

Forest loss amplifies heat stress during dry season in the Horn of Africa

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Forest loss affect land surface temperature (LST) by modifying the energy and water fluxes between land and atmosphere. The horn of Africa has seen a large expansion of agricultural lands at the expense of natural forests. Given this region's social and economic vulnerability to environmental changes, it is important to evaluate to what extent forest loss can affect intra-annual temperature patterns. In this study, we evaluated 16-year time series of remotely sensed environmental data at three selected areas across the Horn of Africa (Abobo, Shakiso and Kapcherop). Forest loss areas were identified using high resolution imagery, while adjacent intact forest areas were used as a reference. LST was assessed using the MODIS MOD11A2 product (8-day composite at 1 km resolution), and quality control flags were used to filter bad quality pixels. Vegetation status was inferred from EVI, which was calculated from MCD43B1 bidirectional reflectance distribution function (BRDF) model parameters considering sun-sensor geometry correction. Our results showed that forest loss has led to an annual average LST increase of approximately 1°C (after accounting for natural climate variability). The increase in LST was significantly stronger during the dry season, in comparison with the rainy period. Dry season LST increased after forest loss on average around 2°C, while during the wet seasons LST changes fluctuated around $\pm 1^\circ\text{C}$. Our analysis indicates that the lack of consistency in warming during the rainy period is explained by the cooling effect of the greening vegetation cover (e.g. croplands), the enhanced soil moisture, and the reduction in the incoming solar radiation flux due to the clouds. The results highlight the influence of forest loss in amplifying the heat stress in the Horn of Africa, as well as the role of land management and forest preservation for mitigating the impacts of droughts and other climate hazards associated with the changing climate.

Key words: Forest loss. LST anomaly. MODIS. Horn of Africa.