Geophysical Research Abstracts
Vol. 15, EGU2013-14099, 2013
EGU General Assembly 2013

Rapid Response Tools and Datasets for Post-fire Erosion Modeling: Lessons Learned from the Rock House and High Park Fires

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Once the danger posed by an active wildfire has passed, land managers must rapidly assess the threat from post-fire runoff and erosion due to the loss of surface cover and fire-induced changes in soil properties. Increased runoff and sediment delivery are of great concern to both the pubic and resource managers. Post-fire assessments and proposals to mitigate these threats are typically undertaken by interdisciplinary Burned Area Emergency Response (BAER) teams. These teams are under very tight deadlines, so they often begin their analysis while the fire is still burning and typically must complete their plans within a couple of weeks. Many modeling tools and datasets have been developed over the years to assist BAER teams, but process-based, spatially explicit models are currently under-utilized relative to simpler, lumped models because they are more difficult to set up and require the preparation of spatially-explicit data layers such as digital elevation models, soils, and land cover. The difficulty of acquiring and utilizing these data layers in spatially-explicit models increases with increasing fire size.

Spatially-explicit post-fire erosion modeling was attempted for a small watershed in the 1270 km2 Rock House fire in Texas, but the erosion modeling work could not be completed in time. The biggest limitation was the time required to extract the spatially explicit soils data needed to run the preferred post-fire erosion model (GeoWEPP with Disturbed WEPP parameters). The solution is to have the spatial soil, land cover, and DEM data layers prepared ahead of time, and to have a clear methodology for the BAER teams to incorporate these layers in spatially-explicit modeling interfaces like GeoWEPP. After a fire occurs the data layers can quickly be clipped to the fire perimeter. The soil and land cover parameters can then be adjusted according to the burn severity map, which is one of the first products generated for the BAER teams.

Under a previous project for the U.S. Environmental Protection Agency this preparatory work was done for much of Colorado, and in June 2012 the High Park wildfire in north central Colorado burned over 340 km2. The data layers for the entire burn area were quickly assembled and the spatially explicit runoff and erosion modeling was completed in less than three days. The resulting predictions were then used by the BAER team to quantify downstream risks and delineate priority areas for different post-fire treatments. These two contrasting case studies demonstrate the feasibility and the value of preparing datasets and modeling tools ahead of time. In recognition of this, the U.S. National Aeronautic and Space Administration has agreed to fund a pilot project to demonstrate the utility of acquiring and preparing the necessary data layers for fire-prone wildlands across the western U.S. A similar modeling and data acquisition approach could be followed