State of Northern Spotted Owls on U.S. Forest Service Lands
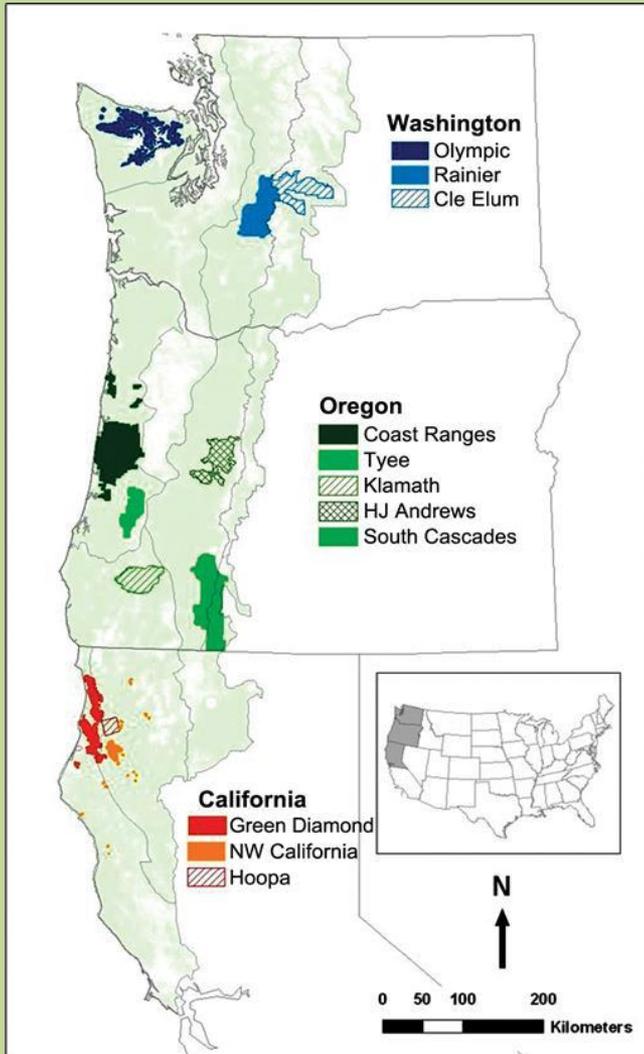
Alan B. Franklin, Peter C. Carlson, Angela Rex, Jeremy T. Rockweit, Kenneth Wilson, and Patricia Krueger
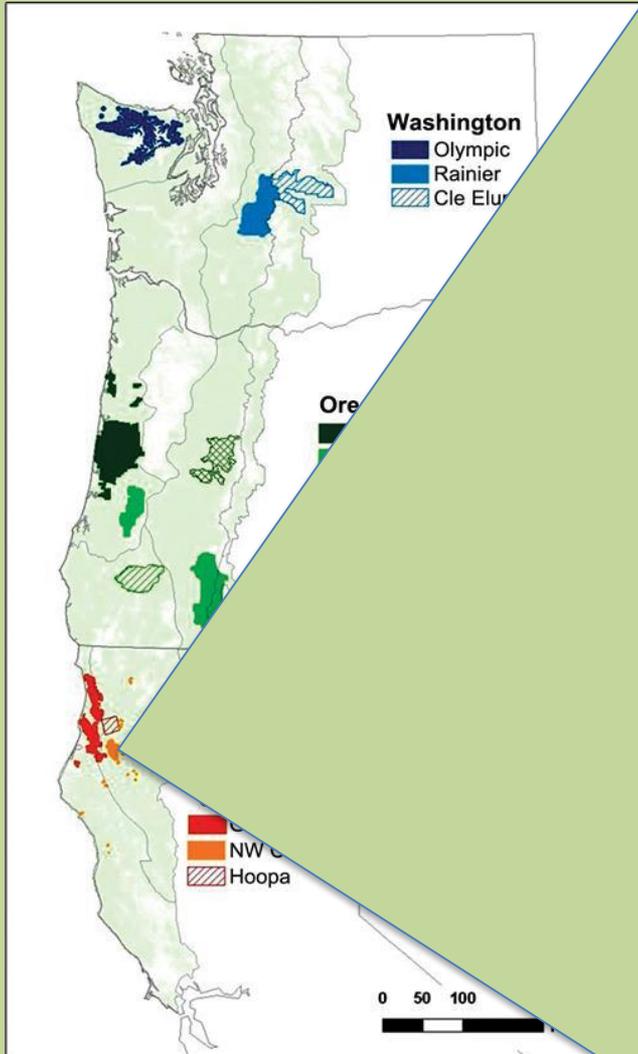
➢ Background
- o NSO Demographic Study Areas
- o Analytical Methods

➢ Current NSO Population Trends
- o Annual rates of change
- o Realized change

➢ Factors Affecting NSO Populations
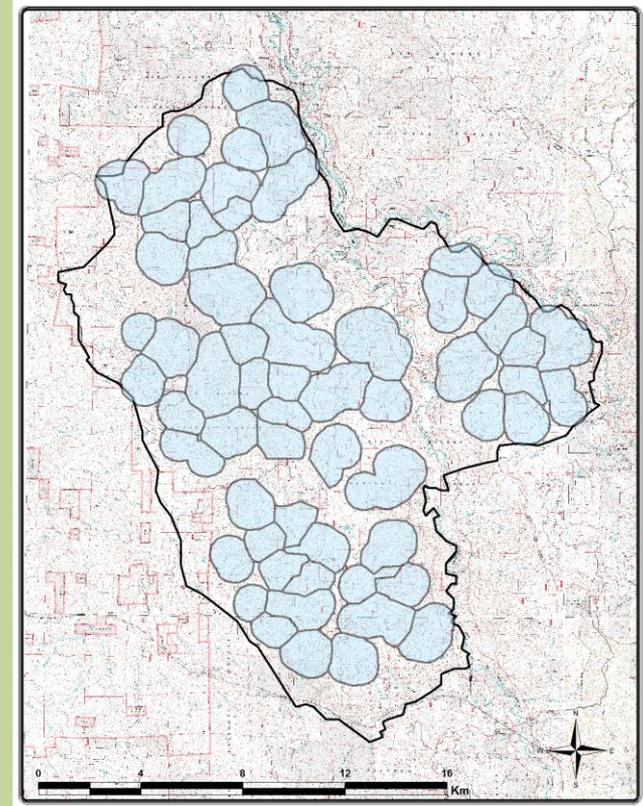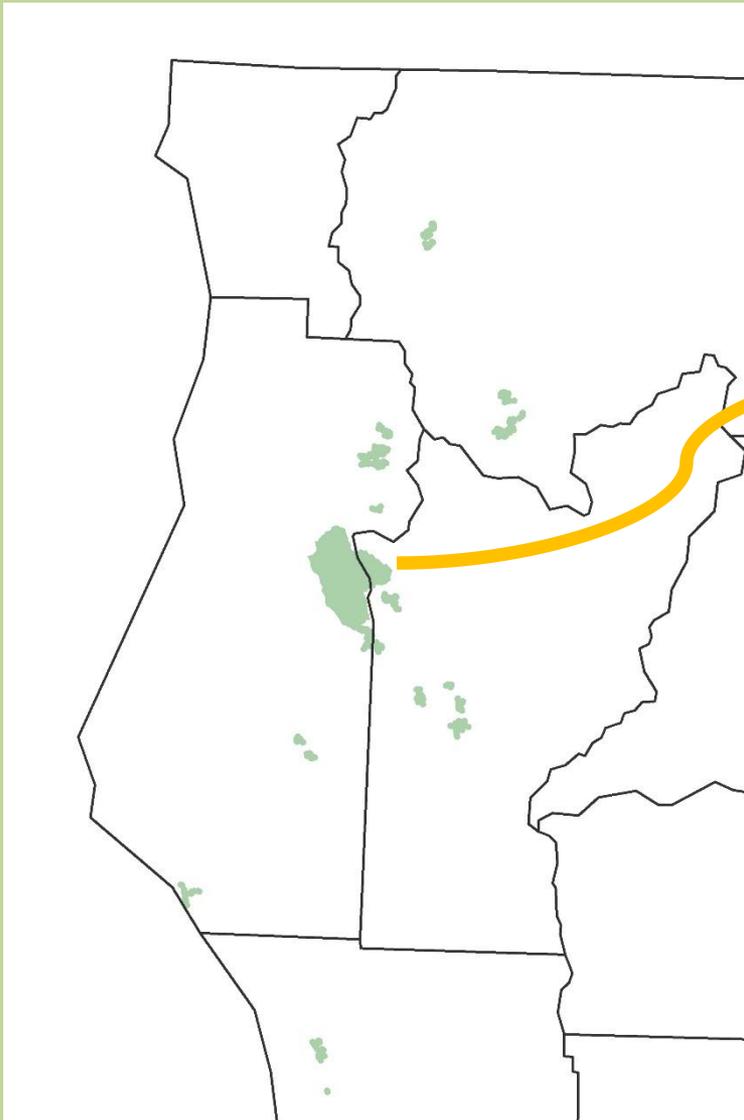- o Climate
- o Wildfire
- o Barred Owls

➢ Summary

NSO Demographic Study Areas

United States Department of Agriculture

NSO Demographic Study A

NW California Study Area

United States Department of Agriculture

WILLOW CREEK STUDY AREA (WCSA)

- Density study area
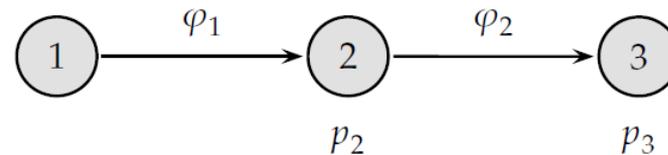- 292 km^2
- 61 NSO Territories

- 95 NSO Territories

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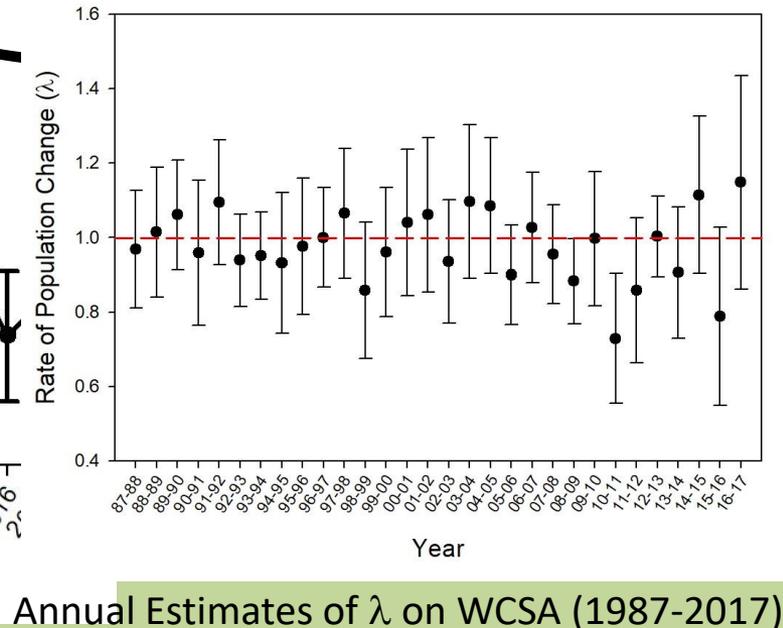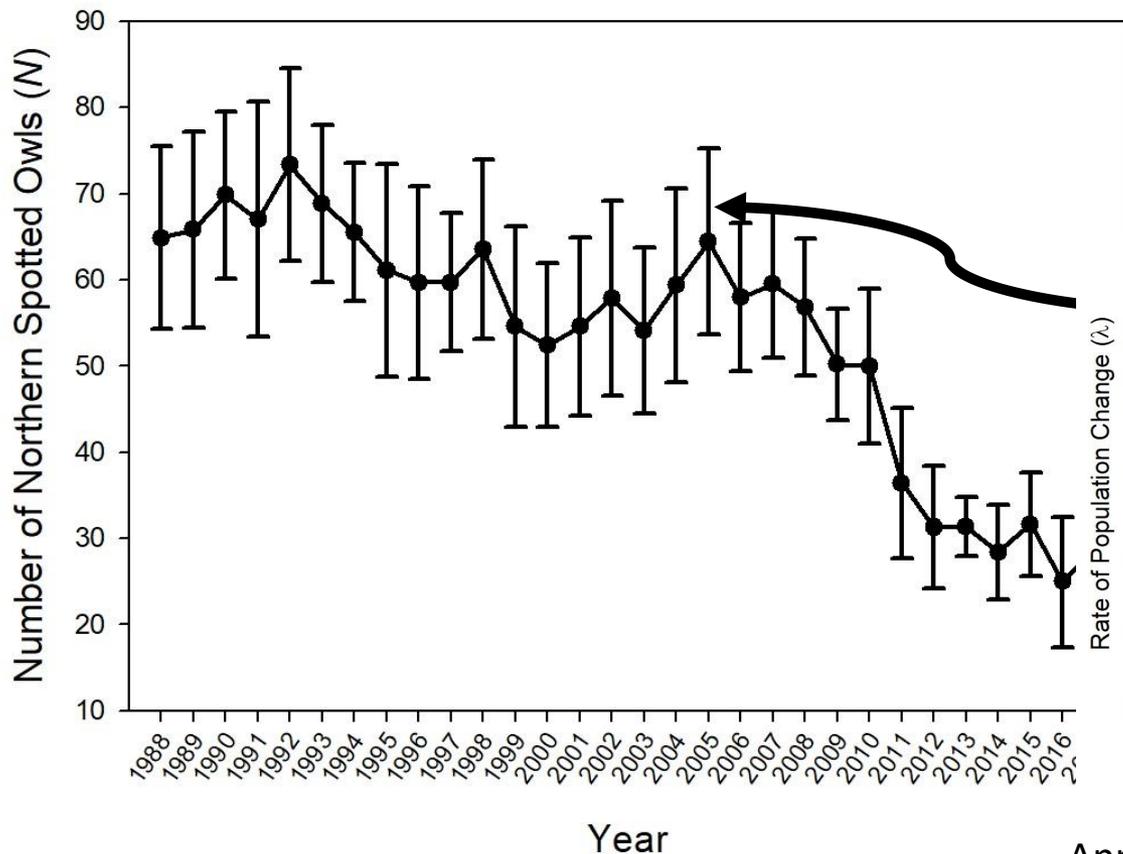 - Reproductive Status
  - Age

ANALYTICAL METHODS
- Mark-recapture Estimators
  - CJS Models
  - Pradel Reverse-time Models
- Occupancy Estimators
- Incorporate imperfect detectability

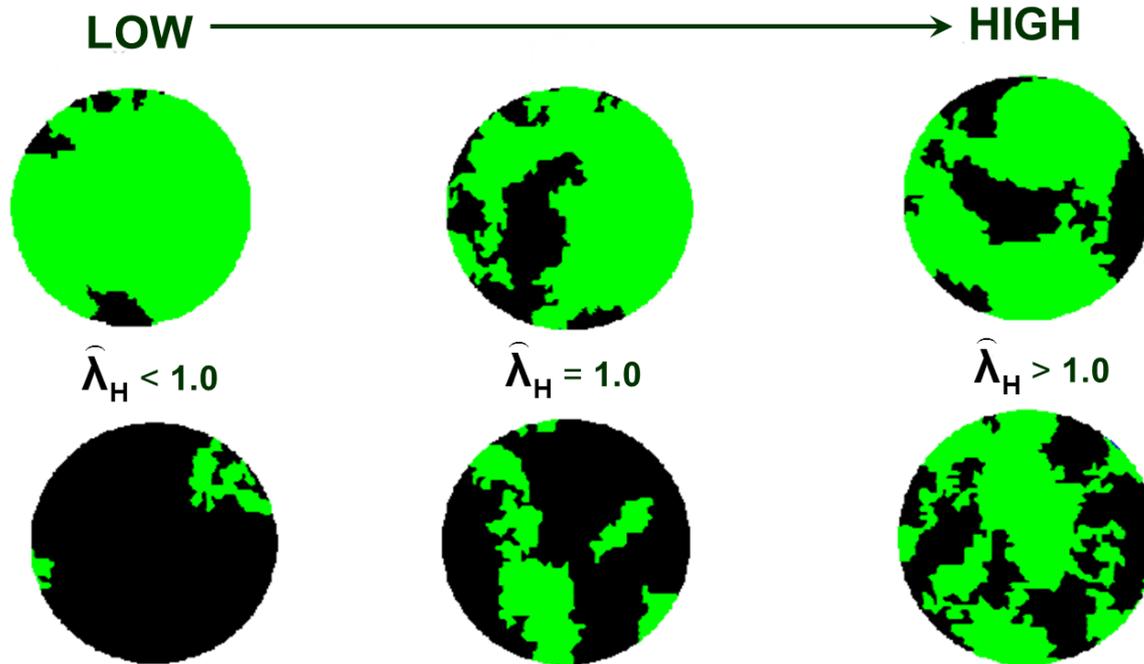## ANNUAL ESTIMATES OF POPULATION CHANGE (λ) ON WCSA (1987-2017)
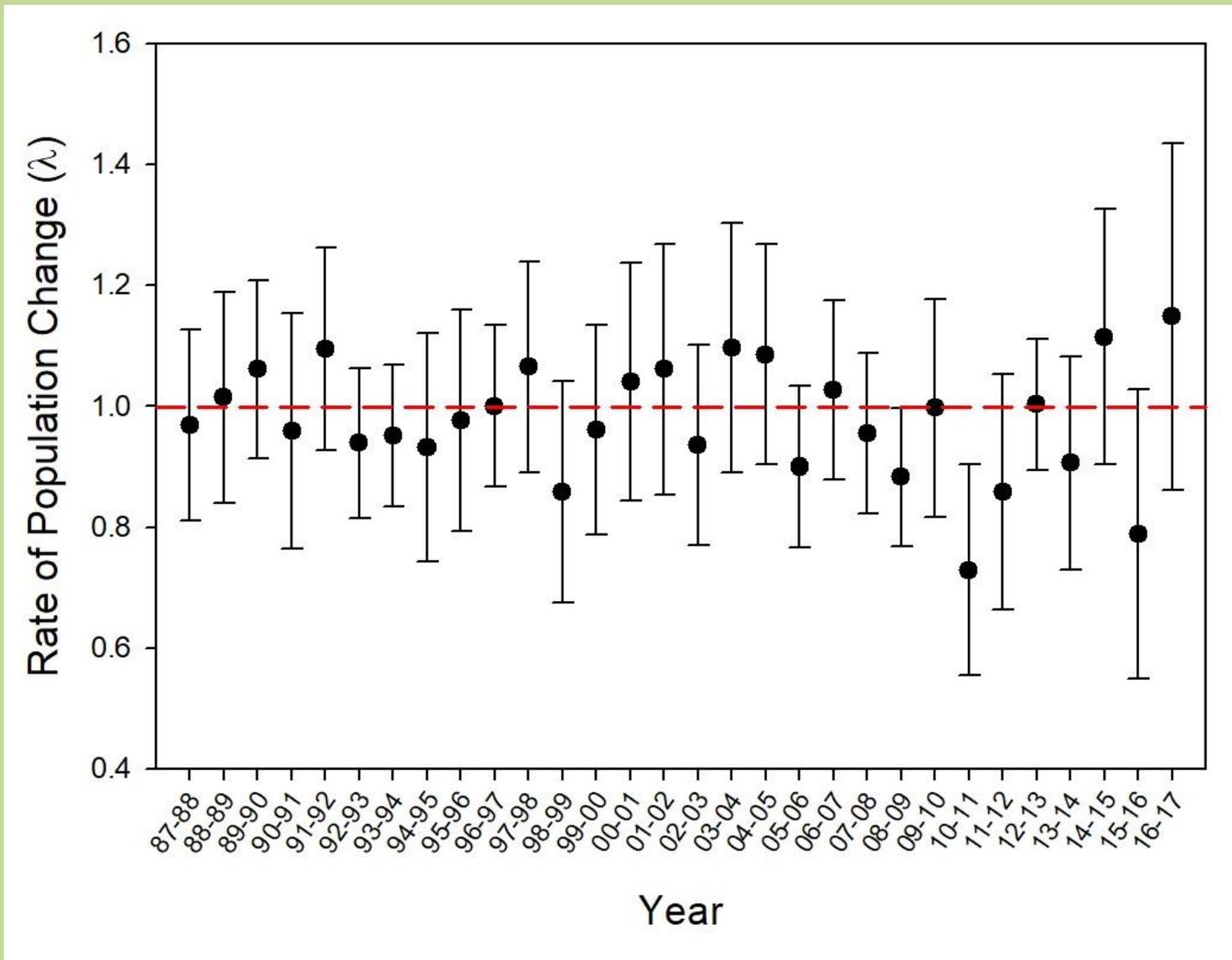
TREND IN ABUNDANCE ON WCSA (1988-2017)


Annual Estimates of λ on WCSA (1987-2017)

58.8% decrease in NSO abundance on WCSA

LOW ⟶ HIGH

$\hat{\lambda}_H < 1.0$ $\hat{\lambda}_H = 1.0$ $\hat{\lambda}_H > 1.0$

$\lambda_H > 1$: Territory occupants more than replacing themselves (***contributors***)

$\lambda_H \approx 1$: Territory occupants just replacing themselves (***maintainers***)

$\lambda_H < 1$: Territory occupants not replacing themselves (***non-contributors***)

Franklin et al. 2000. Ecol Mono 70:539

Climate Effects on Survival

Franklin et al. 2000. Ecological Monographs 70:539

Climate Effects on Survival

USDA
United States Department of Agriculture
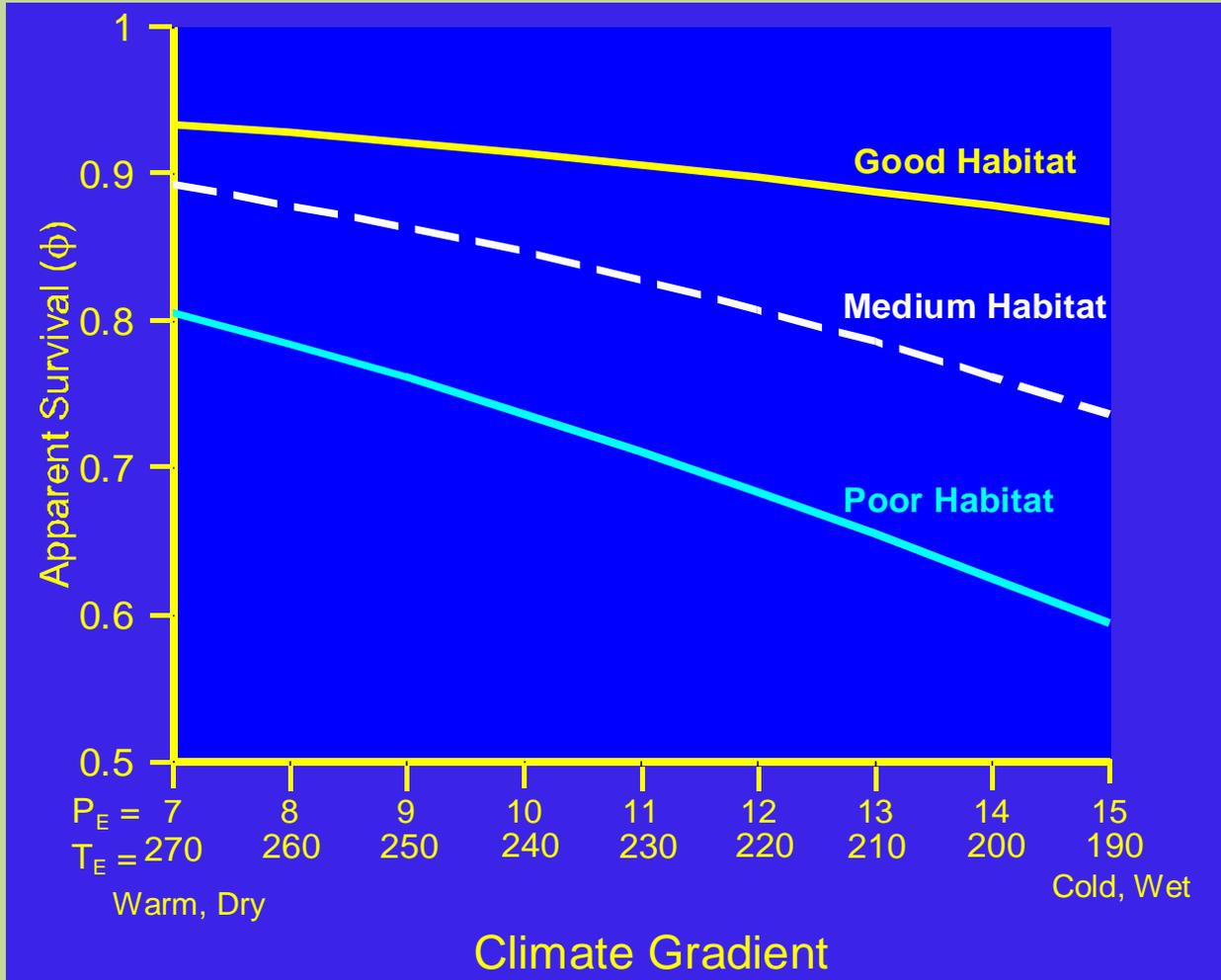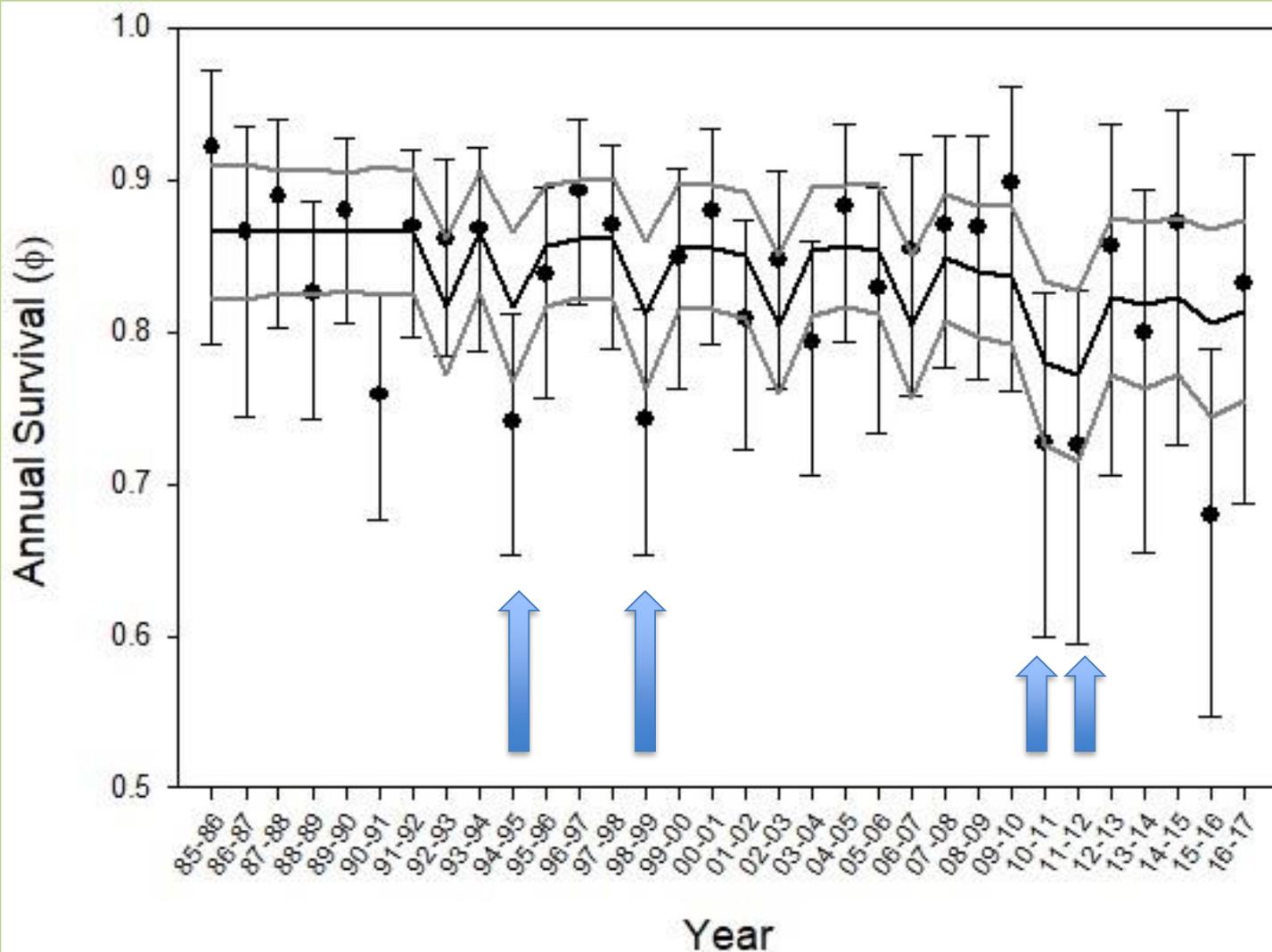
CONTINUUM OF WILDFIRE EFFECTS ON NSO

Survival & recruitment
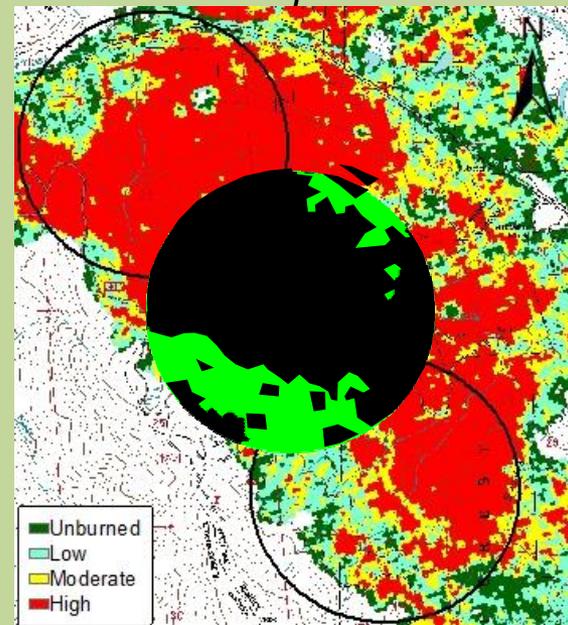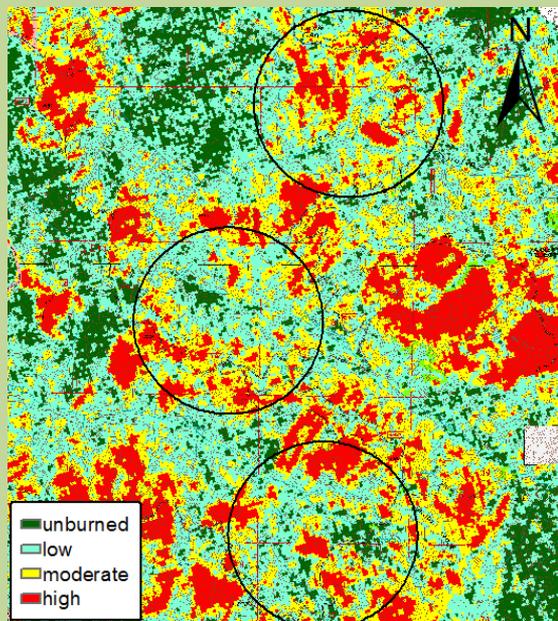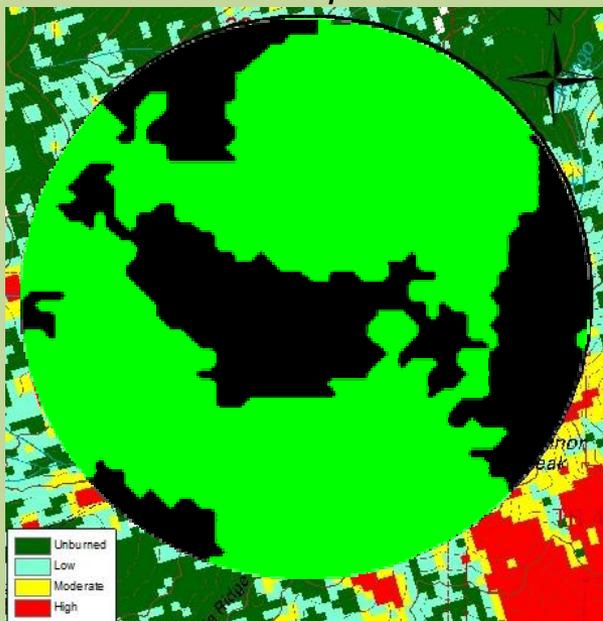unchanged

Reduced survival,
increased recruitment

Reduced survival
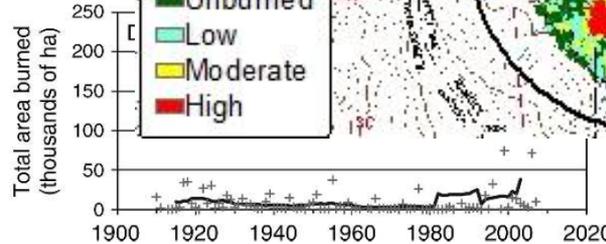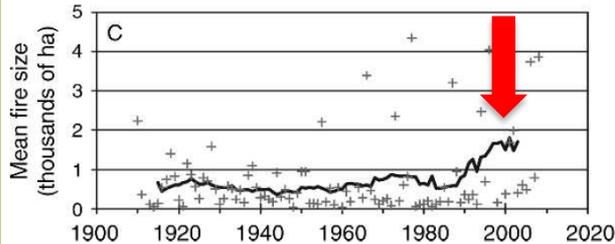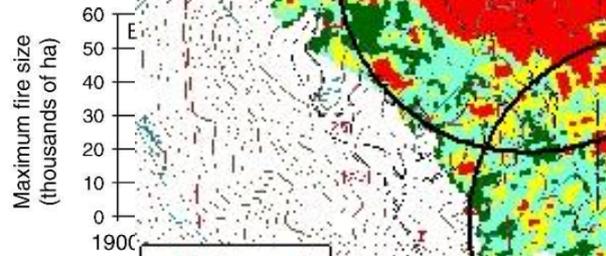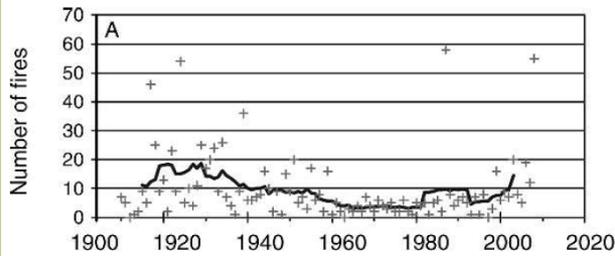Reduced recruitment

*Habitat quality
maintained/improved*

*Habitat quality
reduced*

*Loss of Habitat
Components*

Legend:
- Unburned
- Low
- Moderate
- High

Rockweit et al. 2017 Ecology 98:1574-1582
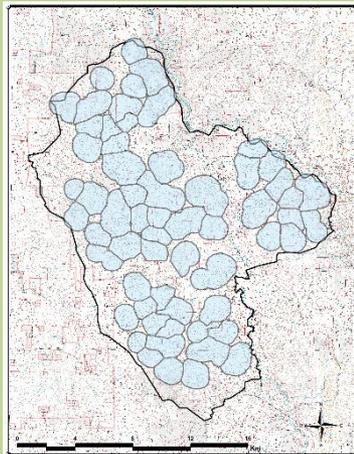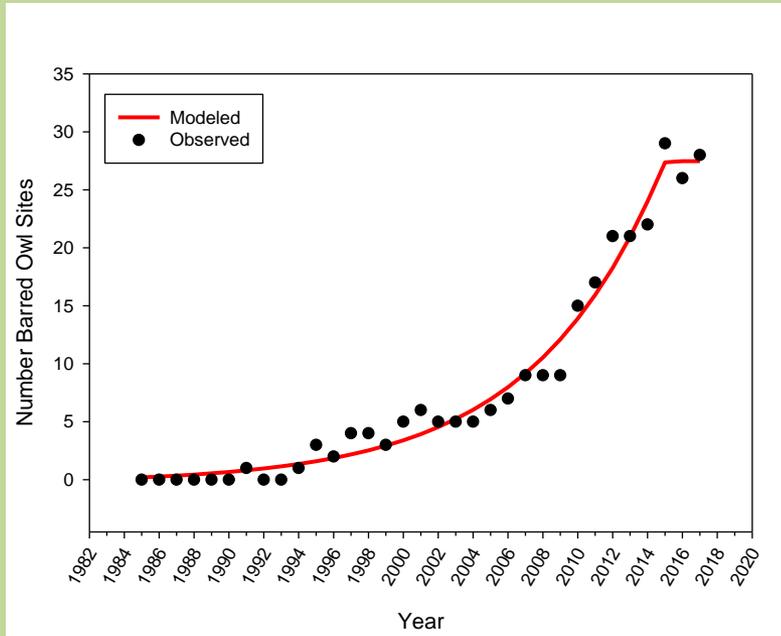
TEMPORAL TRENDS IN FIRES IN NW CA
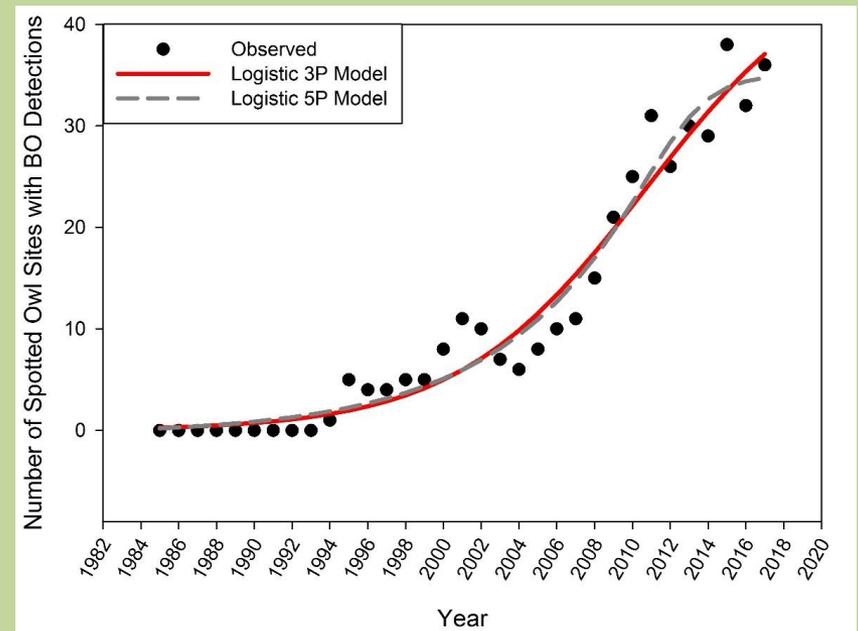
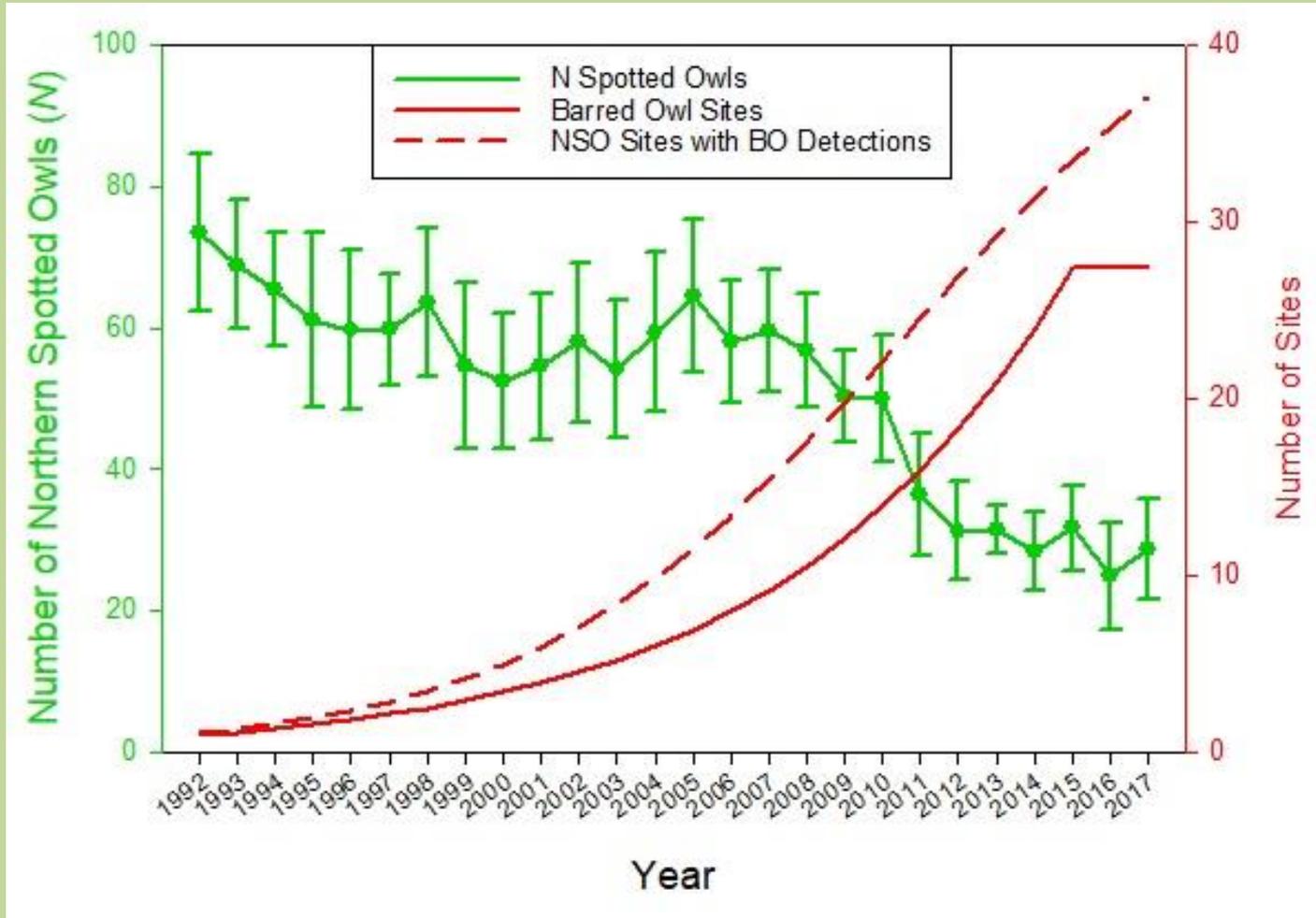*Habitat quality maintained/improved*
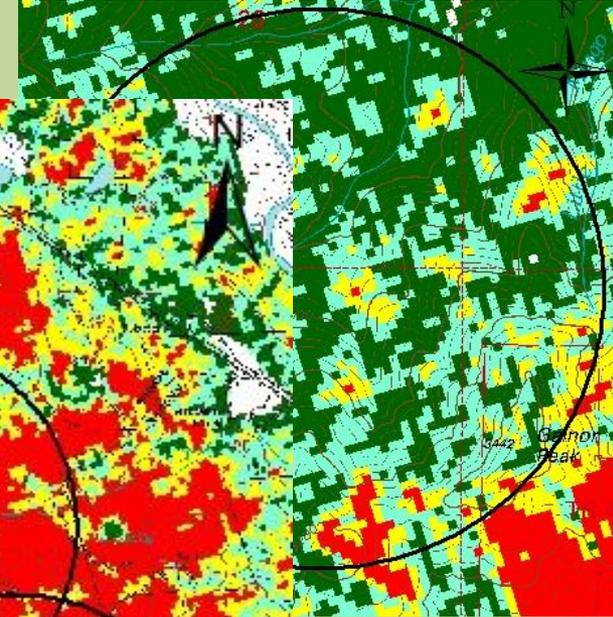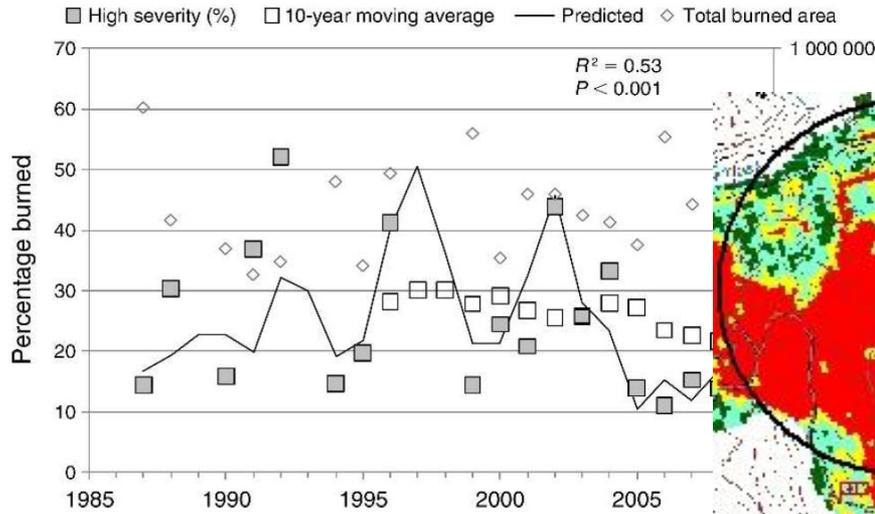
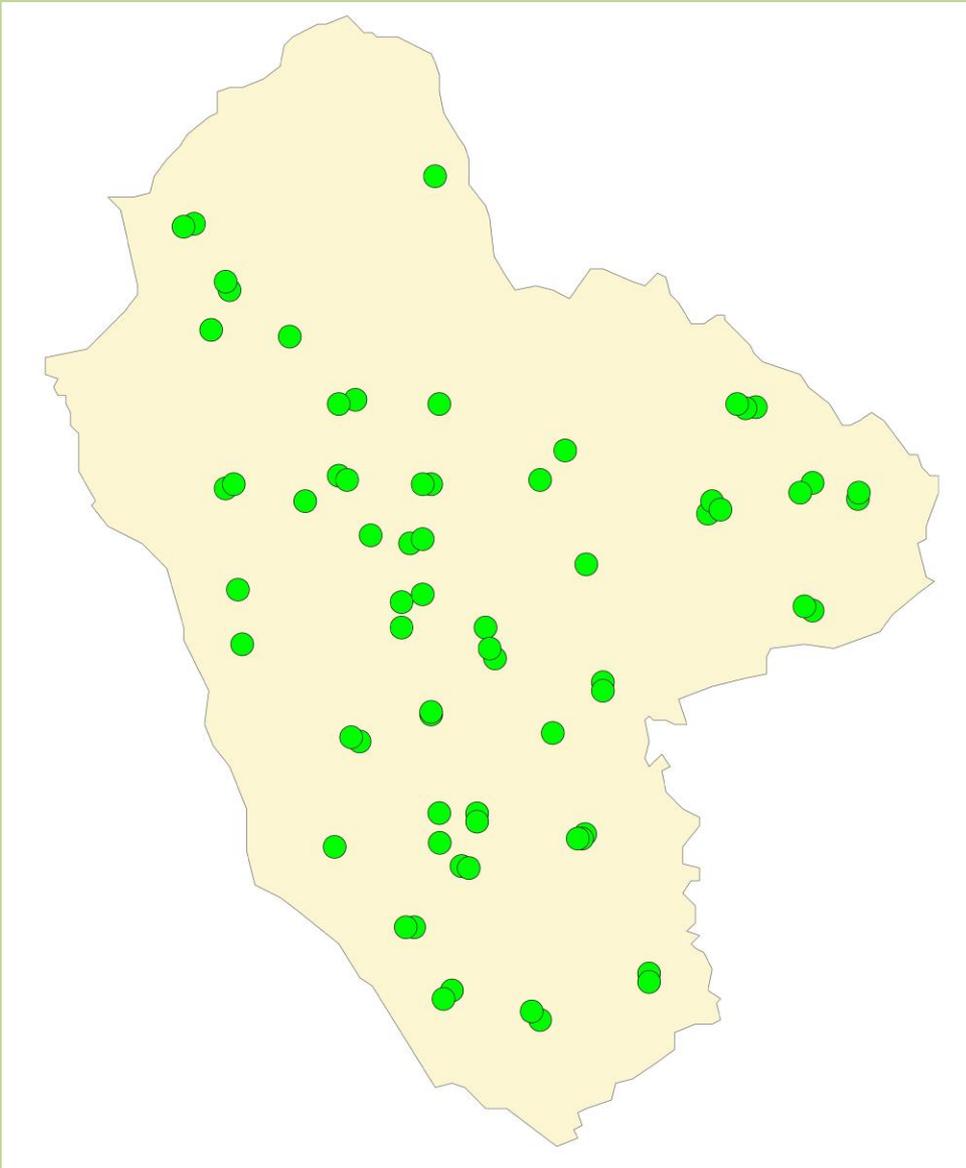**NUMBER OF BARRED OWL SITES ON WCSA**

WCSA with NSO territories

NUMBER OF NSO TERRITORIES ON WCSA WITH BO DETECTION

DECLINE IN NSO POPULATION COINCIDES WITH BO INCREASE

United States Department of Agriculture
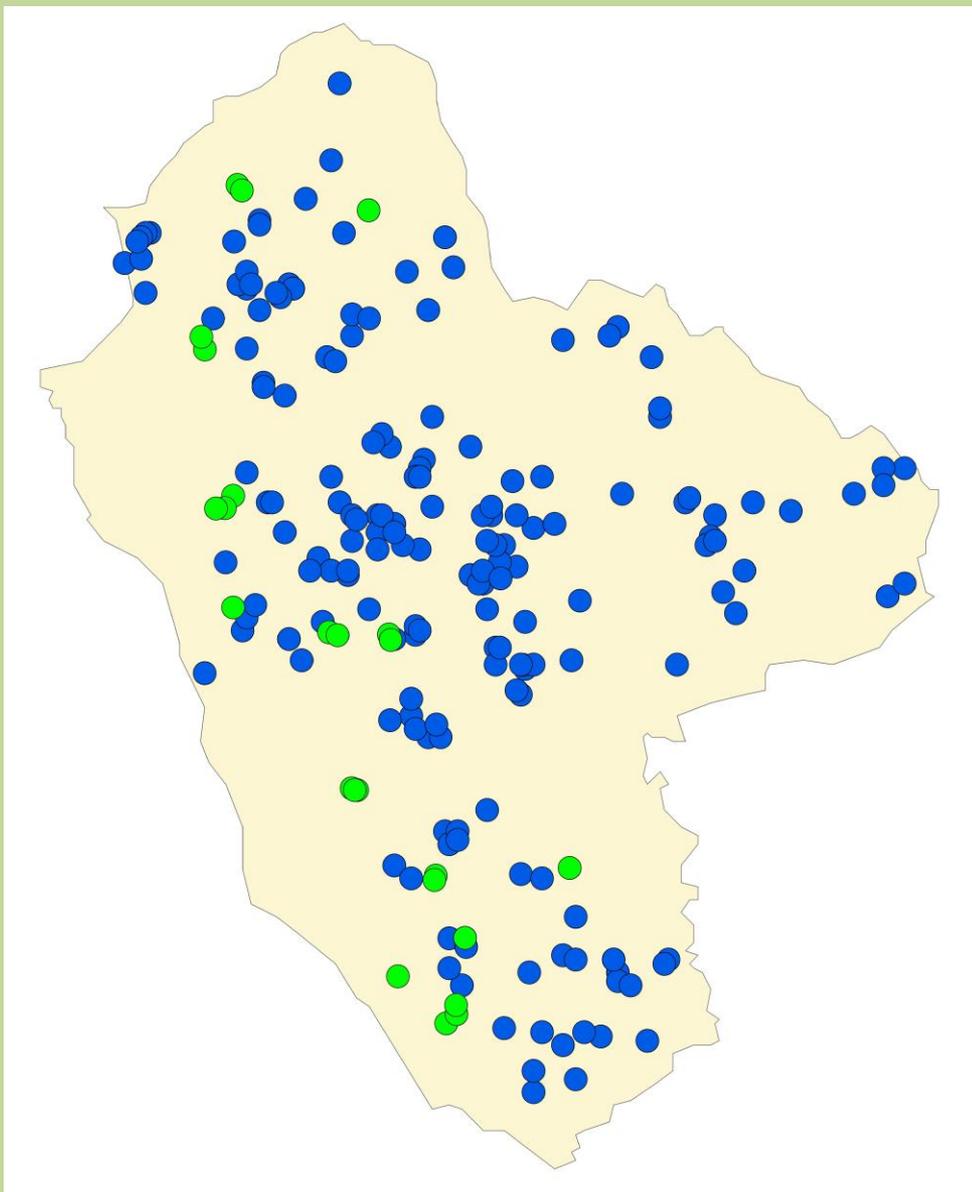
NSO LOCATIONS ON WCSA (1991)

NSO LOCATIONS ON WCSA (1991)

BO LOCATIONS ON WCSA (2018)

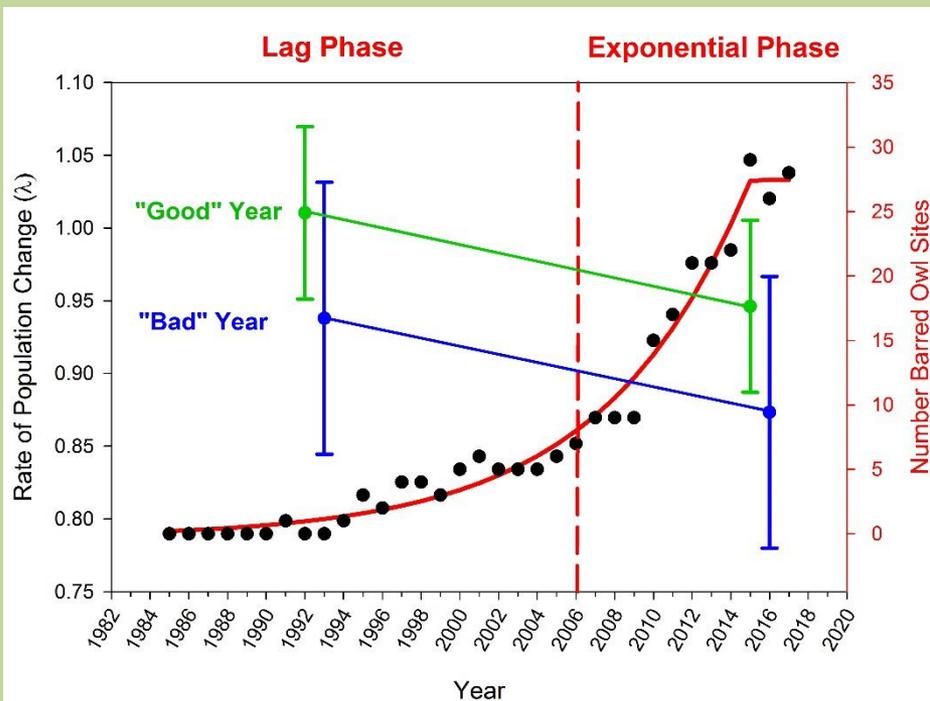United States Department of Agriculture
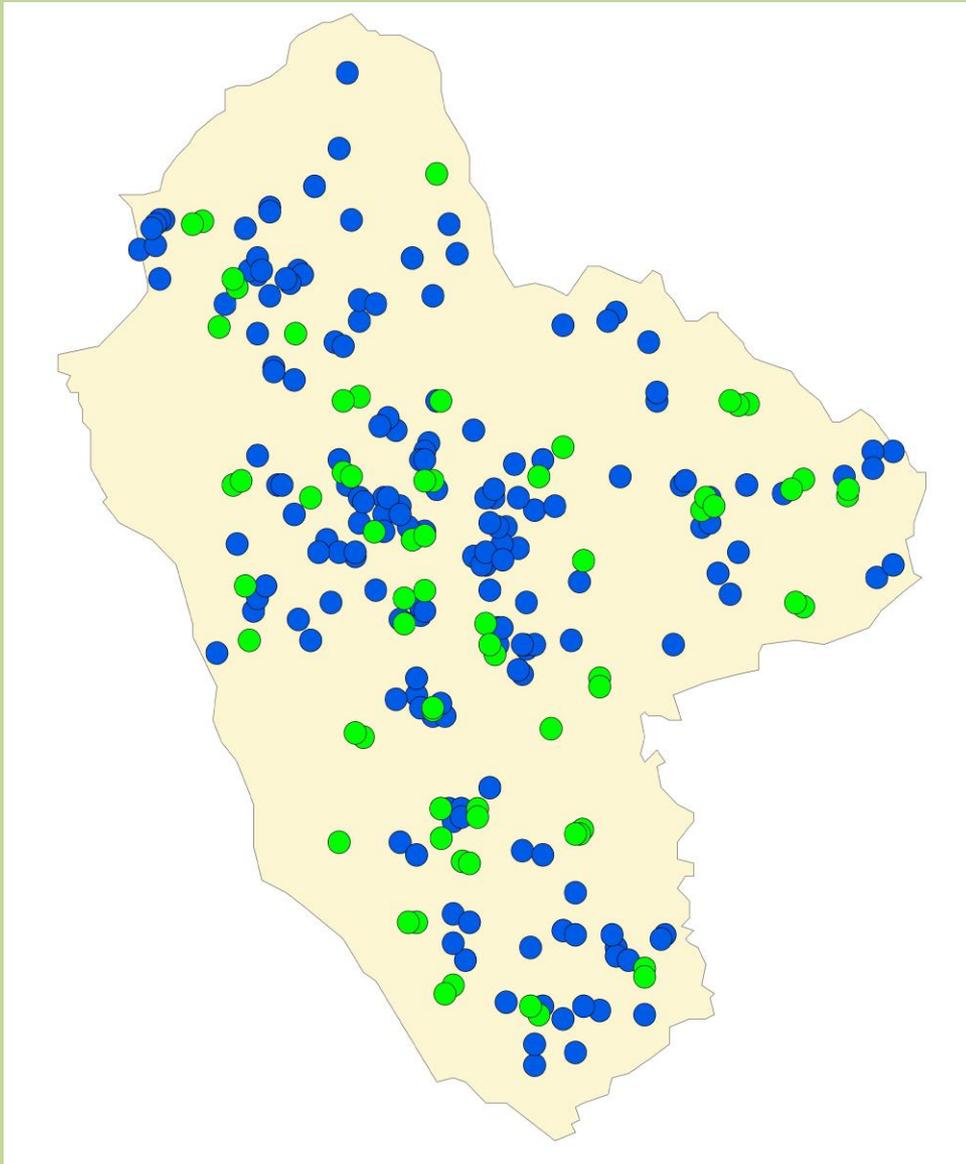
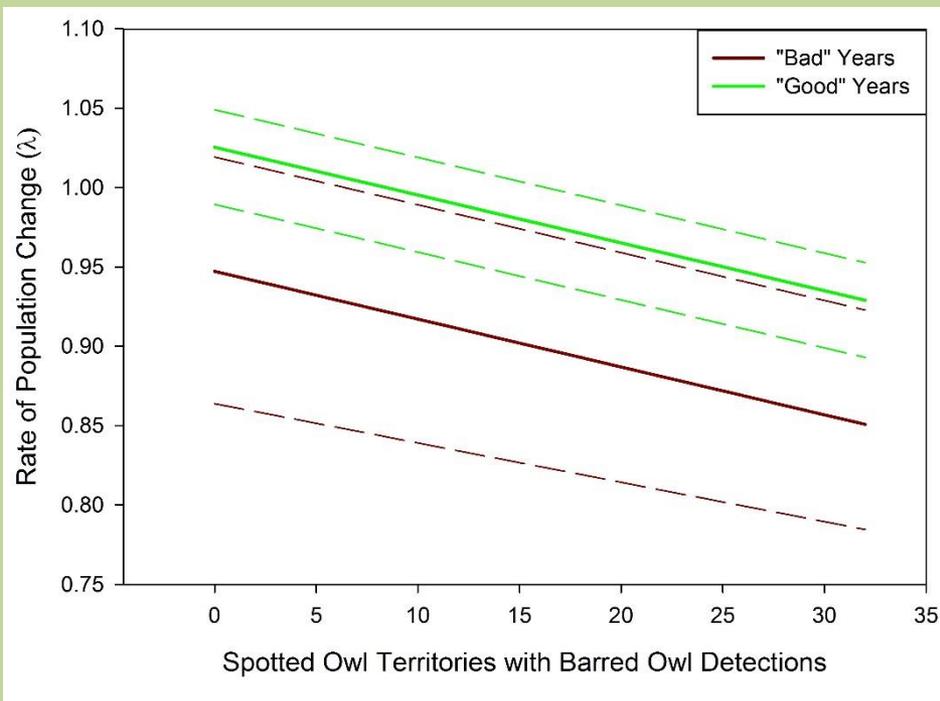**NSO LOCATIONS ON WCSA (2018)**

BO LOCATIONS ON WCSA (2018)

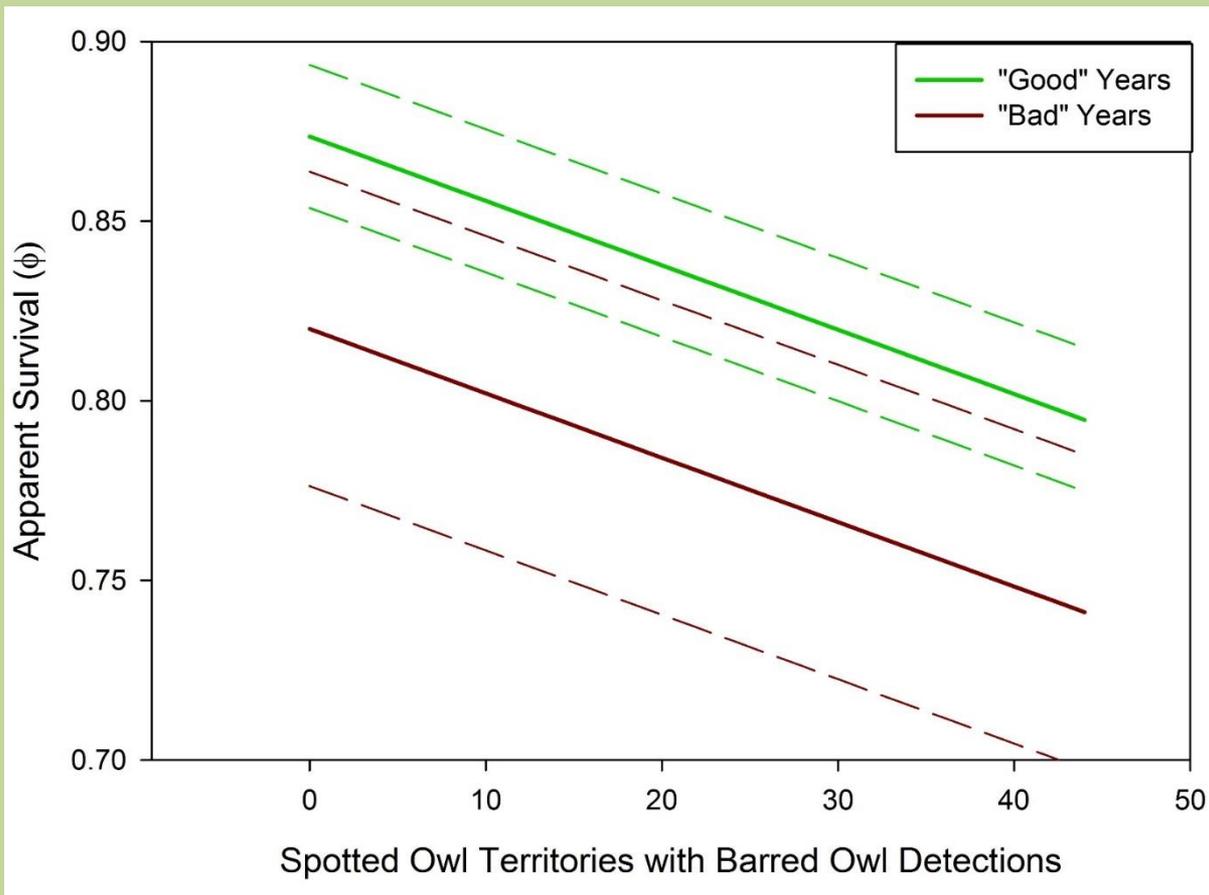**EFFECTS OF BARRED OWLS ON RATES OF POPULATION CHANGE (λ)**

1. Barred Owl Sites
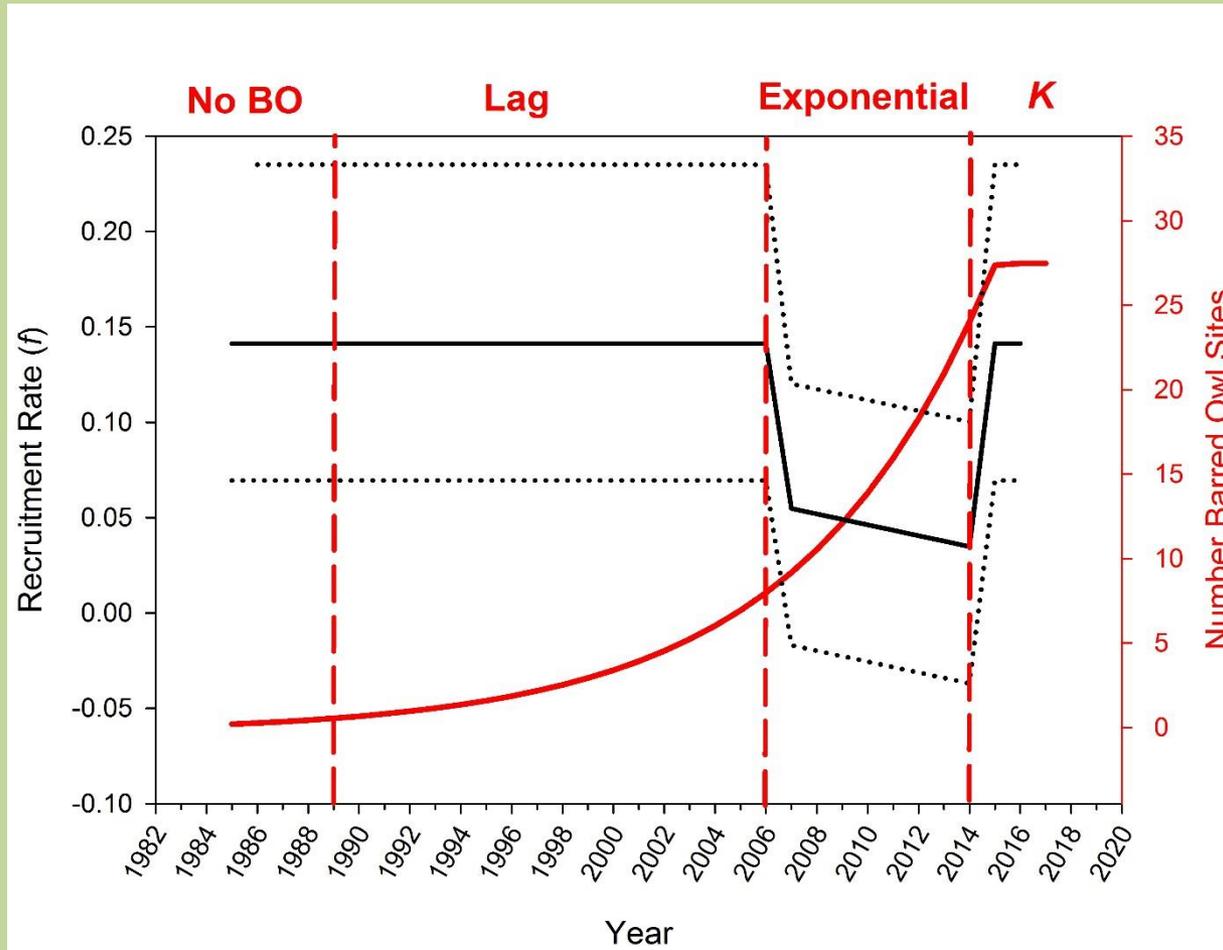
2. Barred Owl Detections on NSO Sites

- In both models, effects of BO additive with "bad" climatic years
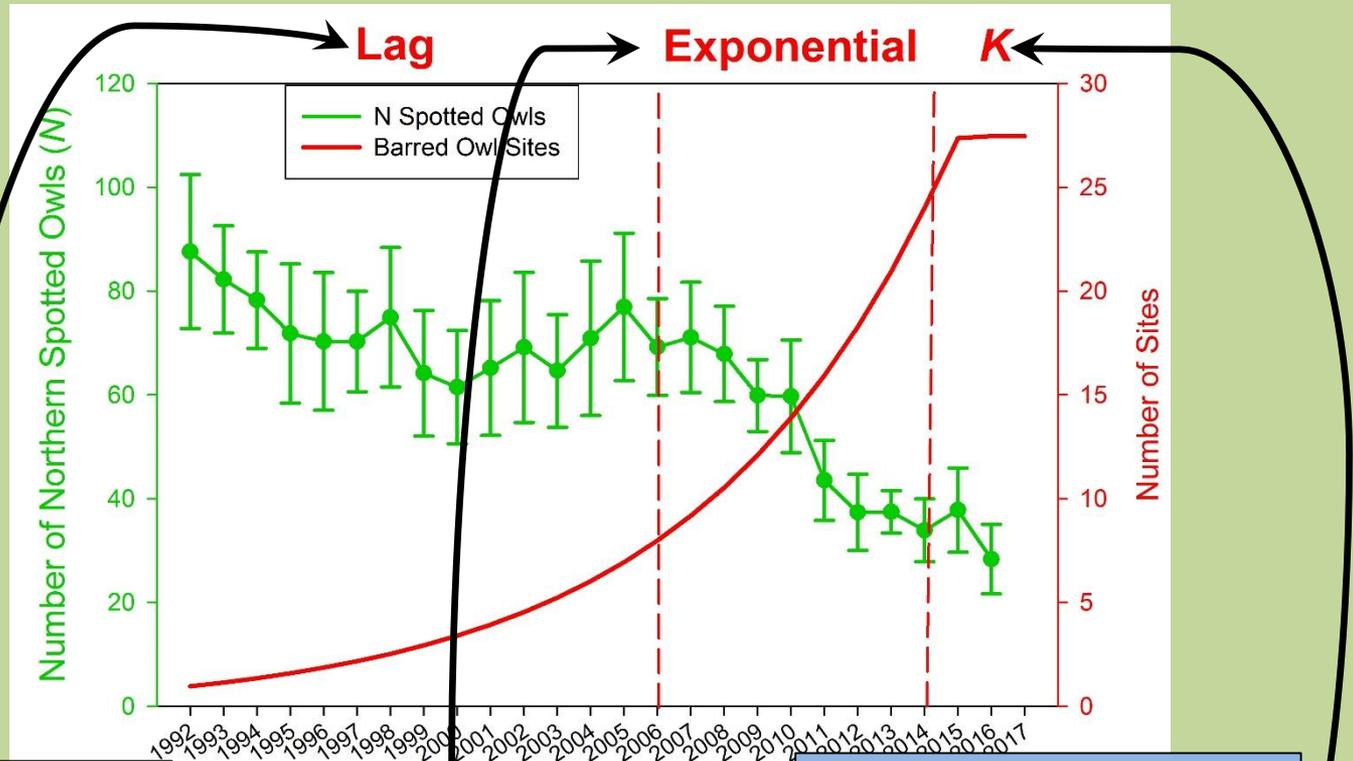
COMPONENT OF (λ): APPARENT SURVIVAL (φ)

$$\hat{\lambda} = \hat{\varphi} + \hat{f}$$

COMPONENT OF (λ): RECRUITMENT (*f*)

$$\hat{\lambda} = \hat{\varphi} + \hat{f}$$

SUMMARY OF BARRED OWL EFFECTS

1. Northern Spotted Owl population have experienced dramatic decline on our study area in last decade
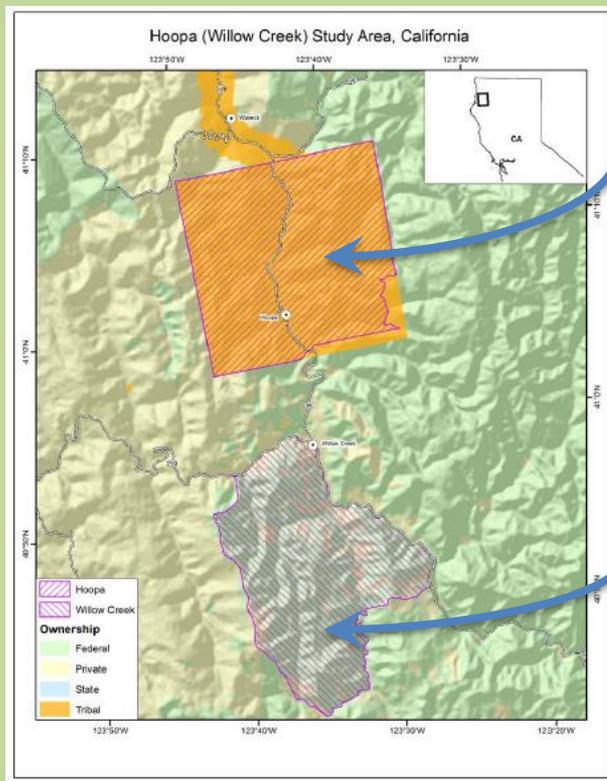 ➤ Question is where population is headed
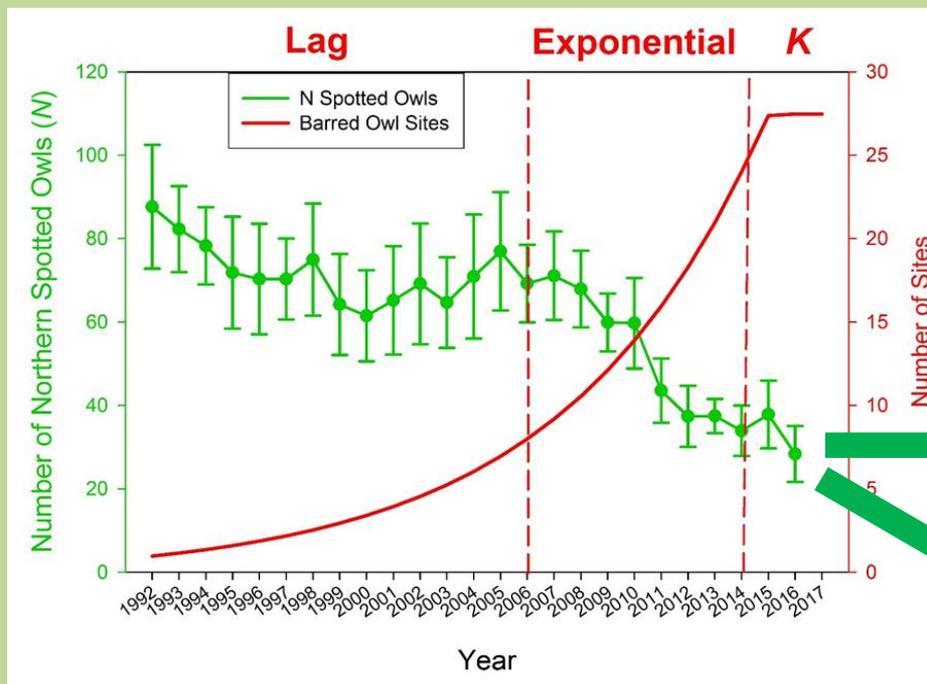
2. Barred Owls implicated as primary factor in recent Northern Spotted Owl population decline

➢ Further investigated with experimental removal of barred owls

Hoopa (Willow Creek) Study Area, California

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?