V(A). Planned Program (Summary)

Program # 4

1. Name of the Planned Program

Climate Change

2. Brief summary about Planned Program

The arctic and subarctic zones are experiencing major impacts in the wake of global climate change. AFES and CES will play a pivotal role in research, teaching and outreach to provide information about adaptation to climate change in Alaska and northern ecosystems. Management of Alaska's boreal forest and of Southeast Alaska's temperate rainforests will play a role of increasing importance in insect and disease disturbance and adaptation. Fire management strategies, permafrost degradation and the slow rate of boreal forest growth will be taken into account. As energy continues to become a growing concern throughout the world, the boreal forest has the potential to provide products for the production of fuels alternative to petroleum and coal. The USFS Forest Inventory and Analysis Unit (FIA) for Alaska is incomplete. The economic potential of Alaska's forests is under-realized in timber and nontimber products. The forest ecosystem can play a role in diversifying the economy of Alaska. AFES will continue to provide long-term data on the characteristics of soils associated with Alaska's forests and for soils information baseline for modeling climate change, boreal forest management and temperate rain forest management. Soils are a fundamental resource, and knowledge about the cold-climate soils of Alaska is crucial for most Alaska resource management. Proper knowledge and planning of soil-disturbing activities can prevent major impacts on other resources. Under current Alaska climate variability, cold soils are experiencing significant changes that are, in turn, causing changes in natural and managed ecosystems. Proper knowledge and planning of soil-disturbing activities can prevent major impacts on other resources. Natural resource managers and other stakeholders need to understand the concepts and practices of creating, analyzing and displaying spatially referenced natural resource and human community data. Nearly all maps and most data about natural resources are now stored, shared and analyzed as digital spatial files. A critical missing component to data mapping of Alaska's forests and agricultural lands is a ground-based data connection to modeling efforts. Signatures of forest and soil types have yet to be established to allow remote data collection technology to provide accurate information of existing ground cover that ranges from the northern rain forest in Southeast Alaska, to the boreal forest of Interior Alaska, to the tundra of Northern Alaska. Basic research proposed in the Boreal Alaska: Learning, Adaptation, and Production (BAK-LAP) is wrapping up but the outreach will continue to K-12 learning, through investigations of the changing characteristics of the boreal forest. Another critical component of ecosystem management is remote sensed data applying ground-truthed measurements to create GIS mapping and climate models. Creating and interpreting models is a necessary component of today's resource planners and managers toolkit, particularly at the regional level.

3. Program existence : Mature (More then five years)

4. Program duration : Long-Term (More than five years)

5. Expending formula funds or state-matching funds : Yes

6. Expending other than formula funds or state-matching funds : Yes

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%		10%	
122	Management and Control of Forest and Range Fires	15%		10%	
123	Management and Sustainability of Forest Resources	50%		70%	
132	Weather and Climate	15%		0%	
605	Natural Resource and Environmental Economics	10%		10%	
	Total	100%		100%	

V(C). Planned Program (Situation and Scope)

1. Situation and priorities

The arctic and subarctic zones are expected to sustain the greatest impacts is tied to global climate change, which may result in warmer and drier conditions in boreal forest and coastal forest regions. The large expanse of public land in Alaska will require skilled and knowledgeable management of natural landscapes into the indefinite future. We will maintain a leadership role in examining the sensitivity of northern resources to climate variability and change and will contribute to integrated assessments of the effects of climate change to Alaska's ecosystems. In this role, ground database information will continue to be amassed and used as the basis to persuade remote sensing specialists of the need to establish indicator links for ground to remote-sensed information. This link is necessary to assure accurate information for more precise predictions of future change and impacts. State leaders will be targeted as they plan to develop both renewable and nonrenewable natural resources to contribute to the economic well-being of its citizens without compromising ecological integrity and biodiversity. To be sustainable, any development activities require knowledge of desirable practices that balance technologies and economic necessity with environmental imperatives. Concern for the health and survival of resource biodiversity will continue to be a central issue in resources management in Alaska and elsewhere. Geographic information and a link to ground data is critical to the management of vast natural resource areas. Professionals who will be future land managers will need to be conversant in technology and methodology to obtain both land and remotely sensed information. An excellent training base for these future managers is curricula that incorporate visual learning through electronic media. In view of the vast acreage in Alaska and the potentially high carbon storage capacity in the boreal forest and the potentially high release of carbon into the atmosphere as arctic soils warm, it is critical that there be an understanding of the balance of the boreal forest and tundra soils if ecological modeling is to enhance the capabilities of land managers. As the effects of climate change become more apparent, Alaskans will need to know about successful adaptation to these changes and emergency preparedness to respond to extreme weather events.

2. Scope of the Program

- In-State Extension

- In-State Research

- Multistate Research

● Integrated Research and Extension

V(D). Planned Program (Assumptions and Goals)

1. Assumptions made for the Program

The condition and productivity of Alaska's forest and wild land resources is strongly influenced by climate, which is highly variable in Alaska. Interest in climate change will remain strong and national assessments of climate and resources will be a national and international priority. We assume that in Alaska's and the circumpolar North's future knowledge of ecosystem resources, a database and data management system will be critical to allow us to:

• Evaluate and manage disturbance
• Recommend sustainable best management practices for recovery
• Develop ground-based signatures correlated to remotely sensed images
• Incorporate ground-based signatures into climate models
• Enhance product production and use
• Encourage sustainable economic development

Outreach and education are a part of AFES's and Extension's mission to assist clients in sustainable use of natural resources and ecosystem management. The teams we have and will assemble include scientists in key program knowledge areas in forest and ecosystem sciences, forest products, range management, recreation, policy and law and community development. Funding sources are becoming more available through competitive grants and community, state and federal support. Geographic information is critical to the management of vast natural resource areas. Increasingly, geographic information is derived from and transmitted using remote images. Professionals who will be future land managers will need to be conversant in technology and methodology to obtain both land and remotely sensed information. AFES will maintain programs in soil science, GIS, and ecosystem modeling that will be supported by these assumptions:

• Global climate will not remain constant and current models predict increases that will impact northern latitudes first and hardest.
• Warming climates will increase incidence and magnitude of forest fires, diseases and insect infestations in the boreal forest of Interior Alaska.
• Resource extraction of petroleum and minerals will continue and without proper management will impact Alaska's soil resources in a negative way.
• Forest management will increasingly include multiple forest products including timber, nontimber products and fuels for energy production.

Integration of this work will deliver information to managers and users of natural resources and will in turn bring information back for further program development.

2. Ultimate goal(s) of this Program

The goal of this program is the management of the biological, physical and human ecosystem to produce, conserve and enhance harvestable products and biodiversity in Alaska and the North, increase understanding about the effects of climate change adaptation as it relates to communities and ecosystems, and to improve understanding of the effects of natural resource policies and regulations on the management and health of Alaska's ecosystems. This includes:

• Sustainable biodiversity in undeveloped areas
• Long-term monitoring programs
• Data management systems to support sustainable ecosystems and communities
• Sustainable community growth

- Development of a diversity of forest products
- Development of ground-based data with indices that correlate to remotely sensed data
- Use of the indices in models that reflect the biological, physical and cultural impacts of climate change
    To attain these goals it will be necessary to develop a knowledge base that will address interactions between global warming, wild land fire, forest diseases and insect infestation, soil properties and characteristics in a forest ecosystem regime, soil carbon bioavailability, forest product development, nonextractive forest uses and community development. Work will focus on:

- Soil properties of northern forests
- Origin, formation, and classification of high-latitude soils
- Soil responses to climate change
- Long-term forest productivity data conversion and incorporation into mega data systems for compatibility with long-term ecological research, fire management, forest health, and forest ecosystem data sets
- Curricula that train future land managers in ecosystem stability and geospatial technology
- Climate change effects on northern forest ecosystems
- Federal, state, and community government policy and regulation concerning ecosystem management
- Development of a ground-based data set incorporating soils and forest types with specifics related to remotely sensed data
    This work combined with effective education and outreach will play a vital role in resource management and learning, adaptation and productivity in the face of climate change in Alaska and the circumpolar North.

V(E). Planned Program (Inputs)

1. Estimated Number of professional FTE/SYs to be budgeted for this Program

Year	Extension		Research	
	1862	1890	1862	1890
2017	1.0	0.0	4.0	0.0
2018	1.0	0.0	4.0	0.0
2019	1.0	0.0	4.0	0.0
2020	1.0	0.0	4.0	0.0
2021	1.0	0.0	2.0	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

Research and outreach strategies will include a database and data management system necessary for:

- Forest stand characterization of the Alaska boreal and coastal rain forest
- Long-term ecosystem monitoring and GIS modeling of the taiga forest dynamics
- Model of predictive relationships between weather factors and growth of climate sensitive forest species in Alaska
- Remote sensing to investigate landscape level responses in response to burn severity within black spruce ecosystems in Alaska

- Land-based data sets to correlate animal distributions on the landscape with remote images
- Precipitation control on soil moisture and its effect on boreal forest growth and carbon balance
- Agricultural land characterization including soils and crop types
- Compilation of a database on agricultural production of crops and crop residues

High latitude soil research over the next five years will center on the following research topics and activities:

- Characterization of northern forest soils in boreal regions of Alaska in terms of the organic carbon pool and relationship with forest management practices
- Soil carbon balance and nitrogen dynamics following disturbance by wildfire and logging
- Evaluation of the relationship between local climate and soil carbon balance

Research, education and outreach activities include:

- Land-based information correlation 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

2. Type(s) of methods to be used to reach direct and indirect contacts

Extension

Direct Methods	Indirect Methods
● Education Class	● Public Service Announcement
● Workshop	● Newsletters
● Group Discussion	● TV Media Programs
● One-on-One Intervention	● Web sites other than eXtension
● Demonstrations	● Other 1 (Publications)

3. Description of targeted audience

The target audience includes 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 our natural resources that will benefit all citizens and help them adapt and become resilient as the climate changes. Advisors and the target audience includes: Alaska Board of Forestry, Society of American Foresters, USDA Natural Resource Conservation Service, the USDA Forest Service, the Alaska Department of Natural Resources, borough governments and Alaska Native corporations. Information on impact of fires on soil organic matter will assist the Department of Natural Resources Division of Forestry and private landowners and managers.

V(G). Planned Program (Outputs)

NIFA no longer requires you to report target numbers for standard output measures in the Plan of Work. However, all institutions will report actual numbers for standard output measures in the Annual Report of Accomplishments and Results. The standard outputs for which you must continue to collect data are:

- Number of contacts

  - Direct Adult Contacts

  - Indirect Adult Contacts

  - Direct Youth Contacts

  - Indirect Youth Contact

- Number of patents submitted

- Number of peer reviewed publications

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(H). State Defined Outputs

1. Output Measure

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

- Output 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.

- Output 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.

- Output 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 and updated.

- Output 5. Research providing base line data for modeling timber availability will continue. Forest management specific to fuel/energy demand drives the research. Measurable outputs will be publications and presentations.

- Output 6. Recreation opportunities are important in urban and rural forests. Recreation management in Alaska are primarily tied to national and state parks and forest. Measurable outputs are publications and presentations.

☑ Clicking this box affirms you will continue to collect data on these items and report the data in the Annual Report of Accomplishments and Results.

V(I). State Defined Outcome

O. No	Outcome Name
1	Outcome 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 2. Increase knowledge through classroom and field course delivery. The outcome measures will be curricula delivered and number of students reached.
3	Outcome 3. Respond to community and individual knowledge needs 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.
4	Outcome Measure #4: Demonstrate effective collaboration between research and Extension to resolve issues.

Outcome # 1

1. Outcome Target

Outcome 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 Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Outcome 2. Increase knowledge through classroom and field course delivery. The outcome measures will be curricula delivered and number of students reached.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 122 - Management and Control of Forest and Range Fires

4. Associated Institute Type(s)

- 1862 Research

Outcome # 3

1. Outcome Target

Outcome 3. Respond to community and individual knowledge needs 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. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 122 - Management and Control of Forest and Range Fires

4. Associated Institute Type(s)

- 1862 Extension

- 1862 Research

Outcome # 4

1. Outcome Target

Outcome Measure #4: Demonstrate effective collaboration between research and Extension to resolve issues.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 101 - Appraisal of Soil Resources
- 123 - Management and Sustainability of Forest Resources
- 132 - Weather and Climate
- 122 - Management and Control of Forest and Range Fires
- 605 - Natural Resource and Environmental Economics

4. Associated Institute Type(s)

- 1862 Extension

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect 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.)

Description

Alaska is experiencing impacts of the changing climate in the degradation of sea ice, the ecology of the boreal forest and its ice-impregnated northern soils. This influences the focus of ecosystem management in coming years. Policy and regulation and competing public priorities affect land use and 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. Transportation costs continue to effect regional and local management for energy and other local wood products. Finally, as demographics of the population change and the forest industry moves toward management with a specific product objective, as well as an objective of sustainable and resilient northern ecosystems, the demand for continuing adult education and higher education to fill workforce vacancies or new positions is increasing. In this program area, AFES has lost three faculty positions and positions lost to anticipated retirements will not be replaced in the near future. This severely impacts research and education. The university has experienced budget cuts as a result of the reduction in oil revenues for the last seven years which has dramatically affected programs. UAF policy rewards external grants but disparages land grant funds and its required state match.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

The evaluation specialist will be available for program evaluation and survey assistance.