United States Department of Agriculture

Deer Habitat Restoration on the Tongass and the LiDAR-Winter Habitat Model

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Bonnie Bennetsen, Tongass Wildlife Program Manager

Overview

Sophie Gilbert

- Deer as a Critical Resource
- Habitat Needs and Concerns
- Objectives, Treatments, & Priorities
- LiDAR Winter Habitat Model
- Restoration Benefits & Science
- Accomplishments
- Opportunities

Deer as a Critical Resource

- Subsistence and Cultural Value
  - 79% of Rural Households in Southeast Alaska
  - Higher in more remote communities
- Economic Value
- Ecological Value
  - Endemic subspecies
  - Population concerns
  - Predator-prey relationships
  - Habitat needs ⇔ Forest management

$363M in spending
$360M in economic activity
$30M in govt revenue
$138M in labor income
2,463 jobs annually
(EcoNorthwest 2014)

Unit 2: ↓10-37% in next 30 years

(Gilbert et al. 2016)

Habitat Needs

Old Growth Forest

- A structural mosaic
- Light penetration + snow interception
- Species and structural diversity
- Good winter forage, movement, cover

Habitat Concerns

- Past even-aged timber harvest
  - >435,000 acres of Young Growth
  - > 162,000 acres in Conservation Areas
- Young clearcuts as movement barriers during heavy snows
  - Abundant summer forbs & shrubs
  - No snow interception = barriers during heavy snows
  - Heavy snows = major driver of deer population declines
- Stem exclusion in older young growth
  - Little forage and diversity
- Slash from thinning
  - Impacts connectivity and forage accessibility

Objectives

1) Accelerate and promote development of old-growth characteristics
2) Promote accessible winter forage for deer => fine- and broad-scale heterogeneity in young-growth landscapes
3) Retain landscape connectivity for deer
4) Retain and protect residual trees and patches

Treatments

- Variable density thinning
- Small gap creation & tree release
- Pruning, girdling, slash mitigation
- Unthinned corridors and patches

Priorities

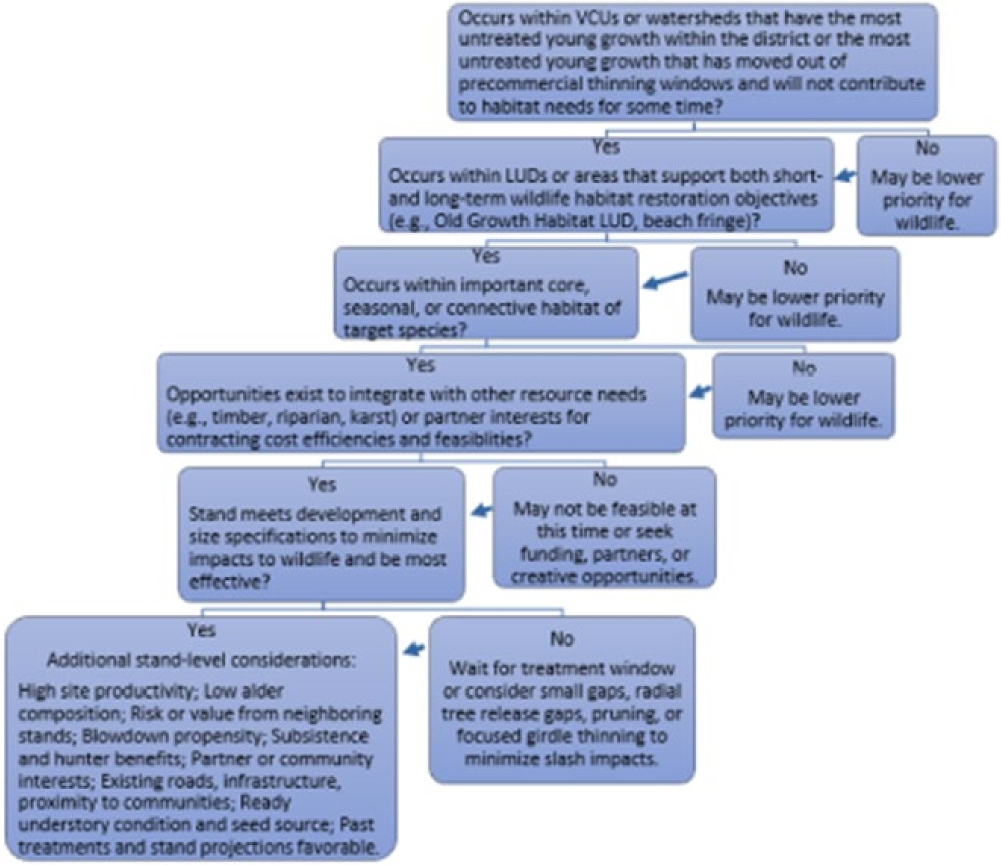

Figure 7. Ranking criteria for prioritizing young-growth treatment areas for Tongass wildlife. Criteria are generally presented in order of broad to fine scales and should be considered together.

- Most impacted/untreated
- Short- & long-term goals
- Stand readiness, timing window, anticipated benefit
- Integration with other resources, partners, community interests
- Deer winter range

Tongass Wildlife Young-Growth Strategy (2020)

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd976594.pdf

LiDAR Winter Habitat Model

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Using LiDAR and Random Forest to improve deer habitat models in a managed forest landscape

Colin S. Shanley[a,*], Daniel R. Eacker[b], Conor P. Reynolds[c], Bonnie M.B. Bennetsen[d], Sophie L. Gilbert[e]

[a] The Nature Conservancy, 416 Harris St., Suite 301, Juneau, AK 99801, USA
[b] Alaska Department of Fish & Game, Douglas, AK, USA
[c] The Nature Conservancy, Juneau, AK, USA
[d] United States Forest Service, Juneau, AK, USA
[e] University of Idaho, Moscow, ID, USA

A R T I C L E I N F O

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A B S T R A C T

Conservation strategies are hindered by a lack of accurate maps of important habitat for many wildlife species, but especially for species inhabiting managed forest landscapes. Prioritizing restoration efforts on Alaska's Tongass National Forest from past extensive clearcut logging is extremely challenging given the difficulty in accurately mapping its remote, rugged temperate rainforest landscapes. We tested the application of airborne light detection and ranging (LiDAR) technology to build a winter habitat model for Sitka black-tailed deer (*Odocoileus hemionus sitkensis*), the primary herbivore in the coastal temperate rainforest. We analyzed the importance of geomorphometric and forest structure characteristics as predictors of deer winter habitat selection using Random Forest applied to a 3-year GPS relocation dataset collected from 40 adult female deer. The LiDAR-based habitat model had a predictive performance of 94% (Out-of-bag error = 6%), a 10% lower model error compared to air-photo interpreted polygons and modeled plot data. Random Forest also outperformed analogous resource selection function models based on a comprehensive *k*-fold cross-validation. Deer habitat selection patterns in the LiDAR-based model were nonlinear across geomorphometric and forest structure predictive variables, and generally supported existing studies of deer habitat selection. Besides improving deer conservation and management on the Tongass National Forest, our approach could greatly enhance the accuracy and resolution of habitat maps used for conservation and restoration planning across large managed forest landscapes.

LiDAR Point Cloud

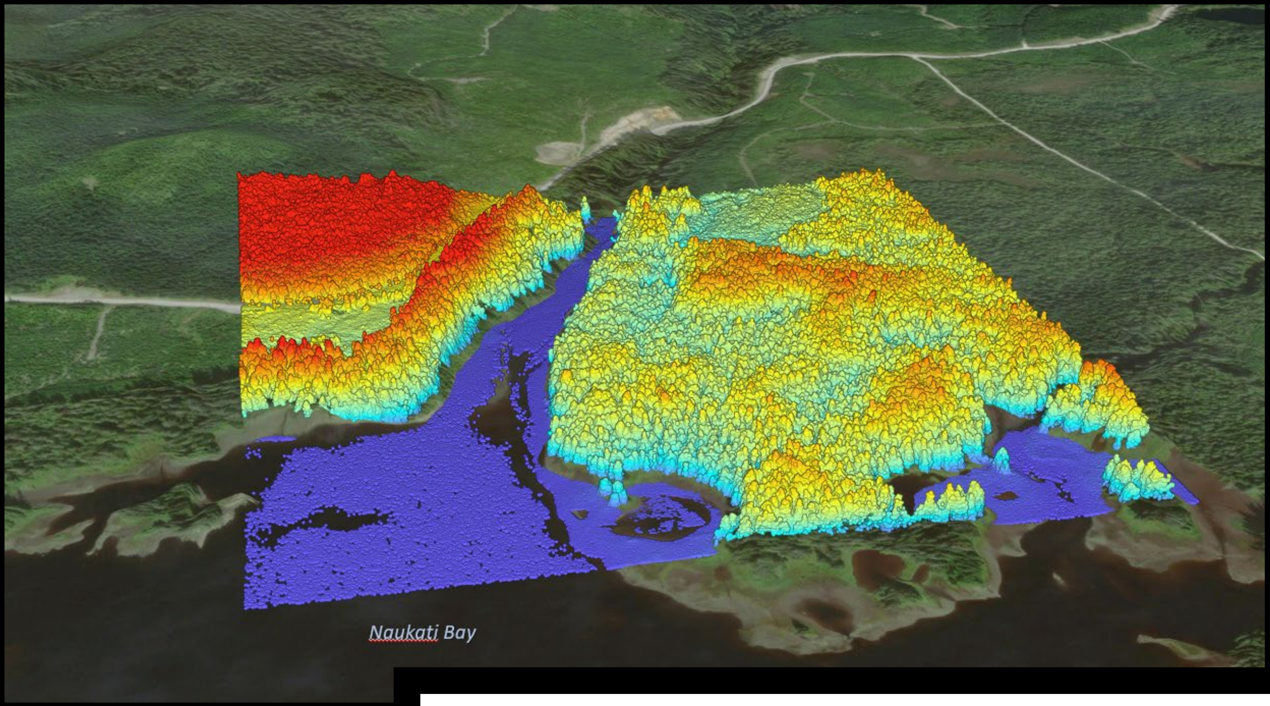
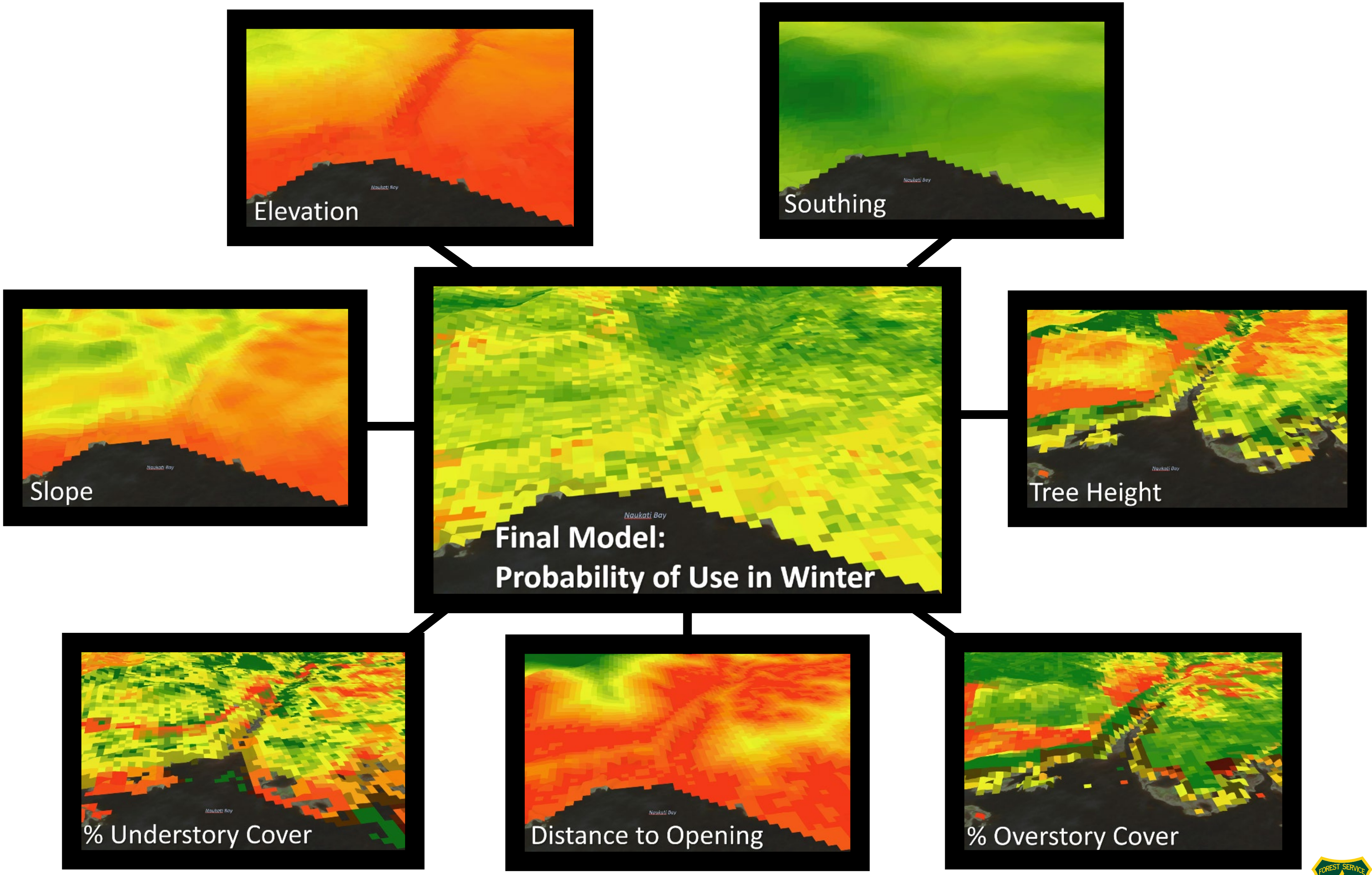


Fig. 2. LiDAR point cloud illustrating the 8-point per square meter resolution of the data in a riparian forest stand in southeast Alaska, USA, collected in summer 2017.

Variables => Final LiDAR Model



LiDAR Model Performance and Next Steps

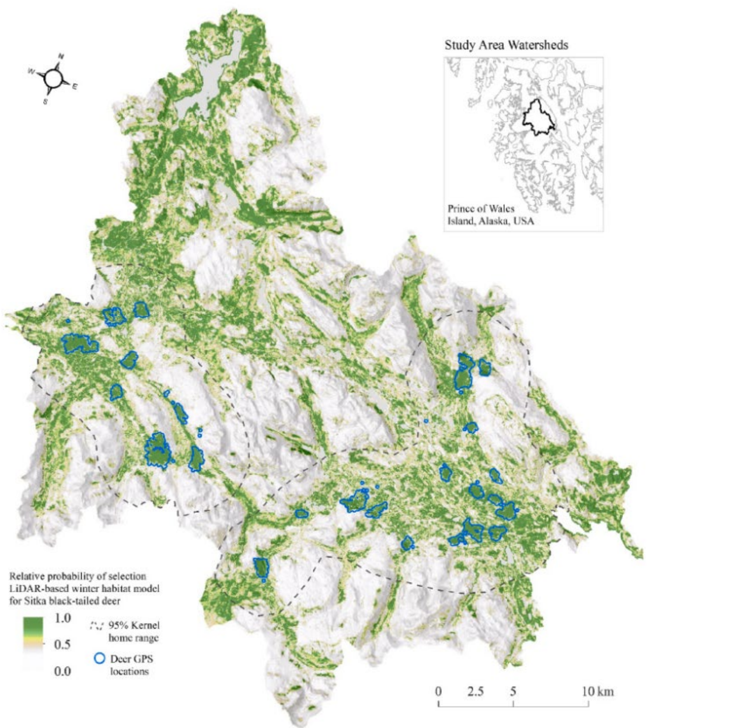


Fig. 5. A LiDAR-based winter habitat model for Sitka black-tailed deer using a Random Forest machine learning algorithm on Prince of Wales Island in southeast Alaska, USA, during 2010–2012. All deer GPS locations are buffered by 100 m for visual purposes.

- Accuracy = 94%
  - 40 GPS collared deer over 3 years
- Prioritizing Restoration = **TBD**
- Probability of Use Vs. Slash Load Predictors

Restoration Benefits & Science

- Understory Vegetation (29 studies)
- Vertical and Horizontal Structural Diversity (15 studies)
- Tree Species Diversity and Composition (11 studies)
- Large Trees (16 studies)
- Large Branches (8 studies)
- Natural/Historical Growth Rates (2 studies)
- Large Tree Potential (Poage & Tappeiner 2002, Sensenig et al. 2013)
  - Growth rate and size at age 50 is strongly related to ultimate size of old-growth trees
  - >70% of height growth and crown development occurs by 60 years of age
  - Suggests trees growing in heavy stem exclusion are not as likely to reach large size potential without restorative treatments
- Stand Stability (3 studies)
- Adaptive Capacity and Ecosystem Resilience (2 studies)

Tongass Wildlife Young Growth Strategy (2020)

https://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd976594.pdf

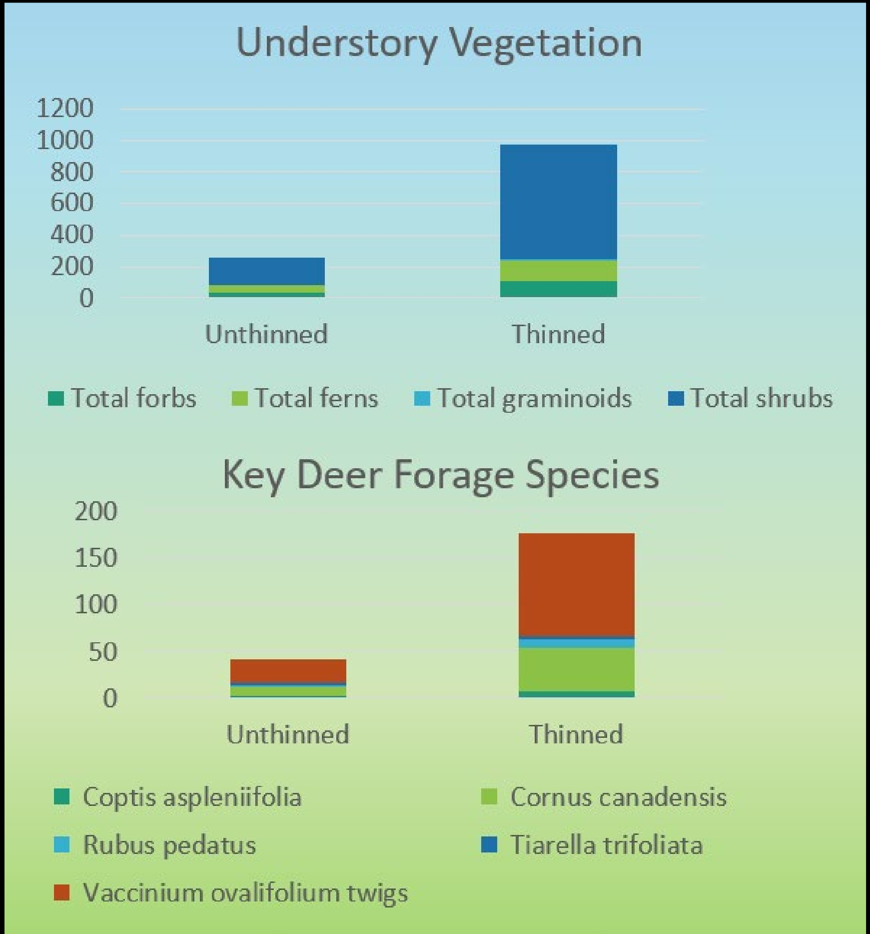
Benefits: 2 Pictures are Worth A Thousand Words

Both Stands = Age 54, Medium productivity

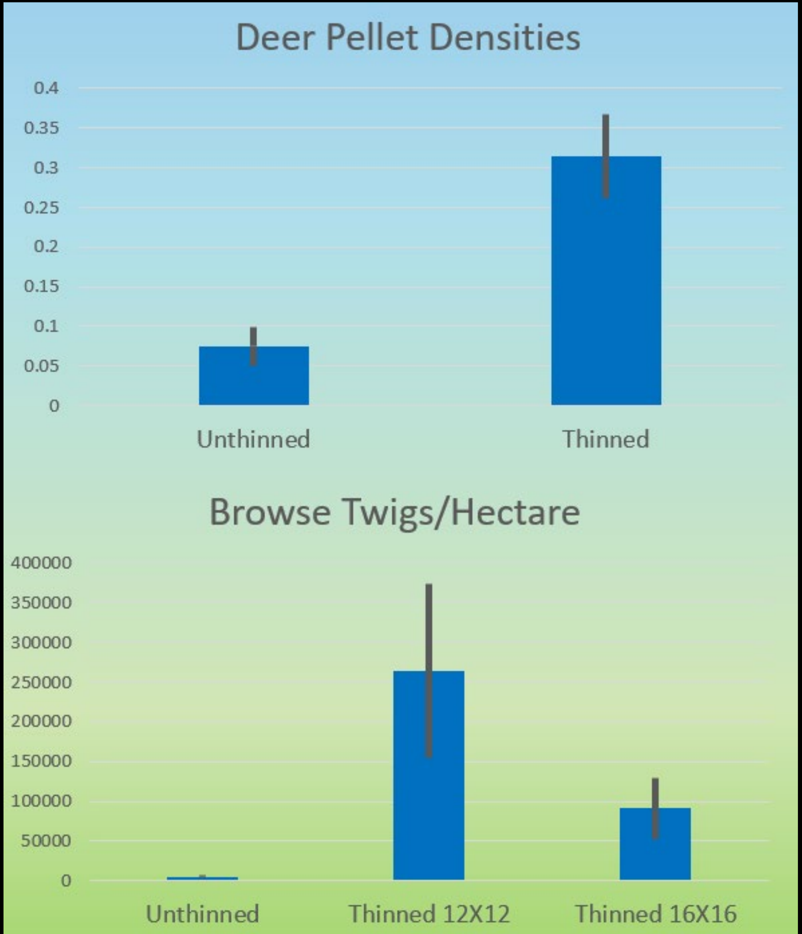
Unthinned

Thinned at Age 20

Benefits to Deer



(Hanley et al. 2013)



(Doerr and Sandburg 1986)

Additional Science - Influences on Deer


Sophie Gilbert

- Small Gaps
  - ⇧ Browse by deer: DeMeo et al. 1990
  - ⇧ Winter deer carrying capacity: Alaback 2010
  - ⇧ Winter deer forage: Harris & Barnard 2017
- Precommercial Thinning
  - ⇧ Summer forage, but less with deep snow: Cole et al. 2010, Crotteau et al. 2020
  - ⇧ Key deer forage species: Crotteau et al. 2020
- Commercial Thinning
  - ⇧ Deer forage: Zaborske et al. 2002
- Slash (unpublished data in Martin et al. 2019)
  - ⇧ Slash biomass => ⇩ Deer abundance
  - ⇧ Slash DBH =>
    - ⇧ Slash biomass
    - ⇧ Amount of time for slash to decompose
    - ⇧ Amount of time for deer to use the habitat

- Average slash DBH <5 inches = ideal

Accomplishments – with Partners

- Habitat Improvement
  - 4,350 acres in 2022 benefit deer
- Increasing Knowledge
  - LiDAR-based winter habitat model
  - FRESH-Deer
  - Snow and slash effects on forage accessibility
  - Tongass-Wide Young-Growth Surveys
- Outreach and Workshops
  - POW Deer Summit
  - SE AK Watershed Workshop

Opportunities

- Need
- Treatments
- Benefits
- NEPA-Cleared
- Bipartisan Infrastructure Law
    - $$ for Subsistence Thinning

- Partnerships
- Mechanism
- Outreach/Support


Thank You!
Questions?
Sheila Spores