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M8 Using Terrestrial LiDAR to Model Shrub Fuel Beds for Fire Behavior Simulation

Presenter: Adams, Theodore
Additional Author(s): Seielstad, Carl, Fire and Fuels Program Manager / Associate Professor, University of Montana-Fire Center

Terrestrial LiDAR provides a basis for accurate, replicable fuel inputs to a variety of 3-D fire models. At present, this application of technology has not yet been demonstrated, and the state of science for fuel models remains semi-statistical distributions of fuel elements within simple volumes such as cubes and spheres. In diffuse-form shrubs such as chamise and sagebrush, the absence of discrete fuel elements presents additional complications for fire modelers. The purpose of this study was to develop fuel matrices for chamise and sagebrush at very fine resolution for use in sub-grid fire behavior simulations. T-LiDAR was used to characterize the spatial distribution of biomass in laboratory fuel beds before and after combustion. T-LiDAR's ability to characterize physical traits of shrubs within volumes was tested and issues associated with misrepresenting the geometry of scanned samples were identified. Occlusion of biomass in fuel bed interiors remains a shortcoming of the technique that requires generalization of at least part of the fuel bed. Despite the limitations of T-LiDAR in this setting, the findings of the study show that the technology can be used to estimate volume, structure, and biomass for individual shrubs. Models relating filled volume to fuel mass (Adj. R2: 0.598, P-Value: 0.0012) and mass loss following combustion (Adj. R2: 0.7796, P-Value: <0.0001) show considerable improvements over current methods of fuels estimation and have potential for broader application in fire modeling. Keywords: T-LiDAR, 3D Fuels Models, Fire Behavior Input