quickNotes
the information note of fRI Research

fRI Research
Informing Land & Resource Management

Erosion, Sediment Delivery, and Consequence from Roads in Foothills Watersheds in West-Central Alberta: A Case-Study in the Simonette| Part 1: Road Surfaces

Jared Fath and Axel Anderson

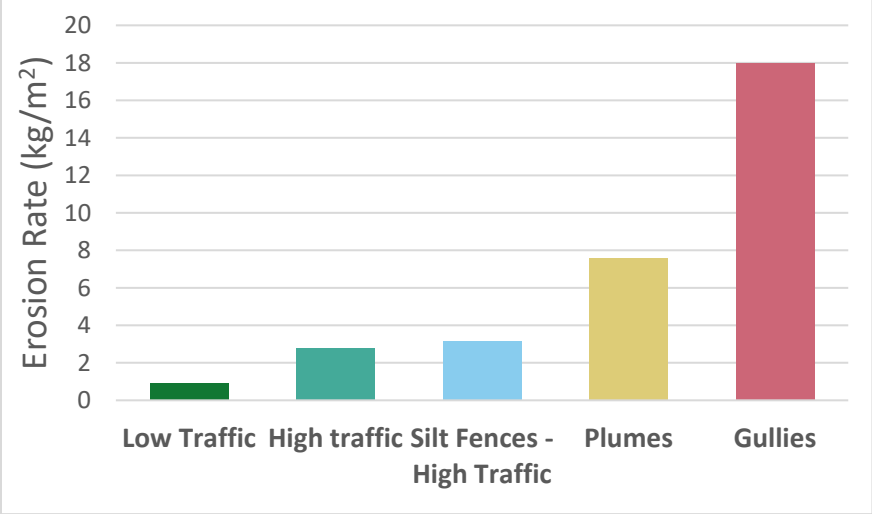
Past research on forest roads highlights the importance of managing erosion from the road surface in watershed planning. This erosion is problematic as it often makes up the majority of erosion from the road and right-of-way, and most of this erosion is fine-grained material. Fines that transport from the road surface and into bodies of water have negative impacts on aquatic life: they commonly infiltrate into interstices in the gravel matrix reducing water exchange through the streambed and reducing the flow of oxygenated water to fish young and streambed invertebrates.

This is part one of a four-part discussion on risk thresholds in the Simonette watershed, West-Central Alberta. In this part we discuss the relative magnitude of road erosion in the Simonette and how hydrology of the road surface can affect the rate of erosion.

Results

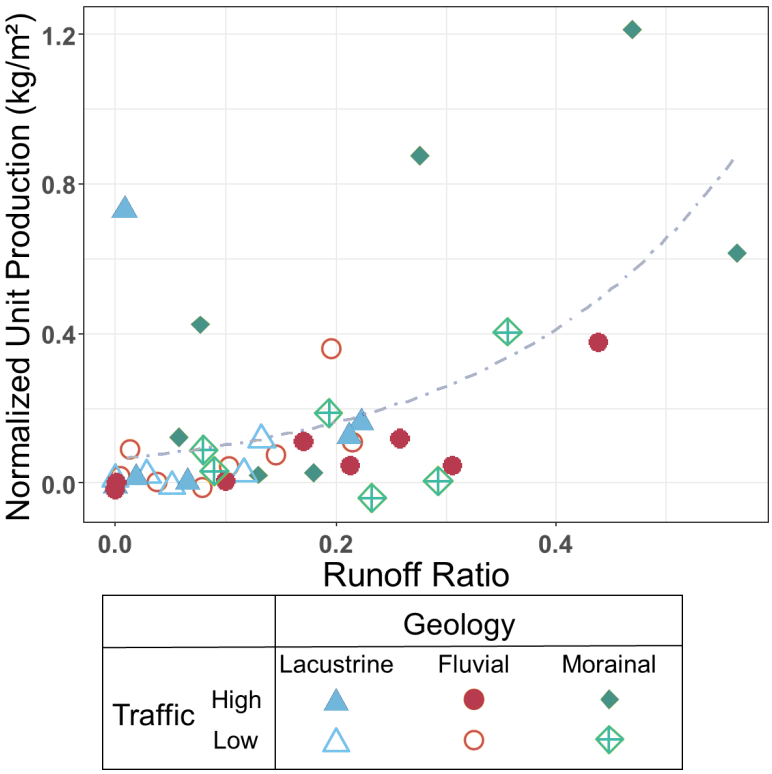
Road erosion was studied in detail using multiple modes of investigation including settling tanks with monitored flow outlets, silt fences, surveys of sediment discharges from the road surface and the size of gullies formed in the ditchline (covered in Part 2). Below we show the relative rates of road surface erosion measured using these four techniques. Erosion rates differ according to traffic level and measurement technique. Road surface erosion generates anywhere between 0.9 kg/m^2 to around 7.6 kg/m^2, and gullied road sections generate between two to four times as much sediment. The difference in erosion rates is driven by road surface hydrology and by thresholds for severe gullying.

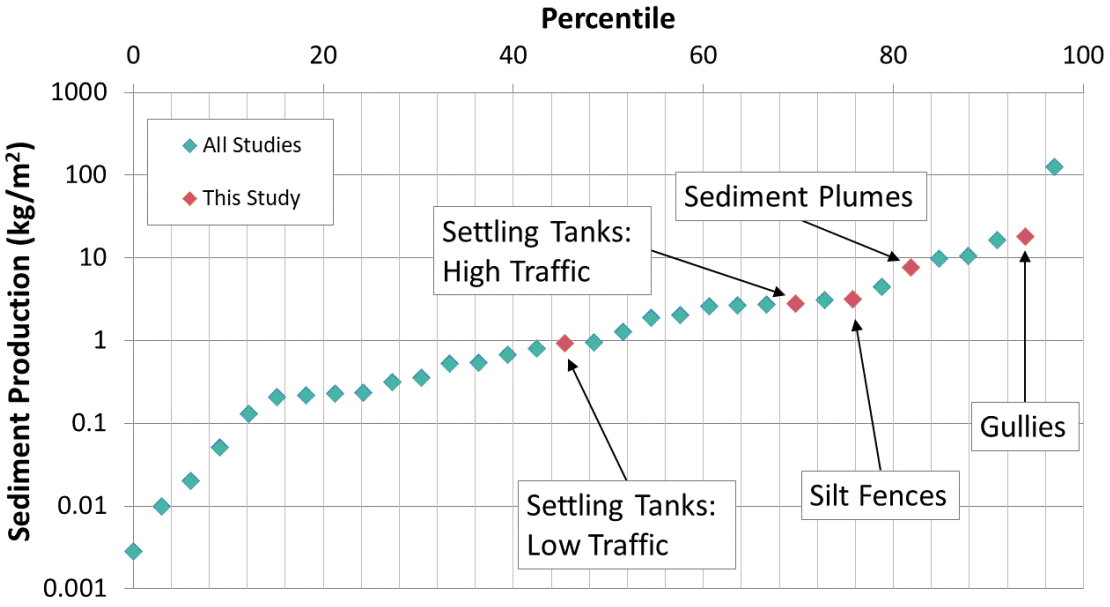
A graph of percent runoff versus sediment production normalized for plot geometric characteristics for settling tanks shows a general increase in unit production with runoff ratio. Runoff ratio is not consistent for each plot because the road surfaces have relatively consistent rates of infiltration, whereas natural storms in the Simonette have widely varying intensity and duration.



For more information on this or other Water Program publications, please contact: Axel Anderson.
Tel.: (780) 221–7050, Email: aeanders@ualberta.ca or visit wp.friresearch.ca

Two trends are worth noting: plots in morainal material tend to have higher runoff ratios, and plots in lacustrine material have lower runoff ratios. The low-traffic lacustrine plot is in a clean beach sand with very high infiltration capacity, whereas many fluvial plots have similar infiltration characteristics to morainal plots, probably because the fluvial layer is relatively thin and is removed during road-building, leaving compacted, relatively impermeable glacial material underneath. Regardless of the cause, the hydraulic characteristics of road segments are a significant driver of erosion. The combination of impermeable soils, foothills climate, and high traffic also makes roads in the Simonette among the most erodible in Western Canada and the United States.





For more information on this or other Water Program publications, please contact: Axel Anderson.
Tel.: (780) 221–7050, Email: aeanders@ualberta.ca or visit wp.friresearch.ca