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Mitigation of greenhouse gas emissions from global croplands under a changing climate and increasing food demand

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Agricultural nitrogen (N) inputs have grown massively over the last century, driving increases in crop yields, but also resulting in increased greenhouse-gas emissions and nutrient overloading of ecosystems. Of particular note is the increase in emissions of N₂O, a greenhouse gas with 300 times the warming potential of CO₂. While the total global yearly N₂O emissions can be easily deduced from atmospheric measurements, much less is known about the contribution of different cropping systems, and how increasing food demand will affect these emissions in the future. This knowledge is important for developing well-targeted mitigation strategies that reduce N₂O emissions while increasing crop production. In order to help resolve this issue, we have simulated global croplands, one of the main beneficiaries of increased N inputs, using a process-based model that captures both crop growth and nitrogen and carbon cycling through the soil. This allows us to quantify total N₂O emissions by crop type, identify hotspots and explore how a changing climate and increasing food demand are likely to impact future emissions. The idea is that this will aid in the search for agricultural management strategies that ensure food security while reducing the climate impact.