

**V(A). Planned Program (Summary)**

**Program # 6**

**1. Name of the Planned Program**

Production/Sustainable Forestry

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			60%	
124	Urban Forestry			10%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants			10%	
511	New and Improved Non-Food Products and Processes			20%	
	<b>Total</b>			100%	

**V(C). Planned Program (Inputs)**

**1. Actual amount of FTE/SYs expended this Program**

Year: 2014	Extension		Research	
	1862	1890	1862	1890
<b>Plan</b>	0.0	0.0	7.0	0.0
<b>Actual Paid</b>	0.0	0.0	7.2	0.0
<b>Actual Volunteer</b>	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	14270	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	957036	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	533033	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 bio-product 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. Past work has included identification of underutilized hardwood species including red maple and yellow poplar. One important issue on economic utilization of these species involves developing low-cost methods of screening wood samples to determine whether or not the particular sample is suitable for high-grade veneers or structural or nonstructural applications. The goal of the project during this project period was to develop an automated non-destructive optical and high-speed ultrasonic waveform capturing system for evaluating full size veneer and lumber that allows for mechanical property predictions, an improved classification/sorting system, and quantification of various inherent wood characteristics (e.g., grain pattern, diving grain, and defect percentage). The non-destructive system was successfully developed. Specifically, the system was designed as a low-cost system that utilized a linear slide to move a CCD camera over the length of the lumber and veneer. The system allows for taking images at various rates and image resolutions. At the completion of the project period, the system has been developed and we have begun to start evaluating lumber and veneer material. Specifically, work was underway to scan and grade lumber produced from three red oak logs. The work hopes to be able to grade and classify defects and grain patterns. Additionally, we plan to create a program that recomposes the log into a 3-D replication using the details gained from the lumber. This process would allow for determining if a better cutting solution may be possible to improve the grade of the final lumber and veneer material. The end result of this work will be greater utilization of low-cost underutilized hardwood species in the timber industry.

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. Progress this reporting period included experiments that determined strain deformation) measured on the bark of trees is statistically the same as strain on the xylem or wood measured in a laboratory. These tests confirm that it will be possible to utilize stereo a photogrammetry system to measure strain and thus applied load transfer in standing tree without the need of destructive testing.

Another project is designed to explore an efficient means to effectively enhance the productivity and value of eastern hardwood stands. Many thousands of acres of newly regenerated stands are created with 40,000+ stems/ac. Decades will typically pass before the next treatment. By this time, a significant portion of the rotation has passed without any attempt to improve productivity or species composition, thereby continuing the sub-optimal growth and a high-representation of low-value species. Improving the growth and representation of species with high monetary and ecologic value will improve economic and amenity returns to landowners. The objectives of this research will focus on addressing questions related to improving the profitability and productivity of natural and artificially regenerated eastern forests by focusing on non-traditional areas associated with pine and hardwood culture.

**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**

2014	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: 2014

Actual: 0

**Patents listed**

**3. Publications (Standard General Output Measure)**

**Number of Peer Reviewed Publications**

2014	Extension	Research	Total
Actual	0	5	0

**V(F). State Defined Outputs**

**Output Target**

**Output #1**

**Output Measure**

- Presentations on research at professional meetings

Year	Actual
2014	22

**Output #2**

**Output Measure**

- Popular press articles on research

<b>Year</b>	<b>Actual</b>
2014	4

**Output #3**

**Output Measure**

- Completed graduate degree programs

<b>Year</b>	<b>Actual</b>
2014	9

**V(G). State Defined Outcomes**

**V. State Defined Outcomes Table of Content**

O. No.	OUTCOME NAME
1	Growth in state timber industry - % change
2	Development of new state wood products and materials and new uses for forestry by products.
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 Knowledge Outcome Measure

**3b. Quantitative Outcome**

Year	Actual
2014	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 and to find processes to reduce production costs and increase the value of products from these underutilized 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. Past work has included identification of underutilized hardwood species including red maple and yellow poplar. One important issue on economic utilization of these species involves developing low-cost methods of screening wood samples to determine whether or not the particular sample is suitable for high-grade veneers or structural or nonstructural applications. The goal of the project during this project period was to develop an automated non-destructive optical and high-speed ultrasonic waveform capturing system for evaluating full size veneer and lumber that allows for mechanical property predictions, an improved classification/sorting system, and quantification of various inherent wood characteristics (e.g., grain pattern, diving grain, and defect percentage). The non-destructive system was successfully developed. Specifically, the system was designed as a low-cost system that utilized a linear slide to move a CCD camera over the length of the lumber and veneer. The system allows for taking images at various rates and image resolutions.

**Results**

At the completion of the project period, the system has been developed and we have begun to start evaluating lumber and veneer material. Specifically, work was underway to scan and grade

lumber produced from three red oak logs. The work hopes to be able to grade and classify defects and grain patterns. Additionally, we plan to create a program that recomposes the log into a 3-D replication using the details gained from the lumber. This process would allow for determining if a better cutting solution may be possible to improve the grade of the final lumber and veneer material. The end result of this work will be greater utilization of low-cost underutilized hardwood species in the timber industry.

#### 4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources

#### Outcome #2

##### 1. Outcome Measures

Development of new state wood products and materials and new uses for forestry by products.

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

#### 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 use 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

Our standard annual evaluation results are detailed in the state defined outputs and state defined outcomes sections of this report. 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. In addition, this year, we were evaluated by the directors of the McIntire Stennis Program. In general our review was very positive, particularly regarding our program of research. We were advised to work more closely with West Virginia State University. We took that advise seriously and met with faculty and directors at WVSU, sharing the details of our research programs. We have identified two areas for collaboration: applied research in restoring damaged soils and ecosystems and urban forestry.

### **Key Items of Evaluation**

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. In addition, this year, we were evaluated by the directors of the McIntire Stennis Program. In general our review was very positive, particularly regarding our program of research. We were advised to work more closely with West Virginia State University. We took that advise seriously and met with faculty and directors at WVSU, sharing the details of our research programs. We have identified two areas for collaboration: applied research in restoring damaged soils and ecosystems and urban forestry.