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

John D. Alexander & Jaime L. Stephens

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Acknowledgements

Coauthors

Bob Altman
Kate Halstead
Matt Betts et al.
Sam Veloz et al.
Nat Seavy et al.
CJ Ralph.

Field Technicians

25 year!

Images

Jim Livaudais
Gary Bloomfield

Partners

Klamath Bird Observatory

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

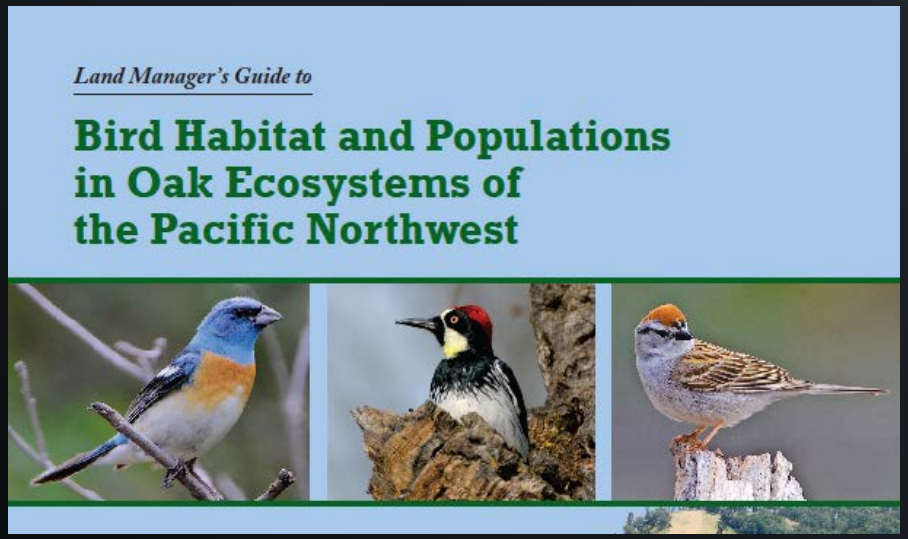
Klamath Siskiyou Bioregion

Avian Knowledge Northwest
A Partner of Avian Knowledge Network

International partnerships and capacity building

PARTNERS IN FLIGHT · PARTENAIRES D'ENVOL · COMPAÑEROS EN VUELO

Bird Conservation Plans



(Rosenberg et al 2017, Altman and Alexander 2012, Altman and Stephens 2012)

Suites of indicators

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

(Alexander 2011, Chase and Geupel 2005, Hutto et al. 1998)

Habitat Attributes and Focal Species

Forest Stage/ Habitat Attribute	Large snags	Large trees	Decid trees	Mid-story layers	Closed canopy	Open mid-story	Decid shrub layer	Forest floor complex	Decid trees	Residual trees	Snags	Decid shrub layer
Old-Growth/ Mature	**PIWO** ***BRCR*** CBCH NPOW RBSA VASW	**BRCR** ***HEWA*** CBCH COHA GCKI NOGO NPOW RECR	**PSFL** ***BGWA*** ***BGHR*** ***VATH*** CAVI PUFI RBSA	**VATH** ***WIWA*** HUVI NSWO								
Mature/Young					**HEWA** ***BRCR*** ***WIWR*** COHA GCKI NPOW STJA TOWA RECR	**HAFL** ***PSFL*** COHA NOGO	**WIWA** ***BLGR*** ***OCWA*** ***RUHU*** HUVI MGWA RUGR	**WIWR** ***OCWA*** ***WIWA*** MGWA				
Young/Pole									**BGWA** ***CAVI*** ***BHGR*** ***PSFL*** HUVI PUFI RBSA RUGR			
Sapling/Seedling										**OSFL** ***WETA*** COHA NOGO RECR STJA	**NOFL** PUMA WEBL	**OCWA** ***BLGR*** ***HUVI*** ***RUHU*** DUFL FOSP MGWA MOQU RUGR SPTO WIFL WREN

Photos by Erik Ackerson

(Altman and Alexander 2012)

Avian Knowledge Network

Avian Knowledge Northwest

A Partner of Avian Knowledge Network

Choose a Data Collection

- [x] PRBO - Point Count
- [ ] PRBO - Banding
- [ ] PRBO - Area Survey
- [ ] PRBO At Sea
- [ ] Breeding Bird Survey
- [ ] eBird
- [ ] Ventana Wildlife Society - Banding
- [ ] MAPS Stations - Banding
- [x] Klamath Bird Monitoring Network - Point Count
- [ ] Klamath Bird Monitoring Network - Checklist
- [ ] Klamath Bird Monitoring Network - Area Survey
- [ ] Klamath Bird Monitoring Network - Banding
- [x] North Pacific LCC - Point Count

Choose a Map Overlay

- (•) States
- ( ) Counties

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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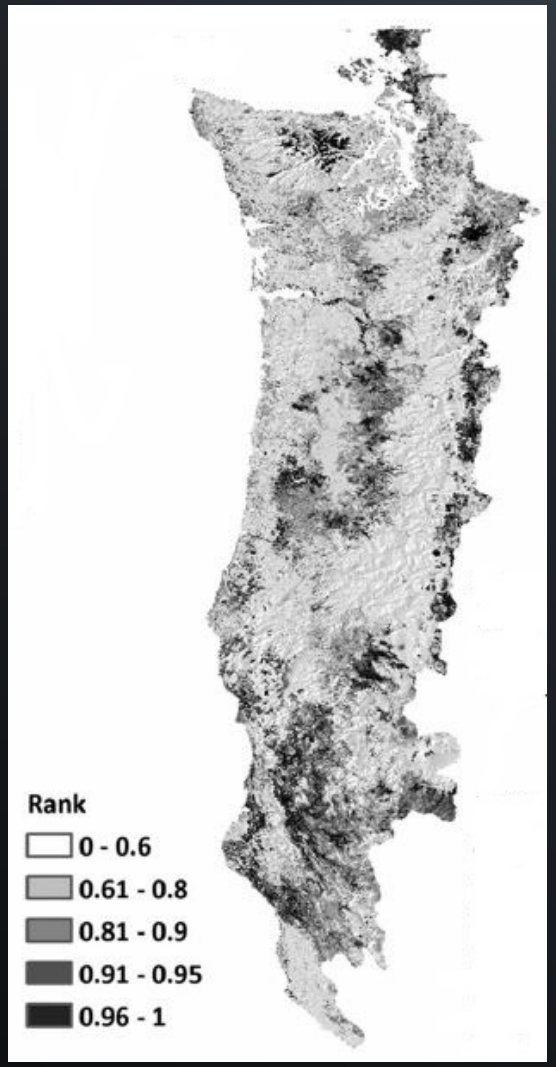
Identifying priority conservation areas



(Veloz et al 2015, Conservation Biology)

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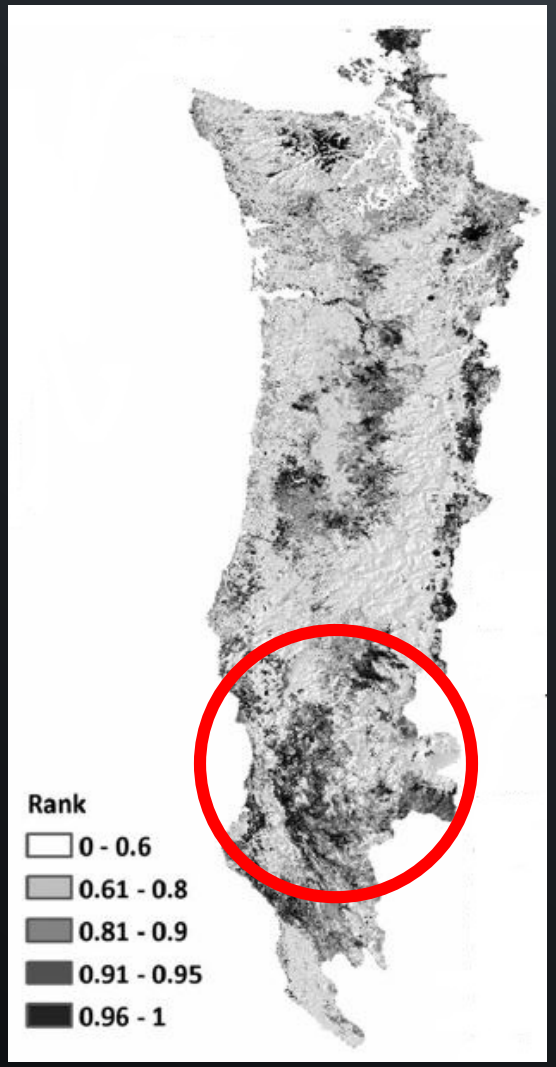
Identifying the highest priority conservation areas

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

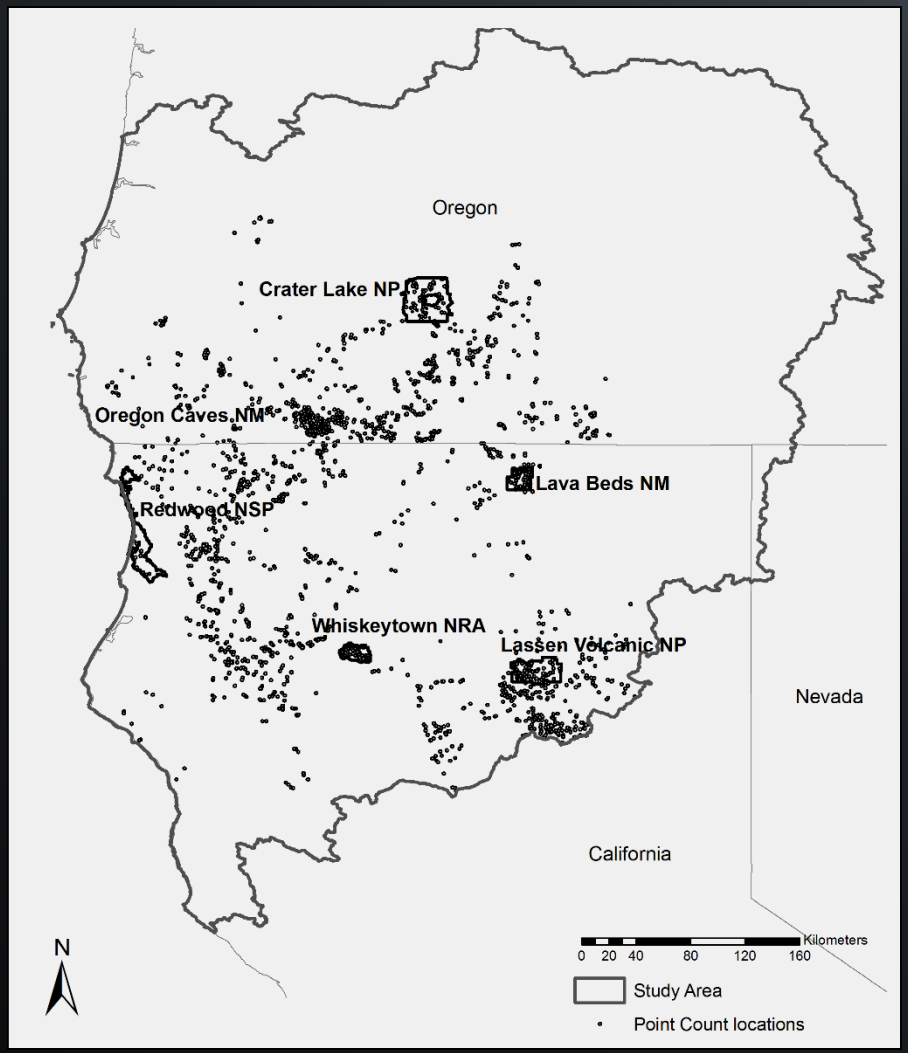
- Ecoregion
- Habitat type
- Park unit

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?

Ecological drivers at all scales

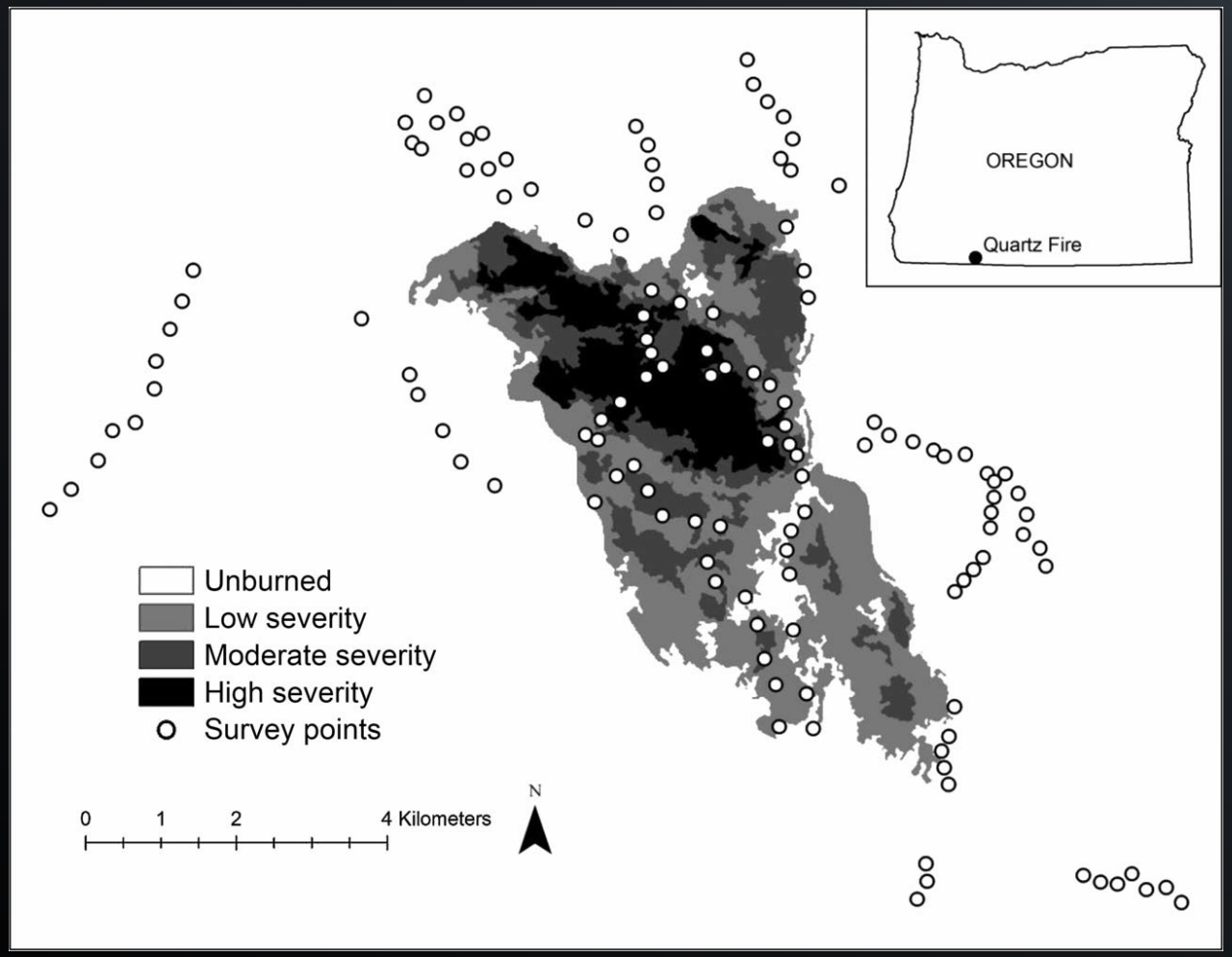
- Climate
  - Temperature – mean breeding season and range
- Geographic
  - Elevation
- Vegetation
  - Coarse measures – Habitat type

Important at smaller scales

- Succession
- Disturbance

(Stephens et al 2015, PlosONE)

Quartz Fire



(Stephens et al 2015, Condor)

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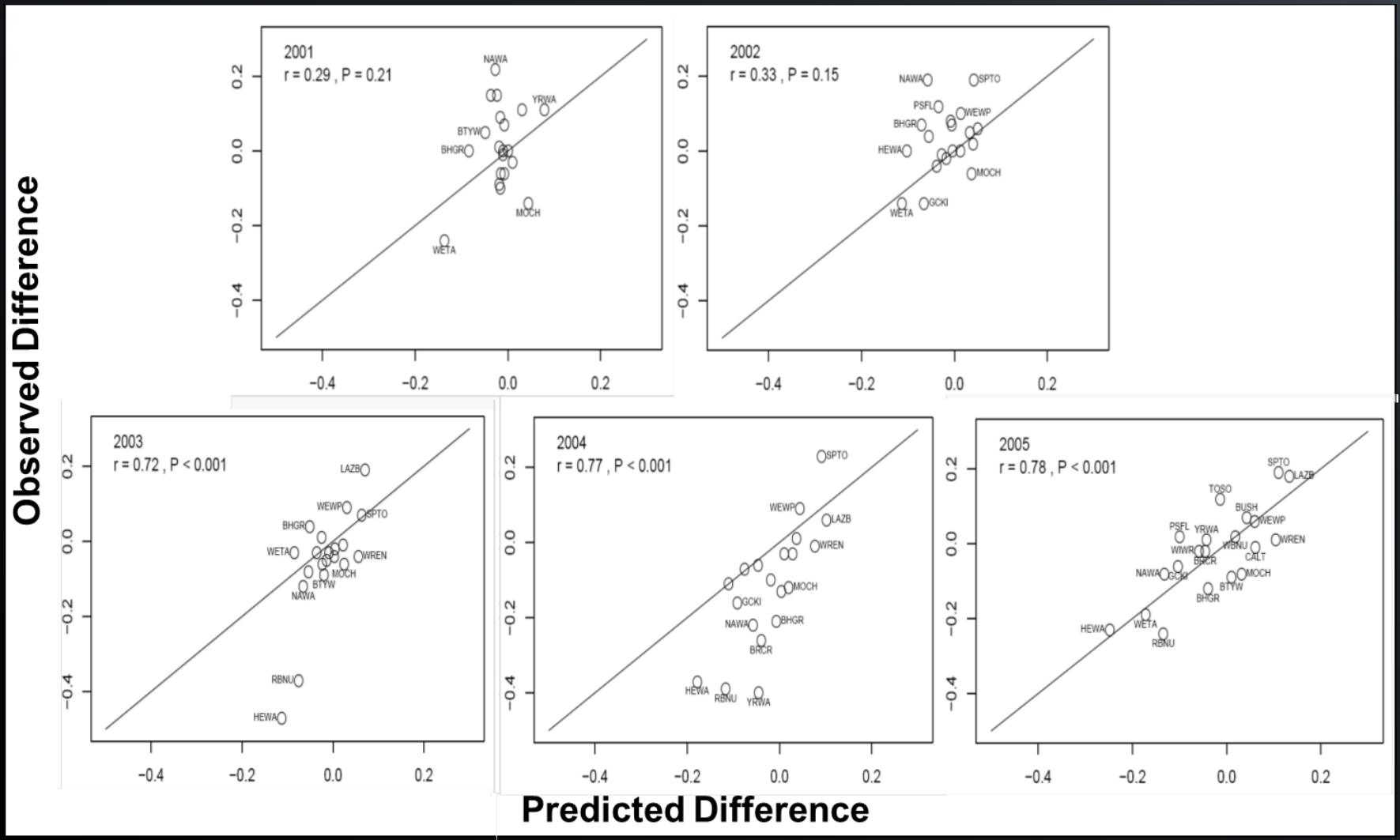

(Seavy and Alexander 2011, JWM; Seavy 2006, PhD Dissertation)

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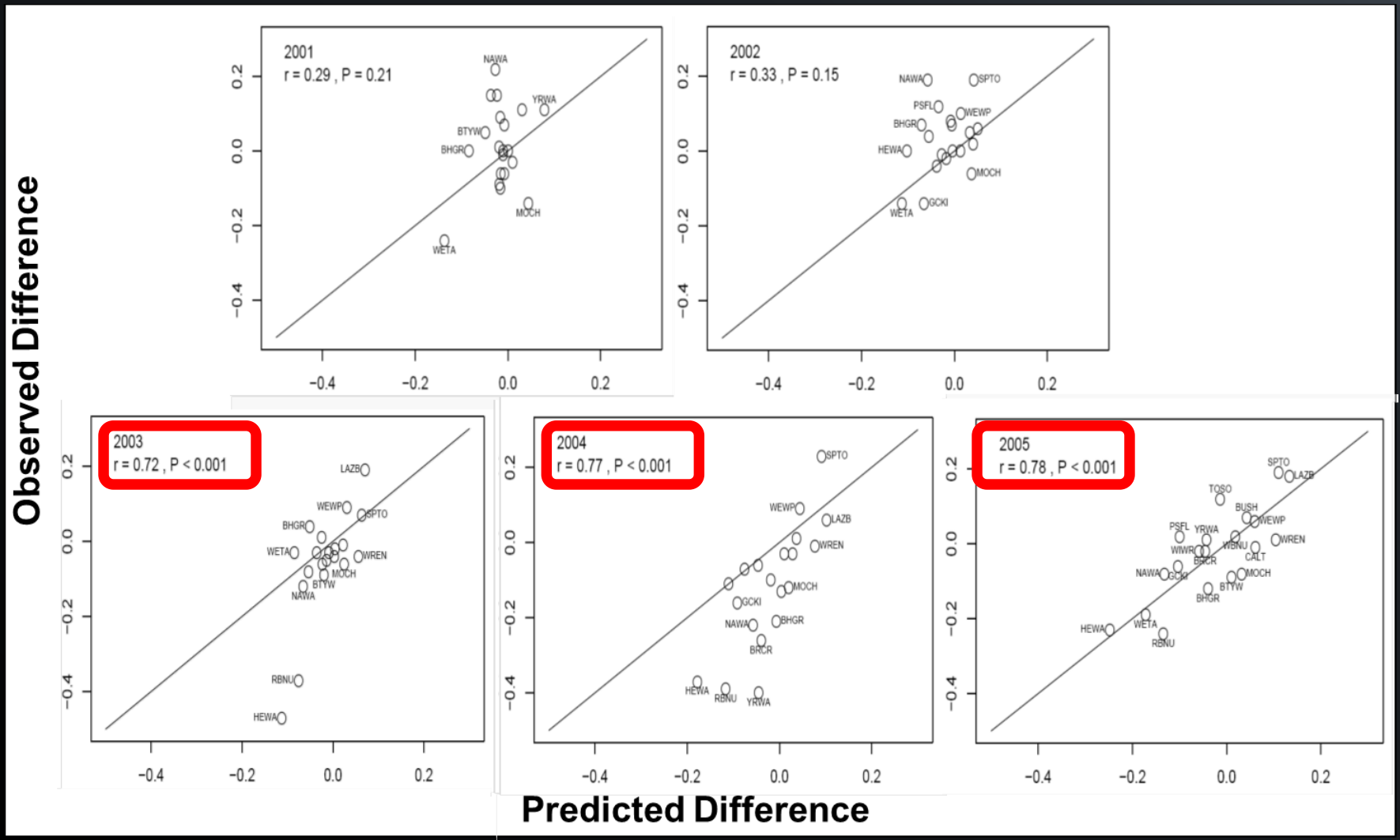

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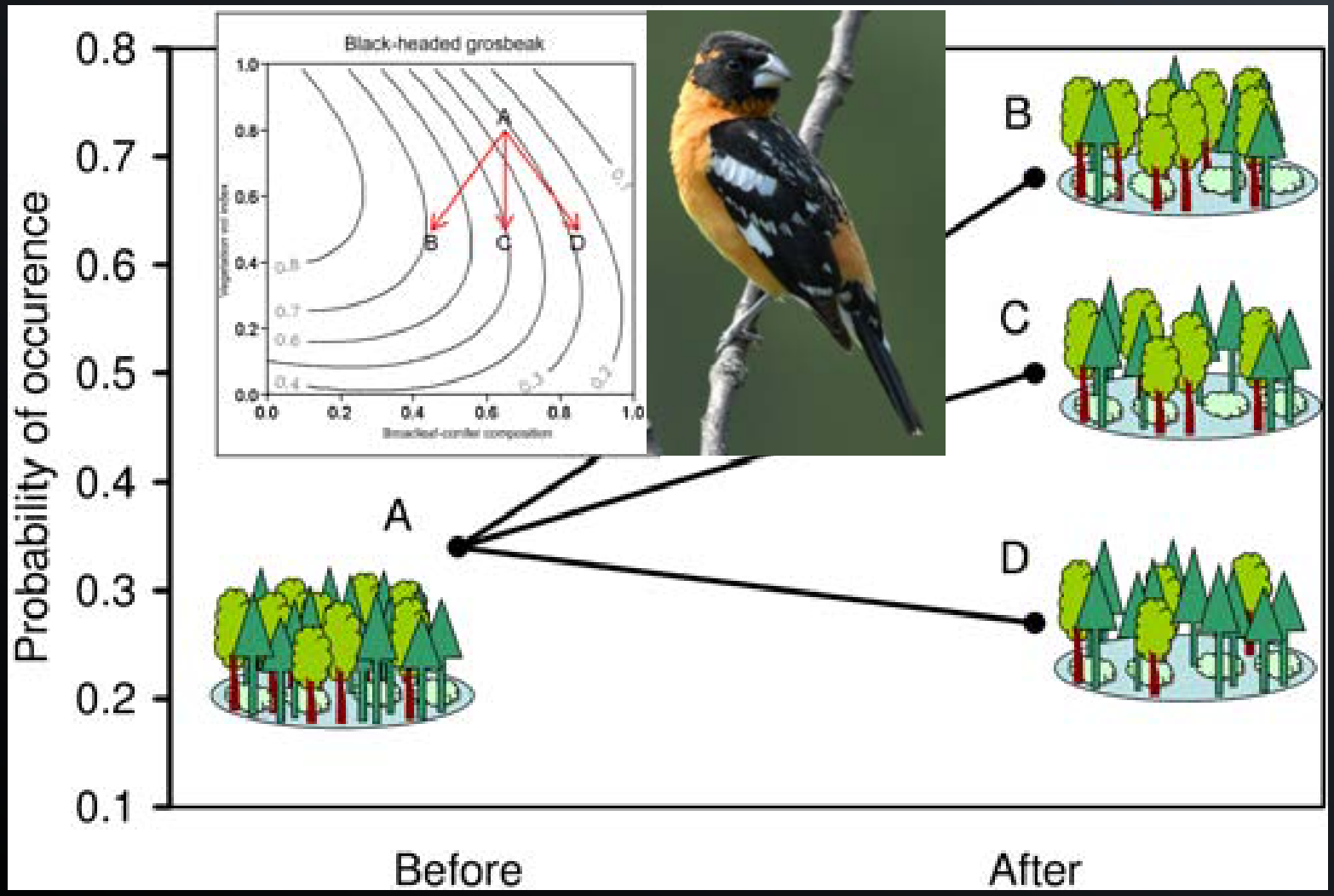
Management Implications



(Seavy and Alexander 2011)

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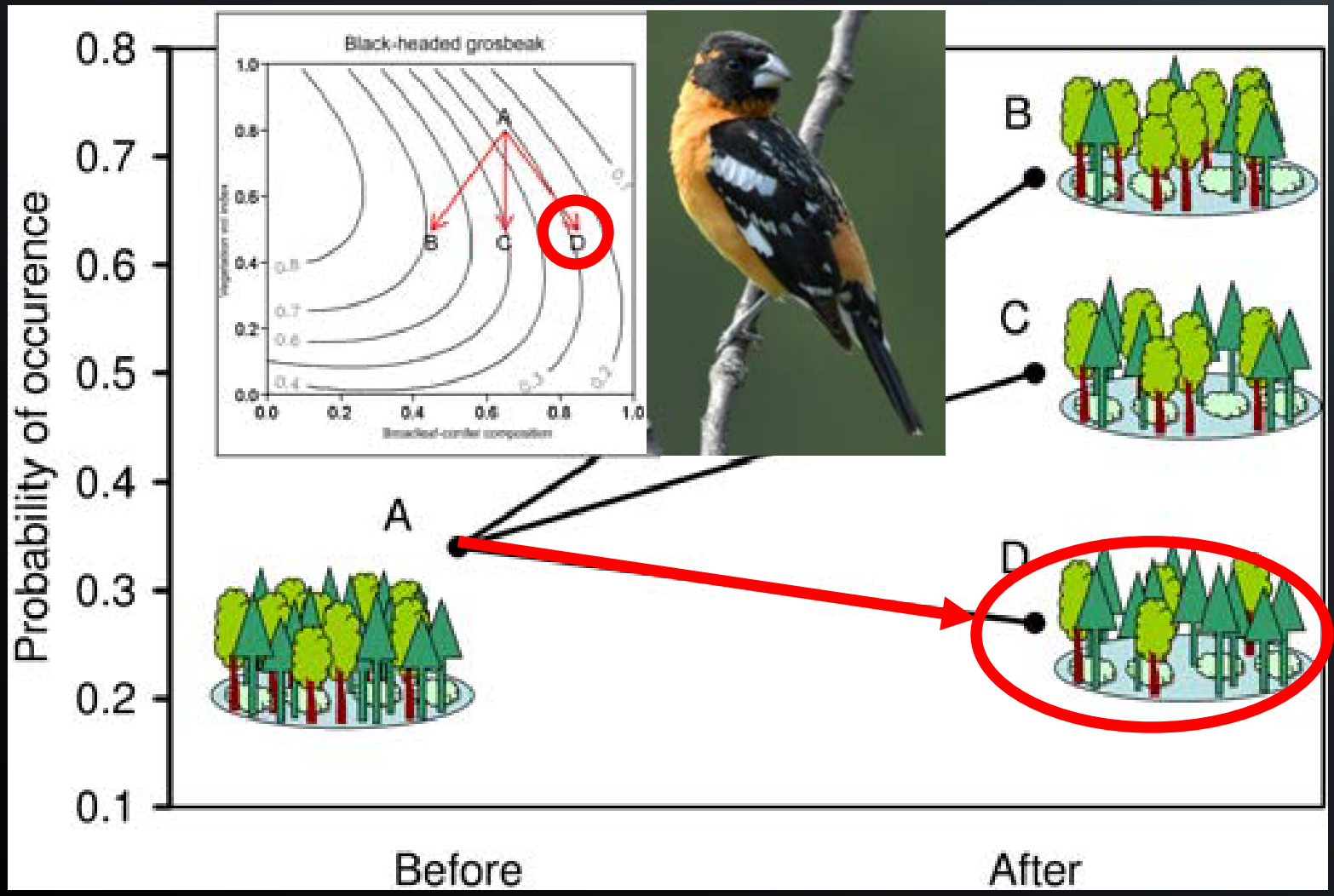

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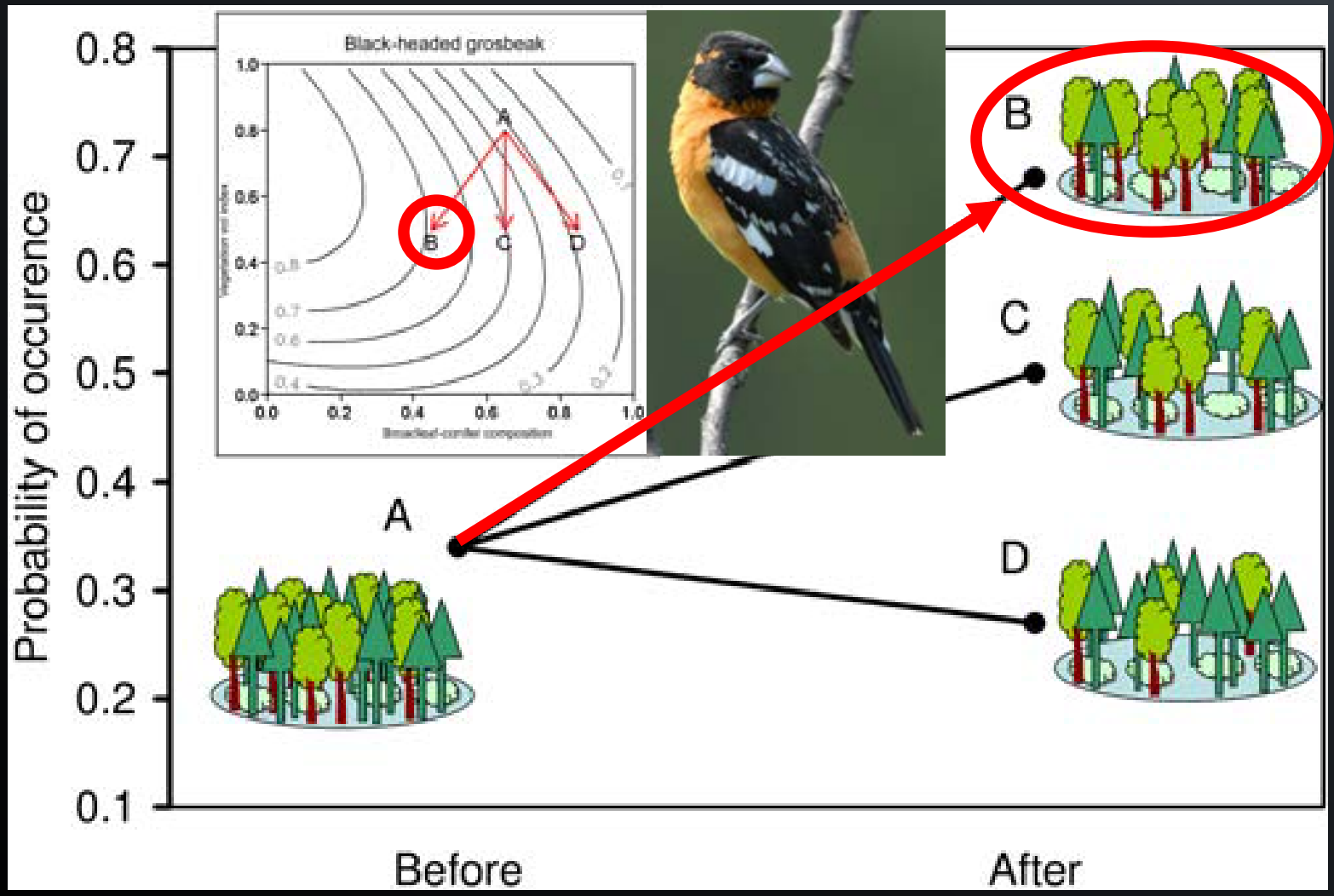
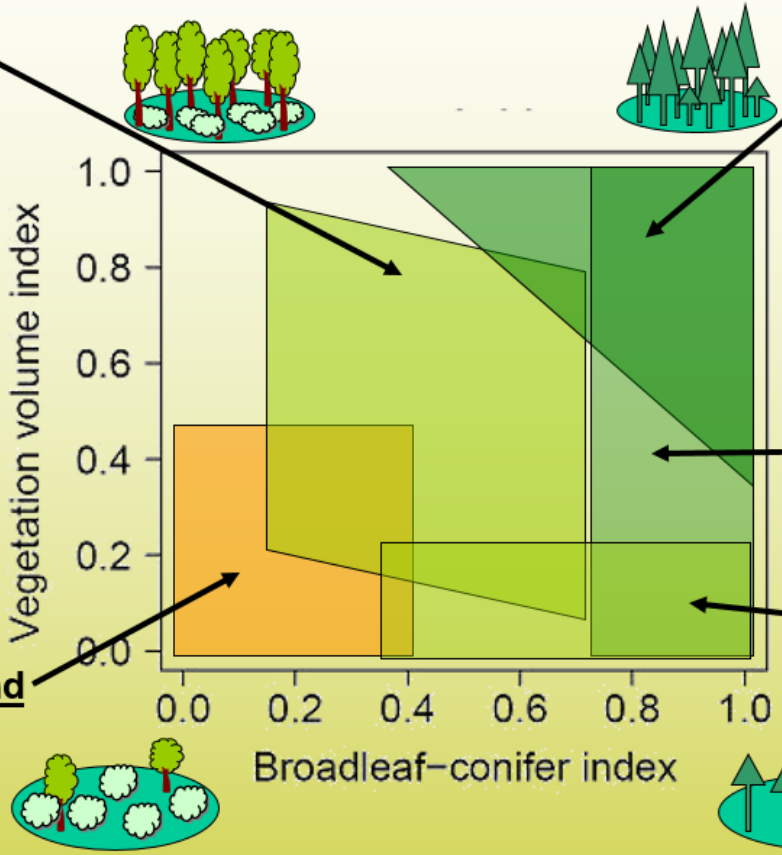


(Seavy and Alexander 2011)

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

Low volume conifer
Mountain Chickadee
Green-tailed Towhee

Chapparal and Oak woodland
Bewick's Wren
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Lesser Goldfinch
Western Scrub-Jay
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*** Oregon-Washington PIF Focal Species (Western Coniferous Forests)**

(Betts et al. 2010; Seavy and Alexander 2011; Altman and Alexander 2012)

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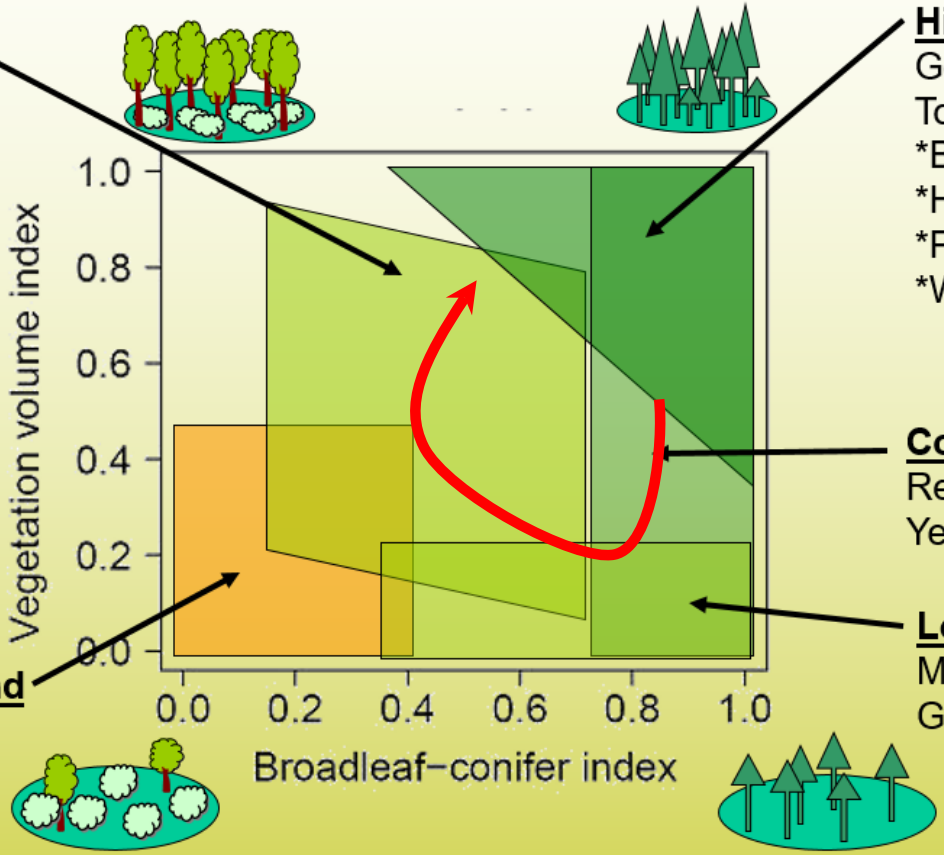

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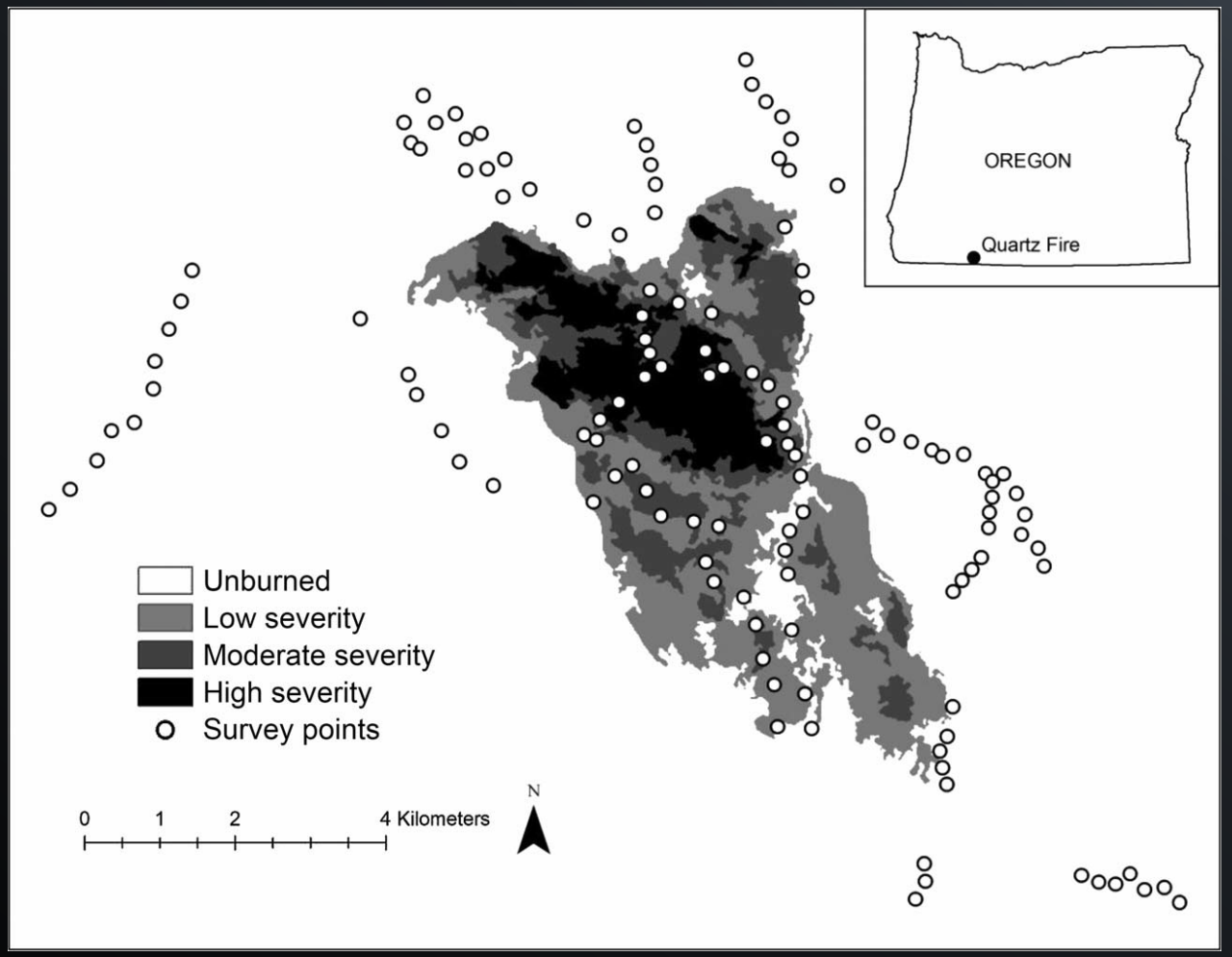
Fire Severity and Time



(Stephens et al 2015, Condor)

Fire Severity and Time

Interactive effects

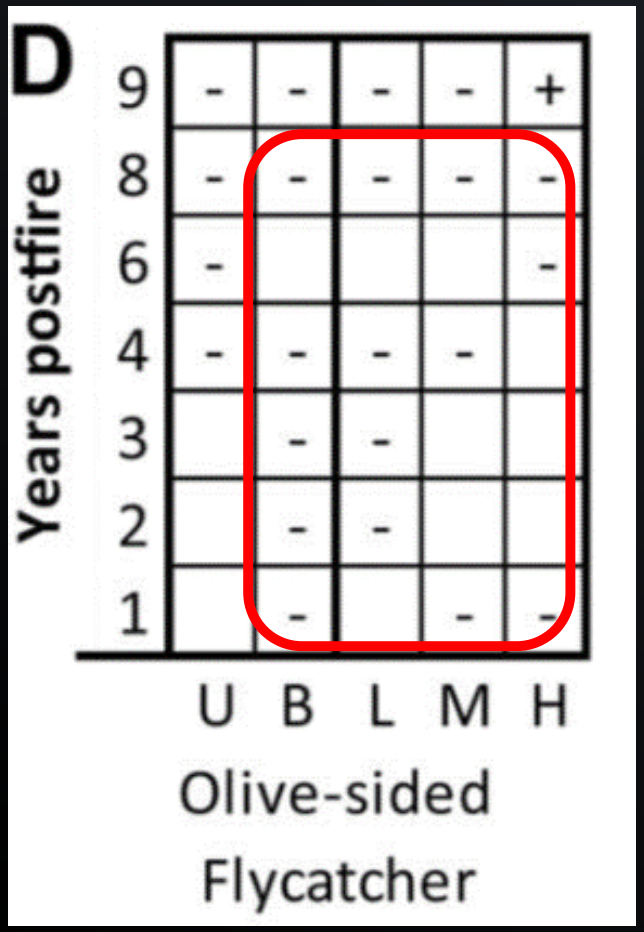
Years postfire (D)	U	B	L	M	H
9	-	-	-	-	+
8	-	-	-	-	-
6	-				-
4	-	-	-	-	
3		-	-		
2		-	-		
1		-		-	-

Olive-sided Flycatcher

(Stephens et al 2015, Condor)

Fire Severity and Time

Interactive effects



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Fire Severity and Time

Interactive effects

Years postfire	U	B	L	M	H
9	-	-	-	-	+
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4	-	-	-	-	
3		-	-		
2		-	-		
1		-		-	-

D

Olive-sided Flycatcher

(Stephens et al 2015, Condor)

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
- Long-term studies
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Restoration
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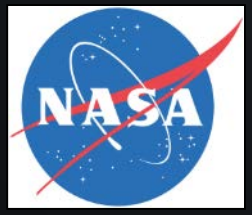
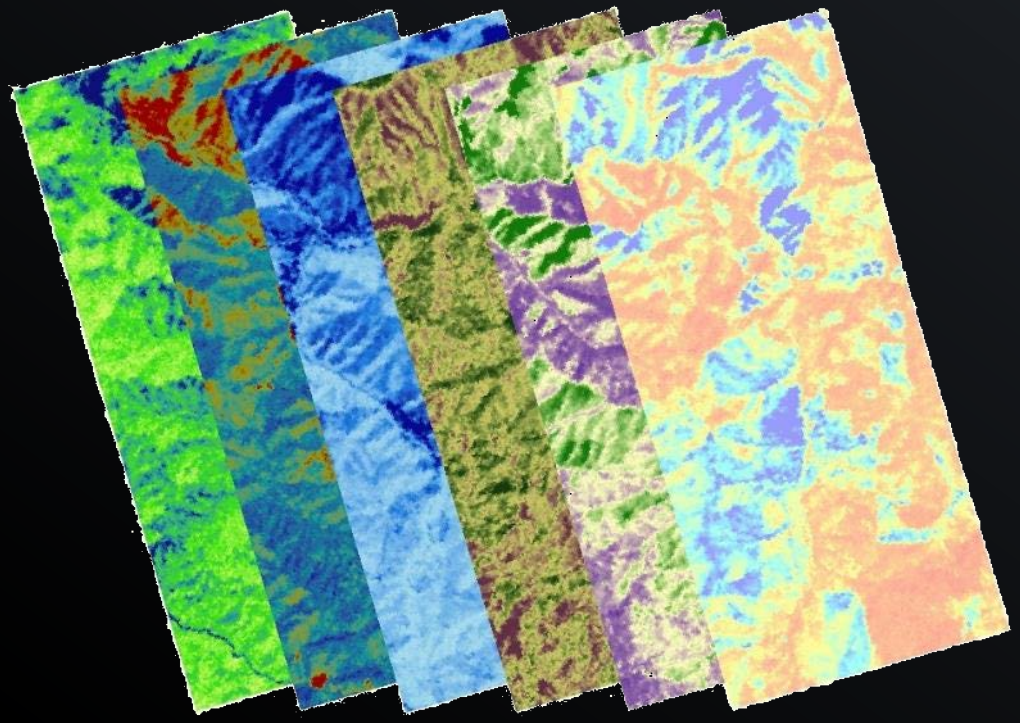
Population/Landscape Relevance

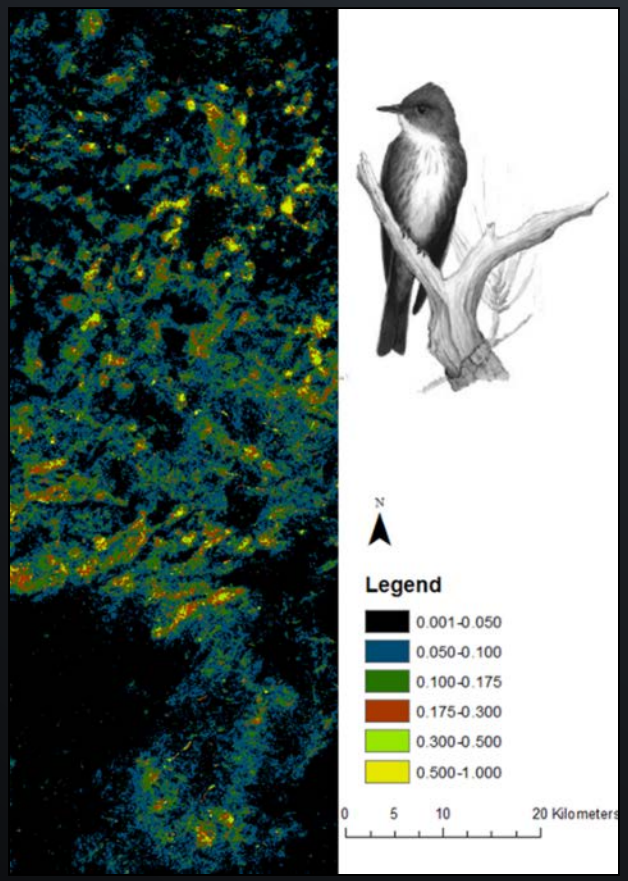
(Stephens et al 2015, Condor)

Image Derived Distribution Models

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





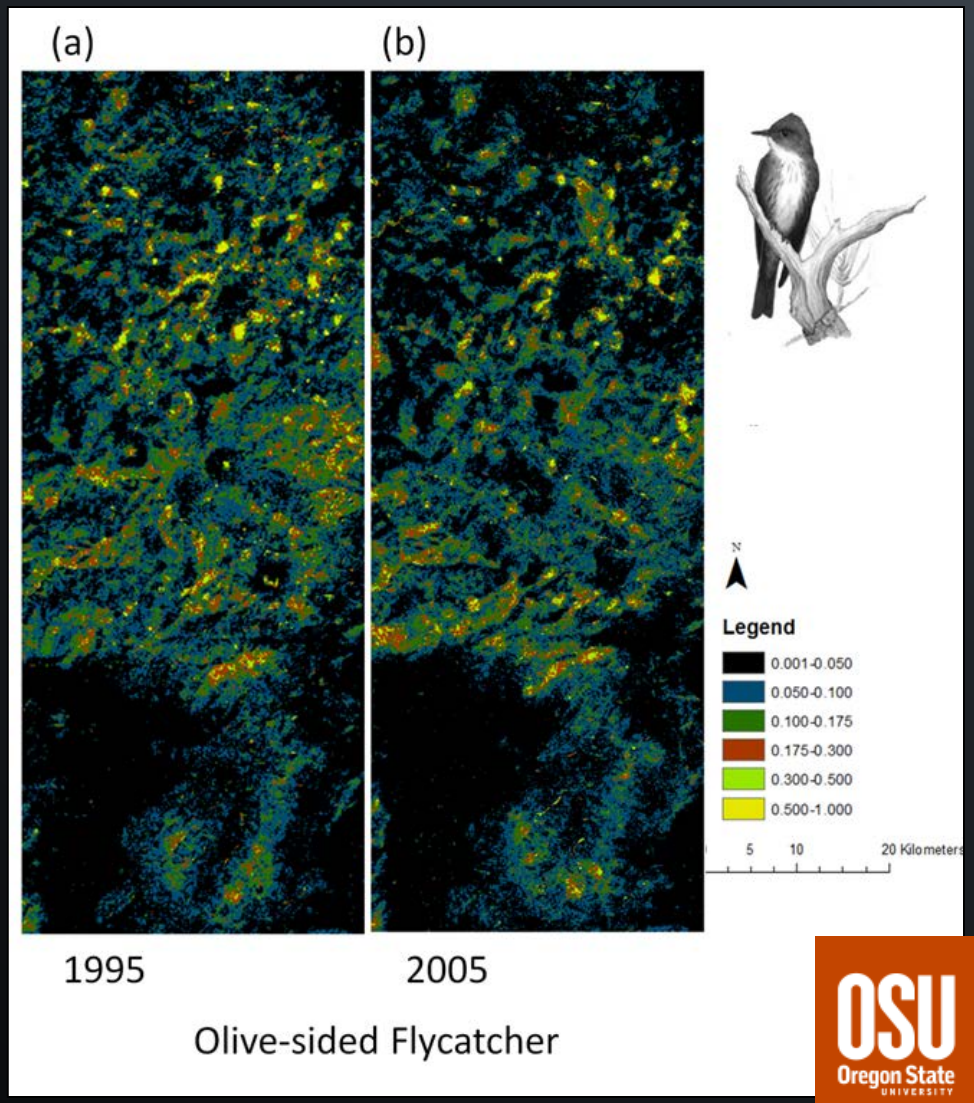


(Shirley et al. 2013)

Image Derived Distribution Models

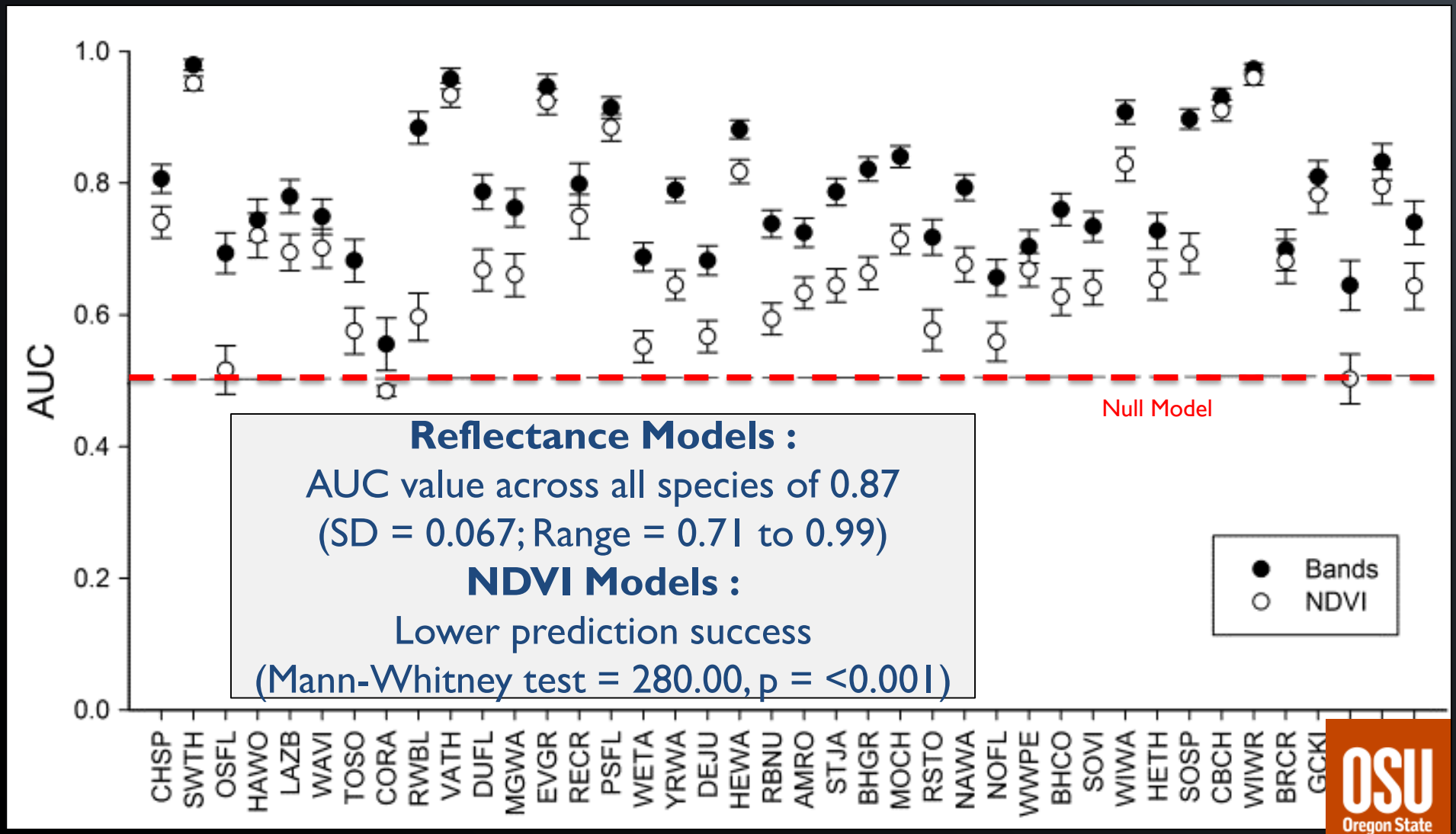
Compared to Land Cover Derived Models:

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



(Shirley et al. 2013)

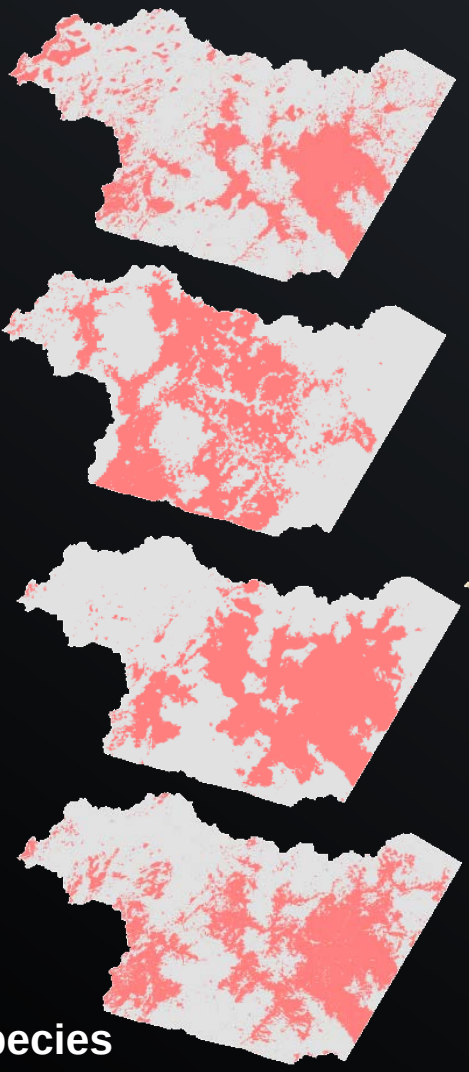
Reflectance and NDVI Models (AUC ± S.E.)



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)

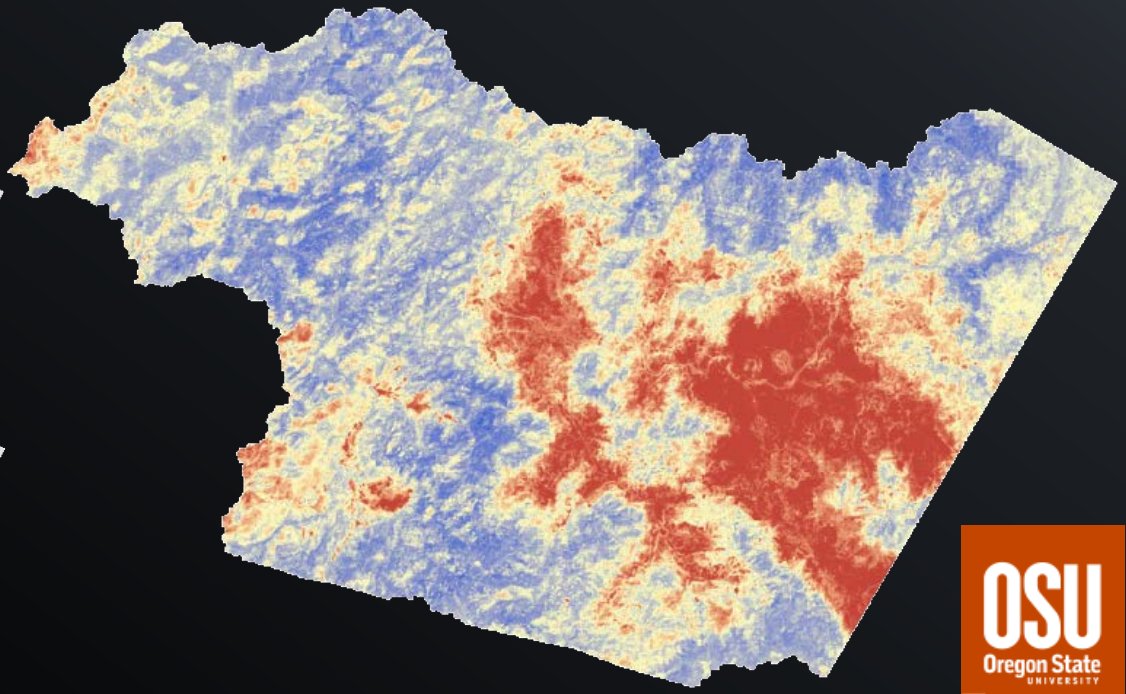
(Shirley et al. 2013)

Species-centric Habitat Models



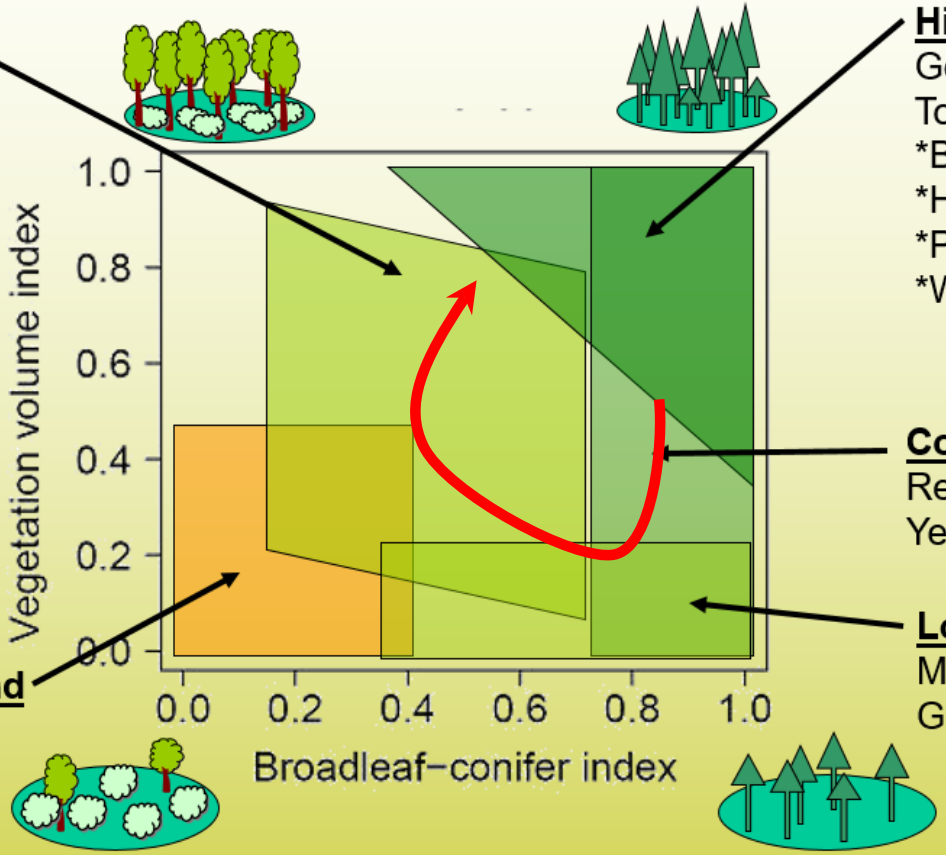
Etc… N = 48 species

Predicted oak-associated species richness *or* habitat suitability



(Halstead 2013, Betts et al 2015)

Forest Birds and Succession



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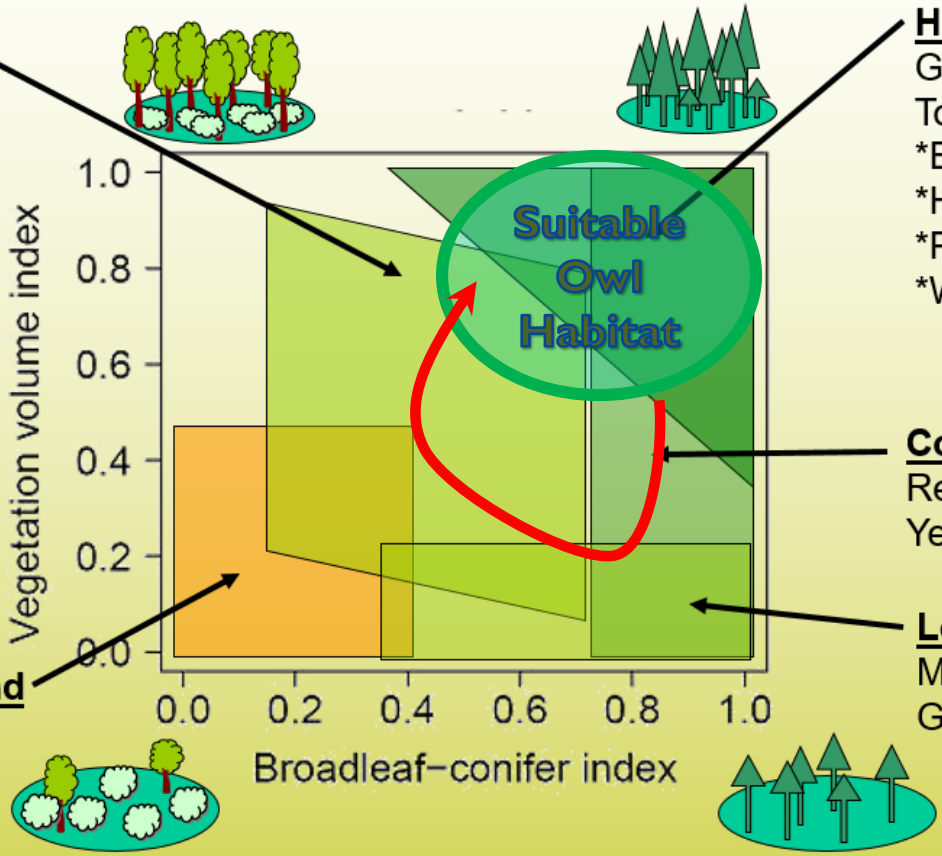

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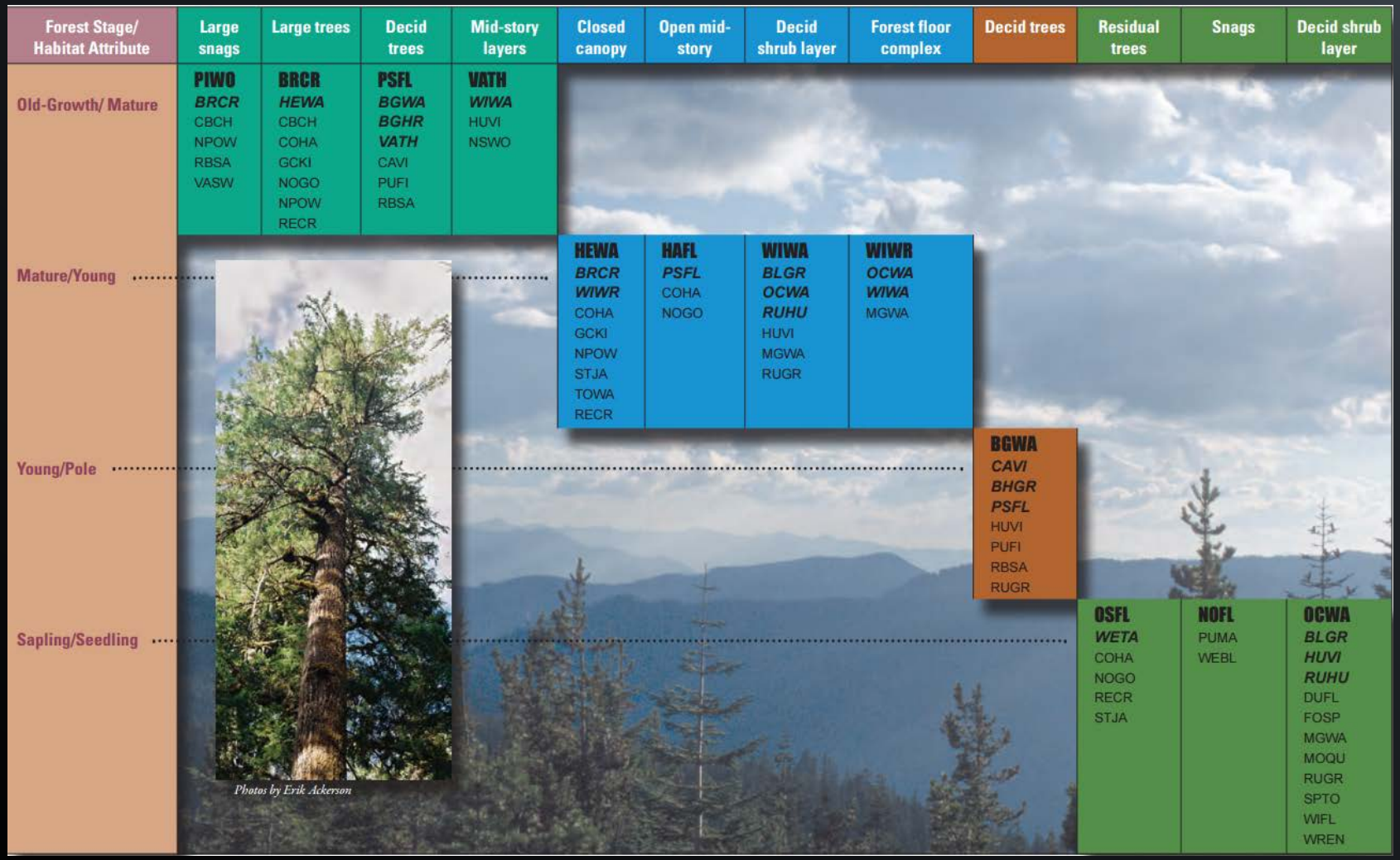
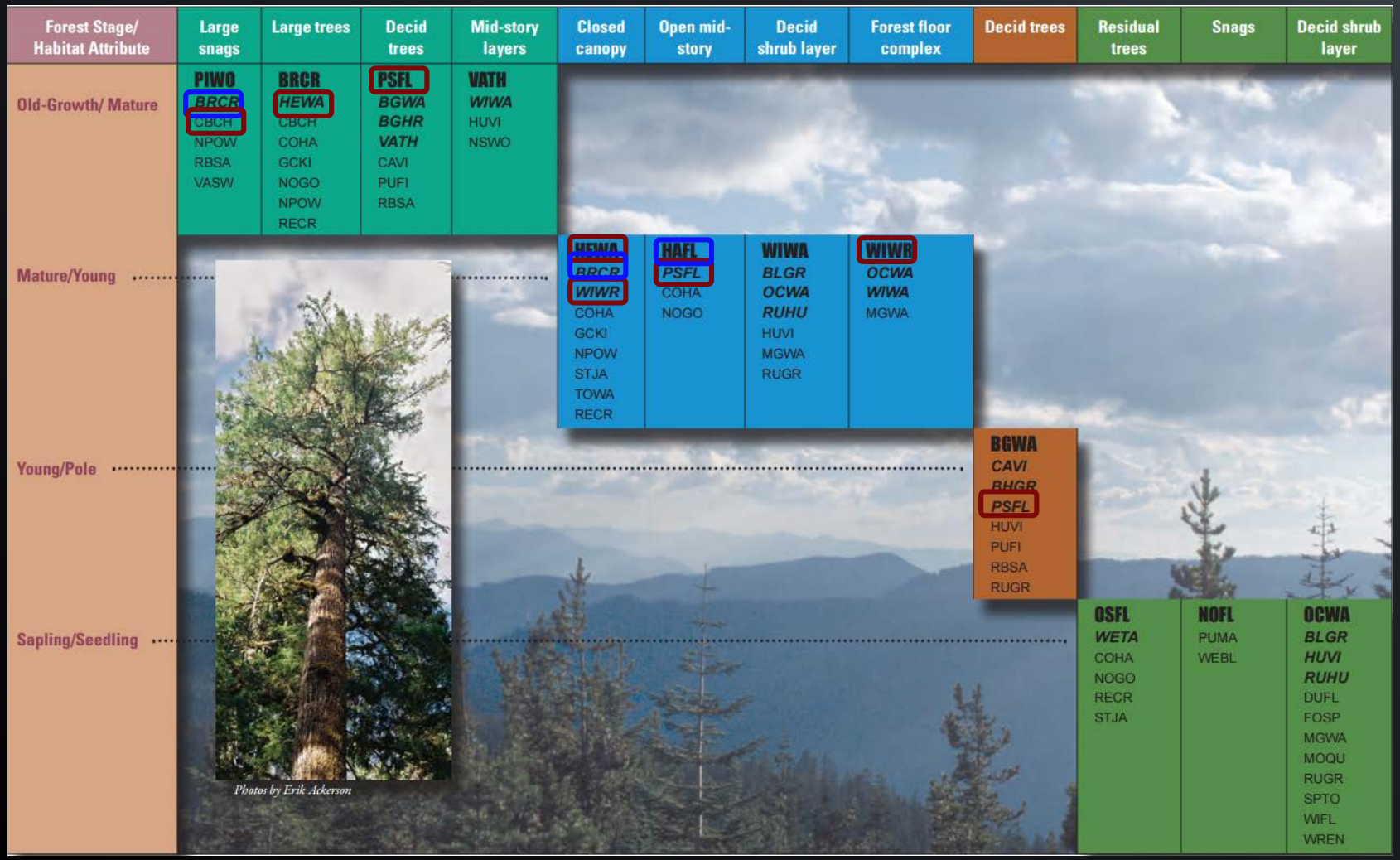


Quantitative Habitat and Population Objectives

(Altman & Alexander 2012; ; Chase and Geupel 2005)

Forest Birds and Succession



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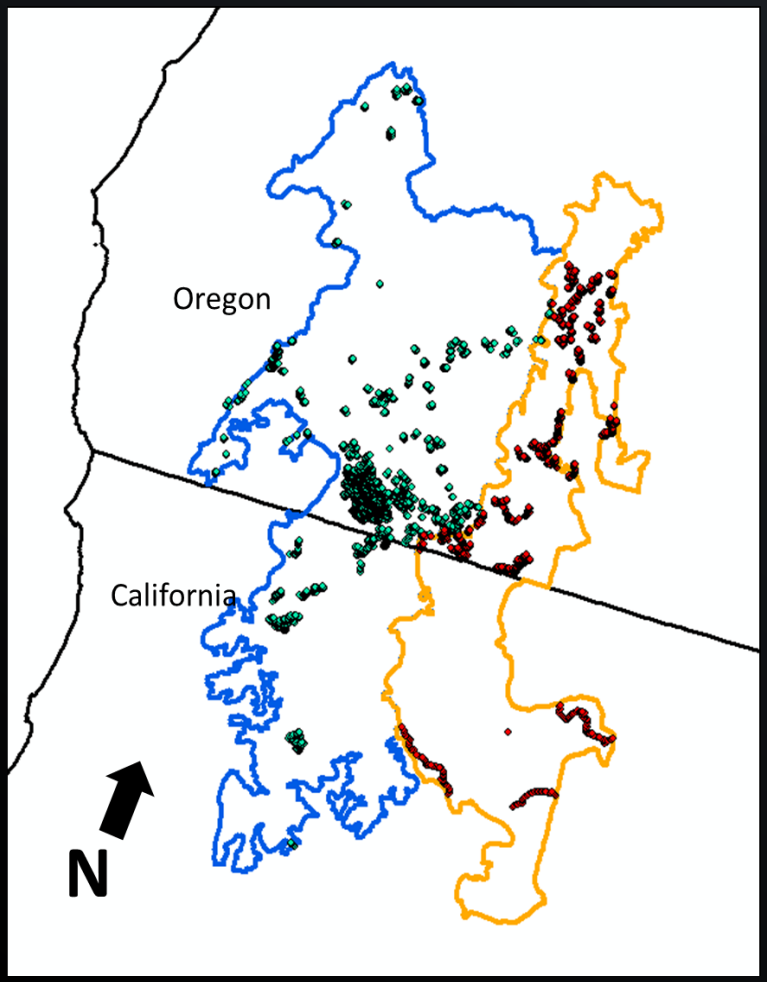
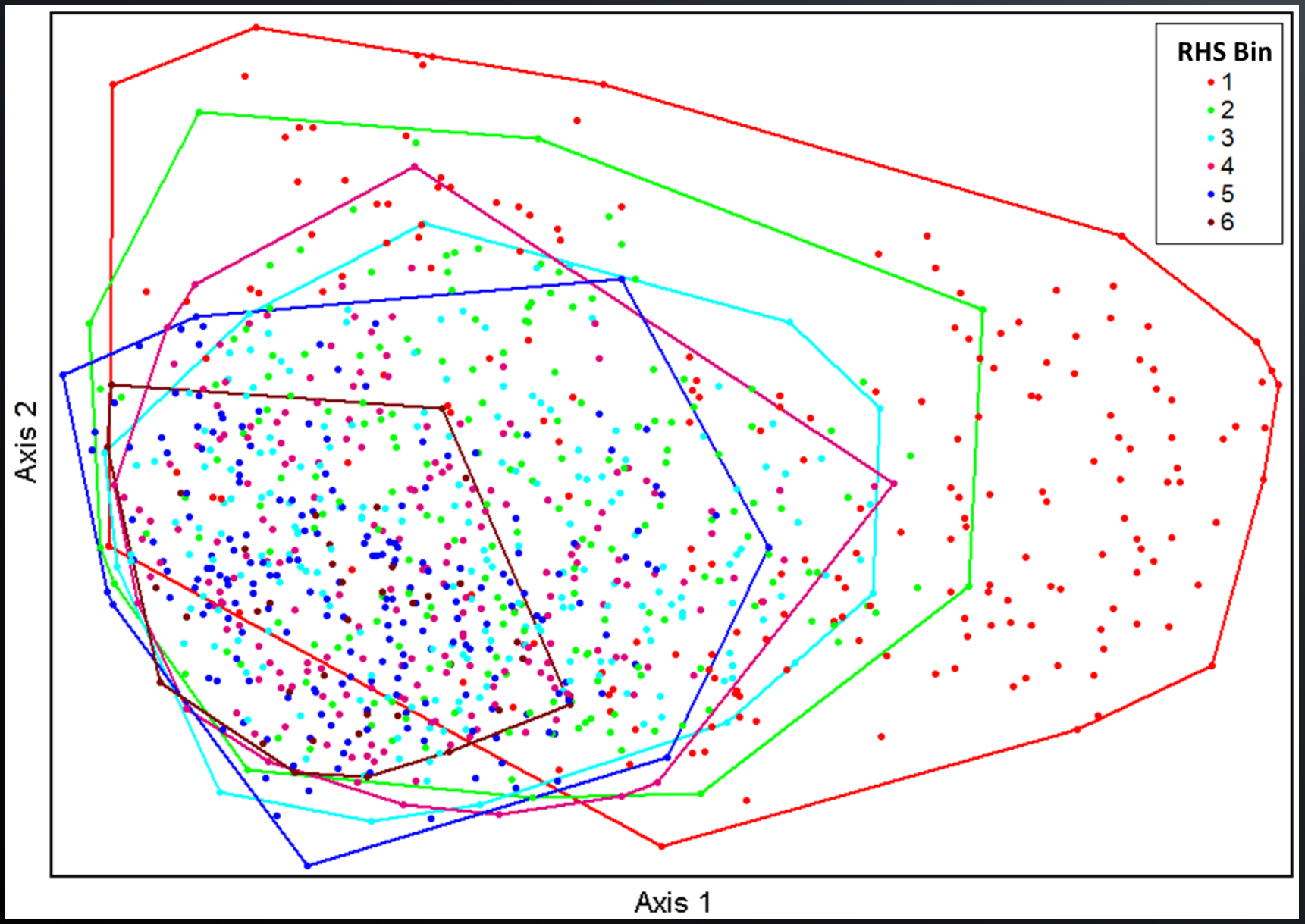
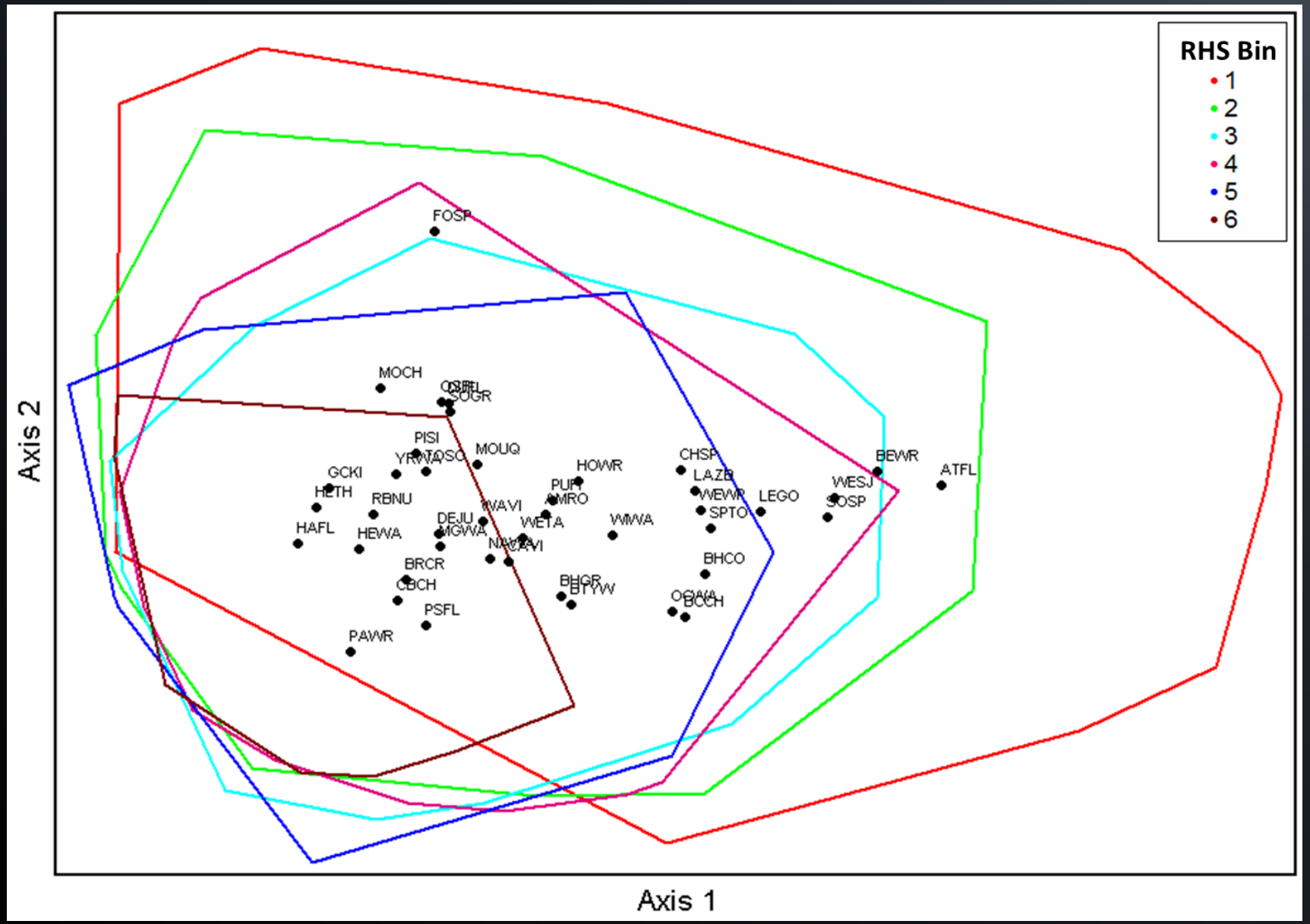
Forest Birds and Succession

Surrogate for Spotted Owl Habitat Suitability





Klamath-Siskiyou East



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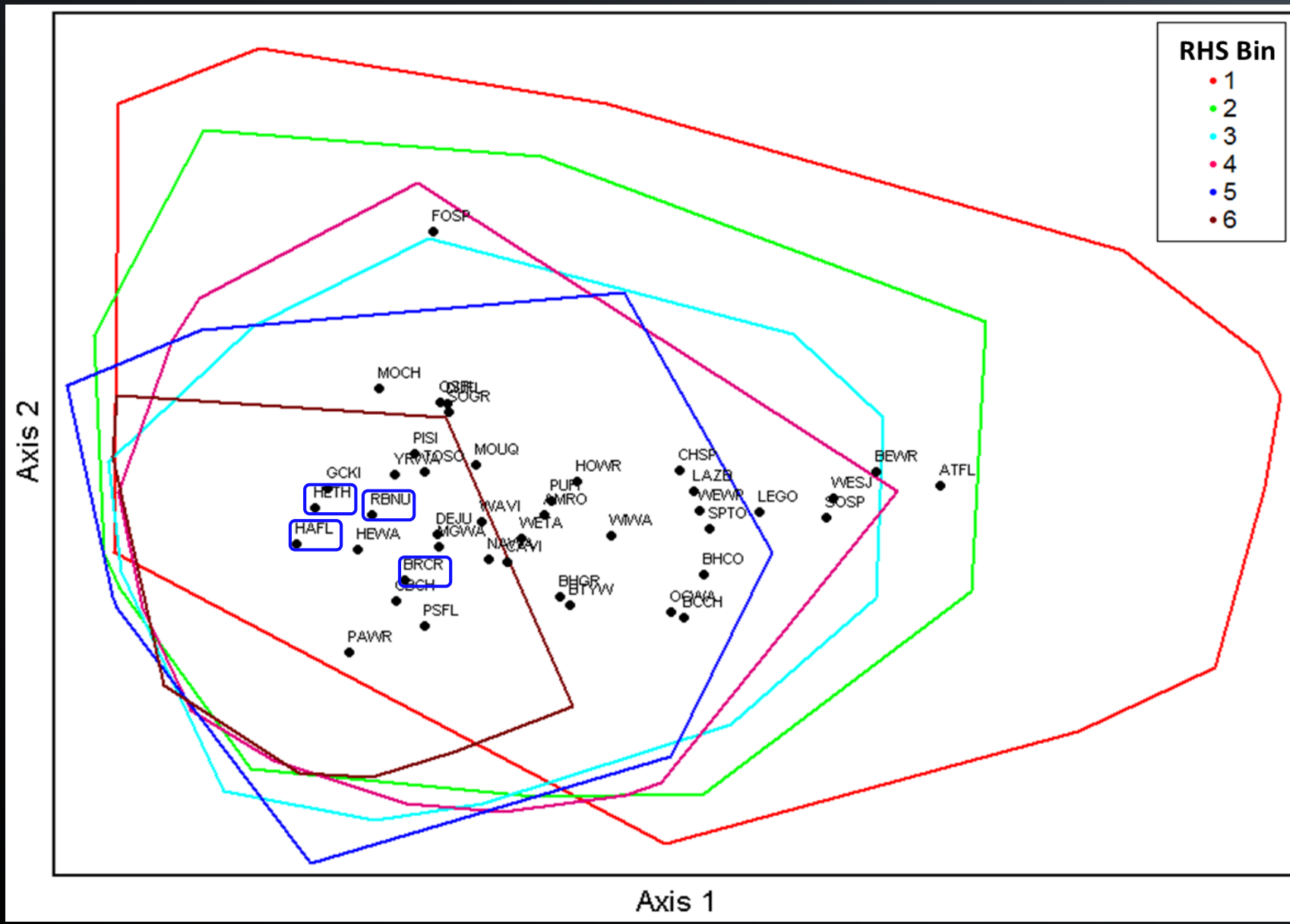
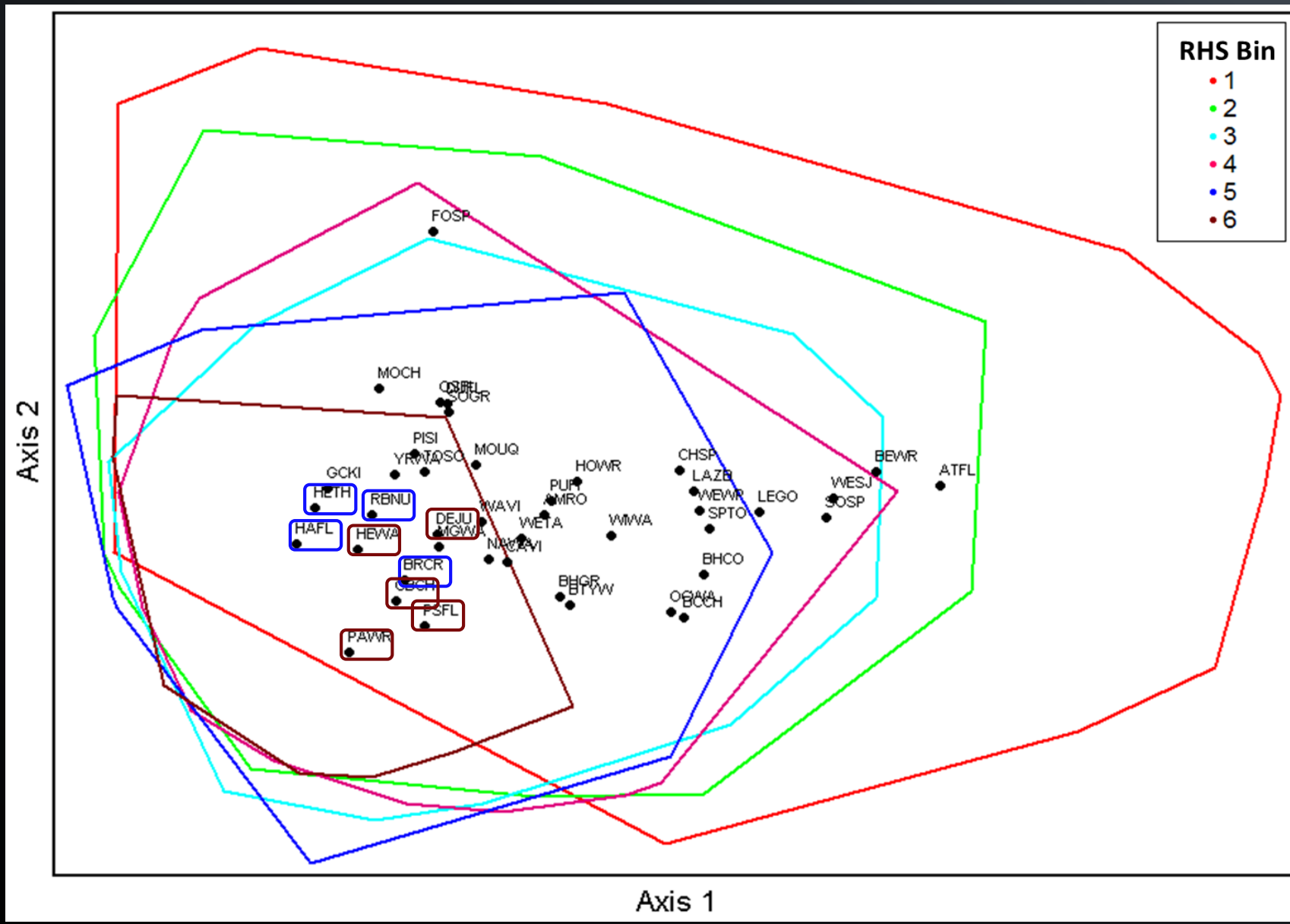


Klamath-Siskiyou East

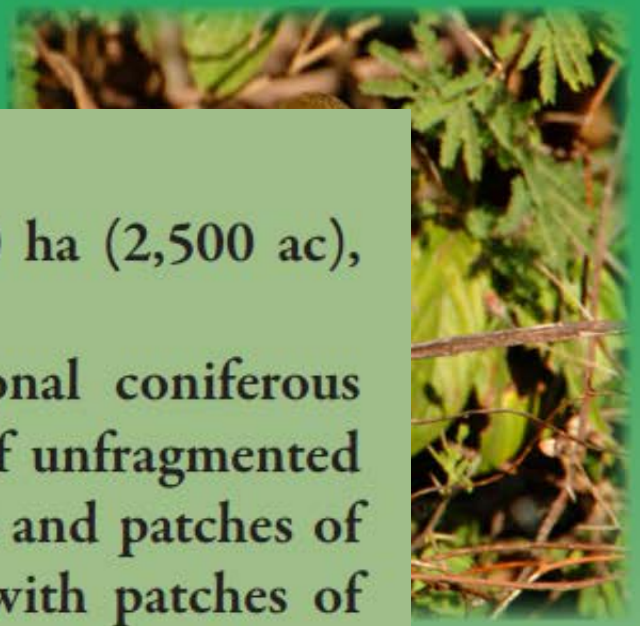


Klamath-Siskiyou East

Photo by Bob Altman

Photo by Jim Livaudais

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.

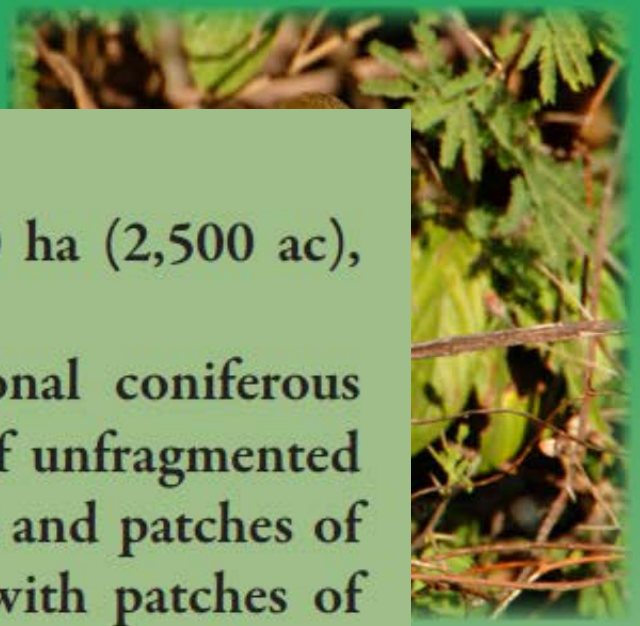


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Photo by Bob Altman

Photo by Bill Hubick

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

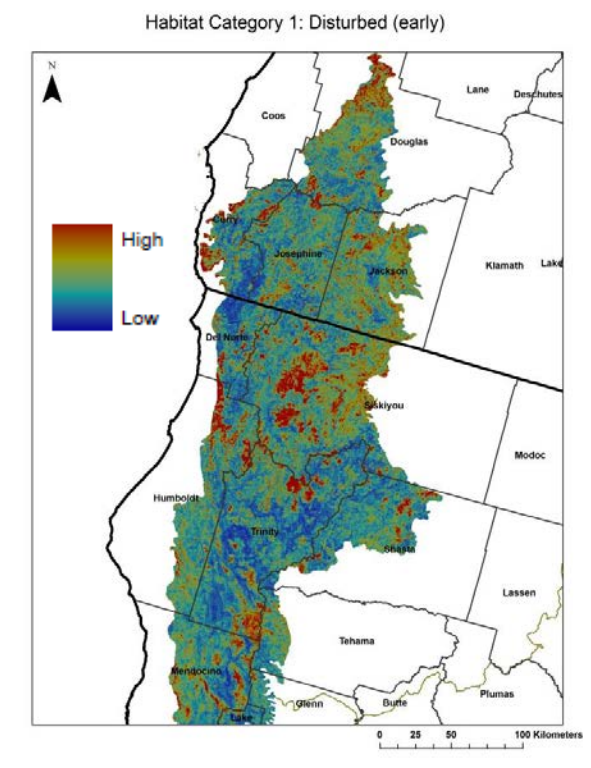
Photo by Erik Ackerson

Photo by Michael Stubblefield

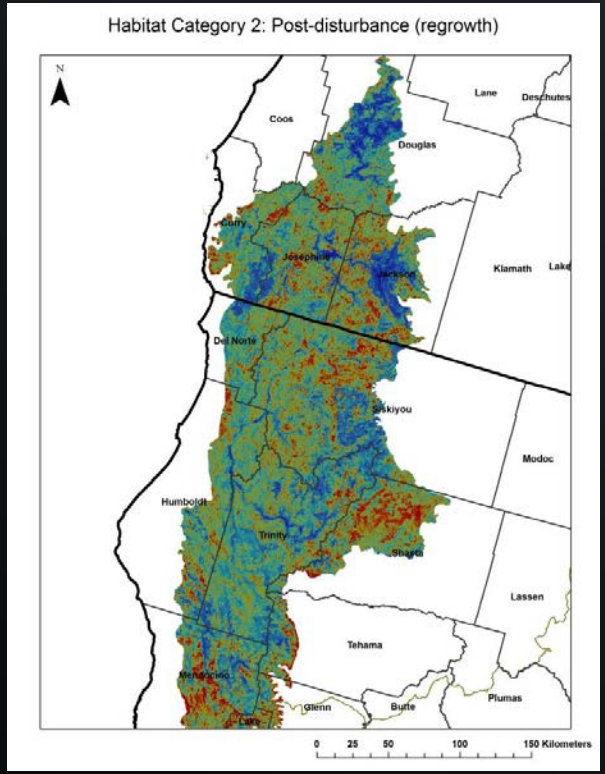
Forest Stage: OLD GROWTH/MATURE FOREST
Habitat Attribute: LARGE TREES
Focal Species: BROWN CREEPER (*Certhia americana*)

Species-centric Habitat Models

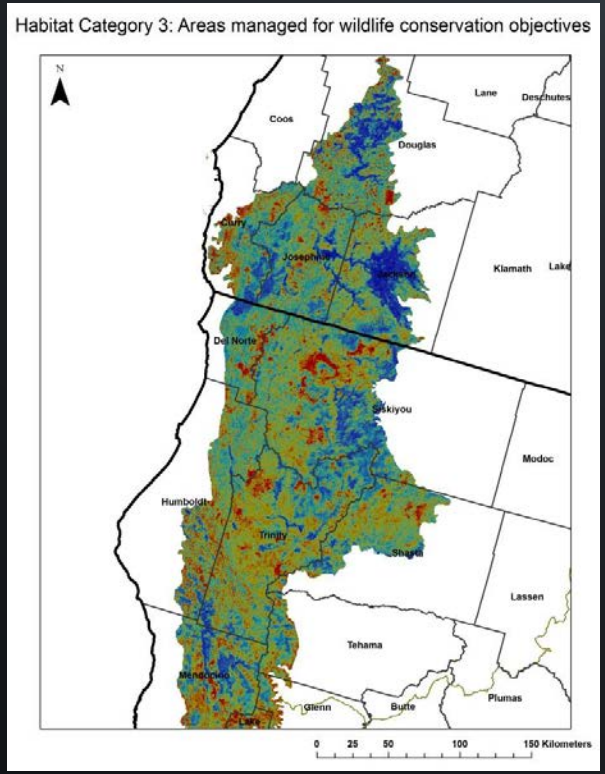
Recently disturbed
6 species



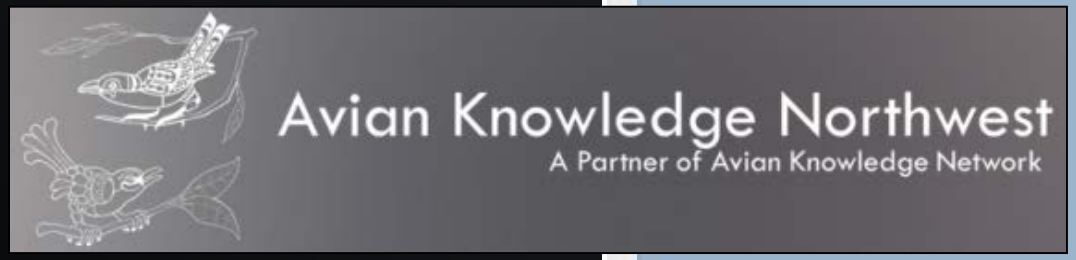
Post-disturbance
4 species

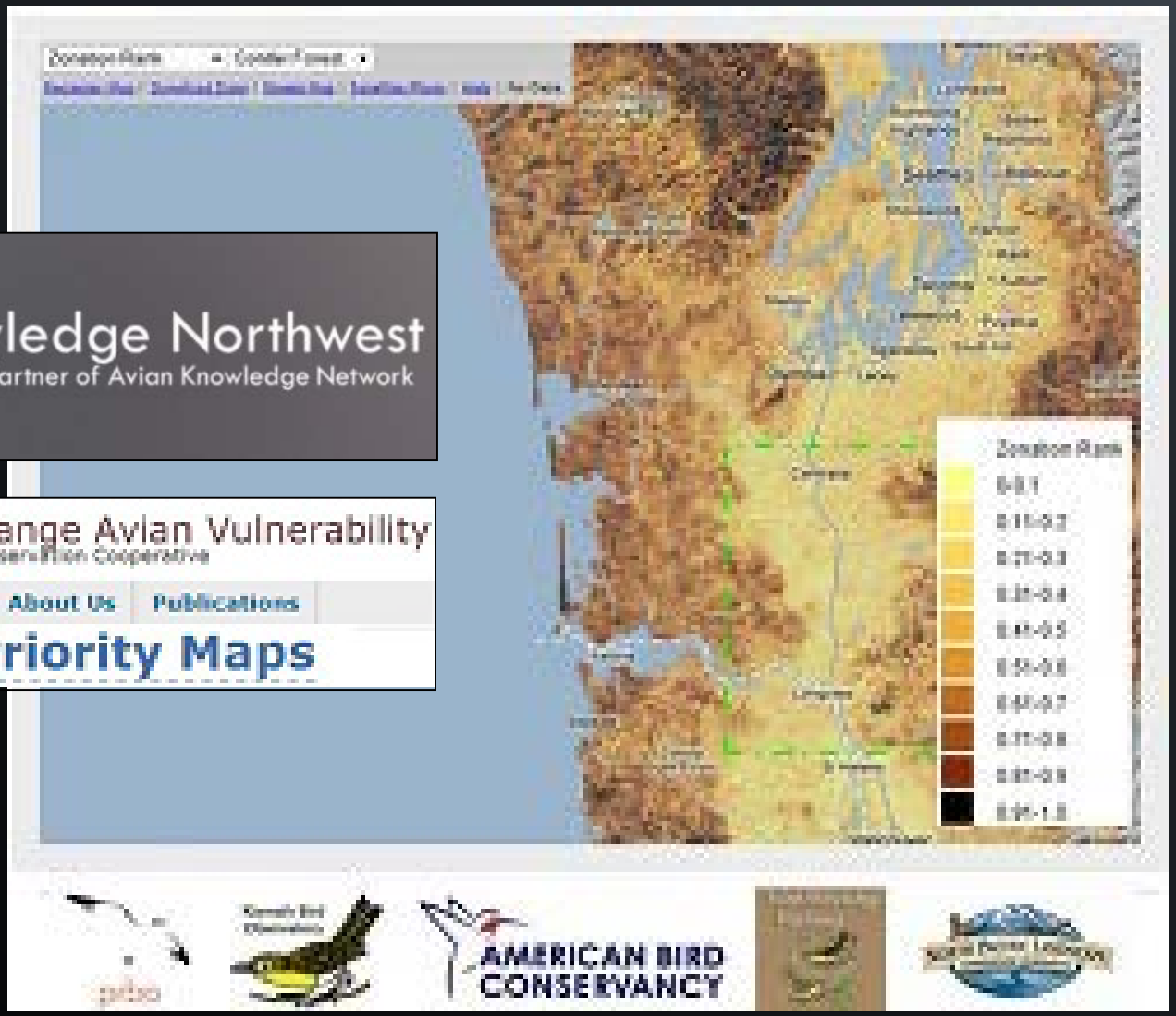


Wildlife
6 species



Climate-wise planning

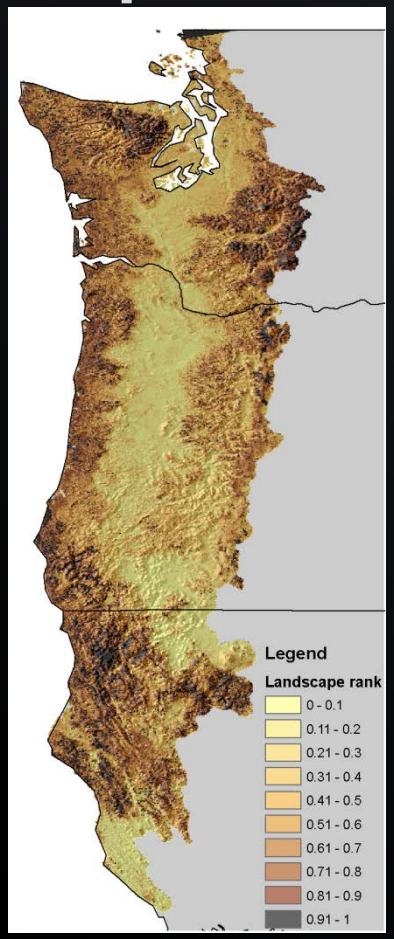




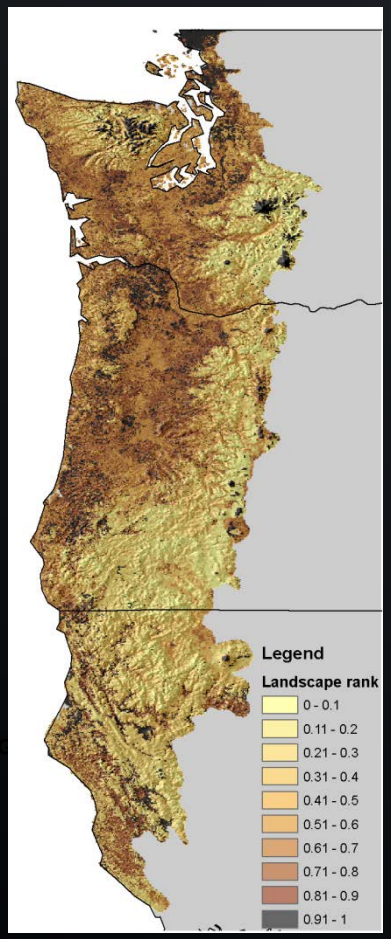
(Veloz et al 2008)

Climate-wise planning

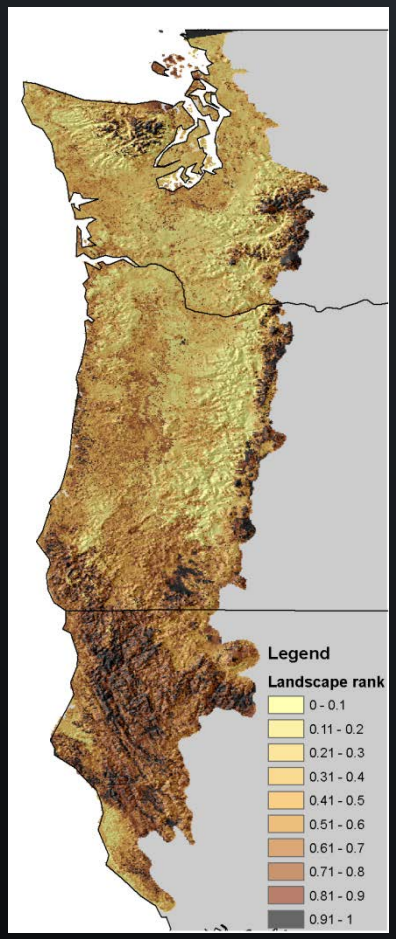
Conifer species



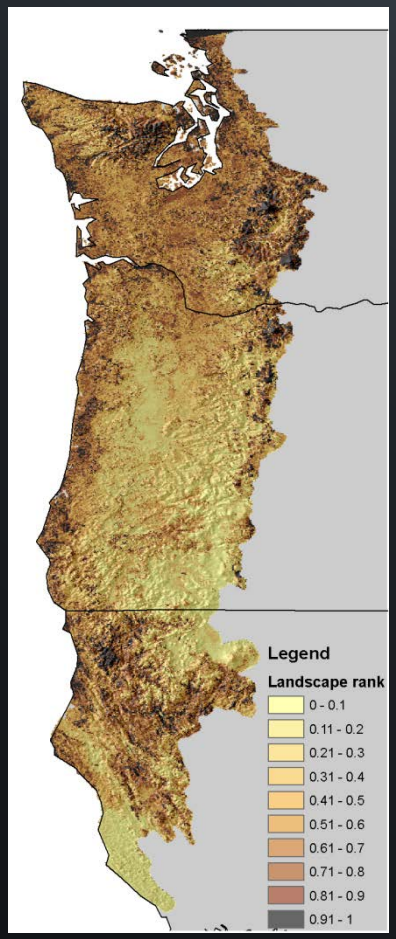
Grassland species



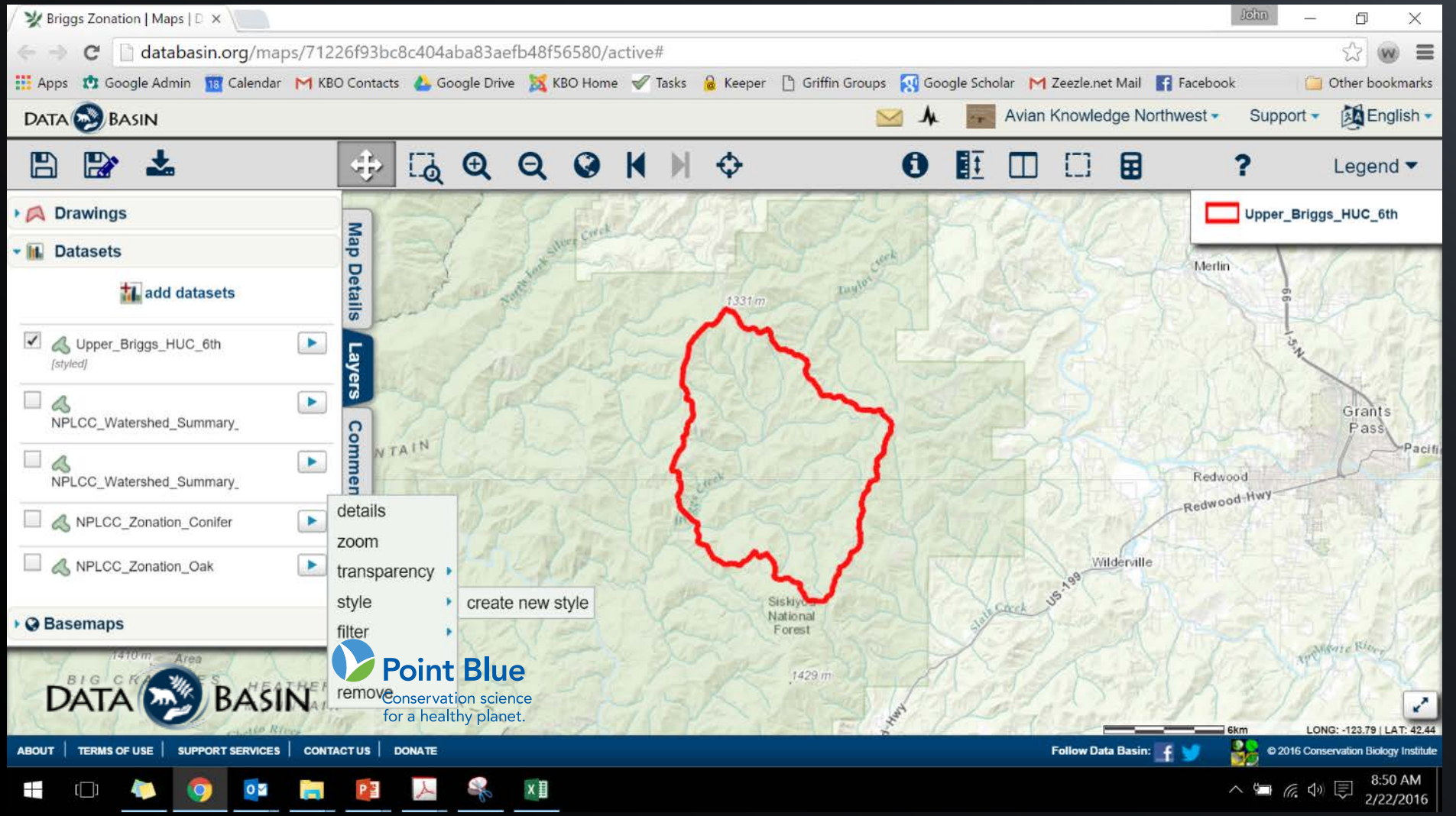
Oak woodland species



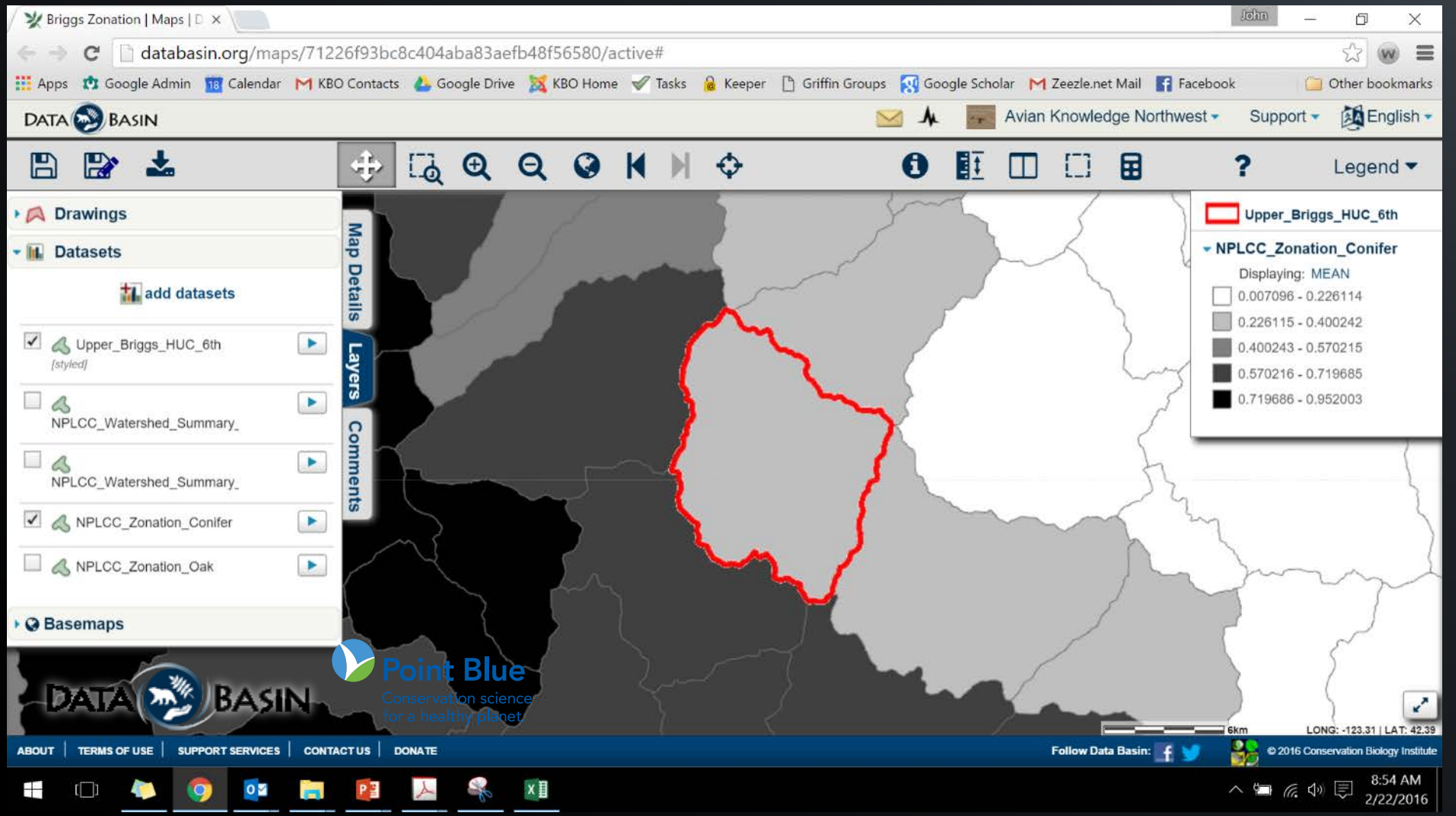
Riparian species



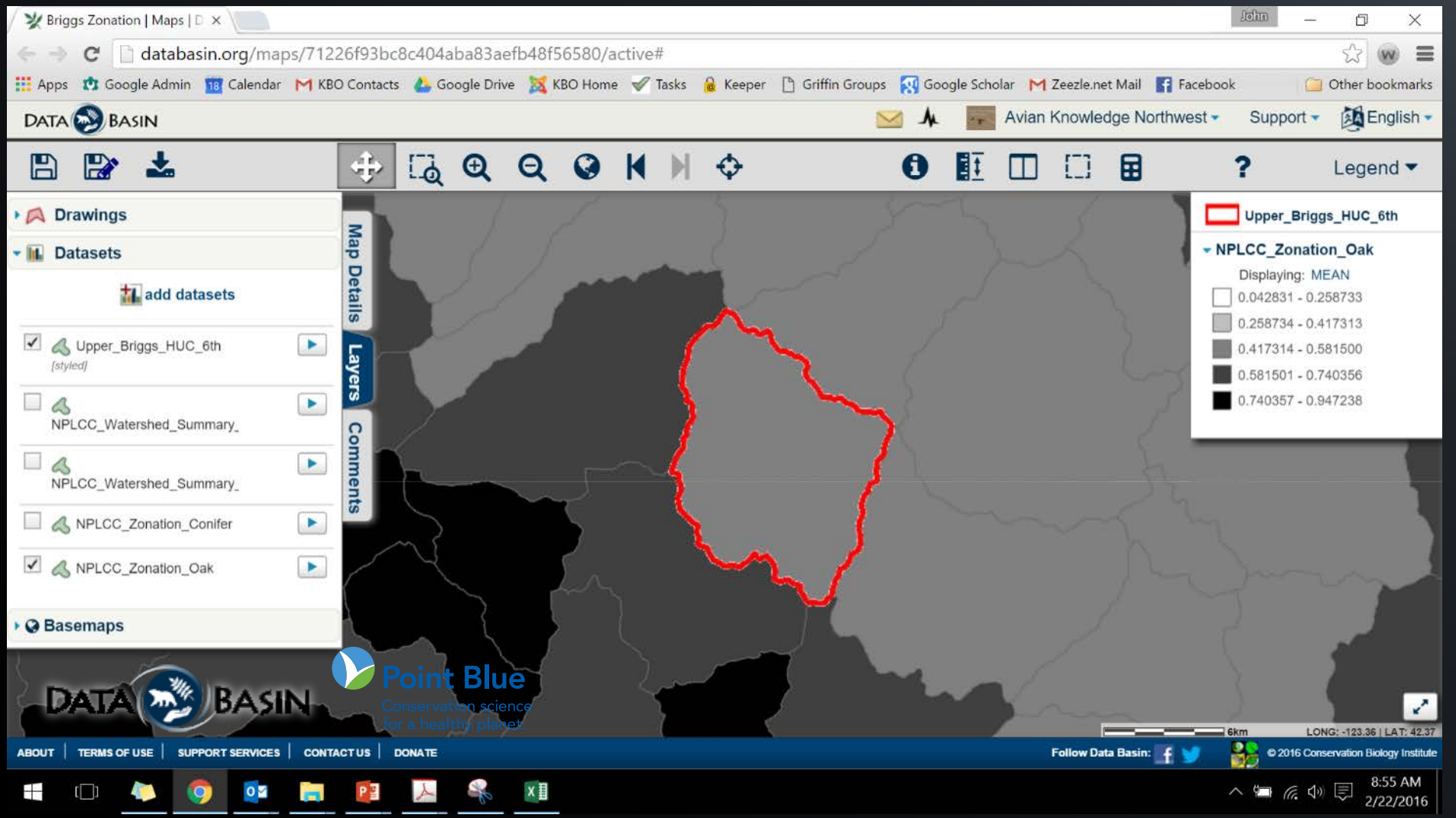
Climate-wise planning



Conifer Zonation



Oak Zonation



Purple Finch Habitat Attributes

(Altman & Alexander 2012)

Purple Finch Habitat Attributes

Habitat Objectives

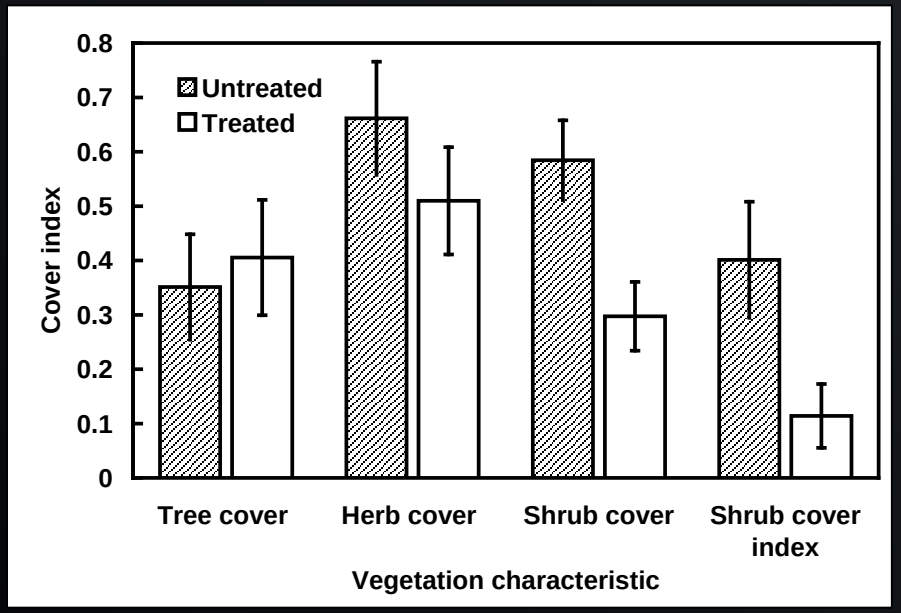
- Sites: Maintain >60% canopy/subcanopy closure, especially where pine and oak are part of the canopy.
- Sites: Where ecologically appropriate (e.g., drier sites), maintain >25% canopy cover of pine and oak trees.

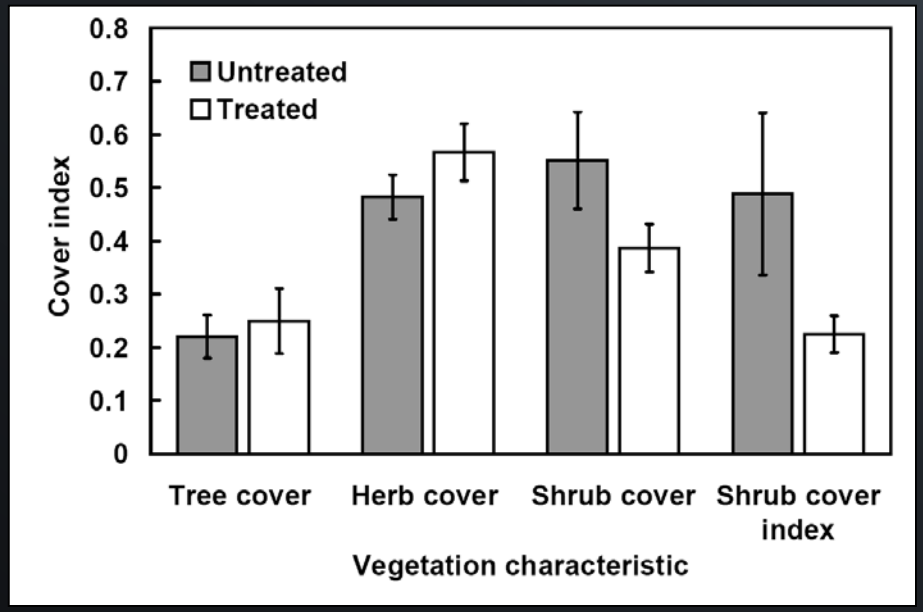
Habitat Conservation Strategies

- 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).

(Altman & Alexander 2012)

Oak Restoration: Management effects

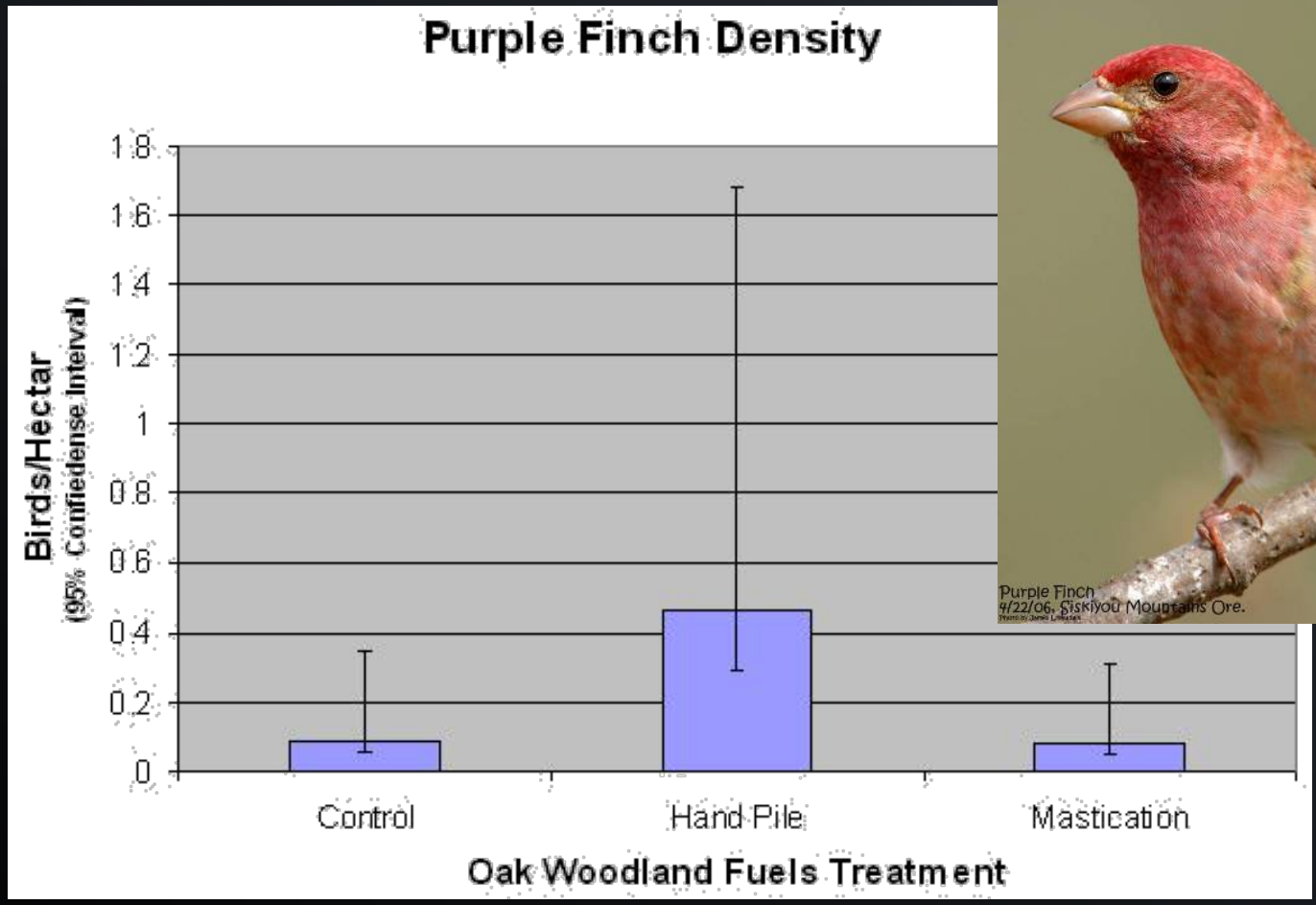




Mechanical vs. Manual Treatments?

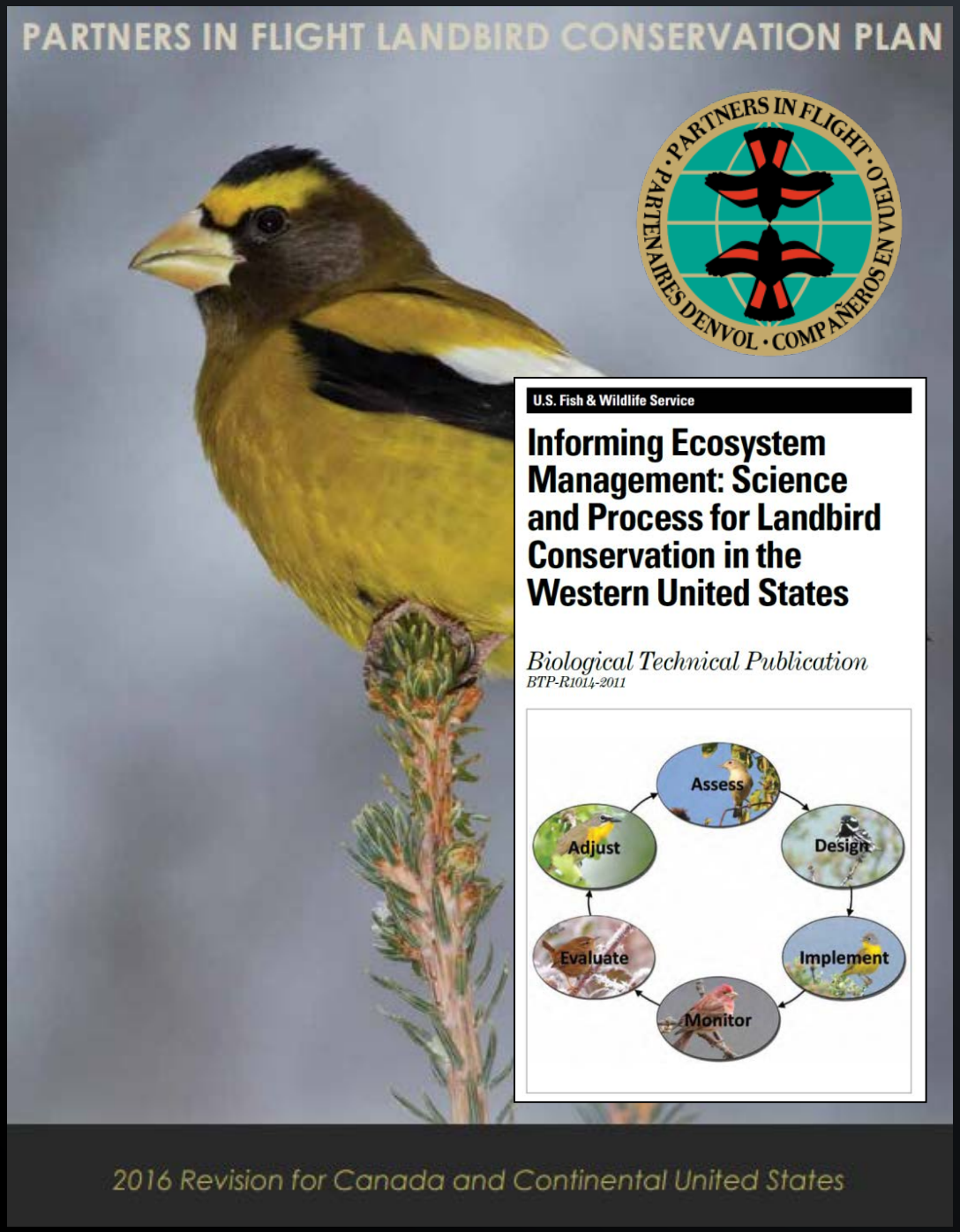
(Alexander et al. 2007, Seavy et al. 2008; Forest Ecology and Management)

Oak Restoration: Management effects



Mechanical vs. Manual Treatments?

(Alexander et al. 2007, Seavy et al. 2008; Forest Ecology and Management)



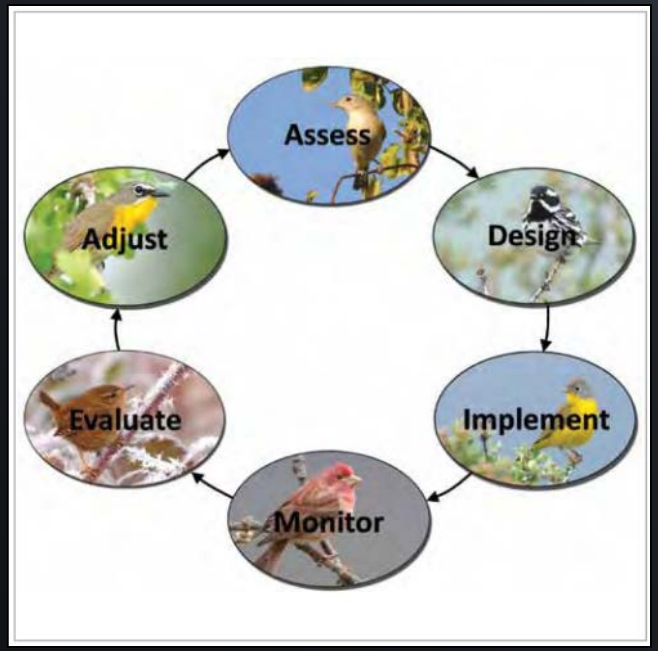
"PIF's multi-species, science-based approach can serve as a catalyst for improving ecosystem management on public lands"

(Rosenberg et al 2016, Stephens et al 2011)

Science-based Approach

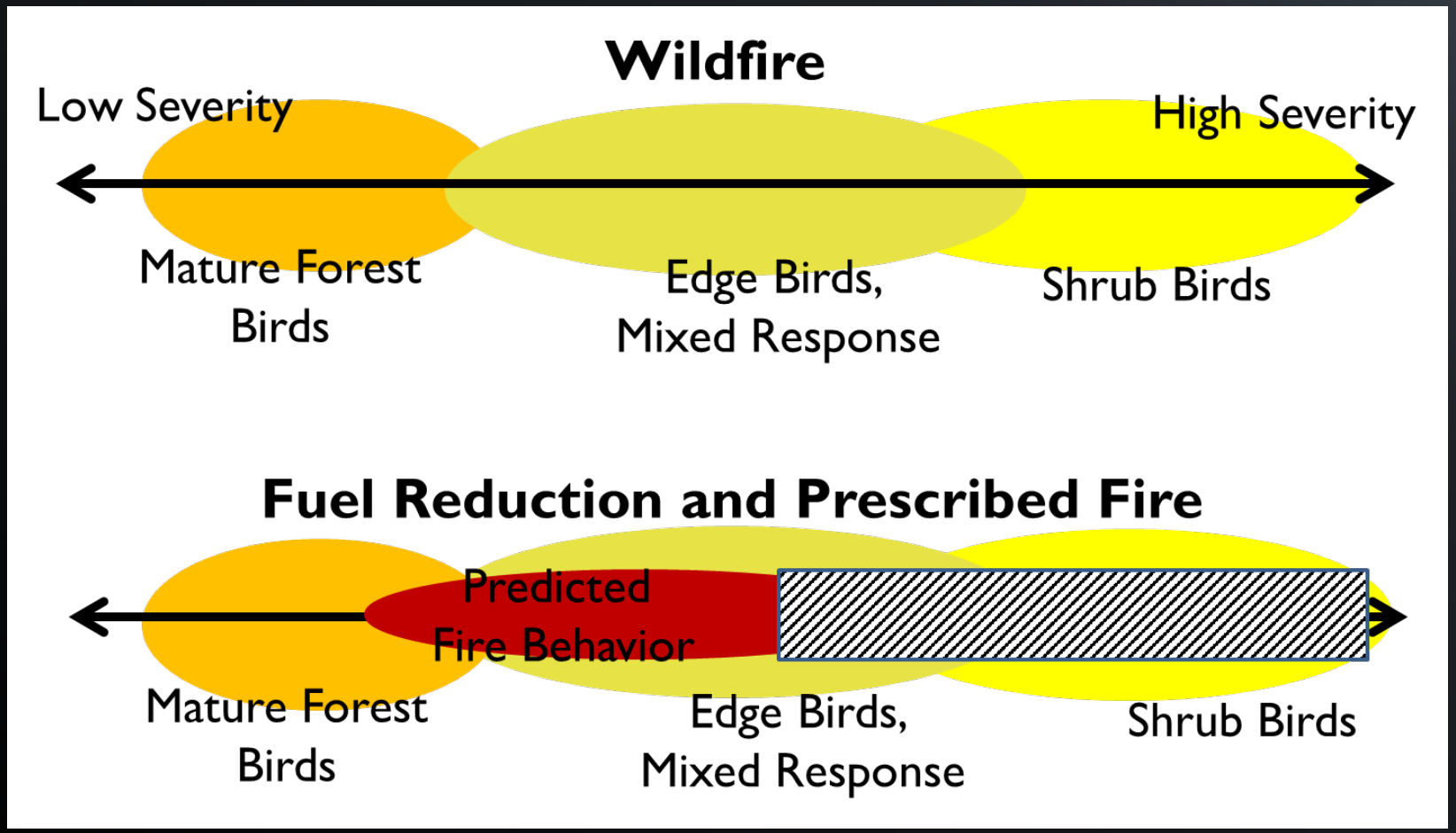
Conservation Objectives ⟷ Management Objectives

- **Assess conservation needs**
- **Set measurable objectives**
- **Design management**
- **Measuring effectiveness**



(Rpsenberg et al 2016, Alexander 2011, Stephens et al 2011)

Prescribed fire as restoration



THANK YOU!

John D. Alexander, jda@KlamathBird.org, (541) 890-7067

Klamath Bird Observatory

Avian Knowledge Northwest
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2017 Klamath Fire Ecology Symposium

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