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Influence of Antecedent Hydrologic Conditions on Nitrate and Phosphorus Export from a Small Agricultural Catchment in Southern Ontario, Canada

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The ability of the scientific community to quantify and predict discharge and nutrient transport in a range of settings is confounded by the effects of antecedent hydrologic conditions in upland areas.

Previous work has empirically linked spatial variables such as land use, soil type, topography, and drainage characteristics to hydrochemical export from various landscapes (e.g. MCDOWELL et al., 2001; ARHEIMER and LIDEN, 2000; STAMM et al., 1998; JORDAN et al., 1997; WELSCH et al., 2001). However, the specific reasons why similar types of events produce different nutrient export patterns are poorly understood. Nutrient (nitrate, soluble and total phosphorus) transport from agricultural catchments is difficult to quantify and predict because of the influence of variable hydrologic flowpaths and their interaction with varying nutrient pools.

This research examines the role of antecedent hydrologic conditions on stream discharge and nitrate (NO3-), soluble reactive phosphorus (SRP) and total phosphorus (TP) export from a small (2.7 km2) first-order agricultural catchment in Southern Ontario, Canada. During 59 events occurring over a two-year sampling period (year-round), runoff ratios ranged from 0-0.99). Runoff ratios increased throughout successive events as conditions became wetter although key indices of antecedent wetness such as water table position, pre-event streamflow and soil moisture did not yield predictive relationships. Nitrate, SRP and TP transport from the catchment increased with antecedent wetness during some periods but decreased with antecedent wetness during other periods. This variability appears to be linked to a combination of the position of water table before and during the event, as well as timing of fertilizer application. It is hypothesized that in general, wetter antecedent hydrologic conditions increase nutrient transport from the catchment by increasing macropore connectivity between surface soil horizons and tile drains, although this is not always the case.

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