

EFFECTS OF LAND USE ON STREAMFLOW YIELDS OF SELECTED CONSTITUENTS FOR WATERSHEDS IN GWINNETT COUNTY, GEORGIA

Mark N. Landers and Paul D. Ankorn

AUTHORS: Hydrologists, U.S. Geological Survey, 3039 Amwiler Road, Suite 130, Peachtree Business Center, Atlanta, Georgia 30360-2824.
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Abstract. Managing watershed land use is vital to the protection of drinking water, recreational opportunities, and stream ecosystem health. However, the effect of land use and management practices on streams typically is difficult to assess and often unmeasured. Nonpoint-source pollution is complex in its sources, transport, impacts, and response to management practices. In six watersheds of Gwinnett County, Georgia, the results of intensive monitoring show the effects of land use on streamflow and on yields of suspended solids, metals, and nutrients.

EFFECTS OF LAND USE ON STREAM HYDROLOGY

Changes in watershed land use affect the hydrology of a watershed. Bare or impervious areas and a more developed stormwater drainage system result in greater volumes of high-energy stormflow, and reduced baseflow in a stream. A measure of this effect is the average stormflow component of the total flow of a watershed, in percent. An indicator of overall watershed development is transportation land use. Transportation relates closely to the total impervious area that is connected to the drainage network. Figure 1 shows the relation between transportation land use and the stormflow component of total flow, from 1996 to 2000, for six watersheds in Gwinnett County.

EFFECTS OF LAND USE ON CONSTITUENT YIELDS

Increased stormflow accelerates erosion of the land surface, particularly for areas of exposed soils, and causes scouring of stream channels. This causes much higher yields of stream sediment for developed versus undeveloped watersheds. As storms recede, sediment is deposited in the stream, degrading aquatic habitat.

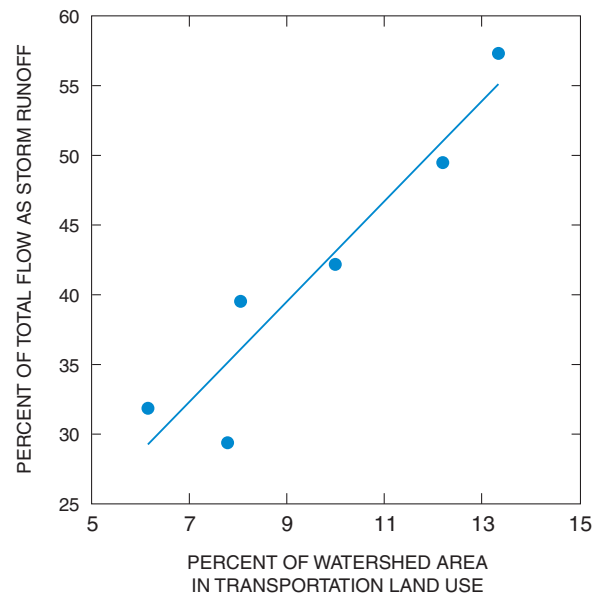


Figure 1. Stormflow, as a percent of total flow, and transportation land use, in percent.

Total suspended solids are used as a measure of overall development impacts in some watershed protection plans. Streams are particularly sensitive to land use in and near their floodplains. Stream corridor areas may filter out and substantially reduce pollutants entering streams. Figure 2 illustrates the strong relation between total suspended solids yield and transportation land use in the stream corridor zone.

Lead yields in the six monitored watersheds are closely related to transportation land use in the stream corridor, as shown in Figure 2. This may be due to increased lead deposition on paved areas by atmospheric effects and by transportation and related land uses. This deposition, coupled with reduced infiltration of runoff from these surfaces, may contribute to increasing yield of lead with increasing transportation land use.

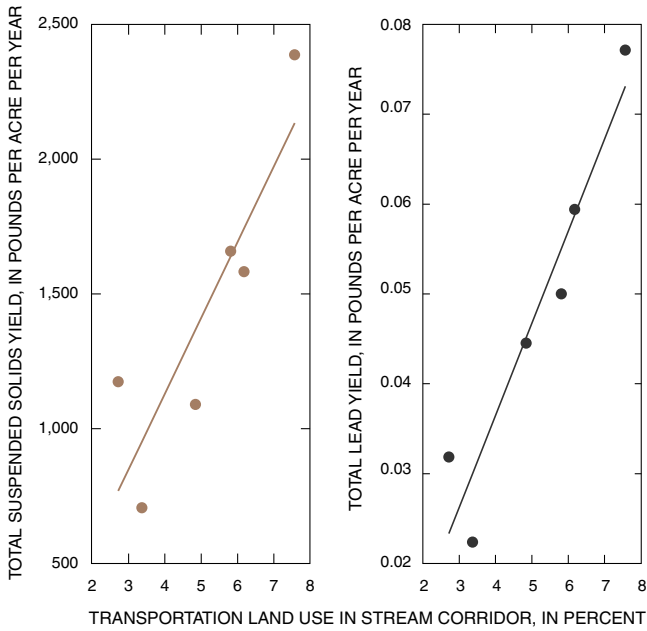


Figure 2. Watershed yield of total suspended solids and total lead, and transportation land use in a stream corridor.

The annual yield of a constituent in streamflow is affected by an array of land uses, potential point sources, hydrologic factors, chemical processes, and other factors. Effective water resource management is difficult because of these many factors. However, these results illustrate how stream monitoring can provide information and tools that are valuable for watershed assessments and land-use planning.

REFERENCE

Landers, M.N., P.D. Ankcorn, K.W. McFadden, and M.B. Gregory. 2002. Does land use affect our streams? A watershed example from Gwinnett County, Georgia, 1998–2001. U.S. Geological Survey Water Resources Investigations Report 02-4281, 6 pp.