

loading at a watershed scale and to evaluate the nonlinear effects and policy options. It was observed that in addition to urbanized subwatersheds, subbasins with less than 10% impervious factor dominated the study area. This result corroborates other studies that used IBI and biological indicators [Horner *et al.*, 1997]. This is important in developing conservation policies as higher rates of sediment loading were observed during smaller levels of imperviousness. The sediment loading was also high in subwatersheds with higher impervious factor. There existed two distinct regions of high sediment loading rates -low impervious level and high impervious level. On a spatial scale, impervious factor in headwaters contributed to higher loading rates.

[46] Transition zones (changes in curvature property) were observed on a continuous range of impervious coverage. The transition effects arise because of nonlinear influences at varying stages of urbanization. As impervious factor increased, higher variance in sediment loading was observed among various observations (divergence).

[47] There existed lower sediment loading in some subwatersheds compared to those at the same level of impervious factor. These subwatersheds formed the lower envelop of the distribution and represent best approaches to handle sediment loading. This advantage in sediment efficiency is due to locational advantage, Best Management Practices, and proportion of open space. The role of nonlinearity in influence varied based on various levels of impervious cover. In general the role of nonlinearity played a major role in explaining sediment-impervious relationship.

[48] Three types of policy instruments were evaluated. Impervious taxes could be a viable option to reduce impervious factor. If properly designed it could provide incentives of reducing external impacts through BMPs. While a linear model is easier to translate to tax rates, nonlinear models involved changing tax rates based on variable impacts at varying impervious levels. These elements need to be constantly updated to include changes in landscapes and practices and for transferability to other watersheds. Subsidies to reduce impervious cover or to incorporate BMPs can also be used to address water quality problems in urbanizing areas. Another incentive policy is cost sharing to encourage adoption of new BMPs or to voluntarily reduce impervious percentage.

[49] The study results are useful in approaching the water quality problems relates to urbanization by using targeted policy measures. While this is a wide area of study, future extensions of the work could incorporate other pollutants and quantity issues. Other policy approaches could be studied through implicit modeling of economic behavior of a land manager. Given that storm water runoff, sediment dredging, suburbanization, and nonpoint source pollution are becoming major problems facing communities, policy and assessment approach like this study provides an alternative approach to mitigate urban influence on water quality.

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