



Vulnerability of global crop production systems to drought extremes

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Drought is a major climate extreme damaging crop production. While this fact is empirically well known, detailed geographic pattern of drought damage to the crop production is undisclosed. As more wide-spreading drought would be anticipated under climate change, understanding of historical changes in the vulnerability of crop production system to drought is substantial. Here we estimated drought-induced damage to maize, rice, soy and wheat during 1984–2009 worldwide using empirical relationships between a yield anomaly and a drought magnitude. We found that more than three fourths of the global harvested areas — mostly distributed around semi-arid regions — experienced drought-induced yield losses accounting for 109 billion United States dollars during the period. We highlighted that decreased vulnerability (or increased resilience) of crop production system to drought accompanies improvements in agronomic technology and management represented by increase in per capita gross domestic product. Our findings offer a basis in estimating economic losses in crop production systems caused by climate extremes, and ultimately enable us to estimate the adaptation cost to drought under climate change.