DISTRIBUTION AND TURNOVER OF DOC IN NATURAL AND CONSTRUCTED WETLANDS IN THE FLORIDA EVERGLADES

J. C. Stern (FSU, Geology); Y. Wang (FSU, Geology); B. Gu (SFWMD, Everglades Division)

Introduction

In this study, we measured the stable and radiocarbon isotopic ratios of DOC, dissolved inorganic carbon (DIC) and particulate organic carbon (POC) in both natural and constructed wetlands in the Florida Everglades. Our objectives were to examine the source and turnover rate of DOC in these wetland ecosystems, and to quantify the efficiency of carbon and P cycling in constructed vs. natural wetland. We also wanted to determine if radiocarbon measurements could be effectively utilized to gauge the progress of ecosystem restoration in the Everglades.

Experimental

The CO_2 generated by the combustion of DOC and POC samples was cryogenically extracted and its carbon isotopic ratios were measured on a Finnegan isotope ratio mass spectrometer (IRMS) at Florida State University. Radiocarbon content of the purified CO_2 was analyzed at the National Ocean Sciences AMS Facility at the Woods Hole Oceanographic Institution. Carbon isotope ratios of plant samples were measured on a new EA-IRMS (Finnigan MAT Delta Plus XP) at the FSU/NHMFL Isotope Geochemistry Laboratory.

Results and Discussion

DOC concentrations decreased, with phosphorus (P) concentrations, along a water quality gradient from the agriculturally impacted areas in the northern Everglades to the more pristine Everglades National Park. $\delta^{13}C$ values of DOC in the area reflect contributions of both wetland vegetation and sugarcane from agriculture. Radiocarbon ages of DOC, POC and DIC in the Everglades ranged from 2010 years BP to ">modern". The old ^{14}C ages of DOC and POC were found in impacted areas near the Everglades Agricultural Area (EAA) in the northern Everglades. In contrast, DOC and POC in pristine marsh areas had near modern or ">modern" ^{14}C ages. These data indicate that a major source of POC and DOC in impacted areas is the degradation of historic peat deposits in the EAA. In the pristine areas of the marsh, DOC represents a mix of modern and historic carbon sources, whereas POC comes from modern primary production as indicated by positive $\Delta^{14}C$ values. High $\Delta^{14}C$ values of DIC indicate that dissolution of limestone is not a significant source of DIC in the Everglades wetlands. A 60 - 70% turnover of DOC from the northern to the southern Everglades was estimated using radiocarbon data.

Conclusions

Our study suggests that $\Delta^{14}C$ measurements can be a useful indicator of the progress of ecosystem restoration in the Everglades. As a restored wetland moves towards its "original" or "natural" state, the ^{14}C signatures of DOC should approach that of modern atmosphere. In addition, measurements of concentration and carbon isotopic composition of DOC in two small constructed wetland test cells indicate that these freshwater wetland systems contain a labile DOC pool with rapid turnover times and that the test cells are overall net sinks of DOC.

Acknowledgements

This work received financial support from South Florida Water Management District contract number PCP-401443 and from NSF grant EAR-0073851. The authors also wish to thank the Duke Wetland Center for field support.

References

Jorge, J., *et al.,* SFWMD Annual Report, 1-67 (2002).
Farquhar, G.D., *et al.,* An. Rev. of Plant Phys. and Plant Mol. Bio., 40, 503-537 (1989).
Raymond, P.A. *et al*., Organic Geochemistry, 32(4), 469-485 (2001).
Wang, Y., *et al.,* Biogeochemistry, 61(3), 269-289 (2002).