RELATIONSHIPS BETWEEN WILDLAND FIRES AND WATERSHED HYDROLOGY ACROSS THE CONTIGUOUS U.S.

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Wildland fires contribute to the natural succession in forested watersheds by stimulating growth and biodiversity. Notwithstanding, these fires present an increasing hazard at the wildland-urban interface, and cover large areas as a result of the high fire severity associated with forest densification. Fire severity and intensity determine to a large degree the total burnt area and loss of leaf area (LAI), however our knowledge of the impact on hydrology is far from complete. Loss of LAI and interception can increase runoff and sediment loads threefold or more, and is considered a first-order effect of fire. A study involving an Arizona ponderosa pine forest shows that infiltration rates decrease by up to 62 percent on a severely burnt soil, and may cause higher peak flow (e.g. 201-290 percent) and accelerated erosion as a result of reduced soil wettability. Simulations with the WaSSI water balance model suggest that a reduction of LAI by 50 percent can lead to a significant increase in water yield (e.g. >17-93 mm/yr, or 7-21 percent in wet regions with annual precipitation >800 mm and 3-32 mm/yr, or 10-20 percent in regions with 300-800 mm of precipitation). Forested watersheds are important sources of water supply, and stakeholders are becoming increasingly aware of the potential effects of wildland fire on these water supplies and the occurrence of flash floods causing severe damage to property and infrastructure. Nevertheless, there are many ways to mitigate excessive runoff due to fire, such as pre-fire management, Burned Area Emergency Response, and recent studies recommend a total ground cover of at least 60 percent with straw mulch, which reduces runoff and sediment yields during at least one year following a wildland fire, however the effect of combinations of fuel management at different scales (local, regional) remains uncertain. In this contribution we present an overview of the advances in scientific literature on the relationship between wildland fires and watershed hydrology across the contiguous United States, and aim to identify new avenues for research that can enhance the resilience of forest ecosystems and assist decision making with regard to prescribed fuel treatments. This research was supported in part by an appointment to the USFS. Research Participation Program administered by the ORISE through an interagency agreement between DOE and the USFS. All opinions expressed in this work are the author's and do not necessarily reflect the policies and views of USDA, DOE, or ORAU/ORISE.

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