Comments on “Sample Size Requirements for Estimation of Throughfall Chemistry Beneath a Mixed Hardwood Forest”

Recently Kostelnik et al. (1989) concluded that “total deposition estimates based on throughfall volume estimates from circular-funnel type collectors may significantly underestimate actual deposition because of errors in measuring throughfall volume.” Previously, Helvey and Patric (1965) found no significant difference between trough and funnel gauges. Resolution of this disparity of view is of major importance for throughfall and rainfall studies because the majority of studies use funnel collectors. Here, the results of Kostelnik et al. (1989) are reexamined and the case for using randomized relocation of standardized samplers is reemphasized.

Experimental. The salient design of Kostelnik et al.’s (1989) study for water volume estimation is as follows. Throughfall collections were made using 40 funnel and 24 trough collectors for a 2.5-ha study area on Leading Ridge Experimental Watershed. The collectors were located randomly along eight randomly spaced transects in rectangular zones: five funnel gauges per “funnel transect,” three trough gauges per “trough transect.” In total, data for five sets of events were presented.

The results show that the funnel gauges provide catches that are 8 to 22% (average 18%) lower than the trough gauges.

Discussion. At first sight, one might argue that the trough gauges give the better estimate than the funnel gauges: higher catch volumes are collected; the surface area of catch (per collector) is higher for the trough compared with the funnel collector (1524 cm$^2$ and 1134 cm$^2$, respectively). However, there are five factors that reverse the conclusion.

First, almost twice the number of funnel gauges (40) have been used, compared with trough gauges (24). Hence, the funnel array provides a greater chance of integrating spatial variability. Second, areal catch is higher for the funnels (40 X 1134 = 45,360 cm$^2$) than for the troughs (24 X 1524 = 36,576 cm$^2$). Third, edge collection interference effects are minimized by using circular topped sampling devices because the ratio of the area collected to the length of edge exposed is maximized. Fourth, detailed meteorological studies of different types of rainfall collectors show the funnel gauges to be virtually as efficient as those deemed most accurate (Rodda and Robinson, 1969). Fifth, many collection devices have been used that produce a variety of results: a subjective choice is required to assign accuracy (Rodda, 1967, 1970; Rodda and Robinson, 1969).