



Selection of sap well trees by a keystone species: the red-naped sapsucker (*Sphyrapicus nuchalis*)

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Figure 1. A Red-naped Sapsucker prepares to feed its nestlings in an aspen tree

Background

Red-naped Sapsucker: a keystone species

- Nesting pairs excavate a new nest cavity every year in aspen (*Populus tremuloides*) trees (Fig. 1)
- Several species of birds, mammals, and insects nest in old sapsucker nest holes (Fig. 2)
- Sapsuckers feed from sap wells that they drill into aspens and other trees/shrubs; many species of birds, mammals, and insects feed on these wells (Figs. 3 and 4)

Aspen woodlands

- Dominant deciduous tree in the Rocky Mountains (Fig. 5)
- Extremely important in providing ecosystem services (e.g., tourism) and essential habitat for many species
- Sapsuckers nest almost exclusively in aspens infected with the heartrot fungus, *Phellinus tremulae* (Fig. 6)
- Aspen woodlands have recently suffered extensive die-back associated with drought and infection by pathogens such as black canker (*Ceratocystis fimbriata*) and polypore canker (*Cytospora chrysosperma*; Fig 7)
- The effects of sapsucker sap well scars on aspens are largely unknown



Figure 6. Sporocarp of aspen heartrot fungus (*Phellinus tremulae*) above sapsucker nest cavity on aspen tree



Figure 4. Sap wells on aspen. Sapsuckers drill the wells in rows. Age of damage ranges from fresh scars near the top right to old merged scars at the bottom.

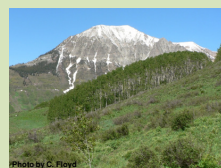


Figure 5. Small grove of aspen woodland near Crested Butte, CO



Figure 7. Cytospora canker (left; *C. chrysosperma*) and black canker (right; *C. fimbriata*) infecting aspen trees

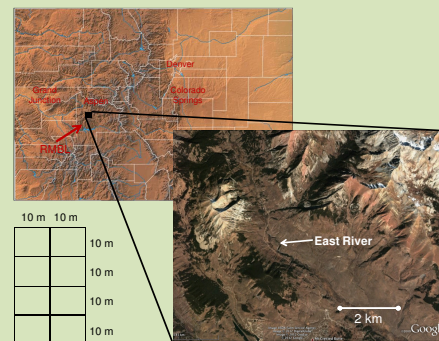


Figure 8. Upper East River Valley, near the Rocky Mountain Biological Laboratory, Crested Butte, CO. Study sites were in aspen groves ~ 20-500 m upslope from river

Abstract

Conserving keystone species requires understanding their feeding requirements. One of the most important keystone species is the Red-naped Sapsucker, a woodpecker that excavates its nest holes in aspens and drills sap wells in aspens and other trees/shrubs. By creating a supply of tree holes and sap, sapsuckers incidentally provide essential nesting habitat and a rich food source for many other species. Local extinction of sapsuckers could, thus, trigger a decline in local species diversity; this is a conservation concern because sapsucker habitat has undergone widespread degradation. During the summer of 2011 we investigated the criteria used by sapsuckers in their choice of sap well trees in aspen woodlands of the Rocky Mountains. After comparing aspens with and without sap wells we found a positive association between sap wells and prevalence of pathogenic cankers. Our results suggest that sapsuckers either prefer canker-infected aspens as a source of sap, or that their sap-feeding activity tends to promote pathogen infection. These results have important implications for management of aspen woodlands.

Objective

- Determine what characteristics of aspens influence their probability of being selected by sapsuckers for sap well drilling
- Look for evidence that sapsuckers facilitate infection by fungal pathogens

Methods

- Study site: Upper East River Valley, near the Rocky Mountain Biological Laboratory (RMBL), Crested Butte, CO. (Fig 8)
- Randomly chose 44 sites in aspen woodlands; at each site we laid out a 0.1-ha rectangular plot composed of a 50-m long center line and two lines running parallel to and 10 m from the center line. Directional orientation of plot was randomly chosen. Every 10 m along the center line we laid out another line, 10 m on either side, perpendicular to the center line, thus creating 10 subplots, 5 on each side, each subplot 10 x 10 m (Fig. 9).
- In each subplot, we selected two aspens—one with sapsucker wells/scars and one without. To select aspens we walked along the center line until we reached the midpoint of the subplot (at 5, 15, 25, 35, 45 m). We then looked along an imaginary line bisecting the subplot running perpendicular to the center line and found/selected the sap-well-bearing aspen closest to the line and the nearest non-sap-well-bearing aspen closest to the line.
- Only living aspen trees with a DBH (diameter at breast height) of ≥ 5 cm were selected.
- For each selected aspen, we measured the DBH; height; crown ratio (proportion of tree height supporting live foliage); and presence/absence of canker, heartrot fungus (*P. tremulae*), scars, wind damage, lesions, or abnormal growth. For trees with sap well scars, we measured the number of rows of scars and the age of the scar rows. Scar row age was quantified on a scale of 1 to 7, with 1 being fresh (current year), and 7 being scars so old that the holes had merged into a line (Fig. 4).
- We compared 213 aspens with sap wells to 213 without

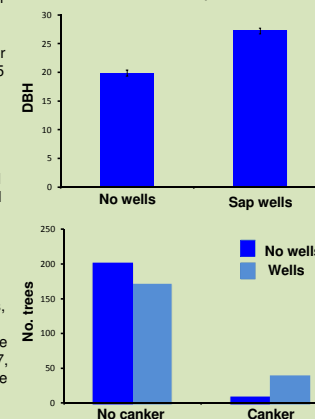


Figure 10. Relationship between DBH (diameter in cm at breast height) and presence of sap wells (drilled by Red-naped Sapsuckers) in aspens. We compared 212 trees without and 212 trees with sap wells. Error bars show ± 1 SE

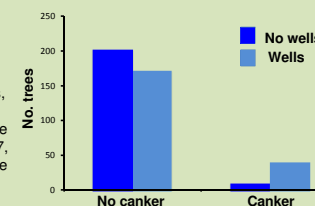


Figure 11. Association between presence of sap wells and infection by canker (cytospora and/or black cankers) in 213 aspen trees sampled in the CO Rocky Mountains.

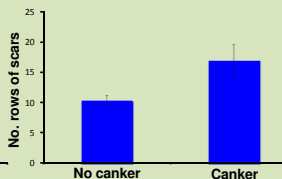


Figure 12. Relationship between amount of sap well excavation (average number of rows of sap well scars) and canker infection in aspens (comparing 172 trees with canker and 41 without canker). Error bars show ± 1 SE

Conclusions

- We found evidence of a positive association between sap well excavation and the presence of pathogenic cankers in aspens
- There was no effect of sap wells on crown ratio, suggesting that sap well-drilling does not directly harm aspens
- However, teasing apart cause-and-effect in this system will require further research (summer 2012)

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