

Nest site selection and influence of woodpeckers on succession in a burned forest of the Sierra Nevada

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Several factors affect colonization of bird and small mammal populations post-fire



Burn severity

Isolation and extent of burned area



Colonization ability

Facilitative actions of keystone species

Woodpeckers may act as keystone species in burned forests



Early colonizers



Create foraging areas



Mediate insect populations



Create habitat through cavity excavation

Importance of cavity-dependent communities

- Depend on woodpeckers for cavities
- Diverse
 - Seed dispersers
 - Insectivores
 - Prey base
 - Raptors and small carnivores
 - Species of concern

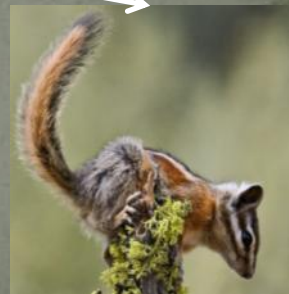


Objectives

Determine the influence of woodpeckers on colonization of birds and mammals in burned forest



Determine factors influencing woodpecker nest site selection in burned forest



Materials and Methods

Focal species



Black-backed woodpecker

Picoides arcticus



Hairy woodpecker

P. villosus



White-headed woodpecker

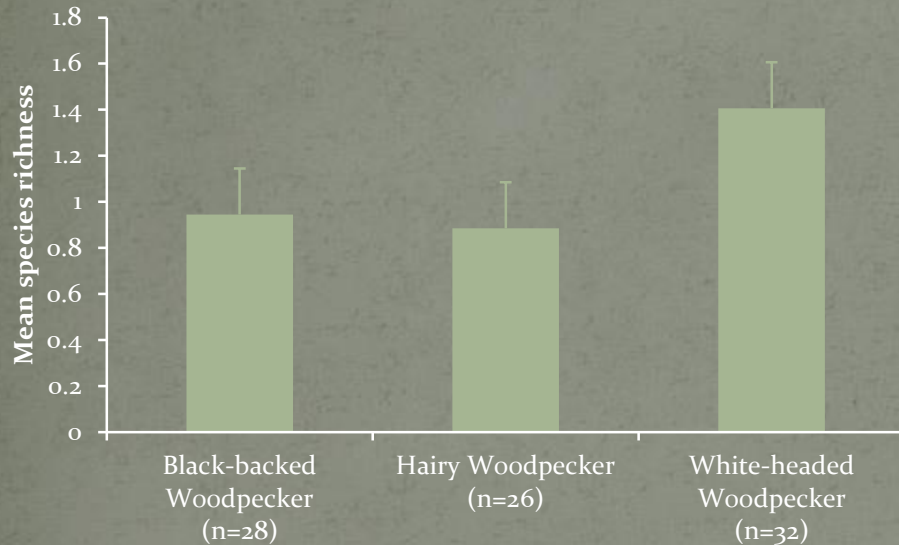
P. albolarvatus

Results: Nest searching

Excavator	Nests discovered	Nests monitored	Nests with detection
Black-backed Woodpecker	39	18	89%
Hairy Woodpecker	80	26	73%
White-headed Woodpecker	50	32	94%
Totals	169	76	86%

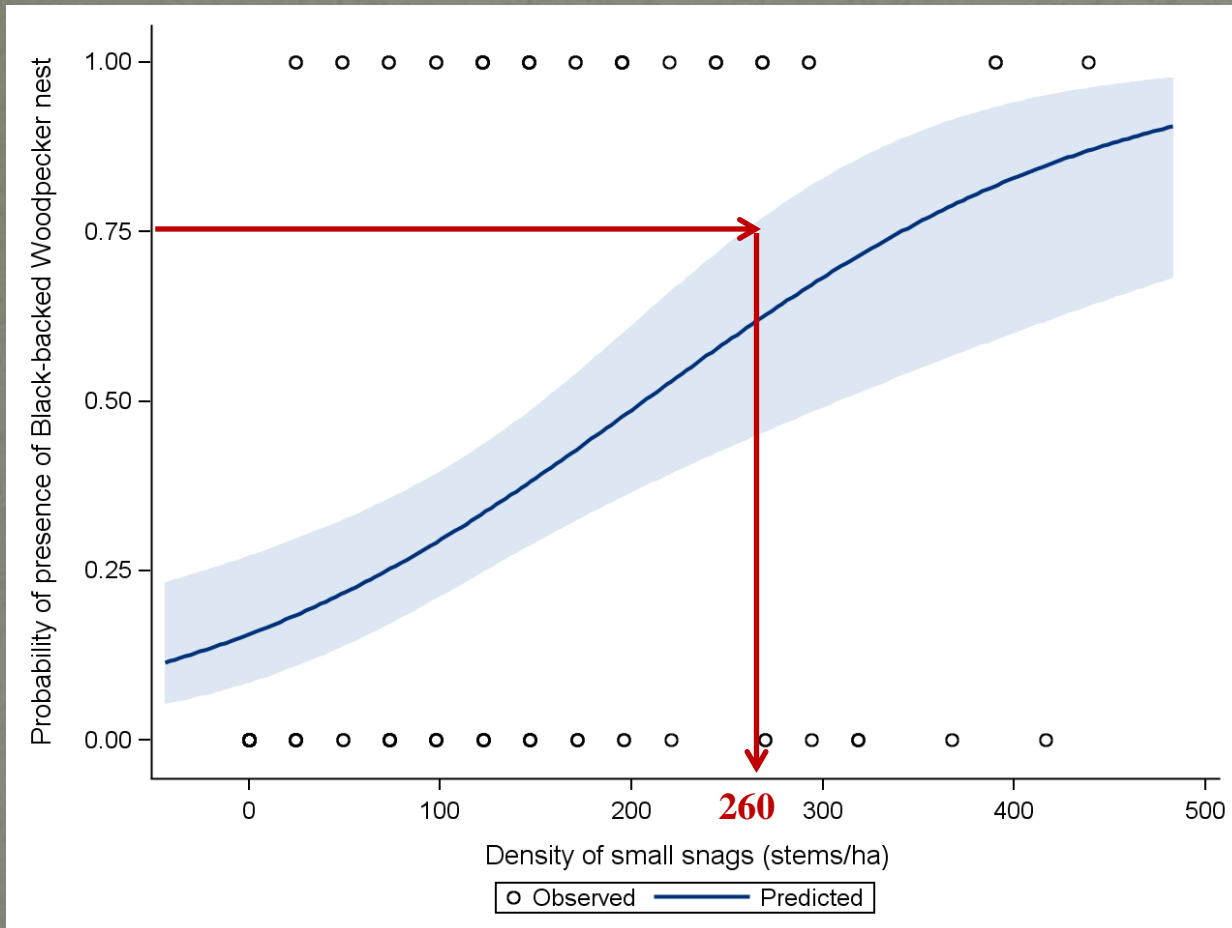


Results: Secondary cavity use



Significant difference in mean rank of species richness (Kruskal-Wallis, $H_2=7.10$, $p=0.03$)

Nest site selection



Shaded area is 95% confidence interval



Scorched, shorter,
and highly decayed
snags in stands
without small trees



Smaller
diameter less
decayed snags in
stands with high
density of small
snags

Scorched, less
decayed snags in
stands without
small trees



Discussion

- White-headed and Black-backed Woodpeckers exerted strongest influence on colonization
- Cavities excavated by Hairy Woodpecker were used least relative to their availability
- Woodpecker species are not ecologically equivalent in habitat creation



Photo credit: T. Will Richardson

Discussion

- Maintaining total secondary cavity community may require all three woodpecker species
- Cavity availability may limit population size of secondary cavity users
- Influence of woodpeckers may be ephemeral in burned forest due to low snag persistence and post fire harvest



Management of cavity dependent communities in burned forests



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Results: Cavity Utilization Index

$$\text{Cavity Utilization Index}_{spp} = \text{utilization}_{spp} * \text{proportion used}$$

Species	Utilization _{sp} p	Proportion of cavities used	Cavity Utilization Index
White-headed woodpecker	2.5	94%	2.35
Black-backed woodpecker	1.89	89%	1.68
Hairy woodpecker	1.58	73%	1.15

Secondary cavity users preferred White-headed Woodpecker cavities over those excavated by other species (Fisher's Exact Test, $p=0.04$)

Decay classes

Code	Bark	Heartwood Decay	Sapwood Decay	Limbs	Top Breakage	Bole Form	Time Since Death
1	Tight, intact	Minor	None to incipient	Mostly Present	May be present	Intact	1-5 years
2	50% loose or missing	None to advanced	None to incipient	Small limbs missing	May be present	Intact	>5 years
3	75% missing	Incipient to advanced	None to 25%	Few remain	Approx. 1/3	Mostly intact	>5 years
4	75% missing	Incipient to advanced	25%+	Few remain	Approx. 1/3 to 1/2	Losing form, soft	>5 years
5	75%+ missing	Advanced to crumbly	50%+ advanced	Absent	Approx. 1/2+	Form mostly lost	>5 years

Habitat Data

Nest tree	Nest Site	Territory
Species	Tree/snag density	Forest type
DBH	Canopy cover	Impervious
Decay class	Coarse woody debris	Burn severity
Scorch	Burn severity	
Height		
cavity height		

Avian secondary cavity users

<i>Secondary avian cavity users</i>		
Common Name	Code	Scientific Name
Brown Creeper	BRCR	<i>Certhia americana</i>
European Starling	EUST	<i>Sturnus vulgaris</i>
House Wren	HOWR	<i>Troglodytes aedon</i>
Mountain Chickadee	MOCH	<i>Poecile gambeli</i>
Mountain Bluebird	MOBL	<i>Sialia currucoides</i>
Pygmy Nuthatch	PYNU	<i>Sitta pygmaea</i>
Red-breasted Nuthatch	RBNU	<i>Sitta canadensis</i>

White-breasted Nuthatch	WBNU	<i>Sitta carolinensis</i>
Tree Swallow	TRES	<i>Tachycineta bicolor</i>
Western Bluebird	WEBL	<i>Sialia mexicana</i>
American kestrel	AMKE	<i>Falco sparverius</i>
Flammulated owl	FLOW	<i>Otus flammeolus</i>
Western screech owl	WSOW	<i>Otus kennicottii</i>
Spotted owl	SPOW	<i>Strix occidentalis</i>
Barred owl	BAOW	<i>Strix varia</i>
Northern pygmy owl	NPOW	<i>Glaucidium gnoma</i>
Northern saw-whet owl	NSWO	<i>Aegolius acadicus</i>

Mammalian secondary cavity users

<i>Secondary mammalian cavity users</i>					
	Code	Scientific Name			
Douglas Squirrel	TADO	<i>Tamiasciurus douglasii</i>	Shadow chipmunk	TASE	<i>Tamias senex</i>
Flying Squirrel	GLSA	<i>Glaucomys sabrinus</i>	Lodgepole chipmunk	TASP	<i>Tamias speciosus</i>
Western gray squirrel	SCGR	<i>Sciurus griseus</i>	Bushy-tailed woodrat	NECI	<i>Neotoma cinerea</i>
Yellow-pine chipmunk	TAAM	<i>Tamias amoenus</i>	Porcupine	ERDO	<i>Erethizon dorsatum</i>
Least chipmunk	TAMI	<i>Tamias minimus</i>	Pine marten	MAAM	<i>Martes americana</i>
Long-eared chipmunk	TAQU	<i>Tamias quadrimaculatus</i>	Short-tailed weasel	MUER	<i>Mustela erminea</i>
			Long-tailed weasel	MUFR	<i>Mustela frenata</i>

Secondary cavity user	“Preferred” Woodpecker	SCU habitat associations
N. Flying squirrel	Black-backed	Mature tree stands ₁
House wren	Black-backed	Edge, low canopy closure ₁
Northern flicker	Black-backed	Low stand density ₁
Chipmunk	White-headed	Substantial understory/canopy
Mountain chickadee	White-headed	<70% canopy closure ₁
Western bluebird	White-headed	Open, prefers edge ₁
White-breasted nuthatch	White-headed	Low to intermediate crown cover ₁
Mountain bluebird	White-headed and Hairy	Open ₁ to moderately dense snag stands ₂
Douglas squirrel	Hairy	High canopy closure, avoids shrub ₁

1. Vernor and Boss, 1980
2. Saab et al, 2009

Materials and Methods

Analysis: Cavity Utilization Index

Influence of each woodpecker species on secondary cavity users was represented by the Cavity Utilization Index:

Utilization_{spp} = average of
(#breeding species * 2) +
#non-breeding species +
(#taxonomic classes - 1)

Cavity Utilization index_{spp} = *utilization_{spp}* * proportion of
cavities with detections