V(A). Planned Program (Summary)

Program # 6

1. Name of the Planned Program

Production/Sustainable Forestry - Timber Management and Wood Products

☑ Reporting on this Program

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: 2013	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.0	0.0
Actual Paid Professional	0.0	0.0	6.5	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	8996	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	893907	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	502684	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.

A continuing study is looking at market potential and alternative-uses for abundant but under-utilized Appalachian hardwoods such as yellow poplar and especially red maple. One facet of this study is identification and manufacturing of new, value-added veneer-based products from these under-utilized species. The impact of the project during this project period was the development of alternative composite materials using hardwood biomass materials that went through a value-added conversion process. Specifically, in terms of the alternative composites, mixed hardwood biomass that was carbonized (i.e., biochar) was used as a reinforcement for a film material that could be used for a variety of applications. In additional to a reinforcement for film material, research was performed to look at using carbonized hardwoods to make sensors that could be used in a variety of applications such as humidity and temperature monitoring, gas emission monitoring, and general touch sensors. The use of carbonized hardwood has potential for being used for electrical sensing, energy storage, composite, and fuel cell applications. The research led to a better understanding of how carbonized wood acted in terms of reinforcing polymer films and improving the electrical conductivity of sensors. The project is expected to have a positive impact on converting low-value hardwoods into high-value materials with predictable properties that can be used in energy storage, sensor, and composite applications. Work is underway to investigate the electrical conductivity of these materials under dynamical mechanical thermal conditions. This work is expected to produce a unique type of touch sensor produced from carbonized hardwood as the electrical conductor. Through this work, we also realized a change in knowledge on the unique nature of carbon from woody biomass sources, as compared to other carbon sources. We think we can harness these unique properties in the development of unique bio-based electrical conducting materials.

A project titled, "Using Biomechanical Approaches to Understand How Branch Development Leads to Stable Crown Form," is looking at how urban tree branches grow and develop so arborists and urban foresters can better understand how to manage urban trees and minimize the risk of failure. Understanding development will help managers increase the resiliency of urban trees, hopefully leading to fewer power outages during storm events or reducing the duration of outages.

A forestry program has examined the role of peer-to-peer learning as a vehicle for outreach compared with more traditional technical assistance programs. Peer-to-peer learning involves sharing of knowledge or experiences among landowners either through formal or informal social networks. Empirical evidence in other states has shown that landowners tend to trust people like themselves and are therefore more likely to adopt new programs if they see their peers do so. Given the vast number of woodland owners in our state (estimated to be about 250,000), it is in the interest of the West Virginia Division of Forestry to promote networks of woodland owners that are self-sustaining and that provide an efficient way to enroll woodland owners and other stakeholders in landscape conservation efforts. The cornerstone of our promotion of peer-to-peer networks is the woodland tour. On these tours of private woodland properties, woodland owners and general nature enthusiasts come together to learn from one another. During the FY2013 period, we hosted nine field-based woodland tours. A total of 229 individuals attended

these tours. We maintained a list of addresses for the attendees and are currently developing a mail-based questionnaire to assess the impacts of the woodland tours. The questionnaire will be sent out in January 2014.

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

2013	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:	2013
Actual:	0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2013	Extension	Research	Total
Actual	0	8	8

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Actual
2013	22

Output #2

Output Measure

- Popular press articles on research

Year	Actual
2013	2

Output #3

Output Measure

- Completed graduate degree programs

Year	Actual
2013	4

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Growth in state timber industry - % change
2	Growth in state wood products and furniture industry - % change
3	Program and workshop participants will gain information that will improve their forest operation management skills (% of participants who report a gain in knowledge).

Outcome #1

1. Outcome Measures

Growth in state timber industry - % change

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Condition Outcome Measure

3b. Quantitative Outcome

Year	Actual
2013	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. One way of expanding the industry is to find markets for underutilized hardwood species.

What has been done
A continuing study is looking at market potential and alternative-uses for abundant but under-utilized Appalachian hardwoods such as yellow poplar and especially red maple. One facet of this study is identification and manufacturing of new, value-added veneer-based products from these under-utilized species.

Results
The impact of the project during this project period was the development of alternative composite materials using hardwood biomass materials that went through a value-added conversion process. Specifically, in terms of the alternative composites, mixed hardwood biomass that was carbonized (i.e., biochar) was used as a reinforcement for a film material that could be used for a variety of applications. In additional to a reinforcement for film material, research was performed to look at using carbonized hardwoods to make sensors that could be used in a variety of applications such as humidity and temperature monitoring, gas emission monitoring, and general touch sensors. The use of carbonized hardwood has potential for being used for electrical sensing, energy storage, composite, and fuel cell applications. The research led to a better understanding of how carbonized wood acted in terms of reinforcing polymer films and improving the electrical conductivity of sensors. The project is expected to have a positive impact on converting low-value hardwoods into high-value materials with predictable properties that can be used in energy storage, sensor, and composite applications.

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

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Program and workshop participants will gain information that will improve their forest operation management skills (% of participants who report a gain in knowledge).

Not Reporting on this Outcome Measure

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

The sequestration in 2013 limited the funding we were able to use to conduct our research program in this area.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Experiment Station research program evaluation will take place at two levels and on two different time cycles. All programs will using these general criteria plus additional criteria tailored to each program as detailed in the Plan of Work under Outputs and State Defined Outputs and Outcomes.

Annual evaluation will continue as before, looking at productivity in terms of immediate impact:

- Referee journal articles and books
- Professional presentations
- General audience papers and news reports

- M.S. and PhD graduates
- Trends in terms of competitive funding

And in terms of longer-term impact:

- Citations in scientific journals
- Patents
- Successful technology transfer or start-ups based on research programs
- Awards based on continuing impact and research excellence

In addition, every five years we will have a full portfolio review of our research programs in terms of:

- Long term productivity
- Relevance to our constituent groups and the State and Region
- The allocation of research inputs among the programs
- Consideration of eliminating some research programs that are not productive or have diminished relevance given NIFA and State priorities
- Consideration of adding additional program areas given NIFA and State priorities

The Forestry/Natural Resources Program is evaluated annually by a board of advisors composed of university researchers, industry representatives and representatives of relevant government agencies.

Key Items of Evaluation

This year we continued to implement the results of last year's evaluation to upgrade the laboratories and facilities in our Forestry program. We were delayed due to budgetary issues, but the renovations are now in progress. We also had a joint evaluation of our research programs with the regional USDA Forest Service. The results of that review were extremely positive and will lead to more cooperative work with the Forest Service and may also lead to some joint hires in strategic areas.