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Hydrological connectivity of road and stream networks and implications for material transfer and channel morphology

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Gravel roads in rural and upland landscapes are important sources of runoff and sediment to water ways. The downstream effects of these sources should be related to the connectivity of roads to receiving waters. Recent studies have probed this idea, but only simple metrics have been used to characterize connectivity and few studies have quantified the downstream effects of road-stream connectivity on sediment or solute budgets and channel morphology. We propose a set of connectivity metrics that utilize features of landscape position and delivery pathway to characterize road-stream connectivity in upland settings. We draw on a set of studies exploring road effects on runoff, sediment production, nutrient runoff, and channel morphology to evaluate the effect of roads on material transfer to receiving waters and the downstream geomorphic effects of these transfers. We propose that these metrics can be used to evaluate the importance of gravel roads in water quality degradation and identify roads that could be targeted for restoration or removal to improve downstream water quality.