

V(A). Planned Program (Summary)

Program # 7

1. Name of the Planned Program

Sustainable Energy

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	0%		20%	
125	Agroforestry	0%		20%	
131	Alternative Uses of Land	0%		20%	
205	Plant Management Systems	0%		20%	
511	New and Improved Non-Food Products and Processes	0%		20%	
	Total	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	2.4	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	338958	0
1862 Matching	1890 Matching	1862 Matching	1890 Matching
0	0	202324	0
1862 All Other	1890 All Other	1862 All Other	1890 All Other
0	0	216118	0

V(D). Planned Program (Activity)

1. Brief description of the Activity

AFES researchers will concentrate primarily on yield potential of lignocellulosic crops as well as evaluate oilseed crops as bioenergy crops in Alaska. 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, which 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. Brief description of the target 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, Alaska Forest Association, Society of American Foresters, Alaska Farm Bureau, and the Alaska Northern Forest Cooperative.

V(E). Planned Program (Outputs)

1. Standard output measures

2010	Direct Contacts Adults	Indirect Contacts Adults	Direct Contacts Youth	Indirect Contacts Youth
Plan	{NO DATA}	{NO DATA}	{NO DATA}	{NO DATA}
Actual	0	0	0	0

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

Patent Applications Submitted

Year: 2010
 Plan:
 Actual: 0

Patents listed

3. Publications (Standard General Output Measure)

Number of Peer Reviewed Publications

2010	Extension	Research	Total
Actual	0	0	0

V(F). State Defined Outputs

Output Target

Output #1

Output Measure

- 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.

Year	Target	Actual
2010	{No Data Entered}	4

Output #2

Output Measure

- Determine the potential for biomass crops as feedstocks for energy uses by testing Alaska grown plant species. Measure will be species tested.

Year	Target	Actual
2010	{No Data Entered}	3

Output #3

Output Measure

- Determine chemical composition of Alaska woody species for biomass to biofuel production.

Year	Target	Actual
2010	{No Data Entered}	3

V(G). State Defined Outcomes

V. State Defined Outcomes Table of Content

O. No.	OUTCOME NAME
1	Identify crops suitable for sustainable production of bio-based energy in Alaska. The measure is number of crops.
2	Identify new value-added uses for by-product from bio-based energy crops and woody species. Measure is publications.

Outcome #1

1. Outcome Measures

Identify crops suitable for sustainable production of bio-based energy in Alaska. The measure is number of crops.

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}	27

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Fuel costs are high in Alaska and especially in remote areas of rural Alaska. Currently in northern rural villages fuel is as much as \$8.50 per gallon in spite of the fact that Alaska produces and exports large quantities of crude oil. Alternative energy sources need to be developed in wind, solar, and biomass. Several communities in the boreal forest region of Alaska are considering using biomass for fuel, but there is a question of sustainability due to slow tree growth. Communities outside boreal forested regions could use other hardwoods and willows. Grass and forb species are found throughout the state.

What has been done

Cultivation techniques are being developed for production and management of species suitable for biomass fuel that could ultimately lead to development of a sustainable, renewable biomass energy resource in Alaska. Field research grass plots have been established in Fairbanks and in Delta Junction for smooth brome grass, hairgrass and wheatgrass, as well as willow spacing and coppicing studies. Fall and spring harvests were compared. The higher yields for wheatgrass were likely because it stood up better under snow than other species. At both locations, harvesting twice produced similar yields to a single harvest at the end of the growing season, indicating no advantage to a two harvest management regime.

Results

A preliminary study at Fairbanks showed comparable yields for tall fireweed and better yields for bluejoint reedgrass, both species native to the area. No yields are yet available for woody species as the first harvest is not scheduled until fall 2011. It is too early to provide impacts for this project. Expected impacts include provision of management information for farmers and communities wishing to grow biomass crops for energy use in high latitude environments.

4. Associated Knowledge Areas

KA Code	Knowledge Area
205	Plant Management Systems
511	New and Improved Non-Food Products and Processes

Outcome #2

1. Outcome Measures

Identify new value-added uses for by-product from bio-based energy crops and woody species.
Measure is publications.

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}	4

3c. Qualitative Outcome or Impact Statement

Issue (Who cares and Why)

Energy costs in Alaska are the highest in the nation, with Native and remote communities being the most affected. Alaska's 180 remote villages are paying 10% of their annual income for diesel fuel at \$8/per gal. The available forest resources include small diameter, non-merchantable species, including fire killed and beetle killed biomass that has no commercial value. Most rural communities in Alaska lack transportation infrastructure that most of the states enjoy, which results in energy costs being prohibitively expensive. This biofuel program is providing urgently needed research support and educational outreach to find alternatives to fossil fuels.

What has been done

Pyrolysis was used to produce and characterize liquid and gaseous hydrocarbons derived from local small diameter trees. Characterization of black spruce and alder was conducted. Small scale pyrolysis for molecular modeling was conducted. Large scale pyrolysis of alder was conducted. Downdraft gasification was used as a means of producing combustible gases to run a small electric generator unit. Characterization and optimization of the gasification parameters was based on available small diameter trees. Characterization of alder syngas was conducted. Small scale pyrolysis for molecular modeling was conducted. Large scale Gasification of alder was conducted.

Results

Pyrolysis oil from small diameter alder was sent to Thermochem Recovery International in Baltimore, MD, for helping this startup gasification Fisher-Tropsch company address tar scrubbing issues. We are still in the early stages of this research. Several stakeholder groups have toured

the bioproducts facilities, and invited talks have been given to local schools. Videos of the gasification process have been shown to several stakeholders. Work on renewable based hydrocarbons was presented at the Chena Hot Springs Energy Fair. Gasification of alder and other biomass work was presented at an ACS National Conference.

4. Associated Knowledge Areas

KA Code	Knowledge Area
123	Management and Sustainability of Forest Resources
131	Alternative Uses of Land

V(H). Planned Program (External Factors)

External factors which affected outcomes

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

Brief Explanation

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, changing weather patterns, and its ice-impregnated northern soils. This will influence the thrust of agriculture in coming years. Changes in state and federal policy and regulation will affect appropriations to the university and the economy of the state of Alaska. Current energy dialogue in the state centers on oil and gas despite discussions of alternate energy. Should a successful proposal for a gas line be announced, this will inject jobs and dollars into Alaska and most likely change priorities from an increasing focus on using alternative forms of energy that are regionally produced to, once again, export of a raw resource.

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

1. Evaluation Studies Planned

- After Only (post program)
- Retrospective (post program)
- Before-After (before and after program)
- During (during program)
- Comparisons between program participants (individuals, group, organizations) and non-participants
- Comparisons between different groups of individuals or program participants experiencing different levels of program intensity.
- Comparison between locales where the program operates and sites without program intervention

Evaluation Results

Key Items of Evaluation