Abstract

A hazard classification scheme for identifying hydrogeomorphic hazards for forest management on fans was developed over the period 2000–2004 in west central British Columbia. The scheme involves predictive hazard models, aerial photographic features, site features, and management recommendations. The scheme is based on sampling of 65 fans: 10 in a natural state and 55 with some degree of forest management on the fan (the associated watersheds did not have forestry activity). During 2003–2004 the predictive models were tested on 51 randomly selected fans in the Bulkley Timber Supply Area, and reconnaissance sampling in other areas of the province was undertaken to determine the applicability of the scheme. The objective during 2004–2005 was to undertake extension and produce publications for forest practitioners and the scientific community.

Introduction

A fan is a cone-shaped deposit of sediment formed where a stream emerges from the confines of a mountain (Bull 1977). Sediment originates in a source-area watershed and is transported to a fan by hydrogeomorphic processes (floods, debris floods and debris flows [Hungr et al 2001]). In some cases, the deposition of sediment is linked to paraglacial episodes unrelated to modern conditions (Ryder 1971a, 1971b; Church and Ryder 1972; Ritter et al. 1993). In other situations, it is apparent that fans are actively growing (Beaty 1970). In mountainous terrain, it is not uncommon for contemporary hydrogeomorphic processes (Innes 1985; Jakob and Jordan 2001) to be actively influencing at least a portion of the fan surface. We have proposed that this zone of activity, which is characteristically, but not always, limited to the stream channel area, be referred to as the hydrogeomorphic riparian zone (Wilford et al. 2005c).

Hydrogeomorphic hazards on fans have been described (VanDine 1985; Kellerhals and Church 1990) and studies of specific fans have led to hazard zonation (Thurber Consultants 1983). However, these hazards are not commonly identified during forest management. The result is that forest management activities commonly aggravate natural hydrogeomorphic processes leading to increased erosion and destabilization of fan surfaces and stream channels (Wilford et al. 2003). To address this situation, a hazard classification scheme for forest management on fans was developed (Wilford 2003). This scheme is timely, since the Forest and Range Practices Act (FRPA) Regulations
came into effect in the spring of 2004, specifying that it was an offence to destabilized fans on the coast (Section 54), or impact fish habitat or soils in the interior (Sections 35 and 57).

The scheme was developed based on field sampling in west central British Columbia during the period 2000–2003 (Wilford 2003), and was tested during 2003–2004 with a random sample of 51 fans in the Bulkley Timber Supply Area (Final Technical Report for R04-020). The scheme is based on site and aerial photographic features, predictive models, and recommended forest management prescriptions (Wilford 2003). The scheme recognizes floods, debris floods, and debris flows (Hungr et al. 2001). The power of these hydrogeomorphic processes is based upon the ability of an event to clear a forest stand. High power events clear a forest stand while low power events spread sediment under a forest canopy. High power events have two classes: stand-level events clear a swath 20 m or wider (visible on aerial photographs), and site-level events clear a swath less than 20 m wide.

Reconnaissance sampling was undertaken in other areas of the province from 2002-2004. We found all aspects of the scheme were broadly applicable, with the exception of the predictive models. This led us to conclude that provincial-scale field training and field manuals for forest practitioners were appropriate (the focus of the current project).

**Progress of extension activities**

Four factors hindered participation in extension activities for the fan project in previous years: delays in implementing FRPA, restructuring of the Ministry of Forests (MOF), the lack of a published handbook with supporting peer-reviewed scientific articles, and a downturn in the forest industry.

FRPA regulations came into effect in the spring of 2004. While this did not lead to immediate increases in workshop attendance, there was a slowly growing recognition that conventional practices on fans are no longer appropriate—for legal, economic, and environmental reasons. Given the significant issues facing senior forest managers—softwood tariffs, general economic downturn, land claims—it was a challenge to gain their attention, and thus gain approval for their staff to attend workshops. However, progress was made in discussions with senior staff from the MOF, Council of Forest Industries, and the Coast Forest and Lumber Association (Group 2 of our target audience identified in our Extension Plan).

Restructuring of the MOF was based on the view that forest management would be the responsibility of forest licensees. This led to a change in the focus MOF staff to compliance, enforcement, and oversight work, and a shifting of staff to the newly created BC Timber Sales (BCTS). MOF staff were no longer “doers”. This change was significant for extension activities because historically at least 50% of the participants at field workshops were MOF staff. Participation of BCTS staff in extension activities was limited for two reasons: BCTS was in start-up mode with staff focused on the
organization rather than meeting production quotas, and most of the BCTS fieldwork was undertaken by consultants (BCTS staff are primarily contract administrators). Given the role of MOF District Managers in approving Forest Stewardship Plans, a necessary extension emphasis was to ensure they were aware of our research results.

A prime goal of 2004-05 was the production of a Land Management Handbook for forest management on fans. This was published as LMH 57 (Wilford et al. 2005b). The document presents the hazard classification scheme and general forest management prescriptions. To our knowledge, this is the first guide for forest management on fans. A second handbook (Wilford et al. 2005a) provides techniques for using trees to date geomorphic and hydrologic events. These techniques allow forest practitioners to determine the frequency of events—a key aspect of hazard identification.

A paper title “Fans with forests: contemporary hydrogeomorphic processes on fans with forests in west central British Columbia, Canada” was accepted for publication by the internationally respected Geological Society of London (Wilford et al. 2005c). A key aspect of this paper is the presentation of a case for the recognition of the hydrogeomorphic riparian zone—the first publication that introduces the concept. The quality of forest management activities within this zone has been shown to be critical—inappropriate prescriptions result in fan destabilization. A poster on the hydrogeomorphic riparian zone was accepted for presentation at the IUFRO Congress in Australia in August, 2005 (all costs associated with this presentation will be covered by non-FSP funding).

Presentations were delivered at two major conferences: the Joint Conference of IUFRO 3.06 Forest Operations under Mountainous Conditions and the 12th International Mtn. Logging Conf, Vancouver, June 14, 2004, and the Annual General Meeting of the Association of Professional Engineers and Geoscientists (APEG) of BC, Whistler, October 22, 2004. The focus of the IUFRO presentation was on improving the bottom-line, through improved recognition of hydrogeomorphic hazards on fans and the development of appropriate prescriptions. The APEG AGM provided an opportunity to update the Division of Engineers and Geoscientists in the Forest Sector with our 2003–2004 research results.

One-day office-field workshops were held in Salmon Arm and Chilliwack. The workshops familiarized participants with a range of methods and techniques to assist them identify hazards and develop appropriate forest management on fans. A very successful field workshop was held in Squamish, with 38 members of the Division of Engineers and Geoscientists in the Forest Sector exploring hydrogeomorphic hazards, dendroecology, and forest management prescriptions on two fans. Training sessions were advertised for Woss (1-day) and Smithers (3-day), but were cancelled due to low registration.
Conclusions

Publication of the two Land Management Handbooks was a major accomplishment in 2003-04. Opportunities were provided for forest practitioners to attend field workshops. Interaction with Group 2 of our target audience is anticipated to result in increased participation in field workshops in 2005-06. Continued publication of peer-reviewed articles is raising scientific awareness of forested fans.

Literature Cited