

V(A). Planned Program (Summary)

Program # 5

1. Name of the Planned Program

Climate Change and Ecosystem Management

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
101	Appraisal of Soil Resources	10%		20%	
102	Soil, Plant, Water, Nutrient Relationships	0%		20%	
122	Management and Control of Forest and Range Fires	15%		20%	
123	Management and Sustainability of Forest Resources	50%		30%	
132	Weather and Climate	15%		0%	
605	Natural Resource and Environmental Economics	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Inputs)

1. Actual amount of FTE/SYs expended this Program

Year: 2012	Extension		Research	
	1862	1890	1862	1890
Plan	1.0	0.0	11.4	0.0
Actual Paid Professional	0.4	0.0	7.8	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
17292	0	40419	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
22707	0	170455	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
148406	0	1731190	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

Research and outreach is primarily carried out through the Agricultural and Forestry Experiment Station located at the University of Alaska Fairbanks. Strategies for research included annual updating databases and management systems for:

- Forest stand characterization of the Alaska boreal and coastal rain forest.
- Long-term ecosystem monitoring and GIS modeling of the boreal forest dynamics.
- Discovery of and complete predictive relationships between weather factors and growth of climate sensitive forest species in Alaska.
- Remote sensing to investigate temporal patterns of vegetation indexes in boreal Alaska.
- University of Alaska Forest
- Photo monitoring of major changes in the boreal forest due to climate change
- Wood biomass in a changing environment.

High latitude soil research concerned:

- Chronic soil moisture stress in northern forest soils in boreal regions in relation ecosystem function and carbon balance.
- Soils characterization for agricultural crop production.
- Characterization of hydric soils impacted by volcanic ash deposits.

Education and outreach activities include workshops, classes, publications and presentations concerning:

- Correlating land-based information with remotely sensed images for forestry and agriculture.
- Geographic Information Systems
- Maps and spatial data sets of long-term value
- Climate change adaptation as it relates to communities and ecosystems
- Improving STEM teaching and learning outcomes

2. Brief description of the target audience

The target audiences include producers and consumers, communities and small business entrepreneurs, individuals and groups concerned about the quality of the Alaska environment, public resource agencies, public and private resource managers, other faculty and researchers, and undergraduate and graduate students. Our efforts will be directed toward environmentally and economically sustainable development and conservation of natural resources that will benefit all citizens

and help them adapt and become resilient as the climate changes. Advisors and the target audience include: Alaska Forest Association, Society of American Foresters, and the Alaska Northern Forest Cooperative. Specifically, this program will provide new information on soil properties and classification to the USDA Natural Resource Conservation Service, the USDA Forest Service, the Alaska Department of Natural Resources, Alaska Division of Forestry, borough governments, and Alaska Native corporations.

3. How was eXtension used?

eXtension was not used in this program

V(E). Planned Program (Outputs)

1. Standard output measures

2012	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Actual	313	20000	25	0

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

Patent Applications Submitted

Year: 2012
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2012	Extension	Research	Total
Actual	0	13	13

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- Output Target 1. Soils research will concentrate on the classification of permafrost soils, soil carbon properties in relation to climate change, and soil disturbance dynamics in upland and lowland forest ecosystems. Publications are output measures.

Year	Actual
2012	5

Output #2

Output Measure

- Output Target 2. Long-term forest productivity data sets will be converted to formats compatible with existing megadata systems for compatibility with long-term ecological research, fire management, and forest disturbance dynamics. Outputs measured will be publications and data sets converted.

Year	Actual
2012	0

Output #3

Output Measure

- Output Target 3. Development of data sets providing information on wildlife and domestic (traditional and alternative) livestock impact on rangelands will continue. Output measures will be data sets developed and publications.

Year	Actual
2012	0

Output #4

Output Measure

- Output target 4. Curricula that train future and present land managers in ecosystem stability and geospatial technology will be developed and implemented. Output measure will be curricula implemented.

Year	Actual
2012	0

Output #5

Output Measure

- Output Target 5. Climate change will affect northern forest ecosystems that will impact economic development of communities and will have cultural implications as well on communities and individuals. Causes and effects of change on ecosystems and reverberations felt by communities and individuals will be investigated. The measured output will be publications.

Year	Actual
2012	0

Output #6

Output Measure

- Output Target 6. Research related to product development to include timber products and non-timber products including energy will continue. Forest management specific to fuel/energy demand will be initiated. Measureable outputs will be publications and business starts.

Year	Actual
2012	0

Output #7

Output Measure

- Output Target 7. Recreation opportunities are important in urban and rural forests and are a part of ecosystem services. Recreation management in northern ecosystems is a part of management of ecosystems research. Measurable outputs are publications.

Year	Actual
2012	0

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Outcome Target 1. Increase knowledge of arctic and subarctic soils and forest productivity among peer scientists, managers, and governments. Knowledge outcome measures will be publications, conferences, and workshops.
2	Outcome Target 2. Increase animal producer and wildlife manager knowledge on range use and animal impact. Measurable outcomes are publications, workshops, and conferences.
3	Outcome Target 3. Increase knowledge through classroom and field course delivery. The outcome measures will be curricula delivered and number of students reached.
4	Outcome Target 4. Increase community and individual knowledge on the impact of climate change in northern ecosystems and effects on cultural lifeways, economies, and individual well-being. Outcome measures will be publications, workshops, and conferences.
5	Outcome Target 5. Provide research information that leads to product development and recreational opportunities. Outcome measures will be publications, business starts, conferences, and workshops.
6	Outcome Measure 6: To increase knowledge for land owners and managers. Measures are databases, inventories, presentations and consultations.

Outcome #1

1. Outcome Measures

Outcome Target 1. Increase knowledge of arctic and subarctic soils and forest productivity among peer scientists, managers, and governments. Knowledge outcome measures will be publications, conferences, and workshops.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	8

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

As climate changes, both the history and morphology of soil data becomes increasingly important. Agency personnel at USDA NRCS, USGS, U.S. Fish and Wildlife, the Alaska Science Center and Louisiana State University, as well as international collaborators, are interested in Alaska soil data, especially in terms of hydric soils indicators in some problem areas.

What has been done

Soil morphological properties are described and evaluated according to the National Cooperative Soil Survey standards and classified accordingly in the Soil Taxonomy. Hydric (wet) soils from areas impacted by volcanic ash deposits under mixed forest in Southcentral Alaska and tundra vegetation in the Aleutian Islands were analyzed with a portable spectrometer.

Results

The Portable X-ray Fluorescence Spectrometer (PXRF) proved itself by demonstrating accurately the ability to distinguish soil matrix materials. The major findings were that these soils were misidentified as hydric but should be classified as oxyhydric. Also discovered was that the distribution of upland versus lowland vegetation on Adak Island is caused by a cemented tephra layer that impedes drainage and separates the well-drained soils on convex slopes from the poorly drained soils in concave slopes. This information about volcanic soil properties is useful to agency personnel and mining and land managers who are major stakeholders in Alaska.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources

- 102 Soil, Plant, Water, Nutrient Relationships
- 123 Management and Sustainability of Forest Resources

Outcome #2

1. Outcome Measures

Outcome Target 2. Increase animal producer and wildlife manager knowledge on range use and animal impact. Measurable outcomes are publications, workshops, and conferences.

Not Reporting on this Outcome Measure

Outcome #3

1. Outcome Measures

Outcome Target 3. Increase knowledge through classroom and field course delivery. The outcome measures will be curricula delivered and number of students reached.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Action Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	360

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

OneTree Alaska's collaborative approach brings K-12 students and teachers together with scientists, professional artists, artisans, and government-based STEM professionals to investigate diverse aspects of the local boreal forest. Teachers find that introducing science and math concepts via STEAM (STEM plus Art) is highly effective in increasing student engagement and learning outcomes. As a community of learners, students, artists, and scientists have gained a deeper appreciation of the forest while working with local materials and making observations about the natural world.

What has been done

In OneTree, K-12 students learn about the forest by conducting experiments with schoolyard trees and by making things with local resources. The project was given significant new life in late September by the Alaska State Legislature, which awarded a three-year, \$1 million Capital Improvement Project (CIP) to the state Division of Forestry. As one of the first initiatives, two

courses were offered: a K-12 teacher professional development course and a graduate student service-learning course. The two cohorts meet to discuss and plan activities that will take place throughout the year, implementing the OneTree philosophy both in and outside the classroom.

Results

OneTree is providing the model for the project's K-12 education and outreach component and proceeding as a partnership among UAF's School of Natural Resources and Agricultural Sciences (SNRAS), the Fairbanks North Star Borough School District (FNSBSD), and local artists, artisans, and homeschoolers. This partnership model spans multiple generations, helps develop youths' critical thinking skills and fosters active youth/teacher /scientist/artist partnerships.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources
132	Weather and Climate

Outcome #4

1. Outcome Measures

Outcome Target 4. Increase community and individual knowledge on the impact of climate change in northern ecosystems and effects on cultural lifeways, economies, and individual well-being. Outcome measures will be publications, workshops, and conferences.

2. Associated Institution Types

- 1862 Extension
- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	24

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

It has long been expected that the Arctic and Subarctic regions would experience climate warming from greenhouse gas processes. Recent syntheses confirm widespread, warming effects across the Arctic and Subarctic in the last 30 years. But change in Alaska is happening at a rapid rate, and coherent and consistent evidence of warming is seen in changes in hydrology,

permafrost, forests, disturbances and other features. In recent decades, the Arctic and Subarctic regions have experienced the greatest warming on earth. Everyone--from engineers to wildlife managers to farmers--will need to take economic change, social change and climate change into account when planning for the future, as well as take advantage of potential opportunities, in order to avoid costly mistakes.

What has been done

Aerial photos of the boreal forest have been collected since 1989, resulting in a collection of 12,591 pictures. This project captures a rich visual record of many of the major changes in the boreal forest of central Alaska in the past quarter-century, including the transition on burned sites from small tree regeneration to an emerging forest, and the outbreak and now decline of major waves of insect defoliation and tree death, since warm weather anomalies triggered outbreaks following a climate regime shift in the late 1970s.

Results

The tree regeneration database allows faster data entry, quicker search and retrieval of tree-specific information and fewer errors during data entry and manipulation. The collaboration through the BAKLAP project is assisting in upgrading Alaska forest research data and management practices to improve the value of Alaska's forests and to meet the rapidly expanding demand for wood biomass energy in a changing environment.

4. Associated Knowledge Areas

KA Code	Knowledge Area
101	Appraisal of Soil Resources
102	Soil, Plant, Water, Nutrient Relationships
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources

Outcome #5

1. Outcome Measures

Outcome Target 5. Provide research information that leads to product development and recreational opportunities. Outcome measures will be publications, business starts, conferences, and workshops.

Not Reporting on this Outcome Measure

Outcome #6

1. Outcome Measures

Outcome Measure 6: To increase knowledge for land owners and managers. Measures are databases, inventories, presentations and consultations.

2. Associated Institution Types

- 1862 Research

3a. Outcome Type:

Change in Knowledge Outcome Measure

3b. Quantitative Outcome

Year	Actual
2012	14

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Long-term forest measurements increase knowledge available to Alaska's land owners and managers. Climate change, very much apparent in Alaska, is affecting growth and survival of local species. Effects of increasing forest fire frequency, insect infestations and water stress through climate change are monitored.

What has been done

The 20-year assessment and inventories were completed on 156 plots and plantations in several locations in the state. Data was provided to the U.S. Forest Service for its Forest Vegetation Simulator program. Data was also shared with the State Division of Forestry inventory program; presentations were made at meetings with the Alaska Resource Managers, the Society of American Foresters, West Valley High School classes, Resource Management Society, UAF and the Matanuska-Susitna Borough. Also, 2800 hours of employment and training was provided to young forest technicians.

Results

Applied knowledge of Alaska's northern forests was increased through dissemination of data, analysis and presentation of information. The databases are available to partners on the LTER website <http://www.lter.uaf.edu/>. White spruce cubic foot volume models were distributed to and are in use by land owners and managers in northern Alaska. One Ph.D. student completed his field of study.

4. Associated Knowledge Areas

KA Code	Knowledge Area
102	Soil, Plant, Water, Nutrient Relationships
122	Management and Control of Forest and Range Fires
123	Management and Sustainability of Forest Resources

V(H). Planned Program (External Factors)

External factors which affected outcomes

- Natural Disasters (drought, weather extremes, etc.)
- Economy
- Public Policy changes
- Government Regulations
- Competing Public priorities
- Competing Programmatic Challenges
- Populations changes (immigration, new cultural groupings, etc.)

Brief Explanation

Alaska is already seeing impacts of the changing climate in its sea ice degradation, the ecology of the boreal forest and its ice-impregnated northern soils. This will influence the thrust of ecosystem management in coming years. Policy and regulation and competing public priorities are already coming to the fore as endangered species affect land use and hence management of forests and rangelands. Programmatic challenges will occur as consideration is given to the management of the forests for fuels to mitigate demands on petroleum and coal supplies. A continuing rise in transportation costs is already drawing attention to regional and local management for energy and other local wood products. Finally, as demographics of the population change and demographics of the forest industry change toward management with a specific product objective as well as an objective of sustainable and resilient northern ecosystems, there will be a need for continuing adult education and higher education to fill workforce vacancies or new positions that are created.

The School of Natural Resources and Agricultural Sciences and the Agricultural and Forestry Experiment Station are going through a reorganization and strategic reassessment. The School of Natural Resources and Agricultural Sciences, the Agricultural and Forestry Experiment Station and the Cooperative Extension Service at UAF will continue to serve the needs of the citizens of the State of Alaska.

SNRAS lost the Forest Measurement research faculty through transfer, although the research is continuing. Also lost through retirement is the Forest Hydrologist position. Replacement of these positions is uncertain.

External factors affecting implementation of the CES climate change theme include the political nature of climate change, the disparate impact from climate change in various parts of Alaska and the large portion of the state not in fee simple private ownership. Climate change impacts are most noticeable along western and northern Alaska coastal areas, along Interior Alaska rivers, near glaciers and where permafrost is melting. Aside from those sparsely populated areas, climate change is more often thought of as weather events, which Alaskans have learned to live with. The limited amount of fee simple private land in Alaska detaches some Alaskans from climate change events impacting the land and natural resources which they have no management or oversight of. Alaskans, in large part, become involved in climate change adaptation only when changes directly impact their lives. As climate change impacts to Alaska's resources and infrastructure become more

evident and directly impact Alaskans, there will be greater interest in Extension climate change programs. One of our agents is working with a climate change initiative, which grew out of an ANREP meeting and a subsequent conference. This working group is working to identify regional priorities.

V(I). Planned Program (Evaluation Studies)

Evaluation Results

Basic and applied research will soon be leading to methods of climate change adaptation and mitigation for the benefit of society living in northern ecosystems.

Key Items of Evaluation