Geophysical Research Abstracts,
Vol. 11, EGU2009-12829-1, 2009
EGU General Assembly 2009

Can post-wildfire Burned Area Emergency Response treatments mitigate watershed degradation?

D. Neary (1), P. Ffolliott (2), S. Bautista (3), and L. Wittenberg (4)

(1) Rocky Mountain Research Station, Southwest Watershed Science Team, Flagstaff, Arizona, United States (dneary@fs.fed.us / FAX +01-928-556-2130), (2) University of Arizona, Tucson, Arizona, USA, (3) University of Alicante, Alicante, Spain, (4) University of Haifa, Haifa, Israel

Wildfire is a natural phenomenon that began with the development of terrestrial vegetation in a lightning-filled atmosphere 350 million years ago. As human populations developed in the Pleistocene and Holocene epochs, mankind transformed fire into one of its oldest tools. A negative impact of prime concern in the 21st Century is desertification. This term refers to land degradation, not the immediate creation of classical deserts. It is about the loss of the land's proper hydrologic function and biological productivity as a result of human activities and climate change. It affects 33% of the earth's surface and over a billion people. Fire-related desertification has a number of environmental, social, and economic consequences. The two key environmental consequences are soil erosion and exotic plant invasions. Wildfires typically have exotic plant species abundances ten times that of undisturbed forests (Neary et al. 2003). Seeding has been used for many years in the USA as a prime Burned Area Emergency Response (BAER) treatment. Until recently, this seeding contributed to exotic plant invasions since fast-growing, but non native plants seeds were used. The use of native plant seeds and sterile hybrids has reduced this problem somewhat. Erosion after wildfires documented in the USA can be in the range of <1 to 370 Mg/ha, depending on fire severity, degree of water repellency, slope, and post-fire rainfall events. Soil losses in the high end of that range definitely exceed soil loss tolerances and contribute to desertification. Soil disturbance and degradation after wildfires is a function of fire severity, and the impacts can range from the minimal to catastrophic and long-lasting. The most obvious impact is the loss of organic matter from combustion of the forest floor. Changes in soil physical and chemical properties with high-severity wildfire can produce water repellency, aggravating rainfall runoff and erosion. Since soils take long times to form (50 to 75,000 years), degradation as a result of wildfire-related erosion or soil property changes can result in severe and rapid desertification. Soil degradation is a "one-way street" not easily reversed. Although trees can be replanted on burned sites, soil lost in erosion is rarely replaced, just rehabilitated. There are techniques to rehabilitate these degraded soils but they are quite expensive. Disruptions to soil micro-fauna and micro-flora can also reduce post-fire site vegetation productivity. An environmental consequence of wildfire related to soil disturbance, is the loss of hydrologic function. Again, the level of hydrologic function loss is related to fire severity. Although this ecosystem function tends to recover within 5 – 10 years after wildfire as vegetation cover returns, the immediate impacts can be considerable. The removal of the protective layer of the forest floor by combustion, and the development of water repellent layers in the soil combine to aggrevate flood potentials. Flood peak flows after wildfires with high percentages of high severity wildfire (>30%) commonly have increases of 10-fold. Higher increases (20 to 2,000 fold) have been measured as the percentage of high-severity soil damage approaches 100%. The other side of high flood runoff is the reduction in baseflow that sustains stream flow due to the reduction in rainfall infiltration. This has water supply implications for forested watersheds that are sources for municipal water supplies. In addition, post-wildfire ash slurry flows can substantially degrade the quality of municipal water sources. Although this phenomenon is relatively short lived (<2 years), it can have serious supply impacts. This paper examines the capabilities of BAER treatments in dealing with this problem.