SUPPORTING INFORMATION

S1.1. Field surveys

In the Glenelg region, we deployed camera-traps once at each site. In the Otway region, we redeployed camera-traps annually for three years. For the Otway region, all 2017 camera-sites were resurveyed each year, except for four logistically challenging sites in the southern grid. In 2018, we also added 16 sites in the southern grid, and 36 sites in the northern grid. All 2018 sites were resurveyed in 2019.

At each site, we deployed a single Reconyx (Holmen, Wisconsin) branded camera-trap with passive infrared sensor that detects a thermal differential between the subject and the background temperature. The majority of camera-traps were Reconyx Hyperfire HC600 (97% in the Glenelg region; 78% in the Otway Ranges). In the Glenelg region, PC900's were deployed at the remainder of sites (3%). In the Otway Ranges, PC900, PC800, HC500 and HF2X models were also used (Table S1). We programmed cameras to the 'high sensitivity' setting and to take five consecutive photographs when triggered (no 'quiet period'). We attached each camera to a tree, approximately 30 cm above the ground, facing toward a lure 2 - 2.5 m away. The lure comprised an oil-absorbing cloth doused in tuna oil, placed inside a PVC pipe container with a mesh top. We secured each lure to the top of a 1-m wooden stake and attached a handful of small white feathers to the outside of the PVC pipe container. Feathers were not used in the Lower Glenelg National Park survey. We cleared vegetation from the camera's line-of-sight to reduce false triggers and avoid obscuring cat coat markings.

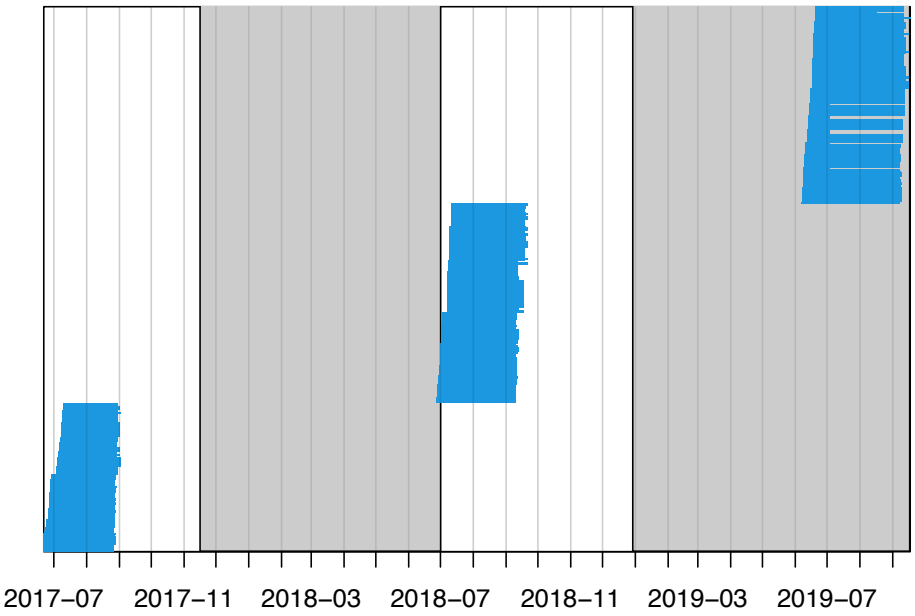

Figure S1: Camera-trap operation times in the Otway region, Australia. Each blue horizontal line represents one camera-trap deployment. Grey shading indicates periods of fox control in the impact landscape.

Table S1: Frequency of different Reconyx camera-trap models used in surveys

Region	Camera model	Frequency
Glenelg	HC600 HYPERFIRE	413
Glenelg	PC900 PROFESSIONAL	12
Otway	HC600 HYPERFIRE	405
Otway	HYPERFIRE 2 COVERT	59
Otway	PC900 PROFESSIONAL	34
Otway	HC500 HYPERFIRE	9
Otway	PC800 PROFESSIONAL	6

Figure S2: Example of a typical camera-trap set-up in the Otway region, Australia. The viewer is looking at the back of the lure post; behind which is the camera-trap positioned on the central tree trunk facing the viewer.

S1.2. Individual cat identification

We first labelled every camera-trap image with a species metadata tag using DigiKam software. For cat images, we also added metadata tags for each cat coat type: black, mackerel/spotted tabby, classic tabby, ginger and other (coats with multiple colour blends; Fig. 3). This allowed us to summarise species records and extract cat images using the 'camtrapR' R-package (Niedballa, *et al.* (2016). camtrapR: an R package for efficient camera trap data management. *Methods in Ecology and Evolution*, 7(12), 1457-1462).

In the Otway Ranges, we considered all black cats to be of the 'unmarked' category in spatial mark-resight models - even the few with white splotches on their underside (as these couldn't always be seen as cats move with their head down). In the Glenelg region, black cats were rarer (not detected at two landscapes) and often more distinctive, and so we could identify some individuals.

For each of the 'marked' coat categories, we identified individual cats based on their unique pelage markings where possible. Our ability to identify individuals substantially increased as the image library for each cat increased. Therefore we made the easiest identifications first to build up these libraries, before making decisions on the less obvious detections. We examined and matched all coat markings seen between two particular detections. Markings on the front legs were the most useful for identification as the patterns do not skew as much with different body positions. Unidentifiable detections were mainly due to only part of a cat appearing in the frame or because photos were blurry (because of cat movement or a foggy camera lens).

In a small number of instances (less than ten), only left or right flanks were ever seen. For these cases, the side with the most repeat detections was labelled as an individual, whereas the side with the least number of detections was considered unidentifiable. Additionally, an extremely small portion of cats detected in the Otway region had ginger coats (no cats detected in Glenelg had ginger coats). When ginger coats are photographed with an infrared flash, they become overexposed and no markings can be seen (see the image in bottom-right corner in Fig. S3). Therefore, if there were multiple ginger cat detections in a single grid, we treated them in the same way as one-sided flank detections.

For the Glenelg region, one observer identified the feral cats from landscape pairs 1 and 2 (MR) and pair 3 (Luke Woodford). For the 2017 and 2018 Otway datasets (where there were substantially more cat detections and fewer distinct coat patterns), two independent observers identified individual cats and discrepancies

between observers were reviewed together until consensus was reached (MR, MLP, BH). If no consensus was reached, the cat was considered unidentifiable. In the 2019 Otway dataset, many of the identified cats were sighted in the previous surveys, making it easier to identify individuals, and only one observer was used (MR). We supplemented our image libraries for each individual cat with images from additional camera-trap surveys conducted within the Otway region grids (just before each of our surveys) using white flash camera-traps (Zoï Banikos, unpublished data).

This process left us with three groups of cats: unmarked, marked (cats which could be identified to the individual-level with complete certainty) and mark status unknown (marked cats which couldn't be identified to the individual-level with complete certainty).

We ignored the few detections of cats which were obviously young enough to be dependent on a parent, as these kittens do not have independent activity centres or movements and were not yet recruited into the adult population.

Figure S3: Feral cat coat categories from left-right, top-bottom: mackerel/spotted tabby, classic tabby, other, black, ginger and ginger with infrared flash.

S1.3. Vegetation categories

We condensed the main Ecological Vegetation Class groupings (Department of Environment, Land, Water & Planning 2020) into three categories for each region by merging similar groups. In the Glenelg region, we merged dry forests with lowland forests. In the Otway region, we merged rainforests with wet forests, as well as merged dry forests and heathy woodlands. This resulted in three categories for each region: cleared land, heathy woodlands, and either lowland forests (Glenelg region only) or wet forests (Otways region only).

A very small proportion of other Ecological Vegetation Class groupings were present in the habitat masks: riparian scrubs or swampy scrubs and woodlands, coastal scrubs grasslands and woodlands, wetlands, riverine grassy woodlands or forests, plains woodlands or forests, herb-rich woodlands. We removed these groups, and interpolated cell values from the nearest of the three vegetation categories.

Reference

Department of Environment, Land, Water & Planning. (2020) Bioregions and EVC Benchmarks, https://www.environment.vic.gov.au/biodiversity/bioregions-and-evc-benchmarks

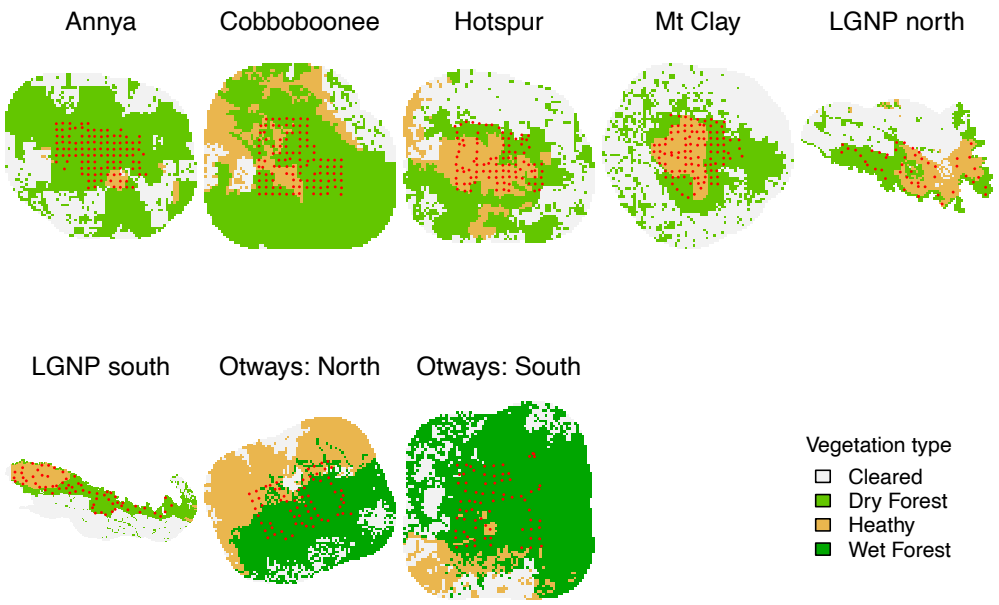

Figure S4: Condensed Ecological Vegetation Class groups in each study landscape used as habitat mask covariates in spatial mark-resight models (base models).

S1.4. Fox spatial occurrence

S1.4.1. Glenelg region

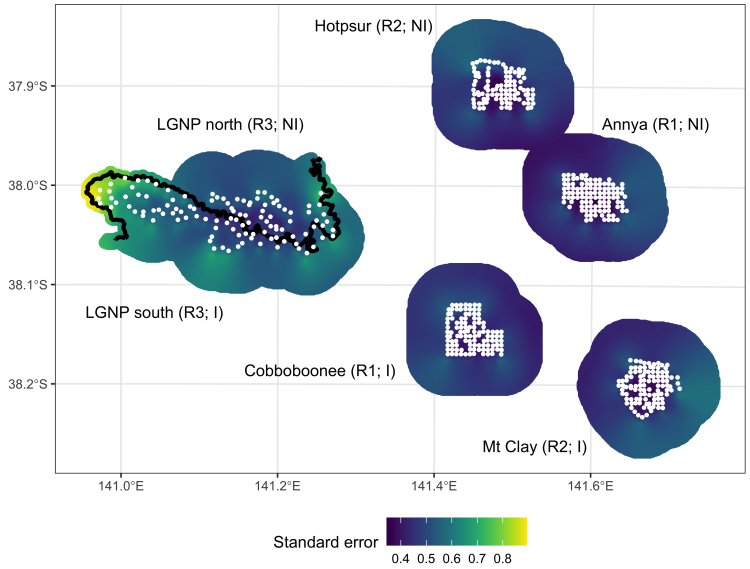

Figure S5: Standard error estimates on the response scale around red fox occurrence probabilities derived from generalised additive models within each impact (I) and associated non-impact (NI) landscape in the Glenelg region, Australia. White dots represent camera-traps.

S1.4.2. Otway Region

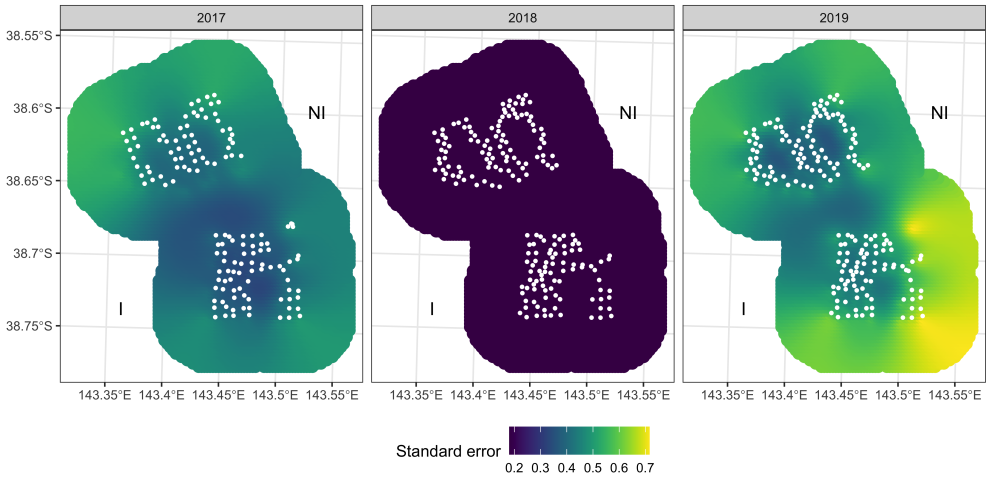

Figure S6: Standard error estimates on the response scale around red fox occurrence probabilities derived from generalised additive models within each impact (I) and associated non-impact (NI) landscape survey session in the Otway region, Australia. White dots represent camera-traps.

S1.5. Feral cat detection plots

S1.5.1. Glenelg region

Replicate 1.

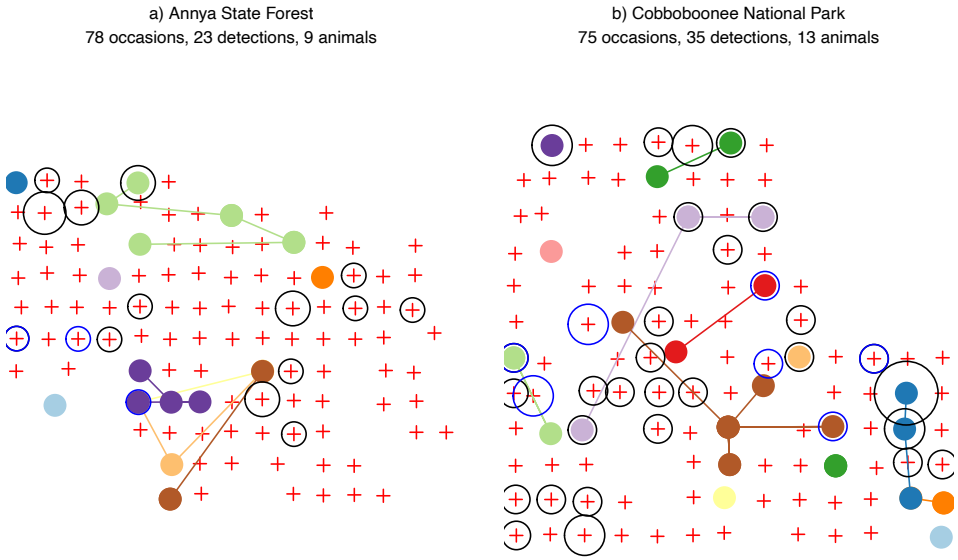

Figure S7: Feral cat detections in the first replicate grid pair in the Glenelg region, Australia. Camera-traps are indicated by red crosses. Solid fill coloured circles represent identified cats with lines indicating observed movements. Black open circles indicate black cat detections; blue circles indicate unidentifiable tabby cat detections, with circle radius scaling positively with the number of daily detections. Fox control does not occur in Annya (a; non-impact) but does in Cobboboonee (b; impact).

Replicate 2.

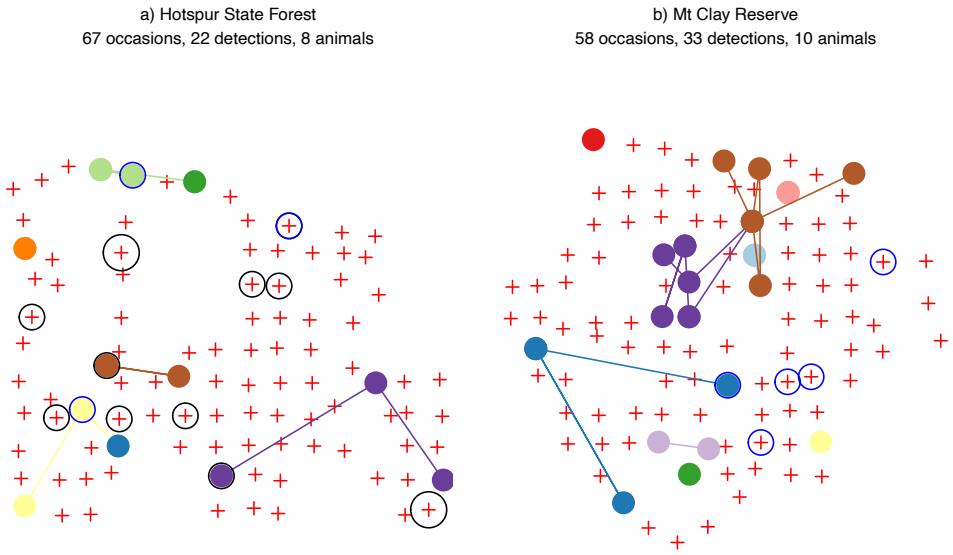

Figure S8: Feral cat detections in the second replicate grid pair in the Glenelg region, Australia. Camera-traps are indicated by red crosses. Solid fill coloured circles represent identified cats with lines indicating observed movements. Black open circles indicate black cat detections; blue circles indicate unidentifiable tabby cat detections, with circle radius scaling positively with the number of daily detections. Fox control does not occur in Hotspur (a; non-impact) but does in Mt Clay (b; impact).

Replicate 3.

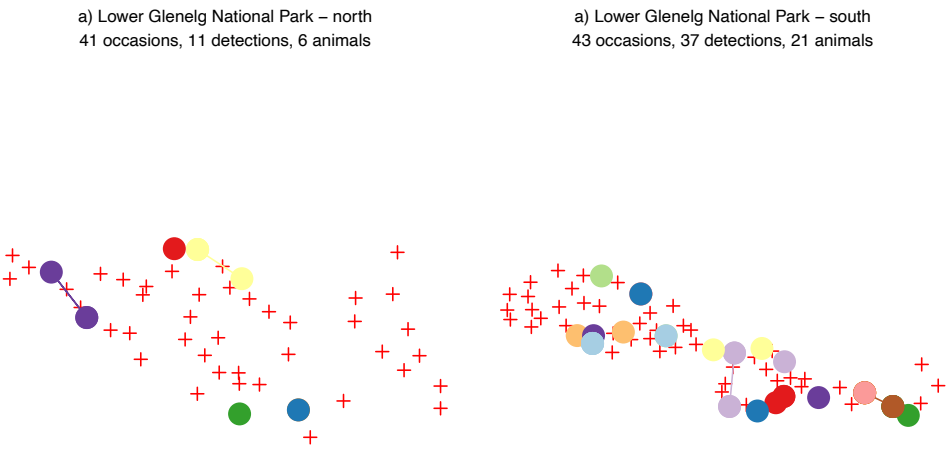

Figure S9: Feral cat detections in the third replicate grid pair in the Glenelg region, Australia. Camera-traps are indicated by red crosses. Solid fill coloured circles represent identified cats with lines indicating observed movements. Fox control does not occur in the north (a; non-impact) but does in the south (b; impact) of Lower Glenelg National Park.

S1.5.2. Otway region

2017.

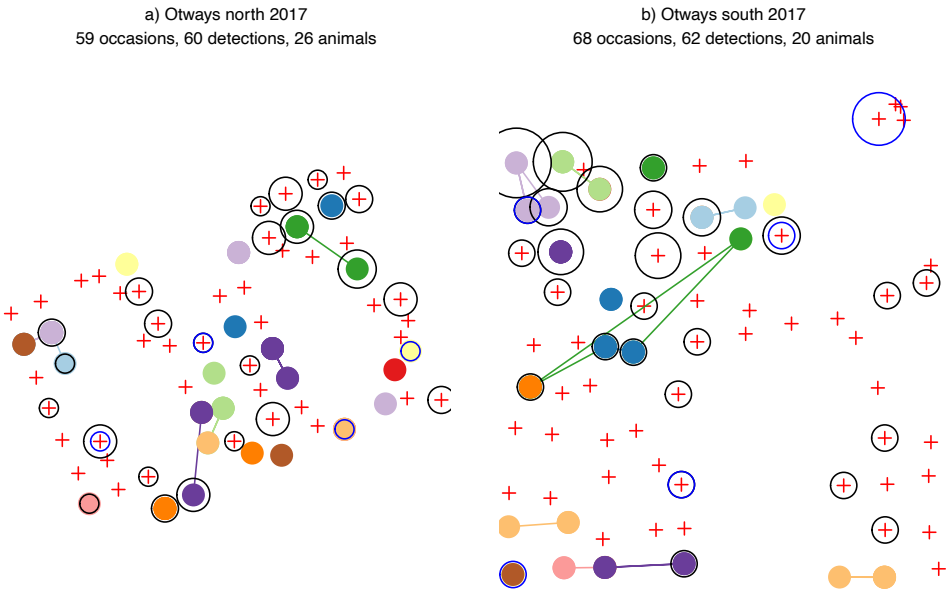

Figure S10: Feral cat detections in the Otway region, Australia, 2017. Solid fill coloured circles represent identified cats with lines indicating observed movements. Black open circles indicate black cat detections; blue circles indicate unidentifiable tabby cat detections, with circle radius scaling positively with the number of daily detections. Fox control did not occur in either of the landscapes during this time.

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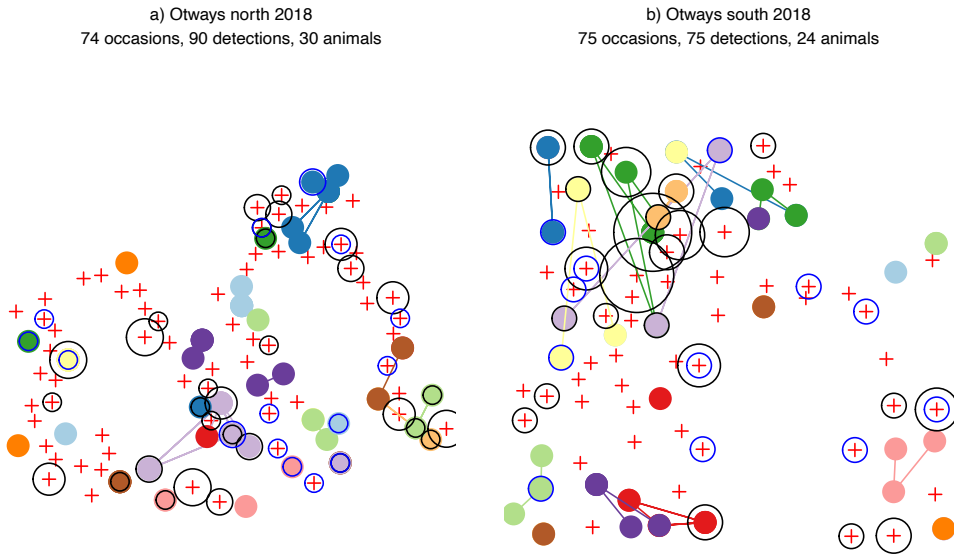

Figure S11: Feral cat detections in the Otway region, Australia, 2018. Solid fill coloured circles represent identified cats with lines indicating observed movements. Black open circles indicate black cat detections; blue circles indicate unidentifiable tabby cat detections, with circle radius scaling positively with the number of daily detections. Fox control did not occur in the north landscape (a; non-impact),. Fox control occurred, but lapsed just prior to the survey in the south landscape (b; impact).

2019.

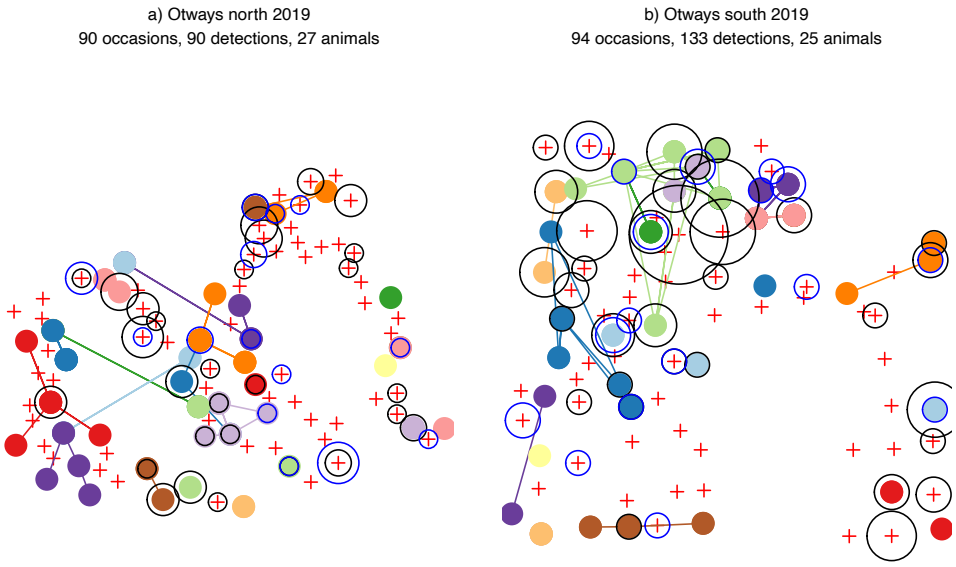

Figure S12: Feral cat detections in the Otway region, Australia, 2019. Solid fill coloured circles represent identified cats with lines indicating observed movements. Black open circles indicate black cat detections; blue circles indicate unidentifiable tabby cat detections, with circle radius scaling positively with the number of daily detections. Fox control did not occur in the north landscape (a; non-impact); foxes were controlled in the south landscape (b; non-impact) during this survey.

S1.6. Spatial mark-resight models

S1.6.1. Glenelg region

Table S2: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Glenelg region; model set 1.

Detector function	K	logLik	AIC	AICc	dAICc	AICcwt
exponential	3	-1745.99	3497.99	3498.37	0.00	1
half-normal	3	-1763.02	3532.04	3532.43	34.06	0

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

Table S3: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Glenelg region; model set 2.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~1 g0~1 sigma~1	3	-1309.93	2625.85	2626.23	0.00	0.39
D~vegetation g0~1 sigma~1	5	-1307.68	2625.37	2626.35	0.12	0.37
D~vegetation g0~s(T) sigma~1	7	-1306.25	2626.50	2628.40	2.16	0.13
D~1 g0~s(T) sigma~1	5	-1308.83	2627.66	2628.64	2.41	0.12

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

s(T) - nonlinear time trend smooth with three knots (g0 only)

Table S4: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Glenelg region; model set 3.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~session g0~fox_occ sigma~fox_occ	10	-1297.46	2614.93	2618.86	0.00	0.62
D~session g0~1 sigma~1	8	-1300.66	2617.32	2619.80	0.95	0.38

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

fox_occ - fine-scale occurrence probability of foxes derived from generalised additive models

session - landscape (n = 6)

Table S5: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Glenelg region; model set 4.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~fox_occ g0~1 sigma~1	4	-1306.67	2621.33	2621.98	0.00	0.49
D~fox_occ g0~fox_occ sigma~fox_occ	6	-1304.97	2621.94	2623.34	1.36	0.25
D~s(fox_occ) g0~1 sigma~1	5	-1306.61	2623.21	2624.20	2.22	0.16
D~1 g0~1 sigma~1	3	-1309.93	2625.85	2626.23	4.26	0.06
D~s(fox_occ) g0~s(fox_occ) sigma~s(fox_occ)	9	-1303.41	2624.81	2627.97	5.99	0.02
D~1 g0~fox_occ sigma~fox_occ	5	-1309.41	2628.82	2629.80	7.82	0.01
D~1 g0~s(fox_occ) sigma~s(fox_occ)	7	-1307.91	2629.81	2631.71	9.73	0.00

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

fox_occ - fine-scale occurrence probability of foxes derived from generalised additive models

s(fox_occ) - nonlinear smooth of fox_occ with three knots

Table S6: Feral cat density per square kilometre as estimated by the AICc top-ranked model in the Glenelg region, Australia.

Landscape	Estimate	5% CI	95% CI	Treatment	Replicate
Annya	0.24	0.17	0.34	Non-impact	1
Cobboboonee	0.60	0.40	0.88	Impact	1
Hotspur	0.22	0.14	0.33	Non-impact	2
Mt Clay	0.24	0.18	0.31	Impact	2
LGNP north	0.15	0.07	0.35	Non-impact	3
LGNP south	0.56	0.34	0.90	Impact	3

S1.6.2. Otway region

Table S7: Akaike's Information Criterion values for detector functions in the Otway region, Australia; model set 1.

Detector function	K	logLik	AIC	AICc	dAICc	AICcwt
exponential	3	-5591.00	11188.01	11188.17	0.00	1
half-normal	3	-5743.26	11492.52	11492.69	304.52	0

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

Table S8: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Otway region; model set 2.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~year g0~1 sigma~1	5	-3550.63	7111.26	7111.67	0.00	0.51
D~year g0~s(T, k = 3) sigma~1	7	-3548.91	7111.82	7112.59	0.92	0.32
D~year + vegetation g0~1 sigma~1	7	-3550.04	7114.08	7114.86	3.19	0.10
D~year + vegetation g0~s(T, k = 3) sigma~1	9	-3548.32	7114.64	7115.90	4.23	0.06
D~year g0~model sigma~1	9	-3550.42	7118.84	7120.11	8.44	0.01
D~year g0~s(T, k = 3) + model sigma~1	11	-3548.65	7119.30	7121.18	9.51	0.00
D~year + vegetation g0~model sigma~1	11	-3549.84	7121.69	7123.57	11.90	0.00

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

s(T, k = 3) - nonlinear time trend (g0 only)

model - Reconyx camera-trap model

Table S9: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Otway region; model set 3.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~session g0~fox_occ sigma~fox_occ	10	-3541.77	7103.55	7105.11	0.00	0.99
D~session g0~1 sigma~1	8	-3548.37	7112.73	7113.74	8.63	0.01

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

fox_occ - fine-scale occurrence probability of foxes derived from generalised additive models

session - landscape by year (n = 6)

Table S10: Akaike's Information Criterion values adjusted for small sample size for feral cat density models in the Otway region; model set 4.

Model	K	logLik	AIC	AICc	dAICc	AICcwt
D~year + fox_occ g0~fox_occ sigma~fox_occ	8	-3541.80	7099.59	7100.60	0.00	0.33
D~year + s(fox_occ) g0~s(fox_occ) sigma~s(fox_occ)	11	-3538.59	7099.19	7101.07	0.47	0.26
D~year g0~s(fox_occ) sigma~s(fox_occ)	9	-3541.07	7100.13	7101.40	0.80	0.22
D~year g0~fox_occ sigma~fox_occ	7	-3543.44	7100.87	7101.65	1.05	0.19
D~year + fox_occ g0~1 sigma~1	6	-3548.26	7108.51	7109.09	8.49	0.00
D~year + s(fox_occ) g0~1 sigma~1	7	-3547.47	7108.94	7109.72	9.12	0.00
D~year g0~1 sigma~1	5	-3550.63	7111.26	7111.67	11.07	0.00

K - number of parameters

AICc - Akaike's Information Criterion with small-sample adjustment

dAICc - difference between AICc of this model and the model with smallest AICc

AICcwt - AICc model weight

fox_occ - fine-scale occurrence probability of foxes derived from generalised additive models

s(fox_occ) - nonlinear smooth of fox_occ with three knots

Table S11: Feral cat density per square kilometre as estimated by the AICc top-ranked model in the Otway region, Australia.

Landscape	Estimate	5% CI	95% CI	Treatment	Year
north 2017	1.00	0.74	1.35	Non-impact	2017
south 2017	0.74	0.52	1.05	Impact	2017
north 2018	0.81	0.64	1.02	Non-impact	2018
south 2018	0.82	0.63	1.06	Impact	2018
north 2019	0.73	0.55	0.95	Non-impact	2019
south 2019	0.98	0.76	1.27	Impact	2019