

**V(A). Planned Program (Summary)****Program # 8****1. Name of the Planned Program**

Climate Change

**V(B). Program Knowledge Area(s)**

## 1. Program Knowledge Areas and Percentage

<b>KA Code</b>	<b>Knowledge Area</b>	<b>%1862 Extension</b>	<b>%1890 Extension</b>	<b>%1862 Research</b>	<b>%1890 Research</b>
101	Appraisal of Soil Resources	0%		7%	
102	Soil, Plant, Water, Nutrient Relationships	0%		4%	
123	Management and Sustainability of Forest Resources	0%		6%	
125	Agroforestry	0%		1%	
136	Conservation of Biological Diversity	0%		6%	
201	Plant Genome, Genetics, and Genetic Mechanisms	0%		9%	
202	Plant Genetic Resources	0%		4%	
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants	0%		17%	
205	Plant Management Systems	0%		2%	
206	Basic Plant Biology	0%		9%	
212	Pathogens and Nematodes Affecting Plants	0%		7%	
213	Weeds Affecting Plants	0%		2%	
216	Integrated Pest Management Systems	0%		2%	
302	Nutrient Utilization in Animals	0%		4%	
305	Animal Physiological Processes	0%		5%	
503	Quality Maintenance in Storing and Marketing Food Products	0%		2%	
609	Economic Theory and Methods	0%		4%	
703	Nutrition Education and Behavior	0%		2%	
712	Protect Food from Contamination by Pathogenic Microorganisms, Parasites, and Naturally Occurring Toxins	0%		5%	
805	Community Institutions, Health, and Social Services	0%		2%	
	<b>Total</b>	0%		100%	

**V(C). Planned Program (Inputs)****1. Actual amount of professional FTE/SYs expended this Program**

Year: 2010	Extension		Research	
	1862	1890	1862	1890
Actual	0.0	0.0	9.9	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	402420	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	391861	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	63415	0

**V(D). Planned Program (Activity)**

**1. Brief description of the Activity**

- Develop the US National Virtual Herbarium
- Assess distribution and origins of genetic diversity in Vermont's fiddlehead fern
- Investigate the pace of regional warming on montane forests in Vermont
- Develop new strategies to control plant disease
- Protect food from contamination by pathogenic microorganisms, parasites, and naturally occurring toxins
- Study how earthworms modify the amount of organic matter in soil
- Increase our understanding on the effects of different environmental conditions as well as the mechanism of plant response
- Predict invasiveness of introduced species

**2. Brief description of the target audience**

- Agriculture: Maple producers
- Agriculture: Crop growers
- Agriculture: Farmers
- Greenhouse Growers

**V(E). Planned Program (Outputs)**

**1. Standard output measures**

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
<b>Plan</b>	{NO DATA}	{NO DATA}	{NO DATA}	{NO DATA}
<b>Actual</b>	500	1000	0	0

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

**Patent Applications Submitted**

Year: 2010

Plan:

Actual: 3

**Patents listed**

Booster Spout

Dual Spout

Method of improving maple sap yields in tubing systems

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

**Number of Peer Reviewed Publications**

2010	Extension	Research	Total
<b>Actual</b>	0	8	8

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

**Output Target**

**Output #1**

**Output Measure**

- {No Data Entered}

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

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

O. No.	OUTCOME NAME
1	Increase of regional warming on montane forests in Vermont.
2	Invasion of European and Asian earthworms to hardwood forests.
3	Effect of mid-winter high temperatures on plant survival.

## **Outcome #1**

### **1. Outcome Measures**

Increase of regional warming on montane forests in Vermont.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

General population and agricultural farming. Vegetation effects of environmental changes due to warming trends.

#### **What has been done**

Project compared the present and past tree composition of vegetation plots that were originally established in the early 1960's in order to assess changes in forests associated with regional warming trends. Research used historical aerial photographs and satellite images to determine elevational shifts in forest trees associated with regional warming trends.

#### **Results**

We detected a significant shift in forest composition and a rapid upslope shift in the ecotone between lower elevation hardwood forests and upper elevation boreal forests over the last half century. Northern hardwood trees have increased in abundance in the ecotone while boreal forests have declined. The change in forest composition and upward shift in the ecotone is consistent with regional warming trends. We have projected continuing shifts of forests to higher elevations with a general expansion of more southernly forest species and reductions in area of boreal forest.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
123	Management and Sustainability of Forest Resources

## **Outcome #2**

### **1. Outcome Measures**

Invasion of European and Asian earthworms to hardwood forests.

### **2. Associated Institution Types**

- 1862 Research

### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	0

### **3c. Qualitative Outcome or Impact Statement**

#### **Issue (Who cares and Why)**

Agricultural community; Soil fertility and plant nutrition may be affected by the action of earthworms

#### **What has been done**

A greenhouse experiment was conducted in which three earthworm treatments and one control treatment were analyzed for leached nutrients. Analyses of aggregates from these treatments are still to be carried out pending the installation of an instrument that measures the pore structure in individual soil aggregates.

#### **Results**

In a lab experiment, the common night crawler (*Lumbricus terrestris*) significantly reduces the amount of calcium leached (an element which is an essential element of lime often added to improve soil fertility). The amount of calcium leached from a treatment with a more aggressively invading worm, *Amyntas agrestis*, on the other hand maintains calcium losses at the level of the control. *Lumbricus* species, including *L. terrestris*, do not have lungs and carbon dioxide needs to be disposed of in a different form of respiration. *Lumbricus* species have the ability to fix calcium using a calciferous gland that combines calcium and carbon dioxide to make calcite, a calcium carbonate mineral that is not easily dissolved and leached. This sequesters carbon dioxide from the atmosphere into the soil. How this process changes organic matter in the soil is unknown.

### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
101	Appraisal of Soil Resources
123	Management and Sustainability of Forest Resources

### **Outcome #3**

#### **1. Outcome Measures**

Effect of mid-winter high temperatures on plant survival.

#### **2. Associated Institution Types**

- 1862 Research

#### **3a. Outcome Type:**

Change in Knowledge Outcome Measure

#### **3b. Quantitative Outcome**

<b>Year</b>	<b>Quantitative Target</b>	<b>Actual</b>
2010	{No Data Entered}	0

#### **3c. Qualitative Outcome or Impact Statement**

##### **Issue (Who cares and Why)**

Growers overwintering perennials will benefit from knowing the effect of mid-winter high temperatures and cycling on subsequent plant survival when exposed to freezing. This will enable them to save money either in plant losses, scheduling labor and covering treatments more appropriately, and saving costs and fuel in heating if not needed.

##### **What has been done**

Study examined a marginally hardy species of perennial shasta daisy (Becky) and a normally hardy selection of yarrow (Apricot Delight), both popular perennials.

##### **Results**

Result showed that in midwinter (January), even just 5 days at 16C was enough to deacclimate plants, resulting in loss in subsequent subzero soil temperatures. Returning plants to 4C during the night did not compensate for the deacclimation. There were no differences between one or two weeks held at 16C prior to subsequent freezing. Plants in a normally fluctuating greenhouse (-2 to 8C, mean 4C), continuous 4 or 2C showed no differences, all surviving similarly. This study also supported previous results that plants not sufficiently rooted had poor winter survival.

#### **4. Associated Knowledge Areas**

<b>KA Code</b>	<b>Knowledge Area</b>
203	Plant Biological Efficiency and Abiotic Stresses Affecting Plants

## **V(H). Planned Program (External Factors)**

### **External factors which affected outcomes**

- Appropriations changes
- Public Policy changes

### **Brief Explanation**

Temperature changes affect maple production. Vermont maple industry is a large economic factor. Tourism is also an important economic base for the state. The tree cover, maple and agriculture industry attracts tourists to the state.

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

### **1. Evaluation Studies Planned**

### **Evaluation Results**

{No Data Entered}

### **Key Items of Evaluation**

{No Data Entered}