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Save the forests to mitigate climate, twice

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Deforestation impacts climate in two major ways: affecting the atmospheric CO_2 concentration and modulating the land-atmosphere fluxes of energy and water vapor. While the mitigation effects of forest biogeochemistry have been largely investigated and are accounted for in climate protocols, the biophysical impacts of forest cover are still debated in the scientific community and are ignored in climate treaties. On the other hand, currently available model predictions of land biophysical effects are rather uncertain thus additional robust experimental evidence at the global scale is required to inform climate policy. In this work we report an observation-driven analysis of the biophysical impacts of forest losses and gains on the local climate, based on a combination of Earth observations of forest cover, surface radiometric temperatures, and in-situ air temperatures. Results show that deforestation causes significant local changes in mean air temperature. In addition, forest losses produce a substantial increase in both the diurnal and annual temperature variation at all latitudes, by increasing daytime and reducing nighttime temperatures (except in the case of snow cover when both days and nights are cooled). These experimental observations provide a global and robust quantification of the local climate sensitivities to deforestation and a novel assessment of the mitigation potentials of forests on the diurnal and seasonal temperature variations. Ultimately, these findings may support the development of land-based mitigation strategies that build on the integration of biogeochemical and biophysical effects of afforestation and deforestation.