

SPECIES ALL IN ONE: EPHEMERALS, RODENTS, AND THEIR PREDATORS SHAPE THE EFFECTS OF EL NIÑO ON ARID PERENNIAL VEGETATION

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Study Description

We applied 25 years of data across three trophic levels to characterize how biotic interactions in thorn-scrub habitat interact with ENSO-driven precipitation to influence long-term vegetative responses in semiarid Mediterranean Chile. Response of shrub cover to precipitation was mediated by (1) a complex interplay between subtle top-down controls (herbivory) that become more apparent in the long-term, (2) competition with ephemeral plants during wet years, and (3) an unanticipated indirect effect of predators on subdominant shrubs and perennial herbs. In the face of global change, understanding how multi-trophic controls mediate dryland vegetation responses to climate is essential to properly managing the biodiversity of arid systems.



Photo 1: Long-term research field site at Bosque Fray Jorge National Park (Chile) one year after the onset of the biotic exclusion plots (1990; left) and in 2013 (right). The white (left) and green (right) meshes are the roofs of the predator exclusion plots. Size of each plot is 75×75 m. Photo credit: (left) Peter Meserve; (right) Andrew Engilis.



Photo 2: Field site in 2014, a neutral to weak La Niña dry year (45.5 mm rainfall; upper), and in 2015, an El Niño wet year (160.0 mm rainfall; lower). The perennial plant community is composed of 34 spp., being five the dominant ones, while the ephemeral plant community can host up to 95 spp. Both photographs were taken in September, at the peak of the growing and blooming season (end of winter). Photo credit: María del Pilar Fernández-Murillo.



Photo 3: Representative species of the small mammal community (12 spp.). From upper-left to lower-right corner: *Abrocoma bennettii* feeding on *Senna cumingii* leaves; Peter Meserve and Andrea Previtali during fieldwork and weighing a *Phyllotis darwini*; *Octodon degu* one of the core, largest, and most abundant rodents in this semiarid system; *Oligoryzomys longicaudatus*; and *Thylamys elegans* (insectivorous) on the top of an *Adesmia bedwellii* shrub. Photo credit: Peter Meserve (except that of *Oligoryzomys*; Andrea Previtali, and that of *Thylamys*; Brian Lang).



Photo 4: Different predators of the small mammal community. From top-left to bottom-right corner: Culpeo fox (*Lycalopex culpaeus*); Great Horned Owl (*Bubo virginianus*); Black-chested Buzzard-Eagle (*Geranoaetus melanoleucus*); lateral view of a predator exclusion plot; Austral burrowing Owl (*Glaucidium nana*); a Chilean green racer (*Philodryas chamissonis*) digesting an *Octodon degu*; and Douglas Kelt collecting feces of Culpeo fox. Photo credit: Peter Meserve (except that of the birds; Andrew Engilis, and the snake; Brian Lang).



Photo 5: Field site view taken from the top of the Altos de Talinay coastal range. The predator exclusion plots (green mesh roofs) can be seen at the bottom of the valley. Photo credit: María del Pilar Fernández-Murillo.

These photographs illustrate the article “Species interactions across trophic levels mediate rainfall effects on dryland vegetation dynamics” by Ariel A. Fariás, Cristina Armas, Aurora Gaxiola, Alex P. Cea, Jose Luis Cortés, Ramiro P. López, Fernando Casanoves, Milena Holmgren, Peter L. Meserve, Julio R. Gutiérrez, Douglas A. Kelt published in *Ecological Monographs*. <https://doi.org/10.1002/ecm.1441>.