ABSTRACT

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Can we manage a future with more fire? Effects of defensible space and spatial configuration on local and landscape-level fire severity

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Background/Question/Methods

Defined as the area where structures meet or intermingle with undeveloped wildland vegetation, the rapidly growing Wildland Urban Interface (WUI) comprises 10% of the land and one third of the population of the conterminous United States. Fire probability is expected to increase substantially in nearly 40% of existing western US WUI in the next 20 years. Spatial arrangement of structures and defensible space both affect probabilities of structure loss, but it is unclear how relationships might change under future climates and fire activity. Fuels management reduces fire intensity, which can decrease firebrand production and likelihood of structure ignition from radiant heat. For a forested landscape (1,600 ha) in the Northern Rocky Mountains, we used a scenario-based approach with different management configurations to ask, *(1) how does the effectiveness of management in reducing fire severity (a proxy for fire intensity) compare under future versus historical climate and fire conditions and (2) how does management affect landscape patterns of fire severity?* We simulated three combinations of fuels management and spatial configuration of structures (no management and either dispersed or clumped management) under historical (1990-2009) and future (2050-2069) climate. We assessed how scenarios altered local and landscape-level fire severity.

Results/Conclusions

The number of fires more than doubled and area burned increased thirteen-fold in future (mean 0.277 fires yr^{-1} and 13.483 ha burned yr^{-1}) versus historical climate (mean 0.117 fires yr^{-1} and 0.983 ha burned yr^{-1}). Areas that were managed also burned more frequently under future versus historical climate (0.915 ha yr^{-1} versus 0.085 ha yr^{-1}, respectively) but burned at lower severity than unmanaged hectares across all scenarios (70.45 ± 1.46% crown kill in managed versus 98.77 ± 0.08% crown kill in unmanaged ha). Effects of management on local fire severity did not differ between historical and future climates or between spatial arrangement scenarios. However, the arrangement of management did alter landscape-level fire severity compared to no management, with effects varying between future and historical climate periods. Variance in landscape-level fire severity increased in future compared to historical climates, likely due to larger fire sizes. Management decreased the range at which fire severity was spatially autocorrelated compared to no management (by ~400 m) in future, but not historical, climate. Our results suggest defensible space management may play an increasingly important role in

altering local and landscape-level fire severity and structure loss as fire activity increases in western subalpine WUI.