Managing Headwaters in the High Country

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Outline

• The forest-water supply connection
• Impacts of drought
• How could forest management help?
Forests and water

- The cleanest and most regulated supplies of water come from forested landscapes
- Forests can be managed in ways that do not negatively impact water quality

Chattahoochee River, GA
Distribution of water supply in the US

Brown et al., 2008
Nelson et al., 2010

Forests comprise 29% of land area; National Forest lands 11%
Importance of forests for water supply

Forests comprise 29% of land area, but provide 53% of water supply

Brown et al., 2008
Quantifying the Role of National Forest System Lands in Providing Surface Drinking Water Supply for the Southern United States

Peter Caldwell, Corinne Muldoon, Chelcy Ford Miniat, Erika Cohen, Suzanne Krieger, Ge Sun, Steven McNulty, and Paul V. Bolstad
National Forest contribution to surface water supply
State and Private Forest contribution to surface water supply
Drinking water intakes receiving water from National Forest System Lands

N=1,541 intakes
19 million served
Millions in the South depend on water originating on forested lands.

- **National Forests** provide more than 50% of water supply for 50 communities serving 820,000 people.
- **State and Private Forests**: provide more than 50% of water supply for 641 communities serving 10.9 million people.
Some example communities

<table>
<thead>
<tr>
<th>Population served (millions)</th>
<th>0.8</th>
<th>2.2</th>
<th>0.4</th>
<th>0.2</th>
<th>0.2</th>
<th>0.7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of intakes</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

Population served:
- Little Rock, AR
- Louisville, KY
- Greater Atlanta, GA
- Greenville, SC
- Charlotte, NC
- Richmond, VA
Irrigated agriculture depends on surface water from forests.
Drought impacts on forests and related ecosystem services

• Impacts on forests
  – Mortality
  – Altered nutrient, carbon, and water cycling
  – Increased susceptibility to invasion of non-native species, insect outbreaks and wildfire

• Impacts on ecosystem services
  – Water supply production
  – Water quality
  – Productivity

Vose et al., 2016
Sensitivity of water supply to drought

Change in water supply due to a 10% change in precipitation

- > 40%
- 40% - 30%
- 30% - 20%
- 20% - 10%
- No yield

Modified from Sun et al., 2015
Drought impacts on water supply from National Forests

Difference during “top-five” drought years of 1962-2012 relative to mean

Sun et al., 2015
Drought impacts on water supply from National Forests

Sun et al., 2015
Droughts over time

• Trends in drought frequency and intensity are difficult to detect or project
  – lack of direct observations
  – methodological uncertainties
  – geographical inconsistencies in the trends.
• Low confidence there was a global-scale trend in drought since the mid-20th century
• Droughts will continue to occur, and are projected to become more prolonged and severe in some regions

IPCC AR5, 2015
How could forest management help?

• Reduce vulnerability
  – Thinning/fuel management to reduce water use and reduce risk of wildfire
  – Increase species and age-class diversity within stands to reduce insect attack intensity

• Facilitate transition to a new condition
  – Change forest composition to drought tolerant species that use less water

Vose et al., 2016
Summary

• Forested lands are important for water supply; droughts can have a major impact
• Drought trends difficult to detect, but droughts will continue to occur and we will need to adapt
• Active forest management could help mitigate drought impacts