



Alaska Fire Science Consortium FY20 Annual Report Narrative

1. Highlights and achievements

In FY20, the Alaska Fire Science Consortium (AFSC) activities included: 2 semi-annual workshops, 3 training sessions, attendance and participation at 5 conferences and symposia, 5 direct partner/agency/leadership briefings, 12 field consultations and engagements as members of an expert cadre, authorship on 3 peer-reviewed publications (Bieniek et al, 2020; Duncan et al, 2020; Ziel et al, 2020), 6 webinars, 68 responses to help desk inquiries, 47 archived videos, 10 Fire Science Highlights (blog posts), 14 email newsletters, 186 Facebook posts, the ongoing maintenance and expansion of a research map and database and a reference database, and many activities to advance collaborations between scientists and managers. The updated AFSC website serves as a complete archive of events, publications, reports, videos, and webinar recordings, hosted by the Fire Research And Management Exchange System (FRAMES). All AFSC activities include opportunities for participant feedback, and these evaluation data are regularly reviewed. Although COVID-19 disrupted some plans, it also highlighted the important role of science in informing decisions and reducing risk.

Primary partnership with Advisory Board and Alaska Wildland Fire Coordinating Group. The Alaska Fire Science Consortium's activities have their fundamental basis in AFSC's primary partnership with Alaska's interagency fire management community. This partnership is steered by the 17 member AFSC advisory board, whose membership reflects that of the Alaska Wildland Fire Coordinating Group (AWFCG), the coordinating organization for planning and implementing interagency fire management statewide since 1994. AFSC's ongoing collaboration with the AWFCG and its committees includes iterative information exchange to develop AFSC's activities to meet the community's identified fire science needs. In general, Alaska's fire managers share a broad range of information needs related to the rapidly changing northern climate, including:

- Improved understanding of **climate change effects** on the region's environment and its fire regimes. For example, evidence indicates that climate warming is altering **fire self-regulation processes** in the boreal forest; this topic was the focus of several AFSC activities in FY20, and we anticipate sustained attention on it in future.
- Improved scientific basis for **management responses** to changing fire regimes, including advancing the use of **remotely sensed data**, evaluating **fuel treatment effectiveness**, enhancing **seasonal depiction, analysis, and prediction**, and acquiring the most accurate and relevant **geospatial data** available in Alaska for use in decision-support tools.

These topics are AFSC's highest priorities for our ongoing activities in both science delivery and research development. In FY20, AFSC drew on resources from both the management and research communities, as well as our existing and new staff expertise, to advance the use of the best available science to support decisions in Alaska's challenging wildland fire environment and to develop new products to serve our audience. Peer-reviewed publications, as well as results from our internal evaluations (see box next page) show that AFSC has been effective in spanning the boundaries between fire scientists and fire managers (Maletsky et al, 2018), assisting Alaska's fire management community in using the best available science to adapt to climate change (Rutherford and Schultz, 2019), and helping develop co-produced science to meet specific management needs (Colavito et al, 2019). A recent review (Hunter et al, 2020), however, highlights continued barriers to the use of science in wildland fire management and the value of boundary organizations in accelerating its adoption and co-production. Specific highlights of AFSC's FY20 activities are detailed below, with feedback from evaluations featured in boxes.

Managers value AFSC

Quotes from FY20 event evaluations show the continuing value of AFSC to Alaska's management community:

- *I use information from AFSC every fire season*
- *I am new to the AWFCG fire research committee liaison and the information provided will allow me to better share the research that is happening and where to report or ask questions.*
- *Management decisions (planning, operations): change comes slowly to complex bureaucracies, but awareness of new information or paradigms for interpretation is an important step for bottom-up changes.*
- *Tech transfer from scientific demonstration (proof of concept) into agency routine is always a slow process because of bureaucratic inertia. There is a need for reasonable balance to validate new technology or analysis methods before making a complete transition, but at times the transition can be slower than prudent because organizations often resist change that requires new thinking or perceptions of extra work. AFSC is doing a good job in putting new information in the hands of fire managers.*
- *For someone like myself [wildlife biologist] for whom fire is a small part of my overall duty, [AFSC] is a source of a range of information. Web page briefings are particularly useful.*
- *The webinars and presentations shared by AFSC help to keep me apprised of the latest wildfire research, and aids in informed decision making in a rapidly changing world.*
- *I and my management team have considered climate change effects information (transferred via AFSC) in recent land use planning efforts. This was key information that helped support our plans.*
- *Refinement of predictive tools and research that models future vegetation change/fire behavior/effects is directly of benefit to my organization [BLM] from a health/safety and budgetary standpoint.*
- *Fuel break studies have been very good and helped justify and receive funding for new projects [for a tribal non-profit].*
- *Provides a place for managers, scientists, and fire practitioners to go and get an overview of current and past research and operational tools. Makes it easier to connect people with different disciplines who have a shared interest or need for fire information. Small staff, but great combination of different skill sets make the Consortium a successful endeavor.*

Seasonal Workshops. In FY20, AFSC convened 2 half-day workshops--one in October 2019 and one in March 2020--each in association with annual seasonal statewide interagency management meetings convened by AWFCG (Interagency Fall Fire Review in October and Spring Operations Meeting in March). These science workshops are now an established part of the Alaska management community's annual calendar of events, and AFSC staff serve on the AWFCG organizing team that plans each season's management meetings.

Fall 2019. The fall workshop was attended by 125 individuals from 26 agencies, an increase of more than 40% in both categories over Fall 2018. The workshop began with an open networking lunch on site with posters and handouts. The formal workshop sessions focused on updates from several relevant research projects and a session titled *Science and Practice: Is wildfire behavior evolving in Alaska's boreal forest?* As climate warms, the complex interactions among flammability, reburns, and forest composition in this region seem to be changing from the accepted norm, known as **fire self-regulation**, in which early successional vegetation in recently burned areas can act as a reliable natural fuel break. Instead, under some conditions, areas that have recently burned are burning again, including examples from the 2019 fire season in Alaska. The workshop session, moderated by AFSC fire ecologist Jandt, featured 3 presentations by both academic and agency scientists summarizing our state of knowledge of boreal fire self-regulation, followed by a panel discussion of operational personnel sharing their personal observations, interpretations, and responses. This session was well received by the audience (see box below).

A compelling topic for ecologists as well as operationally relevant, the emerging climate-driven shift in **fire self-regulation** is a major theme in AFSC's work in FY20 and beyond, recurring in several recent Fire Science Highlights as well as presentations at the November 2019 Association for Fire Ecology special session on Fire in the Last Frontier and in an AFSC webinar featuring a recent JFSP-funded project (led by B. Buma at the University of Colorado; see below for details on both). AFSC is providing organizational support to a multi-institutional working group on the topic that plans to develop a synthesis product in FY21, and we have begun planning for management collaborations and science delivery with a new JFSP-funded project (led by B. Gaglioti at UAF) that aims to assess how natural fuel-break effectiveness varies with time since last fire, fuels, topography, and fire weather in the boreal forest.

Panel Feedback

Quotes from Fall 2019 workshop evaluations on the fire self-regulation presentations and panel:

- *Loved this panel! Very helpful for scientists!*
- *Fascinating discussion with pulling in a variety of expertise to push the science forward.*
- *This was excellent. This session was especially relevant across a wide spectrum of interest areas (fire and non-fire applications).*
- *Interesting discussion. The issue of reburn is something we will have to deal with more frequently.*
- *Good range of discussion on operational challenges where novel situations cannot be addressed using historic experience of what does/not carry fire into former burned areas.*

Spring 2020. The timing of the Spring 2020 management meeting (March 23-27) coincided with the rapid worldwide shift to remote work due to the COVID-19 pandemic. With about a week lead time, the AWFCG meeting planners immediately requested AFSC's expertise to help them transition the week of in-person meetings to virtual platforms, including adding a full day of 9 simultaneous breakouts for each section (Logistics, Plans, Operations, etc.) of the Alaska Type 1 and Type 2 Incident Management Teams (IMT) to discuss planning needed for COVID-19 mitigation. AFSC supported this transition by providing advice, technical support, and access to our online resources, and the resulting virtual AWFCG meetings and AFSC workshop went very smoothly. Meeting moderators repeatedly acknowledged AFSC's contributions as key to the successful transition, improving our name recognition with rank and file management personnel.

AFSC quickly reorganized our planned 4 hour in-person spring 2020 workshop agenda into 3 shorter online events presented by webinar. 90 individuals from 16 agencies attended at least one of the 3 workshop events, an increase of 26 individuals (40%) over Spring 2019. A highlight of the spring workshop was the presentation of the first **seasonal forecast** for the upcoming Alaska fire season, the result of multiple years of collaboration between investigators at the University of Alaska Fairbanks, Alaska fire weather program managers, and AFSC, supported by funding from NOAA and NSF EPSCoR (details on EPSCoR below). This experimental product, which shows some forecasting skill, is a genuinely co-produced effort using management-relevant fire danger metrics (CFFDRS Build Up Index) and geographic divisions (Predictive Service Areas) to provide managers with guidance on the likelihood of significantly above or below normal fire danger over the season in specific areas of the state. AFSC plans to continue to host the seasonal forecast team to evaluate each spring's forecast in the fall and provide a new forecast each spring. Other workshop sessions featured new work on **remotely sensed products** for active fire and post-fire analysis and fuels mapping (also supported by EPSCoR) and a round-up of new fire science relevant to Alaska focused on **climate change effects** presented by AFSC fire ecologist Jandt.

Proceedings of both FY20 workshops are available on the AFSC website (<https://www.frames.gov/event/549386> and <https://www.frames.gov/event/560588>), and their recorded presentations have been played 116 times on the AFSC Vimeo site (<https://vimeo.com/channels/alaskafirescience>).

Workshop feedback

Quotes from FY20 workshop evaluations

Fall 2019

- *Today helped me to understand the programs and models available to help meet land management objectives.*
- *Better understanding of some of the science and short-term/long-term challenges we face as fire and land managers.*
- *Excellent cross section of fire science and management community. Excellent presentations.*
- *Thought-provoking presentation that catalyzed discussion on a topic we'd "like" to ignore but cannot.*
- *Relevant to my work, I'll definitely check out IMERG datasets.*
- *Fire managers need to message suppression vs having fire on the landscape to the public and politically. The science helps.*
- *Good variety of current issues.*
- *Very good info, pertinent to what I do.*
- *Appreciated the posters and handouts/reprints.*
- *This bridges the disconnect between academia and ops. Learned about new tools available.*
- *The diversity of people and topics was great. Randi and Alison are very very helpful at facilitating partnerships.*
- *It was great to have the extra networking time [over lunch]. That is really important but we don't seem to get enough.*
- *So helpful to have researchers connecting with operations so that outcomes are useful and relevant.*

Spring 2020

- *I am going to learn more about VPD and see how to use it as a manager.*
- *Much better than other virtual meetings I have had, thank you.*
- *It's been a long-standing not-to-be-missed event in the AK Fire community.*
- *This is an interesting piece of work coming from a very strong research team.*
- *I especially liked that several recent research papers and articles were highlighted as being particularly informative.*
- *Good to have contacts who have done work with machine learning.*
- *Definitely liked hearing about the work on predicting fire size from initial start.*
- *I work for SOA [State of Alaska] DEC [Dept of Environmental Conservation] AQ [Air Quality] and have a degree in emergency management, aside from the obvious crossover between fire science and air quality (PM2.5), learning more about this topic is helpful and interesting.*
- *Thanks for lining up short webinars in the near future with the folks who were going to speak at the in-person event. Short is good for remote events.*
- *All of these highly technical researchers did a great job of explaining their research quickly and clearly.*
- *Great new info on fire detections, very relevant.*
- *Great series of presentations- a lot of new things on the horizon that will help with fuels mapping and fire behavior modeling.*
- *These workshops help me to understand the state of the science that is relevant to my work in fuels management. It helps me understand what sort of information is available, and how to access it, or what is currently being worked on. It also allows us to provide feedback and give ideas for further study to the researchers.*

Webinars. AFSC hosted or co-hosted 6 webinars in FY20 with a total attendance of 260 (not including the 3 spring workshop sessions carried by webinar, reported under Workshops). The FY20 webinars presented a range of research and management topics, including introductions and results from JFSP-funded research such as the new North American Wildland Fuels Database, Evaluating Flammability of Reburns in Boreal Forests (relevant to **fire self-regulation**), and Environmental Legacies of Tundra Fires. All were recorded and available on the AFSC website (total of 332 plays; <https://www.frames.gov/afsc/events-webinars/archive>).

Other videos. AFSC supplements its webinar and workshop offerings by recording and sharing presentations such as thesis defenses, conference presentations, or departmental seminars when relevant. In FY20, AFSC recorded more than 20 such presentations, in large part because of opportunities presented by the Association for Fire Ecology's November 2019 International Fire Ecology and Management Congress, where AFSC recorded presentations from special sessions on *Fire in the Last Frontier*, organized by AFSC advisory board member Rachel Loehman (**fire self-regulation** in the boreal forest was again a prominent theme in this session) and *Lessons from the First 10 Years of the JFSP FSEN*. These recordings have been viewed 122 times. <https://www.frames.gov/partner-sites/afsc/events/previous-events/previous-webinars/>

Subject matter experts. The AFSC staff is built around 2 part-time subject matter experts who are retired from careers in fire management: fire ecologist Randi Jandt and fire analyst Robert (Zeke) Ziel. Their valuable and complementary experience provides a critical foundation to every AFSC activity. Specific highlights from their work in FY20 included:

- **Help desk.** In FY20, AFSC responded to 68 inquiries from managers, scientists, students, the media, and the public on topics related to fire science and management in Alaska. Examples include organizing and providing fire weather information to visiting researchers on a field trip to the 2019 Shovel Creek fire, assisting a journalist reporting on high latitude overwintering fires for an article in *Eos*, and providing information about tundra fuels to a graduate student.
- **Agency and leadership briefings.** In FY20, AFSC staff provided 5 targeted briefings on specific wildland fire science issues to agency and leadership audiences, including the National Wildfire Coordinating Group (NWCG) Fire Behavior Subcommittee, the NWCG Remote Sensing Data Standards Task Group, a cohort of USFS fire analysts, and Alaska Division of Forestry leaders.
- **Field consultations and expert cadres.** AFSC personnel provided subject matter expertise on specific issues 12 times in FY20. For example, fire analyst Ziel worked with Alaska Interagency Coordination Center and NWS staff to evaluate the use of a new gridded precipitation estimate model. He also provided an introduction to FLAMMAP to a research team working on fire risk. Fire ecologist Randi Jandt was a co-author on a section on Fire Regimes for a synthesis chapter in Reviews of Geophysics titled *Space-Based Observations for Understanding Changes in the Arctic-Boreal Zone*.
- **Training.** AFSC personnel contributed to 3 training sessions, supported by supplemental agency funding in some cases. The National Wildland Fire Coordinating Group provided funding for fire analyst Ziel to continue his work updating the online Fire Behavior Field Reference Guide, and he briefed the cadre for S590 (Advanced Fire Behavior Interpretation) on using this resource. He also taught S482 (Strategic Operational Planning). Fire ecologist Jandt provided training on fire logistics and IMT at the Wallowa-Whitman National Forest.
- **Meetings and conferences.** Because Alaska is relatively underserved in science, AFSC staff monitor and assess the relevance of new and emerging research by attending scientific meetings and other events. Meetings also offer opportunities to engage specific audiences. AFSC personnel attended and/or presented at 5 major meetings in FY20. Highlights included coordinator York presenting on *Lessons Learned from 10 Years of AFSC* at the special session celebrating 10 years of the JFSP FSEN at the November 2019 International Fire Ecology and Management Congress as well as at a special session on co-production of knowledge at the December 2019 American Geophysical Union Fall Meeting. Fire analyst Ziel presented on *Leveraging Fire Science and Fire Management Perspectives on the Alaska Fireground* at the 2019 Wildland Fire Canada conference and on *Remote Sensing for Wildland Fire* at the 2020 Burning Issues Workshop. Fire ecologist Jandt presented on *Why is Alaska's 'firescape' so sensitive to warming climate and what are possible management strategies to cope with the changing fire regime?* during the special session on Fire in the Last Frontier at the November 2019 International Fire Ecology and Management Congress.

2. Priorities and initiatives

As explained in section 1, AFSC's priorities reflect Alaska's interagency wild-land fire management community's science needs, which include:

- Improved understanding of **climate change effects** on the region's fire regimes, such as altered **fire self-regulation** processes in the boreal forest.
- Improved scientific basis for **management responses** to changing fire regimes, including advancing the use of **remotely sensed data**, evaluating **fuel treatment effectiveness**, enhancing **seasonal depiction, analysis, and prediction**, and acquiring the most **accurate and relevant geospatial data** available in Alaska for use in decision-support tools.

Co-production of knowledge to meet management needs. Knowledge co-production occurs when scientists work directly with end users throughout the research process, including idea generation, proposal writing, data collection, analysis, and creating research products. AFSC investments over the past few years in maintaining reciprocal and iterative knowledge exchange between researchers and practitioners have resulted in 9 funded, co-produced research projects active in this reporting period (Table 1). These projects directly address management research priorities such as **reliable seasonal outlooks** and **climate effects on fire weather and fire behavior** and often involve agency personnel as collaborators. Much of our co-production effort in FY20 has focused on maintaining the flow of information with these projects as they move forward. We use a variety of mechanisms for this, including small group meetings, demonstrations, workshop and webinar presentations. Our evaluations indicate that managers appreciate being kept in the loop as researchers design their projects, collect and analyze data, and present results and products (see box).

Leveraged funding. Scientists also see the value of AFSC in connecting their research to managers in Alaska and demonstrate this value by including AFSC staff in their research proposals. In addition to the essential and ongoing part-time support from JFSP, AFSC staff Jandt, York, and Ziel received salary from 8 additional sources (Table 2) in FY20. This leveraging enables them to participate fully in specific co-produced projects that address high priority research topics and strengthens the AFSC network.

Remote sensing. AFSC has long prioritized improving **application of remotely sensed data** in fire management in Alaska. During the Spring 2020 breakout sessions for IMT sections to discuss COVID response, we were gratified that **managers working in every IMT section** mentioned the need to continue Alaska's now **routine use of remotely sensed data** to support decisions as key to **reducing personnel exposure** to unnecessary risk, including COVID. We see this broad awareness of remotely sensed data's value among managers with diverse responsibilities as a major validation of AFSC's multi-year effort to help Alaska's managers consistently access and use these data with confidence; Alaska was recently recognized as having "independently innovated solutions" on this issue compared to CONUS locations (Lindley et al, 2020), where use of remotely sensed data in fire management remains relatively limited and ad hoc (Hunter et al, 2020; Ziel, personal communication). AFSC plans to continue work to advance this priority as new products become available; see sections below on EPSCoR and ABoVE for specifics.

AFSC co-production

Quotes from FY20 evaluations:

- *It is good to see these projects continuing and some of the new projects look like they could be highly valuable. The snow free satellite data will be highly beneficial.*
- *Interesting to see the evolution and looking forward to seeing it in operation.*
- *Great introduction to the new project.*
- *It is encouraging to see research groups working to improve input data to Alaska Fire and Fuels and other sites. It would be nice to see NOAA and NASA play a more direct role in refining their products.*
- *Was not aware of the project. I plan on speaking with the researchers.*
- *Very good overview on all the projects that are happening. Anxious to see results from some of the researchers next season!*
- *Very interesting work on an obvious need for better precip measurements and estimates. Get this woman some funding!*
- *Think this team should talk more with managers about fire suppression priorities in the state.*
- *Integration of fire managers into research is consistent.*
- *[From AFSC, I] have gotten hands-on perspectives and access to new datasets.*
- *AFSC provides a great service by allowing managers to influence research and giving researchers an opportunity to gain new perspectives.*
- *My collaboration with eg. Robert Ziel would never have happened without it [AFSC]. I am also working on overwintering fires after discussing with managers.*

AFSC/ACCAP collaboration. Information regarding **climate impacts on fire regimes, fire weather, and fire behavior** is among the top priorities for AFSC and our audience. AFSC's ongoing partnership with the Alaska Center for Climate Assessment and Policy (ACCAP), a NOAA program housed at the University of Alaska Fairbanks (UAF), is key to AFSC's ability to address these information needs. In FY20, highlights of this partnership included:

- Introducing fire managers to an ACCAP publication and website on **climate change** for a general audience called *Alaska's Changing Environment* at the AFSC Fall 2019 workshop. This was very well received by managers, who shared it widely among their networks. This enthusiasm motivated AFSC to create a similar document focused on wildland fire, *Alaska's Changing Wildfire Environment*. AFSC science communication specialist Zav Grabinski is collaborating with ACCAP, other UAF experts, and agency education and prevention leadership to develop this publication, which we expect to release early in FY21.
- ACCAP and AFSC collaborated to host two undergraduate NOAA Hollings Scholars for 9 week virtual summer research internships focused on **climate effects on fire weather** in Alaska, co-advised by AFSC fire analyst Ziel, the Science Operations Officer of the Fairbanks NWS Forecast Office, and the co-director of ACCAP. The scholars gave a joint AFSC/ACCAP webinar on their work in FY20, and will present at the American Geophysical Union and the American Meteorological Society and submit at least one peer-reviewed publication from this work in FY21.

EPSCoR Boreal Fires collaboration. *Fire and Ice: Navigating Variability in Boreal Wildfire Regimes and Subarctic Coastal Ecosystems* is a 5-year, \$20 million effort by Alaska NSF EPSCoR to study two major Alaskan regions undergoing climate-driven changes. One of the program's two major research groups is a Boreal Fires team. Boreal Fires researchers are working to:

- identify large-scale **climate drivers relevant to fire weather**;
- use hyperspectral **remote sensing** to better map and measure fuel conditions and active fire behavior; and
- conduct research into the **economics of fire management and into impacts of fire** on subsistence communities.

All these topics are of major interest to Alaska's fire management community. AFSC personnel are members of the Boreal Fires core team along with 11 faculty and staff from UAF and the University of Alaska Anchorage. The program got underway at the beginning of FY19, and one of its first activities was a presentation on its plans at the AFSC Fall 2018 workshop. Since then, AFSC has worked actively to ensure that management perspectives and priorities are understood and incorporated into the project. In addition to AFSC staff participation, more than a dozen Alaska managers are actively involved in Boreal Fires research projects, including regularly attending the team's biweekly meetings, and the Boreal Fires team engages with the larger management community by providing them with progress reports at every AFSC seasonal workshop. This effort is yielding a series of truly co-produced research projects as the program enters its third year. The project also provided some short-term funding in FY20 in response to the COVID pandemic to develop new products from **remotely sensed data** to help managers reduce personnel exposure; these products were the subject of a AFSC Fire Science Highlight. AFSC is also engaging to a lesser extent with the EPSCoR education team, who are currently revising curriculum materials related to boreal fire and will support several activities in the coming years to advance STEM education. We anticipate that these materials will be useful in our planned work with public audiences (see section 3, Plans for the Future).

Arctic Boreal Vulnerability Experiment (ABoVE). The NASA Arctic Boreal Vulnerability Experiment (ABoVE) is a major, 10-year research initiative with a focus on **climate change vulnerability**, including wildland fire, in Alaska and western Canada. The ABoVE science portfolio has clear applicability to wildland fire management problems, and AFSC has engaged directly with ABoVE planning and implementation since 2013 to advance that application. In FY20, AFSC planned to collaborate with ABoVE to convene a Research to Operations workshop on using ABoVE data in fire and resource management, to be held in association with the annual ABoVE Science Team Meeting (STM) scheduled for May 2020 in Fairbanks. The planned workshop was intended to build on the progress made at the 2017 AFSC-NASA **remote sensing** workshop. AFSC assembled a workshop organizing group, which guided a needs assessment process to identify priority topics for the workshop and developed a draft workshop agenda between December 2019 and March 2020. Due to COVID-19, however, the ABoVE STM was held virtually, with plans to convene in-person in Alaska in May 2021. AFSC encouraged our audience to participate in the virtual STM and published a Fire Science Highlight on applications of the science presented at the meeting. In consultation with the

workshop organizing group, our Advisory Board, and ABoVE leadership, however, AFSC decided to postpone the planned workshop to coincide with the anticipated in-person STM in 2021. We will revisit the workshop planning process in FY21.

International collaborations. Alaska's fire environment has more in common with other high latitude locations, particularly Canada, than with most of the CONUS, and improving information sharing with our circumpolar colleagues is another ongoing AFSC priority. AFSC regularly invites Canadian managers and investigators to present at AFSC events and seeks opportunities to contribute to Canadian efforts. In FY20, fire analyst Ziel presented on *Leveraging Fire Science and Fire Management Perspectives on the Alaska Fireground* at the 2019 Wildland Fire Canada conference, where he made many valuable connections. The Natural Sciences and Engineering Research Council of Canada asked coordinator York to serve on both the site review panel and the board of directors for the new Wildland Fire Research Network headquartered at the University of Alberta, with a specific focus on helping the new network adopt some of the best practices identified by the JFSP FSEN. More broadly, AFSC PI Trainor and communication specialist Grabinski contributed to a chapter on *Societal Impacts* in a report on *Climate Issues of Concern* organized by the Arctic Monitoring and Assessment Program for the Arctic Council, and coordinator York and fire analyst Ziel contributed an essay on *Wildland Fire in High Latitudes* to the 2020 NOAA Arctic Report Card; both of these products will be released in FY21. In addition, fire analyst Ziel is serving as a mentor to an Australian fire manager through a program organized by the International Association of Wildland Fire.

Ongoing partnerships. AFSC also maintains partnerships with other programs at the University of Alaska Fairbanks (UAF), including the USGS Alaska Climate Adaptation Science Center (AK CASC), Scenarios Network for Alaska and Arctic Planning, Geophysical Institute, Alaska Center for Unmanned Aerial Systems Integration, Bonanza Creek Long Term Ecological Research, and Geographic Information Network for Alaska, as well as with several research teams outside of Alaska who are pursuing relevant lines of work in boreal/arctic ecosystems, including Michigan Tech Research Institute (remote sensing, soil moisture), University of Idaho (paleoecology/modeling), and Colorado State University (climate change, management response options). A highlight in FY20 was a publication from a research team supported by the AK CASC quantifying historical variability and trends in lightning, a key driver of wildfire activity in Alaska. The research team presented their work at AFSC's Spring fire science workshop.

3. Plans for the future

As outlined in our 2019 renewal proposal, AFSC bases its priorities for the future on feedback from our Advisory Board, Alaskan fire managers, our evaluation data, identified regional research needs, and recent research. AFSC will build on vital existing relationships to provide the services that our audience has come to expect and, in response to requests from the fire management community, we will also pursue the following innovations, discussed in more detail in our 2019 proposal. **First**, because the fire environment in Alaska is isolated from the rest of the U.S., much national applied fire management research and technology development advances without Alaska-relevant data domains. We increasingly find that managers require **regionally relevant data** for use in required fire management tools, such as LANDFIRE. We will work with managers, scientists and tool developers to ensure that accurate data is available for use in the Alaska domain, including Alaska Fire and Fuels data for weather and forecasting tools, expanded multi-day precipitation data, and remotely sensed active fire and burn severity data. **Second**, compared to other regions, there are relatively few visual communication products available in Alaska. On recommendation from our Advisory Board and other fire managers, we are developing **interpretive geospatial products** such as story maps to meet manager needs. Story maps provide a useful structure for communicating topics related to fire ecology and management by using the intuitive format of storytelling with the benefit of being geospatially integrated. Alaska in particular benefits from geocentric media because of the scale and complexity of the state's geography. **Third**, the active 2019 Alaska fire season and the extraordinary 2020 season in the western U.S. and in high latitude locations such as Siberia have rekindled public interest in wildland fire, climate change, and forest management issues. In turn, agency administrators and public information officers have asked AFSC to assist with **information resources that target the general public**. To address this need, we plan to work directly with the requesting personnel and the AW-FCG committee on Education and Prevention. Anticipated activities will include:

- presentations on high latitude fire and **climate change** for the general public through venues such as museums

- and community centers (AFSC fire ecologist Jandt is a masterful presenter to such audiences);
- completion and distribution of a new publication titled *Alaska's Changing Wildfire Environment*, developed in collaboration with ACCAP (details above under AFSC/ACCAP Collaboration);
- reviewing, updating, and providing photos, references and graphics to refresh agency website content, and
- producing multi-use **geospatial communication tools** such as story maps.

In addition to supporting relevant funded studies, such as those in Tables 1 and 2, with tech transfer and science delivery, we will foster communication, build relationships, and convene opportunities that lead to knowledge co-production. Building on our existing strong partnerships with the interagency fire management community and with researchers and scientists, AFSC will advance agency and research partnerships and capacity among scientists to become aware of, understand, and meet agency science needs. AFSC's role as boundary spanner, convener, translator, and facilitator has proven effective in assisting agency and academic partnerships to leverage funding, increase collaborative proposal submissions, and support new research that is designed to meet regional management priorities (Colavito et al, 2019), and we share lessons learned from these co-production efforts. We anticipate an emerging line of work related to managing COVID exposure in fire management, based on discussions at the 2020 Interagency Fall Fire Review. Faculty at the University of Alaska Anchorage supported by the EPSCoR Boreal Fires Team have relevant public health expertise and are engaging with managers on this issue, facilitated by AFSC.

We will augment our ongoing internal evaluation efforts to ensure that we remain responsive to our audience needs by administering an online survey to our audience based on the JFSP FSEN evaluation tools developed by the Cooperative Extension team at the University of Nevada Reno. AFSC last participated in that survey in 2016. We expect to release this survey early in FY21.

Staffing. Our staffing model of employing fire ecologist Randi Jandt and fire analyst Robert Ziel as part-time subject matter experts who are retired from management careers has been key to our success (Colavito et al, 2019). These individuals provide deep experience in fire management problems and are therefore exceptionally skilled in understanding how research can help managers and in building bridges between science and management. The expertise of our subject matter experts in the fields of fire ecology, fire behavior, and fire danger will continue to be a centerpiece of our team. While this staffing model is exceptionally effective, we also recognize the need for long-term planning in anticipating a point in the future when these individuals may desire to reduce their hours and fully retire. In early FY20 AFSC added a new Science Communication Specialist, Zav Grabinski, who recently earned a MS in Natural Resource Management from Humboldt State. Zav has excellent GIS skills and is a key resource for AFSC to develop interpretive geospatial products to meet manager needs such as story maps. Zav is also leading development of *Alaska's Changing Wildfire Environment*, which should be submitted to our agency partners for review in the near future.

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| Funding Agency | PI | Proposal Title | Project Dates |
|-----------------------|-----------------|---|--|
| NOAA | Bhatt | Seasonal Climate Forecasting Applied to Wildland Fire Management in Alaska | 2016-19 |
| JFSP | Schultz | Impacts of Climate and Management Options on Wildland Fire Fighting in Alaska | 2016-19 |
| JFSP | Gaglioti & Mann | Alaskan Tundra Fires during a Time of Rapid Climate Change | 2016-20 |
| NASA | Bourgeau-Chavez | SMAP data for organic soil fuel moisture estimation in boreal-arctic ecosystems | 2016-19 |
| NOAA | Proton | Hollings Scholar projects: Exploration of the Hot Dry Windy Index and wildfire; Climate Change and overnight fire growth | 2019-21; Research internship summer 2020 |
| USGS | Bieniek | Assessing Alaska fire indices for daily to seasonal wildfire prediction under present and future climate scenarios | 2017-19 |
| JFSP | Buma | Evaluating Flammability of Reburns in the Boreal Forests of Interior Alaska | 2019-2021 |
| NSF-EPSCoR | Veazey | Fire and Ice: Navigating Variability in Boreal Wildfire Regimes and Subarctic Coastal Ecosystems | 2018-2023 |
| NSF-NNA | Schmidt | Arctic Urban Risks and Adaptations (AURA): a co-production framework for addressing multiple changing environmental hazards | 2019-2023 |

Table 1. Funded projects active in FY20, co-produced through AFSC engagement to address Alaska fire management research priorities. Co-production in this context includes direct involvement of AFSC personnel and/or management personnel (facilitated by AFSC) in reciprocal and iterative information exchange with project personnel during the research process from idea generation through proposal writing, project implementation, and creation of final products.

| Funding Agency/PI | Project | Project Dates | AFSC staff | Time |
|--------------------------|--|----------------------|-------------------|-------------|
| JFSP/Little | Duration and cost effectiveness of fuel treatments in the Alaska boreal region | 2014-19 | Jandt | 1 mo/yr |
| NOAA/Trainor | Alaska Center for Climate Assessment and Policy (ACCAP) | 2006-21 | York | 1 mo/yr |
| USFS/York | Revising and updating the online Fire Behavior Field Reference Guide | 2017-21 | Ziel | 5 wks/yr |
| | | | York | 16 hrs/yr |
| JFSP/Horel | Assessment of HRRR model forecasts of convective outflows in the fire environment | 2017-20 | Ziel | 3 mo/yr |
| USGS/Bieniek | Assessing Alaska fire indices for daily to seasonal wildfire prediction under present and future climate scenarios | 2017-20 | Ziel | 1 mo/yr |
| DoD-SERDP/Goetz | Resiliency and Vulnerability of Boreal Forest Habitat to the Interaction of Climate and Fire Disturbance across DoD Lands of Interior Alaska | 2018-22 | Jandt | 100 hrs/yr |
| | | | York | 100 hrs/yr |
| NSF-EPSCoR/Veazey | Fire and Ice: Navigating Variability in Boreal Wildfire Regimes and Subarctic Coastal Ecosystems | 2018-23 | Jandt | 2 wks/yr |
| | | | York | 2 wks/yr |
| NSF-NNA/Schmidt | Arctic Urban Risks and Adaptations (AURA): a co-production framework for addressing multiple changing environmental hazards | 2019-23 | Ziel | 1 mo/yr |

Table 2. Supplementary funding sources for AFSC staff, FY20.