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Biophysical climate effects of changing forest cover across scales

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Changes of forest cover regulate climate system directly through the alteration of water vapor, energy, and momentum exchange between land surface and the atmosphere. These land-based biophysical effects vary with locations and seasons and cause regional cooling or warming, which enhances or diminishes the climatic benefits of forest carbon drawdown in different cases. Biophysical climate effects of forest conversion exhibit the largest uncertainty in the mid-latitudes. The sign and magnitude of biophysical effect in temperate zones are still under hot debate. Over the past two decades, most of our understandings on how forest affects climate through biophysical processes came from sensitivity analysis of climate modeling, by comparing paired model simulations of forest and short vegetation covers. However, much remains unknown in the real world due to the complicated process and uncertainty in magnitude, especially in the temperate bioclimate regions. Here we reviewed complex results and debates from model simulation, field measurements, and satellite observation, and then applied satellite-based observation to investigate the biophysical climate response to potential forest conversion in temperate regions, especially on the spatial and temporal patterns and underlying mechanisms. We also interpret some key findings on land-climate interactions from recent IPCC special report on climate change and land (SRCCL).

Readings:

Jia, G., E. Shevliakova, P. Artaxo, et al. (2019): Land-climate interactions, *in Skea J. et al. (eds.)* IPCC Special report on climate change and land. Intergovernmental Panel on Climate Change. IPCC, Geneva (in press) https://www.ipcc.ch/srccl/chapter/chapter-2/

Ma, W., **G. Jia**, and A. Zhang (2017): Multiple satellite-based analysis reveals complex climate effects of temperate forests and related energy budget, J. Geophys. Res. Atmos., 122, 3806–3820, doi:10.1002/2016JD026278

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