

Regional-scale vegetation die-off in response to future climate change in the 21st Century

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Abstract

Rapid and large-scale tree mortality due to recent climate change and climate-change induced insect outbreaks has been observed in western North America. Climate models have projected an increase in future temperatures and changes in precipitation for this region. However, quantitative assessments of the magnitude and timing of potential climate-driven changes in vegetation mortality are lacking. We use an Earth System Model (the Community Earth System Model) coupled with a dynamic vegetation model (DGVM) to assess future potential changes in vegetation distributions over western North America under the future A2 emissions scenario. In order to better span uncertainties in future climate, different future sea surface temperature (SST) projections provided by CMIP3 (phase 3 of the Coupled Model Intercomparison Project) are used as boundary conditions. Although all model simulations project different future climates, there is a broad consensus amongst our simulations that a decrease (from 45% to 22%) in needleleaf evergreen tree coverage coincident with an increase (from 14% to 33%) in shrubs and grasses will likely happen starting in the mid-21st century over western North America. Our findings suggest that a shift of tree-covered landscape to shrubs and grasses dominated landscape in western North America may take place due to future warming and consequent increases in water deficits.