



National Park Service Alaska Region Fire Ecology Annual Report Calendar Year 2016

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A. Summary

Overview

The National Park Service (NPS) Alaska region fire ecology program provides science-based information to guide fire and land management planning, decisions and practices in order to maintain and understand fire-adapted ecosystems in Alaska.

During the 2016 field season, the Alaska NPS fire ecology program conducted monitoring at the Wrangell-St. Elias McCarthy University Subdivision fuels reduction site, re-measured plots that have burned multiple times in Denali (Fig. 1),

and assisted with fire research projects at both sites. The regional fire ecologists were involved with preparing monitoring protocols, agreements and research proposals, instructing classes, and participating on several agency and interagency committees. Communication and outreach continued to be a focus for the program. This annual report provides a brief summary about the NPS Alaska 2016 fire season, fire ecology monitoring results, fire research projects, and fire ecology program activities and outreach.



Figure 1. Fire Ecologists monitoring the impacts of multiple fires in Denali (NPS photo 2016).

2016 Fire Season

The 2016 fire season in Alaska started early, with numerous human starts in April. The early spring was followed by a warm, but very wet summer in much of the interior Alaska and resulted in relatively low number of acres burned for the year statewide. By the end of the season, a total of 573 fires were reported and 500,794 acres burned statewide for Alaska in 2016 (AICC Situation Report Nov. 2, 2016, <http://fire.ak.blm.gov/>).

National Park Service in Alaska had a moderately active fire season, with a majority of the fires occurring in the Eastern Area Fire Management parks. Five parks had wildfires during the summer of 2016. There were 22 fires that burned within the park boundaries and a total of 59,532 acres burned within and adjacent to the park boundaries (Table 1). Of the area burned, 23,077 acres were on NPS owned lands. Wrangell-St. Elias had the greatest amount of area burned on AKR NPS lands and number of fires in 2016 (20,423 acres, Table 1). The largest fire, Steamboat Creek, burned within the area of 2009 Chakina fire. Yukon-Charley Rivers had several natural fires (Fig. 2), but most remained fairly small. The fire management staff carried out prescribed fire pile burns in Denali and Wrangell-St. Elias during 2016 at 3 sites (Table 1) and accomplished fuels reduction projects at several sites in the parks.



Figure 2. A lightning ignited wildfire in Yukon-Charley Rivers NPr shows active torching in spruce on the Kandik River fire June 29, 2016. (NPS Photo).

Table 1. Wildfires and prescribed fires in Alaska park units from 2016.

Park Unit	Number of Wildfires ¹	Total Acres Burned ¹	Number of Wildfires started on NPS Lands ²	Acres Burned NPS Lands ²	Number of Prescribed Fire Units	Acres of Prescribed Fires
Denali National Park & Preserve	1	3	1	3	2 (Toklat, Kantishna)	7.3
Gates of the Arctic National Park & Preserve	1	34,591	0	1,342	-	-
Noatak National Preserve	1	206	1	206	-	-
Wrangell-St. Elias National Park & Preserve	11	23,034	8	20,423	1 (Slana)	2
Yukon-Charley Rivers National Preserve	8	1,698	4	1,103	-	-
Total for Region	22	59,532	14	23,077	3	9.3

¹ Includes total number of fires and acres of all fires that burned within or partially within the boundaries of the park unit. NPS boundaries include inholdings of lands not owned or managed by NPS. ² Number of fires started and acres burned on NPS owned lands (WFMI stats).

B. Monitoring & Inventory

Monitoring and inventories are utilized by the fire ecology program to provide feedback to the NPS fire management program on activities such as fuels treatments and to continue to gain a better understanding of the effects of wildfire on the landscape. Table 2 provides a list of the number of plots measured in 2016 and the total number of fire/fuels monitoring or inventory plots established in Alaska parks since 2003.

During 2016 the NPS Alaska fire ecology program re-measured mechanical fuels reduction plots in Wrangell-St. Elias in McCarthy and established permanent fire effects monitoring plots in Denali to measure the impacts of shortened fire return intervals. Brief descriptions and preliminary results from the two monitoring projects are provided below.

Table 2. Fire effects and fuels treatment (TX) plot workload (2016) and total monitoring plots Installed 2003-2016.

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn/TX 2016	1yr Post 2016	Post (2-20 yrs) 2016	Annual Total	Total Plots
Lake Clark	Currant Cr Fire 2013	CBI, AKR Fire & Fuels Plots					43
	Kristin Cr Fire 2013	CBI & Cover					7
Wrangell-St. Elias	Carl Cr RX	AKR Carl Cr Plots					29
	Chakina Fire 2009	CBI & Cover					56
	Chakina Fire 2009	AKR Fire & Fuels Plots					9
	Susan Smith – Hazard Fuels Plots - TX	AKR SS Hazard Fuels Plots					13
	Headquarters – TX	AKR Hazard Fuels Plots					19
	Fire Effects – Paired Plots	AKR Paired Plots					2
	McCarthy University Subdivision - TX	AKR Hazard Fuels Plots			27	27	27
Yukon-Charley Rivers	2004 Woodchopper Fire	AKR Fire & Fuels Plots					7
	1999 Witch Fire	Fire effects - other					15
	2004 Fire – Paired Plots	AKR Paired Plots					5
	1999 Fires Landcover-CBI	AKR Fire & Fuels Plots					30
Denali	Headquarters – TX	AKR Hazard Fuels Plots					27
	VDM Highpower fire reburns	AKR Fire & Fuels Plots					10
	Landcover-CBI	AKR Fire & Fuels Plots			11	11	55
	BeaverLog Fire 2013	CBI & Cover					13
	Toklat R. East Fire 2013	CBI & Cover					25
Noatak	2010 Fires	CBI & Cover					34
	2004 Uvgoon Fire	AKR Fire & Fuels Plots					6
	2012 Uvgoon/ Kungiakrok Fires	CBI & Cover					22
	1977 Fires Racine Plots	Racine Plots					8

Park	Monitoring Unit	Type of Plot (FMH, photo point, other)	Pre-burn/TX 2016	1yr Post 2016	Post (2-20 yrs) 2016	Annual Total	Total Plots
Bering Land Bridge	1977 Fire Racine Plots	Racine Plots					8
	Fairhaven Ditch Cabins- TX	AKR Hazard Fuels Plots					4
Total					38	38	474

Wrangell-St. Elias McCarthy University Subdivision Fuels Reduction Monitoring

The rural community of McCarthy is located in a natural setting of boreal forest in south central Alaska within the boundaries of Wrangell-St. Elias National Park and Preserve (WRST). In 2011 a 36 acre fuels treatment project was conducted adjacent to the remote community of McCarthy, Alaska. The McCarthy University Subdivision Hazard Fuels Reduction project was designed to aid in the protection of human infrastructure and human lives in the event of a wildland fire near the community of McCarthy. The primary purpose of this fuels reduction project was to create a buffer zone, or shaded fuel break, between NPS land and private property in the University Subdivision area. The area was a mix of closed to open black spruce (Fig. 3), open mixed white and black spruce (Fig. 4) and open deciduous forests of aspen or balsam poplar forests. There was an abundance of old fire history evidence on the ground (burned logs and stumps) at the site, indicating the area burned in the past and had a good potential to burn again.

The specific fuels reduction project objectives were as follows:

1. *6' Bole spacing between needleleaf trees*- needleleaf trees will be mechanically thinned; needleleaf tree bole spacing will be 6 feet between tree boles.
2. *Needleleaf tree limbing to ≥ 5 feet*- needleleaf trees will be mechanically limbed; live and dead ladder fuels lower than 5 feet up the tree bole from the ground surface will be removed.
3. *Large woody debris removed*- 100hr and 1000hr fuels will be removed by hand; 80% of 100hr and 1000hr fuels will be removed.
4. *Tall shrub density reduction*- dead and decadent shrubs will be mechanically thinned; 80% of shrubs greater than 50% dead will be removed.
5. *Deciduous trees retained*- live deciduous trees will not be removed.

The fire ecology program worked with the park and fire managers to develop a monitoring program to 1) document the pre- and post-treatment condition of the vegetation and fuels at the fuels treatment site, 2) assess if prescriptions were met, and 3) model changes in fire behavior for the site. Twenty-seven plots were installed to evaluate the success of the mechanical fuels treatment in meeting prescription objectives. Pre-treatment monitoring data was conducted early in the summer of 2011, the hazard fuels reduction treatment was implemented in late summer of 2011. One year post-treatment monitoring occurred in 2012 and five year post-treatment monitoring occurred in 2016. One plot (MUS-30) was within a road buffer area that was not thinned and was excluded from the analyses presented below.



Figure 3. Dense black spruce and dead willow in the Wrangell St. Elias McCarthy University Subdivision fuels break were thinned and limbed in 2011 to provide a fuel break in the event of a wildfire. Photos from McCarthy fuels treatment monitoring plot (MUS-03) are shown from left to right; pre-treatment (2011), 1 year post treatment (2012) and 5 years post treatment (2016).



Figure 4. White and black spruce trees in the Wrangell St. Elias McCarthy University Subdivision site were thinned and limbed in 2011 to provide a fuel break in the event of a wildfire. The dead and dying tall willows were also cut, but have grown back in 5 years (note the tall shrubs in the background). Photos from the monitoring plot (MUS-14) are shown from left to right; pre-treatment (2011), 1 year post treatment (2012) and 5 years post treatment (2016).

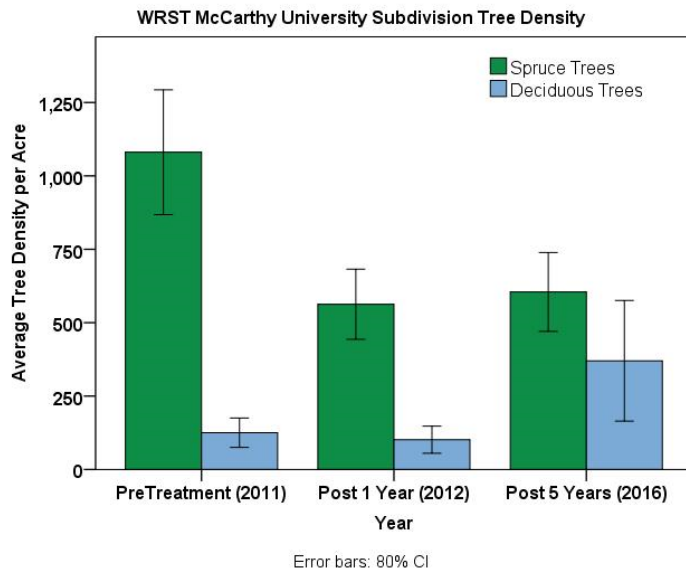


Figure 5. Average density (trees per acre) of spruce (green bars) and deciduous trees (blue bars) at treatment plots for pre-treatment (2011), 1 year post-treatment (2012), and 5 years post-treatment (2016) at the Wrangell-St. Elias McCarthy University Subdivision mechanical fuels reduction site. (n= 26 plots, 80% CI error bars).

Based on the 2016 monitoring plots, the prescribed thinning of spruce trees to 6 foot bole spacing was maintained. Similar to the 2012 monitoring data, the prescription was exceeded. Six foot bole spacing would result in approximately 1210 trees/acre. The five year post-treatment plots in 2016 had an average of 605 (80% CI 470 - 739) spruce trees/acre, reduced from the initial pre-treatment density of 1081 (80% CI 892-1302) spruce trees/acre (Fig. 5, Table 3). Although the prescription was written for bole spacing, the pre-treatment crown spacing was approximately 2 feet based on an average density of 1081 trees/acre with an estimated 2 foot crown radius. The fuels treatment increased the crown spacing to approximately 4.5 feet between tree

crowns. The treatment opened up the spruce canopy which should help reduce the potential for crown fire.

Some deciduous trees (aspen and balsam poplars) were cut during the treatment, which resulted in a slight reduction in deciduous tree densities at the plots one year after the treatment (Fig. 5). The cut trees caused the aspen and balsam poplars to sucker or re-sprout and were observed 1 year post treatment, but they were not tall enough to tally as trees (>4.5 feet tall). By 5 years post treatment the aspen and poplar suckers were tall enough to be tallied as trees in many of the plots. Five years after the treatment the density of deciduous trees increased from an average of 156 trees/acre (80% CI 93-214) pre-treatment to 377 trees/acre (80% CI 179-575) five years after the treatment (Fig. 5). In general aspen and balsam poplar are less flammable than spruce, so this change will likely contribute to creating a better fuel break.

The fuels treatment significantly improved the ladder fuel heights at the site. Prior to treatment the average height from the ground to the lowest dead branches on spruce trees was less than 1 inch (1.5 cm) above the ground (Fig. 6, Table 3). In 2016 the average height to the lowest dead branches on spruce trees was 3.4 feet (104 cm) and the lowest live branches average was 4.6 feet (139 cm) (Fig. 6). Neither of these heights achieved the objective of the 5 foot limbing height prescription, but the increased crown base height still reduces the potential for surface fires to move into the canopy.

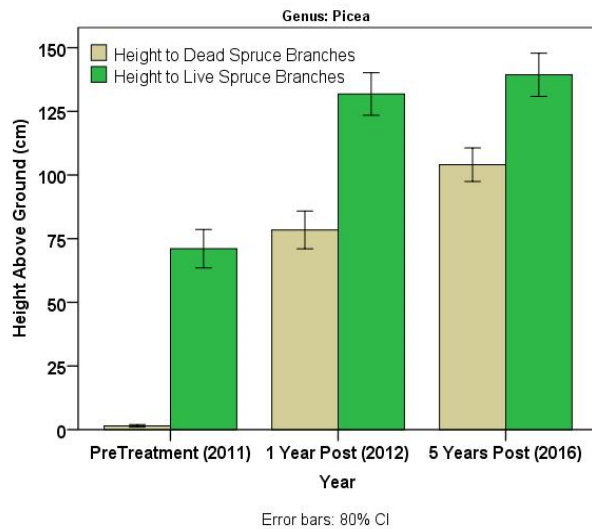


Figure 6. Bar graph of the average dead and live spruce branch height above the ground in centimeters shows an increase in limb heights after the fuels treatment at Wrangell-St. Elias McCarthy University site.

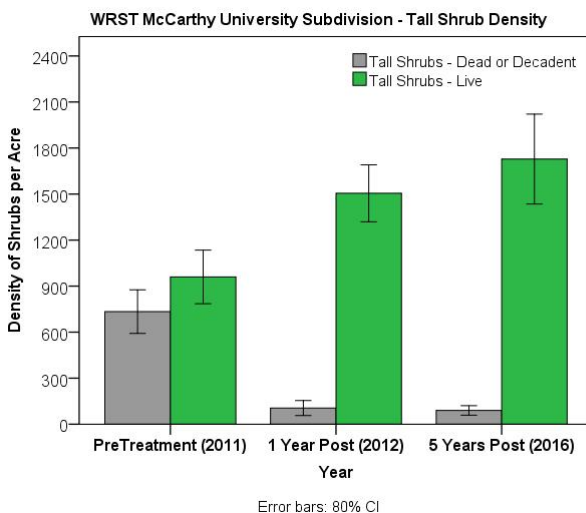


Figure 7. Bar graph of the average dead/decadent tall shrubs (grey bars) and live shrubs (green bars) per acre shows the reduction of decadent/dead shrubs, but an increase live shrubs post treatment at the fuels treatment at Wrangell-St. Elias McCarthy University site. (n=26 plots)

The project area was in an old fire area that likely resulted in a lot of willow shortly after the fire. Overtime as the trees have overtopped the willow in the area, the willows have died back resulting in lots of dead and broken willow stems prior to the treatment (note the dead willow in the 2011 photos in Fig. 3 and 4). The dead and decadent tall shrubs were reduced by 87%, which met the target objective of 80% reduction (Table 3, Fig. 7). There was an average of 734 shrubs/acre (80% CI 591-876) of tall dead or decadent shrubs prior to the treatment; these were reduced to 105 shrubs/acre (80% CI 56-154) 1 year after the treatment and have been maintained by 5 years after the treatment with an average of 90 shrub/acre (80% CI 59-120) (Table 3, Fig. 7).

However, the cutting of the decadent willows has resulted in vigorous re-sprouts from the cut willow. The number of live willow shrubs has increased from 960 shrubs/acre (80% CI 785-1135) pre-treatment to 1728 shrubs/acre (80% CI 1434-2021) 5 years after the treatment. Further discussions and assessment of whether the increased shrub density will impact fire potential or impede access to the fuels treatment during the event of fire will take place this spring.

Table 3. Management Objectives and Monitoring Results. A summary of the management and ecological objectives for 2016 projects are presented in this table. All results shown are 80% confidence intervals of the mean. An underlined number of plots indicates that the minimum sample size has been attained for that variable.

Monitoring Unit	Management Objective	Monitoring Results (80% Confidence Interval)	Objective Achieved?	Year Last Analysis Completed & Years included in analysis
WRST McCarthy University Subdivision Fuels Treatment	Reduce spruce tree density to 6 foot bole spacing in spruce (1210 spruce/acre) (+/- 80% confidence interval). Note 6 foot crown spacing in spruce is approx. 436 trees/acre.	Spruce Tree Density (<u>n</u>=26 plots) Pre-treatment (n=26 plots): 1081 (868-1293) trees/acre 1 yr Post-treatment (n=26 plots): 563 (443-682) trees/acre 5 yrs Post-treatment (n=26 plots): 605 (470-739) trees/acre	YES , but exceeded bole spacing.	2016 (2011-2016)
	Limb spruce to 5 ft (152 cm)	Dead Ladder Fuel height Pre-treatment (n=181 trees): 1.48 cm (0.98 – 1.97 cm) 1 yr Post-treatment (n=158 trees): 78.4 cm (70.9 – 85.9 cm) 5 yrs Post-treatment (<u>n</u>=160 trees): 103.9 cm (97.4 – 110.5 cm)	NO , average was 3.4 ft	2016 (2011-2016)
	80% of tall shrubs that are greater than 50% dead will be removed	Dead/Decadent Shrub Density Pre-treatment (n=27 plots): 745 (608-883) shrubs/acre 1 yr Post-treatment (n=26 plots): 105 (56-154) shrubs/acre 5 yrs Post-treatment (n=27 plots): 98 (67-130) shrubs/acre Percent removed: 86.8%	YES	2016 (2011-2016)

Denali Shortened Fire Return Interval Monitoring

In managing fires, recently burned areas are often used as natural fuel breaks by fire managers in Alaska, yet the reliability of this assumption seems to be changing with changing climate. In 2015 and 2016 some fires in the Alaska parks burned into recently burned area, leading to the question of the longevity and effectiveness of recently burned areas providing effective fire breaks or fire slowing conditions. In addition, little monitoring has occurred to understand and reasonably predict vegetation successional pathways due to fire burning a vegetated stands on multiple occasions (repeat fire events) with various levels of burn severity. In 2016, AKR NPS Regional Fire Ecology program partnered with USGS, FWS, BLM Alaska Fire Service, and the State of Alaska, DNR DOF in a preliminary study to assess the: 1) extent and trends in repeat fire (reburn) in Alaska; 2) characteristics that allow older fires to act as fuel breaks for new wildfires; 3) evaluate what climatic, weather and fuels conditions do fires reburn recently burned areas; and 4) evaluate the impacts of shortened fire return intervals and reburns have on vegetation succession and composition.

The 2015 Carlson Lake fire in Denali burned into the 2000 Foraker fire (and other fires) and burned 8 plots that had been established after the 2000 fire. In 2016, the team re-measured 7 of the 8 plots that burned both in 2015 and 2000 and re-measured 4 plots that were only burned in the 2000 fire.

Monitoring goals for the fire monitoring plots included:

- Document vascular and non-vascular plant cover changes
- Document changes in active layer depths
- Monitor tree seedling establishment
- Document changes in tree densities by diameter size class

The plots sampled were of two general vegetation types prior to the fires: 1) lowland woodland black spruce with tussocks (Fig. 8) and 2) mesic black/white spruce with feathermoss (Fig. 9). The mesic spruce sites burned with higher severity under both fires than the woodland black spruce sites. Seven years after the 2000 fire the three mesic spruce plots had paper birch (*Betula neoalaskana*) establishing. The 2015 burned top-killed many of the sapling paper birch, but many were re-sprouting after the second fire. Forb cover (fireweed) increased after the second fire at the mesic spruce sites. Over all the mesic spruce sites had less vegetation cover than the lowland woodland black spruce sites (Fig. 10 and Table 4) after the initial and second fire. The lowland black spruce sites were dominated by tussock sedges (*Eriophorum vaginatum*) and shrubs (*Ledum palustre*, *Betula nana*, *Vaccinium uliginosum*) after the first fire (Post Burn Year 7 and 16) and after the second fire (Post Burn Year 1 x2 Fires). The lowland black spruce sites revegetated quickly after the fires due to the ability of many of the plants to re-sprout post fire. These sites appear to be more resilient to multiple burns.

Preliminary analysis indicates that even with a second burn, seedling spruce survived or regenerated after the second fire. The average density of black spruce seedlings at the twice burned lowland spruce sites was 8,318 spruce seedlings/acre, while the once burned sites had an average of 6,407 spruce seedlings/acre. The data was variable with the small sample size. Additional analyses will be completed on these plots and other sites that have been monitored in the past. The work will continue next year in Wrangell-St. Elias, where the 2016 Steamboat Creek fire burned within the 2009 Chakina fire.

Table 4. Average percent cover of vascular plants by life form types for sites that have been burned 1 time and 2 times in the past 16 years in Denali. The number of plots are shown as “n” in the table.

Mesic Spruce	n	Forb/herb	Graminoid	Sedge	Shrub	Subshrub	Trees
PostBurn Year 1 x2 Fires	3	23.9	1.7	3.3	6.7	0.0	3.9
PostBurn Year 7	3	3.9	0.0	2.8	14.4	10.0	10.0
Woodland Black Spruce							
PostBurn Year 1 x2 Fires	3	0.6	0.6	48.9	32.8	33.9	2.2
PostBurn Year 7	7	0.0	0.0	70.2	58.6	36.4	1.0
PostBurn Year 16	4	0.0	0.0	56.3	61.7	44.6	0.0



Figure 8. This lowland woodland black spruce tussock site in Denali was burned by the 2000 Foraker fire and the 2015 Carlson Lake fire. The photo on the left was taken in 2002, 2 years after the 2000 fire. A re-measurement of the same plot in 2007 (middle) shows increased low shrubs, 7 years after the fire. In 2015 the plot was burned again, and the photo on the right shows the plot in 2016 with multiple burns, low shrubs and tussocks have re-sprouted after the second fire.

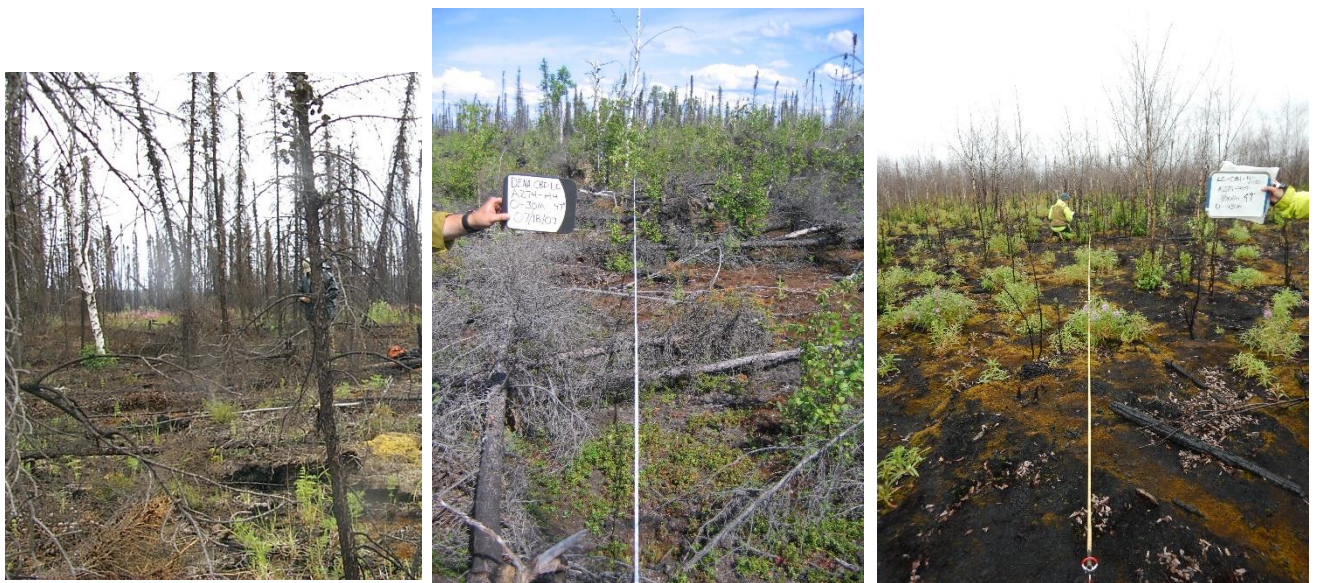


Figure 9. White and black spruce mixed forest in Denali was burned in 2000 and again in 2015. The photo on the left was taken 2 years after the fire (2002). A re-measurement of the same plot in 2007 (middle) shows paper birch saplings, low shrubs and downed trees 7 years after the fire. In 2015 the plot was burned again, and the photo on the right shows the plot in 2016 with multiple burns.

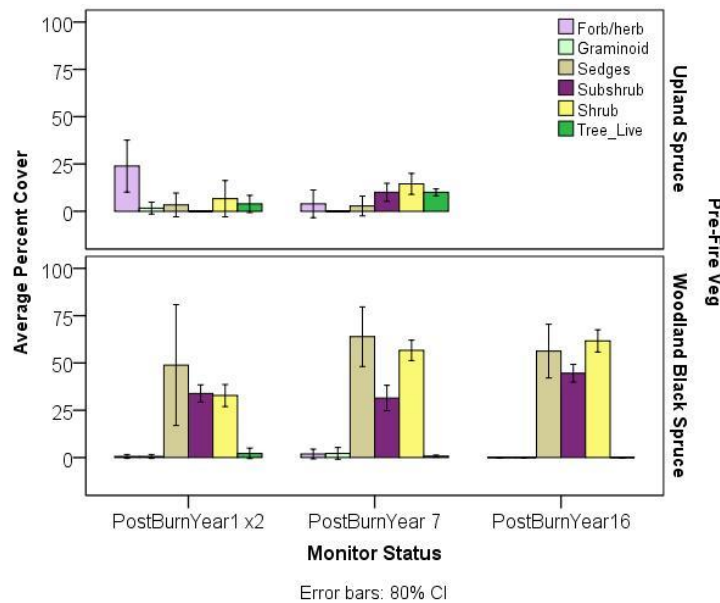


Figure 10. Average cover of vascular plants by life form from the Foraker-Carlson Lake fire monitoring plots in Denali. Overall the woodland black spruce forest types appear more resilient to multiple fires.

Data Management

Data for all recent monitoring projects have been entered into FFI (FEAT/FIREMON Integrated) - a plot-level monitoring sequel server software tool designed to assist managers with collection, storage and analysis of ecological information (<http://www.frames.gov/partner-sites/ffi/ffi-home/>). Digital archives and metadata for the AK databases were uploaded to the NPS Data Store IRMA in Feb 2017. The Alaska Eastern Area fire ecology data set is located here and includes data for YUCH and WRST: <https://irma.nps.gov/DataStore/Reference/Profile/2238367> and the Alaska Western Area fire ecology data set includes data for DENA, NOAT, BELA, and LACL: <https://irma.nps.gov/DataStore/Reference/Profile/2238363>. The updated FFI databases reflect the recent data additions and QC to the AK NPS fire ecology databases (Table 5).

Table 5. Monitoring Data Entry and Number of Treatment Units Monitored for 2016

Park/Project	% 2016 Data Entered	% 2016 Data Quality Checked	# Prescribed Fires Monitored	# Non-fire Fuels Treatments Monitored	# Wildfires Monitored	# BAER Treatments Monitored
Denali CBI and Landcover – Repeat Fire Plots	100%	100%	0	0	1	0
Wrangell St. Elias McCarthy University Subdivision Fuels Project	100%	100%	0	1	0	0

C. Research & Technology

The AKR fire ecology program coordinates **research** and facilitates the use of scientific data, modeling and technology to address the needs of the fire management program. In 2016 three fire research proposals were submitted to NPS and other funding organizations (see Table 6). Funding was received from USGS and FWS-LCC to assess the extent, cause and impacts of shortened fire return intervals in boreal forests. Field work was completed in 2016 to assess changes after fires that occurred in 2000 and 2015 in Denali (as described under the monitoring section of this report). A tree ring study in Wrangell-St. Elias (WRST) was funded in FY15 with NPS Reserve Fuels Research funds and field work occurred during 2016 (see below for more information).

Both fire ecologists are part of the interagency Fire Research, Development and Application Committee (FRDAC) for the Alaska Wildland Fire Coordinating Group (AWFCG) and are on the board for the JFSP Alaska Fire Science Consortium. Both ecologists participated in workshops and meetings for an interagency effort to update the Alaska Fuel Model Guide Book.

Table 6. Research workload in 2016.

Park	Are research needs identified in FMP or Monitoring Plan? (yes or no)	# of Proposals Submitted in 2016	# of Proposals Funded in 2016	# of Research Projects Supported in 2016 ¹	Additional Comments
Wrangell-St. Elias NPPr	yes	0	0	1	NPS FY15 Reserve Fund
Denali NPPr	Under revision	3	2	1	1 USGS NRPP proposal submitted - not funded. Funded by USGS and FWS-LCC.

¹Number of funded research projects, new or ongoing, supported by the fire ecology program including logistical info or support, staffing, etc.

WRST Fire History and Tree Ring Research

While monitoring the fuels treatment project conducted in Wrangell-St. Elias National Park and Preserve (WRST) at the McCarthy University Subdivision, numerous burned stumps were observed suggesting evidence of a previous old fire. The fuels project happened to occur in an area that was presumably burned in a very large (estimated 380,000 acre) fire from 1915 (Lutz 1956). During the fuels treatment over 100 cross sections of trees cut during the thinning project were collected for aging the stand, and preliminary tree ring counts indicated the stand was younger than 1915 (Barnes and Northway 2015).

In 2015 a research proposal was funded through the NPS Reserve Funds to age the stand and study the tree ring growth patterns to infer growth release and suppression at the site to potentially relate to climate and weather parameters that may lead to large fire growth in this region of Alaska. In 2015 the Cooperative Ecosystem Study Unit Agreement was created with the University of Montana (PI: Dr. Phil Higuera). The collected tree cross sections that were collected previously were mailed to the University.



Figure 11. Researchers from University of Montana collect tree cores from the WRST McCarthy University Subdivision fuels treatment site to age the stand and determine time since last disturbance (NPS Photo 2016).

During the summer of 2016, the PI and undergraduate student from the University of Montana joined the fire ecology program at the McCarthy University Subdivision fuels treatment project to collect additional tree cross sections and cores to validate age/height relationships of previously collected cross-sections (Fig. 11). During their field work 120 tree cores and 63 tree cross-sections were collected (32 from cut stumps). In addition the researchers collected information on stump heights and moss heights to develop age relationships to where the trees were cut. The material collected are being sanded and analyzed in the lab. Preliminary results are expected to be completed by the spring of 2017.

D. Communicating Results

Communicating results of projects or research is an important aspect the fire ecology program in order to provide **information and outreach** to fire managers, park staff, and the public. Table 7 lists the number of monitoring reports and presentations completed by park/affiliated group.

The fire ecology program had another year with a train-the-trainer theme. In May the regional fire ecologist and the assistant ecologist each gave presentations to interpretation staff at Lake Clark and Wrangell-St. Elias.

June continued to be a busy month for outreach with presentation/field day sessions for two different programs. First, the regional fire ecologist participated in a teacher intensive in Denali National Parks. Teachers learned about fire in the park through a day-long field trip investigating previous fires. Then, the assistant fire ecologist worked with the North for Science Program (co-sponsored by NPS FAPLIC) as one of subject matter experts on a week-long science education program for small group 8th grade students. The group traveled north through Gates of the Arctic learning about monitoring and evaluating various natural science topics including



Figure 12. Students in the North for Science program measuring an unburned plot just outside the 2005 Chapman Creek Fire for comparison. Carol Scott (2016).

wildfire. For this topic, students (and education program leaders) learned about the natural role of fire in Alaska through a classroom presentation and also participated in a field session to observe and collect fire monitoring data in the 2005 Chapman Creek Fire. Part of this project, including travel for the assistant fire ecologist and the purchase of educational field monitoring equipment, was funded by a NPS Fire Communication and Education Grant.

The same equipment was used by NPS communication and outreach staff in August for an educational program at Coal Creek Camp (YUCH) with Eagle School students. Unfortunately, the fire program could not attend but were able to provide guidance, training, and materials to the outreach staff. They were successful in presenting a fire ecology session and re-measuring plots in the 2004 Woodchopper fire with the students. Later in August, the assistant fire ecologist and the western area fire management officer presented basic Alaskan fire ecology information and the potential impacts of climate change to a group of teachers and science educators/communicators at the Earth to Sky program (co-sponsored by NPS FAPLIC).

In addition to these activities, formal oral and poster presentations were given at the NPS Centennial Science Symposium in October regarding the use of satellite imagery to improve our fire history records and new tools and products available to fire managers. The regional fire ecologist discussed the impacts of climate change and burn severity on fires in Alaska during a brief to the Washington DC State Envoy on Climate Change and spoke specifically on tundra fires and climate change to the Alaska Natural Resource & Outdoor Education (ANROE) Association. A video of the presentation to the ANROE Association is available here: <http://www.anroe.net/educator-and-student-resources/youtube-videos/>).

See Appendix A for a list of reports, presentations, and other forms of communication completed in 2016.

Table 7. Communicating Results - 2016

Park	# of Project Monitoring Reports completed in 2016	# of Annual meeting(s) with Park staff	# of Formal presentations of results	Do you use Minitab?*
Yukon-Charley Rivers	0	0	1	No
Denali	0	0	1	No
Noatak	0	0	0	No
Lake Clark	1	0	1	No
Wrangell-St. Elias	1	0	1	No
FAPLIC (Fairbanks Alaska Public Lands Information Center)			2	No
Alaska Regional Office		2		
Arctic Inventory & Monitoring Network	1			

*This information will help to assess Minitab multi-user license needs.

E. Planning and Compliance

The fire ecology program participates in **planning** activities for the Fire Management and Park Land Management Programs. Table 8 has a list of parks with fire management plans and the status for fire monitoring plans and Desired Future Conditions within the plans or other planning documents (<http://www.nps.gov/policy/DOrders/draftDO2-1.html>).

Table 8. Fire Management Plan - Fire Monitoring Plan Status as of 2016

Park	Does Park have written Desired Future Conditions (DFCs)? (yes or no)	Date Park-level Monitoring Plan completed (or revised)	Total # of Project- or Community-level Monitoring Plans	Assisted with how many BAER plans in 2016?
Denali	Yes in RSS	Planned for 2017	4	0
Gates of the Arctic	Yes - Interim Fire Desired Conditions in FMP	2014	1	0
Katmai	Yes – Suggested Fire Desired Conditions in FMP	2012	0	0
Lake Clark	No - Fire Management Objectives in FMP	2010	1	0
Western Arctic National Parklands	Yes - Interim Fire Desired Conditions in FMP	2012	4	0
Wrangell-St. Elias	No - Fire Management Objectives in FMP	2010	5	0
Yukon-Charley Rivers	No - Fire Management Objectives in FMP	2010 (under revision for 2017)	2	0

F. Fire ecology accomplishments and areas of focus

Fire Ecology Staffing 2016

The Alaska NPS Fire Ecology Program has a regional fire ecologist and a subject-to-furlough assistant regional fire ecologist. In general the fire ecology fieldwork has been accomplished with the assistance of the NPS fuels seasonal technicians or fire staff under the guidance of the regional fire ecologists. This has worked well, since the NPS Alaska Western Area (AWAFM) and Eastern Area Fire Management (EAFM) programs have generally hired multi-disciplinary fuels seasonal staff and allocated some of their time to fire ecology projects. Table 9 provides an overview of the personnel that work on or have assisted with fire ecology projects in 2016.

Table 9. Fire Ecology Staffing 2016

Ecologist and Monitors	Starting Date	Ending Date	# of Pay Periods	READ Qualified (Yes or No)	Training and Development
Jennifer Barnes (Regional Fire Ecologist)	1/1/2016	12/31/2016	26	No	ArcGIS Training, RT-372
Jennifer Hrobak (Assistant Regional Fire Ecologist)	1/29/2016	12/31/2016	24*	No	ArcGIS Training, S-491, RT-372
2 AWAFM Fire Crew Members/Staff			1	-	-
2 EAFM Fire Crew Members/Staff			1	-	-

*13 pay periods on base funding, additional pay periods on I&M funds, fire and other project funds.

Regional Fire Ecologists Accomplishment/Focus Areas

The Alaska regional fire ecologist facilitates planning, monitoring, research and outreach for the *region* and *park* programs. This position is responsible for monitoring plans, protocol development, compliance, administration, field instruction, field work, data analysis, and reporting on projects for the parks and region. In 2016, the regional fire ecologist worked on writing the Arctic Network Inventory & Monitoring (ARCN) fire monitoring protocols; prepared online lesson for S-495 Geospatial Fire Analysis, Interpretation and Application course; planned and implemented two field projects; prepared cooperative agreements for research projects; and prepared presentations. Table 10 provides a summary of the Alaska Regional Fire Ecologist focus areas and accomplishments for the calendar year of 2016.

Table 10. Fire Ecologist 2016 Accomplishments/Focus Areas (J. Barnes)

Category	Percent Time	Accomplishments and/or areas of activities
Planning	25%	I&M Network Fire Monitoring Protocols – ARCN Interagency agreement preparation for Repeat Fire Research Compliance for field work Field prep for field work – Project Aviation Safety Plans, etc. Multi-Park EA Fire Management for Coastal Parks – review Annual Spring Training Preparation (Presentation materials, handout, meeting logistics, etc.)
Presentations/ Reports	15%	Presentations: NPS, Public, Interagency Meetings Annual reports for Fire Ecology program and I&M network Teacher education classes – DENA Review manuscripts for Noatak Carbon project LACL fire story to ESRI conference Articles for NPS High Latitude Highlights Abstracts for Science Symposium WRST Fire Ecology Story Map
NPS Meetings/ task groups	14%	AKRO Regional and Park Fire Meetings Regional Fire Ecologist conference calls I&M Technical Committee meetings BELA State of the Park meetings BELA, WEAR RSS workshops
Interagency work	6%	S495 Geospatial Analysis - Cadre – Online Lesson Plan preparation CAN491 Canadian Fire Behavior - Cadre AWFCG Fire Research, Development & Application Committee AWFCG Fire Modeling and Application Committee Alaska Fire Science Consortium (Board member) LANDFIRE calls
Wildfire assignments	1%	GSAN work in Alaska - NPS
Prescribed fire projects (implementation)	1%	FIRB(t) pile burns in WRST – Slana RX
Non-fire fuels projects (implementation)	0	
Research	6%	NOAT research paper reviews USGS/FWS-LCC Repeat Fire research coordination WRST Tree Ring project coordination NASA AboVE research meetings Proposal reviews and letters of support

Category	Percent Time	Accomplishments and/or areas of activities
Data collection	6%	DENA LC-CBI repeat fire monitoring WRST Headquarters Fuels Treatment Monitoring Fuel Moisture Sampling
Data entry	1%	Data entry supervision and database assistance QC of data
Data analysis	7%	NOAT Tundra fire carbon WRST HQ Fuels and DENA CBI/Veg Burn severity and fire history stats
Supervision/Admin	10%	Supervision STF GS-9 Fire Ecologist Paperwork and administrative (time, travel, email) Budget
Training	5%	RT-371 Helicopter Manager Refresher ESRI Building Geodatabases Annual NPS Spring Training (RT-130, etc.) Bear & Shotgun Safety Training
Travel out-of-park for plot or project work	2%	All field work requires a travel authorization, multi-day trips away from duty station.
Miscellaneous	1%	

Assistant Fire Ecologist Accomplishments/Focus Areas

The subject-to-furlough assistant regional fire ecologist works for the regional fire ecologist in Alaska. This position helps plan and implement fire effects and fuels monitoring projects. This position also assists in the development of park fire management plans, fire monitoring plans, and compliance for fire ecology activities. The majority of work this year shifted from planning (20% in 2015) to presentation and report writing (21% in 2016). Much of that workload focused on completing SOPs for the ARCN Fire Extent and Burn Severity Monitoring Protocol and preparing presentations and activities for outreach/education (North for Science, Earth to Sky, NPS staff, and NPS Centennial Science Symposium). Other primary accomplishments include project planning (3 field site visits), field data collection, entry, and analysis, training (S-491, ESRI course, etc), and a fire assignment in Alaska as a trainee RCDM/LSC3.

Table 11. Assistant Fire Ecologist Accomplishments/Focus Areas 2016 (J. Hrobak)

Category	Percent Time	Accomplishments and/or areas of activities
Planning	11%	DENA – Repeat Burn Project (Logistics, Flight Planning, Sampling Locations, Gear Prep, Maps, Field Crew Coordination, etc.) WRST – MUS 5 YR Post Treatment Monitoring (Logistics, Gear Prep, Maps, Field Crew Coordination, etc.) Updating Monitoring Protocols (i.e., Minimum Hazardous Fuel Treatment Monitoring, Facility Risk Assessments, and Repeat Fires) Annual Spring Training Preparation (Presentation materials, handouts, meeting logistics, etc.) Annual Field Project Preparation (Trimble updates, data dictionary editing, camera settings, Garmin waypoint organization, Task Orders, Project Aviation Safety Plans, Compliance, etc.)
Presentations/ Reports	21%	ARCN Standard Operating Procedures for Monitoring Fire Frequency and Extent including GIS Analysis/QC and Summaries. ARCN Standard Operating Procedures for Monitoring Burn Severity Reviewer NPS Reports Poster and Oral Presentations at NPS Centennial Science Symposium

Category	Percent Time	Accomplishments and/or areas of activities
		Presentation for WRST Interpretive Staff Presentation/Field Trip for North for Science Program (Coldfoot, AK) Presentation for Earth to Sky Program Extreme Fire Behavior Events & Watchout Situations (Spring Training) CFFDRS FWI: Anticipating Extreme Fire Behavior (Spring Training) Fuel Moisture Sampling and Plant ID demonstrations (Spring Training) High Latitudes Highlights Article review
NPS Meetings/ task groups	6%	AKRO Regional Staff Meetings (weekly) AK Region Fire Management Meetings (monthly) AKRO Fire Annual In-Person Staff Meetings Centennial Event Planning Meetings (Parkie Pine 5K Race) Miscellaneous Project Conference Calls (STARFire, Risk Assessments, Repeat Fires, etc.)
Interagency work	2%	AK Fuel Model Guide Book Revision Meetings Alaska Fire Science Consortium – Advisory Board AWFCG Fire Research, Development & Application Committee AWFCG GIS Committee Alaska Incident Management Team Meetings Alaska Type 3 Team Simulation Cadre/Coach Alaska Fire Science Consortium Workshops NPS Representative for IARPC AFSC Historical Scan Project CFFDRS Course Cadre
Wildfire assignments	12%	Fire Assignment as RCDM(t)/LSC3(t)
Prescribed fire projects	0%	
Non-fire fuels projects	0%	
Research	1%	USGS/FWS-LCC Repeat Fire Research Meetings NASA AbOVE Research Meetings
Data collection	8%	Fuel Moisture Sampling WRST MUS Hazardous Fuel Treatment Plots DENA Repeat Fires Project (two site visits)
Data entry	9%	FFI Data Entry (WRST and DENA) Fuel Moisture Sampling Data Entry and Data Cleaning (FAS)
Data analysis	9%	Facility Risk Assessments for GAAR & YUCH Repeat Fires Project – NW Boreal LCC Geospatial Data Analysis
Supervision/Admin	3%	Quick Time, Travel Authorizations/Vouchers, Credit Card Statements, Fire Physicals, Email, etc.
Training	10%	S-491 Intermediate National Fire Danger Rating System Aviation Courses (A-205, A-303, A-304, A-305, A-307, A-309, A-310) RT-372 Helicopter Manager Refresher CAN491 – Intro to CFFDRS (Coach) Annual NPS Spring Training (RT-130, First Aid, CPR, etc.) Bear Safety Training/ Shotgun Certification ESRI: Building Geodatabases DOI Required Courses (FISSA+, Sexual Harassment, Scientific Integrity)
Travel out-of-park for plot or project work	3%	Travel to WRST & DENA (twice) for projects Travel to L-48 for S-491 training Travel for Alaska Fire Assignment Travel for North For Science Program Travel to NPS Fire Management Annual Meetings
Miscellaneous	5%	

G. 2017 Fire Ecology Program Direction

The major focus for 2017 will be to finalize Arctic Network I&M fire protocols, work with development fire risk modeling, and work towards completing reports for past projects. Field work expected for 2016 include re-measuring fuels reduction plots at the Wrangell-St. Elias in the 2009 Chakina and 2016 Steamboat Creek fire areas that twice burned plots, and re-measuring 40 year old tundra burn plots in Noatak with the Arctic Network Alaska I&M plant ecologist. See lists below for the proposed direction of the AKR fire ecology program for 2017.

Planning

- ARCN Fire Protocols & SOPs -Final
- Alaska Region - Fire Risk and STARfire project
- Compliance for field work
- FMP reviews/revisions
- RSS work for parks

Monitoring Field Projects and Data Entry

- WRST Chakina/Steamboat Creek repeat and post fire monitoring
- NOAT tundra fire plots - Racine
- Fuel moisture monitoring – DENA and Fairbanks

Reports/Outreach

- Report: WRST Headquarters and McCarthy Subdivision HZF
- Publications on repeat fire data
- Education presentations

F. Overall Data Entry Status and FFI suggestions

Data Entry Status

Table 12 estimates the number of fire ecology or fuels plots and number of projects since the mid-1980s that have data in FFI or another database format for the Alaska region parks. A majority of the plots and projects that are not in FFI are from projects prior to 2003. These projects include CBI plots from 2000-2003, and other fire effects projects that were implemented prior to 2003, with the exception of the 1980s NPS Alaska Region Fire Paired Plots project which includes over 500 plots. The Paired Plots were entered into an Access database and then converted to FFI. Only one known project has not been entered into any database, this includes fire behavior, weather and vegetation observations from a 2007 fire in Yukon-Charley Rivers.

Table 12. Number of known fire ecology or fuels plots and number of projects from the Alaska NPS Region and database formats.

Database Type	Number of Plots	Number of Projects	% Plots	% of Projects
Access	570	9	38%	29%
Excel	23	2	2%	6%
FFI	901	20	60%	65%
Totals	1494	31		

It would be desirable to convert some of the Access database projects into FFI, particularly the CBI plots. A higher priority would be to have global fixes for some of the current data entered into FFI. Over time, some of the projects data were entered with different units of measurements and also with issues on density calculations (see below) data needs to be fixed to calculate density correctly for some of the AKRO datasets in FFI.

FFI Feedback

The following are some suggestions to improve FFI, additional suggestions may be sent later. The Alaska Region has not used FFI-Lite.

- Provide for alternative or circular plot dimensions in density protocols (and likely other protocols). The current protocols only allow for square or rectangular plot dimensions (length and width).
- Clearly identify what fields are used for density calculations in reports in the FFI User Guide or within the system itself.
- Update the FFI User Guide to give definitions of data fields and their intended uses. It is very unclear within the individual tree protocol what the data fields are intended for, particularly the canopy and ladder fuel fields.
- Allow the user to define the plot size and dimensions for a projects protocol. Make the data of plot metadata (size and dimensions) available for each new sampling event; e.g. have it auto-populate with the predefined dimensions. Provide the opportunity for the user to modify it on a plot by plot or sampling event basis if needed. A huge amount of time is wasted entering the field headers on the data entry forms over and over again, and there is no global replace when something was entered incorrectly.
- Improve the output for the CSV exports. Having the plot meta data headers above each row of data for a plot makes very little sense and always needs to be cleaned up for use of the data. Possibly export the plot meta data headers as one sheet and the data as another CSV.
- Improve the query format so it is more user friendly or provide clear instructions in the FFI User Guide on how to create queries.
- Make FFI-Lite available on iPads

Appendix A. Reports, publications, or presentations completed in 2016 in conjunction with the Alaska Region Fire Ecology Program.

Barnes, J.L. 2016. Alaska Fire Management & Monitoring: vast areas, large fires, and limited staff. (Presentation). RX-510 Class. Tucson, AZ. January 2016.

Barnes, J.L. 2016. Alaska climate change, burn severity and impacts. (Presentation). Briefing for Washington DC State Envoy on Climate Change. Fairbanks, AK. March 2016.

Barnes, J.L. 2016. Climate change impacts on fire return interval in Alaska's Boreal Forests: risks and implications for managing fires and ecosystems. (Article). High Latitude Highlights. Fall 2016.

Barnes, J.L. 2016. Alaska fire and fire ecology in Lake Clark. (Presentation). LACL Seasonal Staff Training. Port Alsworth, AK. May 2016.

Barnes, J.L. 2016. Tundra fires in a Changing Climate. (Presentation and Video). Alaska Natural Resource & Outdoor Education Association. <http://www.anroe.net/educator-and-student-resources/youtube-videos/>

Barnes, J.L. 2016. Discovering Fire in Denali. (Presentation and Field Day). Denali Teacher Intensives. Denali Park, AK. June 2016.

Barnes, J.L. and Hrobak, J.L. 2016. Record Breaking Fire Season of 2015, what's in store for 2016. (Article). NPS High Latitude Highlights. Spring 2016.

Barnes, J.L. and Hrobak, J.L. 2016. Staying Safe: Entrapment and fire behavior in Alaska. (Presentation). NPS Alaska Fire Refresher, Fairbanks, AK. April 2016.

Hrobak, J.L. 2016. CFFDRS Fire Weather Index: Anticipating extreme Fire Behavior. (Presentation and Materials). NPS Alaska Fire Refresher, Fairbanks, AK. April 2016

Hrobak, J.L. 2016. Fire Ecology in Alaska & 2005 Chapman Creek Fire. (Presentation and Field Day). North for Science program. Coldfoot, AK. June 2016.

Hrobak, J.L. 2016. Logistics in Alaska. (Presentation and Materials). Alaska Type 3 Team Simulation. May 2016.

Hrobak, J.L. 2016. New tools for fire management: maps, apps, and fire risk assessments. (Poster). Centennial Science and Stewardship Symposium. Fairbanks, AK. October 2016.

Hrobak, J.L. 2016. Viewing fires from space: using satellite imagery to improve historical records in the Arctic Network parks. (Presentation). Centennial Science and Stewardship Symposium. Fairbanks, AK. October 2016.

Hrobak, J.L. and Barnes, J.L. 2016. Climate change and fire ecology in interior Alaska. (Presentation). Earth to Sky program. Fairbanks, AK. October 2016.

Hrobak, J.L. and Devcich, J. 2016. Fire Regimes, Fire Ecology and Fire Risk in Wrangell-St. Elias. (Presentation). WRST Seasonal Staff Training. Copper Center, AK. May 2016.

Hudspith, V., Belcher, C., Barnes, J.L. Dash, C., Kelly, R., and Hu, F.S. 2016. (in Review). Charcoal reflectance suggests heating duration and fuel moisture affected burn severity in four Alaskan tundra wildfires. International Journal of Wildland Fire.