One past, many futures: using history to inform climate-change adaptation

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Abstract

Adaptation to future climate change on the part of natural-resource managers and planners is challenged by the indeterminacy of future states and conditions. Interactions between anthropogenic greenhouse-gas forcing and natural high-frequency climate variability translates into multiple potential climate pathways into the future as global climate change proceeds. The path-dependent nature of ecological dynamics (e.g., disturbance, recruitment, incumbency) ensures that multiple ecological outcomes can arise given similar initial conditions, similar future 'average' climate, and alternative climatic pathways or sequences. Paleoecological records provide numerous examples of contingent dynamics, historical legacies, and multiple endpoints on spatial (local to regional) and temporal (annual to decadal) scales most relevant to management decisions. Traditional management approaches, whereby a single future state is predicted and management decisions follow accordingly, may lead to poorly informed decisions and management failures. Therefore, robust and adaptive management strategies must incorporate a broad array of potential future states. Scenario planning and other approaches can be informed and enriched by insights from paleoecological records. The future will, by definition, be novel, and knowledge of past outcomes and dynamics can broaden perceptions of possible future states, leading ultimately to better management choices in the present.

Keywords: global change, paleoecology, history, conservation, future

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