Whitebark Pine:
Implications of drought and a high-mountain ecosystem

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Seed Shell (whitebark pine)
Valuable Foodsource

**Mammals**
- Black Bear
- Grizzly Bear
- Red Fox
- Chipmunks
- Golden-mantled Squirrel
- Douglas Squirrel
- Red Squirrel

**Birds**
- Williamson’s Sapsucker
- Hairy Woodpecker
- Three-toed Woodpecker
- White-headed Woodpecker
- Stellar’s Jay
- Raven
- Mountain Chickadee
- White-breasted Nuthatch
- Pine Grosbeak
- Cassin’s Finch
- Red Crossbill
- Clark’s Nutcracker
Ecosystem services:
Community development and stability; protects our “water towers”

• Regulates snow melt and downstream flow.
• Reduces soil erosion; stabilizes snow—avalanche control.
• Nurse tree on harsh sites.
• Tree island initiator and component.
• Because nutcrackers cache above treeline, whitebark pine may respond quickly to climate change.
Damaging Agents

- Airborne Fungus
- Non-native
- Very Low Natural Resistance
- No Known Cure
Smith and others (20086)
Canada: *Endangered* 2012

USA: *‘Warranted but precluded’* 2011
## BC Snow Basin Indices – March 1, 2017

<table>
<thead>
<tr>
<th>Basin</th>
<th>% of Normal</th>
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<tbody>
<tr>
<td>West Kootenay</td>
<td>91</td>
</tr>
<tr>
<td>East Kootenay</td>
<td>99</td>
</tr>
<tr>
<td>Boundary</td>
<td>59</td>
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Summer Weather

Creston, BC

Summer Mean Temp. (°C)

Summer Mean PPT (mm)

Source: Environment Canada
“Unprecedented reductions in the snowpack in recent decades in the Rocky Mountains coupled with earlier spring melt and longer summer drought...” (Wong and Daniels 2016)

+ Record-high Temperatures

Water Deficit Stress

Blister rust, Beetles, Mistletoe, Pine Engraver
Wong and Daniels (2016)
Whitebark pine growth rates have been declining for almost 50 years in the Pioneer and Gravelly Ranges. “Drought may be an important driver” (Fajardo and McIntire 2012)

“Mortality in all [whitebark pine samples] was strongly associated with a multiyear drought that began in 2006 and continued through 2010.” (Millar and others 2012)

• Interactions with mountain pine beetles
### Impact on Streamflow?

<table>
<thead>
<tr>
<th>Impact</th>
<th>Inconsistent</th>
<th>No Impact</th>
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Impact on Snow Melt Timing?

<table>
<thead>
<tr>
<th>Earlier Melt</th>
<th>Inconsistent</th>
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<tbody>
<tr>
<td>Pugh and Small (2012)</td>
<td>Slinski and others (2016)</td>
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</table>
Conclusions

Whitebark pine has persisted with drought and fire for millennia.

However, accelerated decline of whitebark pine populations is occurring due to tree-level stress induced by:

- More frequent and intense hot droughts.
- Blister rust, Beetles, Mistletoe, Pine Engraver
- Various combinations of the above
End