Selection of sap well trees by a keystone species: The Red-naped Sapsucker (Sphyrapicus nuchalis)

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What is a keystone species?

- The keystone at the top of an arch holds all of the stones in place; without it the arch would collapse.
- Similarly, a keystone species has disproportionately large effect on ecological communities: if the keystone is lost, biodiversity will suffer.
- Famous examples of keystone species include sea otters and beavers.

The Red-naped Sapsucker: a keystone engineer

- Our study subject is the Red-naped Sphyrapicus nuchalis).
- These woodpeckers excavate their nest cavities in aspen woodlands of the Rocky Mountains.
- Sapsuckers are considered keystone species for two reasons:
  - Old sapsucker nests provide essential nesting space for other cavity-nesting species, such as bluebirds and tree swallows.
  - Sapsuckers drill sap wells in shrubs and trees.
  - These wells supply a rich food resource to many species of insects and birds that rob the wells.

Objectives and significance

- Objective: learn more about the sap-feeding preferences of sapsuckers, as inferred from patterns of sap well scars in aspens.
- Significance: we must understand the feeding requirements of keystone species to adequately conserve them and the communities that depend on them.
- Our work will also shed light on the effects of sap wells on aspens, a tree of considerable economic and ecological importance.

Study sites

- Aspen woodlands in the East River Valley, near Crested Butte, Colorado
- Elevation: 2750-3000 m
- Data collected in June-July
  - 2011: 44 sites
  - 2012: 40 sites

Methods

- Sites chosen using randomized latitude-longitude points and Google Earth.
- Each site was a randomly-oriented 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. Each plot was split into ten 10 x 10 m subplots.
- In each subplot two aspens were selected—one with sapsucker wells/scars and one without. Aspens were selected by looking along an imaginary line bisecting the subplot (running perpendicular to center line) and selecting the sap-well-bearing aspen closest to the line and 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.
- Characteristics measured for each selected aspen included: 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.
- The number and height of sap well clusters was recorded; for each cluster the number of rows was counted (rows are usually clustered).
- The relative ages of the scar rows were ranked from 1-8 as shown below:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (fresh)</td>
<td>Sapsucker well still uncarved or slightly carred</td>
</tr>
<tr>
<td>2 (woody scar tissue)</td>
<td>Sapsucker well scarred, but not significantly scarred</td>
</tr>
<tr>
<td>3 (woody scar, raised, elongated, partially connected with other wells)</td>
<td>Sapsucker well scarred, raised, and partially connected with other wells</td>
</tr>
<tr>
<td>4 (woody scar, raised, elongated)</td>
<td>Sapsucker well scarred, raised, and partially connected with other wells</td>
</tr>
<tr>
<td>5 (woody scar, raised, elongated, partially connected with other wells)</td>
<td>Sapsucker well scarred, raised, and partially connected with other wells</td>
</tr>
<tr>
<td>6 (woody scar, raised, elongated)</td>
<td>Sapsucker well scarred, raised, and partially connected with other wells</td>
</tr>
<tr>
<td>7 (scar merged to extent that individual former wells can barely be distinguished)</td>
<td>Sapsucker well scarred, raised, and partially connected with other wells</td>
</tr>
</tbody>
</table>

Summary of results

- Aspens with sap wells were larger (greater DBH and height) than those without (Figure 1).
- Aspens with sap wells were significantly more likely to be infected with aspen heartrot fungus (Phellinus tremulae; Figure 2).
- We found no relationship between canopy ratio and any of the well/scar measurements.
- We found no relationship between tree size and number of wells.
- The vast majority of sap wells were drilled in the trunk below the canopy, approximately half way to the tree top (Figure 3).
- Trees with older sap well scars tended to be larger (Figure 4).

Conclusions

- Sapsuckers may prefer slightly larger aspens and the approximate middle of the trunk (below the canopy) for well placement.
- Our results suggest that aspens with sap wells do not accumulate well rows continuously throughout their lives, perhaps indicating a defensive response by the aspen to sap well drilling.
- There was little evidence that sap well drilling harmed aspens.

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