



Article 4

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Nutrient Movement from the Lawn to the Stream

Are lawns a significant source of nutrients to urban streams? The answer to this frequently asked question appears to be “maybe.” On the one hand, over-fertilization of home lawns has been frequently cited as an important and controllable nutrient source within urban watersheds, and has been a key element of many local outreach and pollution prevention campaigns. On the other, turfgrass researchers report that well-tended lawns produce minimal runoff and nutrient export. In this article, we explore the question of whether nutrients are moving from the lawn to the stream, by examining three areas:

- Trends in urban fertilizer use
- Research on the nutrient cycle in urban lawns
- Actual nutrient levels recorded in urban streams

The article begins with an analysis of recent trends in lawn fertilization *recommendations*, and then summarizes what we know about *actual* fertilizer applications and behavior by the homeowner and lawn care companies.

Next, the nutrient cycle of the lawn is described, including major *inputs*, *storage components*, and *outputs* of nitrogen and phosphorus. Potential nutrient *inputs* include fertilizer applications, atmospheric deposition, runoff from impervious areas such as rooftops, irrigation water with elevated nutrient content, fixation, and decomposition of clippings left on the lawn. *Storage components* include soil, thatch, and standing turf. Potential *outputs* include volatilization, denitrification, runoff, leaching, and clippings not left on the lawn.

Lastly, the article reviews monitoring data from nearly 40 residential watersheds across the country to detect whether nutrient levels in urban streams are elevated during storm events, in relation to other land uses or nutrient sources.

Trends in Urban Lawn Fertilization

Historical Fertilizer Use

Fertilizer use mushroomed after World War II along with the chemical industry. Fertilization rates recommended by turf researchers and garden writers also grew sharply during this period. A typical recommendation prior to 1940 was 44 pounds of nitrogen* fertilizer per acre per year (Jenkins, 1994).

By the 1965 edition of the popular *America's Garden Book*, recommended fertilization rates had climbed to 283 pounds nitrogen per acre annually. Some fertilizer recommendations during the 1970s were as high as 348 pounds per acre per year (Jenkins, 1994). By 1984, EPA estimated nearly a million tons of chemical fertilizers were applied yearly across the nation's lawns—more than India applied to all its food crops in the same year (Bormann, 1993).

In recent years, the trend toward ever greater fertilization has begun to change. Part of this is due to the recognition that excess nutrients can degrade the water quality of streams, lakes, and estuaries. Also, hardier grasses such as fine fescues and native buffalograss have become more popular in response to growing water shortages. These tough grasses have lower nitrogen requirements than other grasses (Schultz, 1989). Lastly, turf research documented that lawn clippings can provide significant nutrient value and help promote dense and vigorous grass. In response to these trends, some extension agents are now recommending lower nitrogen fertilization rates. For example, according to the Northern Virginia Soil and Water Conservation District a good rule of thumb is to use half of the manufacturer's recommended application—generally less than 44 lbs/acre in any single application. Other current extension and garden literature recommendations range from 87 to 174 lbs/acre/year of nitrogen.

* Lawn feeding recommendations are often expressed in terms of nitrogen since this nutrient keeps grass green and soft by promoting rapid leaf growth. The vast majority of retail lawn fertilizers are “complete” fertilizers, meaning they contain nitrogen, phosphorus, and potassium. Nitrogen stimulates leaf growth; phosphorus enhances stem and root strength (as well as promoting flowering); and potassium encourages seed-ripening and stress-tolerance. Phosphorus and potassium also impart insect and disease resistance. The percentages vary, from nitrogen-heavy formulas such as 29-3-4 to more even-handed formulations such as 10-6-4, or 10% nitrogen, 6% phosphorus, and 4% potassium by weight.