

Appendix A

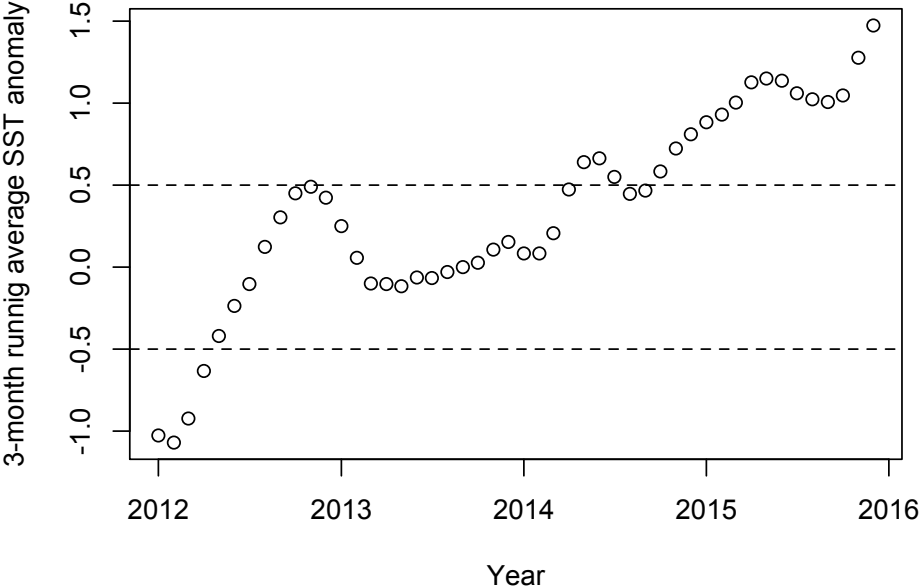


Fig. A.1. The 3-month running mean of SST anomalies in the Niño 4 region over the study period (2012-2015). In the wet years (2012-2013), the measure never surpassed a threshold of +0.5 °C. In the dry years, it surpassed the threshold in 6 months in 2014 and 12 months in 2015.

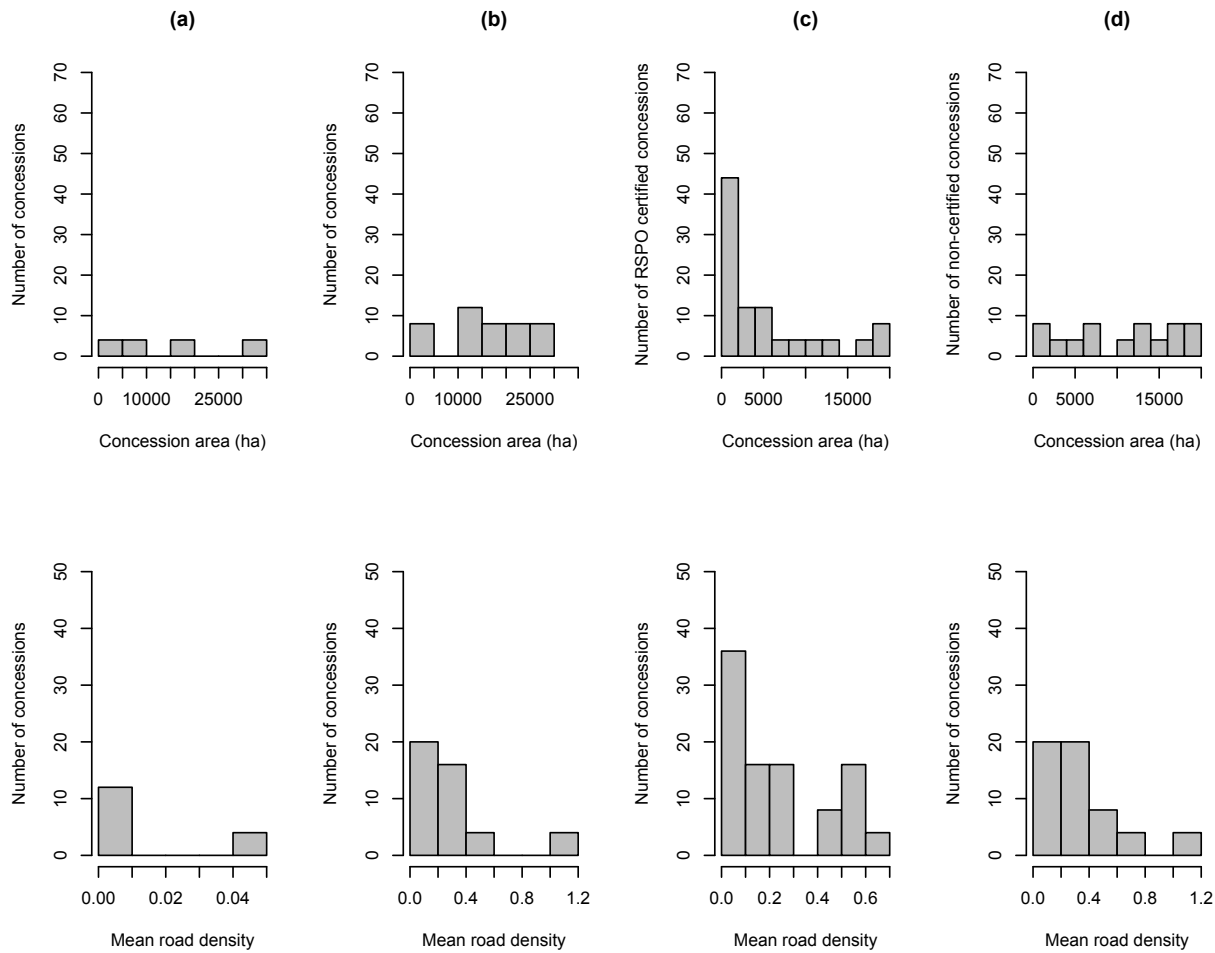


Fig. A.2. Covariate distribution for propensity scoring. Frequency distribution of concessions for concession area (ha) and mean road density for (a) RSPO certified concessions and (b) non-certified concessions in peatlands and for (c) RSPO certified concessions and (d) non-certified concessions in non-peatlands.

Table A.1. Characteristics of the subset of oil palm concessions used in the analyses compared with the characteristics of all oil palm concessions on Sumatra and Kalimantan. The subset may be larger and more accessible by road. Differences in covariates between the subset of concessions and all concessions tested using KS-tests are shown with the following significance codes: --- > 0.10, * < 0.10, ** < 0.05, *** < 0.01.

	Concession area (ha)	Mean road density	Kalimantan	Sumatra
Subset of concessions	9,557.3 (\pm SD 8,614.1)	0.26 (\pm SD 0.25)	94.3%	5.7%
All concessions	8,048.8 (\pm SD 8,467.6)	0.18 (\pm SD 0.20)	76.6%	23.3%
K-S tests	***	***	N/A	N/A

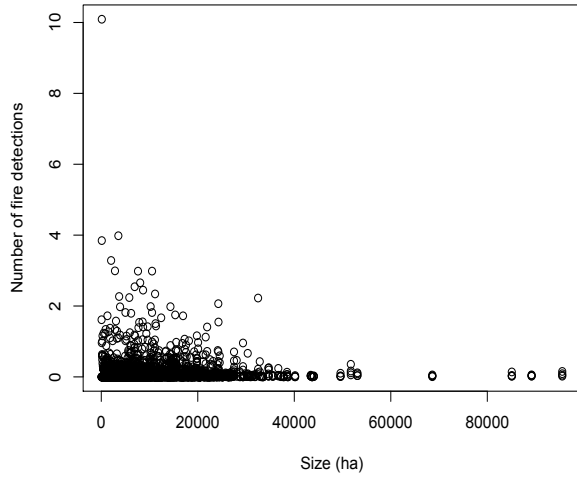
Table A.2. Characteristics of covariates for propensity scoring: mean and standard deviation of concession area (ha) and mean road density for RSPO certified concessions and non-certified concessions in peatlands and in non-peatlands. Differences in covariates between RSPO certified and non-certified concessions tested using KS-tests are shown with the following significance codes: --- > 0.10, * < 0.10, ** < 0.05, *** < 0.01.

Land cover type	Covariate	RSPO certified concessions (unmatched)	Non-certified concessions (unmatched)	Non-certified concessions (matched)	KS-tests	% balance improvement
Peatland	Concession area (ha)	14,525.8 (±SD 11,230.0)	16,242.0 (±SD 9,390.7)	NA	---	NA
	Mean road density	0.013 (±SD 0.021)	0.286 (±SD 0.275)	0.068 (±SD 0.051)	***	79.7
Non-peatland	Concession area (ha)	5,092.9 (±SD 6,078.8)	10,538.8 (±SD 6,229.2)	5,287.2 (±SD 6,111.9)	***	96.4
	Mean road density	0.238 (±SD 0.209)	0.330 (±SD 0.269)	0.170 (±SD 0.247)	***	25.5

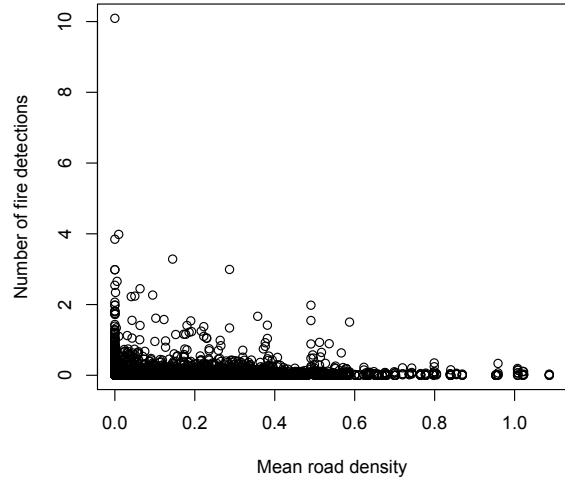
Table A.3. Density of fire activity, including the density of fire detections km⁻², fire ignitions km⁻², and escaped fires km⁻² for RSPO certified concessions (N=24) and non-certified concessions (N=14, N=8 after matching) and on peatlands for RSPO certified concessions (N=4) and non-certified concessions (N=11, N=4 after matching), divided into wet years (2012-2013) and dry years (2014-2015), including area-based estimates of fire activity within concessions (assigning every pixel bifurcated by a concession boundary to ‘within a concession boundary’ or ‘outside of a concession boundary’ based on the majority area of that pixel), low estimates of fire activity within concessions (assigning every pixel bifurcated by a concession boundary to ‘outside of a concession boundary’) and high estimates of fire activity within concessions (assigning every pixel bifurcated by a concession boundary to ‘within a concession boundary’). Differences in fire activity between RSPO certified and non-certified concessions before and after matching tested using KS-tests are shown with the following significance codes: --- > 0.05, * < 0.05, ** < 0.01.

Land cover type	Years	Fire activity	Estimate	RSPO certified concessions	Non-certified concessions (unmatched samples)	Non-certified concessions (matched samples)	KS-tests (unmatched)	KS-tests (matched)	
Peatland	Wet years (2012-2013)	Fire detections km ⁻²	Area-based			0.030 (±SD 0.025)	---	---	
			Low	0.017 (±SD 0.028)	0.036 (±SD 0.057)				
			High	0.014 (±SD 0.022)	0.027 (±SD 0.040)	0.023 (±SD 0.022)	---	---	
		Fire ignitions km ⁻²	Area-based				0.030 (±SD 0.025)	---	---
			Low	0.011 (±SD 0.019)	0.018 (±SD 0.023)	0.021 (±SD 0.016)	---	---	
			High	0.008 (±SD 0.013)	0.013 (±SD 0.017)	0.015 (±SD 0.013)	---	---	
		Escaped fires km ⁻²	Area-based				0.021 (±SD 0.018)	---	---
			Low	0.014 (±SD 0.020)	0.019 (±SD 0.026)	0.021 (±SD 0.018)	---	---	
			High	0.000 (±SD 0.000)	0.000 (±SD 0.000)	0.000 (±SD 0.000)	NA	NA	
	Dry years (2014-2015)	Fire detections km ⁻²	Area-based				0.000 (±SD 0.000)	NA	NA
			Low	0.000 (±SD 0.000)	0.001 (±SD 0.004)	0.000 (±SD 0.000)	NA	NA	
			High	0.000 (±SD 0.000)	0.000 (±SD 0.000)	0.000 (±SD 0.000)	NA	NA	
		Fire ignitions km ⁻²	Area-based				0.012 (±SD 0.015)	---	---
			Low	0.180 (±SD 0.348)	0.054 (±SD 0.102)				
			High	0.110 (±SD 0.219)	0.034 (±SD 0.068)	0.010 (±SD 0.014)	---	---	
		Escaped fires km ⁻²	Area-based				0.016 (±SD 0.014)	---	---
			Low	0.074 (±SD 0.106)	0.028 (±SD 0.047)	0.010 (±SD 0.012)	---	---	
			High	0.044 (±SD 0.069)	0.021 (±SD 0.033)	0.008 (±SD 0.011)	---	---	
Non-peatland	Wet years (2012-2013)	Fire detections km ⁻²	Area-based				0.000 (±SD 0.000)	NA	NA
			Low	0.001 (±SD 0.002)	0.000 (±SD 0.001)	0.000 (±SD 0.000)	NA	NA	
			High	0.007 (±SD 0.013)	0.000 (±SD 0.001)	0.000 (±SD 0.000)	NA	NA	
			Area-based			0.043 (±SD 0.083)	**	**	
				0.012 (±SD 0.033)	0.043 (±SD 0.083)				

Dry years (2014- 2015)	Fire ignitions km ⁻²	Low	0.009 (±SD 0.024)	0.032 (±SD 0.065)	0.032 (±SD 0.065)	**	**	
		High	0.019 (±SD 0.041)	0.047 (±SD 0.088)	0.047 (±SD 0.088)	*	**	
		Area-based	0.010 (±SD 0.022)	0.028 (±SD 0.045)	0.028 (±SD 0.045)	**	**	
		Low	0.007 (±SD 0.018)	0.020 (±SD 0.034)	0.020 (±SD 0.034)	**	**	
		High	0.013 (±SD 0.027)	0.031 (±SD 0.048)	0.031 (±SD 0.048)	**	**	
		Escaped fires km ⁻²	Area-based	0.000 (±SD 0.000)	0.000 (±SD 0.003)	0.000 (±SD 0.003)	NA	NA
	Fire detections km ⁻²	Low	0.000 (±SD 0.000)	0.000 (±SD 0.001)	0.000 (±SD 0.001)	NA	NA	
		High	0.000 (±SD 0.000)	0.000 (±SD 0.001)	0.000 (±SD 0.001)	NA	NA	
		Area-based				---	---	
		Low	0.059 (±SD 0.142)	0.045 (±SD 0.059)	0.045 (±SD 0.059)			
		High	0.025 (±SD 0.081)	0.035 (±SD 0.043)	0.035 (±SD 0.043)	*	*	
		High	0.082 (±SD 0.172)	0.047 (±SD 0.064)	0.047 (±SD 0.064)	---	---	
	Fire ignitions km ⁻²	Area-based	0.037 (±SD 0.075)	0.030 (±SD 0.033)	0.030 (±SD 0.033)	---	---	
		Low	0.015 (±SD 0.043)	0.026 (±SD 0.027)	0.026 (±SD 0.027)	*	*	
		High	0.052 (±SD 0.096)	0.032 (±SD 0.038)	0.032 (±SD 0.038)	---	---	
		Escaped fires km ⁻²	Area-based	0.001 (±SD 0.008)	0.000 (±SD 0.000)	0.000 (±SD 0.000)	NA	NA
			Low	0.000 (±SD 0.002)	0.000 (±SD 0.001)	0.000 (±SD 0.001)	NA	NA
			High	0.000 (±SD 0.000)	0.000 (±SD 0.000)	0.000 (±SD 0.000)	NA	NA



a.



b.

Fig. A.3. Relationship between (a) the size of concession and the number of fire detections and (b) the accessibility of concession (road density) and the number of fire detections.