Barred Owls and Northern Spotted Owls in the Eastern Cascades, Washington

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Talk Outline:

- Introduction to Barred Owls and Spotted Owls
- Some findings from our Barred Owl radiotelemetry study
  - Home Range Size
  - Within-home range forest structure
  - Landscape-scale habitat selection
- Provincial-scale Barred Owl habitat assessment & comparison with Spotted Owls
- How this information is being used to model effects of interactions between Spotted Owls, Barred Owls, and disturbance in dry forests

Introduction: The Problem

- **Northern Spotted Owl (NSO) populations declined 7% annually in WA demography study areas from 1985-2003**

- **Barred Owl (BO) first detected in WA in 1970s, now abundant**

- **Substantial anecdotal information suggesting that BO displace NSO**

- **Ecological interactions poorly understood**

Barred Owls & Spotted Owls

Northern Spotted Owl
(Strix occidentallis Caurina)

	Male	Female
Wing Length:	32 cm	33 cm
Tail Length:	22 cm	22 cm
Weight:	579 g	663 g

Barred Owl
(Strix varia varia)

	Male	Female
Wing Length:	33 cm	34 cm
Tail Length:	22 cm	23 cm
Weight:	621 g	872 g

Measurements from Johnsgard 2002, North American Owls

Introduction: Barred Owl Range Expansion
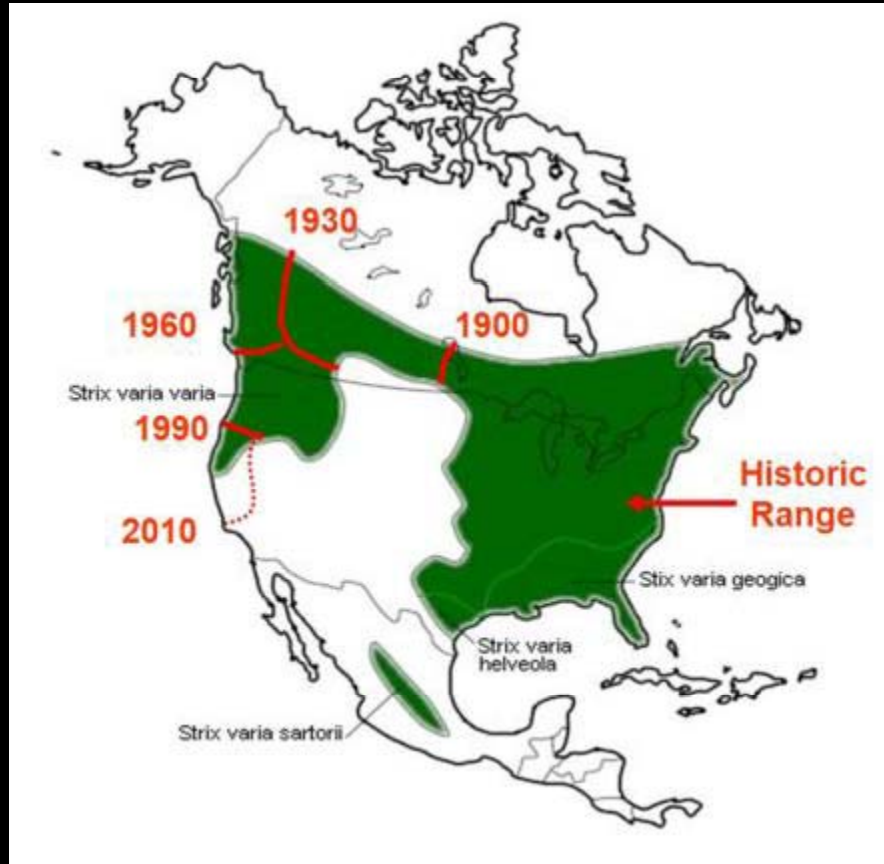
Barred Owl Range Expansion
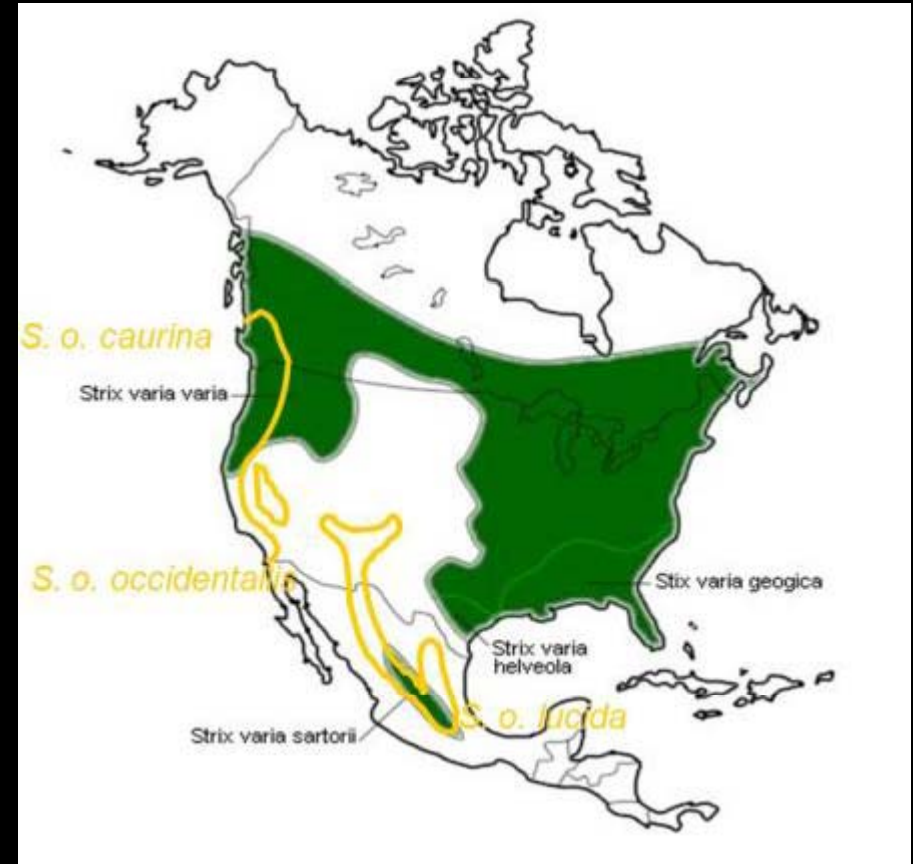
Spotted Owl Distribution

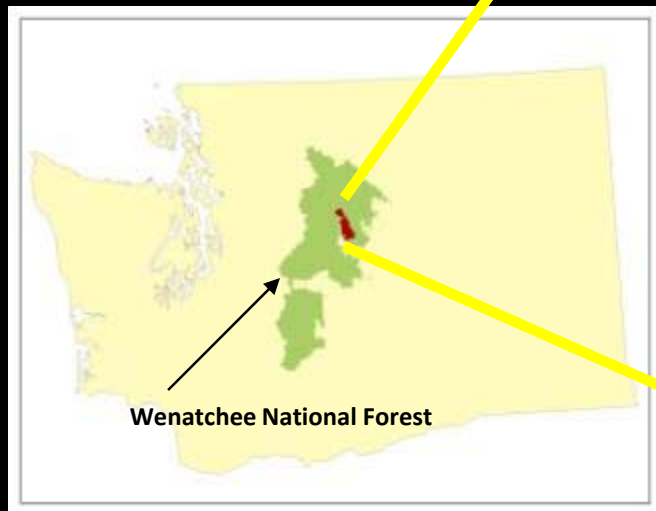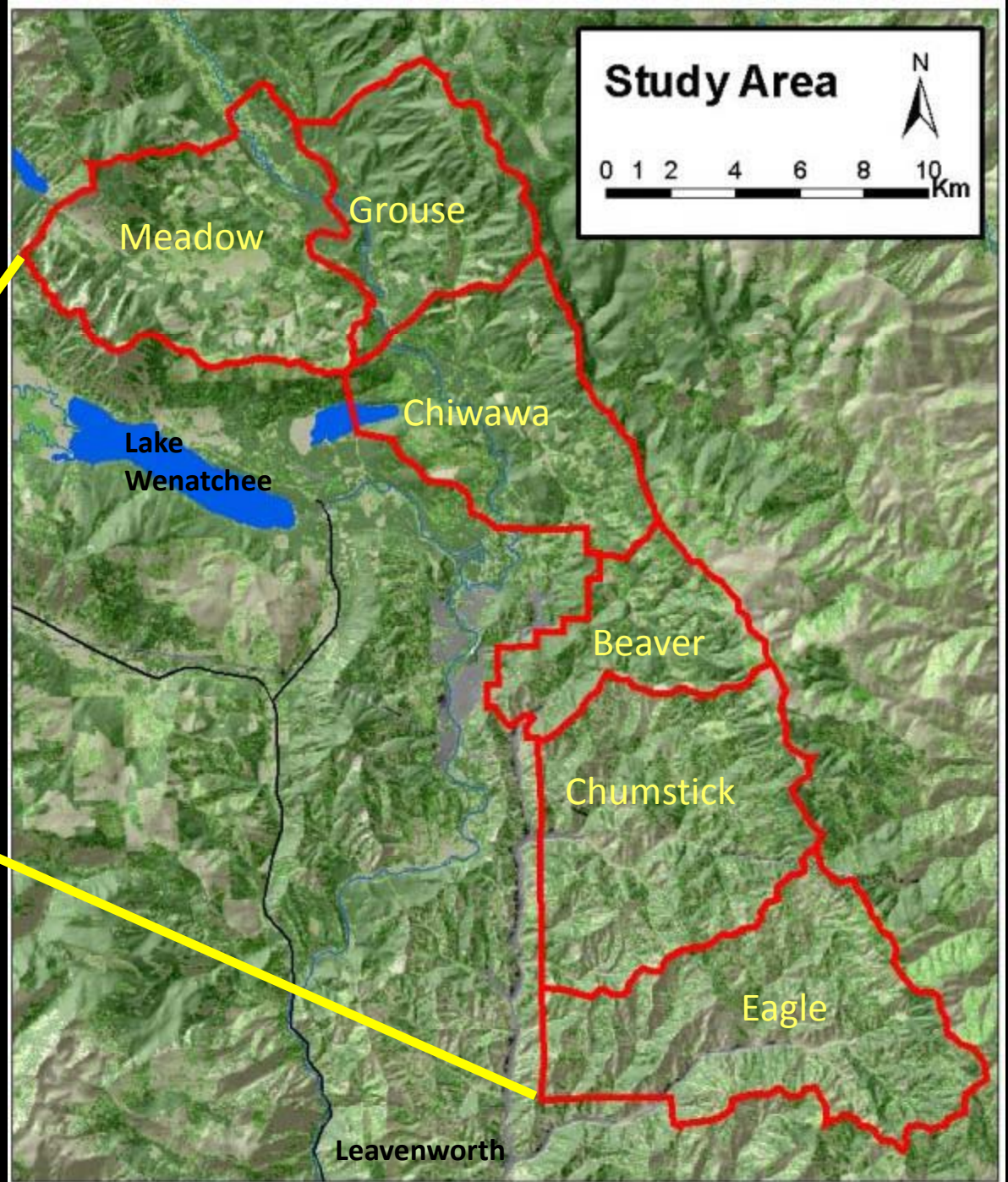# Introduction: Risks to spotted owls in dry forests

Harvest

Fire

Insects

Barred Owls

Chumstick – Chiwawa Barred Owl Radiotelemetry Study Area

Wenatchee National Forest

Total area: 309 km²

Study Area

0 1 2 4 6 8 10 Km

N

Meadow

Grouse

Chiwawa

Lake Wenatchee

Beaver

Chumstick

Eagle

Leavenworth

Methods:
Field Methods

Capture

Call Surveys

Radio Telemetry

The Chumstick-Chiwawa Barred Owl Study
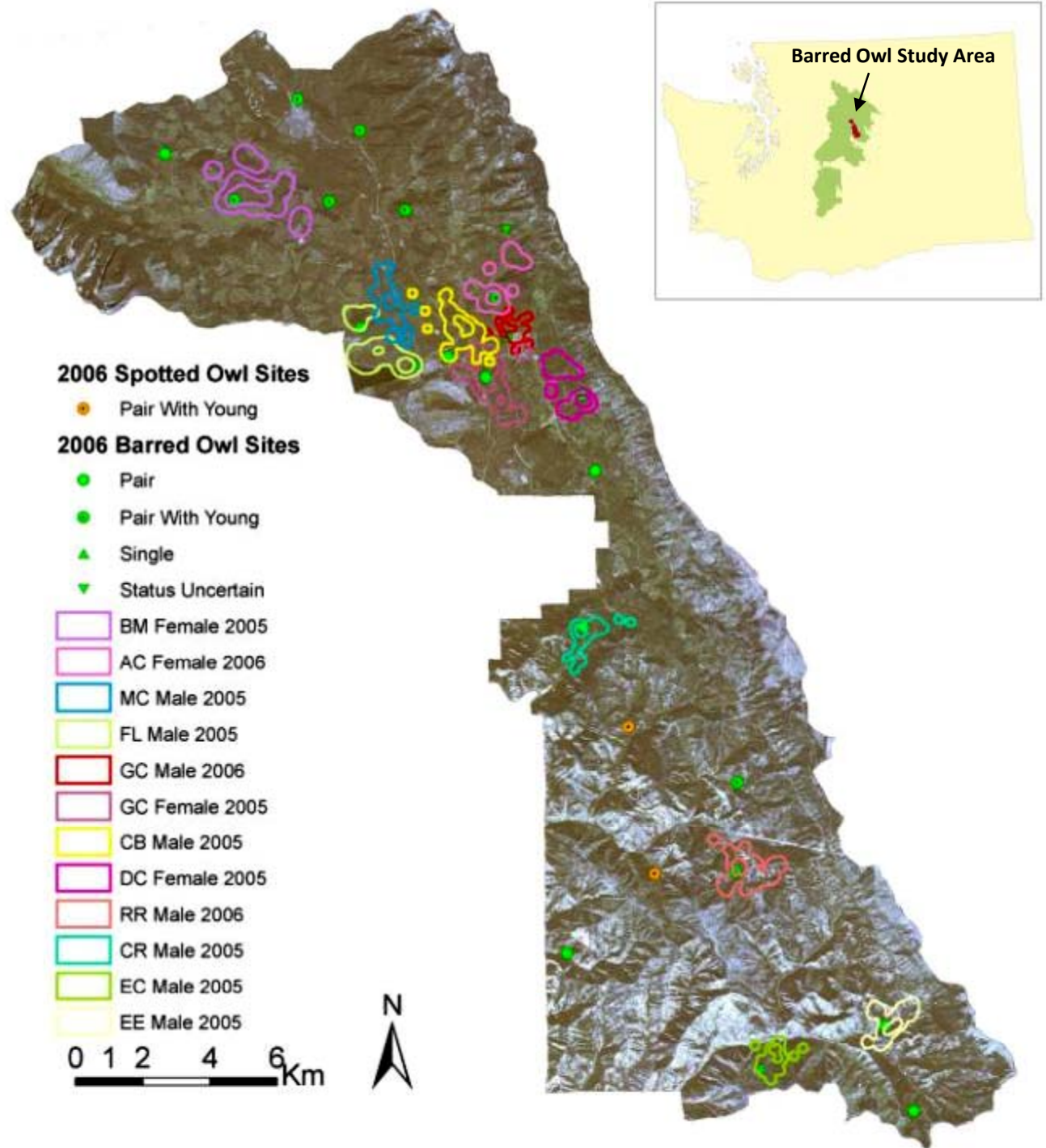
2004 – 2006

Call survey results:
21 Barred Owl Sites
2 Spotted Owl Sites

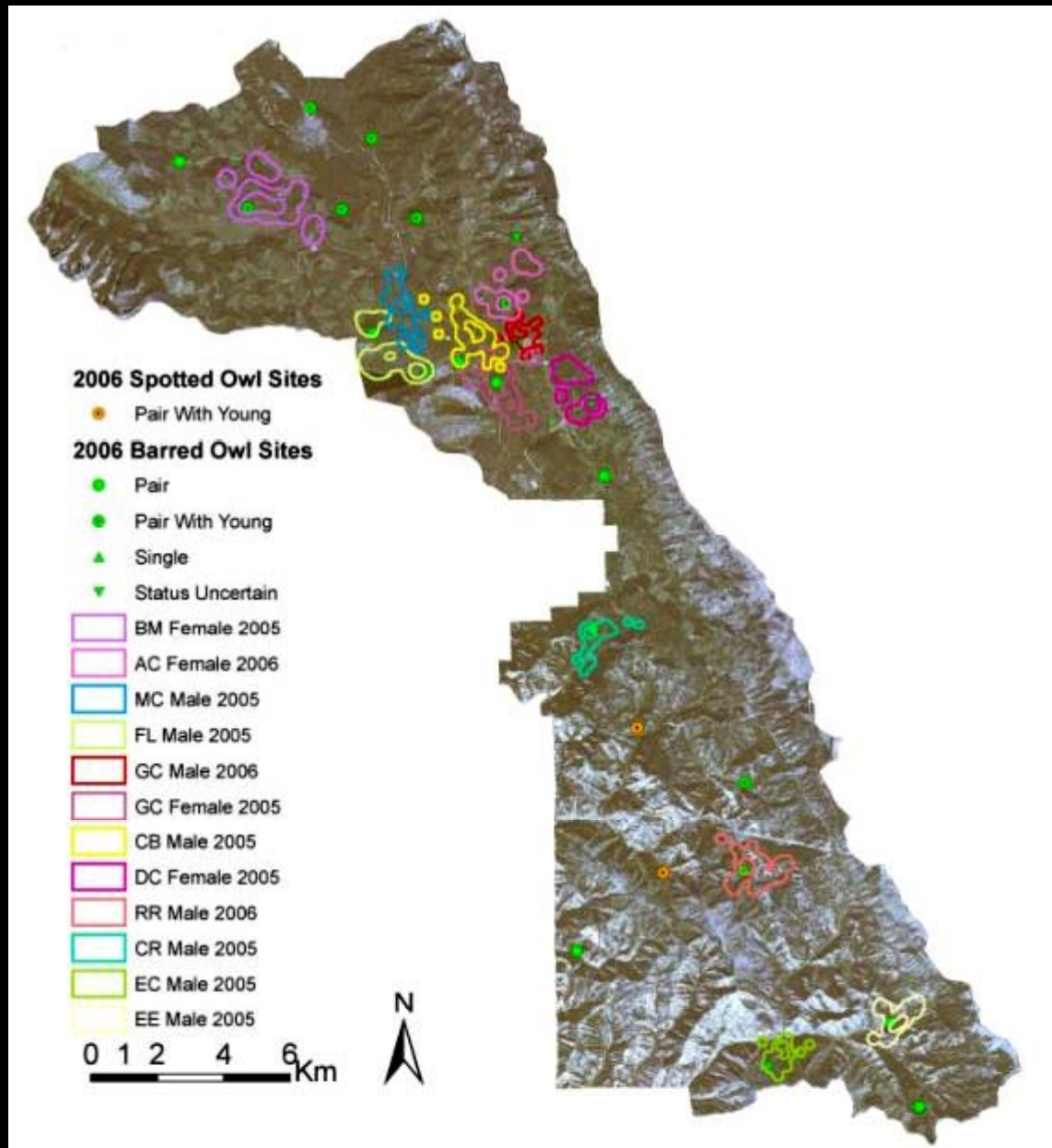Radiotelemetry data from 14 individuals at 12 pair sites

Singleton et al. 2010. Journal of Wildlife Management 74(2)

Barred Owl Telemetry Results

Barred Owl Home Range Sizes:

	Season	KHR (Ha)	MCP (Ha)	n
Female	BR	218	217	6
	NB	279	322	5
Male	BR	199	198	15
	NB	337	428	7

2006 Spotted Owl Sites
- Pair With Young

2006 Barred Owl Sites
- Pair
- Pair With Young
- Single
- Status Uncertain
- BM Female 2005
- AC Female 2006
- MC Male 2005
- FL Male 2005
- GC Male 2006
- GC Female 2005
- CB Male 2005
- DC Female 2005
- RR Male 2006
- CR Male 2005
- EC Male 2005
- EE Male 2005

0 1 2 4 6 Km

N

Barred Owl Within Home Range Forest Structure

Field Methods – Forest Structure Sampling

Code	Description	Units	Min	Max
SLOPE	Slope	Degrees	0	45
SOLR	Solar energy (annual daily mean watt hours/m^2)	Degrees	972	2787
CANOPY1	Layer 1 (<0.6 m) canopy closure	Percent	10	99
CANOPY2	Layer 2 (0.6-1.8 m) canopy closure	Percent	5	92
CANOPY3	Layer 3 (1.8-4.9 m) canopy closure	Percent	5	90
CANOPY4	Layer 4 (>4.9 m) canopy closure	Percent	0	90
TR_HT_MN	Mean tree height	Meters	0	51.6
TR_HT_SD	Std. Dev. Of tree height	Meters	0	17.2
TR_ULC_MN	Mean height to unconsolidated live crown	Meters	0	21.3
TR_ULC_SD	Std. Dev. Of height to unconsolidated live crown	Meters	0	56.8
TH_S2	Trees per ha., size class 2 (12.7-22.9 cm dbh)	Count	0	167
TH_S3	Trees per ha., size class 3 (23.0-50.8 cm dbh)	Count	0	187
TH_S4	Trees per ha., size class 4 (50.9-101.6 cm dbh)	Count	0	147
TH_S5	Trees per ha., size class 5 (>101.6 cm dbh)	Count	0	79
TH_TOT	Total Trees per ha.	Count	0	305
PCT_ABGR	Percent of dom. and subdom. trees that are ABGR	Percent	0	1.00
PCT_PIPO	Percent of dom. and subdom. trees that are PIPO	Percent	0	1.00
PCT_PSME	Percent of dom. and subdom. trees that are PSME	Percent	0	1.00
SW_DIV	Shannon – Weiner tree diversity	Index	0	1.67
SN_HA	Snags (>22.9 cm dbh) per hectare	Count	0	138
LOG_CNT2	Count of logs (>22.9 cm diameter at mid-point) encountered along a 22 m transect	Count	0	7
MTOE_PCT	Hawksworth mistletoe index	Index	0	0.79

Within Home Range Forest Structure Results

Mean (95% CI) UD Probability by forest structure type

Open PIPO	Dense PSME	Mixed ABGR

Breeding Season (Mar-Sep)

Mixed Effects Model –
test of equal use across the groups:

	Estimate[1]	Std. Error[1]	P value[2]
Open PIPO			
Dense PSME			
Mixed ABGR			

Preliminary Results Removed

[1] From a no-intercept linear mixed effects model using the individual owl as the random effect
[2] From an intercept-included model, same as above

Within Home Range Forest Structure Results

Group 1: Open PIPO

Group 2: Dense PSME

Group 3: Mixed ABGR, large trees.

	Group 1		Group 2		Group 3	
	Mean	se	Mean	se	Mean	se
SLOPE						
SOLR						
CANOPY1					▮	▮
CANOPY2						
CANOPY3						
CANOPY4					▮	▮
TR_HT_MN					▮	▮
TR_HT_SD					▮	▮
TR_ULC_MN						
TR_ULC_SD						
TH_S2						
TH_S3						
TH_S4					▮	▮
TH_S5					▮	▮
TH_TOT						
PCT_ABGR					▮	▮
PCT_PIPO	▮	▮				
PCT_PSME			▮	▮		
SW_DIV						
SN_HA					▮	▮
LOG_CNT2					▮	▮
MTOE_PCT						
PROB						

Preliminary Results Removed

Landscape Scale Barred Owl Habitat Mapping
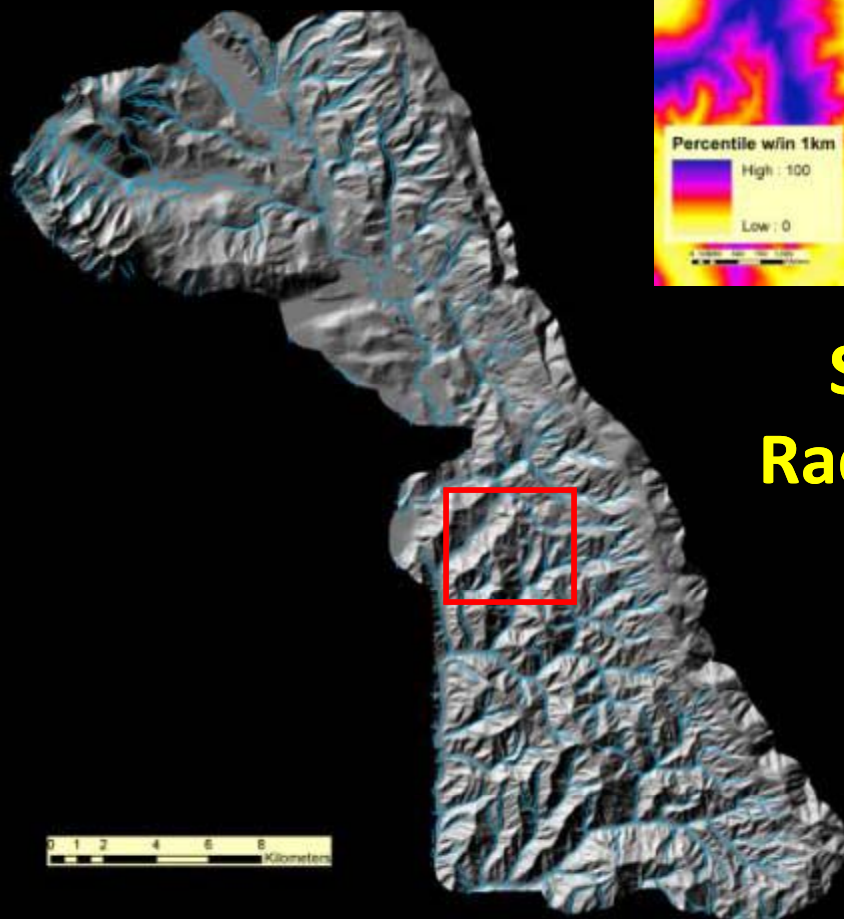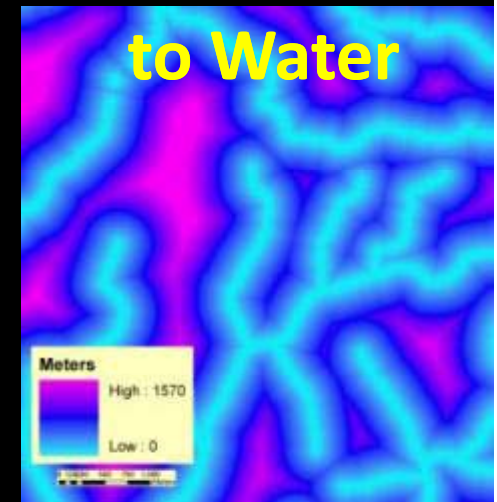
Topographic Position
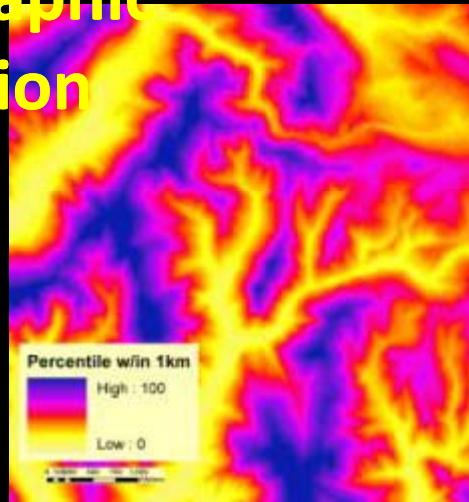
Slope
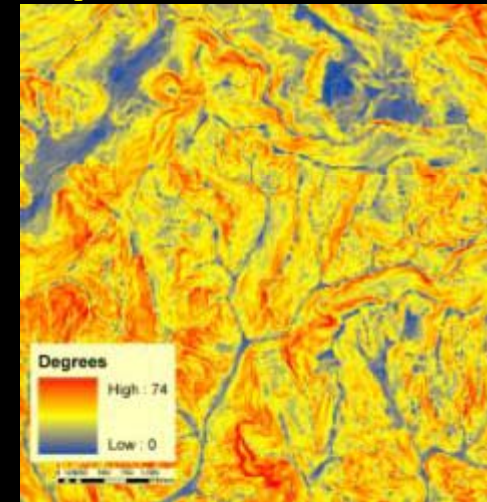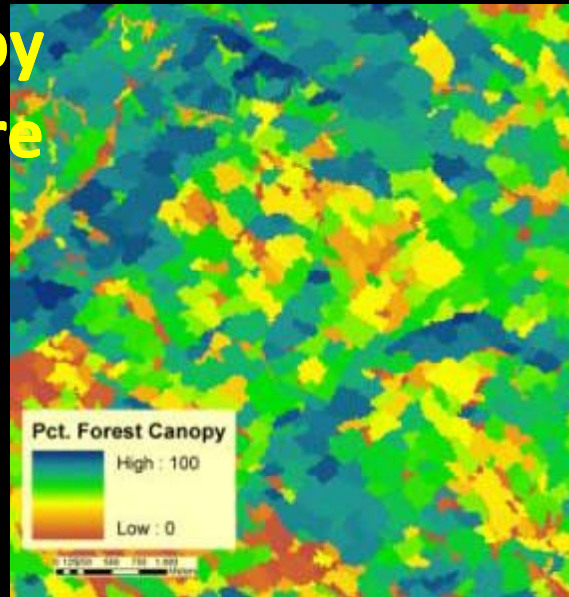
Solar Radiation

Distance to Water

Landscape Scale Habitat Mapping – Vegetation

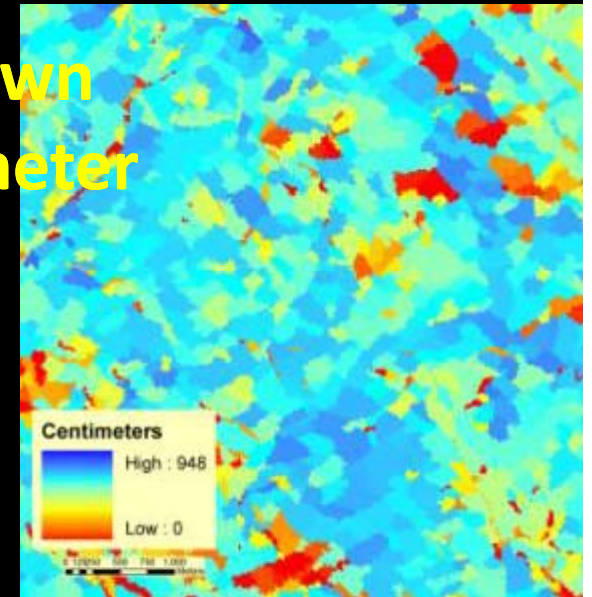Derived from 30cm resolution QuickBird satellite imagery
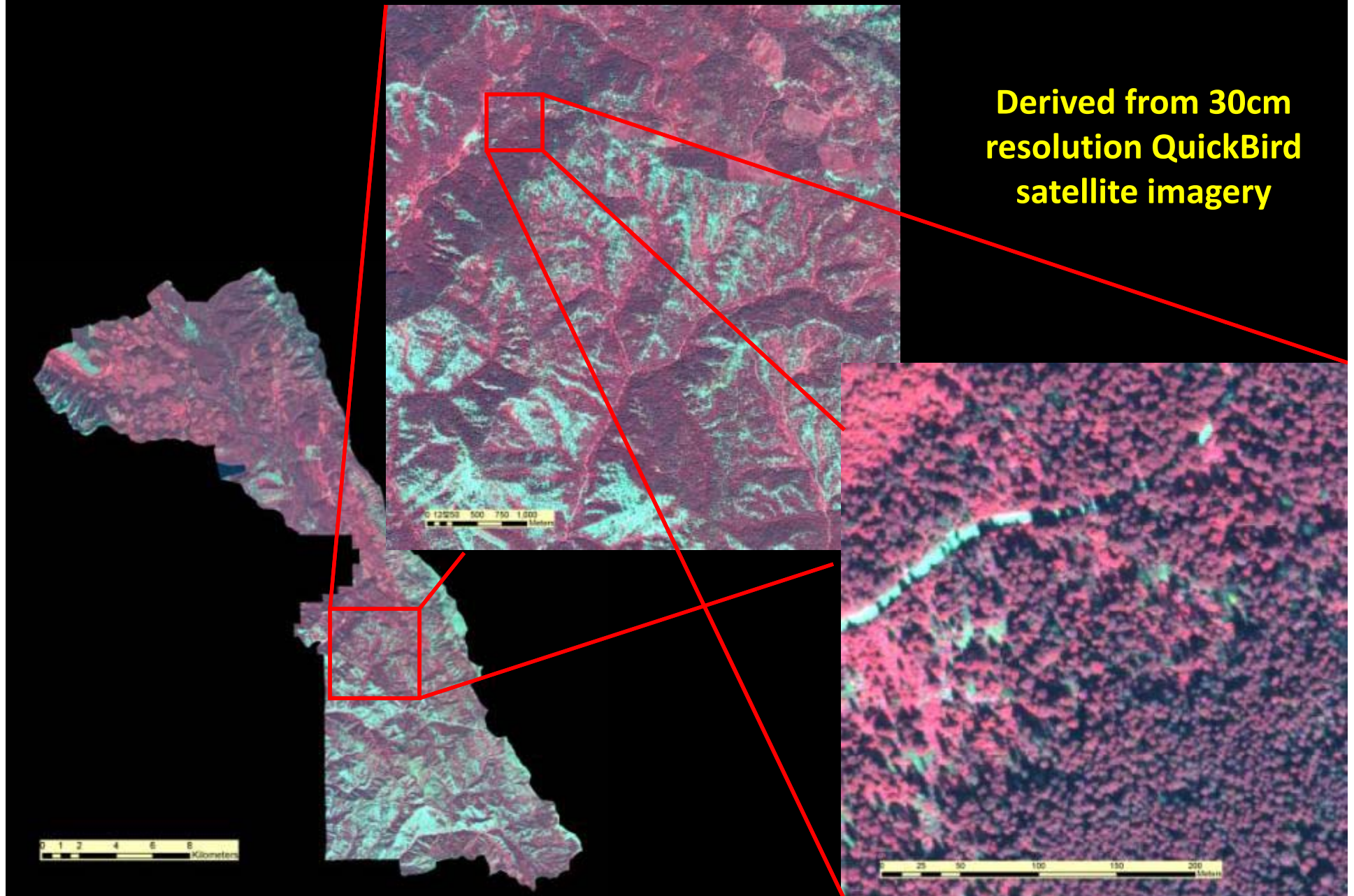
Landscape Scale Habitat Mapping – Vegetation

Canopy Closure

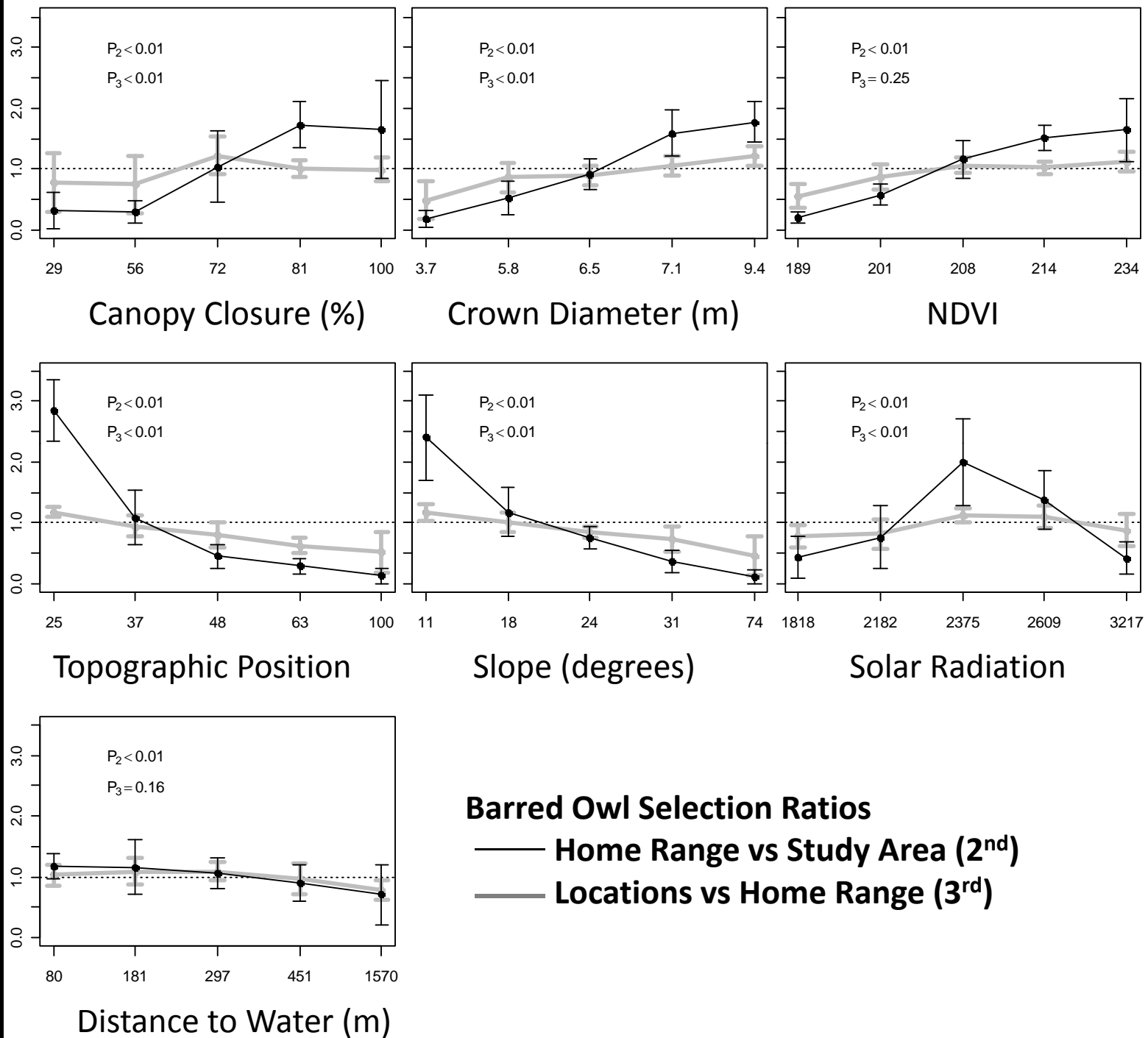**Crown Diameter**

Normalized Difference Vegetation Index

Canopy Closure (%)

Crown Diameter (m)

NDVI

Topographic Position

Slope (degrees)

Solar Radiation

Distance to Water (m)

Barred Owl Selection Ratios

— **Home Range vs Study Area (2nd)**

— **Locations vs Home Range (3rd)**
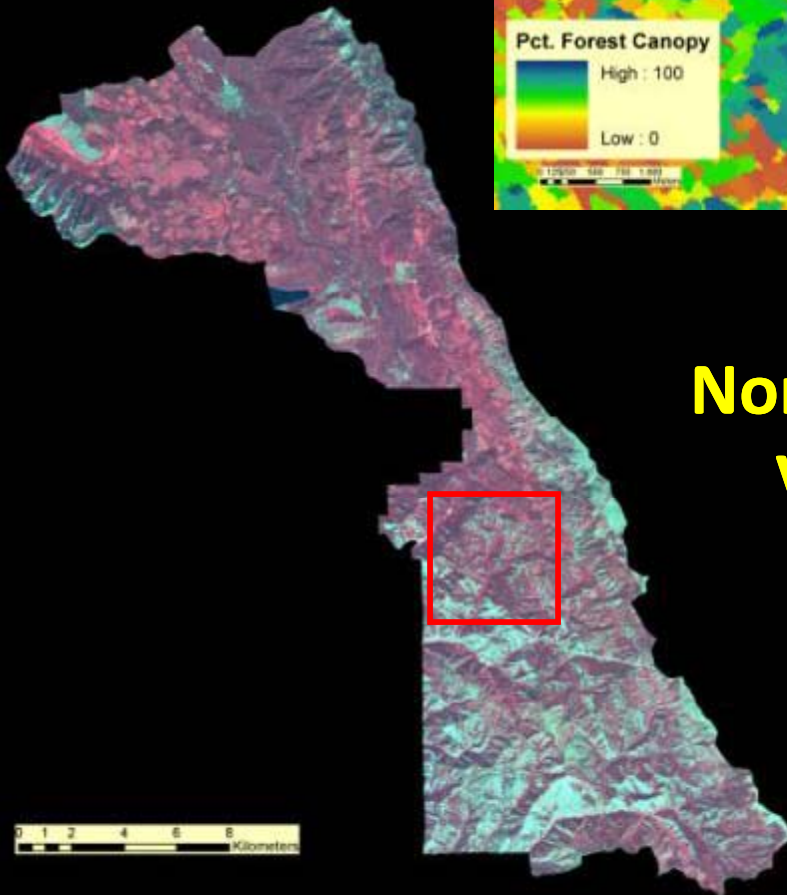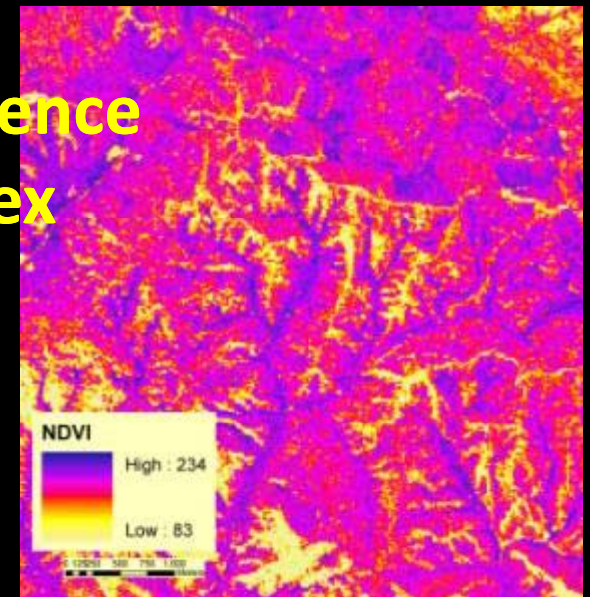
Barred Owl Resource Selection Function

Barred Owl Sites
Spotted Owl Sites
High : 0.96
Low : <0.01

Provincial Scale Barred Owl Habitat

Model Validation Surveys

	Barred Owl Detections:			
Habitat:	None	Single	Pair	Total
Poor				
Moderate				
Good				
Grand Total				

Preliminary Results Removed

Non-habitat
Poor
Moderate
Good

Maxent Niche Modeling Comparison of Spotted Owl and Barred Owl Pair Sites

We used Maximum Entropy Niche Modeling to compare habitat characteristics at 240 historic Spotted Owl pair sites and 29 Barred Owl Pair Sites

Model Covariates:

Vegetation (from 2010 GNN data)

      Mean DBH (cm)

      Canopy Cover (%)

      Percent of basal area in grand fir (%)

      Percent of basal area in Douglas fir (%)

Topographic Characteristics (from 10m DEM)

      Slope (degrees)

      Solar Radiation

      Topographic Position

Maxent Results

Maxent Covariate Effects (with percent contribution) :

Spotted Owl

Preliminary Results Removed

Barred Owl

Maxent Habitat Suitability Maps:

Preliminary Results Removed

Maxent Niche Modeling Results

Spotted Owl and Barred Owl
Habitat Overlap (ha):

Spotted Owl

	Poor (<0.4)	Good (>0.4)
Barred Owl Poor (<0.4)		
Good (>0.4)		

Total landscape area: 984,541 ha

Preliminary Results Removed

Ecological Differences Between Barred and Spotted Owls

	Barred Owl	Spotted Owl
Annual Home Range Size	~450 ha	~2500 ha
Prey Preference	Ground Dwelling Vertebrates and Invertebrates	Medium-sized Arboreal Mammals (i.e. Northern Flying Squirrels and Woodrats)
Behavior	Very Aggressive, Little Con-specific Home Range Overlap	Less Aggressive, More Con-specific Home Range Overlap
Within Home Range Habitat Characteristics	Closed Canopy, Structurally Diverse Mixed Conifer Forest	Closed Canopy, Structurally Diverse Mixed Conifer Forest
Landscape Scale Habitat Associations	Generally Use Flat Ground in Valley Bottoms	Less Strongly Associated with Topographic Characteristics

Discussion

What does this information mean in terms of conservation planning?

- Do these results suggest niche partitioning or displacement?

- Is there adequate niche space to allow for spotted owl population persistence?

- What are the implications for source-sink dynamics for spotted owls?

Interactions between spotted owl and barred owl populations are spatially complex.

Next Steps…

Modeling interactions between spotted owl and barred owl populations in a dynamic landscape: The Vegetation – Fire – Owl Project.

- Use individual-based population models (HexSim) to evaluate spotted owl vulnerability to disturbance and interactions with barred owls
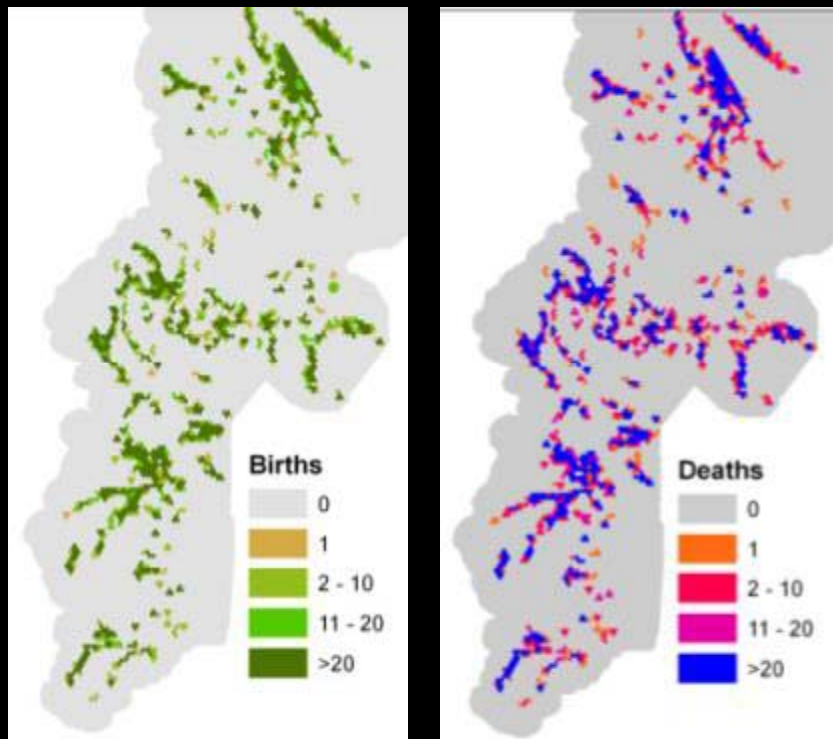
Vegetation – Fire – Owl Modeling

- Modeling Approach:
  - Landsum forest growth models to project vegetation at 10 year increments (Kennedy)
  - 4 to 7 management scenarios to evaluate different management approaches
  - Fire risk and fire spread modeling to simulate effects of fire each decade
  - Individual-based Spotted Owl population modeling, including effects of Barred Owls
  - Run the models out 100 years, 100 times for each scenario...