Abstract Details

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COMBINING HYDROLOGIC SIMULATIONS AND STREAM-NETWORK MODELS TO REVEAL FLOW-ECOLOGY RELATIONSHIPS Flow regimes influence river organisms and ecosystem functions, but regulatory approaches often lack the scientific basis to support sustainable water allocation. Here, we use a hydrological model to simulate 23 years of natural flow regime in 100 bioassessment sites in an Alpine river, and to identify nivo-glacial, nivo-pluvial, and pluvial reaches.We then applied spatial stream-network models (SSN) to investigate the relationships between hydrologic and macroinvertebrate metrics. Macroinvertebrate metrics correlated strongly with summer, winter and temporal variation in streamflow, but effects varied across flow regime types: i) taxon richness appeared limited by high summer flows and high winter flows in nivo-glacial and pluvial streams, respectively; ii) invertebrate grazers increased proportionally with the annual coefficient of flow variation in nivo-glacial streams but declined with flow variation in pluvial streams. Although local land-use and water quality also affected benthic communities, most variation in macroinvertebrate metrics was associated with spatial autocorrelation. These findings highlight the importance of developing environmental flow management policies in ways that reflect specific hydro-ecological and land use contexts. Our analyses also illustrate the importance of spatially-explicit approaches that account for auto-correlation when quantifying flow-ecology relationships

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