The Bio-Geo-Socio-Chemistry of Nitrogen in Urban Watersheds.

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In the Baltimore Ecosystem Study, one of two urban long-term ecological research (LTER) projects funded by the U.S. National Science Foundation, we are using "the watershed approach" to integrate ecological, physical and social sciences. Watersheds are a natural (and well-used) physical unit for bio-geo-chemical research and can also function as a focus for human-environment interactions, i.e. bio-geo-socio-chemistry. Suburban watershed input/output budgets for nitrogen (N) have shown surprisingly high retention which has led to detailed analysis of sources and sinks in these watersheds. Home lawns, thought to be major sources of N in suburban watersheds, have more complex coupled carbon and N dynamics than previously thought, and are likely the site of much N retention. Riparian zones, thought to be an important sink for N in many watersheds, have turned out be N sources in urban watersheds due to hydrologic changes that disconnect streams from their surrounding landscape. Geomorphic stream restoration designed to reverse structural degradation caused by urban runoff can increase in-stream retention by creating features with high denitrification potential. Considering the "human element" in these biogeochemical source and sink processes is critical to improving the environmental performance of urban and suburban ecosystems. Understanding why and how people manage their lawns is critical to reducing the water quality impacts of this dominant suburban cover type. Including human goals in stream restoration can help to establish connections between people and streams, which can lead to improvements in water quality as people become monitors and advocates for stream ecosystem integrity. Creating positive feedbacks between ecological restoration and human preferences can be key for achieving specific biogeosociochemical goals in urban and suburban watersheds.