State of Northern Spotted Owls on U.S. Forest Service Lands

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➢ Background
  o NSO Demographic Study Areas
  o Analytical Methods
➢ Current NSO Population Trends
  o Annual rates of change
  o Realized change
➢ Factors Affecting NSO Populations
  o Climate
  o Wildfire
  o Barred Owls
➢ Summary
NSO Demographic Study Areas

- **Washington**: Olympic, Rainier, Cle Elum
- **Oregon**: Coast Ranges, Tyee, Klamath, HJ Andrews, South Cascades
- **California**: Green Diamond, NW California, Hoopa

Background
Background

NSO Demographic Study Areas

NW California Study Area

- Siskiyou
- Trinity
- Humboldt
- Mendocino
WILLOW CREEK STUDY AREA (WCSA)

- 95 NSO Territories

Activities:
- Density study area
- 292 km²
- 61 NSO Territories
Background

FIELD DATA COLLECTION
• Track marked individuals over time
• For each individual each year determine:
  • Sex
  • Pair Status
  • Reproductive Status
  • Age

ANALYTICAL METHODS
• Mark-recapture Estimators
  • CJS Models
  • Pradel Reverse-time Models
• Occupancy Estimators
• Incorporate imperfect detectability
ANNUAL ESTIMATES OF POPULATION CHANGE ($\lambda$) ON WCSA (1987-2017)
58.8% decrease in NSO abundance on WCSA
Factors Affecting NSO Populations

\[ \lambda_H > 1: \text{Territory occupants more than replacing themselves (contributors)} \]
\[ \lambda_H \approx 1: \text{Territory occupants just replacing themselves (maintainers)} \]
\[ \lambda_H < 1: \text{Territory occupants not replacing themselves (non-contributors)} \]

Franklin et al. 2000. Ecol Mono 70:539
Factors Affecting NSO Populations

Climate Effects on Survival

Franklin et al. 2000. Ecological Monographs 70:539
Factors Affecting NSO Populations

Climate Effects on Survival
Factors Affecting NSO Populations

CONTINUUM OF WILDFIRE EFFECTS ON NSO

- Survival & recruitment unchanged
- Reduced survival, increased recruitment
- Reduced survival

Habitat quality

- Maintained/improved
- Reduced
- Loss of Habitat Components

Rockweit et al. 2017 Ecology 98:1574-1582
Factors Affecting NSO Populations

TEMPORAL TRENDS IN FIRES IN NW CA

Habitat quality maintained/improved

Miller et al. 2012 Ecological Applications 22:184-203
Factors Affecting NSO Populations

NUMBER OF BARRED OWL SITES ON WCSA

<table>
<thead>
<tr>
<th>Year</th>
<th>Number Barred Owl Sites</th>
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<td>2020</td>
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WCSA with NSO territories

NUMBER OF NSO TERRITORIES ON WCSA WITH BO DETECTION

- Observed
- Logistic 3P Model
- Logistic 5P Model

Year
Number of Spotted Owl Sites with BO detections
0, 5, 10, 15, 20, 25, 30, 35, 40...
DECLINE IN NSO POPULATION COINCIDES WITH BO INCREASE
Factors Affecting NSO Populations

NSO LOCATIONS ON WCSA (1991)
Factors Affecting NSO Populations

NSO LOCATIONS ON WCSA (1991)

BO LOCATIONS ON WCSA (2018)
Factors Affecting NSO Populations

NSO LOCATIONS ON WCSA (2018)

BO LOCATIONS ON WCSA (2018)
Factors Affecting NSO Populations

EFFECTS OF BARRED OWLS ON RATES OF POPULATION CHANGE ($\lambda$)

1. Barred Owl Sites

2. Barred Owl Detections on NSO Sites

- In both models, effects of BO additive with “bad” climatic years
COMPONENT OF ($\lambda$): APPARENT SURVIVAL ($\phi$)

\[ \hat{\lambda} = \hat{\phi} + \hat{f} \]
COMPONENT OF ($\lambda$): RECRUITMENT ($f$)

\[ \hat{\lambda} = \hat{\phi} + \hat{f} \]
SUMMARY OF BARRED OWL EFFECTS

Chronic BO Effect
↓ Survival
 ↔ Recruitment

Acute BO Effect
↓ Survival
↓ Recruitment

Chronic BO Effect
↓ Survival
 ↔ Recruitment
1. Northern Spotted Owl population have experienced dramatic decline on our study area in last decade
   ➢ Question is where population is headed
2. Barred Owls implicated as primary factor in recent Northern Spotted Owl population decline

➢ Further investigated with experimental removal of barred owls

**TREATMENT AREA**
- Hoopa Tribal Lands
- BO Removal

**CONTROL AREA**
- WCSA
- No BO Removal
3. Climate and large, high-severity wildfires implicated as secondary factors in Northern Spotted Owl population declines
   - Exacerbate effects of Barred Owls
   - Mixed severity wildfire a dynamic process that shaped spotted owl habitat in the past
QUESTIONS?

“IT’S TOUGH TO MAKE PREDICTIONS, ESPECIALLY ABOUT THE FUTURE.”
—Yogi Berra