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Ecohydrology: Disturbance and the intersection of vegetation pattern and landscape structure

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Watershed ecohydrology is a function of the intersection of vegetation pattern and landscape structure. The hydrologic implications of vegetation disturbance depend on the spatial extent and pattern of change on this ecohydrologic template. Here we investigate this intersection with a focus on a recent mountain pine beetle (Dendroctonus ponderosae) epidemic that is increasingly affecting areas in the Rocky Mountains. Our research area was the Tenderfoot Creek Experimental Forest (TCEF), Montana, USA. We calibrated QuickBird remote sensing imagery with leaf level measures by developing a spectral library for TCEF vegetation. The spectral library was used to determine which vegetation indices were optimal for differentiating between stages of infestation; thereby maximizing the information obtained from the QuickBird image. These indices were applied to the QuickBird imagery to establish baseline mortality, and the extent and magnitude of infestation across the watershed. In addition, we calculated LiDAR based topography and vegetation structure indices for joint topographic, vegetation, and disturbance analyses. We seek to determine which forest stands are most susceptible to beetle infestation, and how these infestation patterns are related to hydrologic, topographic, and forest ecosystem compositional characteristics. Our efforts to monitor vegetation mortality across space and time provide a context for assessing the drivers of mountain pine beetle infestation and how outbreak patterns may affect watershed ecohydrology via energy, water, and biogeochemical cycles.