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# Applying paleoenvironmental records to critical problems in natural resource management

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## Abstract

Many watersheds in western North America are undergoing rapid, fundamental transformations due to interactions among climate change, widespread fire and pathogen outbreaks, species invasions, and altered patterns of human land-use. In turn, natural resource managers face great challenges in identifying and implementing effective adaptation and mitigation strategies, challenges that are amplified by uncertainties in predicting local to regional-scale climate change. Paleoenvironmental records can provide valuable insights by revealing the range of natural variability in key processes, and by showing how ecosystems have responded to past changes in climate of various types, magnitudes, and rates. Here we describe a suite of applications to problems in natural resource management drawn from both the high latitudes of Alaska and the high elevations of the Rocky Mountains. Rather than simply providing cautionary tales about the potential for extreme events, paleoenvironmental records can be used as direct inputs to simulation models, and provide a foundation for exploring ecosystem vulnerabilities within a robust, probabilistic framework. When combined with forecasts of future climatic change, paleoenvironmental records offer detailed, realistic scenarios that can reveal ecosystem vulnerabilities, and help managers identify "win-win" strategies for responding to a broad range of potential futures. Most importantly, these studies show that paleo records are an excellent tool for engaging diverse groups in discussions of environmental change, and for promoting concrete management actions in the face of significant uncertainty.

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