Ecological determinants of nest-site selection by a keystone engineer: the red-naped sapsucker

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Abstract

Woodpeckers are considered keystone engineers because they excavate nest cavities that ultimately provide shelter for other species. In aspen woodlands of the Rocky Mountains, red-naped sapsuckers are the predominant woodpecker, providing nest holes for multiple bird species. Sapsuckers also create sap wells in willows thus supplying a food resource for many species. Conserving sapsuckers and the associated community requires that we understand sapsucker habitat requirements. Our research conducted in the East River Valley of Colorado during 2007-2008, which compared sites with sapsucker nests to those without, found that nest sites had more surrounding willow and more aspen heartrot fungus, which promotes nest excavation. In 2009, we began sampling randomly selected points in the ERV in order to better understand the relationship among the fungus, willow, and other variables. Preliminary results showed that the prevalence of sap well-scared trees declined with distance from willow. This pattern is intriguing because we previously found that nest sites had relatively high prevalence of aspen sap well scars but were not significantly closer to willows. Apparently, the relationship between willows, fungus, and sapsucker feeding/nesting habits is more complex than previously thought.

Objective:
To better understand the relationships between sapsucker activity, heartrot fungus, and characteristics of aspen stands and surrounding landscape

Results

$R^2 = 0.18$, $P = 0.04$

• Prevalence of sap well-scared aspens decreased with distance to nearest willow (Fig. 6).

• Plots located > 120 m from willows lacked sapsucker well scars.

• No other significant relationships were found

Discussion

• Our results concord with those from an earlier study of sapsuckers in the East River Valley, in which Daily et al. (1993) found a sharp decrease in sapsucker activity (as measured by sap well scars) as distance from willow increased.

• However, our results do not concord with a more recent study (conducted by Floyd et al. in 2005-07), which found that nest sites had relatively high prevalence of aspen sap well scars but were not significantly closer to willows, compared to sites without sapsucker nests.

• The relationship between willows, fungus, and sapsucker feeding/nesting habits appears to be more complex than previously thought.

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Nest cavities in aspens

The red-naped sapsucker (Sphyrapicus nuchalis) is the predominant woodpecker species in the Colorado Rocky Mountains, where it excavates its nest holes in aspen trees (Populus tremuloides; Fig. 1). Nesting sapsuckers create a new cavity every year, thus ultimately providing habitat for other cavity-nesting species. In Colorado, at least seven bird species rely heavily on sapsucker cavities.

Sap wells and willows

The sapsuckers also excavate sap wells in aspens and willows (Salix sp.), providing a valuable food resource to many species of birds, mammals, and invertebrates that rob the wells (Fig. 1). Daily et al. (1993) found evidence that sapsuckers strongly prefer to nest near (< 300 m from) willows.

Aspen heartrot fungus

Sapsuckers in the CO Rockies nest only in aspens infected by the heartrot fungus, Phellinus tremulae (pictured right), which softens the aspen heartwood, allowing easier excavation. Little is known the ecology of this fungus which is arguably the primary keystone in the sapsucker/aspen/willow system.

Conservation implications

Several factors threaten the sapsucker-associated community, including extensive die-back of aspen woodlands (Fig. 4), and destruction of willows due to grazing and development.

Conserving sapsuckers and associated species requires that we better understand the potentially complex relationships in the community. This is what our study attempts to do.

Variables measured

• Number of large, small, and sapling aspens, classified by diameter at breast height (Large ≥ 17 cm; small ≥ 5 and < 17 cm; sapling < 5 cm)

• Number of aspens with heartrot fungus

• Number of aspens with sap well scars

• Number of conifers

• Number of snags (dead standing aspen)

• Distance to nearest meadow, willow, and water.

Data were analyzed using R statistical software.

Figure 1. Aspen with nest cavities excavated by red-naped sapsuckers (feeding nestling in upper right).

Figure 2. Sap well scars on willow (inset, with insects robbing sap) and aspen (old scars on trunk above).

Figure 3. Reproductive conk of aspen heartrot fungus.

Figure 4. Dying aspen stand in CO. The causes and ecological impacts of the extensive aspen die-back in the Western US is unknown.

Figure 5. Location of study site (East River Valley near the Rocky Mountain Biological Laboratory, Gothic, CO.), distribution of 0.25 ha plots (yellow stars in middle figure), and spatial scale of measurements.

Figure 6. Prevalence of sap well scars on aspens in 0.25 ha plots as a function of distance to nearest willow (Salix sp.). Prevalence was measured as proportion of total aspens with sap well scars (excavated by red-naped sapsuckers). $R = $ linear regression coefficient. Proportions were arcsine transformed (not shown) before analyses.

Study site and plots

We used Google Earth and ArcGIS to randomly select study plots in the East River Valley near the Rocky Mountain Biological Laboratory (RMBL), Gothic, CO (Fig 5).

Each site was composed of a 0.25 ha circular plot centered on an aspen tree (Fig. 6).

Variables measured

• Number of snags (dead standing aspen)

• Distance to nearest meadow, willow, and water.

Methods

Figure 7. Prevalence of sap well scars on aspens in plots (Salix sp.) as a function of distance to nearest willow. Prevalence was measured as proportion of total aspens with sap well scars (excavated by red-naped sapsuckers). $R = $ linear regression coefficient. Proportions were arcsine transformed (not shown) before analyses.

• Our results concord with those from an earlier study of sapsuckers in the East River Valley, in which Daily et al. (1993) found a sharp decrease in sapsucker activity (as measured by sap well scars) as distance from willow increased.

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Figure 8. Spatial scale of plots (yellow stars in middle figure), and spatial scale of measurements.

Figure 9. Location of study plots in the East River Valley near the Rocky Mountain Biological Laboratory, Gothic, Colorado.

Figure 10. Location of nearest meadow, willow, and water.

Figure 11. Location of study plots in the East River Valley near the Rocky Mountain Biological Laboratory, Gothic, Colorado.