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Energetic compensation breaks down over time in a desert rodent community

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Abstract Text:

Background/Question/Methods

Energetic compensation can occur when declines in energy use from some species in an assemblage are offset by gains from others. When observed, energetic compensation is consistent with a zero-sum competitive dynamic, and renders assemblage-level function resilient to species' fluctuations. When compensation is mediated by niche structure, it is contingent on the

degree to which the species present in an assemblage are functionally substitutable. If species differ in their responses to changing conditions over time, shifting conditions may modulate the degree of redundancy between species and cause compensation to be variable over time – even within a single assemblage.

Some of the strongest evidence of energetic compensation has come from long-term experiments on the rodent community near Portal, AZ. Since 1977, kangaroo rats have been excluded from experimental plots. Partial energetic compensation from smaller granivores was observed immediately, and near-complete compensation occurred beginning in 1996, with the establishment of the functionally analogous *Chaetodipus baileyi.* We combine long-term temporal analysis of the original experiment with new implementations of the same treatments, initiated in 2015, to explore whether the historically documented energetic compensation has persisted despite major transitions in the habitat and rodent community structure at the site over time.

Results/Conclusions

Since 2010, total energy use on kangaroo rat exclosure plots declined to ~40% that on controls, compared to 70% from 1996-2010 and 24% before 1996. This coincided with a precipitous decline in *C. baileyi,* a long-term increase in the proportion of energy use from small granivores sitewide – from 5% of total energy use on control plots before 1996, to 30% after 2010 – and decreasing gains in small granivore energy use on treatment relative to control plots. While kangaroo rat removal now results in a smaller decline in total energy use than at the beginning of the study, this is due to a general increase in small granivore energy use rather than increasing compensation from species other than the now-scarce *C. baileyi.* These findings are consistent between long-term and new experimental plots.

We suggest that over time, the degree of functional overlap between kangaroo rats and smaller granivores has decreased, weakening the potential for energetic compensation, even from species that compensated under past circumstances. Our results highlight that energetic compensation is a dynamic, contingent phenomenon. Assemblage-level resilience to species loss, and zero-sum competitive dynamics, may therefore be temporary and most detectable over long temporal scales – in this case, spanning decades.

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Preferred Presentation Format:
Oral

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