Alaska Wildland Fire Coordinating Group, Fire Research Development and Application Committee
2017 Research Needs List

https://www.frames.gov/partner-sites/afsc/partner-groups/frdac/

The following list of fire research topics and questions were generated by the agencies and organizations within AWFCG during 2016 Fall Fire Review and through other solicitations. The topics were initially ranked by the AWFCG Fire Research, Development and Application Committee (FRDAC) based on 3 criteria: direct management application, data needs, and use to multiple agencies. The list below is sorted by priority. The Research-ID is a unique identifier that can be used to refer to the topic. The list is updated every 2-3 years and there may be changes in priority order from previous lists.

Priority 1

Category: Fire Behavior

Research ID: 2010-29

Topic: Fire Behavior Models: Validation and Application

Research is needed to improve the knowledge of fire behavior and appropriate fuel models for Alaska. More information on the 40 Fuel Models and the Canadian Forest Fire Behavior Prediction (FBP) Fuel Models is needed on a spatial scale and in relation to fire behavior modeling. Fire modeling tools are currently utilized by Alaska fire managers (e.g. Fire Spread Probability [FSPro] in the Wildland Fire Decision Support System [WFDSS]). Efforts have been made to relate LANDFIRE ecotypes to Alaskan Fuel Models. However, questions remain about the accuracy of the LANDFIRE vegetation classifications and crosswalks between LANDFIRE and Alaskan fuel types. There is a need for research that will improve the knowledge of fire behavior and appropriate fuel models for several unique fuel types; wetlands, shrublands, and tundra ecosystems as well as in forested ecosystems with insect and disease damage. Additionally, fuel models and fire behavior in early successional post-fire forest types are also of particular interest since shortened fire return intervals are occurring and recent burned areas are no longer acting as fuel breaks.

Issue: Fire behavior validation of the 40 Fuel Models and Canadian Fuel Models used in Alaska.

Issue: How accurate are the LANDFIRE vegetation classifications? How accurate are the crosswalks between LANDFIRE and Alaskan fuel types?

Issue: Landscape-level landcover classifications and fuels maps need to be updated to incorporate succession within recent burns before modeling application.

Issue: Which fuel models should be used for non-forested tundra ecosystems, early successional post-fire forests and forested ecosystems with insect and disease damage? Validate fuel models against actual fire behavior.

Issue: Are fire behavior modeling tools accurately reflecting drought conditions? How well do the models correlate with CFFDRS indices, fuel moisture, and observed fire behavior?

Priority 2

Category Fire Danger Research ID 2010-04

Topic CFFDRS Fire Weather Indices: Evaluation and Calibration

In Alaska, fire planners, fire managers, and firefighters heavily utilize the CFFDRS indices for prescribed burn planning, daily resource availability and allocation, operational strategies and suppression tactics. The CFFDRS Fire Weather Indices are based on empirical data from eastern red and jack pine stands. Further empirical studies are needed to determine if Alaskan fuels should have modified algorithms to better relate observed data to the CFFDRS indices. Specifically, there is a strong need for calibration of the CFFDRS indices for Alaskan boreal fuel types to ensure accurate representation of seasonal changes in duff moisture. Also needed is a mechanism for standardization of spring start-up values for the CFFDRS indices to adequately reflect the effects of over-winter drought conditions, snowmelt date, and soil thaw on fire danger.

Issue: Are indices calculated from remote automated weather stations (RAWS) accurately representing duff moisture? Do they adequately reflect the effects of over-winter drought conditions, snowmelt date, and soil thaw?

Issue: Evaluate CFFDRS fire weather indices and drying trends throughout Alaska. Are there variations across regions?

Issue: Evaluate relationships between CFFDRS indices and: 1) probability of ignition, 2) rate of spread, 3) fire duration and 4) depth of organic fuel consumption.

Issue: How does soil moisture fluctuate throughout spring melts and summer drying? How accurately are these fluctuations represented by the moisture codes?

Issue: Should over-winter drying values or default startup values be utilized for drought codes, particularly in relation to the occurrence of fires that overwinter? Can these codes be tied to early season fire danger predictions?

Priority 3

Category Fuels Treatment Research ID 2010-18

Topic Fuels Treatments: Short- and Long-term Effectiveness

Information on fuel treatment effectiveness continues to be a top research priority. Specifically, evaluation of the continued effectiveness of existing fuels treatments in various ecotypes and in different stages of recovery is needed. Monitoring of existing fuel breaks needs to continue beyond treatment implementation to determine short-term and long-term effectiveness in reducing fire risk and smoke emissions. Also, post-treatment vegetation recovery could affect fuel loading and lead to seasonal variations in fire risk. It is essential for managers and planners to understand vegetative succession within fuel treatments to avoid promotion of undesirable species, insect infestations, and highly flammable surface fuels.

Issue: Are fire risk and smoke emissions reduced by fuels treatments?

Issue: How long are various fuels treatments effective, what types of fuels regenerate, and what are associated fire risks?

Issue: Should post-fuels treatment reforestation be considered? What landscapes would be most suitable?

Issue: What alternative treatments should be tested to maintain fuel breaks (e.g., domestic livestock foraging of grass regeneration, planting/seeding of desirable species)?

Issue: What are the financial costs of maintaining effective fuels treatments?

Issue: What treatment methods and timing can be used to minimize bark beetle infestations?

Issue: Should desirable vegetation establishment be considered in planning operations?

Priority 4

Category: Climate and Fire Regime Change

Research ID: 2010-16

Topic: Climate Impacts on Fire Regimes: Past, Present, and Future

Fire and land managers, along with policy-makers, seek research which will provide a clearer understanding of: 1) climate linkages to past and present natural fire regimes and 2) current and future departures from historic conditions. A concerted effort is needed to document and model future fire regimes in response to climate change across all vegetation cover types in Alaska. Resulting possible scenarios will be used to inform fire and land managers on potential changes in fire intervals, fire extent, seasonality, and severity. Knowledge of expected change will allow for a planned response to predicted changes in fire activity.Recent syntheses, which incorporate records from the last decade and historical data, have improved our understanding of past and present fire regimes but are not yet comprehensive, are limited in scale, and do not clearly illustrate potential for future regime shifts.

Issue: What are potential feedback mechanisms which could alter the probability of future fires?

Issue: What are the historical departures from current fire regimes?

Issue: How will possible changes in future fire regimes impact management strategies and suppression tactics?

Issue: Very long term fire history (paleoecology) are needed in many areas of the state.

Issue: What are historic fire regimes for Alaska tundra ecotypes and what are predicted responses to climate change?

Issue: What changes in fire size, return interval, intensity, severity and seasonality can we expect under a changing climate? How will changes in these elements differ between vegetation types?

Priority 5

Category Weather

Research ID 2010-27

Topic Fire Weather Forecasting

There is a strong need for better weather and lightning prediction models. Good long-range fire management decisions are not possible when weather predictions are limited to a few days. More accurate and longer-term information on trends in lightning activity, weather patterns and the interactive effects of weather and lightning activity on fire activity would greatly benefit fire managers in Alaska.

Issue: What are long-term trends in lightning activity?

Issue: What are predictions about future lightning activity?

Issue: More research is needed to improve fire weather predictions in Alaska.

Priority 6

Category Climate and Fire Regime Change

Research ID 2017-01

Topic Shortened fire return intervals

Global warming could could change fire regimes and drive shortened fire return intervals. What fuel, climate, and weather factors contribute to repeat burns?

Issue: What are the trends in areas burning multiple times, have they changed?

Issue: In light of recent fire seasons where past burns are no longer acting as fuel breaks, how are shorter fire return intervals impacting fuels, flammability, and vegetation regeneration/succession?

Issue: What are the characteristics (age, fuel load, vegetation type, moisture, etc.) that allow some older fires to act as fuel breaks for new fires?

Issue: What climatic, weather and fuels conditions allow fires to burn into recently burned areas?

Priority 7

Category Fire Effects

Research ID 2010-09

Topic Human Subsistence Lifestyles

People practicing a subsistence lifestyle must constantly adapt to changes in resource distribution, including changes caused by disturbance events. With rising costs of transportation fuel, concerns are frequently raised at public meetings about how fire will affect subsistence resources on public lands near communities (e.g. fish, wildlife, edible plants, fuel, timber). There is a need for more study of fire impact on human communities in Alaska. Recommended studies include: 1) retrospective studies (sample resources in burns of different age and interview subsistence users relative to fire history), 2) contemporary studies (establish monitoring program), or 3) predictive (forecast future conditions based on present paradigms). Results from these types of investigations could be invaluable to land owners and managers facing with decisions about prescribed fire or fire suppression near communities.

Issue: How does fire history and spatial distribution affect subsistence resource (e.g. fish, wildlife, edible plants, fuel, and timber) abundance and accessibility by humans?

Issue: How does fire affect berry production?

Issue: How should land owners and managers respond to fire impacts on subsistence resources? **********

Priority 8

Category Fire Effects Research ID 2010-06

Topic Burn Severity: Detection and Trends

Burn severity influences vegetation succession, permafrost, nutrient cycling, water quality, and water availability. We need improved methods to document burn severity at landscape and local levels. In addition, we need methods to determine changes or trends in burn severity over time.

Issue: Are there current changes in levels of burn severity?

Issue: Develop fine scale but expansive remote sensing severity method.

Issue: How can burn severity maps be improved for better monitoring of burn severity trends?

Issue: How does fire history influence severity?

Priority 9

Category Climate and Fire Regime Change Research ID 2010-01

Topic Climate Change Effects on Fire Effects

Little is known about the potential effects of a changing climate on various fire effects. For example, how could a warming climate impact fire regimes, successional pathways, fuel consumption, burn depth and duration, severity, ecosystem type conversions, animal habitats, pathogens and disease? More information about potential climate impact on fire effects for all Alaskan ecotypes is needed, especially for tundra, shrubland, and tree-line forests.

Issue: Develop models to provide background information necessary for climate change scenario planning.

Issue: What are the effects of deeper- and longer-burning fires on successional pathways?

Issue: How could climate change impact consumption/burn duration and ultimately succession and fire effects?

Issue: Determine whether fire management options or definition of resources at risk need to be changed in relation to predicted changes.

Priority 10

Category Fire Effects Research ID 2010-13

Topic Fish Habitat and Populations

Fish habitat, especially spawning areas, can be affected by post-fire changes in overstory canopy, increased erosion or ash flow, sedimentation, turbidity, and nutrient dynamics, buildup of leaf litter, and woody debris. The extent to which these changes alter fish population dynamics and thus availability for harvest and wildlife forage is unknown. The impacts of fire on hydrological parameters that could affect fisheries requires more study.

Issue: What are fire effects on fisheries resources?

Issue: What impacts to aquatic ecosystems occur as a result of fires, potentially including decreased stream channel stability, discharge, altered coarse woody debris delivery and storage, increased nutrient availability, higher sediment delivery and transport, and increased solar radiation and altered water temperature regimes? And how do these impact fisheries?

Priority 11

Category Fire Effects Research ID 2010-15

Topic Invasive Plant Species

Recent investigations indicate that fires, even low severity burns, can be vectors for invasive plant colonization. Research suggests that 10-to 20-year-old fires in black spruce forests may be most susceptible to colonization by invasive plants. Species spread may also occur through movement of suppression personnel and equipment contaminated with seeds or propagules. Therefore, it has been recommended that exotic species management should be considered for all recent burns.

Issue: Do fire events and fire suppression activities increase the potential for introduction and spread of non-native plant species?

Issue: What are the best strategies for post-fire inventory and monitoring of non-native, invasive species?

Issue: What is the potential for spread once invasive plants are established?

Issue: Which species are a concern? What activities promote spread or introduction?

Issue: What preventative measures can be implemented to reduce introduction or expansion of these species?

Priority 12

Category Pyro

Research ID 2014-1

Topic Development and Fire Risk

Trends in fire frequency, cause, and area burned can provide essential information on how these parameters may change in response to climate, vegetation changes, fuel moisture, ignition sources and development. For example, the number of human caused fires in Alaska is strongly influence by roads, development, and access. Research is needed to determine how changes in infrastructure and development may change fire occurrences.

Issue: Over time as infrastructure and access changes and increases in Alaska, how will this affect the fire occurrences and suppression needs?

Priority 13

Category Fire Effects

Research ID 2010-05

Topic Post-Fire Vegetation Succession Pathways

An improved understanding of vegetation successional pathways can provide managers with better planning tools for assessment and predictions of fire effects and flammability. Although recent studies have been conducted on successional trajectories in black spruce forests, there is limited information on pathways for tundra, shrublands, tree-line forests, and other fuel types. Managers are also interested in: 1) the impacts of permafrost degradation after fires and succession, 2) how future climate change scenarios will influence pathways, and 3) how shortened fire return intervals are affecting fuels and vegetation regeneration (particularly where recently burned areas in the early stages of succession are no longer acting as fuel breaks and burning again).

Issue: What are the successional pathways, based on fire severity and seasonality, for different primary vegetation types (e.g. white spruce, broadleaf, shrub, and tundra)? How will climate change impact these pathways?

Issue: How does fire effect permafrost degradation and what are the subsequent impacts on vegetation species composition and structure?

Issue: What characteristics result in post-fire conversion, especially from forest to grasslands, in future fire/climate scenarios?

Issue: How are shortened fire return intervals impacting vegetation succession and other ecological factors?

Priority 14

Category Tactics

Research ID 2010-24

Topic Current Fire Management Option Application Effectiveness

The Alaska Interagency Wildland Fire Management Plan was established in the 1980's with the acknowledgement that fire suppression was not always cost effective (net financial benefit) or ecologically beneficial for desired resources (e.g., subsistence foods) or purposes (natural disturbance). Under the plan land owners and managers were provided with four Fire Management Options. It may be necessary to re-evaluate the application of these Fire Management Options in light of; 1) changes in ecological knowledge about fire effects on the landscape, 2) cost of suppression and value of resources protected in Alaska and 3) climate change.

Issue: Should the Modified option be removed, allowing fires to burn earlier in the fire season?

Issue: If less severe, early-season fires were allowed to burn would there be less impact on permafrost and reduced carbon release?

Issue: What are the landscape level implications of removing some areas from the Limited Management Option to protect development (e.g. oil and gas infrastructure) and other interests (e.g., carbon sequestration, use of small diameter timber for bio-energy production [chips, pellets])?

Issue: Should the Limited Management Option be utilized during drought conditions? If resources are not directly at risk in Limited, what is consequence of suppression during drought on remaining fuels and future fire potential?

Priority 15

Category Weather

Research ID 2010-22

Topic Fire Season Weather Forecasting

Fire season planning, including preparedness and staffing levels, are dependent on accurate fire season forecasts. It is essential that these forecasts are available to fire managers early in the fire season.

Issue: More accurate forecasts of regional and sub-regional fire season potential.

Issue: Continued improvement of existing climate and circulation models.

Issue: Good fire season predictions available early in the season (by May 15th).

Priority 16

Category Tools & Technology for the Fire Community Research ID 2014-2

Topic New Technologies for improved Information Delivery and Exchange

Often fire research is completed but not well utilized by the fire community. As computer –aided dispatch systems, mobile devices, models, databases, remote-sensing tools, on-line learning applications, etc. improve there is a growing need for research that assesses how science information is being delivered, accessed, and utilized by the wildland fire community. Technologies abound but the funds to support them do not so information as to which methods are both theoretically effective and actually embraced by the science users is highly desired.

Issue: How science is being delivered, assessed, and utilized by the wildland fire community.

Priority 17

Category Fire Effects Research ID 2010-10

Topic Ungulate Habitat and Populations

Additional research is needed on the effects of fire on ungulates (moose, caribou, Dall sheep and muskoxen) and their habitat in Alaska. Shifts in ungulate habitat in response to fire may alter ungulate species distributions and population sizes, predator/prey relationships, and subsistence hunting patterns. More information is needed about how fire-induced changes in forage nutritional quality affect ungulate distribution.

Issue: What specifically are the effects of fire on ungulate spatial distribution and forage nutrition?

Issue: How does fire affect ungulate ecology in Alaska?

Issue: Effects of fire on forage lichen abundance and succession. Ground science and remote sensing are needed.

Priority 18

Category Smoke and Carbon Emissions Research ID 2010-31

Topic Carbon Sequestration

The cold, organic soils of boreal and arctic ecosystems have served as a carbon reservoir for millennia, but these regions may transition into global sources of carbon in response to climate change and altered disturbance regimes. Research is needed to determine how fire activity and fire management strategies in northern systems affect the global balance of greenhouse gases.

Issue: How do vegetation type and burn severity influence emissions?

Issue: How might future carbon sequestration patterns in Alaska affect fire management strategies, carbon balance, and natural diversity?

Issue: Does carbon uptake by post-fire vegetation growth exceed carbon levels released by burning?

Issue: How is carbon uptake related to vegetation type and stand age?

Issue: Do fuels treatments reduce emissions of greenhouse gases during subsequent wildfires?

Issue: What is the concentration of greenhouse gas emissions generated by wildfire and suppression activities in Alaska?

Priority 19

Category: Fire Effects

Research ID: 2010-07

Topic: Hydrology, Wetlands, and Permafrost Features

Baseline data on the impact of fire on hydrology, wetlands and permafrost features is needed. For instance, more information on fire effects on water-related topics (e.g. water budgets, thermokarsting, sediment loading, water chemistry, debris, subsidence, nutrients and aquatic organisms) would provide valuable insights for managers. These data could also be integrated to fish, wildlife and climate change studies to respond to subsistence and resource concerns. An ultimate goal would be to develop a predictive tool of how wetlands may change under different climate scenarios and fire regimes.

Issue: How does burn severity influence permafrost, nutrient cycling, water quality, and water availability?

Issue: How does fire alter hydrological processes, wetland dynamics (e.g. drying), and permafrost features (e.g. thermokarst)?

Issue: What are the relative effects of altered wetland dynamics and permafrost features on fish, wildlife, and habitat?

Priority 20

Category: Tactics

Research ID: 2010-25

Topic: Fire-line Rehabilitation Effectiveness

Post-fire rehabilitation of hand and mechanical fire-lines is implemented with the objectives of soil stabilization and minimal water pollution, thus helping to meet the goal of preserving the sustained productivity of treated areas. Few studies have addressed either the need for, or success of, rehabilitation efforts in Alaska.

Issue: Previously implemented fire-line rehabilitation efforts (esp. dozer lines) should be monitored to determine success in boreal forest and tundra ecotypes.

Issue: What is the most effective way of rehabilitating fire-lines?

Priority 21

Category: Sociological, Education, and Information — Research ID: 2010-30

Topic: Fire Outreach and Public Awareness Effectiveness

The boreal forest surrounds interior Alaskan communities, rendering them islands susceptible to wildland fire. Because of this reality, a need to educate Alaskans about the natural role of fire, fire management and Firewise concepts exists. A number of agencies have been actively working to address this need for education. However, there remains a need to assess the effectiveness of current fire education and awareness efforts.

Issue: What are criteria to define the adequate level of outreach; (e.g., how much is “enough” or what is “effective” or “successful?”)

Issue: Is “human dimensions research” on public response to fire information 1) delivery methods and 2) message content needed for better outreach success?

Issue: Are social media, online updates (Inciweb), and press releases reaching target audiences?

Issue: Are agency managers’ perceptions of public understanding of fire information messages accurate?

Priority 22

Category: Socioeconomics — Research ID: 2017-03

Topic: Effects & Cost of Fire Management

Information is needed on the impacts of changing fire management strategies in Alaska. What are the implications of having remote areas in “Full” versus roaded areas in “Full”? What will be the implications in terms of cost and potential availability of fire fighting resources for areas of Full in roaded or populated areas?

Issue: Cost of fire management with Full in road areas and in remote areas.

Priority 23

Category: Smoke and Carbon Emissions — Research ID: 2010-23

Topic: Smoke Models and Human Impacts

There is evidence that wildfire smoke can hurt people’s eyes, irritate the respiratory system and worsen chronic heart and lung disease. There is a need for more research on smoke effects on human health and how fire managers can predict, address and/or mitigate these effects.

Issue: What are smoke impacts on public health? Do perceived health impacts differ from actual impacts?

Issue: Can accuracy of emission factors for Alaska fuels be improved?

Issue: What are possible mitigations of smoke impacts on public health?

Issue: There is a need for improved models for predicted smoke plume trajectories to predict impacts on communities.

Priority 24

Category: Fire Behavior — Research ID: 2017-02

Topic: Holdover Fires

Holdover fires – why, where and when? What conditions allow for fires to overwinter and start back up the following season? Are there serious implications from holdover fires for fire management?

Issue: How frequent do holdover fires occur in Alaska?

Issue: What conditions allow or prevent a fire from overwintering?

Priority 25

Category: Tactics — Research ID: 2010-26

Topic: Fire Suppression Method Effectiveness

A variety of fire suppression methods are employed by fire managers in Alaska including various combinations of resources (e.g. aircraft, personnel, and specialized equipment). More information is needed on the relative effectiveness of these methods.

Issue: Better information is needed on the effectiveness of suppression method applications

Priority 26

Category: Fire Effects — Research ID: 2010-11

Topic Bird Habitat and Populations

Alaska provides breeding grounds for a substantial proportion of North America's migratory waterfowl and passerine species, however little is known about fire effects on most species and their habitat. There is some evidence that fire can provide good habitat for a subset of migratory and non-migratory bird species in Alaska. Other species require mature older-successional habitat. A climate-change induced increase in early season fire activity could have a detrimental effect on nesting migratory birds which arrive in Alaska during April and May.

Issue: Are fire-related changes in boreal forest dynamics affecting forage and nest- site availability and distribution of birds?

Issue: What are long-term impacts of fire on birds in Alaska, especially neotropical migrant passerine and waterfowl species?

Issue: What are the potential effects of increased early-season fire activity on nesting bird species populations?

Priority 27

Category Fire Effects Research ID 2010-12

Topic Furbearer and Small Mammal Habitat and Populations

Small mammals (especially microtines) and snowshoe hares are an important component of the ecosystem, serving as a prey base for numerous species of wildlife and influencing vegetative patterns through foraging, digging, and stashing of seeds. Furbearers are a primary predator on small mammals and are also important to subsistence lifestyles.

Issue: What are fire effects on furbearer and small mammal populations?

Priority 28

Category Fuels Treatment Research ID 2010-19

Topic Utilization of Fuels Treatment Byproducts

It is possible to reduce hazard fuels treatment costs and increase the use of woody biomass residuals (thus reducing post-treatment fuel loading) in an environmentally and economically sound manner by allowing rural community residents access to treatment residues However, more research on the appropriate treatment applications and rotations is needed.

Issue: Is specialized equipment required for handling and processing small diameter wood?

Issue: What are potential uses of fuels treatment residuals (woody biomass) in bio-energy (chips, pellets) or other applications?

Issue: What are the relative energy values and appropriate rotations of biomass harvests?

Priority 29

Category	Fuels	Research ID 2010-28
Topic	Decomposition Rates of Woody Debris	
	Site characteristics and climatic conditions control the relative importance of fire and decomposition in release of nutrients. Cold, dry environmental conditions limit biological decay which allows for accumulation of plant debris. Warm, wet conditions are conducive to biological decay. Coarse woody debris loading directly impacts fire behavior and fire regime.	
Issue:	How would coarse wood debris from past fires be assessed (directly or remotely) as a fuel type at the landscape scale for use in fire management decisions?	
Issue:	What are post-fire coarse woody debris decomposition rates in Alaska's boreal forests?	

The Fire Research Development and Application Committee (FRDAC) is dedicated to identifying, prioritizing, and promoting current fire research needs in Alaska to inform and support fire management decisions. It is a committee of the interagency Alaska Wildland Fire Coordinating Group (AWFCG), whose mission is to provide a forum that fosters cooperation, coordination, collaboration, and communication for wildland fire management and related activities in the state of Alaska.

One of the primary activities of the FRDAC is to develop a prioritized list of research needs at 2-3 year intervals. Other activities include development of fire effects monitoring and fuel moisture sampling protocols along with contributions to statewide products including an interactive map of fire research plots, a bibliographic reference collection on fuels and fire effects, and a fuel model guide to Alaska vegetation.

New solicitations for research topics are accepted at any time. Contact your agency's representative or the FRDAC chair.

https://www.frames.gov/partner-sites/afsc/partner-groups/frdac/