

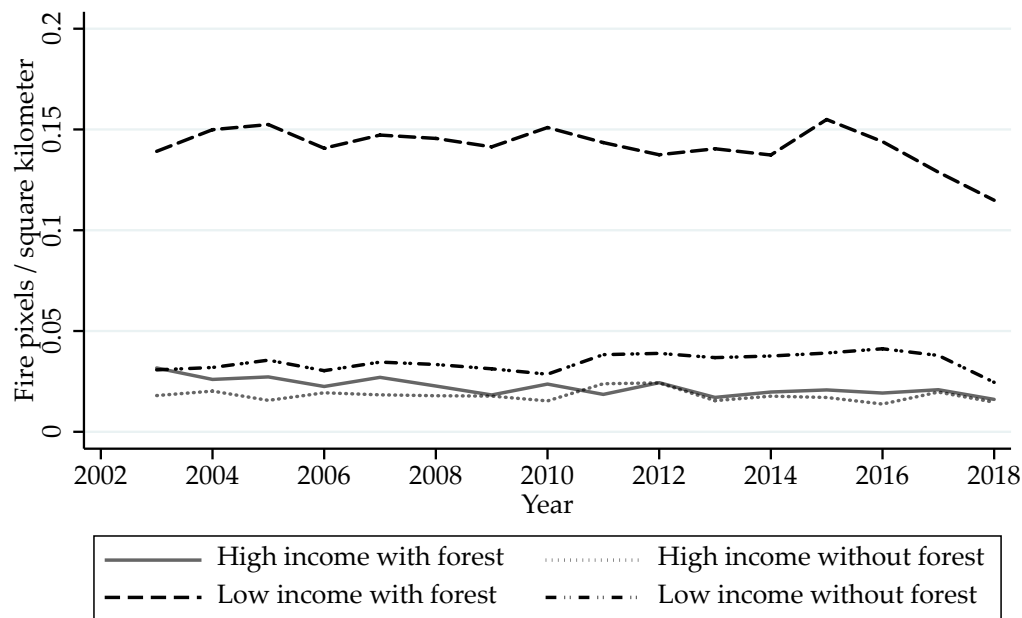
Online Appendix (not intended for publication) for: The Origins and Control of Forest Fires in the Tropics

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May 5, 2023

A. Additional figures

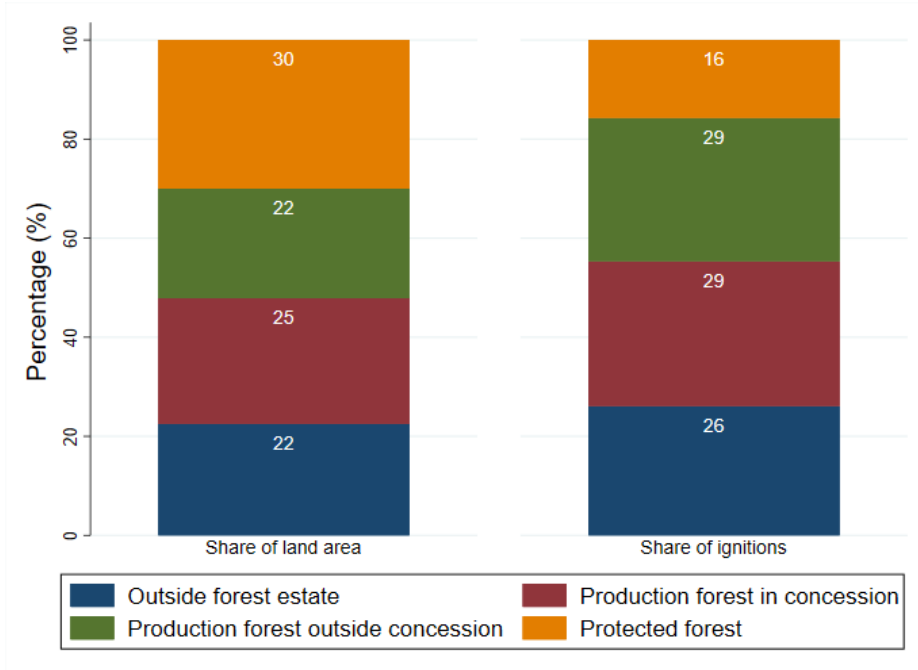
Figure A.1: Global (country-level) Incidence of Fires by Forest Cover and Income level



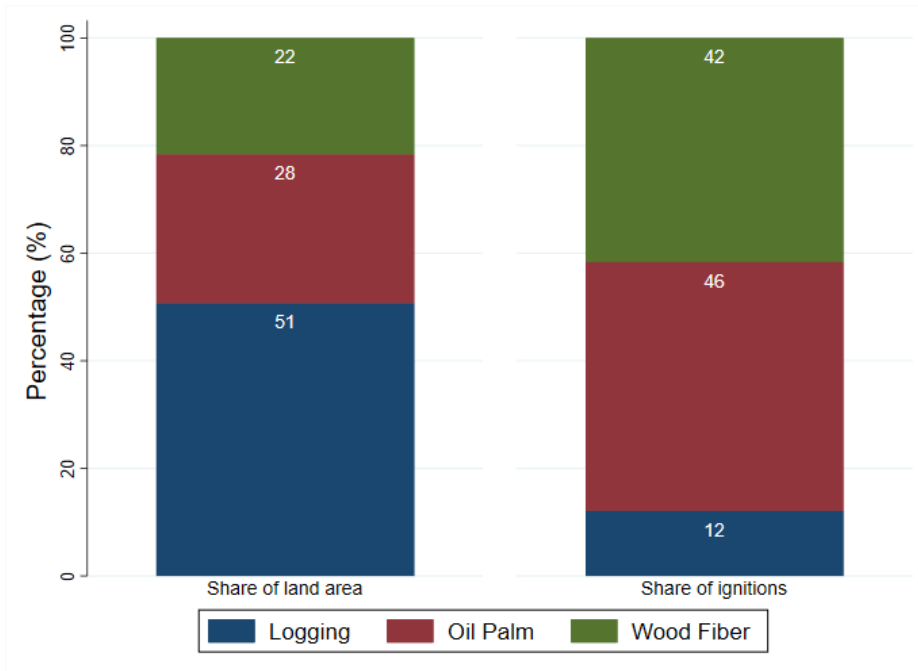
Note: The figure shows the number of fire pixels per square kilometer for four groups of countries, split by income and forest cover. High income countries are those designated as upper or upper middle income, and low income those designated as lower and lower middle income by the World Bank in 2016. With forest are countries with forest cover above 30%, and without those below 30% in 2016.

Figure A.2: Ignitions and Land-use

(a) Share of Land Area and Ignitions by Forest Zone



(b) Share of Land Area and Ignitions Inside Concessions by Concession Type



B. Impact of same year and lagged deforestation on ignitions

Table B.1: Impact of Deforestation on Ignitions

Dependent variable = Number of fires in pixel*month*year	Pixel FE	Pixel Month & Year FE
Forest loss (km2) in year t	4.2373*** (0.1487)	4.4648*** (0.1450)
Forest loss (km2) in year t-1	1.7696*** (0.1612)	1.9456*** (0.1618)
Forest loss (km2) in year t-2	0.5217*** (0.1453)	0.3937*** (0.1517)
Forest loss (km2) in year t-3	0.2178 (0.2277)	0.7487*** (0.1843)
Observations	2,502,720	2,502,720
Mean of Dep. Var.	0.0109	0.0109

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table B.2: Impact of Deforestation on Ignitions: Controlling for Previous Fire

Dependent variable = Number of fires in pixel*month*year	Pixel FE	Pixel Month & Year FE
Fire before	-2.0230*** (0.1057)	-4.3006*** (0.1966)
Forest loss (km2) in year t-1	1.9937*** (0.1779)	2.7883*** (0.2711)
Forest loss (km2) in year t-2	0.7177*** (0.1774)	1.2168*** (0.2194)
Forest loss (km2) in year t-3	0.7817*** (0.2103)	1.2705*** (0.2174)
Observations	3,235,680	3,235,680
Mean of Dep. Var.	0.0100	0.0100

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands. The 'Fire before' variable captures whether a fire was observed previously in the observation's pixel.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

C. Serial correlation in the risk index

Table C.1: Serial Correlation in the Risk Index

Dependent variable = Risk index in pixel m-y	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Risk index - 1 month lag	0.2559*** (0.009067)	0.2499*** (0.009191)	0.2349*** (0.008551)
Risk index - 2 month lag		0.05597*** (0.004246)	0.05567*** (0.004105)
Risk index - 3 month lag		-0.06018*** (0.005491)	-0.03305*** (0.005418)
Risk index - 4 month lag			-0.07869*** (0.004527)
Risk index - 5 month lag			-0.05371*** (0.005407)
Risk index - 6 month lag			-0.09253*** (0.006805)
Observations	39723501	39279663	38613906

Robust standard errors clustered at level of 50km2 grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

D. Impact of neighboring land type on fire spread

Conditional on a fire starting, we estimate the effect of uninteracted neighboring land type on fire spread using the following OLS specification to determine how the spread of fire f ignited in pixel i at time t is influenced by surrounding land type:

$$\begin{aligned}
 FireSpread_{fimt} &= \alpha + \delta_m + \delta_t \\
 &+ \sum_j \beta_1^j NeighborLandType_i^j \\
 &+ \beta_2 X_i + \epsilon_{fimt}
 \end{aligned} \tag{1}$$

We provide additional evidence leveraging the interaction of surrounding land type with predicted fire spread risk based on prevailing weather conditions using the following specification:

$$\begin{aligned}
 FireSpread_{fimt} &= \alpha + \gamma_i + \delta_m + \delta_t + \beta_1 Weather\widehat{SpreadRisk}_{imt} \\
 &+ \sum_j \beta_2^j NeighborLandType_i^j \times Weather\widehat{SpreadRisk}_{imt} \\
 &+ \beta_3 X_i \times Weather\widehat{SpreadRisk}_{imt} + \epsilon_{fimt}
 \end{aligned} \tag{2}$$

The results of these analyses are shown in Table D.1, panel A for the uninteracted case and panel B for the interacted case. These suggest that, conditional on a fire starting, it is less likely to spread if surrounded by areas of higher population density (with weaker evidence for deterrent effects of surrounding protected forest), consistent with the intuition that greater effort may be exerted to avoid burning areas where damages and the probability of punishment may be particularly severe

Table D.1: Impact of Surrounding Land Type and Weather Spread Risk Index on Fire Spread

Dependent variable = Spread extent (total fire area minus ignition area)	M & Y	M & Y	M & Y	M & Y	M & Y	M & Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	-0.009953** (0.004348)	-0.008767** (0.004011)	-0.009206** (0.003907)	-0.01081** (0.004296)	-0.004446 (0.005113)	-0.004139 (0.004944)
Num pixels in 6km buffer outside forest estate	-0.01523* (0.008390)	-0.01342 (0.008516)	-0.01575* (0.008625)	-0.01483* (0.008483)	-0.01176 (0.007926)	-0.007372 (0.008568)
Num pixels in 6km buffer in protected forest	-0.01383* (0.007461)	-0.009311 (0.007599)	-0.01318* (0.007452)	-0.01392* (0.007349)	-0.008919 (0.009053)	-0.004997 (0.008997)
Num pixels in 6km buffer in productive forest outside concession	-0.009853* (0.005370)	-0.008755* (0.004563)	-0.008990** (0.004494)	-0.01070** (0.005356)	-0.004003 (0.004138)	-0.003774 (0.003778)
Average population density in 6km buffer	-0.008041** (0.003173)	-0.01033*** (0.003810)	-0.007781** (0.003031)	-0.007768** (0.003113)	-0.006526** (0.003153)	-0.009236** (0.003691)
Control: Island	NO	YES	NO	NO	NO	YES
Control: Concession Type	NO	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	NO	YES	YES
Observations	38,788	38,788	38,788	38,724	38,788	38,724
Mean of Dep. Var.	1.172	1.172	1.172	1.172	1.172	1.172
Panel B: With Pixel FE and Risk Index	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Risk index in standard deviation units	1.6890*** (0.3982)	2.1585*** (0.4537)	1.5457*** (0.3835)	1.1367 (0.7845)	1.9170*** (0.5732)	2.3983** (0.9702)
Risk index * Num pixels in 6km buffer in different concession from central pixel	-0.003002 (0.005159)	0.001112 (0.005376)	-0.002213 (0.004973)	-0.003364 (0.004896)	-0.004691 (0.005274)	-0.001862 (0.005127)
Risk index * Num pixels in 6km buffer outside forest estate	-0.01080 (0.01193)	-0.002587 (0.01267)	-0.01089 (0.01195)	-0.01123 (0.01165)	-0.01211 (0.01227)	-0.004032 (0.01290)
Risk index * Num pixels in 6km buffer in protected forest	-0.01589* (0.008558)	-0.005681 (0.008260)	-0.01511* (0.008257)	-0.01509* (0.008507)	-0.01742** (0.008622)	-0.007603 (0.008136)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.009128 (0.009491)	0.01027 (0.009018)	0.01008 (0.009460)	0.008103 (0.009316)	0.007128 (0.009302)	0.005506 (0.008761)
Risk index * Average population density in 6km buffer	-0.006774* (0.003940)	-0.007458* (0.004140)	-0.006520 (0.003960)	-0.006884* (0.004032)	-0.007398* (0.004180)	-0.008444* (0.004422)
Control: Risk Index × Island	NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type	NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	NO	YES	YES
Observations	20,044	20,044	20,044	20,013	20,044	20,013
Mean of Dep. Var.	1.333	1.333	1.333	1.332	1.333	1.332

OLS regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

E. Results using variation in other weather variables

Table E.1: Impact of Wind Speed on Fire Spread

Dependent variable = Average fire spread area (burned area minus ignition area)	Pixel FE	Pixel Month & YearFE
Wind speed in km/h	0.1851*** (0.03484)	0.2461*** (0.04443)
Observations	5,897	5,897
Mean of Dep. Var.	4.608	4.608

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All regressions control for number of ignitions in pixel-month. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

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Table E.2: Impact of Precipitation on Fire Spread

Dependent variable = Average fire spread area (burned area minus ignition area)	Pixel FE	Pixel Month & YearFE
Precipitation (mm)	-0.006339*** (0.0008903)	-0.007673*** (0.0008650)
Observations	5,897	5,897
Mean of Dep. Var.	4.608	4.608

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All regressions control for number of ignitions in pixel-month. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.3: Impact of Temperature on Fire Spread

Dependent variable =	Pixel	Pixel
Average fire spread area (burned area minus ignition area)	FE	Month & YearFE
Temperature (Celsius)	0.5713*** (0.1343)	0.5872*** (0.1988)
Observations	5,897	5,897
Mean of Dep. Var.	4.608	4.608

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All regressions control for number of ignitions in pixel-month. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.4: Impact of Surrounding Land Type and Wind Speed on Ignitions

Dependent variable =	Pixel	Pixel	Pixel	Pixel	Pixel	Pixel
Number of fires in pixel*month*year	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs
Wind speed (kmh)	0.1839*** (0.03246)	0.3090*** (0.05109)	0.3108*** (0.04011)	0.1013** (0.04528)	0.2879*** (0.03618)	0.4332*** (0.06168)
Wind speed * Number of pixels in 6km buffer in different concession from central pixel	0.002409*** (0.0004707)	0.001393*** (0.0004125)	0.001601*** (0.0004104)	0.002215*** (0.0004420)	0.001566*** (0.0004598)	0.0008923** (0.0003556)
Wind speed * Num pixels in 6km buffer outside forest estate	-0.001616** (0.0007007)	-0.001930*** (0.0006338)	-0.001507** (0.0006157)	-0.001737*** (0.0006736)	-0.002308*** (0.0006982)	-0.001943*** (0.0005592)
Wind speed * Num pixels in 6km buffer in protected forest	-0.00008261 (0.0006873)	0.0001375 (0.0004583)	-0.0006397 (0.0005307)	-0.00004413 (0.0006528)	-0.0008715 (0.0006544)	-0.0002967 (0.0004323)
Wind speed * Num pixels in 6km buffer in unleased productive forest	0.001707*** (0.0005108)	0.001799*** (0.0004840)	0.0008001 (0.0005142)	0.001639*** (0.0004888)	0.0008899* (0.0004610)	0.001074*** (0.0003974)
Wind speed * Average population density in 6km buffer (PODES)	0.0004785 (0.0004568)	0.0001937 (0.0003951)	0.0003816 (0.0003564)	0.0004730 (0.0004724)	0.0002122 (0.0004058)	0.0001224 (0.0003212)
Control: Wind speed × Island	NO	YES	NO	NO	NO	YES
Control: Wind speed × Concession Type	NO	NO	YES	NO	NO	YES
Control: Wind speed × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Wind speed × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” interaction with wind speed. Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” interactions with wind speed.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.5: Impact of Surrounding Land Type and Precipitation on Ignitions

Dependent variable =	Pixel	Pixel	Pixel	Pixel	Pixel	Pixel
Number of fires in pixel*month*year	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs
Precipitation (mm)	-0.01138*** (0.0004663)	-0.01106*** (0.0005667)	-0.01258*** (0.0005419)	-0.01051*** (0.0006952)	-0.01257*** (0.0005697)	-0.01124*** (0.0008164)
Precipitation * Num pixels in 6km buffer in different concession from central pixel	-0.00001430* (0.000007633)	-0.000004704 (0.000007233)	-0.000006973 (0.000007169)	-0.00001344* (0.000007657)	-0.000004806 (0.000007404)	4.656e-07 (0.000006970)
Precipitation * Num pixels in 6km buffer outside forest estate	-0.00001276 (0.00001536)	-0.000006084 (0.00001448)	-0.00001640 (0.00001600)	-0.00001321 (0.00001512)	-0.000007259 (0.00001582)	-0.000006348 (0.00001532)
Precipitation * Num pixels in 6km buffer in protected forest	-0.00001101 (0.00001256)	8.492e-07 (0.00001100)	-0.000004370 (0.00001171)	-0.00001108 (0.00001241)	-0.000003151 (0.00001254)	0.000004559 (0.00001094)
Precipitation * Num pixels in 6km buffer in productive forest outside concession	-0.00002129*** (0.000008099)	-0.00001957** (0.000007989)	-0.00001304 (0.000008155)	-0.00002167*** (0.000008032)	-0.00001120 (0.000008178)	-0.00001404* (0.000008045)
Precipitation * Average population density in 6km buffer	-0.00001314** (0.000006495)	-0.00001300** (0.000006377)	-0.00001092* (0.000006569)	-0.00001302** (0.000006415)	-0.000009948* (0.000005872)	-0.00001119* (0.000006176)
Control: Precipitation × Island	NO	YES	NO	NO	NO	YES
Control: Precipitation × Concession Type	NO	NO	YES	NO	NO	YES
Control: Precipitation × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Precipitation × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” interaction with precipitation. Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” interactions with precipitation.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table E.6: Impact of Surrounding Land Type and Temperature on Ignitions

Dependent variable = Number of fires in pixel*month*year	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Temperature (Celsius)	0.6583*** (0.09828)	0.9408*** (0.1479)	0.2155 (0.1410)	0.1628 (0.1130)	0.6915*** (0.1270)	0.04974 (0.1734)
Temperature * Num pixels in 6km buffer in different concession from central pixel	-0.005204*** (0.001845)	-0.003739** (0.001576)	-0.002448 (0.001642)	-0.006335*** (0.001839)	-0.005465*** (0.001753)	-0.003420** (0.001505)
Temperature * Num pixels in 6km buffer outside forest estate	-0.002891 (0.002773)	-0.001920 (0.003136)	-0.004257 (0.002805)	-0.002692 (0.002572)	-0.003062 (0.002851)	-0.003696 (0.002827)
Temperature * Num pixels in 6km buffer in protected forest	-0.002869 (0.002449)	-0.00002987 (0.002182)	-0.0007146 (0.002299)	-0.002935 (0.002610)	-0.003086 (0.002535)	0.0003754 (0.002174)
Temperature * Num pixels in 6km buffer in productive forest outside concession	0.0007996 (0.001712)	0.001525 (0.001608)	0.003429* (0.001820)	0.00008796 (0.001715)	0.0005561 (0.001744)	0.001727 (0.001601)
Temperature * Average population density in 6km buffer	0.0004312 (0.001182)	-0.0008072 (0.001132)	0.001380 (0.001131)	0.0003873 (0.001155)	0.0003258 (0.001128)	0.0001715 (0.0009971)
Control: Temperature × Island	NO	YES	NO	NO	NO	YES
Control: Temperature × Concession Type	NO	NO	YES	NO	NO	YES
Control: Temperature × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Temperature × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” interaction with temperature. Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” interactions with temperature.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

F. Results using Daily Variation in Wind Speed

Table F.1: Impact of Wind Speed on Fire Spread: Daily

Dependent variable = Fire spread area (burned area minus ignition area)	Pixel FE	Pixel Day & Year FE
Wind speed in kmh	0.1397*** (0.02530)	0.1376*** (0.01803)
Observations	6,780	6,780
Mean of Dep. Var.	4.678	4.678

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All regressions control for number of ignitions in pixel-day. All pixels inside wood fiber and palm oil concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table F.2: Ignition Results by Surrounding Land Type (Daily-level)

Dependent variable = Any fire in pixel*day	Pixel D & Y FEs	Pixel D & Y FEs	Pixel D & Y FEs	Pixel D & Y FEs	Pixel D & Y FEs	Pixel D & Y FEs
Wind speed in kmh	0.1179*** (0.01200)	0.1192*** (0.01463)	0.1984*** (0.01413)	0.08646*** (0.01825)	0.1680*** (0.01414)	0.1932*** (0.01978)
Wind speed * Num pixels in 6km buffer in different concession from central pixel	0.001223*** (0.0002286)	0.0005243*** (0.0001899)	0.0007060*** (0.0001824)	0.001138*** (0.0002196)	0.0008167*** (0.0002209)	0.0002837* (0.0001693)
Wind speed * Num pixels in 6km buffer outside forest estate	-0.0006085* (0.0003171)	-0.0008736*** (0.0002769)	-0.0006515** (0.0002775)	-0.0006534** (0.0003071)	-0.0009292*** (0.0003069)	-0.0008539*** (0.0002525)
Wind speed * Num pixels in 6km buffer in protected forest	0.0003909 (0.0003531)	0.0002682 (0.0002455)	0.0001054 (0.0002422)	0.0004415 (0.0003411)	0.00001939 (0.0003292)	0.00008774 (0.0002126)
Wind speed * Num pixels in 6km buffer in productive forest outside concession	0.0007342*** (0.0002311)	0.0007883*** (0.0002058)	0.0001956 (0.0002096)	0.0007157*** (0.0002220)	0.0003509* (0.0002110)	0.0004154** (0.0001868)
Wind speed * Average population density in 6km buffer	0.00005089 (0.0001301)	-0.00004817 (0.0001755)	0.000003943 (0.00009379)	0.00004958 (0.0001370)	-0.00007072 (0.0001287)	-0.00007776 (0.0001320)
Control: Wind speed × Island	NO	YES	NO	NO	NO	YES
Control: Wind speed × Concession Type	NO	NO	YES	NO	NO	YES
Control: Wind speed × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Wind speed × Concession Area	NO	NO	NO	NO	YES	YES
Observations	143728572	143728572	143728572	143493104	143728572	143493104
Mean of Dep. Var.	0.000270	0.000270	0.000270	0.000270	0.000270	0.000270

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” interaction with wind speed. Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” interactions with wind speed.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

G. Results broken down by wood fiber and palm oil concessions

Table G.1: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Wood Fiber Concessions

Dependent variable = Number of fires in pixel*month*year	M & Y	M & Y	M & Y	M & Y	M & Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	0.0004012 (0.001627)	-0.0002099 (0.001419)	0.001003 (0.001573)	-0.002946** (0.001477)	-0.001127 (0.001398)
Num pixels in 6km buffer outside forest estate	-0.006021* (0.003533)	-0.007954** (0.003122)	-0.007191** (0.003424)	-0.008997** (0.003607)	-0.009826*** (0.003067)
Num pixels in 6km buffer in protected forest	-0.009144*** (0.003302)	-0.009684*** (0.002992)	-0.008607*** (0.003281)	-0.01244*** (0.003325)	-0.009997*** (0.002940)
Num pixels in 6km buffer in productive forest outside concession	0.007296*** (0.001755)	0.003932*** (0.001505)	0.007764*** (0.001654)	0.003897** (0.001584)	0.003296** (0.001553)
Average population density in 6km buffer	0.002471** (0.001160)	0.0005308 (0.001340)	0.0005524 (0.001426)	0.001708 (0.001197)	-0.002045 (0.001717)
Control: Island	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	YES	YES
Observations	24306300	24306300	24282360	24306300	24282360
Mean of Dep. Var.	.00088598	.00088598	.0008843	.00088598	.0008843
Panel B: With Pixel FE and Risk Index	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Risk index in standard deviation units	1.3849*** (0.1056)	1.4231*** (0.1395)	1.0022*** (0.1233)	1.5978*** (0.1083)	1.2563*** (0.1447)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.003548** (0.001712)	0.002574 (0.001654)	0.003107* (0.001628)	0.002113 (0.001483)	0.001198 (0.001271)
Risk index * Num pixels in 6km buffer outside forest estate	-0.002962 (0.002439)	-0.002986 (0.002433)	-0.002266 (0.002241)	-0.004044* (0.002449)	-0.003245 (0.002261)
Risk index * Num pixels in 6km buffer in protected forest	-0.001969 (0.002179)	-0.0007744 (0.002190)	-0.001229 (0.002116)	-0.003036 (0.002214)	-0.001321 (0.002159)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.008238*** (0.002120)	0.008907*** (0.002172)	0.008043*** (0.002009)	0.006712*** (0.001826)	0.007344*** (0.001681)
Risk index * Average population density in 6km buffer	0.0009853 (0.002071)	0.0007024 (0.002163)	0.0008091 (0.002120)	0.0001725 (0.001876)	0.0001110 (0.002164)
Control: Risk Index × Island	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	YES	YES
Observations	2667600	2667600	2660220	2667600	2660220
Mean of Dep. Var.	.0080728	.0080728	.00807189	.0080728	.00807189

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table G.2: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Palm Oil Concessions

Dependent variable = Number of fires in pixel*month*year	M & Y	M & Y	M & Y	M & Y	M & Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	-0.004078** (0.001892)	-0.005157*** (0.001931)	-0.004085** (0.001876)	-0.006435*** (0.001913)	-0.006157*** (0.001933)
Num pixels in 6km buffer outside forest estate	-0.007087 (0.006192)	-0.006730 (0.005954)	-0.007018 (0.006147)	-0.009977 (0.006213)	-0.007992 (0.006012)
Num pixels in 6km buffer in protected forest	-0.0001780 (0.004866)	0.002135 (0.004372)	-0.00008927 (0.004963)	-0.002402 (0.004949)	0.001160 (0.004716)
Num pixels in 6km buffer in productive forest outside concession	0.003874* (0.002137)	0.003033 (0.001966)	0.003877* (0.002115)	0.001293 (0.002065)	0.001872 (0.002073)
Average population density in 6km buffer	-0.003174** (0.001259)	-0.005767*** (0.001659)	-0.003282*** (0.001251)	-0.003301*** (0.001266)	-0.005852*** (0.001609)
Control: Island	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	YES	YES
Observations	15550920	15550920	15537780	15550920	15537780
Mean of Dep. Var.	.00110945	.00110945	.00111026	.00110945	.00111026
	Pixel	Pixel	Pixel	Pixel	Pixel
Panel B: With Pixel FE and Risk Index	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs
Risk index in standard deviation units	1.9081*** (0.1211)	2.0495*** (0.1227)	1.9318*** (0.1614)	1.7625*** (0.1460)	1.9394*** (0.1820)
Risk index * Num pixels in 6km buffer in different concession from central pixel	-0.0004278 (0.001491)	-0.0008641 (0.001455)	-0.0004240 (0.001490)	0.0006291 (0.001543)	0.0002082 (0.001503)
Risk index * Num pixels in 6km buffer outside forest estate	-0.01115*** (0.002506)	-0.01014*** (0.002667)	-0.01110*** (0.002489)	-0.009952*** (0.002505)	-0.008862*** (0.002595)
Risk index * Num pixels in 6km buffer in protected forest	-0.001458 (0.002256)	-0.001182 (0.002322)	-0.001461 (0.002259)	-0.0007353 (0.002307)	-0.0005278 (0.002339)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.001695 (0.001523)	0.001368 (0.001450)	0.001708 (0.001526)	0.002783* (0.001610)	0.002538 (0.001588)
Risk index * Average population density in 6km buffer	0.0002328 (0.0008126)	-0.0001267 (0.0008396)	0.0002128 (0.0008254)	0.0002347 (0.0008190)	-0.0001358 (0.0008431)
Control: Risk Index × Island	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	YES	YES
Observations	2047500	2047500	2047140	2047500	2047140
Mean of Dep. Var.	.00842637	.00842637	.00842688	.00842637	.00842688

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

H. Results in all concessions (logging, wood fiber and palm oil)

Table H.1: Impact of Deforestation on Ignitions: All Concessions

Dependent variable = Number of fires in pixel*month*year	Pixel FE	Pixel Month & Year FE
Forest loss (km2) in year t-1	1.1450*** (0.1170)	1.4130*** (0.1244)
Forest loss (km2) in year t-2	-0.2934** (0.1253)	-0.2407* (0.1235)
Forest loss (km2) in year t-3	-0.4930*** (0.1777)	-0.3928*** (0.1499)
Observations	3,707,424	3,707,424
Mean of Dep. Var.	0.00995	0.00995

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table H.2: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: All Concessions

Dependent variable = Number of fires in pixel*month*year	M & Y	M & Y	M & Y	M & Y	M & Y	M & Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	0.009929*** (0.001255)	0.004726*** (0.001265)	-0.0003032 (0.001371)	0.008336*** (0.001228)	-0.0002028 (0.001236)	-0.002343* (0.001303)
Num pixels in 6km buffer outside forest estate	0.01087*** (0.002649)	0.0006743 (0.002754)	-0.001194 (0.002609)	0.006102** (0.002576)	-0.0009802 (0.002825)	-0.005586** (0.002657)
Num pixels in 6km buffer in protected forest	-0.006397* (0.003724)	-0.007725** (0.003573)	-0.004074 (0.003023)	-0.005253 (0.003672)	-0.01494*** (0.003726)	-0.006046* (0.003143)
Num pixels in 6km buffer in productive forest outside concession	0.01710*** (0.001436)	0.01082*** (0.001488)	0.006324*** (0.001430)	0.01519*** (0.001408)	0.006813*** (0.001367)	0.003533*** (0.001234)
Average population density in 6km buffer	0.002464*** (0.0003470)	0.0002571 (0.001035)	0.0007138 (0.0008281)	0.001231*** (0.0003509)	0.002174*** (0.0006459)	-0.003161* (0.001906)
Control: Island	NO	YES	NO	NO	NO	YES
Control: Concession Type	NO	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	NO	YES	YES
Observations	98051400	98051400	98051400	98012160	98051400	98012160
Mean of Dep. Var.	0.000449	0.000449	0.000449	0.000448	0.000449	0.000448
Panel B: With Pixel FE and Risk Index	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Risk index in standard deviation units	1.4726*** (0.08449)	1.6394*** (0.1278)	1.3205*** (0.08624)	1.1242*** (0.1135)	1.7550*** (0.08301)	1.7558*** (0.1279)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.004356*** (0.001179)	0.001853 (0.001155)	0.002671** (0.001169)	0.004024*** (0.001158)	0.001824* (0.001040)	0.0001936 (0.0009554)
Risk index * Num pixels in 6km buffer outside forest estate	-0.002778 (0.001752)	-0.003469* (0.001858)	-0.002939 (0.001809)	-0.002801 (0.001711)	-0.005697*** (0.001706)	-0.004339** (0.001717)
Risk index * Num pixels in 6km buffer in protected forest	-0.002028 (0.001962)	-0.0001523 (0.001414)	-0.002999* (0.001660)	-0.001903 (0.001928)	-0.003652** (0.001839)	-0.001223 (0.001360)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.007362*** (0.001392)	0.006515*** (0.001523)	0.005370*** (0.001408)	0.007132*** (0.001322)	0.004379*** (0.001209)	0.004411*** (0.001176)
Risk index * Average population density in 6km buffer	-0.001185*** (0.0004166)	-0.001017*** (0.0003182)	-0.001164*** (0.0003344)	-0.0009529** (0.0004017)	-0.0006533** (0.0002896)	-0.0007488* (0.0003195)
Control: Risk Index × Island	NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type	NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	NO	YES	YES
Observations	5404140	5404140	5404140	5396040	5404140	5396040
Mean of Dep. Var.	0.00815	0.00815	0.00815	0.00814	0.00815	0.00814

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B) .

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I. Alternative clustering

I..1 Clustering at the level of spatial grids

Table I.1: Impact of Deforestation on Ignitions

Dependent variable = Number of fires in pixel*month*year	25x25km clusters	50x50km clusters	100x100km clusters
Forest loss (km2) in year t-1	1.3472*** (0.1087)	1.3472*** (0.1321)	1.3472*** (0.1584)
Forest loss (km2) in year t-2	-0.3081** (0.1212)	-0.3081** (0.1335)	-0.3081** (0.1451)
Forest loss (km2) in year t-3	-0.3492*** (0.1336)	-0.3492** (0.1490)	-0.3492** (0.1740)
Observations	3,235,680	3,235,680	3,235,680
Mean of Dep. Var.	0.0100	0.0100	0.0100

Poisson regressions with pixel, month, and year fixed effects. Robust clustered standard errors as indicated in column title. All pixels inside wood fiber and palm oil concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table I.2: Impact of Wind Speed, Temperature and Precipitation on Fire Spread

Dependent variable = Average fire spread area (burned area minus ignition area)	25x25km clusters	50x50km clusters	100x100km clusters
Wind speed (kmh)	0.1510*** (0.04898)	0.1510*** (0.04452)	0.1510*** (0.04329)
Temperature (Celsius)	0.5700*** (0.1532)	0.5700*** (0.1679)	0.5700*** (0.1967)
Precipitation (mm)	-0.006626*** (0.0008335)	-0.006626*** (0.0008751)	-0.006626*** (0.0008829)
Observations	5,897	5,897	5,897
Mean of Dep. Var.	4.608	4.608	4.608

Poisson regressions with pixel, month, and year fixed effects. Robust clustered standard errors as indicated in column title. All regressions control for number of ignitions in pixel-month. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table I.3: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions

Dependent variable = Number of fires in pixel*month-year	25x25km	50x50km	100x100km
Panel A: Main Effects (Month and Year FE)	clusters	clusters	clusters
Num pixels in 6km buffer in different concession from central pixel	-0.003603*** (0.001159)	-0.003603*** (0.001362)	-0.003603** (0.001546)
Num pixels in 6km buffer outside forest estate	-0.006287*** (0.002386)	-0.006287** (0.002718)	-0.006287* (0.003642)
Num pixels in 6km buffer in protected forest	-0.003699 (0.002442)	-0.003699 (0.003310)	-0.003699 (0.004057)
Num pixels in 6km buffer in productive forest outside concession	0.003119** (0.001241)	0.003119** (0.001330)	0.003119** (0.001362)
Average population density in 6km buffer	-0.004975*** (0.001105)	-0.004975*** (0.001236)	-0.004975*** (0.001513)
Control: Island	YES	YES	YES
Control: Concession Type	YES	YES	YES
Control: Forest Cover 2000	YES	YES	YES
Control: Concession Area	YES	YES	YES
Observations	39852540	39852540	39852540
Mean of Dep. Var.	0.000972	0.000972	0.000972
Dependent variable = Number of fires in pixel*month-year	25x25km	50x50km	100x100km
Panel B: With Risk Index (Pixel, Month, and Year FE)	clusters	clusters	clusters
Risk index in standard deviation units	1.6269*** (0.1245)	1.6269*** (0.1488)	1.6269*** (0.1568)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.0004953 (0.0009162)	0.0004953 (0.001042)	0.0004953 (0.001101)
Risk index * Num pixels in 6km buffer outside forest estate	-0.005808*** (0.001491)	-0.005808*** (0.001878)	-0.005808** (0.002282)
Risk index * Num pixels in 6km buffer in protected forest	-0.001045 (0.001566)	-0.001045 (0.001590)	-0.001045 (0.001645)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.004476*** (0.001096)	0.004476*** (0.001282)	0.004476*** (0.001214)
Risk index * Average population density in 6km buffer	0.0004254 (0.001021)	0.0004254 (0.001084)	0.0004254 (0.001246)
Control: Island	YES	YES	YES
Control: Concession Type	YES	YES	YES
Control: Forest Cover 2000	YES	YES	YES
Control: Concession Area	YES	YES	YES
Observations	4707360	4707360	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823

Poisson regressions. Panel A includes month and year FEs. Panel B includes pixel, month and year FEs. Robust clustered standard errors as indicated in column title. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B) .

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

I..2 Concession-level clustering

Table I.4: Impact of Deforestation on Ignitions: Concession-level Clusters

Dependent variable = Number of fires in pixel*month*year	Pixel FE	Pixel Month & Year FE
Forest loss (km2) in year t-1	1.1119*** (0.1148)	1.3472*** (0.1185)
Forest loss (km2) in year t-2	-0.3690*** (0.1389)	-0.3081** (0.1341)
Forest loss (km2) in year t-3	-0.5480*** (0.1530)	-0.3492*** (0.1349)
Observations	3,235,680	3,235,680
Mean of Dep. Var.	0.0100	0.0100

Poisson regressions. Robust standard errors clustered at level of concessions. All pixels inside wood fiber and palm oil concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table I.5: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Concession-level Clusters

Dependent variable = Number of fires in pixel*month*year	M & Y	M & Y	M & Y	M & Y	M & Y	M & Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	-0.0005364 (0.001198)	-0.001199 (0.001078)	-0.001463 (0.001240)	-0.0005091 (0.001165)	-0.004285*** (0.001095)	-0.003603*** (0.001200)
Num pixels in 6km buffer outside forest estate	-0.004221 (0.002643)	-0.005263** (0.002544)	-0.003636 (0.002652)	-0.004795* (0.002627)	-0.007181*** (0.002662)	-0.006287** (0.002566)
Num pixels in 6km buffer in protected forest	-0.003017 (0.002881)	-0.002399 (0.002761)	-0.003388 (0.002762)	-0.002543 (0.002880)	-0.006460** (0.002760)	-0.003699 (0.002672)
Num pixels in 6km buffer in productive forest outside concession	0.006851*** (0.001375)	0.005740*** (0.001295)	0.005894*** (0.001380)	0.006899*** (0.001336)	0.002998** (0.001294)	0.003119** (0.001328)
Average population density in 6km buffer	-0.0002219 (0.0006683)	-0.003038*** (0.0009357)	-0.0005620 (0.0007211)	-0.001095 (0.0007519)	-0.001033 (0.0007201)	-0.004975*** (0.001134)
Control: Island	NO	YES	NO	NO	NO	YES
Control: Concession Type	NO	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	NO	YES	YES
Observations	39889620	39889620	39889620	39852540	39889620	39852540
Mean of Dep. Var.	0.000972	0.000972	0.000972	0.000972	0.000972	0.000972
Panel B: With Pixel FE and Risk Index	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs	Pixel M & Y FEs
Risk index in standard deviation units	1.4919*** (0.09157)	1.5532*** (0.1193)	1.6850*** (0.09082)	1.2089*** (0.1135)	1.7316*** (0.08477)	1.6269*** (0.1309)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.003237*** (0.001163)	0.002154* (0.001140)	0.002042* (0.001087)	0.002922** (0.001158)	0.001323 (0.0009946)	0.0004953 (0.0009475)
Risk index * Num pixels in 6km buffer outside forest estate	-0.005492*** (0.001826)	-0.005403*** (0.001785)	-0.005127*** (0.001856)	-0.005434*** (0.001796)	-0.006830*** (0.001736)	-0.005808*** (0.001709)
Risk index * Num pixels in 6km buffer in protected forest	0.0001574 (0.001798)	0.0002460 (0.001680)	-0.0009392 (0.001698)	0.0002413 (0.001788)	-0.001484 (0.001740)	-0.001045 (0.001631)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.006644*** (0.001390)	0.006552*** (0.001417)	0.005312*** (0.001328)	0.006436*** (0.001358)	0.004616*** (0.001174)	0.004476*** (0.001116)
Risk index * Average population density in 6km buffer	0.001078 (0.0009791)	0.0008309 (0.0009907)	0.0007956 (0.0009147)	0.001112 (0.0009894)	0.0004371 (0.0008765)	0.0004254 (0.0009002)
Control: Risk Index × Island	NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type	NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of concessions. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

J. Alternative fixed effects

Table J.1: Impact of Deforestation on Ignitions: Month-Year FE & Month-Year-Island FE

Dependent variable = Number of fires in pixel*month*year	Pixel Month-Year FE	Pixel Month-Year-Island FE
Forest loss (km2) in year t-1	1.3472*** (0.1321)	1.3571*** (0.1268)
Forest loss (km2) in year t-2	-0.3081** (0.1335)	-0.4250*** (0.1347)
Forest loss (km2) in year t-3	-0.3492** (0.1490)	-0.4151*** (0.1484)
Observations	3,235,680	3,120,230
Mean of Dep. Var.	0.0100	0.0104

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells.
All pixels inside wood fiber and palm oil concessions inside forest estate in In-
donesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table J.2: Impact of Wind Speed, Temperature and Precipitation on Fire Spread: Month-Year FE & Month-Year-Island FE

Dependent variable =	Pixel	Pixel
Average fire spread area (burned area minus ignition area)	Month-Year FE	Month-Year-Island FE
Wind speed in km/h	0.1321** (0.05447)	0.1681** (0.07832)
Temperature (Celsius)	0.4639 (0.3070)	0.7291* (0.4047)
Precipitation (mm)	-0.007354*** (0.001150)	-0.007418*** (0.001503)
Observations	5,803	4,838
Mean of Dep. Var.	4.646	5.106

Poisson regressions. Robust standard errors clustered at level of 50km2 grid cells. All regressions control for number of ignitions in pixel-month. All pixels inside wood fiber, palm oil, and logging concessions inside forest estate in Indonesia excl Java and Lesser Sunda Islands.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table J.3: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Month-Year FE

Dependent variable = Number of fires in pixel*month*year	M-Y	M-Y	M-Y	M-Y	M-Y	M-Y
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	-0.0005364 (0.001233)	-0.001199 (0.001231)	-0.001463 (0.001389)	-0.0005091 (0.001192)	-0.004285*** (0.001240)	-0.003603*** (0.001362)
Num pixels in 6km buffer outside forest estate	-0.004221 (0.002819)	-0.005263* (0.002773)	-0.003636 (0.002765)	-0.004795* (0.002776)	-0.007181** (0.002897)	-0.006287** (0.002718)
Num pixels in 6km buffer in protected forest	-0.003017 (0.003516)	-0.002399 (0.003389)	-0.003388 (0.003357)	-0.002543 (0.003554)	-0.006460* (0.003442)	-0.003699 (0.003310)
Num pixels in 6km buffer in productive forest outside concession	0.006851*** (0.001388)	0.005740*** (0.001288)	0.005894*** (0.001503)	0.006899*** (0.001338)	0.002998** (0.001319)	0.003119** (0.001330)
Average population density in 6km buffer	-0.0002219 (0.0007267)	-0.003038*** (0.001139)	-0.0005620 (0.0007562)	-0.001095 (0.0008061)	-0.001033 (0.0008162)	-0.004975*** (0.001236)
Control: Island	NO	YES	NO	NO	NO	YES
Control: Concession Type	NO	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	NO	YES	YES
Observations	39889620	39889620	39889620	39852540	39889620	39852540
Mean of Dep. Var.	0.000972	0.000972	0.000972	0.000972	0.000972	0.000972
Panel B: With Pixel FE and Risk Index	Pixel M-Y FEs	Pixel M-Y FEs	Pixel M-Y FEs	Pixel M-Y FEs	Pixel M-Y FEs	Pixel M-Y FEs
Risk index in standard deviation units	1.5694*** (0.1063)	1.6188*** (0.1357)	1.7791*** (0.1095)	1.2807*** (0.1384)	1.8180*** (0.09847)	1.6858*** (0.1483)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.003443*** (0.001303)	0.002159* (0.001227)	0.002187* (0.001249)	0.003146** (0.001291)	0.001483 (0.001133)	0.0005367 (0.001066)
Risk index * Num pixels in 6km buffer outside forest estate	-0.005253*** (0.001991)	-0.005258*** (0.001969)	-0.004830** (0.002026)	-0.005220*** (0.001950)	-0.006650*** (0.001944)	-0.005677*** (0.001955)
Risk index * Num pixels in 6km buffer in protected forest	0.0004710 (0.001994)	0.0003302 (0.001738)	-0.0006545 (0.001798)	0.0005505 (0.001939)	-0.001223 (0.001911)	-0.0009210 (0.001667)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.006534*** (0.001533)	0.006445*** (0.001563)	0.005121*** (0.001485)	0.006341*** (0.001489)	0.004458*** (0.001316)	0.004431*** (0.001281)
Risk index * Average population density in 6km buffer	0.001005 (0.001129)	0.0007724 (0.001178)	0.0006761 (0.001050)	0.001062 (0.001164)	0.0003630 (0.001015)	0.0003788 (0.001099)
Control: Risk Index × Island	NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type	NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.	0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table J.4: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Month-Year-Island FE

Dependent variable = Number of fires in pixel*month*year	M-Y-I	M-Y-I	M-Y-I	M-Y-I	M-Y-I	M-Y-I
Panel A: Main Effects	FEs	FEs	FEs	FEs	FEs	FEs
Num pixels in 6km buffer in different concession from central pixel	-0.001199 (0.001231)	-0.001199 (0.001231)	-0.002277* (0.001349)	-0.001178 (0.001215)	-0.003190** (0.001335)	-0.003603*** (0.001362)
Num pixels in 6km buffer outside forest estate	-0.005263* (0.002773)	-0.005263* (0.002773)	-0.004385 (0.002686)	-0.005580** (0.002714)	-0.006677** (0.002847)	-0.006287** (0.002718)
Num pixels in 6km buffer in protected forest	-0.002399 (0.003389)	-0.002399 (0.003389)	-0.002762 (0.003221)	-0.001844 (0.003431)	-0.004220 (0.003321)	-0.003699 (0.003310)
Num pixels in 6km buffer in productive forest outside concession	0.005740*** (0.001288)	0.005740*** (0.001288)	0.004434*** (0.001323)	0.005969*** (0.001259)	0.003433** (0.001341)	0.003119** (0.001330)
Average population density in 6km buffer	-0.003038*** (0.001139)	-0.003038*** (0.001139)	-0.003953*** (0.001194)	-0.004077*** (0.001176)	-0.003415*** (0.001174)	-0.004975*** (0.001236)
Control: Island	NO	YES	NO	NO	NO	YES
Control: Concession Type	NO	NO	YES	NO	NO	YES
Control: Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Concession Area	NO	NO	NO	NO	YES	YES
Observations	36939178	36939178	36939178	36782122	36939178	36782122
Mean of Dep. Var.	0.00105	0.00105	0.00105	0.00105	0.00105	0.00105
Panel B: With Pixel FE and Risk Index	Pixel M-Y-I FEs	Pixel M-Y-I FEs	Pixel M-Y-I FEs	Pixel M-Y-I FEs	Pixel M-Y-I FEs	Pixel M-Y-I FEs
Risk index in standard deviation units	1.4840*** (0.08958)	1.6302*** (0.1075)	1.5857*** (0.1032)	1.2444*** (0.1239)	1.6275*** (0.1020)	1.6331*** (0.1404)
Risk index * Num pixels in 6km buffer in different concession from central pixel	0.001630 (0.001167)	0.001890 (0.001162)	0.001145 (0.001210)	0.001493 (0.001155)	0.0005949 (0.001032)	0.0005710 (0.001023)
Risk index * Num pixels in 6km buffer outside forest estate	-0.003095* (0.001735)	-0.002644 (0.001795)	-0.002906 (0.001781)	-0.003055* (0.001703)	-0.003915** (0.001767)	-0.003159* (0.001831)
Risk index * Num pixels in 6km buffer in protected forest	-0.0006053 (0.001639)	-0.0001528 (0.001619)	-0.0009819 (0.001624)	-0.0005590 (0.001623)	-0.001470 (0.001648)	-0.001129 (0.001582)
Risk index * Num pixels in 6km buffer in productive forest outside concession	0.005530*** (0.001486)	0.005343*** (0.001497)	0.004902*** (0.001487)	0.005409*** (0.001445)	0.004311*** (0.001308)	0.003698*** (0.001273)
Risk index * Average population density in 6km buffer	0.0004035 (0.001108)	0.0005285 (0.001065)	0.0002382 (0.001076)	0.0005105 (0.001163)	0.0001060 (0.001050)	0.0002435 (0.001022)
Control: Risk Index × Island	NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type	NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000	NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area	NO	NO	NO	NO	YES	YES
Observations	4510278	4510278	4510278	4498648	4510278	4498648
Mean of Dep. Var.	0.00860	0.00860	0.00860	0.00861	0.00860	0.00861

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B) .

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table J.5: Impact of Surrounding Land Type and Weather Spread Risk Index on Ignitions: Concession FE

Dependent variable = Number of fires in pixel*month*year		Concession	Concession				
Panel A: Main Effects		M & Y FEs	M & Y FEs				
Num pixels in 6km buffer in different concession from central pixel		0.001501 (0.0009200)	0.001328 (0.0009236)				
Num pixels in 6km buffer outside forest estate		0.003766* (0.002131)	0.003331 (0.002126)				
Num pixels in 6km buffer in protected forest		0.0008189 (0.002097)	0.001135 (0.002136)				
Num pixels in 6km buffer in productive forest outside concession		0.001223 (0.001115)	0.001236 (0.001107)				
Average population density in 6km buffer		-0.001959*** (0.0006709)	-0.002144*** (0.0007064)				
Control: Forest Cover 2000		NO	YES				
Observations		36493020	36454680				
Mean of Dep. Var.		0.00106	0.00106				
Panel B: With Pixel FE and Risk Index		Pixel	Pixel	Pixel	Pixel	Pixel	Pixel
		M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs	M & Y FEs
Risk index in standard deviation units		1.4919*** (0.1000)	1.5532*** (0.1313)	1.6859*** (0.1062)	1.2089*** (0.1324)	1.7316*** (0.09203)	1.6269*** (0.1488)
Risk index * Num pixels in 6km buffer in different concession from central pixel		0.003237** (0.001297)	0.002154* (0.001215)	0.002042 (0.001243)	0.002922** (0.001282)	0.001323 (0.001120)	0.0004953 (0.001042)
Risk index * Num pixels in 6km buffer outside forest estate		-0.005492*** (0.001934)	-0.005403*** (0.001898)	-0.005127*** (0.001964)	-0.005434*** (0.001892)	-0.006830*** (0.001887)	-0.005808*** (0.001878)
Risk index * Num pixels in 6km buffer in protected forest		0.0001574 (0.001915)	0.0002460 (0.001670)	-0.0009392 (0.001734)	0.0002413 (0.001858)	-0.001484 (0.001823)	-0.001045 (0.001590)
Risk index * Num pixels in 6km buffer in productive forest outside concession		0.006644*** (0.001549)	0.006552*** (0.001586)	0.005312*** (0.001507)	0.006436*** (0.001500)	0.004616*** (0.001321)	0.004476*** (0.001282)
Risk index * Average population density in 6km buffer		0.001078 (0.001156)	0.0008309 (0.001180)	0.0007956 (0.001082)	0.001112 (0.001185)	0.0004371 (0.001038)	0.0004254 (0.001084)
Control: Risk Index × Island		NO	YES	NO	NO	NO	YES
Control: Risk Index × Concession Type		NO	NO	YES	NO	NO	YES
Control: Risk Index × Forest Cover 2000		NO	NO	NO	YES	NO	YES
Control: Risk Index × Concession Area		NO	NO	NO	NO	YES	YES
Control: Risk Index × Concession FE		NO	NO	NO	NO	NO	NO
Control: Risk Index × Concession FE		NO	NO	NO	NO	NO	YES
Observations		4715100	4715100	4715100	4707360	4715100	4707360
Mean of Dep. Var.		0.00823	0.00823	0.00823	0.00823	0.00823	0.00823

Poisson regressions. Robust standard errors clustered at level of 50km² grid cells. All pixels inside wood fiber and palm oil concessions inside forest estate excl Java and Lesser Sunda Islands. Omitted category: “Num pixels in 6km buffer in same concession as central pixel” and interaction with risk index (panel B). Suppressed categories: “Num pixels in 6km buffer in sea”, “Num pixels in 6km buffer in Malaysia / PNG” and interactions with risk index (panel B).
 * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

K. Indonesian policies to prevent forest fires: background and sources

This Appendix describes the sources used in the section of the paper on Indonesian policies to prevent forest fires. Ardiansyah et al. (2015) give a detailed review of forest governance in Indonesia. Jepson et al. (2002) describe how the 1967 Basic Forestry Law was used for zoning and particularly the designation of protected zones. The main text describes several instruments to control the conversion of land: The 2011 moratorium on forest clearing is discussed in Murdiyarso et al. (2011). Peatland protection policies were strengthened following the 2015 fires and made permanent in 2019, as described by Jong (2019). Presidential Instruction No. 11/2015 requires all levels of government to develop land and forest fire management systems and to apply sanctions for businesses who do not implement fire management. Mongabay (2018) discusses the 2018 moratorium on issuing palm oil plantation licenses. Finally, Indrarto et al. (2012) discuss general issues with land planning (ambiguous planning, tenure conflicts, and others).

As described in the main text, land use policies are supplemented by penalties on fire setters. The legal basis for this is the 1999 Forestry Law. The sections of the 1999 Forestry Law pertaining to forest fires are: Article 48 (responsibility to engage in forest protecting activities), Article 49 (responsibility for forest fires with title/license holders), Article 50 (prohibition of burning), and Article 78 (fines and criminal provisions). Details on the prosecution of firms after the 2015 fires and the failure of the firms to pay these fines are discussed in *The Guardian* (2017) and by Greenpeace (2019).

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