SUPPLEMENTARY MATERIALS

STable 1. Range of climate values in industrial plantations. These ranges represent the minimum and the maximum values of the Worldclim bioclimatic variables observed in the industrial oil palm plantations of the IUCN layer.

bioVariables	minValues	maxValues	Units
Annual mean temperature	18.50	28.90	°C
Mean diurnal range	6.00	14.50	°C
Isothermality	57.00	95.00	%
Temperature seasonality	1.19	22.19	°C
Max temperature of warmest month	24.10	36.50	°C
Min temperature of coldest month	12.90	24.20	°C
Temperature annual range (bio05-bio06)	7.10	18.30	°C
Mean temperature of wettest quarter	18.70	29.00	°C
Mean temperature of driest quarter	18.30	29.00	°C
Mean temperature of warmest quarter	18.90	29.60	°C
Mean temperature of coldest quarter	18.20	28.10	°C
Annual precipitation	987.00	5032.00	mm
Precipitation of wettest month	134.00	831.00	mm
Precipitation of driest month	1.00	274.00	mm
Precipitation seasonality	9.00	101.00	Coef. of variation
Precipitation of wettest quarter	386.00	2069.00	mm
Precipitation of driest quarter	7.00	911.00	mm
Precipitation of warmest quarter	107.00	1795.00	mm
Precipitation of coldest quarter	8.00	1955.00	mm

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STable 2. List of countries where we confirmed the presence of oil palm plantations with the global oil palm layer for the second half year of 2019.

| Central America	South America	Western Africa	Central Africa	SE Asia	Pacific
Dominican Republic	Ecuador	Togo	Angola	Indonesia	Papua New Guinea
Mexico	Venezuela	Ghana	Burundi	Singapore	Solomon Is
El Salvador	Colombia	Cote d'Ivoire	Rwanda	Brunei	Vanuatu
Guatemala	Peru	Guinea	Uganda	Philippines	
Panama	Brazil	Guinea-Bissau	Tanzania	Malaysia	
Costa Rica		Sierra Leone	Cameroon	Thailand	
Nicaragua		Liberia	Equatorial Guinea	Burma	
Honduras		Benin	Sao Tome & Principe	Cambodia	
Belize		Nigeria	Gabon	Vietnam	
			Rep of the Congo		
			Central African Rep		
			Dem Rep of the Congo		

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STable 3. Confusion matrix of the global oil palm layer (second half year of 2019) validated with 13,252 points.

	Other	Industrial	Smallholder
Other	11955	66	37
Industrial	112	682	71
Smallholder	36	15	304

STable 4. Comparison of the classification image obtained with the convolutional neural network (CNN) and the classification image presented in Xu et al., 2020 for 2016. In order to compare both methodologies, we applied the CNN to Sentinel-1 and 2 composites of the second half of 2016, which corresponds to the last year of the multi-anual analysis in Xu's data set. We used 5,199 points randomly distributed in the study area, which covers Malaysia, Sumatra, and Borneo.
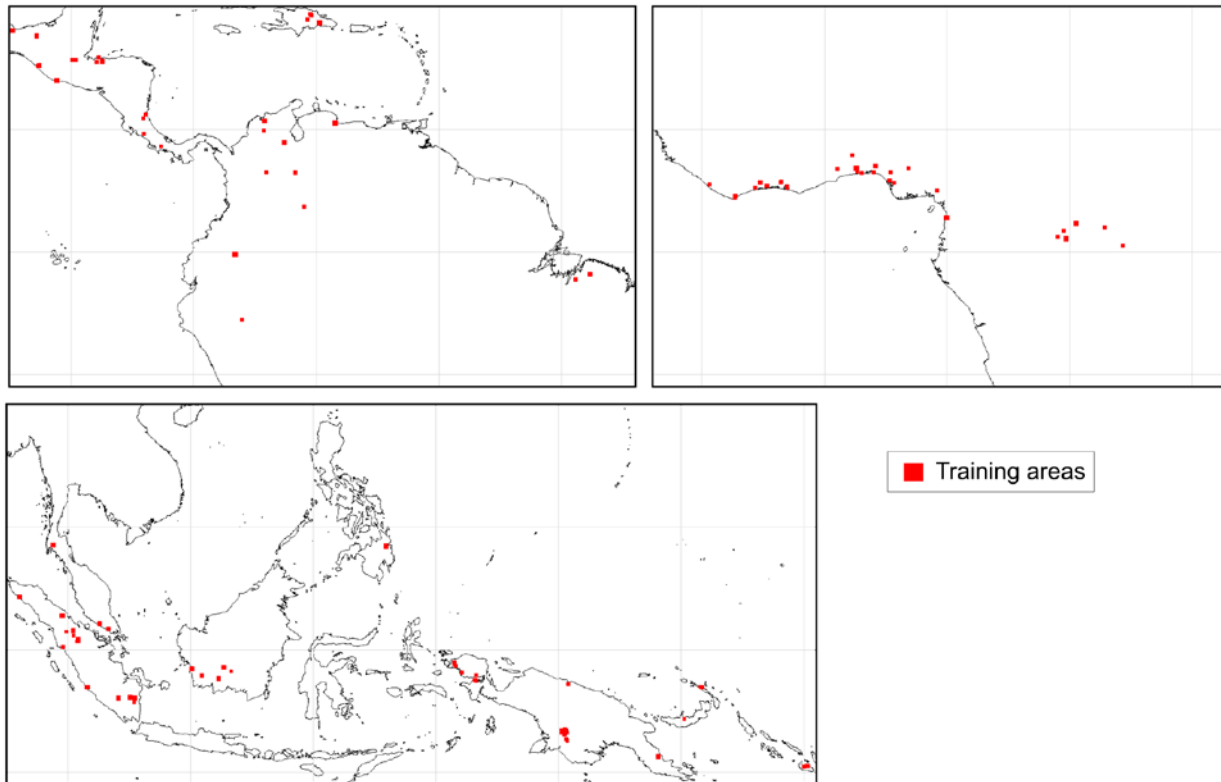
|		Global OP year 2016 (SE Asia)	Chen, 2020 (2016)
OA (%)		96.6	92.2
kappa		77.4	61.2
UA (%)	Other	96.6	97.4
	Industrial + smallholder	96.6	57.4
PA (%)	Other	99.7	94.0
	Industrial + smallholder	67.1	76.3
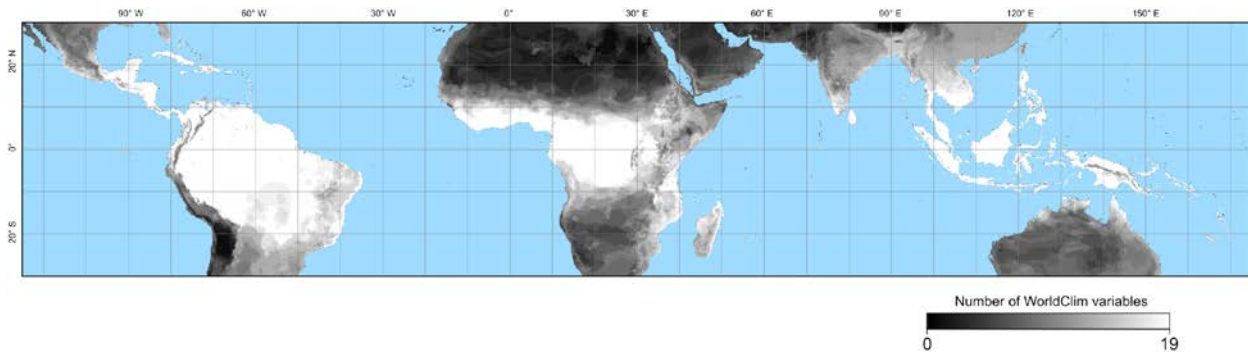
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SFigure 1. Potential area for oil palm growth. The map reflects the number of WorldClim bioclimatic variables that fall within the range observed in the industrial oil palm plantations (IUCN layer).

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SFigure 2. Location of areas where Sentinel-1 and 2 was collected for training the convolutional neural network.
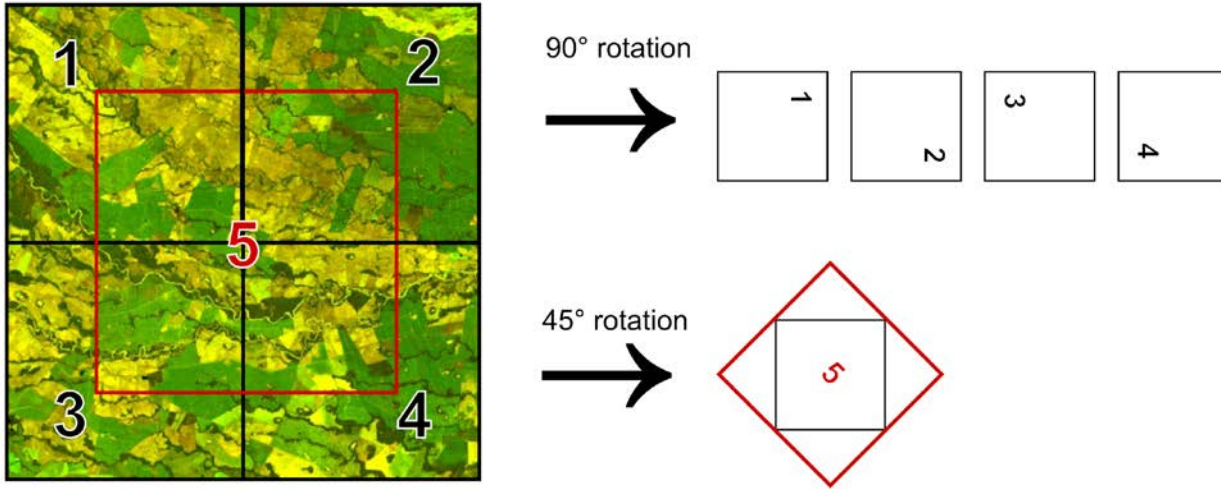
SFigure 3. Data augmentation used in the training data. Sentinel-1 and 2 were labelled in images of size 1000 x 1000 pixels. These training images were rotated 90° clockwise to increase the size and quality of the training data set. We also applied a rotation of 45° in labelled images of size 2000 x 2000 pixels.

Industrial oil palm with closed-canopy curvy terrain. Sumatra. Detected	Industrial oil palm with closed-canopy on flat surface. Sao Tome. Detected	Industrial oil palm with closed-canopy on flat surface. Venezuela. Detected	Industrial oil palm with closed-canopy on flat surface. Kalimantan. Detected
Smallholder oil palm with closed-canopy on curvy terrain. Sumatra. Detected	closed-canopy smallholder oil palm. Tanzania on flat surface. Detected	Smallholder oil palm with open canopy (young >3yrs old) on flat surface. Sumatra. Detected	Smallholder oil palm with open canopy on flat surface. Sumatra. Detected
Industrial oil palm mixed with large forest trees on flat surface DRC. Partially detected	Industrial oil palm, heterogenous stand on flat surface. Sumatra. Not detected	Industrial oil palm with open canopy (<3yrs) on flat surface. Kalimantan. Not detected	Area cleared for industrial oil palm, but plantation failed. Papua. Not detected
Scattered Smallholder oil palm. Benin on flat surface Not detected	Semi-wild smallholder oil palm mixed undergrowth on flat surface. Nigeria. Not detected	Smallholder oil palm freshly planted on flat surface. Sumatra. Not detected.	

SFigure 4. Examples of oil palm plantations around the world that have been detected or not detected by the model. One square is about 390m x 390 m = 15 ha.
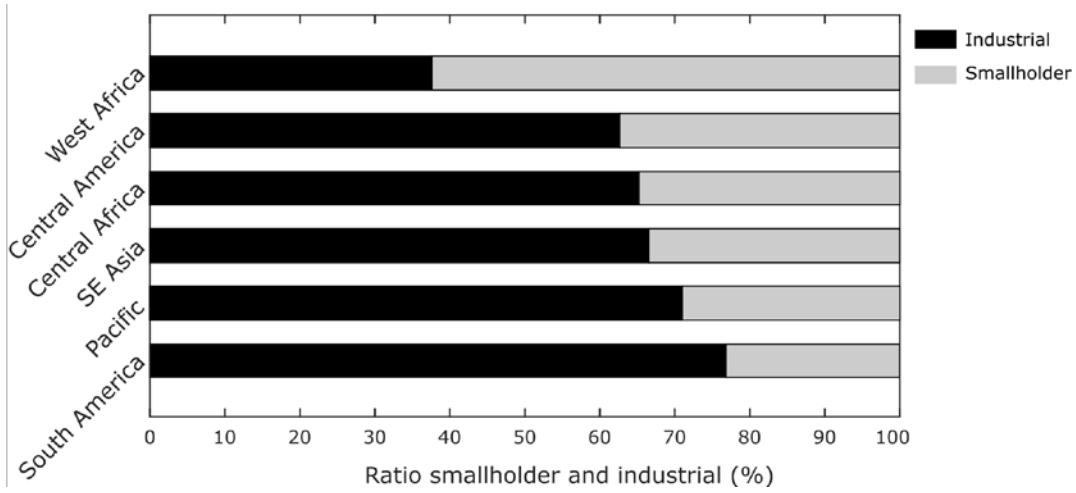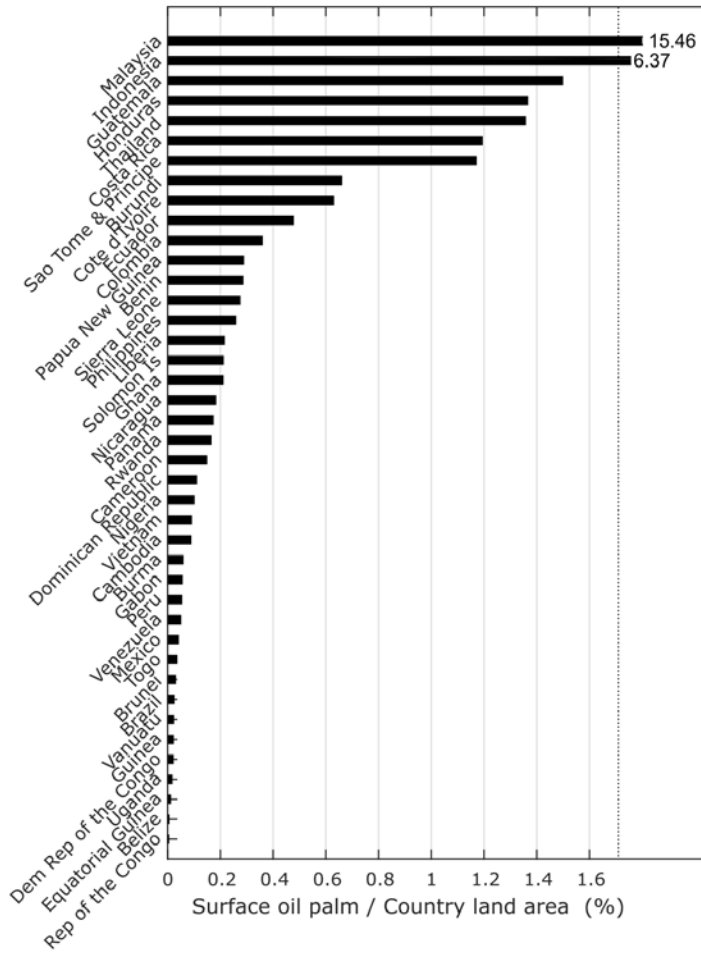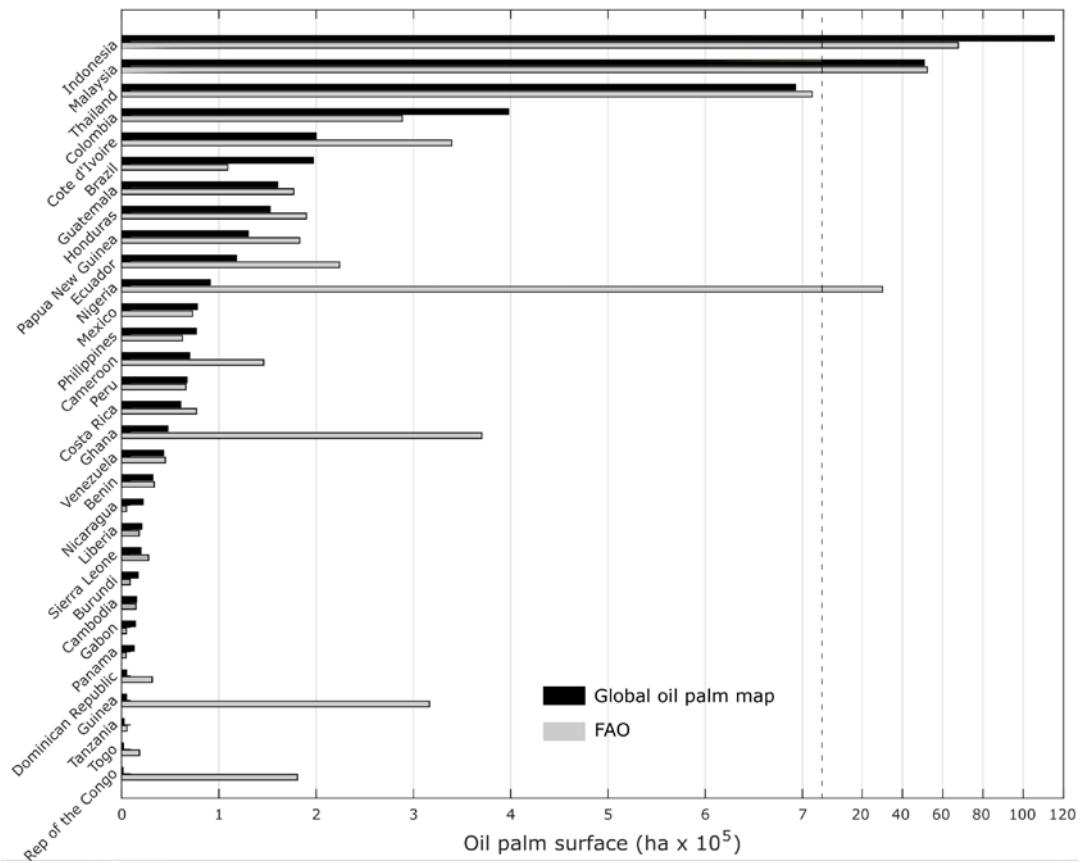
SFigure 5. Ratio smallholders and industrial at sub-continental scale. The ratio was obtained with the global oil palm layer for the second half year of 2019.

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SFigure 6. Percentage of country land area dedicated to oil palm.

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SFigure 8. Smallholder oil palm planted right up to the river edge in Sumatra. These large areas of industrial-scale oil palm plantings are operated under smallholder licenses, potentially making it easier to bypass environmental legislation to prohibit planting of oil palm to within 50 m of river banks.

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