

Mountain Pine Beetle-Induced Changes in Lodgepole Pine Fuel Complexes



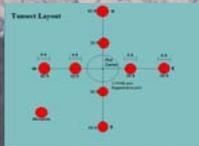
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1. Introduction

We measured the forest biomass of stands with endemic, epidemic, and post-epidemic mountain pine beetle (MPB) populations. We then compared the quantity and quality of fuels present within each beetle population phase and produced fuel models that were customized to the actual set of fuel conditions created by the activity of MPBs over the course of an epidemic. With these custom fuel models and average worst case fire weather estimates we predicted potential fire behavior (rate of spread, flame length, intensity and potential for crowning) using the Rothermel (1983) fire spread model and BEHAVEplus.



Planar transect layout for each plot



Endemic



Epidemic



Post-epidemic

2. Fuels Results

Epidemic vs. Endemic Stands

1. Dead and down, woody, fine fuel loadings (litter and 1 hour fuels) were significantly greater in current epidemic stands.
2. The only significant differences detected for the aerial fuels were the amounts of dead foliage in the overstories.

Post-Epidemic vs. Endemic Stands

1. Greater than 80% MPB produced significant increases in dead and down woody fuels in all but the smallest size classes. The largest increase occurred in the 1000 hour sound fuels.
2. Small fuels decay over time and return to background levels after about 20 years.
3. Post-epidemic stands had significantly lower available canopy fuels, crown base heights, and crown bulk densities.
4. The live shrubs, total live understory fuels, and subalpine fir regeneration were also significantly greater in the post-epidemic stands.

3. Fire Behavior Results

1. The post-epidemic stands had increased rates of surface fire spread, fireline intensity, and total heat release
2. The post-epidemic stands also had increased chances for crown fire initiation but decreased chances for active crown fire spread
3. The current epidemic stands for both areas had increased rates of spread and fireline intensities than the endemic stands
4. Chances for crown fire initiation were also greater due to large amounts of dead aerial fuels in the overstory

4. Conclusions

MPB mortality can alter fuels and fire behavior lodgepole pine forests. Increased rates of surface fire spread, fireline intensities, and crown fire potential were all detected in both the current and post-epidemic stands. However, the potential for active crown fire spread (from tree to tree) was lower in the post-epidemic stands. These results need to be evaluated in the context of larger scale processes, including the spatial pattern of fuels across large landscapes and the role that these changes have in the development and maintenance of lodgepole pine forests. While fire behavior may be altered by the MPB it may not necessarily be out of its natural historical range.

5. FHM Applications and Technology Development

We are currently developing photo guides (below) for appraising MPB affected fuels in lodgepole pine stands. Forest Health Monitoring can use this information and technology to better assess fuel characteristics in affected stands. Fire and fuels managers can use this information to design methods to adequately evaluate fuel loads at scales relevant to fire ignition and initial spread and to aid in wildland fire planning and prescribed fire operations.



FUEL MODEL: 112, 113				FIRE POTENTIAL	
DOWN & DEAD FUEL LOADINGS				RATING	
Site Class (Default)	Fire	Height	Area base depth	LAFCI	Fire Potential
0-20	0.89	1.00	1.00	1.00	1.00
0-20	0.89	0.89	1.00	1.00	1.00
1-3	0.75	0.75	1.00	1.00	1.00
Subtotal 0-3	0.40	0.40	1.00	1.00	1.00
0-4	0.40	0.40	1.00	1.00	1.00
0-10	0.40	0.40	1.00	1.00	1.00
10-20	0.40	0.40	1.00	1.00	1.00
20+	0.40	0.40	1.00	1.00	1.00
Subtotal 0+	0.40	0.40	1.00	1.00	1.00
TOTAL	1.62	1.62	1.00	1.00	1.00

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