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Erosion, Sediment Delivery, and Consequence from Roads in Foothills Watersheds in West-Central Alberta: A Case-Study in the Simonette | Part 4: Instream consequences and road crossings

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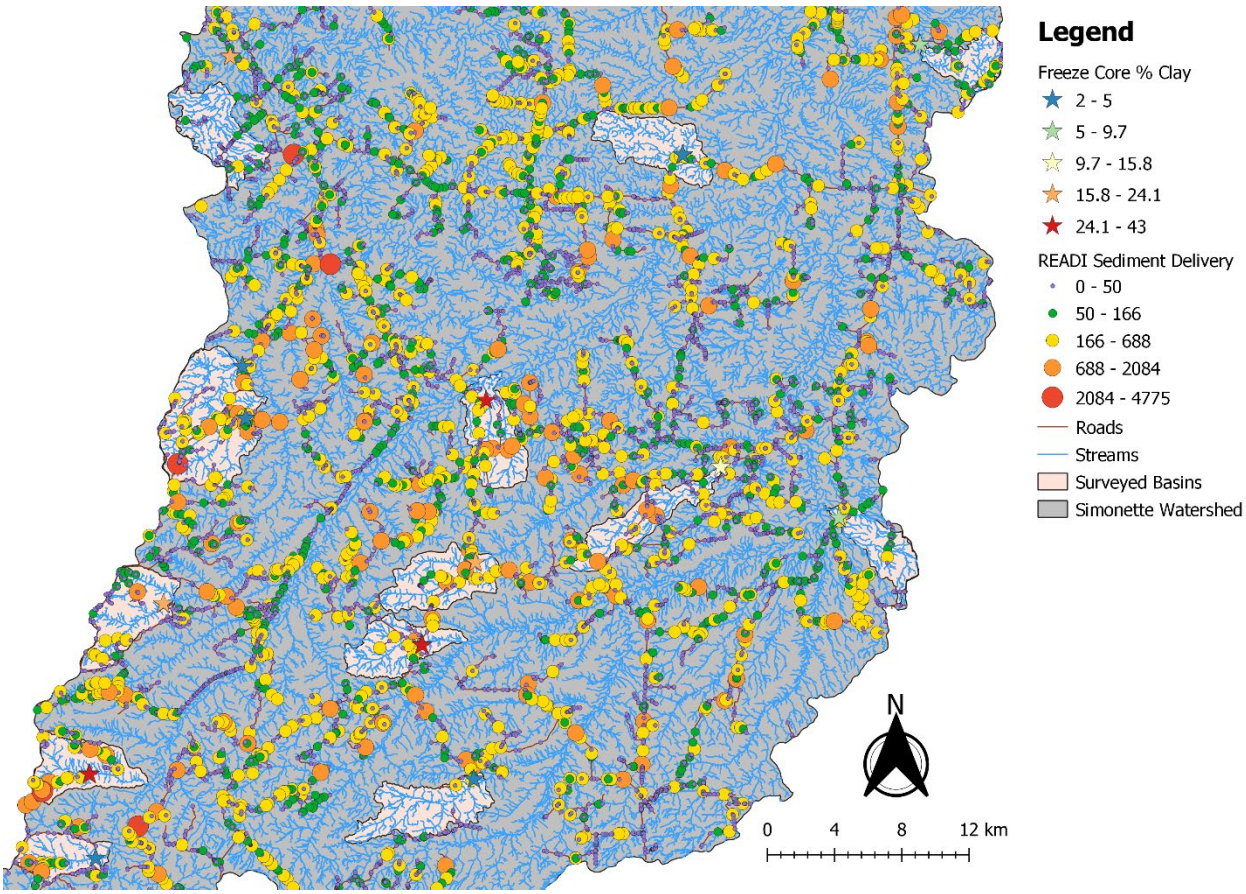
Parts 1 through 3 of this research notes series have focused on erosion, gullying and sediment delivery to streams in the Simonette watershed. We used the results of our research on erosion and connectivity processes in the Simonette to calibrate road erosion and sediment delivery models implemented in the Netmap extensions to ArcGIS developed by TerrainWorks. One of the models is the Geomorphic Roads Analysis and Inventory Package (GRAIP), which is used in managing federal forest lands in the United States. The model is called the Road Erosion and Sediment Delivery Index (READI), created by TerrainWorks. The map below is an example of an output from READI. Problematic sediment delivery areas are shown as large red and orange circles:



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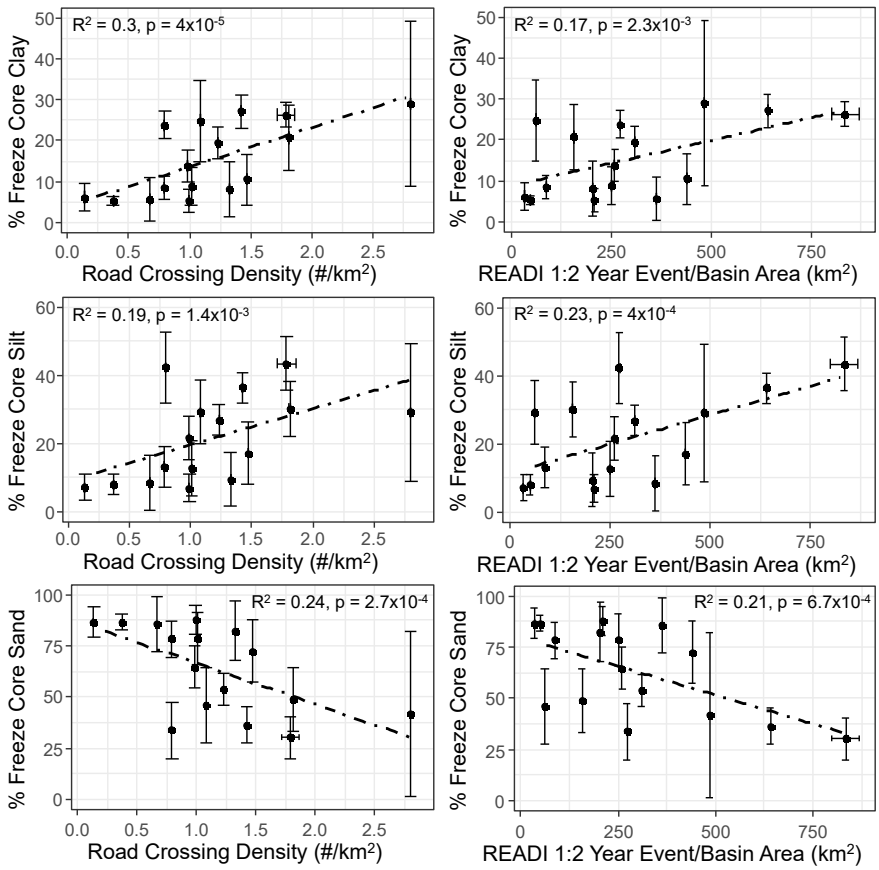
We also performed surveys of stream condition in the Simonette using dimensional measurements, surface grain counts, and freeze-coring. Instream parameter measurements were compared with the outputs of READI and GRAIP as well as commonly-used road pressure indicators, including road density, and road-crossing density.

We found that the composition of streambed matrix material obtained from freeze cores correlated with both stream crossing density in the watershed, and inputs from READI averaged over watershed area. A key finding of this study is that road stream crossings can supply excess clay and silt to streams, which are deposited in sensitive streambed areas such as riffle crests and side-channel bars, where water flows into the streambed. Furthermore, we found that READI, which estimates sediment delivery using a hydrological model, better predicted problematic streambed conditions than GRAIP. One reason for this may be that sediment delivery curves for GRAIP_Lite are calibrated to mountainous areas in the Western United States, where road connectivity may be more influenced by downhill slope and presence of obstructions, whereas in more gently- to moderately-sloping areas like Alberta, connectivity may be more related to climate and the hydrological properties of soils. Regardless, the research indicates that stream crossings are a main element of concern for managing the environmental consequences of roads in Alberta.



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