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Influence of allochtonous carbon input and food-web structure on freshwater biotic communities and sedimentation process

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Soil erosion in freshwaters induces important changes in lake metabolism. The organic matter and the nutrients supplied by soil inputs can change internal biogeochemical cycles and subsidize the whole food web from basal organisms to top-predators. Since the last two decades, the role of allochthonous organic matter as a basal resource for aquatic food webs in natural and controlled conditions has received a growing attention. We studied the impact of soil on the functioning of pond ecosystems by performing monthly additions of soil in freshwater mesocosms. In addition, the food-web structure was manipulated by addition of omnivorous fish to study interactions between the bottom-up effect of soil addition and the top-down effect of fish. The effects of soil and fish addition on the, the elemental and the biochemical compositions of pelagic compartments and recent sediment, on the biomass of seston and zooplankton and on the sediment rates were studied.
Soil inputs had no effect on biomass, stoichiometry and lipid composition of seston and zooplankton but fish growth was enhanced by soil addition. Soil treatment had several (but idiosyncratic) effects on the stoichiometry and on the lipid composition of recent sediment. However, the sedimentation rates and the potential biodegradability of recent sediment were not affected by soil inputs.
Fish addition affected chlorophyll-a concentration of the water column, seston biomass, sedimentation rates and stoichiometry of seston, zooplankton and short-term sediment. The lipid composition of recent sediment was also influenced by fish addition. However, fish addition did not change the biodegradability of recent sediment. Finally, we did not observe any significant interaction between soil and fish treatments.
Our results suggest that the addition of soil as allochthonous inputs to aquatic ecosystem induced a subsidize of the food web only on fish, probably due to direct foraging on bottom sediment. Nevertheless, this process does not induce an effect on the biodegradability of recent sediments. Therefore, allochthonous inputs appear to have little effects on nutrient cycling. The predominance of the effects of food-web structure over allochthonous inputs and the absence of interaction between these top-down and bottom-up controls suggest that the bottom-up control was minor compared to the top-down one exerted by top-predators.