods

- Sampling
- Mail

Description

Extensive use of state Department of Health reports and annual report of West Virginia Behavioral Risk Factor Survey

Report.

V(A). Planned Program (Summary)**Program #5****1. Name of the Planned Program**

Production Agriculture

2. Brief summary about Planned Program

This program includes research supporting both animal and plant production agriculture. The focus in animals is on production of ruminants (beef and sheep) utilizing forages from pasture as the major feed input and on optimum nutrient delivery and efficiency for poultry production. Additional research centers on cool water aquaculture, feed efficiency in beef cattle, and dietary regulation of adipose tissue accretion in meat producing animals. Related research at West Virginia State University will examine the feasibility of utilizing recovered proteins from poultry litter treated in an anaerobic bioreactor, as a dietary supplement in fish diets.

Research emphasis in plants will be on the production of forages, tree fruits and ornamentals, as well as on organic production of a variety of vegetables and fruits holistically with small animals (sheep, goats, chickens) and animal products (eggs, wool, milk). Related research at West Virginia State University is evaluating germplasm to develop improved cultivars of peppers, watermelons and tomatoes. Emphasis for peppers and watermelons is to identify germplasm which exhibits enhanced disease or pest resistance and/or will be suitable for developing useful nutraceuticals. Research in tomatoes is focused on the greenhouse tomato industry with objectives to improve organoleptic traits and resistance to insects and diseases.

West Virginia University Extension conducts educational outreach programs to ensure technology transfer to end users in most College research areas in production agriculture. Specific examples include educational programs related to production of cool water fish for food and sport, grasslands management, beef and sheep production and marketing, commercial and individual horticulture and plant pest and pathogen diagnostics.

3. Program existence : Mature (More than 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
133	Pollution Prevention and Mitigation			15%	
202	Plant Genetic Resources and Biodiversity			5%	
205	Plant Management Systems			15%	
211	Insects, Mites, and Other Arthropods Affecting Plants			10%	
212	Pathogens and Nematodes Affecting Plants			10%	
301	Reproductive Performance of Animals			15%	
302	Nutrient Utilization in Animals			10%	
303	Genetic Improvement of Animals			5%	
304	Animal Genome			5%	
307	Animal Production Management Systems			10%	
	Total			100%	

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

1. Situation and priorities

Most farmers in West Virginia, and in the Northeast US as well, are poorly positioned to compete in commodity markets for fruits, vegetables, field crops and livestock products, due to various combinations of circumstances. Example circumstances include small acreages, difficult terrain, dense population in some locations, high land prices and taxes, limited availability and high cost of labor, etc.

To remain viable, West Virginia producers typically must improve efficiency – either by increasing the value of what they produce, by producing at lower cost, or both. Specific strategies include avoiding enterprises which require extensive amounts of mechanical tillage or harvest; reducing costs of major inputs such as feed, labor, and facilities; focusing on higher value products including those with ornamental or recreational uses; increasing real or perceived product value in specialty, niche or out-of-season markets; diversifying product offerings; taking advantage of proximity to markets, etc.

The objective of this research program in the West Virginia Agricultural and Forestry Experiment Station is to generate new knowledge with positive impact on economic activities for which state producers have some degree of competitive advantage. Station research will focus on economic activities meeting one, or more often multiple, circumstances listed above and generally

having land as a primary input. Examples include forage production / livestock grazing; poultry production; organically produced vegetables, fruits and/or animal products; production of ornamental plants; and cool water aquaculture for food and sport fishing.

2. Scope of the Program

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

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

1. Assumptions made for the Program

For the foreseeable future, West Virginia will remain a largely rural state with a need for economic activities which thrive in non-urban settings. Land-based enterprises operate naturally and logically in rural settings; many rural West Virginia citizens own land which can be a valuable input, as well as a major input, to such enterprises.

2. Ultimate goal(s) of this Program

To generate information which will contribute to a diverse and robust rural economy based on responsible and sustainable use of land, water and air.

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
2010	0.0	0.0	10.5	0.0
2011	0.0	0.0	10.5	0.0
2012	0.0	0.0	10.0	0.0
2013	0.0	0.0	10.0	0.0
2014	0.0	0.0	10.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research; report results in scientific manuscripts, technical and popular presentations; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Producers, extension specialists, consultants, regulators, policy makers, researchers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	8	0	8
2011	9	0	9
2012	8	0	8
2013	9	0	9
2014	9	0	9

V(H). State Defined Outputs

1. Output Target

- Presentation on research at professional meetings

2010 9 2011 12 2012 :10 2013 9 2014 9

- Popular press articles on research

2010 3 2011 5 2012 :8 2013 9 2014 :11

- Completed graduate degree programs

2010 3 2011 4 2012 :3 2013 3 2014 3

V(I). State Defined Outcome

O. No	Outcome Name
1	Growth in state production of beef and lamb - % increase
2	Growth in state aquaculture industry - annual % increase
3	Growth in state number of farms marketing organically produced vegetables - annual % increase
4	Growth in state broiler, egg and turkey industries - annual % increase

Outcome #1**1. Outcome Target**

Growth in state production of beef and lamb - % increase

2. Outcome Type : Change in Condition Outcome Measure

2010 :2	2011 :2	2012 :3	2013 3	2014 :2
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 205 - Plant Management Systems
- 301 - Reproductive Performance of Animals
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 307 - Animal Production Management Systems

Outcome #2**1. Outcome Target**

Growth in state aquaculture industry - annual % increase

2. Outcome Type : Change in Condition Outcome Measure

2010 :1	2011 :1	2012 :2	2013 2	2014 :3
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 302 - Nutrient Utilization in Animals
- 303 - Genetic Improvement of Animals
- 307 - Animal Production Management Systems

Outcome #3**1. Outcome Target**

Growth in state number of farms marketing organically produced vegetables - annual % increase

2. Outcome Type : Change in Condition Outcome Measure

2010 :1	2011 :2	2012 :2	2013 2	2014 :2
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 202 - Plant Genetic Resources and Biodiversity
- 205 - Plant Management Systems
- 211 - Insects, Mites, and Other Arthropods Affecting Plants

- 212 - Pathogens and Nematodes Affecting Plants

Outcome #4

1. Outcome Target

Growth in state broiler, egg and turkey industries - annual % increase

2. Outcome Type : Change in Condition Outcome Measure

2010 :1 **2011 :**1 **2012 :**2 **2013 :**2 **2014 :**2

3. Associated Institute Type(s)

- 1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 211 - Insects, Mites, and Other Arthropods Affecting Plants
- 307 - Animal Production Management Systems

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Economy
- Appropriations changes

Description

Loss or meaningful reduction in funding and / or a significant downturn in the economy could significantly affect timing of outcomes

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)
- During (during program)

Description

State statistics as appropriate; surveys as needed

2. Data Collection Methods

- Sampling
- Mail

Description

Data are collected and reported by the WV Department of Agriculture and USDA NASS.

V(A). Planned Program (Summary)

Program #6

1. Name of the Planned Program

Production Forestry - Timber Management and Wood Utilization

2. Brief summary about Planned Program

This program includes research to develop optimum, sustainable procedures for timber (primarily hardwood) management and harvest, to increase efficiency of utilization and develop new uses for hardwoods, and to devise means and processes to efficiently utilize wood and timber resources in unique and profitable ways. Timber management research includes specifically the development of models to predict yields from standing timber, protection of forest resources from insect pests, disease, and invasive species; harvest management for optimum regeneration and re-growth; responding to research needs and concerns of corporate and private owners; and providing economic comparisons among alternative management and harvesting methods.

Wood utilization research likewise will be focused on hardwoods with a goal of maximizing hardwood timber to lumber throughput, reducing impact of brown rot fungi; development of non-destructive methods to determine lumber strength and stiffness, expanding uses for Appalachian hardwoods, especially uses for harvest and processing residuals, and devising saw mill systems for moderate sized operations. Additional research will develop systems for use at harvest to optimize bucking; develop new uses for low quality hardwoods, use ground penetrating radar to develop nondestructive scanning methods to identify subsurface defects in hardwood logs, and incorporation of cellulose nanocrystals into biopolymer composites to determine the effect on mechanical properties.

West Virginia University Extension conducts educational outreach program to support research in timber management, logging, milling and forest stewardship practices, and wood utilization.

3. Program existence : Mature (More than 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
123	Management and Sustainability of Forest Resources			80%	
511	New and Improved Non-Food Products and Processes			20%	
	Total			100%	

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

1. Situation and priorities

Hardwood forests cover approximately 80% of the state of West Virginia and represent an enormous state resource. Station research in timber production and wood utilization is focused on efficient, environmentally friendly, and sustainable methods of timber management and harvest, protection of our forest resources from insect pests, diseases and invasive species, and the development of value-added wood products and unique, innovative new uses for hardwood lumber. Examples of specific research areas of interest include examination of alternative harvesting methods; predicting lumber yields from measures on standing timber; protecting stands from diseases such as phytophthora, pests like Gypsy Moth and invasive species like Ailanthus; overcoming copper tolerance of brown rot fungi; developing non-destructive methods to evaluate lumber strength and stiffness; designing sawing systems to optimize profitability for small mills, use of logging residues, etc.

2. Scope of the Program

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

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

1. Assumptions made for the Program

Stands of hardwood timber in West Virginia represent a renewable resource which will exist in perpetuity if properly managed.

2. Ultimate goal(s) of this Program

To increase efficiency and profitability of forest and timber management; control threats to timber production from insects, diseases, and invasive species; develop innovative uses for hardwood products and structures, and assure industry sustainability.

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
2010	0.0	0.0	7.5	0.0
2011	0.0	0.0	7.5	0.0
2012	0.0	0.0	7.0	0.0
2013	0.0	0.0	7.0	0.0
2014	0.0	0.0	7.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research; report results in scientific journals, popular press and professional meetings; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Private and corporate commercial producers, managers, consultants, extension educators, regulators, policy makers

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :1 2012 :0 2013 :0 2014 :0

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	5	0	5
2011	6	0	6
2012	5	0	5
2013	6	0	6
2014	5	0	5

V(H). State Defined Outputs

1. Output Target

- Presentations on research at professional meetings

2010 :4 2011 :5 2012 :6 2013 :6 2014 :5

- Popular press articles on research

2010 :1 2011 :1 2012 :2 2013 :3 2014 :2

- Completed graduate degree programs

2010 :1 2011 :3 2012 :2 2013 :2 2014 :3

V(I). State Defined Outcome

O. No	Outcome Name
1	Growth in state timber industry - % change employee compensation
2	Ability to more accurately predict yields of OSB, Paralam and additional wood species from measures on standing timber - new prediction models developed
3	Growth in state wood products and furniture industry - % change in employee compensation

Outcome #1

1. Outcome Target

Growth in state timber industry - % change employee compensation

2. Outcome Type : Change in Condition Outcome Measure

2010 :1 **2011 :**1 **2012 :**2 **2013 :**2 **2014 :**2

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources

Outcome #2

1. Outcome Target

Ability to more accurately predict yields of OSB, Paralam and additional wood species from measures on standing timber - new prediction models developed

2. Outcome Type : Change in Condition Outcome Measure

2010 :0 **2011 :**1 **2012 :**0 **2013 :**1 **2014 :**0

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources

Outcome #3

1. Outcome Target

Growth in state wood products and furniture industry - % change in employee compensation

2. Outcome Type : Change in Condition Outcome Measure

2010 :1 **2011 :**1 **2012 :**2 **2013 :**2 **2014 :**2

3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Competing Public priorities
- Appropriations changes
- Economy
- Public Policy changes

Description

Loss or meaningful reduction of funding support could change drastically timing of outcomes

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- During (during program)
- Before-After (before and after program)

Description

Measure adoption rates, etc. comparing before and after programs

2. Data Collection Methods

- Mail
- On-Site
- Sampling

Description

State surveys to the extent possible; developed surveys to the extent needed

V(A). Planned Program (Summary)**Program #7****1. Name of the Planned Program**

Systems for Energy Production from Renewable, Bio-based Feedstocks

2. Brief summary about Planned Program

Focus of this program is on the development and analysis of sustainable systems for energy production from renewable, bio-based feedstocks. "Analysis" includes economic assessment, environmental impact determination and public policy evaluation, all measured relative to conventional energy production systems. Systems "development" will include designing methods for cost efficient production of renewable biofuels from agricultural and forest/wood product waste materials, from dedicated production of crops such as algae, grasses and rapid-growth trees, and from the co-processing of fossil and renewable energy sources. An additional component of this research will develop methods to selectively fractionate biomass cell walls into cellulose and lignin, to initiate conversion of cellulose for subsequent fermentation to ethanol or butanol.

Evaluation of environmental impact is a critical component of analysis for any alternative system for energy production. Davis College / West Virginia Station faculty have an extensive history of determining environmental consequences of fossil fuel based energy systems. These results will represent points of comparison for alternative systems producing energy from renewable, bio-based feed stocks. In general, environmental consequences will be determined on a watershed-wide basis and will include impact on soil and water quality as well as on plant and wildlife habitat.

Sustainable use of energy sources alternative to fossil fuel stores will depend upon economic considerations which, in turn, will be determined to a meaningful degree by public policy decisions. Energy policy issues span a broad array of disciplines, including legal issues associated with carbon storage, to costs of various sequestration strategies, to long-term environmental impacts, to contrasts involving non-adjacent areas of energy need and energy supply. Transition to a sustainable energy economy will depend upon adopting policies which encourage behavior consistent with attaining long-term societal goals and with few unintended consequences having negative impact. Analysis of alternative policy decisions will involve multidisciplinary approaches and the development of complex models which will accurately assess the impact of proposed policy and regulatory alternatives.

3. Program existence : New (One year or less)

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
133	Pollution Prevention and Mitigation			15%	
403	Waste Disposal, Recycling, and Reuse			25%	
511	New and Improved Non-Food Products and Processes			20%	
605	Natural Resource and Environmental Economics			20%	
610	Domestic Policy Analysis			20%	
	Total			100%	

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

1. Situation and priorities

Faculty at the West Virginia Station have a significant history of research related to the production and use of energy derived both from conventional fossil fuel (primarily coal) and, more recently from renewable feedstocks. Areas of research related to fossil fuel sources have focused on production efficiency and safety, environmental impact of production (soil and water quality, impact on wildlife habitat, etc.), and public policy issues related to energy harvest and use. Areas of research related to renewable feedstocks include developing systems for the dedicated production of biomass for energy production, and for using bio-materials currently discarded in agricultural production, timber harvest, and wood product manufacturing. West Virginia has access to large quantities of cellulosic waste as well as to a significant quantity of land better suited to the production of energy feedstock (grasses, rapidly growing trees, etc.) than to producing conventional agricultural commodities.

2. Scope of the Program

- Multistate Research

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

1. Assumptions made for the Program

Reducing dependence on foreign sources of energy derived from fossil fuels, while developing renewable, more environmentally friendly, domestic sources will continue to be in the national interest and will remain a research priority for the foreseeable future.

2. Ultimate goal(s) of this Program

To make significant contributions through research and outreach to the efficiency and sustainability of energy production and use in the state and nation.

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
2010	0.0	0.0	1.3	0.0
2011	0.0	0.0	1.8	0.0
2012	0.0	0.0	3.4	0.0
2013	0.0	0.0	3.4	0.0
2014	0.0	0.0	3.4	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Conduct research, publish results in scientific and popular press; present results at professional meetings; train graduate students.

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

Extension	
Direct Methods	Indirect Methods
● {NO DATA ENTERED}	● {NO DATA ENTERED}

3. Description of targeted audience

Individuals currently or potentially participating in the production and/or recovery of bio-energy feedstocks; legislators and policy makers dealing with energy policy.

V(G). Planned Program (Outputs)

1. Standard output measures

Target for the number of persons(contacts) to be reached through direct and indirect contact methods

	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Year	Target	Target	Target	Target
2010	0	0	0	0
2011	0	0	0	0
2012	0	0	0	0
2013	0	0	0	0
2014	0	0	0	0

2. (Standard Research Target) Number of Patent Applications Submitted

Expected Patent Applications

2010 :0 2011 :0 2012 :0 2013 :0 2014 :1

3. Expected Peer Review Publications

Year	Research Target	Extension Target	Total
2010	1	0	1
2011	3	0	3
2012	3	0	3
2013	5	0	5
2014	6	0	6

V(H). State Defined Outputs

1. Output Target

- Presentations on research at professional meetings

2010 2 2011 3 2012 3 2013 5 2014 5

- Energy policy papers

2010 1 2011 1 2012 2 2013 2 2014 2

- Completed graduate degree programs

2010 0 2011 0 2012 2 2013 2 2014 4

V(I). State Defined Outcome

O. No	Outcome Name
1	Increased percentage of state energy consumption from renewable fuels.

Outcome #1

1. Outcome Target

Increased percentage of state energy consumption from renewable fuels.

2. Outcome Type : Change in Condition Outcome Measure

2010 0	2011 : 1	2012 : 1	2013 2	2014 :2
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3. Associated Institute Type(s)

•1862 Research

4. Associated Knowledge Area(s)

- 133 - Pollution Prevention and Mitigation
- 403 - Waste Disposal, Recycling, and Reuse
- 511 - New and Improved Non-Food Products and Processes
- 605 - Natural Resource and Environmental Economics

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

- Appropriations changes
- Economy

Description

Growth or contraction in the state economy can have direct and significant effects on availability of support for research projects through state appropriations.

V(K). Planned Program (Evaluation Studies and Data Collection)

1. Evaluation Studies Planned

- Before-After (before and after program)

Description

Use state economic indicators compiled by others to determine the yearly growth in the state bio-energy industry and the percentage of state energy consumption supplied by renewable feedstocks.

2. Data Collection Methods

- Journals
- Observation

Description

Data collected by others.