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Predicting human-driven changes in global fire activity

N. Andela
D. C. Morton
L. Giglio
Y. Chen
G. R. van der Werf
P. S. Kasibhatla
R. S. DeFries
G. J. Collatz
S. Hantson
S. Kloster
D. Bachelet
M. Forrest
G. Lasslop
F. Li
S. Mangeon
J. R. Melton
C. Yue
J. T. Randerson

Climate variability has a profound influence on global fire activity, and is widely used for fire prediction on annual to decadal time scales. We assessed long-term fire trends using multiple satellite data sets and found that global burned area declined by 24.3 ± 8.8% over the past 18 years. In many regions, the magnitude of burned area trends was similar to decadal variation driven by climate. The estimated decrease in burned area remained robust after adjusting for precipitation variability and was largest in savannas and tropical land-use frontiers. Agricultural expansion and intensification were primary drivers of declining fire activity in these landscapes. Forecasting approaches that specifically incorporate long-term trends in human activity may therefore lead to improved outcomes. In addition, fire models embedded in global ecosystem models were unable to reproduce the pattern and magnitude of observed declines, suggesting that they may underestimate the human influence on fire activity in future projections. Using economic and demographic variables, we developed a conceptual model for predicting fire in human-dominated landscapes. A strong inverse relationship between burned area and economic development in savannas and grasslands suggests that despite potential increasing fire risk from climate change, ongoing socioeconomic development will likely sustain observed declines in fire in these ecosystems during coming decades. In tropical forests, frequent fires for deforestation and agricultural management yielded a sharp rise in fire activity with the expansion of settled land uses, but with increasing investment in agricultural areas fire activity reduced in both savannas and forests.