Boreal Alaska—Learning, Adaptation, Production

September 2012 quarterly report

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AFES MP 2014-02

BAKLAP Technical Report Series

UAF UNIVERSITY OF ALASKA FAIRBANKS

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

2012 Quarter #3 (July 1, 2012 – September 30, 2012)

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Tom Grant – Postdoctoral Researcher, University of Alaska Fairbanks (tagrant@alaska.edu).

Background

The 2012 Alaska Capital Budget (HCS CSSB 160(FIN) am H) appropriated $1,000,000 to the Alaska Department of Natural Resources for "BAK LAP: Upgrade Forest Research Installations for Wood Biomass Energy, Products, Science Education."

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) by the University of Alaska Fairbanks, School of Natural Resources and Agricultural Sciences (SNRAS) and the Alaska DNR, Division of Forestry. This is the first quarterly report of the project.

BAKLAP Project Start

The UAF BAKLAP proposal was completed and submitted by the executive team (G. Juday, J. Dawe, T. Grant) in early June to DNR. The BAKLAP award was received by the UAF Office of Grants & Contracts Administration on August 6, 2012. It was subsequently revised and reissued. The University of Alaska BAKLAP account was established and became active in September 2012. A ceremonial launch of BAKLAP with the sponsoring legislators was held on the UAF campus on October 15, 2012. A description of the event can be found at: http://snras.blogspot.com/2012/10/new-forest-research-and-outreach.html

Financial charges to BAKLAP were authorized as of the date of initial DNR approval, which was in July. Some BAKLAP activities were initiated in early or mid-quarter #3 of 2012 by charging other UAF accounts, but charges were subsequently transferred to BAKLAP. However, several activities, including appointments to positions, were not initiated until the UAF BAKLAP accounts became active. As a result of this timeline, BAKLAP experienced a "rolling start" with different activities launched at different times, and less than full activity in some parts of the project. Quarter #4 of 2012 will be the first quarter with full activity.

For accounting purposes, and because of the differing indirect cost rates, three BAKLAP accounts were established at UAF:

Forest Research

Forest Education Outreach

K20 STEAM Education

This 2012 Quarter #3 report follows that three-fold division for reporting.

BAKLAP Project Personnel

Dr. Glenn Juday, Professor of Forest Ecology. Tenured UAF position is for nine months. BAKLAP supported summer salary June–August 2012.

Dr. Jan Dawe. Appointed as a Research Professional, beginning September 2012. BAKLAP supported salary September 2012.

Dr. Tom Grant. Appointed as a Research Professional, beginning September 2012, previously a post-doctoral researcher. BAKLAP supported his salary for parts of August and for September 2012.

Zach Meyers. Zach Myers completed his MS in the UAF Department of Biology and Wildlife in June 2012. He was hired as a UAF temporary technical (Grade 77), supported by grants and contracts in September 2011. He was supported by BAKLAP funding from July to September 2012.

David Spencer, Research Technician (Grade 76). Supported by grants and contracts since July 2008. He was supported principally by BAKLAP funding from July–September 2012.

Miho Morimoto, PhD Student. Miho Morimoto is a PhD student in the UAF School of Natural Resources and Agricultural Sciences. She was appointed to a research tech position on July 30, 2012 and worked on BAKLAP projects for the remainder of the summer. She was then appointed to a graduate research assistanceship on August 30, 2012. She participated in the GRT sampling field campaign Aug. 27–Sep. 1, and attended the LTER All Scientists meeting Sep. 10–13. She began work for the Operational Regeneration Assessment (ORA) in the BAKLAP deliverables and conducted a field day with Brian Young (DoF) and T. Grant (UAF BAKLAP) to examine regenerated harvest units. During the 2012 Q3 reporting period she published a scientific article based on her previous master's degree work:

» Miho Morimoto, Junko Morimoto, Yoshiaki Moriya and Futoshi Nakamura. 2012. Forest restoration following a windthrow: how legacy retention versus plantation after salvaging alters the trajectory of initial recovery. *Landscape and Ecological Engineering.* DOI: 10.1007/s11355-012-0206-3. www.springerlink.com/content/a8281j9x78120856/?MUD=MP

http://snras.blogspot.com/2012/11/morimoto-publishes-in-landscape-ecology.html

Ryan Jess, Undergraduate student employee. Supported by the National Science Foundation award for Research Experiences for Undergraduates (REU) through Bonanza Creek Long Term Ecological Research (LTER) site. Funding was obtained by Juday under an internal competition within the LTER research group, and the proposal and research/mentoring plan was written to contribute to BAKLAP goals.

Andrew Allaby, MS Student. Andrew Allaby is an MS student in the UAF School of Natural Resources and Agricultural Sciences. He was appointed to a research tech position on July 8, 2012 and worked on NSF funding for the remainder of the summer. He was then appointed to a graduate research assistanceship on August 30, 2012. He participated in the GRT sampling field campaign Aug. 27–Sep. 1 and was part of the field team performing measurements at the Reserve West Forest Reference Stand at Bonanza Creek Experimental Forest.

Randy Peterson, MS Student. Randy Peterson is an MS student in the UAF School of Natural Resources and Agricultural Sciences. In 2011 he designed the Microsoft Access relational database that holds long-term tree measurement files for the post-fire tree regeneration study. In 2012 he participated in the post-fire tree regeneration (Reserve West) measurements in Aug. and Sep. 1, and was supported by BAKLAP funds for about 2.5 weeks of field and database work.

Quarter #3, 2012 Activity: Forest Research

1. Aspen Growth and Health

Presentation to: Ecological Society of America annual meeting (Portland, Oregon)

Glenn Juday presented a paper on Alaska boreal forest growth and health he authored with Tom Grant and David Spencer (UAF BAKLAP) on Aug. 10, 2012, at the Ecological Society of America Annual Meeting in Portland, Oregon. The abstract is below:

Boreal Alaska aspen growth rate collapse and mortality from high temperatures, drought, and insect attack

Glenn Patrick Juday, Thomas Grant III, David Lee Spencer

Background/Questions/Methods

In the early stages of the analysis of possible climate change effects on Alaska forests, aspen, with its adaptation to the warmest and driest sites, was identified as a species that might experience relatively less growth reduction than other tree species as temperatures increased. We conducted a study of the climate sensitivity of aspen in the boreal forest region of Alaska. Our study represents the first significant test of the hypothesis that aspen growth is relatively better under elevated temperatures than other boreal trees in Alaska. We collected, cross-dated, and measured 117 tree disks from 117 aspen trees in 7 widely separated stands across central and eastern Interior Alaska. We also collected 12 birch and 15 white spruce disk samples to compare relative growth performance of those species with aspen in the same stands. The ring width data from the all trees was compared to mean monthly

temperature and monthly total precipitation data from Fairbanks from 1912 through 2011. In addition to climate factors, growth of this population of aspen has been affected by a severe outbreak of the aspen leaf miner that began in 1998 and has continued through 2011.

Results/Conclusions

The earliest aspen ring in the sample was formed in 1795, approaching the earliest known for the species. Sixteen aspen ring width chronologies begin at 1829 or earlier, and a number originate in the 1950s (Figure 1). Radial growth of aspen on the sampled sites is under strong climate control (r^2 0.6+; $p < .01$), with warm summer temperatures a negative predictor of growth and precipitation in specific months a positive factor. From the mid 1970s through the 1990s, strongly unfavorable climate index values were associated with a major growth reduction. Since 2004, aspen experienced a growth rate collapse (Figure 2), with some trees failing to form rings along a portion of the bole. The sustained leaf miner outbreak coincides with overprediction of growth by the climate index. Tree death from climate stress and insect leaf mining has become appreciable in the past three to four years. Our results suggest that as long as the highly unfavorable climate regime of the past several decades persists, aspen productivity will remain at historically low levels, and aspen are at risk of elevated mortality. With further temperature increases, aspen is likely to be eliminated on the warmest and driest sites, a process which may have begun.

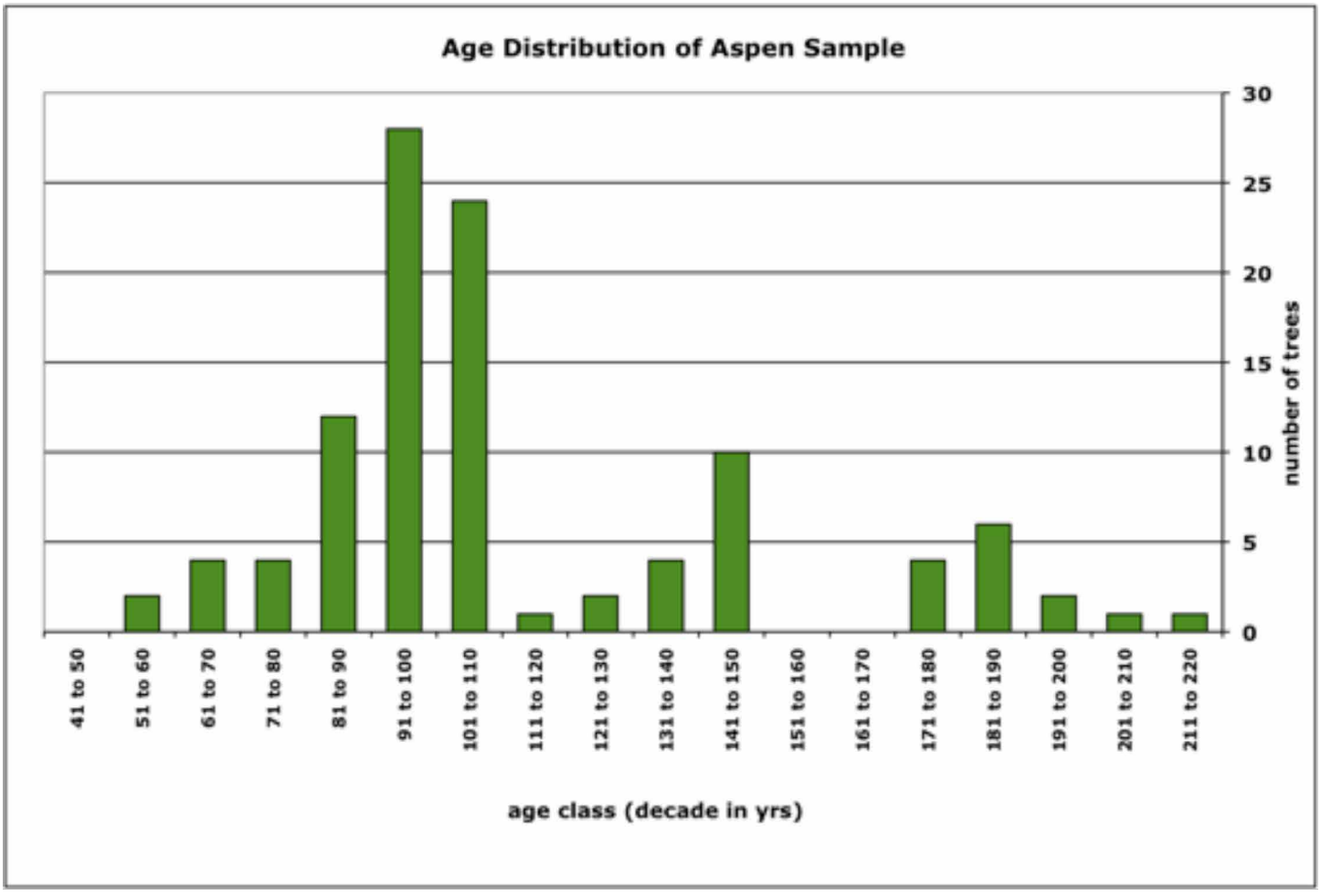

Figure 1. Earliest year of growth from basal disks in a sample of 117 aspen trees from east-central Alaska. Most of the sample was in the range of 80 to 110 years old, the typical age at commercial tree harvest.

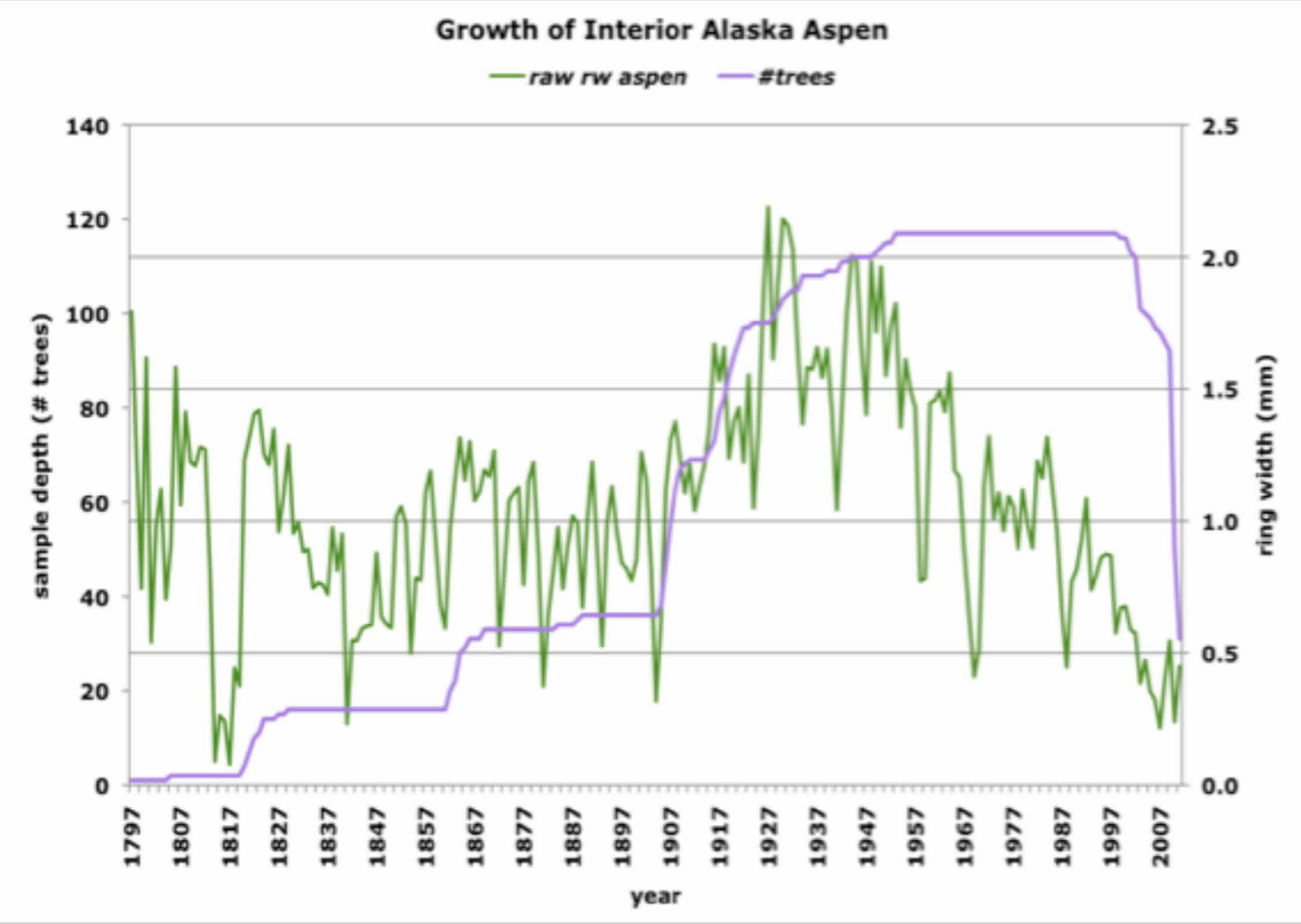

Figure 2. Raw ring-width growth of the 117 tree aspen sample. Growth averaged nearly 1.0 mm per year, but growth in the first half of the twentieth century was optimum and growth since 1998 has been at a historic low.

On a long-term basis white spruce grew about 1.3 times the rate of aspen (ratio of 1.3). Years with abnormal ratios indicating depressed aspen growth are 1904–05; 1967–69; 1988; 2001–2010 (Figure 3). The years of depressed aspen growth match known or suspected defoliating outbreaks of aspen leaf miner and large aspen tortrix. On a long-term basis Alaska birch grew about 1.7 times the rate of aspen (Figure 4). Years of abnormal birch to aspen growth ratios match the years of depressed aspen growth indicated by the spruce to aspen ratios. This growth ratio calculation appears to be a useful technique to identify the level of risk for major growth-reducing outbreaks of defoliating insects in aspen on a century time scale. As a result, we have developed a fundamental technique for identifying tree ring signatures of aspen defoliation outbreaks, which will allow the risk of growing the species as a crop tree to be quantified.

2. Grand River Transect Sampling

The BAKLAP team of Juday, Grant, Spencer, Morimoto, Alaby, and Jess completed a 650-mile river trip to collect white spruce and aspen samples for tree ring (dendrochronology) analysis of climate control over growth and forest growth and health monitoring of long-term forest plots along remote sections of the Tanana, Kantishna, and Yukon rivers (Figure 5, see p. 7). The route involved travel down the Tanana River at Fairbanks to the village of Tanana at the confluence of the Yukon and Tanana Rivers, and then up the Yukon River through the Yukon Canyon, and back. The trip was accomplished by a charter with Alaska River Journeys, with Sam Demientieff as boat pilot.

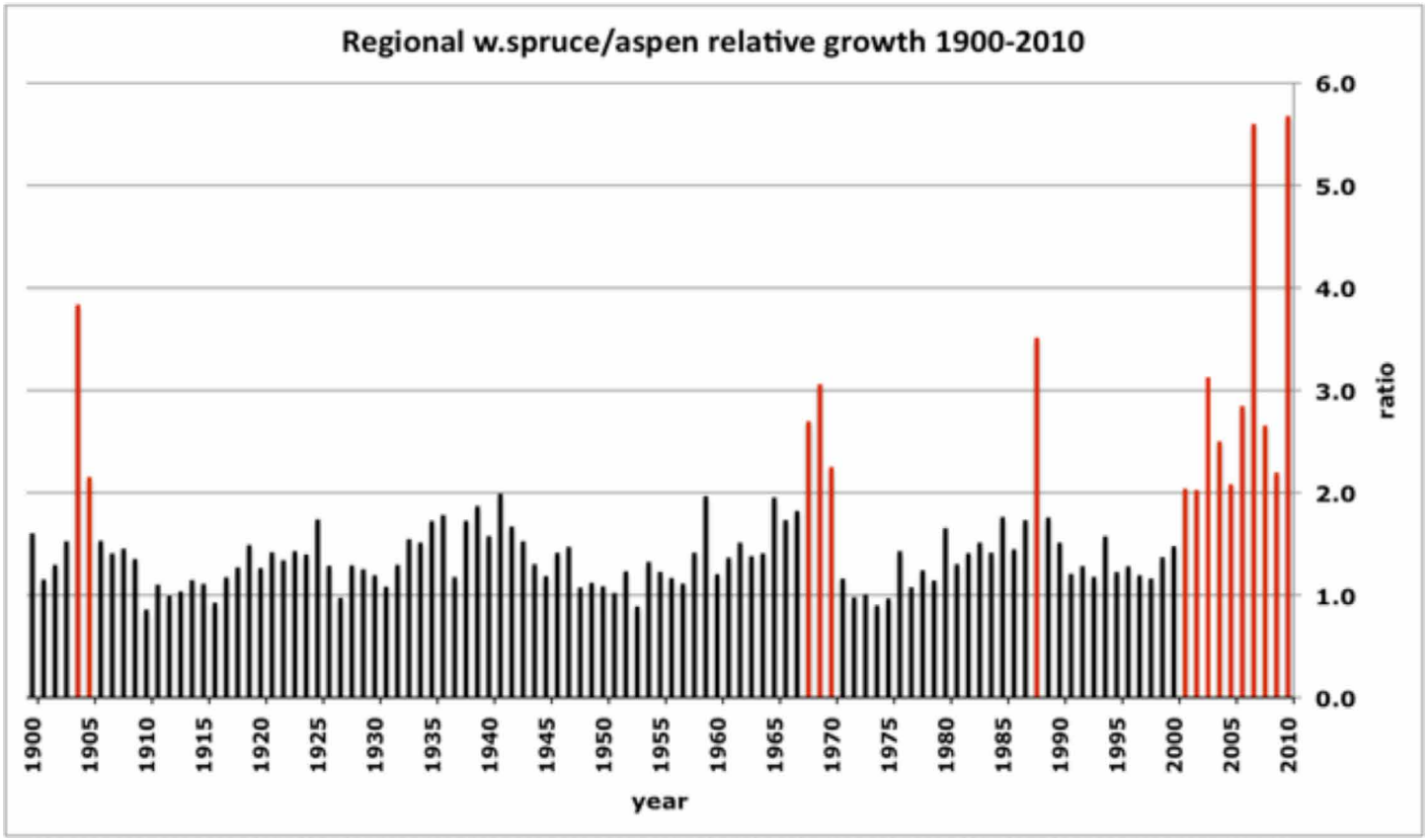

Figure 3. Ratio of ring-width growth of a sample of white spruce (6 stands, 58 trees) to the 117 tree aspen sample. Red bars are years of abnormal ratios indicating depressed aspen growth.

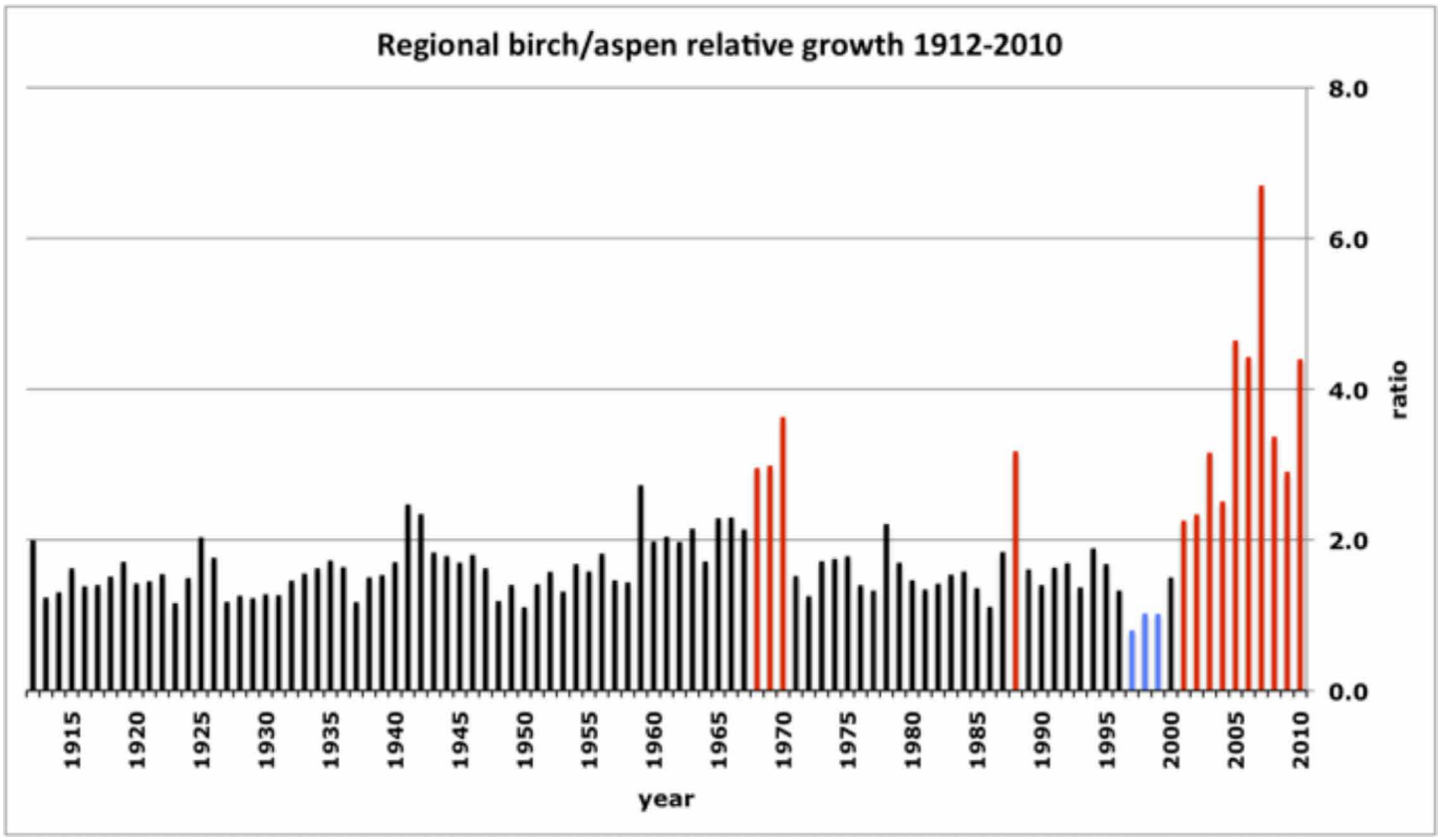

Figure 4. Ratio of ring-width growth of a sample of Alaska birch (3 stands, 60 trees) to the 117 tree aspen sample. Red bars are years of abnormal ratios, indicating depressed aspen growth (1968–70; 1988; 2001–2010). The years of depressed aspen growth also match known or suspected defoliating outbreaks of aspen leaf miner and large aspen tortrix as indicated by white spruce ratios.

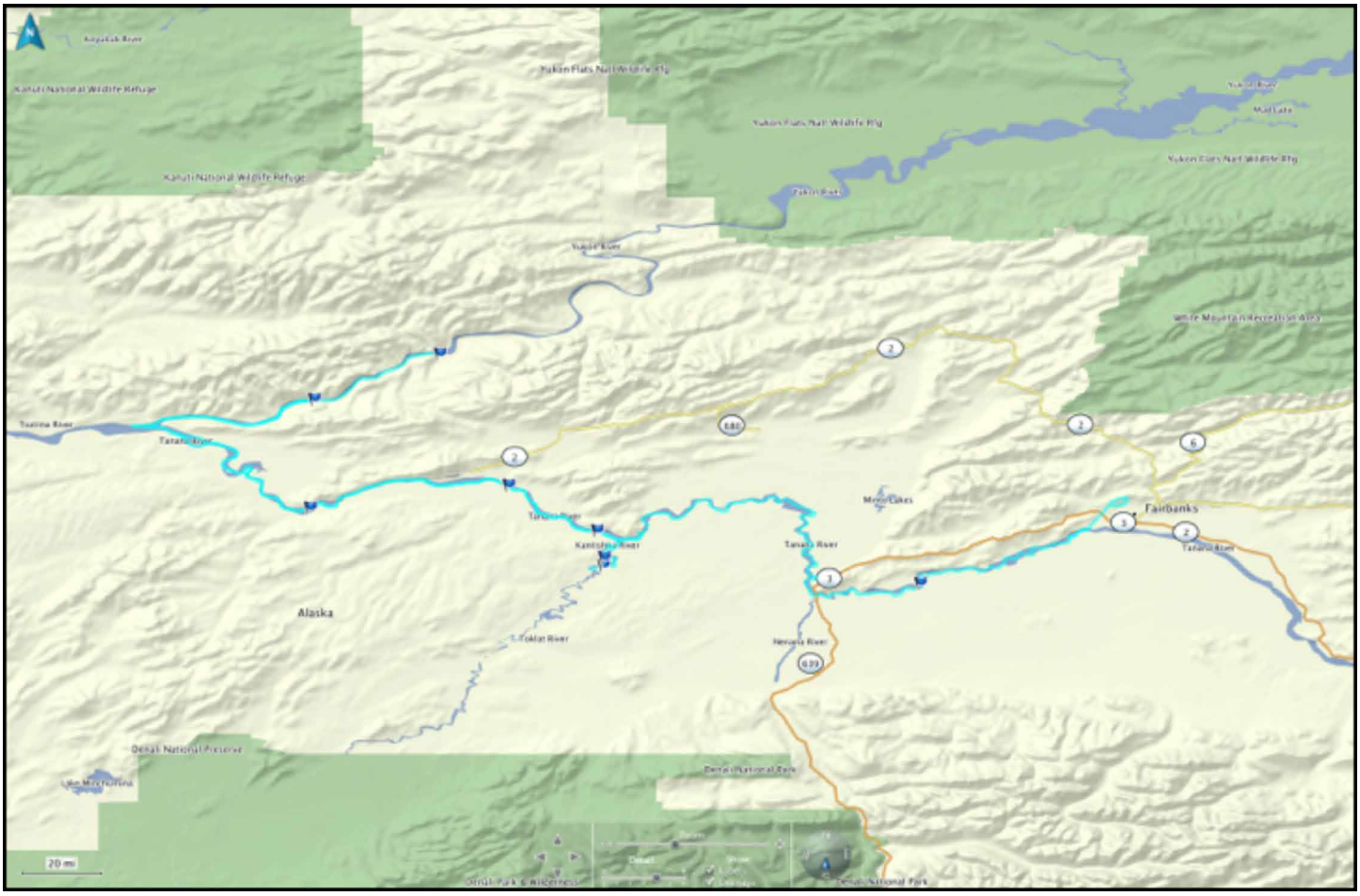

Figure 5. August 2012 boat trip along the Tanana, Kantishna, and Yukon rivers to monitor long-term forest measurement sites and collect tree samples for dendrochronological analysis (approximately 650 miles roundtrip, route marked in light blue, flags represent sampling sites).

The expedition team spent two days at Caribou Crossing Research Natural Area in the Tanana Valley State Forest (TVSF), re-measuring long-term forest growth and health plots. On the departure from there, the team collected cores from white spruce along the Kantishna River section of TVSF. The team also made incidental observations of forest health conditions along the route (Figure 6).

The 2012 sampling effort was carried out to fill in a strategic gap in a larger east to west transect study of highly productive white spruce stands along the Yukon, Tanana, and Kuskokwim rivers (Figure 7), known as the Grand River Transect. The 2012 river sampling resulted in the collection of disks or cores of 77 trees from 8 stands. The entire sample (dating back to collections in 2003, 2007, 2008, 2009, 2010) now totals 540 dominant white spruce trees in 36 stands.

The GRT sample are representative of trees with possibly the greatest commercial wood production potential in Interior Alaska. The ring-width growth record of the GRT white spruce should indicate the productive potential of these highly productive sites.

The GRT is also an unmatched opportunity for an analysis of the climate control of tree growth across boreal Alaska. A number of plans have been developed over the years to establish a north-to-south forest growth transect study in Alaska. Essentially none of these plans have been successful, principally because the diversity of site and soils types, mountain and elevation effects, and the complex precipitation gradients do not allow a simple gradient of north-to-south effects to be detected. But the same is not true for the east-to-west climate/forest growth gradient across boreal Alaska.

Figure 6. Possible symptoms of mber-marked birch leaf miner damage to an Alaska birch leaf, August 30, 2012, State Aspen Canyon plot above the Yukon River. Since the first introduction of this invasive defoliating insect north of the Alaska Range at Eielson Air Force Base, it has spread north and west. If this observation is verified, this would be one of the first observations of leaf damage in this section of Alaska.

Along the major river floodplains (glacial meltwater), productive forests have developed on the same soil type, from the same ecological origin process, in a narrow elevation band, with no aspect/slope differences. In addition, there are three first-order weather stations equally spaced across the area (Figure 7). The main factor affecting long-term forest growth across this area is the gradual change in climate from the warm, dry Interior, to the cooler and moist coastal region.

3. Bonanza Creek Experimental Forest (BCEF) Ground Photo Monitoring

Long-term photo monitoring of forest conditions and health is being carried out in Bonanza Creek Experimental Forest (BCEF) in a network of forest reference stands (Figure 8). The network was established as six paired burned and unburned stands on matched site types of the three main commercial forest types—aspen, Alaska birch, and white spruce. The stands were named based on location and condition, and three-letter standard acronyms were adopted for each for data coding and identification (Table 1).

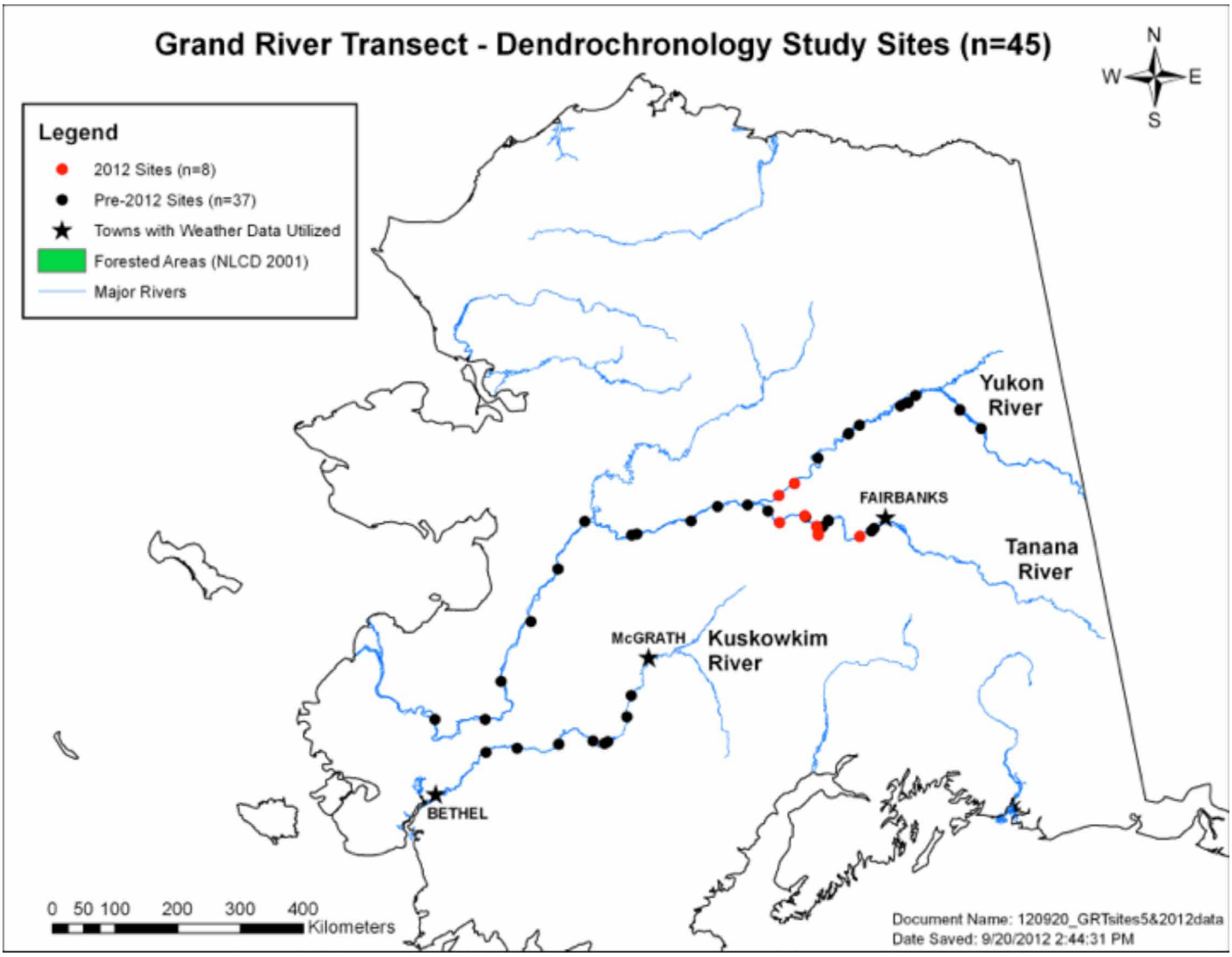

Figure 7. Map of study sites for the Grand River Transect paper and 2012 study sites along the Tanana, Kantishna, and Yukon rivers.

FOREST TYPE	BURNED	NOT BURNED
White spruce *(Picea glauca)*	Reserve West (**RSW**)	Parks Loop South (**PLS**)
Alaska birch *(Betula neoalaskana)*	Burned Birch Control (**BBC**)	Live Birch (**LBR**)
Aspen *(Populus tremuloides)*	Crispy Aspen (**CRA**)	3.2 Mile Aspen (**32A**)

Table 1. Bonanza Creek Experimental Forest reference stand name and acronym by forest type and fire condition.

Each reference stand hectare was established as a square of 100m by 100m. At Parks Loop South, a second hectare was established downhill, and at Crispy Aspen an additional quarter hectare was established to replace an area damaged in salvage logging. Monitoring photos are taken at five fixed locations in the hectare – at the center of each 50m by 50 quarter-hectare and at the center of the hectare. At each fixed location, photos are taken parallel to the perimeter boundaries that correspond most closely to north, south, east, and west, with a final view upward. At each direction a picture is taken at close-distance focus and at distant focus. During Quarter 3 of 2012, monitoring photos were taken during summer (full leaf development) and in the fall (deciduous leaves off, but before snowpack). Pictures that provide a general view of the reference stands or particular features in them are also taken as the changes warrant. The number of photos taken at BCEF in 2012 during the two seasons totals 1,468, with more than 12GB of data (Table 2).

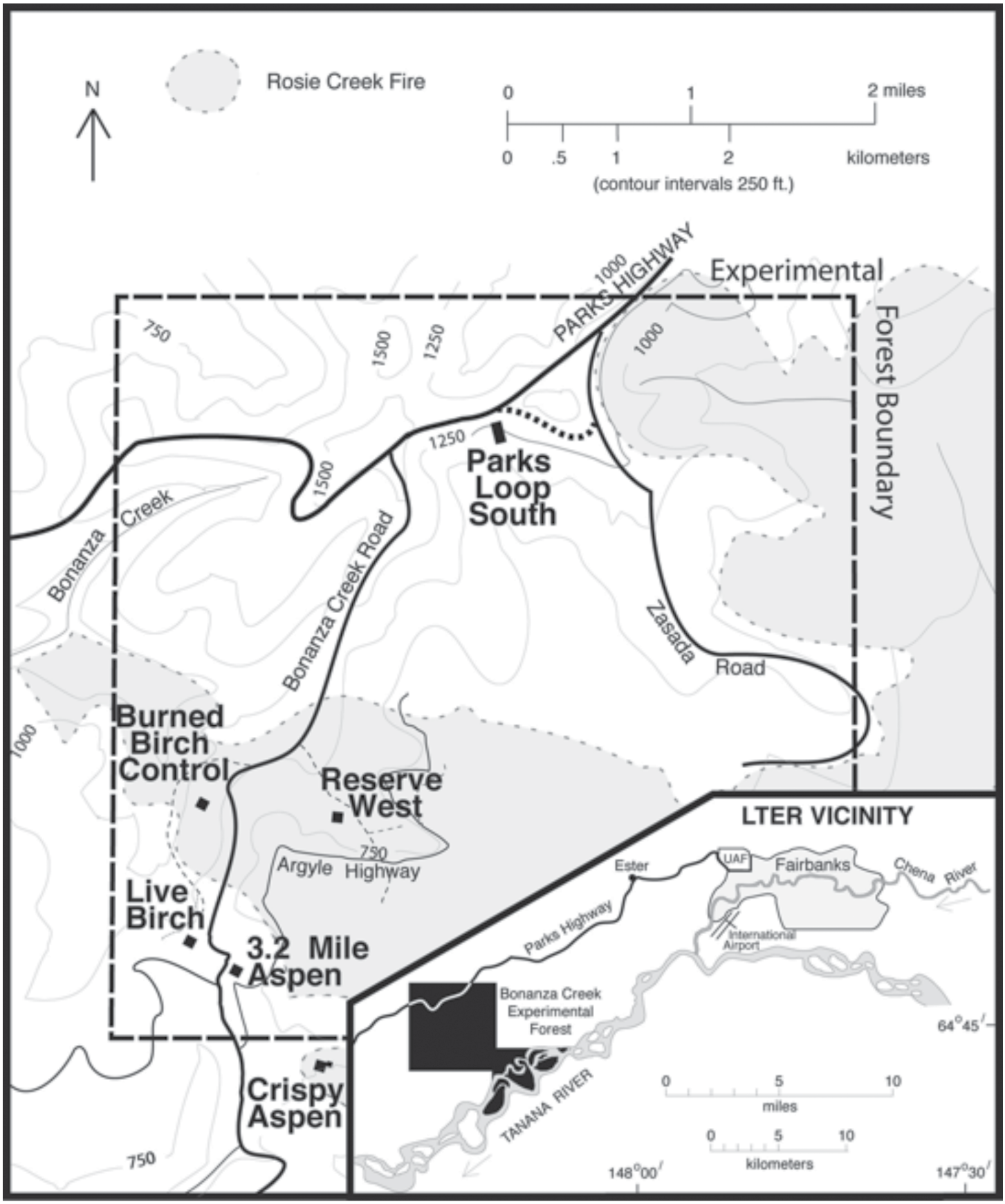

Figure 8. Vicinity of Bonanza Creek Experimental Forest LTER and location of reference stands.

BCEF Reference Stand Hectare[1]	Year	Month	Day	# Photos	Data (MB)
132 A	2012	7	26	72	539.7
132 A	2012	10	1	94	837.9
2 PLS	2012	7	27	68	531.6
2 PLS	2012	10	2	89	868.7
1 PLS	2012	7	27	70	531.9
1 PLS	2012	10	3	91	927.4
1 LBR	2012	7	26	70	522.9
1 LBR	2012	10	1	92	943.0
2 CRA	2012	7	25	67	594.6
2 CRA	2012	9	29	112	816.1
1 CRA	2012	7	25	71	595.6
1 CRA	2012	9	29	108	755.1
GenView 1CRA2012Sep29	2012	9	29	7	49.1
1 BBC	2012	7	27	70	518.6
1 BBC	2012	10	4	91	1001.0
1 RSW	2012	7	26	71	539.5
1 RSW	2012	8	1	72	482.2
1 RSW	2012	10	4	90	927.3
GenView 1RSW2012Sep29	2012	9	10	39	228.4
GenView 1RSW2012Oct03	2012	10	3	24	178.1
All Photos				1468	12388.7

Table 2. Photo monitoring of forest health and growth at Bonanza Creek Experimental Forest in Quarter #3, 2012.

[1] Reference stands: 132A = 1st hectare of 3.2 Mile Aspen; 2PLS = 2nd hectare of Parks Loop South; 1PLS = 1st hectare of Parks Loop South; 1LBR 1st hectare of Live Birch.

Monitoring photos are also taken at Caribou Crossing (CBX) Research Natural Area in Tanana Valley State Forest as the opportunity of site expeditions permits. Three forest reference stands are located at CBX: Y Gulch (50m by 50m), Trap Flats (50m by 25m), and Main Gulch Bench (25m by 25m). The photo series at CBX is 2008, 2010, and 2012. Monitoring photos taken at Y Gulch and Trap Flats in August 2012 show continued overstory tree mortality and extensive mortality of aspen (Figure 9, next page).

Important features of forest health were documented in the BCEF monitoring photos. The severe aspen leaf miner outbreak that has riddled aspen leaves in this part of Alaska since 1998 collapsed definitively in summer 2012. Extremely well-timed rainfall during growing season 2012 produced maximum leaf area development. The 29-year-old forest that has developed within the 1983 Rosie Creek burn is entering a period of canopy closure and intense tree-to-tree competition.

4. Post-fire Forest Development at Reserve West Reference Stand at BCEF

Since 1989, all white spruce trees that could be found in the Reserve West (burned white spruce) reference hectare at BCEF have been mapped and measured annually. The 2012 measurement season was completed in Quarter 3, and the measurements collected represent 2012 annual growth and mortality. At the end of the 2012 measurement season there were 2,271 live trees in the database. The current measurement protocol involves taking eight measurements of each tree, including base diameter, diameter at breast height (137 cm), total tree height, height growth in the current year, spruce budworm damage, shade class, animal damage to leader, and notes of special conditions (Figure 10, p. 13). These eight parameters measured on 2,271 generated 18,136 measurements.

Data were entered into an MS Access relational database and quality checked as the measurement campaign progressed so that errors, questions, and omissions could be addressed immediately. This is the largest and longest running annual plot-level forest measurements series we know of in the boreal forest of Alaska. The monitoring effort is providing unique insight into how forests develop in their early years and the key factors that influence their development after fire.

5. Monitoring Forest Health and Survival at Mature Forest Reference Stands

The network of six reference stands at Bonanza Creek Experimental Forest (Table 1, Figure 7) and satellite Research Natural Areas (RNAs) in the Tanana Valley State Forest make up one of the demonstration entries for the BAKLAP deliverable Data Atlas of Forest Research Installations (DAFRI). Updating measurement to reflect recent events in the forest (e.g., Nov. 2010 ice storm damage, insect-caused tree death) is the final step in preparing these installations for a DAFRI entry. During 2012 Quarter #3, the mature forest stands were revisited and remeasured for these changes (Table 3). Monitoring visits were also conducted to two BLM RNAs, Serpentine Slide RNA and Big Windy Hot Springs. No DNR/BAKLAP funds were provided for the site visits, but the data are being integrated into the BAKLAP reporting system.

Figure 9. Dead aspen and white spruce on slope above the Trap Flats forest reference stand at Caribou Crossing Research Natural Area in the Tanana Valley State Forest, August 28, 2012.

Figure 10. Ryan Jess, undergraduate student funded by the NSF REU program (Research Experiences for Undergraduates) at the Reserve West reference hectare, Bonanza Creek Experimental Forest, September 29, 2012. This reference hectare (2.47 ac) was burned in the 1983 Rosie Creek Fire, and all white spruce seedlings have been followed since. In the 2012 measurements, 2,271 trees were measured, providing a detailed look at early tree survival, health, and growth following wildfire in today's environment.

Finally, T. Grant and other BAKLAP team members completed preliminary tests of LignoVision software, a product that automates tree ring measurements using digitally scanned images. Initial tests show a 95% correlation between the sample measured manually using a laser linear encoder system and the automated systems. If additional quality checks yield similar results, it may be possible to achieve a significant improvement in efficiency of tree growth measurements.

Reference Stand Plot ID	**Date of first measurement** (all stem dia.)	**Additional measurements** (any data type)	**Live trees** (#ha^{-1} >2.0cm at the time of measurement)	**Live basal area** (m^2 ha^{-1})
1PLS	Oct 1986, Jun 1987	Oct 1989, Aug, Oct 1993, Sep 1996, Jul 1997, Sep–Oct 2006, Jun–Jul 2008, May 2010, **Aug 2012**	712	43.0
2PLS	Aug 1993	Aug 1993, Jun 2008, **Aug 2012**	469	36.1
1BBC (burned)	Oct 1986 (retro)	Jul–Aug 1989, Jun–Aug 2009	582 (prefire all spp.) 455 (spruce in 2009) 1,234 (aspen/birch in 2009)	26.2
1LBR	Oct 1986, Aug 1988	Oct 201, Oct 2002, **Aug 2012**	299	21.8
1CRA (burned)	Sep 1988 (retro)	May–Jul 1989, Sep 1990	799 (prefire all spp.) 64,272 (all spp. 1989/90)[b]	33.1
2CRA (burned, 0.25 ha)	Aug 1990 (retro)	none	700 (prefire all spp.)	NA
132A	Oct 1986, Aug 1988	Jun 1989, October 2011	634	36.8

Table 3. Dates of establishment, dates of re-measurement, and general stand density characteristics of the six BCEF reference stands. Remonitoring and measurement in Quarter #3 of 2012 are highlighted in yellow.

[a] Expansion to hectare value based on inventory of 40% of ha (50 m by 50 m, and 50 m by 30 m).

[b] Expansion to hectare value based on inventory of 12.5% of ha (two 1/16th ha plots of 25 m by 25 m).

Quarter #3, 2012 Activity: Forest Education Outreach

T. Grant, M. Morimoto, and G. Juday coordinated with the Alaska Division of Forestry to plan and design research addressing the regeneration of forests following timber harvesting, representing the deliverable ORA (Operational Regeneration Assessment). DoF databases on regenerated timber sales were reviewed, and a field trip to examine regeneration in a representative set of sale units was conducted. Meetings and communication took place for developing an extensive literature review of boreal forest management. The DoF Dutch intern participated in the UAF seminar class NRM 692, and scientific and technical literature relating to wildlife in managed boreal forest environments was compiled.

T. Grant represented BAKLAP at the upcoming Alaska Wood Energy Conference (AWEC) in Ketchikan and presented a poster on the BAKLAP program.

T. Grant, G. Juday, and J. Dawe attended the Tanana Valley State Forest's Citizen Advisory Committee meeting. Opportunities for coordination of BAKLAP into state forest plans and operations were examined.

G. Juday, T. Grant, and J. Dawe attended the biennial Long-Term Ecological Research (LTER) All Scientists Meeting (ASM) meeting in Colorado (http://asm2012.lternet.edu/agenda). ASM sessions and workshops included several of particular relevance in planning proposals, collaborations, and publications relevant to BAKLAP, particularly plant phenology monitoring as part of an emerging national network, and approaches to successful citizen scientist involvement in research. The 2012 ASM meeting was judged a success by NSF sponsors and participants (http://news.lternet.edu/Article2660.html).

T. Grant received NSF travel sponsorship for a pre-ASM meeting at the Sevilleta LTER in New Mexico on improving public access to data collected with public funds.

Finally, BAKLAP team members assisted with coordination of a monthly "brown bag" lunch meeting to improve communication and coordination of people and organizations involved with wood biomass energy in interior Alaska. BAKLAP is working with the Alaska Center for Energy and Power (ACEP) and UAF's Forest Science and Cooperative Extension Programs to coordinate research and management for successful biomass implementation.

Quarter #3, 2012: K–20 STEAM Education Component

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

K–20 STEAM Education's first action at the beginning of the 2012–13 school year was to invite 11 experienced OneTree K–12 classroom teachers to become part of a core group of teacher-leaders to help develop/implement the K–20 STEAM Education program.

Teacher	School	Grade or Subject
Marlene McDermott	Watershed Charter	K
Moira O'Malley	Watershed Charter	1–2
Ronda Schlumbohm	Salcha Elementary	2–3
Deb Bennett	Barnette Magnet	4–6 Science, Math
Chris Pastro	Randy Smith Middle	7–8 Extended Learning
Mike Geil	Randy Smith Middle	7–8 Science
Sarah Drew	Ryan Middle	7–8 Math
Tim Ludwig	Ryan Middle	7–8 Math
Megan McCarthy	Hutchison High	Science, Math
Karen Stomberg	FNSBSD Art Center	K–12 District Art Coordinator

Table 4. Core K–12 STEAM Education Teacher Group.

Eight of the 11 teachers responded/accepted, and two additional middle school math/science teachers were added on the recommendation of one of our teachers. Taken as a group, these 10 teachers teach at all K–12 grade levels (Table 4). They and their classrooms will be the focal point of K–20 STEAM curriculum and professional development during Year 1 of BAKLAP as well as partners and advisors as we plan for Year 2.

As its first activity, the core group is customizing two yearlong experiments for their classroom environments:

1) Investigating factors affecting dormancy of a schoolyard birch "Adopt-a-Tree"

2) Germinating and growing seeds from their school's Adopt-a-Tree.

BAKLAP will support their efforts with standardized protocols, meta-data, and equipment, making school-to-school comparisons of results valid.

An initial meeting of the core group was held Sept. 25, 2012, at which time the yearlong experiments were discussed, an initial weekly schedule of classroom visits developed, and some of the needed equipment distributed. On October 1, visits to six classes at Randy Smith Middle School represented the kick-off of the yearlong experiments. First classroom visits to Salcha Elementary, Watershed Charter, Barnette Magnet, Ryan Middle, and Hutchison High School will be made during the first two weeks of October, and the germination experiment begun in mid-October.

Deliverable 1.4: Forest Entrepreneur Camp (FORENCA)

Andrew Allaby was chosen as the point person for developing once-a-month weekend activities during the academic school year that will culminate in the first "STEAM Works" forest entrepreneur camp next summer. OneTree classroom teachers and students, as well as homeschoolers, will be invited to come make things during

these weekend sessions with forest resources, including everything from knitting needles to artist charcoal and dyes to hand-carved spoons and hand-bound books. We expect the theme(s) of this summer's STEAM Works will develop out of the monthly workshops. Some of these activities may be offered collaboratively with Boreal House, a nascent community art and science center. STEAM Works is tentatively planned for the second half of June.

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

» ***NRM595P:*** During the first half of July, a continuing education course for K–12 educators called the ***"STEAM Intensive: Illustrated Botanical Books"*** was led cooperatively by the FNSBSD and SNRAS. Nineteen K–12 teachers took this one-credit course offered through Summer Sessions as NRM595P. The class successfully demonstrated the STEAM approach, in which each participant, regardless of background or talent, was botanist, botanical illustrator, and bookmaker. The resulting book, ***TRAILWALK***, although actually a byproduct of the course, has proved so popular with the public that the follow-on events mentioned below were developed because of it.

» ***Friday, September 7*** marked the opening of the ***TRAILWALK Exhibit*** at the FNSB School District Central Administration Building and was well attended by school district administrators (including the superintendent and director of curriculum and instruction) and UAF (including the dean and associate dean of SNRAS).

» ***Tuesday, September 19,*** at the FNSB School Board meeting, Karen Stomberg, FNSBSD art center coordinator, provided a "Community Spotlight" about summer art education intensive courses. Karen talked at length about the STEAM Intensive, and the audience particularly singled out the university's support in making this course one of its high-quality professional development opportunities for pre-, during, and post-service K–12 teachers.

» As of October 1, the FNSB School District is creating a new ***one-credit phenology continuing education course*** for the 10-member Core K–12 STEAM Educator Group.

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

T-field Generation OneTree Birch Plot: Beta testing of senescence and tree growth protocols, including photodocumentation, qualitative observations, and quantitative measurements, was completed during September and data are being reduced. Analysis of this data will be a strong component of the second quarter of the K–20 STEAM Education Program.

Community Service Project: During the spring-summer, before BAKLAP was appropriated, a community collaborative citizen science project was initiated between three partners:

a) **Treecycler:** a national customer reward program that seeks to build ongoing partnerships between donors and revegetation efforts world wide,

b) the local **Nordic Ski Club,** because of its interest in revegetating abandoned ski trails,

and

c) **OneTree Alaska.**

After BAKLAP was funded, Treecycler agreed to subsidize K–20 STEAM Education work with K–12 schoolchildren interested in growing tree seedlings to transplant at Birch Hill. For every tree transplanted, Treecycler will give $1 to OneTree. In mid-September, the first 17 seedlings were planted on Birch Hill as a beta test of fall transplanting (recommended and explained to us by the Alaska Department of Natural Resources' Community Forestry Director, Patricia Joyner) of birch, spruce, and cottonwood.

Highlights of Travel and Community Outreach/Networking Opportunities

Outside Alaska: Dawe attended three conferences, including Public Participation in Scientific Research, the Ecological Society of America (July, Portland) and Long-term Ecological Science All-Scientist Meeting (August; Estes Park) during the first quarter of our BAKLAP work. The conferences were particularly well-timed for BAKLAP purposes. Dawe and Juday met with leaders in the academic and citizen-science phenology community, as well as education/outreach specialists from the LTER network. The outcome from those conferences includes, at the least, the recognition of a growing nationwide community of practitioners of K–20 science education/outreach specialists and university-based scientists all focused on phenologic research. Another outcome is recognition of the interest in STEAM (Interdisciplinary Science and Art) K–12 Professional Development. Next steps include programmatically defining STEAM, creating an inventory of institutions and LTER sites engaged in STEAM education/outreach, and developing and sharing best practices in STEAM collaboration.

Community Outreach/Networking: During the first quarter, Dawe, Grant, and Juday attended two meetings of the Tanana Valley State Forest Citizen Advisory Committee as well as two organizational meetings for the wood biomass energy working group, spearheaded by the Alaska Energy Authority (AEA: first meeting) and Alaska Center for Energy and Power (ACEP: second meeting). In addition, Dawe attended an all-day proposal-writing workshop for education/outreach specialists on the UAF campus.

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