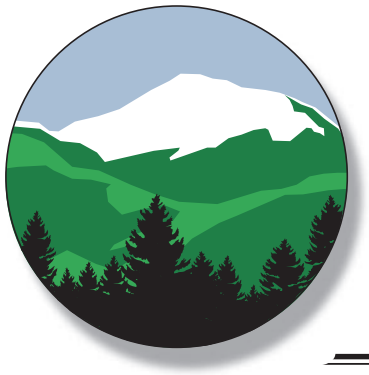

Long-Term Sustainability in Davis Late Successional Reserve

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Abstract—*A pilot watershed analysis along with the Davis Late Successional Reserve analysis in the range of the northern spotted owl identified potential loss of suitable habitat, reduction in the numbers of large trees, and lack of replacements for large trees. A variety of silvicultural thinning techniques has been used to address these important issues and to move toward a sustainable mix of stand conditions on the landscape.*

Introduction

In 1993 President Clinton ordered that a resolution be found to the gridlock between the needs of wildlife associated with late- and old-structured stands (LOS) and the need to thin timbered stands in the Pacific Northwest and northern California areas. He put together a commission, which met in April 1993, to reach consensus on how to conserve the wildlife species that require Late and Old Structure (LOS) within the range of the northern spotted owl. It also purposed to provide a steady flow of timber products from the same landscapes. This resulted in the Northwest Forest Plan (NWFP), or the President's plan as it is commonly referred to, signed April 13, 1994.

The NWFP applied to the whole range of the northern spotted owl. The bulk of the range of the northern spotted owl is west of the crest of the Cascade Mountains in California, Oregon, and Washington. Portions of the range extend to the east side of the Cascades. In the Pacific Northwest, this area is commonly referred to as the east side.

As a result of the decision from the NWFP, a network of late successional reserves (LSR) was identified to provide for old growth dependent species. Davis LSR is one of the east side LSRs nestled mostly in Odell Creek and Moore Creek subwatersheds (figure 1). Along with accompanying standards and guidelines, watershed level analysis at the sixth level watersheds was initiated in certain key areas called pilot areas.

One of the 15 key areas selected as a pilot watershed to assess was the Odell subwatershed on the Crescent Ranger District. This subwatershed grouped the Moore Creek, the Odell Lake, and the Odell Creek subwatersheds for a total assessment area of 74,933 acres. The Odell Pilot Watershed Assessment identified key processes and flows in and through the area in the physical, biological, and social realms. Vegetative condition was common to most of the processes and flows in the subwatershed. From the Odell Pilot analysis, certain items were chosen as key items of concern. One of the key items of concern was the loss of large trees and the lack of replacements for the large trees in the area. Most of the mixed conifer stands currently have overstories of fire-resistant species, primarily ponderosa pine and Douglas-fir.

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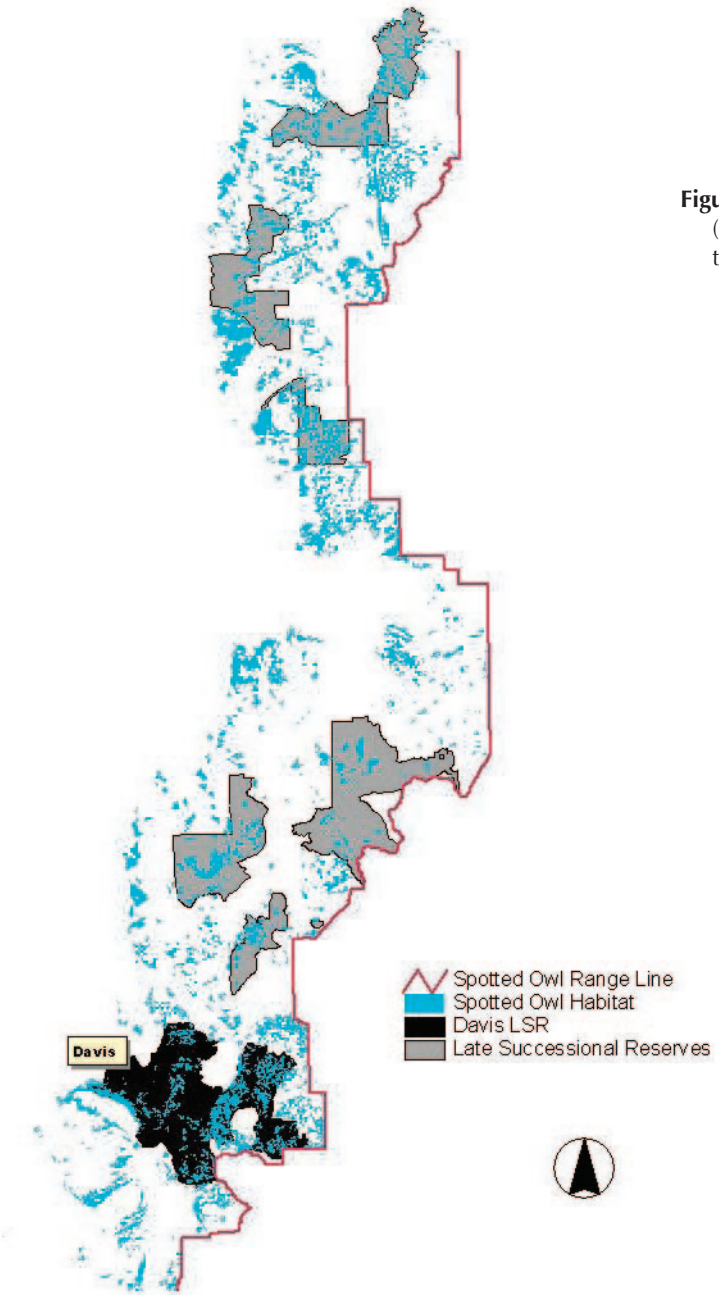

Figure 1—Distribution of Late Successional Reserves (LSRs) and nesting, roosting, and foraging habitat on the Deschutes National Forest.

Understories are comprised mostly of the true fir species and lodgepole pine, so dense that ponderosa pine and Douglas-fir regeneration are few to non-existent and very poor in form, unable to respond to release.

Teamwork

As the issues became clear, time was taken for members of the interdisciplinary team (IDT) to educate each other on the issues, concerns, and desires of their discipline. This was called team teaching. Being able to understand and speak each other's "language" proved to be very effective in communicating with other agencies, administrators, and the general public. Each team member could clearly describe the conditions, processes, flows, and needs of any of the other disciplines. It was common on "show-me" trips to see the wildlife biologist explain the need for silvicultural treatments, the silviculturist to explain the need to retain or provide a particular habitat structure, and/or a fuels specialist to explain the need for certain snags or down woody material for particular wildlife needs.

The cohesiveness of the group and the trust built through this process carried over to implementation of the project. This was key in the success of the project and providing continuity when integrating new people into the project, as all but one of the team members moved away.

Special Place

The 48,890-acre Davis Late Successional Reserve (LSR) (figure 2), one of the largest of the LSRs in the system, was analyzed for its ability to continue functioning as an ecosystem dominated by late and old seral structural conditions. The LSR lies mostly within the Odell Pilot subwatershed, spans seven buttes, and skirts the shores of Davis Lake. It includes lodgepole pine in the flat basins, ponderosa pine at the base of the buttes, mixed conifer stands on the midslopes of the buttes, and mountain hemlock at the tops. Snags and down wood are common from endemic levels of insects, disease, and competition-induced mortality. The elements of the LSR that make it suitable for the northern spotted owl and bald eagles are the multi-storied mixed conifer stands.

The lodgepole and ponderosa pine stands are not suitable as habitat for the northern spotted owl, but each has groups of species associated with its old-structured stands. Stands are, however, used for dispersal by the owls, since the mixed conifer stands are bisected by the other stands across the landscape.

Other animals including deer, elk, coyotes, neotropical migratory birds, owls, woodpeckers, and hawks take advantage of the diversity of habitats.

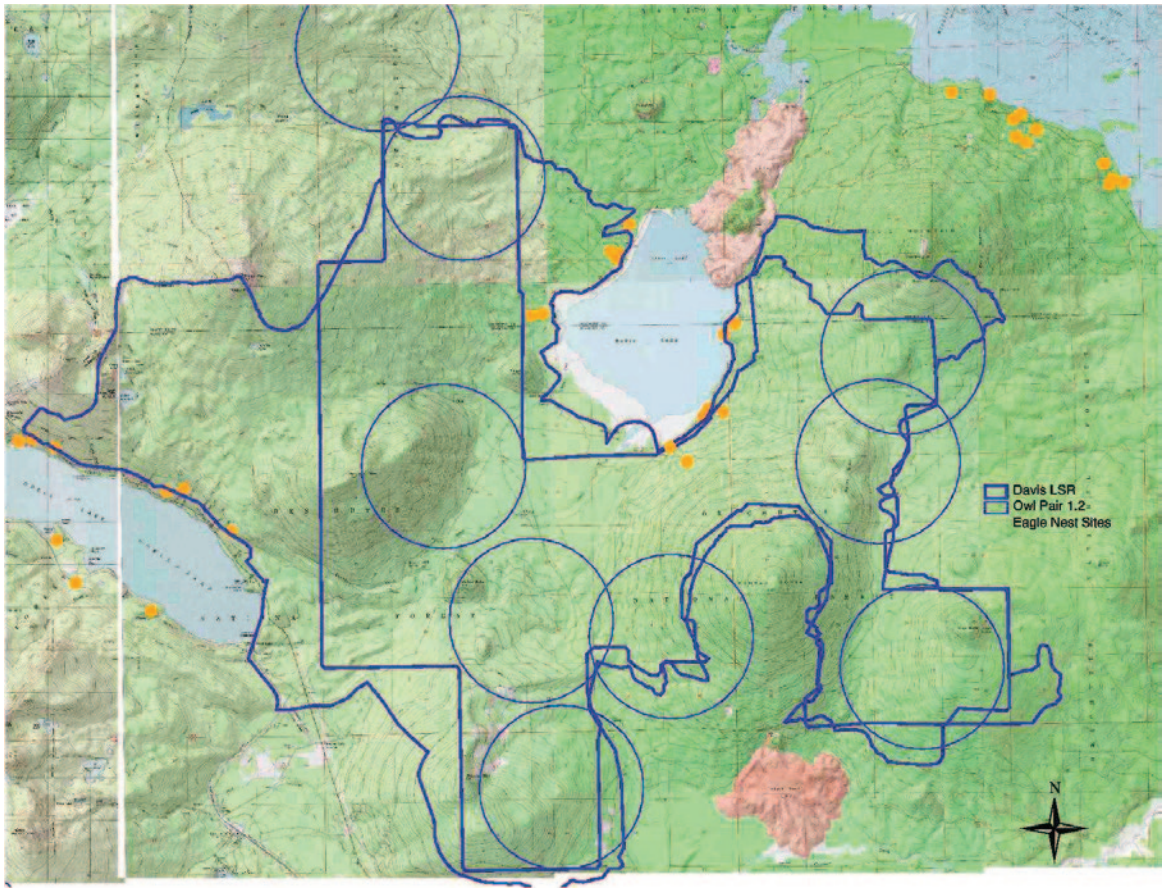

Figure 2—Davis Late Successional Reserve with owl home ranges and eagle use areas.

Home Sweet Home

Davis LSR owl habitat is important to maintain over time. Like other LSRs on the east side, Davis LSR is on the edge of the range of the northern spotted owl. The owls resident to this area are considered important to the genetic base because of their "pioneering" nature; i.e., they go where no owl has gone before and *survived*. This is considered to be an important trait for the survival of the species.

Spotted owls generally require mature or old-growth coniferous forest with complex structure including multiple canopy layers, large green trees and snags, heavy canopy habitat, and coarse woody material on the forest floor. A wide variety of forest types are utilized. Nesting, roosting, and foraging (NRF) habitat for the northern spotted owl on the Deschutes NF includes stands of mixed conifer, ponderosa pine with white fir understory, and mountain hemlock with subalpine fir. Suitable nest sites are generally in cavities in the boles of either dead or live trees of at least 30 inches DBH. Platform nests such as abandoned raptor nests, broken treetops, mistletoe brooms, and squirrel nests are used on rare occasions. Relatively heavy canopy habitat with a semi-open understory is essential for effective hunting and secure movement. Habitat conditions that support good populations of northern flying squirrels (*Glaucomys sabrinus*), western red-backed voles (*Clethrionomys californicus*), and other nocturnal or crepuscular small mammals, birds, and insects are essential to supporting spotted owls.

Edge effects from large forest openings may adversely impact the microhabitat conditions necessary for suitable owl habitat as well as contribute to increasing the risk to spotted owls imposed by predators or to competition from the barred owl (*Strix varia*). Spotted owls will use younger, managed forests that have key habitat components available. These younger forests provide dispersal habitat for owls and foraging habitat if near nesting or roosting areas.

Hence, complexity of stand structure plays a very important role as habitat for the northern spotted owl. This is also a factor for the bald eagle habitat in the LSR. The eagles use the dense, multi-storied stands for winter roosting. The big, open-grown ponderosa pine and Douglas-fir trees with forks in the tops are the preferred sites for nest building. The understory development since fire exclusion has created serious competition and ladder fuel conditions.

Danger in Paradise

Such complex stand structure in east side forests is a condition that is transitory, at best. The historic condition of these stands seems to clearly have been mostly open park-like stands dominated by fire-resistant species such as the pines and Douglas-fir. Ponderosa pine and, to a lesser extent, Douglas-fir, dominate and are the oldest of the overstory trees in the LSR. Fire frequencies ranged from five to 30 years on most of the ponderosa and mixed conifer stands. Most all of the understory trees have come in since the time of fire suppression, about the end of the 18th century. Records of early recreationists and settlers in the area indicate they would often fight fires that were a threat to their campsites and homes (personal communication, Leroy Steece, Archeology Tech).

Since that time, fire intolerant species (lodgepole pine and true firs) have developed in the understories at such densities that competition-associated mortality of the overstory trees is increasing rapidly at a rate that exceeds replacement of those trees. Personal observations of old and newer stumps in the area indicate that the first 8-15 decades of the overstory trees were

characterized by rapid growth, indicating somewhat open-grown conditions. These growth rates certainly exceed those of any overstory replacement trees presently growing in untreated stands. Thus, conditions favorable for species such as the northern spotted owl and its prey were probably not common on the east slopes of the Cascades in much of Central Oregon until the last half century or less. Now, with those conditions common on the landscape, the concern for large tree retention and for stand replacement fire events is high.

Building on the foundation of the Odell Pilot WA, one of the key concerns in the analysis of the LSR was the long-term sustainability of the late-successional stands. Multi-storied stands of the early seral ponderosa pine and Douglas-fir overstories with dense true fir and lodgepole pine understories are highly susceptible to insects, disease and/or fire events at stand replacement intensities. These stands developed because of fire suppression in the area for the last century. This, combined with limited management activities to control densities, has resulted in vegetative structural conditions that probably never previously occurred at this level on the landscape.

Risk Reduction or Habitat on a Timeline

The 7 Buttes and 7 Buttes Return analyses were initiated to try to address the vegetative condition concerns raised in the Odell Pilot and Davis LSR assessments. The purpose and need focused on the key vegetative issues and how to approach them from a silvicultural perspective. A variety of silvicultural approaches were proposed and planned for the landscape. They included:

1. Regeneration harvest (HSH), 32 acres, leaving an overstory in a shelterwood density.
2. Salvage (HSV) or (HSL-SV) of lodgepole pine, 1149 acres, removal of excess dead from stands and/or selective removal of lodgepole understory.
3. Light thinning (HTH9M or S) would reduce the post-harvest basal area to about 90 percent of the upper management zone (UMZ) and maintain a multi-storied stand on 7509 acres or a single-storied stand on 613 acres. These treatments usually include precommercial thinning (PCT) to reach target basal area. The ponderosa pine plant association groups or mixed conifer dry plant association groups with ponderosa pine as the dominant species are targeted for single-storied stands.
4. Moderate thinning (HTH5) would reduce the basal area to within 50 percent to 80 percent of the UMZ and maintain a multi-storied stand on 226 acres and single-storied stand on 163 acres. These treatments usually include precommercial thinning to reach target basal area. The ponderosa pine plant association groups or mixed conifer dry plant association groups with ponderosa pine as the dominant species are targeted for single-storied stands.
5. Single-tree selection (HSL) in three lodgepole pine stands (272 acres), to promote development of larger trees with full crowns.
6. Precommercial thinning on 10,000 acres.

The intent of treatments was to "set the clock back" on the successional processes going on in the area. This was to be done by retaining most or all of the large trees while thinning out the later successional understory species and the lodgepole pine. The goal was to get the stands to 90 percent of upper management zone (UMZ) or less, as discussed in Cochran's paper (1992). The strategy was to have a commercial entry to generate funds that could at least partially offset the costs of thinning the noncommercial components of the stands. Generally speaking, in the mixed conifer stands, if precommercial thinning was not completed, the stands were not effectively

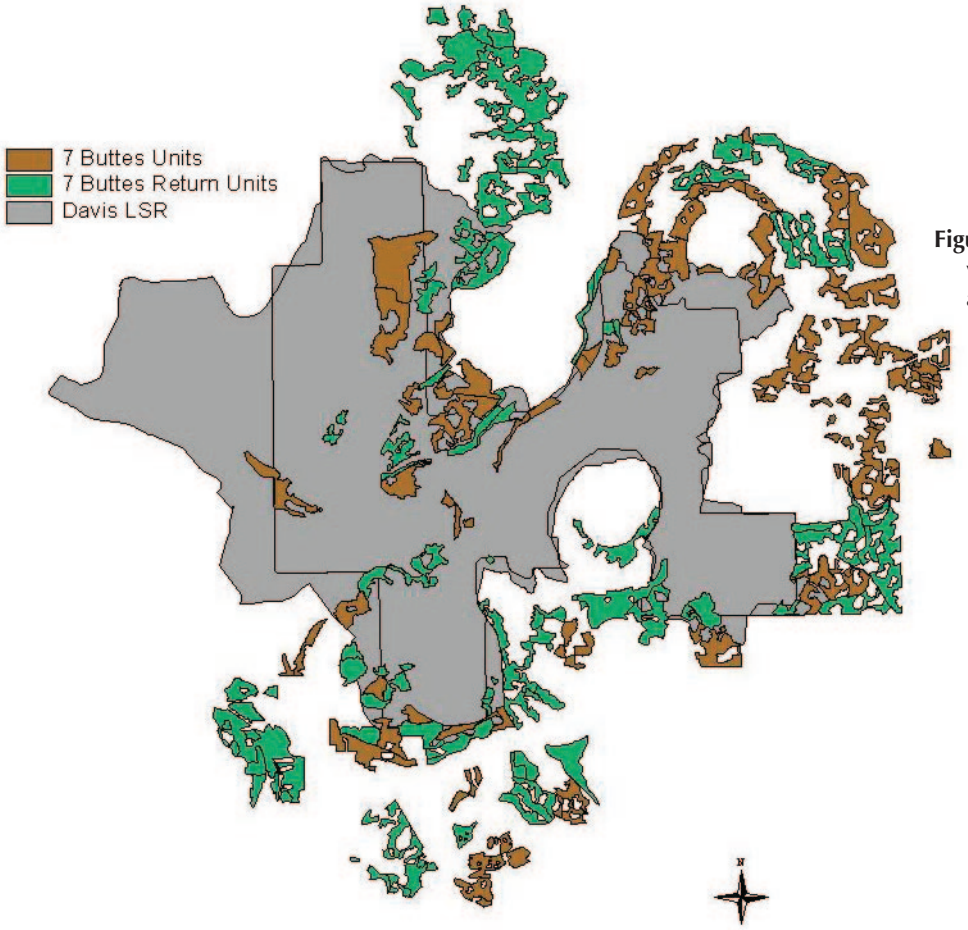

Figure 3—7 Buttes and 7 Buttes Return vegetative treatment units. The shaded area is the Davis LSR.

treated to the stated objectives of increased resistance to insects, disease, and fire and of large tree retention on the landscape.

Most of the stands proposed for treatment with timber sales were considered suitable as nesting, roosting, and foraging habitat, or NRF. Initial evaluations of NRF did not include trees less than 8 inches DBH as part of the habitat structure. However, as precommercial-thinning projects began to emerge, the importance of this component surfaced causing serious concern among biologists. Precommercial thinning to a level appropriate for long-term sustainability of the large tree components clearly removed the stands from NRF status. Any lesser treatment was not considered adequate to meet the long-term goals for the stands. This dilemma prompted field reviews and close coordination with USFWS in order to develop some possible treatment approaches that could allow both effective treatment and retention of NRF at acceptable levels on the landscape. The bottom line is that NRF is not a sustainable condition in these stands.

Nuts and Bolts

The silvicultural treatment objectives within the LSR are based on habitat conditions rather than the traditional production and yield. They include:

- Increase resistance to insects, disease, and wildfire stand replacement events.
- Maintain and/or enhance large tree retention and growth.
- Utilize down dead material in excess of that needed to meet wildlife guidelines.

Treatment specifics to meet these guidelines include reduction of density to below UMZ using basal area as a surrogate for leaf area estimations. Using stand examination information, the stand density index (SDI) was calculated

for each of the stands as outlined by Cochran (1992). The "allocations" of SDI varied between even-aged and uneven-aged stands and were averaged among 10-inch diameter classes for uneven-aged stands. In the even-aged stands, overstory replacement trees were allowed for by stratifying the stands to precommercial size, less than 21 inches and greater than 21 inches trees.

Marking instructions were simplified based on site visits by the silviculturist and interpretation of the SDI information. On many of the stands, both the silviculturist and the wildlife biologist worked with the marking crew to help them apply treatment objectives to their marking. The silviculturist completed random monitoring of the marking and the results were shared with the marking crew in a timely manner.

Harvest activity yielded an average of 6.3 CCF per acre (3.25 MBF per acre) from an average of 35 trees per acre removed from the mixed conifer stands. Most of the volume removed came from the true firs (79 percent) and lodgepole pine (10 percent), with incidental volume from ponderosa pine and Douglas-fir. An average one-third of the basal area per acre was removed and about 26 percent of the merchantable stems was removed. Most stands had from 1000 to 3000 sub-merchantable stems per acre. Precommercial thinning dropped those numbers to 190-270 stems per acre or less.

A variety of precommercial treatments were proposed to try to address the need to keep multi-storied stands. Guidelines developed for NRF habitat in the Davis LSR include 274 trees per acre (12.5-foot spacing) of seedlings, saplings, and small poles. This is a density that makes treating the fuels very difficult. Since these stands are historically fire associated, the goal is to re-introduce fire wherever it is appropriate, based on landscape arrangement of treatments and vegetative conditions. But fuel loadings are so high at present that an intermediate treatment is needed prior to use of prescribed fire. So most of the stands are machine or hand piled and the piles burned with this harvest entry. Then, with the next harvest entry, enough of the true fir and lodgepole pine will be removed that fire can successfully be reintroduced with underburning techniques.

Precommercially thinning to 274 trees per acre (TPA) as a guideline, then, was recognized as a serious concern and alternatives were sought to mitigate the problems. A variety of treatment alternatives were developed, recognizing each alternative would have a different effect on a given site, but would bring the desired conditions across the landscape. In summary, these treatments are:

Prescription 1—Maintain the existing specifications as stated (274 TPA) but use an average 13-foot spacing between leave trees with an average 260 TPA of seedling/sapling and pole size trees. This would leave the approximate numbers of trees but would still include many trees incapable of responding to release in some stands.

Prescription 2—Leave an average 260 TPA of the healthiest understory regardless of size or species and that are likely to respond to thinning. Spacing would not be a very significant factor with this entry, as long as at least 260 trees remained on site.

Prescription 3—Reduce the 274 TPA to approximately 190 TPA averaging 15-foot spacing to accommodate grapple piling machinery to treat slash accumulations, leaving the healthiest trees possible while meeting the spacing requirements.

Prescription 4—Leave portions of units unthinned and portions thinned with only healthy trees remaining and with a minimum spacing specified.

Prescription 5—Thin leaving only healthy trees that meet standards known to effectively respond to thinning with increased growth and vigor. This

differs from option 5 in that no unthinned portions of the units would be left.

A combination of these treatments were applied on two of the sale areas and reviewed by the ID team and US Fish and Wildlife Service personnel and the PAC (Provincial Advisory Committee). It was agreed that using a mix of these treatments across the landscape was probably the best way to mitigate the needs to maintain the desired conditions on the landscape. This would provide a mix of treated and untreated fuels in stands arranged in such a way that different conditions were scattered across the landscape with no single condition contiguous across a large area. This helps meet fuels objectives for suppressing wildfires and meets wildlife objectives of a diversity of structures across the landscape.

Sales successfully moved forward with the various treatments. A second analysis, 7 Buttes Return, was completed to treat additional stands at risk using the lessons learned from the original 7 Buttes. Once all sales and post sale work was completed, 18,000 acres or about 40 percent of the LSR would have fuels reduced, large trees with improved health, and replacements well on their way.

Epilogue

On June 28, 2003, a fire started in the LSR and quickly grew to about 1200 acres by nightfall. The next day, weather conditions were such that as the wind picked up, the fire grew to almost 20,000 acres in about four hours. This resulted in a stand replacement event on about 24 percent of the LSR. Fire conditions were such that the fire spread as a wind-driven plume-dominated event with a plume reaching over 20,000 feet high and spotting ½ to 1 mile ahead of the leading edge. The intensity of the fire was such that very severe fire whorls leveled much of the interior of the fire, burned overstory trees to the point that few or no limbs are evident, and totally consumed all dead material, standing and down.

Interestingly, some of the units that were treated were used successfully as burnout areas effectively stopping the fire. It is not clear, with the weather conditions being what they were, if the outcome would have been any different were more of the area treated as prescribed. In this case, the outcome probably would have been very similar, since all proposed treatment areas were located down wind from where the fire developed its head of steam. However, had the fuels been treated at the ignition source (a very large area of down dead lodgepole pine) the initial attack might have been effective and the large fire may not have happened. The lodgepole pine area at the ignition source was slated for fuels treatment sometime in the next two to three years.

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