Boreal Alaska—Learning, Adaptation, Production

September 2013 quarterly report

Principal Investigators:

Glenn Juday

Jan Dawe

SNRAS

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Quarterly Report #5

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Boreal Alaska – Learning, Adaptation, Production (BAKLAP) Quarterly Report

2013 Quarter #3 (July 1, 2013 – September 30, 2013)

Authors of this Report:

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BAKLAP Quarterly Report

2013 Quarter #3 (July 1, 2013 – September 30, 2013)

Background and Personnel

The Boreal Alaska – Learning, Adaptation, Production project is funded by an appropriation under the 2012 Alaska Capital Budget (HCS CSSB 160(FIN) am H).

Mission Statement:

The goals of BAKLAP are:

1) To upgrade Alaska forest research facilities and management practices to improve the value of Alaska's forests in meeting the rapidly expanding demand for wood biomass energy in a changing environment, and

2) To improve STEM teaching and learning outcomes by developing a model integrated K–12 curriculum based on hands-on experiences with the Alaska boreal forest through inquiry science and art.

The BAKLAP project is being carried out under a Reimbursable Services Agreement (RSA) between the University of Alaska Fairbanks, School of Natural Resources and Agricultural Sciences (SNRAS) and the Alaska Department of Natural Resources (DNR), Division of Forestry. This is the fifth quarterly report in the life of the project, covering the period July 1, 2013 through September 30, 2013.

Personnel status during Quarter #3, 2013:

Quarter #3 of 2013 was the **fifth** quarter for the operation of BAKLAP. The two co-Principal Investigators (Juday and Dawe) were in term-funded positions for the entire period, and Tom Grant began his 20% of full-time equivalent work in his new UAF transition position, as he began work in Colorado. This quarter was the main field season for the project, and a temporary surge of part-time labor and volunteers or cooperators were involved in the project.

Zach Meyers, Instructional Designer. Temporary technical assistant (Grade 77). He was supported by BAKLAP funding for full time (40 hrs/week) from July though September, 2013.

David Spencer, Research Technician. Temporary technical assistant (Grade 76). Left his position with UAF, and provided some short-term and informal transition assistance.

Miho Morimoto, PhD student. She was supported at the standard graduate assistant rate at half time or 20 hrs/week from BAKLAP funding from July though September 2013.

Andrew Allaby, MS student. He was supported by BAKLAP funding (equivalent to) 20 hrs/week, from July though September 2013.

Ryan Jess, Research Technician. Temporary technical assistant (Grade 77). He worked 408.25 hrs from BAKLAP funding. The remainder of his salary came from a BLM contract for White Mountains Fire and Caribou Habitat project.

Dashiell Feierabend, Research Technician. Temporary technical assistant (Grade 74). Worked 65.25 hrs.

Glenn Juday, Professor of Forest Ecology (PI). His salary during the period came from the following sources:

- 7% State appropriations - SNRAS research
- 17% State appropriations - Teaching
- 29% BAKLAP Forest Research
- 29% BAKLAP Forest Education
- 18% Federal McIntire Stennis (land grant funds)

Jan Dawe (Co-PI), Research Assistant Professor (term-funded faculty position). Her salary came 100% BAKLAP funding, and was 0.75 FTE (75% full time).

Tom Grant, Research Assistant Professor Appointed (term-funded faculty position). He holds a position as Research Director of the Mountain Studies Institute in Silverton/ Durango, and maintains an appointment with UAF in which he worked 1 day per week (20%) in his current position title. During quarter #3 of 2013 his UAF work was supported by BAKLAP and the BLM White Mountains Fire and Caribou Habitat project.

Tricia Kent, Student Assistant C. Tricia worked 121.5 hrs total.

Margaret Klass, Temporary Technical Assistant (Artist in Schools). (10% of full time) worked 20.75 hrs.

Diane Hunt, Student Assistant C. Worked 391 hrs total.

Structure of this quarterly report

This 2013 Quarter #3 report follows a threefold division for reporting. For accounting purposes, and because of the differing indirect cost rates, three BAKLAP accounts are maintained at UAF:

Forest Research (FR)

Forest Education Outreach (FE)

K20 STEAM Education (K20 STEAM)

The BAKLAP project is being accomplished through the completion of 13 deliverable products organized into three tiers. The following table provides the names and acronyms for the deliverables used in this report.

Tier 1 Deliverables: Core Products for Management, Science, and Public Use

1.1 Title: Data Atlas of Forest Research Installations (DAFRI)

1.2 Title: Operational Regeneration Assessment (ORA)

1.3 Title: 1.3 Title: K–20 Curriculum Development: STEM to STEAM (STEAM)

1.4 Title: Forest Entrepreneur Camp (FORENCA)

1.5 Title: Scientific Publications on Forest Production and Climate (SCI PUB)

Tier 2 Deliverables: Synthesis and Application of Tier 1 Products

2.1 Title: Scientific Input for Optimum Management Practices: Biomass and Climate (OMP)

2.2 Title: K–12 Teacher Professional Development Courses (K–12PD)

2.3 Title: Curriculum for In-service Biomass Course for Professional Foresters (BICFOR)

2.4 Title: Citizen Science Field Training and Framework Development (CITFORSCI)

Tier 3 Deliverables: Support and Extension of Tier 1 and 2 Products

3.1 Title: Boreal Forest Management and Education - Internet Book/Portal (BFEM)

3.2 Title: BAKLAP Website (BAKLAP WEB)

3.3 Title: Forest Management Outcomes Report (FORMOR)

3.4 Title: Research and Installation Needs Assessment (RINA)

SECTION 1

Quarter #3, 2013 BAKLAP Activity: Forest Education

(Note: In the report that follows, each accomplishment is labeled "QR 3.13" for Quarterly Report 3 for 2013 with #1, #2, etc. following.)

Forest Education QR 3.13 Accomplishment #1:

- Deliverable 3.1 Boreal Forest Management and Education (BFEM)
- Deliverable 3.2 BAKLAP Website (BAKLAP WEB)

During the third quarter of 2013, 11 articles describing aspects of BAKLAP were posted to the School of Natural Resources and Agricultural Sciences (SNRAS) website (Table FE 1 below).

http://snras.blogspot.com/2013/07/interactive-mural-brings-boreal-forest.html
http://snras.blogspot.com/2013/07/steam-rolls-on-through-summer.html
http://snras.blogspot.com/2013/08/oregon-state-post-doctoral-scholar.html
http://snras.blogspot.com/2013/09/snras-offers-service-learning.html
http://snras.blogspot.com/2013/09/snras-launches-new-website.html
http://snras.blogspot.com/2013/09/alumni-profile-martin-wilmking.html
http://snras.blogspot.com/2013/09/noted-ethnoecologist-visits-snras-grad.html
http://snras.blogspot.com/2013/09/baklap-takes-legislators-on-tour-of.html
http://snras.blogspot.com/2013/10/26-years-of-monitoring-at-reserve-west.html
http://snras.blogspot.com/2013/10/peace-corps-fellow-works-with-onetree.html
http://snras.blogspot.com/2013/10/the-new-snrasafes-advisory-council-met.html
Related (SNRAS non-BAKLAP biomass energy project)
http://snras.blogspot.com/2013/10/snras-researchers-find-potential-for.html

Table FE 1. Article describing BAKLAP accomplishments posted to the UAF School of Natural Resources and Agricultural Sciences website—snras.blogspot.com—during the third quarter of 2013.

Forest Education QR 3.13 Accomplishment #2: Alaska Interior Delegation Field Investigation and Report on Project BAKLAP

» Deliverable 3.1 Boreal Forest Management and Education (BFEM)

» Deliverable 3.4 Research and Installations Needs Assessment (RINA)

On September 20, 2013 the BAKLAP investigator team (Dr. Glenn Juday, Dr. Jan Dawe) conducted a four-hour field investigation and report to the Alaska Interior Legislative Delegation on project BAKLAP (see agenda – Table FE 2). At the end of the 2012 legislative session that funded BAKLAP at 60% of the requested amount, which represents the current appropriation of $1.0 million, the legislators involved directed the BAKLAP proposers to conduct the project for a year and then report back for an evaluation of the project and the proposal for its completion. BAKLAP became fully operational in fall of 2012, so fall 2013 represented the one-year milestone for reporting and evaluation.

Information Packet for Field Investigation of Project BAKLAP

(Boreal Alaska – Learning, Adaptation, and Production)

Figure FE 1. Cover of trip guide produced for Alaska Interior Legislative Delegation Field Investigation and report, September 20, 2013.

Three legislators, two state representatives and one senator attended in person. Seven legislative offices were represented, including four state representatives and three senators, and two other offices were briefed beforehand, including one of the principal sponsors of 2012, Rep. Wilson (Table FE 2). In total, four teachers from the Fairbanks North Star School District, four UAF graduate students, and three other professionals working on the project made presentations. In addition, Chancellor Brian Rogers and Provost Susan Henrichs of UAF, and State Forester Chris Maisch attended the second half of the event. The BAKLAP Executive Team received valuable feedback and encouragement for the future of the project.

The field trip covered the early and emerging insights about the empirical record of boreal forest management since statehood, including successes, problems and challenges, and opportunities and needs. Providing these insights to state policy makers and leaders was especially valuable. The attendees were engaged and asked useful and often insightful questions. Some interest was expressed in convening oversight hearings during the regular legislative session on the Alaska boreal forest management situation.

Agenda for Legislative Field Investigation and Report

Boreal Alaska – Learning, Adaptation, and Production (Project BAKLAP), Sept. 20, 2013

1:00 PM. Vehicles arrive at Legislative Information Office (LIO)

5 min: Introduction, orientation, and purpose of field investigation and report (Glenn Juday)

Hand out information packets (maps and information about field installations)

Load vehicles and depart for Bonanza Creek Experimental Forest

1:20: PM. Vehicles depart LIO

1:20-1:45 PM. drive to George Parks Monument overlook on Parks Highway

1:45-2:05 PM. Briefing on Management challenges and opportunities for wood energy

Glenn Juday – Overview of state forest information needs

Miho Morimoto (Ph.D. student) – Operational Regeneration Assessment (ORA)

2:05-2:20 PM. Drive to Mile 2, Bonanza Creek Road

2:20-2:55 PM. Explain Rosie Creek Fire Tree Regeneration Installation (RCF TRI)

Glenn Juday – Reference Stand Network; History of the RCF TRI experiment

Andrew Allaby (M.S. student) – Current study/assessment of RCF TRI for biomass management

Short walk through RCF TRI experimental treatments

2:55-3:30 PM. Drive to UAF University Park Building on University Ave. (Old U Park School)

3:30-3:50 PM. BAKLAP Education activities report at University Park Building (outdoors)

Chris Maisch: (State Forester) welcome back from state forest, relevance of BAKLAP to biomass management and future cooperation in research and education (2-3 min)

Brian Rogers: (UAF Chancellor) welcome to UAF campus, partnerships in research and education (2-3 min)

Jan Dawe: (Co-PI of BAKLAP project) Invitation to hands-on activities (1 min)

Choice of 5-minute activities and pictures (10 min total)

a) Diane Hunt – M.S. student: Tree Planting: Cold Hardiness/Dormancy Experiment

b) Birch Pavelsky – Woodworker: Manufacturing Knitting Needles – Entrepreneurship

3:50-4:00 PM. Walk to University Park Building Room 158, refreshments (indoors)

4:00 PM. Resumption of report;

Steve Sparrow – Interim Dean, School of Natural Resources and Ag. Sciences and Director, Agriculture and Forestry Experiment Station: Integrated research, education and outreach

4:05-4:50 K–20 STEAM Education Reports: BAKLAP team and partners

Jan Dawe – Introduction to K–20 STEAM Education component

Chris Pastro – Randy Smith Middle School Extended Learning Prog.: STEAM in the classroom

Karen Stomberg – FNSBSD Art Center Coordinator – The role of the Arts in STEM Education

Carri Forbes – Tanana Middle School science teacher, and **Jan Dawe** – Service Learning

Tricia Kent – M.S. student – Improving non-timber forest product manufacturing (birch sap)

Zachary Meyers – SNRAS Instructional Designer, **Klara Maisch** – Artist: Watershed Charter School's Interactive Mural

Diane Hunt – M.S. student – Perspectives on place-based learning

Margo Klass – Book Artist: Science-Art Exhibits

4:50-5:00 Glenn Juday – Discussion moderator

5:00-5:20 PM. Drive back to LIO

Attendance, Field Investigation and Report, Sept. 20, 2013

Rep. Scott Kawasaki – was present.

Rep. Doug Isaacson – was present.

Rep. David Guttenberg (not present, **Meredith Cameron** represented his office).

Rep. Steve Thompson (not present, Jan Dawe briefed his office beforehand).

Rep. Tammie Wilson (not present because of a scheduled trip to review education activities on Seward Peninsula, office was not represented, she was briefed by Jan Dawe before the field investigation).

Rep. Pete Higgins (not present, **Clifton Higgins** represented his office).

Sen. John Coghill – was present. **Rynnieva Moss** also attended.

Sen. Pete Kelly (not present, **Bruce Campbell** represented his office)

Sen. Click Bishop – attended indoor pre-trip briefing at LIO, had a previously scheduled meeting.

Table FE 2. Agenda and attendance trip for Alaska Interior Legislative Delegation Field Investigation and report of BAKLAP, September 20, 2013.

Figure FE 2. From left, Meredith Cameron (Rep. David Guttenberg staffer), Sen. John Coghill, Rep. Scott Kawasaki, Glenn Juday and graduate student Andrew Allaby talk about BAKLAP research conducted by Allaby at the Rosie Creek Fire Tree Regeneration Installation on the Sept. 20 field investigation.

Figure FE 3. Jan Dawe explaining products made from birch by BAKLAP cooperators and in BAKLAP project classrooms during the Sept. 20 field investigation, University Park Building, UAF campus. The products were made made from the original OneTree (Cache Creek #1) including wool dyed with inner bark, a Finnish hunting knife made from wood, bark 'washers,' moose bone and stainless steel; a turned wooden bowl, and woven birchbark basket.

Forest Education QR 3.13 Accomplishment #3 – Management lessons for biodiversity from climate change effects – the 35th Natural Areas Conference

» Deliverable 3.1 Scientific Input for Optimum Management Practices: Biomass and Climate (OMP)

Glenn Juday summarized the results of the large landscape level analysis of BAKLAP research for the 35th Natural Areas Conference sponsored by the Natural Areas Association, the largest organization of natural area managers and researchers in the U.S. and Canada. The abstract was accepted and published during the 3rd quarter of 2013, and the conference began on the last day of the quarter. Juday made the presentation on October 2 (Figure FE 4).

Climate Disruption Effects in Boreal Forest of Alaska: Lessons from Research Natural Areas and Bonanza Creek Long Term Ecological Research Site

Glenn Patrick Juday[1], Thomas Grant[1], and Claire Alix[2]

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Climate sensitivities of white spruce, black spruce, aspen, and Alaska birch have been established in the Bonanza Creek Long Term Ecological Research site (BNZ LTER) and satellite Research Natural Areas in central Alaska. Performance of these species in Interior Alaska has been assessed through long term monitoring in hectare scale forest reference stands and tree ring analysis. All species register a negative sensitivity to summer temperature (decreased growth with warming), and are termed "negative responders." The most recent 35 years have been the least favorable for growth of this population in the past 250 years at least. Recent warm anomalies, including 2013, have been extreme and stressed the trees directly and through facilitation of insect outbreaks, especially aspen leaf miner, spruce budworm, and engraver beetles, and eliminated older forests in large scale fires. Old growth dependent species are negatively affected include woodpeckers, arboreal lichens, and cavity nesting birds. However, tree growth and health in some environments in Alaska has improved with warming, and this population is termed "positive responders." A transect down the major Alaska rivers (Yukon, Tanana, Kuskokwim) reveals the coherence of the distribution of positive versus negative responding white spruce populations. Negative responders occupy the interior region with hot dry summers, and positive responders occur in western Alaska closer to the Bering Sea coast. Natural forests to sustain older forest dependent organisms need to be allowed or encouraged to expand in western Alaska and secondarily at high elevations, even at the expense of decreasing tundra.

Figure FE 4. Glenn Juday presenting "Climate Disruption Effects in Boreal Forest of Alaska: Lessons from Research Natural Areas and Bonanza Creek Long Term Ecological Research Site," at the 35th Natural Areas Conference, Chicago IL, October 02, 2013.

Forest Education QR 3.13 Accomplishment #4 – Alaska Board of Forestry meeting, Soldotna, Alaska: "Boreal Alaska: Learning, Adaptation, and Production (BAKLAP) – Midsummer 2013" UPDATE

» Deliverable 3.1 Scientific Input for Optimum Management Practices: Biomass and Climate (OMP)

The Alaska Board of Forestry invited G. Juday to provide an update on progress in BAKLAP at the Board meeting August 12-13, 2013. Juday's presentation focused on the two main empirical research projects being supported by BAKLAP: the Operational Regeneration Assessment (ORA), and the Rosie Creek Fire Tree Regeneration Installation (RCF TRI) (See sections, Forest Research Accomplishment #1 and Forest Research Accomplishment #2 that follow immediately in this quarterly report).

In discussion that followed the presentation the value of the forest regeneration research that was described was recognized. The possibility was raised of initiating a scientific and technical committee to review current reforestation standards under the Alaska Forest Practices Act. Juday expressed a willingness to have BAKLAP contribute to such a process if it is launched.

SECTION 2

Quarter #3, 2013 BAKLAP Activity: Forest Research

Forest Research QR 3.13 Accomplishment #1: Sampling and preliminary analysis for the Operational Regeneration Assessment (ORA)

- Deliverable 1.1 Data Atlas of Forest Research Installations (DAFRI)
- Deliverable 1.3 Operational Regeneration Assessment (ORA)

During Quarter #3 of 2013, a data collection protocol was developed and adopted for Operational Regeneration Assessment (ORA) (See: Forest Research QR 2.13 Accomplishment #2: Operational Regeneration Assessment). The protocol was developed by Miho Morimoto and her graduate advisory committee (G. Juday, Major Advisor) in consultation with Dr. Brian Young, Resource Forester, Alaska Division of Forestry.

In designing the ORA protocol, one goal was to make it as compatible as possible with the Alaska Division of Forestry's forest regeneration survey method, which is used to verify compliance with the standards of the Alaska Forest Practices Act. If the ORA sampling and Forest Practices act systems are comparable, it will be possible to greatly expand the data base for analyses of post-harvest tree regeneration and the success or issues associated with state forest regeneration management. The ORA study adopted a system of subplots of 1.69m radius.

A total of 27 forest harvest units were sampled during the entire field season (Table FR 1), with 699 subplots. Most of the sampled harvest units were west of Fairbanks (Figure FR 1). Three of the units selected for sampling were either not harvested or were burned by subsequent fires through the regenerated forest. In-kind assistance for the ORA sampling was extensive, including French forestry student interns, Division of Forestry trucks, ATV, and boat, and a UAF Experiment Farm vehicle. Sampling according to the full protocol was completed in late August. Data analysis has been performed as the data were collected.

The ORA project has put together the first comprehensive look through time of forest harvest levels and practices. In the 1970s to early 1980s, forest harvest activity in central interior Alaska was very low (Figure FR 2). Regeneration activity has included both natural regeneration and planting of white spruce, with planting being most active from 1985 through 2001, 2004, and 2010 (Figure FR 2A). Less than half the area harvested is scarified, and in the last decade only one year (2010) was a significant amount of harvest area scarified (Figure FR 2B). A number of harvest systems have been used. Clearcutting was a significant amount of all harvest in the 1990s, but since then selection harvest systems have been more common (Figure 2C).

The 27 forest harvest units have been arranged in chronological order for a standard set of comparisons of changes in regeneration characteristics (tree stem density, DBH, biomass) with age (Figure FR 3 A, B, C).

Table FR 1. Operational Regeneration Assessment (ORA) sampling activity during Quarter #3, 2013.

Location	Unit	# subplot	Year	Harvest	Scarification	Reforestation	Dates	Crews*	Other assistance
Bonanza Ck	NC-120	41	1975	partial	none	plant	8/14-15	Morimoto, Jess	DoF truck
Bonanza Ck	NC-190	22	1977	clear	scarify	natural	6/19-23	Morimoto, Jess, Spencer	
Bonanza Ck	NC-249	22	1980	clear	scarify	natural	6/23,7/9	Morimoto, Jess, Heuittmann, Lazlo	UAF farm vehicle
Bonanza Ck	NC-556	20	1986	clear	none	natural	6/18, 8/29	Morimoto, Jess, Guisa	DoF boat
Bonanza Ck	NC-842	7	1992	partial	none	natural	8/12	Morimoto, Jess	DoF truck, ATV
Cache Creek	NC-1129	22	1999	partial	none	plant	6/27-28	Morimoto, Juday, Guisa	DoF truck
Cache Creek	NC-454	44	1991	clear	scarify	plant	8/6, 13	Morimoto, Jess	DoF truck, ATV
Cache Creek	NC-927	43	1998	partial	none	plant	7/17,18,23	Morimoto, Jess, Meyers	UAF farm vehicle
Nenana	NC-747	31	1994	clear	none	plant	6/20-21	Morimoto, Guisa, Charly, Loic	DoF boat
Nenana Ridge	NC-1116	9	2003	partial	scarify	natural	7/29	Morimoto, Jess	UAF farm vehicle
Nenana Ridge	NC-733	45	1992	clear	scarify	plant	8/7-8, 15	Morimoto, Jess	DoF truck, ATV
Rosie Creek	NC-1135	49	2002	partial	none	plant	6/10-6/14	Morimoto, Jess, Spencer, Guisa	
Rosie Creek	NC-305	11	1987	partial	scarify	plant	7/8, 10	Morimoto, Jess	UAF farm vehicle
Rosie Creek	NC-279	21	1982	partial	scarify	plant			
Skinny	NC-1143	28	2004	partial	none	natural	8/5	Morimoto, Jess	DoF truck, ATV
Skinny	NC-93	36	1975	partial	none	natural	7/25, 28	Morimoto, Juday, Madan	UAF farm vehicle
Salcha	NC-1137	29	1997	clear	none	plant	7/31, 8/1	Morimoto, Jess	
Salcha	NC-395	21	1983	clear	none	natural	7/30	Morimoto, Jess	
Salcha	NC-740	8	1991	clear	none	plant	8/1	Morimoto, Jess	
Standard Ck	NC-1085	47	1996	partial	scarify	plant	6/26, 7/15-16	Morimoto, Jess	DoF truck
Standard Ck	NC-1090	7	1999	partial	none	natural	5/30, 7/16	Morimoto, Guisa, Spencer, Jess	UAF farm vehicle
Standard Ck	NC-140-17	8	1979	clear	none	natural	5/27-28	Morimoto, Guisa	
Standard Ck	NC-140-38	7	1982	clear	scarify	natural	5/29	Morimoto, Guisa, Spencer	
Standard Ck	NC-702	9	1993	clear	none	plant	5/30, 7/16	Morimoto, Guisa, Spencer, Jess	UAF farm vehicle
Standard Ck	NC-750	41	1995	clear	scarify	plant	6/24-25	Morimoto, Guisa, Jess	DoF truck
Two Rivers	NC-705	44	1989	clear	scarify	plant	7/1-3	Morimoto, Jess	
Two Rivers	NC-709	35	1991	clear	scarify	plant	8/21, 26-27	Morimoto, Jess, Young	DoF truck, ATV
Two Rivers	NC-760	13	1998	partial	none	natural	8/27	Morimoto, Jess	DoF truck, ATV
Two Rivers	NC-107	20	1973	partial	none	natural	7/5		
Two Rivers	NC-368	17	1983	clear	none	natural	7/5		

Red = units which were sampled in summer 2013, black = units which were visited but not sampled because they were not logged or burned after logging, year = year logged, note = resources provided

**Morimoto, Jess, Spencer, Juday and Meyers = UAF BAKLAP; Guisa, Charly and Loic = internship students at DoF; Young = DoF forester; Heuittmann = UAF faculty and committee member of Morimoto; Lazlo and Madan = internship students for Heuittmann*

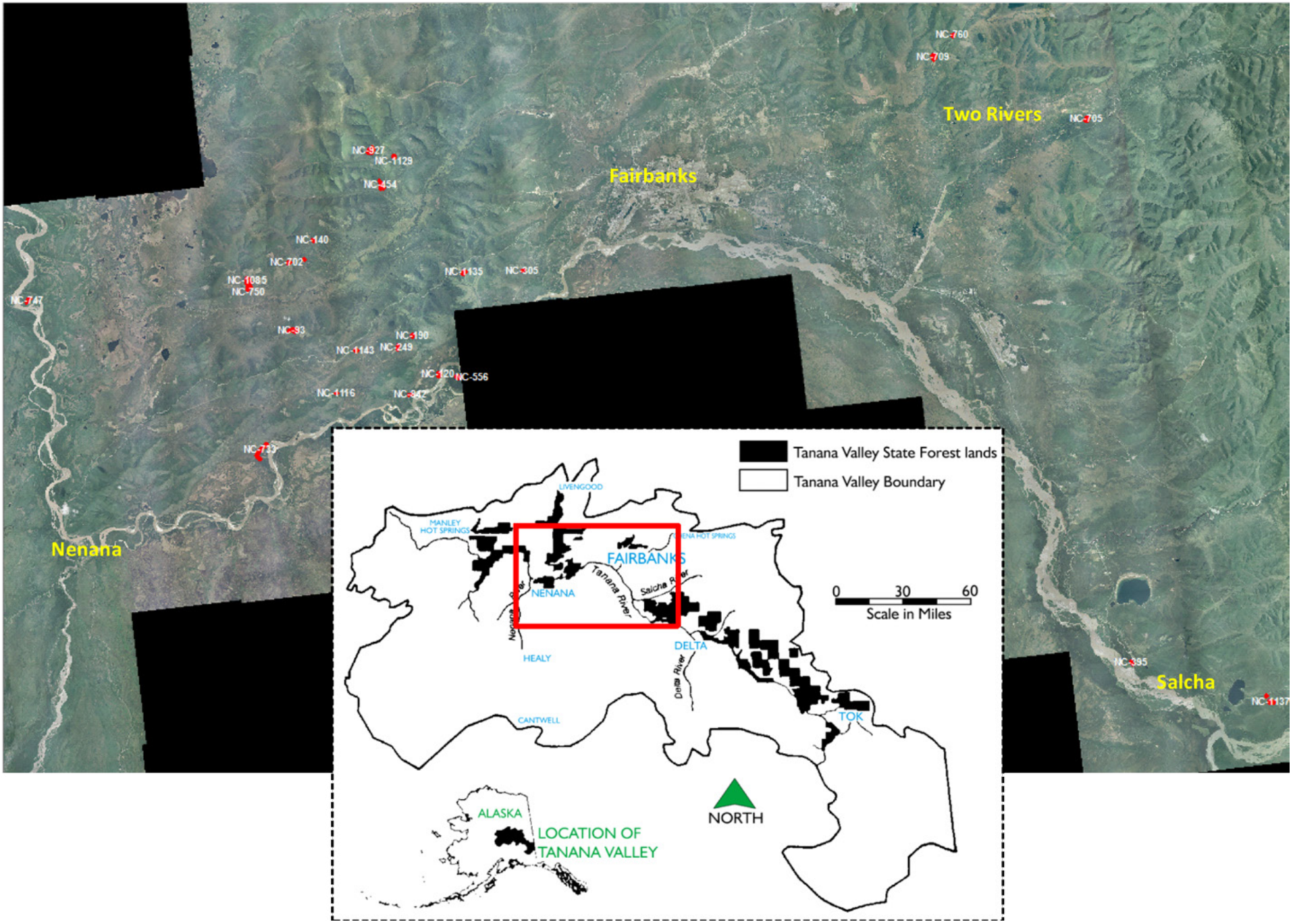


Figure FR 1. Study Area. Fairbanks area of Tanana Valley State Forest.

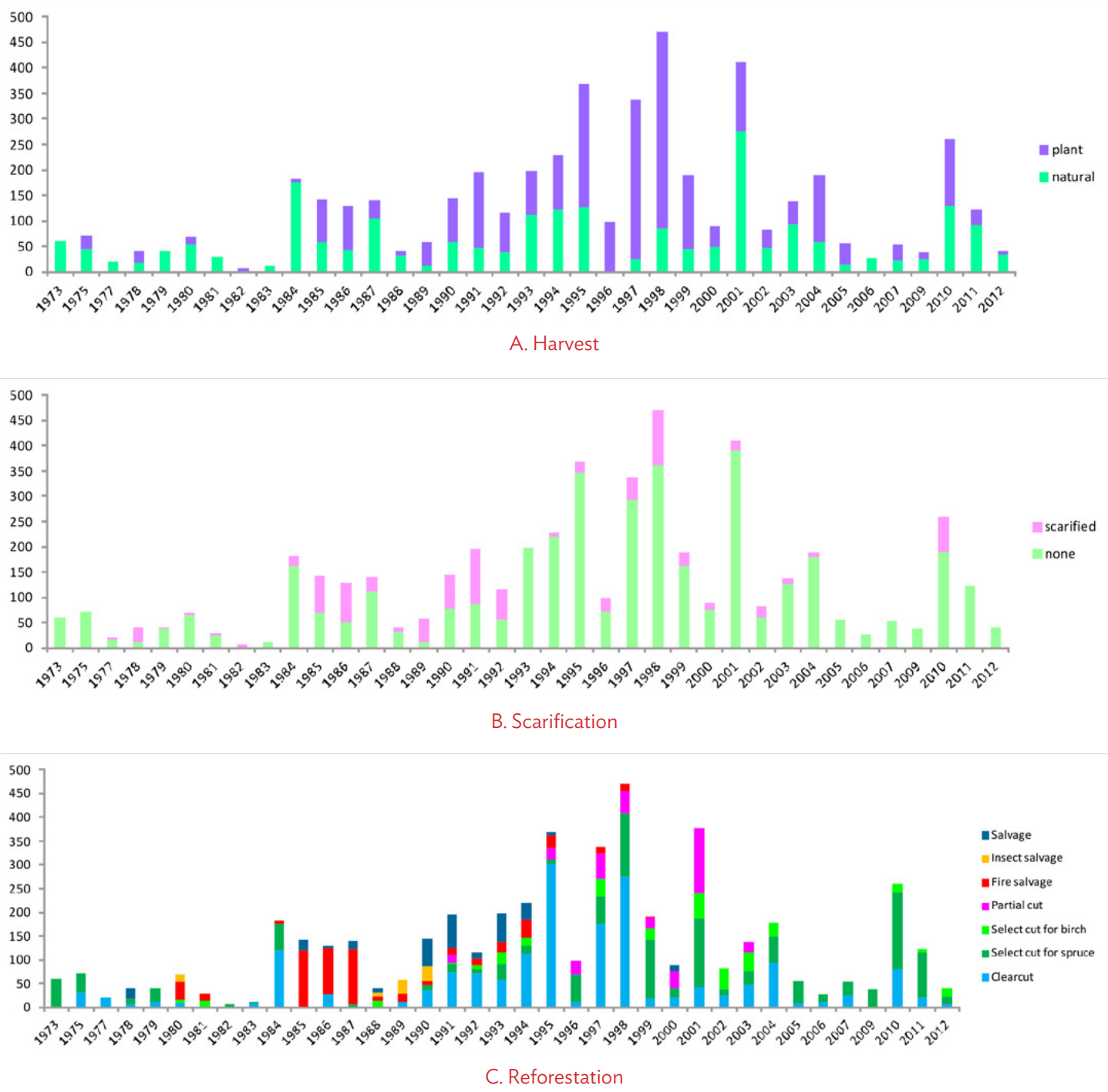
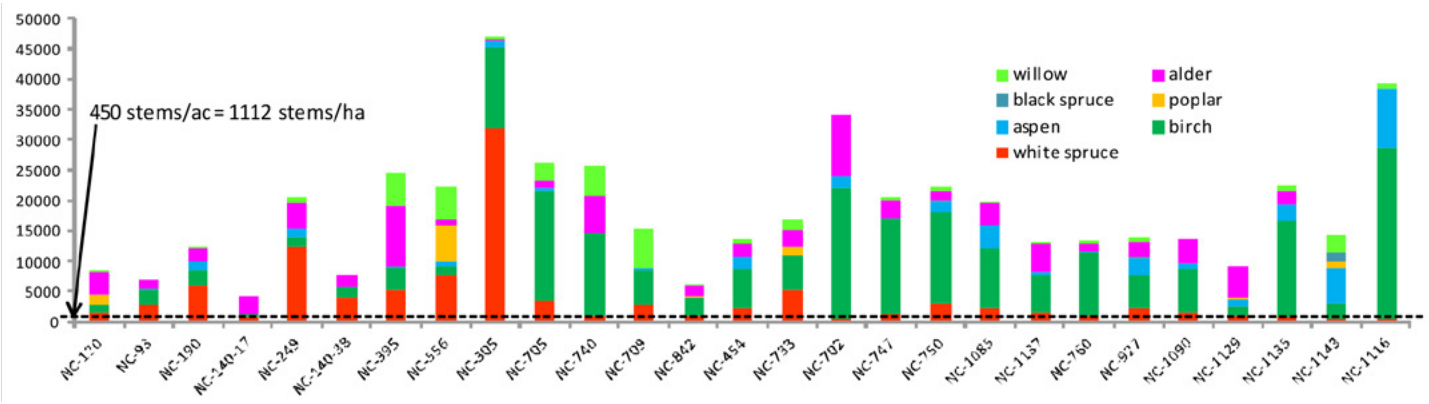
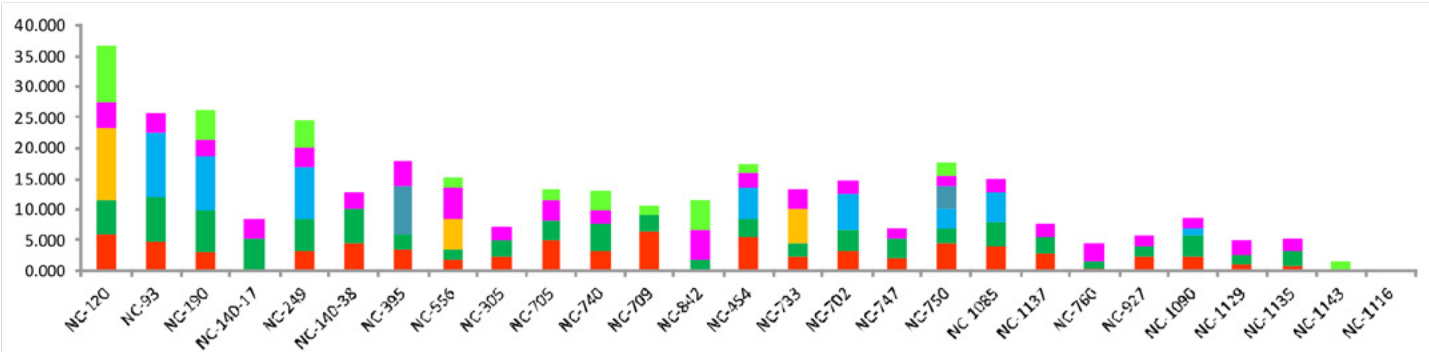


Figure FR 2. Historical trends of harvest area (ha) by (a) harvest, (b) scarification, and (c) reforestation methods.

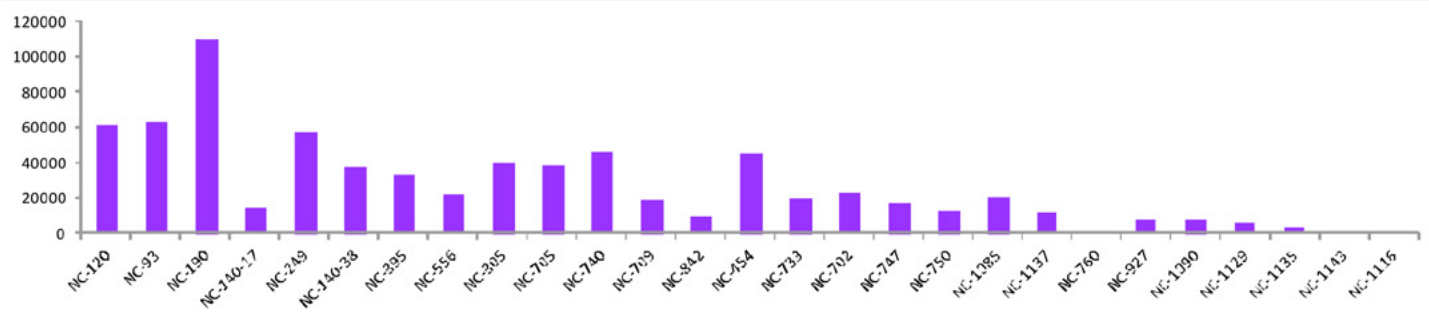
The Alaska Forest Practices Act standard for forest regeneration in Regions II and III (Interior or boreal forest) is 450 well-distributed, effective stems per acre within seven years following harvest. This is equivalent to 1,112 stems per hectare. Most of the forest harvest units sampled for ORA contained more than 1,112 white spruce stems per hectare, and all the units had more than 1,112 stems per hectare when all species were included down to the lower limit of 1.0 cm DBH (Figure FR 3A). The time since harvest (at the time of ORA sampling) was greater than seven years for all harvest units.



A. Stem number per hectare



B. Mean DBH



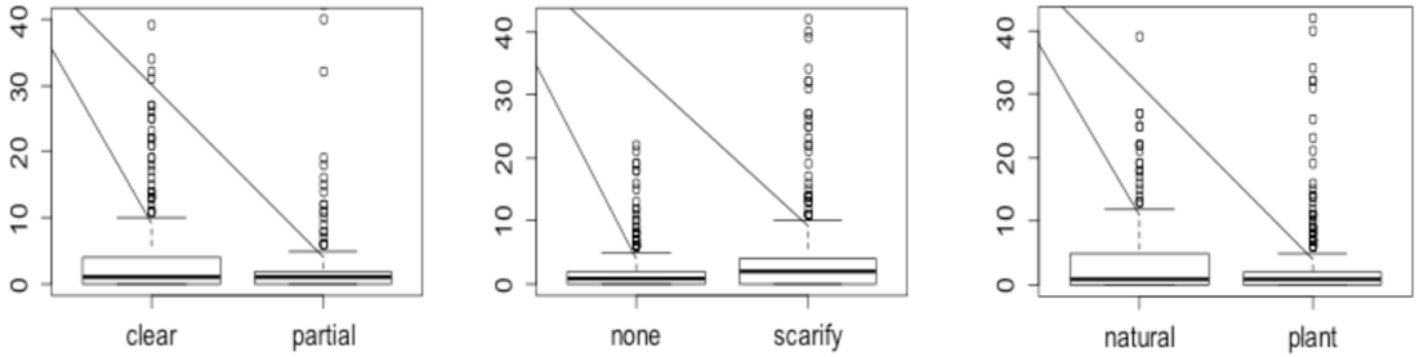
C. Biomass

Figure FR 3. (a) stem number per hectare by species (b) mean DBH by species and (c) biomass (kg) per hectare. The graph is in chronological order (older to younger).

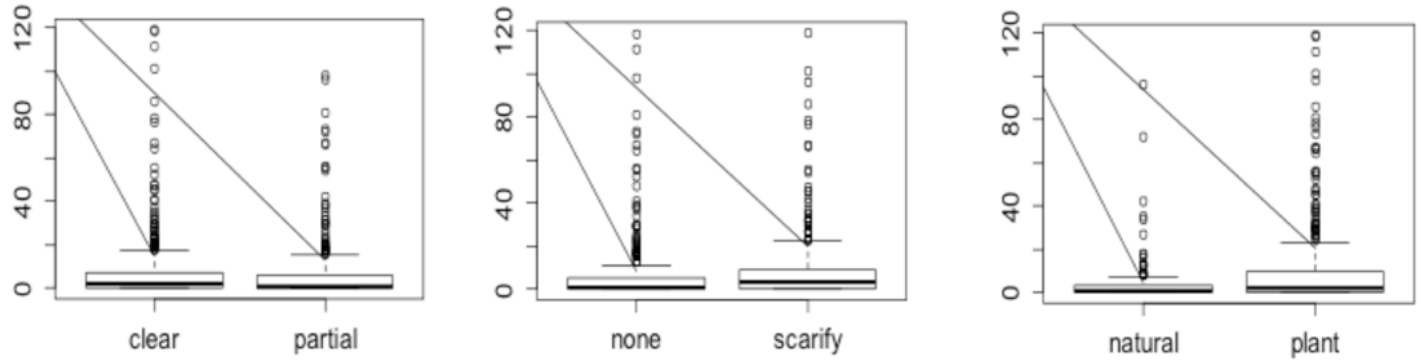
In general, in the ORA chronology of harvest units (to date), younger units contain more birch stems and older units contain more white spruce stems (Figure FR 3A). As expected, average DBH and biomass become steadily larger as the units become older (Figure FR 3B, C), indicating that no regeneration gaps or failures in regeneration during specific periods were incorporated into the ORA sample.

Operational Regeneration Assessment data have been formatted and are presented here as a progress report, but a full analysis has not been conducted yet. The reader is specifically cautioned not to use these preliminary data as conclusions that have been appropriately tested and established.

Clearcutting appears to be associated with increased white spruce stem density (Figure FR 4A) but not birch density (Figure FR 4B). Scarification increased stem density of both white spruce and birch (Figure FR 4 A, B).



A. White spruce stem density in number per hectare (vertical axis) versus management practice



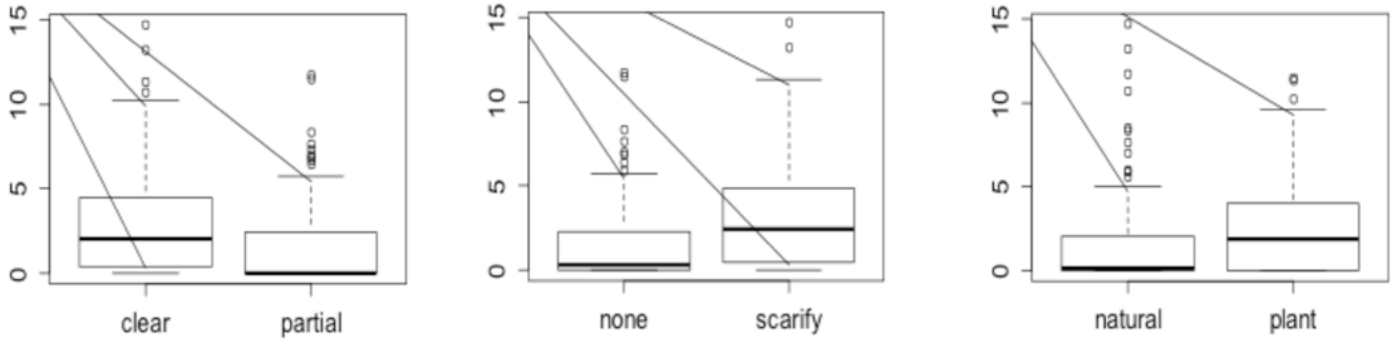
B. Alaska birch stem density versus management practice

Figure FR 4. Comparison of stem density of white spruce and Alaska birch by management practices of harvest type, scarification, and reforestation type.

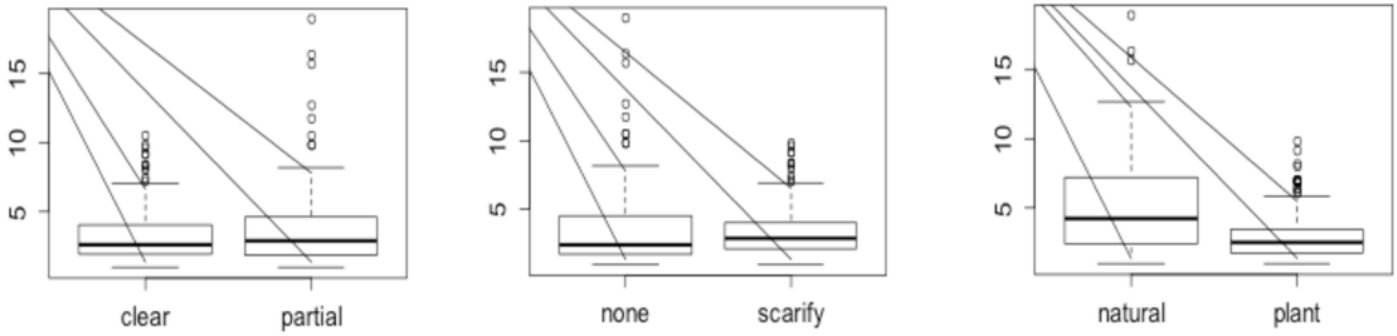
White spruce was more abundant, as measured by stem density, in naturally regenerated units (Figure 4A) while birch was more abundant in planted units (Figure 4B).

White spruce appears to be larger in diameter in clearcuts compared to partially harvested units, on scarified sites versus sites with no scarification, and in planted units compared with naturally regenerated units (Figure FR 5 A). Again, tests for statistical significance of these differences are not complete. Birch appears to be larger in diameter only in naturally regenerated units (Figure FR 5 B). In summary, clearcutting and scarification is associated with an apparent increase in both stem number and mean DBH of white spruce, while planting of white spruce appears to be associated with a reduction in white spruce stem number and an increase in mean DBH. Harvest type and scarification did not appear to affect birch stem number and mean DBH. More birch appear to have regenerated in planted units but mean birch DBH appears to be larger in naturally regenerated units. Statistical testing of the significance of these trends is not complete.

To test the effectiveness of the ORA sampling system, which uses 1.69 m radius subplots spaced at 50 m intervals, a partial tree census was conducted on forest harvest unit NC-140-38 (Figure FR 6). The partial tree census covered alternate 0.25 ha (50m by 50m) blocks across the harvest unit.



A. White spruce mean DBH in cm (vertical axis) versus management practice



B. Alaska birch mean DBH (cm) versus management practice

Figure FR 5. Comparison of mean diameter of white spruce and Alaska birch by management practices of harvest type, scarification, and reforestation type.

In the .25 ha census blocks all stems taller than 1 m and smaller than 1 cm in DBH (size class 2) were counted, and all stems larger than 1 cm in DBH (size class 3) were measured. For all woody stems greater than 1 cm (size class 3), DBH was measured, and then height was measured on every twentieth tree. The data were combined for the circular subplots and compared with the combined data of all 0.25 ha blocks (Figure FR 7).

The proportion of stems (both size classes combined) by species are similar in the partial census blocks compared to the subplot estimate (Figure FR 7A, 7B). However, the actual stem density numbers appear to be underestimated in the subplot sample (Figure FR 7A, 7B) and particularly so for size class 2 stems (Figure FR 7C, 7D). The proportion of species in size class 3 appears to be similar in the partial census blocks compared to the subplot estimate (Figure FR 7E, 7F). The estimate of actual stem density of size class 3 white spruce is quite similar for the subplots estimate versus the partial census, but stem density appears to be underestimated by the subplots for alder and especially for birch (Figure FR 7E, 7F). Because biomass estimates are disproportionally influenced by larger stems, the subplot sampling system may generate useful estimates, although further analysis of the magnitude of sampling uncertainty is needed.

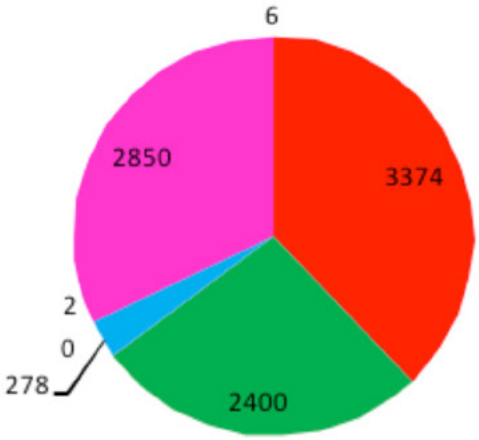
Stem number is underestimated from random sampling, and especially the number of stems at size class 2.

Figure FR 6. Partial tree census in forest harvest unit NC-140-38 (outlined in red). Yellow shaded squares are 50 m by 50 m census areas; standard sample plots are numbered red circles.

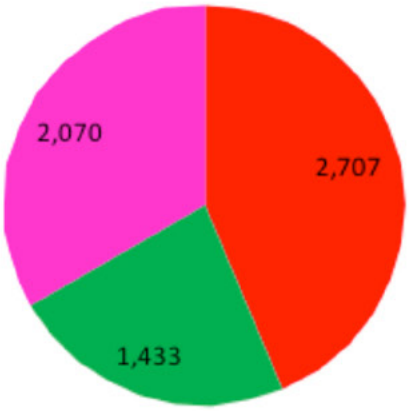
Table FR 2. Comparison of DBH and basal area between partial census and subplots values at forest harvest unit NC-140-38.

	DBH		Basal Area	
	Census	Subplot	Census	Subplot
White spruce	4.07	4.41	5.241	4.146
Birch	6.04	5.66	10.159	4.133
Aspen	9.07		1.983	
Poplar				
Black spruce				
Alder	3.19	2.81	0.476	1.639
Willow	1.95		0.001	
TOTAL			17.860	9.918

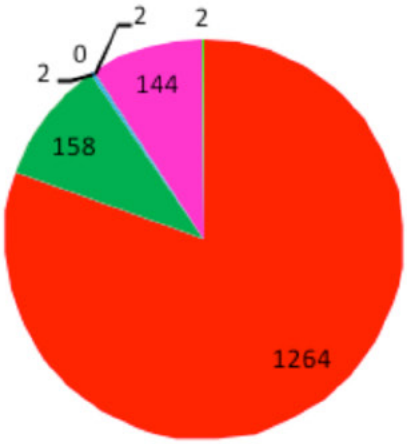
Basal area at forest harvest unit NC-140-38 appears to be similar for white spruce in subplot sampling compared to the partial census, but underestimated for other species (Table FR 2). Further analysis will be performed to either better define the sampling uncertainty or improve the estimates generated from samples.



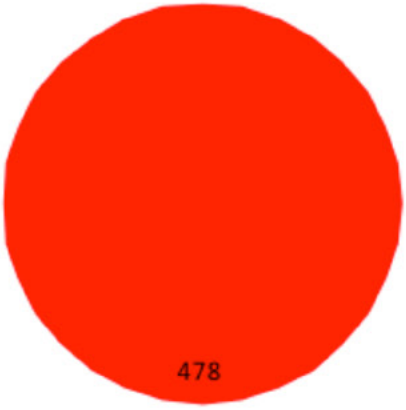
(a) Partial census stem density of size class 2 and 3



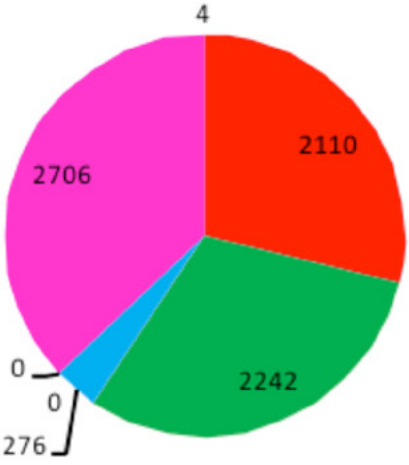
(b) Subplots stem density estimate of size class 2 and 3



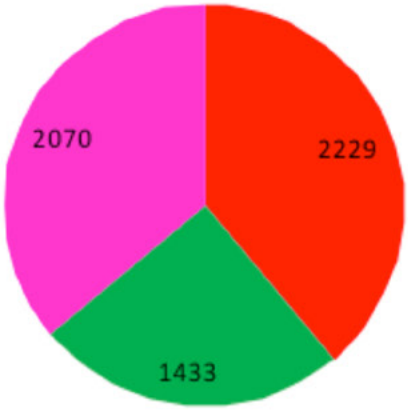
(c) Partial census stem density of size class 2



(d) Subplot stem density estimate of size class 2



(e) Partial census stem density of size class 3



(f) Subplot stem density estimate of size class 3

Figure FR 7. Comparison of stem number per hectare between census and estimate from random sampling in NC-140-38

Forest Research QR 2.13 Accomplishment #2: Sampling and preliminary analysis of Rosie Creek Fire Tree Regeneration Installation (RCF TRI).

» Deliverable 1.1 Data Atlas of Forest Research Installations (DAFRI)

Graduate student Andrew Allaby completed summer field measurements for his MS research, with his thesis provisionally titled "A Boreal Silviculture Experiment and Implications for Wood Biomass." Sampling was in the 28-year old Rosie Creek Fire Tree Regeneration Installation (RCF TRI) located in Bonanza Creek Experimental Forest (Figure FR 8). Principal field effort during the 3rd Quarter was provided by the technicians (and volunteers) listed in Table FR 3.

Table FR 3: Field technical assistance at the Rosie Creek Fire Tree Regeneration Installation (RCF TRI) over the 35 measurement days of field season 2013.

Field Tech	Days in Field
Andrew Allaby	35
Kristy Johnsson	25
Kimberley Maher	7
Roy Flynn	6
Eva Allaby	2
Ryan Jess	2
Alex Allaby	1
Ari Pescovitz	1
Total Person-Days	79

Across the entire RCF TRI, 114 of the 180 experimental subunits were sampled during the 2013 field season. All of the subunits that received the three commonly used white spruce regeneration methods were sampled: 1) planted seedlings, 2) broadcast seeding, and 3) natural regeneration (control) (Figure FR 8). In addition to the three commonly used methods three other regeneration methods were used in the RCF TRI, including 4) spot seeding, 5) spot seeding with a plastic cone shelter, and 6) fall spot seeding. While the subunits with the three less commonly used regeneration methods were systematically avoided on much of the RCF TRI, on one of the replicate blocks, Ridgetop Site Block 3, every subunit was sampled (Figure FR 8).

In the 2013 field season, a total of 16,050 trees were sampled in 114 subunits for species and diameter at breast height (DBH). These results came from 456 one-meter wide transects totaling 17,415 m^2. An additional 5,022 trees were counted in 6 census subunits for species and DBH, and 257 trees were measured for height using a laser rangefinder. A census subunit was completed in each of the 6 blocks, including collection of height data on every 20th tree. In the census units 7,240 m^2 were surveyed; total area measured in both censuses and transects was 2.46 hectares (6.1 acres).

Over two-thirds of the stems (> 1.0 cm) on the entire RCF TRI are birch, with about 17% white spruce, about 7% aspen (Figure FR 9). Compared to stem numbers, the proportion of the basal area among species on RCF TRI is slightly less birch, nearly triple the aspen (18%) aspen, and about the same of white spruce (Figure FR 10).

Most aspen at RCF TRI are in the 50 to 150 mm diameter range, with the largest over 250 mm (Figure 11). Alder stems occupy a narrow range of diameters, with a mean of 36 mm (Figure FR 11). Birch and white spruce have similar diameter distributions, with a strong negative exponential distribution and median values of just over 30 mm (Figures 13 and 14).

Allaby presented his research methods and objectives to representatives of the interior Alaska legislative delegation during a field tour related to the BAKLAP capital appropriation on September 20 (See this report—item QR 3.13 FE #2).

Additional collection of height data and high-precision GPS georeferencing is ongoing, as well as initial statistical analyses.

Species codes for Figures 9 & 10, opposite

Species Code	*Species*
A	Aspen (*Populus tremuloides*)
AL	Alder (*Alnus* spp.)
B	Birch (*Betula neoalaskana*)
C	Balsam poplar (*Populus balsamea*)
WL	Willow (*Salix* spp.)
WS	White spruce (*Picea glauca*)

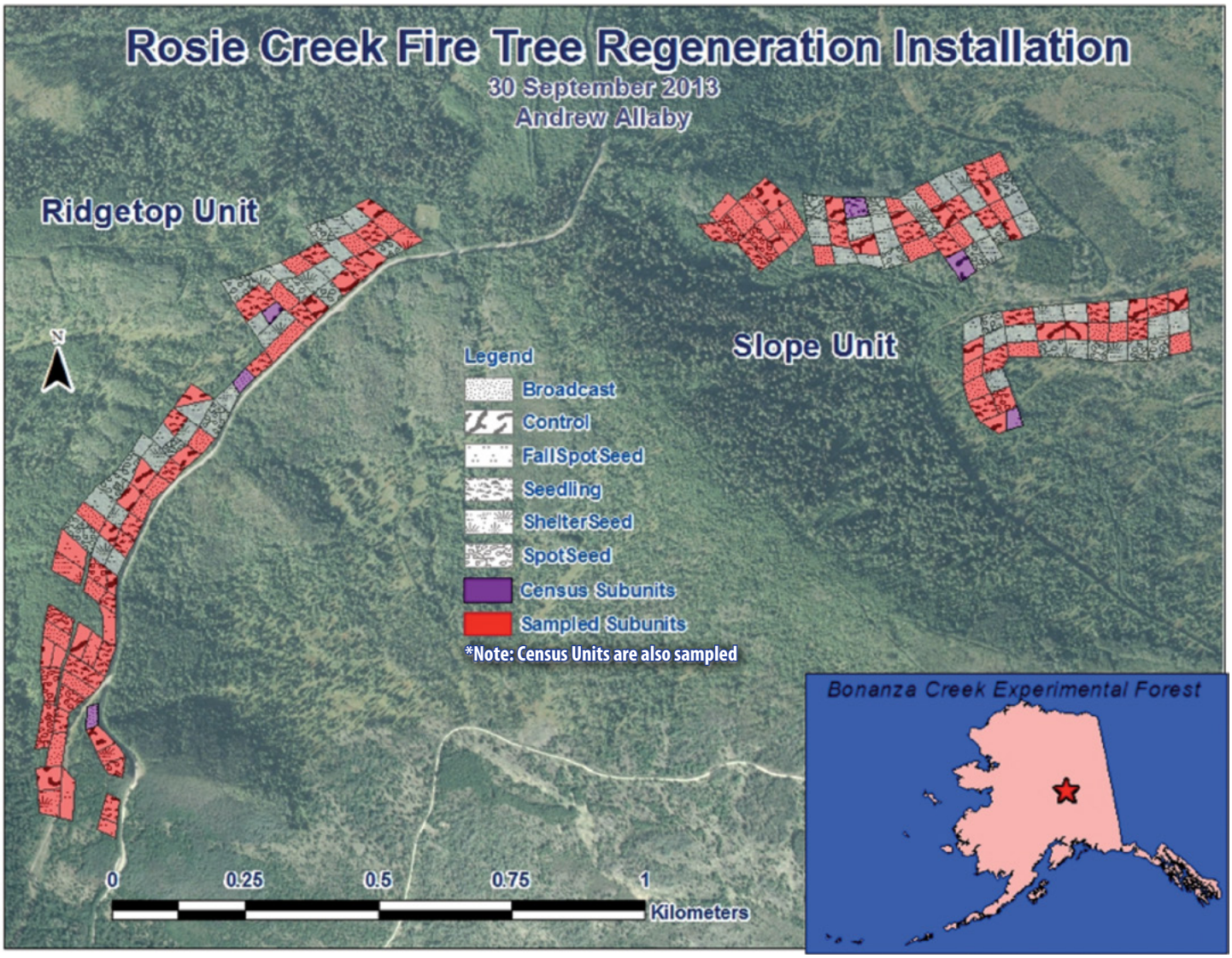


Figure FR 8: Status of 2013 sampling in the Rosie Creek Fire Tree Regeneration Installation.

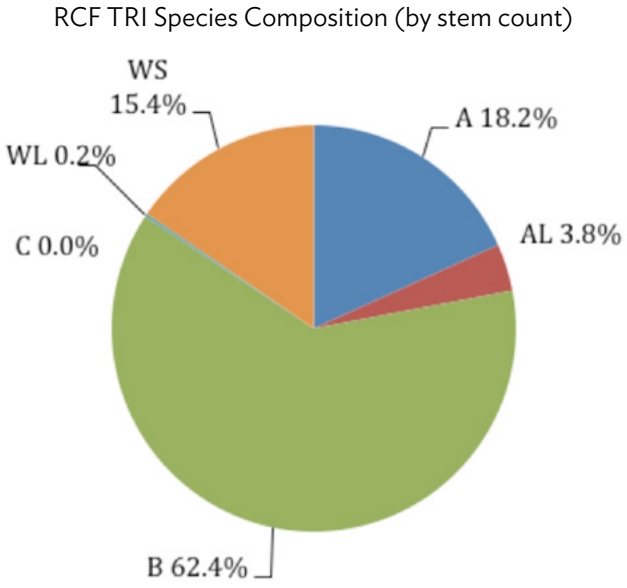


Figure FR 9: Pie chart showing species composition for each tree species surveyed in the RCF TRI sample; data are for the entire site.

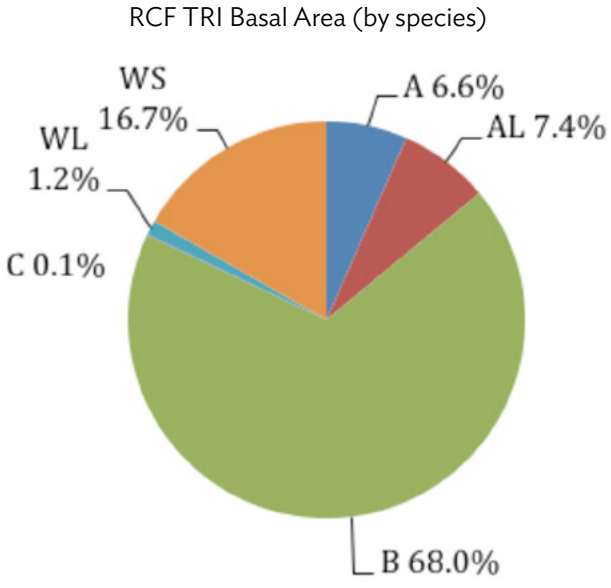
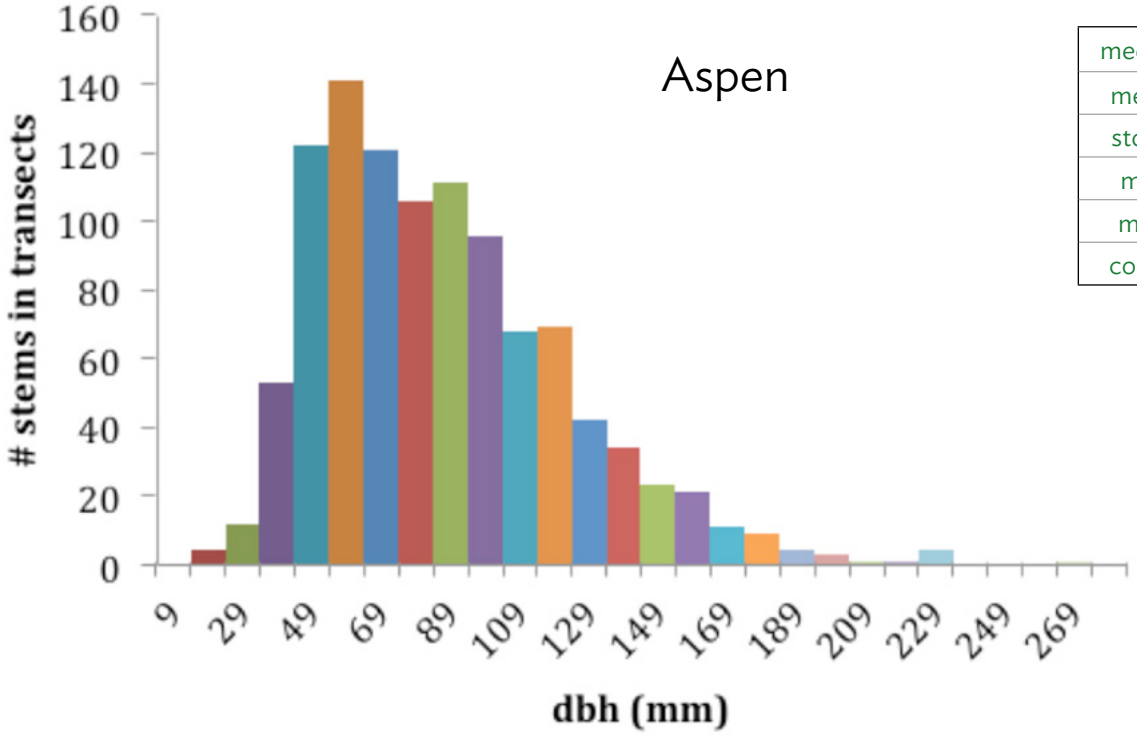
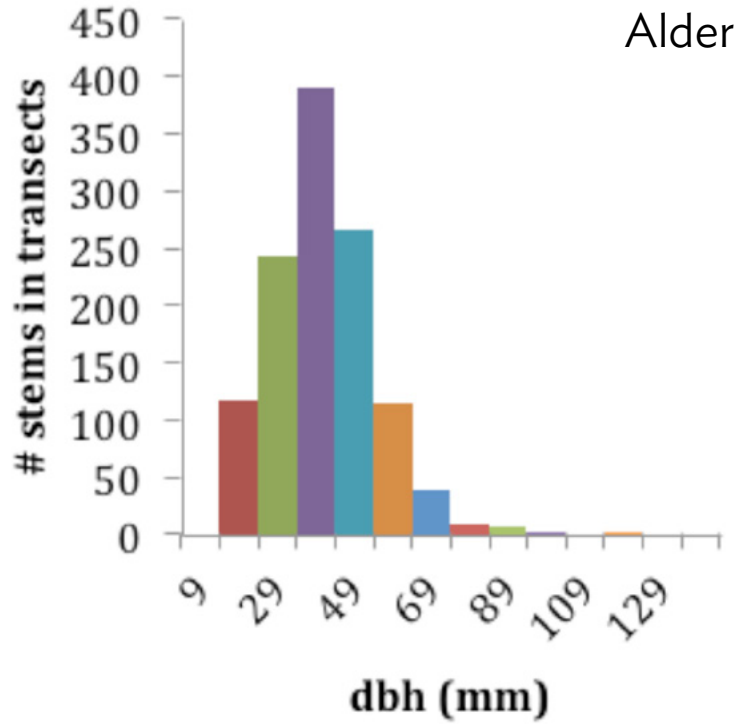


*Figure FR 10: Pie chart showing basal area π * (1/2 * DBH)2 by species for the entire site, where DBH = diameter at breast height, 1.37 m.*



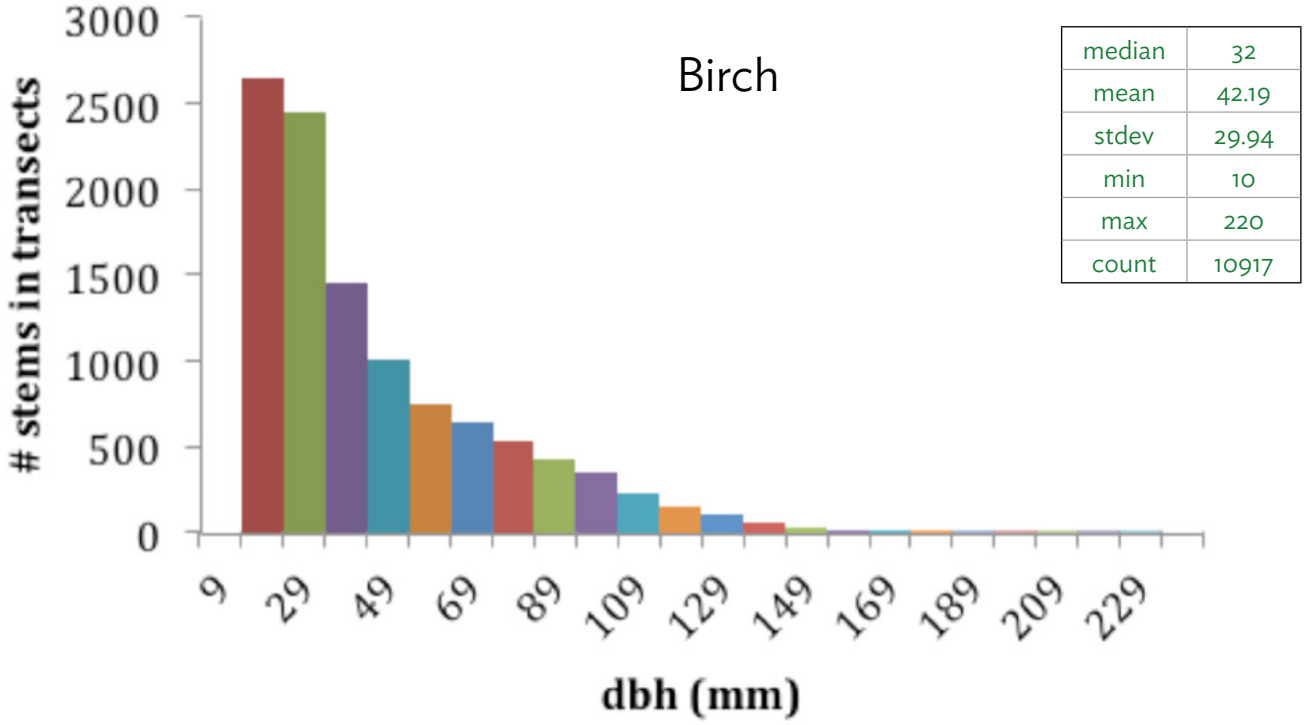
median	77
mean	82.43
stdev	35.94
min	12
max	267
count	1057

Figure FR 11: Distribution and descriptive statistics of DBH (diameter at breast height, = 1.37 m) for all aspen at RCF TRI.



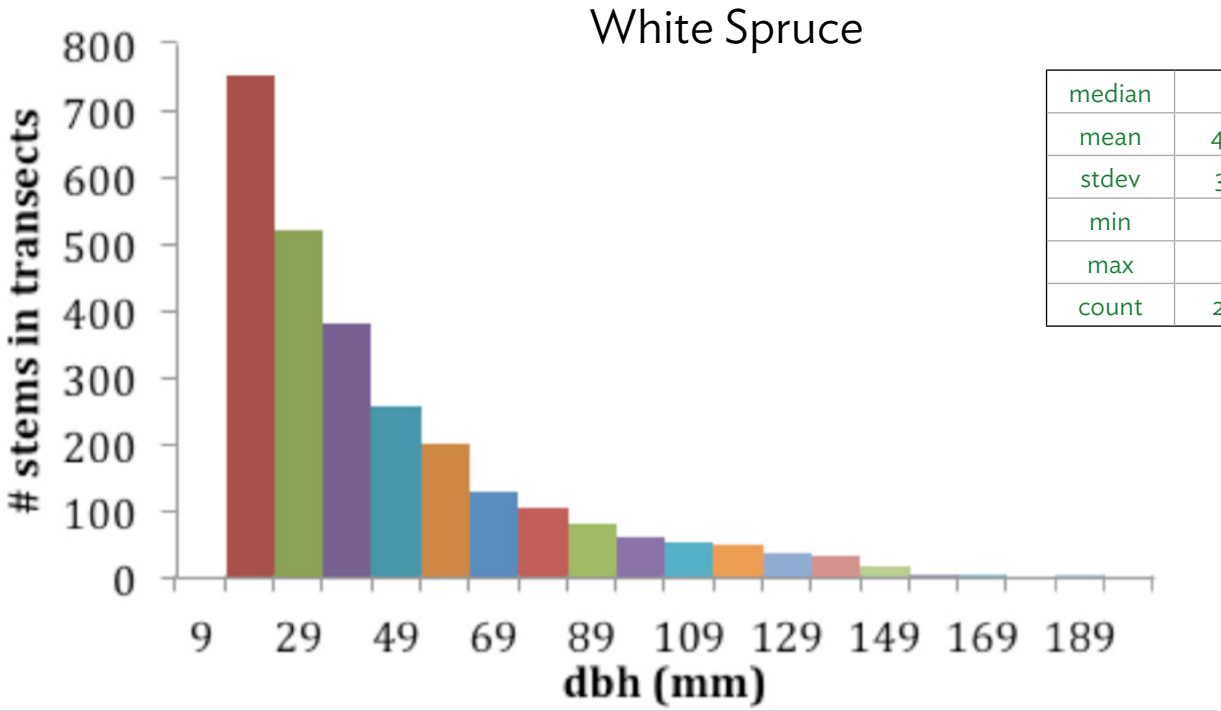
median	35
mean	36.10
stdev	13.22
min	10
max	110
count	1189

Figure FR 12: Distribution and descriptive statistics of DBH (diameter at breast height, = 1.37 m) for all sampled alder at RCF TRI.



median	32
mean	42.19
stdev	29.94
min	10
max	220
count	10917

Figure FR 13: Distribution and descriptive statistics of DBH (diameter at breast height, = 1.37 m) for all sampled birch at RCF TRI.



median	31
mean	41.50
stdev	31.17
min	10
max	185
count	2683

Figure FR 14: Distribution and descriptive statistics of DBH (diameter at breast height, = 1.37 m) for all sampled white spruce at RCF TRI.

Forest Research QR 3.13 Accomplishment #3: Forest Development and Succession Following Wildfire – the Reserve West Forest Reference Stand

- » Deliverable 1.1 Data Atlas of Forest Research Installations (DAFRI)
- » Deliverable 2.1 Title: Scientific Input for Optimum Management Practices: Biomass and Climate (OMP)
- » Deliverable 2.4 Title: Citizen Science Field Training and Framework Development (CITFORSCI)
- » Deliverable 3.3 Title: Forest Management Outcomes Report (FORMOR)

During 2013 Quarter #3, progress was made in compiling data from the Bonanza Creek Experimental Forest Reference Stand Network. Reference stands are hectare-scale plots in which all trees were mapped and measured following the 1983 Rosie Creek Fire. Six reference hectares were established following the fire to represent the three main commercial forest types—aspen dominated, white spruce dominated, and Alaska birch dominated, on sites that were burned in the fire and matched stands that were not burned (Figure FR 15)

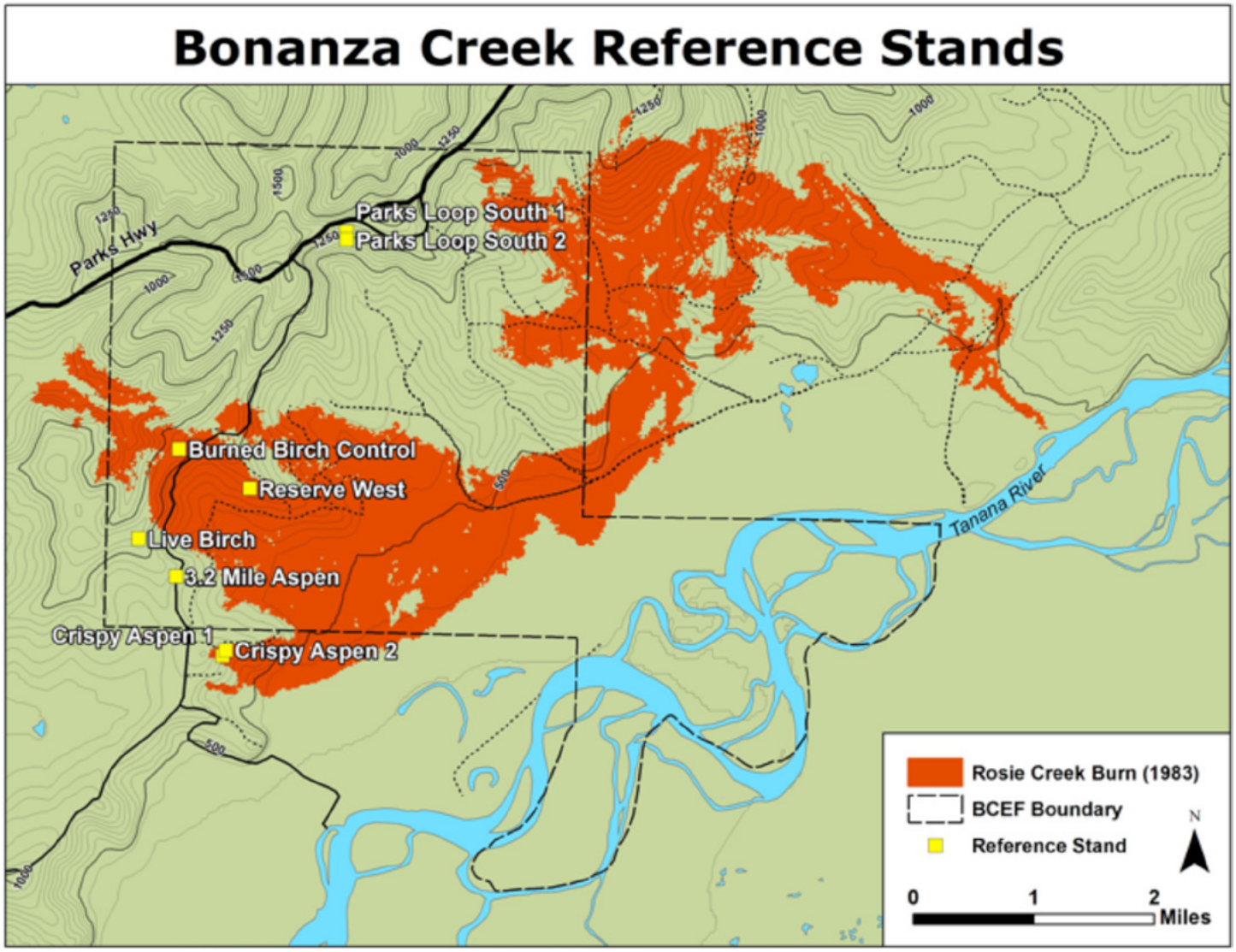


Figure FR 15: Location and name of the six reference stand locations in Bonanza Creek Experimental Forest.

The purpose, layout, and history of the reference stands are described in a chapter in the second volume of Long-term Silvicultural and Ecological Studies (LTSR), Results for Science and Management, published by the Yale School of Forestry and Environmental Studies in 2013 (Figure FR 16). The first print run of the publication contained errors in the figures, and a second edition will be issued.

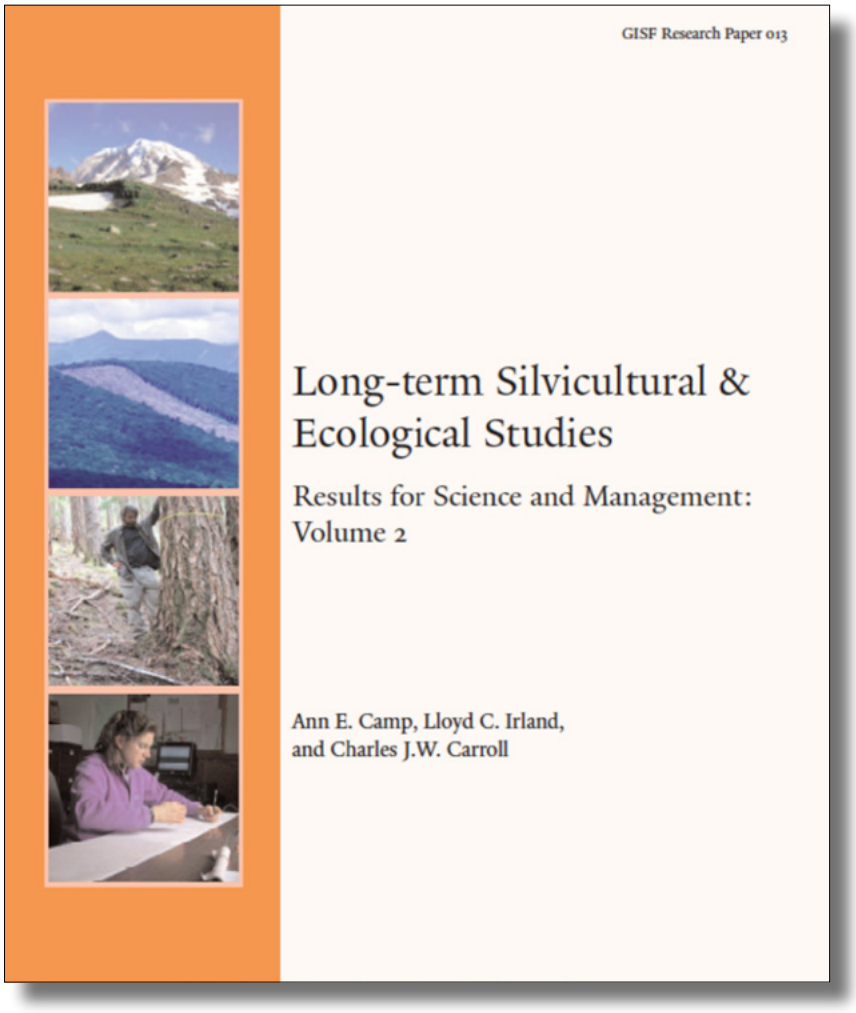


Figure FR 16: Long-term studies publication containing two chapters with BAKLAP-related material.

Volume 2 of LTSR also contains a chapter on the Rosie Creek Fire Tree Regeneration Installation (RCF TRI). The two chapters are:

Juday, Glenn P. 2013. Monitoring Hectare-Scale Forest Reference Stands At Bonanza Creek Experimental Forest LTER. Pp 31-48 In: Camp, A.E.; Irland, L.C.; Carroll, C.J.W. (eds.) *Long-term Silvicultural & Ecological Studies: Results for Science and Management*, Volume 2. Global Institute for Sustainable Forestry Research Paper 013, Yale University School of Forestry and Environmental Studies. 187 p.

Juday, Glenn P.; Densmore, Roseann V.; Zasada, John C. 2013. White Spruce Regeneration Silviculture Techniques 25 years after Wildfire: the Rosie Creek Fire Tree Regeneration Installation. Pp 49-65 In: Camp, A.E.; Irland, L.C.; Carroll, C.J.W. (eds.) *Long-term Silvicultural & Ecological Studies: Results for Science and Management*, Volume 2. Global Institute for Sustainable Forestry Research Paper 013, Yale University School of Forestry and Environmental Studies. 187 p.

This quarterly report will focus on the Reserve West reference hectare (formerly old growth white spruce stand, burned in 1983), located in the central portion of Bonanza Creek Experimental Forest (Figure FR 17).

Reserve West is serving as a test case for the development of the Data Atlas of Forest Research Installations (DAFRI) databases and data atlas entries. The location and layout of permanent photo monitoring stations are shown in Figure FR 18. These standard depictions of the location and layout are being replicated for the other five reference stands.

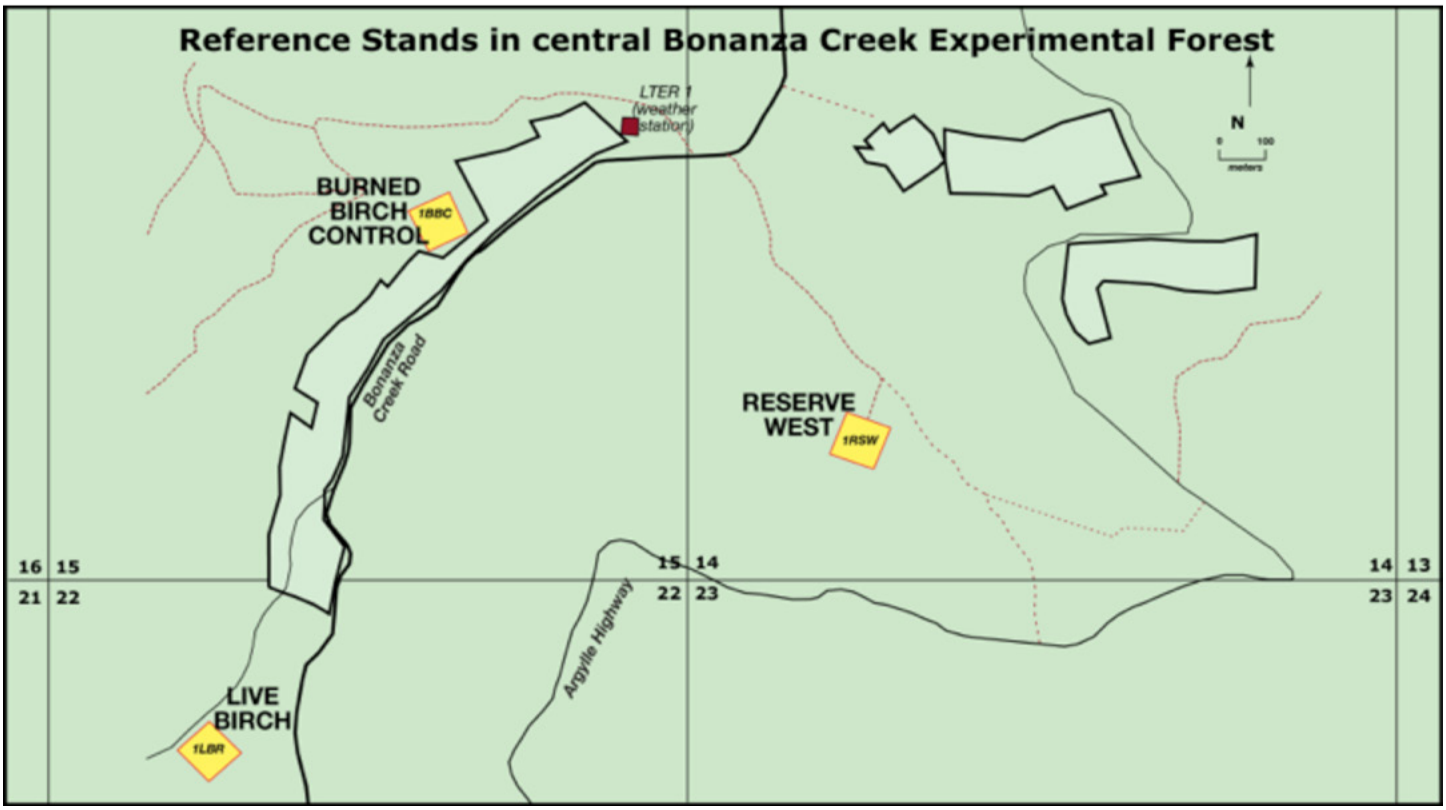


Figure FR 17: Location of Reserve West Reference Hectare in Bonanza Creek Experimental Forest. .

The growth, survival, and condition of all white spruce at Reserve West have been monitored annually since 1988. In 1989 reference hectare was divided up into 10 m by 10 m cells (Figure FR 19). Each 10 m cell has a map of all live white spruce tree locations. It was found that in the field even with a complete list and the tagging of all tree locations (Figure FR 20), a location map was necessary in order to focus the search to relocate each tree.

After a few years of remeasurement of white spruce in the Reserve West Reference Stand, it was determined that more positional references were needed than provided by the positional posts in the 10 m by 10 m grid, so the hectare was gridded with posts places every 5 m. This post gridding system allows a field reference measurement no farther than 2.5 m for any feature in the plot.

Forest Research QR 2.13 Accomplishment #4:

» Deliverable 1.3 Scientific Publications on Forest Production and Climate (SCIPUB)

Climatic variability continues to be a major challenge for the boreal forest of much of Alaska. Weather during 2013 was especially variable, with a record number of days with temperatures more than two standard deviations above or below normal by the end of the third quarter in October (Figure FR 21). The near-record late spring and cold in April and early May were noted in a previous quarterly report. During the third quarter a record number of days with temperatures 80 degrees F or warmer was set at Fairbanks (Figure FR 22).

The late spring and snowmelt, together with moderate summer temperatures and well-timed rains in the 2012 growing season in central Alaska provided substantial relief from the cumulative heat and drought stress to trees that had reached severe levels over the past few decades. The trees entered 2013 growing season in a better condition than in many years. However, the turn back to heat and drought was extreme. The mean temperature

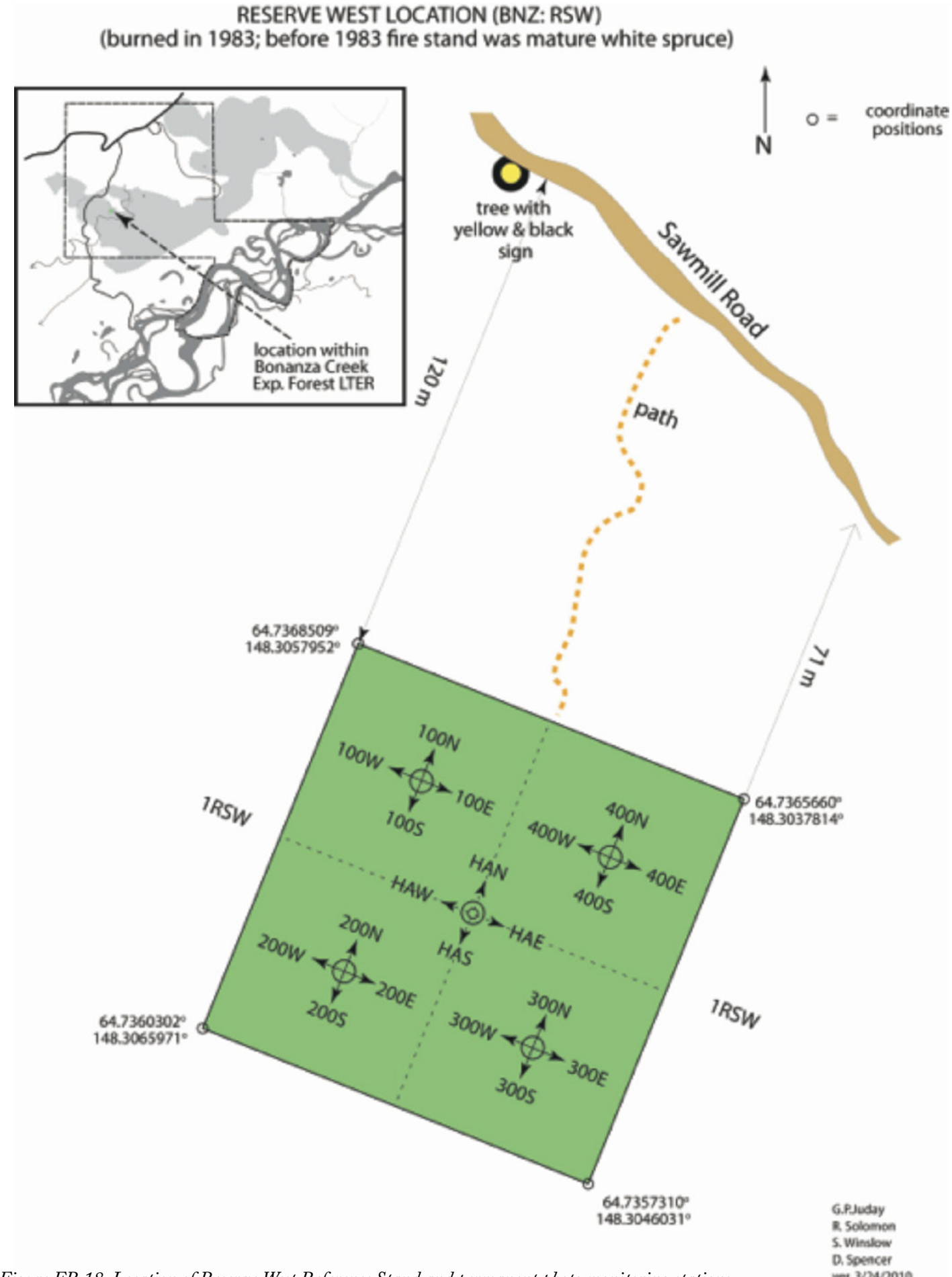


Figure FR 18. Location of Reserve West Reference Stand and permanent photo monitoring stations.

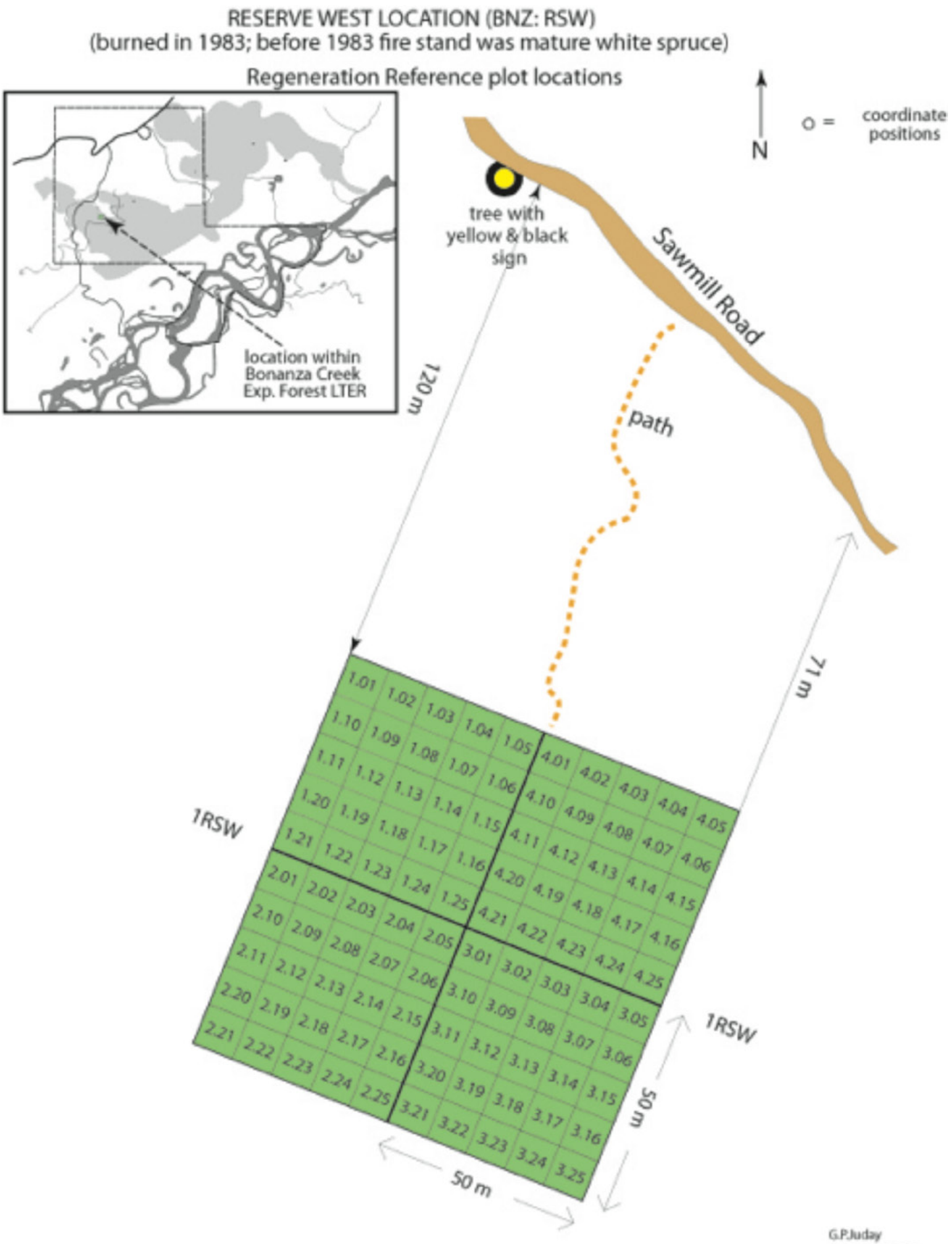
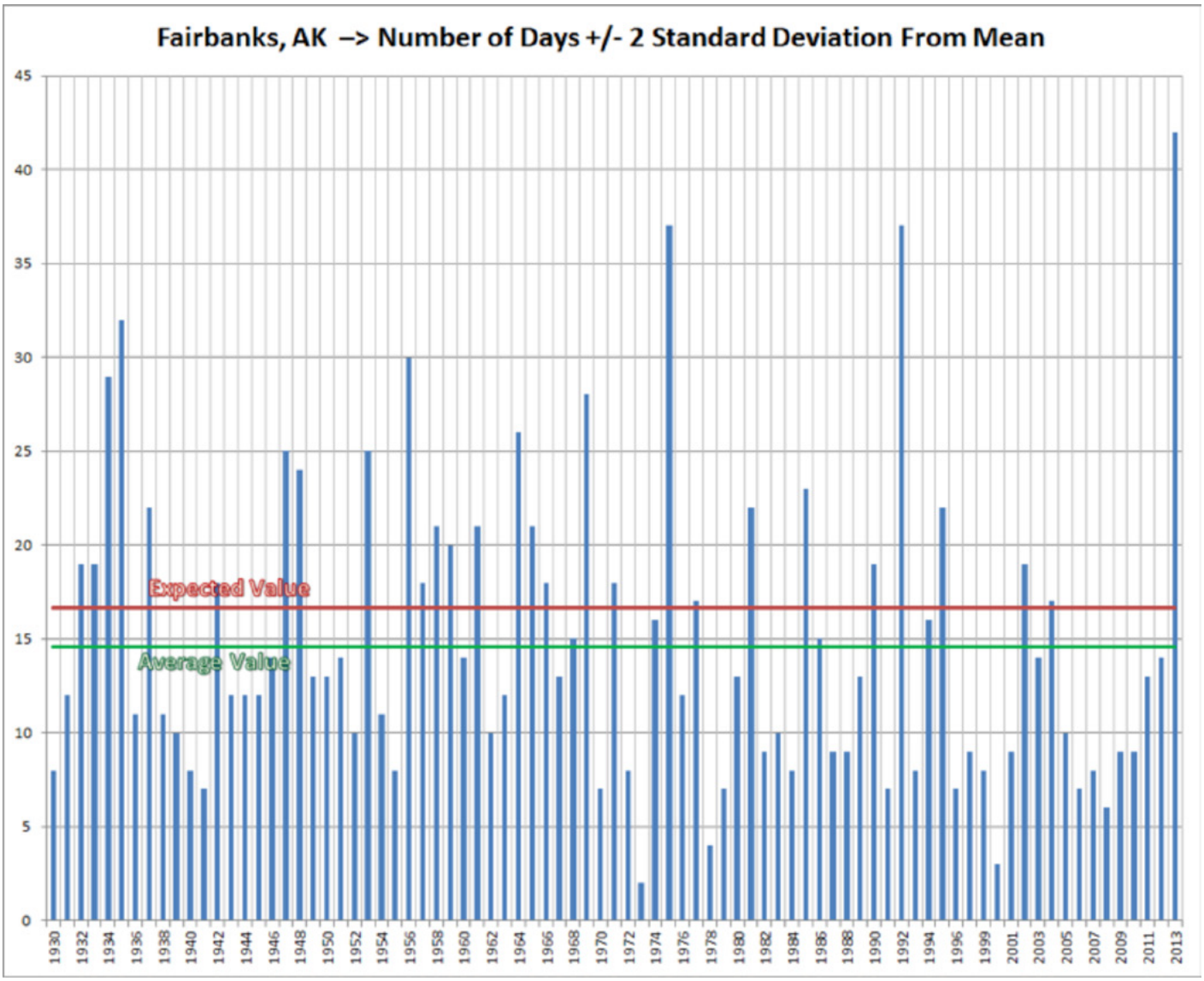


Figure FR 19. Identification number of 10 m by 10 m gridded cells within Reserve West Reference Stand.

for the five-month June through October period in Fairbanks was a record high. Boreal trees on dry sites are now susceptible to decline from stress and are set to experience degraded performance in 2014.

Figure FR 20, right. Pin flag and tag system for marking all 2,252 white spruce alive in the Reserve West Reference Hectare in 2013.

Figure FR 21, below. Number of days with extreme departures from normal temperatures (above or below normal), by year, at Fairbanks Downtown (1930–1948) and Fairbanks International Airport (1949-2013) weather stations. Source: Fairbanks Office, National Weather Service, "Temperature Deviations From Normal" Sunday, October 20, 2013 (http://ak-wx.blogspot.com/). The year 2013 set the record only three-fourths of the way through the year.



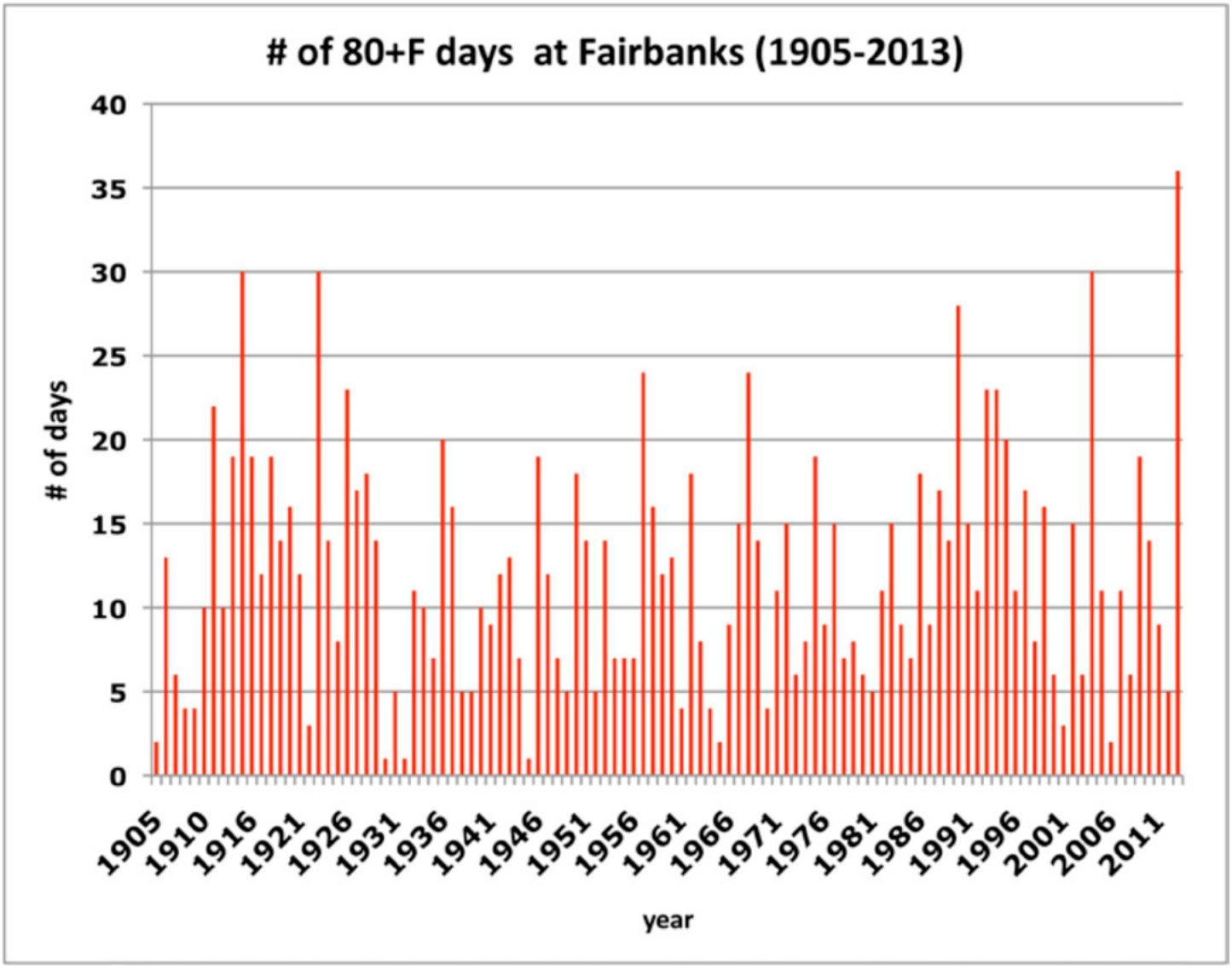


Figure FR 22. Number of days with temperatures equal to or warmer than 80 degrees F at the AFES Fairbanks Experiment Farm (1905–1948) and the Fairbanks International Airport (1949–2013).

Forest Research QR 2.13 Accomplishment #5: Photo monitoring in Reference Stands

» Deliverable 1.3 Scientific Publications on Forest Production and Climate (SCIPUB)

During the 2013 field season 2,756 monitoring photos were taken at fixed stations and views at the six reference stands (See: this report Figure FR 15, p. 24), with an additional 174 general view photos (Table FR 4). The photos were taken on 18 unique days (Table FR 5) in three seasonal sets. The first set was taken after snowmelt but before leaf-out, the second during midsummer full leaf condition, and the third set after deciduous leaf fall but before snow accumulation.

Some fall photos were repeated because the deciduous leaves were retained to the latest period in the fall in the last several decades at least, and it was assumed that fall photos with partial leaf retention would be preferable to photos with snow pack. In reality snow pack accumulation held off to a record-tying late date of October 31, so some fall photos were retaken with full leaf drop, but at the latest date in the 26 years of monitoring in the reference stand record.

A total of 30.9 GB of digital photos were added in 2013 to the collection (Table FR 4). Late in the quarter the BAKLAP team began a process of quality checking the entire collection of 15K photos, and standardizing the naming to make automated searches more feasible and specific.

Table FR 4. Summary of field season 2013 reference stand monitoring photography.

BAKLAP Bonanza Creek Experimental Forest Photo monitoring: 2013 summary

Hectare	Year	Month	Day	# Photos	Data (MB)	# Photos	Data (MB)
132 A	2013	5	25	80	428.5		
132 A	2013	7	27	86	916.5		
132 A	2013	10	4	75	831.2		
132 A	2013	10	19	84	851.9		
Subtotal						325	3028.1
GenView 132A2013Sep16	2013	9	16	8	88.7		
Subtotal						8	88.7
2 PLS	2013	5	28	92	1061.5		
2 PLS	2013	7	26	78	800.8		
2 PLS	2013	9	25	86	852.8		
2 PLS	2013	10	16	70	736.2		
Subtotal						326	3451.3
1 PLS	2013	5	28	95	1071.1		
1 PLS	2013	7	26	83	828.5		
1 PLS	2013	9	25	93	928.7		
1 PLS	2013	10	16	77	800.0		
Subtotal						348	3628.3
1 LBR	2013	5	27	94	1325.0		
1 LBR	2013	7	27	94	1240.0		
1 LBR	2013	10	7	73	829.9		
1 LBR	2013	10	16	84	928.6		
Subtotal						345	4323.5
2 CRA	2013	5	22	112	1279.0		
2 CRA	2013	7	24	72	756.4		
2 CRA	2013	10	4	74	806.8		
2 CRA	2013	10	19	82	937.6		
Subtotal						340	3779.8
1 CRA	2013	5	22	98	1108.1		
1 CRA	2013	7	24	110	1010.0		
1 CRA	2013	10	4	71	841.4		
1 CRA	2013	10	17	82	726.1		
Subtotal						361	3685.6
1 BBC	2013	5	25	92	801.1		
1 BBC	2013	7	27	83	841.9		
1 BBC	2013	9	25	96	991.5		
1 BBC	2013	10	22	80	909.9		
Subtotal						351	3544.4

Continued on the next page

Table FR 4, continued from the previous page

GenView 1BBC2013Sep16	2013	9	16	15	152.9		
GenView 1BBC2013Oct22	2013	10	22	12	130.5		
Subtotal						27	283.4
1 RSW	2013	5	23	93	1078.0		
1 RSW	2013	7	26	81	789.7		
1 RSW	2013	10	7	76	797.4		
1 RSW	2013	10	22	110	1186.7		
Subtotal						360	3851.8
GenView 1RSW2013Sep05	2013	9	5	33	278.6		
GenView 1RSW2013Sep16	2013	9	16	41	347.4		
GenView 1RSW2013Sep26	2013	9	26	36	301.0		
GenView 1RSW2013Oct22	2013	10	22	29	302.3		
Subtotal						139	1229.3
						# photos	Data (MB)
Monitoring subtotal						2756	29292.8
GenView subtotal						174	1601.4
TOTAL						2930	30894.2

Table FR 5. Dates of 2013 reference stand monitoring photography. Blue are spring season photo dates, green are summer dates, and red are fall dates.

2013 month	2013 day	unique
5	22	1
5	23	1
5	25	1
5	27	1
5	28	1
7	24	1
7	26	1
7	27	1
9	5	1
9	16	1
9	25	1
9	26	1
10	4	1
10	7	1
10	16	1
10	17	1
10	19	1
10	22	1
sum		18

Forest Research QR 2.13 Accomplishment #6: Work log for Dashiell Feierabend

Note: covers the period 9/1–10/15

Measuring spruce trees in Reserve West – 10.5 days

Measuring DBH and height of hardwoods in Reserve West – 3 days

Gathering missing data for Reserve West (including sample height protocol with laser) – 2 days

Assisting with Bonanza Creek monitoring photos – 2 days

Data management and map production in GIS

- » Importing Bonanza Creek photo monitoring plots
- » Importing Reserve West spruce and hardwood locations and associated attributes (Figure FR 22)
- » Digitizing Reserve West sampling grid
- » Displaying changes in spruce heights in Reserve West in 3D space from 1993–2013.
- » Comparing hardwood stem counts in Reserve West between 1997/1999 and 2013.
- » Displaying spatial extent of spruce trees taller than DBH height in Reserve West from 1988–2013.
- » Displaying spatial extent of hardwoods and spruce trees in Reserve West in 3D space in 1999.

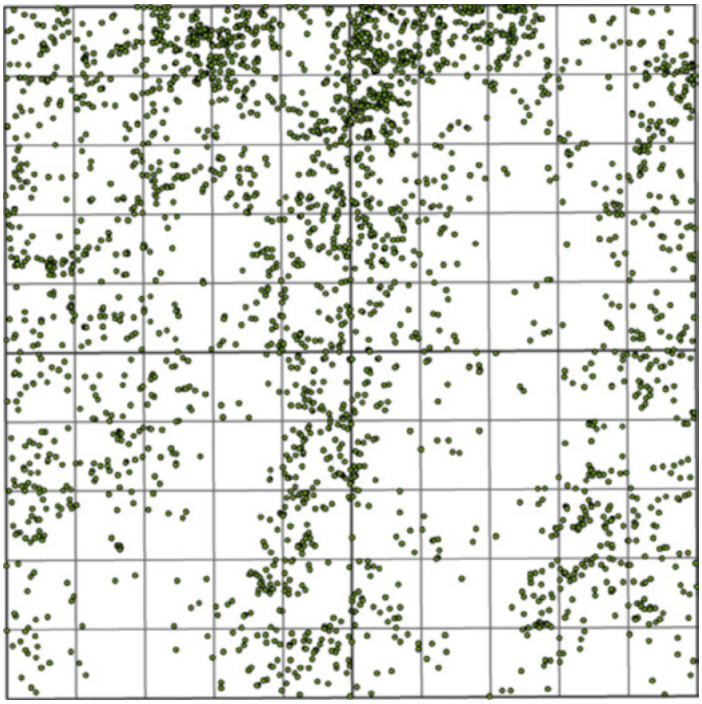


Figure FR 23. Reserve West spruce locations from new GIS file.

Forest Research QR 2.13 Accomplishment #7: Work log for Ryan Jess

(note: excludes BLM and work unrelated to BAKLAP)

July 1 – July 5

3 full days of Miho fieldwork in Two Rivers, forced to move due to Stuart Creek Fire

1 day holiday

1 day West Ridge Phenology measurements, data entry, office work

July 8 – July 12

3 days (11–12hrs ea) Miho fieldwork in Rosie Creek and Bonanza Creek

July 15 – July 19

4 days Miho fieldwork in Cache Creek and Standard Creek

1 day West Ridge Phenology measurements and office work

July 22 – July 26

Vacation

July 29 – August 2

4 days (including one overnight) Miho fieldwork in Salcha, and Nenana Ridge

August 5 – August 9

4 days (including one overnight) Miho fieldwork off Parks Highway, Cache Creek, and Nenana Ridge

August 12 –August 16

4 days Miho fieldwork in Two Rivers, Cache Creek, Bonanza Creek, and Nenana Ridge

August 19 – August 23

3 office days preparing maps and data sheets for Reserve West measurements, testing out the laser accuracy, meetings with crew

1 day Miho fieldwork in Two Rivers with Brian Young

August 26 – August 30

3 days (including one overnight) Miho fieldwork in Two Rivers, and a boat trip to a remote plot across the river from Bonanza Creek

1 office day working on Reserve West preparation, datasheets, and maps

September 3 – September 6

2 days Andrew fieldwork in Bonanza Creek

2 days Reserve West prep/ meetings/measurements

September 9 – September 13

4 days Reserve West measurements

1 day office work finishing up data sheets due to rain

September 16 – September 20

3 days Reserve West measurements

1 office day with meetings and preparation for Legislative Field Trip, gathered materials, etc.

1 day Legislative Field Trip, participated in each event, drove a shuttling vehicle

September 23 – September 27

1.5 days Reserve West, finishing the hectare

1 day Miho fieldwork in Standard Creek census plot

1 day Bonanza Creek Monitoring photos and photo naming

1 day gathering missing height/DBH information from Reserve West

September 30 – October 4

2 days measuring Reserve West Hardwoods

1 day Miho fieldwork in Standard Creek census plots

1 day redo height measurements with laser in Reserve West (laser height sample protocol)

1 day Bonanza Creek Monitoring photos and photo naming

Ryan Jess Totals:

28 days (including many 10+ hour days) working on Miho's fieldwork (including 3 overnights)

Sites include: Nenana Ridge, Bonanza Creek, Two Rivers, Salcha, Cache Creek, and Standard Creek
2 days West Ridge phenology measurements and data entry/management

2 days working on Andrew's fieldwork in Bonanza Creek

10.5 days measuring Reserve West

3 days measuring Reserve West Hardwoods (including hardwood heights with laser)

2 days gathering missing data (including sample height protocol with laser) in Reserve West

2 days of Bonanza Creek Monitoring Photos and naming

1.5 days of Legislative Fieldtrip preparation and participation

5 days office work, including data entry, datasheet creation, RSW maps, field preparations, etc.

SECTION 3

Quarter #3, 2013 BAKLAP Activity: K–20 STEAM Education Component

Summary and Highlights July–September 2013

Progress Made in Year 1 on Deliverables

1) Focus on Deliverable 1.3: K–20 Curriculum Development (STEM to STEAM)

Classroom activities:

a) Germination and tree growth experiments and observations
   1. ***NEW*** "Does Family Matter?"
   2. ***NEW*** Cold Hardiness and Optimal Length of Dormancy
   3. ***NEW*** Growing Hybrid Birch

b) Tapping into Spring

c) Model Collaborative Instructional Design Projects
   1. ***NEW*** Watershed Charter School Interactive Mural
   2. ***NEW*** Effie Kokrine Early College Charter School

2) Deliverable 1.4: Forest Entrepreneur Camp (FORENCA)

3) Deliverable 2.2: K–12 Teacher Professional Development Courses (K–12 PD)

4) Deliverable 2.4: Citizen Science Field Training and Framework Development (CITFORSCI) (Note: reserved for Q4 2013)

Timeline and short reports: Travel, training, workshops, and special guests

Legislative Field Investigation and Report

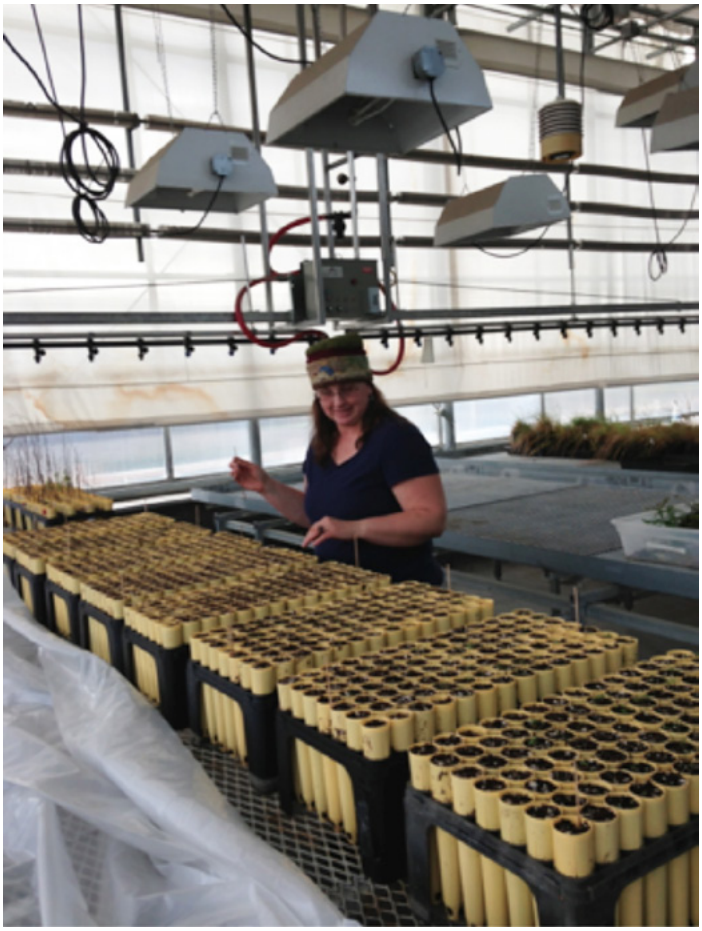
Progress Made in Year 1 on Deliverables

Focus on Deliverable 1.3: K–20 Curriculum Development (STEM to STEAM)

Evaluations and ongoing input from K–12 teachers and students, university service learners and BAKLAP personnel over the past year point in particular to three classroom activities as centerpieces of the project's K–12 approach. These include a) germination and tree growth experiments, b) Tapping into Spring, and 3) the project's commitment in all of its activities to customizing lesson plans and activities to suit grade-level curricula and teachers' special topic focus areas. K–12 teachers also commented how much they appreciate having scientists and graduate student service learners come into their classrooms, and spoke about how inspiring these interactions are for their students (see *Sample "OneTree" Teacher Evaluation* in Appendix).

K–12 classroom-related efforts in Year 2 will focus on further developing these core activities, using our proven project-based, hands-on STEAM approach.

Currently, BAKLAP has grown to such an extent and so many people and institutions are involved that activities need to be scheduled continuously throughout a 12-month calendar. Summer remains a period of intense educational activity and projects. At the new higher tempo of work there is no longer a "shoulder season," and planning and preparation activities to have educational materials and people ready for classroom delivery has become a year-round imperative. However, current funding is only sufficient to accomplish this approach during 2013–2014, and continuation after that will only be possible with additional support.



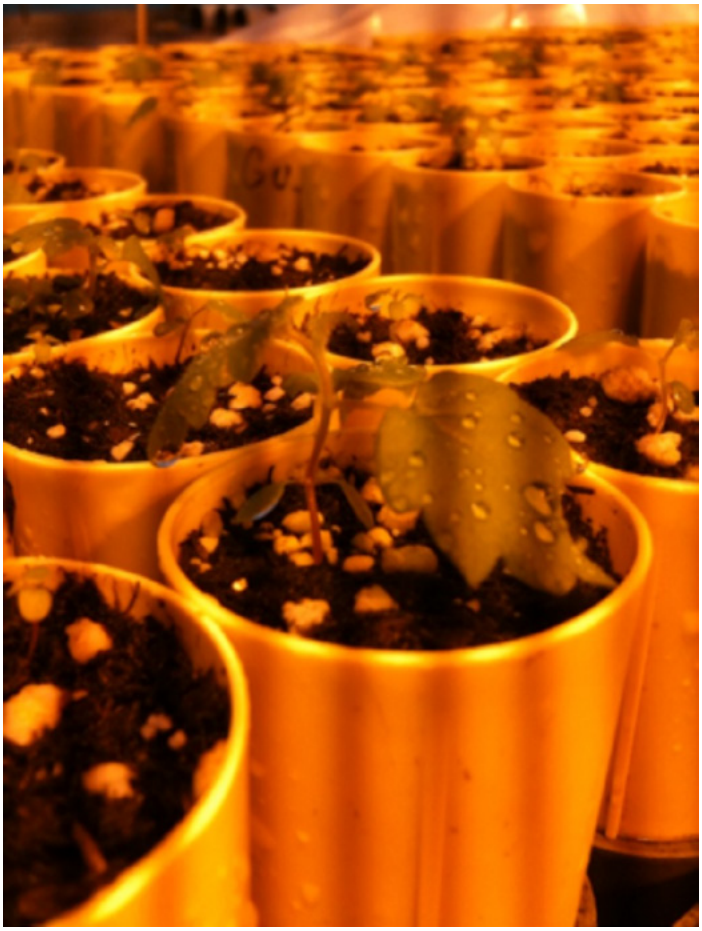


Figure STEAM 1. Left: Master of Education student Diane Hunt tends hundreds of newly germinated Nenana Ridge seedlings (from maternal trees NR5 and NR14), to be used in the university's replicate of Tanana Middle School's "Does Family Matter?" experiment. Right: a one-month-old NR5 seedling with its first set of true leaves (seed sown Sept. 14, photo taken Oct. 14, 2013).

Our goal is to maintain the high standard of content delivery and service while creating greater efficiencies and the ability to extend into more area classrooms. This quarterly report provides examples of classroom activities, the Tapping into Spring program, and model instructional design projects listed in Section 1, as examples of what we plan for Year 2.

Classroom Activities (a) Germination and tree growth experiments and observations (conducted primarily during the first three quarters of the school year (September–early March)

1. ***NEW "Does Family Matter?"*** After participating in BAKLAP Year 1 K–20 STEAM Education, Carri Forbes, a science teacher at Tanana Middle School, became interested in establishing a service learning program at her school. She wrote a successful proposal to State Farm Foundation and secured training for herself and a mechanism to link her students to a nationwide program of school-based community service projects. The grant will pay bus fees for Ms. Forbes' five seventh-grade classes to rotate travelling to the University of Alaska Fairbanks one to two times a month throughout the school year, as well as pay incidental expenses for experiments. Ms. Forbes and K–20 STEAM Education will work together throughout the school year on two observation-based science experiments.

The first, called "Does Family Matter?" will look at interactions between seedlings potted in different configurations. The objective is to learn whether growth response differs when sibling seedlings are grown together, as opposed to when unrelated seedlings are grown together. The experiment will be conducted at Tanana Middle School, with a smaller, parallel study done at the university. Both venues will use progeny from the same Nenana Ridge maternal trees (NR5 and NR14). The motivation to undertake this experiment comes from a new, exciting area of research about kin recognition in plants. Thanks to Ms. Forbes, Peter Shier's four seventh-grade life science classes are considering joining the experiment at the beginning of 2014. (To learn more, please refer to the *NOVA and the World* news brief "Plants With Family Values" in the Appendix, p. 66, and the entry *Carri Forbes – Tanana Middle School science teacher: Tanana Middle School Service Learning Project* in the Legislative Field Investigation and Report section of this report, p. 57)

2. ***NEW Cold Hardiness and Optimal Length of Dormancy Experiment.*** In addition to "Does Family Matter?" Ms. Forbes' students and university service learners will cooperate on a second experiment. "Cold Hardiness and Optimal Length of Dormancy" will be conducted in the Institute of Arctic Biology (IAB) Greenhouse on the university campus. Continuity and oversight of data collection will be the provided by university personnel. Tanana Middle School students will help with data collection and processing during their field trips to campus every two to three weeks throughout the school year. Data collection protocols are being designed so that classes and K–12 teachers can assist with the experiment as the year progresses. Below is more detailed information about the experiment.

Cold Hardiness and Optimal Length of Dormancy

The K–20 STEAM Education component of BAKLAP hopes to contribute to greater understanding of the basic biology of Alaska white birch (*Betula neoalaskana* Sarg.) by studying two critical life cycle factors: 1) onset of winter dormancy and 2) optimal length of dormancy during the 2013–14 school year. Our experiment will directly link university personnel with K–12 teachers and students in the Fairbanks North Star Borough School District. Students and teachers will help with data collection during field trips to the IAB Greenhouse on the University of Alaska Fairbanks campus. They will also help process information by making line graphs of their results once back at school.

The study will be conducted with ±300 Alaska white birch "half-sibling" seedlings, all collected from the same maternal tree, NR14. The seedlings were germinated in January 2013 and reared in the IAB Greenhouse until June, then transferred outside to acclimate to Fairbanks temperatures from June–October 2013. The 2013 growing season, with its exceptionally warm, dry summer and long, moist fall, presents a good opportunity to explore whether local seedlings can take advantage of a growing season that extends past the norm.

Figure STEAM 2. Master of Education student Diane Hunt (left) discusses the cold hardiness and dormancy experiment with Interior legislators, legislative aides, and university personnel during the Legislative Field Tour and Report, Sept. 20, 2013. Photo credit: Nancy Tarnai/SNRAS.

As designed, the experiment will:

1) Estimate, retrospectively, when the trees became fully dormant.

During the early dormancy period (October–November 2013), a sample of 13 dormant seedlings will be brought into the IAB Greenhouse each week and observed for the length of time it takes each seedling to proceed to budburst.

Literature pertaining to the onset of dormancy in temperate North American and European white birch tree species indicates that, apart from considerations of diurnal temperature swings and their interactions with diminishing day length, the threshold value of 10 hours of daylight/day limits further growth in white birch trees. If Alaska white birch behaves similarly, our test population of local one-year-old seedlings would be expected to be fully dormant by October 12–13, the date by which Fairbanks' day length decreases to 10 hours/day each fall.

We will use the point (date) in the graph when the trees begin taking fewer than 28 days to proceed to budburst as the signal that the seedlings are beginning to be able to release from winter dormancy. An estimate of when the trees went fully dormant will be made by back calculating from the date that sample was brought in. If, for example, the sample of trees brought into the greenhouse on November 9 takes 33 days to proceed to budburst, whereas the sample brought in November 16 takes only 26 days, we will calculate that our sample of trees was fully dormant by October 19.

2) Determine the optimal length of dormancy for Alaska white birch.

At this point, scientists do not know the length of the dormancy requirement for Alaska white birch. White birch seedlings from temperate regions have been found to require a minimum winter resting period of three to four weeks in order to break bud, even when placed under favorable experimental growing conditions. This question of the length of time (accumulated chilling units) our local trees need to satisfy winter dormancy is important when considering the potential effects of midwinter thaws on them.

Our expectation is to observe a decrease in the amount of time needed to proceed to budburst in samples (October–March). The point at which the graph levels off will be taken as our proxy for 'optimal dormancy length.' Armed with this information, K–12 students, teachers, and university personnel will then be able to consider the potential effect of midwinter thaws on either side of this threshold date.

Hardening off the research seedlings: To ensure that our test population is fully dormant before being the time series begins, seedlings will be kept outside in ambient conditions until November 2, at which time they will be placed in a minimally insulated, covered trench behind University Park Building. This treatment is being used to simulate the fluctuating temperatures of a Fairbanks winter, with the trees' roots protected below grade. Dr. Meriam Karlsson, professor of high-latitude agriculture, and Cameron Willingham, her research assistant, will provide a data logger to track ambient temperature and humidity in the trench throughout the winter.

Table STEAM 1. Dates when samples will be drawn from two experimental treatments to determine onset and optimal length of dormancy in Alaska white birch.

Number of weeks (and days) seedlings assumed to have been in dormancy	Date	Tray # to be transferred to IAB greenhouse
Week 1 (0)	9 Oct: trays above ground	1
Week 2 (7)	19 Oct	2
Week 3 (14)	26 Oct	3
Week 4 (21)	02 Nov: trays put into trench	4
Week 5 (28)	09 Nov	5
Week 6 (25)	16 Nov	6
Week 7 (42)	23 Nov	7
Week 8 (49)	30 Nov	8
Week 9 (56)	07 Dec	9
Week 10 (63)	14 Dec	
Week 11 (70)	21 Dec	10
Week 12 (77)	28 Dec	
Week 13 (84)	04 Jan	11
Week 14 (91)	11 Jan	
Week 15 (98)	18 Jan	12
Week 16 (105)	25 Jan	
Week 17 (112)	01 Feb	13
Week 18 (119)	08 Feb	
Week 19 (126)	15 Feb	14
Week 20 (133)	22 Feb	
Week 21 (140)	01 Mar	15
Week 22 (147)	08 Mar	
Week 23 (154)	15 Mar	16
Week 24 (161)	22 Mar	
Week 25 (168)	29 Mar	17
Week 26 (175)	5 Apr	
Week 27 (182)	12 Apr	18
Week 28 (189)	19 Apr	19
Week 29 (196)	26 Apr	20
Week 30 (203)	3 May	21

3. ***NEW Growing Hybrid Birch.*** Two OneTree Alaska K–12 teachers, Chris Pastro (Randy Smith Middle School Extended Learning Program) and Marlene McDermott (Watershed Charter School, kindergarten) are leading development of a new component of the K–20 STEAM Education program. After completing last spring's NRM 593, OneTree: From Seed to Tree course (discussed in the Q1 and Q2 2013 reports), these two friends and colleagues decided they wanted to germinate and grow hybrid tree x shrub birch seedlings (*Betula neoalaskana* x *B. glandulosa*) as a classroom observation project this year. On Sept. 14, 2013, Ms. McDermott and Ms. Pastro, joined by Tony Pastro and Jan Dawe, made a collecting trip to Smith Lake. Seeds and plant vouchers from six hybrids, two tree birch, and three shrub birch were collected. The seeds will be germinated in November.

*Figure STEAM 3. Smith Lake hybrid birch collecting trip. At left: A classic sample of a hybrid birch: this three-meter-tall hybrid has the shrub form and red leaves of its shrub parent (*Betula glandulosa*), but the peeling bark and a leaf shape more reminiscent of its tree parent (*B. neoalaskana*). Second image from left: teachers Marlene McDermott and Chris Pastro examine a hybrid shrub before taking a voucher specimen. Second image from right: a close-up showing the leaf shape of the hybrid. At right: Tony Pastro holds a seed packet to make a voucher of this tagged plant. The seed cones (infructescences) are much larger than those found on shrub birch.*

Classroom Activities (b) "Tapping into Spring" (takes place during fourth quarter of the school year: second half of March through mid-May)

The activity of tapping birch trees for sap each spring brings seasonality and tree physiology alive for K–12 students and adults. Even the toughest middle school students seem to connect to their trees with real gratitude when the sap runs for making birch syrup. Sound stewardship makes sense, perhaps for the first time, for many students. They're involved in a reciprocal relationship with the tree and, by extension, with the forest. It comes as no surprise that every school that participated in Tapping into Spring during the 2012–13 school year wants to do so again next spring, and teachers from additional schools are inquiring to see if there's room for them as well.

We learned a number of lessons during the 2013 sap season, which was the latest on record. There are considerable challenges when the sap begins to run only two to three weeks before the end of the school year. Thanks to our teachers' dedication to the task, sap collection continued through the last week of classes, and students were able to boil at least some of the sap they'd collected into syrup. The rest was frozen at the university over the summer. It will be used for training purposes this year.

The popularity of Tapping into Spring, coupled with difficulties that backyard syrup-makers face when trying to turn their hobby an income-generating venture, have prompted BAKLAP to invest time and money into improving sap processing methods as part of our Year 2 work plan. Tappers (called 'sapsuckers' in the trade) agree that the primary hindrances to producing high-quality birch syrup and developing a stronger birch sap industry in Alaska are 1) the high cost of fuel oil to process sap and 2) the near-certainty of scorching sap and creating bitter syrup when the sap is boiled over direct heat. We are taking steps to circumvent these problems by moving away from using #2 fuel oil as our sap evaporator's fuel source next spring. Instead, we are having a special pan made to use excess steam from the UAF steam plant as the evaporator's fuel source. We are also planning to build a do-it-yourself reverse osmosis unit to concentrate sap before it goes into the evaporator, thus reducing overall boiling time. (For more information about these developments, please see entry *Tricia Kent – MS student: Birch Sap Evaporator Update,* p. 58, in the Legislative Field Investigation and Report section of this report.)

Classroom Activities (c) Special projects created collaboratively by classrooms and K–20 STEAM Education personnel: Focus on Model Collaborative Instructional Design Projects

These customized projects cover a wide range of topics, from units exploring the effects of different kinds of light on plant growth, to manufacturing knitting needles and chopsticks and marketing plans for selling them.

The most ambitious project to date is Watershed Charter School's Interactive Mural, started by Moira O'Malley, first- and second-grade teacher at the school, and carried forward by her intern, Laura

Cartier, Klara Maisch, and Zach Meyers. Work on the mural itself began in earnest in April–May 2013. The overwhelming response to its creation led to significant and very rapid developments. First, Maisch, Meyers, and Cartier formed a consulting group, Interactive Media STEAM Studio. Then, thanks in part to the re-budget of the BAKLAP budget made possible by the quick work of DNR's Division of Forestry Business Office and UAF's Office of Grants and Contracts Administration, the team was able to attend and present at a prestigious international conference: EVA (Electronic Visualization and the Arts) 2013 held in London, England at the end of July. In August, additional work on the mural and associated classroom visits began. Details on these developments follow.

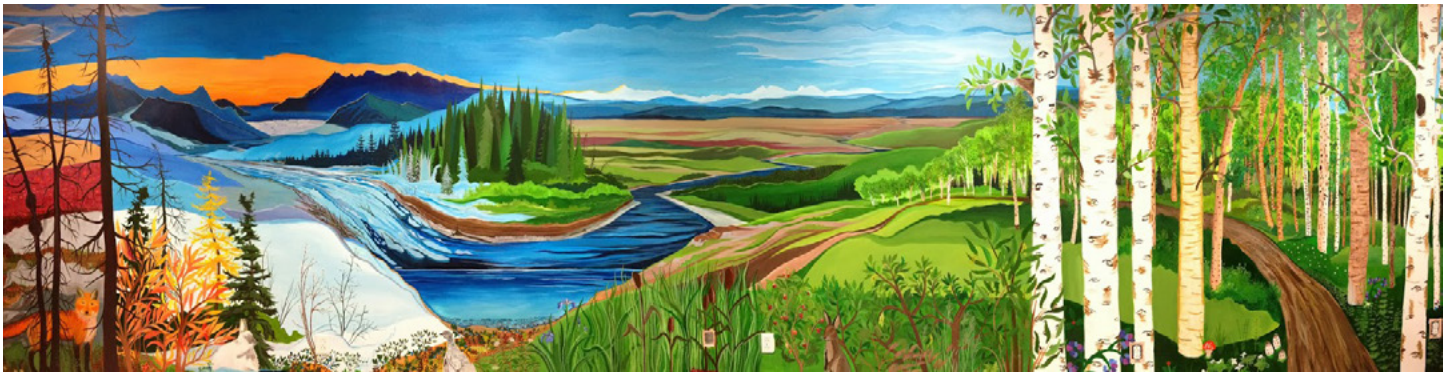


Figure STEAM 4. Watershed's Interactive Mural, taken on July 3rd, 2013. Photo credit: Zachary Meyer.

1. Watershed Charter School Interactive Mural

Summer Art Club and Watershed's Interactive Mural Progress

The canvas for Watershed's Interactive Mural was completed over the summer through hundreds of volunteer hours donated by Klara Maisch, Zachary Meyers, and Laura Cartier. Approximately 45 Watershed students ranging from first through eighth grade had participated during the school year by blocking colors and adding textures and details. Students were invited to continue the work through the summer via an art club, arranged by Laura Cartier. The summer art club had a dozen students ranging from first through sixth grade. Each student played an integral role in the completion of the 8 ft x 40 ft canvas by suggesting content ideas, creating original art pieces, and adding finishing details. The original artworks will be digitally integrated into the mural through augmented reality (AR). The estimated cost thus far is approximately $10,000 with the majority of the cost covering Klara Maisch and Zachary Meyers' salaries. Five different funding entities have contributed to the project including Delta Kappa Gamma Theta, Watershed PTA, Fairbanks Arts Association (Artist-In-The-School Program) BAKLAP, and Boreal House Art and Science Center. This integrative project has been a true collaboration among all the contributors.

Figure STEAM 5. Original artwork from the students of the summer art club. Interactive mural at Watershed Charter School.

Figure STEAM 6. A Watershed student observing frozen dew on the leaves she collected.Photo credit: Zachary Meyers.

Future Plans for Watershed's Interactive Mural

On September 16th Klara Maisch and Zachary Meyers met with John Carlson (Watershed principal) and Moira O'Malley (Watershed first/second grade teacher) to discuss future plans and development of the mural. Maisch expressed interest in adding additional animals and plants to the mural, including a porcupine, a rosebush, fireweed, and highbush cranberries; Carlson and O'Malley loved the idea. The second phase of the project will include content integration. The mural was designed to reflect the place-based content that Watershed Charter School fully embraces. The team is now in the initial phase(s) of collecting content ideas from individual teachers and integrating them in the mural through augmented reality. This will allow students to independently explore the wall and learn about aspects of ecology, plant identification, and salmon lifecycle. Reference materials will be overlaid so students can delve deeper into particular content areas. Maisch and Meyers have also begun to develop integrated activities that use the mural independently of any technology so that the teachers have the option of whether to use AR. This was a concern brought up in the meeting with O'Malley and Carlson. Discussions of holding an open house were also brought up during the planning meeting. A First Friday event has subsequently been scheduled for December.

Classroom Visits

Maisch and Meyers will begin to model integrated mural activities with K–2 classrooms this fall/winter. Because of the age of the students, these classrooms are less likely to use AR with their curricula. Thus, the focus will be on activities that use tactile hands-on comparisons with the mural and the surrounding environment. Lesson plans will be developed concurrently with teachers and tested in the classroom throughout the year. Teachers will be encouraged to develop customizable content with their classroom and the mural. Maisch and Meyers will support the teachers and help cultivate their ideas and address any concerns.

Marlene McDermott, Kindergarten

Klara Maisch and Zachary Meyers have visited Marlene McDermott's kindergarten classroom twice this fall. Both lessons focused on comparing the stylized features of the mural to the natural surroundings outside the school. To take advantage of the prolonged fall season we decided to concentrate on leaf shapes and plant identification. During the first visit we introduced ourselves to the class and asked exploratory questions about seasonality and plant identification. An interactive I-SPY activity was developed to see which plants, animals, and objects the kindergarteners could find on the mural. Students then went on a leaf scavenger hunt to see how many differently shaped leaves they could find.

During the second classroom visit, the students compared the leaves they'd gathered earlier to the mural to determine which plant species were present and which were absent. Maisch and Meyers had the students closely observe the colors of the leaves and draw as much detail as they could. Maisch demonstrated different blending techniques using crayons, which got the students really excited. The work will continue with the kindergarteners this fall, and begin with first and second graders in the coming months.

Figure STEAM 7. Detailed leaf drawings from Watershed Charter school kindergarteners in Marlene McDermott's class.

2. Effie Kokrine Charter School
A Sense of Place: A Student's Perspective

This project will target middle school students from four classrooms at Effie Kokrine Early College Charter School. Students in each classroom will be asked to personally explore a sense of place, starting with a traditional place-based narrative. Students will choose topics and areas of content to explore based upon the events within the traditional place-based narrative. Each exploration will have a tangible project associated with it to serve as an anchor for the content encountered in the story. The teaching is meant to be fluid so the students can maximize the learning experience and link it back to the story in a place-based context. Zachary Meyers and Klara Maisch will lead in the development and implementation of supplemental classroom activities and work in collaboration with the teachers to reinforce classroom content. These activities will incorporate science, art, and technology (old and new) to engage a broad student body and build novel skills. Local elders around Fairbanks will be invited to speak with each classroom to provide context for the narratives. Meyers and Maisch will spend a minimum of three weeks in each class, from September through December of 2013. The last week of class will focus on content integration in relation to the traditional place-based narrative. A suite of tools (i.e. interactive books and object-based media) will be used to tie the classrooms' explorations to the story. The culminating digital work will be housed and accessible through a website which will serve as a portal for sharing content.

An introductory and planning meeting with Zachary Meyers, Klara Maisch, Jan Dawe, Cassie Thacker, Sheryl Meierotto, Sarah States, and Alicia Kangas was held on August 13. Teachers were enthusiastic about incorporating elements from a traditional story and having students explore place-based topics in depth. Teachers will be responsible for choosing the place-based narrative(s) based on their students' overall interests. OneTree Alaska, in collaboration with MapTEACH, IMSS, the Alaska Native Language Center and Alaska Native Language Archive, will lead the project.

Figure STEAM 7a. Leaf and sketch by a pupil in Marlene McDermott's class at Watershed Charter School.

Sheryl Meierotto, 8th grade teacher

Maisch and Meyers have begun developing modulated lessons that weave place-based topics with strands of art and science. A total of four two-hour sessions have been completed to date. Activities ranged from botanical drawings and anatomy of leaves, writing haikus, to mental maps. Students have recently started their final project by constructing an altered book. A presentation by Howard Luke is scheduled to replace the traditional narrative; however, time and place are still being negotiated. As a result, Maisch and Meyers have begun to modify the overall product design to accommodate a broader "sense of place" by incorporating observational skills, botanical terminology, and introspective thinking with the students. The final product will use altered books to convey personal narratives with the students.

Figure STEAM 8. Above and opposite, below: Students in Mrs. Meierotto's eighth grade class begin to develop their altered books about place.

Below and opposite, top: examples of students' altered books.

Deliverable 1.4: Forest Entrepreneur Camp (FORENCA)

BAKLAP's Year 1 Forest Entrepreneur 'Camp' was described in the 2013 Quarter 2 report (see entry under *"Chris Pastro/7th–8th Grade, Extended Learning Program, Literary Arts, and Home Consumer Science Teacher, Randy Smith Middle School"*). In that end-of-school-year project, Chris Pastro invited Birch Pavelsky, a local carpenter working with the K–20 STEAM Education team, to come into her classroom over a ten-day period and help her students turn round birch firewood lengths into finished knitting needles, chopsticks, and hair chops. The students learned about materials science, product design, and engineering by turning square stock into knitting needles, chopsticks, and hair chops on a Stanley 77 tenon and dowel maker. Each piece of stock was measured and weighed as it proceeded through the manufacturing process, to estimate moisture loss and waste. The students' pride in having made something useful and aesthetically pleasing (in time for Mother's Day!) was palpable. This experience convinced the K–20 STEAM team that these kinds of immersive

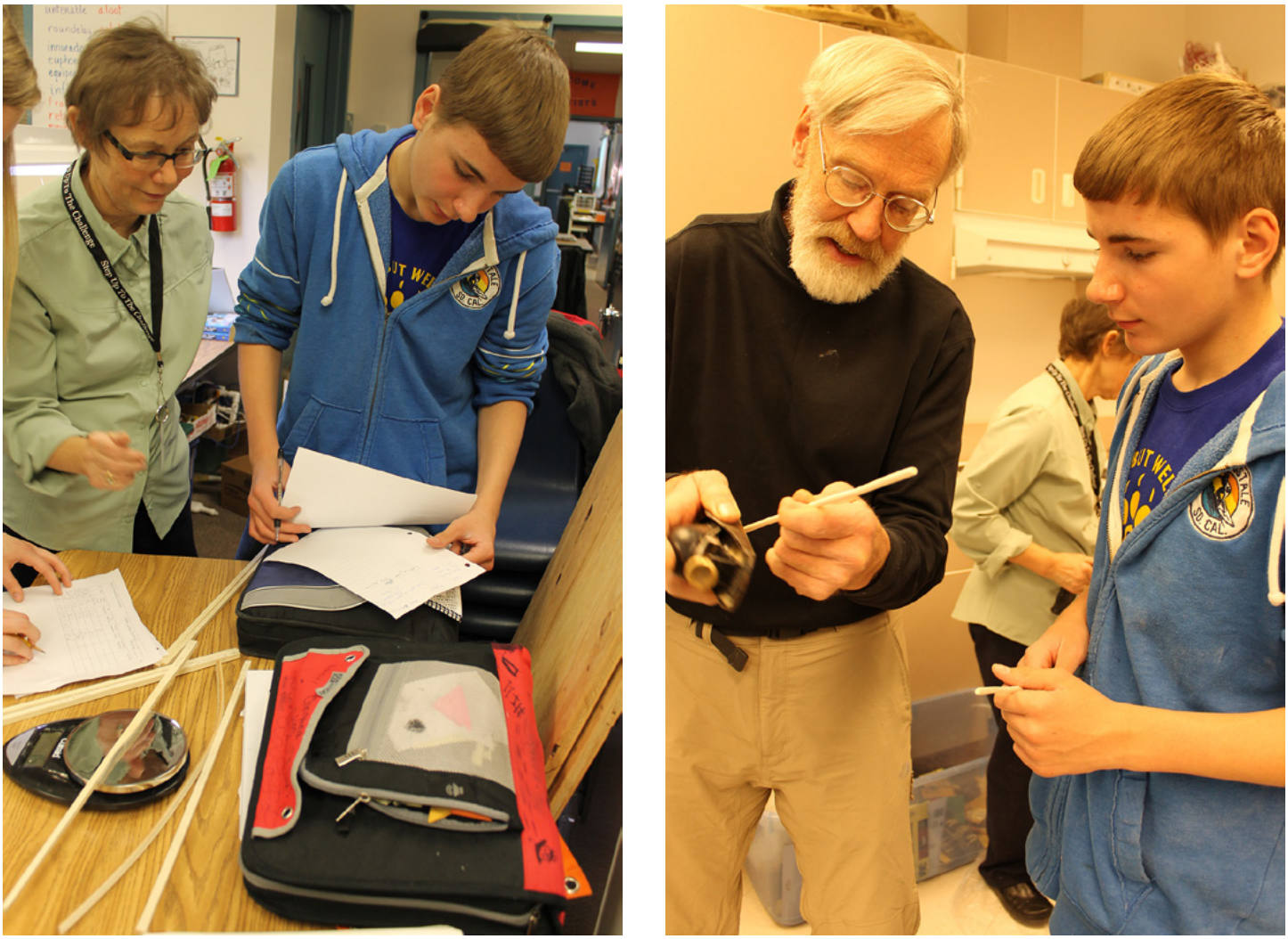


Figure STEAM 9. Chris Pastro helps a student weigh and measure square stock to be turned into knitting needles (left): Birch Pavelsky helps the student finish shaping the tip of the knitting needle. Photo credit: Nancy Tarnai/SNRAS.

projects, which we call a forest entrepreneur 'camp,' could be an important part of the K–12 experience by offering project-based, authentic research into product design and manufacturing.

During the summer, word that the K–12 STEAM Education team was interested in salvage trees, especially exotic woods, spread and allowed us to obtain new materials for the project. Birch Pavelsky worked with samples of wood from one of the oldest chokecherry trees in downtown Fairbanks, as well as crabapple boles cut after their useful life was over as grafting platforms for apple varieties at the Georgeson Botanical Garden. He found that apple wood turns even more easily than birch in the Stanley dowel maker, producing an exceptionally smooth, clean knitting needle; whereas the variably-colored chokecherry will be set aside to provide covers for artist 'flitch' books in upcoming STEAM K–12 professional development courses.

NEW Throughout September, the Facilities Services Grounds and Labor group, led by Darrin "Bear" Edson, helped develop the area behind University Park Building on University Avenue as a forest education outreach center. Three 75-foot long transplant beds were created to provide summer growing space for seedlings grown in classrooms, before they are planted out in community service learning projects. A four-foot-deep, minimally insulated, covered trench was dug to overwinter seedlings being used in science experiments, and a 10' x 12' shed was reconnected to electricity and made available for K–20 STEAM Education woodcutting activities. A space request was submitted in early September for a storage room in University Park Building. If granted, it will provide ample space for the plant materials (milled wood, birch bark, boxes of inner bark, seeds) that are the foundation of OneTree's entrepreneurial projects. We are already

Figure STEAM 10. Facilities Services creates the University Park Forest Education Outreach Center on University Avenue near campus. Left: excavating the trench. Center: building transplant beds. Right: the finished 18' x 4' x 4' trench, ready to receive overwintering tree seedlings and insulated cover.

reaping the benefits of the University Park Forest Education Outreach Center as a foundation for program "maker activities," a field trip destination for K–12 schools, and collaborative space between the university's and other agencies' forest education programs (Cooperative Extension Service and Division of Forestry's Project Learning Tree, and Fairbanks Soil and Water Conservation's "Focus on Forests" in Fairbanks).

Deliverable 2.2: K–12 Teacher Professional Development Courses (K–12 PD)

Field Sketching and Observation, co-taught by Karen Stomberg (artist) and Jan Dawe (botanist) gave participants (teachers, community members, and graduate students) opportunities to work closely with a single tree in the T-field Generation OneTree Long-term Monitoring Plot from May through August. Twelve participants studied progeny of NR8, the oldest maternal tree harvested from Nenana Ridge in 2009. NR8's oldest visible ring dates to 184. Our thanks to the Tree Ring Lab and Dr. Glenn Juday for providing that information. (For more information about the class, see entry *Karen Stomberg – FNSBSD Art Center Coordinator: The Role of the Arts in STEM Education* in the Legislative Field Investigation and Report section of this report, p. 52.)

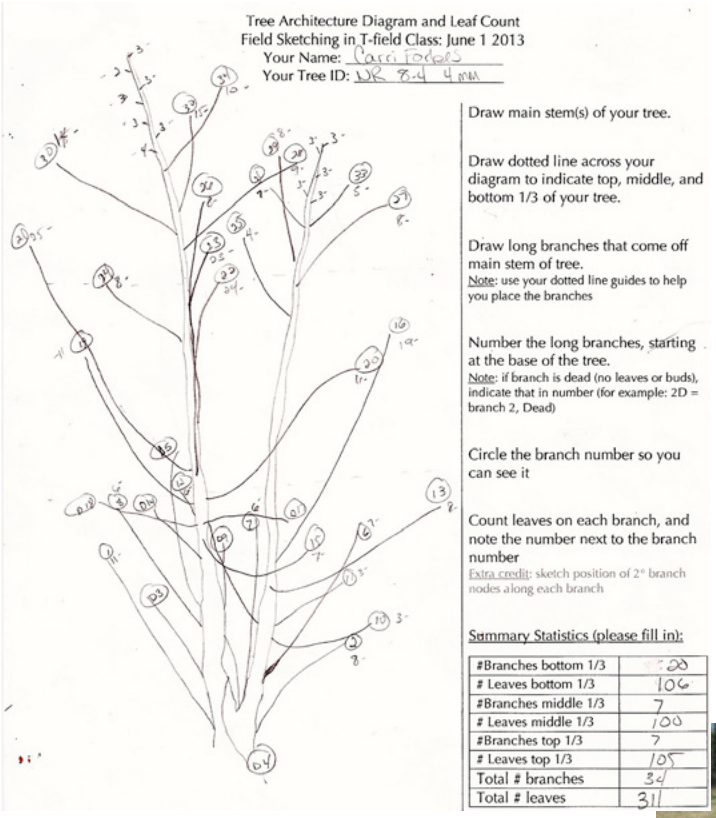


Figure STEAM 11. Four views of NR 8–4 (three-month age cohort) during the 2013 growing season: on far left, an example of a tree diagram drawn on June 1 by Carrie Forbes. Each student drew a diagram and returned to their tree to note changes. Second from left—another tree as it appeared on the same day (June 1). Second from right, the same tree on June 13 (note the greater number of leaves), and on far right, the tree as it appeared July 10. Note the changes in the height of the sapling relative to the flags surrounding it over the time series. Photo credit: Susan Logue.

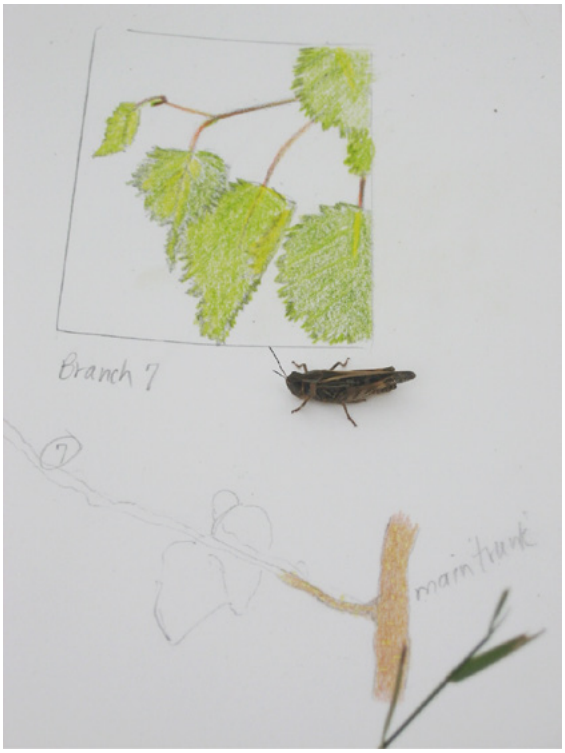
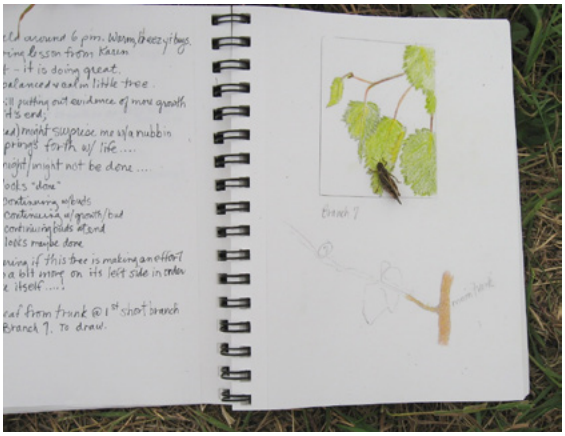


Figure STEAM 12. The grasshopper that landed on Sue Logue's sketchbook, left, then crawled onto her drawing of birch leaves, below. This attests to how lifelike her sketches were!

Timeline and short reports: travel, training, workshops, and special guests

July 17–18: "Science: Becoming the Messenger"

Dawe attended NSF EPSCoR's two-day communication skills-building workshop. Day One equipped the 100+ attendees with fundamental skills needed to plan, create, and execute effective communications. Sessions covered topics from how to design and deliver convincing messages, to how to apply this knowledge using diverse communications platforms (presentations, videos, and blogs). Dawe was one of 20 attendees invited back for Day Two, which featured in-depth hands-on work with the workshop's three nationally prominent communication experts.



July 19–21: Talkeetna Birch Festival

Dawe gave an invited presentation "History and Biogeography of Alaska White Birch." The Festival, sponsored by the Northern Susitna Institute, featured art and science presentations, tours of the Susitna forest and Kahiltna BirchWorks, and an exhibition of products made from Alaska white birch. The event originated as a result of Karen and Arthur Mannix's work with OneTree Alaska and Week in the Woods Family Camp in summer 2010. Subsequently, Mrs. Mannix led a yearlong OneTree project at Susitna Elementary School and participated in a K–12 professional development course led by Dawe during the 2010-11 school year. A highlight of the Talkeetna Birch Festival was an evening of original song, dance, and story-telling related to Alaska white birch. The evening demonstrated the significant and diverse talent of the Talkeetna community.

July 29–31: EVA 2013 Conference

Klara Maisch, Zachary Meyers, and Laura Cartier had the opportunity to attend an international conference in London, EVA (Electronic Visualization and the Arts) 2013. Boreal House Arts and Science Center and BAKLAP contributed significant funding to travel and registration. This was an opportunity to share the work that the team had done on the Watershed Charter School Interactive Mural, as well as learn new methodologies and technologies to enhance the project and spark new ideas. (See Appendix entry *"EVA 2013"* for more information.)

August 1: Lissy Goralnik

Special Guest Lissy Goralnik, a post-doctoral scholar at Oregon State University, met with the Field Sketching and Observation class in the T-field. Dr. Goralnik is conducting research about the

Figure STEAM 13. Lissy Goralnik (front row left) visited with several OneTree collaborators in Fairbanks. Photo Credit: Nancy Tarnai/SNRAS.

impact of arts and humanities projects connected to the National Science Foundation's Long-Term Ecological Research Network. She also has experience as an informal K–12 educator. From the SNRAS blogspot coving Dr. Goralnik's visit to Fairbanks: "After visiting with OneTree collaborators, Goralnik said, "The program feels thoughtful, thorough, and also fun, which is so very important when working with learners of all ages. In my mind, the best education happens in relationship: teacher-student, student-student, student-content, teacher-ideas, and learning community-wider community (inclusive of the natural world). The community building aspects of the program foster this kind of learning environment. As well, the passion of the educators involved nurtures this environment and also serves to inspire wonder. When teachers model curiosity and care for the content students get to feed off this energy and approach their own learning with openness and curiosity, too."

August 6: UAF Day at the Tanana Valley Fair

BAKLAP K–20 STEAM Team members, Diane Hunt and Trish Kent, hosted an interactive OneTree Alaska booth as part of the School of Natural Resources and Agricultural Sciences presence at the fair.

August 13: John Zasada

Special guest John Zasada, retired USFS silviculture researcher, visited the T-field with Dawe to look at seedling growth, tree architecture, and special features, and to give advice about the best opportunities for citizen science training and research. After seeing the range of opportunities presented by the seedlings, Dr. Zasada recommended that the community work

in the T-field focus on documenting the evolution of birchbark structure (about 10% of the seedlings have begun peeling over the past year). Dr. Zasada's reasoning: it's a feature that's not been documented in the literature as far as he knows, white birch's peeling outer bark is 'iconic' and something K–12 teachers, students, and community members could readily study.

September 3–7: Oregon State University visit by Zach Meyers, Instructional Designer

Meyers' trip focused on cultivating and strengthening relationships between the University of Alaska Fairbanks and Oregon State University personnel through collaborating on aspects of OSU's "Discovery Trail." Contacts were made via the Cooperative Extension Service to provide opportunities for future program exchanges and to learn about existing infrastructure/partnerships throughout the Northwest Pacific.

Discovery Trail: On September 4, 2013, Zachary Meyers met with Dr. Lissy Goralnik to discuss the goals and objectives of developing a networked trail system in Andrews Experimental Forest. Goralnik has a deep and diverse education background in environmental ethics and qualitative assessment. She and her advisor Dr. Michael Nelson hope to conduct research on environmental ethics and empathy through the use of a digital mediated experience on the "Discovery Trail." The project is still in its infancy but as lead Principal Investigator to this current funding cycle, Dr. Nelson is striving to bring arts and the humanities to the LTER at Andrews Experimental Forest. Nelson and Dr. Goralnik make the argument that in order for a sustainable environment to be achieved it is essential that "we" determine our role in "place." The following day, Meyers met with Mark Schulze, the Forest Director at Andrews Experimental Forest. Schulze took Goralnik and Meyers on a tour of the Discovery Trail and described the current status of the WiFi network on the trail. Several large standing trees have relays to extend coverage and testing is underway. Schulze hopes to minimize impact on the trail system while simultaneously providing guests with an enriched experience about current research at the Andrews Experimental Forest. A meeting in October is scheduled with all co-PIs and personnel to discuss design and implementation of the project.

Oregon Master Naturalist Program: This new non-degree certification program is offered as an online course for individuals interested in Oregon ecology. A background module on Oregon's natural/cultural history, watershed, landscape, and climate change is offered alongside complimentary courses of specific ecoregions within the state. Once students complete the online coursework, they are expected to volunteer 40 hours with a program in one of four areas including natural resource interpretation, citizen science, land stewardship or program support. The primary demographic of students enrolled in the program range from young professional to retirees. On September 6, 2013 Meyers met with Jason O'Brien to discuss details of the program's content and its model of implementation. Discussion points included possible future collaborations with exchange programs whose theme center on the Northwest Pacific and Arctic biomes.

September 30: Art Teacher In-Service Presentation

Maisch and Meyers were invited by Karen Stomberg, the district wide art teacher for the Fairbanks North Star Borough to give a presentation about the Watershed Charter School's Interactive Mural. The 15 teachers in attendance had questions about mural technology, process, and applicability to the classroom. The presentation was informal and provoked a lively conversation

among the teachers, including discussion of future classroom projects. The teachers were impressed by how much Maisch and Meyers had been able to accomplish in a short amount of time and thanked them for taking the time to make the in-service presentation.

Project Sustainability: New and revised proposals

During the third quarter of 2013, a revised work plan to allow intensive work at Effie Kokrine Early College Charter School was submitted and approved for Dawe and Meyers' 2013 Alaska EPSCoR Native Engagement Award. In addition, a proposal to the US Forest Service 2013 Competitive Allocation Request was submitted in September, to be led collaboratively by Project Learning Tree and OneTree Alaska. (See the Appendix entries a) *2013 Alaska EPSCoR Native Engagement Award: REVISED Scope of Work* and b) *Proposal to the US Forest Service 2013 Competitive Allocation Request* for more details.)

Legislative Field Investigation and Report, September 20, 2013

K–20 STEAM Education Reports: BAKLAP team and partners

Jan Dawe, Research Professor of Natural Resource Management Education and Outreach and Co-PI of BAKLAP: Introduction to K–20 STEAM Education

Dawe presented the project's philosophy as an introduction to eight BAKLAP K–20 STEAM Education Team presentations to area legislators and university leadership:

» K–12 children are budding scientists, artists, technologists, and musicians, capable of entering these worlds by virtue of their innate curiosity, powers of observation, and developing intellects.

Figure STEAM 14. Dawe during a Tapping Into Spring collection event. Photo credit: Nancy Tarnai, SNRAS/AFES.

» K–12 teachers are individuals trained to help each student bring his/her unique self and potential forward.

» BAKLAP's K–20 STEAM Education program, using OneTree Alaska as its model, supports children and teachers in this important work. The local boreal forest serves as a springboard for inquiry-based learning, as both a canvas and an outdoor laboratory.

» The program strives to engage children, connect them to their forest home, and develop inquiry habits of mind so that youth become lifelong learners, critical thinkers and makers, and exquisite expressers. These attributes lie at the heart of a vibrant, well-informed, and civil society and the program's work promotes its foundation: one child—one tree at a time.

Karen Stomberg, FNSBSD Art Center Coordinator: The Role of the Arts in STEM Education

Over the past four years of her work with OneTree Alaska and BAKLAP, Karen Stomberg has developed a successful approach to offering STEAM (Science, Technology, Engineering, Art, Math) intensive workshops for all age groups: K–12 classrooms, teacher professional development short courses, summer community immersion classes, and OLLI (Osher Lifelong Learning Institute) The workshops apply to two deliverables: Deliverable 1.3: K–20 Curriculum Development (STEM to STEAM) and Deliverable 2.2: K–12 Teacher Professional Development Courses (K–12 PD). The following pages show, in reverse order—from most recent to the earliest efforts—the development of this approach. A STEAM committee meets weekly to plan activities. (Please see the Appendix for the STEAM 2014 announcement, p. 78, currently being reviewed by the Alaska Arts Education Consortium for funding.)

Figure STEAM 15. Birch leaves painted by fourth graders who grew trees from seeds, then measured, observed and recorded data about their growth in journals.

Some of the FNSBSD teachers and UAF graduate students who participated in the spring professional development course, "OneTree: From Seed to Tree" were joined by community members in a summer-long course called Field Sketching and Observation.

Participants in the semester-long K–12 one-credit course, NRM 593: "OneTree: From Seed to Tree" learn drawing techniques with the help of a frame to focus their attention on a confined area of the tree. This course also provided training in using the Grinnell System of Nature Journaling: a protocol the teachers and service learners have since adopted and adapted as appropriate for their use.

Spring and summer course participants used the Grinnell method of recording data and recording observations in field sketchbooks—with words and illustrations. Drawing and color theory sessions augmented their skills as recorders of change and closer observation led to inquiry, which deepened scientific understanding.

Figure STEAM 16. Field-sketching and observation course (May–August 2013.)

Figure STEAM 17a. Participants in UAF course NRM 593, spring semester, 2013.

Figure STEAM 17b, above. Art kit: Birch dioramas, one of eight birch art/science kits developed by the Fairbanks North Star Borough School District.

Figure 17c, right. Professional development and workshops in heterogenous learning communities: observing, recording, drawing—learning scientific and artistic processes. Artist Margo Klass with FNSBSD teacher, Osher Lifelong Learning workshop participant, UAF graduate student.

Figure 17d, left. STEAM Institute: Illustrated Botanical Books, Trailwalk 2012.

Each participant adopted a young birch tree from the T Field study plot as their own, to watch, draw, and learn from over a three-month growth period. They began with a meticulous scientific diagram of the structure of their tree and also completed meticulous color renderings of leaves and branching junctures.

The eight kits developed by FNSBSD art specialists about *Betula neoalaskana* have been taught to every student pre-kindergarten through grade six in the district. These kits are now in the District Art Kit library and circulate to teachers for use in their classrooms.

Chris Pastro, Randy Smith Middle School Extended Learning Program: STEAM in the classroom

The following are some of the main points I tried to outline when I presented to the legislators:

1. Connection to Scientists in the Classroom: Scientists in the classroom give students a "real person" to have as a science mentor. They see that they are real people—that they don't always wear lab coats. This is such a positive connection for students.

2. Hands-on Authentic Science: Having OneTree and the BAKLAP scientists and graduate students in the classroom helped students bring the inquiry method to life. It is kid centered and authentic. They understand controls, variables, hypotheses, data analysis, and more! It is hands-on and they are in charge of their own learning!

Figure STEAM 18. Middle school student (left) and Jan Dawe (right) observe winter bud formation in actively growing Alaska white birch seedling. Photo credit: Nancy Tarnai/SNRAS.

3. Art & Creativity: The book making, the scarves, the birch anatomy, chopsticks and knitting needles were all science based, but students were able to be creative. I love to see students make their own choices and decisions that impact their product designs.

4. Connections to UAF: Each time the university works with our students, they have a stronger connection with UAF. The field trip to the greenhouses put them on campus; the sap collection put them on campus. UAF becomes real to them, and it brings their understanding of UAF research and education "up close" and personal!

*Figure STEAM 19. Artist books created in Chris Pastro's Extended Learning Program and Literary Arts classes. Photo credit: Nov. 5, 2010, John Wagner/*Fairbanks Daily News-Miner.

*Figure STEAM 20. Chris Pastro (left) and Margo Klass (right) assist student attach pages to covers of his book. Photo credit: Nov. 5, 2010. Photo credit: John Wagner/*Fairbanks Daily News-Miner.

Figure STEAM 21a. Chris Pastro and Birch Pavelsky introduce knitting needle project to students. Photo credit: Nancy Tarnai/SNRAS.

Birch Pavelsky, Woodworker: Manufacturing Knitting Needles—Inspiring Entrepreneurs

How can schools prepare secondary students for jobs as entrepreneurs? What skills do entrepreneurs need to develop early on? What kinds of analysis are required in turning a raw material into a finished, marketable product? This is a sample of questions OneTree Alaska brings to Fairbanks schools.

I work with OneTree in local schools and in May 2013 demonstrated one approach to forest-to-shop training at a local middle school. The workshop included 75 students in several classrooms, and was one week long. In September 2013 I demonstrated to a group of local legislators and staff the same process I had used in the school workshop.

I explained what OneTree's goals were, and then showed them a section of a local birch log that was chosen for straightness and lack of branch scars (chosen to avoid cross grain weakening). Then I split (cleaved) the log to show how grain can be helical or straight, straight being preferred for needle strength. The product we aimed for at our school was knitting needles.

When a straight-grained log was found, I cut a flitch from it (5/16" x about 3"). From the flitch, a piece of square stock 5/16" x 5/16" x 14". The square

Figure STEAM 21b and c. Birch cuts flitches from round log (above), and then cuts flitches into square stock (below) to be turned.

stock had one end sharpened in a pencil sharpener, then put through a Stanley #77 dowel maker (hand-cranked). This was then sanded using a German-made horizontally mounted, hand-cranked drill. The sharp end was further shaped and, when the 1" square end was shaped, the needle was done. Some children were interested in putting a very fine finish on their needles, and I provided a sanding sealer that was wiped on, allowed to dry, then sanded with 600-grit paper.

The resulting products were not all of marketable grade. But the children were shown basic quality-control processes and the kind of art/science thinking that lies behind a solid product. The children were excited about presenting their needles as Mothers' Day gifts.

Figure STEAM 22. Seventh-grade student turns square stock into round shaft of knitting needle (above);trims the square end (above right) and sands his finished needle (right). Photo credit: Nancy Tarnai/SNRAS.

Carri Forbes, Tanana Middle School science teacher: Tanana Middle School Service Learning Project

My name is Carri Forbes and I am a seventh-grade science teacher at Tanana Middle School. Last year the OneTree staff was able to come into my classroom and inspire my students to do real science. Because of this collaboration my students were able to design experiments using local birch seedlings in the classroom. They were given the opportunity to come work in the greenhouse at UAF helping to transplant trees that had been grown in classrooms. The program not only taught my students but also taught me how to tap birch trees for their sap and process it into syrup.

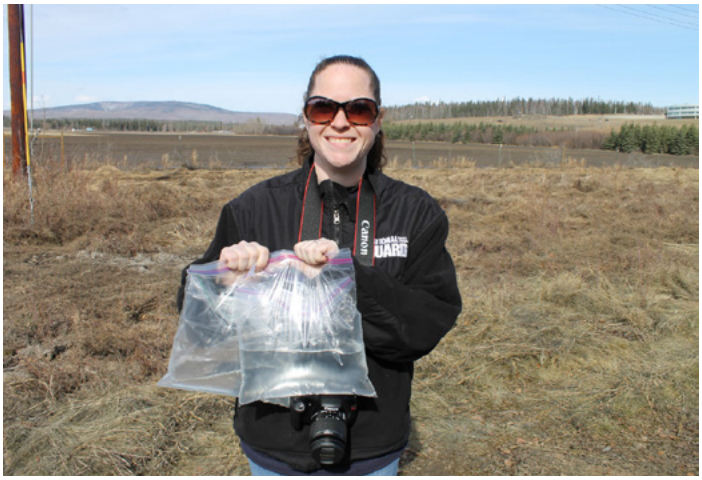


Figure STEAM 23. Carri Forbes displays birch sap harvest from two trees on UAF campus, mid-May 2013. Photo credit: Nancy Tarnai/SNRAS.

Throughout my experience with the OneTree program last school year I was inspired to see how much I could get my students involved in community efforts that included research and ownership by the students. I set out to create service learners that represented Tanana Middle School and Fairbanks, Alaska. In addition our school has adopted a tree-friendly theme this year, "Growing Bright Futures." Due to the high number of military students that attend Tanana Middle School I feel it is important not only to teach them about our local ecosystems but also to help them to explore and become part of it.

To do this I have started a project this year with the help of OneTree and a State Farm grant that will allow my students to grow seedlings from local seeds that they collect into trees that could be planted at Birch Hill in efforts to help with reestablishing the old ski trails that are no longer being used due to the installation of the new international standard trails. The new trails have been developed first for the Junior Nordic Ski Olympic qualifiers that were held last year and for the Arctic Winter Games that will be held in Fairbanks this winter.

We will also work in conjunction with OneTree to grow seedlings from known mother trees. The seedlings will be planted in different patterns: siblings from the same mother tree in one pot vs. non-related seedlings (from two different mother trees) in another plot. The students will be testing cooperation vs. competition between seedlings. This is known as the "Does Family Matter?" experiment. It will be an ideal project to show the importance of replication and the scientific process to students.

In order to make the most of this year I have been and will continue to work closely with the OneTree staff and I am on my way this weekend to a training session in Phoenix, Arizona that is part of my State Farm Grant in order to develop the best Tanana Middle School service learners possible.

I am excited to also be bringing in one of my colleagues at Tanana and his students to these projects. I have encouraged this addition so that every one of the approximately 250 seventh-grade science students at Tanana this year will be included in the "Does Family Matter?" experience. This experience has and will continue to provide students with useful job skills such as collaboration, problem solving, and good old fashioned hard work, just to mention a few. Service learning to me needs to be sustainable and reachable and the more ideas on the table and people on the ground the further the efforts will go.

Tricia Kent, MS student: Birch Sap Evaporator Update

In July I visited three venues—Leader Evaporator Company, CDL, and a syrup maker in Franklin County Vermont—to collect information about creating a steam-powered birch sap evaporator. Leader Evaporator confirmed that they fabricate pans and parts in-house, but CDL has no experience working with steam. CDL passed along the contact information of Harold Torre, a retired engineer who is now a syrup maker among other things. Torre uses steam to make his sap and showed me his design, emphasizing that it is simple and makes excellent-quality syrup. He uses copper tubing radiators that are placed directly into the sap. He generates his own steam using a boiler, but believes that we could easily harvest steam from the power plant and create a similar system in order to make syrup.

Upon returning to Fairbanks, I shared this new information with UAF's Facilities Services, suggested as a possible source of support for fabrication. After several meetings with Facilities Services staff to discuss possibilities for radiator design and evaporator

Figure STEAM 24. Harold Torre in front of his boiler. Franklin County, Vermont. Photo credit: Tricia Kent.

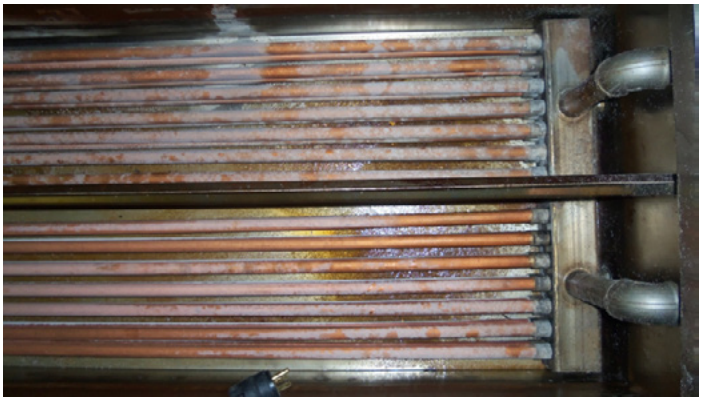


Figure STEAM 25. Looking down on Torre's radiator, showing the design used to pipe steam through sap. Photo credit: H. Torre.

location, it was decided that Facilities Services employees could not fabricate a radiator in-house due to lack of equipment and expertise. It was also determined that the evaporator would need to be located at the UAF power plant because 80–100 lbs of steam would be needed for syrup making, and the utiliduct to our preferred location (University Park Building on University Avenue) can only transport 15–20 lbs of steam. Leader Evaporator, located in Swanton, Vermont was contacted to discuss to possibility of having the evaporator made there. Leader has made dozens of steam radiators and is a reliable choice for a manufacturer. Prices and shipping options are currently being discussed.

Additionally, we are planning to build a reverse osmosis (RO) unit to use in the syrup making process. Reverse osmosis is standard practice with syrup makers because it reduces the time and energy needed for evaporation by reducing the water content of sap prior to boiling. Prices have been investigated for parts for a homemade RO unit.

Zachary Meyers, SNRAS Instructional Designer and Klara Maisch, Artist: Watershed Charter School's Interactive Mural

On September 20, 2013, Klara Maisch and Zachary Meyers gave a presentation to local Fairbanks legislators about the Watershed Interactive Mural Project implemented in May. Maisch and Meyers emphasized the collaborative effort from BAKLAP, Fairbanks Arts Association, and Watershed Charter School. Moira O'Malley and Laura Cartier initiated the mural idea and invited participation from Meyers and Maisch. The idea of having an interactive wall to teach place-based education that houses various elements of each classroom's curriculum is a novel idea that impressed many in the September 20 audience. Another point that was brought home was the total cost of the mural, which was very inexpensive for the value of the project, primarily due to donated time. Maisch and Meyers estimated that it cost $10,000 plus hundreds of volunteer hours donated by students, teachers, and staff. Many legislators requested additional information about the overall process, funding sources, and wanted to know when they could view the functional work of art. After the meeting, legislators and aides came up to Maisch and Meyers to congratulate them on the work.

Figure STEAM 26. The Watershed Interactive Mural presented at the Legislative Field Investigation and Report as well as the Art Teacher in service. Slide from Meyers & Maisch's PowerPoint presentation.

Figure STEAM 27a and b. "Betula neoalaskana*: Celebrating OneTree" exhibited a wide variety of responses to working with birch material from CC1. Artists and craftspeople responded to the charge: "Get to know this material," "See its beauty," "Create!" The show included prints, paintings, sculptures, artist books, hangings, wearing apparel, and functional pieces such as furniture and storage boxes Photo credit: Margo Klass.*

Margo Klass, Visual Artist and UAF Instructor, Curator: Science-Art Exhibitions

One of the goals of BAKLAP is to promote the integration of science and art in the context of learning and engagement of communities. Our efforts in this area build upon some previous experience. The exhibition "*Betula neoalaskana*: Celebrating OneTree" took place in April 2011 at the Well Street Art Co. gallery. A large community was already involved in the OneTree project—students, teachers, artists—everyone was welcome. Material from the birch tree CC1 was distributed—logs, cross sections, twigs, inner bark, outer bark, pieces large and small. Over the next several months artists and craftspeople created art for the OneTree exhibition. On intake day a wide variety of works arrived for exhibition. The resulting one-month show had high attendance and was extremely well received.

Since 2011 so much has happened within the BAKLAP community, it is time to propose another exhibition, this one involving an even wider community and a greater range of responses. *Our*

Figure STEAM 28. A companion exhibition of student work was shown at the Morris Thompson Center. This included examples of student science and art projects. Hands-on activities were featured at the shows opening. Photo credit: Margo Klass.

Boreal Forest: Observing, Interpreting, Communicating is the working title of a show that will be proposed to the Fairbanks Arts Association at its portfolio review for shows to be scheduled in 2015.

Our goals for this show have expanded too. We will be looking for the art, craftsmanship, and imagination of the artists and craftspeople, but the curatorial committee wants to create an exhibition infused with science and where the viewer becomes participant. Some examples of how this can be done (using works from the 2011 show):

1. ***Hands-on activities:*** offer viewers opportunities to work with materials used by artist in creating works in the show. For example, viewers can try their hands at weaving pre-cut strips of birch and take home a sample of a simple weave.

2. ***Augmented reality:*** with embedded codes within the display the viewer can use a digital device (e.g., iPhone) to see a short video about preparation of the bark and formation of the vessel (see image next page).

Figure STEAM 29. Woven birch bark display from 2011 exhibition. From the exhibition, "Betula neoalaskana*: Celebrating OneTree." Photo credit: Margo Klass.*

Figure STEAM 30. Birch bark vessel, from the 2011 exhibition, "Betula neoalaskana*: Celebrating OneTree." Photo credit: Margo Klass.*

3. Writing activity: offer viewers an opportunity to imagine what kind of writing is on the pages of this artist book (Figure STEAM 31) and to write a poem of one's own for the book.

4. Augmented reality: offer information on why shelf mushrooms occur; offer one to handle.

5. Augmented reality: offer viewers scientific explanations of what the material is, how to understand it, and what the notations mean (Figure STEAM 32, opposite).

These are ambitious ideas. They are being incorporated now in science and art museums all over the country. We look forward to the challenge of putting them to work here with the philosophy of making an exhibition that is ***"NOT SO MUCH A DESTINATION BUT A TRAILHEAD."***

Figure STEAM 31. Artist book made of shelf mushrooms and handmade paper. From the exhibition, "Betula neoalaskana: *Celebrating OneTree." Photo credit: Margo Klass.*

Figure STEAM 32. Artist book made from cross-section of birch; embellished with scientific notations. From the exhibition, "Betula neoalaskana*: Celebrating OneTree." Photo credit: Margo Klass.*

Further examples of work from the exhibit "Betula neoalaskana: *Celebrating OneTree." Right: silk scarves stained with birch bark, leaves, and seeds. Artist: Chris Greenfield-Pastro. Far right: bowls turned from a section of birch log for the OneTree project. Photo credits: Margo Klass.*

APPENDIX

Supplemental K–20 STEAM Education documents

Sample OneTree Program Teacher Evaluation 2013

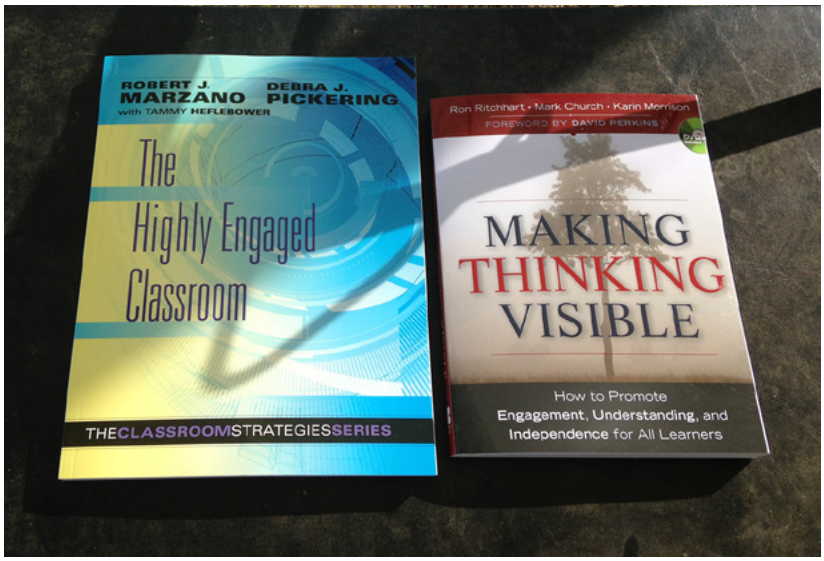
"Plants with Family Values" (a NOVA and the World news brief)

EVA 2013

2013 Alaska EPSCoR Native Engagement Award: Revised Scope of Work

Proposal to US Forest Service 2013 Competitive Allocation Request

Fairbanks STEAM Institute 2014 (preliminary announcement)



Sample OneTree K–12 Teacher Evaluation 2013

May 10, 2013

Please tell us: what was the best part of this program?

Having Andrew and Celia interacting with my students was great. The kids were excited!

What was the most challenging part?

It really was all quite straight forward. I did have a bit of difficulty getting the thermometer to register in a room.

Please tell a story where you saw this program make a difference for a student(s).

My students see me every day, this program gave them an opportunity to have two other adults listen to their opinions. This is a big deal to young people and I appreciate Andrew and Celia listening and engaging my students.

Did you see students excel in the subjects that OneTree delivered? Did they retain the concepts taught? Please give an example.

Yes, during our 'cookie' activity the kids were able to tell me what the layers meant and how to count the age of the tree.

Are you interested in being part of the program next year?

Yes, definitely. It would be great for my returning kids to see how next year's collection differs, or not, from this years.

Your name: (optional):

Marcy Kuntz

Please circle which parts of the year you were involved with OneTree:

Fall 2012 (Spring 2013) All Year

"Plants with Family Values" (a *NOVA and the World* news brief)*

By Anna Rothschild

* Posted 04.11.13 NOVA www.pbs.org/wgbh/nova/nature/plant-family-values.html

When people say, "It's a jungle out there," they generally mean that the world can be cold and heartless. Yet it turns out that a literal jungle may not be so uncaring after all. A team of Canadian scientists has found that some plants recognize close relatives and help them.

The greenhouse at McMaster University in Hamilton, Ontario, teems with life. Banana trees, bamboo, and cacao (the source of chocolate) fill the lush tropical room.

It's a scene of fierce competition. Leaves, pods, and Technicolor flowers sprout in all directions, fighting for the light.

"Our view of nature is sometimes that nature is red in tooth and claw—that every organism is out for itself," says biologist Susan Dudley.

But in her laboratory here, Dudley has shown that nature has a softer side. Even plants can embrace family values.

"Friendly" Plants

Dudley and her students have shown that plants can recognize their siblings and give them preferential treatment. In 2007 they tested a hypothesis: that plants from the same mother would compete less for valuable resources (like root space in the soil) than plants that were strangers. To her amazement, Dudley says, "We found exactly what we predicted."

"For a plant to have this fungus associated with the roots kind of gives them super-roots."

In other words, the plants seemed to act altruistically toward their relatives. Now, this doesn't necessarily mean that the plants are being selfless. This altruism is most likely a strategy that evolved to increase the odds that a plant will pass on its genes.

"If your relative does better, then your relative's genes are passed on and you share some of those genes," says Amanda File, one of Dudley's graduate students.

Figure STEAM 32. The McMaster University greenhouse is home to many tropical plants, including this carnivorous pitcher plant. Photo credit: Courtesy Anna Rothschild / WGBH Educational Foundation

The altruistic behavior the scientists saw in this first study was passive. The plants were not working together; they simply were not being aggressive toward their siblings. So the scientists wondered, was there a situation in which sibling plants would actually cooperate?

To find the answer, Amanda File turned to ragweed.

"Many of us are allergic to it, and it's not very nice to touch because it's very hairy and kind of yucky," File says. But she chose it because, like about 80 percent of land plants, ragweed forms a partnership with something called mycorrhizal fungi.

These are networks of fungi that live in the soil and associate with the roots of many neighboring plants. A plant will provide sugars to the fungus to help it grow. In return, the fungus gives the plant nutrients, water, and in some cases, protection from pathogens.

"For a plant to have this fungus associated with the roots kind of gives them super-roots," Dudley explains.

But there's a catch. Since multiple plants work together to help the fungus grow, there is an incentive to "cheat." A plant could donate no sugar, which is a costly resource, but still receive nutrients from the fungus.

Figure STEAM 33. McMaster University Biology Professor Susan Dudley (right) and graduate student Amanda File examine daffodils being grown for a study of plant altruism. Photo credit: Courtesy Anna Rothschild / WGBH Educational Foundation

Figure STEAM 34. Pairs of ragweed plants. Some are siblings, others are strangers. Photo credit: Courtesy Amanda File

"The more that I know about plant behavior, the more I love what I do."

Dudley and File wondered if plants would be less likely to cheat, and in fact be more generous, in the presence of siblings.

In a recent study, they grew pots of siblings and pots of unrelated plants. They found that plants that were related did, in fact, work together to promote the growth of the helpful fungus. And, in turn, that seemed to benefit the plants.

Dudley says the siblings grown together were healthier overall.

"This is our first bit of evidence that not only do plants change their behavior in the presence of siblings, but they may benefit from the presence of siblings," she says.

Fertile Field of Study

Other labs have made similar findings, but this is still a new and provocative idea, and there are a lot of questions left to answer. For example, how do plants know who their siblings are? One theory holds that plants detect chemicals emitted by roots, but what those chemicals are and how plants sense them remain unclear.

For Amanda File, this is an exciting new frontier in biology.

"The more that I know about plant behavior, the more I love what I do," she says.

"There's just so many cool questions to ask."

The next question she is exploring concerns maternal care in trees. She is studying a species of tropical oak in Taiwan and wants to find out: do mother trees take better care of their own babies than they do the saplings of others?

EVA 2013

EVA (Electronic Visualization and the Arts) 2013
BCS, 1st Floor, 5 Southampton Street, London
July 29–31, 2013

Summary

The 24th Annual Electronic Visualization and the Arts was hosted in Central London from July 29–31, 2013. Approximately 100 delegates attended that conference with representatives from Australia, France, Israel, the United Kingdom, and the United States. Klara Maisch, Laura Cartier, and Zachary Meyers attended the event as representatives from IMSS (Interactive Media STEAM Studio) founded through the collaboration of OneTree Alaska and the Watershed Charter School. Graduate students, museum directors, and IT consultants were among the guest presenters who offered a wide range of topics (i.e. from telepresence performances to augmented reality in museum exhibitions). IMSS gave a dynamic presentation about the progress of the interactive mural project; attendees were elated with the project and many encouraged us to continue our work with helpful suggestions. Overall the conference offered a stimulating platform for collaborations, ideas, and future projects.

Keynote Speakers

Steve DiPaola – A computer-based cognitive scientist, artist, and researcher at Simon Fraser University in Vancouver, Canada. Dr. DiPaola is the director of the Cognitive Science Program, whose works includes modeling beluga whale behavior with 3D rendering technology to using creative computer programs in evolving artwork. His presentation touched upon recent developments from the Cognitive Science Program including the analysis of Rembrandt's use of vision-based techniques to guide the eye path of the viewer. DiPaola postulates that the sharpness and contrast within facial features (i.e., eyes) significantly engage the viewer and direct their gaze. DiPaola's multidisciplinary approach offers a refreshing insight in scientific eye tracking science as well as a historical context in its application.

Linda Candy – A writer and researcher specializing in creativity through art and science. Dr. Candy is adjunct professor in the Creativity and Cognition Research Studios at the University of Technology, Sydney. Her presentation at EVA London 2013 focused on systematically evaluating digital media/systems. The effectiveness of visual and digital systems rarely receives assessment. Candy argues that a methodical evaluation is crucial to assess the progress of the evolution and effectiveness of digital systems.

IMSS began to correspond with Dr. Candy prior to EVA requesting a meeting to discuss evaluative measures for the effectiveness of the interactive mural at Watershed School. She suggested that we evaluate the project through several lenses, firstly to reflect on the process as whole as well as design a questionnaire or form for the students/teachers. This will allow documentation for what worked well and what needed to be improved upon through various perspectives, which in turn will enhance the overall experience of the project as a whole. In addition, the lessons learned from this interactive multimedia project will be beneficial for IMSS in future projects. We would like to thank Dr. Candy for taking the time to meeting with IMSS as well as her sound advice of evaluating the project.

Don McIntyre – Progamme Director/Creative Technologist at the Institute of Design Innovation at Glasgow. McIntyre presented Open Locast, an open-source program that connects people, media, and

Figure STEAM 35. A handout given to attendees at EVA London 2013, highlighting the progress and scope of work on the interactive mural at Watershed School. BAKLAP/OneTree Alaska.

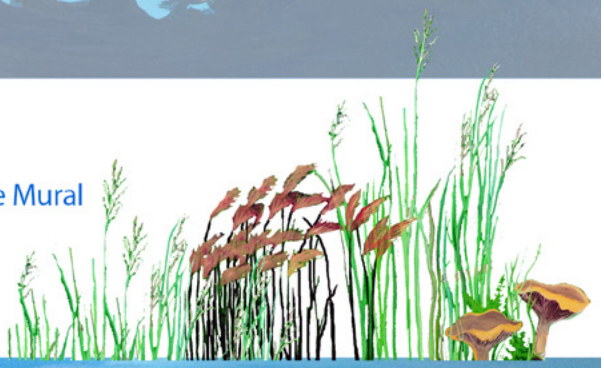
The Watershed School Library Interactive Mural

Place-Based, Augmented Learning

This spring, the partnership between The Watershed School, Fairbanks Arts Association, and OneTree Alaska led to the Watershed Library Interactive Mural. The multimedia and multi-discipline school project developed into a fully interactive mural (8 x 40ft) that ties place-based curricula to appropriate books in the library. Students played a pivotal role in the creative process by brainstorming mural content, creating personalized artwork for augmented reality components and participating in artist-led painting sessions.

INTERACT WITH US:

1. Download Aurasma
2. Follow our channel: Steamworks: Interactive Mural or find us at: http://auras.ma/s/fyvtq
3. View images and explore!



physical spaces. Some of the most provocative parts of the talk included the need for smart design for social change and services. The need for design atheistic and function is prolific in almost every industry and will continue as technology allows customizable interfaces. McIntyre is also working on designing 3-D interfaces for car and interior designers. His unique insight into the artistic and technical world was very thought provoking, leading to the reevaluation of the mural's interface.

IMSS (Interactive Media STEAM Studio) Presentation

On the second day of the conference Laura Cartier asked conference organizer Stuart Dunn if IMSS could present their progress on the interactive mural thus far. Due to unforeseen fiscal delays IMSS registered late to EVA and was unable to provide a paper or secure a time slot. Throughout the conference many of the lecturers gave thought-provoking presentations and we felt that our idea had just as much merit as some of the other topics. Dunn secured us a 30-minute time slot in the afternoon of the third day.

Our dynamic and enthusiastic presentation prompted a lot of excitement in the audience. Many were particularly struck by the student integration throughout the process of developing the mural. The project was unlike any at the EVA 2013 because teachers, students, and community members led it. Moira O'Malley and Laura Cartier, who wrote a $300 grant from Delta Kappa Gamma, drove the mural at Watershed. The majority of the talks at EVA focused on academic interests and had substantial capital to support their research. The idea itself was novel through the integration of community, place, and media. A number of people approached IMSS after the presentation to congratulate us as well as offer helpful suggestions on how to proceed. We were invited to attend the 25th EVA conference next year and offered an opportunity to be a reviewer for future papers submitted to EVA 2014. The overall experience of London inspired and validated all the hard work IMSS and partners have invested in the interactive mural. IMSS would like to thank BAKLAP and

Figure STEAM 36. Laura Cartier, Zachary Meyers, and Klara Maisch (left to right) present at EVA 2013. Photo taken by EVA audience member, using Zach Meyers' camera.

Boreal House for their financial support as well as the teachers at Watershed School who entrusted us with their students. This fall we plan on beginning content integration with kindergarten through second graders at Watershed. We feel that it is crucial that teachers and students be actively involved in the evolution of the mural so that it will create a dynamic platform for learning and exploring.

—Report submitted by Zachary Meyers, Instructional Designer.

2013 Alaska EPSCoR Native Engagement Award: REVISED Scope of Work

Alaska Experimental Program to Stimulate Competitive Research

Project Description

Climate change is disrupting many communities in rural Alaska with increased fire frequency, thawing permafrost, reduction in sea ice, large-scale vegetation changes, and shifts in seasonality. Traditional lifestyles cannot keep pace with the rate of change. Each generation faces greater challenges adapting to environmental change while attempting to preserve its cultural identity.

In the past, oral history was the main vehicle for transmitting cultural knowledge. Today, there is a growing body of literature and documentary films—short stories and memoirs told by Alaska Native elders and storytellers—that act as time capsules for future generations. Many of the traditional stories delve into people's sense of place in relation to the land. These act as great conduits to explore historical environmental change to present and future climatic changes through ecological processes as well as reinforcing the cultural context of the local people.

The goal of this project is to provide tools to blend traditional and scientific knowledge of place names, cultural knowledge, and ecological processes through an integrative multidisciplinary STEAM (STEM + Art) curriculum, using a range of multimedia tools. By learning of past, present, and predicted changes it will help prepare the current generation to respond to socioeconomic and environmental changes.

Scope of Work

This project will target middle school students from four classrooms at Effie Kokrine Early College Charter School. Students in each classroom will begin with a traditional place-based narrative that lends itself to in-depth exploration on local topics (i.e., salmon life cycle, fire ecology, edible plants, and seasonality). Students will choose topics and areas of content to explore based upon the events within the traditional place-based narrative. Each exploration will have a tangible project associated with it to serve as an anchor for the content in relation to the story. The teaching is meant to be fluid so the students can maximize the learning experience and link it back to the story in a place-based context. Zachary Meyers and Klara Maisch will lead in the development and implementation of supplemental classroom activities and work in collaboration with the teachers to reinforce classroom content. These activities will incorporate science, art, and technology (old and new) to engage a broad student body and build novel skills. Local elders around Fairbanks will be invited to speak with each classroom to provide context of the narratives. Meyers and Maisch will spend a minimum of three weeks in each class through the months of September and December of 2013. The last week of class will focus on content integrations in relation to the traditional place-based narrative. A suite of tools (i.e. interactive books, object-based media, etc.) will be used to tie the classrooms' explorations with the story. The culminating digital work will be housed and accessible through a website which will serve as a portal for sharing content.

An introductory and planning meeting with Zachary Meyers, Klara Maisch, Jan Dawe, Cassie Thacker, Sheryl Meierotto, Sarah States and Alicia Kangas was held on August 13. Teachers were enthusiastic about incorporating elements from a traditional story and having the students explore place-based topics in depth. Teachers will be responsible for choosing the place-based narrative(s) based on their students' overall interest level. OneTree Alaska, in collaboration with MapTEACH, IMSS, the Alaska Native Language Center and Alaska Native Language Archive, will lead the project.

How does the project increase engagement of Alaska Native K–12 or university students in STEM activities, thereby increasing Alaska's STEM capacity?

The goal of this project is to work with one K–12 school, to integrate traditional and scientific knowledge in a way that can be used as a model in schools throughout Alaska rural communities. The melding of technology, art and science with traditional place-based narratives will provide a novel way for students to see their surrounding landscape. By studying a specific site though a story, and documenting the story's cultural, historic, and ecological relevance, students will gain a deeper appreciation of, and sense of connection to, their local landscape. They will also gain skills and knowledge to respond to future changes in ways that reflect local interests and values.

The project increases Alaska's STEM capacity by combining the resources and multidisciplinary approaches of OneTree Alaska, IMSS, MapTEACH, the Alaska Native Language Center and the Alaska Native Language Archive, thus providing a rich STEAM experience (Science, Technology, Engineering, Art, Math).

Does the proposal integrate with a test case or a programmatic goal of Alaska EPSCoR ACE?

The proposal targets Effie Kokrine Early College Charter School as a pilot study for the Northern test case in AK EPSCoR ACE. We will collaborate with Elena Sparrow and Gary Kofinas to evaluate the overall methodology of blending disciplines with the common thread being place based narratives. Our goal is use this model in more remote test cases involved in ACE to aid in the delivery of substantive place based content of environmental change.

How will this award assist you in achieving your career goals?

My early career goals were those of a classically trained research plant taxonomist, dedicated to field research, analysis, publication, and undergraduate teaching. In 1993, in response to a forest policy debate, I left university life to engage fully in community-centered work. My concern was that our community had too little information, and too little understanding of the information that was available, to come to an informed decision about the natural resource policy issue being debated (Senate Bill 310: Forest Management Agreements). As Executive Director of Alaska Boreal Forest Council, a single issue, alternative dispute resolution NGO, I helped forge bridges of trust between the university and the broader community. My principal career goal became one of creating communities of learners whose connection and understanding of the Alaska landscape would translate into a sense of personal responsibility and obligation to act as good land, resource, and cultural stewards.

This Native Engagement Award assembles a learning community of unusual partners—K–12 students and university personnel, teachers from mainstream and charter schools, basic and applied researchers, and artists and community members interested in blending traditional and modern technology tools to create enriched learning experiences. This is the kind of learning community that my experience has shown to be the most successful and effective.

The award also significantly advances my secondary career goal: i.e. of developing a cadre of young professionals committed to implementing community collaborative K–20 learning approaches with high academic standards. Previous work on this goal took the form of mentoring AmeriCorps VISTA members (11), Peace Corps International Masters students (3), graduate students involved in the NSF GK–12 project: Changing Alaska Science Education (2), and advanced undergraduate students taking my Silvics and Dendrology course (12).

Much of the responsibility for this project's development and implementation will fall on a member of this new generation of young professionals I helped mentor. Zachary Meyers, working with Klara Maisch (the artist who will co-lead classroom activities with Meyers) will model an exciting new multidisciplinary, multimedia

approach: one that honors old and new technology, traditional and mainstream knowledge. The project will bring the unique promise and attributes of these elements into a new learning context for middle school students at Effie Kokrine Early College Charter School: a model we believe holds great promise for urban and rural schools throughout Alaska.

How do you plan to shore your project results and sustain project outcomes?

An open house of the students' work will be held at the end of the school year to celebrate their accomplishments. In addition, A website will be developed to house the multimedia visualizations each classroom produces. This will serve as an archive for teachers and allow other schools to view the work. The project will be evaluated with the help of AK EPSCoR (Sparrow, Kofinas) and serve as a pilot study for further development in remote Northern Test Case communities.

Proposal to US Forest Service 2013 Competitive Allocation Request

Alaska GreenSchools!

Project Overview:

5 Points. 1,000 Characters Including Spaces – Provide a comprehensive but succinct overview of the proposed project that includes basic details of who is doing what, where, and why. This should give reviewers the "Big Picture."

This project will integrate, evaluate, and promulgate techniques for two forest education programs. Project Learning Tree (PLT) and OneTree Alaska (OTA) will jointly develop an intensive Forest Education Institute that integrates PLT GreenSchools!, K–12 science, and citizen science training. The location will be the community of Fairbanks due to proximity to University of Alaska and highly engaged schools. Partners will include University of Alaska, the Fairbanks North Star Borough School District, Effie Kokrine Early College Charter School, and state and federal agencies. Matching funding will come from the BAKLAP state appropriation, Alaska Natural Resource & Outdoor Educators, American Forest Foundation, and others. A presentation will be given at the 2015 PLT Coordinators Conference. The outcome will be enhanced understanding of forest management by educators, students, and public, and also development of conservation education methods with national applicability.

Context, Goals and Objectives

15 Points. 2,000 Characters Including Spaces – What resource issue/s, threats, and/or opportunities does the project address? What is the desired vision or end state? What are the project goals (long-term) and objectives (short-term), and what impacts do you hope to achieve?

As elsewhere in the country, our forests are an important resource that supports and enhances the quality of life for both urban and rural populations. Conservation and management of these natural resources is challenged by increasing demand for forest products, changing climate and ongoing natural threats, legacy of historic management practices, limited infrastructure, varying community capacity, and fragmented forestland ownerships with a wide range of management objectives. At issue is how to educate the public about these natural resources with such a diverse set of ownership and management challenges.

Project goals are to promote environmental literacy; increase public understanding of the forests and build support for managing forests for maximum benefit. Objectives include: establish the first certified GreenSchools! in Alaska that will serve as a model for other schools; increase the content and quality of forest education in AK K–12 classrooms; increase the knowledge and skills of educators and community citizen scientists; provide natural resource education and outreach service learning opportunities for UAF students and share successes and lessons learned with the nationwide PLT educator network.

PLT GreenSchools! is a nationwide environmental education program that helps improve students' academic performance and provides teachers and students with training and resources to develop and implement service learning projects on and around their schools. The EKECCS will serve as a model GreenSchool hosting a Forest Education Institute targeting teams of educators and community scientists from other Alaska communities at the beginning of Year 2. The institute will result in an additional 10 schools participating in the GreenSchools! program and additional community scientists with the skills to work with the AK Fire Science Consortium.

Proposed Activities

20 Points. 2,500 Characters Including Spaces – What specific activities will be completed using which grant funds and/or which leveraged resources in the Project Budget? Who will do the work over what timeframe? How do the activities contribute to achieving stated project goals and objectives?

1. PLT GreenSchools! Training: by Nov. 15, 2014

Partners will use grant and leveraged funds to work with university faculty and staff to deliver training to teachers and teacher aides, as well as to university service learners involved in the project.

2. Establish Green Teams: Oct. 2014–end of project

University of Alaska Fairbanks (UAF), National Park Service, and the Fairbanks North Star Borough Department of Parks and Recreation will use grant and leveraged funds to mentor educators, conduct school investigations, and identify student projects. Issues addressed through mentoring will include natural resource and public land management, recreation and community involvement, watershed management, art/science sculptures, interactive park kiosks, cultural history of the area, and interviewing community members. Community forums and blogspots on UAF School of Natural Resources and Agricultural Sciences website and Facebook page will keep the university and Fairbanks community apprised about progress on the project.

3. Fuel moisture sampling training: by Dec. 2014

Fire science partners will use leveraged funds to provide new fuel moisture sampling training modules to participating teachers, students, and community members. This training reflects improved methods for monitoring fire effects. This project will provide an anchor point for training efforts across the region.

4. Forest Education Institute: Oct. 2015

A three-day training hosted by EKECCS. Training will include PLT GreenSchools! and OTA STEAM modules, successes and lessons learned establishing Alaska's first GreenSchools! and fuel moisture sampling training. Teams of educators and community scientists from 10 Alaska communities will be invited to participate. PLT and OTA will use grant and leveraged funds to develop training materials; other partners including the Alaska Natural Resource & Outdoor Educators and Fairbanks North Star Borough School District will use leveraged funds to assist with logistic planning, advertising and promotion and provision of continued education credits to participants. AK Fire Science Consortium will use leveraged funds to provide forest fuel moisture sampling techniques reflecting improved methods for monitoring fire effects. Other partners including Society of American Foresters, National Park Service, and University of Alaska Fairbanks will provide technical assistance and review of training materials as well as instructors for training sessions.

Deliverables, Outputs and Outcomes

15 Points. 2,000 Characters Including Spaces – What are the project deliverables, outputs, and outcomes? What metrics or indicators will be used to measure and monitor progress? Outcomes and outputs should relate directly to proposed activities, goals, and objectives.

In Year 1, a successful project will include full EKECCS staff participation in PLT GreenSchools! training; establishment of a Green Team, implementation of one or more school investigations, and application for student project funding. In Year 2, a successful project will include completion of the identified school project and certification of EKECCS as a PLT GreenSchools!; participation of educators and/or community citizen scientists from 10 Alaskan communities in the Forest Education Institute and presentation of the project at the 2015 PLT Coordinators Conference. Benchmarks dates will be identified to monitor progress toward project objectives.

Success for this project will also be measured by an increase in knowledge of participants (pre- and post-training evaluations). Teachers will monitor student engagement in GreenSchools! activities and informally report back to project mentors on their observations. At the end of the year, teachers will provide observations on student learning improvements they attribute to participation in project activities. Although anecdotal, this information

will provide an assessment of project engagement and success. Participants receiving citizen scientist training in monitoring forest fuel moisture content will also be given pre- and post-evaluation surveys to identify any increase in knowledge and skills after the training.

Site visits to the Alaska GreenSchools website and UAF blog sites will provide feedback on interest in PLT GreenSchools! programs for future planning.

The project will directly benefit 240+ underserved youth in grades 7–12 by improving student learning in forest and conservation topics and enhancing 21st century workplace skills. The project will broaden Fairbanks' and Alaska Native communities' recognition of local school accomplishments. The project will increase awareness of the GreenSchools! program and encourage more schools to participate.

Collaboration

15 Points. 2,000 Characters Including Spaces – Describe the contributions and commitments that each partner has made toward the proposed project. What is the nature of their contributions (project planning, implementation, financial resources, etc.)? How does the project integrate S&PF and/or other programs in a meaningful and complementary way that goes beyond "business as usual"?

1. Effie Kokrine Early College Charter School: In Year 1, the staff (9 teachers, 6 special aides and administrators) will become GreenSchools! trained. Classroom and after-school time will be devoted to Green Team project discussions throughout year. The school will be a venue for community events in Year 1, and the Forest Education Institution training site in Year 2.

2. Fairbanks North Star Borough a) Department of Parks and Recreation will provide logistic, legal, and technical assistance for developing trails in Peirce Park and consult on best practices for resource management b) School District Central Office (Curriculum Department/Professional Development) will help plan and market the Forest Education Institute and register participants for continuing education credit.

3. University of Alaska Fairbanks a) Land Management Office will provide technical assistance in developing a multi-landownership MOA for the project b) Facilities Services will provide technical and logistic support for trail development c) School of Natural Resources and Agricultural Sciences/OneTree Alaska will provide mentors and university service learners throughout Year 1 d) Cooperative Extension Service's Project Learning Tree Coordinator will provide GreenSchools! training/mentoring.

3. Alaska Fire Science Consortium will provide citizen science training, protocols, and data management oversight for NEW upland mixed forest fuel moisture data collection efforts.

4. Alaska Natural Resource and Outdoor Educators will provide logistic support for GreenSchools! and PLT workshops and training, and access to their statewide membership of formal and informal educators.

5. Society of American foresters will provide technical assistance and be a resource for teachers and projects at EKECCS.

6. National Parks Service will mentor student projects, Green Team development, and assist in developing citizen science program focused on monitoring Peirce Park's natural and cultural attributes.

Forest Action Plan Integration

10 points. 1,250 Characters Including Spaces – How does the project align with stated priority issues, areas, and/or activities in the State Forest Action Plan?

The AK GreenSchools! Initiative (AK GSI) aligns with both the national and Alaska Forest Action Plan (AK FAP) goal to enhance forest resources and values for communities and private landowners. Effie Kokrine Early College Charter School (EKECCS) is ideally suited to be AK's first GreenSchools! because of its commitment to creating a resource management plan for its campus and surrounding public lands (e.g. the "Peirce Park Project.") Three state and Borough landowners are already partners in the school-led effort to develop Peirce Park as a "citizen science park" for monitoring Alaskan forestry issues. AK GSI will add value and needed partner expertise to this effort: for example, the Alaska Fire Science Consortium (AFSC) will provide fuel moisture training to teachers, students, and community members during Year 1 of the project, and fine-tune training modules and protocols for citizen scientists in grades 7–12. QA/QC and data management will be provided by AFSC. This example shows direct alignment with the AK FAP objective "...to mitigate risks to forest health, ensure best management practices are deployed and ecosystem services are maintained."

Meaningful Scale

10 Points. 1,250 Characters Including Spaces – What is the scale of the project? Why/How will the scale of the project facilitate achievement of the stated goals, objectives, and outcomes?

Year 1 of this project will create the first Alaskan GreenSchools! certified school at the EKECCS and directly involve 240+ youth in AK forestry issues. This school reaches a unique cross-section of underserved youth in Alaska representing several communities and different Alaska Native constituencies. The make-up of the school body provides the opportunity to reach a larger secondary audience of parents and families: These audiences have often lacked access to this type of school- and student-driven activity. In Year 2, AK GreenSchools! will build upon this foundation through extension of the program to 10 new Alaskan schools and reach a larger audience by sharing their story at the 2015 PLT Coordinators Conference. The AK GreenSchools! website and UAF blogspots will provide wider scales of visibility and access for Alaskan communities and schools that may want to develop GreenSchools! programs for their areas. Partner websites will link to the AK GreenSchools! website and UAF blogspots: thus further increasing the network of agency practitioners interested in becoming involved in the project.

Sustainability of Outcomes

10 Points. 1,250 Characters Including Spaces – What skills and capabilities will result from and extend beyond the life of the project; how? Can the project be replicated in other areas; how? What plans are in place or being developed to replicate or expand the project, to build on skills, capabilities, and lessons learned?

PLT inspires students, teachers, families and volunteers to take personal responsibility for improving the environments at their school, home and community. The GreenSchools! program provides a set of tools for students to analyze data and design a student-driven project to address an identified issue or concern. These skills will help them become a more environmentally literate citizen. Benefits to participation schools include possible cost savings to schools, improved student learning, enhanced leadership skills for students, recognition within the wider community of the school's accomplishments, a solid foundation for a lifetime of environmental stewardship, and a healthier school. EKECCS's faculty and staff are committed to developing a resource plan for their campus, directed by and for their students, and represent an ideal model school for Alaska's first GreenSchools!. Sharing their experiences through the national PLT educator network, their successes and lessons learned will serve as an example for schools throughout all states. An Alaska GreenSchools! website will be designed and maintained by UAF-SNRAS-CES to archive project activities and serve as a portal to the program and a resource for other PLT GreenSchools!.

Fairbanks STEAM Institute 2014 (preliminary announcement)

BOREAL HOUSE ART & SCIENCE CENTER

Fairbanks STEAM Institute 2014

Through Multiple Lenses: a Botanical Immersion Stillness, Observation & Interpretation

Dates and times Sunday, July 6th Evening Reception, Keynote
Daily July 7-11 and 14-18 8:30-4:15

Locations This class is both Outdoors on the UAF campus, and Indoors

- Outdoors: North Campus trails, the Arboretum, the OneTree research plot, and Smith Lake
- Indoors: West Valley High School fine arts classrooms (tentative plan)

Description

Join this two-week immersion designed for teachers, artists, scientists, University students, and community members. Educators can earn four 500 level credits while participating in ongoing teacher connections throughout the two-weeks to discuss classroom practice and implementation. A well-developed curriculum piece is required for credit.

Participants will choose a small natural area then will identify and work with the plants, insects, and interrelationships through multiple lenses for the two-week Institute. They will learn, observe, and record with drawing, data collection, words, poetry, technology and design. Each student artist will contribute an illustration to an encased portfolio which will be printed and presented to each participant in the institute.

Faculty

Dr. Jan Dawe - botanist, Natural Resource Education & Outreach
Dr. Margo Klass – mixed media artist, collaborative artist books
Karen Stomberg - artist, art educator, integrated learning
Chris Pastrow –extended learning educator curriculum integration
Zac Meyers – technologist, instructional design
Frank Soos - creative writer, UAF Professor Emeritus

- **S**cience: plant identification, structure, phenology (repeating events in life-cycle of an organism), ecological relationships
- **T**echnology: use of iPads for time lapse photography, augmented reality, writing
- **E**ngineering: design of casement structure for suite of art plates
- **A**rt: drawing in color pencil, fine pen, watercolor, color theory, botanical illustration history, layout and design exercises, completion of an
- **M**ath: scientific measuring, calculations for engineering paper portfolio casement

Collaborators/Sponsors UAF School of Natural Resources and Agricultural Sciences, FNSBSD, AAEC, AKSCA, BAKLAP State Appropriation, State Division of Forestry

For Information please contact: Karen Stomberg karstomberg@gmail.com (907) 590-2605

www.uaf.edu/snras/research/baklap/