Restoration of Whitebark Pine
Through Planned and Unplanned Ignitions

Desired Conditions, Management Considerations and Approaches

Objective of this paper: promote whitebark pine survival and regeneration for ecological diversity, wildlife, hydrologic and other benefits through the use of planned and unplanned ignitions.

The U.S. Fish and Wildlife Service determined that listing *Pinus albicaulis* as threatened or endangered is warranted. They also found that "Fire suppression results in conditions that favor the dominance of shade-tolerant species such as *Abies lasiocarpa*, *Picea engelmannii*, and *Tsuga mertensiana*, which form dense stands that eventually exclude *Pinus albicaulis*…making them more susceptible to white pine blister rust, infestation by mountain pine beetle, and mortality. Succession to more shade-tolerant species also results in less *P. albicaulis* regeneration because *P. albicaulis* is shade-intolerant, and seeds will not survive if cached in heavily shaded forest stands." The Fish and Wildlife Service considers "the current fire regime and fire management practices to be threats that limit the abundance of the species and weaken *P. albicaulis* communities, such that other factors create additional negative impacts to the species" (Federal Register, Vol. 76, No. 138; July 19, 2011; page 42631; available at: O:\NFS\R01\Collaboration\WhitebarkPine\Fed_register).

Whitebark pine will be designated as a Region 1 Sensitive species effective by the end of 2011. See letter dated August 26, 2011, Leslie A.C. Weldon, Regional Forester.

Range-wide Restoration Strategy

The Range-wide Restoration Strategy for Whitebark Pine Forests (Keane et.al. 2011, in press) contains guiding principles, central tenets for a strategy and the following assessment criteria:

Assessment Criteria from Restoration Strategy

1. *Lands having high blister rust infection and mortality have the highest priority for restoration*:
   Landscapes with greater than 50 percent of the area having greater than 50 percent whitebark pine mortality from blister rust should have the highest priority for restoration and *stands* with >90 percent rust infection and >50 percent mortality are best stand candidates for restoration.
2. *Lands having high mountain pine beetle mortality have a higher priority for restoration*:
   Landscapes with evidence of impending mountain pine beetle epidemics should have lowest priority, major epidemics in the recent past are good candidates due to lack of seed sources.
3. *Stands that are in the later stages of successional development have a higher priority for restoration*:
   More than 10-20 percent of area dominated by subalpine fir in late seral stage or landscapes with one or 2 patch types (same age class or vegetation characteristics) can indicate lack of fire or diversity and need for restoration or fragmentation. Whitebark pine stands in later structural stages can be used as surrogate for presence or abundance of cone-producing trees for retention on landscape.
4. *Seed Sources:*
   Landscape assessments need to identify areas where dispersal of seed by nutcrackers is possible (less than 8 to 9 miles from a seed source). Identified seed source areas should be assessed to evaluate if there are sufficient numbers of cone-bearing whitebark pine to

provide the seed for regeneration. At least 20 cone-bearing trees per acre would be needed to be considered a seed source.

Desired Conditions:

Species composition

Desired conditions are whitebark pine dominated stands on those sites with evidence of historical domination by the species. The goal is to increase whitebark pine in the understory and overstory and reduce lodgepole pine, subalpine fir and spruce. Stands dominated by these species, but within the range of whitebark pine, are the highest priority for treatment. Burning will promote the regeneration of whitebark pine (by increasing potential seed caching sites for nutcrackers – see below), thin stands and reduce the competition from subalpine fir, lodgepole pine and spruce. Planting of rust-resistant whitebark pine can be done where there is little live seed source within acceptable range.

Stocking or crown closure

Whitebark pine seeds are dispersed by Clark's nutcrackers over 15 miles and are cached and can regenerate successfully when crown closure is 30 percent or less. Opening up whitebark pine stands to a maximum of 30 percent closure (or <175 sq. ft./acre basal area) with openings ~1/2 acre will aid in the caching and regeneration of seedlings. Ideal structure would be open conditions with clumps of mature, immature or sapling whitebark pine with seedlings eventually filling in openings with reduced surface fuels and mineral soil exposed.

Management Considerations:

Mapping and Distance from Seed Source

Consult with local specialists to create maps of areas where cautions and opportunities maybe located (many maps available in multilayered pdf at O:\NFS\R01\Collaboration\WhitebarkPine\Maps\WBP_all_083011v2.pdf):

- whitebark pine plus trees, seed orchards, areas with high genetic diversity for conservation,
- patches of viable seed sources (greater than 5 acres in size, with more than 20 trees per acre whitebark pine of cone bearing age, especially if apparent rust resistance),
- where investments have been made to improve whitebark pine ecosystems (planting, thinning, bark beetle protection, etc.),
- areas in need of restoration by fire within 8 to 9 miles of viable seed source sites,
- blister rust infection,
- mountain pine beetle mortality,
- species composition,
- fire history.

Blister Rust

Where blister rust has caused extensive mortality of whitebark pine (blue color on map on O drive), burning will be essential to promote rust resistant whitebark over other species. Areas with > 50 % whitebark pine mortality over a majority of an area are the highest priority for burning. However, if there are possible rust resistant trees (pole size or greater whitebark pine survivors of blister rust), use caution to avoid killing them. Regeneration from these individuals is essential – it is critical that this important genetic resource not be completely lost to fire. There are also cone collection plus trees, seed orchards and genetically diverse whitebark pine areas (see map) that are important to protect. In addition, fires in lower elevations below whitebark pine areas can create a landscape mosaic of fuel breaks to help protect rust resistant stands, as well as expand its current range.

Mountain Pine Beetle

Where mortality due to mountain pine beetle is high, (see maps on O drive) complete stand-replacement by fire is acceptable, if adequate whitebark pine seed source (greater than 20 cone producing-age trees per acre in 5 acre patch or larger) are within 8 to 9 miles.

Species Composition
Stands mixed with spruce, lodgepole pine and subalpine fir (where whitebark pine has been a seral species) outside of mapped lynx habitat are good candidates for stand replacing or mixed severity fire to increase desired regeneration. Whitebark pine seed sources need to be within caching distance of 8 to 9 miles to ensure seeding after fire. Areas of pure, live whitebark pine can benefit immensely from surface fire to reduce fuels.

Fire History
Recent fires (see maps) could provide fuel breaks for adjacent whitebark pine areas in need of fire. Fire history maps could also help identify and prioritize areas in need of fire. Those areas without fire in the past 2 decades and in spruce and subalpine fir habitats types, but without whitebark pine present, will be a higher priority for fire. If whitebark pine cone producing seed source is not within 8 or 9 miles of potential ignition area, planting rust resistant whitebark pine will be needed after burning.

Management Approaches:

Burn Conditions
Moderate years (when fire severity conditions are not extreme) have great potential to create the desired conditions described, from either planned or unplanned ignitions. Examples of moderate conditions might include shoulder seasons, a trend of low ERCs for the season or where seasonal severity indicators are acceptable based on risk assessment. Often, a heavy frost in late summer/early fall will kill and dry out fine fuels, facilitating fire spread for wildfire or prescribed burns.

Fires with Multiple Objectives and Prescribed Burns
The maps on the O drive (O:\NFS\R01\Collaboration\WhitebarkPine\Maps) show those areas where fire for multiple objectives is allowed. Pertinent operational details are identified in Forest Response or Operations Guides, Fire Management Plans or elsewhere. These areas might have the greatest potential for restoring whitebark pine. The light green areas do not yet have operational details documented, but may have potential for the future.

Burning near areas with moderate to high levels of blister rust infection and mortality would favor natural selection of rust-resistant individuals because the surviving cone-bearing trees would likely contain rust-resistant genes, providing the nutcrackers do not reclaim much of the cached seed. Burn units would have to be within 8 to 9 miles of those potential seed source areas to be within reasonable caching distance by nutcrackers. Planting of rust resistant seedlings might be necessary.

Citations

Keane, Robert E., Tomback, D., Aubry, C., Bower, A., Campbell, E., Jenkins, M., Manning, M., McKinney, S., Murray, M., Perkins, D., Reinhart, D., Ryan, C., Schoettle, A., Smith, C. 2011, in press. A range-wide restoration strategy for whitebark pine (*Pinus albicaulis*). General Technical Report RMRS-GTR-XXX. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, XXX pp.