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Local surface temperature response to land cover/land management change is driven by non-radiative processes

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Following a land cover/land management change (LCMC), local surface temperature responds to both a change in available energy and to a change in the way energy is redistributed by various non-radiative mechanisms. The extent to which non-radiative mechanisms contribute to the local direct temperature response for different types of LCMC across the world remains uncertain. Here, we combine extensive records of remote sensing and in-situ observation to quantify the local surface temperature response to nine common LCMC perturbations, identifying underlying biogeophysical mechanisms and analyzing global patterns. We find that non-radiative mechanisms dominate the local response in most regions for 8 of 9 LCMC perturbations. Further, the response to forest cover gain is an annual cooling in all regions south of the upper conterminous United States, northern Europe, and Siberia – reinforcing the attractiveness of re-/afforestation as a local mitigation and adaptation measure in these regions. Our results affirm the importance of accounting for non-radiative mechanisms when evaluating local land-based mitigation/adaptation policies.