The role of fire in global forest loss

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Methods

- "Fire-related forest loss": forest loss involving any use of fire in the process, whether before, during or after the loss of forest cover.
- Global fire-related forest loss was estimated for each year during the 2003-2018 period by spatial and temporal overlaying of 500 m gridded fractional forest loss with burned area, supplemented by active fires outside of burned area.
- All forest loss overlapped by **burned area** was considered to be the result of fire.
- For the relatedness of forest loss and **active fires** a statistical approach was used, based on spatiotemporal overlap and fire counts.
- A maximum estimate of fire-related forest loss was calculated by treating active fire detections the same as burned area (i.e. all overlap is fire-related forest loss).

Methods

Datasets used

Dataset	Sensor	Used format	Spatial	Temporal	Product
Forest loss	Landsat 7 ETM+	% 500 m pixel deforested	30 m aggr. 500m	Annual 2001-present	Hansen et al. (2013)
Burned area	MODIS (Aqua/Terra)	Binary burned/unburned	500 m	Monthly 2001-present	MCD64A1 Giglio et al. (2018)
Active fires	MODIS (Aqua/Terra)	# fires in month	1 km	Monthly 2002-present	MCD14A1/ML Giglio et al. (2018)
Active fires	VIIRS	# fires in month	375 m aggr. 500m	Monthly 2012-present	VNP14IMGML Schroeder et al. (2014)

- All used datasets were aggregated to 500 m resolution before analysis.
- Validation of fire-related forest loss algorithm using Sentinel Burned area.

Global forest loss: 240 · 10³ km² yr⁻¹ (almost 6x The Netherlands)



Global burned area: $4100 \cdot 10^3 \text{ km}^2 \text{ yr}^{-1}$ (almost the size of the European Union)



Forest loss related to fire: $38 \pm 9\%$



Fraction of forest loss related to fire

- The fraction of fire-related forest loss remained relatively stable.
- Fire-related forest loss contributed to about 90 \pm 5% of the inter annual variability in global forest loss rates.



Regional summary of results

	Forest loss (2003-2018)		Forest loss explained by fire		Burned area (2003-2018)
	·10 ³ km² yr-1	% of total	Mean %	Variance %	·10 ³ km ² yr ⁻¹
Global	239	100	38 ± 9	89 ± 5	4142
Latin America	59	25	37 ± 12	61 ± 6	364
Africa	33	14	38 ± 17	98±2	2790
Southeast Asia	33	14	26 ± 11	70 ± 10	161
Boreal	68	28	57 ± 5	92 ± 1	119
Temperate	46	19	20 ± 4	43 ± 7	693

Validation using Sentinel BA

Use of 20 m burned area from the Sentinel-2 MSI sensor does not necessarily lead to higher estimates of fire-related forest loss in the tropical forest interior, and the MODIS-based method actually tends to overestimate in this region due to its coarser resolution (commission error). Just like MODIS, Sentinel is expected to miss a substantial part of the fires related to forest loss. However, for heavily cultivated, frequently burning regions Sentinel does give substantially higher estimates.



