



Clean Water: Insect Outbreaks and Watersheds

Research

Technology Transfer

Science Application

Challenge

Mountain pine bark beetle outbreaks are causing rapid, unprecedented change in the headwater forests of Western North America. Infestation and mortality currently threaten more than 80% of the basal area of many lodgepole pine-dominated stands across the West. In Colorado, bark beetle mortality now exceeds 1.5 million acres and the outbreak is projected to ravage 85 to 90% of the mature lodgepole ecosystems in Colorado and Wyoming within the next five years. The consequences of this extensive canopy disturbance and subsequent management activities will characterize western watersheds and forest landscapes for decades to come.



Pine Bark Beetle Outbreak in the Fool Creek watershed at the Fraser Experimental Forest .

Little is currently known about how catastrophic bark beetle outbreak will alter physical and biological processes regulating clean water delivery from Rocky Mountain watersheds, but RMRS researchers working at the Fraser Experimental Forest and other study areas in Colorado and Wyoming are uniquely positioned to address critical research needs. RMRS researchers rely on Fraser's long-term climate, streamflow, vegetation and biogeochemical data records and process-level studies to detect and quantify changes resulting from extensive canopy mortality. This period of rapid change provides unique opportunities to couple assessment of forest management practices with evaluation of resulting changes in watershed

Strategic Questions

- What controls the magnitude and timing of changes in clean water delivery after beetle outbreaks?
- How will post-outbreak salvage operations and post-harvesting treatments influence forest regeneration, site productivity, water quality, streamflow and other watershed resources?



Air, Water &
Aquatic
Environments
Science
Program

Insect Outbreaks and Watersheds

AWAE Research Activities

RMRS's research addresses questions about changing watershed processes and ecosystem conditions following bark beetle outbreaks and subsequent management activities. In 2007, RMRS researchers working at the Fraser Experimental Forest combined support from the USFS Chief's Emergency Fund, funds from NFS partners and municipal water providers to initiate multiple studies aimed at quantifying and evaluating:

- 1) impacts of beetle-related tree mortality on the supply of clean water and the processes that regulate its delivery,
- 2) influence of salvage operations on nutrient, carbon, sediment and large wood retention within riparian buffers and validate the effectiveness of this watershed best management practice for protecting water quality and aquatic resources;
- 3) how mechanical fuel reduction treatments and post-harvest site preparation impact seedling establishment and growth, plant nutrient and moisture relations, and biogeochemical and hydrologic processes; and
- 4) impacts of forest road construction and retirement on hill slope hydrology and nutrient and sediment fluxes.

These new studies link tree, hill slope and basin scale processes and will generate information about snow accumulation, stream flow and water quality, forest water use and carbon storage, soil productivity, riparian and wetland species composition, and wood and stream channel dynamics in salvage logged and untreated areas infested by bark beetle.

