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Title: Weather, topoclimate, and phenology: Population dynamics of Checkerspot butterflies in complex terrain

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Abstract:
Climate change driven by accumulation of greenhouse gases refers to broad-scale forcings of global circulation patterns that result in directional changes (on average) of temperature and moisture patterns. But, organisms themselves live in very local climates determined by topography and vegetation, and downscaling climate changes to the organismal scale requires judicious use of environmental biophysics, empirical measurements, and "seat of the pants" GIS-based statistical modeling. The spatial climate hierarchy ranges from macroclimate (broad atmospheric circulation at 100+ km scales), through mesoclimates (regional climates over 1-100 km), topoclimates (10 m to 1 km), and microclimates at the finest spatial scales. This presentation demonstrates how downscaling macroclimate to the appropriate topoclimatic and microclimatic scales can provide key insights into the vulnerability and resiliency of ecosystems in the face of climate change. The approach used distributed networks of inexpensive temperature sensors, GIS modeling of topoclimatic gradients, and hemispherical photography to quantify canopy structure that drives microclimate. The examples include monarch butterflies in Mexico, plant species distributions in the White Mountains of California, and stream temperatures in steelhead trout and red-legged frog habitat in the San Francisco Bay Area.

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