Using occupancy-based camera trap surveys to assess the critically endangered primate *Macaca nigra* across its range in North Sulawesi, Indonesia

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SUPPLEMENTARY TABLE 1 Collinearity matrix for numeric covariates based on Pearson's rank correlation

	Elevation	Village	Road	Slope	Edge	NDVI	HFP
Elevation	1.000						
Village	0.482	1.000					
Road	0.343	0.506	1.000				
Slope	0.064	0.076	-0.069	1.000			
Edge	0.478	0.426	0.438	0.103	1.000		
NDVI	0.255	0.398	0.315	0.056	0.344	1.000	
HFP	-0.125	-0.234	-0.116	0.037	-0.195	-0.374	1.000

Note: See Table 1 for covariate definitions and abbreviations.

SUPPLEMENTARY TABLE 2 Model Selection results for covariate effects in determining detection probability of *M. nigra* based on a fixed covariate structure for occupancy

Detection Model	NPar	AICc [b]	ΔAICc	W_i	Cum. W_i
Ψ (.) *p*(PA, forest, HFP)	5	1670.951	0.000	0.545	0.545
Ψ (.) *p*(PA, forest, HFP, NDVI)	6	1672.538	1.586	0.247	0.792
Ψ (.) *p*(PA, HFP)	4	1674.027	3.076	0.117	0.909
Ψ (.) *p*(PA, HFP, NDVI)	5	1674.541	3.590	0.091	1.000
Constant Model *p*(.)Ψ(.)	0	1695.780	24.829	<0.001	

Note: Definitions as follows: NPar=number of parameters in the model; AICc = corrected Akaike Information Criterion, ΔAICc = difference in AIC values between each model and the model with the lowest AICc, W_i = AIC model weight. See Table 1 for covariate abbreviations.

SUPPLEMENTARY TABLE 3 List of regions that potentially harbour important *M. nigra* populations and the characteristics of each landscape, combined with an index of relative abundance. Important population landscapes were defined as being spatially unconnected areas of suitable habitat with >50km^2 contiguous forest and >0.7 predicted occupancy. The geography of these areas can be seen in Supplementary Fig. 2.

Region			**Protective Status**	**Forest characteristics**				***M. nigra* Capture Rate**	
ID	Name	Area (km^2)	Status	Forest size (km^2)	Forest perimeter (km)	Forest loss 2001-2017[1] (%)	[2] Proportion of total habitat (%)	Cameras deployed	[3]RAI
1	Tangkoko	82	Protected	61	54	2	3	28	10.2
2	Manembo-nembo	65	Protected	40	51	11	2	2	3.4
3	Gunung Ambang	250	Protected	185	109	7	8	4	2.1
4	Bogani Nani Wartabone*	230	Protected	199	170	8	13	21	4.6
5	Modayag*	561	Unprotected	342	297	10	19	2	0.6
6	Poigar*	237	Unprotected	155	132	7	10	5	10.0
7	Tapa Aog*	330	Unprotected	117	188	9	8	6	2.3
8	Maesan*	449	Unprotected	332	284	9	21	8	8.6

[1] Forest loss was calculated in ArcGIS version 10.2 using the Hansen *et al*. (2013) data set

[2] Amount of forest within each region expressed as a proportion of the total forest estimated to be occupied by *M. nigra* across its range (2101 km^2)

[3] Relative Abundance Index, calculated as the number of days on which *M. nigra* was captured per 100 camera trap days

*First formal documentation of *M. nigra* presence in these regions

SUPPLEMENTARY TABLE 4 Cost benefit analysis for a camera trap survey versus line transect method to estimate occupancy of *Macaca nigra* in North Sulawesi. Data from the equivalent of 639 km of line transects was collected whilst deploying, checking and collecting cameras. We treated the time observers spent inside sites although it was a presence/absence survey by recording any observations of *M. nigra*. This effort resulted in a detection history for *M. nigra* from observers from which it was possible to estimate occupancy. We did this using a constant model without covariates. In turn, we used estimated parameter outputs to estimate the minimum survey effort that would be required to estimate occupancy with a precision of SE=0.05. Using the known cost of each site visit, we extrapolated this cost to the sampling effort that we estimated to be needed using Equation 1 and compare this with the known expense of an equivalent survey that employs camera traps.

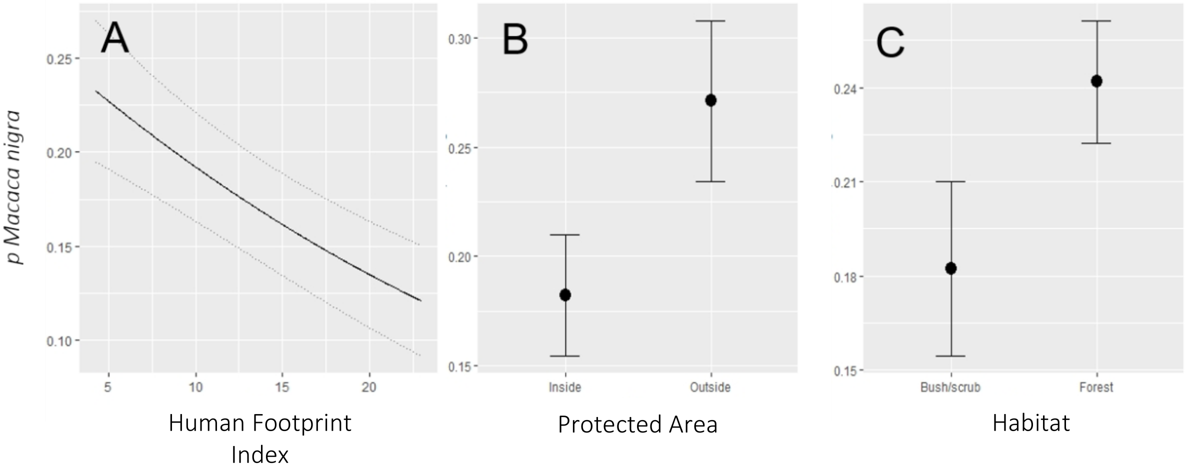
			IDR		USD	
	Number of sites[1]	Number of repeats[1]	Cost per site	Cost per season	Cost per site	Cost per season
Cameras	90	18	6,037,736	543,396,240	398	35,820
Transects	123	3	7,007,299	861,897,777	462	56,826

	IDR	USD
Seasonal savings with cameras	318,501,537	21,006
Cost of 90 cameras[2]	231,585,408	15,264

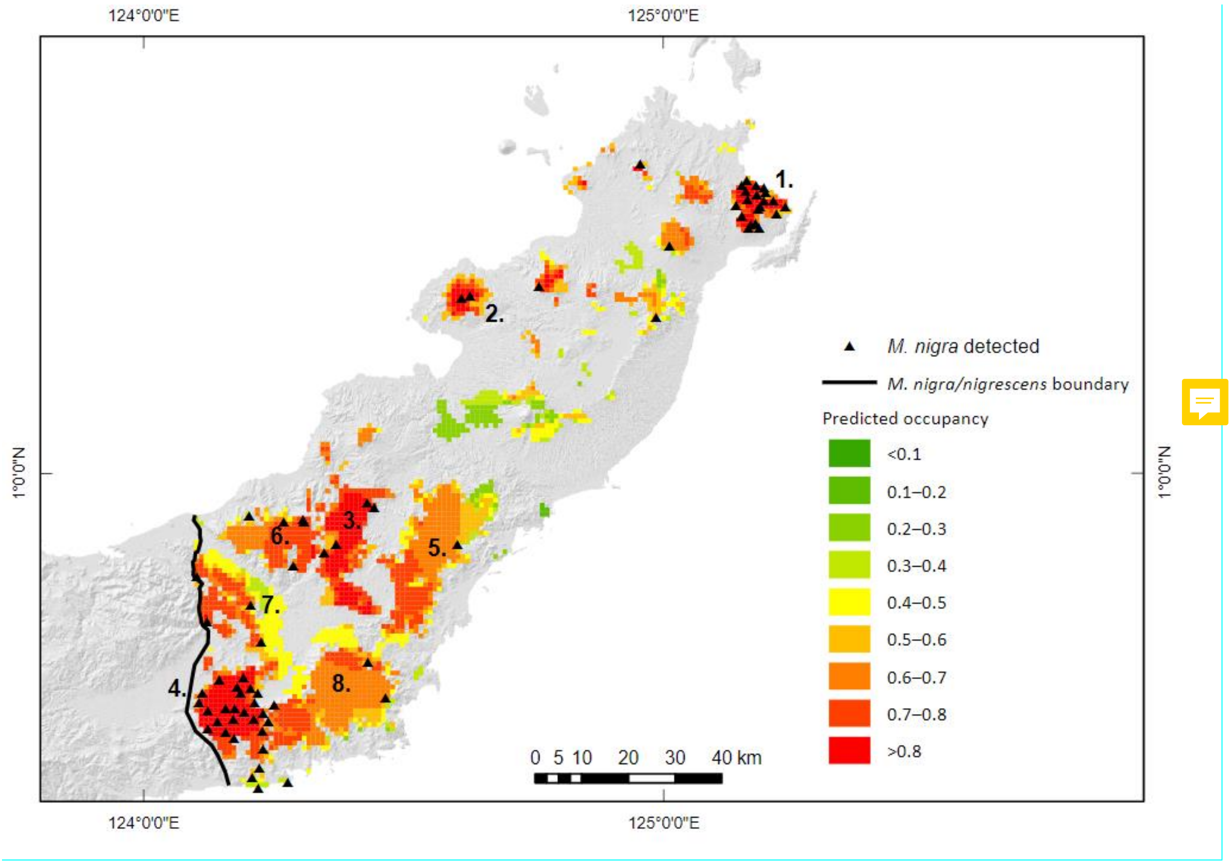
[1]Sites and repeats were calculated as the minimum survey effort needed to achieve a target precision of SE=0.05 in the occupancy estimate, using Equation 1

[2]Camera cost includes individual protective housing, security cable and shipping

Amounts are estimated in Indonesian Rupiah (IDR) and United States Dollars (USD)



SUPPLEMENTARY FIG. 1 The functional relationships of *M. nigra* detection probability (p) with its dominant covariates (A) HFP-Human footprint Index (B) PA - protective status and (C) presence of forest



SUPPLEMENTARY FIG. 2. Geographical representation of the regions that potentially harbour important *M. nigra* populations, shown with those cameras where *M. nigra* were detected. For detailed characteristics of each region, see Supplementary Table 3.