# Two Contrasting Views of Stream Sediment Sources

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Many of us are involved in protecting water quality in one way or another, often by stabilizing the landscape and preventing erosion. Urban and suburban streams still tend to become very turbid during storm flows, and unfortunately this is part of the reason sediment is one of the leading pollutants in our waters. But where does this sediment come from? Even apparently stable, built-out watersheds can produce muddy flows following storm events. Two studies in the Maryland Piedmont have come to very different conclusions about sediment sources in these streams.

Smith and Wilcock selected six ponds that were far enough up in the landscape to be receiving flow from areas that primarily only one use type: forest, agriculture, or suburban development[1]. All areas were in that land use for the life of the pond, and the researchers were able to use historical aerial photography to verify any changes in the channels leading into the ponds. They conducted detailed surveys of the ponds to determine how much sediment had accumulated over the 13-39 years the ponds were in place. The forested watershed yielded 0.3 – 1.4 Mg $ha^{-1}$ $yr^{-1}$ (0.1-0.6 ton $ac^{-1}$), the agricultural watershed 1.0 – 3.4 Mg $ha^{-1}$ $yr^{-1}$ (0.4-1.5 ton $ac^{-1}$), and the suburban watershed 3.7 – 5.3 Mg $ha^{-1}$ $yr^{-1}$ (1.6-2.3 ton $ac^{-1}$). In all cases, the higher sediment yield was the result of erosion in the channel leading into the pond. The authors suggested that the highest yield being the suburban landscape, often considered "stable," is likely a result of many small areas of high erosion rates. In comparison, they cited previous studies of sediment influxes to area reservoirs being in the range of mostly 1-3 Mg $ha^{-1}$ $yr^{-1}$ (0.4-0.1.2 ton $ac^{-1}$). One outlier reservoir received nearly 7 Mg $ha^{-1}$ $yr^{-1}$ (3.1 ton $ac^{-1}$), which they explained was likely due to a great deal of highway and suburban development in that watershed during the measurement period. They suggest that the lower accumulation relative to some land uses is due to storage in the stream floodplains, with net accumulation of 2 mm $y^{-1}$, similar to other studies in the region. From these results, they concluded that stream banks are not contributing significant sediment to the system.

In contrast, using different methodology but in similar landscapes just north of the Smith and Wilcock study, Donovan et al (2015) concluded that stream banks contribute 70% of the sediment in Piedmont streams[2]. They used aerial photographic images of 40 stream sections in Baltimore County, Maryland, USA, taken from 1959-61, to compare 2005 topographic data developed from LiDAR data (3-dimensional radar from planes). They then collected samples and survey data from those same stream cross-sections to estimate the amount of sediment either deposited or eroded at that point. They could also differentiate between "legacy" sediment, which was generated after European settlement and the high erosion associated with agriculture and development, and pre-settlement sediment. One difference in this area is that it is more rural than the Smith and Wilcock study area, with much less (<20%) suburban and urban development. Over the 44-46 years, the streams migrated laterally an average of 2.5% of stream width each year. The resulting bank erosion rate ranged from 0.4 – 3.1 Mg $ha^{-1}$ $yr^{-1}$ (0.2-1.4 ton $ac^{-1}$), but much of this material is redeposited downstream for a net export average of 1.0 Mg $ha^{-1}$ $yr^{-1}$ (0.4 ton $ac^{-1}$), 70% of which came from bank erosion. They noted that stabilizing stream banks would go a long way toward achieving TMDL goals in the region. The authors also emphasized the importance of studying stream dynamics over large areas and long periods of time in order to obtain an accurate assessment.

[1]Smith, S.M.C., and P.R. Wilcock. 2015. Upland sediment supply and its relation to watershed sediment delivery in the contemporary mid-Atlantic Piedmont (U.S.A.). Geomorphology 232 (2015) 33–46. http://dx.doi.org/10.1016/j.geomorph.2014.12.036

[2]Donovan, M., A. Miller, M. Baker, and A. Gellis. 2015. Sediment contributions from floodplains and legacy sediments to Piedmont streams of Baltimore County, Maryland. Geomorphology 235 (2015) 88–105. http://dx.doi.org/10.1016/j.geomorph.2015.01.025