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Microcosms metacommunities in river network: niche effects and biodiversity

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Many highly diverse landscapes exhibit hierarchical spatial structures that are shaped by geomorphological processes. Riverine ecosystems, among the most diverse habitats on Earth, represent an outstanding example of such mechanisms. In these landscapes, in which connectivity directly influences metacommunity processes, habitat capacity contributes to control biodiversity at several levels. A previous study has already highlighted the effect of connectivity on species distribution at local and regional scales, but habitat capacity was kept uniform.

We studied the interaction of connectivity and habitat capacity in an aquatic microcosm experiment, in which microbial communities were grown in 36-well culture plates connected by dispersal. Dispersal occurred by periodic transfer of culture medium among connected local communities, following river network topology.

The effect of habitat capacity in these landscapes was investigated by comparing three different spatial configurations of local community volumes:
1. Power law distributed volumes, according to drainage area.
2. Spatial random permutation of the volumes in the above configuration.
3. Equal distribution of volumes (preserving the total volume with respect to the above configurations).

The net effect of habitat capacity on community composition was isolated in a control treatment in which communities were kept isolated for the whole duration of the experiment. In all treatments we observed that varying volumes induced niche effects: some protozoan species preferentially occupied larger nodes (systematically in isolation). Nevertheless, there is evidence that position along the network played a significant role in shaping biodiversity patterns.

Size distribution measurements for each community were taken with a CASY cell counter, and species abundances data on log scale precision were collected by direct microscope observation.