

# Potential land use and land cover change impacts on climate and air quality

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Given the expected increase in pressure on land resources over the next century as the demand for food swells and productive regions shift with a changing climate, there is a need to understand the total impacts of activities associated with land use and land cover change (LULCC). Here we quantify these impacts using the radiative forcing metric, including forcings from changes in long-lived greenhouse gases, tropospheric ozone, aerosol effects, and land surface albedo. We estimate radiative forcings from the different agents for historical LULCC and for six future projections using simulations from the National Center for Atmospheric Research Community Land Model and Community Atmosphere Models and additional offline analyses. When all forcing agents are considered together we show that 40% (+30%, -20%) of the present-day (2010) anthropogenic radiative forcing can be attributed to LULCC. Changes in the emission of non-CO<sub>2</sub> greenhouse gases and aerosols from LULCC enhance the total LULCC radiative forcing by a factor of 2 to 3 with respect to the forcing from CO<sub>2</sub> alone. In contrast, the non-CO<sub>2</sub> forcings from fossil fuel burning are roughly neutral, due largely to the negative (cooling) impact of aerosols from these sources. Future estimates of climate change can include large contributions from land use and land cover change depending which scenario humans choose.