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Predicting Peak Flows following Forest Fires

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Following forest fires, peak flows in perennial and ephemeral streams often increase by a factor of 10 or more. This increase in peak flow rate may overwhelm existing downstream structures, such as road culverts, causing serious damage to road fills at stream crossings. In order to predict peak flow rates following wildfires, we have applied two different tools. One is based on the U.S.D.A Natural Resource Conservation Service Curve Number Method (CN), and the other is by applying the Water Erosion Prediction Project (WEPP) to the watershed. In our presentation, we will describe the science behind the two methods, and present the main variables for each model. We will then provide an example of a comparison of the two methods to a fire-prone watershed upstream of the City of Flagstaff, Arizona, USA, where a fire spread model was applied for current fuel loads, and for likely fuel loads following a fuel reduction treatment. When applying the curve number method, determining the time to peak flow can be problematic for low severity fires because the runoff flow paths are both surface and through shallow lateral flow. The WEPP watershed version incorporates shallow lateral flow into stream channels. However, the version of the WEPP model that was used for this study did not have channel routing capabilities, but rather relied on regression relationships to estimate peak flows from individual hillslope polygon peak runoff rates. We found that the two methods gave similar results if applied correctly, with the WEPP predictions somewhat greater than the CN predictions. Later releases of the WEPP model have incorporated alternative methods for routing peak flows that need to be evaluated.