

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustainable Energy

2. Brief summary about Planned Program

Alaska's forest and agricultural resource potential for bioenergy production is immense. The economic potential of Alaska's forests is under-realized in biomass harvest, timber and non-timber products. The potential for Alaska to develop new agricultural land is also under-realized. Furthermore, agricultural lands that are currently in Conservation Reserve Program may lend themselves to sustainable production of biomass. The forest ecosystem and agricultural lands can play a role in diversifying the economy of Alaska. State leaders plan to develop both renewable and non-renewable natural resources to contribute to the economic well-being of their citizens without compromising ecological integrity and biodiversity. To be sustainable, any development activities require production practices that balance technologies and economic necessity with environmental imperatives.

AFES and CES will play a pivotal role in research, teaching and outreach, providing information about management of Alaska and northern ecosystems, the production of sustainable energy sources and new methodology for second generation energy systems. As energy continues to become a growing concern throughout the world, the boreal forest and agronomic crops of Alaska have the potential to provide fuel alternatives to petroleum and coal.

3. Program existence : New (One year or less)

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
123	Management and Sustainability of Forest Resources	20%		20%	
125	Agroforestry	20%		20%	
131	Alternative Uses of Land	20%		20%	
205	Plant Management Systems	40%		20%	
511	New and Improved Non-Food Products and Processes	0%		20%	
	Total	100%		100%	

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

1. Situation and priorities

Alaska contains vast forests and lands that have forest product and agricultural production capability. The priority is economic viability without negative impacts on existing agricultural and forestry enterprises. However, a forest inventory analysis (FIA) for Alaska is incomplete at best. Agricultural land surveys exist for most of the state, but are also not complete for Alaska. Additionally, large masses of the productive forest and agricultural lands are not within reach of current transportation infrastructure and existing electrical or power supplies.

Agricultural land surveys for Alaska are published by the USDA Natural Resource Conservation Service (NRCS). It is estimated that within the road system there are 500,000 acres of cropable lands. Grain, grass, and oilseed crops are likely candidates for energy use. The USDA National Agricultural Statistics Service (NASS) provides statistics for grain and hay. There are no statistics for oilseeds or crop residues, although amounts could be estimated. Woody biomass as a crop is also a potential energy source. There have been reasonable successes with these crops in other northern areas. Research at the University of Alaska Fairbanks in AFES is progressing. Willow, poplar, and small-diameter spruce are the species most frequently used and are included in the research.

The Western Governors' Association in the review draft of "Biomass Electric Supply Sources for the Western States" (2005) estimated biomass resources in the Western states including Alaska. The major categories included agricultural, forest, and urban biomass resources. However, much of the information regarding crop residues, energy crops, unused logging slash, primary sawmill residues, biosolids, waste water, and landfill waste had to be estimated based on an average from selected western states, calculated on a per capita or per acre basis as applicable, then extrapolated to obtain totals.

The AFES research wood scientist helped produce a report published by the National Academy of Science titled, "Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy" which addressed the biomass potential on the national level. The model developed found that it was unlikely that the goal set for biomass-based diesel to be consumed in the United States by 2022 would be met.

Much more information exists but, as stated above, is scattered and not organized in a manner specifically directed to give quantifiable answers to those with an interest in using biomass as a dedicated fuel stock. Research and subsequent education and outreach are priority concerns as we move from rough estimates to actual capabilities concerning Alaska potential for sustainable energy production.

2. Scope of the Program

- In-State Extension
- In-State Research
- Multistate Research
- Multistate Extension
- Integrated Research and Extension
- Multistate Integrated Research and Extension

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

1. Assumptions made for the Program

Alaska's forest and agricultural resource potential is immense. There is a need for research on the availability, quality and feasibility of sustainable, economic use of agricultural and forestry biomass in Alaska. Communities that do not have access to the southcentral natural gas distribution system rely heavily (75%+) on high cost petroleum based fuels to satisfy their home/space heating. Most also use

petroleum products or coal for their electrical generation needs. The negative aspects of this reliance are further compounded in relatively isolated rural and village communities by the high cost of transporting these expensive fuels to point of use.

It is this high end-use fuel cost that is driving many individuals and communities to seek alternative fuel sources, especially in the critical realm of home/space heating. Sustainable biomass energy sources are attractive because of their apparent wide distribution, abundance, proximity to affected communities, easy availability and assumed low cost (when combusted in an appropriate technology) and are being strongly considered as a means of alleviating the fuel cost dilemma.

Currently, UAF AFES in Palmer houses the bioenergy and bioproducts laboratory, with research equipment ranging from biomass gasifiers to the production of various liquid fuels from agricultural and forestry biomass. AFES has collected and archived meteorological data over a span of 100 years (the longest continuous weather record for the state) in interior Alaska. AFES has been specifically collecting wind speed and direction for over three years using a 30 m meteorological tower to accurately gauge the potential for energy generation in the Matanuska Valley. Data for solar applications was collected during 1980 - 1995. It was compiled and is available for this region from Extension. In addition, the AFES has equipment and expertise in remote sensing, and in conversion of traditional fossil fuel equipment and vehicles into electrical drives. The faculty at AFES is involved in development and delivery of upper division for-credit classes on biomass and bioenergy, sustainable energy resources and bio-products, with no overlap in scope of teaching or research with other MAUs at the UA system.

2. Ultimate goal(s) of this Program

AFES researchers and CES outreach professionals are seeking new answers in the ever-challenging field of energy production. Our goal is to better qualify/quantify biomass resources and addresses the question of availability, quality and feasibility of biomass so that it might be used in Alaska as an economic, sustainable fuel source by:

- determining the potential for biomass crops as feedstocks for energy uses by testing numerous plant species, both native and introduced.
- compiling a forestry biomass database which will help optimize forestry bioenergy production.
- determining the chemical composition of Alaska woody species as the initial step toward analyzing Alaska biomass for biorefinery applications.
- producing a liquid substance that can mesh with the existing petroleum infrastructure that will greatly enhance the transition toward a renewable energy future.
- developing by-products from a value-added biobased fuel.
- becoming prominent in information and research on alternative energy supplies and technology and energy conservation.

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
2013	0.6	0.0	2.1	0.0
2014	0.6	0.0	2.1	0.0
2015	0.6	0.0	2.1	0.0
2016	0.6	0.0	2.1	0.0

Year	Extension		Research	
	1862	1890	1862	1890
2017	0.6	0.0	2.1	0.0

V(F). Planned Program (Activity)

1. Activity for the Program

AFES researchers will concentrate primarily on yield potential of lignocellulosic crops and woody biomass and oilseed crops. If successful, this research will lead to development of "best practices" management regimes and genetics of bioenergy crops. In the future, we intend to conduct research in remote locations in Alaska to determine the feasibility of various crops in small villages where people often have little experience in agriculture. For this purpose, we will concentrate on crops likely to be successful in these situations, especially woody crops that will require little agricultural knowledge and simple technology.

AFES researchers are continuing to work on the utilization of low value biomass for fuels and chemicals, mostly through thermochemical means (gasification, pyrolysis, supercritical fluids). The chemical composition of alder, birch, hemlock, yellow cedar, Sitka spruce, red cedar, white spruce, and aspen will be evaluated for biofuel production via supercritical liquefaction. CES is working with communities on use of biomass products and with producers to develop value added forest products.

AFES researchers will seek to assimilate all existing information on the total forest and crop biomass available in Alaska into one database, determine the gaps in the database and the information needed to fill the gaps, and determine the biological, physical, and economic feasibility of using Alaska biomass as biofuels.

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

Extension

Direct Methods	Indirect Methods
<ul style="list-style-type: none"> ● Education Class ● Workshop ● Group Discussion ● One-on-One Intervention ● Demonstrations 	<ul style="list-style-type: none"> ● Public Service Announcement ● Newsletters ● TV Media Programs

3. Description of targeted audience

The target audiences include producers and consumers, communities, agriculture and forestry businesses, industry leaders, 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 include: Statewide Board of Advisors, State Board of Forestry, Society of American Foresters, Alaska Farm Bureau, 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, 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 land owners 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: Workshops, demonstrations, short courses, classes, field days, and conferences organized and conducted.
- Output 2: Bioenergy crop varieties tested.
- Output 3: Bioenergy research projects conducted.
- Output 4: Bioenergy crop and technology publications submitted.
- Output 5: Community, organizations, and one-on-one consultation concerning bio-based energy opportunities conducted.

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: Identify crops suitable for sustainable production of bio-based energy in Alaska.
2	Outcome 2: Identify new value-added by-products from bio-based energy crops and woody species.
3	Outcome 3: Compile a forestry biomass database.
4	Outcome 4: Monitor adoption of bioenergy technologies.

Outcome # 1

1. Outcome Target

Outcome 1: Identify crops suitable for sustainable production of bio-based energy in Alaska.

2. Outcome Type : Change in Knowledge Outcome Measure

3. Associated Knowledge Area(s)

- 125 - Agroforestry
- 131 - Alternative Uses of Land
- 205 - Plant Management Systems

4. Associated Institute Type(s)

- 1862 Research

Outcome # 2

1. Outcome Target

Outcome 2: Identify new value-added by-products from bio-based energy crops and woody species.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 123 - Management and Sustainability of Forest Resources
- 125 - Agroforestry
- 131 - Alternative Uses of Land
- 205 - Plant Management Systems
- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Extension
- 1862 Research

Outcome # 3

1. Outcome Target

Outcome 3: Compile a forestry biomass database.

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 # 4

1. Outcome Target

Outcome 4: Monitor adoption of bioenergy technologies.

2. Outcome Type : Change in Action Outcome Measure

3. Associated Knowledge Area(s)

- 511 - New and Improved Non-Food Products and Processes

4. Associated Institute Type(s)

- 1862 Research

V(J). Planned Program (External Factors)

1. External Factors which may affect Outcomes

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

Description

Alaska is the harbinger of climate change in the North. The region 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 to meet demands in energy and ecosystem management fields.

V(K). Planned Program - Planned Evaluation Studies

Description of Planned Evaluation Studies

The objective of the AFES and Extension is to set in place a feedback loop that brings information from our units to our clientele and to bring clientele input back to us to enable us to continue to adjust our work, within the capabilities of our space and budgets, to meet the needs of the people of Alaska.