Mid-term impact of mountain pine beetle on watershed hydrology

By David Maloney

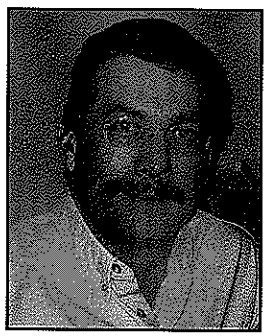
The mountain pine beetle infestation is expected to impact 80 per cent of British Columbia's mature pine forests by 2013.

In 2005 alone, there were approximately seven million hectares of red attack. In response to the outbreak, the chief forester increased the allowable annual cut (AAC) by 4.9 million cubic metres in the Quesnel, Lakes and Prince George timber supply areas, bringing the total AAC uplift to 12.7 million cubic metres. The Ministry of Forests, the Canadian Forest Service and other agencies are currently investigating how the die-off of mature pine and accelerated cut will impact watershed hydrology, aquatic resources and other resource values. These investigations will help develop our forest management strategies for tomorrow's forests.

A review of the hydrological cycle shows that the die-off will affect several hydrological processes. These include evapo-transpiration, groundwater storage, annual water yields, peak flows, soil water chemistry, surface erosion, streambed stability and streambank stability. Research during the late 1980s in a beetle infested watershed in BC's southern interior recorded increases in annual and monthly water yields, increased peak flows and peak flows that occurred earlier in the season. Increased water yields and earlier annual peak flows have also been reported for beetle infested watersheds in Colorado and Montana. From this we can deduce that water quality, fish habitat, streambank stability, channel stability and other aquatic resources are at risk.

With respect to hydrological recovery, it will take, on average, 30 years for pine to reach nine metres. A new forest is considered 90 per cent hydrologically recovered at nine metres plus. Conversely, a dead pine forest with no understorey regeneration will take upwards of 60 years to hydrologically recover. Forest roads and their associated features are a major sediment source that can influence watershed hydrology. There is also some literature that indicates increased water yields and peak flows are unlikely to produce adverse effects on water quality if roads and other ground disturbance are absent.

In 20 years, it is expected that harvesting in the AAC uplifted areas will be winding down. Watersheds will have reached their maximum equivalent clearcut areas (ECAs)—possibly as high as 80 per cent—and highest road densities. It is at this point in time when watersheds will be most vulnerable to hydrologic impacts.



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What we don't know is how the disrupted hydrological processes combined with accelerated harvesting and extensive road construction will affect watershed hydrology.

Forest professionals must be aware that road construction, maintenance and density will play a pivotal role in how a watershed will respond to the mountain pine beetle infestation. It is recommended that roads be built and maintained with sediment and erosion control as a top priority.

Management strategies for road deactivation and seeding of exposed soil are also important. Techniques to mitigate road impacts are well known and have been outlined in past *Forum* viewpoints (articles by Willington and Carson on "Forest Management in Community Watersheds," March/April 2002).

With respect to harvesting, it is recommended that all non-pine leading stands and pine leading stands with an understorey of advanced regeneration be maintained. The retention of these sites will serve as a "hydrological pump" to return moisture back to the atmosphere, reduce ECAs and provide a future timber supply.

Summer harvesting of sites with high water tables near streams should also be avoided to minimize soil puddling, rutting and erosion. Where windthrow may be an issue, utilizing various riparian integrity protection techniques such as feathering or topping should be considered.

With respect to silviculture, the forest manager should consider a number of options to deal with a higher water table. Those include planting a mix of coniferous and deciduous species, mounding and other options.

The mountain pine beetle has made its presence felt in a big way throughout BC's interior. Watershed hydrology will respond accordingly to mature pine die-off; however, high quality forestry and engineering practices can ensure watersheds are well on their way to hydrological recovery in 30 to 40 years.

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