Climate-driven Global Cropland Changes and Consequent Feedback

10th April 2025 (Thu)
4:30 – 6:00 pm (UTC+8)
Rm 221, Chen Kou Bun Building, CUHK

The interdependence of climate change and agricultural land use remains a critical, yet unquantified, area of concern for future food production. In this talk, we discuss the climate-driven cropland change based on counterfactual estimates of agricultural total factor productivity for 110 countries in a scenario without climate change over 1992-2020. By incorporating land-use responses to international trade patterns, we find that 88 Mha (90% CI: 5 – 179 Mha) of cropland currently in use, or 6.3% (90% CI: 3.6 – 12.8%) of the cropland in our studied countries, can be attributed to climate change via reductions in agricultural productivity growth. This area exceeds the observed 3.9% net cropland expansion in the studied counties, indicating that total cropland area would have decreased in the absence of climate effects. The release of about 21.8 Gt CO_2 could have been prevented without climate-driven cropland change, accounting for about 18.9% of land-use change emissions in these countries. Climate-driven cropland change also triggered noticeably warmer and drier local climate feedback in some major production regions, with potential repercussions for food security. The significant contribution to global emissions is likely to impose further long-term negative impacts on agricultural efficiency.

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Prof. Jin is a tenured Associate Professor at the College of Urban and Environmental Sciences, Peking University. His experience also involves research, teaching, and product development at Stanford University, Atlas AI, and the University of Minnesota. He is a recipient of the NSF CAREER Award in the United States. His research focuses on integrating ecological theory, mechanistic modelling, remote sensing, and AI to provide scientific and technical support for the monitoring and management of food production systems. His papers have been published in leading journals such as *Science*, *Nature Climate Change*, *Nature Food*, *Nature Communications*, and *Remote Sensing of Environment*.

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