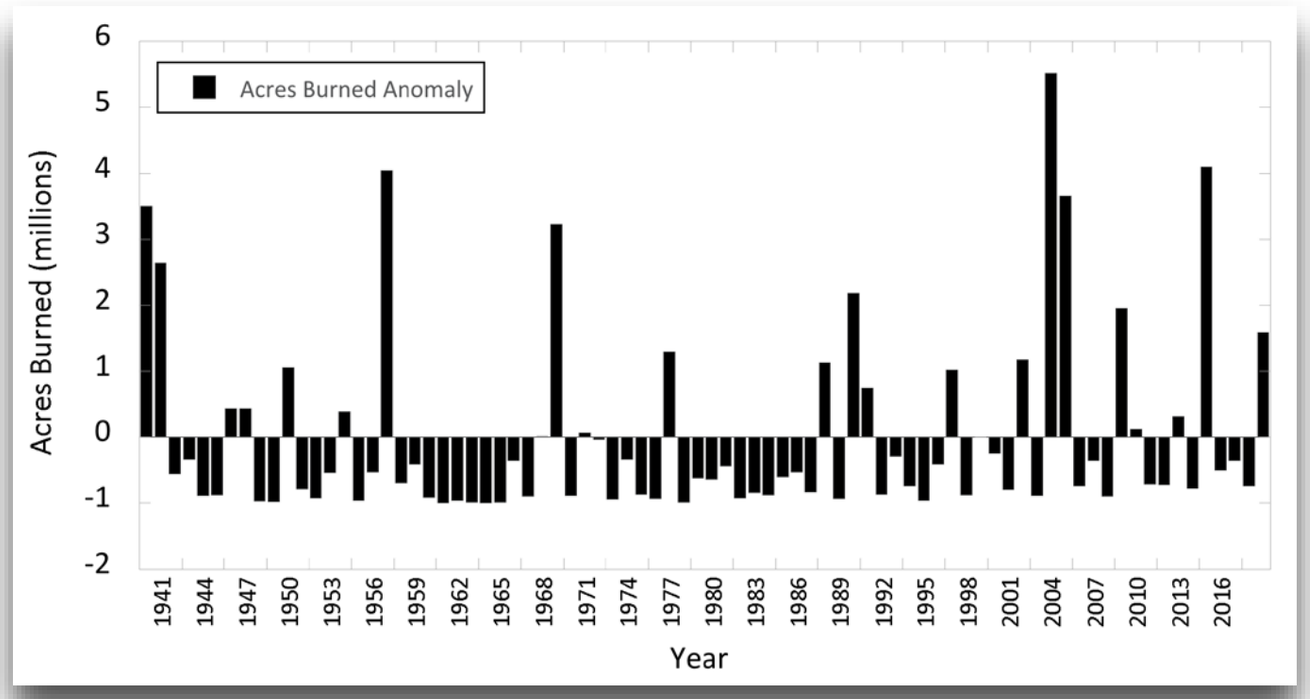
Boreal Fires Update
F&I Fall 2019 All-Hands Meeting

October 3-4, 2019

July 3, 2019 south of Talkeetna, Time Magazine

https://time.com/5657188/alaska-fires-long-climate-change/

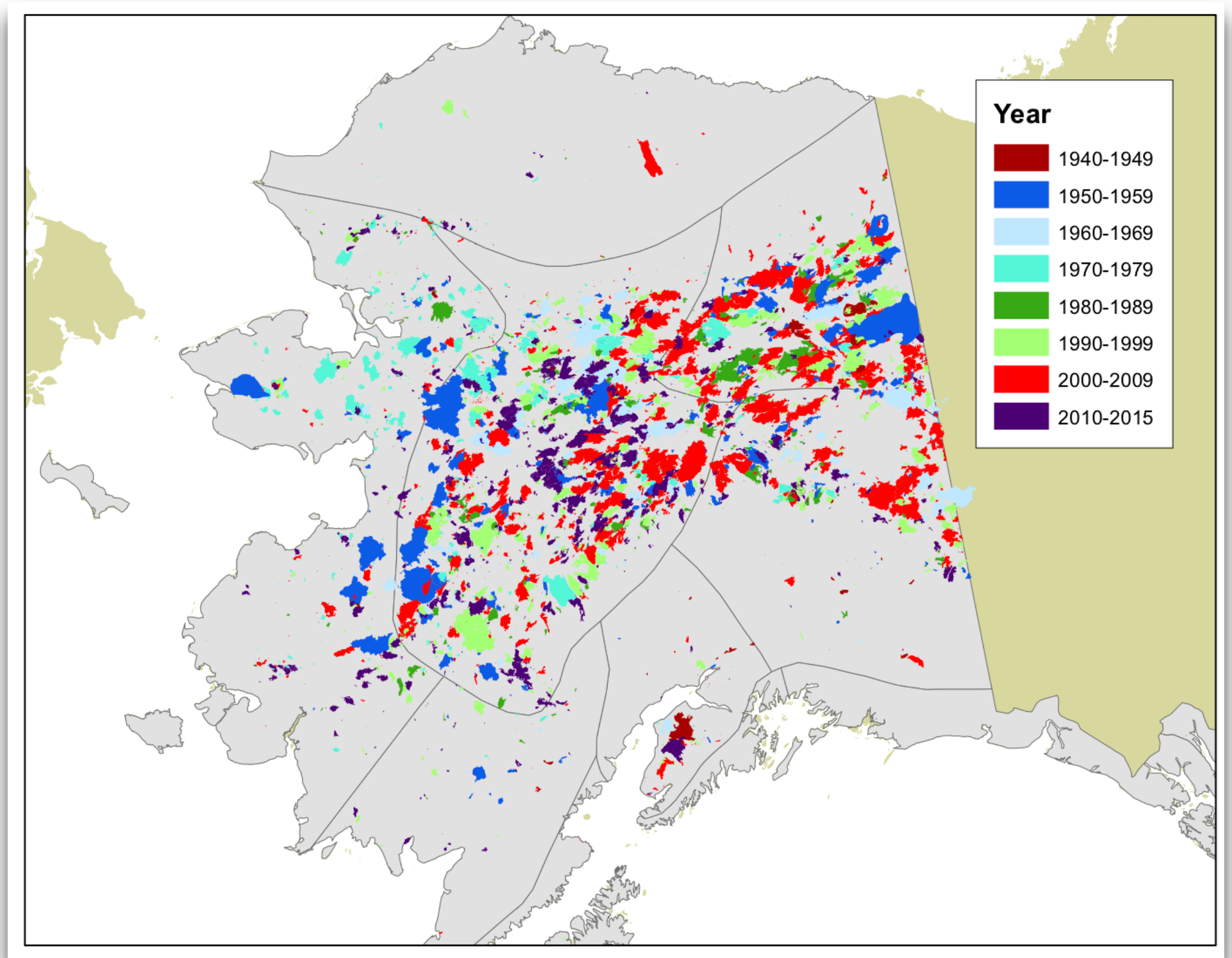


2019 - 2.59 million acres burned in Alaska

4.3 million in the US so far in 2019

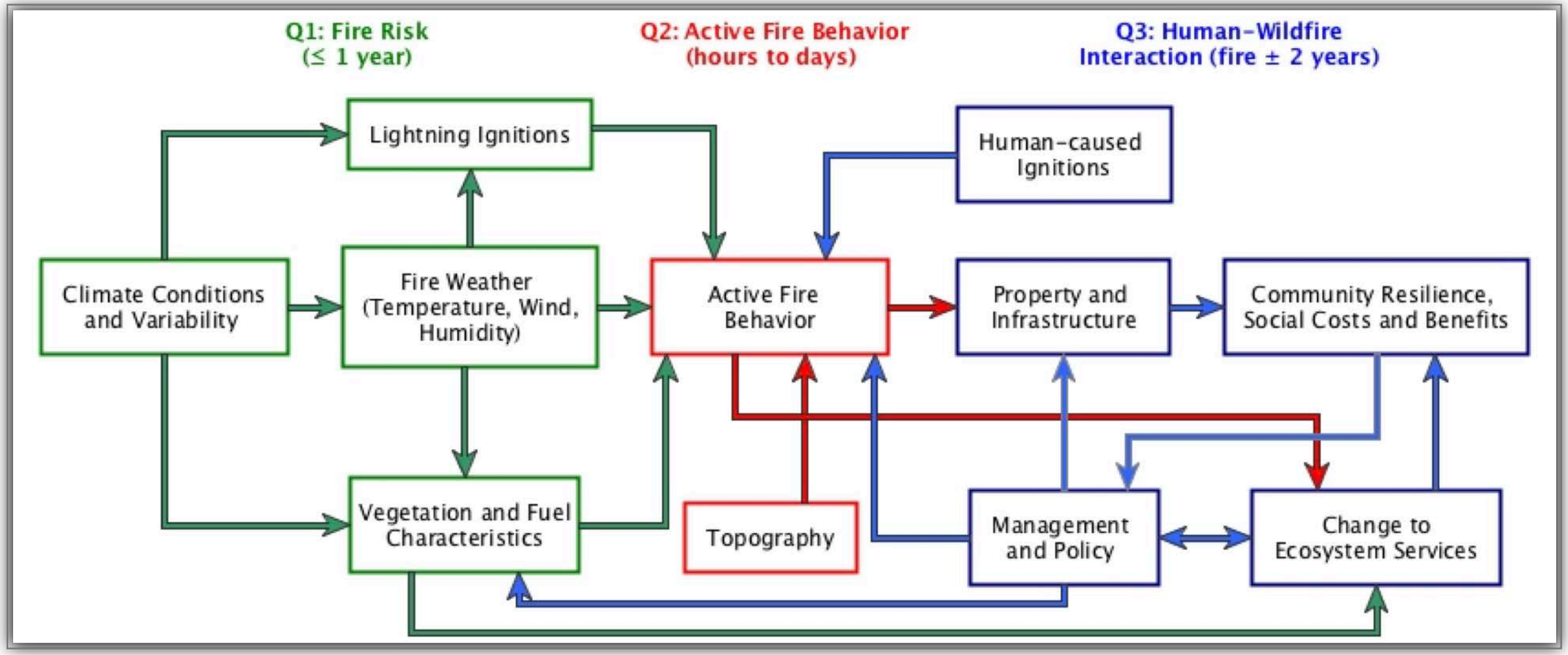
https://www.nifc.gov/fireInfo/nfn.htm

Study Region: Boreal Forest & Rural Communities



[Graphic P. Bieniek]

Project Goals



Research Team Members & Expertise

Uma Bhatt

Climate Variability

Todd Brinkman

Ecology

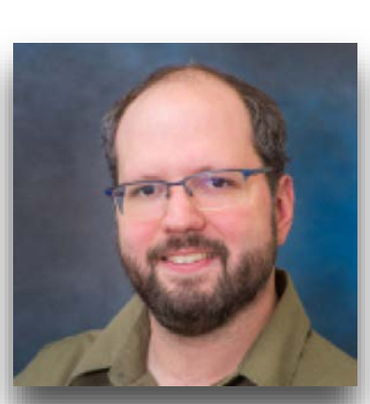
Remote Sensing & Fuel Mapping

Santosh Panda

Hyperspectral Faculty Hire UAF

Martin Stuefer

Climate Variability Analysis and Seasonal Forecasting



Peter Bieniek

J. Chriest

C. Borries-Strigle

C Smith

Hyperspectral Postdoc Hire UAF

Hyperspectral PhD student UAF

Fire Management Expertise

Robert Ziel

Randi Jandt

Allison York

Landscapes Faculty Hire UAA

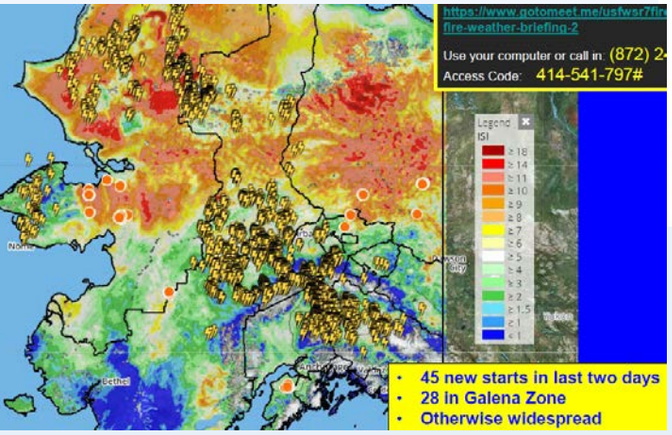
Economics & Ecosystem Services

Matt Berman

Jen Schmidt

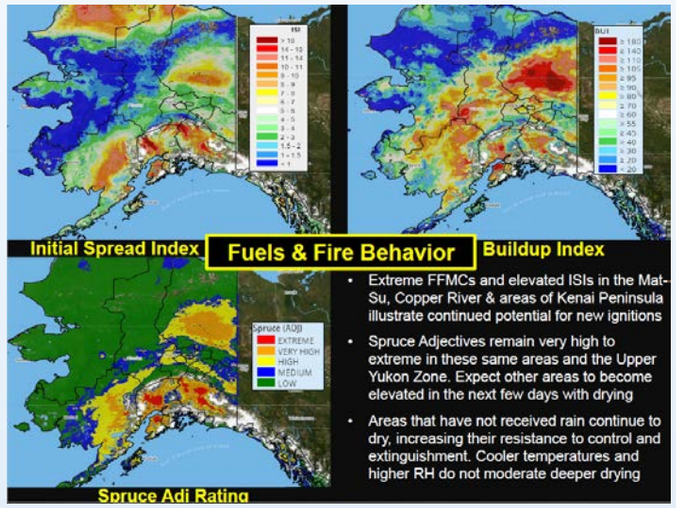
Joseph Little

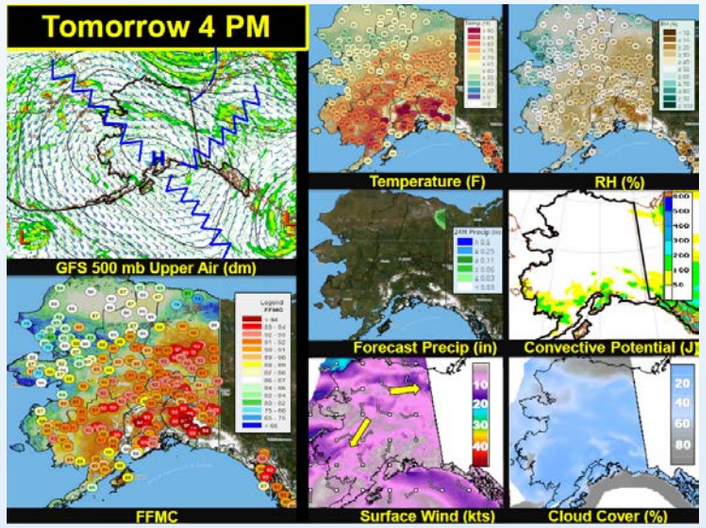
Predictive Services at Alaska Interagency Coordination Center

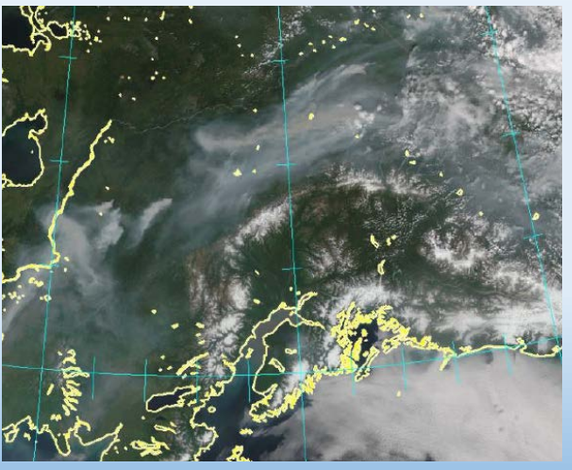


Heidi Strader

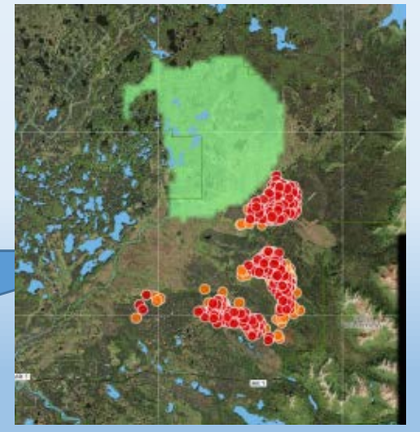
Eric Stevens







Predictive Services at AICC provides information to Fire Managers on weather, fuels, resources



Project Partnerships & Linkages

BONANZA CREEK LTER
Institute of Arctic Biology, University of Alaska Fairbanks

Boreal Ecosystems

Teresa Hollingsworth

FOREST SERVICE U S DEPARTMENT OF AGRICULTURE

ABoVE
ARCTIC – BOREAL VULNERABILITY EXPERIMENT

Brendan Rodgers

IARC

National Park Service
Fire Ecologist

Jennifer Barnes

Alaska Fire Service
GIS Specialist

Jen Jenkins

ACCAP
NOAA RISA

Rick Thoman

Experimental Arctic Prediction Initiative

John Walsh

Joseph Little

ALASKA FIRE SCIENCE CONSORTIUM

Based at IARC
with funding from the
Joint Fire Science Program

Mandate to deliver the "best available science" to support wildland fire management decisions

Sarah Trainor, PI and Director
Alison York, Coordinator

TBD, Science Communication Specialist

Key: Subject matter experts, both retired managers

Randi Jandt, fire ecologist
Robert "Zeke" Ziel, fire analyst

International Arctic Research Center
University of Alaska Fairbanks

Robert Ziel

ALASKA FIRE SCIENCE CONSORTIUM

akfireconsortium.uaf.edu

- Alaska's interagency fire management community is well organized and collaborative, with long history of partnership with UA. Funded since 2009, AFSC is an established resource for managers
- **High priorities include:** Fire behavior modeling, fire weather forecasting, fuels treatment effectiveness, specifics of how climate will affect fire, calibrating fire danger indices, remotely sensed tools
- AFSC draws on science from many programs and agencies to offer webinars, seasonal and topical workshops, research briefs, reference database, etc, relevant to managers' needs
- AFSC works with researchers to make their science relevant and useful in a management context, involving management personnel as early and as much as possible ("*co-production*")

"More information is great, but would I make a different decision?"

Co-producing Knowledge on the Immediate Effects of Wildfire on the Availability of Ecosystem Services

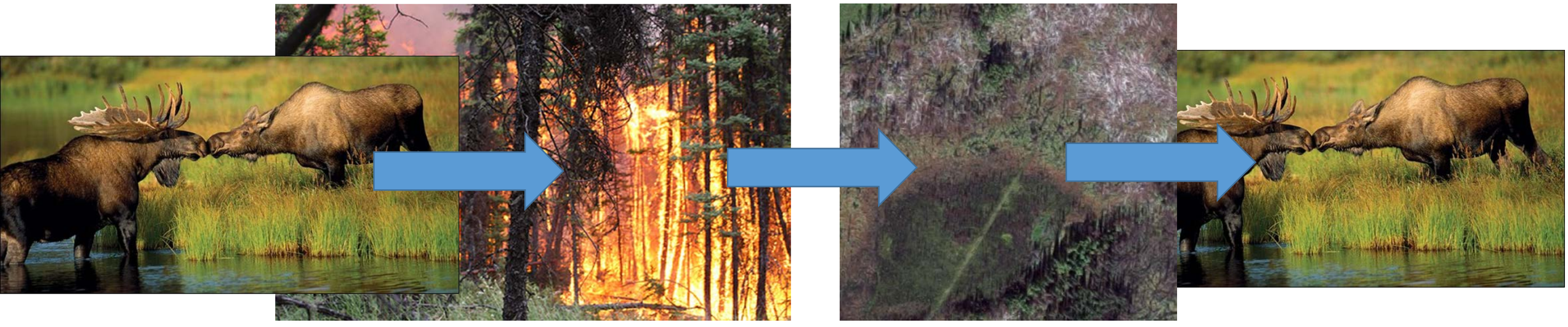
Todd Brinkman

Krista Heeringa

Darcy Peter

Co-production needed to identify & address stakeholder concern regarding wildland fire

- Engage key stakeholder groups
  - Interior Alaska communities, agencies, & tribal organizations
- Identify stakeholder research interests and priorities
- Explore research designs to address local priorities
- Formalize MOA/Us and research questions.



Objectives and Progress

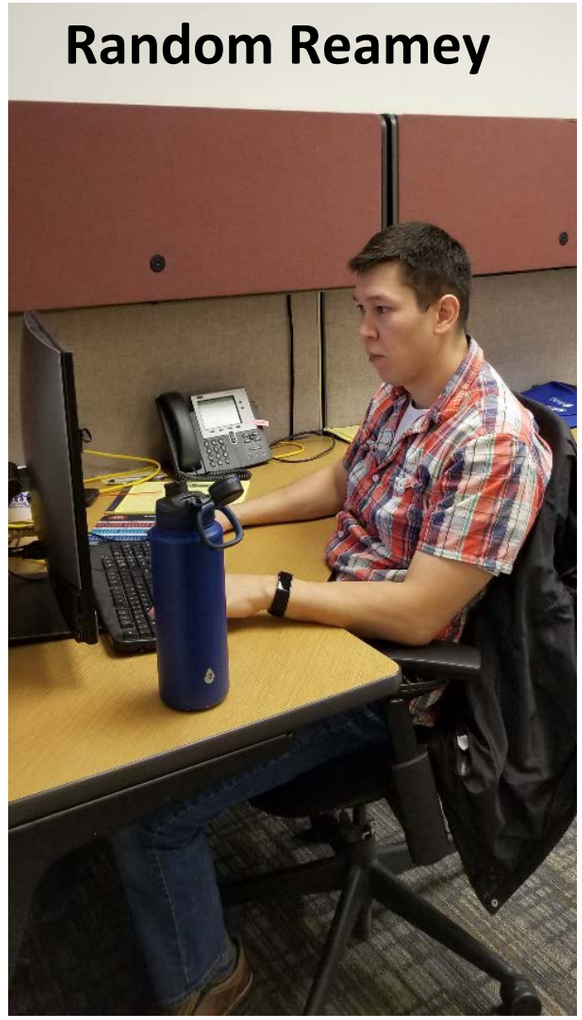
- Identify changes in vector of ecosystem services linked to fuel treatments and areas impacted by WF in interior and south central Alaska
  - Jen and her students suffered wasp attacks and the occasional bout of bad weather to measure changes in ES on fuel treatments and fire scars.
- Compilation of fuel treatment data base
  - Jen diligently compiling geo-spatial information on location of fuel treatment projects around Alaska
- Compile wildfire suppression cost data (federal, state, local) and identify the geo-spatial distribution of costs
  - Matt, Random, and Joe compiled state and federal suppression cost data needed for next stage of work
  - Jen mapped federal state data to identify spatial distribution of costs

EPSCoR Students & fieldworkers

Jennica Kilcher

Christin Swearingen

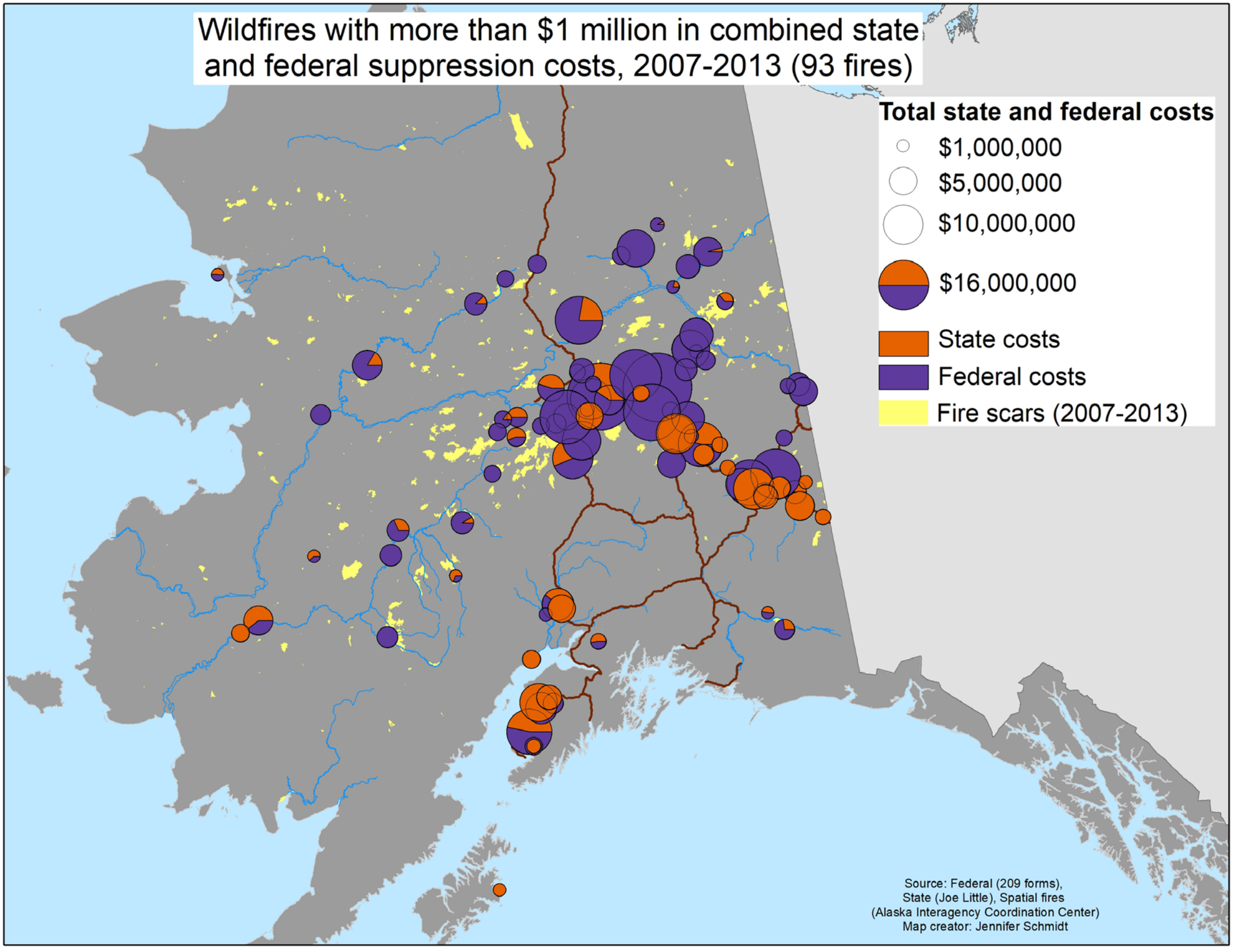
Random Reamey



Field work to document changes to ecosystem services by fire

- **Fire effects monitoring protocol with ecosystem services (transects)**
  - Vegetation and canopy
  - Tree data
  - Duff
  - Woody Debris
  - Moose habitat and browse
  - Berries
  - Invasive species
- **Rapid assessment of ecosystem services (transects with sub-plots)**
  - Canopy
  - Berries
  - Mushrooms
  - Moose habitat
  - Moose and hare browse
  - Moose and hare scat

Wildfire Costs Show Spatial Concentration



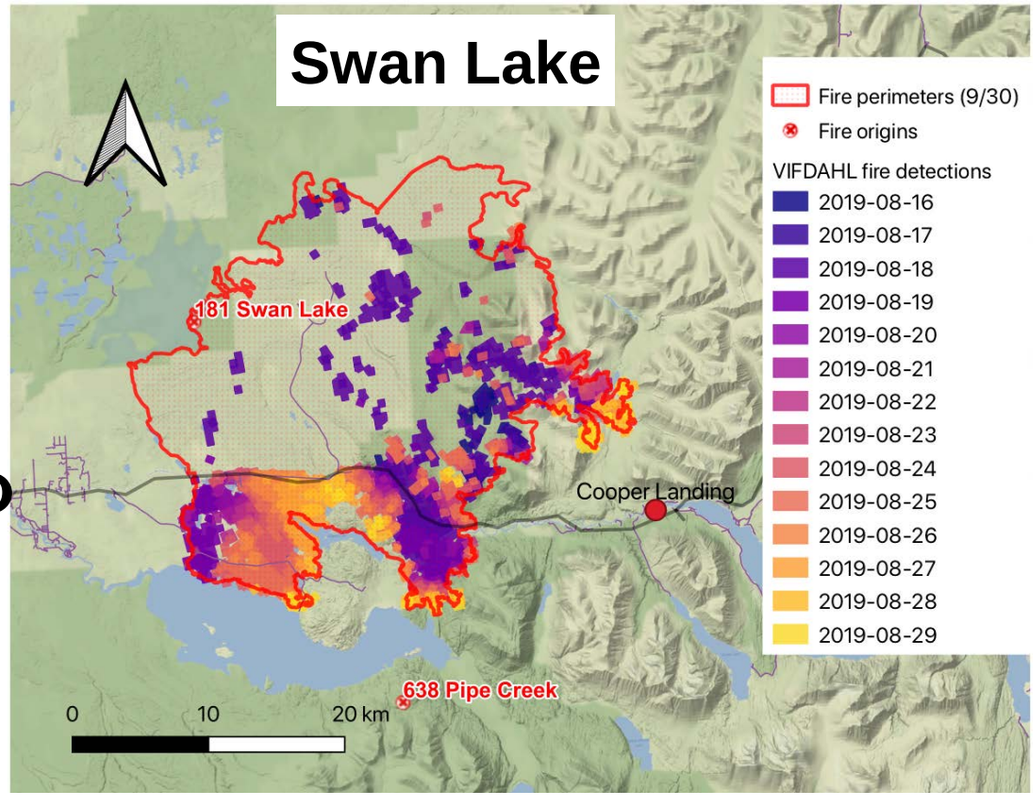
[Schmidt, Reamy, Berman, Little]

Next Steps

- Add to suppression cost data set
  - 2016-2018 suppression costs state/federal
  - Add municipal suppression expenditures
- Validate state and federal suppression cost data
  - some discrepancy between federal and state reports for same incident.
  - confirm cost share federal/state
  - estimate costs for fires with suppression resources identified but no cost listed
- Geo-Spatial mapping of fire perimeters and associated suppression costs
- Spatial modeling of suppression cost data

Fire in our backyard provided opportunities

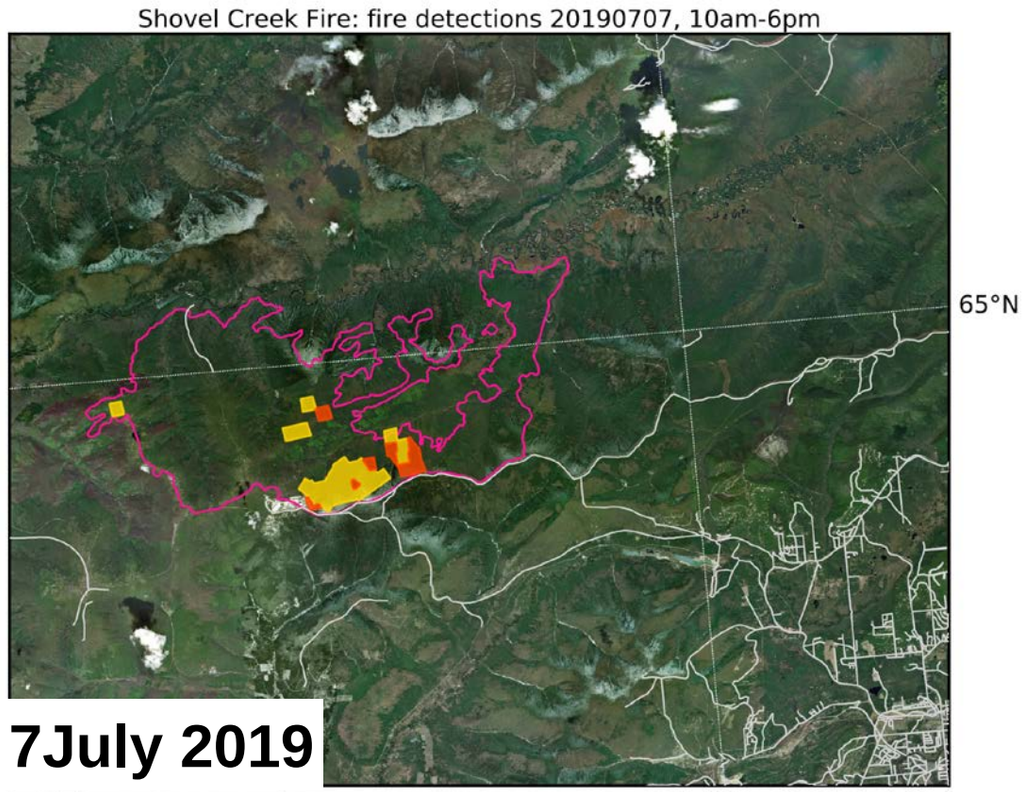
Progression of Swan Lake fire on the Kenai Peninsula. ❾



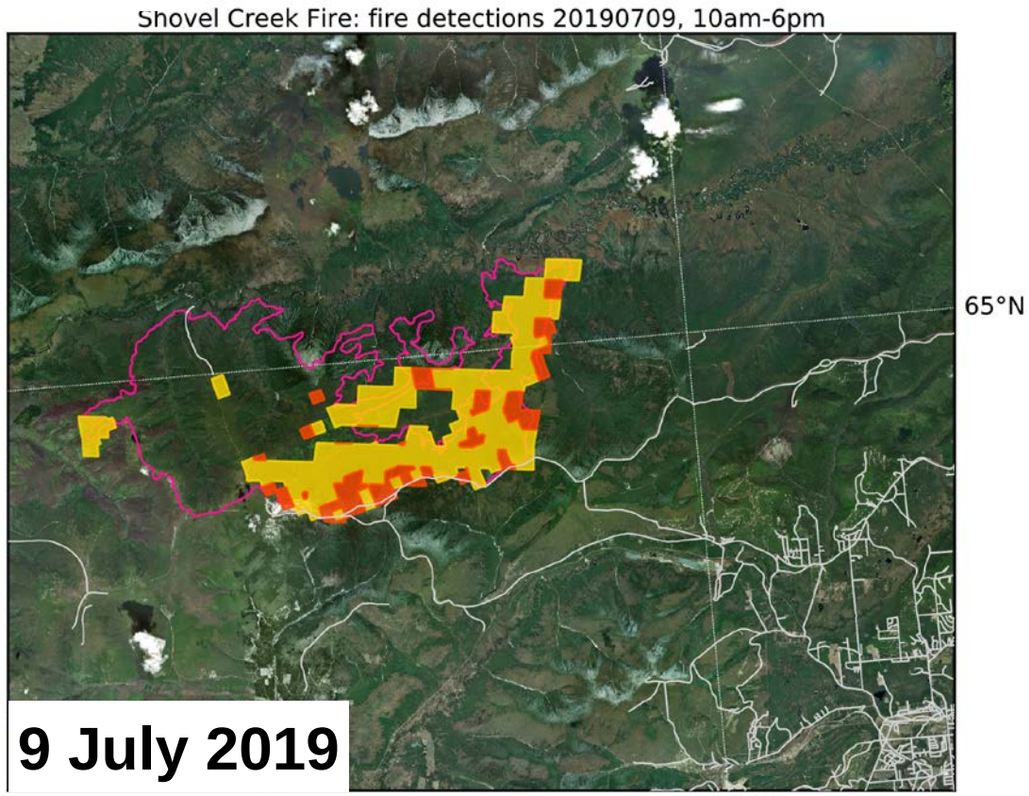
The VIIRS I-band Fire Detection Algorithm for High Latitudes (**VIFDAHL**) is designed to detect fires in the Alaska boreal forest with higher sensitivity than the global VIIRS I-band (375m) algorithm. Can detect residual burns.

Christine Waigl

Shovel Creek



7July 2019

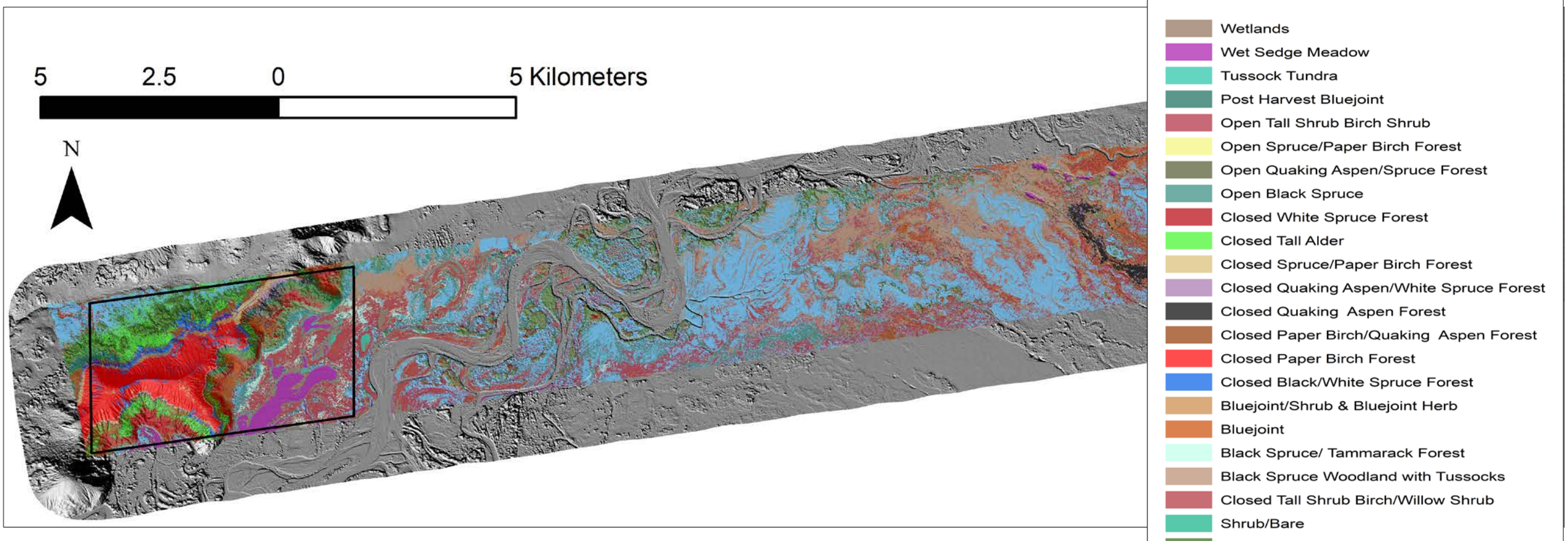


9 July 2019

NASA AVIRIS-NG hyperspectral data: Bonanza Creek, AK

Chris Smith, Santosh Panda, Robert Haan

NASA AVIRIS-NG image: 7/23/2018; 425 bands; pixel size: 5 m; area: 121 km^2
Field survey of vegetation: 42 plots (10 m x 10 m)
Vegetation classes: 25 at Viereck level IV; 18 at Barnes (2018) fuel type level;
Classifier: Random Tree;
Accuracy using training data: ~79% at Viereck level IV; 90% at Barnes (2018) fuel type

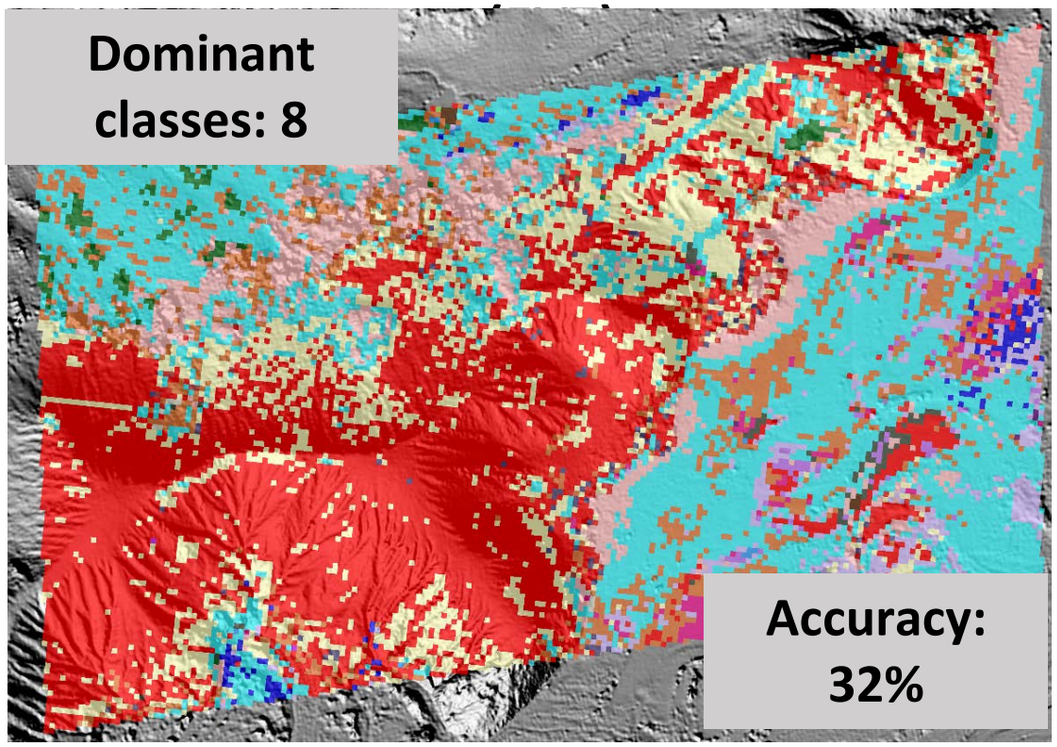


Bonanza Creek

Increased Classes & Accuracy with Hyperspectral

CURRENT FUEL MAP

LANDFIRE Existing Vegetation Type



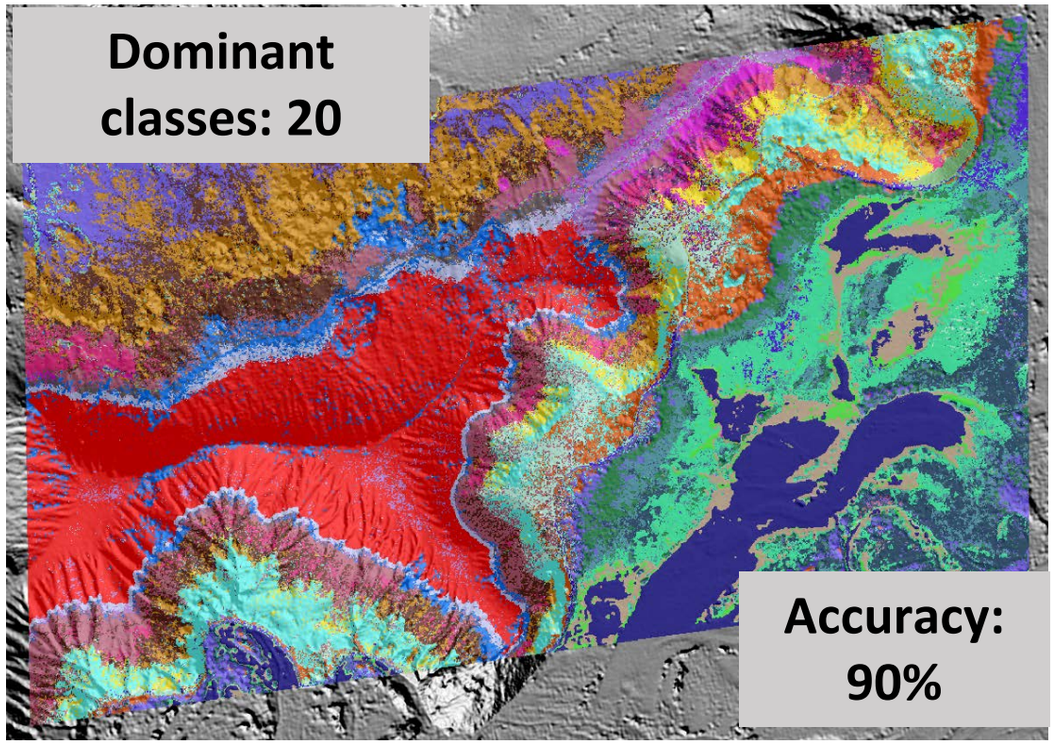
EVT Top Classes

- Birch-Aspen Forest 33%
- Black Spruce Forest 26%
- Scrub Birch-Willow Shrubland 15%
- Coniferous Woody Wetland 9%
- White Spruce Forest 8%
- Shrub-Tussock Tundra 3%

30 m Landsat, 8 classes

IMPROVED FUEL MAP

Vegetation classes from AVIRIS-NG



AVIRIS-NG Top Classes

- Closed Paper Birch Forest 16%
- Open White Spruce 9%
- Closed Tall Alder 9%
- Closed White Spruce Forest 7%
- Wet Sedge Meadow 7%
- Closed Tall Shrub Birch/Willow Shrub 6%

5 m AVRIS-NG, 20 classes

Vegetation Types with Spectral Signatures

Closed Paper Birch Forest

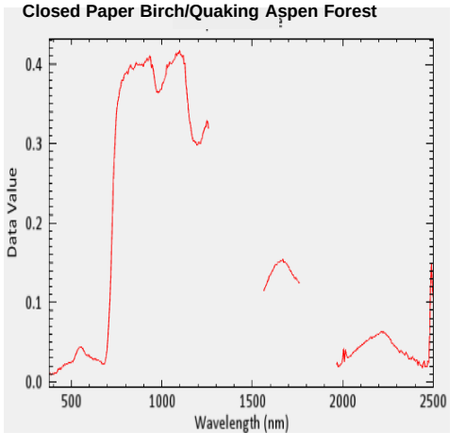
Open White Spruce

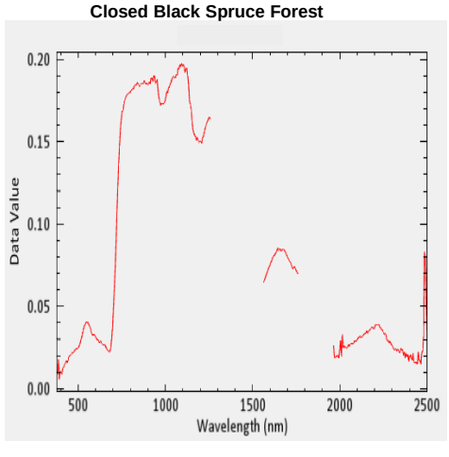
Wet Sedge Meadow

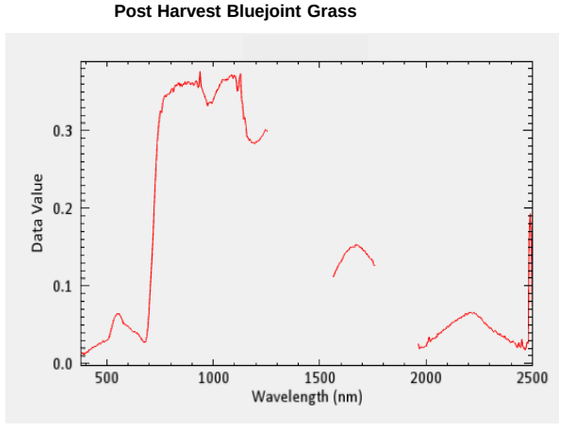
Closed White Spruce Forest

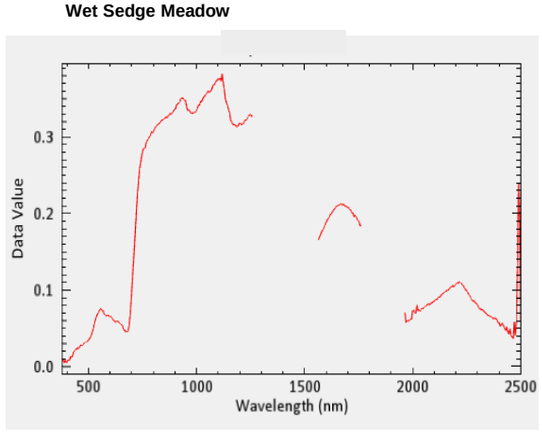
Closed Tall Shrub Birch/Willow Shrub

Closed Tall Alder





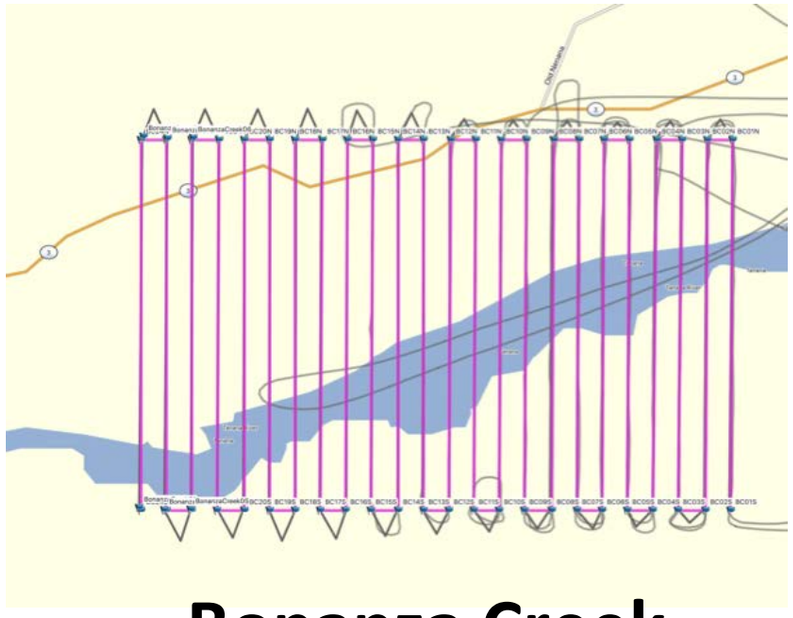




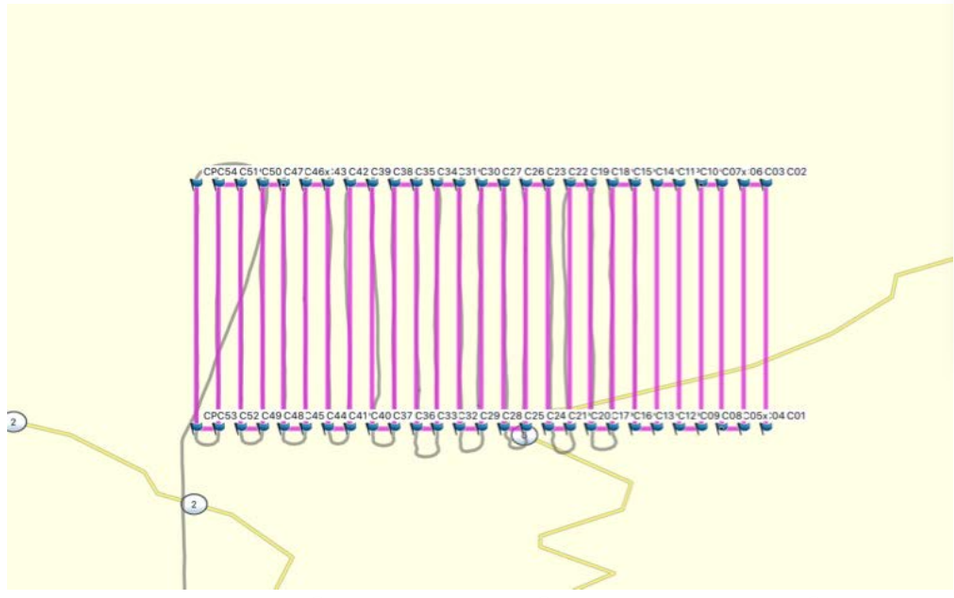
2019 Hyperspectral Boreal Fires Data Acquisition

Martin Stuefer
HyLab, Geophysical Institute, UAF

- **Hyperspectral Instrument became operational in August 2019**
- **Data acquisition has been performed over Bonanza Creek and Caribou Poker Creek.**



Bonanza Creek



Caribou Poker Creek

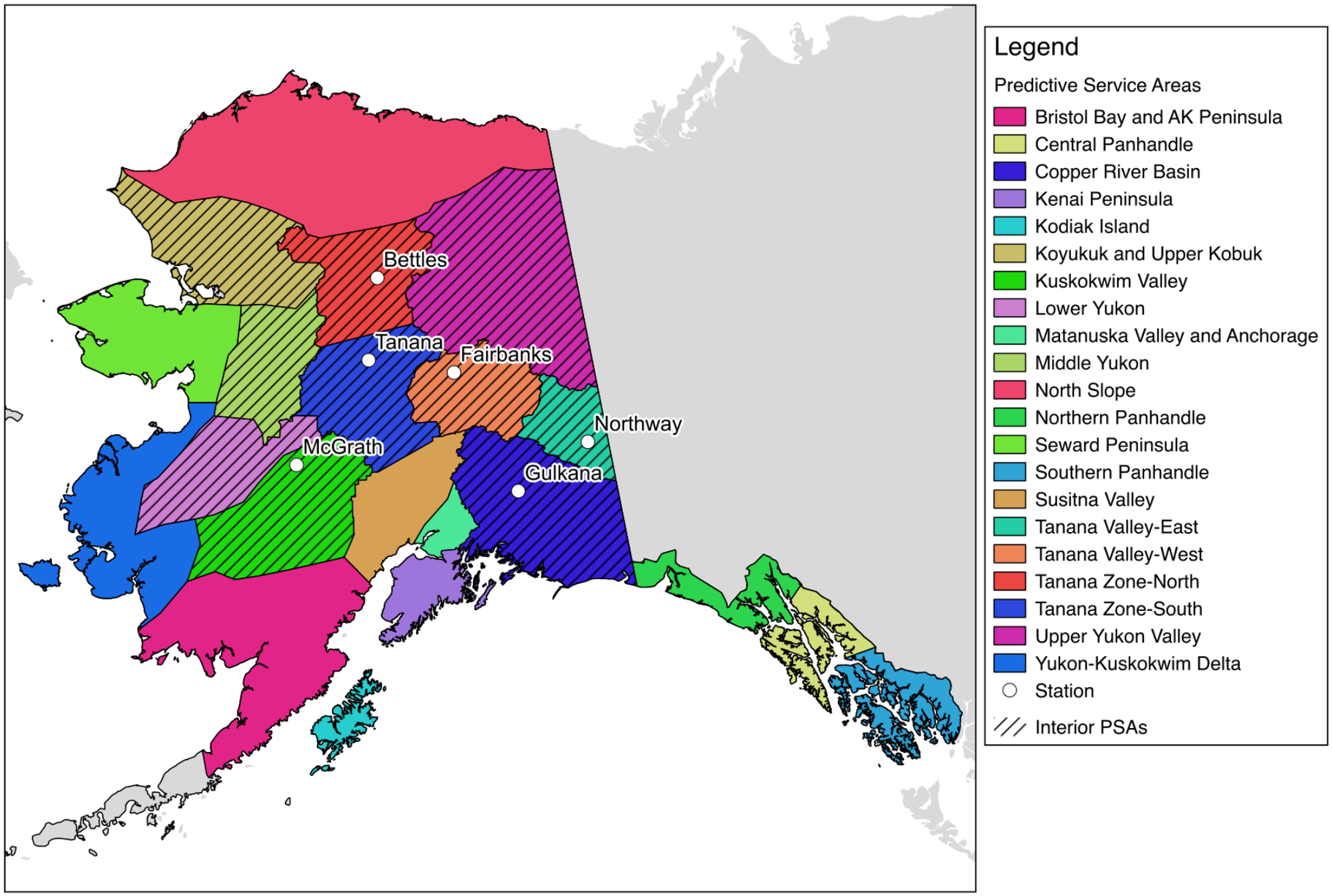
Martin Stuefer

1TB Data

- ‘HySpex’ Data Acquisition along magenta lines
- Data acquisition was performed on August 26, September 6 (Bonanza Creek), and August 17 (Caribou Poker Creek).

Discussions with Fire Managers changed how we approached seasonal forecasts

Predictive Service Areas



Seasonal Forecasts Fire Weather

- **First order Meteorological station observations**
- **PSA level aggregated observations**

What are we trying to do?

1982-2018

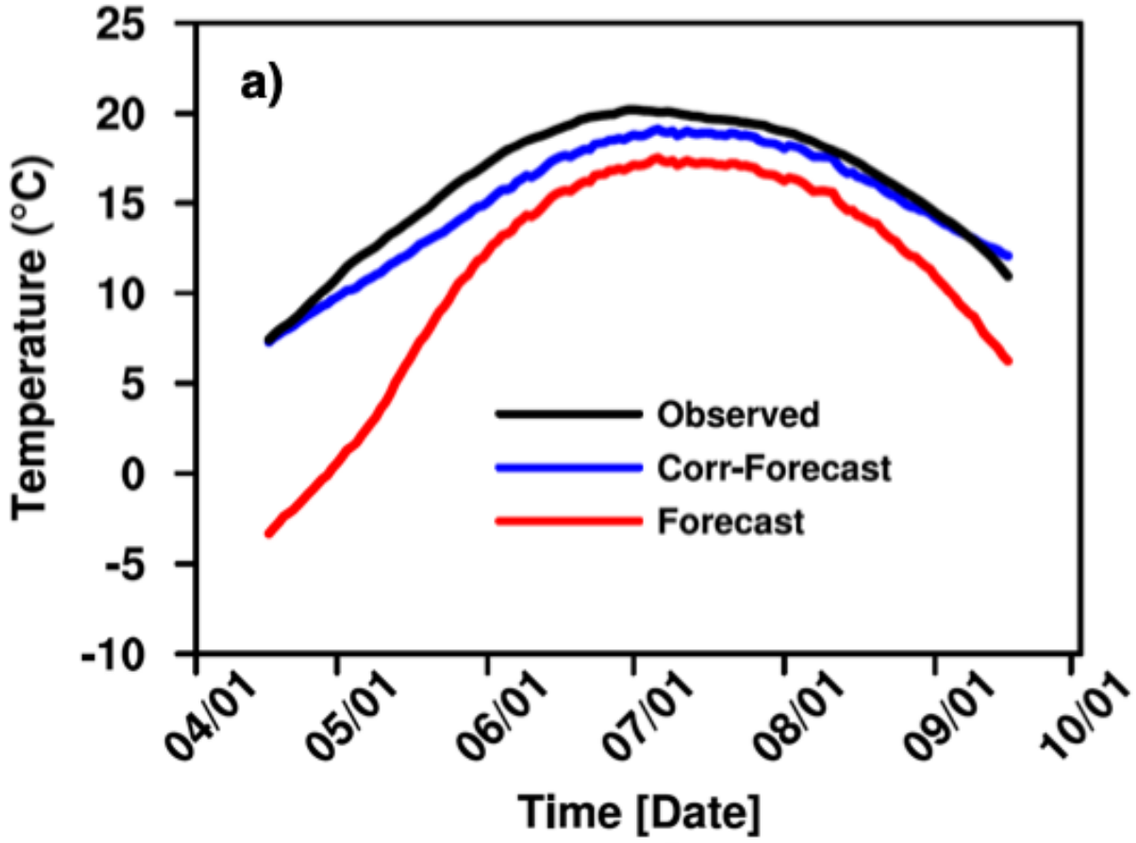
March Start Seasonal Forecasts

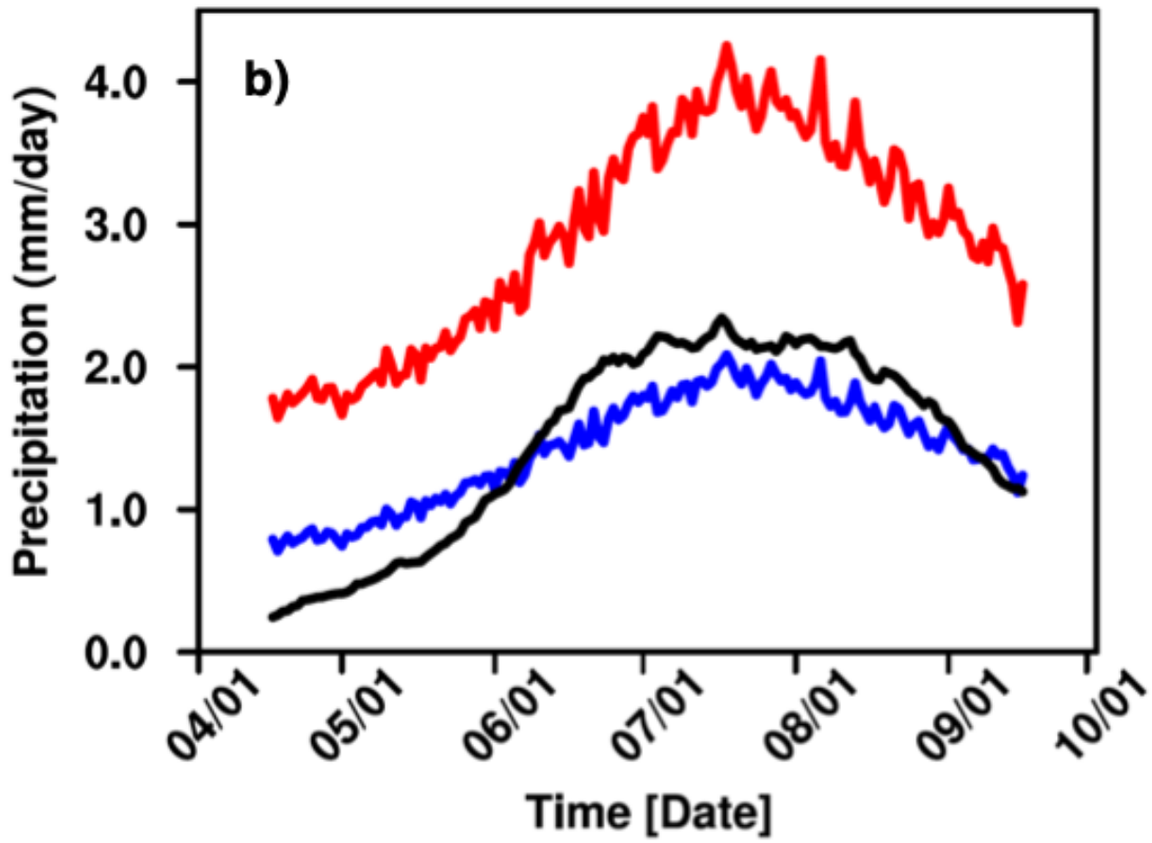
1April- 30September Forecasts of T, P, humidity, and winds

26 to 120 forecasts are made to comprise ensemble

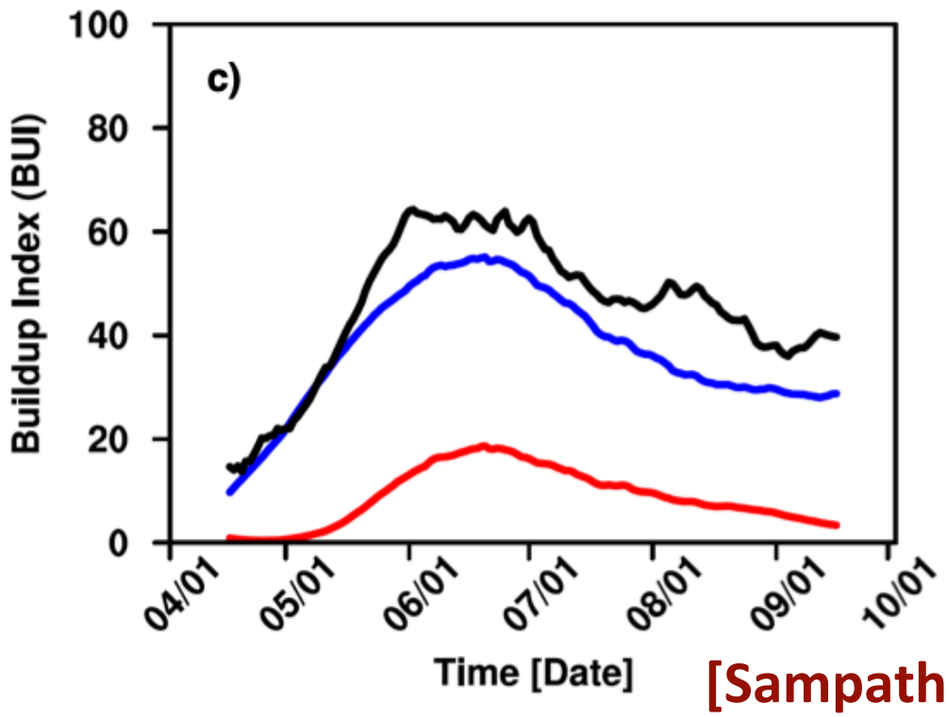
- **Use forecast data to calculate Fire Weather Indices**
- **Correct T & P biases before we can make forecast!**
- **Plan to construct forecast for JJA 2020**

Season Cycle of Temperature & Precipitation Corrections at Tanana Valley West PSA (1994-2017)



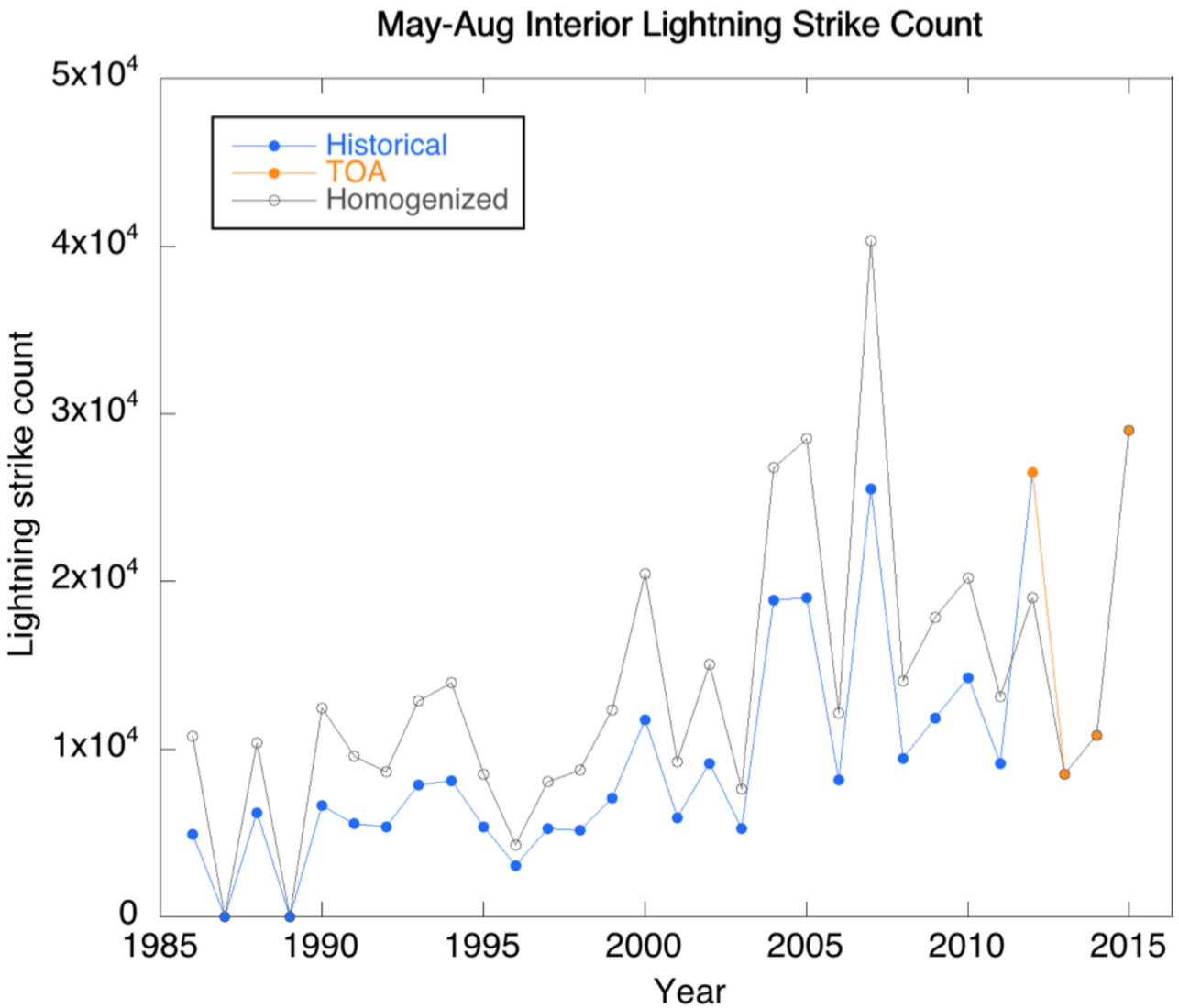


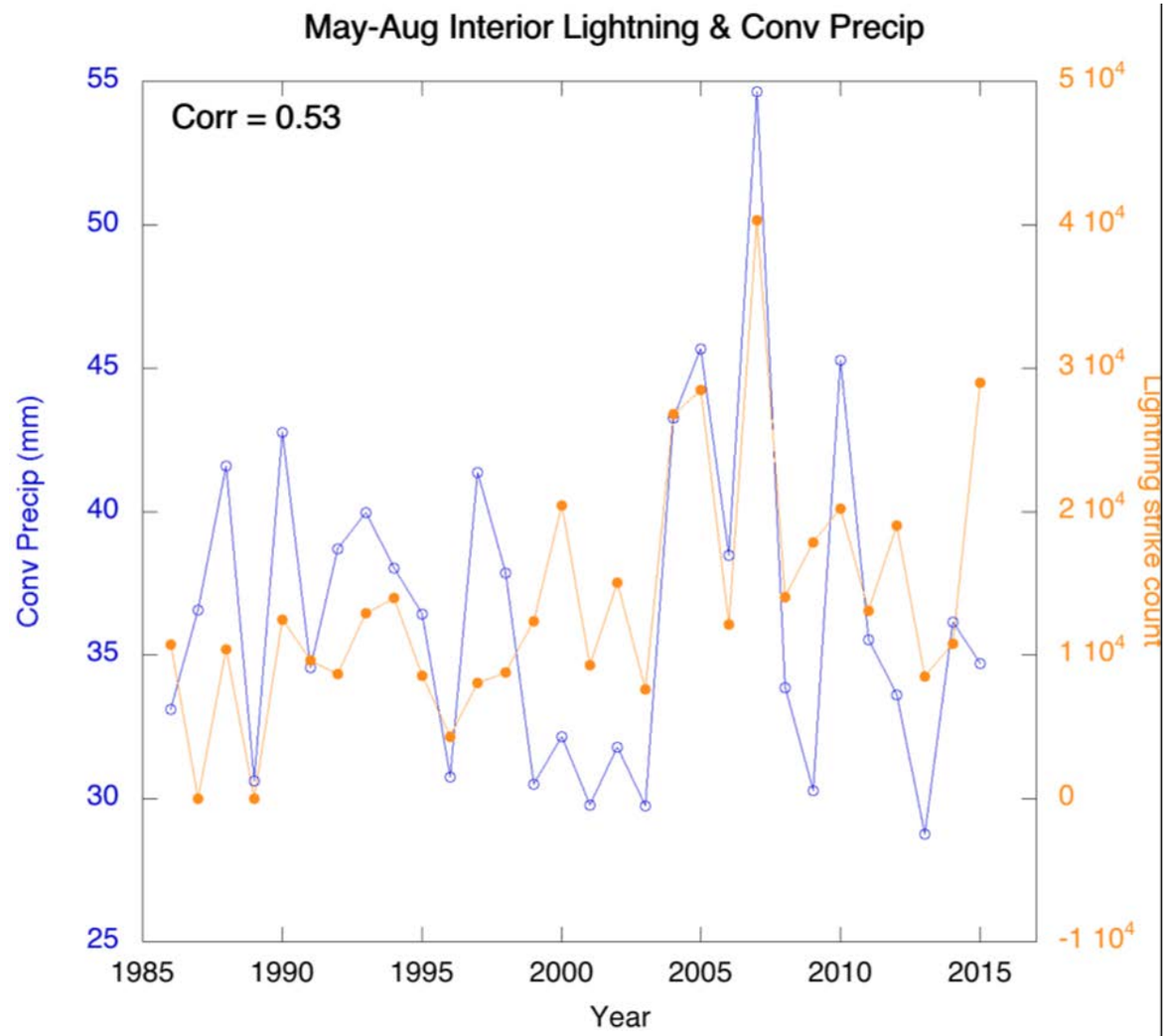
Forecast summers too cold and too wet



[Sampath et al. 2019]

Lightning Strike Count Suggests Increase and is correlated with convective precipitation





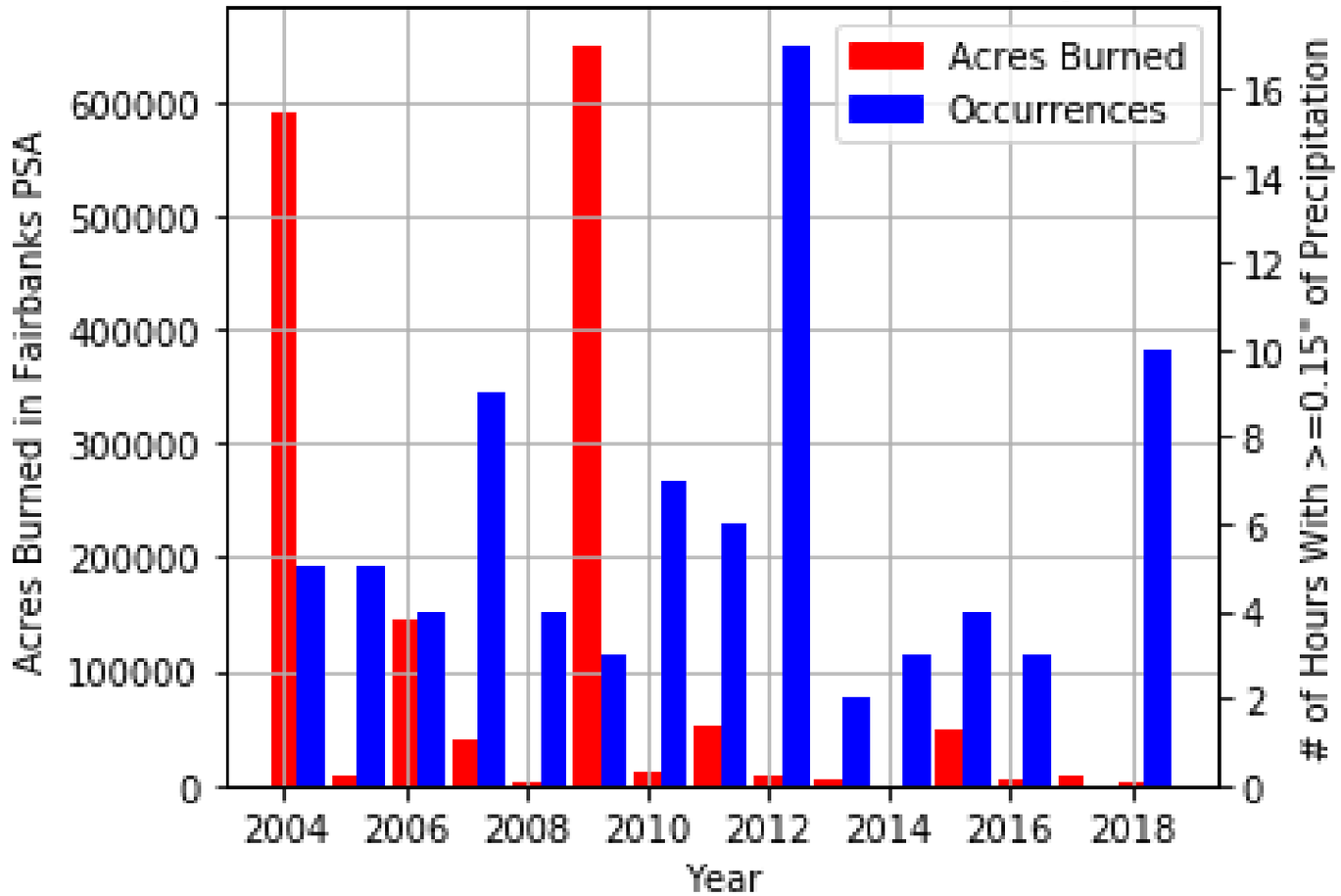
[Bieniek et al. 2019]

National Weather Service Connection Contributes

- Lightning seems to be increasing …
- What are potential proxies for lightning?

J. Chriest

- Convective precipitation is investigated
- Precipitation > 0.15” in one hour added up for summer



Take Home Points

- **We have built a team where individuals have unique skills that will help us advance understanding of the problem of wildland fire in Alaska in a wholistic way.**
- **Really key to reflect at breakout sessions of what worked and what did not work. This will help us adjust tactics as we plan work for year 2.**
- **Grateful to be part of this work that is scientifically interesting but also has clear tangible benefits for society.**

Acknowledgements: This work was supported by NOAA's Climate Program Office's Modeling, Analysis, Predictions, and Projections Program grant NA16OAR4310142. This material is also based upon work supported by the National Science Foundation under award #OIA-1753748 and by the State of Alaska.