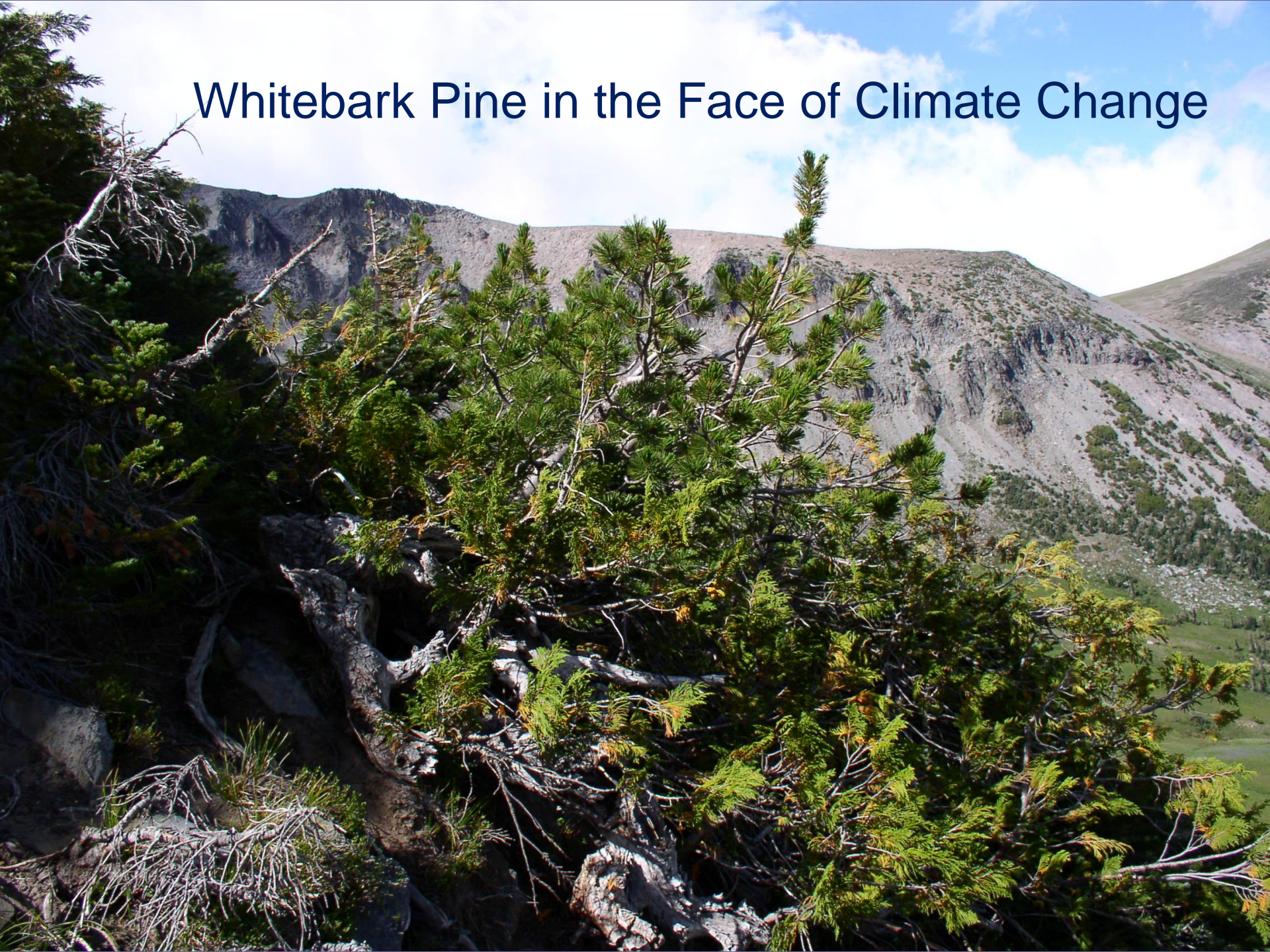
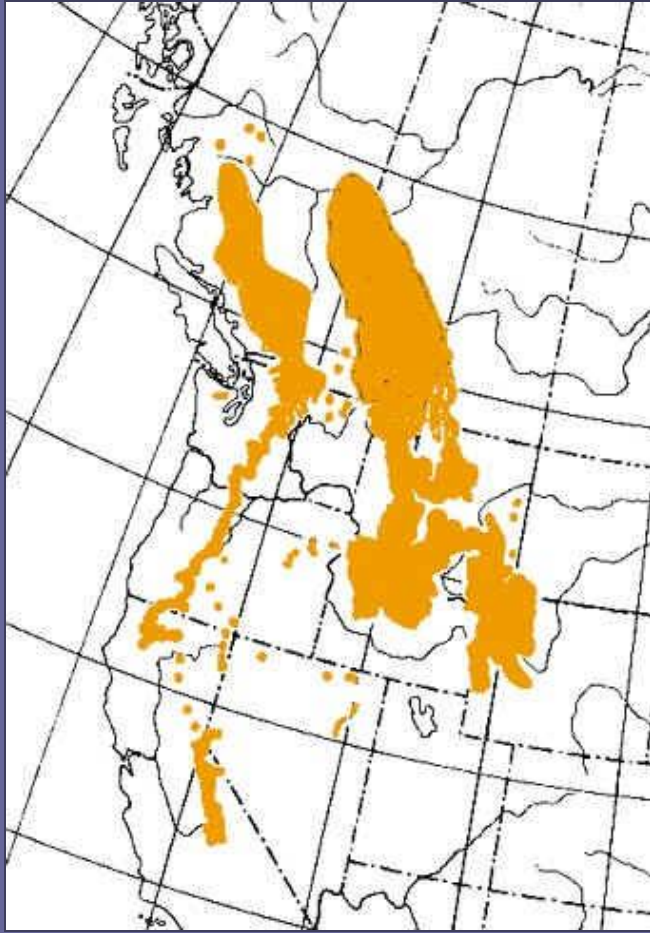


Whitebark Pine in the Face of Climate Change



Distribution of Whitebark Pine



- high-elevation species
- Rocky Mountains west to Cascades and northern Sierra Nevada
- dry, often wind-swept sites
- keystone species

Ecology of Whitebark Pine

- *Pinus albicaulis*, five-needle white pine
- long-lived tree – up to 700 years, cones produced after 100 years
- large, wingless seeds, indehiscent cones
- seeds are distributed by Clark's Nutcrackers



Seeds and cones



Seed Dispersal of Whitebark Pine

- Clark's Nutcracker (*Nucifraga columbiana*) removes seeds with beak from cone
- carries up to 150 seeds in sublingual pouch
- caches seeds up to 10-12 km and 500m in elevation from tree
- can retrieve seeds 9 months later

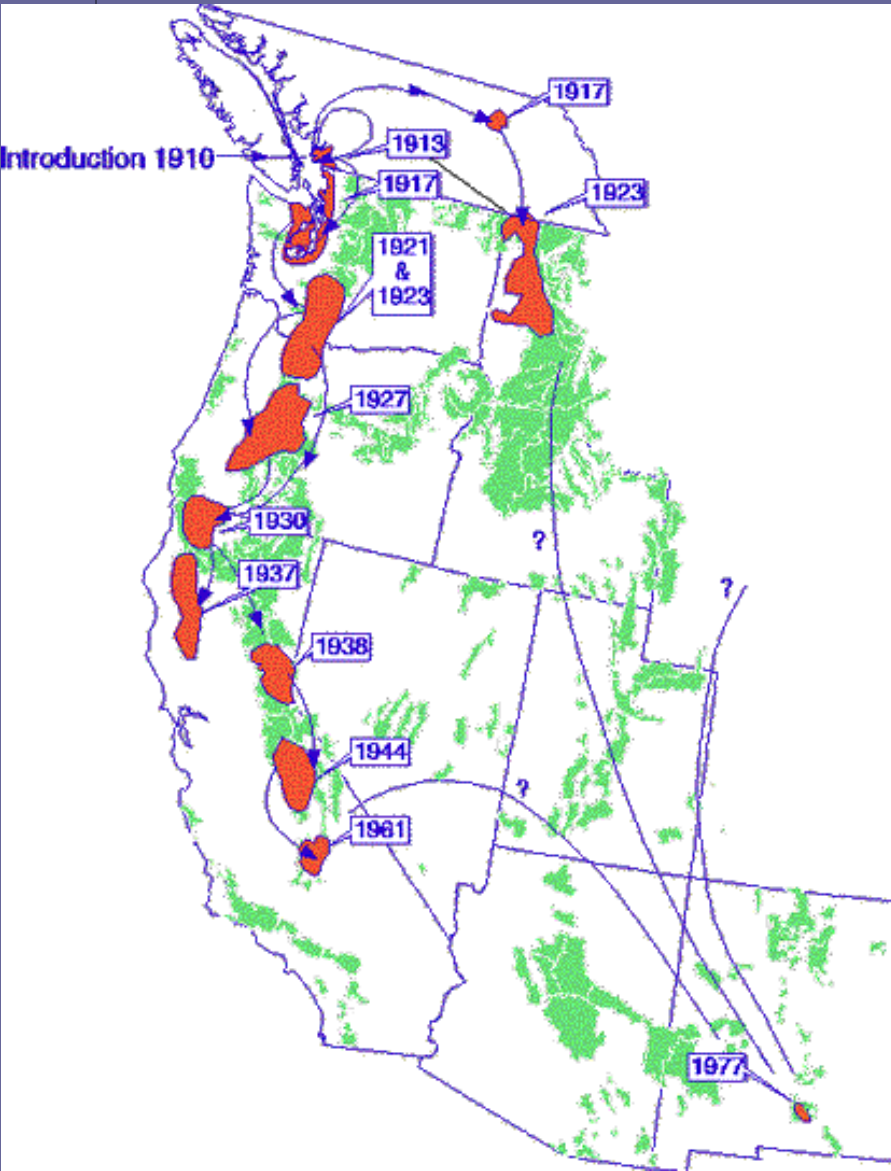


Status of Whitebark Pine



- widespread mortality
- Eurasian blister rust fungus, *Cronartium ribicola*
- fire exclusion
- Mountain Pine beetles
- Under review for listing, July 20, 2010.

Blister Rust, *Cronartium ribicola*



- introduced to west ~ 1910
- Gooseberry or wild current (*Ribes* sp.) and lousewort (*Pedicularis* sp.) alternate hosts
- low levels of resistance in *Pinus albicaulis* populations
- widespread control programs 1920s to 1960s

Blister Rust, *Cronartium ribicola*



Whitebark pine



Ribes sp.

Signs of Blister Rust



Dead top of whitebark pine



Chlorotic needles, flagging

Signs of Blister Rust



Bole canker



Stem Canker

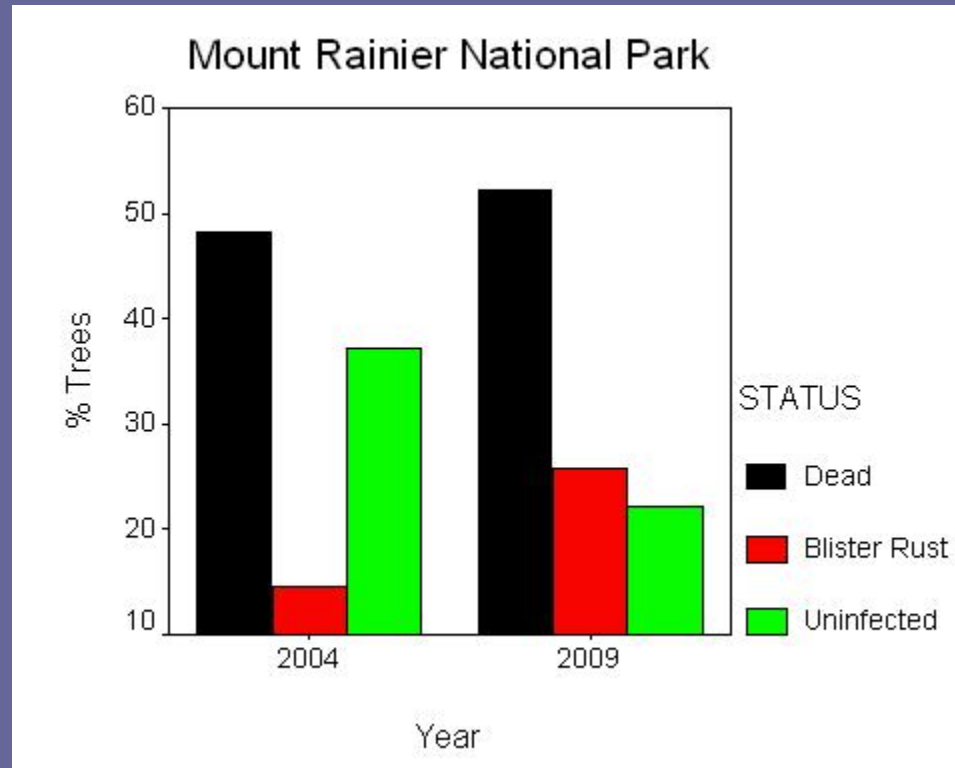
Long-term Monitoring



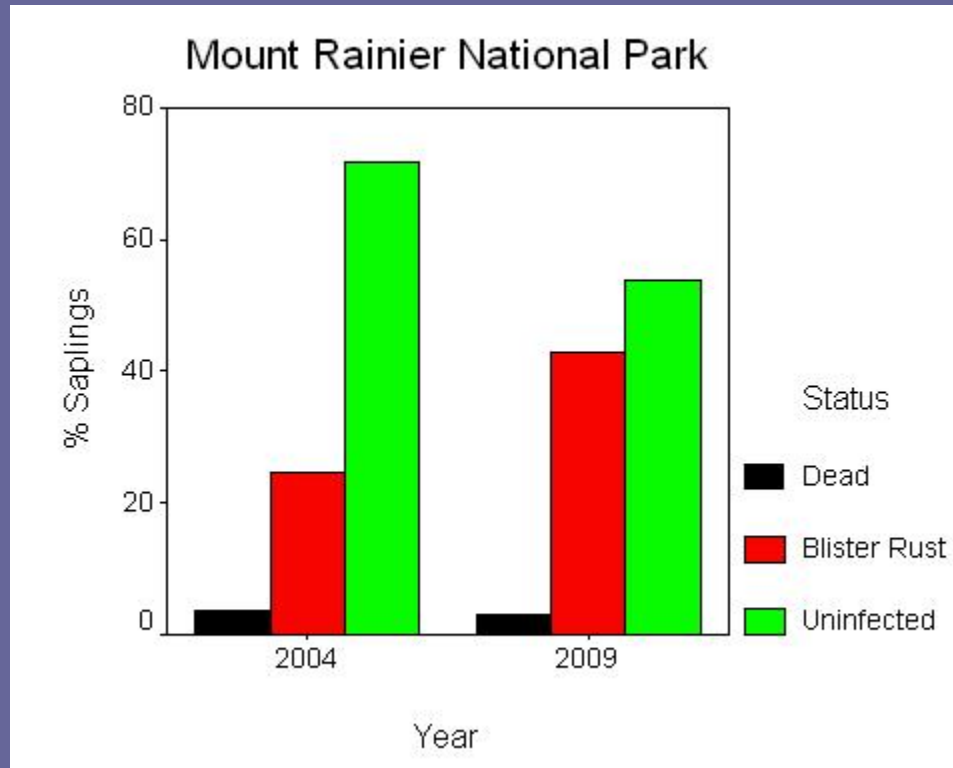
Monitoring Objectives

- Document status & trends in mortality
- Document status & trends in infection rates
- Document changes in species composition of stands
- Determine possible rates of resistance

Results of rust infection on trees



Results of rust on saplings



Mountain Pine Beetle



Mountain pine beetle in whitebark pine



Fire?



Fire?



**What will happen and
Why do we care?**



Potential Effects

- Blister rust spores are sensitive to humidity, if precipitation increases in the summer months blister rust infection may increase
- Mountain pine beetle may increase with warmer temperatures as cold temperatures limit reproduction

Potential Effects (cont.)

- Changing patterns of snow melt and longer growing seasons will reduce seasonal moisture and enhance late-season drought- which may increase fire intensity and frequency
- Reduced nutcracker and small mammal populations
- Altered watershed hydrology: The loss of whitebark pine will alter local patterns of snow accumulation and snow melt, which affects the timing, levels, and quality of water flow.

Potential Effects (cont.)

- Altered successional processes- the hardiness of the seed and the ability for these trees to pioneer after fire or other disturbances facilitates the establishment of other conifers
- Homogenization of the subalpine landscape-it's loss will reduce structural diversity and biodiversity
- Impaired aesthetic and recreational values

