Tracking Alaska Wildland Fire Spread

derived from VIIRS Satellite Thermal Point Data

Melania Stoeber 2025

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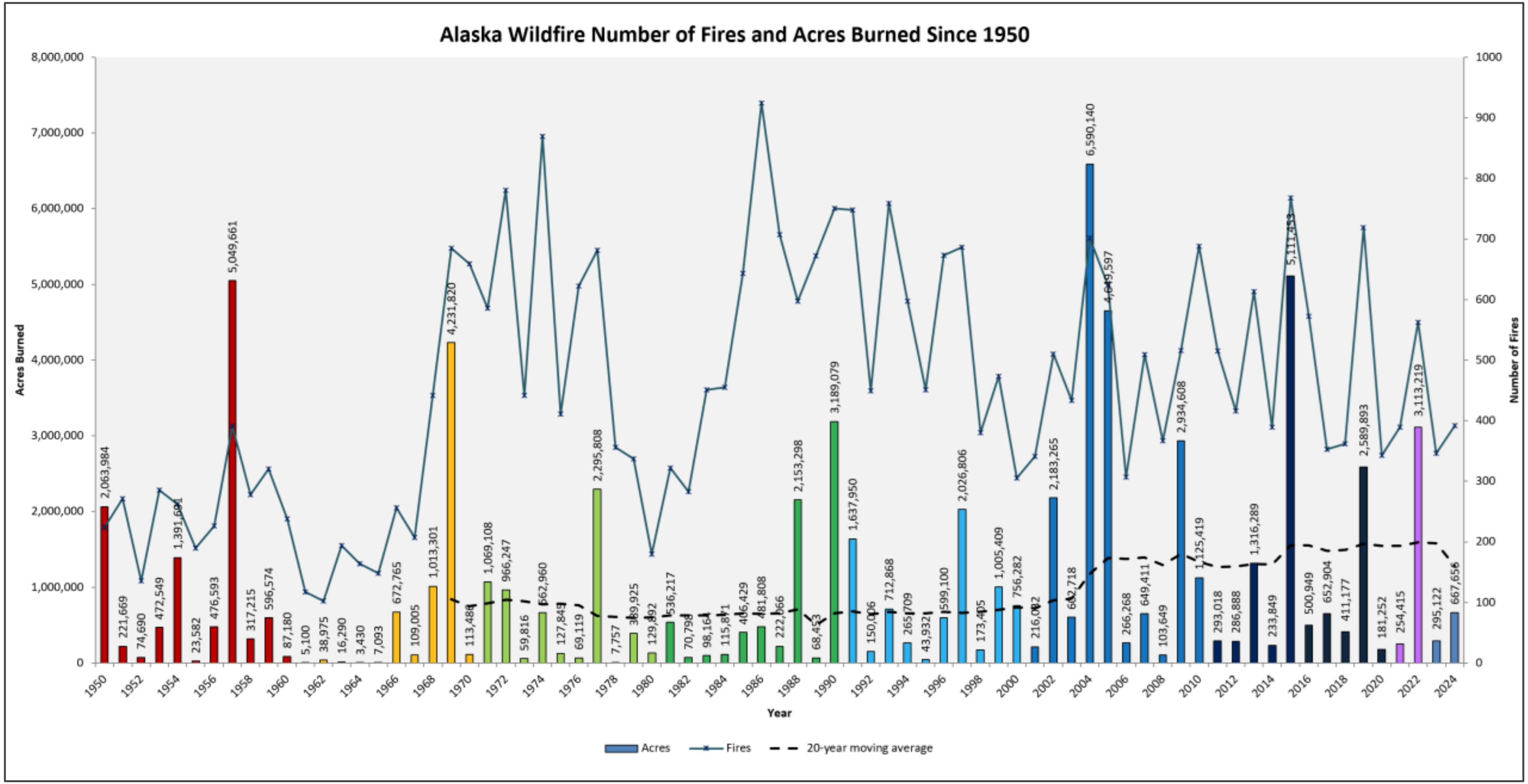
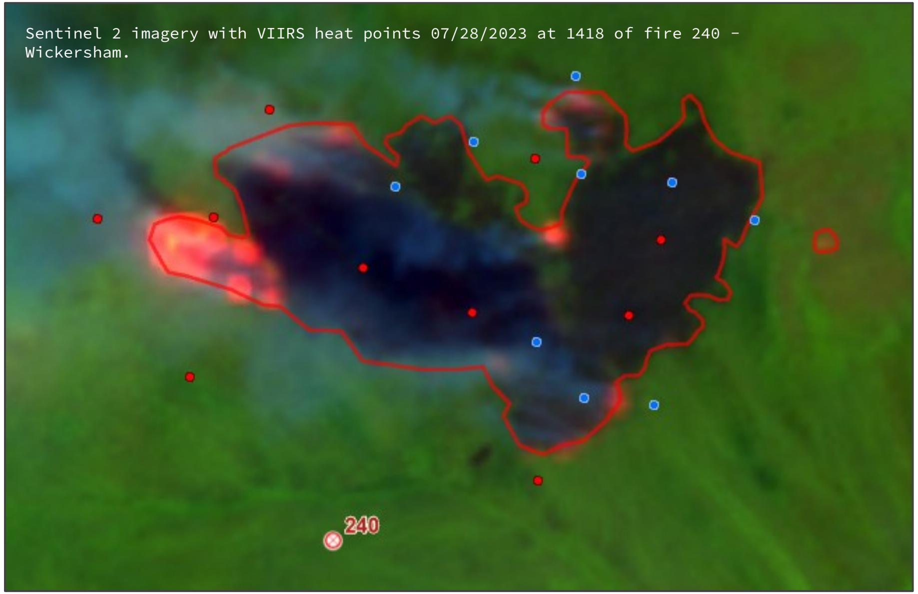
Alaska Fire Season



(Alaska Interagency Coordination Center)

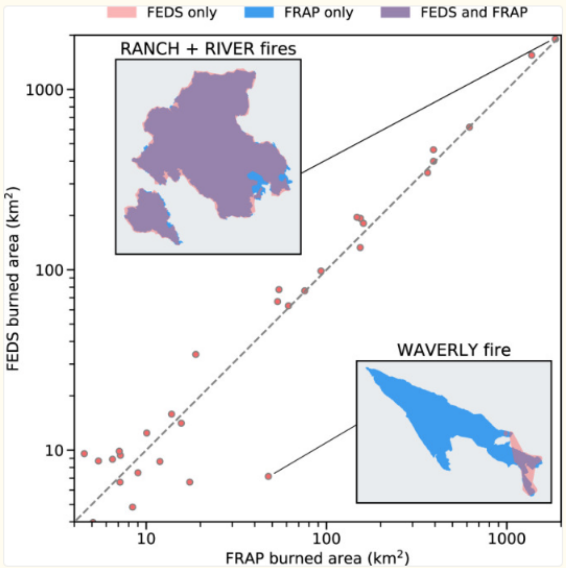
Current Methods of Data Collection



((GINA), 2022, Oliva & Schroeder, 2015, Urbanski et al., 2018)

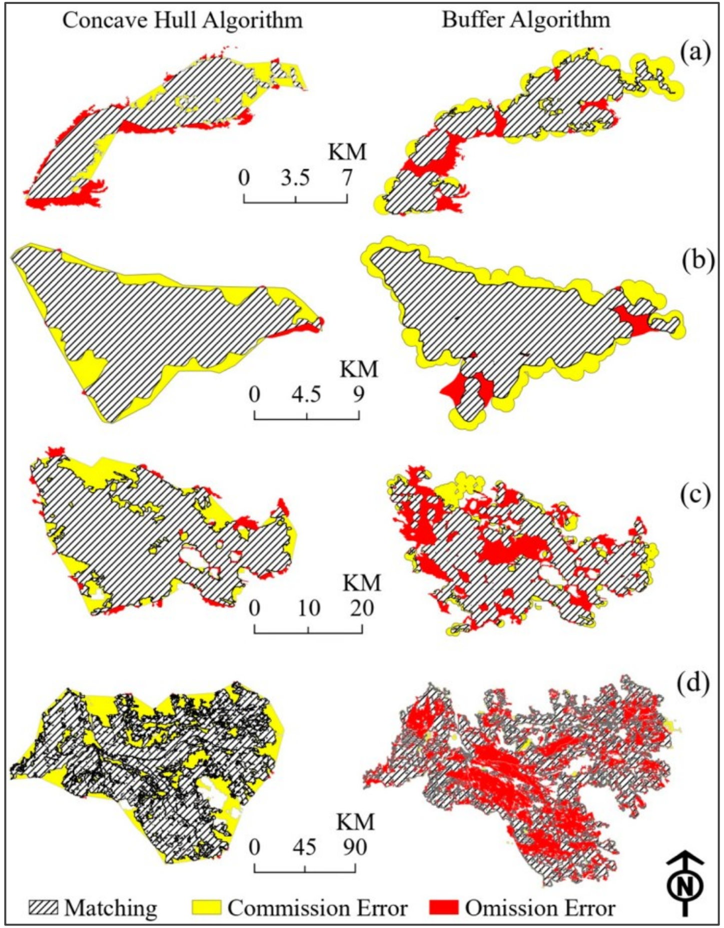
VIIRS Usage for Fire Perimeters

Fig. 7. Comparison of fire perimeter final sizes from the FEDS with FRAP burned area.



Open in a new tab

Each dot represents a large fire (final size > 4 km^2) occurring in California during 2018. Purple areas in inset figures show regions of agreement for the two example wildfires. FEDS fire perimeter generally agrees well with FRAP, but sometimes underestimates the burned area for fast moving grassland fires, such as the Waverly Fire.



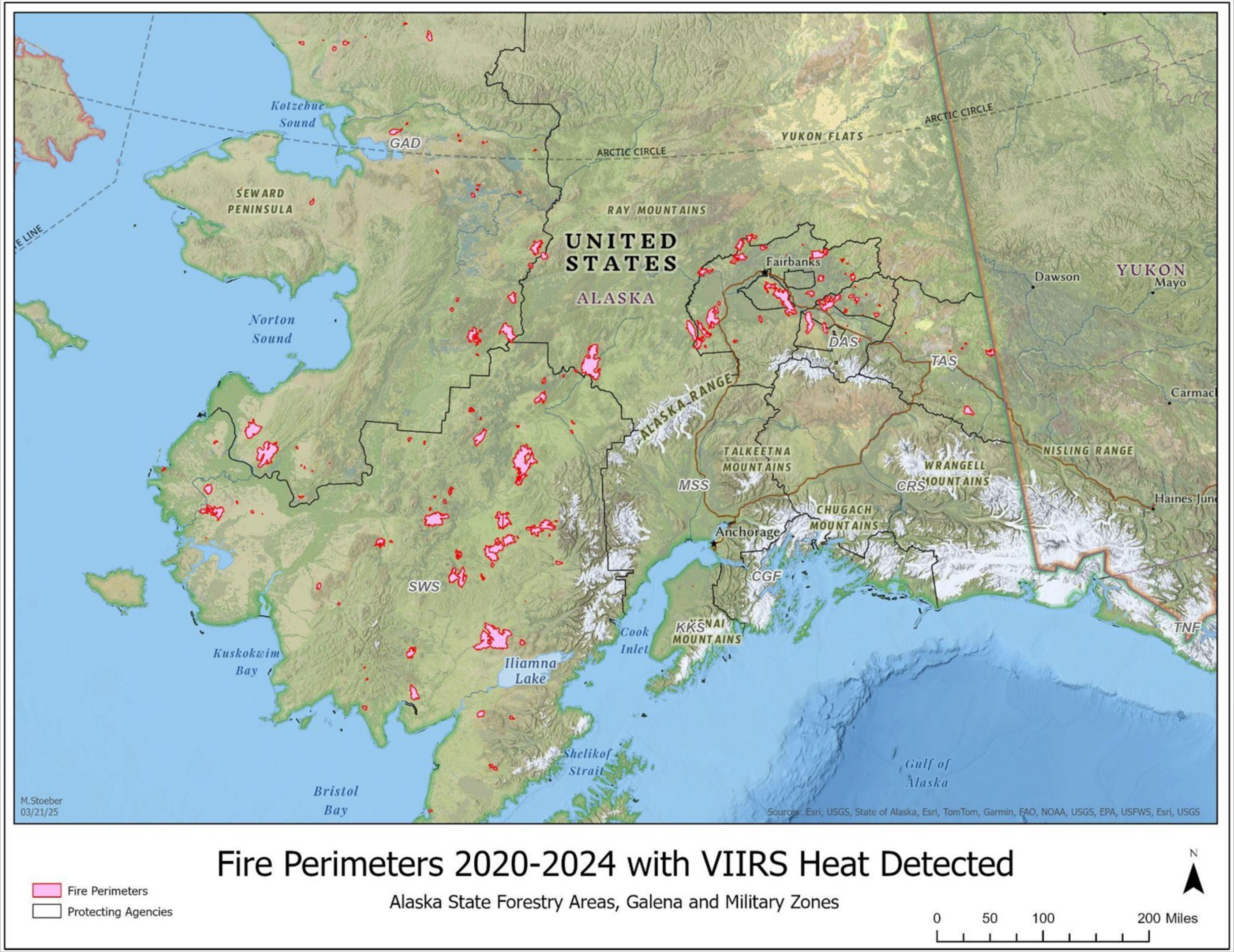
(Bhuian et al., 2024; Chen et al., 2022; Dastour et al.,

Objectives

- ❑ Develop an efficient workflow using VIIRS data to delineate wildland fire burned area perimeters for Fire GIS Specialists.
- ❑ Evaluate the agreement between VIIRS derived polygons and historic Alaskan fire perimeters.

Methods

Study Area


Fire Perimeters 2020-2024 with VIIRS Heat Detected
Alaska State Forestry Areas, Galena and Military Zones
Fire Perimeters
Protecting Agencies
0 50 100 200 Miles
N
M.Stoeber
03/21/25
Sources: Esri, USGS, State of Alaska, Esri, TomTom, Garmin, FAO, NOAA, USGS, EPA, USFWS, Esri, USGS
UNITED STATES
ALASKA
YUKON
Kotzebue Sound
GAD
SEWARD PENINSULA
Norton Sound
ARCTIC CIRCLE
YUKON FLATS
RAY MOUNTAINS
Fairbanks
Dawson
Mayo
DAS
TAS
Carmacks
ALASKA RANGE
TALKEETNA MOUNTAINS
MSS
WRANGELL MOUNTAINS
CRS
NISLING RANGE
Haines Junction
CHUGACH MOUNTAINS
Anchorage
CGF
SWS
KKS
KENAI MOUNTAINS
Cook Inlet
Iliamna Lake
Kuskokwim Bay
TNF
Shelikof Strait
Gulf of Alaska
Bristol Bay

Project Data

Data	Source	Collection Method	Resolution/ File Type
Historic Fire Perimeters	National Incident Fire Center Historic Fire Perimeter Archive	GPS, Infrared Interpretation, Remote Sensing, Imagery Interpretation	Polygon Shapefile
VIIRS Active Fire and Thermal Anomalies product from NOAA-20	NASA/NOAA Suomi National Polar-orbiting Partnership (Suomi NPP) and NOAA-platforms	Polar-Orbiting Satellite	375 m pixel Raster

(GINA, 2022)

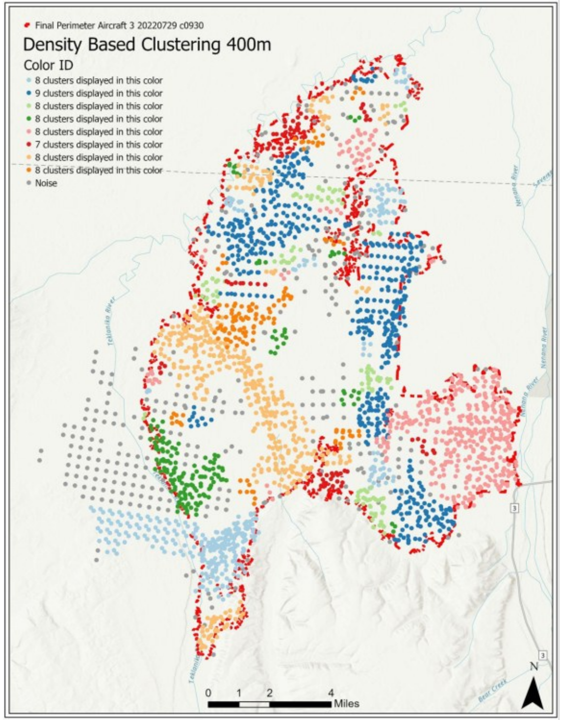
Workflow

Input VIIRS Data	Density-based Clustering	Minimum Bounding Geometry	Two Agreement Inquiries	Intersect over Union
Near-real time (NRT) VIIRS data feed filtered out by confidence. Done to reduce errors in raw data.	Heat points clustered in groups based on proximity and time. Then buffered to 187.5m. To further reduce potential data errors and to replicate pixel resolution.	Convex hull to identify minimum bounding geometry around clusters. Result provides estimate of burned area for this time-step.	Final perimeters around Alaska 2020-2024. And each time step for the 2022 East Fork Fire. To test the difference between total agreement of the lifespan of the fire compared to daily agreement.	For each fire and then for each daily step the difference between the Union and intersecting parts was calculated. To evaluate agreement between the historic fire perimeters and the VIIRS derived polygons.

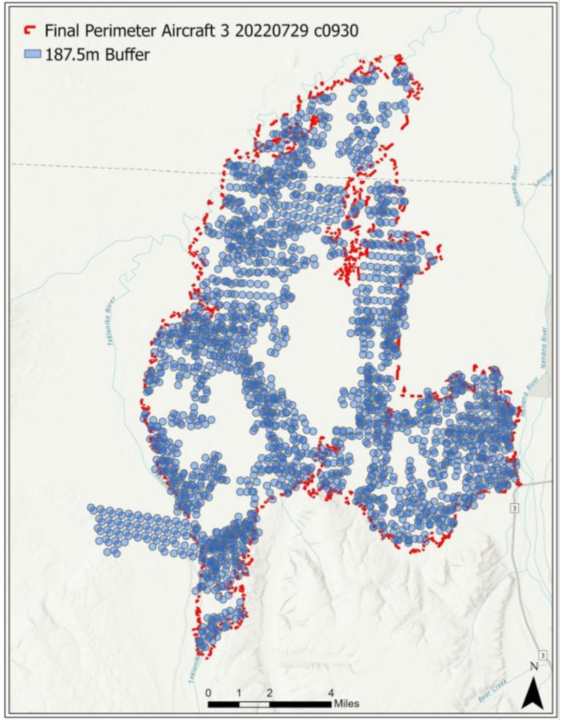
(Chen et al., 2022; Bhuian et al., 2024; Dastour et al., 2024)

Workflow results

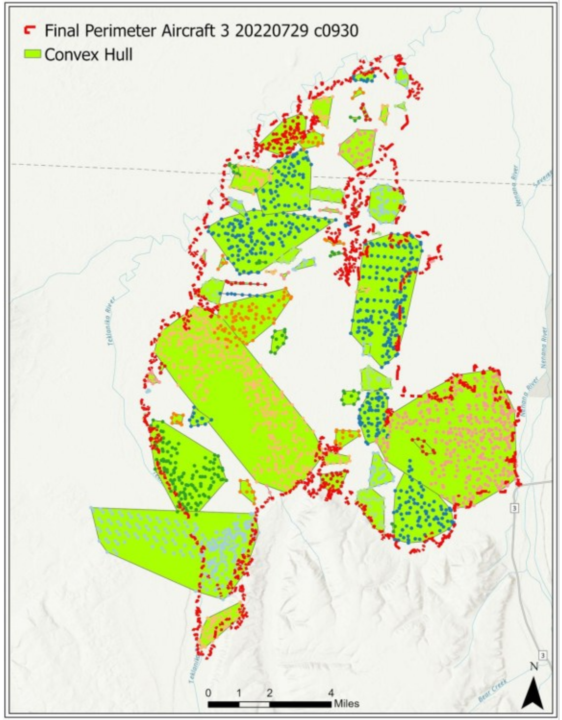
Density Based Clustering Results



187.5M Buffer Results

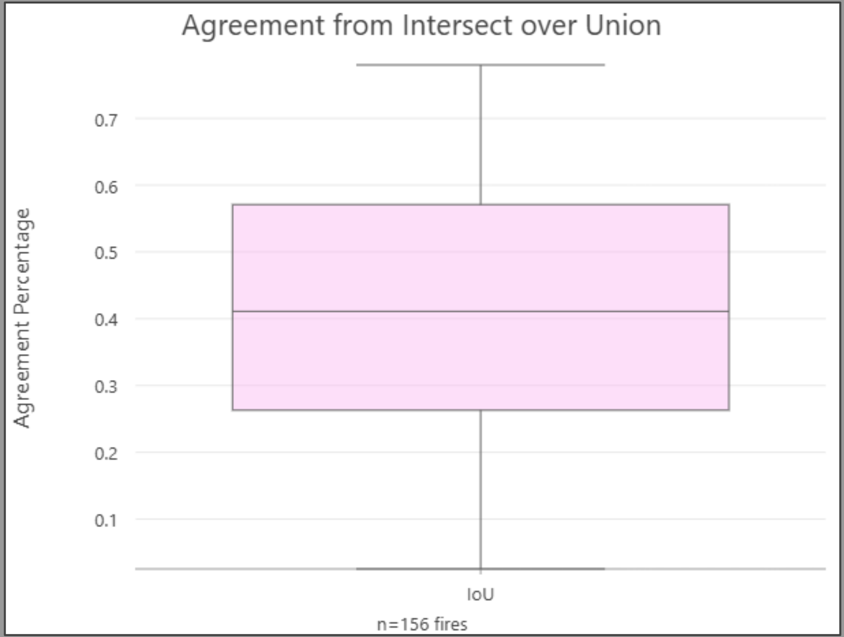


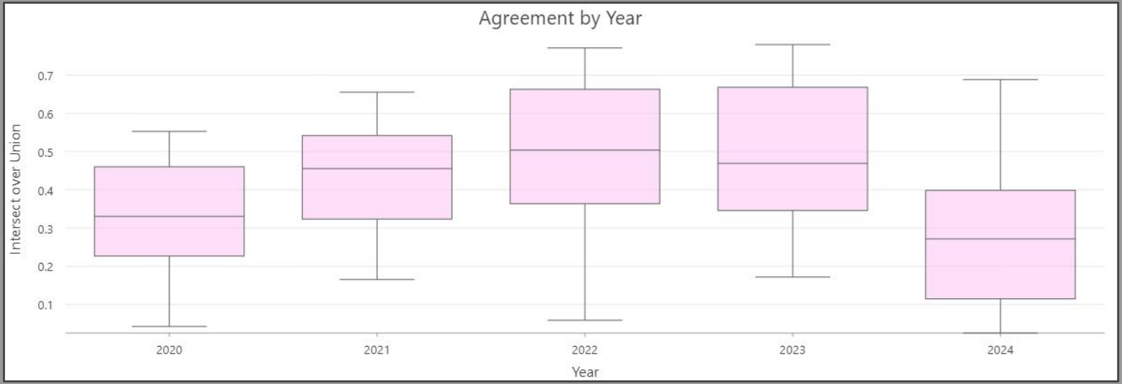
Minimum Bounding Geometry Results

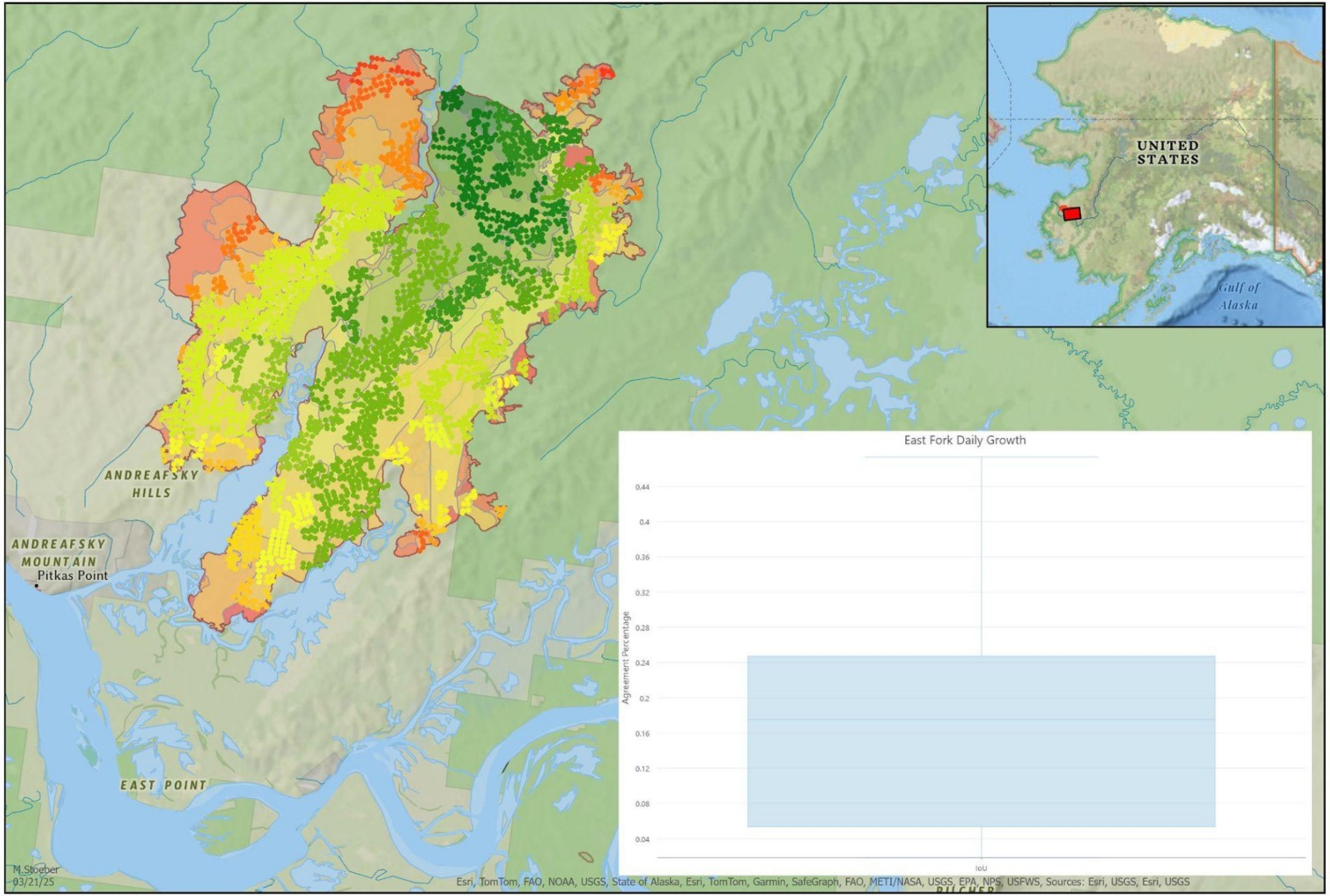


Results

Fires 2020-2024 throughout Alaska







Fire Perimeters
20220601
20220602
20220603
20220604
20220606
20220607
20220608
20220609
20220611
20220612
20220614
20220615
20220616
20220617
20220620

2022 East Fork Fire

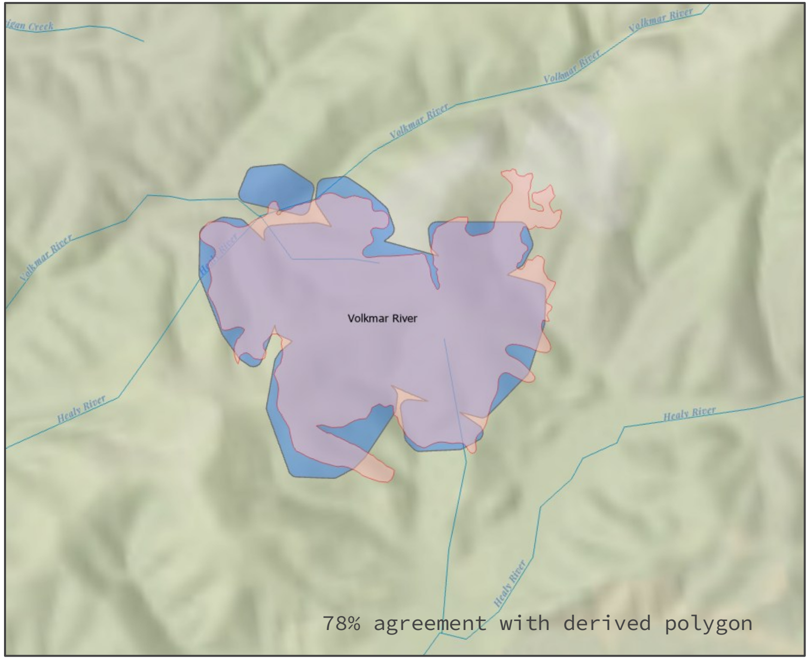
N

0 2.5 5 10 Miles

Discussion

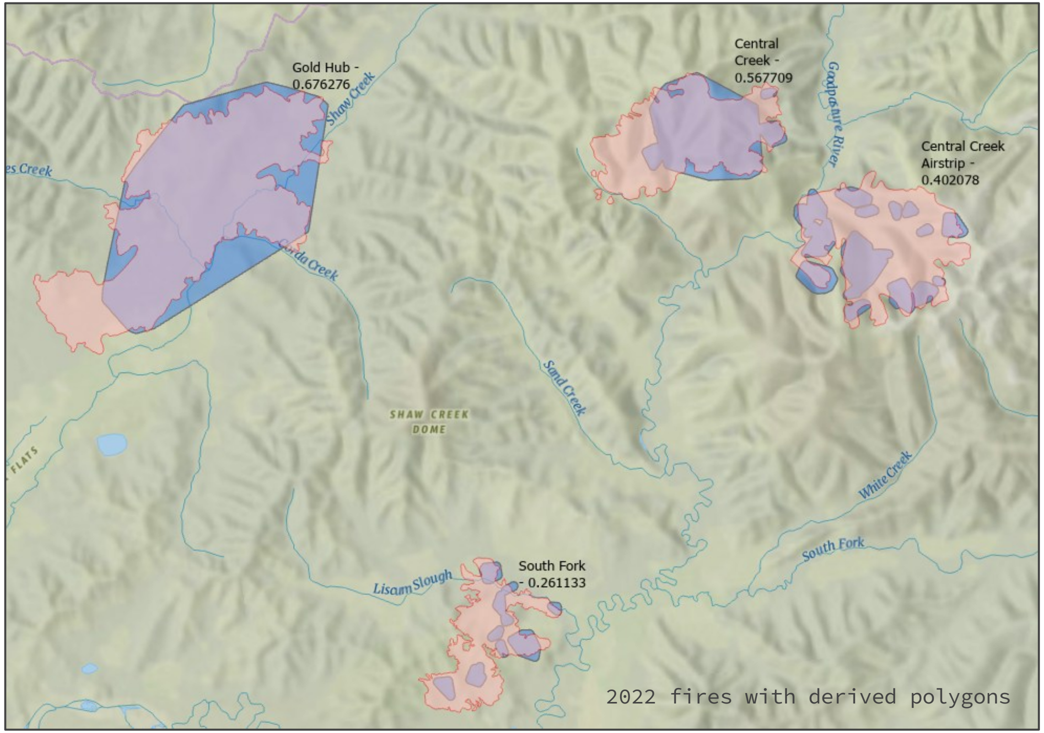
Successes

- Developed an automated workflow to create polygons from VIIRS point data.
- 52 out of 156 fires have agreement greater than 50%.



Challenges

- The derived polygons, when present, approximately coincide with the edges of historic fire data.
- The missing interior VIIRS data greatly reduces the agreement between historic data and derived polygons



Future Work

- Fire season 2025 will serve as a test season for using this process. The script will be completed with an feature service output that will be available through the NIFC AGOL organization.

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