Influence of Land Use on the Stable Carbon Isotopic Composition and Concentration of Dissolved Organic Carbon and Dissolved Inorganic Carbon in Georgia Piedmont Headwater Streams

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Headwater streams are the dominant land-water interface across much of the landscape and provide many important ecological services. Cycling and transport of various carbon fractions, which serve as important food sources for downstream aquatic ecosystems, are among the important functions of headwater streams. Dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC) are two of the most ecologically important carbon fractions. A wet chemical oxidation analyzer coupled to an isotope ratio mass spectrometer is used to measure the stable carbon isotopic composition (delta 13C) and concentrations of DOC and DIC in stream water samples collected monthly from 15 headwater streams. The study area is characterized by extensive poultry and cattle production and a rapidly growing human population, and the study catchments contain varying proportions of forest, pasture, developed, wetland, and open water land cover. Linear regression techniques are being used to develop simple models describing the influence of land cover on DOC and DIC stable isotopic compositions and concentrations.

Results to date indicate that: (1) mean delta 13C-DOC and mean delta 13C-DIC in study streams range from -28.8 to -27.2 parts-per-thousand (ppt) and -18.0 to -13.0 ppt, respectively; (2) mean DOC and DIC concentrations range from 1.5 to 5.9 mg/L and from 3.0 to 8.0 mg/L, respectively; (3) watershed pasture land cover is the best descriptor of DOC concentration and delta13C-DOC; (4) DOC concentration and delta 13C-DOC are positively correlated with watershed pasture land cover; (5) watershed open water (positive correlation) and buffer open water (negative correlation) land cover together provide the best description of DIC concentration; and (6) watershed developed land cover (inverse relationship) is the best descriptor of 13C-DIC. These results suggest that organic wastes added to pastures as a result of poultry and cattle production add measureable quantities of 13C-enriched DOC to indigenous streams.