Post Wildfire Debris Flow and Flood Analysis of the September 2020 Badger Fire in the Trapper Creek and Rock Creek Watersheds, Idaho, USA.

Stephen Turnbull, Nawa Pradhan, and Ian Floyd

There are several different infiltration, overland flow routing, and channel routing schemes that can be used in conjunction with recommended hydrodynamic and infiltration parameter values, which are found within the literature, to provide critical flooding assessments for stakeholders and decision makers. We focus on post wildfire debris flow and flood analysis in two tributaries of the Snake River in Idaho, Trapper Creek and Rock Creek. The Badger Fire started on September 12, 2020 in the Sawtooth National Forest in Idaho, USA, and burned sub-alpine fir, lodgepole pine, juniper, mountain brush and grass communities, in the upper part of both the Trapper Creek and Rock Creek watersheds. Trapper Creek has a U.S. Geological Gaging station, and there are two snow gaging sites available. The biggest concern for flooding and debris flow is the result of a wintertime rain-on-snow event, which resulted in the largest storm in the gaging record period.

To estimate runoff in ungaged stream locations, existing process-based hydrodynamic models can be applied in a distributed form to solve the governing equations for mass, momentum and energy in a spatially explicit way. The purpose of this study is to predict potentially inundated land areas as a result of a rain-on-snow event, using the data in the gages basin to provide flood analysis information for both the gaged (Trapper Creek) and ungaged watershed (Rock Creek). Rain-on-snow events are rainfall events that occur on the snowpack and frozen ground, resulting in a larger magnitude and volume of streamflow. To predict these flows, Gridded Surface Subsurface Hydrologic Analysis (GSSHA) watershed models are prepared and calibrated to simulate rain-on-snow events in both watersheds. The runoff generated from a two dimensional overland flow grid is transferred over land with a finite volume numerical method into a one dimensional channel network. The channel network also uses a finite volume method. The consistency in the identified range of the parametric values and their physical applicability make GSSHA an ideal candidate for this study, as the model equations provide a methods to evaluate a rain-on-snow event.