

Abstract

Ecological communities along gradients of environmental stress are thought to be structured by trade-offs between resisting biotic interactions in physically benign habitats and successfully exploiting physically stressful habitats. However, these trade-offs are likely to be affected by the predictability of abiotic stressors, and variation in the strength of biotic interactions. I investigated community assembly and food web interactions in ponds across an unpredictable gradient of water inundation (pond permanence) in Canterbury, New Zealand. Pond community composition and species richness were strongly influenced by pond permanence. However, species in temporary ponds were a nested subset of generalists that were also found in permanent ponds, rather than a unique assemblage of temporary pond specialists. Subsequent experiments indicated predator impact decreased with pond permanence, partially due to the foraging suppression of predatory invertebrates in permanent ponds by fish. Weak predation in permanent ponds combined with unpredictable drying regimes likely selected for generalist traits, and resulted in community assembly being driven by a gradient of drying stress rather than trade-offs between biotic interactions and drying. Furthermore, predator impact increased over time in temporary ponds. In predictable snow-melt ponds in the Colorado Rocky Mountains, seasonal windows of weak predation were exploited by vulnerable species, leading to increased diversity within habitats. However in unpredictable systems like Canterbury, temporal increases in predation risk that depend on drying history are likely to increase variability in the spatial arrangement of suitable habitats for particular species. This should further favour the evolution of generalist traits and reduce the importance of trade-offs between predation and drying in the assembly of communities. Considering the predictability of disturbance regimes and the spatial and temporal variation in biotic interactions will greatly enhance understanding and management of communities in heterogeneous landscapes.