School of Natural Resources & Agricultural Sciences

Agricultural & Forestry Experiment Station

Annual Report 2010-11

Geography Awareness Week, hosted by the UA Geography Program, a department of SNRAS, included an event on Nov. 19 at the UAF Wood Center based on the theme "Geography: the Adventure in Your Community." Pearl Creek Elementary School fourth grade teacher Mary Maisch brought a huge 3-D map of Alaska her students made. The detailed relief map featured rivers, mountain ranges, parks, forests, cities and villages.

Photo by Nancy Tarnai

This report is published by the Agricultural and Forestry Experiment Station, University of Alaska Fairbanks. For more information about our research and education programs, please contact us at:

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www.uaf.edu/snras

Changes of address or requests for free copies of our publications should be addressed to:

SNRAS/AFES Publications & Information Services
P.O. Box 757200
Fairbanks, AK 99775-7200

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Subscriptions to our annual research magazine, *Agroborealis,* are available free of charge. The annual report, *Agroborealis*, research progress reports, circulars, bulletins, and other publications are available in alternative formats. You may download them from our website at:

www.uaf.edu/snras/publications/

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Deirdre Helfferich

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Webmaster
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UAF UNIVERSITY OF ALASKA FAIRBANKS

Contents:

Letter from the dean:

October 31, 2012

The Honorable Sean Parnell
Governor of Alaska
P.O. Box 110001
Juneau, Alaska 99811-0001

Dear Sir:

I submit herewith the annual reports from the Agricultural and Forestry Experiment Station, School of Natural Resources and Agricultural Sciences, University of Alaska Fairbanks, for the period ending December 31, 2011. This is done in accordance with an act of Congress, approved March 2, 1887, entitled, "An act to establish agricultural experiment stations, in connection with the agricultural college established in the several states under the provisions of an act approved July 2, 1862, and under the acts supplementary thereto," and also of the act of the Alaska Territorial Legislature, approved March 12, 1935, accepting the provisions of the act of Congress.

The research reports are organized according to our strategic plan, which focuses on high-latitude soils, high-latitude agriculture, natural resources use and allocation, ecosystems management, and geographic information. These areas cross department and unit lines, linking them and unifying the research. We have also included in our financial statement information on the special grants we receive. These special grants allow us to provide research and outreach that is targeted toward economic development in Alaska. Research conducted by our graduate and undergraduate students plays an important role in these grants and the impact they make on Alaska.

Very respectfully,

Carol E. Lewis
Dean and Director

AFES Statement of Purpose:

The Alaska Agricultural and Forestry Experiment Station (AFES) provides new information to manage renewable resources at high latitudes, and to improve technology for enhancing the economic wellbeing and quality of life at these latitudes. While foresters, farmers, and land managers use our research results, all Alaskans benefit from the wise use of land resources. Our research projects are in response to requests from producers, industries, and state and federal agencies for information in plant, animal, and soil sciences; forest sciences; and resources management.

Experiment station scientists publish research in scientific journals, conference proceedings, books, and in experiment station bulletins, circulars, newsletters, research progress reports, and miscellaneous publications. Scientists also disseminate their findings through conferences, public presentations, workshops, and other public information programs.

Administratively, AFES is an integral part of the School of Natural Resources and Agricultural Sciences at the University of Alaska Fairbanks. This association provides a direct link between research and teaching. Scientists who conduct research at the experiment station also teach, sharing their expertise with both undergraduate and graduate students.

Graduate students take a tour of the Toolik Field Station. Here, Duke University doctoral student Amanda Koltz explains her research on wolf spiders to Natural Resources Management 102 course students: Survey of Field Research and Methods.

Photo by Kimberley Maher

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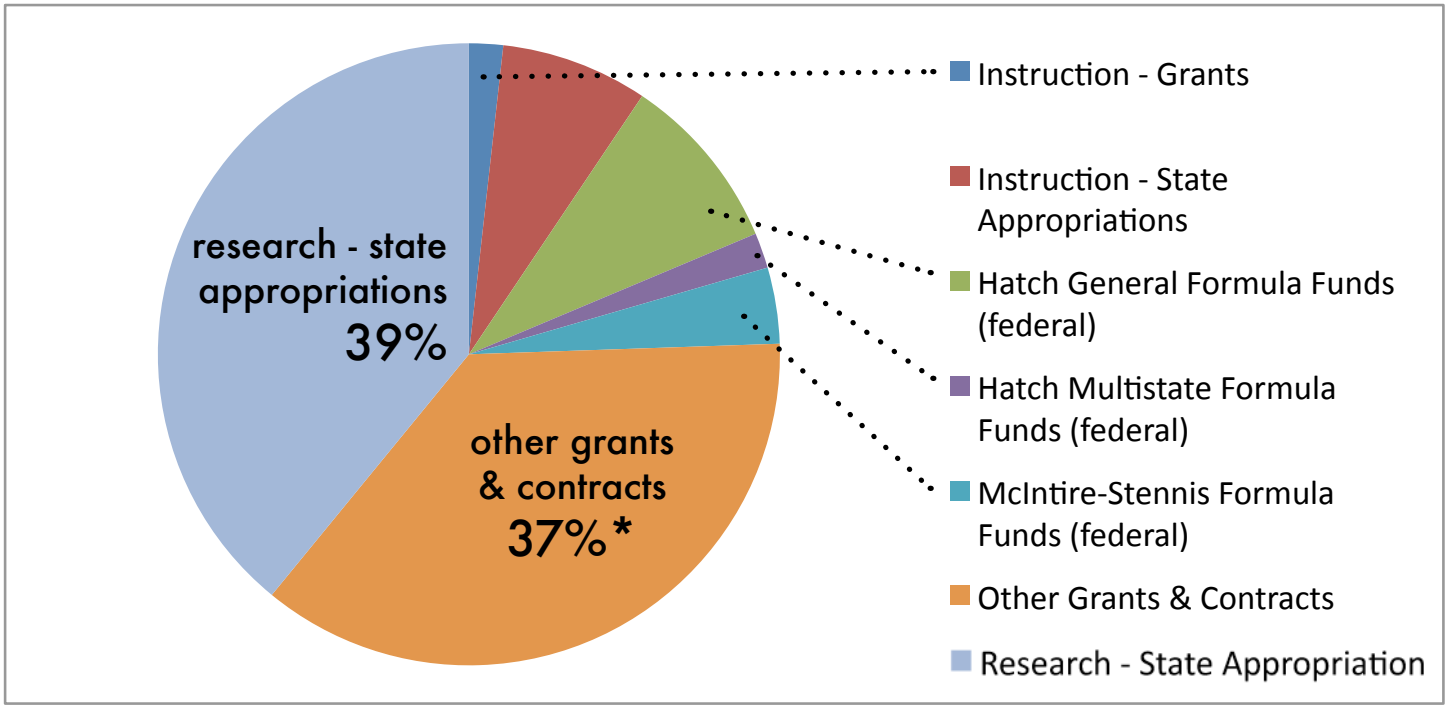
Financial statements

FY12 Expenditures: July 2011 through June 2012

The following statement of expenditures of federal and state funds for the fiscal year beginning July 1, 2011 and ending June 30, 2012 (FY 12) is not an accounting document.

Instruction - Grants	$	221,662.34	2% of total
Instruction - State Appropriations	$	957,253.20	7%
Hatch General Formula Funds (federal)	$	1,160,209.30	9%
Hatch Multistate Formula Funds (federal)	$	230,543.68	2%
McIntire-Stennis Formula Funds (federal)	$	495,544.22	4%
Other Grants & Contracts	$	4,569,963.00	37%*
Research - State Appropriation	$	4,897,292.95	39%
Total Funds:	**$**	**12,532,468.69**	100%

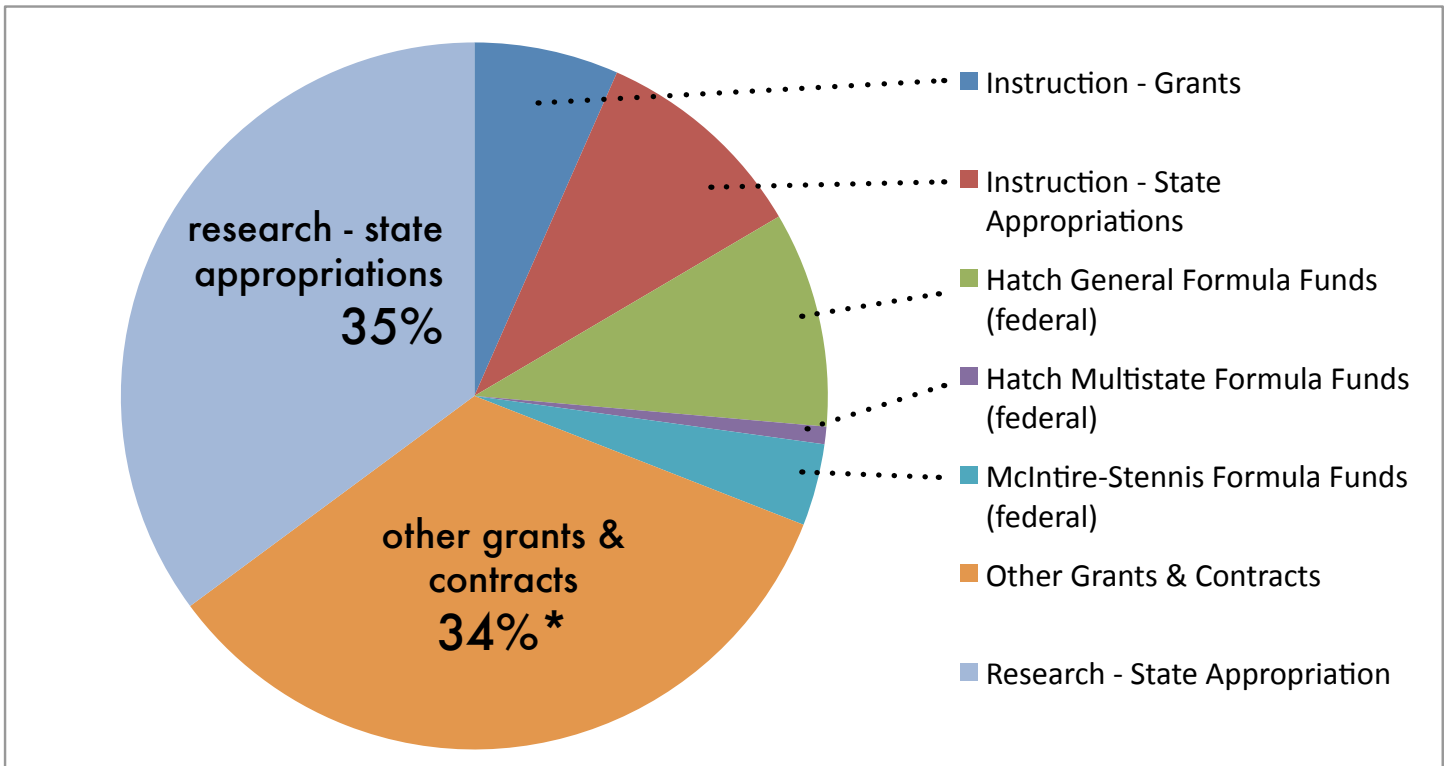


*Other Grants & Contracts (37%):
includes $509,279 in Special Grants from USDA and $502,392 in Public Service grants

FY11 Expenditures: July 2010 through June 2011

The following statement of expenditures of federal and state funds for the fiscal year beginning July 1, 2010 and ending June 30, 2011 (FY 11) is not an accounting document.

Instruction - Grants	$	878,365.85	6% of total
Instruction - State Appropriations	$	1,317,805.45	10%
Hatch General Formula Funds (federal)	$	1,309,597.55	10%
Hatch Multistate Formula Funds (federal)	$	106,363.57	1%
McIntire-Stennis Formula Funds (federal)	$	498,296.84	4%
Other Grants & Contracts	$	4,508,026.73	34%*
Research - State Appropriation	$	4,667,542.79	35%
Total Funds:	**$**	**13,285,998.78**	100%



* Other Grants & Contracts (34%):
includes $270,765 in Public Service grants and $786,868 in USDA Special Grants.

Grants

Grant Funds for 2011

GRANTS & CONTRACTS / SPECIAL FUNDS

Title	PI	Funding Agency
Collaborative Research: Scaffolding Undergraduate Geoscience Inquiry Using New Loggable Google Earth Explorations	Bailey	National Science Foundation
UAF Forest Products Program	Barber	USDA - National Institute of Food & Agriculture
ESA: Genetics	Cronin	State of Alaska
AK Terrestrial Genetics	Cronin	State of Alaska
Reindeer Meat Production	Finstad	Bureau of Indian Affairs
Satellite Telemetry as Reindeer Mgt Tool	Finstad	Natural Resources Conservation Service
Visitor Satisfaction	Fix	Bureau of Land Management
Lime Hills Ecoregional Assessment	Fresco	Bureau of Land Management
ARRA Task Order	Fresco	Nature Serv Foundation
Strategies for Sustainable Livestock Production	Greenberg	National Institute of Food & Agriculture
Children's Health Living	Greenberg	National Institute of Food & Agriculture
Unimak Island Caribou & Habitat Study	Harris	Fish & Wildlife Service
Tundra in Transition	Harris	US Fish & Wildlife Service
Fire History in the Steese/White Mountains	Juday	Bureau of Land Management
AGA Core Operations	Kennedy	National Geographic Foundation
FY11 Hatch	Lewis	USDA - National Institute of Food & Agriculture
FY11 Hatch MS	Lewis	USDA - National Institute of Food & Agriculture
FY11 McIntire-Stennis	Lewis	USDA - National Institute of Food & Agriculture
AK Food Policy	Lewis	State of Alaska
New Crops for Alaska	Lewis	USDA - National Institute of Food & Agriculture
AK Berries: New Products and New Markets	Lewis	USDA - National Institute of Food & Agriculture
Community Approach to Math	Lipka	Alaska Gateway School District
Community Approach to Math	Lipka	Yupiit School District
Math in a Cultural Context	Lipka	Yupiit School District
Relict Sane Dunes and Climate	Mann	Bureau of Land Management
Create Model of Glacier Bay	Mann	National Park Service
AK Disease Free Seed Potato for Export	McBeath	AK Department of Commerce
National Database of UA Soil Data	Ping	University of Idaho
Monitoring permafrost degradation	Ping	Natural Resources Conservation Service
Strategies for Sustainable Livestock Production	Rowell	USDA - National Institute of Food & Agriculture
Climate-Driven Shrub Expansion and Bird Habitat	Rupp	US Geological Survey

Variables Contributing to Fire in Alaska	Rupp	National Park Service
Modeling Caribou Winter Habitat	Rupp	US Geological Survey
Alaska Climate Science Center	Rupp	US Geological Survey
Climate Change Information, Analysis, and Capacity Building—Scenarios Network for Alaska and Arctic Planning	Rupp	Wilburforce Foundation
UA Downscaling	Rupp	US Geological Survey
Identifying Mechanisms of Change	Rupp	University of Florida
Paleoecological analysis	Rupp	Neptune and Co.
Post Fire Tundra Succession	Rupp	US Geological Survey
Integrated Ecosystem Model for Alaska	Rupp	US Geological Survey
Alaska Center for Climate Assessment and Policy (ACCAP) Renewal 2011	Rupp	National Oceanic & Atmospheric Association
Wildland Fire Science Delivery	Rupp	Department of the Interior
Nature Serve REA Task Order for AK	Rupp	Nature Serv Foundation
Vulnerability Assessment of the Tongass National Forest	Rupp	USDA - Forest Service
Strategies for Sustainable Livestock Production	Shipka	USDA - National Institute of Food & Agriculture
Forest Products Program	Soria	USDA - National Institute of Food & Agriculture
Educating AK Agricultural Professionals	Sparrow	USDA: SARE
Evaluation of major crop yield potential and nitrogen leaching under scheduled irrigation in the Delta Junction area of Alaska	Zhang	Delta-Salcha Soil & Water Conservation Service
Soil Nutrient Testing in Delta	Sparrow	Natural Resource Conservation Service
Wildland Fire Science Delivery and Outreach in Alaska	Trainor	Bureau of Land Management
Alaska Center for Climate Assessment and Policy (ACCAP) Renewal 2011	Trainor	National Oceanic & Atmospheric Association
Developing Coastal & Marine Planning and Decision Support Tools for Alaska and the US Arctic	Trainor	State of Alaska
Climate-Induced Impacts and Assessment in Alaska: Partnership for National Climate Assessment, Alaska Region	Trainor	US Geological Survey
Climate Change Information, Analysis, and Capacity Building-Scenarios Network for Alaska and Arctic Planning	Trainor	Wilburforce Foundation
Evaluation of the Joint Fires Science Consortia	Trainor	University of Nevado, Reno
Vulnerability Assessment of the Tongass National Forest	Trainor	USDA - Forest Service
Alaska Center for Climate Assessment and Policy (ACCAP) Renewal 2011	Trainor	National Oceanic & Atmospheric Association
Project of Forest Growth & Yield in Coastal Alaska	Verbyla	USDA - Forest Service
Herbicide Carryover	Zhang	USDA: Agriculture Resource Service
Peony Production w. Organ Amend	Zhang	USDA: Agriculture Resource Service
Laboratory and Field Evaluation of Whitehorse Biochars	Zhang	Yukon College
Evaluation of major crop yield potential and nitrogen leaching under scheduled irrigation in the Delta Junction area of Alaska	Zhang	Natural Resources Conservation Service
Experimental Study of Various Techniques to Protect Ice Rich Cut Slopes	Zhang	AK Department of Transportation

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FORMULA FUNDING, FEDERAL OCT 1 TO SEPT 30 FISCAL YEAR 2012

Hatch Multistate		
Balancing Natural Resource Recreation Mgt, ALK-09-07	Fix	USDA - National Institute of Food and Agriculture
Rangeland Fragmentation W 1192, ALK-07-07	Harris	USDA - National Institute of Food and Agriculture
Commercial greenhouse NE-1035, ALK-09-05	Karlsson	USDA - National Institute of Food and Agriculture
Regional Administration W-106, ALK-99-05	Lewis	USDA - National Institute of Food and Agriculture
Reproductive Performance, W 2112, ALK-12-03	Shipka	USDA - National Institute of Food and Agriculture
Nitrogen Mineralization NC 1032, ALK-07-08	Zhang	USDA - National Institute of Food and Agriculture
Hatch General		
Commercial Reindeer Meat Production, ALK-10-08	Finstad	USDA - National Institute of Food and Agriculture
Balancing Natural Resource Recreation Mgt, ALK-09-07	Fix	USDA - National Institute of Food and Agriculture
Natural Resources & Economic Sustainability, ALK -08-02	Greenberg	USDA - National Institute of Food and Agriculture
Rangeland Fragmentation W 1192, ALK-07-07	Harris	USDA - National Institute of Food and Agriculture
Livestock production on small acreages, ALK 10-03	Harris	USDA - National Institute of Food and Agriculture
Horticultural Crop Production for AK, ALK-08-01	Holloway	USDA - National Institute of Food and Agriculture
Laws Affecting Environment, ALK -05-01	Joly	USDA - National Institute of Food and Agriculture
Legal Conflicts in NRM, ALK 10-05	Joly	USDA - National Institute of Food and Agriculture
Controlled Environment Horticulture for AK, ALK -07-06	Karlsson	USDA - National Institute of Food and Agriculture
Commercial greenhouse NE-1035, ALK-09-05	Karlsson	USDA - National Institute of Food and Agriculture
Potato Phytoplasms in Alaska, ALK-07-13	McBeath	USDA - National Institute of Food and Agriculture
Hydric Soils Monitoring, ALK -09-02	Ping	USDA - National Institute of Food and Agriculture
Reproductive Performance, W 2112, ALK-12-03	Shipka	USDA - National Institute of Food and Agriculture
Season Extension for Market Garden Production, ALK-08-04	Smeenk	USDA - National Institute of Food and Agriculture
Lignocellulosic Energy Crops, ALK-08-03	Sparrow	USDA - National Institute of Food and Agriculture
Issues in Resource Planning in Alaska, ALK-09-01	Todd	USDA - National Institute of Food and Agriculture
Alternative Agronomic Crops for AK, ALK-08-06	Zhang	USDA - National Institute of Food and Agriculture
Nitrogen Mineralization NC 1032, ALK-07-08	Zhang	USDA - National Institute of Food and Agriculture
McIntire-Stennis		
Evapotranspiration from Boreal Forest, ALK-05-04	Fox	USDA - National Institute of Food and Agriculture
Climate Sensitivity of Tree Growth, ALK-07-12	Juday	USDA - National Institute of Food and Agriculture
Biomass pyrolysis and chemical feedstocks, ALK 10-10	Soria	USDA - National Institute of Food and Agriculture
Sensitivity of Carbon Budgets, ALK-07-11	Valentine	USDA - National Institute of Food and Agriculture
Landscape Fire Interactions in Black Spruce ALK-05-03	Verbyla	USDA - National Institute of Food and Agriculture
Remotely Sensed Vegetation Index, ALK 10-09	Verbyla	USDA - National Institute of Food and Agriculture
The Dynamics of Forest Growth, ALK-06-04	Yarie	USDA - National Institute of Food and Agriculture
Measurement & Mgt of Boreal Forest, ALK-09-08	Yarie	USDA - National Institute of Food and Agriculture

Grant Funds for 2010

GRANTS & CONTRACTS / SPECIAL FUNDS

Title	PI	Funding Agency
Collaborative Research: Scaffolding Undergraduate Geoscience Inquiry Using New Loggable Google Earth Explorations	Bailey	National Science Foundation
UAF Forest Products Program	Barber	USDA National Institute of Food & Agriculture
ESA in Alaska-Mammal Genetics	Cronin	State of Alaska
Enhance Reindeer Range Management	Finstad	Natural Resource Conservation Service
Visitor Satisfaction 2010	Fix	Bureau of Land Management
Estimating Visitor Use	Fix	National Park Service
CESU Army Corp of Eng Start UP	Fix	Army
Alaska Residents Statistics Program	Fix	USDA - Forest Service
Canadian Biome Shift Analysis	Fresco	The Nature Conservancy
Alaska Biome Shift	Fresco	US Fish & Wildlife Service
Climate Change Planning	Fresco	National Park Service
Climate Change on the National Petroleum Reserve	Fresco	Bureau of Land Management
Yukon Future Water Availability	Fresco	Yukon College
Great Bear Lake	Fresco	Deline Renewable Resource Council
Matanuska Sports Turf Field	Harris	UA Foundation
Yukon River Basin Study	Juday	US Geological Survey
Sustainable Horticulture Research	Karlsson	UA Foundation
National Geographic Giant Traveling Map	Kennedy	UA Foundation
Alaska Geographic Alliance	Kennedy	National Geographic Foundation
AGA Strategic Planning	Kennedy	National Geographic Foundation
FY10 Hatch	Lewis	USDA - National Institute of Food & Agriculture
FY10 Hatch MS	Lewis	USDA - National Institute of Food & Agriculture
FY10 McIntire-Stennis	Lewis	USDA - National Institute of Food & Agriculture
New Crops for Alaska	Lewis	USDA - National Institute of Food & Agriculture
AK Berries: New Products and New Markets	Lewis	USDA - National Institute of Food & Agriculture
Community Approach to Math	Lipka	AK Gateway School District
Community Approach to Math	Lipka	Yupiit School District
Indigenous Ways of Understanding Math	Lipka	National Science Foundation
Potato Seed Lot Testing	McBeath	AK Division of Agriculture
National Database of UA Soil Data	Ping	University of Idaho
Modeling Caribou Winter Habitat	Rupp	US Geological Survey
Climate-Driven Shrub Expansion and Bird Habitat	Rupp	US Geological Survey
Variables Contributing to Fire in Alaska	Rupp	National Park Service
Alaska Climate Science Center	Rupp	US Geological Survey
Wildland Fire Science Delivery	Rupp	Department of the Interior
Agricultural Development in the American Pacific	Rupp	Cooperative State Research Service
Nature Serve REA Task Order for AK	Rupp	Nature Serv Foundation
Vulnerability Assessment of the Tongass National Forest	Rupp	USDA - Forest Service
Building Alaska Garden Soil	Smeenk	USDA: SARE
Educating AK Agricultural Professionals	Smeenk	USDA: SARE
Elemental Carbon, Nitrogen & Hydrogen for Biomass & Biofuel	Soria	USDA - National Institute of Food & Agriculture

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Soil Nutrient Testing in Delta	Sparrow	Natural Resource Conservation Service
Wildland Fire Science Delivery and Outreach in Alaska	Trainor	Department of the Interior
Evaluation of the Joint Fires Science Consortia	Trainor	University of Nevado, Reno
Climate Change Information, Analysis, and Capacity Building-Scenarios Network for Alaska and Arctic Planning	Trainor	Wilburforce Foundation
Project of Forest Growth & Yield in Coastal Alaska	Verbyla	USDA - Forest Service
Measuring Changes in Lake Surface Kobuk Valley National Park	Verbyla	National Park Service
Laboratory and Field Evaluation of Whitehorse Biochars	Zhang	Yukon College

FORMULA FUNDING, FEDERAL OCT 1 TO SEPT 30 FISCAL YEAR 2011

Hatch Multistate

Balancing Natural Resource Recreation Mgt, ALK-09-07	Fix	USDA - National Institute of Food & Agriculture
Rangeland Fragmentation W 1192, ALK-07-07	Harris	USDA - National Institute of Food & Agriculture
Commercial greenhouse NE-1035, ALK-09-05	Karlsson	USDA - National Institute of Food & Agriculture
Regional Administration W-106, ALK-99-05	Lewis	USDA - National Institute of Food & Agriculture
Reproductive Performance, W 1112, ALK-06-06	Shipka	USDA - National Institute of Food & Agriculture
Mgt of Sustainable Cellulosic Biofuel Crops WERA 1016	Sparrow	USDA - National Institute of Food & Agriculture
Nitrogen Mineralization NC 1032, ALK-07-08	Zhang	USDA - National Institute of Food & Agriculture

Hatch General

Feed and forage for reindeer meat quality, ALK 04-07	Finstad	USDA - National Institute of Food & Agriculture
Commercial Reindeer Meat Production, ALK-10-08	Finstad	USDA - National Institute of Food & Agriculture
Balancing Natural Resource Recreation Mgt, ALK-09-07	Fix	USDA - National Institute of Food & Agriculture
Natural Resources & Economic Sustainability, ALK -08-02	Greenberg	USDA - National Institute of Food & Agriculture
Rangeland Fragmentation W 1192, ALK-07-07	Harris	USDA - National Institute of Food & Agriculture
Horticultural Crop Production for AK, ALK-08-01	Holloway	USDA - National Institute of Food & Agriculture
Laws Affecting Environment, ALK -05-01	Joly	USDA - National Institute of Food & Agriculture
Controlled Environment Horticulture for AK, ALK -07-06	Karlsson	USDA - National Institute of Food & Agriculture
Commercial greenhouse NE-1035, ALK-09-05	Karlsson	USDA - National Institute of Food & Agriculture
Potato Phytoplasms in Alaska, ALK-07-13	McBeath	USDA - National Institute of Food & Agriculture
Hydric Soils Monitoring, ALK -09-02	Ping	USDA - National Institute of Food & Agriculture
Reproductive Performance, W 1112, ALK-06-06	Shipka	USDA - National Institute of Food & Agriculture
Season Extension for Market Garden Production, ALK-08-04	Smeenk	USDA - National Institute of Food & Agriculture
Lignocellulosic Energy Crops, ALK-08-03	Sparrow	USDA - National Institute of Food & Agriculture
Issues in Resource Planning in Alaska, ALK-09-01	Todd	USDA - National Institute of Food & Agriculture
Barley and Bromegrass yield, AK 04-03	Zhang	USDA - National Institute of Food & Agriculture
Alternative Agronomic Crops for AK, ALK-08-06	Zhang	USDA - National Institute of Food & Agriculture
Nitrogen Mineralization NC 1032, ALK-07-08	Zhang	USDA - National Institute of Food & Agriculture

McIntire-Stennis

Evapotranspiration from Boreal Forest, ALK-05-04	Fox	USDA - National Institute of Food & Agriculture
Climate Sensitivity of Tree Growth, ALK-07-12	Juday	USDA - National Institute of Food & Agriculture
Sensitivity of Carbon Budgets, ALK-07-11	Valentine	USDA - National Institute of Food & Agriculture
Landscape Fire Interactions in Black Spruce ALK-05-03	Verbyla	USDA - National Institute of Food & Agriculture
The Dynamics of Forest Growth, ALK-06-04	Yarie	USDA - National Institute of Food & Agriculture
Measurement & Mgt of Boreal Forest, ALK-09-08	Yarie	USDA - National Institute of Food & Agriculture

Students

degrees offered

Bachelor's degrees

Bachelor of Science:

- Geography, options in environmental studies, landscape analysis and climate change studies, or geographic information science and technology
- Natural Resources Management, with options in high-latitude agriculture, forest sciences, or humans and the environment

Bachelor of Arts:

- Geography

Master's degrees:

- Master's of Science in Natural Resources Management
- Master of Natural Resources Management and Geography
- Interdisciplinary Master

Doctoral degrees:

- Doctor of Philosophy in Natural Resources and Sustainability
- Interdisciplinary Doctor of Philosophy*

**coordinated with the Graduate School*

five-year statistics: number of students enrolled, 2007-2011 (majors)

Academic Year	PhD (Sustainability)	PhD (Interdisciplinary)	MS NRM	MS / MA (Interdisc.)	MNRM&G	BS Geography	BA Geography	BS NRM
2007	0	11	26	5		20	19	67
2008	0	11	30	4		21	25	60
2009	2	11	34	1		25	25	65
2010	7	10	36	4	7	34	26	71
2011	13	6	30	3 MS / 1 MA	3	16	14	54

Natural Resources Management 101 students participate in the "Commons Game" where they learn the value of managing resources wisely.
Photo by Nancy Tarnai

Graduates as of May 2010

Summary

39 undergraduate degrees conferred

- BA, Geography: 14
- BS, Geography: 16
- BS, Natural Resources Management: 9
  - Forestry: 1
  - Plant, Animal, and Soil Sciences: 5
  - Resources: 2
  - Interdisciplinary: 1

4 graduate degrees conferred

- Masters in Natural Resources Management and Geography: 1
- MS, Natural Resources Management: 3

Baccalaureate Degrees

Matthew S. Balazs, *cum laude*, BS, Geography: Geographic Information Science and Technology; Landscape Analysis and Climate Change Studies; and *cum laude*, BA, Geography. Golden Key Honor Society

Kasey Lynne Brovold, BS, Geography

David Dunbar, BA, Geography

Hannah Lee Vancouver Harrison, BS, Natural Resources Management: Resources

Ellen Walford Hatch, *magna cum laude*, BS, Natural Resources Management: Plant, Animal, and Soil Sciences. Honors Program. Golden Key Honor Society

Joseph C. Kendall,** BS, Natural Resources Management: Resources

Cori May Kindred, BA, Geography

Tamara S. Lozano, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Christine A. McLean, BS, Geography: Environmental Studies

Robert Michael Mikol,** BS, Geography: Landscape Analysis and Climate Change Studies

Anne Marie Miller, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Amanda J. Peacock,** BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Katherine Elizabeth Riffey, BS, Natural Resources Management: Geographic Information Science and Technology; Landscape Analysis and Climate Change Studies

Matthew H. Sprau, BS, Natural Resources Management: Forestry

Nicole Lynn Swensgard, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Molly Ann Timm, *cum laude*, BA, Geography. Golden Key Honor Society

Master's Degrees

Jennifer Lynn Jenkins,** MS, Natural Resources Management.
BS, Adams State College (Colorado), 1998

Jill Erin Maynard, MS, Natural Resources Management.
BS, Oregon State University, 2001

Ellen Trainor, MS, Natural Resources Management. Golden Key Honor Society.
BS, University of Prince Edward Island (Canada), 2001

Graduates as of May 2011

Summary

31 undergraduate degrees conferred

- BA, Geography: 11
- BS, Geography: 4
- BS, Natural Resources Management: 16
  - Forestry: 1
  - Plant, Animal, and Soil Sciences: 13
  - Resources: 2

3 graduate degrees conferred

- MS in Natural Resources Management: 3

Baccalaureate degrees

Adrian Travis Baer, BA, Geography, *and* BS, Geography, Environmental Studies

Taylor Lynn-Marie Beard,** *cum laude*, BS, Natural Resources Management: Plant, Animal, and Soil Sciences. Golden Key Honor Society

Brittany Lynn Billingsley,** *cum laude*, BA, Geography

Jace William Bures, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Charles David Caster, *magna cum laude*, BS, Natural Resources Management: Resources

Daniel Patrick Coleman, BS, Natural Resources Management: Forestry

Lorna Lee Curran, BS, Geography: Landscape Analysis and Climate Change Studies

Sheila Bernice Dailey, BS, Geography

Sabrena Louise Gneiting, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Brianna M. Graves, BS, Natural Resources Management

Daniel David Hazen,* BS, Geography: Landscape Analysis and Climate Change Studies

Quintan M. Hecimovich,** BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Heidi L. Isernhagen, BA, Geography

James Willard Mills, BA, Geography

Jill Marie Mullen, BA, Geography

Ryan Christopher Peterson, BA, Geography

Cody Josiah Priest, BS, Geography: Geographic Information Science and Technology

Shannon Pearce adjusts the tassel of Kirsten Woodard just prior to UAF commencement, May 15, 2011.
Photo by Nancy Tarnai

Amy Lee Douglas Rath,** BS, Geography: Landscape Analysis and Climate Change Studies

Ray Dan Sabo, BS, Natural Resources Management: Resources

Nina Dee Schwinghammer, BS, Geography: Landscape Analysis and Climate Change Studies

William Tad Sigman, *cum laude*, BA, Outdoor Recreation Management: Interdisciplinary Program

Molly Ann Timm,* BA, Geography (see Graduates 2010)

James Riley Ward, BS, Natural Resources Management: Plant, Animal, and Soil Sciences

Vincent Lee Waters, BS, Natural Resources Management: Resources

Alesha Lark Weiland,** *cum laude*, BS, Geography: Environmental Studies

Kirsten M. Woodard, *magna cum laude*, BS, Natural Resources Management: Plant, Animal and Soil Sciences

Master's Degrees

Thomas Malone, 2011, MS Natural Resources Management

Thesis title: A Path toward Improved Management of the Northern Forests of Alaska: Forest Inventory, Bark Thickness, and Stem Volume

BS, University of Alaska Fairbanks, 1995

Rehanon Pampell,** 2011, MS, Natural Resources Management

Thesis title: Survey of *Bombus* Species (Hymenoptera: Apidae) Near Agricultural Lands in Interior Alaska

BS, Kentucky Wesleyan College, 2008

Jackson Clifford Fox**
MS, Natural Resources Management

BS, University of Alaska Fairbanks, 2006
BA, University of Alaska Fairbanks, 2007
BS, University of Alaska Fairbanks, 2007

Marie Elizabeth Heidemann**
MNRMG, Natural Resources Management and Geography

BS, University of Iowa, 2005

David Randolph Hite, Jr.
MNRMG, Natural Resources Management and Geography

BBA, Cleveland State University (Ohio), 1997

** Summer degree recipient*

*** December degree recipient*

Research at SNRAS & AFES

The school and experiment station pursue their missions with faculty in four departments: High Latitude Agriculture; Forest Sciences; Resources Management; and Geography. Research is also done in cooperation with the Agricultural Research Service and the Boreal Ecology Cooperative Research Unit. Crossing departments and units are five areas of emphasis: 1) geographic information; 2) high-latitude agriculture; 3) high-latitude soils; 4) management of ecosystems; and 5) natural resources use and allocation.

Partners and Collaborators

Agricultural Research Service

The Subarctic Agricultural Research Unit of the US Department of Agriculture (USDA) Agricultural Research Service (ARS) is hosted at the School of Natural Resources and Agricultural Sciences. (ARS was closed in Alaska in 2012.)

www.ars.usda.gov

Alaska Center for Energy and Power

The Alaska Center for Energy and Power (ACEP), based at the University of Alaska, is dedicated to applied energy research and testing, with programs in wind-diesel, hydrokinetic, and diesel applications. The center is focused on lowering the cost of energy throughout Alaska and developing economic opportunities for the state, its residents, and its industries.

www.uaf.edu/acep/

Alaska Community Agriculture Association

This is a group of Alaska farmers and gardeners who grow and sell produce for direct sale to the public. Its members are committed to promoting, supporting, and working toward healthy, sustainable local food systems.

www.alaskacommunityag.org/

Alaska Peony Growers Association

This organization is made up of the state's peony growers, who are working to grow high-latitude peonies for the international market.

www.akpeonygrowers.blogspot.com

Alaska Center for Climate Assessment & Policy

The Alaska Center for Climate Assessment and Policy assesses the socio-economic and biophysical impacts of climate variability in Alaska, and makes this information available to local and regional decision makers, in an effort to improve the ability of Alaskans to adapt to a changing climate.

www.uaf.edu/accap/

Alaska Climate Change Strategy

Formed in September 2007, the Alaska Climate Change Strategy is a subcabinet that advises the Office of the Governor on preparation and implementation of Alaska climate change strategy. It seeks to be of use to Alaskans by conveying state plans for adaptation to warming as well as presenting realistic approaches to mitigating the root causes of climate change.

www.climatechange.alaska.gov/

Boreal Ecology Cooperative Research Unit (BECRU) USDA Forest Service

This unit facilitates conservation and informed management decisions by conducting research to improve knowledge of high-altitude and high-latitude ecosystems. It provides support and coordinates and organizes research at the Bonanza Creek LTER and other research programs. Major research areas are biodiversity, climate/disturbance interactions, hierarchical scaling of processes, and improved forest harvest outcomes. The Alaska Region Forest Service works with the public to manage more than 22 million acres in southcentral and southeast Alaska. The Alaska Region of the Forest Service is a leader in protecting the land's bounty while providing a place for people to work and play.

www.fs.fed.us/r10/ • *www.becru.uaf.edu/*

Chena Hot Springs Renewable Energy Center

The vision at Chena Hot Springs Resort is to become a self-sufficient community in terms of energy, food, heating, and fuel use. The resort is developing renewable energy and sustainable development projects and is forming partnerships within the community and across the US to promote and implement renewable technologies.

www.chenahotsprings.com

Cold Climate Housing Research Center

CCHRC is an industry-based, nonprofit corporation created to facilitate the development, use, and testing of energy-efficient, durable, healthy, and cost-effective building technologies for Alaska and the world's cold climate regions. The research center was conceived and developed by members of the Alaska State Home Builders Association.

www.cchrc.org

Cooperative Ecosystem Studies Unit Network

The North and West Alaska Cooperative Ecosystem Studies Unit is a network of federal agencies, universities, and other organizations that have united in order to better facilitate research in local and regional ecosystems. The University of Alaska hosts the NWA-CESU, with the University of New Hampshire and the Alaska SeaLife Center as partners. Research

focuses on arctic and subarctic anthropology, landscapes, ecology, archaeology, and physical and biological sciences.

www.uaf.edu/snras/cesu/

Cooperative Extension Service

The UAF Cooperative Extension Service is the state's gateway to its university system, serving 60,000 Alaskans annually, and providing a link between Alaska's diverse people and communities by interpreting and extending relevant university, research-based knowledge in an understandable and usable form to the public.

www.alaska.edu/uaf/ces/

EPSCoR: Alaska Experimental Program to Stimulate Competitive Research

Alaska EPSCoR is a university-state partnership which builds Alaska-based research and addresses national scientific priorities, training students for the twenty-first century technologically based workforce. EPSCoR aims to strengthen science and technology infrastructure for enhanced research competitiveness in universities, for broader participation of students in science, mathematics, and engineering, and for increased linkages among higher education, government agencies, and the private sector.

www.alaska.edu/epscor/

Google Earth

Millions of people use Google Earth and Google Maps to explore the world. Google Earth Outreach gives nonprofits and public benefit organizations knowledge and resources. Google sent a team of Googlers to Alaska who are passionate about education and whose goal is to make tools like Google Earth more accessible to educators.

www.earth.google.com

Kawerak Reindeer Herders Association

The Kawerak Reindeer Herders Association provides assistance to its twenty-one members in the development of a viable reindeer industry, by enhancing the economic base for rural Alaska and improving the management of the herds. The program offers administrative, logistical, advocacy, and field support toward the development of a self-sustaining reindeer industry.

www.kawerak.org

National Geographic Society

The National Geographic Society's Education Foundation funds an alliance in every state. The UAGP is the home of the Alaska Geographic Alliance, and receives teaching materials which are distributed to schools throughout the state. The AGA participates in Geography Action!, Geography Awareness Week, My Wonderful World, the Giant Traveling Map program, NGS Summer Institutes, and the State Geographic Bee.

www.nationalgeographic.com/education/alliance

Pike's Waterfront Lodge

The lodge turns over its greenhouse during the growing season to FFA students and university researchers who use the facilities to grow vegetables hydroponically. Nightly educational seminars are offered all summer, and produce is served at restaurant facilities at the lodge. FFA members sell extra produce to the public at the greenhouse. All proceeds benefit FFA.

www.pikeslodge.com

Programs

Alaska Residents Statistics Program

This program seeks to identify common recreation management information needs among federal and state agencies, using surveys in an ongoing effort to gather data, with a core set of questions remaining consistent over time and additional questions regarding specific issues asked on a rotating basis. The goals are to decrease redundancy in data gathering efforts and develop a shared database on recreation trends in Alaska. Data sought to date includes information on travel patterns, participation in outdoor recreation activities, and broad measures of benefits received from recreation on public lands in Alaska. Possible future surveys may gather data on detailed use information for specific sites, economic impacts, attitudes toward land management issues, and value orientations held by Alaskans on natural resource issues.

www.uaf.edu/snras/facilities-programs/alaska-resident-statistic/

Bonanza Creek Long-Term Ecological Research (LTER) program

This research program is located in the boreal forests of interior Alaska. Ecological research is conducted at two main facilities, Bonanza Creek Experimental Forest and Caribou-Poker Creeks Research Watershed. The LTER program is supported and hosted by the University of Alaska Fairbanks and the USDA Forest Service, Pacific Northwest Research Station in Fairbanks, Alaska. Major funding is provided by the National Science Foundation. The LTER program focuses on improving understanding of the long-term consequences of changing climate and disturbance regimes in the Alaska boreal forest by documenting the major controls over forest dynamics, biogeochemistry, and disturbance and their interactions in the face of a changing climate.

www.lter.uaf.edu

Controlled Environment Agriculture Laboratory (CEAL) program

Basic to highly technical controlled environment systems—from temporary cold frames and high tunnels to facilities using technology originally developed for space exploration and missions to Mars—can be adapted to Alaska's regional conditions to improve production of vegetables, berries, and floral crops. Controlled environment and

greenhouse research at CEAL investigates plant requirements, varieties, and treatments to maximize productivity and efficiency. The laboratory facility allows for precise control of lighting, temperature, humidity, and nutrients, so that different varieties and various production techniques can be tested. The new West Ridge greenhouse now under construction will allow research in a technologically advanced greenhouse starting spring 2012.

www.uaf.edu/snras/facilities-programs/controlled-environment-ag/

Forest Dynamics & Management program

Providing the people of Alaska with scientifically accurate information by monitoring the growth and change of the northern forests is the major purpose of the UAF Program of Forest Dynamics and Management. With a goal of best-practice forest management, UAF researchers in this program seek to provide the best scientific information to help land managers and owners with decision making. By setting up a system of permanent plots for long-term monitoring, foresters are providing data for growth and yield models. Nearly 200 plots are being actively studied in the Tanana Valley, Copper River Valley, Matanuska-Susitna Valley, and Kenai Peninsula. The growth models of major tree species define the density and diversity of the forests, and measure site index, growth equations, volume equations, and levels of growing stock. Research is focused on simulation and optimization, forest health, wildland fires, and climate change. In addition to charting the growth and health of forests, the program identifies forest characteristics and regeneration properties. UAF forestry specialists offer free consultations on forest management to all Alaskans, including Native corporations and the forest industry.

www.uaf.edu/snras/facilities-programs/forest-dynamics-managemen/

Global Learning and Observations to Benefit the Environment (GLOBE) program

GLOBE is a worldwide, hands-on, primary and secondary school-based science and education program. It promotes and supports students, teachers, and scientists to collaborate on inquiry-based investigations of the environment and the dynamics of the Earth system, working in close partnership with NASA and National Science Foundation Earth System Science Projects. The Alaska GLOBE program was established in 1996 through the Center for Global Change and Arctic Systems Research at the University of Alaska Fairbanks.

www.cgc.uaf.edu/Globe/default.html

Georgeson Botanical Garden

This nationally recognized botanical garden is part of the Fairbanks Experiment Farm, and is a member of a national network of educational and research institutions dedicated to plant culture and conservation. In 2006 the GBG was the recipient of the All-America Selections Display Garden Exemplary Education Award. The GBG is one of five botanical gardens in the nation to be a satellite test garden for

AFES photo by Nancy Tarnai

the International Hardy Fern Foundation. Garden staff test more than 1,000 trees, shrubs, and herbaceous perennials for hardiness each year, including Alaska native plants and those collected from China, Russia, and Iceland. The garden serves as a location for variety trials of annual flowers, vegetables, herbs, and fruits, where researchers conduct experiments on new horticultural crops for Alaska's conditions, such as peonies.

www.georgesonbg.org/

MapTEACH

MapTEACH is developing a culturally responsive geoscience education program for middle- and high-school students in Alaska that emphasizes hands-on experience with the geosciences and spatial technology (GPS, GIS, and remote sensing imagery). The project draws upon the combined expertise of teachers, education researchers, remote sensing specialists, geoscience professionals, Native elders, and others with traditions-based knowledge. Participants work directly with local experts and Alaska Division of Geological & Geophysical Survey scientists to authentically emulate scientific activities at a novice level, using real data in a real-world setting. Students and teachers have access to locally and culturally relevant geospatial IT curriculum facilitated by web-served imagery, geographic information systems data, analysis tools, and field resources.

www.mapteach.org

Math in a Cultural Context

Math in a Cultural Context is a supplemental elementary school math series. The math modules that compose MCC are the result of a collaboration of educators, Yup'ik elders and teachers, mathematicians and math educators, and Alaska school districts. This culturally relevant curriculum also includes traditional stories that accompany the math modules. This collaboration produces culturally relevant materials that connect local knowledge to school knowledge, and includes integrated materials (literacy, geography, and science). The reform-oriented curriculum is designed for Alaska students, has been extensively studied, and meets the highest research standards. Studies of its efficacy repeatedly show that MCC students outperform comparable control group students who use their regular math curriculum. It is one of the very few curricula for Alaska Native and Native American students that show such powerful results.

www.uaf.edu/mcc/

OneTree Alaska

OneTree, a community outreach and research project coordinated by the UAF Forest Products Program (see below), explores art and science through connections to a single tree. OneTree is based on an earlier project by the same name which got its start in 1998, when a single large oak was felled in the National Trust estate of Tatton Park in Cheshire, England. The OneTree project aims to show the unique value of woodlands and wood products by demonstrating the volume and quality of work that can be made from one tree. By focusing on a common goal—full utilization of a single tree—OneTree unleashes the breadth of creativity in its participants. OneTree creates collaborations among area schools, the university, and community artists and artisans. As a curriculum-building project, OneTree utilizes the Alaska boreal forest as the basis for active learning and inquiry investigations into science, social studies, and the arts.

www.onetreealaska.org

Reindeer Research Program

The Reindeer Research Program is dedicated to the development and promotion of the reindeer industry on the Seward Peninsula and throughout Alaska. Researchers work closely with producers to develop and conduct research projects that can be applied directly to their operations. Outreach is a significant part of the program, which has strong ties to communities and schools across Alaska. Research includes meat science, animal health, range management and nutrition, use of satellite telemetry in herding, and many other production and management issues unique to the far north.

http://reindeer.salrm.uaf.edu

Resilience and Adaptation Program (RAP)

This program integrates several disciplines to address the question of sustainability, emphasizing ecology, economics, and culture: three critical factors for understanding interactions between people and their biotic environment in a regional system. It is part of a national effort to produce new models for graduate learning, the Integrative Graduate Education and Research Traineeship (IGERT) program of the National Science Foundation. RAP trains scholars, policymakers, and managers to address regional sustainability issues in an integrated fashion.

www.uaf.edu/rap/

Scenarios Network for Alaska & Arctic Planning (SNAP)

SNAP is a collaborative network of University of Alaska personnel and stakeholders from state, federal, and local agencies, industry and business partners, and nongovernmental organizations. The SNAP team, consisting of people with expertise in computer programming, database management, GIS and remote sensing, statistical analysis, and public communications, provides direct support to researchers and collaborators to create scenarios of future conditions in Alaska for more effective planning.

www.snap.uaf.edu

UAF Forest Products Program (Wood Utilization Research [WUR])

The long-term objective of the Forest Products Program is to help Alaska become competitive in the value-added forest products industry by providing specific technical,

business, and marketing assistance. Proposals for new markets and new value-added products must take into account such economic factors as high costs of labor and transportation. Program research can potentially increase the volume of wood and nontimber forest products produced and marketed from Alaska's forests.

www.uaf.edu/snras/facilities-programs/forest-productswood-utili/

Research Sites & Facilities

Delta Junction Field Research Site

This 360-acre site near Delta Junction provides space for research on agronomy and forestry, soil fertility, grain variety trials, grass biomass studies, and tree provenance studies.

Fairbanks Experiment Farm

The farm was established in 1906 and operations began in 1907. It includes 260 acres of cropland and pasturage and 50 acres of forest land for research and demonstration projects. The pasture supports a research herd of 75 to 100 reindeer (see Reindeer Research Program). The farm houses a red barn, a 65-foot high grain handling facility, a feed mill, maintenance shop, combination greenhouse and agronomy lab, a controlled environment agriculture lab, two residences, and several storage facilities. Researchers conduct experiments on soil fertility, nutrient cycling, grains, grasses, and other agronomic crops, woody biomass crops, and new crops such as canola, camelina, and sunflowers.

www.uaf.edu/snras/afes/fairbanks-experiment-farm/

Agricultural Soils Research Laboratory

The Agricultural Soils Research Laboratory (ASRL) is located in the O'Neill Building on West Ridge at the University of Alaska Fairbanks. The laboratory supports research and teaching conducted by Dr. Steve Sparrow and Dr. Mingchu Zhang and other UAF researchers. It is also used for research in partnerships with federal and state agencies. ASRL is used to conduct plant and soil sample analyses for studies that are primarily in the areas of 1) biofuels using oilseed crops such as canola, camelina, sunflowers, and other plants, and biomass research on woody and grass plants; 2) nitrogen and phosphorus cycling in cold soil; 3) evaluating traditional soil laboratory procedures and developing new and more accurate nutrient analysis better suited for colder high latitude soils; 4) analysis of Alaska sources of organic nutrient amendments for organic food production; and 5) developing new diagnostic tools for peony nutrition. The laboratory has use of an Astoria Pacific rapid flow analyzer, a Shimadzu organic carbon analyzer, spectrophotometers, a Horiba fluorometer, Ankom fiber analyzers, pH meters, incubators, and other laboratory equipment. ASRL has the capacity for soil and plant sample preparation as well as analysis. It supports field research conducted at the Fairbanks Experiment Farm, the Delta Junction Field Research Site, the Matanuska Experiment Farm, and many other field research locations throughout Alaska. Researchers from the Institute of Arctic Biology, Institute of Water Resources, Geophysical Institute, Alaska Center for Energy and Power, State of Alaska Division of Agriculture, Natural Resource Conservation Service, USDA Agricultural Research Service, US Fish and Wildlife, Alaska Department of Fish and Game and internationally Ag Canada have used the equipment in this laboratory.

Climate and Tree-Ring Laboratory

The CTRL conducts state-of-the-art tree ring studies at UAF. Much of the scientific consensus about climate change is based on tree ring data. With their annual or seasonal resolution, widespread occurrence, and multiple measurable properties, tree rings are one of the best sources of information about past climates and ecosystem conditions. UAF was involved in the early development of tree-ring research. More recently, it was one of the first academic institutions to develop a focus on climate change and has contributed important and widely recognized results in climate and tree-ring research. Many challenging questions remain in the far north in this time of rapid environmental change, such as net boreal forest uptake or release of carbon, reconstruction of past climates, and forest growth. International research groups, federal agencies, and state institutions are increasing their demand for Alaska tree-ring sample preparation, measurement, analysis, and archiving related to climate change issues and to the multiple applications of tree-ring analysis such as the earth sciences and archaeology.

www.uaf.edu/snras/facilities-programs/climate-tree-ring-laborat/

Forest Soils Research Laboratory

The Forest Soils Laboratory (FSL), established in 1966, is located in the O'Neill building on West Ridge at the University of Alaska Fairbanks, and includes a laboratory equipped to carry out a wide array of physical, chemical, and biological analyses of soil and plant tissues, a shop, and office space. The FSL also maintains three trucks, two ATVs, a snowmachine, and three boats to access field sites. Research conducted by the FSL provides information that aids understanding tree growth, forest development, and soil processes in the unique environment of subarctic Alaska. Emphasis is placed on physical, chemical, and biological soil properties and processes in relation to tree growth and forest development. This is done through the study of nutrient cycles (dynamics of chemical elements required by plants) in selected forest types. Much of the research carried out at FSL is conducted on a cooperative basis with other university institutes and departments, including the Boreal Ecology Cooperative Research Unit of the USDA Forest Service, particularly in conjunction with the ongoing Bonanza Creek Long-Term Ecological Research (LTER) program funded by the National Science Foundation. Approximately thirty active field study sites are located in areas broadly representative of the major vegetation types encountered in interior Alaska, ranging from the most highly productive (birch, aspen, balsam poplar

and white spruce, all of potential economic importance) to the most widespread (black spruce, which experiences the greatest impact from fire in interior Alaska). Many sites are jointly maintained with the Bonanza Creek LTER program.

Palmer Center for Sustainable Living

The Palmer Center for Sustainable Living (PCSL) honors the history of the Alaska Agricultural Experiment Station in the Matanuska Valley while providing a vision for the future. It embraces an expanding urban community while retaining the adventurous and independent spirit of the frontier regarding self-sufficiency and the forging of new trails and byways. The PCSL offers a complete academic program for natural resource management and agricultural sciences while also serving as the administrative unit for the Matanuska Experiment Farm, Kerttula Hall, and the future home of the Matanuska Colony History Center. The definition of agriculture worldwide has changed to include more than traditional agriculture. Today agricultural research also relates to forest products, urban landscaping, sports turf, agrotourism and recreation, lake and stream management for fish habitat, and nutrition and habitat for wildlife. The current academic program focuses on environmental studies and sustainable agriculture.

www.uaf.edu/snras/afes/palmer-research-extension/

Kerttula Hall

Kerttula Hall is the centerpiece of our education and research programs in southcentral Alaska. It is the center for many outreach, educational, and research partnerships with other educational institutions and state and federal agencies. Kerttula Hall houses the UAF Soils and Forage Analysis Laboratory, the only public soils lab in the state, and is the headquarters for faculty whose fields range from soil science to plant ecology to wood chemistry. Its location offers a connection to the largest transportation and communications hub in Alaska, and it serves as an important center for southcentral students who are studying to become leaders dealing with the natural resource management and environmental issues facing Alaska.

Renewable-Based Hydrocarbons Laboratory

This new facility focuses on the production of renewable hydrocarbons from biomass using thermochemical processing techniques. The efficient and sustainable use of biomass in Alaska is being addressed through gasification and liquefaction research involving agronomic and forest crops. By controlling the reaction conditions, adding or subtracting chemicals, changing pressures and temperatures, biomass is modified into a mixture of gas, solid, and liquid hydrocarbons. Researchers are investigating ways to convert the chemicals into more familiar types of hydrocarbons, analogous to petroleum. Biomass is the only renewable resource that can produce hydrocarbons. These substances, like those in petroleum, have the potential to be refined into fuel, plastics, resins, lubricants, synthetic medicines, and thousands of other hydrocarbon-based products. Obtaining them from biomass will not only provide Alaskans with a sustainable source for these compounds and help decrease dependence on petroleum, it should also provide the state with new industries.

https://sites.google.com/a/alaska.edu/jasoria/berd-biomass-energy-r-d-lab

Matanuska Colony History Center

Historically, the Matanuska Colony emphasized the importance of reliable food supplies in southcentral Alaska and early research from this facility lead directly to founding of the colony. The historic, pre-1930, buildings of the PCSL will eventually contain a library, a conference center, and faculty offices in addition to the distance delivery center currently housed in the yellow Mess Hall building linking us to the rest of the world. These structures are an important reminder of the state's agricultural history and its potential for the future.

Matanuska Experiment Farm

Since 1917 this farm has provided a site in southcentral Alaska for agricultural and natural resource research. Today the farm continues its history of agricultural research, education, and outreach with work in controlled environments, field horticulture, forage production, organic farming, animal production, turfgrass, and wildlife nutrition. The farm includes 260 acres of cleared, cultivated land and 700 acres of forest land for research and demonstration purposes. There are also field facilities, including barns and feed storage, for research on soils, plants, and animals with a complete complement of farm equipment to produce and harvest grain, forage (both hay and baleage), and other crops. The facility also includes a modern headhouse and four greenhouse units, each 1,100 sq. ft., of which three are heated. The farm connects to properties managed by the Matanuska-Susitna Borough, UAA Mat-Su College, UA Lands, and Alaska State Parks, and coordinates with them on management of an existing, heavily-used trail system known as the Matanuska Greenbelt Trails.

The historic Herdsman's House, formerly known as the South or Ericksen Cottage, on the Matankuska Experiment Farm.
Photo by Norm Harris

Research Highlights

Research Highlights 2010

Integrated pest management for Alaska agriculture–2010

Alberto Pantoja, Dennis Fielding, Jeff Conn, Steve Seefeldt (ARS)

purpose

Since 1973, the winter temperatures in Alaska have increased by 2-3°C resulting in increased concentrations of insects and diseases and renewed attention to the development of the potential of agricultural expansion in the circumpolar region. However, information on biological properties of high latitude pests (weeds, diseases, and insects), pest interaction with crops, and knowledge of best pest management practices for agricultural and natural areas in arctic/subarctic regions is lacking, poorly documented, or not well developed. There is a need for increased research to improve management and to understand the biology of invasive plants, diseases, and insect pests in subarctic regions. The Subarctic Agricultural Research Unit (ARS) is the only unit of the United States Department of Agriculture's Agricultural Research Service that addresses arctic and subarctic Integrated Pest Management (IPM) research strategies. Primary goals are to develop effective, economical pest management strategies with a minimum of adverse environmental impacts. Objectives include identification of insect pests of agricultural importance; prediction of pest damage; development of cultural practices for the integrated management of weeds and grasshoppers; evaluation of the ecological impact of weeds; and preventing the establishment of new invasive pests in Alaska. The work on IPM will contribute to enhanced productivity, profitability, and environmental quality of Alaska's farming industry and natural resource areas by reducing threats posed by insect pests, weeds, and pathogens through research and technology transfer resulting in new and innovative IPM strategies.

The overarching goal of this project is to develop new knowledge to increase the understanding and management of the biology and ecology of non-indigenous invasive plants and insect pests in subarctic agricultural systems, especially in plant hardiness zones not found in the conterminous United States. The proposed research program is designed to provide integrated pest management technologies for weed and insect control in subarctic environments to support the expansion of state, national, and international agriculture. Our research and development programs provide user-friendly, economical, and environmentally acceptable technologies for pest management in subarctic environments. The technologies developed in Alaska will be relevant to other countries in subarctic environments. The research agenda is derived from discussions with collaborating scientists, Alaska producers, and state and federal agencies. This will be achieved by accomplishing the following objectives: 1) Monitor and map the distribution and spread of weeds and invasive plants in high-latitude agricultural systems and immediately adjoining natural land for patterns of diversity, origin, and spread, to provide strategies for integrated weed management programs in a changing climate; 2) Determine expanding habitats of select insect pests and insect vectors, including grasshoppers as a model, to elucidate the impact of landscape and climate variables on IPM strategies for sustainable, high-latitude agricultural systems.

approach, progress, and impact

Herbicide selection is not only based on controlling the weed. Orange hawkweed is a troublesome invasive weed in pastures and open fields in Alaska. ARS researchers in Fairbanks determined that two herbicides, Aminopyralid and Clopyralid, were very effective at controlling orange hawkweed. Aminopyralid is best used where grasses are the desirable vegetation, whereas Clopyralid, which does not control as many broadleaf plant species, would be best in areas where maintaining species diversity is desired. Selection of the most appropriate herbicide should not be based solely on its impact on the intended weed species.

Weed seeds can survive for years in the cold soils of Alaska. Weed seeds that can survive for years in soils can cause problems in the future. ARS researchers in Fairbanks, Alaska determined that 12 of 17 weed species still had viable seed after being buried for 25 years in soils around Fairbanks. Variability was high between replicates showing that some seed burial sites are safer than others for continuing seed viability. The results of this research highlight the importance of developing long-term strategies for the control of weeds in cold climates.

Grasshoppers may become an annual occurrence in northern regions with changing climate. Currently, grasshopper eggs in this region require two years to hatch. Cohorts in odd-numbered years are sparse, whereas cohorts of even-numbered years are abundant. ARS researchers from Fairbanks developed prediction models indicating that an increase of 3 to 4°C in summer temperatures will be result in a significant proportion of the grasshopper population switching to a one-year life cycle, causing a breakdown of the alternate-year population dynamics.

Wireworms from Interior Alaska are different than Palmer. Wireworms are becoming more of a problem in potato producing areas, especially where potatoes are seasonally rotated with grasses, like in interior Alaska. ARS entomologist from Fairbanks determined the species composition and seasonal biology of adult elaterids associated with potato

production at two localities in interior Alaska: Fairbanks and Delta Junction. The species composition was different between localities; in spite of the highest insect trap catch recorded, insect counts in Fairbanks remained low during most of the season, indication the pest low economic importance under the study area. This represents the first long term report on species diversity of elaterids in potatoes from interior Alaska and the first time elaterids have been shown associated with potatoes in Delta Junction.

Potato seed

This is part of a collaborative research project with Jeff Smeenk of SNRAS. Seven non-commercial producers collaborated with UAF and ARS researchers in a sentinel potato study to grow five varieties of certified seed potatoes in communities around Alaska. During 2009 research sites were inspected for virus symptoms. None of the plants at any site exhibited virus symptoms. While no potatoes had aphids, 60 aphids were collected from nearby plants. The ARS entomology team identified the aphids as members of the Euceraphis (18%), Myzus (63%), and Macrosiphum (18%) genera.

A colored-flesh potato study was initiated in 2010. Replicated trials were established at six sites and demonstration plots were established at twelve additional sites to determine both the adaptability of the material and the consumer acceptance of the new material. All sites received the same four novel colored-flesh varieties which were developed and selected through the ongoing collaborative effort between ARS and UAF.

A potato biomass study has been established at the Matanuska Experiment Farm, and the statewide network of potato collaborators will send the two largest potatoes from each variety. Analytic protocols are being developed to evaluate the biomass potentials of the varieties and to determine impacts of harvest dates and production locations on the extractable compounds.

Invasive plant management plan for UAF

Marie Heidemann, Susan Todd

purpose

The purpose of this master's degree project was to prevent the spread of invasive plants from the UAF campus to the surrounding natural ecosystems of interior Alaska by developing an Invasive Plants Management Plan for the campus. The plan spelled out actions for managing existing invasive plants on campus and for preventing their establishment and spread in the future.

approach

Throughout the US and Canada, communities, states, and provinces have found the best way to deal with invasive species is to develop a comprehensive plan that tackles the problem from a number of angles and that considers the underlying causes of the weed infestation. The most successful plans are developed in collaborative processes by a team of stakeholders. We followed this model at UAF.

progress

A map of the current distribution of invasive plants on campus was produced in summer 2008. In the fall of 2009, a UAF Invasive Plant Task Force was established which included invasive plant experts, campus landscaping staff, faculty, and students. These two steps provided the groundwork for this project to develop a plan. The Task Force developed a draft of the plan in the spring of 2010. The campus Landscape Committee and Master Planning Committees endorsed the plan and Chancellor Rogers signed it as official policy in December 2010.

impact

The plan will have an impact on invasive plants on campus and also elevate UAF's status as a model of good environmental stewardship. We are ahead of many other campuses and communities and our work on the plan will help others develop invasive plant plans.

When laws affecting the environment conflict: focus on public lands

Julie Lurman Joly

purpose

The objective is to identify situations in which laws or policies with conflicting purposes or methodologies are in place, to analyze that legal conflict in order to understand how it manifested and what its practical consequences are, and perhaps to recommend changes.

approach

1. An examination of how the courts have failed to properly apply the "Best Scientific Data Available" standard and what statistics has to say about what "scientific" really means.

2. Following up on earlier work examining the potential for direct conflict between the state's Intensive Management statute and the enabling legislation for certain federal land management agencies. The initial work looked at the issue from the perspective of the National Park Service. This follow up works examines the same issues from the perspective of the US Fish and Wildlife Service and the National Wildlife Refuge System.

3. Initiated research related to strengthening the Alaska Department of Natural Resources' position regarding structure protection policy and other real or perceived inequalities in fire suppression.

progress

1. This work analyzes why the courts have not given meaning to the term "scientific" and attempts to define what "scientific" ought to mean within the context of the statutes in which the "Best Scientific Data Available" criteria appears. A manuscript has accepted by the *Stanford Environmental Law Journal* and will be published in the summer of 2010.

2. After an analysis of the applicable statutes and case law was completed it was clear that the conflict in question is impairing the Fish and Wildlife Service's ability to meet its statutory goals regarding Refuge management should preempt these rules on Refuge lands. This manuscript has been accepted for publication and will appear in the June 2010 issue of the *Alaska Law Review*.

3. I have identified several areas of concern related to these issues and have proposed areas of initial inquiry that might yield solutions. This work is ongoing.

impact

1. This work will be of interest to all federal land and resource managers who operate under a statute that contains "best scientific data available" language. Failure to consider whether data is "scientific" can have significant management repercussions.

2. May keep federal land managers from running afoul of the law and risking expensive and time consuming legal challenges. Should provide federal land managers with a clearer understanding of their duties and responsibilities and provide state managers with a better understanding of the laws that constrain their federal counterparts.

3. This work will be useful to state and federal fire management officials who, due to vague legal standards and other issues, face public relations difficulties resulting from real or perceived inconsistencies in fire protection practices.

grants/funding

USDA, Hatch. When Laws Affecting the Environment Conflict: Focus on Public Lands.

Effect of progesterone and melatonin on gestation length in reindeer

Janice Rowell, Milan Shipka

purpose

We investigated the potential of a) progesterone and b) melatonin to accelerate early embryonic growth as evidenced by a shortened gestation length without compromising calf birth weight.

approach

* CIDR = Controlled Internal Drug Releasing device, Eazi-Breed CIDR, Pfizer Animal Health, www.pfizerah.com

progress

H1: Progesterone concentrations during the first 5-12 days post-CIDR treatment - Agricultural and Forestry Experiment Station

The second CIDR treatment in Group 1 successfully increased maternal progesterone levels by an average of 5.5 ng/ml by one week following the seven-day harem period. As of December 2009 a PSPB test confirmed 9/10 pregnant in Group 2 (controls) and 7/10 pregnant in Group 1 (progesterone treated).

Two females were dropped from Group 2 (control), one for an abortion in March 2010 and another for stillborn twins in early April 2010. As of April 26, 2010, 3 of 7 females in Group 1 (treatment) and 4 of 7 in Group 2 (control) have calved. When calving is completed, hair samples will be collected for DNA analysis to establish the sire for each calf.

H2: Exposure to melatonin – Robert G. White Large Animal Research Station

In Group 1 (melatonin), one female was euthanized for reasons unrelated to the study, two females were found not pregnant by ultrasound, one female aborted in March 2010, and six females calved successfully. In Group 2 (control) one female was not pregnant (ultrasound), 2 females failed to calve (ultrasound indicated they were pregnant in November 2009) and 7 females calved. There is no evidence that melatonin treated reindeer had elevated progesterone at the end of the harem period and no difference (P=0.855) between the gestation length of the melatonin treated group (220.5 ± 2.8 d) and the control group (220.1 ± 3.9 d). Blood samples will be assayed to see if elevated melatonin levels are detectable In the treated group.

impact

Understanding these mechanisms and ultimately their potential impact on blastocyst survival, fetal development and calf growth are important to breeding management of reindeer, especially if techniques like artificial insemination are to be applied.

Selection, variety testing, and evaluation of cultural practices for alternative agronomic crops for Alaska

Robert M. Van Veldhuizen, Mingchu Zhang, and Stephen D. Sparrow

purpose

This ongoing research provides a yearly update of information on new and better adapted agronomic crop varieties (small grains and oilseeds) and their response to dryland farming conditions and harvest methods at Fairbanks, Delta Junction, and Palmer. It also provides a database for local producers to determine the economic viability for those crops.

approach

We use variety trials for continued evaluation of spring 6-row feed barley, 6-row hulless barley, hard red spring wheat, hard red winter wheat, hard and soft white winter wheat, winter rye, and oilseeds including Polish canola, camelina, and dwarf, open-pollinated dwarf Sunwheat selected from northern Canadian and US sources for testing against the standard Alaska varieties (Otal spring feed barley, Thual hulless barley, Ingal hard red spring wheat, and Reward Polish canola) for early maturity and high yields. Replicated trials of all varieties were planted at all three test locations, with the exception of

the winter grain and oilseed varieties which were tested only at Fairbanks and Delta Junction.

progress and results

Growing conditions (temperature and precipitation) at all three locations were slightly higher than the long term average. As a result, the growing season was extended into mid September for harvest. This pushed harvest into the same time frame of the annual southern migration of waterfowl. There was no grain left to harvest at the Palmer location. Small grain and oilseed yields and test weights were slightly higher than the long term average for the Fairbanks and Delta Junction locations. Plant height characteristics and lodging were about equal to the long-term average values. Average yields for both feed and hulless barley were higher than the standard test variety, Otal. Average yields for hard red spring wheat were also higher than the standard test variety, Ingal. Winter rye yields were slightly higher than wheat but maturity was significantly later. The Polish canola and camelina varieties had average yields similar to the standard test variety, Reward. The dwarf, open-pollinated Sunwheat "Midnight Sunflower' resulted in yields that were slightly higher than the long term average. This fall was the beginning of a new variety trial/cultural practice study done with winter grains at the Fairbanks and Delta Junction locations. Cultural practices include; traditional seedbed preparation, furrow planting (two inches deeper than the surrounding surface), and stubble planting (in 6–8 inch standing stubble), done to determine the effectiveness for winter survival on various types of winter grains. For 2011, testing of spring and fall planted small grains and oilseed varieties will continue.

Results from phosphorus rate and application methods for barley fertilization indicate that a medium rate of phosphorus applied as a band with the seed produced the highest yields. The use of an urea volatilization inhibitor to reduce nitrogen loss on fall and spring fertilizer applications on bromegrass hay was also continued in 2010. Results showed significant ammonia volatilization occurring without application of the inhibitor. The highest loss occurred with the fall application.

impact

The release of the hulless barley Sunshine in 2009 coupled with the CES development of hulless barley flour recipes in 2010 has continued to create an interest in growing adapted small grains for human consumption in both large and small scale production. The research into the harvest method of spraying Polish canola with glyphosphate continues to result in two percent green seed or less. The oil from this seed is suitable for use as human consumption or as a biofuel with the meal suitable for use in animal feeds as a substitute for imported soybean meal as the energy portion of the diet. This has stimulated interest in using Polish canola as a viable rotational crop for Alaska. Results from both the phosphorus and nitrogen (urea) studies show an increased nutrient plant use efficiency and prevention of loss to the environment.

Reduction of ammonia volatilization by Agrotain® urease inhibitor

M. Zhang, SD Sparrow, B. Van Veldhuizen, d. masiak

purpose

When urea is applied in soil or on a soil surface, urea is converted to NH4+, and NH4+ can be further changed into NH3 (ammonia), a volatile gas, depending on soil pH, temperature, and moisture condition. High pH, dry soil, and high temperature are favorable for NH4+ being converted to NH3. Smooth bromegrass (*Bromus inermis* L) hay is one of the major crops in the interior Alaska. Solid urea fertilizer is usually applied on the surface to increase bromegrass hay yield. Agrotain® is a new urease inhibitor sold on the market. Experiments in the Lower 48 show that using such inhibitor can reduce NH3 volatilization. The objective of this study was to determine if Agrotain® urease inhibitor can reduce NH3 volatilization in the interior Alaska climatic conditions.

approach

An experiment was conducted in a bromegrass field in the UAF Fairbanks Experiment Farm from fall 2008 to fall 2010 to determine NH3 volatilization with and without Agrotain®. Urea was applied at 0, 50, and 100 kg N/ha with or without Agrotain® in fall 2008, 2009 and 2010. Urea was also applied in the spring of 2009 and 2010 with N application rate of 0, 50, and 100 kg N/ha. Immediately after urea application, NH3 traps were set up to capture NH3 volatilized in 1, 3, 5 days after urea was applied. In 2010, length of trapping was extended to 7 days. Bromegrass biomass yield was also determined in 2009 and 2010.

progress

Our results showed that N loss in NH3 volatilization was about 3.3% (average of three years) without use of Agrotain® for fall applied N and 1.5% for spring applied N. This means that for every 100 kg N/ha applied as urea, with no use of Agrotain®, there will be 3.3 kg N/ha loss for fall applied N and 1.5 kg N/ha loss for spring applied N. Our results also showed that N loss through NH3 volatilization occurred in the first five days after urea application. However, this N loss did not affect the bromegrass biomass production.

impact

Historically, many products have been tried to reduce NH3 volatilization. Agrotain® is a new product in market, and beneficial effect on reducing NH3 volatilization has been reported in lower 48 states. Bromegrass is one of the major crops produced in Alaska. Reduce NH3 volatilization can help to improve N use efficiency in bromegrass hay production.

Comparison of P fertilizer application methods

M. Zhang, SD Sparrow, B. Van Veldhuizen, d. masiak

purpose

Phosphorus (P) is very reactive in soil, and can be formed insoluble compounds either in high pH soil (pH≥7) or low

pH soil (pH≤6). As such its use by crops in the current year application is usually less than 20%. Phosphorus fertilizer application can be in broadcasting or in banding. With the rise of fertilizer price, improving P use efficiency can lead to reduce the input cost from P fertilizer application. The objective of this work was to demonstrate the seedrow application can reduce P fertilizer application rate.

approach

A three-year (2008–2010) field experiment was set up in Delta Junction, Fairbanks, and Palmer Experimental Farms with treatments of 1) no P, 2) P fertilizer broadcasting at a rate of 50 kg P2O5/ha; 3) P fertilizer seedrow banding at a rate of 50 kg P2O5/ha; and 4) P fertilizer broadcasting at a rate of 100 kg P2O5/ha. Broadcasting application was made by spreading P fertilizer on the soil surface and then incorporated into soil in a depth of 10 cm. The banding application treatment was made by placing P fertilizer in a depth of 10 cm right beside seed row. Triple super phosphate was used as P fertilizer. In addition, appropriate amount of N, K, and S fertilizer were applied. Barley (Hordeum vulgare L., cultivar: Wooding) was grown on each of the treatments. Plant samples were taken in heading and physiological mature stages (soft dough). Soil samples were taken prior to the start of the experiment and in fall of every year in 0-15 and 15 -30 cm depths. Plant biomass, plant P uptake, and phosphorus concentration in soil in Mehlich 3 and Bray extraction were determined.

progress

The results showed that in some year/site combinations, biomass yield from P banded at 50 kg P2O5/ha was better than the same rate applied in broadcasting, indicating banding in seedrow resulted in more P use by plants. This might be attributed to easy access of banded P by plant roots. In addition, there was no difference in biomass production between low and high P rate application. Also, there was no statistical difference in soil P at the third year of the experiment with two extraction methods. The apparent fertilizer P uptake efficiency in three sites was low for all fertilizer treatments (<10%). However, plant P use efficiency from the banded P is about two percentage points better than the other P fertilizer treatments in the Palmer site.

impact

The research was to evaluate P application method on barley biomass production. The results demonstrated that with banding application, P fertilizer can be more used by barley plants. The research results will help P fertilizer recommendation in the state for crop production.

Research Highlights 2011

Biomass production and carbon sequestration potential of poplar as a short-rotation bio-energy crop

Amanda G. Byrd, William E. Schnabel, Stephen D. Sparrow, and darleen t. masiak

purpose

Biomass may be a key component of renewable energy sources in Alaska's future, and may have the advantage of being cheaper than fossil fuels, especially in rural areas. It may also have the added benefit of net sequestration of carbon. However, there has been little study on management of biomass as an energy source in Alaska. We recently began a study on an experimental landfill cap at Elmendorf Air Force Base to determine the yield potential and overall carbon balance of poplars under semi-intensive management. The objectives are: 1) Estimate rate of accumulation of above ground biomass, both with and without supplemental nutrients added; 2) Assess the feasibility of using biomass as an alternative to diesel fuel for rural Alaska; and 3) Create a carbon balance model based on above ground and below ground biomass.

approach

The study site is part of an experimental municipal waste project at Elmemdorf Air Force Base near Anchorage, Alaska used to evaluate the effect of trees on landfill cover water balance. Saplings (mostly poplars, Populus balsamifera or P. balsamifera x trichocarpa) were planted in 2005. In late winter 2011, we measured tree height, basal and breast-height diameter, and harvested all above ground biomass. The area was divided into four equal sized plots, two of which were treated with slow-release fertilizer to supply 100 N (90 kg / ha), 50 lb P (expressed as P205, 45 kg/ha), and 62 lb K (expressed as K2O, 55 kg/ha). In summer 2011, we collected root and soil samples around three trees to measure below ground carbon. Tree heights and diameters were measured at the end of the 2011 growing season. Both above ground and below ground biomass will be measured at the end of the 2012 growing season to estimate regrowth potential and carbon accumulation potential of established poplars.

progress

The poplar trees produced an aboveground dry biomass yield of 9.6 tons/ac (21.6 metric tons [Mt] per hectare) over six years or 1.6 tons/ac (3.6 Mt/ha) annually. Average tree biomass after six years was 6.6 lb (3 kg). We have not completed soil or root analyses.

impact

Ultimately, this study will provide information for Alaska communities that will help them decide whether to invest in growing poplars as biomass crops for energy use. It will also provide information for resource planners on the effects of growing poplars as bio-fuels on soil carbon balance.

grants/funding

US Air Force

Phosphorus and potassium fertilizer rates for barley, smooth bromegrass, and potatoes using soil test values in the Delta Junction area of Alaska.

Meghan Lene, Stephen D. Sparrow, Mingchu Zhang, Robert Van Veldhuizen, and darleen t. masiak.

purpose

Phosphorus (P) and potassium (K) are among the most limiting nutrients for crop growth in Alaska. Recent increases in fertilizer prices and concerns for environmental degradation due to over application of fertilizers have led to efforts to improve crop use efficiency of applied nutrients. While nitrogen (N) has been widely studied as a plant nutrient in Alaska, there have been little research on P and K crop uptake and use as influenced by soil properties, especially in the Delta Junction area. The objectives of this research are to: 1) characterize the influence of addition of lime to an acidic soil on P and K availability and crop uptake, 2) identify how different P and K application rates influence crop yield, plant use, and residual soil P and K levels, and 3) refine current agronomic P and K application rate recommendations for smooth bromegrass (Bromus inermis), potatoes (Solarum tuberosum), and barley (Hordeum vulgare).

approach

We established field research plots at the UAF Delta Junction Field Research Site in spring 2010. An existing smooth bromegrass stand was used and land previously fallowed was used to establish potato and barley plots. Soil at the site was strongly acidic, so half of each plot area was treated with hydrated lime at 2.5 tons/ac (5.6 Mt/ha) with a goal of raising the pH to near neutral. Each plot area received various P and K combinations and rates, resulting in eight different fertilizer treatments for potatoes and bromegrass, and 11 for barley in 2010 and 2011. All plots received a uniform application of N and sulfur fertilizer at the recommended rate for that crop. Fertilizers and lime were broadcast applied and then tilled into the soil for barley, for potatoes the lime was broadcast and other fertilizers were banded next to the potato row, and for the bromegrass plots they were simply spread on the surface. Our original plan called for irrigating the potatoes but our irrigation equipment did not become functional until spring 2011, so the 2010 potato plots did not receive supplemental water. Soil samples were collected in spring and fall of each year, plant tissue samples were collected at heading and at physiological maturity for barley and at flowering for potatoes. All plots were harvested at the appropriate time for each crop. We took two cuttings, a mid-season and late season harvest, for bromegrass. All samples were sent to a soil/plant analysis laboratory for determination of soil and plant tissue P and K.

progress

Both barley and potatoes responded to fertilizer and lime application, but bromegrass yields did not vary significantly among fertilizer or lime treatments. The lack of response in the bromegrass was likely because the P, K, and calcium (from the lime) remained mostly on the surface and was not readily accessible to the plant roots. Barley yields, averaged over two years showed an increase of about 10% due to the addition of lime; yields were highest in the limed plots at the highest P rate (60 lb expressed as P2O5/ac, 67 kg P2O5/ha) with a grain yield of about 1.3 tons/ac(2.9 metric tons [Mt]/ha). There was little apparent response to K by barley. We have not yet finished compiling yield data for potatoes in 2011; in 2010, application of lime resulted in an overall average yield increase of about 25%. Yields peaked at about 280 hundred weight (cwt)/ac (31Mt/ha) near the 180 lb P2O5/ac (200 kg/ha) rate with little response to K. Plant tissue and soil sample analyses are not yet complete.

impact

This research will ultimately save farmers on fertilizer costs by providing information on the appropriate P and K rate to reach the economic optimum yield for crops in the Delta Junction area of Alaska.

grants/funding

Salcha-Delta Soil and Water Conservation District

Potential perennial lignocellulosic energy crops for Alaska

Stephen D. Sparrow, Mingchu Zhang, darleen t. masiak, and Robert Van Veldhuizen

purpose

The high cost of petroleum-based fuels in Alaska, particularly in rural Alaska, has resulted in high interest in local, renewable energy sources, including growing crops for bioenergy. The purpose of this research is to screen potential plant species, including trees/shrubs and perennial grasses as short-rotation, lignocellulosic energy crops for Alaska and to determine best management practices for efficiently producing bio-energy crops.

approach

We used dormant cuttings to establish replicated plots of three native Alaska woody species, feltleaf willow (*Salix alaxensis*), Pacific willow (*Salix lasiandra*), and balsam poplar (*Populus balsamifera*) at two locations (a well drained and a poorly drained site) at the Fairbanks Experiment Farm in 2008 and 2009. A similar study was established by a cooperator (Alaska Plant Materials Center) in Palmer in 2008. Feltleaf willow spacing and coppicing timing trials were established at Fairbanks in 2010. In addition, numerous woody species and cultivars, including alders (*Alnus*), birch (*Betula*), hybrid poplars, and willows, were established in non-replicated plots or single rows in 2009, 2010, or 2011. We abandoned the plots at Palmer after one year because of excessive weed

competition. We harvested the willow/poplar plots at the well-drained site for the first time in 2011; woody species at the poorly-drained site will be harvested in 2012.

Perennial grass plots established for other purposes were used for biomass trials beginning in Fairbanks in 2008 and at Delta Junction beginning in 2009. Carlton smooth bromegrass (*Bromus inermis*), Nortran tufted hairgrass (*Deschampsia caespitosa*), and Wainwright slender wheatgrass (*Elymus trachycaulus*) were managed under three nitrogen (N) fertilizer rates (9, 45, 90 lb/ac; 10, 50, 100 kg N/ha) and three harvest regimes (two cuts per season, single harvest in fall, single harvest in early spring of succeeding year).We also established replicated plots of 14 perennial grass species at Fairbanks and Delta Junction in 2010. We harvested grass plots in each year of the study.

progress and results

At Fairbanks, feltleaf willow dry matter yield, four growing seasons after establishment, averaged 1.2 tons/ac (2.8 Mt/ha), balsam poplar averaged (0.8 tons/ac (1.9 Mt/ha), and Pacific willow yielded less than ½ ton/ac (< 1 Mt/ha). Fall harvest grass yields at the high N rate, averaged over three years at Fairbanks, were 2.9 tons/ac (6.6 metric tons [Mt]) dry matter per ha for smooth bromegrass, 2.5 tons/ac (5.5 Mt/ha) for tufted hairgrass and 2.1 tons/ac (4.7 Mt/ha) for slender wheatgrass with all species showing a yield response up to the highest N rate. At Delta Junction dry matter yields for the fall harvest under the high N rate averaged over three years were: smooth bromegrass, 2.2 tons/ac (4.9 Mt/ha); tufted hairgrass, 1.8 tons/ac (4.1 Mt/ha) , and slender wheatgrass, 1.4 tons/ac (3.4 Mt/ha). Yields for grasses over-wintered intact and then harvested in spring at Fairbanks were 1.4 tons/ac (3.2 Mt/ha) for smooth bromegrass, 1.6 tons/ac (3.6 Mt/ha) for tufted hairgrass, and 1.6 tons/acre (3.6 Mt/ha) for slender wheatgrass. Spring harvests at Delta Junction (averaged over two harvest years) produced 1.3 tons/ac (2.8 Mt/ha) for smooth bromegrass, 0.8 tons/ac (1.8Mt/ha) for tufted hairgrass, and 1.2 tons/ac (2.7 Mt/ha) for slender wheatgrass. We will do the last spring harvests at Delta Junction in 2012. The over-winter yield loss at both locations indicate spring harvest is not likely a suitable practice for these locations. At both locations, harvesting twice (mid-season and at end of season) produced similar yields to a single harvest at the end of the growing season, indicating no advantage to a two-harvest management regime. A two-year-old study comparing numerous grasses fertilized at 90 lb N/ac at Delta Junction showed highest dry matter yield for smooth bromegrass with an average annual yield of 2.3 tons/ac (5.1 Mt/ha); at Fairbanks on well drained soils, Siberian wildrye (*Elymus sibiricus*) produced the highest average annual yield at 2.3 ton/ac (5.1 Mt/ha); and at a poorly drained site at Fairbanks, reed canarygrass produced the highest average annual yield at 2.9 t/ac (6.5 Mt/ha) but with some plots exceeding 3.5 tons/ac (8 Mt/ha). Unfortunately, reed canarygrass (*Phalaris arundinacea*) has recently been recognized as an invasive weed in most parts of Alaska, and thus may not be suitable as a bio-energy crop.

impacts

This study is still fairly new; several data years, especially for woody species, are needed to draw useful conclusions. Ultimately, this study will provide information for Alaskan farmers and communities that will help them decide whether to invest in establishing short-rotation biomass crops for energy use.

grants/funding

USDA-NIFA, Hatch

Influence of precipitation timing on tree growth in upland and floodplain forest ecosystems in interior Alaska

J. Yarie

purpose

Climate change dynamics will result in alteration in the seasonal precipitation dynamics (both quantity and form) in the boreal forest. In an attempt to investigate changes in forest growth resulting from precipitation changes a set of drought experiments were established in hardwood/conifer ecosystems in upland and floodplain locations in interior Alaska. The overall objective of the study is to determine the influence of summer rainfall or spring snowmelt exclusion on the growth of trees in both landscape locations. The initial hypotheses were: 1) forest growth in upland birch/aspen (*Betula neoalaskana* Sarg./ *Populus tremuloides* Michx.) stands is strongly controlled by summer rainfall, and (2) forest growth in floodplain balsam poplar/white spruce (*Populus balsamifera* L./ *Picea glauca* (Moench) Voss) ecosystems will show no relationship to summer rainfall due to the influence of ground water, linked to river flow dynamics, on soil moisture recharge and 3) forest growth in both upland and floodplain locations is strongly tied to soil moisture recharge resulting from spring snowmelt.

approach

PVC greenhouse panels were used to construct a cover under the overstory canopy in each replicate upland and floodplain summer drought site. The covers were designed to prevent summer rainfall from entering the soil and recharging soil water during the growing season. The covers, designed to drain rainfall off the plot, were placed on wooden framing. On the floodplain sites the high end of the cover was at approximately two meters and the low end at one meter above the ground. On the upland sites the covers were parallel to the sloping surface of the plot. A hole was placed in the cover at the location of each tree and a dam was placed up-slope from each tree to force drainage of water around the tree and off of the treatment area. The snowmelt removal covers were constructed using plywood, placed on 2x4 framing that was set directly on the forest floor. To prevent snowmelt drainage into the holes around trees, the snow pack was removed

from the plywood surface in the spring prior to the start of the snowmelt period (early April). The rainfall covers were assembled in late May of each year and taken down before the first snowfall in early September. Based on the average precipitation characteristics during the study period, the summer rainfall exclusion reduced the annual inputs by 46% with a range from 22.7% to 72.1%. The snowmelt covers are assembled and removed within one day of the placement or removal of the throughfall covers.

progress

Summer rainfall exclusion from the upland sites significantly decreased growth for birch in 1992 and 1993 and balsam poplar in 1992. In all other year's birch, balsam poplar, and white spruce displayed a nonsignificant decrease in growth. Aspen showed no treatment effect. Tree basal area growth was significantly decreased on the floodplain sites due to summer rainfall exclusion for balsam poplar in 1992 and white spruce from 1990 through 2009. After three years of treatment in the upland sites, tree growth was significantly reduced in the first year of treatment but not in the second and third year. This is a potential affect of the low quantities of snowmelt in years two and three. So it is thought that the snowfall quantities so low enough to produce very low growth in the control plots that equaled the low growth in the treatment plots. This was the first year of treatment in upland sites for the snowmelt removal. The floodplain sites were installed the following year and have been in place for only two years (2010 and 2011). No significant differences in tree growth were observed. Again this could be the result of low snowfall in those two years. Soil moisture estimates using TDR equipment showed a difference in soil moisture immediately after soil thaw. This is a good indication that the treatment is working. The first year of treatment in the upland sites did lower tree basal area growth. Basal area growth for the treated trees was 0.6, 0.6, 0.08 and -0.1 sq. cm for aspen, birch, poplar and spruce compared to the control plot with 2.9, 1.1, 3.0 and 2.0 sq cm, respectively

impact

In upland sites soil moisture recharge from melting snow pack is a major moisture supply for tree growth although it is not clear if a significant moisture limitation occurs during the summer even in the control plots. However in the floodplain stands tree growth was highly dependent on seasonal rainfall even though the ground water table was within the rooting zone and the soils were supplied with a spring recharge due to snowmelt. A number of factors are probably causing this strong relationship. These include rooting distribution, soil texture, and the electrical conductivity of the ground water

Birling is one of the most popular events each October at the Farthest North Forest Sports Festival. Competitors vie to be the last man standing on a log floating in Ballaine Lake.

AFES photo by Nancy Tarnai

which is sufficiently high to limit moisture uptake. At this point it is difficult to speculate on the overall importance in spring snowmelt in the control of tree basal area growth. Additional years of treatment are necessary to clarify the results.

Log decomposition in interior Alaska

J. Yarie

purpose

Logs are a significant carbon and organic matter input into the forest floor in natural forest ecosystems. This input will have implications on the carbon, organic matter and nutrient dynamics of forest soils. The purpose of this study is to document the decomposition dynamics of logs within interior Alaska.

approach

Fifteen logs were placed on the forest floor in forest stands for each major upland and floodplain vegetation type. The species sampled were aspen (*Populus tremuloides* Michx.), birch (*Betula neoalaskana* Sarg.), white spruce (*Picea glauca* (Moench) Voss) and black spruce (*Picea mariana* (Mill) B.S.P.) in upland locations and alder (*Alnus tenuifolia* Nutt.), balsam poplar (*Populus balsamifera* L.), white spruce and black spruce in floodplain locations. Each vegetation type was replicated six times. The logs were four meters in length and had a minimum diameter on the small end of 10 cm. In addition sample locations were established in upland and floodplain white and black spruce recently burned ecosystems. Individual logs will be sampled to monitor changes in log carbon, nutrient, cellulose and lignin concentrations over the next century. Due to the timing of initial establishment of all sites field sampling of decomposed logs will be occurring on a yearly basis. The sequence for sampling will follow a consistent time frame of 0, 2, 5, 10, 15, 20, 25, 30 and 10-year intervals until year 100.

progress

Currently all time zero, two, five, ten and fifteen-year samples have been collected for the unburned alder, aspen, birch, balsam poplar, floodplain white spruce and upland white spruce sites. Chemical analysis is continuing on the collected samples. Additional sites that represent floodplain black spruce sites and burned white and black spruce sites in both upland and floodplain locations have been established. The initial results indicate that alder displayed the highest decomposition rates with only 25% of its original wood weight remaining after fifteen years while floodplain white spruce and birch showed the slowest rates of decomposition with 61% and 67%, respectively, remaining after fifteen years. Aspen, balsam poplar, and upland white spruce had 33%, 41% and 54% of their wood weight remaining after fifteen years of decomposition. Loss of the mass of carbon from the logs (wood and bark) ranged from 30% to 71%.

impact

At this time it is not clear what effect coarse woody debris has on the carbon dynamics of the taiga forest in interior Alaska. However it appears to only take a single decade for the logs to loss half of their carbon. The results of this study will help to develop a clear picture of log decomposition dynamics on the carbon balance of forests in interior Alaska.

Relationship of tree growth to environmental and soil fertility factors for forty-four years in interior Alaska

J. Yarie and K. Van Cleve

purpose

Fertilization and thinning studies were developed in birch, aspen and white spruce forest types representing young, middle and old age classes in interior Alaska. The studies were started in the late 1960s. Both climatic and tree growth monitoring has continued through 2011. These measurements represent a long-term record of tree growth and climate data for an age sequence of forest stands.

approach

Fertilization and thinning studies started in the late 1960s are being monitored on a yearly basis. The result is the development of a long-term data set related to tree growth and the effects of fertilization and thinning on a number of age classes of the common forest types found in interior Alaska.

progress

The comparative analysis of a large set of long term fertilization and thinning studies in the major forest types of interior Alaska indicates that nutrient limitations may only occur during the yearly spring growth period after which moisture availability is the primary control of tree growth on warm sites. Temperature dynamics, both air and soil, set seasonal bounds on the nutrient/moisture dynamics. In addition both air and soil temperature limitations are the primary control of growth dynamics in the colder topographic locations in interior Alaska. These locations are usually dominated by black spruce vegetation types. A seasonal progression of growth controlling factors occurs and it is strongly tied to the state factor structure of the landscape.

impact

The long term perspective indicates that changes in the annual and seasonal precipitation dynamics as a result of climate change will have a substantial impact on tree growth and forest ecosystem dynamics in interior Alaska. The magnitude of these changes will be tied to growing season temperature dynamics, vegetation type present on the site, the age structure of the vegetation, and stand density.

Impact of irrigation on barley yield and nitrate leaching under different rate of N application

M. Zhang, SD Sparrow, B. Van Veldhuizen, d. masiak

purpose

Spring drought frequently occurs in the Delta Junction area of Alaska. Lack of soil moisture in spring delays germination and hampers seedling development. Irrigation in the spring therefore can provide adequate water for seed germination and seedling development. But excessive water in

Sunshine barley growing at the Fairbanks Experiment Farm.
Photo by Nancy Tarnai

combination with N fertilizer application may result in NO3-N leaching to ground water. The objectives of the study are to determine barley yield (*Hordeum vulgare* L., cv. Albright) as affected by irrigation, and nitrate leaching with different rates of N application in irrigated and non-irrigated plots. The duration of the project is three years (2011–2013).

approach

Field experiments were set up at the UAF Delta Junction Field Research Sites with nitrogen fertilizer application rates of 0, 50 kg N/ha, 100 kg N/ha, and 150 kg N/ha. The treatments were arranged in a complete randomized block design with four replicates. Irrigation was schedule at 1.5 inch water/week from late May (germination/seedling development stage) to mid July (heading stage). To trace movement of nitrate, KBr was applied in each treatment.

progress

We found that with irrigation, barley reached maturity earlier (~33 fewer growing degree days) than the barley without irrigation. Barley plants were higher with irrigation than without irrigation (111 cm vs. 84 cm). Average seed yield of from irrigated barley nearly doubled that of non-irrigated ones (2,522 kg/ha vs. 1,286 kg/ha). Percentage of seeds in total above ground biomass was 10% more in irrigated barley than the non-irrigated ones, indicating that irrigation helps photosynthetic products moving more toward seeds rather than straw. Soil nitrate and bromide concentration have not been analyzed yet at time of this report.

impact

This research is the first time to illustrate the impact of irrigation on small grain yield and nitrate leaching in Alaska. With increase in awareness of food security and demand for Alaska grown products, the results of this research will provide quantitative information on irrigation benefits and which rate of N application is appropriate for barley production under irrigation.

Peony response to organic amendments

M. Zhang, Robert Van Veldhuizen

purpose

The peony cut flower industry has grown rapidly in Alaska in recent years. Information on peony nutrient requirements is needed in order to grow quality peony cut flowers for market. Large quantities of fish byproducts are produced from fish processing plants in Alaska. These fish byproducts contain high amounts of mineral nutrients needed by peony plants. The objectives of the study are to determine the peony plant response to fish byproducts and inorganic N addition, above ground nutrient uptake by peony plants, and to develop a quick diagnostic tool to evaluate N nutrient status of peony.

approach

Fish byproducts of fish meal, fish bone meal, and fish hydrolysate at a N rate of 50 kg N/ha were applied to two-year-old peony plants at the Georgeson Botanical Garden (GBG). For comparison, a control treatment with no nutrient addition was set up, and urea treatments were at 50 and 100 kg N/ha rate. There were five plants per treatment, and the experiment was arranged in a completely randomized design. Nutrients were applied in late June. At the GBG there exists an organic amendment experiment started about six years ago with compost, peat, and a control. Biomass samples were taken from fish byproduct and organic amendment experiments in fall for analysis of N, P, and K concentration. Leaf chlorophyll index was also determined from leaves of each treatment.

progress

We found no difference among treatments for above ground biomass for fish byproduct and organic amendment experiments, perhaps attributing to the high soil fertility in the garden, and to variation in growth of individual plant. The two-year-old plant from the fish byproduct study weighed 26 g (dry weight)/plant, with average uptake of N at 300 mg N/plant, P at 3 mg P/plant, and K at 222 mg K/plant. The mature plants (≥ 6 yrs) from the organic amendment trial weighed 64 g (dry weight)/plant, with average uptake of N at 2,239 mg N/plant, P at 305 mg P/plant, and K at 1,415 mg K/plant. The N:P:K ratio for the young plant was 1:0.01:0.74, and for the mature plant, it was 1:0.14:0.62. Apparently, the peony plant did not require more P at its early ages. However, either young or matured plants required high K for their growth. The chlorophyll meter was able to detect chlorophyll level for different leaves within a plant and among plants. Challenges still remain to select a most sensitive leaf within a plant for N response, and to relate leaf color to chlorophyll concentration.

impact

The preliminary results of this research provide information on peony N, P, and K nutrient requirements. This will help growers to manage peony nutrient application. However, confirmation for this requirement needs more years of research.

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Special guests wielded shovels at the groundbreaking ceremony for a new greenhouse April 22, 2011. The greenhouse is now being used for research and teaching.

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Trainor SF. Climate Change and Fire in Alaska. Presentation for Stakeholder Workshop, Climate Change Observations in Rural Interior Villages. International Arctic Research Center. February 16, 2010.

Trainor SF. Climate Change Impacts and Adaptation in Alaska: Indigenous Perspectives and University Collaborations. Presentation at the Association of American Geographers Annual Meeting, Washington, DC. April 14–18, 2010. Also panelist for A Deeper Sense of Place: New Geographies of Indigenous-Academic Collaboration.

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United States Department of Agriculture

Agricultural Research Service*

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**The USDA Agricultural Research Service was closed down in Alaska in 2011. Below are the names and titles of the scientists working under its aegis until then.*

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Peter Bechtel, Research Food Technologist
Cynthia Bower, Research Food Technologist
Ted Wu, Research Food Technologist

Integrated Pest Management - Fairbanks

Jeff Conn, Research Agronomist/Weed Scientist
Dennis Fielding, Research Entomologist
Aaron Hagerty, Research Entomologist
Alberto Pantoja, Research Leader and Entomologist
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Lori Winton, Research Plant Pathologist

Germplasm - Palmer

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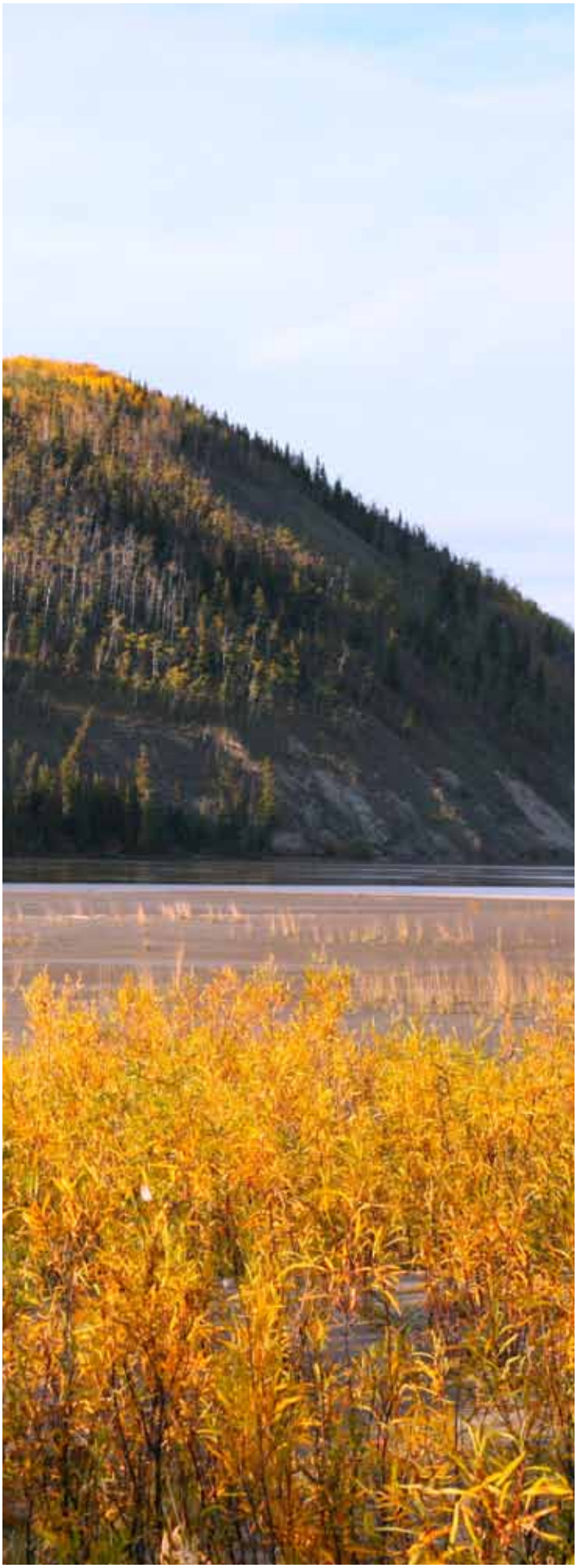
Nancy Robertson, Research Plant Pathologist



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