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A dynamically downscaled projection of past and future microclimates

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Abstract. Ecological forecasting requires information about the climatic conditions experienced by organisms. Despite impressive methodological and computational advances, ecological forecasting still suffers from poor resolutions of environmental data. Published data comprise relatively few layers of surface climate and suffer from coarse temporal resolution. Hence, models using these data might underestimate heterogeneity of microclimates and miss biological consequences of climatic extremes. Moreover, we currently lack predictions about vegetation cover in future environments, a key factor for estimating the spatial heterogeneity of microclimates and hence the capacity for behavioral thermoregulation. Here, we describe

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microclimates and vegetation for the past and the future at spatial and temporal resolutions of 36 km (approximately 0.3°) and 1 h, respectively. We used the Weather Research and Forecasting model to downscale published, bias-corrected predictions of a global-circulation model from a resolution of 0.9° latitude and 1.25° (approximately 100 km in latitude and 130 km in longitude). Output from this model was used as input for a microclimate model, which generated temperatures and wind speeds for 1980–1999 and 2080–2099 at various heights, as well as soil temperatures at various depths and shade intensities. We also predicted the percentage of green vegetation and the percentage of shade given the angle of the sun. These data were evaluated using several criteria, each of which shed light on a different aspect of value to researchers. The metadata describe the modeling protocol, microclimate calculations, computer programs, and the evaluation process.

Key words: climate change; downscaling; extreme events; microclimate; shade; soil temperatures; stochasticity; vegetation; wind speed.

The data sets for *this* abstract published in the Data Papers section of the journal is published electronically in *The Knowledge Network for Biocomplexity* at:

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The computer programs and data-processing algorithms are available in the Supporting Information file DataS1.zip.

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