Populations are not declining and food webs are not collapsing at the Luquillo Experimental Forest

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In PNAS, Lister and Garcia (1) report declines in abundances of understory arthropods and lizards between 1976 and 2012 and claim similar declines in populations of arthropods, frogs, and insectivorous birds based on data from the Luquillo Long-Term Ecological Research project (LUQ). Their conclusion, that increasing temperature has led to a collapse of the food web, has attracted considerable attention from public media, but this conclusion is not corroborated by empirical evidence from LUQ (see Supplementary Materials, https://luq.lter.network/pop-trends-yunque-luquillo). Also, the authors fail to consider the effects of hurricanes and subsequent changes during secondary succession.

Lister and Garcia (1) interpret temporal changes in abundance of the walking stick (*Lamponius portoricensis*), canopy arthropods, frogs (*Eleutherodactylus coqui*), and birds at El Verde to be a consequence of increasing annual mean maximum daily temperature. In many cases, abundance data are not adjusted to consider variation in sampling effort. Moreover, the authors combine data files that are not compatible to create the temperature record for analyses. Indeed, maximum temperature from this record evinces a significant linear decrease at El Verde (cooling) in the period during which Lister and Garcia analyzed demographic data, a pattern evident in figure 1A of ref. 1 (see figures 1 and 2 of Supplementary Materials).

Using Lister and Garcia's (1) analytical approach for temporal trends, we found a significant decline in density of *Lamponius* from 1993 to 2011, but density was not statistically related to temperature during this period (figures 3 and 4 of Supplementary Materials). These results contradict those of Lister and Garcia and suggest a more complex interplay of factors affecting variation in abundance of *Lamponius* (2). Canopy arthropod density does not decline between 1994 and 2009 but does increase significantly with increasing temperature (figures 5 and 6 of Supplementary Materials), even for the 10 most abundant taxa (tables 1 and 2 of Supplementary Materials), which Lister and Garcia claimed to have used (3).

Long-term data do not suggest a simple decline in adult frogs from 1987 to 2017 (figure 7 of Supplementary Materials) but do document an increase in numbers with increasing temperature (figure 8 of Supplementary Materials). Numbers vary in a consistent and nondirectional manner, except for short-term increases after Hurricanes Hugo and Georges, which modified habitat structure, followed by decreases to predisturbance levels (4) (figure S3B of ref. 1). Although prehurricane data exist for all 4 of Woolbright's (4) plots, Lister and Garcia (1) do not include these data (figure S3A, C, or D of ref. 1). Stewart's (5) data used by Lister and Garcia are consistent with this phenomenon [i.e., higher numbers after Hurricane David (1979)], followed by a decline to the typical range observed as recently as August 2017.

Lister and Garcia (1) do not consider the effects of changing forest structure following Hurricane Hugo (1989), which inflated avian captures rates at the beginning of the sampling period (6, 7). Their conclusion that the abundance of the insectivorous Puerto Rican tody (*Todus mexicanus*) declined by 90% is not supported by mist-netting data (capture rates from 1980 are similar to those from 2005) or point-count data from the same period (figures 9–11 of Supplementary Materials).

We found no evidence to support the conjecture that food webs are collapsing at LUQ as a result of warming. The narrow focus on temperature-related aspects of climate change as the causative agent does not address the multiple disturbances (e.g., hurricanes and droughts) that affect the forest (8).

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