Article 22

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Comparison of Forest, Urban and Agricultural Streams in North Carolina

Recent stream research has frequently demonstrated that stream quality indicators decline from baseline conditions as impervious cover in the contributing watersheds increases. The baseline for measuring this decline is usually a non-urban reference watershed. Although it is often impossible to find a totally undisturbed watershed, most studies have used watersheds that are mostly forested and are not actively disturbed as a reference.

Some argue, however, that a forested watershed is not the best baseline to measure changes in stream quality indicators for many regions of the country. This is due to the fact that prior land use in many urbanizing watersheds is often dominated by agriculture and not forest. The choice of a reference land use can have important implications for urban watershed managers. Will the same dramatic decline in stream quality indicators occur if an agricultural watershed is converted into a suburban one? Or have agricultural activities already degraded or impaired stream quality so that little if any decline is noted?

There are a number of good reasons to suspect that agriculture can degrade stream quality. Agricultural areas, for example, produce more runoff, greater soil erosion and higher nutrient loads than forested watersheds. In addition, current or past agricultural practices often modify natural drainage patterns, alter the riparian zone and drain wetlands. On the other hand, agricultural watersheds have little or no impervious cover, and produce only a fraction of the destructive storm flows of an urban watershed. Where, then, do agricultural watersheds fit in?

A paired watershed study conducted by Crawford and Lenat (1989) sheds some light on this issue. The investigators intensively monitored three small watersheds in the North Carolina piedmont over a two-year period (Figure 1). The dominant land uses in each watershed were forest, agriculture and urban, respectively. Riparian condition was generally good in all three watersheds, and point sources were not a factor. Other key watershed characteristics are compared in Table 1.

In each watershed, Crawford and Lenat sampled suspended sediments, water quality, bottom sediments, macroinvertebrates and fish populations. At each study site, instantaneous suspended sediment discharge was statistically correlated with stream discharge. Annual suspended sediment loads were then calculated using daily discharge values. In addition, the particle size distribution and sediment chemistry of stream substrates were sampled at randomly selected intervals in each stream.

Findings: Water Quality and Stream Substrate

The three watersheds had contrasting water quality and substrate conditions (Table 2). Sharp differences, for example, were noted in their nutrient levels. The agricultural stream had the highest phosphorus and nitrogen concentrations, whereas nutrients were present at low and possibly limiting levels in the forested stream. The urban streams had an intermediate level of nutrients, but did exhibit the highest level of dissolved nitrogen. With respect to stream temperature, the forested stream was the coolest, whereas the urban stream was the warmest.

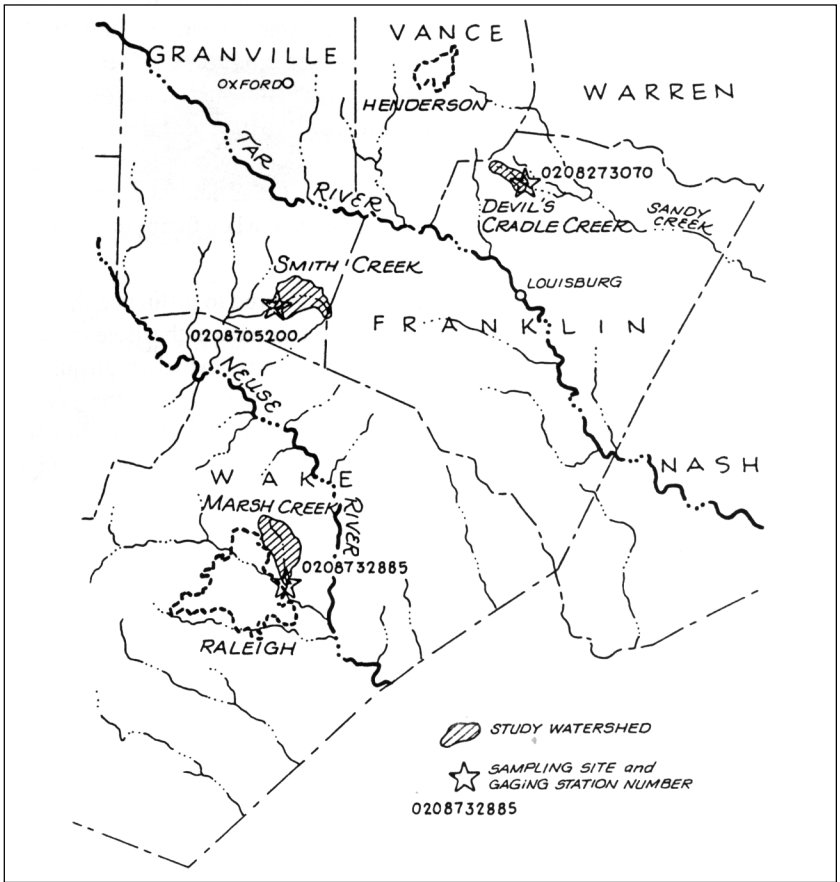

Figure 1: Location of Three Paired Watersheds in North Carolina