Effects of land use change on stream water chemistry in three meso-scale catchments in Eastern Amazonia

Ricardo de Oliveira Figueiredo, Embrapa Amazônia Oriental, ricardo@cpatu.embrapa.br (Presenting)
Daniel Markewitz, University of Georgia, DMARKE@warnell.uga.edu
Eric Atlas Davidson, The Woods Hole Research Center, edavidson@whrc.org
Marysol A.E. Schuler, Universidade Federal do Pará, marysolschuler@click21.com.br
Patrício de Sousa Silva, Universidade do Estado do Pará, patriciomat@bol.com.br
Lívia Gabrig T. Rangel-Vasconcelos, Embrapa Amazônia Oriental, livia@amazon.com.br
Renata Tuma Sabá Paes, Embrapa Amazônia Oriental, renatatuma@hotmail.com
Lilianne Maia Lima, Embrapa Amazônia Oriental, lilianne@cpatu.embrapa.br

We are measuring changes in water chemistry by upstream-downstream sampling along three streams from their headwaters in remnant mature forests, through pastures, secondary forests, and large fertilized fields of soy bean, rice and corn in the Paragominas region, in Eastern Amazonia. These three catchments have the following areas and percentages of forested cover: Cinquenta e quatro (Cq) watershed (130 km^2) with 18% forest; Sete (St) watershed (150 km^2) with 34% forest; and Pajeú (Pj) watershed (45 km^2) with 45% forest. Field campaigns of stream chemistry measurements were conducted monthly from April 2003 to October 2005, including discharge, pH, conductivity, turbidity, alkalinity, DO, DOC, DIC, Ca^{2+}, Mg^{2+}, K^+, Na^+, NH_4^+, NO_3^-, PO_4^{3-}, SO_4^{2-} and Cl^-. Among the three streams, turbidity (Cq= 66.7; St=14.9; Pj=14.2 FTU) and pH (Cq=5.6; St=4.5; Pj=4.6) are highest in the most deforested watershed. Results from the watershed containing significant cropland at the lower reaches of the stream reveal higher nitrate concentrations near the cropland, which increase nitrate mean concentration in Cq (Cq=256; St=146; Pj= 84 µg L^{-1}). Because soils are relatively similar within the study area, we suspect land use conversion is an important factor affecting the observed trends in stream chemistry. In addition to the effects of land-uses on inputs of nutrients to the streams, in-stream processes are also important. In-stream dissolved oxygen concentration consistently decreased in on-farm retention ponds, and nitrate concentrations generally followed a similar pattern as DO concentrations. In Pajeú, for instance, average measured DO was 3.69 mg L^{-1}, while in free flowing stream it was 5.04 mg L^{-1}. Similarly, nitrate in Pj decreased from 95 µg L^{-1} in free flowing areas to 67 µg L^{-1} in retention ponds. In phase III of our project we are investigating the role of the riparian zones as a filter of nutrients and sediments arriving from upslope land covers of forest, pasture, or agricultural land and whether riparian zones and/or in-stream processes significantly modify or uncouple the upslope soil solution chemistry and the stream chemistry.

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