MEETING

Fostering Post-Wildfire Research

AGU Chapman Conference on Synthesizing Empirical Results to Improve Predictions of Post-Wildfire Runoff and Erosion Response; Estes Park, Colorado, 25–31 August 2013

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Post-wildfire research is challenging because wildfires frequently burn in complex mountainous terrain, and responses are frequently driven by additionally complex mesoscale (on the order of 1 to 10,000 square kilometers), spatially and temporally variable rainfall. Thus, responses are highly variable spatially and transient in nature, producing shallow, unsteady overland flow on hillslopes (1 centimeter or less) and unsteady, non-uniform flow in channels.

Despite the vast amount of empirical data on post-wildfire hydrological and erosional responses, post-wildfire research has yet to be recognized as a scientific discipline. To help bring this field to maturity, a Chapman conference was organized to bring together researchers from different countries, representing a variety of scientific disciplines, who had not previously met as a group with sufficient time to synthesize the different hydrological and erosional post-wildfire responses reported worldwide.

In addition, meteorologists were invited to help address some of the persistent multidisciplinary research issues (J. A. Moody et al., *Earth-Science Reviews, 122,* 10–37, 2013). Some of the general issues include determining how to scale up results, identifying appropriate temporal and spatial rainfall metrics, quantitatively relating soil burn severity to parameters that govern rainwater infiltration into soil, identifying causes for increased post-wildfire runoff, and identifying how to measure and represent post-wildfire transient processes.

The conference was organized around five topic sessions: developing an organizational framework for the discipline as well as understanding post-wildfire meteorology, infiltration, runoff, and erosion. Highlights and new challenges emerged from discussion of each topic.

At the start of the conference, an organizational framework was proposed that grouped post-wildfire responses into similar domains based on characteristics of fire, precipitation, and geomorphic regimes. The purpose was to identify patterns and thus to understand the reasons for different post-wildfire responses. Some insights were that human activity and drought are becoming increasingly important in modifying fire regimes, and, thus, fire regimes are nonstationary, such that fire-return intervals based on historical records may not be representative of current and future conditions. Large wildfires and the planting of trees over large areas for commercial purposes were identified as causing major changes in vegetation composition in some landscapes, resulting in new fire regimes, but post-wildfire responses still depend on vegetation recovery characteristics.

Several new insights were presented during the meteorology and infiltration sessions. A new fire behavior model was demonstrated that couples for the first time the atmosphere with wildfire behavior in complex mountainous terrain. Such terrain can cause differential heating and instability, leading to intensified rainfall over burned areas. Runoff models were shown to be insensitive to available techniques of representing rainfall and to predict relative change (useful for land and emergency managers) better than absolute change. Intermittency and the temporal structure of rainfall were highlighted as important characteristics controlling post-wildfire runoff responses that need further research. The temporal sequence of rain may be important in runoff generation and may promote transient ash crust development (which can further increase runoff by temporarily impeding infiltration), whereas the lack of rain expressed as "landscape aridity" was found to correlate with the degree of channel erosion within burned areas.

The runoff and erosion sessions presented some new perspectives. "Breach" or "surge" hydrology was identified as a new challenge needed to improve prediction of post-wildfire floods as burned debris frequently forms temporary "dams" in channels and on hillslopes. These dams store water and, when breached, create a sudden surge with greater peak discharges than expected. Additionally, field measurements indicate that time to peak discharge is shorter for post-wildfire than pre-wildfire floods.

Breach hydrology was further highlighted by recent modeling of debris flows in channels with varying gradients. Landscape erosion was found in some circumstances to have a positive rather than negative relation with increasing spatial scale, possibly reflecting increased post-wildfire runoff connectivity. There was recognition of a lack of models to predict post-wildfire channel scour, bank erosion, and biological effects on sediment transport, all of which impact infrastructure and water quality. Snowmelt was identified as an additional driver of post-wildfire response in some regions. Finally, because of field complexity, meeting attendees agreed that physically based models are needed to isolate, investigate, and provide insight into the effects of single variables on runoff and erosion.

Several oral and poster presentations identified the need to create a set of widely applicable standard measurement methods for quantifying post-wildfire response (e.g., ash, pyrogenic carbon, soil hydraulic properties, erosion, and soil erodibility). Such standard methods will readily permit meaningful comparisons and insights into the causes of different responses. Implementing these standards and collaborating with the meteorologists will help advance post-wildfire research as a recognized scientific discipline.

The impact of this Chapman Conference on the post-wildfire responses community did not end with the closing remarks. Several working groups volunteered to formulate plans for resolving some of the important issues required to enable post-wildfire science to advance. Collected abstracts are available at http://chapman.agu.org/post-wildfire/.

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