August 4, 2017: A Plan for the Lolo Peak Fire

By Jane Kapler Smith. This report is summarized from the Incident Decision published on August 4, 2017, provided by LaWen Hollingsworth, USDA Forest Service, Rocky Mountain Research Station. The Decision documented the analysis of fire weather, topography, and fuels that was used to develop plans for managing the fire from July 29 through mid-August.

Situation When the Fire Started

The Lolo Peak Fire started on July 15, 2017, at the southern end of the Lolo National Forest. The fire was started by lightning when a thunderstorm moved through the northern Rocky Mountains. There were 68 new fires in the Northern Rockies Geographic Area on that date, totaling 2,105 acres. Eight of these fires were on the Lolo National Forest. From Jan. 1 to July 15, 2017, there had already been 880 fires in this Geographic Area started by humans (29,414 acres) and 400 fires started by lightning (32,654 acres). The Lolo National Forest had already had 7 fires from Jan. 1 to July 15, which had burned 4,514 acres.¹

The Lolo Peak Fire originated between Lolo Peak and the South Fork of Lolo Creek at 6,600 ft elevation. The fire was on a west-facing slope dominated by subalpine firs, with many whitebark pine snags. The fire originated in the Selway-Bitterroot Wilderness, approximately 0.5 mile south of the wilderness.

¹ Information on regional situation provided by Faith Ann Heinsch, Rocky Mountain Research Station Fire Science Lab, March 7, 2018.
boundary. Lolo Peak is in the northern part of the Bitterroot Mountains, which is a steep, craggy range with many prominent rocky ridges.

**Weather Outlook for 1-2 weeks**

Both the 6-10 day and 8-14 day weather forecasts show a high probability of above normal temperatures over the fire area. The 6-10 day forecast shows below-normal precipitation. Chances of precipitation move back to normal (average) in the 8-14 day forecast.

**Critical Fire Weather Patterns**

In mid to late summer, movement of dense, cold, high-altitude air across the northwestern United States usually causes turbulent weather and dry thunderstorms in the northern Rocky Mountains. Analysis of data from the past 117 years shows that the first of these “dry cold fronts” is likely to arrive during the third week of August. Dry cold fronts can significantly affect fire growth. They cause increased rates of spread and mid- to long-range spotting. Outflow winds created by thunderstorms can spread spot fires in all directions.

**Fuels**

Fuel composition has strongly affected behavior of the Lolo Peak Fire to date. Most of the area is covered by these types of forest:

- From the valley floor up to approximately 5000’ elevation, ponderosa pine dominates the overstory. On north- and east-facing slopes in these forests, ponderosa pine stands are dense and contain many fir trees because no fires have occurred in the past 100 years. On south- and west-facing slopes, ponderosa pine stands are typically more open and have a grassy understory.
• From 5000-7500’ elevation, the forest is dominated by a mixture of conifer species. These stands have heavy loads of dead and down fuels, because many mature trees have been killed by pathogens. The species in these stands include lodgepole pine, subalpine fir, grand fir, Douglas-fir, and western larch. During the last two weeks of July, the fire was most active in this fuel type. During the nighttime hours, a “thermal belt” of warm air has tended to stay in place in this elevation band. Because of the thermal belt, the fire has shown slow but consistent growth through the nighttime, and fuels have stayed very dry rather than recovering some moisture from the higher humidity in cool nighttime air.

• Above 7500’ elevation, the forest is primarily dominated by subalpine firs of all ages and sizes, intermixed with whitebark pine snags. There are also extensive stands of alpine larch. Near the ridge tops, bands of forest are interspersed with bands of rock and meadow.

Fuels at all elevations are critically dry, as defined by local fire personnel. Thermal belts are likely to persist and continue to keep nighttime humidities low and fuels very dry.

Fire Behavior Expected in Fuel Types
In the low-elevation ponderosa pine forests, fire managers will use burnouts to create a buffer between the fire and control lines. They will use nighttime ignitions to keep fire intensities low. This will limit mortality of ponderosa pines in larger size classes (about 10 inches or more in diameter). Mortality of other conifer species will be greater than that of ponderosa pine.

In middle-elevation lodgepole pine forests, stand-replacing fire is likely because this species and associated firs have little resistance to heating and tend to grow in dense stands. Lodgepole pine stands already contain many large patches of dead trees killed by mountain pine beetles. On north-facing slopes where the forest is dominated by western larch, fire is expected to be less intense and less likely to burn continuously through crowns.

Forests at high elevations, comprised of subalpine firs and whitebark pine snags, are susceptible to the strong winds that flow along ridge tops. In many locations, a wide buffer of rock lies between the high-elevation forest and the ridge top, so surface fires are unlikely to spread.
across ridges. However, subalpine firs, once ignited, are likely to torch rapidly and shower thousands of firebrands downwind, igniting spot fires.

**Fire Weather and Topography**

The major factors that have influenced the fire’s growth to date have been:

- The atmosphere was quite dry during much of July and early August, and occasionally the atmosphere was also quite turbulent. This allowed for rapid fire growth and promoted long-range spotting even when there was little wind.
- Forests consist largely of old, decadent conifer stands that have not burned in more than a century. These stands are often dense, and fuel loads are heavy.
- Rapid fire runs have occurred in drainages that align with prevailing winds. This alignment increases fire’s rate of spread and may promote crown fire in some vegetation types.
- The fire has been most active between 5000’ and 7500’ elevation, where strong thermal belts prevent nighttime temperatures from cooling off and nighttime humidities from rising, so fuels do not recover moisture overnight.
Model runs indicate that these influences on fire growth will probably continue. Moistures of both live and dead fuels are critically low as we enter the month of August, which is the historical peak of the fire season in the northern Rocky Mountains.

Use of Fire Spread Probability Model
The Fire Spread Probability model (FSPro) is a long-term analysis tool that helps managers establish priorities for fire management. FSPro is based on analyses of historical climate data and weather forecasts for a specific area, current fire growth, and past experience – especially experience of large fire growth in the area. FSPro compiles a variety of scenarios and then models fire growth for thousands of possible combinations of conditions. Using FSPro, we identified the probability of specific fire spread patterns, and also the likelihood of rare events that could have important consequences, from July 29 to August 4, 2017.

The FSPro map below depicts possible growth of the Lolo Peak Fire from July 29 to August 4, 2017\(^2\), based on analysis of fire growth, weather, and previous experience in the northern Rocky Mountains.

\(^2\) The following assumptions and caveats were applied: The model runs did not include suppression actions. We used Highway 93 as a barrier to fire spread. We altered fuels based on results of on-the-ground measurements. We used the “Scott and Reinhardt” approach to modeling crown fire. We did not include extreme wind events, because this was done in separate analyses.
FSPro model results helped us identify criteria for days when the fire may grow rapidly. A combination of three or more of the following conditions sets the stage for a day of large fire growth:

1. Sunny skies (intense solar radiation)
2. Temperature > 85° F
3. Relative humidity < 20%
4. Very dry and sometimes turbulent atmosphere
5. Wind speeds > 10 mph (measured 20 ft above the ground)

Conclusions

Fuels are extremely dry for the last week in July; such dry burning conditions usually don’t occur until late August. Model results suggest a high probability that the fire will become established in the Lolo Creek drainage and move to the east and northeast towards developed areas along Highway 12 and the town of Lolo. Once the fire is established in the Lolo Creek drainage, alignment of the drainage with the prevailing westerly winds will tend to increase rates of spread and push the fire eastward more rapidly. Additional spread to the south (further into the Selway-Bitterroot Wilderness) and west is also likely.

As of this time, the fire has not become established east of the Bitterroot Divide. Discontinuous fuels along the crest of the Bitterroot Mountains may prevent this. However, the high-elevation forests have abundant subalpine fir trees, which produce massive quantities of firebrands when they ignite. A significant wind event or outflows from thunderstorms could cause the fire to crown in subalpine fir forest, then spot over the Divide and become established on the eastern side of the Bitterroot range, in the main Bitterroot River drainage and the Highway 93 corridor.