Pinecrest Sooty Grouse Study:
Habitat Modeling and Population Assessment

Principal Investigator: James Bland

Occupied habitat → **Field measurements** → **Suitability model**

Acknowledgements

Support

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Field Technicians

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Objectives

1. Determine the seasonal habitat associations of Sierra Sooty Grouse.

2. Determine the spatial and topographic relationships between seasonal habitats, and characterize movements between these habitats.

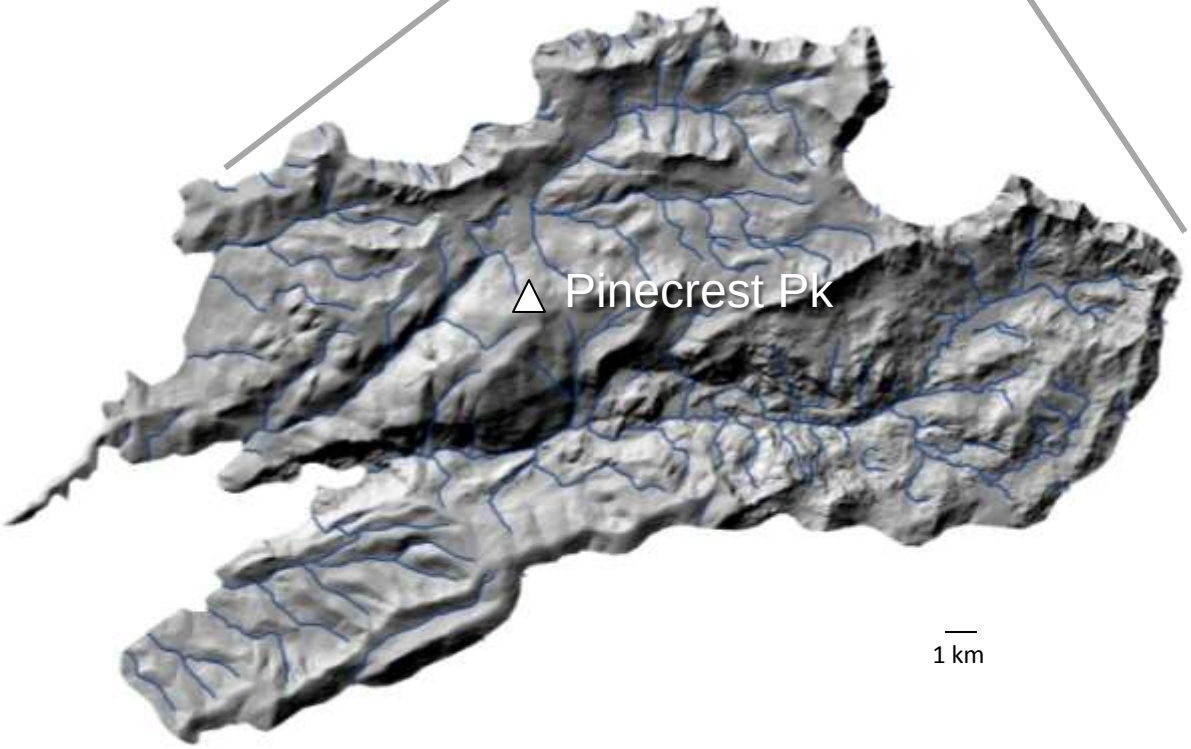
3. Determine the degree to which Sierra Sooty Grouse are associated with old forests, large trees, and mountain meadows.

4. Develop a GIS-based habitat model that will facilitate prediction and Management of Sooty Grouse habitats throughout the Sierra Nevada.

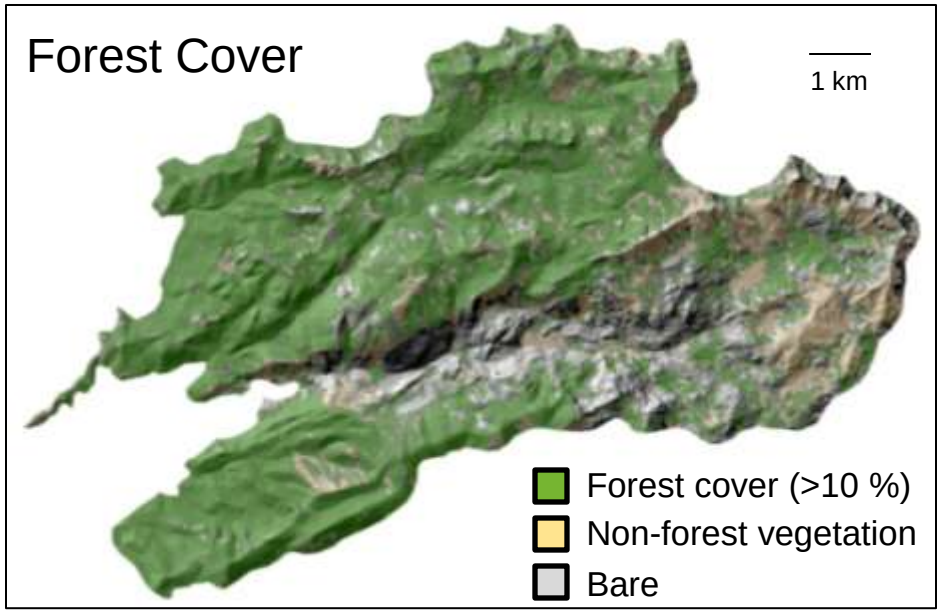
5. Develop a Sooty Grouse population survey protocol.

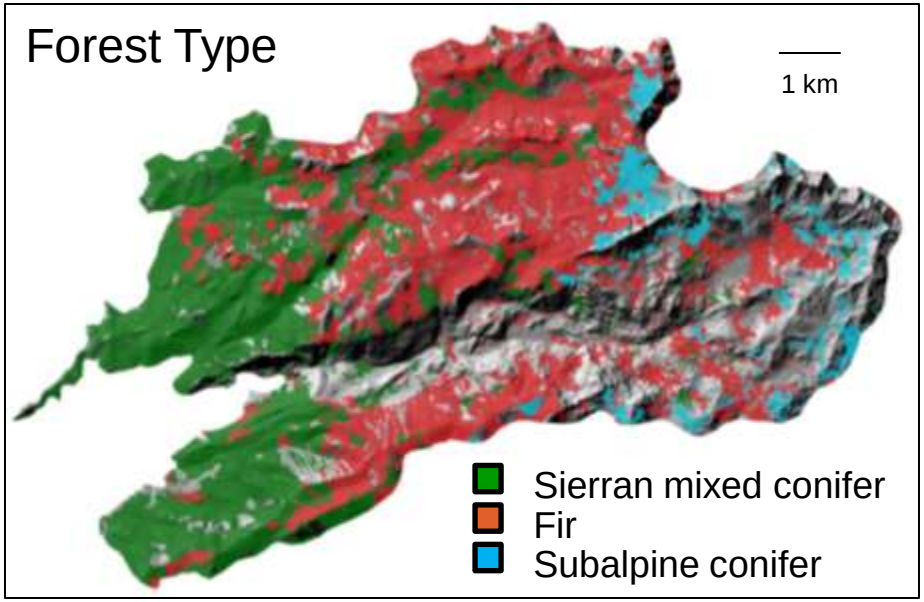
Study Area

Pinecrest, Tuolumne County
Stanislaus National Forest
167 km^2
Elevation: 1775 – 2800 m



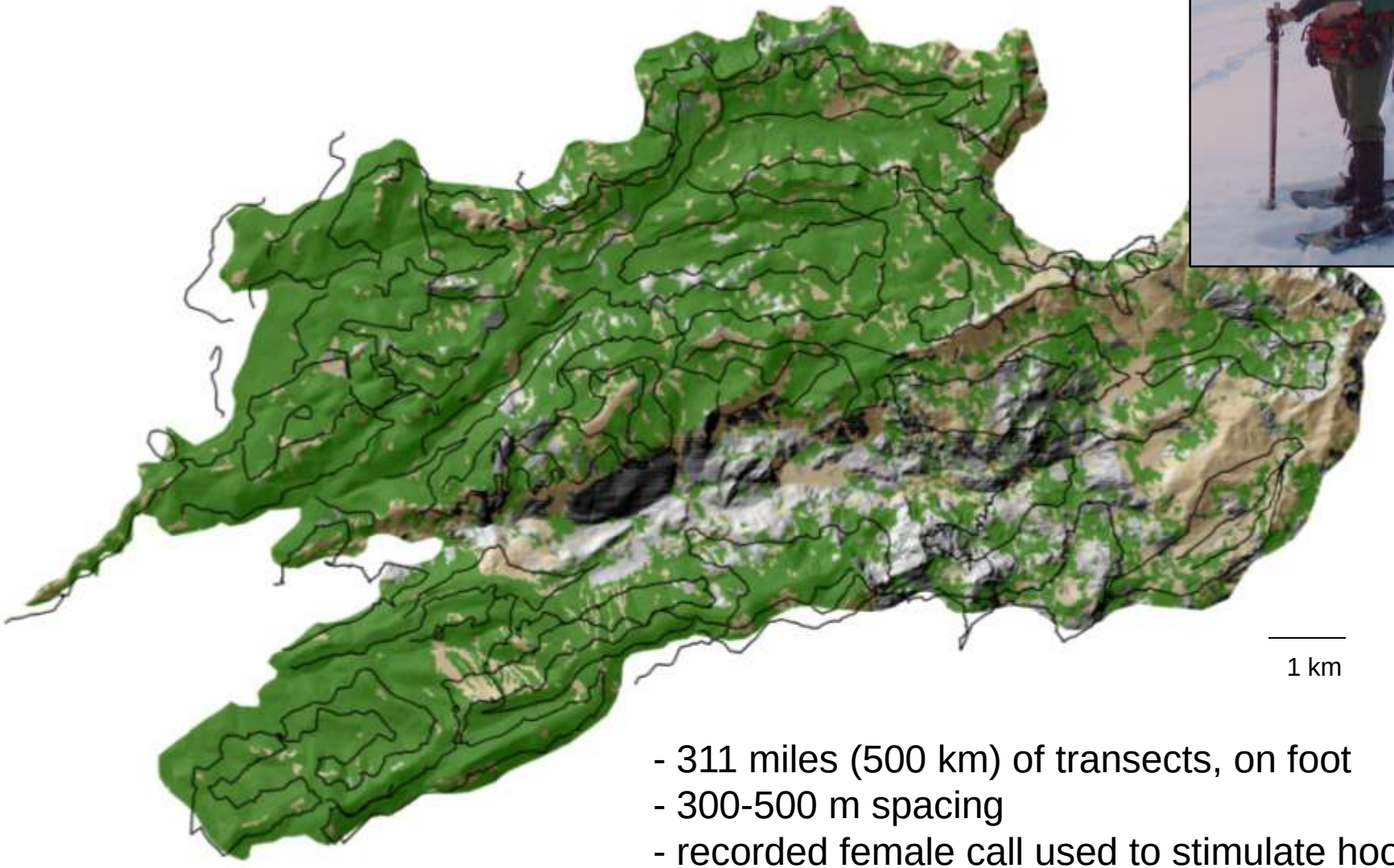
Vegetation


Forest Cover
1 km
Forest cover (>10 %)
Non-forest vegetation
Bare


Forest Type
1 km
Sierran mixed conifer
Fir
Subalpine conifer

Methods

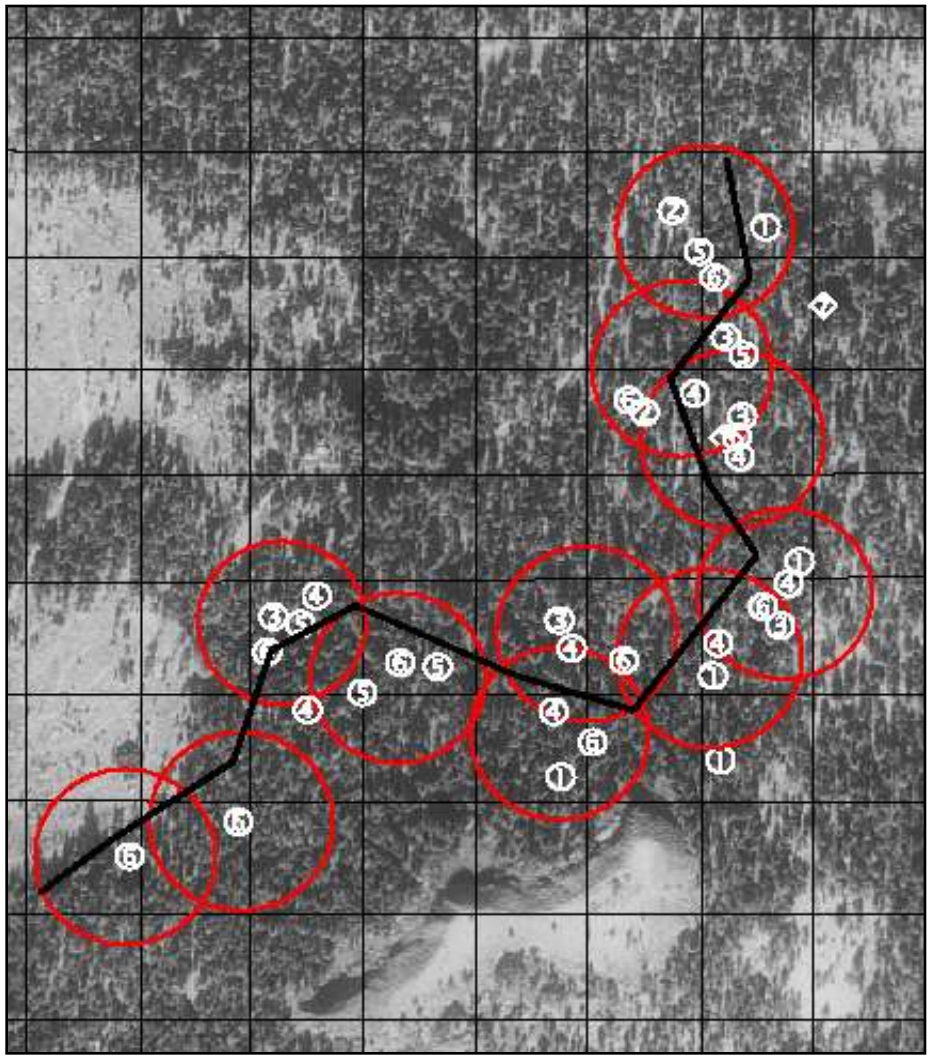
1) Landscape-scale surveys for “hooting” males



- 311 miles (500 km) of transects, on foot
- 300-500 m spacing
- recorded female call used to stimulate hooting

2) Group-scale censuses of hooting males

Locations of displaying males were plotted repeatedly to estimate the number of individuals in an area (territorial spot-mapping).



3) Accumulation of fecal droppings at territorial songposts (perches)

4) Trapping and radio-tagging

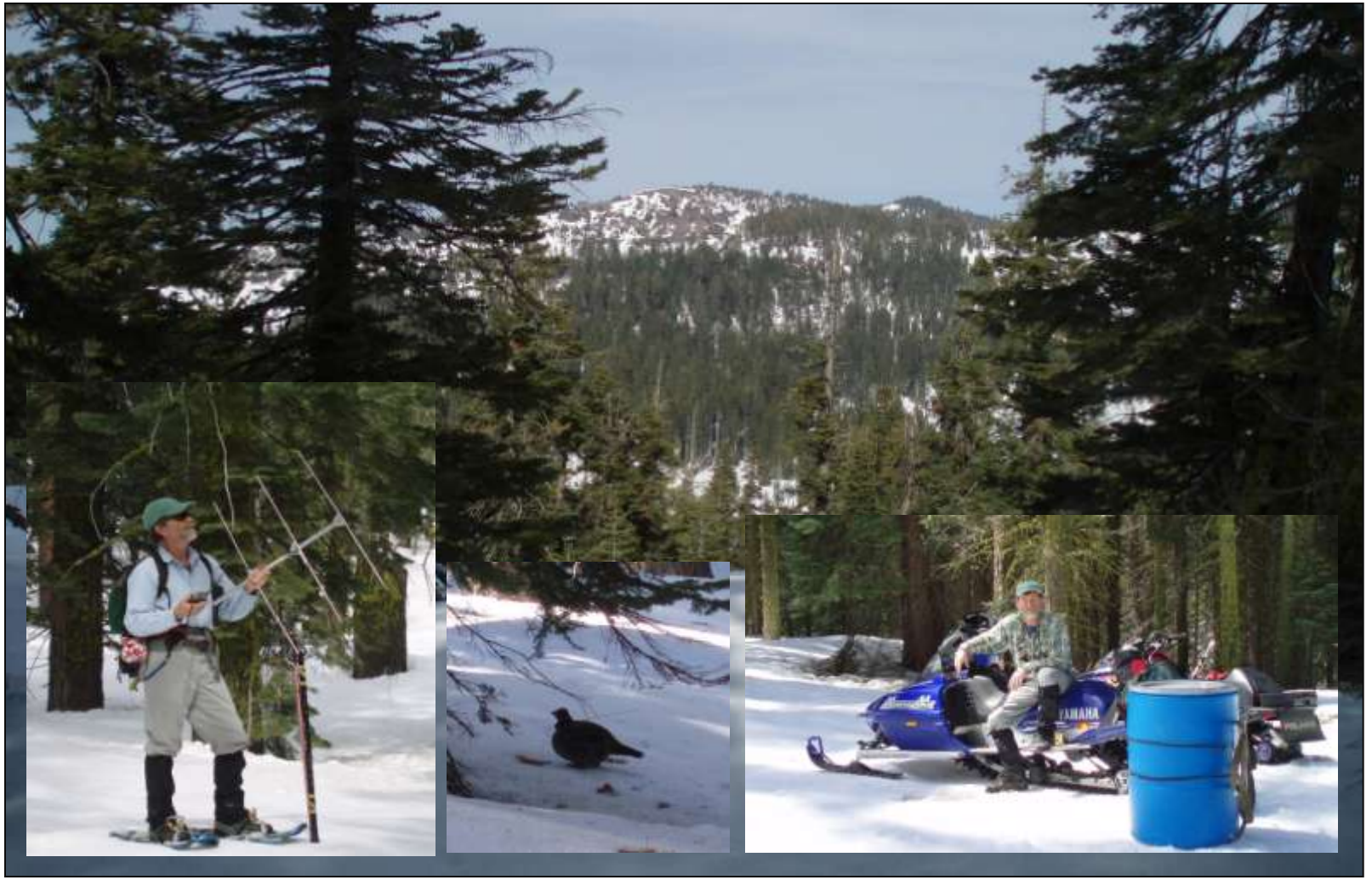
Trapping camp and some reluctant participants

Bow-nets and female decoys for trapping breeding males

Nest searches and night-lighting for catching females

5) Radiotelemetry

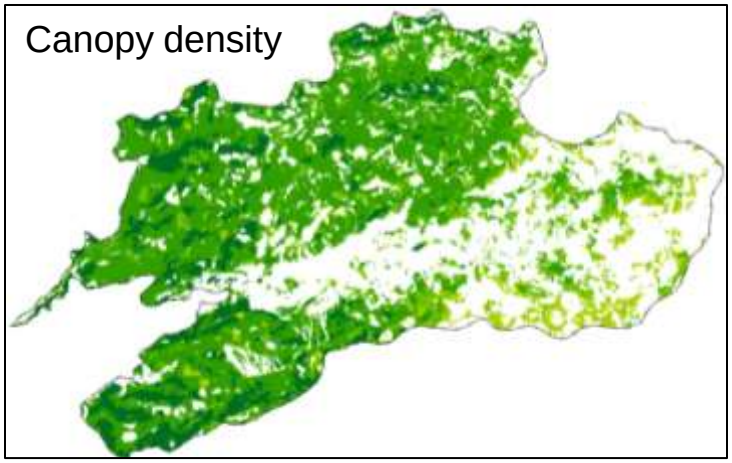
10 males and 4 females
18 gram necklace-style VHF transmitters
Relocated every ~10 days by homing, year-round, 2007-2009

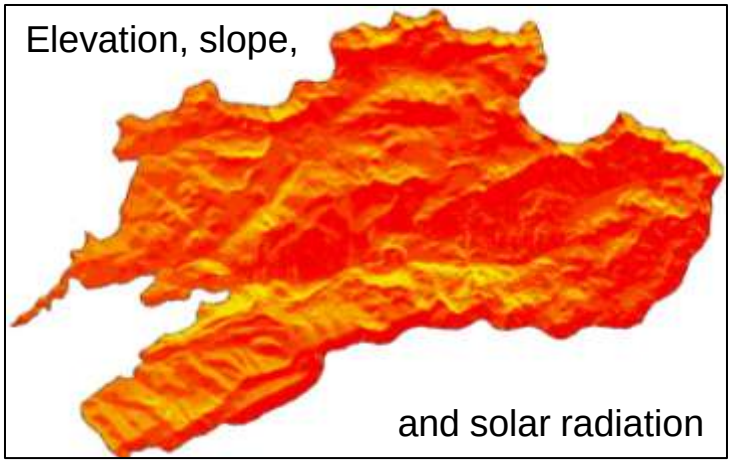


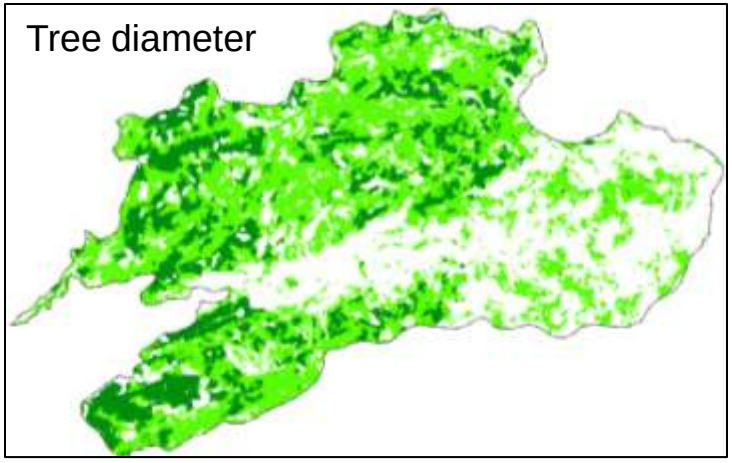
6) Multi-scale habitat assessment

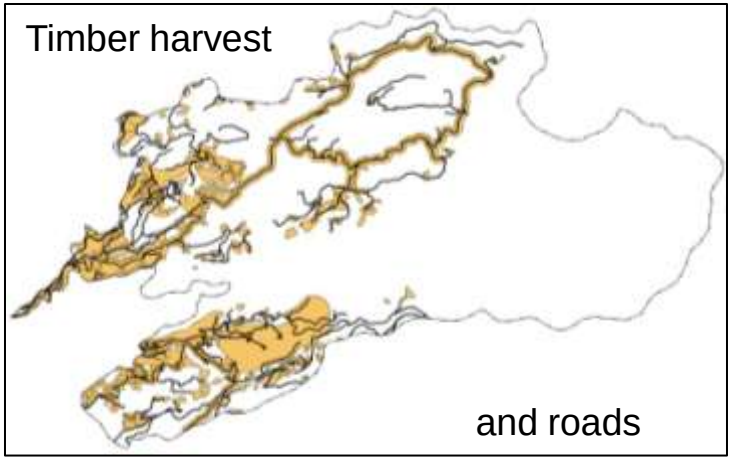
a. Patch-scale habitat assessment

Available GIS layers: forest type, canopy density, tree diameter, elevation, slope, aspect, roads, and harvest history.





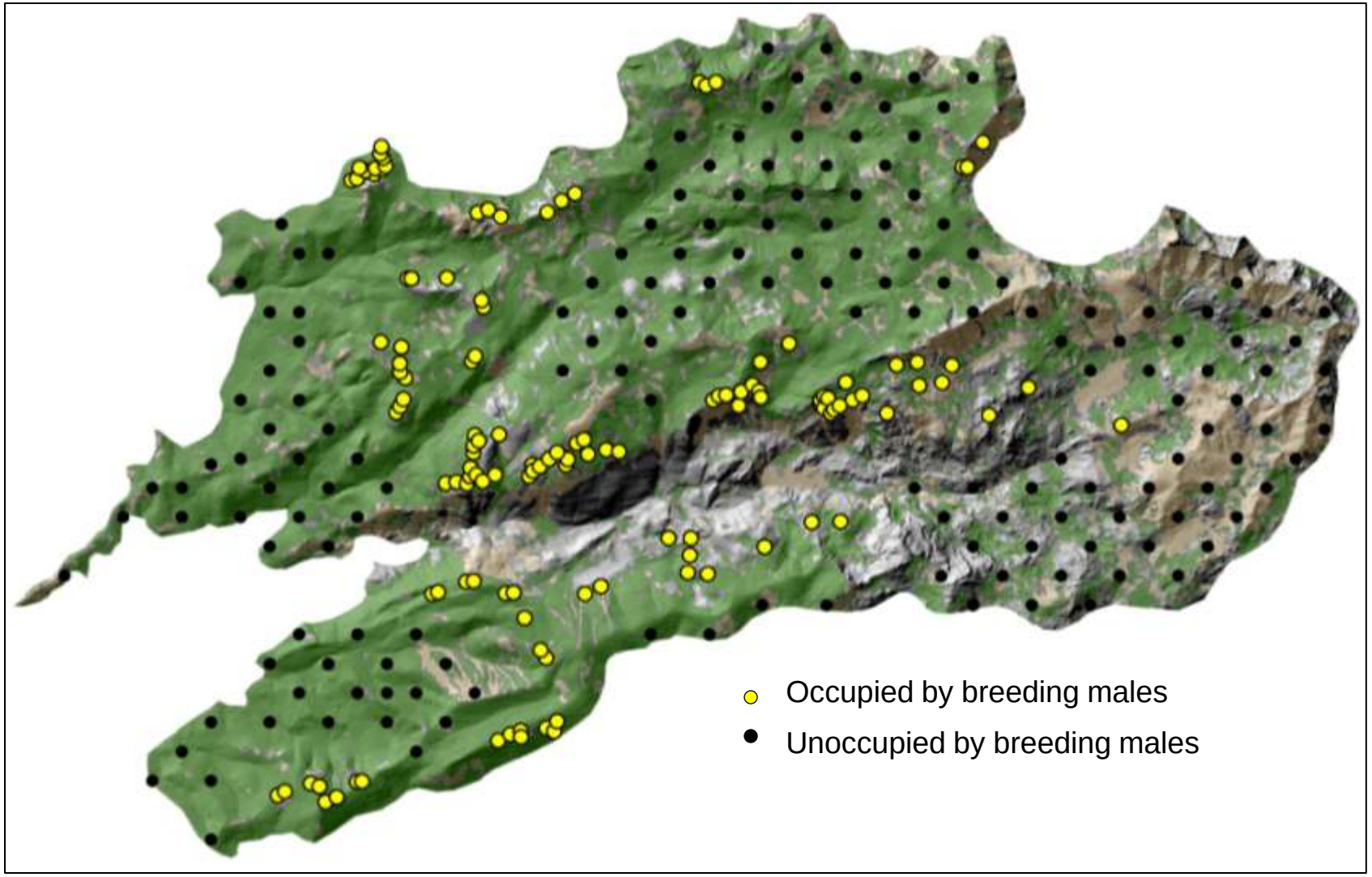




b. Micro-scale habitat assessment

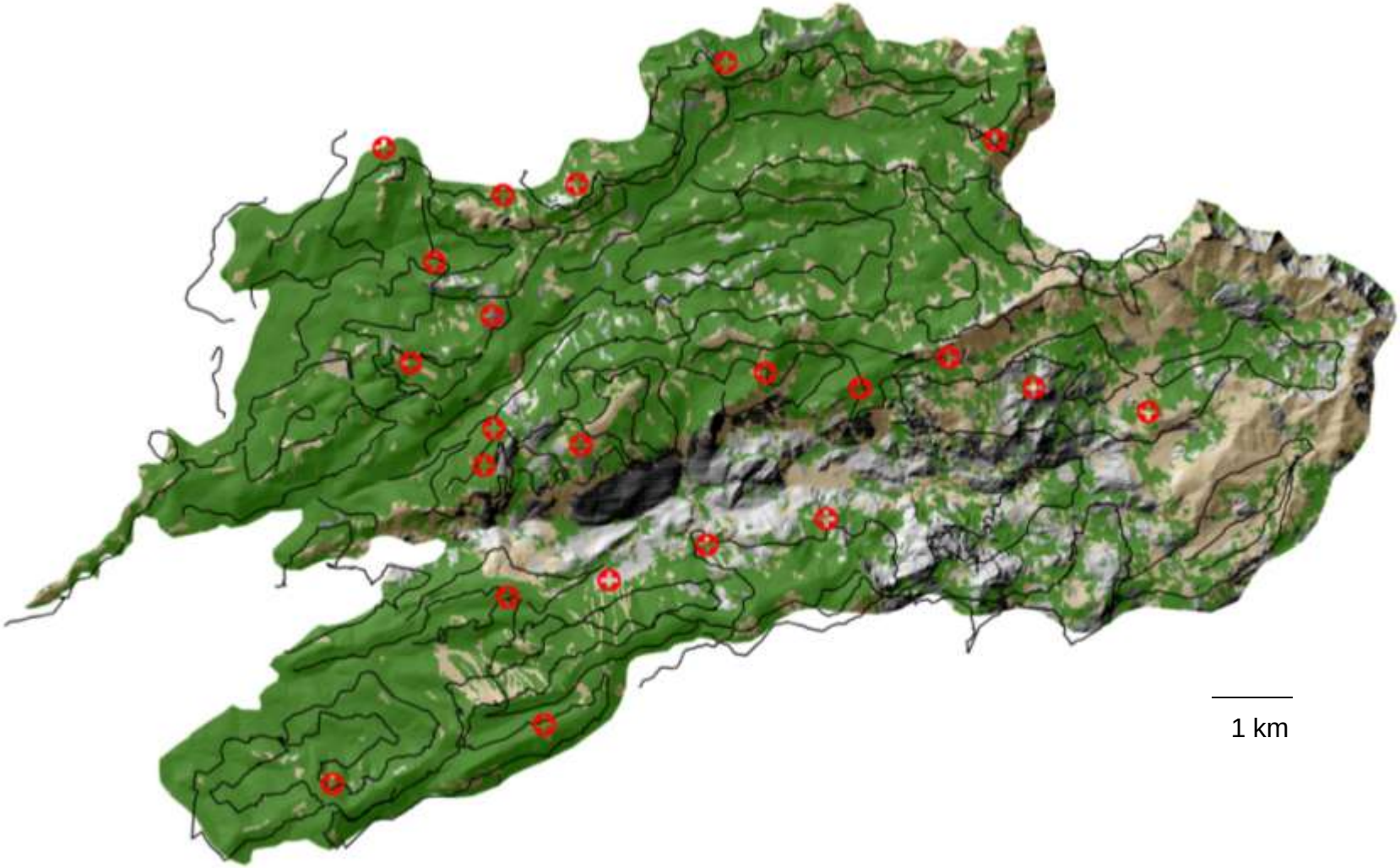
Original data collected at 4.0 and 0.1 ha plots; canopy patchiness, forest edge, tree size and density, shrub height and density, herbaceous cover, logs, stumps, and coarse woody debris.

Micro-scale data were collected at occupied sites and systematically sampled unoccupied sites.



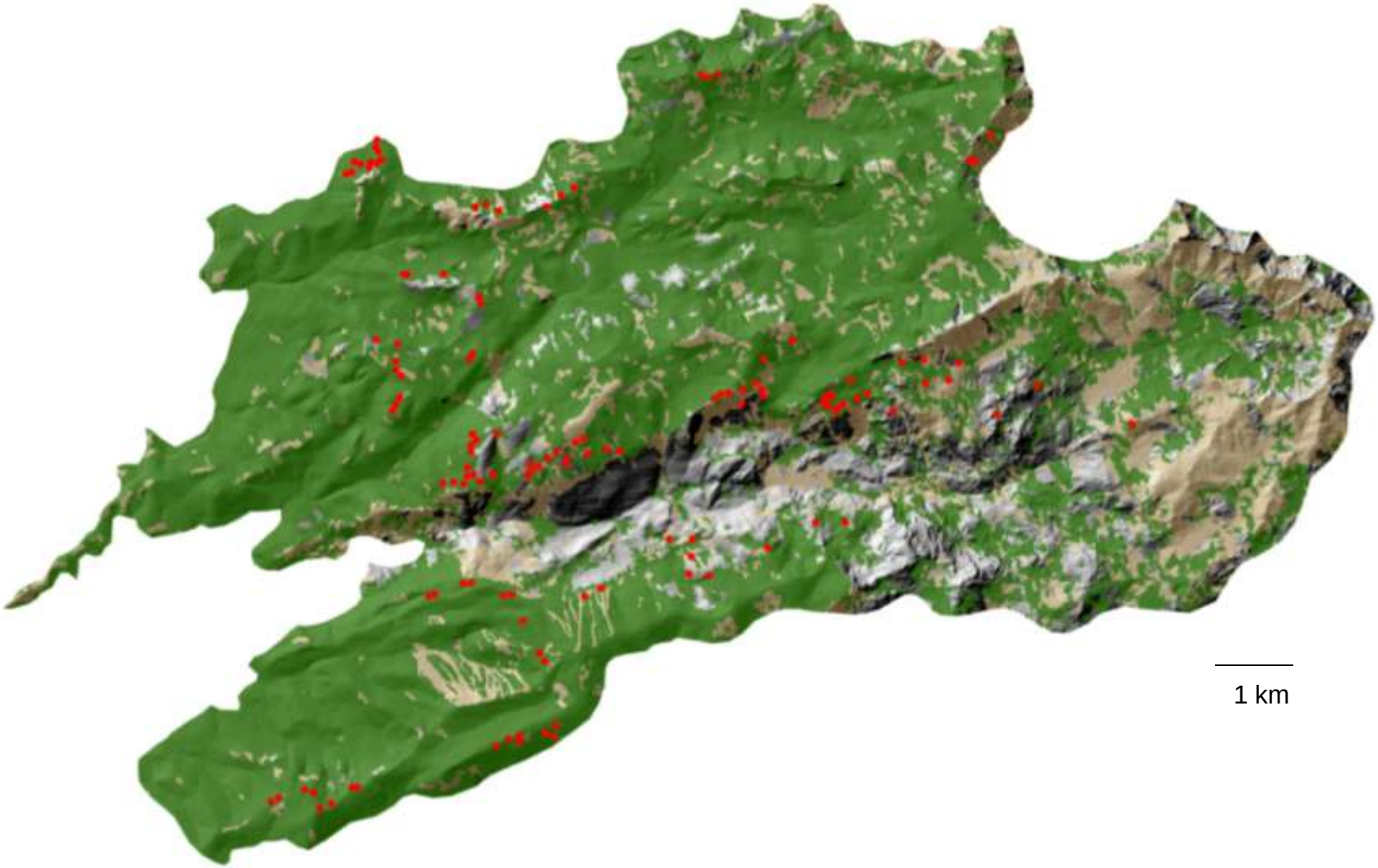
Findings

Landscape-scale surveys revealed 22 groups of breeding males (hooting groups).
Average distance between nearest-neighbor groups = 1.9 km.

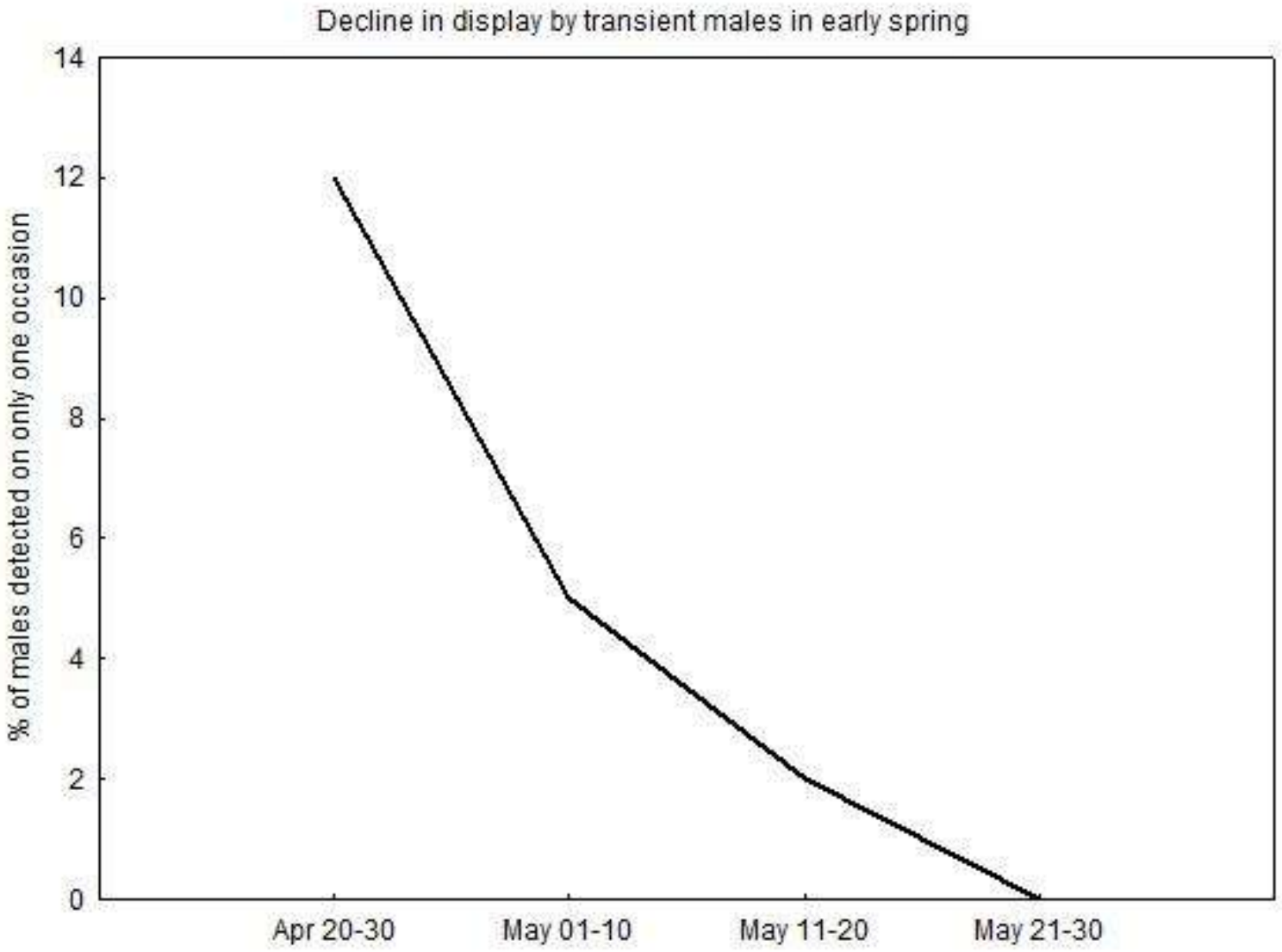


Group-scale censuses revealed 137 male breeding territories

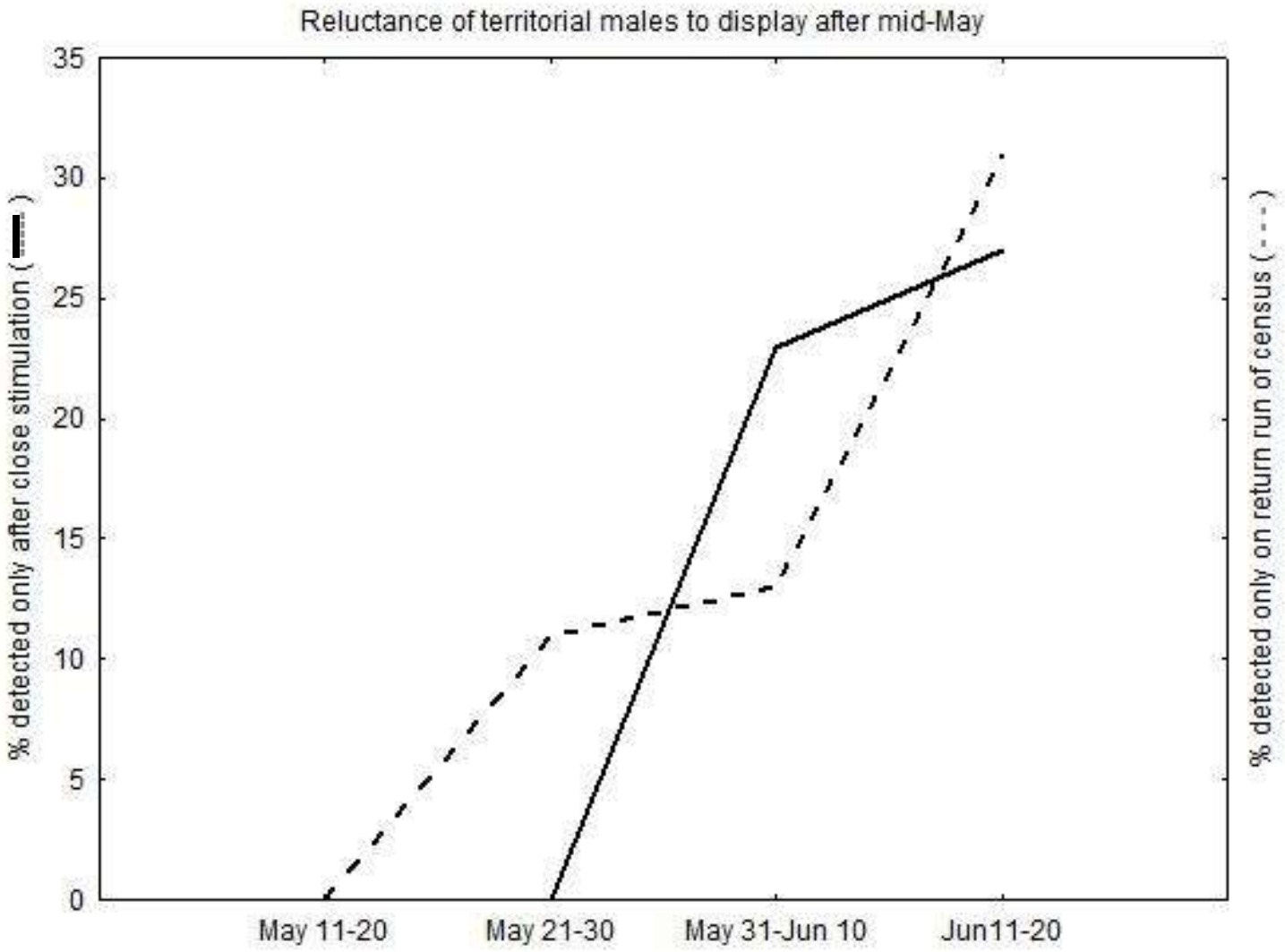
Average group size = 4.9 males (range, 2-10)
Average distance between nearest-neighbor males = 209 m (range, 75-638 m)
Estimated density of territorial males in 167 km^2 study area = 0.6/km^2



Anomalous singing by yearling (transient) males was rare after early May.

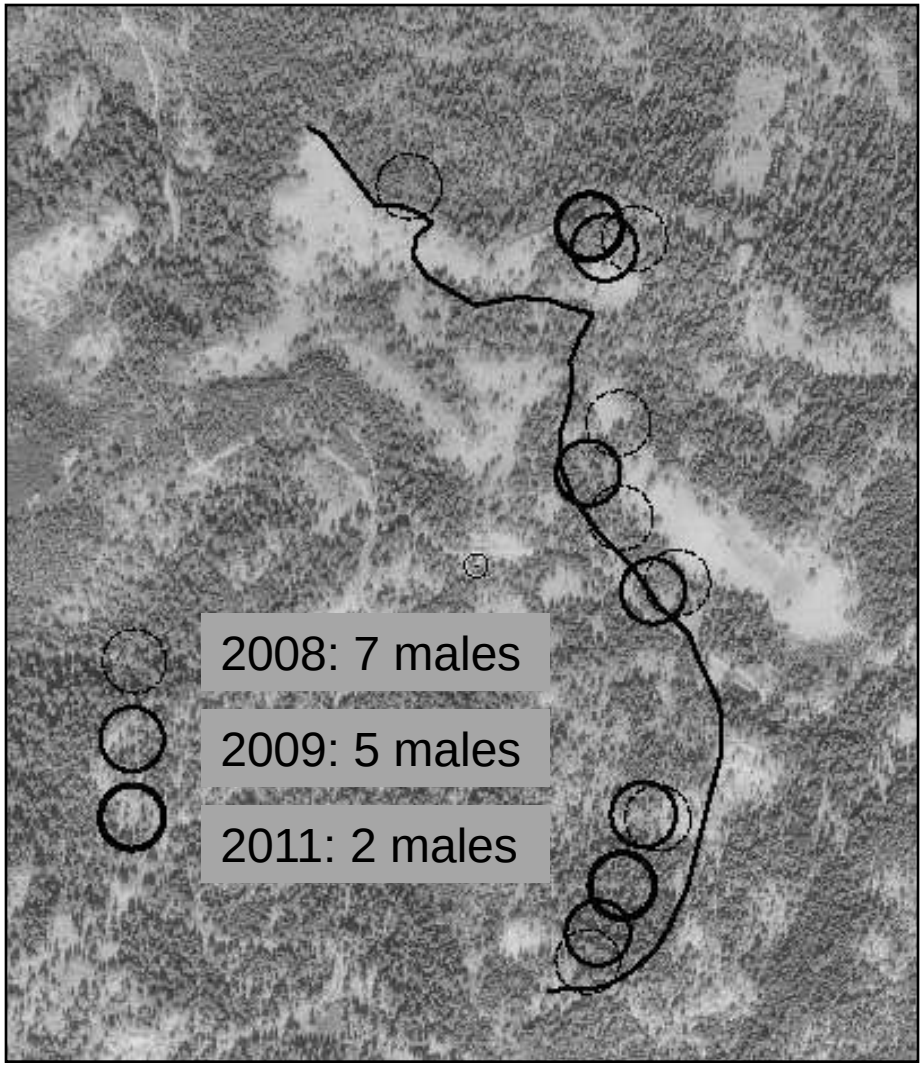


Persistently territorial males became reluctant to display after mid-May



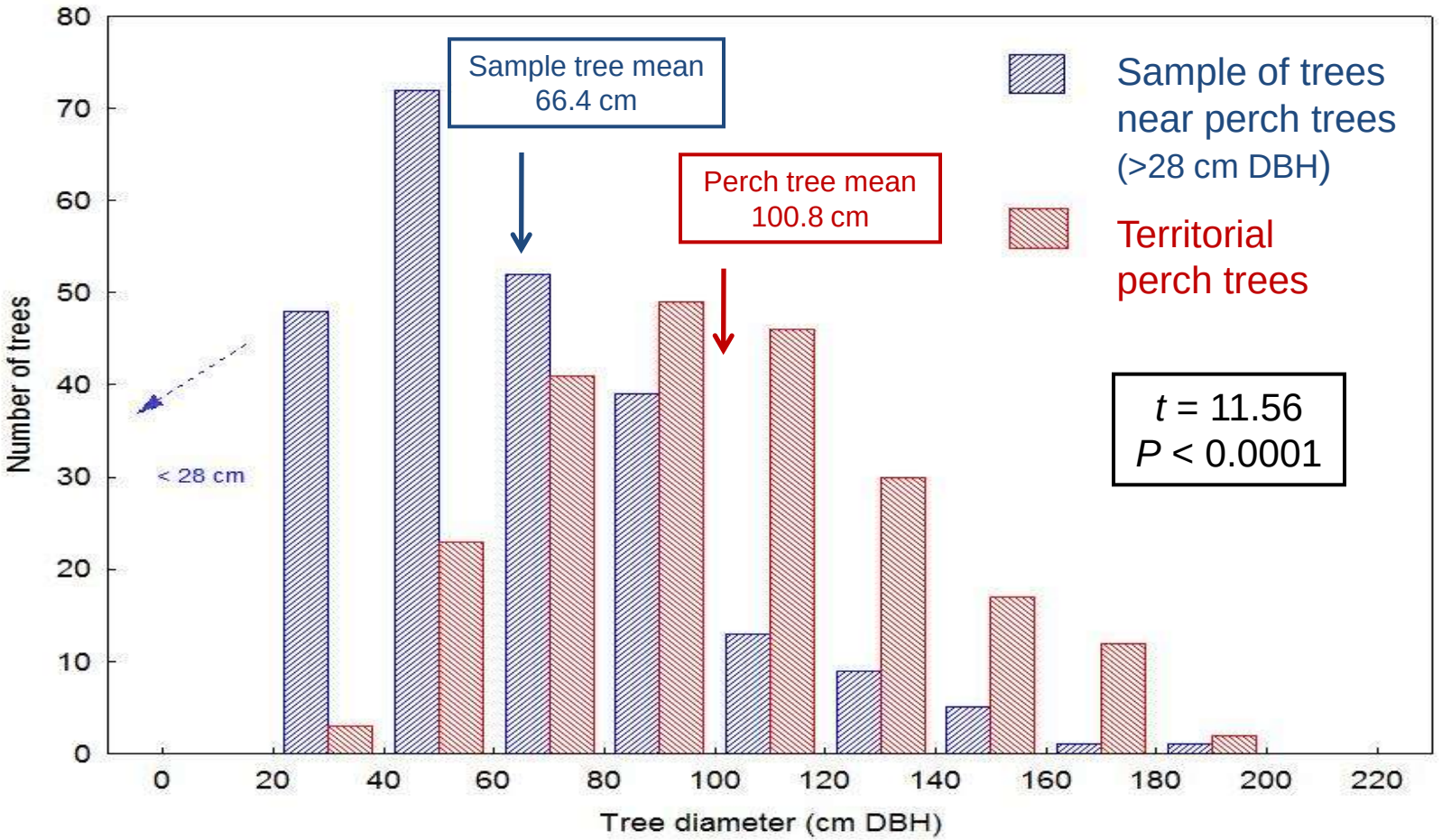
The total number of persistently territorial males was static between 2009 and 2011

However, the Punch Bowl group did decline significantly between 2007 and 2011



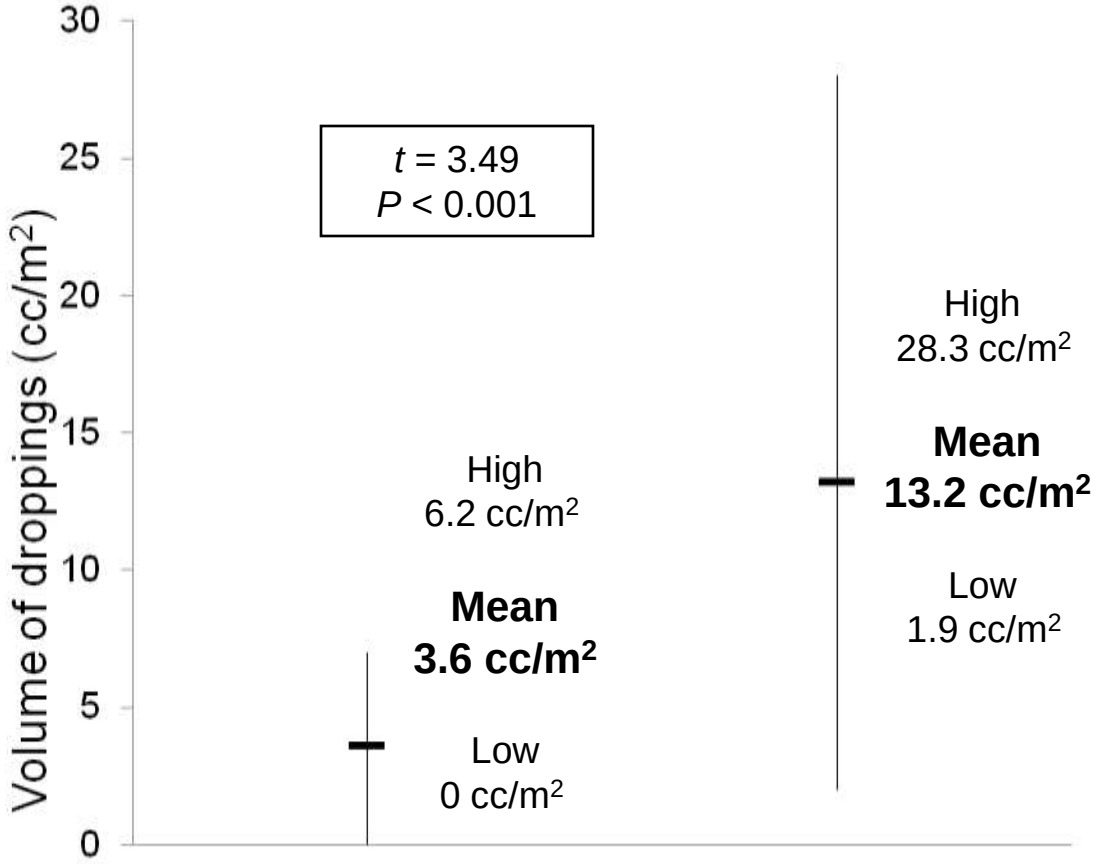
Breeding males preferred large trees for territorial songposts (perches)

Average territorial perch tree = ~1 m in diameter



Territorial males using large trees as songposts

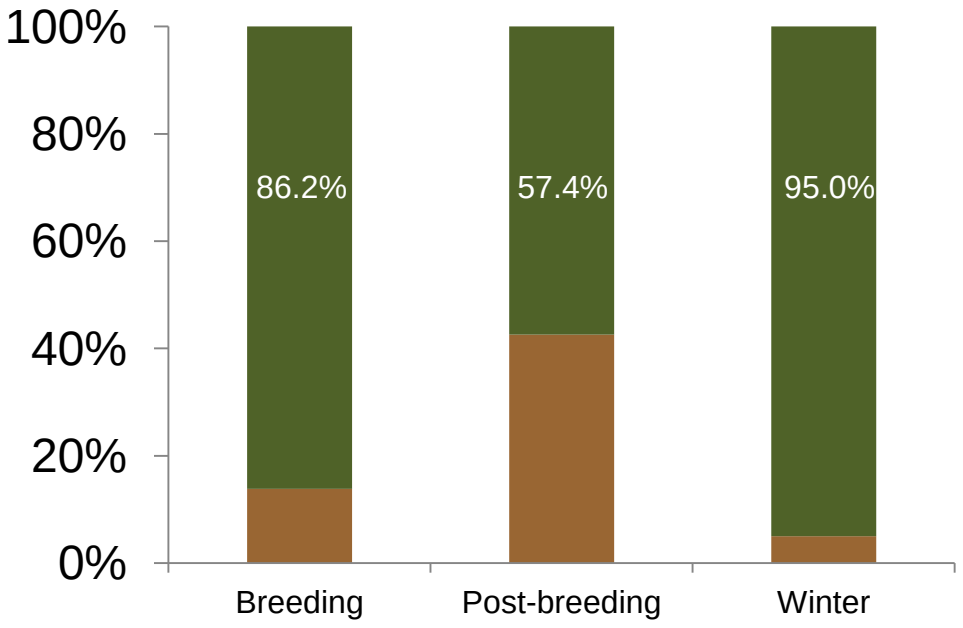
Dropping accumulations confirmed large trees were preferred



Sierra Sooty Grouse are highly arboreal

In winter, 95 % of detections of radio-marked males were in trees
In breeding season, 86 % of detections were in trees (winter and spring diets consist almost entirely of conifer needles and buds).
In post-breeding season, detections in trees declined to 57.4 % (post-breeding diets include berries and herbs, acquired on the ground).

Detections of radio-marked males in trees

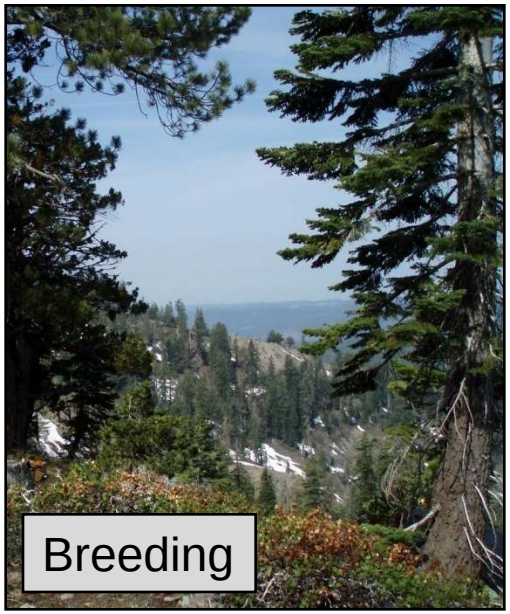


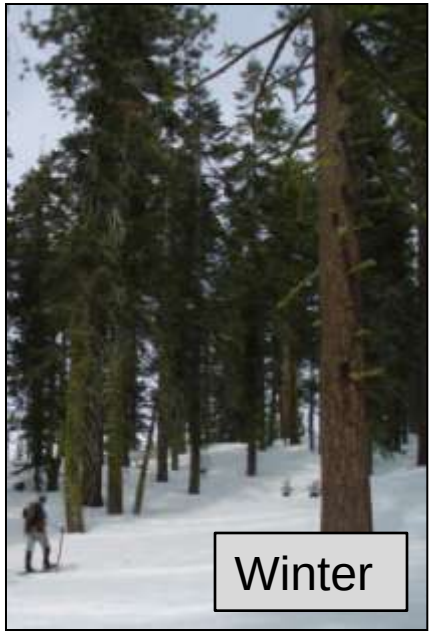
In trees

On the ground

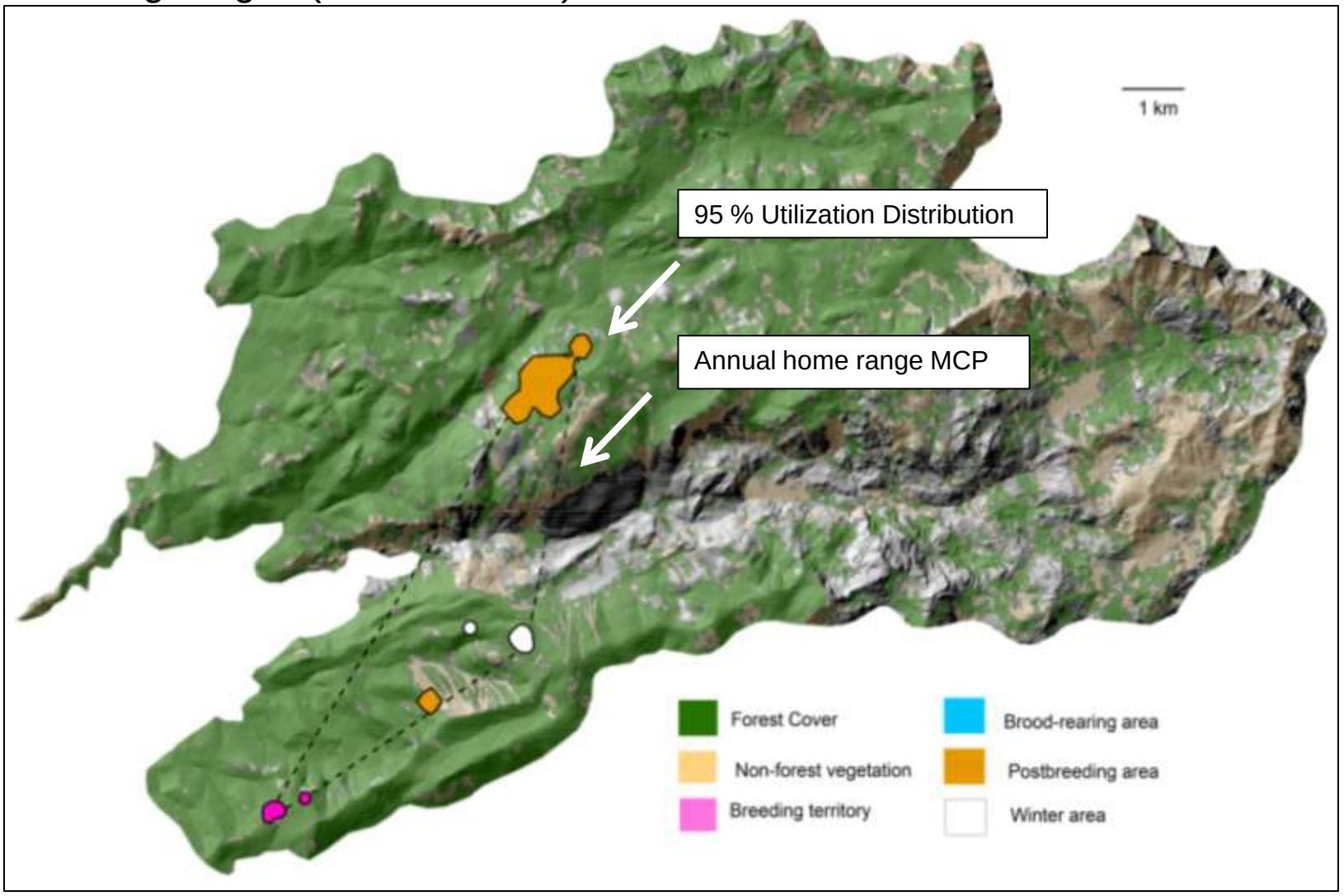
50 % of radio-tagged birds (3 males and 2 females) migrated seasonally between dispersed breeding, post-breeding, and wintering areas.

The greatest seasonal altitudinal change was from breeding to post-breeding range
    Higher elevation environments were cooler and more moist in summer
Birds then descended to wintering range, and again to breeding range
Average elevation of breeding and wintering ranges was not statistically different

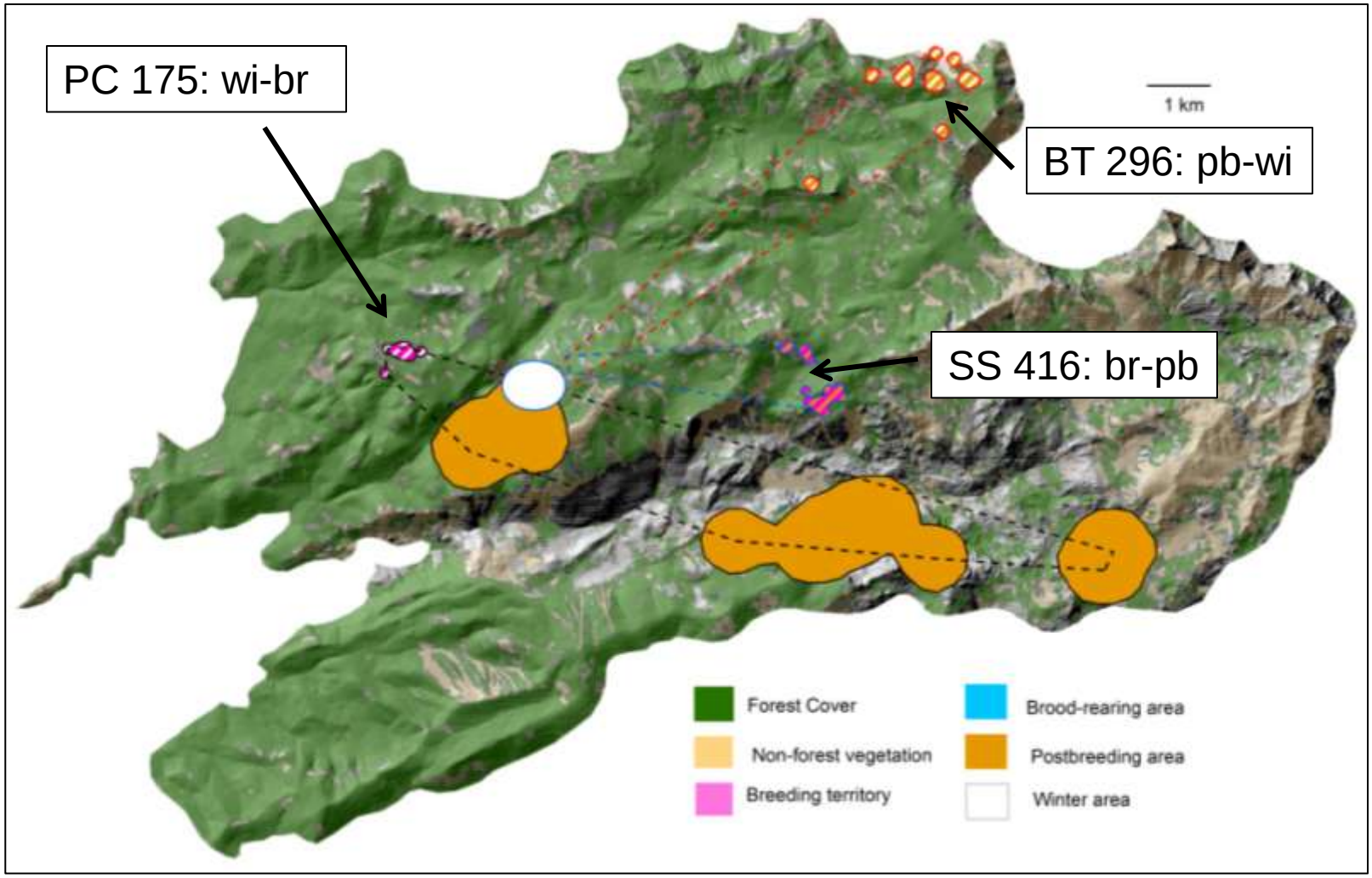




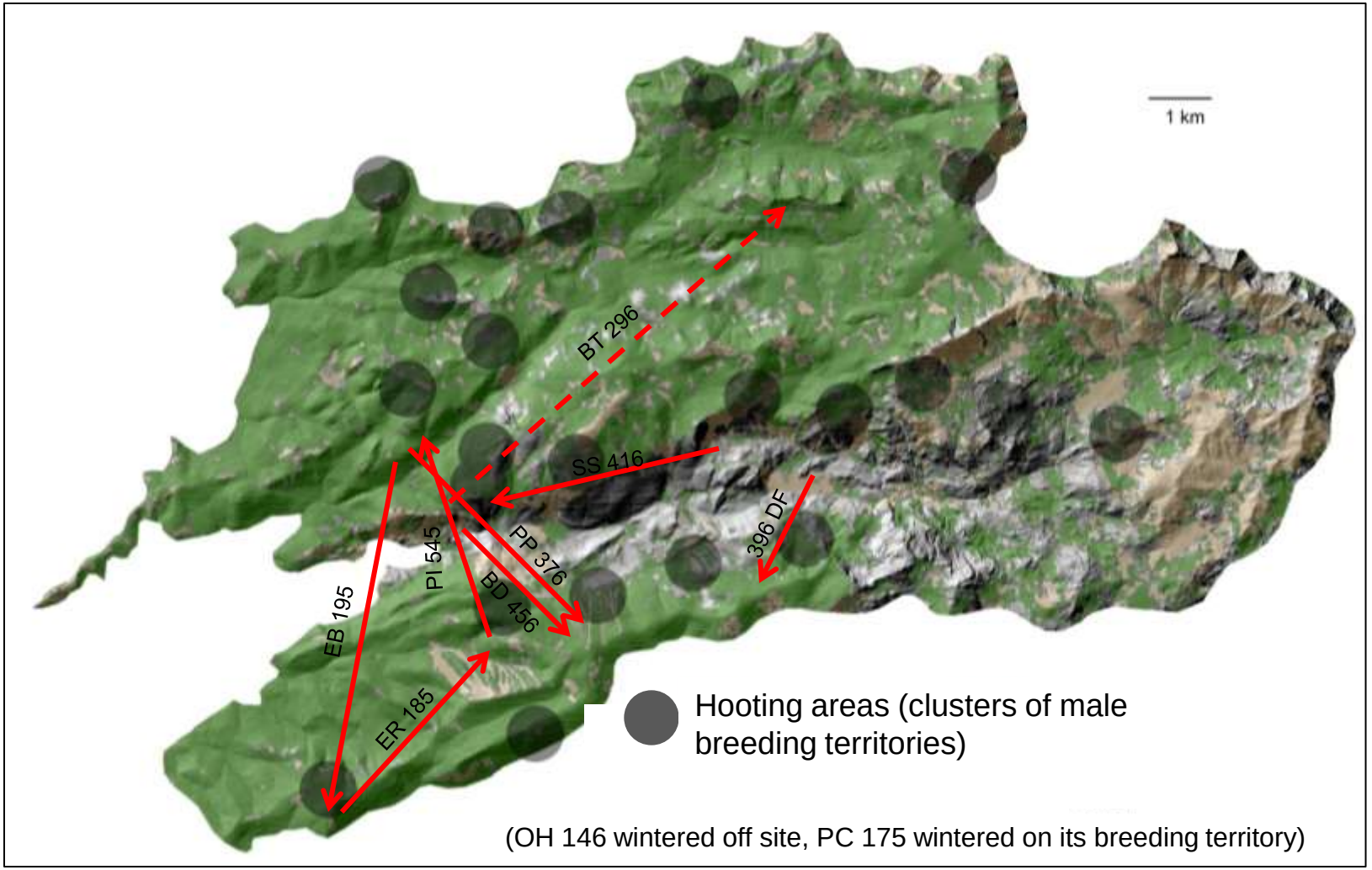
An annual circuit that included dispersed breeding, postbreeding, and wintering ranges (ER 185, male)



Other individuals remained in one area through two successive seasons



Breeding areas of some served as wintering areas for others:
"seasonal range time-sharing"



Average annual home range size:

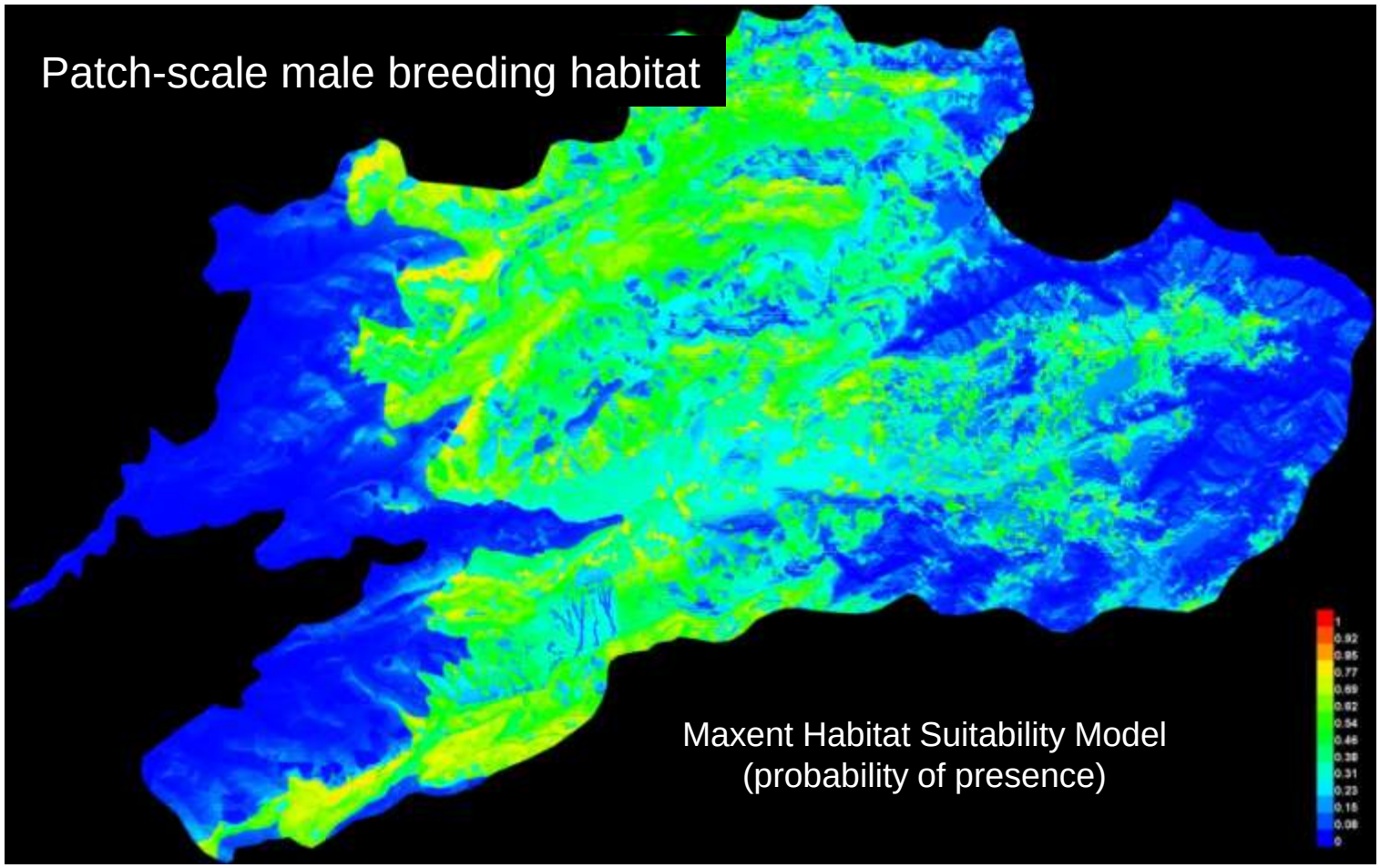
Min. Convex Polygon (95% of fixes): 11.9 km^2 (range: 0.5-27.3 km^2)
Fixed kernel (95% utilization dist.): 7.5 km^2 (range: 1.3-13.3 km^2)

Average seasonal home range size:

Range type	Minimum Convex Polygon ha (range)
Male breeding (n = 7)	6.1 (0.6-21.1)
Female brood-rearing (n = 2)	420.0 (26.5-813.1)
Postbreeding (n = 9)	344.4 (4.8-1085.7)
Winter (n = 6)	15.1 (1.8-66.5)

Seasonal habitat associations:

Patch scale male breeding habitat was most strongly associated with elevations between ~2075-2350 m, moderate to high tree canopy densities, high solar radiation in March, and absence of timber harvest history.



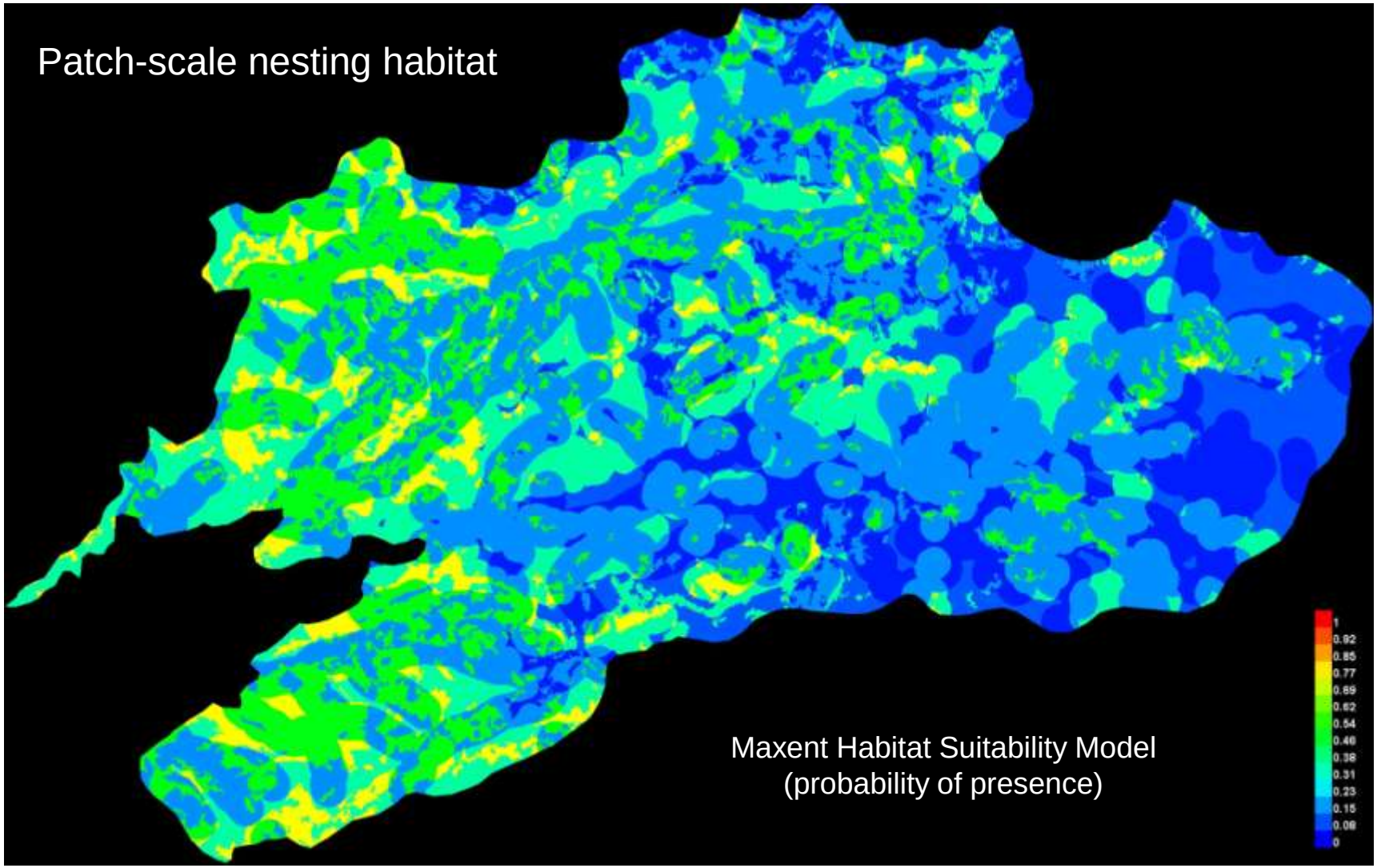
Micro-scale male breeding habitat was best distinguished from systematic samples by:

-higher % slope
-higher low:high forest edge
-frequent *Abies* >62 cm DBH
-lower *Calocedrus* >62 cm DBH
-higher grass height
-higher herb height
-convex slope contour
-frequent *Salix*

Some other variables that differed between male breeding micro-habitat and systematic samples:

-lower north aspect
-higher forest edge
-higher no. trees > 62 cm DBH
-higher DBH of large *Abies*
-higher snowberry cover
-lower tree seedling cover
-higher log abundance
-lower stump abundance
-higher prostrate shrub cover

Patch scale nesting habitat was most strongly associated with large tree diameter, perennial water within 300 m, and pine-dominated forest within 200 m.



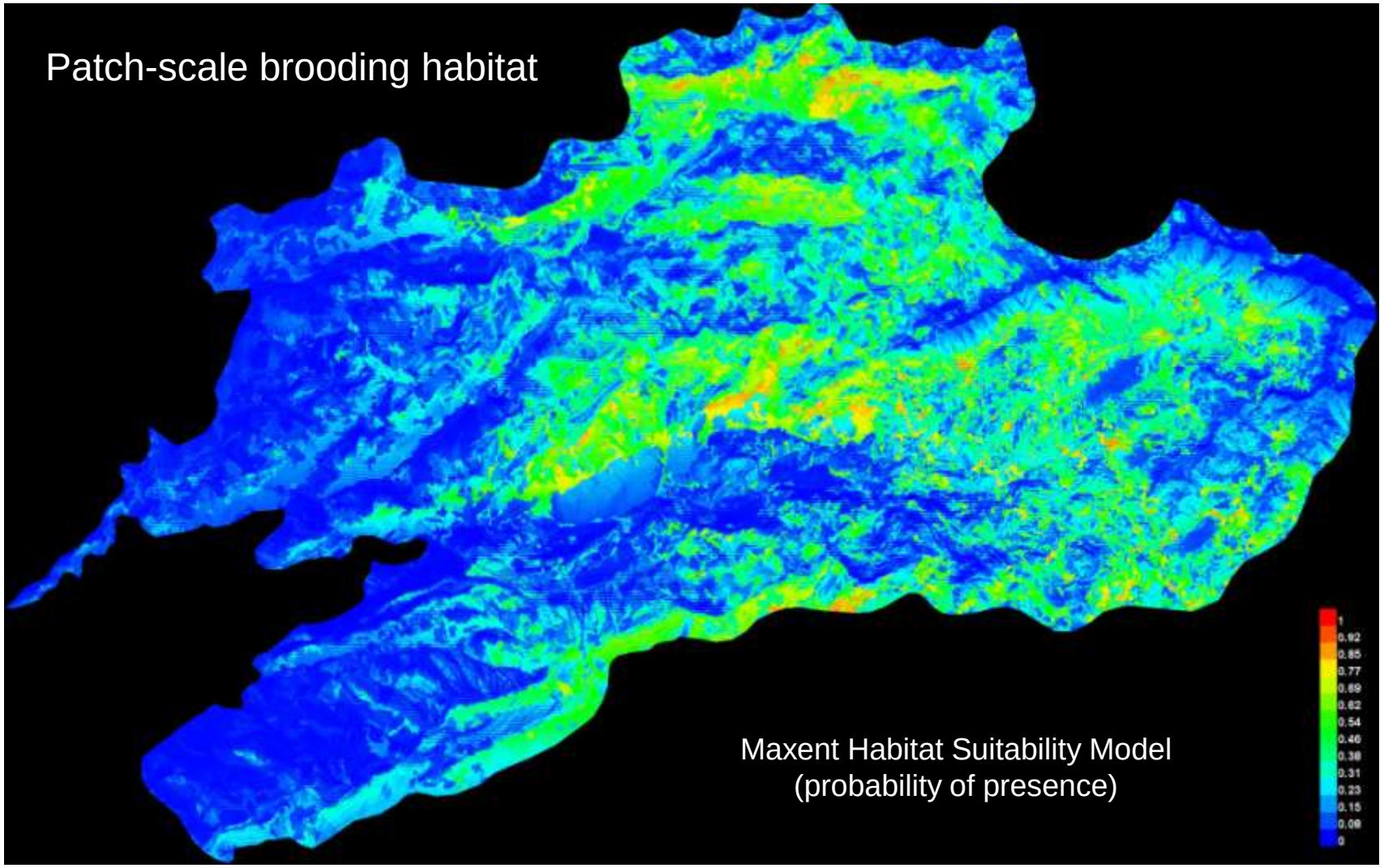
Micro-scale nesting habitat was best distinguished from systematic samples by:

-higher no. lg. *Abies* firs
-higher prostrate shrub ht
-higher *Symphoricarpos* cover
-lower herb cover
-higher cliff area

Other variables that differed between nesting micro-habitat and systematic samples:

-higher % slope
-higher canopy cover
-higher no. trees >62 cm DBH
-higher *Castanopsis* cover
-higher log abundance
-abundant coarse woody debris
-lower grass cover

Patch-scale brooding habitat was most strongly associated with elevations between ~2400-2750 m, mixed shrub vegetation, high solar radiation, large average tree diameter, and relatively gentle slopes (15-30 %).



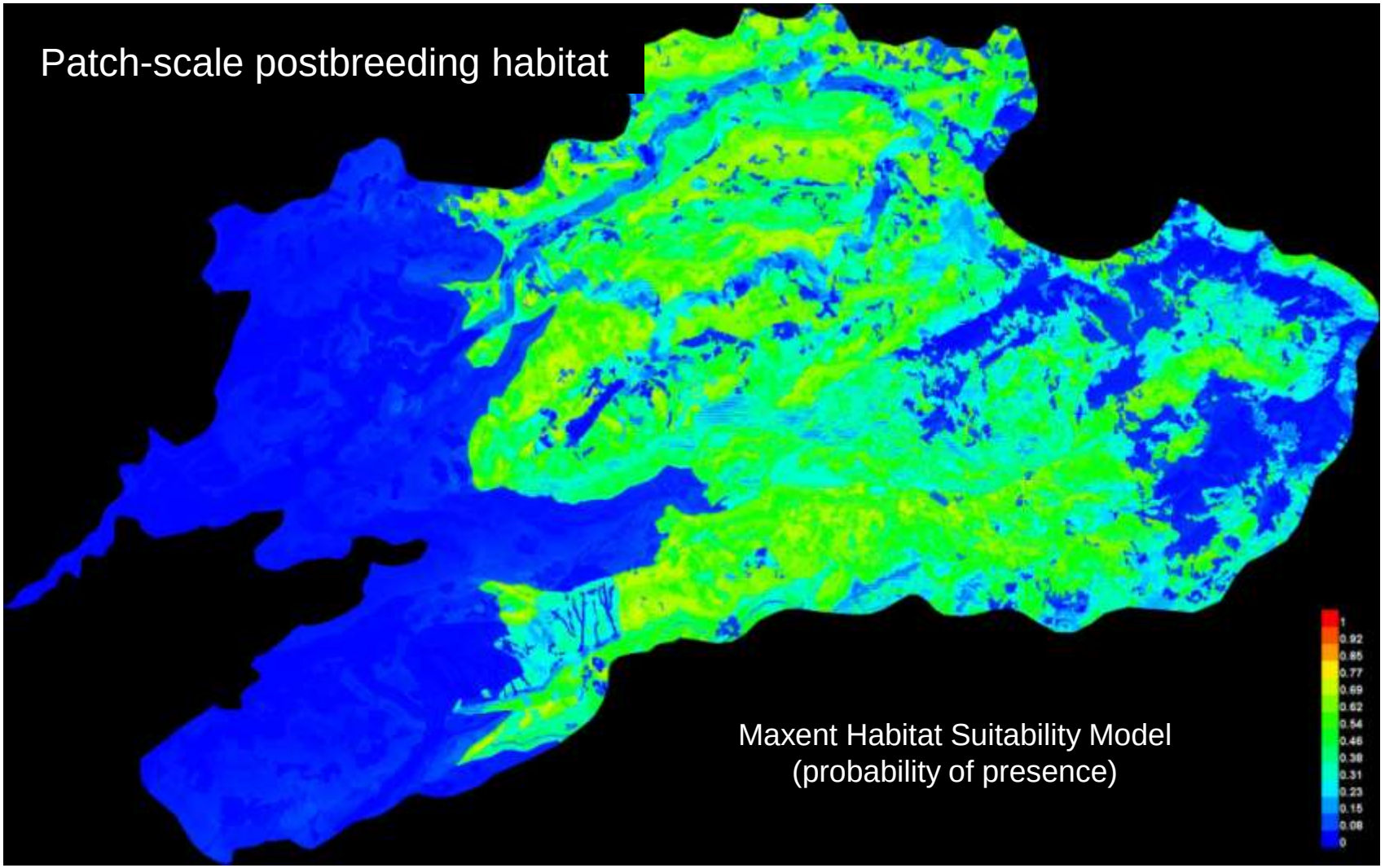
Micro-scale brooding habitat was best distinguished from systematic samples by:

-higher % slope
-higher southeast aspect
-higher tall shrub ht
-lower grass cover
-higher herb ht
-lower woody debris abundance
-higher elderberry presence

Other variables that differed between brooding micro-habitat and systematic samples:

-higher elevation
-lower overall canopy closure
-higher forest edge
-higher area of canopy cover <10 %
-higher low:high forest edge
-lower no. trees <61 cm DBH
-larger lodgepole pine >62 cm DBH
-higher tall shrub cover
-higher corn lily presence

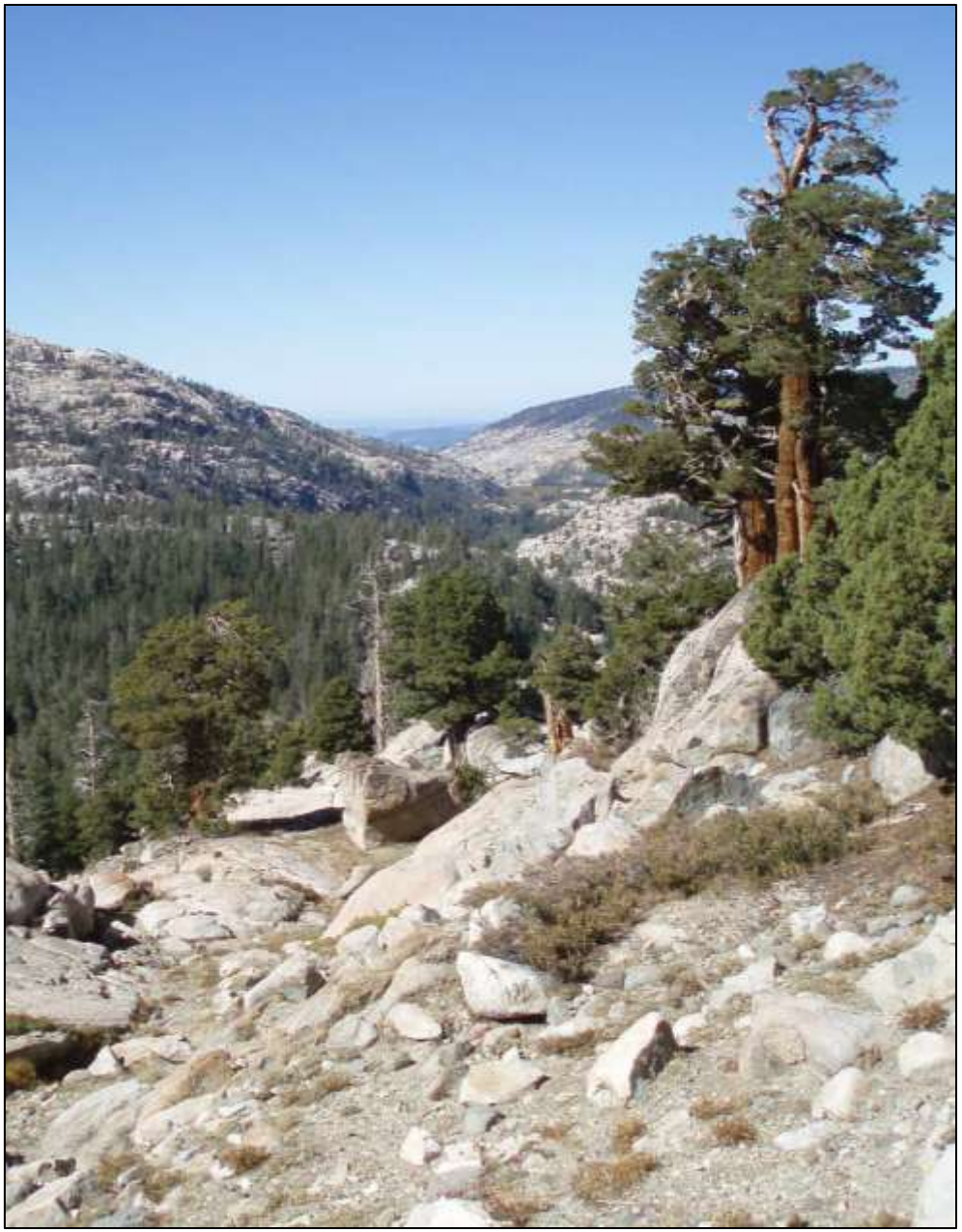
Patch-scale postbreeding habitat was most strongly associated with elevations between ~2225-2750 m, absence of meadow vegetation, presence of red fir forest, low solar radiation, and moderately steep slopes (15-60 %).



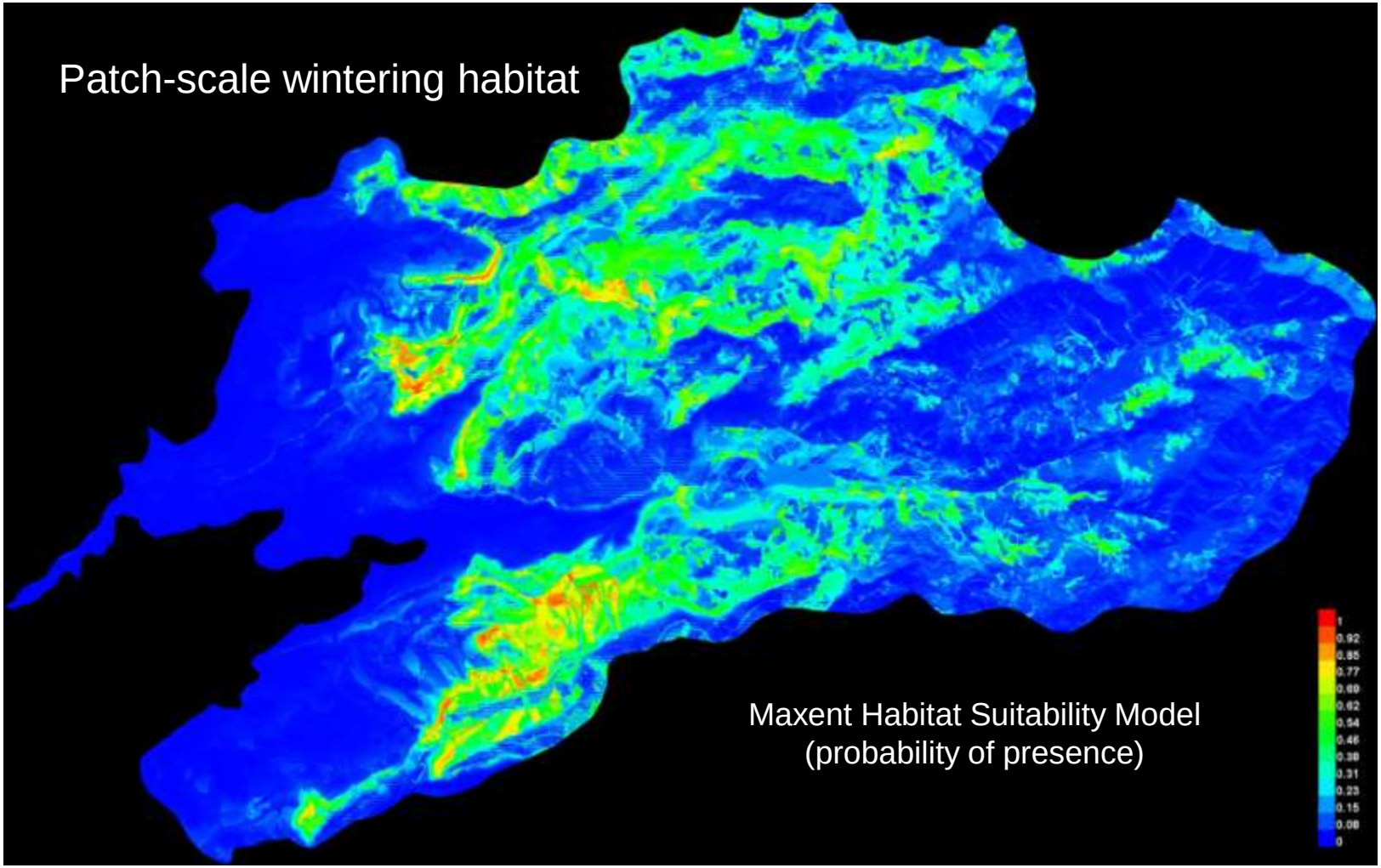
Micro-scale postbreeding habitat

Resource constraints did not permit field measurement of vegetation at postbreeding sites, but some terrain features were determined from GIS databases. Among these, micro-scale postbreeding habitat was best distinguished from systematic samples by:

-higher elevation
-lower distance to ridge
-higher position on a slope



Patch-scale wintering habitat was most strongly associated with elevations between ~2100-2400 m, presence of fir forest, low solar radiation, history of timber harvest, and large overstory tree DBH (51-76 cm).



Micro-scale wintering habitat

Because wintering habitats were covered with a deep layer of snow when occupied, shrub and ground strata were not measured in the field. Among other micro-scale variables measured, wintering habitat was best distinguished from systematic samples by:

- -higher perimeter of low density patches
- -higher perimeter of high density patches
- -higher low:hi forest edge
- -higher total forest edge
- -higher no. trees >62 cm DBH
- -higher no. *Abies* firs
- -higher no. lodgepole pines
- -higher position on a slope

Other variables that differed between wintering micro-habitat and systematic samples:

- -higher % slope
- -lower no. of cedar trees
- -lower no. of *Pinus* trees

Summary and Conclusions

1. Population density at Pinecrest was low; ~0.6 males/km^2. Average hooting group size was 4.9 individuals (2-10), and average distance between nearest-neighbor groups was 1.9 km (1.2-3.7 km).
2. Auditory censuses are best conducted 1 May-15 June, after most yearling males have ceased singing and before persistently territorial males become reluctant to display. Three to four well-timed census repetitions are sufficient for an unbiased estimate of territorial males. The number of males at Pinecrest was static between 2009 and 2011.
3. Resource agencies should adopt my census methods for monitoring Sooty Grouse populations throughout the Sierra Nevada.
4. Sierra Sooty grouse were highly arboreal: 95 % of male winter detections and 86 % of male spring detections were in trees. Males selected large trees for songposts, averaging ~1.0 m DBH.
5. 50% of radio-marked birds used dispersed breeding, postbreeding, and wintering areas. The other individuals remained in one area over two successive seasons. Average elevation of breeding and wintering sites did not differ. The greatest elevation change occurred between breeding and postbreeding seasons.

6. Annual home range averaged 11.6 km^2 by minimum convex polygon (0.5-27.3 km^2) and 7.5 km^2 (1.3-13.3 km^2) by fixed kernel methods.
7. Breeding areas frequently served as wintering areas for individuals that bred elsewhere. Breeding sites (hooting areas) are high-value multi-season habitats for local populations. Resource agencies should inventory these sites and maintain optimal forest composition and structure.
8. Male breeding habitat was associated with steep slopes at elevations between ~2075-2350 m, on convex slope contours with high solar radiation. Canopy closure ranged from moderately low to high, and the patchy forest canopy was comprised of high- and low-density patches. Large *Abies* trees were abundant and cedar trees were absent. There was little or no history of timber harvest. *Salix* shrubs were frequently present, and grasses and herbs were relatively tall.
9. Nesting habitat was located in the vicinity of cliffs, perennial water, and pine-dominated forest. Average overstory tree DBH was large, and *Abies* trees >62 cm DBH were relatively abundant. Prostrate shrub species were relatively tall, *Symphoricarpos* shrub cover was high, and herb cover was low.

10. Brooding habitat occurred at moderately high elevations (~2400-2750 m), on moderately steep, south-tending slopes, where solar radiation was high and shrubby vegetation was relatively extensive. Average tree diameter was relatively small, elderberry was frequent, tall shrub species and herbs were relatively tall, grass cover was low, and coarse woody debris were relatively abundant.
11. Postbreeding habitat occurred at relatively high elevations (~2225-2750 m), near the upper reaches of moderately steep slopes (15-60 %), in areas where solar radiation was relatively low. Red fir forest was frequently present and meadow vegetation was frequently absent.
12. Wintering habitat occurred on the upper portions of slopes at intermediate elevations (~2100-2400 m), where solar radiation was low. The patchy forest canopy was comprised of high- and low-density patches. Fir-dominated forest and timber harvest were frequently present. Average overstory tree diameter was high, as was the number of large trees, particularly large *Abies.* Lodgepole pines were rare. Shrub and ground layers were assumed to be inconsequential for winter habitat selection.

13. Resource agencies should use my habitat models to streamline population surveys and habitat inventories. The patch-scale models should be used to initially identify GIS polygons that appear to offer suitable habitat. Those areas should then be check in the field to determine whether values for key micro-scale features are optimal.
14. Sierra Sooty Grouse were strongly associated with characteristic elements of old forest, including large trees and logs, during breeding and wintering seasons (in late summer and fall broader use was made of meadows and shrubby environments, especially by females with broods). Breeding males selected songpost trees averaging 97.9 cm DBH, and were negatively associated with timber harvest. There was a positive association with harvested areas in winter at the patch scale, but at the micro-scale a positive association with large trees remained. Only brooding females exhibited a positive association with mountain meadows.
15. The current status of Sierra Sooty Grouse as “not dependent upon” old forest is possibly erroneous, and could potentially result in mismanagement of Sooty Grouse habitats. Resource agencies should consider the findings of this study whenever planning the management or restoration of habitats occupied by Sierra Sooty Grouse.

Deliverables

1. Survey Protocol For Sooty Grouse (draft manuscript submitted to US Forest Service).
2. Paper accepted for publication: "Estimating the number of territorial males in low-density Sooty Grouse populations" (*Western Birds*).
3. Papers in preparation: "Seasonal movements and home ranges in a southern population of Sooty Grouse" and "Seasonal habitat suitability models for Sierra Sooty Grouse."