Workshop fills knowledge gap on

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Watershed managers require information describing the potential impacts of wildfire and post-fire land management (e.g., salvage logging) on a range of watershed values, including water quantity, water quality, and aquatic ecology. As a result, FORREX and the Forest Investment Account–Forest Science Program organized and hosted a "Wildfire and Watershed Hydrology Workshop," which was attended by more than 100 people representing industry, academia, consulting, non-government organizations, First Nations, and municipal, provincial and federal governments.

Kevin Bladon photo

Increased snow accumulation in a burned stand following the Lost Creek wildfire.

Following the 2003 wildfire season, which was one of the most catastrophic in recorded history for British Columbia, Alberta, and the western US, numerous research projects were initiated to address many important questions in this field. The broad intent of this workshop was to highlight the preliminary and final results of ongoing and recently completed research projects that are focused on the hydrologic and geomorphic effects of wildfire. The workshop's specific objectives were to:

- increase awareness and knowledge of the potential effects of wildfire and post-fire land management (e.g., salvage logging, post-fire rehabilitation) on a range of water values;
- provide feedback to researchers that may help refine research plans and interpretation of results; and
- provide opportunities for networking and developing collaborations to help address the increased challenges associated with wildfire and watershed hydrology.

The workshop opened with a talk by **Steve Taylor** (Canadian Forest Service) on the future wildfire risk under a changing climate in British Columbia, the rest of Canada, and globally. He showed that the occurrence and severity of wildfire is a function of many natural factors, including fuel availability, temperature, humidity, precipitation, wind, lightning strikes, and anthropogenic factors. Climate change can affect most of these natural factors, and therefore, influence the wildfire season across a range of temporal and spatial scales. Thus, in some regions, such as the Southern Interior of BC, there are projections for increased wildfire frequency, severity, and area burned in the coming decades. This opening talk provided the context for the remaining discussions about the implications of wildfire on a range of water values.

The technical presentations on the first day of the workshop provided results from wildfire research in BC, Alberta, and Australia, and highlighted the state of the knowledge on many topics and identified gaps in our understanding of the potential effects of wildfire and post-fire salvage harvesting on aquatic systems. Central themes from the technical sessions included:

- Snow accumulation amounts and ablation rates may increase, but with high inter-annual variability, following natural disturbances that result in the loss of forest cover.
- Peak flow responses to wildfire are likely to be watershed specific. The magnitude of peak flows may be increased or decreased (due to desynchronization of melt across the watershed), while the onset of the melt period and the timing of peak flow may occur up to 2–3 weeks earlier in burned watersheds.
- Post-disturbance reductions in stream bank strength can have important implications for channel morphology (e.g., channel widening); however, responses are likely to be complex, involving lags and multiple time scales.
- Soil erosion and debris flow risk is often, but not always, increased after wildfire. Increased risk has been linked to the potential for high-intensity rainstorms or rapid snowmelt on water-repellent soils, as well as the legacy of forest operations (e.g., roads, landings, and skid trails).
- The volume of in-stream wood loading may increase after wildfire, with important long-term implications for channel morphology and the creation of aquatic habitat.
- A well-co-ordinated, rapid assessment of the risk of post-fire erosion, as exemplified by the US Burned Area Emergency Response (BAER) teams in Australia, can provide land managers

wildfire and watershed hydrology

with the knowledge necessary to understand the risks to water resources and infrastructure and evaluate treatment options.

The second day of the workshop was highlighted by presentations on post-fire treatment options, ecohydrologic effects of wildfire, and the potential downstream implications. Key findings from the presentations included:

- The use of mulching treatments (e.g., wood chips and straw mulch) can be effective in reducing the risk of erosion and sediment production from burned hillslopes, but timing of application and consideration of mulch quality (e.g., minimize potential for weed seeds) are critical to success.
- Water-repellent soils do not appear to have an effect on forest tree regeneration.
- There may be numerous changes in water quality, with variable rates of recovery, following wildfire. Potential effects include increased turbidity, nutrients (e.g., nitrogen and phosphorus), dissolved organic carbon, heavy metals (e.g., mercury), and temperature. All of these parameters can be negatively influenced by salvage harvesting activities.
- Even small changes in water quality can have significant impacts on aquatic ecology, resulting in greater algal production, increased aquatic invertebrate abundance, and shifts in invertebrate community structure.
- Wildfire-related changes in water quality present several public health protection challenges for water purveyors and can potentially increase the risks for drinking water treatment. Thus, when compared to increased treatment levels, appropriate protection of source waters is often a more effective and less expensive option to ensure high-quality drinking water.

The culmination of the workshop was a panel discussion, during which five professionals engaged the audience in a discussion on where and when to salvage harvest or use other land management options (e.g., do nothing). The primary topics of this discussion included the following:

- Despite much recent work, there is still uncertainty about the effects of various natural disturbances (e.g., wildfire and mountain pine beetle) and the potential incremental effects of salvage harvesting on a range of water values.
- However, it was agreed that salvage logging can potentially increase watershed risks. These risks need to be considered and weighed against various watershed values when making any post-disturbance land management decisions.
- The current economics and jurisdictional authority of the forest industry are challenging and, in most cases, prohibitive to the use of many other post-disturbance management options (e.g., mulching treatments).
- From the perspective of the water purveyors, there needs to be a greater consideration for the potential incremental challenges for water treatment that may be created by post-disturbance land management.

While most workshop participants agreed that the workshop was successful at increasing their knowledge of the potential hydrologic and geomorphic effects of wildfire and associated forest management activities, there are still many knowledge gaps in this field. The FORREX Watershed Management Extension Program plans to continue to work with its broad range of partners to address these knowledge gaps.

To download the workshop handbook, which includes the schedule, presentation abstracts, and participant list, please visit the FORREX website at ***www.forrex.org/program/water/wildfire_watershed_hydrology.asp***

Chris Williams photo

Increased spring peak flow and altered water quality following the Lost Creek wildfire.