Supplemental Material
**Figure S1.** Changes in tree PFTs from 1850 to 2000 prescribed in high-resolution and low-resolution LULCC experiments.
**Figure S2.** Changes in the diurnal cycle of $T_s$ (top) and $T_{2m}$ (bottom) over the deforested areas in the Northern Hemisphere. The deforested areas are defined as the grid cells with complete tree loss (shown as figure 1a) in the high-resolution simulations.

**Figure S3.** Changes in diurnal cycle of $T_s$ (top) and $T_{2m}$ (bottom) over the afforested areas in North America and Europe. The afforested areas are defined as the grid cells with complete tree gain (shown as figure 1a) in the high-resolution simulations.
Figure S4. Change in daytime latent heat flux (LE), evaporation of canopy interception ($E_c$), ground evaporation ($E_g$), and canopy transpiration ($T_c$) over the deforested and afforested areas.
Figure S5. Daytime and nighttime surface radiation and fluxes over the forest areas (the same pixels for the deforested areas as Figure 4) in the Northern Hemisphere derived from the high-resolution pre-industrial simulation. Positive values are defined as downward shortwave or longwave radiation, sensible heat flux (H) transferred from the surface to the lower atmosphere for, and ground heat flux (G) transferred from the surface into subsurface soil.
Figure S6. Changes in $T_s$ (top) and $T_{2m}$ (bottom) over the deforested areas based on aggregated high-resolution (from $0.47^\circ \times 0.63^\circ$ to $1.9^\circ \times 2.5^\circ$) and low-resolution simulations. Their differences (low resolution – high resolution) are shown in the right column. The deforested areas here are defined as the grid cell in the low-resolution simulations have at least 15% of the area with tree loss, which accounts for at least 3 high-resolution grid cells having complete tree loss within the low-resolution grid cell.