

Plant diversity loss affects stream ecosystem multifunctionality

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Biodiversity loss is occurring globally at unprecedented rates, altering the functioning of the Earth's ecosystems. Multiple processes are often key components of ecosystem functioning, but it is unclear how biodiversity loss affects ecosystem multifunctionality (i.e., the ability of ecosystems to maintain multiple processes simultaneously). This is particularly true for some ecosystem types such as streams, which have been understudied, despite their key role in global biogeochemical cycles and their serious impairment by the widespread loss of riparian vegetation as a result of global change. Using a microcosm experiment, we tested whether losing riparian plant diversity affected stream multifunctionality, taking into account nine key processes related to litter decomposition, animal biomass production, and nutrient cycling, and simulating plant species loss from four to one in the presence or absence of litter-feeding detritivores. Multifunctionality increased with plant diversity in the presence of detritivores and decreased in their absence, evidencing a key role of detritivores in biodiversity-ecosystem-functioning (BEF) relationships. Moreover, by exploring effects of plant diversity on each process individually we were able to reveal potential mechanisms underlying BEF relationships; for example, effects of plant diversity on nutrient cycling occurred at least partly via indirect nutrient transfer, and were possibly accompanied by changes in microbial stoichiometry. Such mechanisms were unnoticeable when examining multifunctionality metrics, suggesting that individual processes provide crucial information to understand how stream

ecosystem functioning is impaired by biodiversity loss. © 2019 by the Ecological Society of America

detritivore growth

detritus-based streams

ecosystem functioning

F POM production

litter decomposition

multiple processes

nutrient cycling

plant diversity

biodiversity

biogeochemical cycle

decomposition

detritus

ecosystem function

global change

litter

microcosm

riparian vegetation

species diversity

stoichiometry

stream

Animalia

animal

biodiversity

ecosystem

plant

plant leaf

river

Animals

Biodiversity

Ecosystem

Plant Leaves

Plants

Rivers