Developing a "Reference" Sediment Transport Relationship

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Abstract. Land an water management practices continue to be one of the dominant contributors to water quality impairment through impacts on sediment loading to channel systems, transport processes, and channel morphology. Suspended sediment and bedload transport data from more than 160 streams in Colorado, Wyoming, Idaho, and Alaska were used in an analysis to determine if 1) a "reference" sediment transport relationship for stable river systems could be defined, and 2) if so, could the "reference" relationship be used to document departure in sediment transport from disturbed or degraded river systems. The initial assumption in the analysis was that the sediment transport/discharge relationships could be presented in a dimensionless format and stratified by Channel Type (Rosgen 1994) and Stability Rating (Pfankuch 1972). The dimensionless, or normalized, form for the sediment transport/discharge data for each watershed was achieved by dividing each sediment rate (Y_i) by the sediment rate that occurs at bankful discharge and by dividing each discharge rate (X_i) by the bankful discharge rate. Once the data were converted, dimensionless models were fitted for each watershed. Sequential analysis of the dimensionless models indicated, for bedload transport, that streams with a "poor" stability rating were different than streams with either a "good" or a "fair" rating but that there were no differences in transport that could be attributed to Channel Type. Variability within Channel Type and across Stability Ratings was greater for suspended sediment transport, than was true for bedload, but again there were no differences in suspended sediment transport that could be attributed to Channel Type. Suspended sediment and bedload data sets from a variety of sites, intensively sampled, in Colorado and Wyoming were then used to develop "reference" dimensionless sediment transport curves. The "reference" curves encompass a range in flows in excess of the 25-year maximum instantaneous event for all watersheds used in the analysis. Subsequent evaluation of the "reference" curves developed indicates they are useful in documenting departure in streams whose watershed has been impacted by road construction and timber harvest. In addition they can be converted back to a "dimensional" format that mimics and then can be used to extend the range in observed transport from other stable, undisturbed systems. In addition, inferences drawn from the analysis of all the transport data available for the study help explain the transition in sediment transport that occurs as unstable systems aggrade or degrade to a different channel type. In summary, a hypothesis is presented for further testing that defines a "reference" sediment transport relationship for both suspended sediment and bedload transport from watersheds in the Central Rocky Mountains. If proved valid, the proposed "reference" relationships could prove quite useful in describing, and assessing, sediment transport from disturbed and stable river systems.

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