



Forest health conditions in Alaska: A review of recent surveys

*Jason Moan, Forest Health Program Manager
Alaska Division of Forestry*

September 17, 2019



Outline

- Program introduction
- Forest health surveying
- Data availability
- Insects – Bark beetles
- Insects – Defoliators
- Other tree stressors





Alaska Division of Forestry

Forest Health Program

Program
funding
provided
by



- Forest health diagnostics – What is wrong with the trees and shrubs?
- Forest insect management recommendations
- Surveys and monitoring for native and invasive threats
- Investigation of forest insect impacts and improved management technologies
- Outreach and education through presentations, reports, etc.

CONTACTS:

Jason Moan, *Program Manager*
jason.moan@alaska.gov
907-269-8460

Martin Schoofs, *Forest Health Forester*
martin.schoofs@alaska.gov
907-269-8475

How we monitor forest health



Wood-Tikchik State Park
J. Moan, AKDOF



Ground Surveys

- Aerial survey pre-flight recon or post-flight ground checks
- Investigation of ongoing outbreaks, insect behavior, hosts, etc
- Detection and documentation of invasive insect threats
- Documentation of disease progression and severity



Spruce beetle field surveys

- Provide assessments of attack severity, extent, success
- Can provide information on life cycle timing, affected hosts
- Provides localized flight period timing and duration



Aerial Surveys

Cooperative effort between

- USDA Forest Service - Forest Health Protection
- Alaska Division of Forestry - Forest Health Program

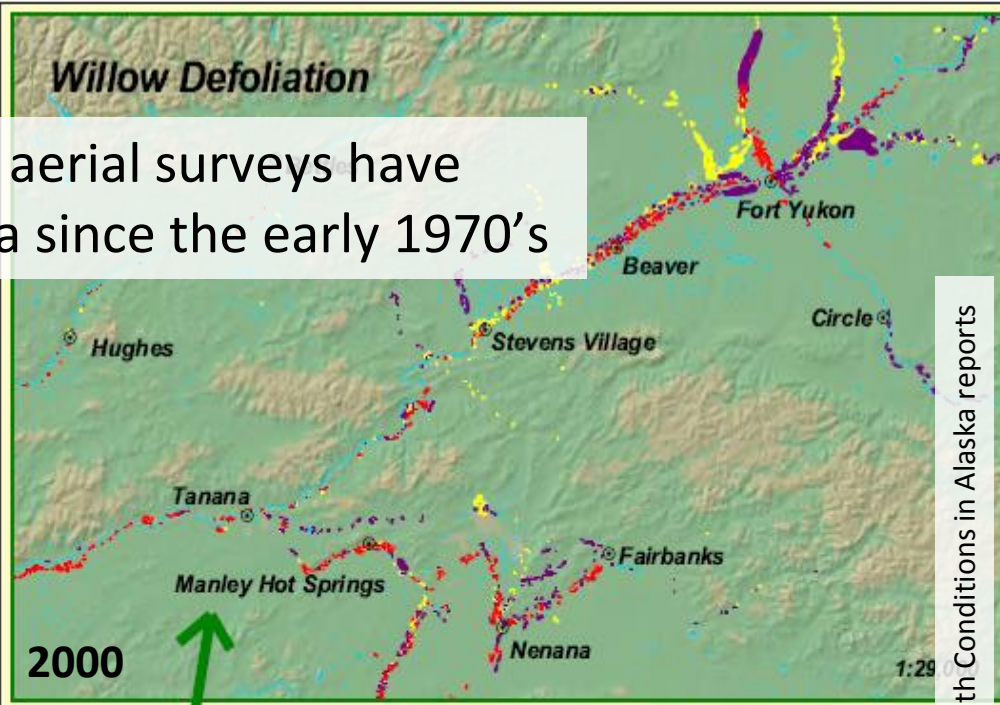
Surveys occur each July and cover
~28-32 million acres statewide annually



1978

4B Dillingham

Forest Health aerial surveys have occurred in Alaska since the early 1970's



Year Mapped

- 2000 Defoliation
- 1999 Defoliation*
- 1998 Defoliation*

* May be masked by subsequent year

Sources: 1998-2000 forest damage from MD Aerial Survey, USFS, FHP & ADNR | USDA Forest Service Forest Health Protection Date Form: 11/20/00

Map by Chris DeWitt

Excerpts from Forest Health Conditions in Alaska reports

Heavy spruce needle rust

SAMSUNG

70% 11:08 AM



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QUICK KEYS LISTS LAYERS

LAT-m	SBR-BS
SBR-WS	SBW-WS-h
SBW-WS-m	SDF-WS-h
SDF-WS-m	Slide-ALL
SMB-INT-h	SMB-INT-m
SPB-WS	WDB-INT
WID-INT-h	WID-INT-m
Wind-ALL	Winter-ALL
WLM-INT-h	WLM-INT-m

Percent of treed area affected:

1-3 4-10 11-29 30-50 > 50

AUTO SAVE

CLR. APPLY



Spruce beetle – Susitna River valley 2016



Spruce aphid - Halibut Cove 2015



J. Moan, AKDOF

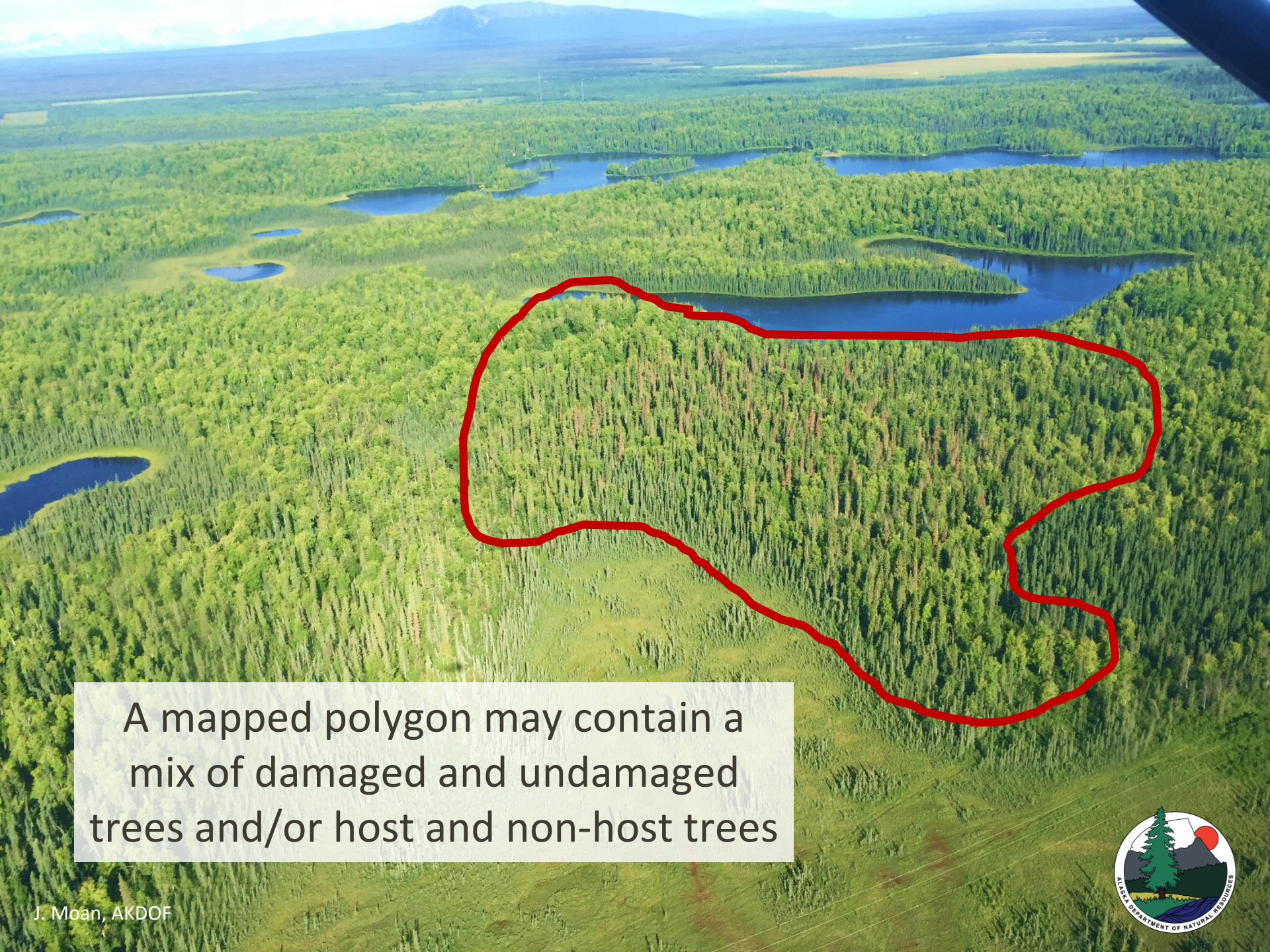


Willow leafblotch miner and dieback – Kandik River 2016

Current year
damage



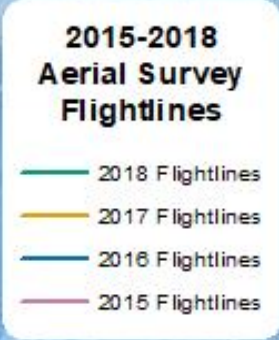
Aspen leafminer – Interior Alaska 2014



A mapped polygon may contain a mix of damaged and undamaged trees and/or host and non-host trees



Treed forest areas are the target, though some shrubland and tundra are flown as well



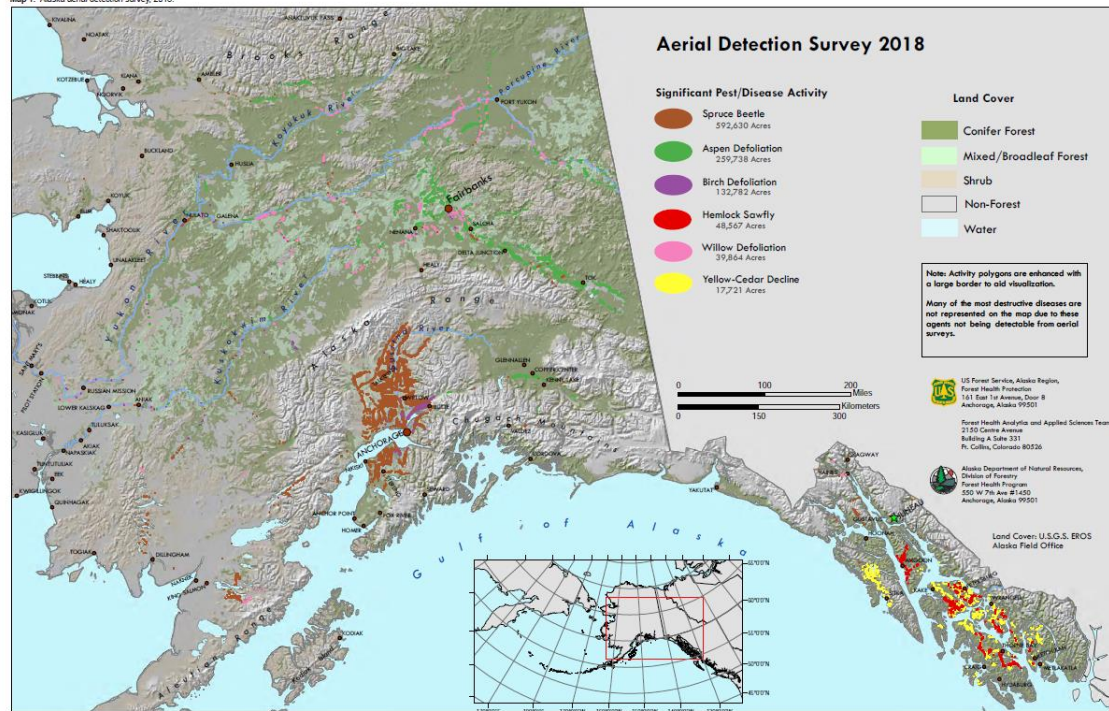
Forest Health Conditions in Alaska - 2018

A Forest Health Protection Report

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/FSEPRD628142.pdf



Map 1. Alaska aerial detection survey, 2018.



GIS data and maps are also available...

Bark Beetles



J. Moan, AKDOF



Spruce beetle



Actual adult size $\approx 1/4''$

L: adapted from UBC Spencer Entomological Collection, R: M. Schoofs, AKDOF



Native to Alaska's spruce forests

*Figure 2 — The geographic
range of the spruce beetle.*

Source: Spruce beetle Forest Insect and Disease Leaflet #127
https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_043099.pdf



Susceptible Host Species

Native

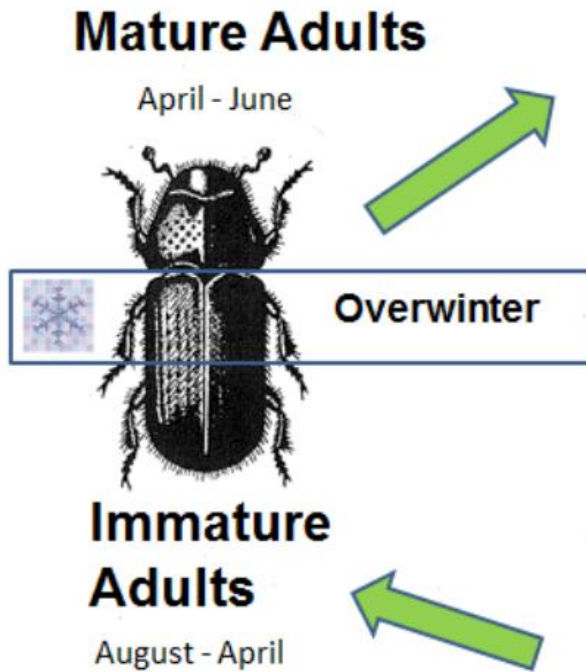
- White spruce
- Lutz spruce
- Sitka spruce
- Black spruce*

Ornamental

- Norway spruce
- Engelmann spruce
- Blue spruce*

* indicates less favored host

Spruce Beetle Life Cycle



Eggs

June



Larvae

July - July



Overwinter

Pupae

July-August

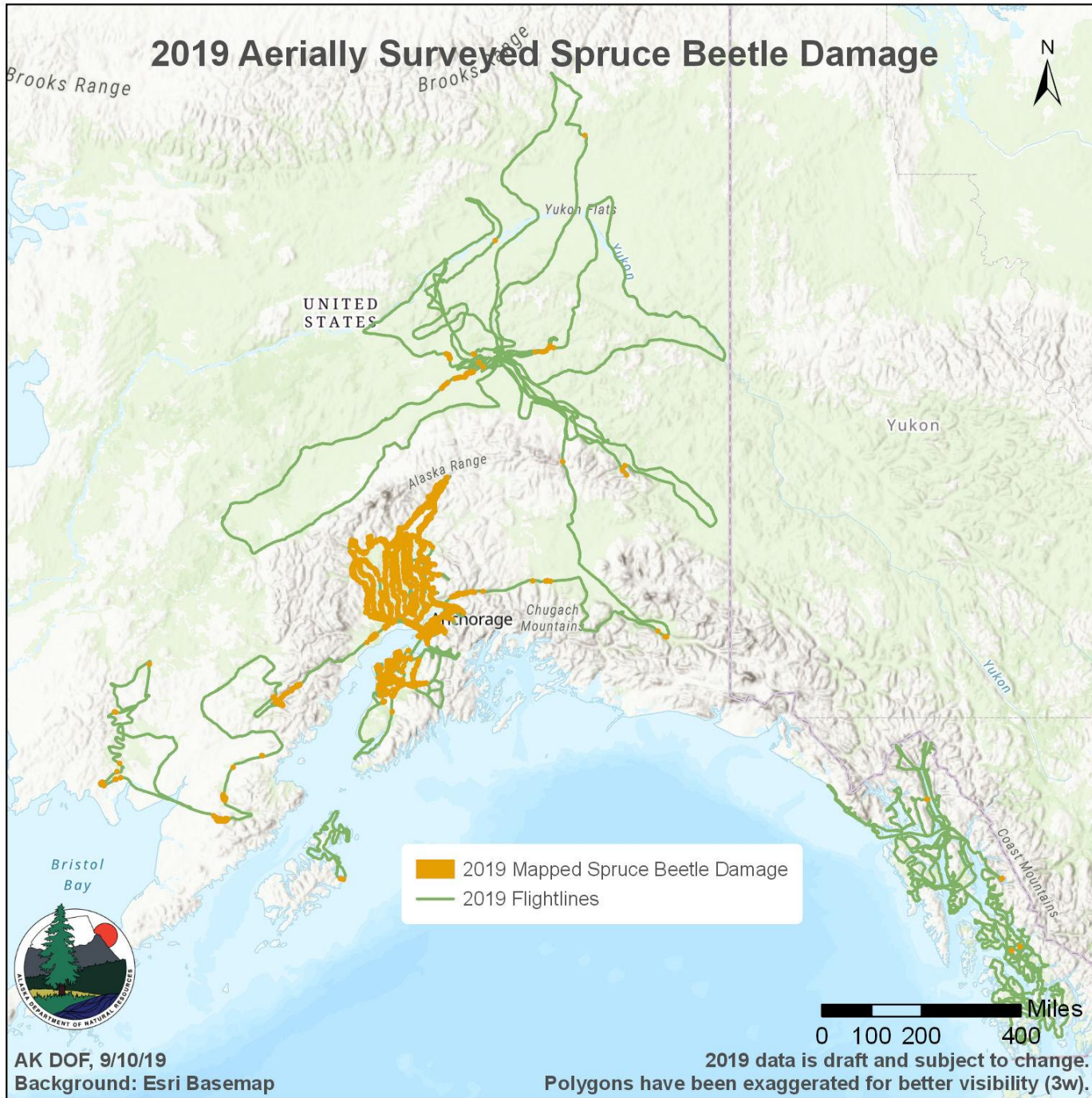


2-year life cycle

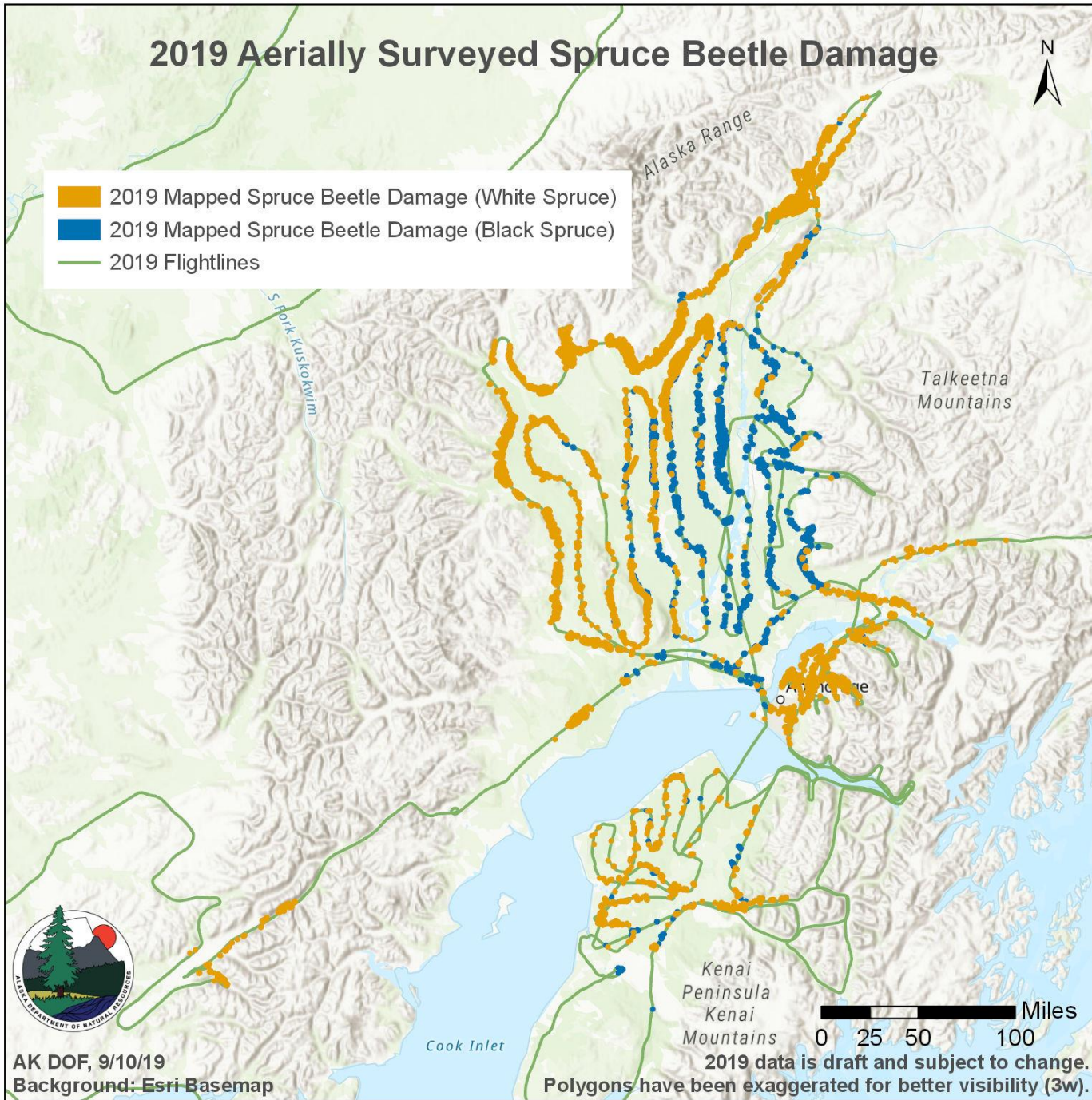
Timing is closely tied to temperature



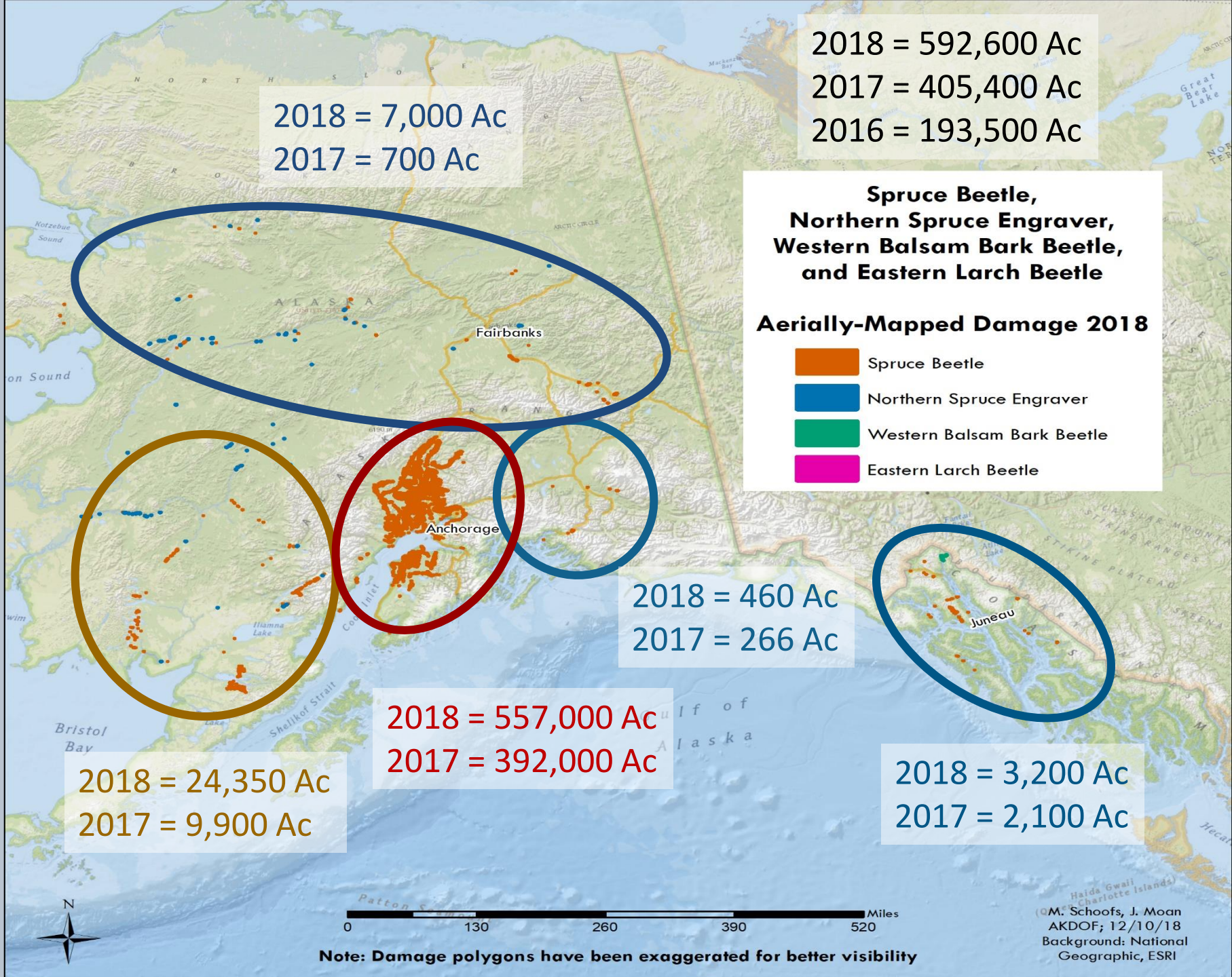
2019 - Spruce beetle Damage DRAFT



2019 - Spruce beetle Damage DRAFT



2018 – Spruce beetle activity



2018 = 7,000 Ac
2017 = 700 Ac

2018 = 592,600 Ac
2017 = 405,400 Ac
2016 = 193,500 Ac

**Spruce Beetle,
Northern Spruce Engraver,
Western Balsam Bark Beetle,
and Eastern Larch Beetle**

Aerially-Mapped Damage 2018

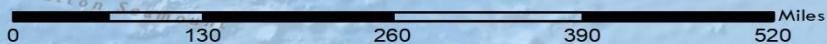
- Spruce Beetle
- Northern Spruce Engraver
- Western Balsam Bark Beetle
- Eastern Larch Beetle

2018 = 24,350 Ac
2017 = 9,900 Ac

2018 = 557,000 Ac
2017 = 392,000 Ac

2018 = 460 Ac
2017 = 266 Ac

2018 = 3,200 Ac
2017 = 2,100 Ac



Note: Damage polygons have been exaggerated for better visibility

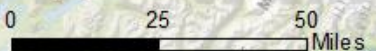
QM: Schoofs, J. Moan
AKDOF; 12/10/18
Background: National Geographic, ESRI

2018 – Spruce beetle activity

2018 Aerially Observed Spruce Beetle Damage



2018 = 557,000 Ac
2017 = 392,000 Ac

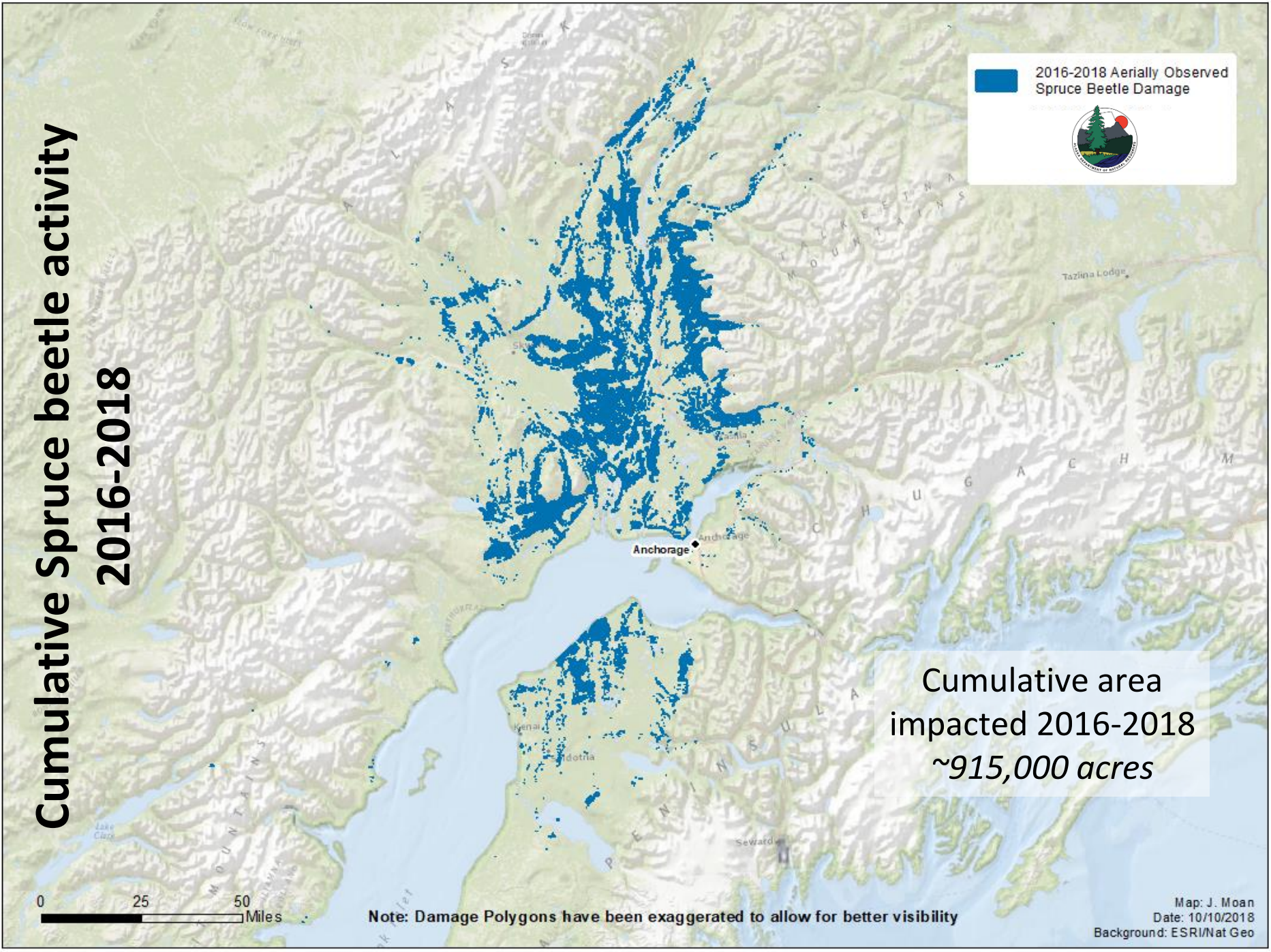


Note: Damage Polygons have been exaggerated to allow for better visibility

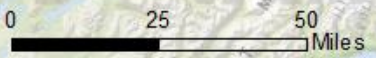
Map: J. Moan
Date: 10/10/2018
Background: ESRI/Nat Geo

Cumulative Spruce beetle activity 2016-2018

2016-2018 Aerially Observed Spruce Beetle Damage



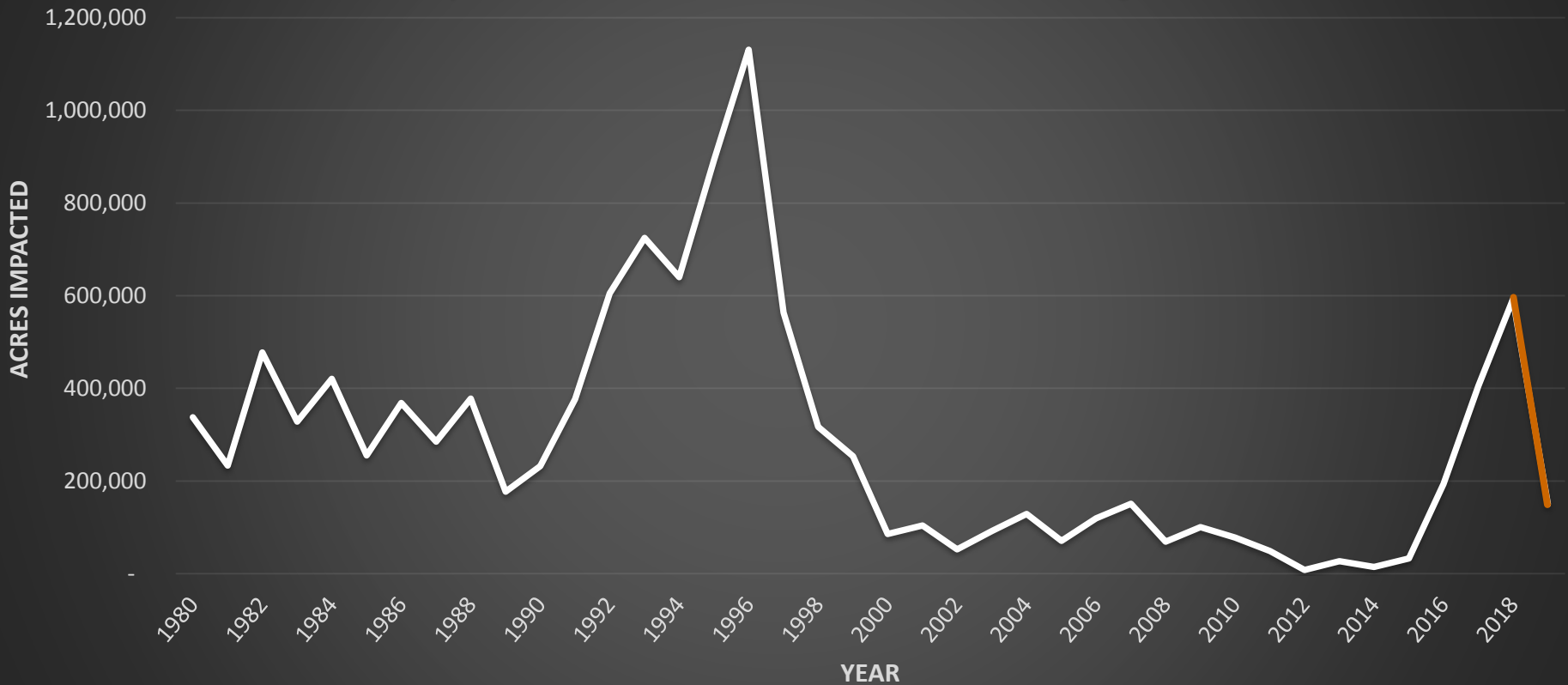
Cumulative area impacted 2016-2018
~915,000 acres



Note: Damage Polygons have been exaggerated to allow for better visibility

Map: J. Moan
Date: 10/10/2018
Background: ESRI/Nat Geo

Spruce beetle - Acres of observed damage 1980-2019*



*** 2019 data is still being processed and is subject to change**



Factors Influencing Outbreak Development

Unmitigated large-scale disturbance

Abundant susceptible host species

Suitable environmental conditions

Factors Influencing Outbreak Decline

Natural predators/disease

Exhaustion of susceptible host

Unfavorable environmental conditions



Possible climate and weather impacts

Potential direct effects of increased temperatures:

Beetle life-cycle timing – Shift from 2-year to 1-year

Earlier spring emergence, longer flight period duration

Better overwinter survival

Possible climate and weather impacts

Potential indirect effects:

Increased tree stress = increased host susceptibility

Moisture, both in excess and in drought, and the seasonal timing of such can impact tree stress

Temperatures can affect tree dormancy timing, duration, and flowering among other factors

Northern spruce engraver *Ips perturbatus* (“Ips”)



Spencer Entomological Collection, Beaty Biodiversity Museum, UBC



Northern spruce engraver *Ips perturbatus*

- Commonly associated with trees and slash stressed by fire, wind, and erosion
- 1-year life cycle
- Typically attack relatively small diameter spruce and tops of large spruce

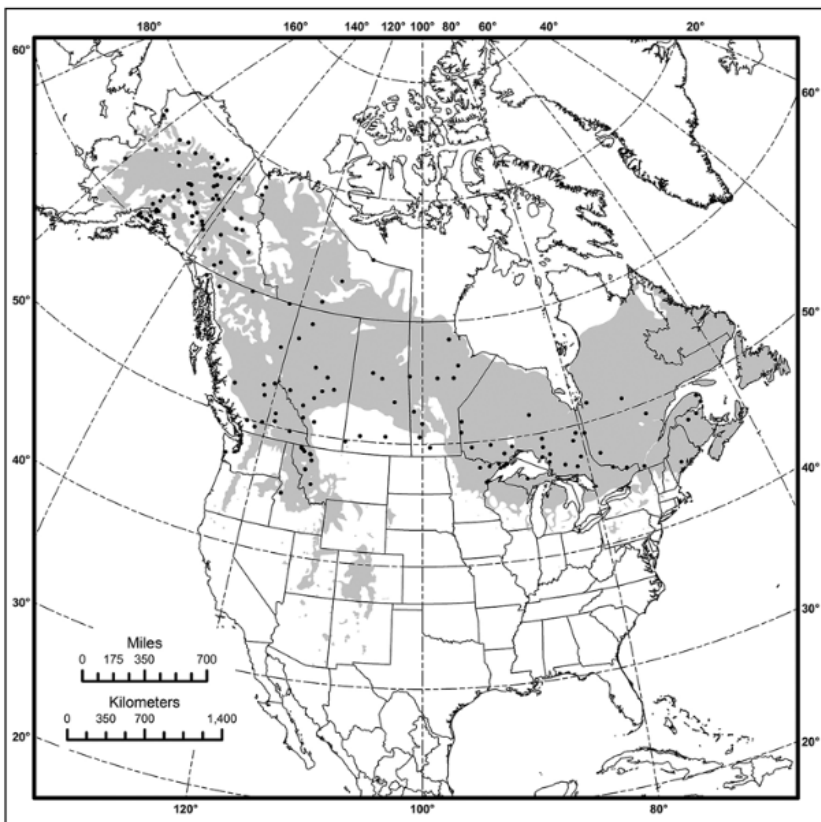


Figure 2. North American distribution of northern spruce engraver (shown as black circles) assembled from historical collection records (Bright 1976, Wood 1982) and pest surveys across the range of its major hosts, white spruce and Engelmann spruce (shown in gray).

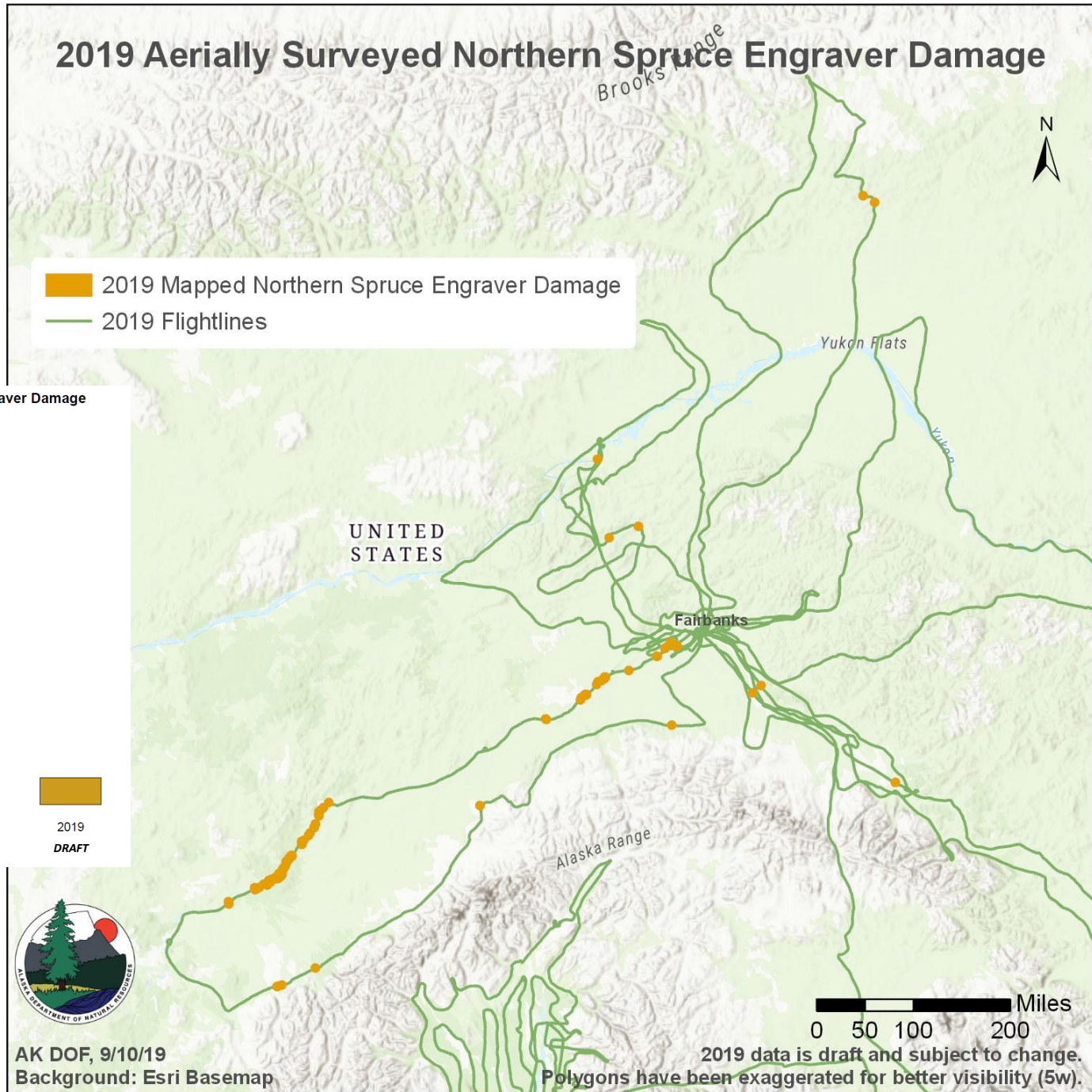
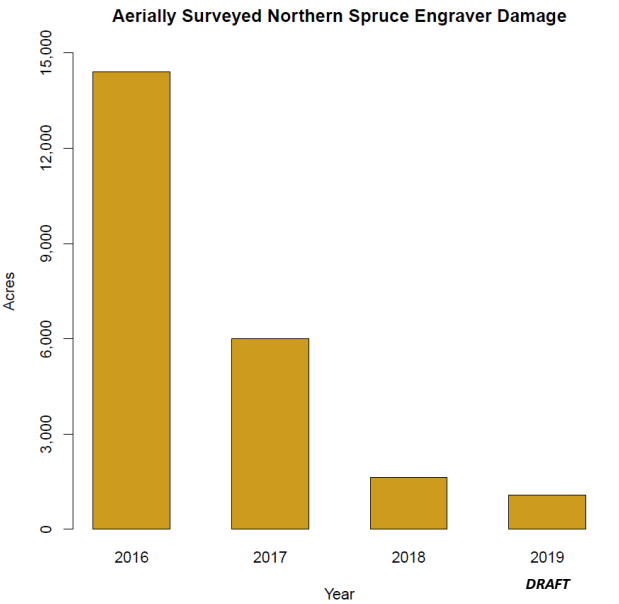
Burnside et al. 2011. Northern Spruce Engraver FIDL 180
<http://forestry.alaska.gov/pdfs/insects/stelprdb5339770.pdf>



2019 Northern spruce engraver

2019 Aerially Surveyed Northern Spruce Engraver Damage

- 2019 Mapped Northern Spruce Engraver Damage
- 2019 Flightlines



AK DOF, 9/10/19
Background: Esri Basemap

Draft Data

Defoliators

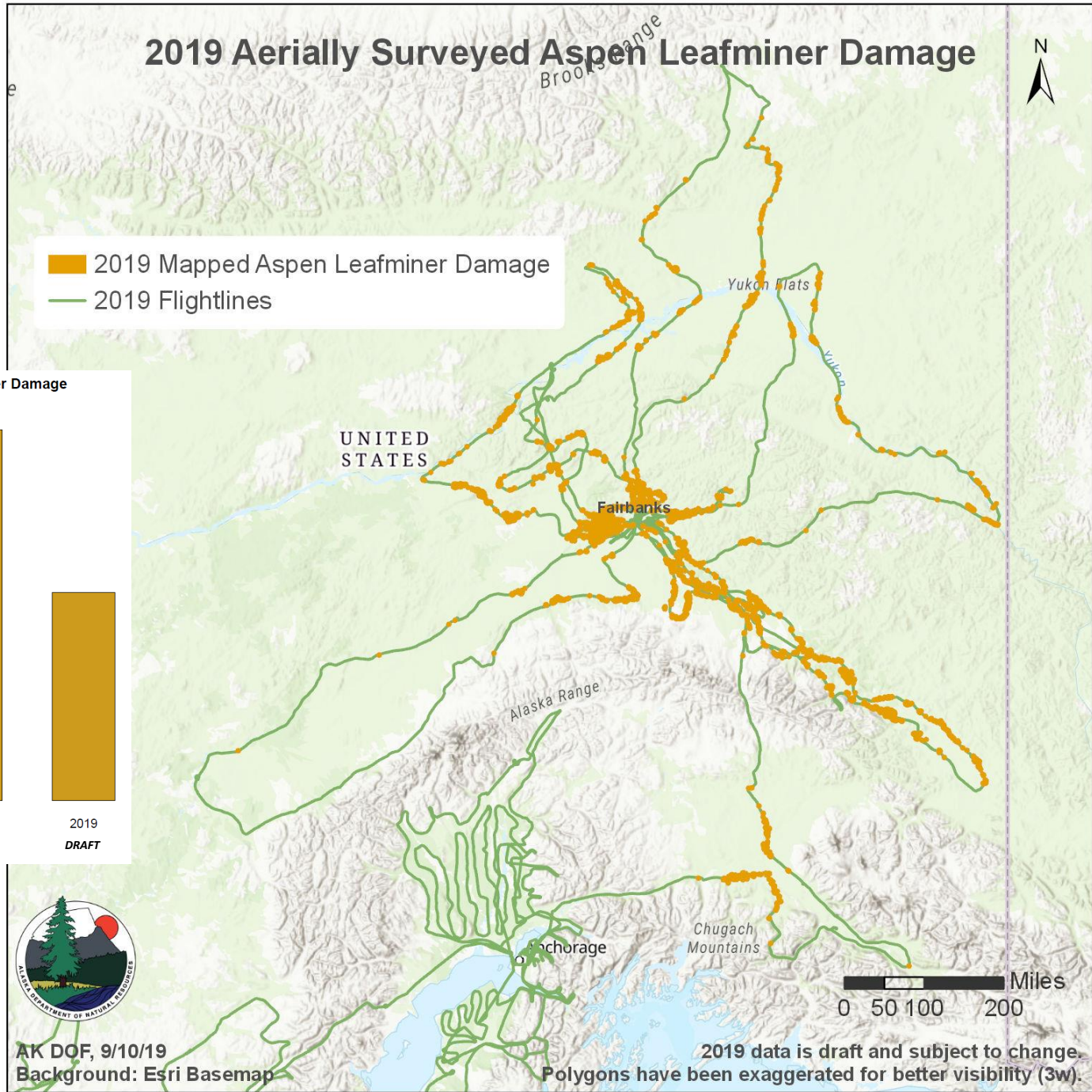
*Insects that feed
on tree leaves*



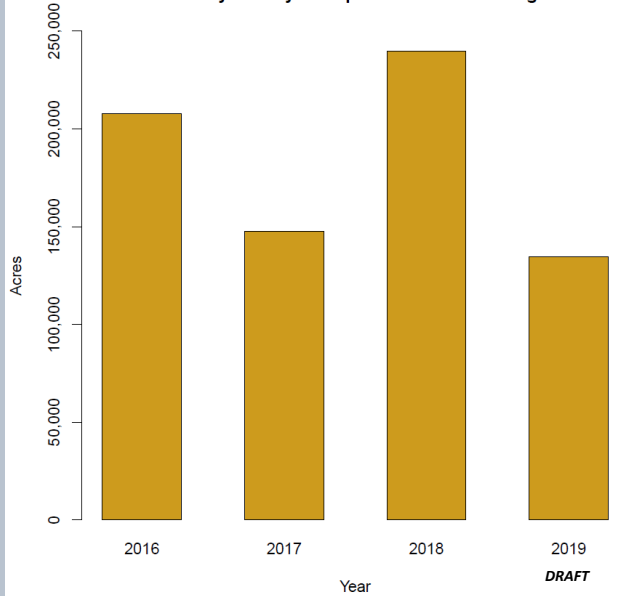
Aspen leafminer



2019 Aspen leafminer



Aerially Surveyed Aspen Leafminer Damage

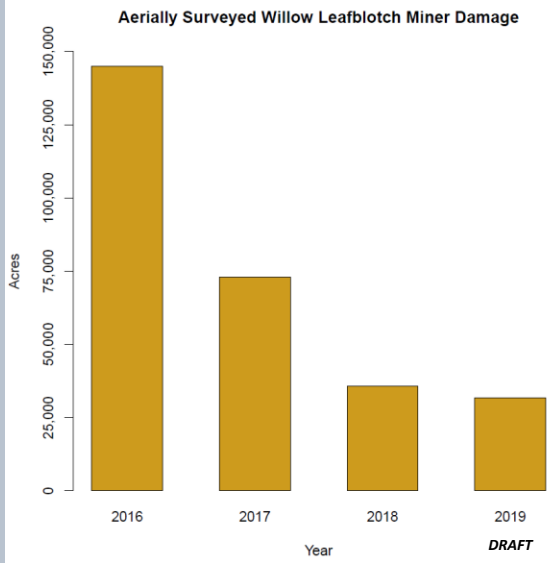
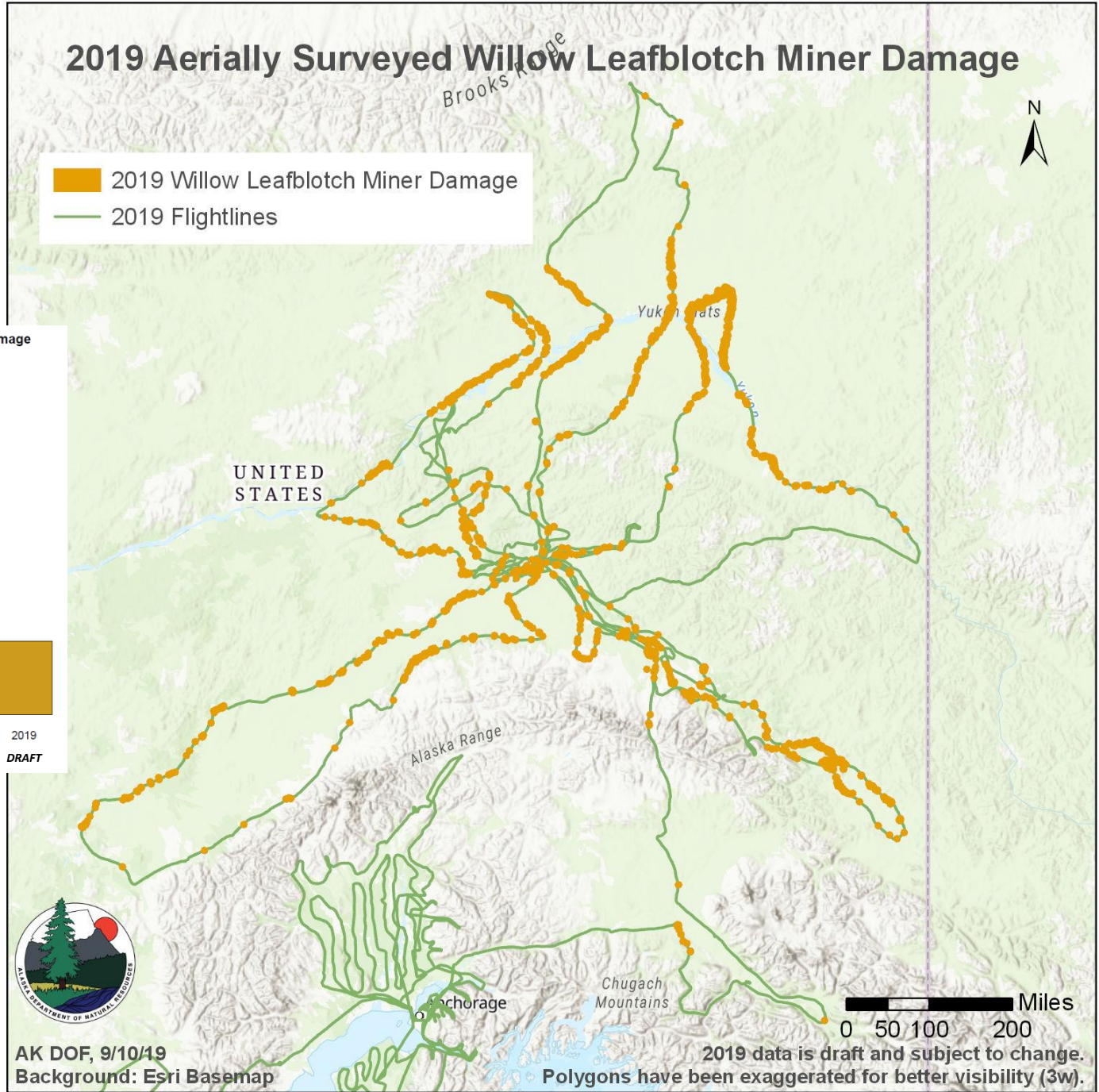


Draft Data

Willow leafblotch miner



2019 Willow leafblotch miner



DRAFT

Draft Data



AK DOF, 9/10/19
 Background: Esri Basemap

2019 data is draft and subject to change.
 Polygons have been exaggerated for better visibility (3w).

Hemlock Sawfly

An aerial photograph of a vast forest on a mountain slope. The forest exhibits a distinct color gradient from the foreground to the background. In the foreground, the trees are a mix of green and yellowish-brown. As the forest extends up the slope, the color shifts to a deep, uniform brown, indicating a significant infestation of Hemlock Sawflies. The background shows a valley with more green forest and some snow patches on the mountain slopes.

Hemlock Sawfly

- Native to Southeast Alaska
- Western hemlock is preferred host but can also feed on mountain hemlock as well as Sitka spruce
- Feed on older foliage
- Occasionally results in top-kill and rarely mortality unless outbreak coincides with western blackheaded budworm
- Outbreak began in 2018 with ~48,000 acres recorded
- Damage skyrocketed in 2019



**2019
Hemlock
Sawfly
*Draft Data***



Spruce Aphid

INVASIVE

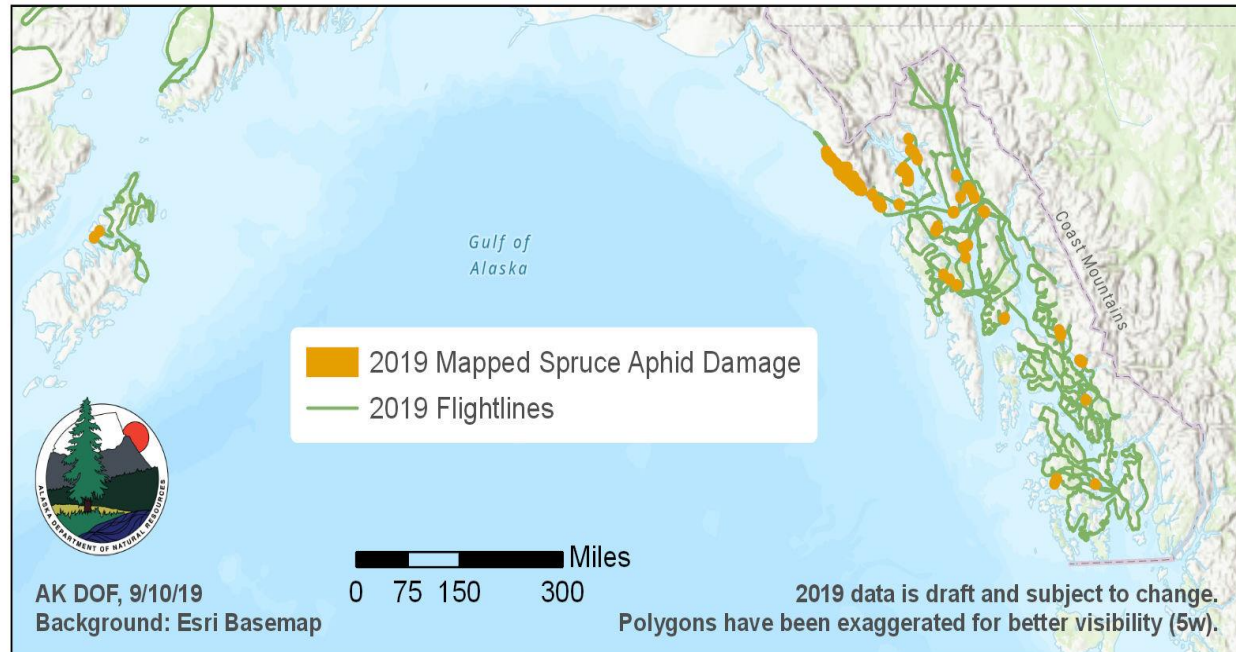
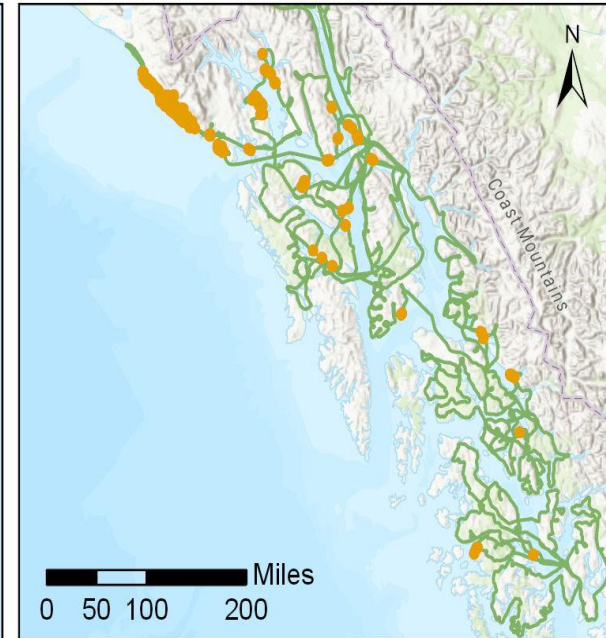
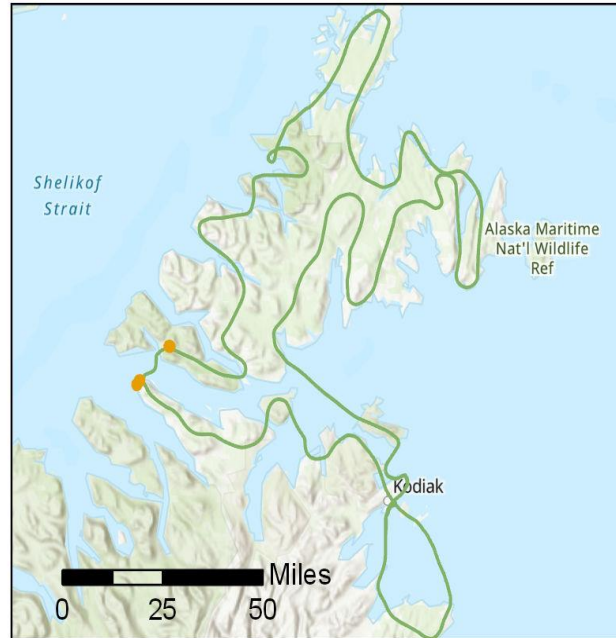
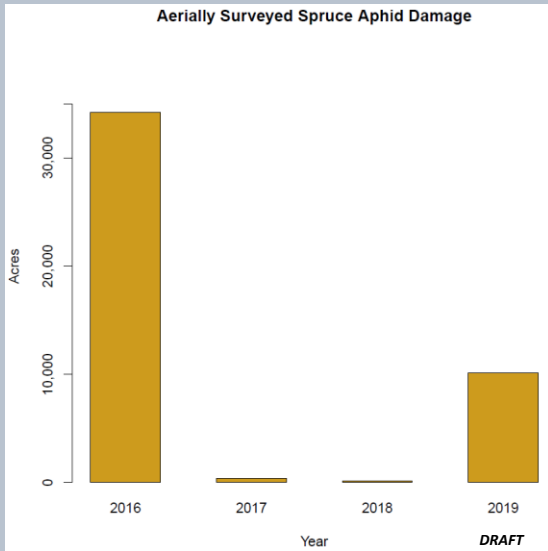
Spruce aphid (*Elatobium abietinum*)

- Native to Europe
- Occurs in Southeast, Kenai, Prince William Sound, Kodiak
- Pest of Sitka spruce in coastal Alaska
- *Highly sensitive to winter temperatures*



2019 Spruce Aphid

2019 Aerially Surveyed Spruce Aphid Damage



Draft Data

Birch leafminers

INVASIVE

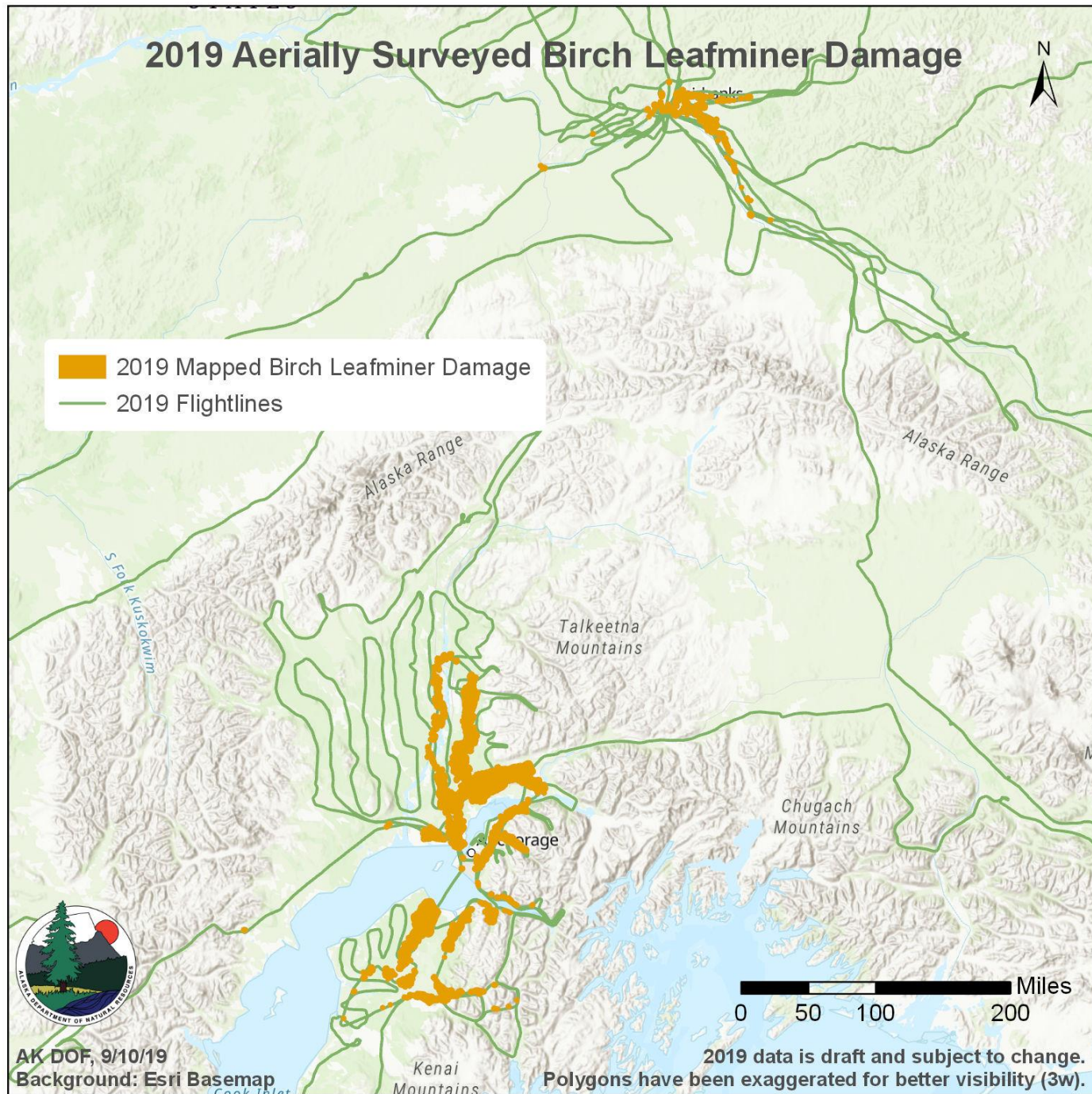


Background: J. Moan AKDOF; Inset L: G. Dubois USFS FHP; Inset R: University of Alberta, E.H. Strickland Entomological Museum

- Amber-marked birch leaf miner
- Late birch leaf edge miner
- Both established in Southcentral Alaska for 10+ years



**2019
Birch
leafminers
Draft Data**



Other Tree Stressors



Spruce needle rust



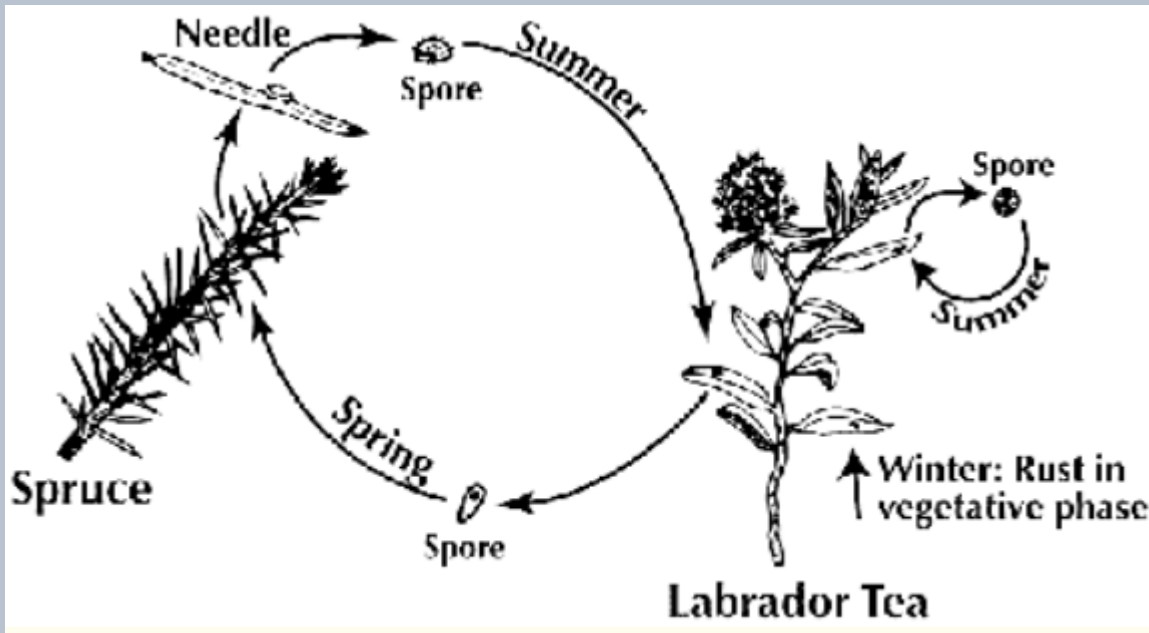
Photos: J. Moan AKDOF

**2019: Observed in Southwest (pictured),
Southcentral, Interior**



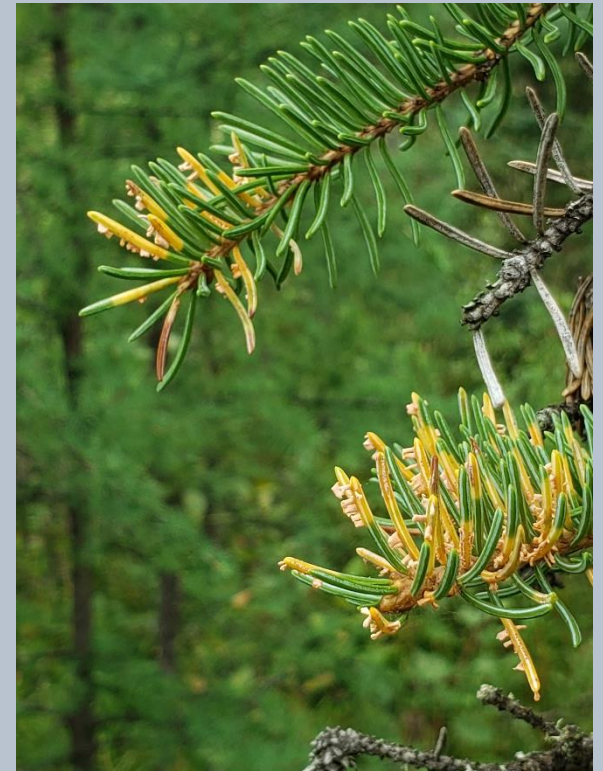
Spruce needle rust

- Affects current year needles only
- Labrador tea is alternate host
- Rarely kills trees
- Damage is mostly aesthetic



Life Cycle

https://www.fs.usda.gov/detail/r10/forest-grasslandhealth/?cid=fsbdev2_038417



J. Moan AKDOF



**2019
Spruce
needle rust
*Draft Data***



Balsam woolly adelgid

INVASIVE



UGA1510051

- Pest of true firs
 - Subalpine fir
 - Pacific silver fir
- Causes gouting and eventual tree death
- Established in Pacific Northwest and Appalachian mountains
- **First find in Alaska: Juneau 2019**

UGA1510053



Balsam woolly adelgid

INVASIVE



**Please keep an eye out in
Southeast communities!**

Background Photos: E Graham, USFS FHP; Inset: J. Moan, AKDOF



Thanks! Contributors to this presentation:

- Martin Schoofs, Alaska Division of Forestry - Forest Health
- Elizabeth Graham, US Forest Service - Forest Health Protection Entomologist
- Robin Mulvey, US Forest Service - Forest Health Protection Pathologist



www.Alaskasprucebeetle.org

Spruce Beetle in Alaska's Forests

Jason Moan

Forest Health Program Manager

Alaska Division of Forestry

Jason.Moan@alaska.gov

Program
funding
provided by

