**Context dependence and historical contingency in zero-sum dynamics**

Definitions

Zero-sum dynamics: species are using a shared pool of resources, such that declines in one species can be offset in gains by another resulting in no net change in overall resource use. Implies strong competition. Kind of how we think about Portal since the arrival of Bailey’s. Sometimes an assumption of models but not clear how ubiquitous. Evidence is mixed and difficult to come by. If it’s common, implies that system level function may be more resilient than species composition.

Context dependence: the direction, strength, or outcome of an interaction/effect shifts depending on environmental conditions, additional species present, etc. Makes prediction tough in ecology.

Historical contingency: possibly a special case of context dependence, where not only does the outcome depend on the environmental/biotic conditions *now*, but on the conditions in the past.

Portal is a good place to test these ideas because: history of strong competition; long term data; repeated implementations of the same manipulations.

We can test for context dependence by looking at old exclosures vs controls. Context dependence in this case would be whether changing (environmental) conditions mean that even the *same set of species* – with PB present – is now no longer able to compensate for krats. Means that something has shifted such that species no longer overlap sufficiently in their niches for PB to fully exploit the resources that krats are exploiting on control plots. Maybe resources are available in a different way that krats can get at but PB can’t, or some non-resource factor is driving PB to decline. Underscores that PB is not really functionally redundant with krats, but can compensate *under specific circumstances*.

Functional compensation is dependent on the species pool and the match of the available traits to the environment, and environmental shifts outpace dispersal resulting in lags/failures to stay aligned. Even in systems where it is known to occur, zero-sum is not stable or consistent over time, or may occur with very long time lags contingent on significant metacommunity dynamics. Zero sum may thus be better understood as a temporary phenomenon observed when environmental conditions and the traits available in the local species pool are aligned, but that fades as conditions shift, than as a long-lasting attribute of certain systems.

Could also be that we see zero-sum again, but this time it’s a different species (PB). This is an indication

We can test for *historical contingency* by comparing the response on new exclosures to on old exclosures. We may or may not be able to disentangle veg shifts with other sources of contingency. Regardless, some lingering effect of krat presence may cause the same perturbation to result in not the same outcome when induced now vs when it has been in place for a long time.