Integrating disparate occurrence reports to map data-poor species ranges and occupancy: a case study of the Vulnerable bearded pig *Sus barbatus*

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SUPPLEMENTARY MATERIAL 1 Methods

We used a minimum convex polygon instead of a kernel approach to create ranges because the geographical clustering of records was not caused by spatially autocorrelated environmental factors but by sampling bias (Hernandez et al., 2006). We decided against using alpha hulls because although they can reduce bias (IUCN Standards and Petitions Subcommittee, 2016), we found that they inaccurately removed large portions of the known range of bearded pigs *Sus barbatus* from our estimates when these areas had few data points.

TABLE S1 The contribution of various data sources to the known range of the bearded pig in 2010, and prior to 2000 (in parentheses).

	Area ($\times$ 1,000 km^2)			Total
	Sumatra	Peninsular Malaysia	Borneo	
Literature review	32.5 (180)	3.4 (71.5)	338 (454)	373.9 (705.5)
Museum records	0 (0)	0 (0)	0 (3.9)	0.0 (3.9)
Citizen science	0 (0)	0 (0)	7.3 (0)	7.3 (0)
Survey of experts	11.4 (0)	1.5 (0)	4.6 (1.7)	17.5 (1.7)
Camera trap	0.2 (0)	0 (0)	0.7 (0)	0.9 (0)
Total	44.1 (180)	4.9 (71.5)	350.6 (459.6)	399.6 (711.1)

TABLE S2 Forest cover and beard pig range in 1980–1990 and 2000.

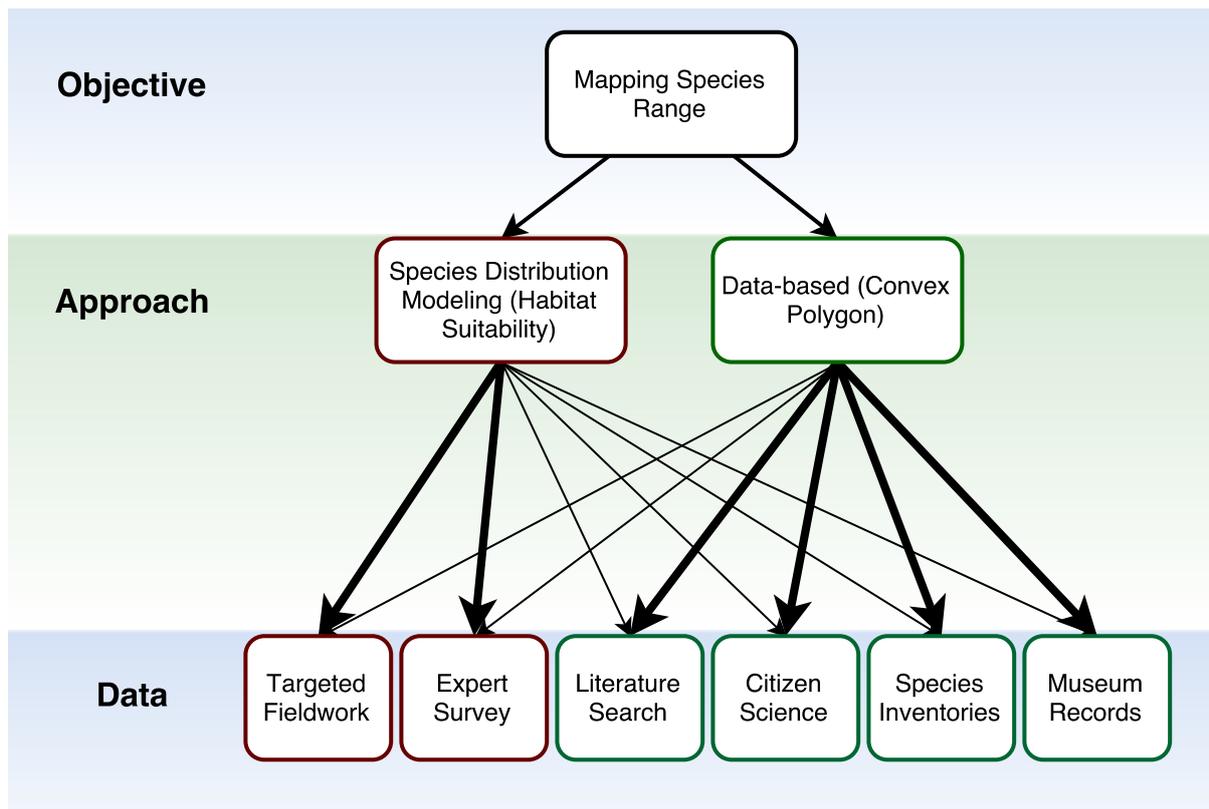|	Sumatra	Peninsular Malaysia	Borneo	Total
Forest cover (× 1,000 km^2)				
1980–1990	276.2	75.2	466	817.4
2010	105.8	50.7	359.3	515.8
Change	−62%	−33%	−23%	−37%
Bearded pig range (× 1,000 km^2)				
1980–1990	180.4	71.5	459.7	711.6
2010–2015	43.9	4.9	350.8	399.6
Change	−76%	−93%	−24%	−44%

FIG. S1 Approaches, methods and data commonly used for mapping species' ranges and occupancy. Thicker lines represent more commonly used data sources for each approach. Species distribution modelling infers or extrapolates likely occupied areas from ecological information about a species' habitat preferences, usually gained from fine-scale observations. This information is most commonly acquired from targeted (species-specific) fieldwork and expert opinion. Mapping a species based on actual occurrence data benefits from larger collections and better coverage of coarse-scale presence/absence observations, which can be collated from a variety of sources.
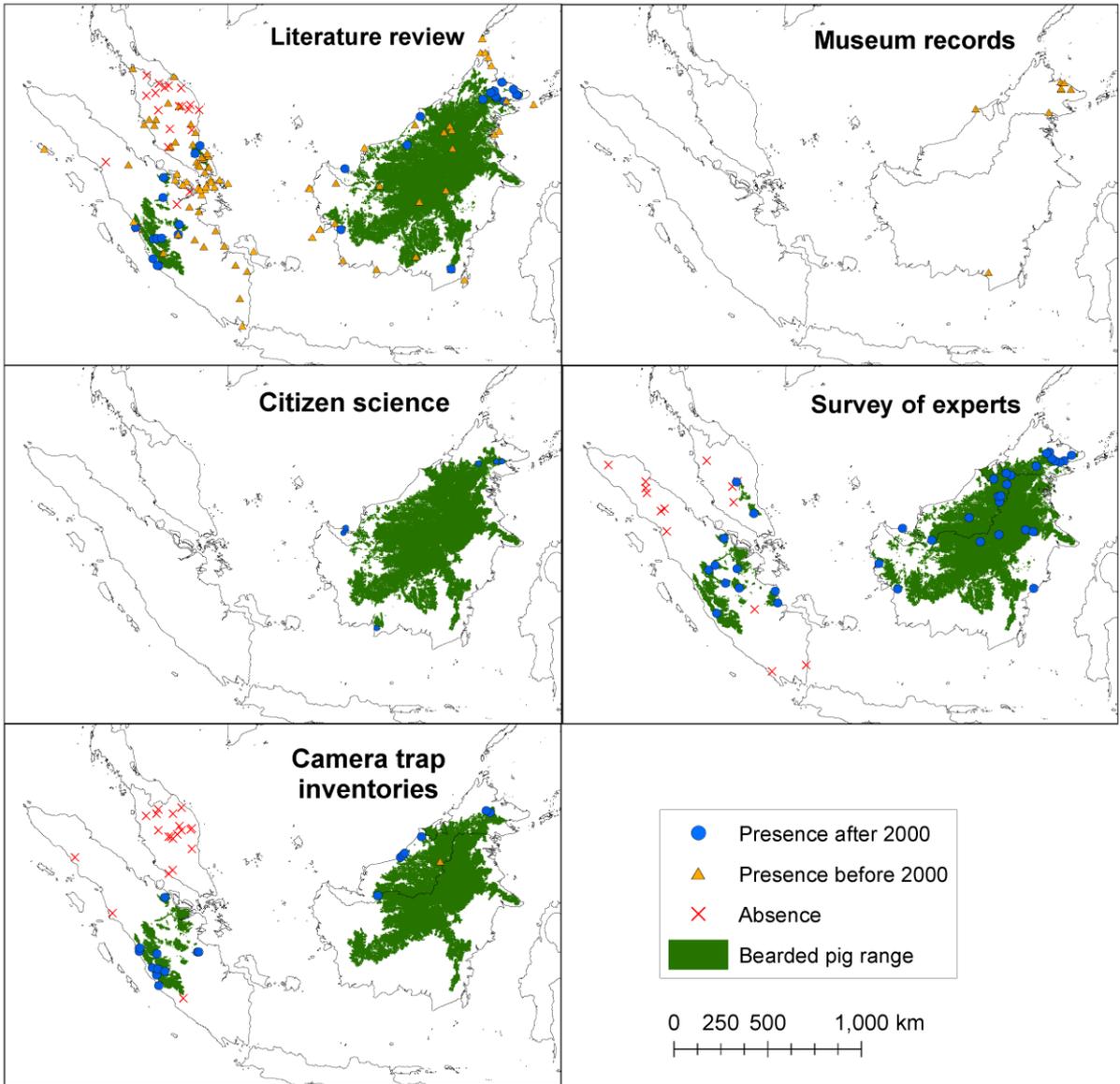
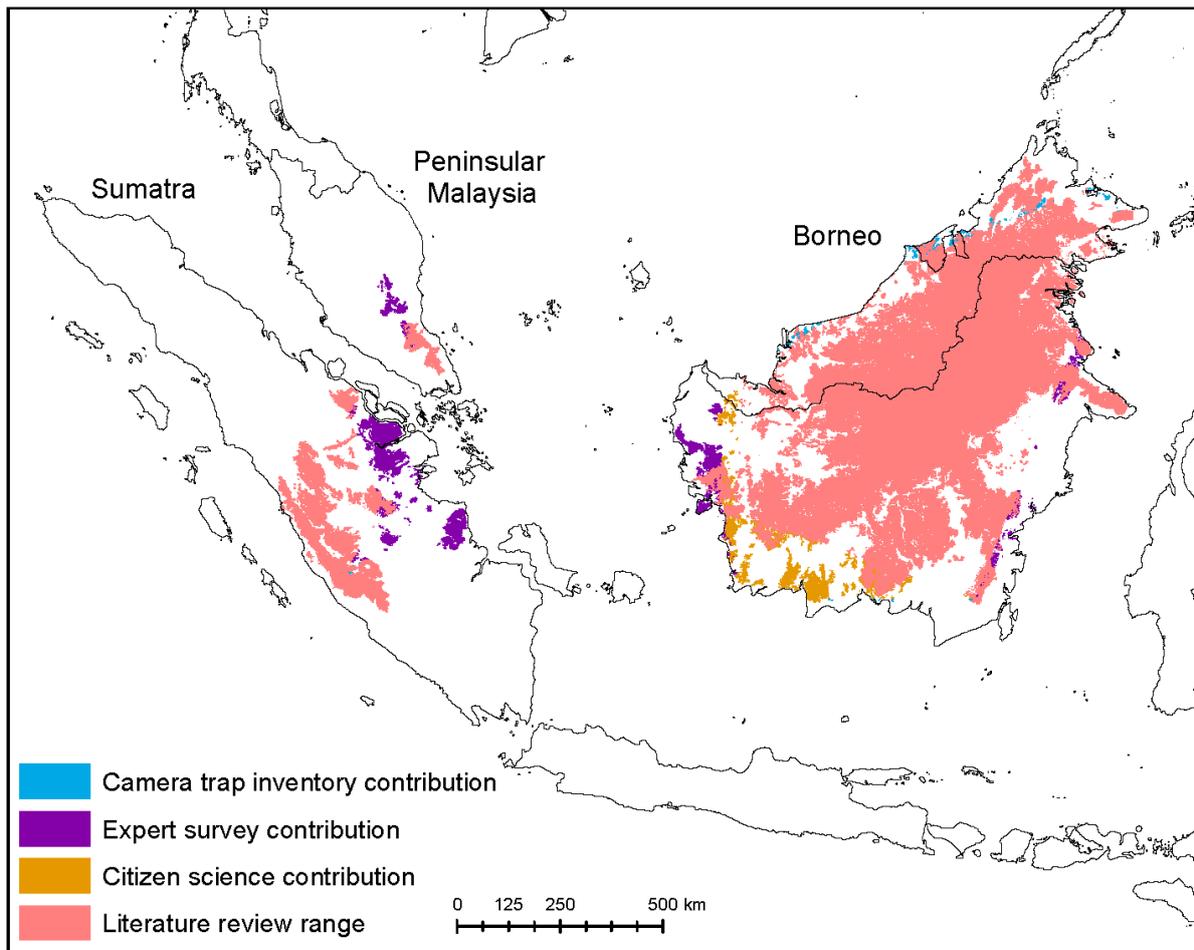FIG. S2 AOO of bearded pigs in Sumatra, Peninsular Malaysia and Borneo, based on various data sources.

FIG. S3 Relative contribution of various data sources to mapping the current range of the bearded pig in South-east Asia. Only occurrence data after 2000 were included. The following hierarchy was used for evaluating new data: literature review, citizen science, expert survey, species inventories from camera trap studies.
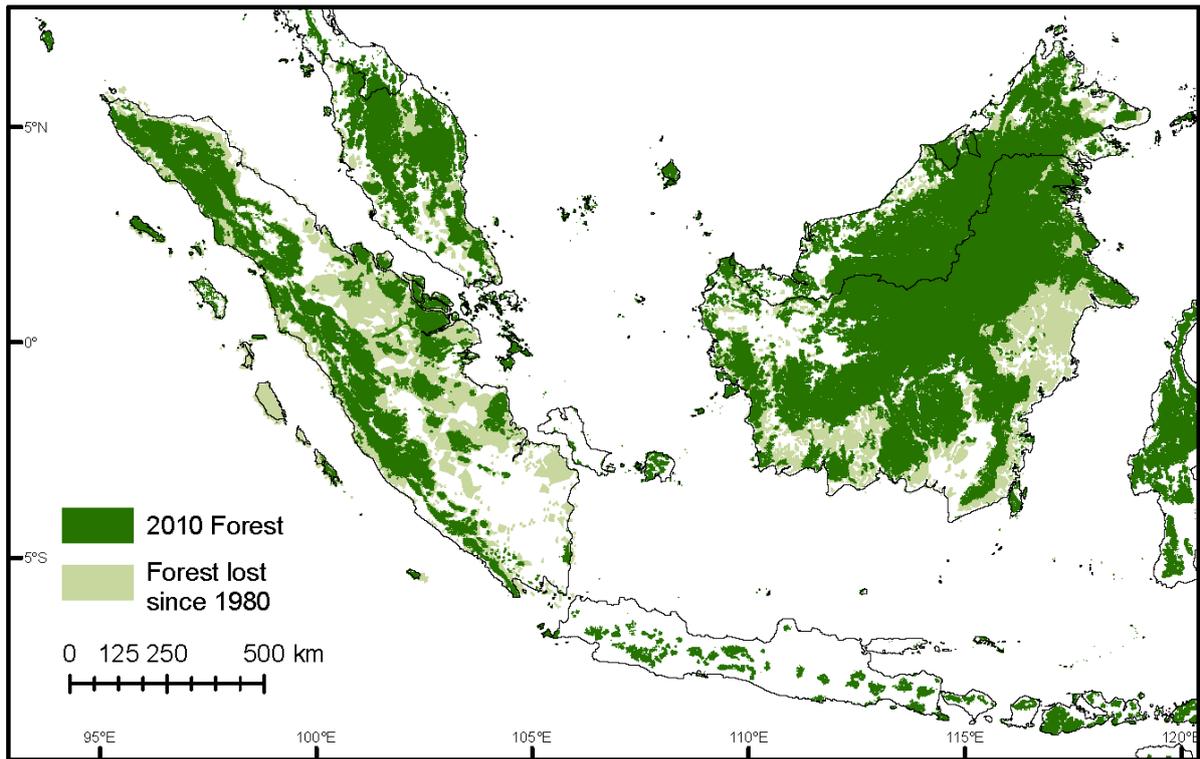
FIG. S4 Forest loss in South-east Asia during 1980–2010. Landcover data are from Nellemann (2007), Margono et al. (2012), Brown et al. (1994) and Miettinen et al. (2011).