

Whitebark Pine Ecosystem Foundation, Science and Management Workshop
14 September 2012, Kimberley, B.C.

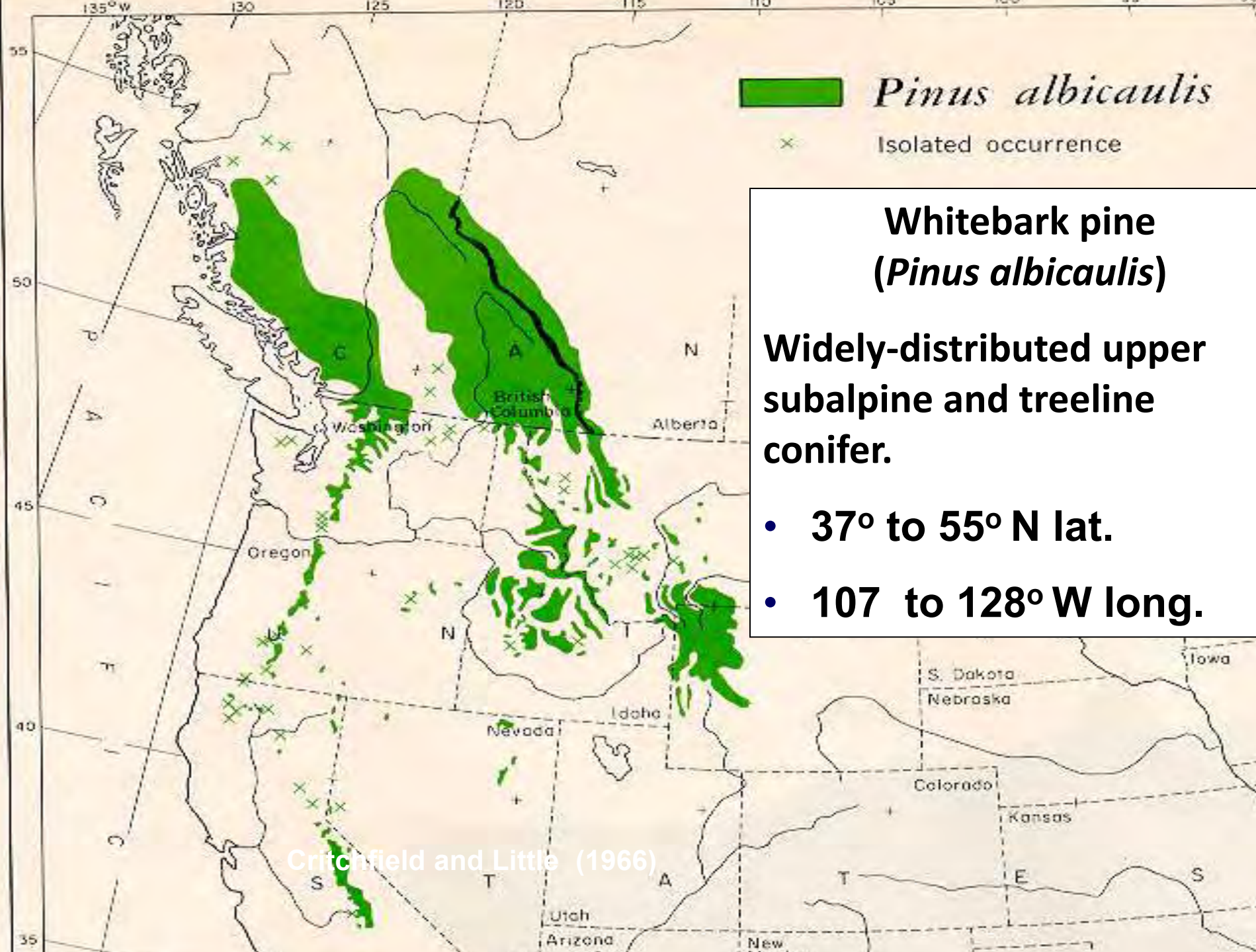
Whitebark pine: Ecology, Threats, and Why We Care

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Whitebark Pine Growth forms



Rob Mutch





Crater Lake NP



Yosemite NP



Beartooth Plateau, MT



Banff NP

Northern Rocky Mountains-- Whitebark pine community types

- *Successional communities* on favorable sites, upper subalpine zone
- *Climax communities* on exposed upper subalpine sites and in treeline ecotone

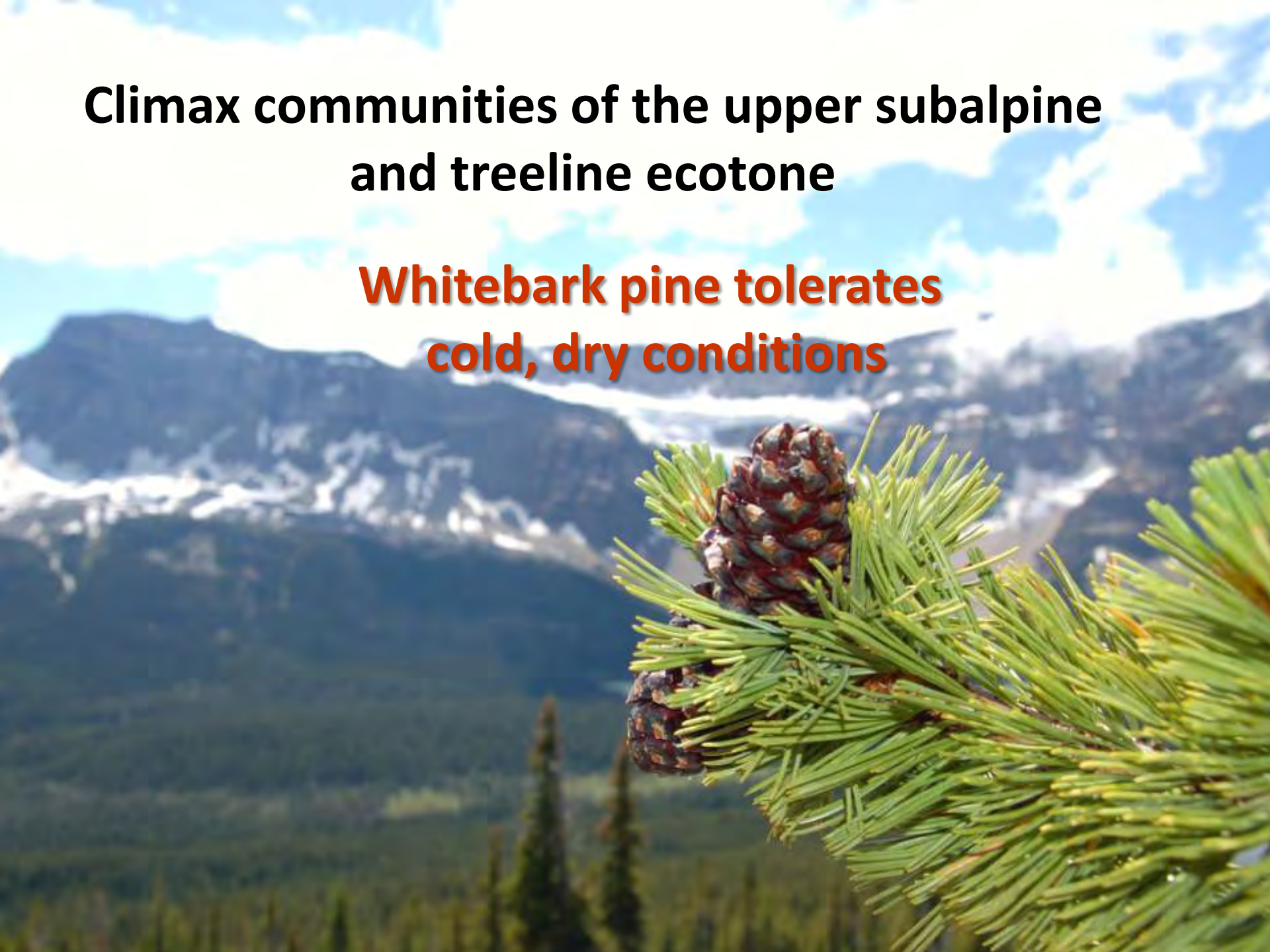


Successional communities on favorable sites: renewed by fire



Climax communities of the upper subalpine and treeline ecotone

**Whitebark pine tolerates
cold, dry conditions**



Clark's Nutcracker is the primary seed disperser for whitebark pine



Adaptations of whitebark pine for seed dispersal by nutcrackers:

- Large, wingless seeds
- Cones remain closed
- Horizontally oriented cones on upswept branches
- Seed morphology adapted for caching mode of dispersal



Krugman & Jenkinson 1974



Seed dispersal

- Carry up to 150 seeds in sublingual pouch.
- Bury seeds in caches of 1-15 seeds, typically 3 or 4.
- Bury seeds 1 to 3 cm under soil or gravel.
- Carry seeds a few meters to 12 km (max. known 35 km).
- Stored per bird: 35,000 to 98,000 seeds.
- Birds use spatial memory to retrieve caches.
- Unretrieved caches germinate, leading to regeneration.



Impact of seed dispersal by nutcrackers

Distribution on landscape—elevation and topography.

Climate change—treeline.

The “tree cluster” growth form.

Population genetic structure at multiple scales.



Tree cluster growth form

Whitebark pine seeds are an important wildlife food

- **Birds: 6 families, 13 species**
- **Small Mammals: 2 families, 8+ species**
- **Large Mammals: 1 family, 2 species: Grizzly and black bears**
- **When seeds are ripe, good cone crop, canopies busy with foraging birds and mammals.**

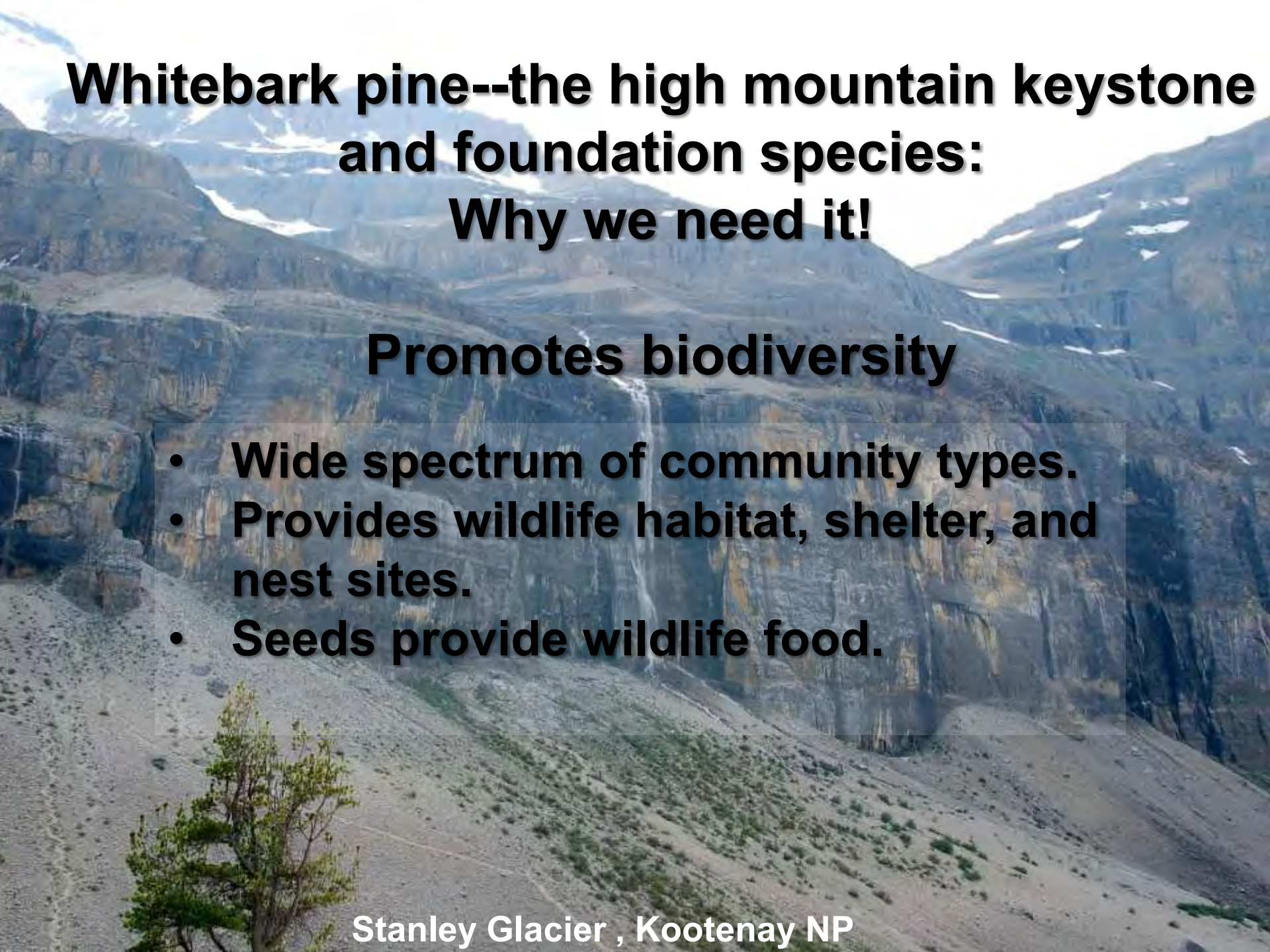


Red squirrels



- Major competitors for whitebark pine seeds.
- Cut down whitebark pine cones for winter food.
- Squirrels bury cones in middens in their territories.



A scenic view of a mountain valley. In the foreground, a lone green tree stands on a rocky slope. A waterfall cascades down a rocky cliff in the middle ground. The background features rugged mountains with patches of snow under a clear sky.

Whitebark pine--the high mountain keystone and foundation species: Why we need it!

Promotes biodiversity

- **Wide spectrum of community types.**
- **Provides wildlife habitat, shelter, and nest sites.**
- **Seeds provide wildlife food.**

Ecosystem services: Community development and stability, protects our “water towers”

- **Regulates snow melt and downstream flow.**
- **Reduces soil erosion; stabilizes snow---avalanche control.**
- **Fosters community development after disturbance.**
- **Tree island initiator and component.**
- **Rapid response to warming or cooling at treeline.**

Grand Teton National Park

Building a tree island.

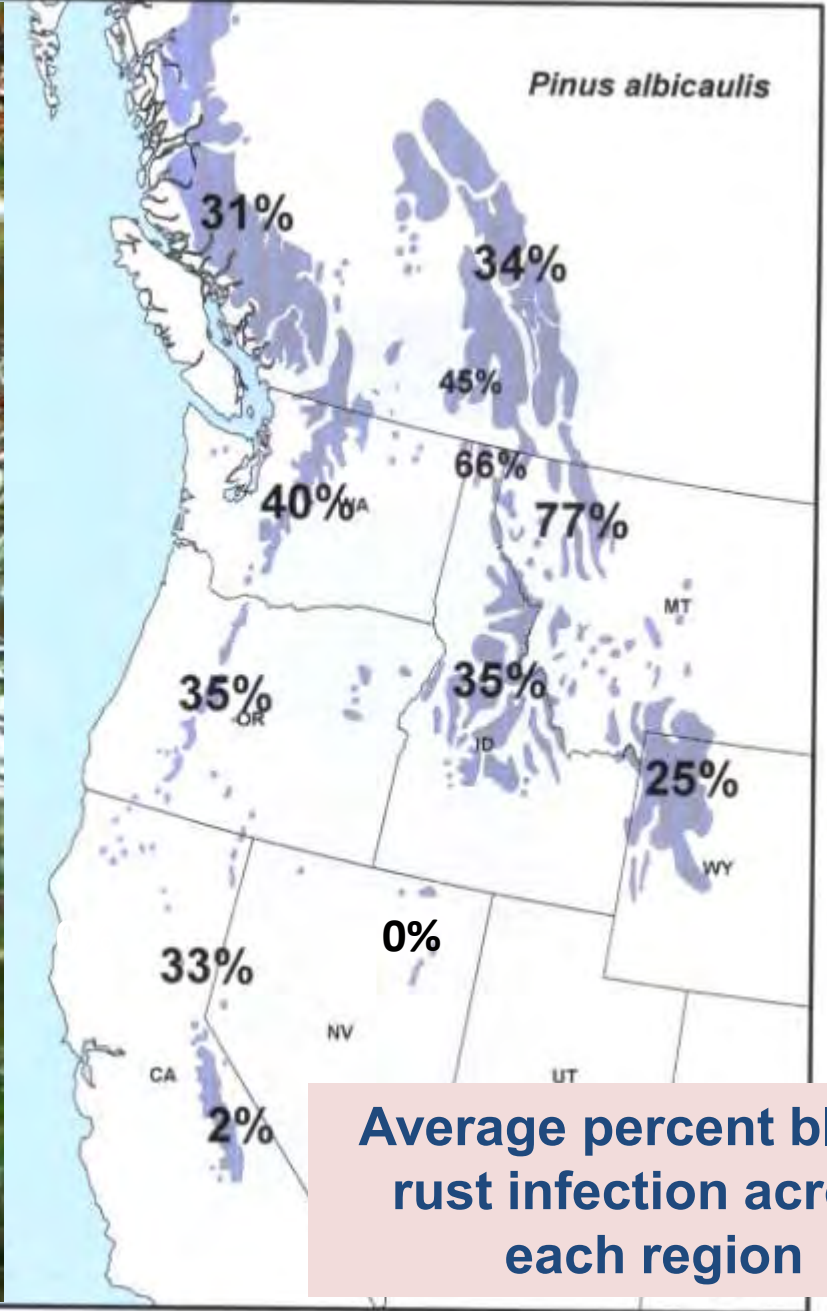


Whitebark pine “in peril”



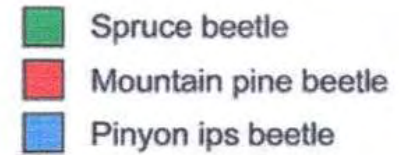
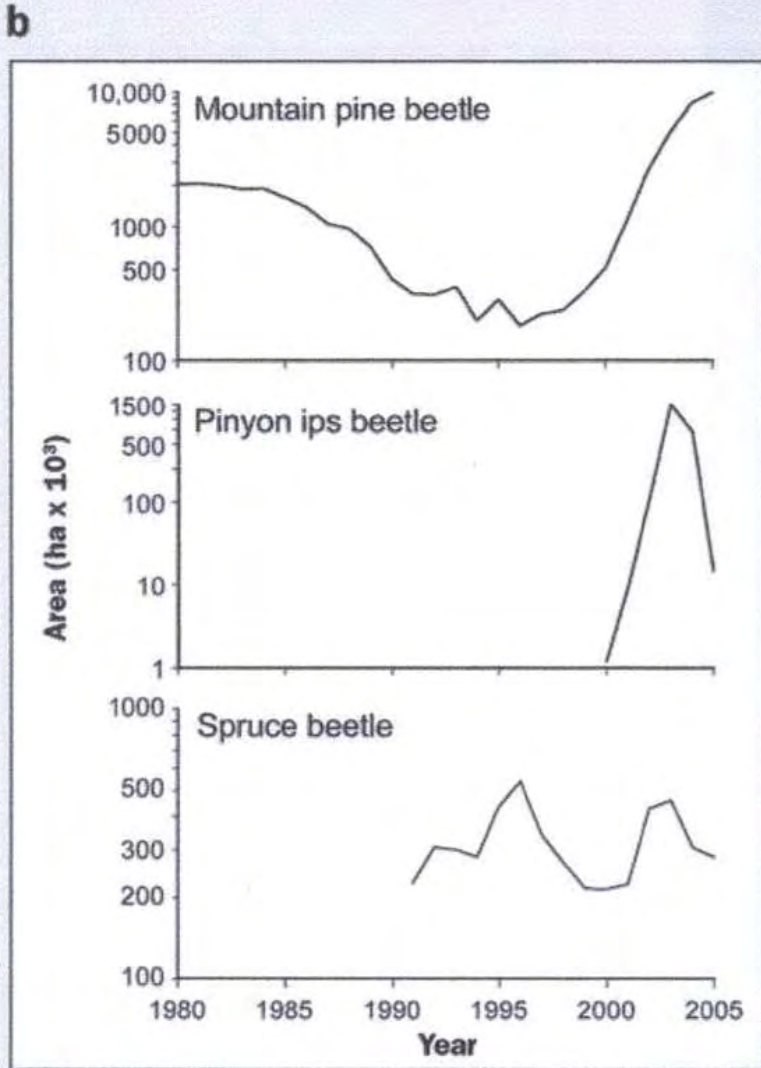
- The introduced, invasive pathogen *Cronartium ribicola*—white pine blister rust.
- Mountain pine beetle outbreaks.
- Altered fire regimes—successional replacement.
- Climate warming—sustaining pine beetle outbreaks, producing drought stress and mortality, and altering pine distributions.





Average percent blister rust infection across each region

Total acres with mpb-killed whitebark pine across the Western U.S. as of 2007: 470,000 with up to 90% mortality.
(Gibson et al. 2008)



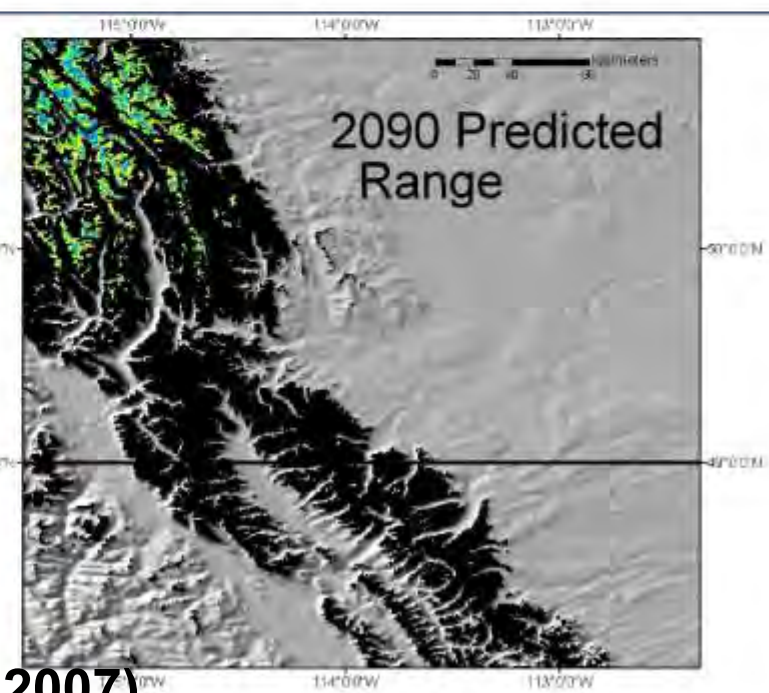
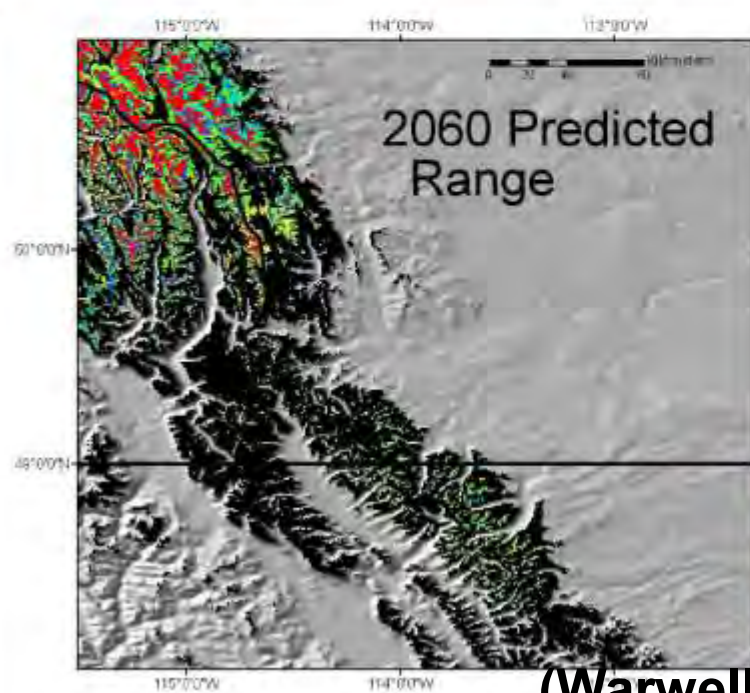
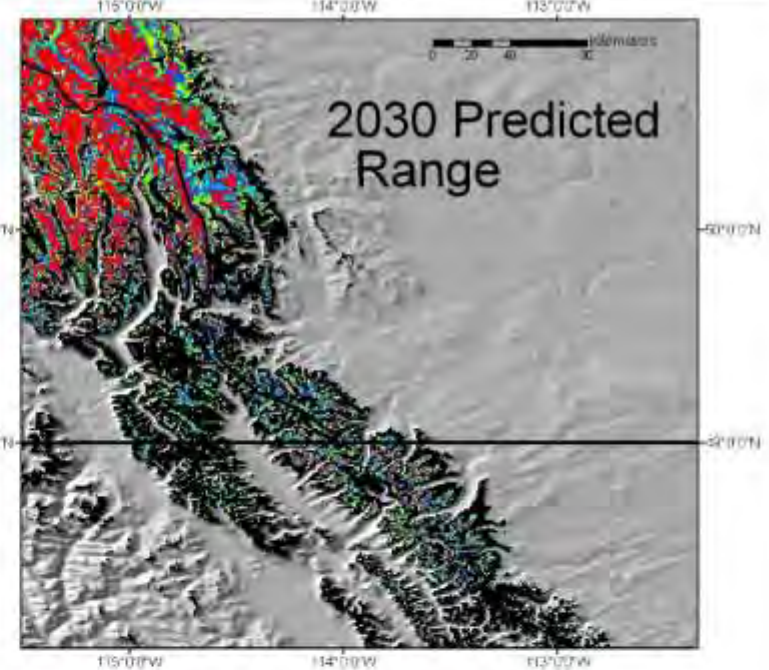
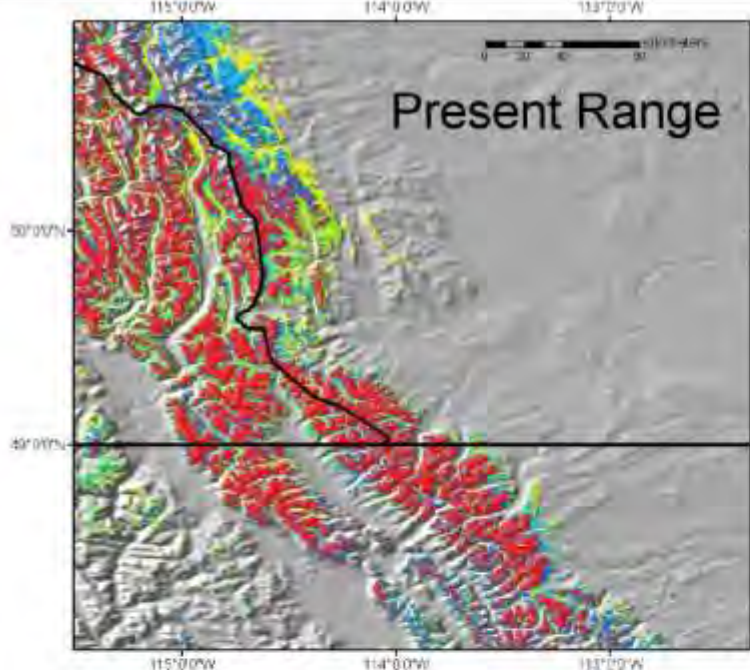
Raffa et al. 2008

Mountain pine beetle



Avalanche Peak, Yellowstone National Park, EcoFlight





(Warwell et al. 2007)

Without whitebark pine:

- Grizzlies wander widely in search of pre-hibernation food.
- Forest regeneration takes longer after fire.
- On harsh sites, less treeline vegetation.
- The “water towers” are not as effective.
- Treeline response to climate change delayed.

Whitebark pine is so widely distributed, its extinction or even local extirpation will have significant consequences for forest composition, ecological function and ecosystem services

- In July 2011 after full status review by U.S. Fish and Wildlife Service, whitebark pine was named a Candidate Species for listing under the Endangered Species Act.
- Cited: blister rust, mountain pine beetles, fire exclusion, climate change: the trajectory is down...
- In June 2012, whitebark pine was listed as endangered in Canada under the Species at Risk Act.
- Thank You!