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Global change, stream carbon loss, and a roadmap for improved stream health

Abstract: Stream health is threatened globally through an underappreciated pathway: the reduced inputs and accelerated losses of dead leaves and wood. Ecosystem services that streams provide, including fish production and uptake of pollutants, depend on a sufficient carbon base. Terrestrially-derived detrital carbon is particularly critical for these services as it has a slow turnover rate and serves as a year-round source of food and habitat in most streams and rivers. Many stressors associated with global change, including increased nutrients and temperature, result in accelerated losses of detrital carbon. Our experimental whole-stream enrichments have been some of the only studies to examine these loss processes at large scales. We found that carbon was retained only half as long in streams with moderate nutrient inputs due to stimulation of bacteria and fungi and feeding by insect larvae. Increased temperatures are also predicted to accelerate carbon loss, which will be explored in future studies. Management actions that 1) increase terrestrial C inputs and physical retention and 2) reduce stressors that result in carbon loss are needed to improve the health of streams and the ecosystem services they provide.

February 17, 2017, 3:30 PM
GGY room 200C