No Tree Left Behind: Interesting findings from two case studies in whitebark pine: climate change and release

Sarah Flanary and Bob Keane
USDA Forest Service
Rocky Mountain Research Station
Fire Sciences Laboratory
Decline a result from the complex interactions of many factors

Our ability to address these interactions will dictate rangewide restoration success

Great Burn Roadless Area, Idaho
Climate Change
May exacerbate decline

- Increase beetle outbreaks
- Create longer rust infection spans
- Increase wildland fire

- Modify habitat
Whitebark Pine
Climate change impacts to habitat

Conventional Wisdom:

- Pinched off tops of mountains
- Pushed northward
- Relegated to cove sites
- Experience local extinctions

See Keane et al. (2017) for review
Whitebark Pine into the future
SDM models
Warwell et al. 2007
FireBGCv2 Simulation results
Whitebark pine basal area in Bitterroot upper subalpine (Keane et al. 2017)

Climate
- Historical
- Future: hot, dry

Fire management
- N-No suppression
- L-Low supp (50%)
- H-High supp (92%)

Restoration treat
- N-None
- L-Low (10 ha/yr)
- H-High (100 ha/yr)

Planting
- N-None
- L-Low (10 ha/yr)
- H-High (100 ha/yr)
How do you evaluate Climate Change Impacts

Look at recent changes in the field:

- Encroachment into high environments
- Status and health in current environments
- Encroachment into lower environments

GYE habitat analysis
Validation of predictions
Whitebark pine encroachment into a sagebrush grassland

Near Dillon Montana

Photos by Emily Guiberson, BLM
WEST study
Whitebark Encroachment into Sagebrush Transitions
Funded by BLM - Guiberson

Three Study Sites

- Harkness
- Morrison
- Jeff Davis

WEST study
Whitebark Encroachment into Sagebrush Transitions
Three Study Sites
WEST study

Three Study Sites

Harkness 1953

Jeff Davis 1954

Morrison 1954

Harkness 2018

Jeff Davis 2018

Morrison 2018
WEST study
Whitebark Encroachment into Sagebrush Transitions
Methods
WEST study
Whitebark Encroachment into Sagebrush Transitions

Results

- No encroachment into upper elevation sites
- Only encroachment to sagebrush grasslands
- Many trees producing cones
- All trees healthy with minor rust
- Scattering of seedlings
- Only 5 Douglas-fir trees at Harkness
WEST study
Whitebark Encroachment into Sagebrush Transitions

Why did whitebark pine encroachment only go downhill?

Speculations

- Regeneration following a fire exclusion gradient
- Presence of mycorrhizae in sagebrush environments
- Whitebark pine is certainly more drought tolerant than expected

Caveats

- Did not happen everywhere
- Haven’t seen this encroachment in other areas
- Have observed encroachment in subalpine meadows
Stateline study
Whitebark pine DBH and height increase after daylighting

• Ten year results of DBH and height growth in whitebark pine seedlings and saplings that were treated using daylighting

• Original study implemented by John Schwandt FHP and given to RMRS to complete
Stateline study
Whitebark pine DBH and height increase after daylighting

Two Study Sites

• **Square Lake**
• **Flattop**

**Both TSME/LUHI**

Stateline study
Whitebark pine DBH and height increase after daylighting

**Methods**

- **Schwandt identified 790 seedlings/saplings**
- **Two daylighting radii**
  - 2 m (6.8 ft)
  - 4 m (11.8 ft)
- **Three height classes**
  - 2-4.5 ft
  - 4.5-10 ft
  - >10 ft
- **Measured in 2008, 2013, and 2018 (10 yr)**

<table>
<thead>
<tr>
<th>Treatment #</th>
<th>Tree Height (feet)</th>
<th>Radius (m)</th>
<th>Desired number of trees</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2-4.5</td>
<td>2</td>
<td>100</td>
<td>Thin</td>
</tr>
<tr>
<td>2</td>
<td>2-4.5</td>
<td>-</td>
<td>100</td>
<td>Control</td>
</tr>
<tr>
<td>3</td>
<td>4.5-10</td>
<td>2</td>
<td>100</td>
<td>Thin</td>
</tr>
<tr>
<td>4</td>
<td>4.5-10</td>
<td>4</td>
<td>100</td>
<td>Thin</td>
</tr>
<tr>
<td>5</td>
<td>4.5-10</td>
<td>-</td>
<td>100</td>
<td>Control</td>
</tr>
<tr>
<td>6</td>
<td>&gt;10</td>
<td>4</td>
<td>100</td>
<td>Thin</td>
</tr>
<tr>
<td>7</td>
<td>&gt;10</td>
<td>-</td>
<td>100</td>
<td>Control</td>
</tr>
</tbody>
</table>
Stateline study
Whitebark pine DBH and height increase after daylighting

Results

Ten year increase in Height (ft)
Conclusions

- The 4 m (11.8 ft) radius worked sometimes
- Daylighting prescription made at wrong scale
- Too small a radius to have real increases in vigor & too large of residual trees
- Wrong site for daylighting