Precipitation Change Effects Evaluated For Seven Ecosystems With Distinctive Vegetation and Hydrology

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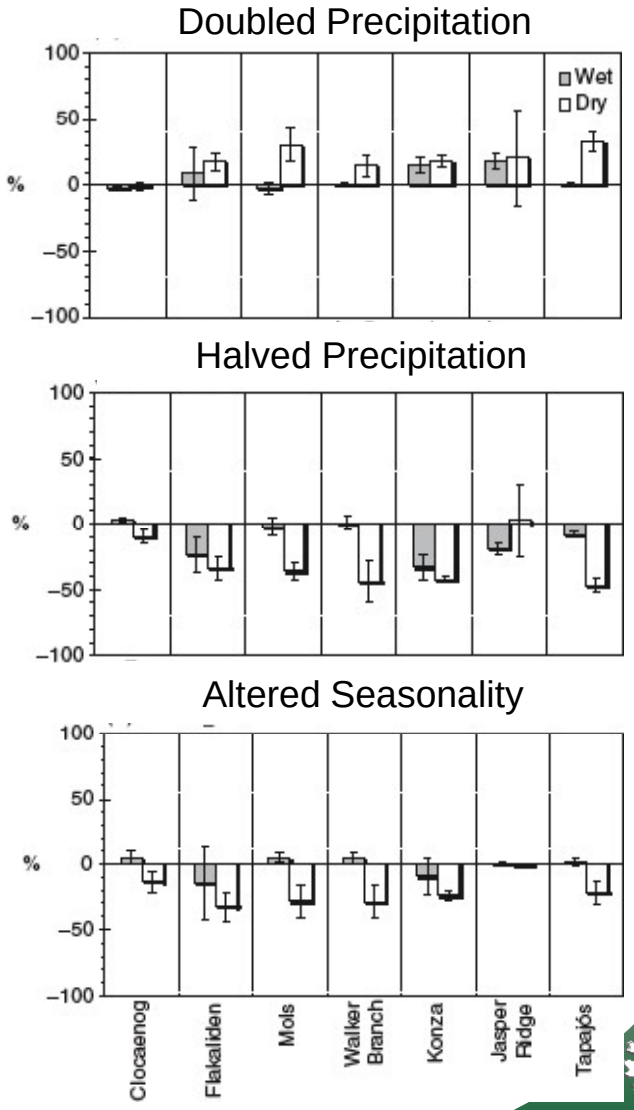
- Four well-established process-based ecosystem models (LPJ, DayCent, ORCHIDEE, TECO), were used to explored effects of potential precipitation changes (P) on water limitation and net primary production (NPP) in seven terrestrial ecosystems with distinctive vegetation located in different hydroclimatic zones.
- The magnitudes of productivity change were determined by the degree of ecosystem water limitation.
- Humid sites and/or periods were least responsive to any change in P as compared with moderately humid or dry sites/periods.
- Productivity across systems responded more strongly to doubling or halving of P and a seasonal shift in P occurrence than to altered P frequency and intensity at constant annual amounts.
- This study underscores the importance of P as a driver of change in ecosystems, but the quantitative response of a particular site depends on the detailed nature and seasonal timing of P change.



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The ongoing changes in the global climate expose the world's ecosystems not only to increasing CO_2 concentrations and temperatures but also to altered precipitation (P) regimes. Using four well-established process-based ecosystem models (LPJ, DayCent, ORCHIDEE, TECO), we explored effects of potential P changes on water limitation and net primary production (NPP) in seven terrestrial ecosystems with distinctive vegetation types in different hydroclimatic zones. We found that NPP responses to P changes differed not only among sites but also within a year at a given site. The magnitudes of NPP change were basically determined by the degree of ecosystem water limitation, which was quantified here using the ratio between atmospheric transpirational demand and soil water supply. Humid sites and/or periods were least responsive to any change in P as compared with moderately humid or dry sites/periods. We also found that NPP responded more strongly to doubling or halving of P amount and a seasonal shift in P occurrence than that to altered P frequency and intensity at constant annual amounts. The findings were highly robust across the four models especially in terms of the direction of changes and largely consistent with earlier P manipulation experiments and modeling results. Overall, this study underscores the widespread importance of P as a driver of change in ecosystems, although the ultimate response of a particular site will depend on the detailed nature and seasonal timing of P change.

Gerten D, Luo Y, Le Maire G, Parton WJ, Keough C, Weng E, Beier C, Ciais P, Cramer W, Dukes JS, Hanson PJ, Knapp A, Linder S, Nepstad D, Rustad L, Sowerby A (2008) Modelled effects of precipitation on ecosystem carbon and water dynamics in different climatic zones.
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