DISAGGREGATING LANDSCAPE-SCALE NITROGEN ATTENUATION

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Evaluating how nitrogen (N) sources are attenuated throughout the landscape is critical to further our understanding of catchment-scale N budgets. We developed catchment-scale nitrate budgets for 16 springs in Florida, with springshed areas ranging from 10 to 1000 km^2. We used in situ measurements (nitrate leaching fluxes and attenuation), and long-term records (surface N inputs and spring exports) to estimate landscape-scale N loading, attenuation, and export. Nitrate concentrations have been rising in Florida springs over the past 50 years alongside increases in population and changes in land use. Spring discharge integrates the inputs, transport, and attenuation factors over the entire springshed. Here we evaluate the relative contributions to total N flux from Florida springs that can be attributed to land use, human population density, and soil types associated with N attenuation. Surface N loads were estimated based on land use and population density. Attenuation was estimated based on in situ measurements of vadose zone nitrate flux, aquifer push-pull tests, and excess N_2. Travel time distributions were estimated based on recharge rates and springshed area and morphology. We predicted attenuation of up to 90% (± 3% standard deviation) of N inputs, in close agreement with N loss calculated using measured spring mass discharge. Further, when this attenuation is disaggregated along hydrological flow paths, we estimate up to 64% of inputs are lost in the surface soil, 20% in the vadose zone, and 6% in the aquifer. Our model-based estimates of the relative contributions of different N sources were also independently supported based on measured isotopic signatures of both recharged and discharged nitrate.