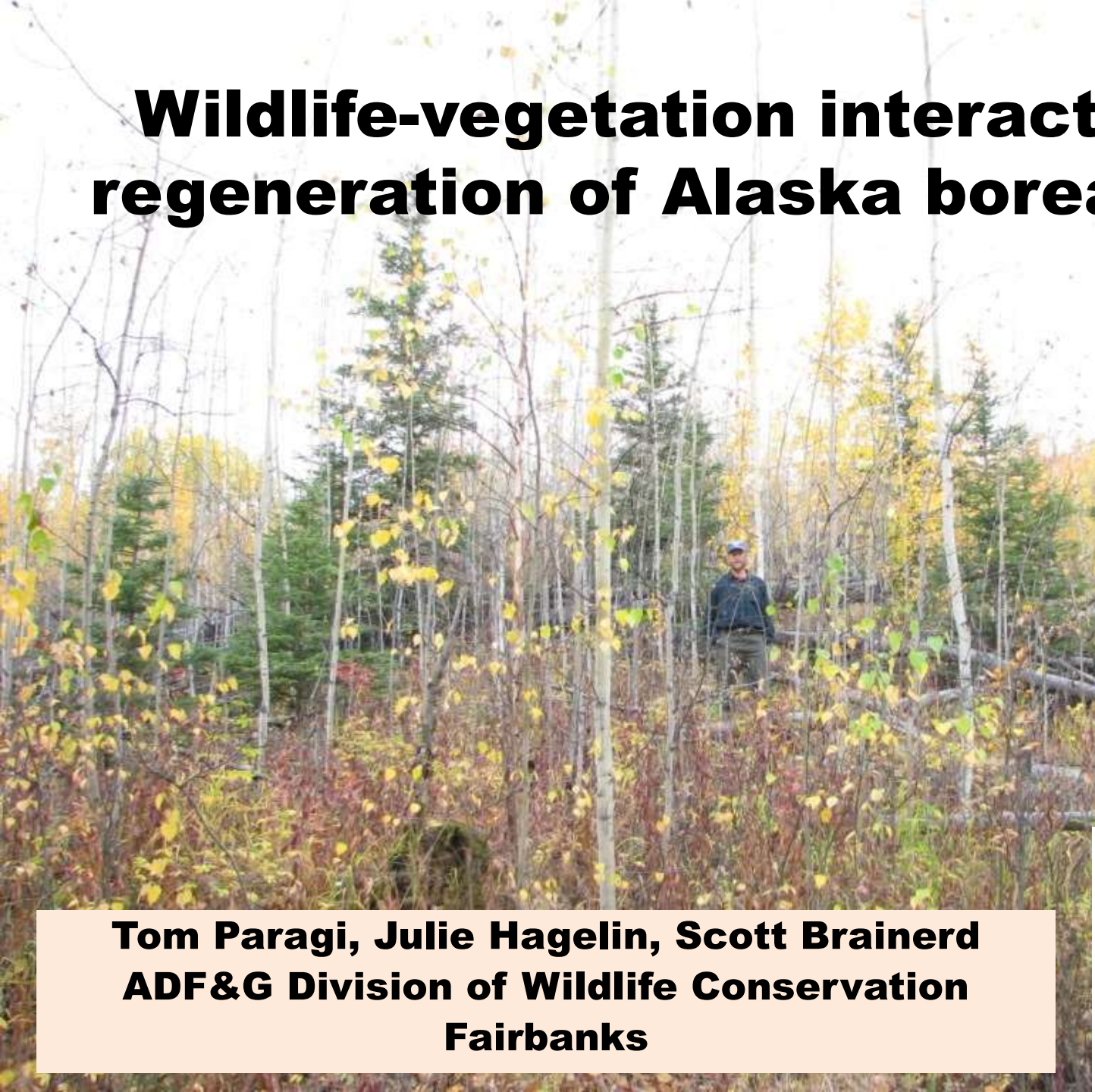
Wildlife-vegetation interactions in regeneration of Alaska boreal forest



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Presentation outline

1. Wildlife roles in forest regeneration

2. Potential effects of regeneration practices on wildlife abundance

3. Ecological context of “site” and “time” in regen. practices and monitoring

Recovery

Altered structure

Wildlife

+, -

Wildlife effects

+, -

Habitat effects

1. Wildlife roles in forest regeneration

- Herbivory and seed predation (--)
- Fungal inoculation (+)
- Predation on herbivores (+)
- Concept of “damage”

Flying squirrel eating truffle fungus

Bark removal by voles

Northern hawk owl

Herbivory during stand initiation (seedlings)

Bill Casselman

Slater Museum

***Clethrionomys rutilis*, *Tamiasciurus hudsonicus* (forest)**

Seed predation

***Microtus* spp. (grassland)**

Bark removal*
<u>Root</u> removal

***Lepus americanus* (forest/shrub)**

Twig clipping
Bark removal*

***girdling = mortality**

Herbivory during stem exclusion (saplings)

- Tree stocking density
- Tree species composition

Lepus americanus

Twig clipping,
Bark removal

Coniferous and Deciduous

Alces alces

Leaf stripping,
Twig clipping,
Stem breakage

“Deciduous “ (pine in AK?)

Herbivory of crop trees

Rateeveryanimal

Erethizon dorsatum

Bark removal

Bilblescienceguy

Castor canadensis

Felling for bark removal

Alces alces

Bark removal

Herbivore effects on trees: individuals vs. population

Trees

- Stress (predisposition)—winter browsing worse for conifers
- Height and radial growth rates—compensation (+) ?
- Growth form (defect)
- Wood properties (stain)

Stands

- Differential species mortality affects composition (+) ?
- Stumpage by tree species (+) ?
- Reduced litter fall lowers soil nitrogen

Generally positive correlation of herbivore density and tree / stand effects, but site factors have influence

- Ground cover, woody debris, and understory vegetation influence habitat use (predation risk)
- Forage selection -- a mixture of tree species (and sizes) receives unequal risk of herbivory
- Small patches of "forage" in matrix of mature forest may be heavily affected even at low hare / moose density
- Caution on translating findings from Eurasia to Alaska
  - dominance of intensive pine forestry in Fennoscandia
  - if few mountain hares, microtine rodents important (snowshoe hare dominant in N.A. boreal ecosystem)

Managing herbivore abundance to maximize tree regeneration

Natural history traits of abundance regulation

r-selected

- Large, multiple litters annually
- Short lived, variable abundance ("cycles")

K-selected

- 1-3 young
- 1+ yr. maturity
- Long lived

Public interest in harvesting

Low

High

Facts ➡ Ecological effects ➡ Herbivore "damage"

Science

Ecological effects
individual tree events translate to changes in abundance or biomass at stand level

Management

Herbivore "damage"
changes in abundance or biomass are judged to be an economic liability warranting mitigation (no longer tolerable)

Defining "damage" requires an explicit definition of silvicultural objective(s) for context:

"Stocking density and size of ≥1 tree species at rotation age"

Soil inoculation with mycorrhizal fungi following disturbance (stand initiation)

Flying squirrel digging truffle

Glacomys sabrinus

Feeding on "truffles" (hypogeous fungi)

Images Slater Museum

2. Potential effects of forest regeneration practices on wildlife abundance

- **Habitat (arrangement of food, cover, and structure)**
  ⟶ wildlife fitness

- **Cover: prey protection**
- **Structure: predator advantage**

- **Maintaining fungal dispersers and herbivore predators**
  - **resilience to short-term disturbance**
  - **adaptation to long-term change**

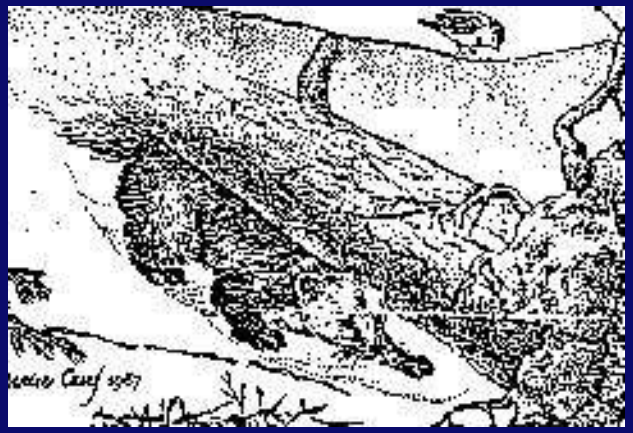
Task force report on sustaining long-term forest health and productivity (SAF 1993:14)

Maintain habitat of predators on voles, hares, and potentially detrimental insects

Northern goshawk (nest)

Great gray owl (nest with young)

Olive-sided flycatcher (hunting perch)



Marten (subnivean access)

Northern flicker (cavity nest)

Beneficial wildlife effects in forest regeneration and health

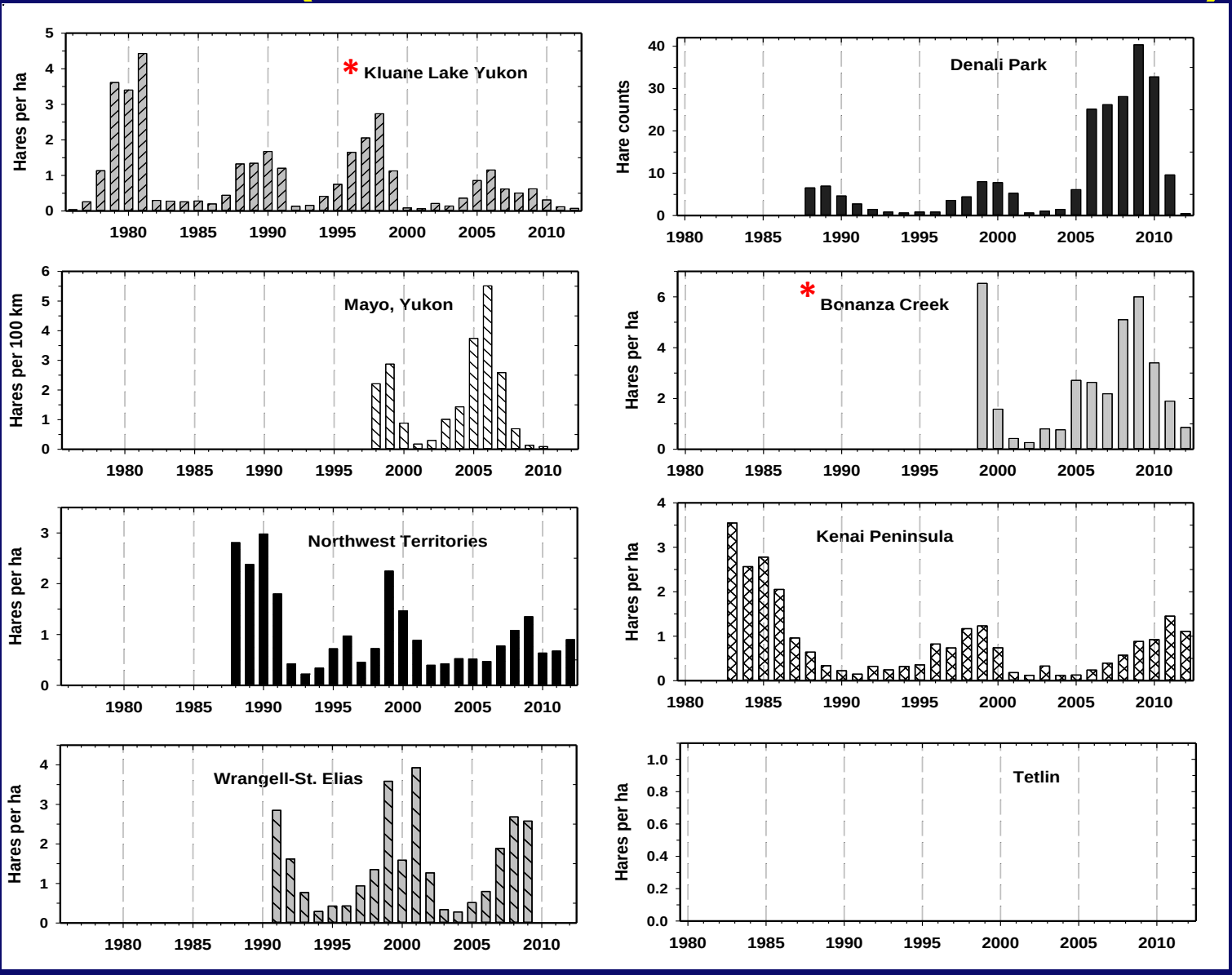
- Jacobs and Louma 2008: Lesser degrees of tree retention in PNW reduced fungal spores in small mammal diets. “Island” retention for small mammal and fungi refugia benefits micorrhizal inoculation

- Huitu et al. 2012: Reducing vole damage in Fennoscandia reforestation
  - Avoid peak vole years for planting; use enough larger seedlings
  - Use variable-retention instead of clearcut (less grass cover, forage)

- Fayt et al. 2005: Empirical observations, exclosure experiments, and modelling all suggested that woodpeckers (esp. 3-toed WP, occurs in AK) play a significant role in regulating bark beetle populations

- Mantyla et al. 2011: Meta-analysis (tropical, temperate, boreal) indicated sapling and mature plant biomass positively correlated to presence of avian predators (insectivores, carnivores)

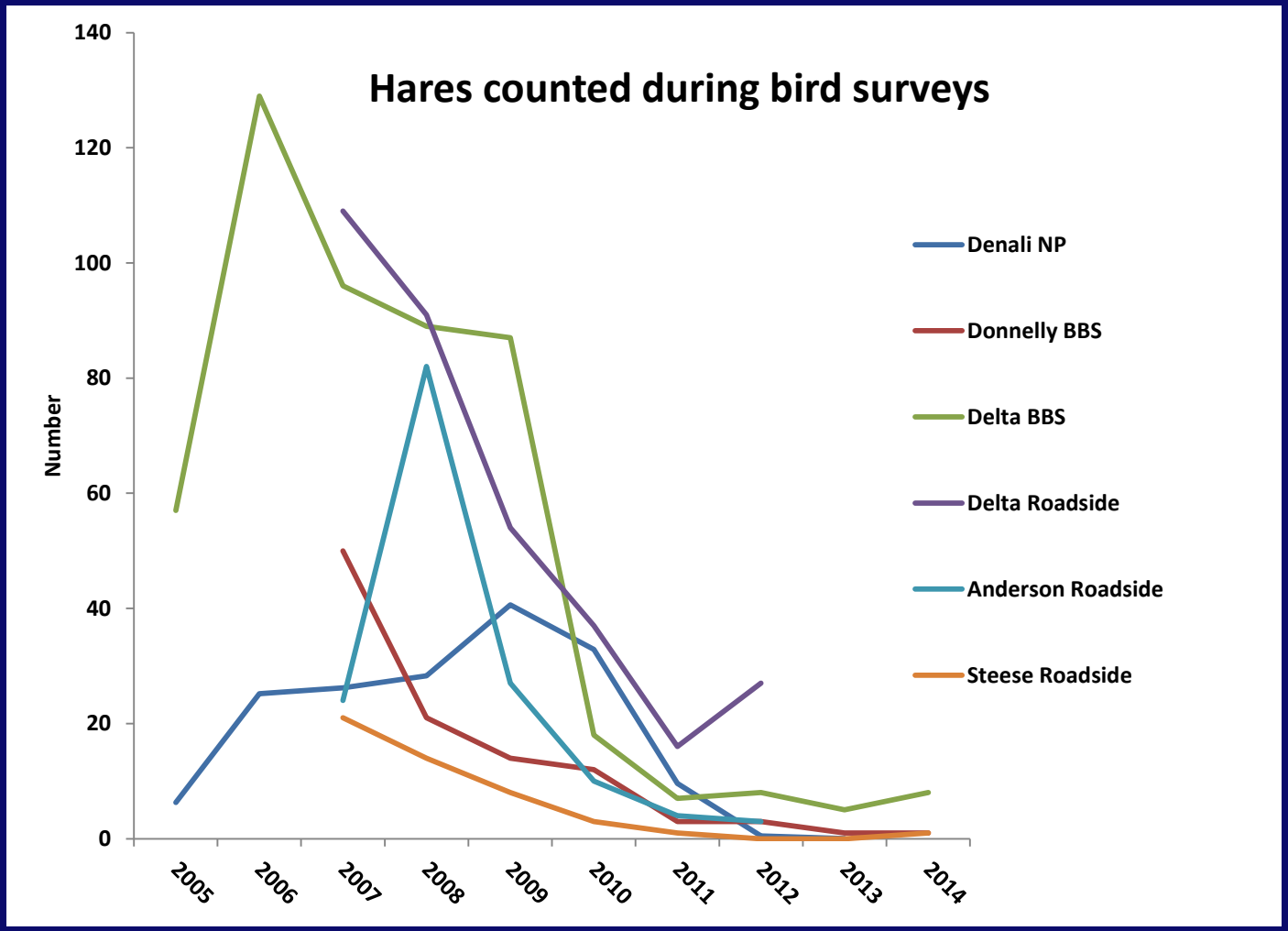
Monitoring temporal risk factors (snowshoe hare abundance)



*Capture – mark-recapture estimates; other study sites used pellet indices

Graphs courtesy Dr. Knut Kielland, University of Alaska-Fairbanks

Monitoring temporal risk factors



"Status of grouse, ptarmigan, and hare in Alaska, 2014" (ADF&G)

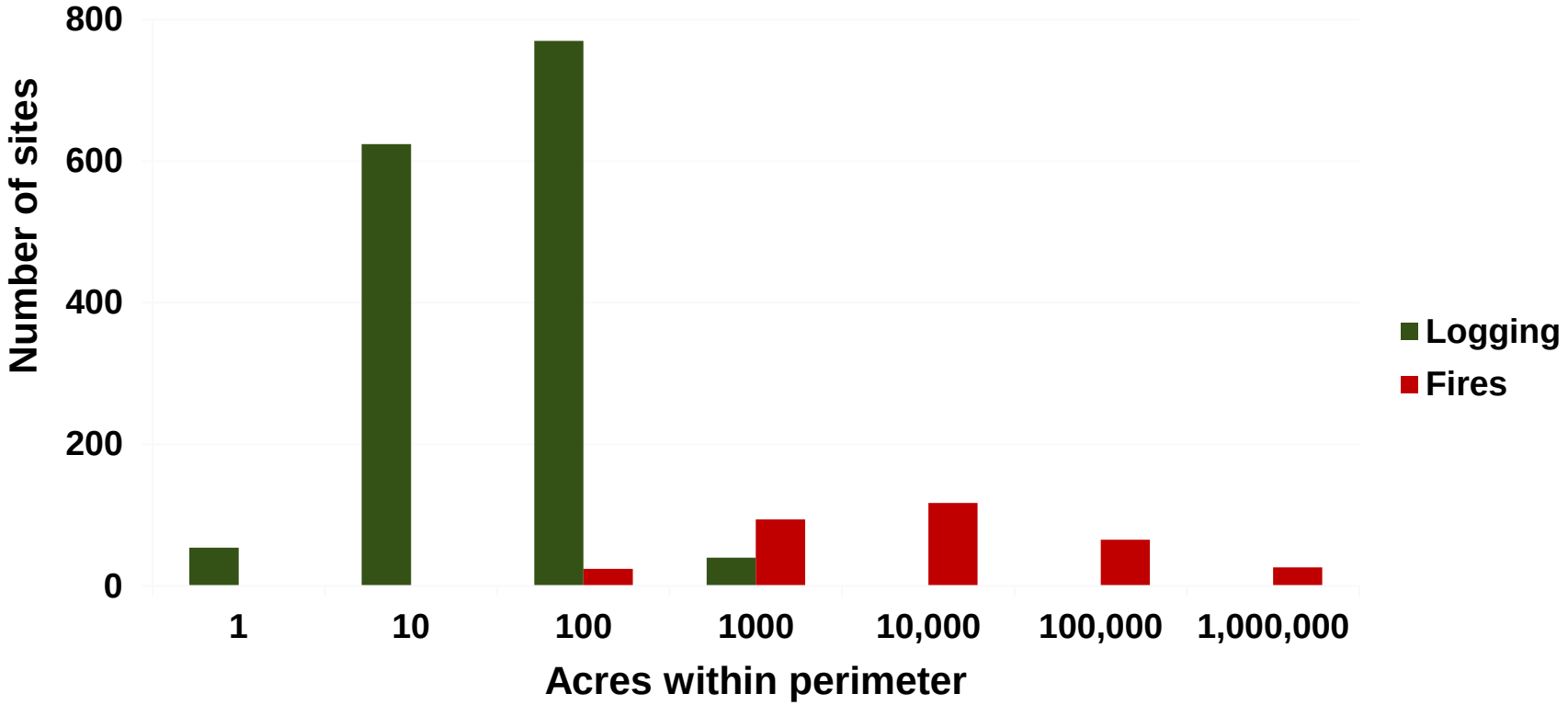
Spatial (scalar) factors predisposing herbivory

Patch

Stand

Landscape

“20 mile Tanana Valley State Forest buffer” 1963-2013



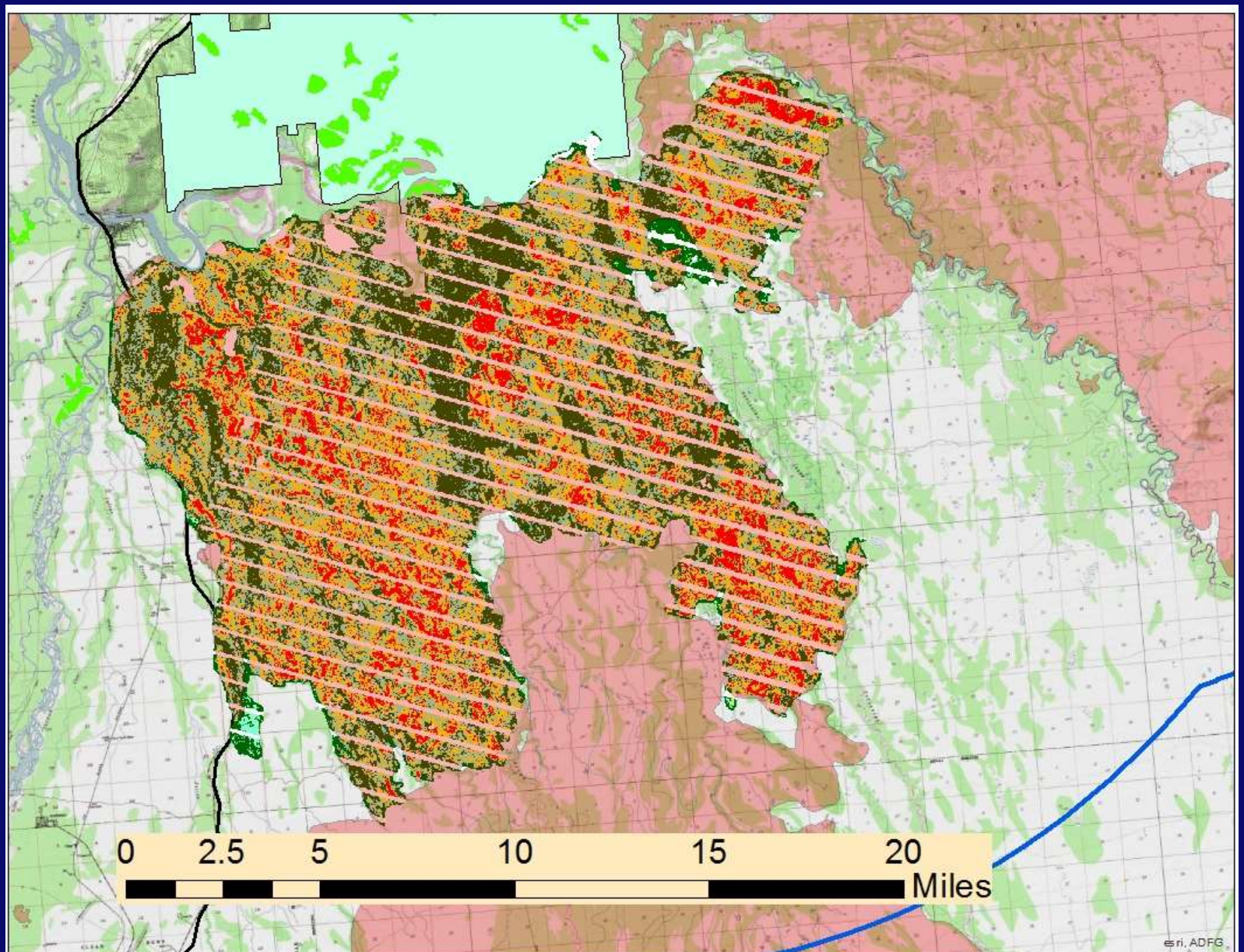
Logging (mean = 24 acres, total = 35,000 acres, N = 1488)

- Controlled disturbance
- Harvest & scarification…
- Salvage dead wood?

Fires (mean = 26,045 acres, total = 8,500,000 acres, N = 326)

- Limited control
- Patchy w/ variable severity
- Standing dead / debris

Unburned inclusions and patchiness of fire severity (unburned areas akin to “green tree retention”)



Spatial (scalar) factors predisposing herbivory

Are small logging units attractive environments of herbivore food and cover in a less inviting mature forest?

Plant in large burns during hare highs?

Patch

Stand

Landscape

3. Ecological context of site and time in regen. practices and monitoring

- No universal guidelines ("checklist" of factors…)
- Use silvicultural prescription to optimize habitat for "beneficial" wildlife interactions
- Reduce tree mortality risk by using wildlife (and insect?) data sources
- Ensure temporal (and spatial?) flexibility in standards to allow adaptive management