Large Woody Debris in Small Streams in Alberta’s Foothills

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Background

Logs in streams, commonly called large woody debris (LWD), provide channel structure and create step-pools, providing in-stream habitat and contributing to invertebrate and fish biodiversity. Our research of LWD focuses on headwater streams in the Foothills of Alberta. We are using tree-ring analyses to answer three research questions. What is the fate of LWD that is created by forest fires? How fast does post-fire LWD decay? How long does it reside in streams and contribute to steam habitat and biodiversity? To answer these questions, we are comparing the abundance and age of LWD in post-fire riparian forests of two different ages: <5 years (Dogrib fire near Sundre) and >100 years (Foothills Model Forest near Hinton) since last fire.

Study Locations

To date we have sampled LWD in 9 streams (4 streams > 100 years since disturbance and 5 streams < 5 years since disturbance) surrounded by black and white spruce forests in the Sundre area (Dogrib fire 2001) as well as in the Foothills Model Forest (FMF).

Field and Laboratory work

In each stream we surveyed all LWD along a 50-100 m transect. The species, size (length and diameter), position relative to the stream and stage of decay of each log were noted. Disks from every log within the stream reach and increment cores from 20 dominant trees in the surrounding riparian forest were collected for tree-ring analyses. The disks and cores were dried and sanded with successively finer sandpaper, to 600 grit, so that rings were clearly visible. Rings were measured and crossdated to determine the outermost ring date of each sample.
Analysis and Results

Compared to mature riparian forest plots, which had not experienced major disturbance in > 100 years, the amount of LWD present in recently disturbed (fire in 2001) riparian forests plots were not significantly different. The distribution of LWD in the mature forest plots was suggestive of chronic input (uniform input rate through time) although there is some evidence to suggest that stand developmental processes (self thinning and gap phase dynamics) may be causing some deviation from this chronic rate. The expected pulse of LWD, post-disturbance, accounted for ~34% of the total LWD abundance currently found in the recently disturbed streams. However, there was also a substantial amount of residual LWD from small, pre-fire disturbance events (Figure 1). Furthermore, it is expected that standing dead trees will continue to contribute LWD to streams over the next several decades as they periodically fall across streams and integrate into the banks and the streambeds (Figure 2, right).

Figure 1. Relative age/frequency distribution of LWD within small streams from mature forest (left) and burned forest plots (right).
The residence time of LWD in streams reached a maximum of 143 years in the mature forest plots which was similar to the residence time (132 years) of the recently burned plots. We also observed that dead trees took, on average, 60 years to decompose to the point where the LWD began to integrate into the stream banks and stream beds. It is important to note that the post-fire cohort of LWD had not decomposed to the point where they were contributing to stream function through the integration into stream sediments.

Further research directed towards a better understanding of the temporal aspects of tree death and fall as well as the processes by which logs integrate into the stream bed will begin in the summer of 2007. By sampling across a chronosequence of riparian forests that originated after fires about 25, 50 and 75 years ago, we aim to track post-disturbance cohorts of dead wood to document decay processes and more accurately predict how the function of LWD changes through time.

Figure 2. Typical small stream LWD distribution in mature (left) and recently burned (right) riparian areas.

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