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Effect of wildfire on stemflow velocity of pine

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Stemflow, as one of the most important elements of forest precipitation redistribution, affects the delivery and spatial distribution of water and nutrient. Although approximately 4% of forests are affected by wildfire worldwide, no study has measured stemflow velocity after forests are affected by wildfire. The aim of this study is to determine (1) whether stemflow velocity changes after wildfire, (2) whether stemflow velocity changes with stem flow rate and height, (3) whether stem surface roughness affects stemflow velocity. In this study, we designed a device to quantify stemflow velocity. Our study revealed that the destructions of bark morphology and biological crust on the stem surface were the main factors affecting the change of stemflow velocity. The wildfire caused an enhanced stemflow velocity by roughly 30% for the burned pine compared to pine that did not affect by the wildfire. The stemflow velocity increased with stemflow rate following a power function. The width of pine bark had a negative linear relationship with stemflow velocity. With the increase in stemflow rate, the difference in stemflow velocity between burnt pine and unburnt pine was not significant. Stemflow velocity did not increase with the height of stemflow starting point increased, probably because increased stemflow energy caused the stemflow to detach from the stem. This study implies stemflow velocity affected the migration rate and spatial distribution of water and nutrient on stems and land surface around the base of tree. The increased stemflow energy is also likely to exacerbate soil erosion. All these can affect the restoration process of forest ecosystems from wildfire.