

# Nest site selection by red-naped sapsuckers: Influence of willow availability, aspen heartwood rot fungus, and other ecological factors



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## Abstract

Woodpeckers are considered keystone species because they excavate tree cavities that provide habitat for other cavity nesting species. In aspen (*Populus tremuloides*) woodlands of the southern Rocky Mountains, red-naped sapsuckers (*Sphyrapicus nuchalis*) are the predominant woodpecker, providing essential nest cavities for multiple bird species. Sapsuckers also create sap wells in willows (*Salix* sp.) and aspen, providing food for many species. Previous work indicated that sapsucker nest densities decreased strongly with distance from willows. However, previous work did not account for potentially confounding effects of other variables such as the prevalence of the heartwood rot fungus, *Phellinus tremulae*. The sapsuckers nest almost exclusively in *Phellinus*-infected aspens. In the summers of 2007-08, we sampled willow proximity (distance to nearest willow), willow cover, fungal prevalence, and other variables in 0.25 ha plots centered on aspens with sapsucker nests ("nest sites") and otherwise suitable aspens without ("null sites"); our objective was to determine how these variables influence nest tree selection by sapsuckers. We found no difference between nest sites and null sites in terms of willow proximity. However, nest sites had significantly more surrounding willow cover (within 300m and 900m radii) and significantly higher prevalence of heartwood rot fungus. Nest sites and null sites differed weakly with respect to other variables, such as size of the center tree and elevation. Our results suggest that the availability of willows and prevalence of large ( $\geq 17$  cm DBH), *Phellinus*-infected aspens may be the most important factors influencing sapsucker nest site selection. To properly conserve the sapsucker-associated community we need to better understand the ecology of *Phellinus* and relationships among multiple factors in the aspen-willow-*Phellinus* system.

## Background

### Red-naped sapsucker as a keystone species and ecosystem engineer



The red-naped sapsucker (*Sphyrapicus nuchalis*; Fig. 1) is the predominant woodpecker species in the southern Rocky Mountains. Sapsuckers function as a keystone species and ecosystem engineers by:

- excavating new nest cavities every year, providing essential nest sites for secondary cavity nesting animals (Fig. 2), and
- drilling and maintaining sap wells in willows (*Salix* sp.) and aspen, providing food for many species of birds, mammals, and insects (Fig. 3)

Daily et al. 1993 found that the prevalence of sapsucker sign (aspen sap well scars; Fig 3) decreased strongly with distance from willows. However, this previous work did not consider the effect of other variables, such as the prevalence of the aspen heartwood rot fungus, *Phellinus tremulae*; Fig 4).

Figure 1. Red-naped sapsucker (*S. nuchalis*) about to feed its nestlings in aspen tree (*Populus tremuloides*)



Figure 2. Violet-green swallow (left) and tree swallow (right) are among several species that nest in aspen cavities excavated by red-naped sapsuckers.



Figure 3. Willow (*Salix* sp.) grove near Gothic, CO (top). Files feeding at sapsucker sap well on willow (bottom left). Sap well scars on aspen trunk (bottom right). Several species of insects, birds, and mammals feed at sapsucker wells.

### Aspens and heartwood rot fungus



Red-naped sapsuckers nest almost exclusively in large (DBH [diameter breast height]  $\geq 17$  cm) aspens infected with heartwood rot fungus (*Phellinus tremulae*), which promotes cavity excavation by softening the heartwood (Fig 4).



Figure 4. Left: Aspen tree infected with the heartwood rot fungus, *Phellinus tremulae*. Middle: reproductive cone of *Phellinus*. Right: *Phellinus*-infected aspen tree that snapped at sapsucker cavity.

## Question

Which factors are most important to sapsuckers in their choice of nest sites?

To address this question we compared sites with sapsucker nests to sites without with respect to the following factors:

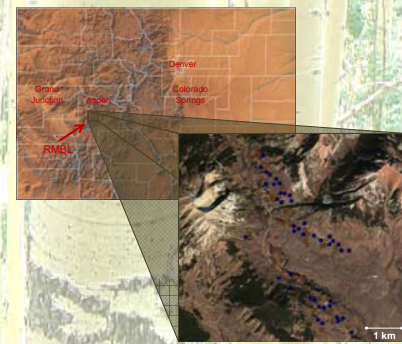
- proximity to willows
- area of willow cover within 100, 300, and 900 m
- prevalence of aspen heartwood rot fungus
- proximity to riparian zones and meadows
- tree size, elevation, woodland density, etc.

## Methods

### Study sites

- Study site: upper East River valley near the Rocky Mountain Biological Laboratory in Gothic, CO (Fig. 5).
- Sapsucker nests were found during June-July, 2005-2007, by traversing aspen groves on foot, looking for sapsuckers/cavities, and listening for sapsucker calls.
- Sites with sapsucker nests were compared to null sites, which were randomly chosen sites with no recent (2005-2007) sapsucker nest or other null site within 100 m. Each sapsucker site (n = 44) was centered on an aspen tree containing a recent sapsucker nest. Each null site (n = 44) was centered on a randomly chosen suitable aspen ( $> 17$  DBH, containing *Phellinus* conks) lacking a nest cavity.

Figure 5. The Rocky Mountain Biological Laboratory (RMBL) is located in west-central Colorado (above). Data were collected from 88 sites in aspen woodlands near RMBL. Yellow markers (right) represent sapsucker nesting sites from 2005-2007. Blue markers represent null sites (randomly chosen sites lacking recent sapsucker nests or other null sites  $\leq 100$  m away).



### Data Collection

The following variables were measured within 0.25 ha circular plots (Fig. 6) each centered on a sapsucker nest tree or null-site tree:

- Number of large ( $\geq 17$  cm DBH) and small ( $\geq 5$  and  $< 17$  cm DBH) aspen trees; number of large and small aspens with *Phellinus* conks, sapsucker well scars, and/or cavities; number of large snags and conifers
- Distance between center tree and
  - nearest stand of suitable willows
  - nearest willow bearing sapsucker damage
  - nearest water
  - edge of nearest meadow (defined as area  $\geq 100$  m<sup>2</sup> lacking trees  $\geq 5$  cm DBH)



Figure 6. Example of 0.25 ha study plot centered on a sapsucker nest tree

## Results

- Prevalence of heartwood rot fungus was significantly higher in sapsucker nest sites relative to null sites (Fig. 7).
- Compared to null sites, nest sites had significantly more willow cover within 300 m and within 900 m (Fig. 8)
- Mean willow proximity did not significantly differ ( $P = 0.63$ ) between site types (nest:  $119.1 \pm 16.7$  [SE] m; null:  $130.8 \pm 17.0$  m).
- Nest trees were slightly larger and located at slightly higher elevations than null site (center) trees:
  - nest tree mean DBH = 28.1 cm (SD = 3.5); null tree mean DHB = 26.3 cm (SD = 6.1);  $P < 0.1$
  - nest tree mean elevation = 2935 m (SD = 64.2); null tree mean elevation = 2966 m (SD = 56.7);  $P < 0.02$

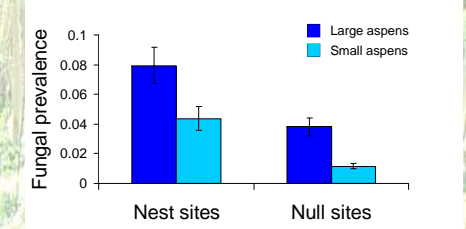


Figure 7. Proportion of aspen trees infected with heartwood rot fungus (*P. tremulae*) within 0.25 ha circular plots centered on a sapsucker nest tree (Nest sites) or suitable aspen with no sapsucker nest (Null sites)  $\leq 100$  m of the tree. Shown are means  $\pm$  SE at 44 sapsucker nests sites and 44 null sites for large ( $\geq 17$  cm DBH) and small ( $\geq 5$  and  $< 17$  cm DBH) aspens. Fungal prevalence was significantly higher at nest sites (proportions were arcsine transformed for t-tests;  $p < 0.004$ ).

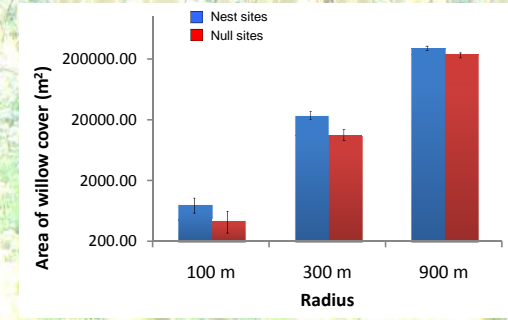


Figure 8. Mean  $\pm$  SE area (m<sup>2</sup>) of willow (*Salix* sp.) cover within concentric circles of 100, 300, and 900 m radii centered on each of 44 sapsucker nests and 44 null sites ( $t = 1.25$ ,  $P = 0.22$ ;  $t = 2.87$ ,  $P = 0.01$ ;  $t = 2.26$ ,  $P = 0.03$ ). Area was estimated using ArcGIS.

## Conclusions

- Nest-site selection by sapsuckers is explained best by willow availability and prevalence of *Phellinus*-infected aspens.
- To properly conserve the sapsucker-associated community we need to better understand the ecology of *Phellinus* and the multivariate relationships in the aspen-willow-*Phellinus* system.

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