Research Article

Landscape predictors of stream dissolved organic matter concentration and physicochemistry in a Lake Superior river watershed

Paul C. Frost[1],*, James H. Larson[1], Carol A. Johnston[2], Katie C. Young[3], Patricia A. Maurice[3], Gary A. Lamberti[1] and Scott D. Bridgham[4]

[1] Department of Biological Sciences, University of Notre Dame, Notre Dame, Indiana 46556, USA

[2] Center for Biocomplexity Studies, South Dakota State University, Brookings, South Dakota 57007, USA

[3] Department of Civil Engineering and Geological Sciences, University of Notre Dame, Notre Dame, Indiana 46556, USA

[4] Center for Ecology and Evolutionary Biology, University of Oregon, Eugene, Oregon 97403-5289, USA

Abstract. We examined landscape predictors of dissolved organic matter (DOM) concentration, molecular weight (M_w), and molar absorptivity at 280 nm (ε_{280}) in 60 streams from the Ontonagon River watershed in northern Michigan. During our sampling period (September 19–22, 2002), DOM concentration ranged from 4 to 35 mg C L^{-1} across streams. DOM M_w and ε_{280} also showed considerable variation among streams. Multiple factor regression showed that stream DOM concentrations were related to watershed area, mean watershed slope, and the percentage of watershed area in certain types of land cover (lake, total wetlands, emergent wetlands, and lowland conifer forests). Streams with higher DOM concentration also had higher DOM M_w and molar absorptivity. Moreover, DOM M_w and ε_{280} were negatively related to the % lake and positively related to the % total wetlands in the watershed. In general, landscape variables explained more among stream variation in DOM concentration than in DOM M_w or ε_{280} in this watershed. It thus appears that the many biogeochemical processes controlling DOM input, transportation, and degradation weaken relationships between stream DOM composition and terrestrial organic matter dynamics in this relatively large watershed. Our results indicate that the total proportion of wetlands alone may be inadequate to predict DOM concentration or physicochemistry in streams flowing from large watersheds of variable morphology and land cover composition.

Key words. Dissolved organic matter; streams; wetlands; AIC; landscape; lakes.