Large brown mudfish populations are keystones of landscape-scale resilience to global warming in Westland swamp-forests

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Typical scaling of population size with probability of persistence suggests only small populations will lack resilience to increasing environmental stochasticty associated with global warming, but this relationship may depend on the quality of habitat patches which can be affected by land use. Using empirically-derived models of a swamp-forest fish metapopulation, we show their resilience to global warming-induced drought-extremes was almost entirely dependent on land-use changes which limited persistence of large populations. Population persistence increased indefinitely with population carrying capacity in large stable patches, but this relationship was asymptotic at low population size in small unstable patches contracted in size by forest logging. Metapopulation persistence in logged forests dropped 93 percent due to asymptotic scaling and lost persistence of large populations, compared to unaffected metapopulations. Thus even large populations are vulnerable in stochastic environments, the loss of which has disproportionate effects at landscape scales. These results confirm longstanding theory predicting asymptotic population size-persistence thresholds will occur as environmental stochasticity rises, and highlight the keystone role of large populations in maintaining landscape-scale resilience to climate change. Consequently, achieving high carrying capacity in large stable habitats maybe the most effective tool for mitigating the impacts of extreme climate events under global warming.