foothills MODEL FOREST
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FMF Fish and Watershed Program Quicknote #2

October 2003 **By: Richard McCleary**

Sources of Instream Sediment - Observations from the Dogrib Fire

Identifying instream sediment sources was one component of our research aimed at increasing understanding of riparian ecosystems in Alberta's foothills. Given the importance of water quality and aquatic habitat, locating instream sediment sources and determining their relative magnitude are important watershed management activities. Although many of our best management forest practices have focused on reducing hillslope generated sediment inputs, instream sediment can originate either from hillslopes or within riparian areas.

Hillslope sediments can enter a stream as a result of surface erosion or mass wasting. Surface erosion from individual raindrops can initiate sheet erosion, which can develop into rills and then gullies. A gully that terminates in a stream channel would indicate a major instream sediment source. Mass wasting events of concern include rotational slumps and landslides that terminate in stream channels.

Riparian sources include previously deposited fluvial sediments stored within the floodplain, streambanks and channel bed. Recent studies have identified riparian sediment sources as the dominant source of instream sediment in Canada's glaciated landscapes.

Live vegetation plays an important role in moderating the processes of hillslope erosion, mass-wasting and streambank erosion. The widespread mortality of overstory and understory vegetation resulting from the Dogrib fire provided an ideal opportunity to observe the relative importance of hillslope versus riparian erosional processes. In order of importance, the sediment sources observed during fieldwork included:

1. Erosion of bed and banks of steep intermittent stream channels (Figure 1);
2. Local areas where very steep terrain drained directly into a stream channel (Figure 2);
3. Areas where steep intermittent or small permanent streams flowed through naturally unstable terrain (Figure 3); and
4. Although not naturally occurring, road related sediment sources were also identified including erosion of re-contoured slopes at road crossings over steep intermittent and steep small permanent streams (Figure 4).

In conclusion, riparian areas were the dominant sediment source observed. Based on our observations, there are a number of adaptive management and research opportunities for consideration in future post-fire research and timber salvage planning:

1. To promote the storage of sediment within the actively eroding steep intermittent stream channels, increasing retention and minimizing harvest-related disturbance along these watercourses could be considered. Channel structure of the steep intermittent streams can include steps and pools associated with large woody debris. Considerable sediment storage was observed within these steps and maintaining them may be an important part of maximizing sediment storage within these steep channels.
2. Steep slopes that are not separated from stream channels by a well-developed riparian area with sediment filtering capacity should be avoided.
3. Naturally unstable areas with any indication or history of slumping or other soil mass movements should be avoided. These areas are considered non-operational during normal forest harvest operations.
4. Erosion control measures, such as grass seeding, planting of shrubs along watercourses and retention of structural elements, such as large woody debris, could be included as standard practice during reclamation of roads and skid trails that cross small permanent and intermittent stream channels.

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Figure 1. Extensive streambank erosion and channel-bed scour in an intermittent stream. Loss of rooting strength of vegetation along intermittent channels and increased runoff may have contributed to erosion.

Figure 2. Steep non-vegetated hillslopes provided isolated sediment sources to stream channels. In all observed cases, soil movement was limited to sheet erosion and there was no evidence of rill or gully formation.

Figure 3. Extensive channel erosion occurred in steep intermittent and small permanent streams flowing through naturally unstable terrain, such as a slumping hillslopes in the Wildhorse Creek watershed.

Figure 4. A reclaimed road crossing at an intermittent stream with a gully terminating in an 80cm headcut. Although intermittent streams may be so small they are unmapped, post-fire runoff can be sufficient to scour the un-vegetated portion of reclaimed road crossings.