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			10%	
133	Pollution Prevention and Mitigation			15%	
135	Aquatic and Terrestrial Wildlife			25%	
605	Natural Resource and Environmental Economics			10%	
	Total			100%	

V(C). Planned Program (Inputs)

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

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Plan	0.0	0.0	7.9	0.0
Actual	0.0	0.0	4.3	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	317266	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	531583	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	370441	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 minelands' 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 was made in assessing the ecological functions of restored and created wetlands.

One study examined wetland management techniques and the success of amphibian species, an important measure of the health of a wetland ecosystem. This project also has an outreach component that involves working with private landowners to encourage more positive attitudes toward maintaining wetlands on their properties. Another study examined the ability of current wetlands mitigation strategies on reclaimed minelands to restore long-term ecosystem health. The goals of this project are to quantify aquatic ecosystem functions on reclaimed mines and compare them to the functions of native systems and quantify changes in aquatic ecosystem functions on reclaimed mine sites over time. Results from this research are being used to develop a state-wide stream mitigation trading and banking program based on functional stream ecosystem values. Results also are being integrated into a state-wide process to maximize stream restoration effectiveness in mined watersheds. This research team made 25 presentations to state agencies, federal agencies, industry partners and conservation stakeholder groups in 2010. They also published 5 articles in peer-reviewed journals in 2010. Finally, we secured an additional $500,000 in research funds to leverage our Hatch capacity funds.

Another related project that has been very successful at leveraging Hatch capacity funds by attracting competitive and other external sources of funding involves conducting a suite of studies related to management of riparian forested habitats and the population resistance and resilience in brook trout populations in headwater streams. This work is co-funded by the WV DNR, and two offices of the USDA Forest Service. Significant progress has been made on all study objectives for these allied projects and has resulted in three presentations and three publications.

Soil survey research continued at our National Soil Survey Center Geospatial Research Unit. Major work has been concentrated on two areas: (i) development of preliminary map products derived from gridded versions of the STATSGO and SSURGO databases for the properties as specified by the GlobalSoilMap.net project, and (ii) pilot projects for generating raster continuous soil maps based on terrain attributes. Related research involves improving our understanding of the processes, characteristics, and interpretations of hydromorphic, hydric, and subaqueous soils, and to inventory wetland and soil carbon resources using field indicators of hydric soils, geospatial modeling, and remote sensing.

Finally, a long-term study of the effects of gypsy moth defoliation on forest regeneration and wildlife populations found that although gypsy moths completely destroyed large tracts of forest habitat in this area, isolated patches of quality vegetation structure (refugia) remained and that those areas were used by forest birds. Moreover, the defoliated tracts were subject to immediate understory release and the density of birds associated with that early succession plant type increased substantially, leading to an overall increase in the number of bird species present and individual population densities.

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.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	0	0	0	0
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010
Plan: 0
Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Plan	0	5	
Actual	2	12	14

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Presentations on research at professional meetings

Year	Target	Actual
2010	8	8

Output #2

Output Measure

- Popular press articles on research

Year	Target	Actual
2010	2	4

Output #3

Output Measure

- Completed graduate degree programs

Year	Target	Actual
2010	2	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Reduce the percentage of West Virginia streams classified as 'impaired' (%).
2	Reduce percentage of state streams classified as impaired by agricultural and forestry activities (%).
3	Gain an understanding of the long-term impacts of periodic gypsy moth defoliaiton.
4	To better understand the ecological services provided by wetlands and to educate landowners about those services.

Outcome #1

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #2

1. **Outcome Measures**

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

Not Reporting on this Outcome Measure

Outcome #3

1. **Outcome Measures**

Gain an understanding of the long-term impacts of periodic gypsy moth defoliaiton.

2. **Associated Institution Types**

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Gypsy moth populations increase and decrease in periodic cycles. A better understanding of the long-term environmental consequences of defoliation events at the peaks of the cycles would help policy makers decide whether appropriate management should involve aggressive spraying of insceticides or a more passsive approach that allows natural predators and defoliaiton to limit the population of gypsy moths.

What has been done
A long-term study of the effects of gypsy moth defoliation on forest regeneration and wildlife

populations found that although gypsy moths completely destroyed large tracts of forest habitat in this area, isolated patches of quality vegetation structure (refugia) remained and that those areas were used by forest birds. Moreover, the defoliated tracts were subject to immediate understory release and the density of birds associated with that early succession plant type increased substantially, leading to an overall increase in the number of bird species present and individual population densities.

Results
The finding that periodic defoliation by gypsy moths can actually have a neutral or even positive impact on certain plant and animal species may lead to reduced use of pesticides in dealing with gypsy moth infestations, leading to reduced environmental and ecological damages from outbreaks.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
132	Weather and Climate
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

Outcome #4

1. Outcome Measures

To better understand the ecological services provided by wetlands and to educate landowners about those services.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Quantitative Target	Actual
2010	{No Data Entered}	0

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)
Wetlands provide numerous ecological services, many of which are not fully understood by researchers and landowners. As such, landowners often treat wetlands as a nusiance and drain

or fill them, thus damaging the ecological services provided by the wetland.

What has been done
One study examined wetland management techniques and the success of amphibian species, an important measure of the health of a wetland ecosystem. Another study examined the ability of current wetlands mitigation strategies on reclaimed minelands to restore long-term ecosystem health. The goals of this project are to quantify aquatic ecosystem functions on reclaimed mines and compare them to the functions of native systems and quantify changes in aquatic ecosystem functions on reclaimed mine sites over time. This project also has an outreach component that involves working with private landowners to encourage more positive attitudes toward maintaining wetlands on their properties.

Results
Results from this research are being used to develop a state-wide stream mitigation trading and banking program based on functional stream ecosystem values. Results also are being integrated into a state-wide process to maximize stream restoration effectiveness in mined watersheds. This research team made 25 presentations to state agencies, federal agencies, industry partners and conservation stakeholder groups in 2010. They also published 5 articles in peer-reviewed journals in 2010. Finally, we secured an additional $500,000 in research funds to leverage our capacity funds.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
112	Watershed Protection and Management
133	Pollution Prevention and Mitigation
135	Aquatic and Terrestrial Wildlife
605	Natural Resource and Environmental Economics

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Economy
- Appropriations changes
- Competing Programmatic Challenges

Brief Explanation

We are in the process of investing resources in faculty positions in the wildlife ecology, conservation genetics, and climate change areas. While our SY's in this category are lower this year than planned, we hope to rectify that situaiton in the future by devoting more resources to this program.

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

1. Evaluation Studies Planned

- Before-After (before and after program)

Evaluation Results

{No Data Entered}

Key Items of Evaluation

{No Data Entered}