A 20 year reassessment of the health and status of whitebark pine forests in the Bob Marshall Wilderness Complex, Montana, USA

Using citizen science to assess whitebark pine decline

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Bob Marshall Wilderness Foundation
Outline

• About

• Running an effective WBP Citizen Science project

• 1990 vs. 2014 comparative study

• Health of WBP in the Bob

• Implications of using citizen science
The Bob Marshall Wilderness Complex and surrounding wildlands were devastated by fires in 2015. Due to fires and smoke, 6 projects had to be cancelled in 2015. In coming years BMWF will work to help reopen trails and areas affected by these fires.
Whitebark Pine in the BMWC

- Bob Marshall Wilderness Complex (BMWC) comprised of Great Bear, Bob Marshall and Scapegoat Wilderness Areas
- Nearly 1.5 million acres
- Wide variation in plant communities and climate
- 44% BMWC has potential to support Whitebark pine
Whitebark Pine Heath

Previous studies in BMWC

- Between 1990 - 1994, 116 plots were established throughout the BMWC
- Examined health and status of whitebark pine
Whitebark Pine Citizen Science Project 2013-2014

- Goal: to relocate and remeasure 20% of the plots from the ‘90-94 study
- Use citizen scientists to collect data that would assess change in health and status over the past 20 years.
Whitebark Pine
BMWF Study Area

- Black dots represent plots re-visited in 2013-2014
- 20% (25) of the original 116 plots were revisited
- Sites were selected to cover from across the landscape
- Some time and access challenges
Method

- Recruit and train hardy volunteers that wanted to climb to the top of peaks and ridges in the Bob
- Relocate the plots from 1990 study
- Measure 0.1 acre plots using standard Forestry methods
Conducting an Effective Citizen Science Project

Train the Crew Leader to train the volunteers.
Volunteer practice.
Relocating the plots

- The original plots were not permanently marked (Wilderness)
- Convert NAD 27 to WGS 84, navigate to plot center
- Use photographs to refine plot center

1994

2013
Whitebark Pine

BMWF Remeasurement Methods

• **Live tree > 12 cm DBH:**
  - Measured tree height, crown base height, DBH, canopy position, health
  - Percent crown kill for WBP

• **Snags > 12 cm DBH:**
  - Recorded height, DBH, decay class
  - Recorded cause of death when evidence existed

• **Count of saplings and seedlings**
Engaging Volunteers with the Science
Whitebark Pine
BMWF Study Findings

Live (green) and dead (red) whitebark pine tree density (t ha\(^{-1}\)) in 1994 and 2014.

87% decline in density
Whitebark Pine
BMWF Study Findings

The majority of mortality was from blister rust, but more mountain pine beetle
Whitebark Pine
BMWF Study Summary

<table>
<thead>
<tr>
<th>Whitebark pine attribute</th>
<th>1994</th>
<th>2014</th>
<th>% change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Live tree density (t ha⁻¹)</td>
<td>365</td>
<td>46</td>
<td>-87*</td>
</tr>
<tr>
<td>Dead tree density (t ha⁻¹)</td>
<td>197</td>
<td>219</td>
<td>+11</td>
</tr>
<tr>
<td>Percent mortality (%)</td>
<td>35</td>
<td>83</td>
<td>+137*</td>
</tr>
<tr>
<td>Healthy trees (t ha⁻¹)</td>
<td>22</td>
<td>7</td>
<td>-68</td>
</tr>
<tr>
<td>Live but damaged trees (t ha⁻¹)</td>
<td>343</td>
<td>39</td>
<td>-89*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mortality by agent (%)</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Whitepine blister rust (t ha⁻¹)</td>
<td>63</td>
<td>13</td>
<td>-79*</td>
</tr>
<tr>
<td>Mountain pine beetle (t ha⁻¹)</td>
<td>3</td>
<td>10</td>
<td>+233**</td>
</tr>
<tr>
<td>Wildland fire (t ha⁻¹)</td>
<td>5</td>
<td>12</td>
<td>+140**</td>
</tr>
<tr>
<td>Unknown (t ha⁻¹)</td>
<td>29</td>
<td>65</td>
<td>+124*</td>
</tr>
</tbody>
</table>

A 137% increase in tree mortality

*Indicates significance (p ≤ 0.05),
**Indicates too few trees to calculate statistical significance
Whitebark Pine Citizen Science Conclusions

- Data is only as good as the training given to the volunteers.
- The public loves to be involved in the science behind the decision making.
- Engaging volunteers gives them an invested interest in the importance of public lands.
Thank you!

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