

THE ENVIRONMENTAL IMPLICATIONS  
OF AGGRADATION IN MAJOR BRAIDED RIVERS  
AT MOUNT RAINIER NATIONAL PARK, WASHINGTON

An Abstract of a Thesis  
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## ABSTRACT

The purpose of this study is to quantify the historic rate of river bed filling, and to the extent possible, evaluate the factors that control sedimentation in river channels at Mount Rainier National Park. Mount Rainier is the tallest and the most glaciated of the Cascade volcanoes, located in southwestern Washington State. Steep, glacially-fed braided rivers radiate outward from the volcano in all directions and transport materials varying from fine sediment to cobbles and large boulders. As the gradient in the channels decreases downstream, sediment is no longer entrained and accumulates in the river bed. Over time, the river bed surface increases in height, or aggrades. River aggradation was previously estimated at 0.5 to 1 ft (15 to 30 cm) per decade, but until now, there has been no measured, long term data on river filling.

Geologists at Mount Rainier surveyed cross sections in the summers of 1997 and 2005. We conducted additional surveying in 2006 to quantify the current rates of aggradation in the Nisqually and White Rivers, two major river channels that have the greatest potential to affect primary infrastructure in the park. These rates were also compared with data derived from historical topographic maps as well as longitudinal profiles of the Nisqually and White Rivers, measured in 1910.

Aggradation rates quantified in this study depend on gradient and are approximately 6 to 14 in (15 to 36 cm) per decade on the Nisqually River. This rate appears to be increasing based on longitudinal profiles and topographic map analysis. In areas that experienced debris flows, the aggradation rate averaged 5.7 ft (1.74 m) in a single event with some locations seeing increases greater than 14 ft (4.3 m).

In November 2006, Mount Rainier was ravaged by a severe storm that dropped almost 18 in of rain in 36 hours. Surveying found few, if any, places that saw erosion in the river channel from this event, an unexpected finding. In fact, in areas that had no debris flows, aggradation was measured ranging between 0.4 ft (12 cm) and depths greater than 5 ft (1.5 m). Tahoma Creek, near the main Park road, filled in and now the river channel is less than 5 ft (1.5 m) from the bottom of the bridge.

Aggradation is a serious management and safety concern for Mount Rainier National Park, as a great deal of Park infrastructure is located in valley bottoms near – or in – major river channels. Because of the effects of aggradation on braided rivers over time, river flooding, debris flows, and glacial outburst floods can cause overtopping of natural stream banks and levees built along the river which impact roads and buildings as well as Park visitors. These concerns are compounded with the prospect of increased sediment loads due to glacial retreat associated with climate change.