We told you so 20+ years ago!

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Abstract

We review 25+ years of published climate impacts projections for the continental United States under a variety of climate scenarios and compare them with observations from field and remote sensing. Summers have become warmer and drier, fire season longer, drought stress more severe, endemic pests more lethal, vegetation shifts obvious. We present results from a dynamic global vegetation model that has been used since 1995 to simulate ecosystem responses to a variety of climate futures. Strengths and weaknesses of the vegetation model and its drivers are listed but overall results show that despite its obvious shortcomings, the model simulated fairly well the observed trends and the order of magnitude of the changes. One major conclusion of the study is that uncertainty with climate and vegetation model projections is much less than that of human choices and sociopolitical decisions which affect land use and greenhouse gas emissions.

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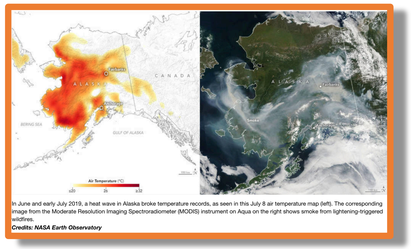
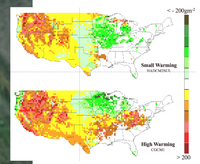
Dominique M Bachelet, Oregon State University and Tim Sheehan, Conservation Biology Institute, Corvallis, Oregon
and many others (C. Daly, J. Lenihan)

Methods
Model used MC1 DGVM
Limitations:
Natural Vegetation
No Land Use
No pests or pathogens
No human fire ignitions

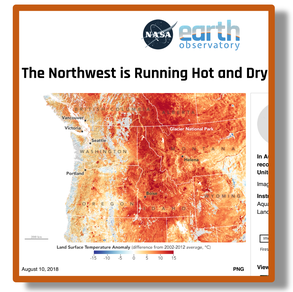
Bachelet et al. 2005:"*Projections show that by the end of the 21st century, 75%–90% of the area simulated as tundra in 1922 is replaced by boreal and temperate forest.*"

Alders are expanding across tundra

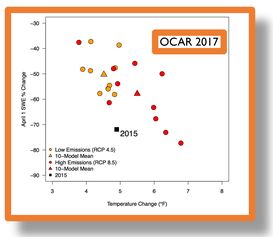


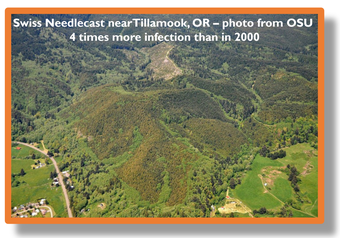


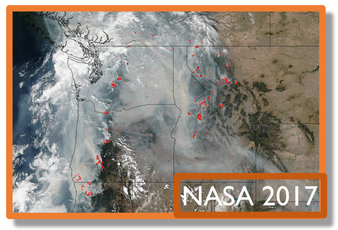
Bachelet et al. 2001:" *Because temperatures increase in the first few decades of the 21st century as precipitation slightly decreases, the hypothesized early green-up does not materialize under CGCM1. Instead, there is a rapid loss in vegetation density until mid-century.*"



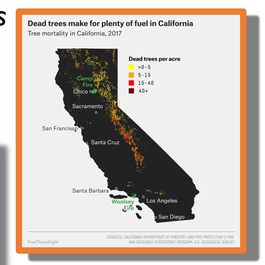
Bachelet et al. 2004: "*The Northwest alternates as either a source or a sink of carbon with HADCM2SUL, whereas it is mostly a sink of carbon with CGCM1* ***except in the 2010s*** *and* ***the 2060s****, when up to 40 Tg C are released to the atmosphere.*"







Lenihan et al. 2003."*The simulated response to changes in precipitation were complex, involving not only the effect of changes in soil moisture on vegetation productivity, but also changes in tree–grass competition mediated by fire. Summer months were warmer and persistently dry under both scenarios, so the trends in simulated fire area under both scenarios were primarily a response to changes in vegetation biomass.*"



Lenihan et al. 2008: "*The model results indicate fire will play a critical role in the adjustment of semi-arid vegetation to altered precipitation regimes, be it slowing or limiting the encroachment of woody vegetation into grasslands under less dry conditions or hastening the transition from woody communities to grassland under drier conditions.*"