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Modelled climate response to regional-scale deforestation

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At this point it is estimated that 15-30% of Earth's natural forests have already been converted to pasture or cropland. With such large amounts of forest being converted to cropland and grassland, it is important to determine the climatic effects of these actions. To date, most modeling efforts towards understanding the climatic effects of deforestation have simulated global deforestation or have been based on experiments where trees were removed from large areas, i.e. the entire Amazon or all forests above 40° N.

Here we use the University of Victoria Earth System Climate model to evaluate the response to deforestation of 5 - 100% of the forested areas in three latitude bands: high (above 40° N), mid (above ± 20°) and low (between ± 20°). High latitude deforestation lead to cooling and increase in soil carbon for all fractions of deforestation. There was a decrease in atmospheric CO_2 in the 45% -100% high-latitude deforestation simulations due to increased soil sequestration. Low-latitude and mid-latitude deforestation initially produced warming in all scenarios, although all were colder than the control by the end of the simulation. Atmospheric CO_2 increased in all simulations, as well as soil carbon. Mid-latitude deforestation had less warming and cooling compared to low latitude deforestation.