Indicators of disturbance effects and forest conditions: Results from two decades of bird monitoring in the Klamath

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Pacific Southwest Research Station
American Bird Conservancy
Avian Knowledge Network
Working Together
Klamath Bird Observatory

Advancing bird and habitat conservation through science, education, and partnerships

Klamath Siskiyou Bioregion

Avian Knowledge Northwest

International partnerships and capacity building
Bird Conservation Plans

Habitat Conservation for Landbirds in the Coniferous Forests of Western Oregon and Washington

Land Manager’s Guide to
Bird Habitat and Populations in Oak Ecosystems of the Pacific Northwest

Suites of indicators

- Cost effective to monitor
- Responsive to management actions
- Partner-friendly (non-regulatory)
- Representative of desired future conditions for healthy ecosystems

Habitat Attributes and Focal Species

(Altman and Alexander 2012)
Density Distribution Models

Predict density of bird species across landscapes

- Added value

(Veloz et al 2015, Conservation Biology)
Density Distribution Models

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Identifying priority conservation areas

(Veloz et al 2015, Conservation Biology)
Density Distribution Models

Predict density of bird species across landscapes

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Identifying the highest priority conservation areas

Klamath Siskiyou Bioregion.

(Veloz et al 2015, Conservation Biology)
Bird Community Ecology

3 scales
- Ecoregion
- Habitat type
- Park unit

(Stephens et al 2015, PlosONE)
Bird Community Ecology

3 scales
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2,000 sites from 19,395

96 Passerines

Metrics
- Climate
- Geography
- Vegetation

(Stephens et al 2015, PlosONE)
What Drive Bird Communities?

Ecological drivers at all scales

- **Climate**
  - Temperature – mean breeding season and range

- **Geographic**
  - Elevation

- **Vegetation**
  - Coarse measures – Habitat type

(Stephens et al 2015, PlosONE)
What Drive Bird Communities?

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Important at smaller scales

- **Succession**
- **Disturbance**

(Stephens et al 2015, PlosONE)
Quartz Fire

(Stephens et al 2015, Condor)
Quartz Fire

Observed Difference

Predicted Difference

(Seavy and Alexander 2011, JWM; Seavy 2006, PhD Dissertation)
Quartz Fire

(Seavy and Alexander 2011, JWM; Seavy 2006, PhD Dissertation)
Management Implications
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(Seavy and Alexander 2011)
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Indicators: Habitat Models

**Broadleaf-conifer mix**
- Bushtit
- Lazuli Bunting
- Spotted Towhee
- Black-headed Grosbeak
- *Black-thr. Gray Warbler
- Nashville Warbler

**High volume conifer**
- Golden-crowned Kinglet
- Townsend’s Solitaire
  - *Brown Creeper
  - *Hermit Warbler
  - *Pacific-slope Flycatcher
  - *Winter Wren

**Conifer generalists**
- Red-breasted Nuthatch
- Yellow-rumped Warbler

**Chapparal and Oak woodland**
- Bewick’s Wren
- Bullock’s Oriole
- California Towhee
- Lesser Goldfinch
- Western Scrub-Jay
- Western Wood-pewee
- White-breasted Nuthatch

*Oregon-Washington PIF Focal Species (Western Coniferous Forests)*

*(Betts et al. 2010; Seavy and Alexander 2011; Altman and Alexander 2012)*
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Fire Severity and Time

(Stephens et al 2015, Condor)
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Interactive effects

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Fire Severity and Time

Interactive effects
- Long-term studies
- Severity matters

Restoration
- Mimic nature
- Mixed severity
- Post-fire conditions

(Stephens et al 2015, Condor)
Fire Severity and Time

Interactive effects
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Population/Landscape Relevance

(Stephens et al 2015, Condor)
Image Derived Distribution Models

6 Landsat TM Spectral Reflectance Bands
Band 1 + 2 + 3 ... 5 + 7 = Probability of occurrence

(Shirley et al. 2013)
Image Derived Distribution Models

Compared to Land Cover Derived Models:

- High prediction ability
- Wider temporal range
- Avoid uncertainty:
  - misclassification of habitats
  - omission of fine-scale features
  - subtle changes in vegetation

(Shirley et al. 2013)
Reflectance and NDVI Models (AUC ± S.E.)

Reflectance Models:
AUC value across all species of 0.87
(SD = 0.067; Range = 0.71 to 0.99)

NDVI Models:
Lower prediction success
(Mann-Whitney test = 280.00, p = <0.001)
Predicted oak-associated species richness or habitat suitability

Species-centric Habitat Models

Etc… N = 48 species

(Halstead 2013, Betts et al. 2015)
Forest Birds and Succession

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Forest Birds and Succession

Quantitative Habitat and Population Objectives
(Altman & Alexander 2012; Chase and Geupel 2005)
### Quantitative Habitat and Population Objectives

(Altman & Alexander 2012; Chase and Geupel 2005)
Forest Birds and Succession

Surrogate for Spotted Owl Habitat Suitability
Klamath-Siskiyou East
Forest Stage: OLD GROWTH/MATURE FOREST
Habitat Attribute: DECIDUOUS CANOPY/SUBCANOPY TREES
Focal Species: PACIFIC-SLOPE FLYCATCHER (*Empidonax difficilis*)
Habitat Objectives

- Landscapes: Within landscapes >1,000 ha (2,500 ac), maintain approximately 90% as late-successional coniferous forest that includes a high percent of unfragmented core areas of densely canopied forest and patches of thinly canopied forest interspersed with patches of mixed coniferous-deciduous forest and deciduous forest (includes riparian habitat) (2-10%) with site-level habitat conditions as described below.

- Sites: Where ecologically appropriate in forests >40 years old provide
  - >20% deciduous canopy cover, particularly where associated with riparian zone or wet site deciduous trees especially red alder.
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Forest Type: KLAMATH MOUNTAINS MIXED CONIFER and MIXED HARDWOOD-CONIFER FORESTS
Habitat Attribute: PINE-OAK CANOPY/SUBCANOPY TREES
Focal Species: PURPLE FINCH (Carpodacus purpureus)

Forest Stage: OLD GROWTH/MATURE FOREST
Habitat Attribute: LARGE TREES
Focal Species: BROWN CREEPER (Certhia americana)
Species-centric Habitat Models

Recently disturbed
6 species

Post-disturbance
4 species

Wildlife
6 species
Climate-wise planning

Avian Knowledge Northwest
A Partner of Avian Knowledge Network

Pacific Northwest Climate Change Avian Vulnerability
Conservation Priority Maps

(Veloz et al 2008)
Climate-wise planning

- Conifer species
- Grassland species
- Oak woodland species
- Riparian species
Climate-wise planning
Conifer Zonation
Oak Zonation
Purple Finch Habitat Attributes

Forest Type: KLAMATH MOUNTAINS MIXED CONIFER and MIXED HARDWOOD-CONIFER FORESTS
Habitat Attribute: PINE-OAK CANOPY/SUBCANOPY TREES
Focal Species: **PURPLE FINCH** (*Carpodacus purpureus*)

(Altman & Alexander 2012)
**Habitat Objectives**

- Sites: Maintain >60% canopy/subcanopy closure, especially where pine and oak are part of the canopy.
- Sites: Where ecologically appropriate (e.g., drier sites), maintain >25% canopy cover of pine and oak trees.

**Habitat Conservation Strategies**

- Retain all mature pine-oak canopy trees.
- Conduct thinning or other forest management to select for growth of mature pine and oak trees in ecologically appropriate sites.
- Where managed regeneration is occurring, plant pine and oak trees in ecologically appropriate sites (e.g., drier sites).
Oak Restoration: Management effects

Mechanical vs. Manual Treatments?

(Alexander et al. 2007, Seavy et al. 2008; Forest Ecology and Management)
Oak Restoration: Management effects

Mechanical vs. Manual Treatments?

(Alexander et al. 2007, Seavy et al. 2008; Forest Ecology and Management)
“PIF’s multi-species, science-based approach can serve as a catalyst for improving ecosystem management on public lands”
Science-based Approach

*Conservation Objectives*  
• Assess conservation needs  
• Set measurable objectives  
• Design management  
• Measuring effectiveness

*Management Objectives*

Prescribed fire as restoration
THANK YOU!

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