2011 West Virginia University Research Annual Report of Accomplishments and Results

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I. Report Overview

1. Executive Summary

The West Virginia Agricultural and Forestry Experiment Station is part of the Davis College of Agriculture, Natural Resources and Design. While the West Virginia Cooperative Extension Service is a separate administrative unit and not part of the College, research and extension are integrated through joint appointments, through coordination of activities and planning at the deans, directors and associate-directors levels, through integrated research, extension and education projects and programs funded by Hatch, Smith-Lever and McIntire-Stennis capacity funds and through competitive funding from NIFA and other sources. In 2011 we continued to coordinate efforts by the Experiment Station and Extension to encourage joint faculty efforts to go after competitive funding, particularly AFRI funding. The areas of focus for 2011 were rural development, organic farming, and nutrition and childhood obesity. For 2012 we plan to coordinate research and extension work on Marcellus shale, an area of growing economic and environmental importance in our region. We have also recently signed a memorandum of understanding with Penn State and the University of Maryland to share extension and research resources regionally rather than station by station to support our regional tree fruit industry. We are optimistic that this agreement will lead to further regional cooperation in other areas of concern in the future.

Efforts were made in 2010 to improve communication and better coordinate the programs of the West Virginia Agricultural and Forestry Experiment Station and West Virginia State University. In 2011 we continued to work together on education and outreach programs coordinated with WVU Extension. The Associate Director of the WV Agricultural and Forestry Experiment Station and the Associate Director of Community Resource and Economic Development at WV State University both serve on the Board of Directors of the Northeast Regional Center for Rural Development, which is leading to increased communication in the rural development area. We did not make as much progress in 2011 as we hoped, mainly due to transitions in leadership as both the Davis College and WVU Extension had interim directors. With a new dean/director starting at the Davis College in June 2012 we hope to continue to improve our efforts to work cooperatively with WV State University.

The vision of the Davis College of Agriculture, Natural Resources and Design is to be a leader in learning, discovery, and engagement programs in natural social and human resources aimed at improving the quality of life for the citizens of West Virginia and beyond. The mission of the Davis College is to enrich the lives of the citizens of West Virginia and beyond. This is accomplished by implementing programs designed to provide excellence in undergraduate and graduate education and research, train future leaders, collaboratively engage critical issues and promote stewardship of natural, renewable and human resources.

The Davis College houses 5 divisions: Animal and Nutritional Sciences, Design and Merchandising, Plant and Soil Sciences, Forestry and Natural Resources and Resource Management, with varied programs of study and multiple degree options. The Greenhouse, Dairy, and Rumen Fermentation Laboratory provide additional opportunities for learning and study, and provide valuable community service. In addition, the College and Experiment Station utilize our 3,425 acres of farmland and 8,134 acres of forest for teaching, research and outreach activities.

Faculty in the West Virginia Agricultural and Forestry Experiment Station conduct research in eight program areas: Economic Development and Quality of Life in Rural Communities; Climate Change, Environmental Quality and Stewardship; Global Food Security and Hunger: Fundamental Plant and Animal Systems; Global Food Security and Hunger: Production/Sustainable Agriculture; Childhood Obesity, Human Nutrition and Health; Production/Sustainable Forestry: Timber Management and Wood Products; Sustainable Energy; and, Food Safety. We have reorganized our program areas to better reflect the five priorities of NIFA in our research by making Production/Sustainable Agriculture and Fundamental Plant and Animal Systems appropriate sub areas under Global Food Security and Hunger, by making Environmental Quality and Stewardship a part of Climate Change, and by making Human Nutrition and Foods a part of Childhood Obesity. We have also added the term sustainable agriculture to the production agriculture and production forestry program areas to better reflect the type of research that is conducted under these areas.

Needs of State citizens dictate that a large portion of the research projects in these programs is related to economic development in rural communities, improving human nutrition, health and quality of life in rural communities, and protecting and preserving state natural resources and the environment. Four centers and one organizational unit exist within the College to help focus and direct our efforts on economic development, natural resources and the environment. They also contribute to our ability to leverage Hatch and McIntire-Stennis capacity funding by attracting external competitive grants and other external sources of funding. The four centers are the Natural Resource Analysis Center (NRAC), the Environmental Research Center (ERC), the National Geospatial Development Center (NGDC) and the Appalachian Hardwood Center (AHC). The organizational unit is the West Virginia Cooperative Fish and Wildlife Unit.

The Natural Resource Analysis Center (NRAC) was formed in the early 1990s as a multi-disciplinary research and teaching facility in the Davis College of Agriculture, Natural Resources and Design at West Virginia University. Geographic Information Systems and Remote Sensing have been integral parts of the research and teaching programs of the Davis College for many years. The wide range of research and teaching activities at the Center have been designed to complement work within the College, and include environmental planning, environmental and natural resource economics, recreation, wildlife management, forest ecology, and land and water reclamation. Areas of expertise at NRAC include economic development and environmental sustainability, remote sensing, land cover mapping, landscape analyses, watershed-based analysis and applications, and GIS-based planning and decision making. Recent projects have included development of water resource GIS datasets for West Virginia and parcel prioritization methodology development for land conservation.

The goal of the Environmental Research Center (ERC) is to provide a center of excellence at West Virginia University that facilitates the integration of environmental research, outreach/education, and practitioner science. The ERC acts as an unbiased intermediary among groups and as a regional and national leader in integrated environmental and social research and outreach. The Center is housed in the Davis College of Agriculture, Natural Resources and Design, and is a collaborative venture involving faculty and staff from numerous programs and colleges throughout WVU as well as external collaborators from both the public and private sectors. The center's goal is to serve as the nucleus tying together various groups who are interested in interdisciplinary environmental research and education. As a college center, the ERC focuses on being a key driver behind large multi- and interdisciplinary research, teaching, and outreach efforts focused on environmental topics.

Funded by the Natural Resources Conservation Service (NRCS) and in partnership with West Virginia University, the National Geospatial Development Center (NGDC) was established to develop geospatial technologies that support the business mission of the NRCS. The Center operates collaboratively with university researchers, other NRCS Centers, as well as private and public partners to advance the integration and utilization of geospatial technologies in NRCS. The mission of the National

Geospatial Development Center is to enhance NRCS capacity to produce, utilize, and apply soil and natural resources information through the innovative application of geospatial technologies in partnership with Cooperative Ecosystem Study Units, private industry, and other USDA technology centers.

Forest lands in West Virginia represent an enormous resource in the form of hardwood timber, wildlife habitat, and areas for human recreation and restoration. Station research in timber management and wood utilization seeks enhanced profitability of timber production balanced against protection of wildlife habitats and recreational environments. Both are served by research projects which limit negative impacts of insects, disease and invasive species. Timber management research also is strongly influenced by the fact that a majority of state forest lands are in relatively small tracts, owned by many different individuals coexisting with several relatively large lumber producing companies. Research and outreach programs to serve both types of producers are supported. The Appalachian Hardwood Center (AHC) at West Virginia University is a jointly supported center of the WVU Extension Service and the WVU Davis College of Agriculture, Forestry, and Consumer Sciences. The center was established in 1987 by the West Virginia Legislature to provide technical and research support for the state's growing wood products industry. The AHC is a center of excellence for outreach; extension and technology transfer; professional development; and applied research. The AHC serves sustainable, natural resource-based businesses and communities as well as private forest landowners and natural resource professionals in the Appalachian forest region.

The quantity and variety of wildlife in West Virginia are extremely important to the economy and character of the state. Research in this planned program is designed to better understand habitat requirements for wildlife in West Virginia, and to determine the impacts of human activity on wildlife habitat, particularly habitat for fish and song birds. A large majority of the research in this program represents cooperative research between West Virginia Station faculty and scientists with the West Virginia Division of Natural Resources, USGS, US Fish and Wildlife Service, and the Wildlife Management Institute, a group collectively known as the West Virginia Cooperative Fish and Wildlife Unit. While capacity funding provides infrastructure for this program, the majority of research in wildlife management is supported by external funds, another example of how capacity funds allow us to develop the infrastructure to attract external funding to deal with real-world problems.

This annual report provides an overview of the programs in the WV Agricultural and Forestry Experiment Station with selected accomplishments for 2011 highlighted in the narrative for each program area.

Total Actual Amount of professional FTEs/SYs for this State

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	39.8	0.0
Actual	0.0	0.0	42.5	0.0

II. Merit Review Process

1. The Merit Review Process that was Employed for this year

- Internal University Panel
- Expert Peer Review

2. Brief Explanation

Individuals with expertise in the fields of science addressed in each Hatch or McIntire-Stennis proposal are selected by the Division Director, Experiment Station Director or designee and asked to judge technical merit, likelihood of achieving stated objectives, and potential impacts for each proposed project. A minimum of three peer scientists (i.e., individuals qualified by their status in the same discipline, or a closely related field of science), are asked to read and provide written comments on the proposed activities. The terms of reference for the reviewers focuses 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 the station's 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 are asked to present their findings in writing, and records of the reviewers' comments are preserved for the life of the project or for a period of three years in the event that a project is not initiated. Competitively awarded grants requiring peer review or contract research requiring grantor approval are exempt from this process.

III. Stakeholder Input

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

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

Brief explanation.

Much stakeholder input is collected in conjunction with West Virginia University Extension (administratively distinct from the College of Agriculture, Natural Resources and Design) since we share a majority of stakeholders. We discontinued special meetings which had as their sole purpose, the gathering of stakeholder input and instead, have more recently relied upon input gathered at meetings with other primary purposes (annual or regular meetings of West Virginia Farm Bureau, West Virginia Forestry Association, West Virginia Grasslands Steering Committee, State Aquaculture Forum, Organic Research Project annual meeting, the West Virginia Farmer's Market Association, etc.) We find the new procedure more efficient and to represent a larger and more diverse segment of our stakeholders. Input also originates from various advisory groups associated with specific interest areas within College Divisions (e.g., Organic Research Project Steering Committee within the Division of Plant and Soil Sciences; Appalachian Hardwood Council; Advisory Board in the Division of Forestry and Natural Resources, etc.) as well as from advisory

groups established at the College/Station level (Davis College Visiting Committee).

2(A). A brief statement of the process that was 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
- Use Internal Focus Groups
- Use External Focus Groups

Brief explanation.

As the focus of the College evolves with time we realize that our stakeholder groups also change. We also felt a need to strengthen our interaction with our existing stakeholder groups. To meet these needs an administrative position for Outreach and Community Affairs was established July 1, 2010 under the Associate Dean and Associate Director of the Agriculture and Forestry Experiment Station to enhance our communication and working relationship with commodity and industry groups, state agencies and community organizations that represent our College disciplines within the State of West Virginia. The major stimulus for this action is to enhance the College's relationship with our stakeholders and make our programs more relevant to needs of the State. We truly believe that our success as a College will be measured by how well we serve the citizens of West Virginia, then the nation and the world. We value our work with the stakeholders and partnerships within our State and need their input to improve and make more relevant this relationship in the future.

2(B). A brief statement of the process that was 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 specifically with non-traditional groups

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.

3. A statement of how the input will be considered

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

Brief explanation.

Stakeholder input which relates to College/Station research portfolio is discussed regularly with College advisory groups and with College administrative groups, particularly when work or strategic plans are being prepared and when staffing decisions are pending. We will be entering a new strategic planning process in 2012 soon after the arrival of our next dean on June 1 and will be reaching out to traditional and new stakeholder groups to aid our planning process.

Brief Explanation of what you learned from your Stakeholders

We are in a transition of leadership at the Davis College. We have had an interim dean for the last year and will have a new permanent dean as of June 1, 2012. We held a visiting committee meeting in 2011 and learned from our stakeholders that they would like to be utilized more effectively in College planning, recruiting and development. We perceive a need to broaden the stakeholder group represented in our visiting committee, in particular we are implementing a three year term limit to encourage a wider level of participation among our stakeholder groups and to encourage development of new ideas. We have also been asked to return to our past procedure of holding visiting committee meetings in diferent areas of the State.

IV. Expenditure Summary

1. Total Actual Formula dollars Allocated (prepopulated from C-REEMS)			
Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	3237872	0

2. Totaled Actual dollars from Planned Programs Inputs				
	Extension		Research	
	Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
Actual Formula	0	0	2807052	0
Actual Matching	0	0	5846456	0
Actual All Other	0	0	3712949	0
Total Actual Expended	0	0	12366457	0

3. Amount of Above Actual Formula Dollars Expended which comes from Carryover funds from previous				
Carryover	0	0	1540704	0

V. Planned Program Table of Content

V(A). Planned Program (Summary)

Program # 1

1. Name of the Planned Program

Economic Development and Quality of Life in Rural Communities

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			10%	
134	Outdoor Recreation			15%	
511	New and Improved Non-Food Products and Processes			15%	
604	Marketing and Distribution Practices			15%	
605	Natural Resource and Environmental Economics			10%	
608	Community Resource Planning and Development			20%	
724	Healthy Lifestyle			5%	
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures			5%	
903	Communication, Education, and Information Delivery			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	5.5	0.0
Actual Paid Professional	0.0	0.0	8.0	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	426289	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	709414	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	338787	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

West Virginia is considered to be a lagging region in terms of economic development and growth, a characteristic shared by many states in the Appalachian Region. While the region has abundant natural resources, particularly coal, natural gas, forests, water and recreational opportunities, unemployment is typically higher than in the rest of the Nation. Accordingly, the West Virginia Agricultural and Forestry Experiment Station has designated economic development and the quality of life in rural communities as one of our primary program areas. Work in this program area is divided into two categories: economic development and quality of life.

A significant part of rural employment growth nationwide has occurred in non-traditional economic activities including those capitalizing on natural resources and climate. A number of possible economic opportunities are currently being investigated in West Virginia, including pasture finished beef, cool water aquaculture, wood utilization, organic production of vegetables and animal products, and ecotourism. Cutbacks in Agricultural Research Service (ARS) budgets and the closing of the ARS facility in Beaver, WV, will lead to a reduction in the research resources devoted to the pasture finished beef projects. The elimination of congressionally directed spending will also lead to reduced activity in the aquaculture and wood utilization areas. These cutbacks increase the relative importance of federal capacity funding and AFRI competitive funding to the success of our research programs. There is also an ongoing study of the effects of socio-economic characteristics including race and ethnic characteristics on participation in recreational activities and another study on the impact of the textile and apparel industry on the economy of the State.

Advances were made in the aquaculture/aquaponics project. A flow through aquaponic system supplied with trout effluent was covered with a high tunnel to lengthen the growing season. Lettuce was planted into each cell of three seedling trays on 5 occasions during the summer and harvested after 37 days. Production averaged 127 g/sq m/day during the summer season. A used geotextile bag (GB) was opened and the waste solids removed. The cleaned and resealed GB was placed in service in tandem with a new bag. After 1 year in service materials used to reseal the opened seams are performing well. The reused bag was comparable to a new GB in all parameters tested (tot solids, TSS, particle size retention, BOD, soluble nutrients). A 12-week experiment evaluated batch versus successive cropping of lettuce. Production was higher in the batch culture but differences were not significant. A second 12-week spring experiment examined nutrient removal characteristics of Swiss chard, nasturtium, calendula, kohlrabi, lettuce and strawberry. Kohlrabi was most effective at removing nutrients with removal of 25% of NH3, 22% of the NO3 and 7 % of PO4. Nasturtium and Swiss chard were also effective at nutrient removal. Lettuce grew well but removed few nutrients. A feeding trial with rainbow trout where one treatment was

fed to satiation and another was fed based on a schedule designed to provide enough nutrients to meet potential growth. After 384 days, feed conversion averaged 1.11 in the satiation treatment and 1.01 in the schedule treatment. This represents an improvement in feed efficiency of about 10%. Total production was similarly higher in the satiation treatment showing a trade-off between the two strategies.

Regional economic opportunities need to be based on the natural and human resources present in the region. One study attempted to assess whether the 299 counties (148 are non-metropolitan) in the Northeast (NE) region of the US can successfully build and pursue a growth strategy that depends on the local and neighborhood amenities (natural and built). Overall there is no evidence of a consistent and strong relationship between amenities and regional economic growth. Amenities within a county and/or surrounding counties play a significant role in the process of population growth. Historical and cultural amenities like museums, historical sites, zoos, and other attractions, play a positive direct and indirect role in attracting new immigrants. While the direct effect of natural amenities was negative, the indirect effect coming from surrounding counties was positive. This is an important finding which has major policy implications. This implies that a county that lacks natural or historical attractions of its own can still benefit from the rich natural amenities of its surrounding counties. Regional cooperation in preservation and management of natural resources and recreational facilities should be one of the main focuses in developing an amenity-led development strategy and then policy makers have to address how these resources are managed and funded. Generally, natural amenities are public goods. If the cost of maintenance and development is left to the county within which the amenities reside, they would tend to be underfunded and underdeveloped. Regional coordination is required to take full advantage of the natural amenities in the regional economic growth process.

Another study estimated the relationship between self-employment and regional economic development in the rural Northeast region of the United States. The positive relationship between self-employment and growth in employment indicates that greater employment opportunities are associated with a higher self-employed population which was unexpected. Generally, more job opportunities lead to more income in wage/salaried jobs and discourage self-employment. The employment growth positively affects per capita income growth indicating that an increase in the number of jobs created ultimately causes an increase in per capita income. The empirical results show a negative relationship between self-employment and per capita income growth which indicates that self-employers earn less income than wage/salaried jobs. Some other factors such as survival rate of firms have positive effects on self-employment growth. Thus, from the empirical findings it is evident that self-employment plays an important role in enhancing economic development in the region. The overall conclusion of the study is that self-employment can be considered as an important tool to reduce poverty, unemployment, and to enhance economic development in the rural counties of the region. Self-employment earns income for rural residents and families and increases societal welfare in the region.

Ongoing studies focus on pasture-based beef (PBB) as an emerging niche product in Appalachia, as well as the role of such niche products in sustainable economic development, particularly at the local level. The primary goal of this project is to provide information to assist producers, the industry and policy makers in making better decisions. Secondary goals are to enhance profitability, better manage risk, and enhance industry sustainability. Toward this end, research is underway to better understand how PBB systems can fit into achieving societal goals of improved environmental quality and energy independence alongside the goal of food production that could be more profitable for producers, healthier for consumers, and more sustainable for communities. Another study compared the costs and returns of supplemental forage production using a mix of warm and cool season forages, with those from naturalized pasture. A system where sudangrass was grown in summer and triticale in fall produced the highest economic returns when nitrogen fertilizer was applied at the rate of 200 kg ha-1 and glyphosate was used as a method of pre-plant vegetation control. Results suggest that sudangrass can be used to supplement naturalized pasture in summer, and triticale and a mixture of annual ryegrass and turnip in fall for high quality and quantity supplemental feeds. Even higher returns are possible if fall annuals are harvested again in spring.

A meta-analysis of the several studies that looked at how county extension agents provide information and how their target audiences desired to receive information, in all cases it was found that extension is in tune to the means by which their audiences desire to receive information, but need to do a better job of assessing the types of information desired. Extension audiences indicated their least preferred means of receiving information or being notified of meetings is via the Internet. They still prefer newsletters, newspapers and popular agricultural magazines, indicating that Extension personnel need to explore popular agricultural magazines as a means to disseminate information.

Another project involved surveys on information transfer between beef producers and extension agents in West Virginia, satisfaction of contract poultry producers in West Virginia and Virginia and perceptions of West Virginia beef producers on preparedness for an agro-terrorism attack. Study results have created an awareness of the need for biosecurity training for beef producers.
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2. Brief description of the target audience

The primary audience for our community and economic development activities is community managers, planners, policy makers, consultants and local development committees or groups. For aquacultural and agricultural product development and marketing, the audience includes producers, processors and distributors. Our work on the quality of life is used by local and State planners and policy makers and educators.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	13	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Actual
2011	7

Output #2

Output Measure

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

Year	Actual
2011	3

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2011	8

Output #4

Output Measure

- Popular press reports.

Year	Actual
2011	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Customized designs for enhanced economic development prepared for, and adopted by, state rural communities (#)
2	Increase production and marketing information available to farmers in the Appalachian Region about economic opportunities in the aquaculture industry.
3	Increase the economic returns to farmers in the Appalachian Region.

Outcome #1

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	3

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Many communities in West Virginia are lagging economically and need assistance in developing plans to enhance their economic development, quality of life, and attractiveness to tourists. Our Community Design Team (CDT) has operated for 13 years to provide multidisciplinary University teams to help regional communities with economic development, tourism, flood control, transportation planning and design issues. The CDT is a joint venture of the Davis College and WVU Extension.

What has been done
In 2011 two new communities were visited by the team and one community was revisited. Followup activities were initiated with six communities that were previously visited.

Results
Two new economic development/design reports were prepared for the two new communities and followup evaluation studies were done for six communities that were visited in prior years.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
605	Natural Resource and Environmental Economics
608	Community Resource Planning and Development
804	Human Environmental Issues Concerning Apparel, Textiles, and Residential and Commercial Structures

Outcome #2

1. Outcome Measures

Increase production and marketing information available to farmers in the Appalachian Region about economic opportunities in the aquaculture industry.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
There are many economic opportunities in cool-water aquaculture in the Appalachian Region due to the proximity to markets on the Eastern Seaboard and the relative abundance of clean and cold water. Increasing the productivity of this industry is critical if it is to remain economically viable.

What has been done
A feeding trial with rainbow trout where one treatment was fed to satiation and another was fed based on a schedule designed to provide enough nutrients to meet potential growth. After 384 days, feed conversion averaged 1.11 in the satiation treatment and 1.01 in the schedule treatment.

Results
Feeding trout to satiation rather than on a fixed schedule represents an improvement in feed efficiency of about 10%. Total production was similarly higher in the satiation treatment. This informaiton will be valuable to producers seeking to improve feed efficiency and production levels.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
604	Marketing and Distribution Practices
903	Communication, Education, and Information Delivery

Outcome #3

1. Outcome Measures

Increase the economic returns to farmers in the Appalachian Region.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
West Virginia has abundant pasture land and a large, low intensity, beef cattle industry but no feedlots are located within the State. There is a need to increase the productivity of pasture-based beef cattle systems to keep WV cattle producers competitive.

What has been done
Ongoing studies focus on pasture-based beef (PBB) as an emerging niche product in Appalachia, as well as the role of such niche products in sustainable economic development, particularly at the local level. The primary goal of this project is to provide information to assist producers, the industry and policy makers in making better decisions. Secondary goals are to enhance profitability, better manage risk, and enhance industry sustainability.

Results
A study that concluded in 2011 found that a system where sudangrass was grown in summer and triticale in fall produced the highest economic returns when nitrogen fertilizer was applied at the rate of 200 kg ha-1 and glyphosate was used as a method of pre-plant vegetation control. Results suggest that sudangrass can be used to supplement naturalized pasture in summer, and triticale and a mixture of annual ryegrass and turnip in fall for high quality and quantity supplemental feeds. Even higher returns are possible if fall annuals are harvested again in spring.

4. Associated Knowledge Areas

KA Code	Knowledge Area
131	Alternative Uses of Land
604	Marketing and Distribution Practices
608	Community Resource Planning and Development

903 Communication, Education, and Information Delivery

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Cutbacks in Agricultural Research Service (ARS) budgets and the closing of the ARS facility in Beaver, WV, will lead to a reduction in the research resources devoted to the pasture finished beef projects. The elimination of congressionally directed spending will also lead to reduced activity in the aquaculture and wood utilization areas. These cutbacks increase the relative importance of federal capacity funding and AFRI competitive funding to the success of our research programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State Defined Outcomes #2 and #3.

V(A). Planned Program (Summary)

Program # 2

1. Name of the Planned Program

Climate Change, Environmental Quality and Stewardship

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			15%	
102	Soil, Plant, Water, Nutrient Relationships			10%	
112	Watershed Protection and Management			15%	
132	Weather and Climate			15%	
133	Pollution Prevention and Mitigation			15%	
135	Aquatic and Terrestrial Wildlife			20%	
605	Natural Resource and Environmental Economics			10%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	8.0	0.0
Actual Paid Professional	0.0	0.0	5.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	458451	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	803577	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	726333	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research to assist in the preservation of West Virginia's soil, water, forest and wildlife resources is a high priority in the West Virginia Experiment Station particularly given the extra stresses and uncertainty imposed by a changing climate. The focus of Station research is on studying, protecting and restoring environmental quality while developing economically effective and environmentally sustainable management practices for agriculture, forestry, mining and rural communities and anticipating and adapting to climate change. Our primary environmental research areas involve mine land restoration, ecosystem resiliency to climate change and other environmental stressors, water quality, wetlands, and aquatic and terrestrial wildlife ecology.

Contamination of soil and water with acid mine drainage from abandoned surface and underground mines and restoration of the landscape from surface mining are important issues in West Virginia. Research is being conducted to characterize the nature and scope of these problems and to develop cost effective remediation programs. Relevant research projects include restoring surface mines to productive forestland or grassland (including switchgrass as a possible feedstock for biofuels) and restoring lost aquatic ecosystem functions on reclaimed mine sites and watersheds. Progress continues in assessing the ecological functions of restored and created wetlands.

One project involved a study of amphibians in 12 mitigated and 12 natural wetlands. Data were collected in support of objectives, data are being analyzed, and laboratory work (diet analyses and aquarium studies) continued. The investigators completed identification of invertebrates in approximately 150 samples taken at wetlands. Identification of invertebrates was completed in approximately 150 samples taken via gastric lavage from the stomachs of red-spotted newts. The results will be used to increase the success of restored and created wetlands in the Central Appalachians and elsewhere. Beyond the ability to create better wetlands the research will result in an enhanced understanding of general amphibian ecology for the region including diet, survey protocols, and habitat use. Preliminary project results were disseminated via two presentations to outside audiences and incorporation into several classroom lectures.

Another project is contributing to an international collaborative effort among scientists and managers to ensure the long-term sustainability of Eastern Golden Eagle populations, ultimately making the species a flagship species for conservation. Efforts in 2011 included mapping of eagle movements, studying the demography of eagles and building models to understand population dynamics of the Eastern Golden Eagle. Movements of about 20 eastern golden eagles have been mapped and are being analyzed to understand how those movements may be impacted by development of wind energy.

A project titled "Whole Farm Dairy & Beef Systems for Environmental Quality," concluded in 2011. The project focused on systems research utilizing beef cattle specifically focusing on the improvement of animal nutrient utilization, reduced nutrient excretion and overall improvement of ruminant production systems. The research reported over the life of this project was conducted based on the following specific objectives: determine a best management system of winter forage utilization for growing beef calves, to identify individual animals deemed efficient and inefficient in feed utilization, and, to quantify potential associations of measures of efficiency with other easily measurable traits. Specifically, work was conducted investigating winter forage systems to extend the grazing season/provide acceptable winter growth of calves destined for pasture finishing and investigating progeny from sires divergently selected for residual feed intake (RFI; a measure of efficiency). Experiments conducted over the life of the project studied identification, productivity and propagation of cattle in terms of efficiency. The outcomes of this project have yielded much needed insight into the development of sound ruminant production systems.

Data indicate that differences in RFI of parental stock equate to differences in production efficiency of offspring with efficiency differences existing as a result in both maintenance and growth efficiency. These differences are associated with metabolic differences in these animals. The audience for the research includes livestock producers and grassland managers, university extension personnel, and scientific community. The results were disseminated to these groups via university, extension and interest group sponsored field days, dinner meetings, workshops and producer meetings as well as scientific meetings as a part of the American Society of Animal Science and National Association of Animal Breeders. Presentations to core groups such as extension personnel, specialty groups (Southern States Beef Feedmaster Program & National Association of Animal Breeders) and at regional and national livestock meetings have allowed for a widespread dispersal of information.

Finally, another study examined the economic and biophysical implications of energy and climate change policies on carbon dioxide emissions, terrestrial carbon sequestration, and land use. The investigators analyzed and modified the IPCC approach for estimating soil carbon accumulation on agricultural soils. The structure and approach for the new model is currently being documented. The modified IPCC model can now be used to estimate carbon accumulation in agricultural soils over two time periods, one of fifteen years (1982-1997) and one of twenty years (1997-2017). This represents a significant change from the way the model has been used in the past. To begin developing soil C supply curves, a method for estimating the cost to landowners of making cropland management and land-use changes that increase soil C is required. Since the predominant method for enhancing soil C accumulation is to reduce soil disturbance, a reasonable way of determining the minimum carbon payment required to encourage adoption of no-till is the difference between returns from no-till and conventional tillage production. Crop enterprise budgets that included the costs and returns from both conventional and no-till for the crops considered in the analysis were collected from various Land Grant institutions. The biophysical estimates of carbon sequestration from the modified IPCC model were combined with the crop enterprise budgets to estimate soil carbon supply curves for corn, sorghum, soybean, and wheat crops produced on U.S. agricultural land. The results of this project will be used to provide an assessment of the costs of crop and land management activities that could be implemented to increase the amount of carbon stored in agricultural soils. This information, combined with estimates of the biophysical potential for agricultural lands to sequester carbon will aid in determining appropriate policy and legislation activities to address issues of global concern.

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2. Brief description of the target audience

The activities in this area are used to contribute to the body of knowledge in the environmental and natural sciences, and to inform policy makers, planners, regulatory agencies and public interest and citizens groups.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	13	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Actual
2011	6

Output #2

Output Measure

- Popular press articles on research

Year	Actual
2011	1

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual

2011 2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduce percentage of state streams classified as impaired by agricultural and forestry activities (%).
2	Improve the profitability of pasture-based beef production while minimizing impact on the environment.
3	Improved understanding of the migration patterns of the Eastern Golden Eagle in order to protect the species.

Outcome #1

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #2

1. Outcome Measures

Improve the profitability of pasture-based beef production while minimizing impact on the environment.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Pasture-based beef is an important agricultural enterprise in West Virginia. Unfortunately, the hilly topography can lead to soil erosion and runoff of nutrients into waterways. It is important to design sustainable pasture-based beef systems that are economical but still protect the environment.

What has been done
A project titled Whole Farm Dairy & Beef Systems for Environmental Quality, concluded in 2011. The project focused on systems research utilizing beef cattle specifically focusing on the improvement of animal nutrient utilization, reduced nutrient excretion and overall improvement of ruminant production systems.

Results
The outcomes of this project have yielded much needed insight into the development of sound ruminant production systems. Feed efficiency has improved by about 40 percent, decreasing from a ratio of about 8.5 pounds of feed for each pounds of growth to about 5 pounds of feed per pound of growth. Beyond the feed cost benefits for producers, WVU researchers are finding unexpected advantages. Our eight years of data indicate that feed efficiency is related to

methane production, a commonly criticized byproduct of livestock enterprises. The better an animal's feed efficiency, the less methane they produce, which reduces the greenhouse gases associated with livestock.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
605	Natural Resource and Environmental Economics

Outcome #3

1. Outcome Measures

Improved understanding of the migration patterns of the Eastern Golden Eagle in order to protect the species.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The Eastern Golden Eagle population is threatened by loss of habitat and potentially by increases in wind farm development.

What has been done
Efforts in 2011 included mapping of eagle movements, studying the demography of eagles and building models to understand population dynamics of the Eastern Golden Eagle.

Results
New discoveries have been made about teh extent of migratory travel of this species. Movements of about 20 eastern golden eagles have been mapped and are being analyzed to understand how those movements may be impacted by development of wind energy.

4. Associated Knowledge Areas

KA Code	Knowledge Area
135	Aquatic and Terrestrial Wildlife

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

The elimination of congressionally directed spending will also lead to reduced activity in the aquaculture and wood utilization areas and eliminates base funding for our Environmental Research Center. These cutbacks increase the relative importance of federal capacity funding and AFRI competitive funding to the success of our research programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State Defined Outcomes #2 and #3.

V(A). Planned Program (Summary)

Program # 3

1. Name of the Planned Program

Global Food Security and Hunger -- Fundamental Plant and Animal Systems

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 (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	4.0	0.0
Actual Paid Professional	0.0	0.0	5.8	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	722749	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	940382	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	377309	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research involving fundamental plant and animal systems is designed to increase our basic science understanding of reproductive, nutritional and general physiological systems and processes. On the animal side, practical problems addressed include embryonic mortality in sheep and cattle, performance limiting amino acids in animal rations, and health and disease resistance in poultry. For plants, the program emphasis varies from determining functions of ubiquitin and other polypeptide tags, to understanding basic mechanisms of flower senescence and cold shock adaptation, to combating the impacts of phytophthora and Chestnut blight, to defining and eliminating negative effects on grazing animals of ergot alkaloids produced by fungi that are symbiotic with pasture grasses.

One study examined ovarian influences on embryonic survival in ruminants. The investigators tested the efficacy of four importin &alpha8 siRNA species in silencing importin &alpha8 during meiotic maturation. Results indicate that importin &alpha8 is required for oocyte meiotic maturation and early embryogenesis, and interacts with known oocyte-specific nuclear factors. Understanding the functions of this oocyte-specific importin &alpha in controlling early events of embryonic development may ultimately lead to the development of new strategies to improve the efficiency of nuclear transfer and reproduction in cattle.

On the plant science front, researchers continued to expand our library of intraspore and intraspecies mycorrhizal fungi gene sequences, which now total more than 200, documenting variation within and between spores of a species and between species. With that data in hand, they are now able to apply this information to place nonsporulating fungi from field samples in taxonomic groups and compare correspondence with known species. With strong congruence between morphology and these sequence data, they are reevaluating the phylogenetic value of all morphological characters. Histochemical reactions of spore internal structures, for example, have been given considerable weight but they have proven to be uninformative. At the molecular level, a collaboration with scientists at Cornell University has revealed that the polyphyletic evolution found amongst species in one large Glomus clade in Glomeromycota may be due in part to two divergent rRNA gene variants (long and short) that appear to be stable because concerted evolution is impaired. They are using other single spore cultures to analyze clonal variation within and between individual spores. In collaboration with the same group at Cornell, they provided a wide range of fungal germplasm to determine the extent to which a 400 million year old association between glomeromycotan fungi and endosymbiotic bacteria is evolving toward obligacy or is in a stable facultative symbiosis. Evidence indicates the latter, with genes being transmitted horizontally as well as vertically. They also continue to develop pure cultures of fungi trapped from U.S. grasslands and natural habitats in Africa. In their work with industry, they are developing methods that can test for quality control and for certification of product lines and identifying new fungal genotypes that can expand application of inoculants to new markets.

An important line of research involving researchers from the Davis College involves increasing our understanding of the process of nitrogen fixation in legumes with the ultimate goal of establishing nitrogen fixation other species such as corn. While this research is still in its very basic phase the possible implications of success are enormous in terms of increased food production with decreased need for nitrogen fertilizers and reduced environmental impacts from agricultural production. The results so far indicate surprisingly that Medicago truncatula can grow without evidence of stress in very high levels of B i hydroponics (up to 1 mM, when 30 uM is normally supplied). From the expression analyses, they identified a candidate B transporter gene that is specific to nodules, and started functional analyses efforts. The research, part of an international effort, led to a publication in the prestigious journal, Nature, titled "The Medicago genome provides insight into the evolution of rhizobial symbioses," Nature 2011 Nov 16. doi:

10.1038/nature10625.

Work continued on identifying the triggers of flower senescence. Specifically, manipulating flower longevity will lead to higher crop productivity by increasing the window of opportunity for flowers to be pollinated. This in turn has the potential of increasing crop yields. In contrast inducing full or partial flower senescence may lead to more efficient breeding efforts by alleviating the need to emasculate flowers. In addition decreased flower longevity may result in a decrease of invasiveness of crop and ornamental plant species. The major outcome and/or impact of the work during the past year is the development of a new vector that leads to efficient cloning and transient expression of target genes in Petunia. This vector will not only be helpful in our work but will be shared and used by other labs. The use of this vector should allow us to make rapid progress in screening genes we postulate to have an effect on flower senescence and therefore flower longevity.

2. Brief description of the target audience

The target audience for this area is composed of animal and plant scientists, biochemists, professional practitioners, dieticians, regulators and agribusiness firms.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	6	6

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentation on research at professional meetings

Year	Actual
2011	4

Output #2

Output Measure

- Completed graduate degree programs

Year	Actual
2011	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

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
5	Progress in the long research path to induce nitrogen fixation in nonleguminous plants

Outcome #1

1. Outcome Measures

Identify and map genes affecting flower senescence - # new genes

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Manipulating flower longevity will lead to higher crop productivity by increasing the window of opportunity for flowers to be pollinated. This in turn has the potential of increasing crop yields. In contrast inducing full or partial flower senescence may lead to more efficient breeding efforts by alleviating the need to emasculate flowers. In addition decreased flower longevity may result in a decrease of invasiveness of crop and ornamental plant species.

What has been done
The major outcome and/or impact of the work during the past year is the development of a new vector that leads to efficient cloning and transient expression of target genes in Petunia. This vector will not only be helpful in our work but will be shared and used by other labs.

Results
The use of this vector should allow us to make rapid progress in screening genes we postulate to have an effect on flower senescence and therefore flower longevity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

Outcome #2

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #4

1. **Outcome Measures**

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

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Better understanding of ovarian specific gene expression may help to increase reproductive success in ruminants and other animals.

What has been done
One study examined ovarian influences on embryonic survival in ruminants. The investigators tested the efficacy of four importin RNA species in silencing importin alpha8 during meiotic maturation.

Results

Results indicate that importin alpha8 is required for oocyte meiotic maturation and early embryogenesis, and interacts with known oocyte-specific nuclear factors. Understanding the functions of this oocyte-specific importin alpha in controlling early events of embryonic development may ultimately lead to the development of new strategies to improve the efficiency of nuclear transfer and reproduction in cattle.

4. Associated Knowledge Areas

KA Code	Knowledge Area
301	Reproductive Performance of Animals
304	Animal Genome
305	Animal Physiological Processes

Outcome #5

1. Outcome Measures

Progress in the long research path to induce nitrogen fixation in nonleguminous plants

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
An important line of research involving researchers from the Davis College involves increasing our understanding of the process of nitrogen fixation in legumes with the ultimate goal of establishing nitrogen fixation other species such as corn. While this research is still in its very basic phase the possible implications of success are enormous in terms of increased food production with decreased need for nitrogen fertilizers and reduced environmental impacts from agricultural production.

What has been done
The results so far indicate surprisingly that Medicago truncatula can grow without evidence of stress in very high levels of B i hydroponics (up to 1 mM, when 30 uM is normally supplied). From the expression analyses, they identified a candidate B transporter gene that is specific to nodules, and started functional analyses efforts.

Results
The research, part of an international effort, led to a publication in the prestigious journal, Nature, titled "The Medicago genome provides insight into the evolution of rhizobial symbioses," Nature 2011 Nov 16. doi: 10.1038/nature10625.

4. Associated Knowledge Areas

KA Code	Knowledge Area
201	Plant Genome, Genetics, and Genetic Mechanisms
206	Basic Plant Biology

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Natural Disasters (drought, weather extremes, etc.)
- Appropriations changes
- Competing Public priorities

Brief Explanation

Reductions in ARS extramural funding will reduce our genome research budget by $540,000 in 2012.

These cutbacks increase the relative importance of federal capacity funding and AFRI competitive funding to the success of our research programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State defined outcome #5.

V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Global Food Security and Hunger -- Production/Sustainable Agriculture

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			10%	
202	Plant Genetic Resources			5%	
205	Plant Management Systems			10%	
211	Insects, Mites, and Other Arthropods Affecting Plants			10%	
212	Pathogens and Nematodes Affecting Plants			10%	
216	Integrated Pest Management Systems			5%	
301	Reproductive Performance of Animals			15%	
302	Nutrient Utilization in Animals			15%	
303	Genetic Improvement of Animals			5%	
307	Animal Management Systems			10%	
313	Internal Parasites in Animals			5%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	10.5	0.0
Actual Paid Professional	0.0	0.0	8.2	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	566758	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	1183532	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	1065382	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This program area involves applied research in plant and animal production systems. Projects are focused on increasing the productivity and sustainability of agriculture thereby contributing both to food security and alleviating world hunger.

West Virginia agriculture is dominated by high intensity poultry production and low intensity pasture-fed ruminant production with a declining amount of acreage in tree-fruit production. Much of the land in West Virginia is characterized by steep slopes and high rates of erosion that are suitable to pasture but not to intensive row-crop production. Most intensive crop production, including some fruits and vegetables, is limited to those regions of the state that have relatively flat terrain and favorable soil characteristics. To be competitive, West Virginia producers typically must become competitive either by increasing the value of what they produce or by reducing transportation and production costs by relying on locally-marketed products, by taking advantage of the State's proximity to major urban markets or by developing niche products. Some examples of successful enterprises include encouraging markets and consumer acceptance of pasture-raised and pasture-finished beef; cool water aquaculture; focusing on higher priced products such as those with ornamental or recreational use; increasing real or perceived product value in specialty or out-of-season markets such as lamb and organic products; and by diversifying product offerings. A number of projects at the Davis College involve long-term organic farming research involving plant systems, animal systems, integrated plant and animal systems and non-chemical control of parasites in sheep.

In our organic farming research a field trial compared yield response to applied compost in lettuce, tomato, green beans, and watermelon. The compost effect was significant 4 out of 5 harvest dates and the compost-by-cultivar interaction was statistically significant for 2 out of 5 dates. In almost all cases, yields were higher in plots with compost than in plots without, but there was a tendency for the low input plots to have higher yields very late in the growing season, suggesting that compost promotes early yielding. Compost increased yields of all five watermelon cultivars: Crimson Sweet, Starlite, Sugar Baby, Sweet Dakota Rose, and Sweet Favorite, but differences among cultivars were not significant. In a taste test, Sweet Dakota Rose and Sweet Favorite consistently ranked as the preferred cultivars in flavor, sweetness and crispness, while Starlite and Sugar Baby ranked low in all categories, as was the case in 2010. No significant pest pressure was observed.

Organic growers struggle to maintain high levels of soil fertility, and are prohibited from using synthetic pesticides. The recent introduction of the Brown Marmorated Stink Bug (BMSB) has also created problems for organic growers because few control options are available. Use of tolerant cultivars and soil

amendments can influence final yields and pest incidence. These results indicate that tomato and watermelon yields were increased by compost, contrary to results in 2010, but yields of green beans were reduced with compost. No correlation between compost treatments and BMSB incidence or damage level was observed. These results provide preliminary results to support new research grant proposals in organic farming systems research.

The Japanese Hornfaced bee, Osmia cornifrons, has become an increasingly important pollinator for tree and fruit crops given the decline of honeybee populations. A parasitic mite, C. kromeini, is damaging populations of the Hornfaced bee by consuming pollen reserves that were intended for the bee larva. Research determined that parasitic activities were more damaging to female bees than to males which is highly detrimental to bee populations. The research showed that control of the parasitic mite is extremely important for orchardists that use the Hornfaced bee as a pollinator.

Progress continued to be made in an important integrated project concerned with enabling out-of-season lamb production and promoting the sheep industry in the region. The project has helped to stabilize sheep numbers in West Virginia over the last 13 years. The program provided updates on disease factors and emphasized out-of-season breeding and management methods in an afternoon field trip. Attendance exceeded 50 producers. The project sponsored 3 shearing schools in 2011 in an attempt to facilitate the urgent need for more shearers within the region. Project leaders participated in three regional educational meetings. Project personnel conducted breeding soundness examination on over 50 rams for producers in advance of the breeding season. Out-of-season estrous synchronization was demonstrated at producer meetings on two farms and pregnancy testing continues in numerous ewe flocks. Studies of late embryonic and fetal mortality in goats in conjunction with Lincoln University in Missouri were completed in 5 goat herds in three states. These data were added to those collected in 4 herds in 2009-2010. Out-of-season breeding research activities in 2011 included breeding of over 1000 ewes and production of over 1000 fall-born lambs. The project website was updated in 2011 and continues to provide a significant resource for cooperating and other producers. Producer use of pregnancy diagnosis data and of the FAMACHA technique of evaluating an animal's need for deworming increased during 2011 and training in these approaches will continue.

In the pasture-based beef systems, research steers from Virginia Tech were sequentially grazed on permanent grassland, orchard grass and tall fescue. These grasslands lose quality at different rates once winter starts and grazing them in sequence provides animals with a higher quality pasture-based diet. Utilizing the grasslands in sequence provided grazing for a similar period to previous years and reduced the cost of fencing and labor. The experiment is being repeated in 2011-2012. Another aspect of this project deals with a market assessment of pasture-based beef. Results provide an idea of how consumers react to the product after experiencing it, and how they value it in relation to other retail products. For example, researchers found that a majority of consumers preferred pasture-based beef (74% in the case of steak and 82% in the case of ground beef), and were willing to pay premiums of $2.00 to $5.00 per pound above conventional beef prices. Preliminary results also show that a target carcass endpoint grade of Select could satisfy consumer preferences for a leaner yet highly palatable cut, while simultaneously reducing the amount of finishing time necessary. This information can assist the industry in the four P's of marketing (Price, Product, Place, Promotion) and can subsequently be used to set "marketing claim standards" so that products labeled "Appalachian Pasture Raised Beef" can be sold at the retail level and consumers can be assured of product quality and consistency.

Statistical analysis was concluded on a study examining the efficacy of the use of essential oil supplements for lactating dairy cows. While these supplements are gaining popularity, their efficiency has not been supported by research. The research published this past year will aid dairy producers regarding the decision to purchase these supplements or not.

Data was collected to validate the fire blight prediction model, Maryblyt. Fire blight is a disease that

affects apple and pear producers. The program was evaluated, slightly modified and rewritten for the Windows operating system. The rewritten program has been disseminated using 1) email update to colleagues, growers, agents, and consultants (list culled from a world-wide list of fire blight professionals); 2) presentations at professional meetings; 3) presentations at grower meetings; 4) written publication in Plant Health Progress; and 5) a web page for delivering the program to potential users. The software was downloaded 180 times in 2011 with visits recorded from 35 countries. The software allows for proper timing of antibiotic applications and facilitates monitoring activities. Project evaluations indicated that users regarded the new software very highly. Apple cultivar evaluations for disease relative susceptibility are widely used by growers to fine tune management strategies for cultivars with notable resistance or susceptibility characteristics. Sooty blotch and fly speck disease often is a limiting factor in both conventional IPM systems and organic systems. An improved understanding of the fungal complex involved in this disease is needed to reduce fungicide use and production costs.

West Virginia University's Davis College has one of the most productive feed manufacture and animal nutrition research programs in the United States as evidenced by WVU's number of industry collaborations and publications, and by invitations to speak at national and international professional conferences. Current work in poultry feed pellet quality focuses on designing the feed in such a way that there is less breakage and waste when it is consumed. This work has resulted in an advantage of $0.02 per lb. of saleable carcass through the feeding of high quality pelleted feed. This cost savings is very large considering the size of integrated poultry operations. A major operation in Moorefield, WV, produces approximately 90 million birds per year that have an average carcass weight of 3 lbs. Depending on the cost of commercially manufacturing the higher quality pellets, this research could save this producer from $1 to $3 million annually.

Major water quality problems exist in the multi-state Chesapeake Bay Watershed. Among the many suspected contributors to those water quality problems are agricultural operations in the watershed. Contributing factors to water quality problems can include runoff from dairy operations in Southern Pennsylvania and phosphorus runoff from confined poultry operations in West Virginia. WVU has a unique research relationship with a large turkey integrator (currently the 10th largest turkey producer in the nation). Recent work has demonstrated that phosphate in feeds may be reduced in diets to a degree that live performance and yield are not affected while potential environmental stressors associated with land application of litter are significantly reduced. These data are crucial to alleviate concerns associated with the perception of production agriculture's negative effect on the Chesapeake Bay watershed. The research collaboration has also investigated amino acid density, feed form, and beta glucan inclusion, all in hopes of improving breast yield, the most economically important muscle meat yielded by large tom turkey production.

Several studies are underway that look at non-pharmaceutical methods of reducing gastrointestinal nematode infections in sheep. One compared the immunity of St. Croix and Suffolk Cross lambs infected with and then cured of nematode infection with a control group of lambs that did not have prior infection. As a result of the prior infection St. Croix lambs never developed a measureable fecal egg count over a period of 7 weeks whereas the previously infected Suffolk cross lambs ended the study with an average fecal egg count of 3,000 eggs/gram. The impact of this study is that the results will allow us to further substantiate claims that St. Croix hair sheep have a pronounced ability to reduce fecal egg count. These reductions are in large part to due to enhanced immune responses. This experiment also allowed us to validate our model system of generating native sheep and testing immune responses. Over 100 sheep producers have attended events where our results were presented.
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2. Brief description of the target audience

The target audience for this program area includes producers, processors, distributors, extension

specialists, agricultural consultants, regulators, policy makers and other researchers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	180	0	0

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

Patent Applications Submitted

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	13	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentation on research at professional meetings

Year	Actual
2011	10

Output #2

Output Measure

- Popular press articles on research

Year	Actual
2011	4

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2011	12

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Growth in state production of beef and lamb - % increase
2	Growth in state aquaculture industry - annual % increase in gross revenue
3	Growth in state number of farms marketing organically produced vegetables - annual % increase
4	Growth in state broiler, egg and turkey industries - annual % increase
5	Reduce the water quality impact of the broiler and turkey industries

Outcome #1

1. Outcome Measures

Growth in state production of beef and lamb - % increase

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Beef cattle and sheep production are important sectors of the WV agricultural economy, given the relative abundance of high quality pasture land and the relative shortage of prime farmland for intensive agricultural product production. Production of lambs out of the traditional season would give producers an economic advantage due to higher market prices for out-of-season lambs.

What has been done
We have a long-term integrated pasture-based beef program that has examined ways to increase the production quantity and quality of pasture grass and to enhance the market opportunities for pasture raised beef.

WVU has been studying means of inducing estrus out of season to extend the production season for lambs.

Results
Pasture-based beef market studies found that a majority of consumers preferred pasture-based beef (74% in the case of steak and 82% in the case of ground beef), and were willing to pay premiums of $2.00 to $5.00 per pound above conventional beef prices. Preliminary results also show that a target carcass endpoint grade of Select could satisfy consumer preferences for a leaner yet highly palatable cut, while simultaneously reducing the amount of finishing time necessary. This information can assist the industry in the four P's of marketing (Price, Product, Place, Promotion) and can subsequently be used to set "marketing claim standards" so that products labeled "Appalachian Pasture Raised Beef" can be sold at the retail level and consumers can be assured of product quality and consistency.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
301	Reproductive Performance of Animals
302	Nutrient Utilization in Animals
303	Genetic Improvement of Animals
307	Animal Management Systems

Outcome #2

1. Outcome Measures

Growth in state aquaculture industry - annual % increase in gross revenue

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Organic farming represents a potential economic opportunity for WV farmers. It is crucial that organic farming decisions be based on sound science and proven methods.

What has been done
In our organic farming research a field trial compared yield response to applied compost in lettuce, tomato, green beans, and watermelon.

Results
The compost effect was significant 4 out of 5 harvest dates and the compost-by-cultivar

interaction was statistically significant for 2 out of 5 dates. In almost all cases, yields were higher in plots with compost than in plots without, but there was a tendency for the low input plots to have higher yields very late in the growing season, suggesting that compost promotes early yielding.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
202	Plant Genetic Resources
205	Plant Management Systems
211	Insects, Mites, and Other Arthropods Affecting Plants
212	Pathogens and Nematodes Affecting Plants

Outcome #4

1. Outcome Measures

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

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The poultry industry in WV (broilers, eggs and Turkeys) is the single largest agricultural industry in the State. There is considerable pressure on this industry due to increasing costs of production, regional competition and pressures to reduce phosphorus pollution in the Potomac Watershed.

What has been done
West Virginia University's Davis College has one of the most productive feed manufacture and animal nutrition research programs in the United States as evidenced by WVU's number of industry collaborations and publications, and by invitations to speak at national and international professional conferences. Current work in poultry feed pellet quality focuses on designing the feed in such a way that there is less breakage and waste when it is consumed.

Results

This work has resulted in an advantage of $0.02 per lb. of saleable carcass through the feeding of high quality pelleted feed. This cost savings is very large considering the size of integrated poultry operations. A major operation in Moorefield, WV, produces approximately 90 million birds per year that have an average carcass weight of 3 lbs. Depending on the cost of commercially manufacturing the higher quality pellets, this research could save this producer from $1 to $3 million annually.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
211	Insects, Mites, and Other Arthropods Affecting Plants
307	Animal Management Systems

Outcome #5

1. Outcome Measures

Reduce the water quality impact of the broiler and turkey industries

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Major water quality problems exist in the multi-state Chesapeake Bay Watershed. Among the many suspected contributors to those water quality problems are agricultural operations in the watershed. Contributing factors to water quality problems can include runoff from dairy operations in Southern Pennsylvania and phosphorus runoff from confined poultry operations in West Virginia.

What has been done
WVU has a unique research relationship with a large turkey integrator (currently the 10th largest turkey producer in the nation). Recent work has demonstrated that phosphate in feeds may be reduced in diets to a degree that live performance and yield are not affected while potential environmental stressors associated with land application of litter are significantly reduced.

Results
These data are crucial to alleviate concerns associated with the perception of production agriculture?s negative effect on the Chesapeake Bay watershed. The research collaboration has also investigated amino acid density, feed form, and beta glucan inclusion, all in hopes of improving breast yield, the most economically important muscle meat yielded by large tom turkey production.

4. Associated Knowledge Areas

KA Code	Knowledge Area
133	Pollution Prevention and Mitigation
302	Nutrient Utilization in Animals
307	Animal Management Systems

V(H). Planned Program (External Factors)

External factors which affected outcomes
- Economy
- Appropriations changes
- Competing Public priorities

Brief Explanation

Cutbacks in Agricultural Research Service (ARS) budgets and the closing of the ARS facility in Beaver, WV, will lead to a reduction in the research resources devoted to the pasture finished beef projects. The elimination of congressionally directed spending will also lead to reduced activity in the aquaculture and wood utilization areas. These cutbacks increase the relative importance of federal capacity funding and AFRI competitive funding to the success of our research programs.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State defined outcomes #1, #4 and #5.

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Childhood Obesity, Human Nutrition and Health

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			15%	
502	New and Improved Food Products			15%	
702	Requirements and Function of Nutrients and Other Food Components			20%	
703	Nutrition Education and Behavior			30%	
724	Healthy Lifestyle			20%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	2.5	0.0
Actual Paid Professional	0.0	0.0	4.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	237785	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	780036	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	289367	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

West Virginia citizens have the second highest level of obesity in the Nation (32.5%, Center for Disease Control, 2010). West Virginia is also above the national averages for incidence of diabetes, high blood pressure, and cardiovascular disease, as well as for osteopenia and osteoporosis. Station research in human nutrition and health is focused on determining the current and potential impacts 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). The program also is testing the efficacy and safety of bioactive compounds in foods, including krill protein, and is developing omega-3 DHA enhanced diets and educational programs to support their adoption.

Bone loss (osteoporosis) may be lessened if bone health is improved by optimizing nutrition intervention. The n-3 polyunsaturated fatty acids (PUFAs) have been suggested to improve bone health. However, n-3 PUFA sources differ in the types of fatty acids, ratio, and structural form. Therefore, a research project was undertaken to determine the effect of n-3 PUFAs from different sources on bone mineral, microarchitecture, and strength and potential mechanisms of affect.The target audience is researchers, medical professionals, industry, and consumers. The use of n-3 PUFA supplements are widely used by the public due to reports of various health benefits. However, few studies have investigated the role of n-3 PUFA supplements in the prevention of kidney calcification or bone loss. Our study investigated the different sources of n-3 PUFAs on renal and bone health due to the expanding available sources of commercially available n-3 PUFAs. Based on the study results, the degree of nephrocalcinosis in female rats was influenced by different types of fatty acids in the diet. The study results suggest that rather than focusing on a single source of n-3 PUFAs, perhaps a variety of sources of n-3 PUFAs should be consumed in order to improve bone health during growth.

A related study looked at the relative effectiveness of DHA derived from algal versus fish-based PUFAs. In the first study it was determined that DHA from algal oil is not as efficiently incorporated into tissue lipids as DHA from fish oil; nearly 2X as much dietary DHA from algal oil was required. Furthermore, even at equal tissue DHA concentrations, algal oil is less effective at reducing body fat and serum lipids than fish oil. Greater than 4X as much tissue DHA was needed to result in similar serum triglyceride and cholesterol levels as fish oil-fed mice. In the second study they confirmed that coconut oil-fed mice are more sensitive to dietary conjugated linoleic acid, as they are leaner and have enhanced lipolysis.

An integrated research/extension project on local food choices, eating patterns and population health concluded in 2011. A study evaluating the demand for Omega-3 enhanced trout was conducted using surveys of restaurants and distributors specializing in fish and seafood in 6 states. Data were analyzed regarding willingness to pay for Omega-3 enhanced brook trout. Results were disseminated through the WV aquaculture newsletter and in poster form at the annual WV Aquaculture Forum. The WVU Extension Service conducted a number of workshops and created teaching materials related to home food preservation and processing and preparing venison. Extension faculty and staff were trained at these workshops. Five fact sheets on home food preservation were written or updated and distributed at the State Fair and on the website. Home food preservation workshops were featured on local television news programs. Venison workshops were featured on at least two local news programs. Extension faculty initiated a project to help consumers choose more fruits and vegetables. Eleven vegetables that are grown in WV were highlighted. For each vegetable a faculty member developed a fact sheet and one or more recipes. These were professionally printed and distributed to 10 counties to be handed out at farmers markets. Extension agents gave cooking demonstrations and sponsored fun, educational activities for children at farmers markets to encourage greater attendance. Extension faculty conducted a Survey of

Home Canning Practices in WV to determine whether people who can foods at home were knowledgeable about and used the recommended safe food preservation practices. The Extension Service in partnership with the Davis College, WVU Small Business Incubator, and WV Dept. of Agriculture sponsored two Food Business Workshops for home food entrepreneurs. These 2-day workshops included presentations on developing a business plan, marketing, protecting assets, and value added products along with information on regulatory and approval processes. This information is being developed into an online format for delivery through the WVU continuing education system.

We learned that although chefs were interested in brook trout they were not willing to pay a price premium for Omega-3 enhanced brook trout. Surveys of consumers who purchased fish at a farmers market help farmers increase sales of aquaculture products by understanding and meeting the needs of their customers; increased consumption of aquaculture products should improve the health of consumers. WVU Extension's work on home food preservation and venison processing improved the skills of individuals who will answer questions brought by the public and who will conduct workshops and trainings. The final impact should be improved food safety and health. Extension's vegetable fact sheets and cooking demonstrations at farmers markets should lead to increased vegetable consumption and improved health. The survey of home canning practices should raise awareness and improve food safety. This survey also made people aware that the county Extension office was a source of reliable canning information. Approximately 45 current and potential small food business owners who participated in one of the two Food Business Workshops indicated that the information was thorough and very well received and should help them start or improve their businesses. Understanding and better meeting the needs of farmers market customers through Extension's surveys of customers should improve vendor sales and lead to successful farmers markets that have an economic impact on their communities, as we learned that Morgantown's farmers market leads to increased sales at nearby businesses. The number of farmers markets in WV has increased over the last 5 years and a statewide Farmers Market Association has formed to continue their success and improvement. The development of a local food system in West Virginia, as promoted by the WV Food and Farm Coalition, should lead to greater access to fresh fruits and vegetables and improved health of West Virginians along with improvements in community food security. Policymakers gain knowledge from understanding the economic impacts of farmers markets and other aspects of local food systems, along with how food availability is related to food insecurity and health outcomes. We learned that land is not a barrier to the expansion of fruit and vegetable production in WV and this expansion would create jobs and improve access to fresh fruits and vegetables. County level research on the food environment and health outcomes indicated that generally health is better in areas with more direct-to-consumer sales (per capita).

A project titled "Development of Nutritionally-Enhanced Foods to Improve Health" developed nutritionally-enhanced low-cholesterol egg sticks fortified with omega-3 rich oils (algae, menhaden, flaxseed, canola oil and a blend of these with krill oil). Eggs are an excellent source of protein; an average large egg provides 7 g of protein, 4 g of which are within the egg white. Eggs are one of the top 25 foods eaten and contribute 11% to daily calorie consumption. Unfortunately, eggs are also in the top 15 of foods that contribute to dietary saturated fat and cholesterol which is associated with increased risk of cardiovascular disease (CVD), the number one cause of death in the United States. Therefore, our first objective was to develop an omega-3 enriched fatty acid egg product by egg yolk removal and incorporation of high omega-3 FA oils into the egg whites. Freeze-dried egg whites were included to replace the protein lost with the yolk. The proximate composition (crude protein, total fat, moisture and ash) were similar to that of a whole egg control. The total fat of the experimental eggs contained a greater amount of n-3 FAs and significantly less cholesterol and saturated fat than the whole egg ($P < 0.05$). In a follow-up study, the sensory and quality parameters of the nutritionally-enhanced, low cholesterol, vacuum-packed, ready-to-eat (RTE) egg product similar those developed previously were tested over a 14-d storage period. Proximate composition, pH changes, lipid oxidation, color changes and consumer acceptance were examined. Differences were reported in attributes between samples but sensory evaluation of the samples show that they were positively perceived, with a combined average overall liking

score of 5.9 on a scale with 1 being "disliked extremely" and 9 being "like extremely". The results indicate that the experimental eggs were accepted by consumers on the same level as mixed whole eggs and suggest market potential for this type of product. These egg sticks have been named for commercialization and a trade mark application has been filed. Consumer sensory studies showed that the egg sticks were well-liked and that there was a willingness to buy such a product. The findings from this research have resulted in the submission of a "disclosure of intellectual property" and a provisional patent application with the US Patent and Trademark Office.

2. Brief description of the target audience

The target audience for this program area includes dieticians, nutritionists, policy makers, researchers, extension specialists, 4-H and other youth program developers, community leaders and State citizens.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 1

Patents listed

Provisional patent application for a type(TM) of Omega 3 fortified egg sticks.

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	8	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at scientific meetings

Year	Actual
2011	6

Output #2

Output Measure

- Popular press articles on research

Year	Actual
2011	3

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2011	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Annual reduction in state incidence of obesity and obesity related health problems (diabetes, cardiovascular disease, hypertension, etc.)-% reduction
2	Reduction in state incidence of osteoporosis and similar or related disorders - % reduction
3	Osteoporosis and kidney calcification are both major health issues that are linked in part to diet. Few studies have investigated the role of n-3 PUFA supplements in the prevention of kidney calcification or bone loss.
4	To develop nutritious food products that include Omega-3, patent the product and initiate commercialization of the product.

Outcome #1

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Osteoporosis and kidney calcification are both major health issues that are linked in part to diet. Few studies have investigated the role of n-3 PUFA supplements in the prevention of kidney calcification or bone loss.

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Bone loss (osteoporosis) may be lessened if bone health is improved by optimizing nutrition intervention. The n-3 polyunsaturated fatty acids (PUFAs) have been suggested to improve bone health. However, n-3 PUFA sources differ in the types of fatty acids, ratio, and structural form.

What has been done
One study investigated the different sources of n-3 PUFAs on renal and bone health due to the expanding available sources of commercially available n-3 PUFAs.

Results
Based on the study results, the degree of nephrocalcinosis in female rats was influenced by different types of fatty acids in the diet. The study results suggest that rather than focusing on a single source of n-3 PUFAs, perhaps a variety of sources of n-3 PUFAs should be consumed in order to improve bone health during growth.

4. Associated Knowledge Areas

KA Code	Knowledge Area
502	New and Improved Food Products
702	Requirements and Function of Nutrients and Other Food Components

Outcome #4

1. Outcome Measures

To develop nutritious food products that include Omega-3, patent the product and initiate commercialization of the product.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	1

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Eggs are one of the top 25 foods eaten and contribute 11% to daily calorie consumption. Unfortunately, eggs are also in the top 15 of foods that contribute to dietary saturated fat and cholesterol which is associated with increased risk of cardiovascular disease (CVD), the number one cause of death in the United States.

What has been done
WVU researchers developed an omega-3 enriched fatty acid egg product by egg yolk removal and incorporation of high omega-3 FA oils into the egg whites. Freeze-dried egg whites were included to replace the protein lost with the yolk.

Results
The results indicate that the experimental eggs were accepted by consumers on the same level as mixed whole eggs and suggest market potential for this type of product. These egg sticks have been named for commercialization and a trade mark application has been filed. Consumer

sensory studies showed that the egg sticks were well-liked and that there was a willingness to buy such a product. The findings from this research have resulted in the submission of a "disclosure of intellectual property" and a provisional patent application with the US Patent and Trademark Office.

4. Associated Knowledge Areas

KA Code	Knowledge Area
501	New and Improved Food Processing Technologies
502	New and Improved Food Products
724	Healthy Lifestyle

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Appropriations changes

Brief Explanation

This area has been positively affected by the shift in priorities in NIFA to include Childhood Obesity. Investigators secured two large multi-unit AFRI grants in the Childhood and Nutrition area in 2011.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State defined outcomes #3 and #4.

V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Production/Sustainable Forestry - Timber Management and Wood Products

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			65%	
124	Urban Forestry			5%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
511	New and Improved Non-Food Products and Processes			20%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.5	0.0
Actual Paid Professional	0.0	0.0	7.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	20297	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	842835	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	486949	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This program includes research to develop improved procedures for hardwood timber management and harvest, to increase the efficiency of wood utilization while developing new uses for hardwoods, and, increasingly, to devise new processes to efficiently utilize wood and timber resources in the production of renewable bio-energy and bio-products. Timber management research includes specifically the development of models to predict yields, systems to protect forest resources from insect pests, acid precipitation, fire, disease, and invasive species; harvest management protocols for optimum regeneration and re-growth; methods to use harvest and processing wastes to efficiently produce bio-energy; feedstock and bioproduct logistics; and, programs that respond to research needs and concerns of corporate and private owners and provide economic comparisons among alternative management and harvest methods.

One continuing study is looking at market potential and alternative-uses for under-utilized Appalachian Hardwoods. Preliminary investigation was conducted on the current market for hickory, which was identified as an under-utilized species that could be used to produce furniture, panel products, and flooring. Specifically, research to investigate the potential for hickory as biofuel feedstock is underway. Given hickory is quite dense, it requires more energy to grind, as compared to some other biomass feedstock, so processing techniques have been of more importance. Research is being conducted to examine use of hickory borer beetles (Megacyllene caryae) as a means to process hickory into fine particles for biofuel use. Particle size analysis has been conducted on hickory that was processed via a hickory borer infestation. On-going work is being conducted to determine the higher heat values (HHV) and chemical composition (i.e., cellulose, hemicellulose, and lignin) of hickory processed by conventional means as compared to that processed by the hickory borer. Additionally, thermo-gravimetric, ultimate, and proximate analysis techniques are being used to analyze the hickory feedstock. The work to date on the project related to market potential has been presented at two poster session at international conferences.

A research project on Beech Bark Disease continued with USDA-Forest Service collaborators. This work is intended to discover ecological factors that contribute to the incidence and severity of beech bark disease. Beech bark disease (BBD) is a complex of causal agents, primarily the beech scale insect, Cryptococcus fagisuga, and various canker- causing Neonectria fungi. Resistance to scale infestation by American beech is heritable; however, a variety of environmental factors may induce ecological resistance, a temporary condition allowing susceptible individuals to remain disease-free. This project intends to identify factors lending to ecological resistance, focusing on biotic and abiotic factors and their relation to BBD incidence and severity. Sample plots have been established in stands with a several-decade history of BBD and a component of disease-free beech. Data collected describe species composition, canopies, topography, coarse woody debris, litter layers and soils. Beech scale infestation and Neonectria infection are qualitatively estimated using a five-category system ranging from no infestation/infection to heavy infestation/infection. The rating systems developed for this project represent a significant improvement over previous methods used for evaluating their populations. Quantitative assessments of these organisms are lacking and the development of image-based reference materials will improve the efficacy of field survey. About 1-2% of American beech are reported to be genetically resistant to BBD, but this survey indicates that beech with no trace signs of BBD appear at frequencies of 15% or more, supporting the hypothesis that factors other than genetics are influencing disease incidence and severity.

A study of nonindustrial private forest (NIPF) landowners was initiated in 2011. The main objective of this research is to explore the overall management pattern of forest landowners in West Virginia. During the reporting period, a survey was conducted among NIPF landowners to examine the influence of existing forestry policy instruments in their forest management decisions. Specifically, the survey was conducted to investigate what influences landowner decisions with regard to participation in conservation easement programs. Factors influencing landowners' decision to participate in easement programs were also identified, and include: landowner concern with transferring property rights to future generations and/or

their ability to pay the current property taxes, individual perception of government and non-governmental organizational trustworthiness, woodland location, forest cover percentage, years of property ownership, landowner motivations and perceptions about the property, and demographic characteristics (e.g., educational level, gender). Survey results were also used to gain insights into the attributes of landowners enrolled in easement programs. According to the study, a likely NIPF participant profile in West Virginia would be well-educated and slightly younger landowner that has a relatively larger salary. The most common primary use of eased land in the state was farmland and the primary motivation for easing the property was to prevent development. Most of the conservation easements were located in the developmentally sensitive eastern panhandle of West Virginia. Lastly, a forensic policy analysis of the Uniform Conservation Easement Act (UCEA), which is the basis for the West Virginia Conservation and Preservation Act, was conducted to identify fundamental causes that resulted in the legislative action and to compare the policy to three other alternatives (no policy change, privatizing, and education) using three principles: effectiveness, administrative feasibility and ethics. Results showed the UCEA to be the most efficient policy instrument for protecting private land against development.

NIPF landowners play an important role in sustaining timber resources nearby and nationwide due to the extent of their forest ownership. Protection of private forestland from development, fragmentation and parcelization is vital to West Virginia and the nation as a whole. It will be essential to increase NIPF landowner enrollment in conservation easement programs moving forward. Therefore, defining what causes West Virginia's private landowners to place conservation easements on their property is essential to increasing their participation in such programs and furthering conservation. A lack of information available to landowners has been shown to be an area of difficulty for the effective conservation easement as well. Researching landowner motivations for involvement may provide knowledge on how these shortcomings affect decisions by the private sector. Moreover, investigating NIPF participation in conservation easements offered by government and independent agencies may help in alleviating these problems. Since the survey was conducted, we have gotten several calls from landowners expressing their interest to the program. Thus, this study has been very helpful in bringing information to the landowners about programs that can assist them in protecting and managing their forest lands. In addition, agencies and organizations carrying out conservation easement programs in the state has shown interest in this study by participating in the survey.

2. Brief description of the target audience

The target audience for this program includes professional foresters, the forest-product industry, small and large woodlot owners, extension specialists, consultants, regulators and policy makers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	7	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Actual
2011	2

Output #2

Output Measure

- Popular press articles on research

Year	Actual
2011	1

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2011	5

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Growth in state timber industry - % change employee compensation
2	Growth in state wood products and furniture industry - % change in employee compensation
3	Development of genetic and other mechanisms for reducing the impact of Beech Bark Disease (BBD)

Outcome #1

1. Outcome Measures

Growth in state timber industry - % change employee compensation

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The WV State forest industry is larger than the agricultural sector in terms of its contribution to the State economy. The health of the forest sector is thus crucial to the health of the State economy. It is a renewable resource based industry and is thus sustainable if managed properly. Nonindustrial private forest (NIPF) landowners play an important role in sustaining timber resources nearby and nationwide due to the extent of their forest ownership. Protection of private forestland from development, fragmentation and parcelization is vital to West Virginia and the nation as a whole. It will be essential to increase NIPF landowner enrollment in conservation easement programs to preserve the integrity of our forest resource base.

What has been done
A survey was conducted among NIPF landowners to examine the influence of existing forestry policy instruments in their forest management decisions. Specifically, the survey was conducted to investigate what influences landowner decisions with regard to participation in conservation easement programs.

Results
Results showed the Uniform Conservation Easement Act to be the most efficient policy instrument for protecting private land against development. This study has been very helpful in bringing information to the landowners about programs that can assist them in protecting and managing their forest lands. In addition, agencies and organizations carrying out conservation easement programs in the state has shown interest in this study by participating in the survey.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

Outcome #2

1. Outcome Measures

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Development of genetic and other mechanisms for reducing the impact of Beech Bark Disease (BBD)

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
American beech is an important commercial species that is currently being threatened by Beech Bark Disease.

What has been done
A research project on Beech Bark Disease continued with USDA-Forest Service collaborators. This work is intended to discover ecological factors that contribute to the incidence and severity of beech bark disease. Beech bark disease (BBD) is a complex of causal agents, primarily the beech scale insect, Cryptococcus fagisuga, and various canker- causing Neonectria fungi. Resistance to scale infestation by American beech is heritable; however, a variety of environmental factors may induce ecological resistance, a temporary condition allowing susceptible individuals to remain disease-free. This project intends to identify factors lending to ecological resistance, focusing on biotic and abiotic factors and their relation to BBD incidence and severity.

Results
About 1-2% of American beech are reported to be genetically resistant to BBD, but this survey indicates that beech with no trace signs of BBD appear at frequencies of 15% or more, supporting

the hypothesis that factors other than genetics are influencing disease incidence and severity.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

State defined outcome #3.

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustainable Energy

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			10%	
403	Waste Disposal, Recycling, and Reuse			20%	
511	New and Improved Non-Food Products and Processes			40%	
605	Natural Resource and Environmental Economics			15%	
610	Domestic Policy Analysis			15%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	1.8	0.0
Actual Paid Professional	0.0	0.0	2.1	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	**1890 Extension**	**Hatch**	**Evans-Allen**
0	0	97795	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	171449	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	278082	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

This program focuses on biofuel and bioenergy production. We have increased activity and funding of this area as indicated in the Plan of Work. The program so far is focused on examining different biomass feedstocks for the production of biofuels (ethanol, biodiesel, syngas) and biomaterials, nondestructive methods for characterizing the physical and chemical propertied of lingo-cellulosic biomass, and syngas production from co-firing coal and biomass. The feedstocks examined so far include algae, switchgrass and mixed grasses, and residual woody biomass from forestry operations.

A continuing project focuses on production of biofuels and bioproducts from biomass. Work in 2011 revealed that Mechano-enzymatic pretreatment of both the lignocellulosic specimens (hard maple and corn stover) showed an elevated production of sugars. Each sequential treatment of depolymerizing enzymes had mixed results. Treatments that showed the highest sugar yield with the minimum number of enzymes were evaluated. Two types of particle sizes were obtained after enzyme hydrolysis. This reduction of particle sizes can be attributed the combined action of cell wall depolymerizing enzymes and wet milling. Elevated yield of total sugars increased enzyme concentration. The maximum sugar yield was observed in wet milled specimens at the highest energy and dosage level.

Another project involves material handling and co-gasification reactive properties of coal-biomass mixtures to produce syngas for combined heat and power and liquid fuel synthesis. Logging residues (Red Oak and Red maple) were collected from the West Virginia University Forest and coal samples (West Virginia Sub-bituminous Kingwood Coal and Texas Brown Lignite Coal) were also sampled. Physical properties, like, cell wall density (true density), moisture content, and calorific values of logging residue were determined. The moisture content was 35.1% for red maple and 41.6% for red oak. The calorific values were 19.2 MJ/kg for red oak and 19.3 MJ/kg for red maple. Thermo-gravimetric analysis under nitrogen atmosphere showed that both logging residue samples produced less than 20% char residue. Differential thermo-gravimetric (DTG) curves were prepared to show fractional conversion over a temperature range of 25 to 550*C. DTG curves showed two distinct peaks for both samples. The first peak was at 250*C in red oak while it was close to 300*C in red maple. The second peak was close to 300*C in red oak and 350*C in red maple. The different locations of peak can be attributed to difference in ash content, especially alkali like Na and K, and difference in hemicelluloses, cellulose and lignin content. This fact will be explained after getting results for proximate, ultimate, and chemical composition analysis.

2. Brief description of the target audience

The target audience for this program area includes the bio-fuels and materials industries, the electricity generating industry, researchers, regulators, policy makers, and foresters.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	2	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Actual
2011	2

Output #2

Output Measure

- Energy policy papers

Not reporting on this Output for this Annual Report

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2011	1

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Increased percentage of state energy consumption from renewable fuels.

Outcome #1

1. Outcome Measures

Increased percentage of state energy consumption from renewable fuels.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
The economy of WV is heavily dependent on the coal and natural gas industries, both exhaustible fossil fuels. There is a need to diversify both the State economy and our portfolio of energy sources. Increasing the amount of renewable energy production will help diversify the State economy, reduce our dependence as a country on imports of fossil fuels, and lead to a more sustainable energy supply. One way to do this is combining coal with renewable sources of biomass to produce energy products.

What has been done
Another project involves material handling and co-gasification reactive properties of coal-biomass mixtures to produce syngas for combined heat and power and liquid fuel synthesis. Logging residues (Red Oak and Red maple) were collected from the West Virginia University Forest and coal samples (West Virginia Sub-bituminous Kingwood Coal and Texas Brown Lignite Coal) were also sampled. Physical properties, like, cell wall density (true density), moisture content, and calorific values of logging residue were determined.

Results
The moisture content was 35.1% for red maple and 41.6% for red oak. The calorific values were 19.2 MJ/kg for red oak and 19.3 MJ/kg for red maple. Thermo-gravimetric analysis under nitrogen atmosphere showed that both logging residue samples produced less than 20% char residue. The next step is to characterize proximate, ultimate, and chemical composition analysis.

4. Associated Knowledge Areas

KA Code	Knowledge Area
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(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

Like our Child Obesity and Nutrition program, this program benefited from the inclusion of Sustainable Energy in the five NIFA goal areas. Several competitive grants were obtained for this program in 2011 from AFRI and from DOE.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

V(A). Planned Program (Summary)

Program # 8

1. Name of the Planned Program

Food Safety

V(B). Program Knowledge Area(s)

1. Program Knowledge Areas and Percentage

KA Code	Knowledge Area	%1862 Extension	%1890 Extension	%1862 Research	%1890 Research
711	Ensure Food Products Free of Harmful Chemicals, Including Residues from Agricultural and Other Sources			40%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins			60%	
	Total			100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2011	Extension		Research	
	1862	1890	1862	1890
Actual Paid Professional	0.0	0.0	1.4	0.0
Actual Volunteer	0.0	0.0	0.0	0.0

2. Actual dollars expended in this Program (includes Carryover Funds from previous years)

Extension		Research	
Smith-Lever 3b & 3c	1890 Extension	Hatch	Evans-Allen
0	0	276928	0
1862 Matching	**1890 Matching**	**1862 Matching**	**1890 Matching**
0	0	415231	0
1862 All Other	**1890 All Other**	**1862 All Other**	**1890 All Other**
0	0	150740	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

While food safety is a component of many of the projects listed under Global Food Security and Hunger, we will report projects whose primary concern is food safety in this NIFA mandated program. The primary activities in this program area involve food safety issues in pre-slaughter management of processed fish fillets in cold-water aquaculture operations and developing procedures for testing for and eradicating newly emerging water borne bacteria that may enter the food supply.

In collaboration with USDA/ARS/National Center for Cool and Cold Water, phenotypic characterization of fish growth and fillet quality attributes was completed on 5 fish from each of 95 families. Body, organ, and viscera weights were collected. Carcass attributes including butterfly fillet and separable muscle weights, various morphometric measures (fillet and belly flap thickness), muscle color, pH, and texture were measured. A subset of samples was selected from 95 families based on separable muscle weight (High Yield, HY; Low Yield, LY) and composition (High Fat, HF; Low Fat, LF). Growth, proximate composition, fatty acid composition, lipid and adipocyte gene expression and adipose cellularity will be evaluated in 5 fish from 4 phenotype combinations. These data will aid identification of potential genetic markers for development of germplasm with improved growth and fillet attributes. Moreover, these gravimetric, morphometric, and composition data will be used in development of ultrasonography as a tool for rapid carcass evaluation in selection and management of rainbow trout as a food fish. An evaluation of the impact of rigor state (pre-rigor, rigor, post-rigor), when filleted, on rainbow trout muscle quality has been completed and includes measurement of ATP and its catabolites (ADP, AMP, IMP, Inosine, and Hypoxanthine), sarcomere length, texture, composition, and rigor angle. Rigor angle was determined at 0, 3, 6, 24, 27, 36, and 48 h to define and identify rigor state for filleting; these data will be used to develop best processing practices for rainbow trout.

These outcomes are the result of a continued partnership among the Davis College, the Conservation Fund's Freshwater Institute and the National Center for Cool and Cold Water Aquaculture. The current year's work demonstrates fillet quality differences from multiple rainbow trout families. Implications regarding identification of genetic markers for fillet quality attributes and use of ultrasonography in predicting fillet yield are forthcoming. Rigor state of trout muscle at filleting did not affect texture development following cooking. Implications of rigor state on processing attributes and freshness indicators are forthcoming.

2. Brief description of the target audience

The target audience for this program area includes the food processing industry, the aquacultural producers and marketers, regulators and policy makers.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2011	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2011

Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2011	Extension	Research	Total
Actual	0	2	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Professional Presentations

Year	Actual
2011	2

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Development of filleting and processing techniques that improve consumer acceptance and protect food safety.

Outcome #1

1. Outcome Measures

Development of filleting and processing techniques that improve consumer acceptance and protect food safety.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2011	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Handling of fish fillets from aquaculture can have a major impact on texture, consumer acceptance and food safety.

What has been done
In collaboration with USDA/ARS/National Center for Cool and Cold Water, phenotypic characterization of fish growth and fillet quality attributes was completed on 5 fish from each of 95 families. Body, organ, and viscera weights were collected. Carcass attributes including butterfly fillet and separable muscle weights, various morphometric measures (fillet and belly flap thickness), muscle color, pH, and texture were measured.

Results
The current year's work demonstrates fillet quality differences from multiple rainbow trout families. Implications regarding identification of genetic markers for fillet quality attributes and use of ultrasonography in predicting fillet yield are forthcoming. Rigor state of trout muscle at filleting did not affect texture development following cooking. Implications of rigor state on processing attributes and freshness indicators are forthcoming.

4. Associated Knowledge Areas

KA Code	Knowledge Area
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes

Brief Explanation

V(I). Planned Program (Evaluation Studies)

Evaluation Results

This year evaluation consisted of annual evaluation of short term impacts as documented in Outputs and State Defined Outputs and Outcomes. In the future evaluation will also consist of longer term impacts and a research program portfolio review as documented in the Plan of Work.

Key Items of Evaluation

This is a very small program and there are no key items to report this year.