SUPPLEMENTARY MATERIAL

Impacts of widespread badger culling on cattle tuberculosis: concluding analyses from a large-scale field trial

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Trial implementation — triplet-years

Each matched set of three areas ('triplet') was enrolled in the trial for a different time period. Observation began at the end of the initial proactive cull (proactive cull 1). For the analysis of proactive culling we consider all data collected up to one year after the end of the last proactive cull in each triplet. This resulted in the durations of observation presented in Table S1.

Trial area — descriptive statistics

We measured the permeability of trial area boundaries for badgers as the proportion of the boundary that was *not* composed of geographical features considered likely to impede badger movement.[1] For our primary measure, these features comprised coastline, major rivers, dual carriageways, motorways, or conurbations.

For each trial area, we calculated indices of badger activity prior to the random allocation of treatments, including those based on the numbers of active setts, active holes, and latrines recorded. Each of these indices gives a measure of badger density, albeit a very approximate one.[2–4]

Data on these characteristics are presented in Table S2 for proactive and survey-only trial areas.

Overall effect of proactive culling on TB incidence in cattle

The overall effect of proactive culling on TB incidence in cattle is shown in Tables S3 and S4.

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Table S1 Years of observation by triplet stratified by time periods used in the analysis of proactive culling

Triplet	Years of observation				
	From the end of proactive cull 1 until one year after the end of the last proactive cull	From the end of proactive cull 1 until the end of proactive cull 2	From the end of proactive cull 2 until the end of proactive cull 3	From the end of proactive cull 3 until the end of proactive cull 4	From the end of proactive cull 4 until one year after the last proactive cull
A	6.74	2.32	1.47	0.50	2.46
B	7.88	0.99	0.93	2.04	3.92
C	6.90	1.25	1.69	1.05	2.91
D	3.40	0.42	1.32	0.66	1.00
E	6.30	0.67	1.71	0.70	3.22
F	5.92	1.87	1.55	0.77	1.75
G	5.61	1.71	1.00	0.91	1.99
H	5.63	1.55	1.21	0.65	2.22
I	3.80	0.98	1.08	0.73	1.00
J	3.56	0.81	1.29	0.47	1.00
Mean	5.57	1.26	1.33	0.85	2.15

Table S2 Years of observation by triplet stratified by time periods used in the analysis of proactive culling

Triplet	Permeability		Baseline active sett density (per km^2)		Baseline active hole density (per km^2)		Baseline latrine density (per km^2)		Land area surveyed (km^2)	
	Proactive	Survey-only	Proactive	Survey-only	Proactive	Survey-only	Proactive	Survey-only	Proactive	Survey-only
A	0.69	0.93	1.45	2.18	3.53	5.66	4.97	7.75	87.61	96.35
B	1.00	0.60	3.82	1.01	10.36	2.85	8.32	2.89	91.03	74.43
C	1.00	1.00	2.65	3.78	8.57	11.37	8.95	8.77	108.58	115.52
D	0.98	1.00	4.02	2.51	12.02	7.13	10.04	8.19	80.80	88.51
E	0.83	0.74	4.24	4.15	12.28	11.81	8.84	11.21	91.24	84.09
F	0.55	0.79	3.18	3.61	10.47	14.43	13.26	13.13	85.49	95.20
G	0.85	0.97	3.82	3.31	9.16	9.89	8.96	8.69	84.78	86.78
H	0.99	1.00	4.58	7.61	11.15	20.89	5.84	14.11	100.46	92.26
I	0.91	0.80	3.91	1.47	12.83	4.68	4.30	2.60	107.70	91.04
J	1.00	1.00	4.49	2.95	14.71	9.91	9.23	7.18	102.40	82.42
Mean	0.88	0.88	3.62	3.26	10.51	9.86	8.27	8.45	94.01	90.66

Dependence of the effect of proactive culling on the number of repeat culls

The dependence of the effect of proactive culling on the number of repeat culls is shown in Figures S1 and S2.

Dependence of the effect of proactive culling on position within the trial area

Dependence of the effect of proactive culling on position within the trial area is shown in Figures S3–S5.

Investigation of the influence of the foot-and-mouth disease (FMD) epidemic on the effect of proactive culling

The prevalence of *Mycobacterium bovis* infection in badgers rose abruptly part-way through the Randomised Badger Culling Trial (RBCT).[1] This rise was associated with the suspension of cattle TB testing during the 2001 epidemic of FMD, which delayed removal of TB-affected cattle; evidence suggests that this increased opportunities for cattle-to-badger transmission of infection, as well as cattle-to-cattle transmission.[1,5] Whatever its causes, this widespread increase in the background prevalence of *M. bovis* infection in badgers would be expected to lead to greater per-badger risks of transmission to cattle and, hence, to increased benefits of removing badgers by culling during this period.[1]

The effect of proactive culling on the incidence of confirmed breakdowns inside proactive trial areas was similar before (20.9% reduction; 95% CI 44.9% reduction to 13.5% increase; $p = 0.20$) and after (23.9% reduction; 95% CI 34.0% to 12.2% reduction; $p < 0.001$) the FMD epidemic. These analyses used cattle herd locations from the VetNet database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over three years). The cut-off date for before the FMD epidemic was 20 February 2001 and the cut-off date for after the FMD epidemic was

Table S3 Estimated effects of proactive culling on the incidence of *confirmed* cattle TB breakdowns. Analyses adjusted for triplet, baseline herds, and historic TB incidence (over *one year*)

	Proactive effect			Overdispersion	
	Estimate	95% CI	*p*-Value	Factor	*p*-Value
Inside trial areas					
Using VetNet location data					
From initial cull (cull 1)	−20.4%	(−34.2%, −3.7%)	0.019	1.48	0.032
From first follow-up cull (cull 2)	−24.3%	(−37.2%, −8.7%)	0.004	1.29	0.11
Between initial and follow-up	−2.9%	(−33.2%, 41.1%)	0.88	1.33	0.090
Using RBCT location data					
From initial cull (cull 1)	−18.6%	(−33.0%, −1.1%)	0.038	1.49	0.030
From first follow-up cull (cull 2)	−22.0%	(−35.1%, −6.3%)	0.008	1.24	0.15
Between initial and follow-up	−1.0%	(−31.7%, 43.5%)	0.96	1.33	0.090
Up to 2 km outside trial areas					
Using VetNet location data					
From initial cull (cull 1)	35.6%	(10.7%, 66.3%)	0.003	1.03	0.38
From first follow-up cull (cull 2)	28.8%	(−3.8%, 72.6%)	0.090	1.30	0.11
Between initial and follow-up	68.1%	(10.0%, 156.9%)	0.016	0.76	0.77
Using RBCT location data					
From initial cull (cull 1)	33.3%	(−0.2%, 78.0%)	0.051	1.16	0.23
From first follow-up cull (cull 2)	26.8%	(−5.5%, 70.0%)	0.11	1.04	0.38
Between initial and follow-up	81.9%	(−3.9%, 244.5%)	0.066	1.11	0.28

Table S4 Robustness of effects to different measures of the size of the cattle population at risk of infection. Figures show estimated proactive effects based on *confirmed* TB breakdowns *inside trial areas*, adjusted for triplet, historic cattle TB incidence (over *three years*) and one of four measures of the size of population at risk. The analyses indicate that results are very robust to different measures of the size of the population at risk

	Proactive effect			Overdispersion	
	Estimate	95% CI	*p*-Value	Factor	*p*-Value
Using VetNet location data					
From initial cull (cull 1)					
Baseline herds	−23.2%	(−32.7%, −12.4%)	<0.001	0.67	0.87
Baseline cattle	−22.0%	(−33.3%, −8.8%)	0.002	0.66	0.88
Cattle tested	−22.4%	(−32.8%, −10.4%)	0.001	0.66	0.88
Herd tests	−23.1%	(−32.5%, −12.5%)	<0.001	0.66	0.88
From first follow-up cull (cull 2)					
Baseline herds	−26.6%	(−36.8%, −14.8%)	<0.001	0.93	0.53
Baseline cattle	−24.5%	(−36.7%, −9.8%)	0.002	0.94	0.52
Cattle tested	−25.5%	(−36.6%, −12.4%)	<0.001	0.94	0.52
Herd tests	−26.9%	(−36.8%, −15.3%)	<0.001	0.92	0.55
Using RBCT location data					
From initial cull (cull 1)					
Baseline herds	−17.4%	(−27.2%, −6.2%)	0.003	0.79	0.74
Baseline cattle	−18.7%	(−28.4%, −7.6%)	0.001	0.92	0.55
Cattle tested	−18.9%	(−28.8%, −7.5%)	0.002	0.93	0.53
Herd tests	−17.9%	(−27.5%, −7.1%)	0.002	0.72	0.83
From first follow-up cull (cull 2)					
Baseline herds	−21.0%	(−31.6%, −8.8%)	0.001	0.86	0.64
Baseline cattle	−22.6%	(−33.2%, −10.3%)	0.001	1.03	0.39
Cattle tested	−22.8%	(−33.8%, −9.9%)	0.001	1.05	0.36
Herd tests	−22.0%	(−32.2%, −10.3%)	<0.001	0.77	0.76

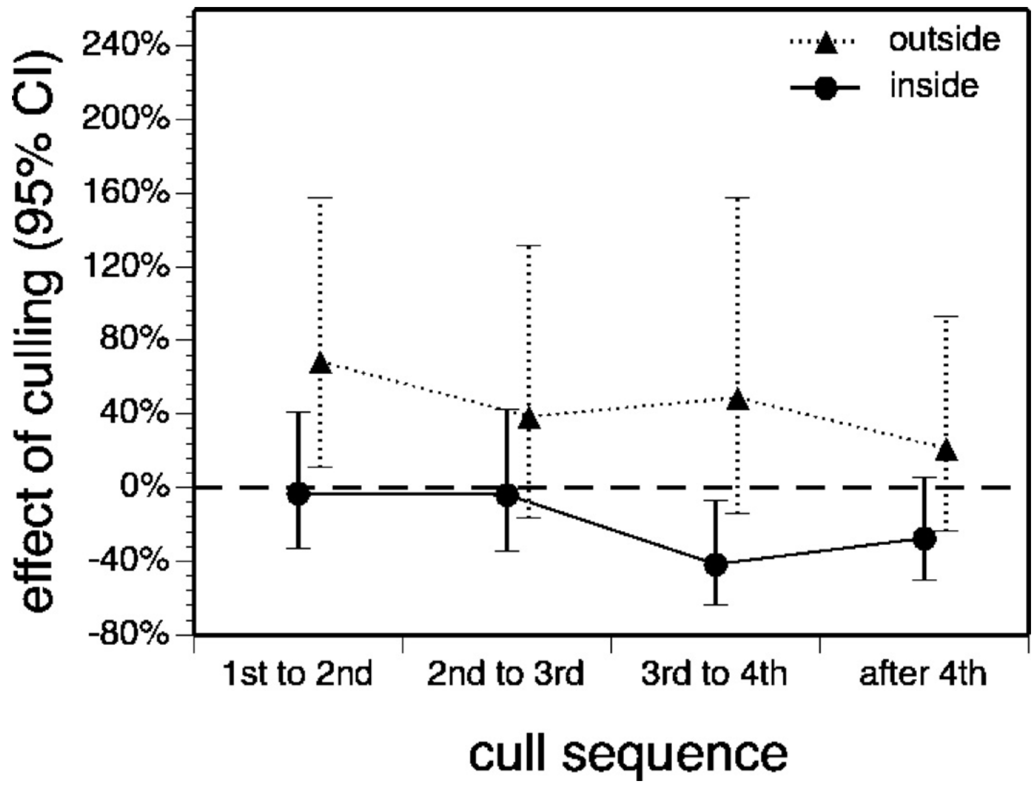

Figure S1 Variation in the effect of proactive culling based on *confirmed* TB breakdowns by the number of repeat culls. This analysis used cattle herd locations from the *VetNet* database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over *one year*). Error bars denote 95% confidence intervals. The linear trends with culling sequences (increasing beneficial effects inside trial areas and diminishing detrimental effects outside trial areas) were not significant ($p = 0.26$ and $p = 0.095$, respectively).

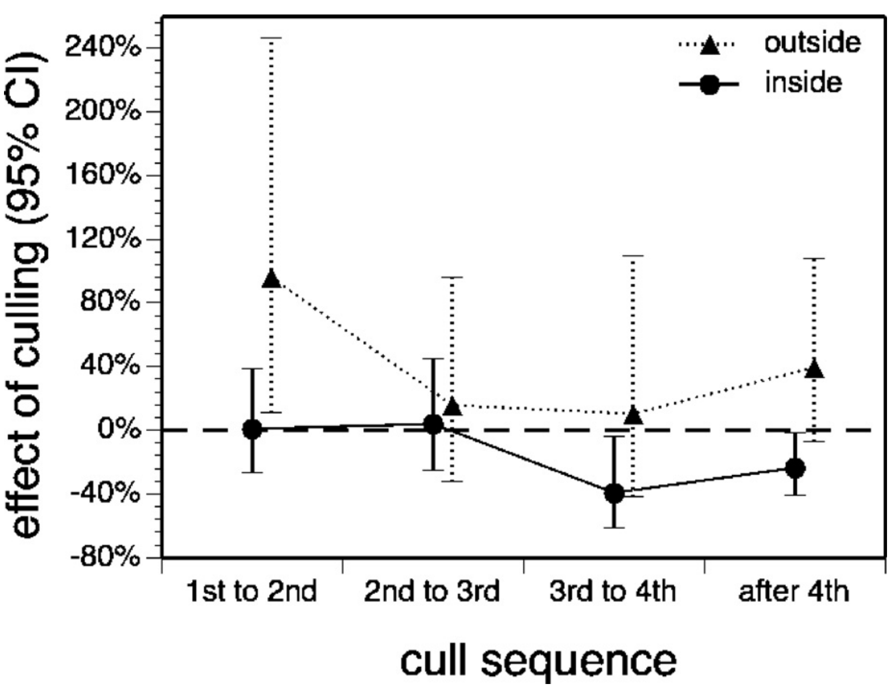

Figure S2 Variation in the effect of proactive culling based on *confirmed* TB breakdowns by the number of repeat culls. This analysis used cattle herd locations from the *RBCT* database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over *three years*). Error bars denote 95% confidence intervals. The linear trends with culling sequences (increasing beneficial effects inside trial areas and diminishing detrimental effects outside trial areas) were not significant using the RBCT herd location database ($p = 0.25$ and $p = 0.59$, respectively).

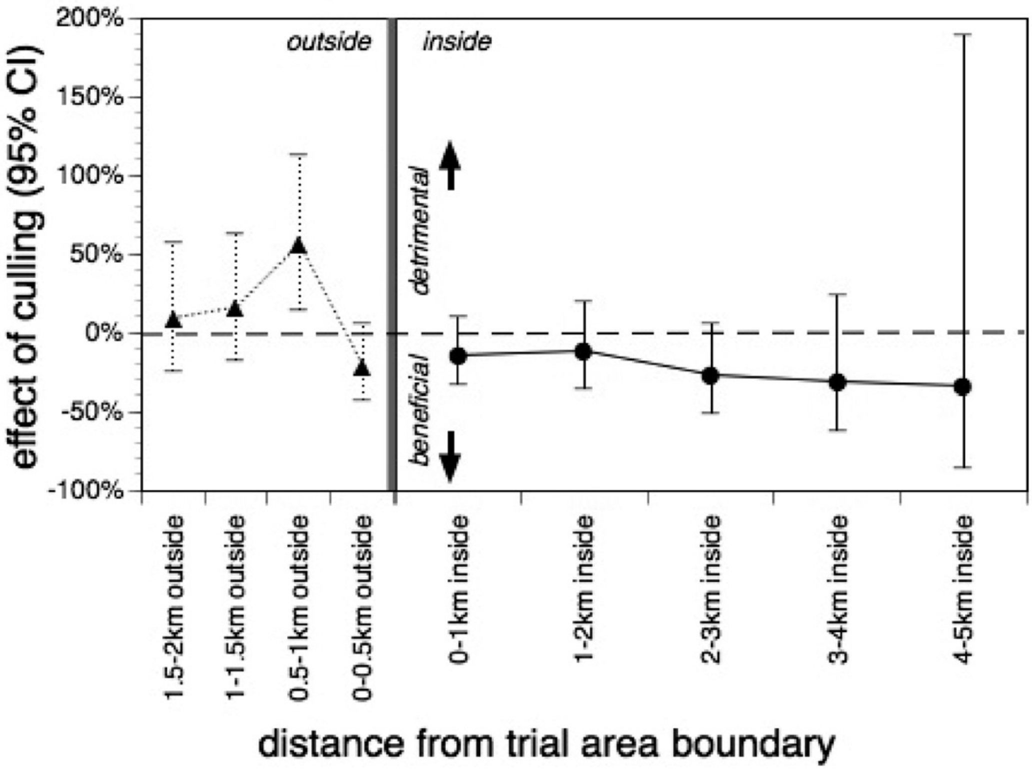

Figure S3 Variation in the effect of proactive culling based on *confirmed* TB breakdowns at different distances from the trial area boundary. This analysis used cattle herd locations from the *VetNet* database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over *one year*). Error bars denote 95% confidence intervals. There is a trend for increasing beneficial effects with increasing distance from the trial area boundary inside trial areas ($p = 0.070$).

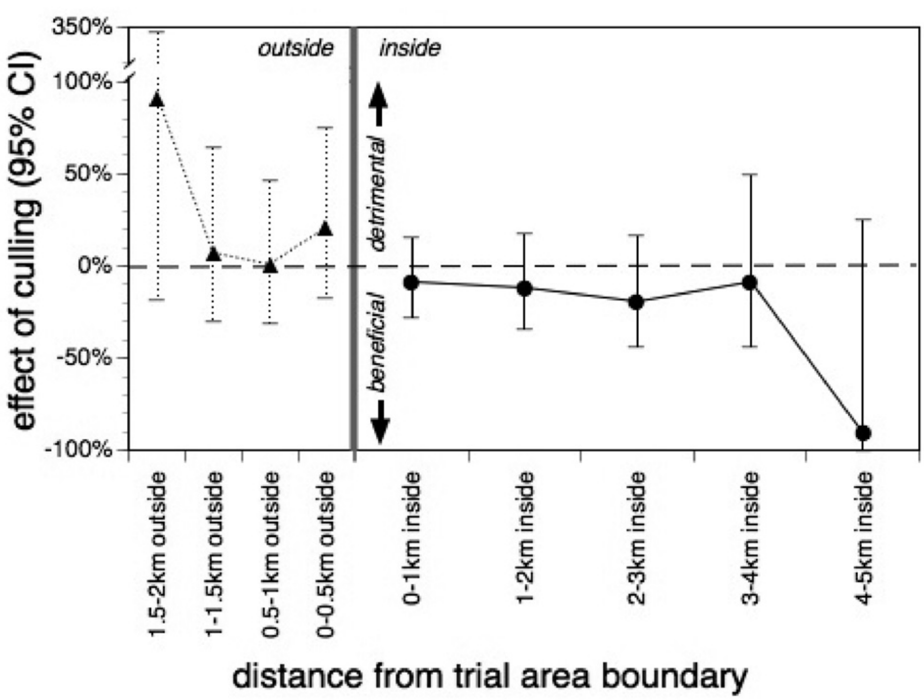

Figure S4 Variation in the effect of proactive culling based on *confirmed* TB breakdowns at different distances from the trial area boundary. This analysis used cattle herd locations from the *RBCT* database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over *three years*). Error bars denote 95% confidence intervals. The linear trend for increasing beneficial effects with increasing distance from the trial area boundary inside was not significant using the RBCT herd location database ($p = 0.60$).

28 November 2001. These findings therefore provide no evidence that our results were compromised by the FMD epidemic.

Effects of proactive culling on total (confirmed and unconfirmed) TB incidence in cattle

Analyses of all (confirmed and unconfirmed) breakdowns revealed attenuated estimates of the impacts of proactive culling, in comparison with analyses considering confirmed breakdowns only (compare Table S5 with Table 1 in the main text). To investigate this, we examined analyses of unconfirmed breakdowns (Table S6) only and found considerable overdispersion inside trial areas, estimated effects that were all consistent with no effect of proactive culling on unconfirmed breakdowns and many estimates that were in the opposite direction to the significant effects found on confirmed breakdowns. For these reasons we conclude that there is no evidence of an impact of proactive culling on unconfirmed breakdowns and focus our attention on the analyses based on confirmed breakdowns only.

Dependence of the effect of proactive culling on boundary permeability and other factors

We sought evidence that various factors (including boundary permeability) modified the effects of badger culling on the incidence of cattle TB both inside trial areas and in the neighboring areas. Results are summarized in Table S7. The descriptions of the factors considered in Table S7 are shown in Table S8.

There was a significant interaction for the proactive effect on confirmed breakdowns in the neighboring areas with the proportion of traps available to badgers (inside the trial area). However, this interaction was far from significant using the RBCT herd location database. Given the large number of tests performed and reported in Table S7, we do not consider this in detail given the likelihood that some of the interactions would appear to be significant due to random chance.

However, the interaction for the proactive effect in the neighboring areas on confirmed breakdowns with the density of latrines is worthy of consideration as these findings are consistent for both herd location databases. The detrimental effect of culling was reduced outside trial areas where high densities of badger latrines had been recorded on the initial culls. This is surprising, since detrimental effects might, if anything, be expected to be most severe in areas of high badger population density (indicated by high latrine densities). The reason for this effect is unknown; however, because no significant interactions were detected with other indices of badger density (densities of setts, main setts, active setts and active holes), the result may be due to chance.

Land access within the proactive trial areas

As stated in the main text, there were three levels of consent for landholders enrolled in the RBCT: consent for surveying and culling ('culling' land), consent for surveying but not culling ('survey' land) and refusal of all access ('refusal' land). Additionally, each trial area contained land for which no landholder could be identified ('unsigned' land).

The complete data on consent for each land parcel and/or cattle herd at the outset of the RBCT are no longer available. As landholders were able to change consent status at any point during the RBCT, the databases (either tabular or GIS) were designed to reflect these changes, with the data field recording consent being overwritten with each change in

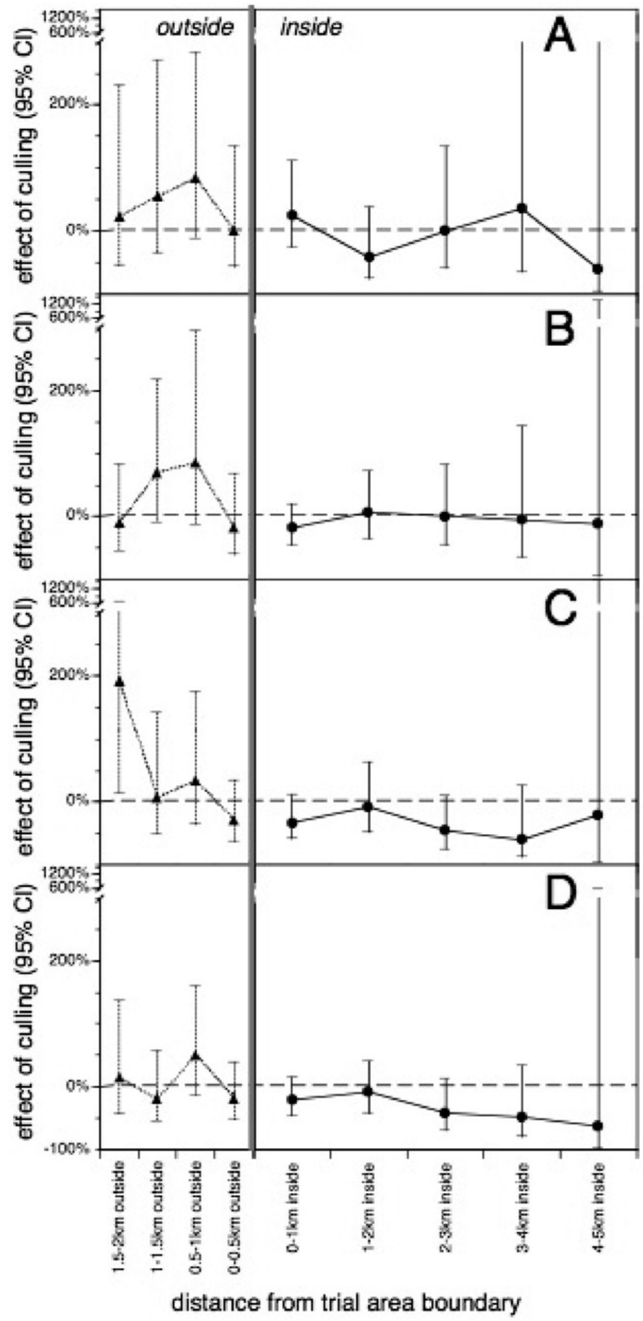

Figure S5 Variation in the effect of proactive culling based on *confirmed* TB breakdowns at different distances from the trial area boundary, on successive culls. This analysis used cattle herd locations from the *VetNet* database and adjusted for triplet, baseline herds, and historic cattle TB incidence (over *three years*). Error bars denote 95% confidence intervals.

Table S5 Estimated effects of proactive culling on the incidence of *all* (*confirmed and unconfirmed*) cattle TB breakdowns. Analyses adjusted for triplet, baseline herds, and historic TB incidence (over *three years*)

	Proactive effect			Overdispersion	
	Estimate	95% CI	*p*-Value	Factor	*p*-Value
Inside trial areas					
Using VetNet location data					
From initial cull (cull 1)	−11.7%	(−22.5%, 0.7%)	0.063	1.26	0.14
From first follow-up cull (cull 2)	−12.9%	(−25.2%, 1.5%)	0.078	1.30	0.10
Between initial and follow-up	−5.2%	(−30.6%, 29.6%)	0.74	1.36	0.073
Using RBCT location data					
From initial cull (cull 1)	−6.3%	(−19.2%, 8.6%)	0.39	1.43	0.045
From first follow-up cull (cull 2)	−6.0%	(−19.8%, 10.2%)	0.45	1.37	0.068
Between initial and follow-up	−5.8%	(−33.2%, 33.0%)	0.74	1.51	0.025
Up to 2 km outside trial areas					
Using VetNet location data					
From initial cull (cull 1)	13.5%	(−5.3%, 36.0%)	0.17	1.24	0.15
From first follow-up cull (cull 2)	11.6%	(−7.3%, 34.5%)	0.25	1.14	0.24
Between initial and follow-up	23.8%	(−11.3%, 72.7%)	0.21	0.83	0.68
Using RBCT location data					
From initial cull (cull 1)	29.3%	(5.2%, 59.1%)	0.015	0.73	0.81
From first follow-up cull (cull 2)	27.3%	(0.6%, 60.9%)	0.044	0.65	0.88
Between initial and follow-up	41.5%	(−9.9%, 122.4%)	0.13	0.81	0.71

consent status. This was accomplished within the database by associating a date with the consent recorded for the landholder. Thus, in any given snapshot of the data there would be four classes of landholders:

1. Landholders that were present at the outset of the RBCT and have *not* changed consent since the initial proactive cull (i.e., the date the landholder was enrolled to the RBCT and the date associated with the consent are both before the initial proactive cull).
2. Landholders that were present at the outset of the RBCT and *did* change consent since the initial proactive cull (i.e., the date the landholder was enrolled to the RBCT was before the initial proactive cull but the date associated with the consent was after the initial proactive cull).

Table S6 Estimated effects of proactive culling on the incidence of *unconfirmed* cattle TB breakdowns. Analyses adjusted for triplet, baseline herds, and historic TB incidence (over *three years*)

	Proactive effect			Overdispersion	
	Estimate	95% CI	*p*-Value	Factor	*p*-Value
Inside trial areas					
Using VetNet location data					
From initial cull (cull 1)	−3.4%	(−28.0%, 29.5%)	0.82	1.49	0.029
From first follow-up cull (cull 2)	5.8%	(−21.6%, 42.8%)	0.71	1.35	0.076
Between initial and follow-up	−31.0%	(−57.5%, 11.9%)	0.13	1.10	0.30
Using RBCT location data					
From initial cull (cull 1)	11.9%	(−17.4%, 51.7%)	0.47	1.59	0.014
From first follow-up cull (cull 2)	25.4%	(−7.0%, 69.2%)	0.14	1.38	0.062
Between initial and follow-up	−28.8%	(−57.2%, 18.3%)	0.19	1.18	0.20
Up to 2 km outside trial areas					
Using VetNet location data					
From initial cull (cull 1)	−11.8%	(−31.8%, 14.1%)	0.34	1.05	0.35
From first follow-up cull (cull 2)	−7.7%	(−31.2%, 23.8%)	0.59	1.13	0.25
Between initial and follow-up	−36.5%	(−69.9%, 34.0%)	0.23	0.76	0.78
Using RBCT location data					
From initial cull (cull 1)	3.0%	(−31.9%, 55.8%)	0.89	1.11	0.28
From first follow-up cull (cull 2)	2.6%	(−33.3%, 57.8%)	0.91	1.02	0.40
Between initial and follow-up	−3.3%	(−59.2%, 128.9%)	0.94	0.92	0.54

Table S7 Factors that could potentially modify the effects of proactive culling. All of the factors (except historical TB incidence and number of baseline herds) are attributes of the trial area that are tested to see if they modify the effect of proactive culling inside the trial area and the effect of proactive culling in the neighboring land (up to 2 km outside trial areas). See Table S8 for detailed descriptions. Figures give *p*-values for tests of interactions between the treatment variable and other covariates, from analyses of *confirmed* breakdowns, for the full period of the RBCT. Analyses adjusted for triplet, baseline herds, and historic TB incidence (over *three years*). The two significant effects are shown in bold type

Covariate	Inside trial areas		Up to 2 km outside trial areas	
	Using VetNet location data	Using RBCT location data	Using VetNet location data	Using RBCT location data
Historical TB incidence (over three years)	0.92	0.64	0.74	0.99
Badgers culled 1986–98	0.93	0.33	0.74	0.58
Badger removal operations 1986–98	0.98	0.20	0.90	0.46
Mycobacterium bovis prevalence in badgers 1986–98	0.12	0.49	0.95	0.69
Triplet duration	0.96	0.76	0.35	0.55
Density of setts	0.52	0.70	0.84	0.66
Density of active setts	0.45	0.61	0.80	0.87
Density of main setts	0.88	0.79	0.49	0.45
Density of active holes	0.54	0.91	0.81	0.89
Density of latrines	0.80	0.80	0.055	**0.034**
Badgers caught	0.46	0.66	0.76	0.29
Mycobacterium bovis prevalence in badgers culled in initial and first follow-up culls	0.55	0.58	0.28	0.11
Permeability of trial area boundary	0.73	0.68	0.69	0.82
Permeability of trial area boundary (excluding small watercourses)	0.86	0.97	0.84	1.00
Number of baseline herds	0.29	0.84	0.41	0.21
Proportion of land occupiers granting access	0.46	0.91	0.77	0.95
Proportion of traps available to badgers	0.80	0.56	**0.042**	0.75
Wildlife Unit	0.29	0.98	0.85	0.96
Reduction in density of badger road kills associated with culling	0.50	0.84	0.68	0.75
Reduction in density of active badger setts associated with culling	0.16	0.91	0.75	0.48
Reduction in density of badger latrines associated with culling	0.62	0.94	0.55	0.12
Reduction in sett persistence associated with culling	0.25	0.46	0.24	0.47

3. Landholders that were enrolled after the start of the RBCT and have *not* changed consent (i.e., the date the landholder was enrolled to the RBCT was after the initial proactive cull and the date associated with the consent was $\leq$14 days after the date of enrolment).
4. Landholders that were enrolled after the start of the RBCT and *did* change consent (i.e., the date the landholder was enrolled to the RBCT was after the initial proactive cull and the date associated with the consent was $>$14 days after the date of enrolment).

As changes to consent are relatively rare (approximately 2% of landholders per year changed consent between March 2003 and March 2005), a reasonable approximation of the initial consent status of most landholders may be constructed using the information from the earliest available snapshot (April 2001). Using this approach, 5955 of the landholders listed in the RBCT database as being inside the trial area boundaries were assigned their original consent status, whereas only 79 landholders appeared to have changed consent (numbers of landholders are totaled for all treatments).

The land area attributed to each landholder was recorded in a GIS database; the earliest information available dated from November 2002. Consent was assigned to land parcels according to the consent recorded for the listed landholder as of April 2001, or if the landholder was not listed in April 2001, the consent as recorded in January 2003 (the next earliest available data). No later consent information was considered. All land parcels within the treatment areas of the triplets not attributed to a landholder as of November 2002 were recorded as 'unsigned'.

As for previous analyses of cattle herd TB incidence, two alternative datasets were used. The first comprised those herds that were attributed to landholders in the database maintained for the study; these are designated 'RBCT herds'. The second dataset included herds for which the point coordinate recorded with their herd record in the State Veterinary Service's VetNet system mapped inside RBCT trial areas; these are designated 'VetNet herds'. These two datasets overlapped considerably; however, each identified herds not contained within the other.

Table S8 Descriptions of the factors considered in Table S7

Covariate	
Historical TB incidence (over three years)	The number of confirmed TB Confirmed herd breakdowns in the three years prior to the initial proactive cull or prior to the 2001 UK foot-and-mouth disease epidemic for triplets first culled in 2002
Badgers culled 1986—98	Number of badgers caught during the interim strategy (April 1, 1986 to December 12, 1998)
Badger removal operations 1986—98	Number of culling operations conducted during the interim strategy (April 1, 1986 to December 12, 1998)
Mycobacterium bovis prevalence in badgers 1986—98	Percentage of *Mycobacterium bovis* positive badgers caught during the interim strategy (April 1, 1986 to December 12, 1998)
Triplet duration	Number of years since the completion of the initial proactive cull within that triplet
Density of setts	Number of setts identified during initial surveys before the random allocation of treatments divided by the estimated size of the surveyed trial area in km^2
Density of active setts	Number of active setts identified during initial surveys before the random allocation of treatments divided by the estimated size of the surveyed trial area in km^2
Density of main setts	Number of main setts identified during initial surveys before the random allocation of treatments divided by the estimated size of the surveyed trial area in km^2
Density of active holes	Number of active holes identified during initial surveys before the random allocation of treatments divided by the estimated size of the surveyed trial area in km^2
Density of latrines	Number of latrines identified during initial surveys before the random allocation of treatments divided by the estimated size of the surveyed trial area in km^2
Badgers caught	Number of badgers caught in initial and first follow-up proactive culls
Mycobacterium bovis prevalence in badgers culled in initial and first follow-up culls	Percentage of *Mycobacterium bovis* positive badgers caught at initial and first follow-up proactive culls
Permeability of trial area boundary	Percentage of the trial area boundary not considered likely to substantially reduce badgers' ability to enter the area; barriers comprised coastline, major rivers, and motorways
Permeability of trial area boundary (excluding small watercourses)	As above but also excluding small watercourses
Number of baseline herds	Baseline herds must have had a whole herd test in the five years before the initial proactive cull or during the RBCT and also have been in existence on VetNet
Proportion of land occupiers granting access	Percentage of all cage traps set to catch, which were available to catch badgers, i.e., that were not damaged or removed, and did not catch non-target species, etc.
Proportion of traps available to badgers	Percentage of occupiers agreeing to cull and survey in August 2004
Wildlife Unit	The two Defra Wildlife Unit bases, which undertook trial fieldwork including culling operations
Reduction in density of badger road kills associated with culling	Proportional difference in road kill density in proactive and survey-only areas in 2005, derived from Ref. 6
Reduction in density of active badger setts associated with culling	Proportional change between pre-cull and third post-cull survey, derived from Ref. 6
Reduction in density of badger latrines associated with culling	Proportional change between pre-cull and third post-cull survey, derived from Ref. 6
Reduction in sett persistence associated with culling	Measured as proportion of active setts persisting from pre-cull to third post-cull survey, derived from Ref. 6

Consent was assigned to RBCT herds on the basis of the April 2001 database snapshot. Landholders that were enrolled to the trial after April 2001 were assigned the consent recorded for them in the first of the quarterly database snapshots (commencing in January 2003) in which they appeared (unless there was evidence of a change to their consent status between the date they were enrolled and the date of the snapshot in which case, the change was noted). The consent status of VetNet herds was determined by the consent of the location within the trial areas where the herd mapped.

Table S9 Areas of accessible and inaccessible land *within treatment boundaries* of each proactive trial area. Further stratification is also given of the inaccessible land by its distance to the nearest accessible land

Proactive treatment area	Initial cull date	Total treatment area (km^2)	Accessible land area (km^2) (% of treatment area)	Inaccessible land area (km^2) (% of treatment area)	Area (km^2) of inaccessible land stratified by distance from accessible land (% of inaccessible land)		
					≤200 m	>200–500 m	>500 m
A	Jan 2000	103.8	82.2 (79%)	21.6 (21%)	17.4 (80%)	4.2 (19%)	0.1 (0%)
B	Dec 1998	101.8	88.2 (87%)	13.7 (13%)	11.2 (82%)	1.5 (11%)	1.0 (8%)
C	Oct 1999	121.2	98.2 (81%)	23.0 (19%)	18.9 (82%)	3.9 (17%)	0.2 (1%)
D	Dec 2002	104.1	75.9 (73%)	28.2 (27%)	22.4 (79%)	4.3 (15%)	1.5 (5%)
E	May 2000	118.8	77.9 (66%)	40.9 (34%)	32.3 (79%)	7.7 (19%)	0.9 (2%)
F	Jul 2000	110.8	55.8 (50%)	54.9 (50%)	36.5 (66%)	16.0 (29%)	2.5 (5%)
G	Nov 2000	114.0	74.0 (65%)	39.9 (35%)	33.2 (83%)	6.0 (15%)	0.8 (2%)
H	Dec 2000	116.0	77.5 (67%)	38.6 (33%)	22.8 (59%)	10.5 (27%)	5.2 (14%)
I	Sep 2002	131.4	84.0 (64%)	47.5 (36%)	29.5 (62%)	12.2 (26%)	5.7 (12%)
J	Oct 2002	110.5	83.0 (75%)	27.4 (25%)	20.4 (74%)	6.8 (25%)	0.3 (1%)
Total		1132.5	796.8 (70%)	335.7 (30%)	244.4 (73%)	73.1 (22%)	18.2 (5%)

Table S10 Areas of accessible and inaccessible land *within trial area boundaries* of each proactive trial area. Further stratification is also given of the inaccessible land by its distance to the nearest accessible land

Proactive treatment area	Initial cull date	Total trial area (km^2)	Accessible land area (km^2) (% of trial area)	Inaccessible land area (km^2) (% of trial area)	Area (km^2) of inaccessible land stratified by distance from accessible land (% of inaccessible land)		
					≤200 m	>200–500 m	>500 m
A	Jan 2000	95.7	76.1 (80%)	19.6 (20%)	15.5 (79%)	4.0 (21%)	0.1 (0%)
B	Dec 1998	99.8	86.6 (87%)	13.3 (13%)	21.7 (89%)	2.6 (11%)	0.0 (0%)
C	Oct 1999	105.1	85.9 (82%)	19.2 (18%)	18.6 (81%)	4.0 (18%)	0.3 (2%)
D	Dec 2002	98.8	72.2 (73%)	26.6 (27%)	10.7 (81%)	1.5 (11%)	1.0 (8%)
E	May 2000	105.2	66.5 (63%)	38.8 (37%)	19.8 (84%)	3.7 (16%)	0.2 (1%)
F	Jul 2000	95.7	48.8 (51%)	46.8 (49%)	21.8 (69%)	7.7 (25%)	1.8 (6%)
G	Nov 2000	101.9	66.8 (66%)	35.1 (34%)	15.6 (81%)	3.4 (18%)	0.2 (1%)
H	Dec 2000	95.3	60.8 (64%)	34.5 (36%)	20.6 (79%)	4.9 (19%)	0.6 (2%)
I	Sep 2002	99.8	62.7 (63%)	37.1 (37%)	18.5 (87%)	2.7 (13%)	0.1 (1%)
J	Oct 2002	100.7	75.6 (75%)	25.1 (25%)	21.3 (80%)	3.8 (14%)	1.5 (6%)
Total		998.1	702.0 (70%)	296.0 (30%)	184.2 (81%)	38.3 (17%)	5.9 (3%)

The herds within these strata could be resolved, based on their consent and whether there was evidence of a change of consent, into five categories:

1. *Cull* — where the herd was associated with 'cull' land and there was *no* evidence of change in consent following the initial proactive cull.
2. *Change to cull* — where the herd was associated with 'cull' land but there was evidence of change in consent following the initial proactive cull.
3. *Survey or refusal* — where the herd was associated with 'survey' or 'refusal' land and there was *no* evidence of change in consent following the initial proactive cull.
4. *Change to survey or refusal* — where the herd was associated with 'survey' or 'refusal' land but there was evidence of change in consent following the initial proactive cull.
5. *Unsigned* — where the herd was associated with 'unsigned' land (by definition, only VetNet herds could be classified as unsigned).

We consolidated these five strata conservatively by assuming that any herds recorded as having switched to survey or refusal following their initial cull had allowed culling at the time of the initial cull. Similarly, we assumed that any herds recorded as having switched to cull following their initial cull were either survey or refusal at the time of the initial cull. This allows stratification of land (and thus associated herds) into three categories:

1. *Accessible* — a combination of the 'cull' and 'change to survey or refusal' categories.
2. *Inaccessible: survey or refusal combined* — a combination of the 'survey or refusal' and 'change to cull' categories.
3. *Inaccessible: unsigned* — as before.

Table S11 Numbers of herds with changes to consent stratified by experience of breakdowns. Percentage of herds in the row shown in parentheses

Time period	Herd type	No change		Change to consent			
				Negative		Positive	
Mar 03—Jan 07	No breakdown	2927	(0.94)	149	(0.05)	39	(0.01)
	Breakdown	1102	(0.94)	54	(0.05)	14	(0.01)
Breakdown in the same time period as consent change							
Mar 03—Mar 04	No breakdown	3754	(0.97)	76	(0.02)	32	(0.01)
	Breakdown	425	(0.98)	5	(0.01)	4	(0.01)
Mar 04—Mar 05	No breakdown	3769	(0.98)	61	(0.02)	15	(0.00)
	Breakdown	469	(0.98)	8	(0.02)	2	(0.00)
Mar 05—Mar 06	No breakdown	3842	(0.98)	49	(0.01)	10	(0.00)
	Breakdown	436	(0.98)	6	(0.01)	1	(0.00)
Mar 06—Jan 07	No breakdown	4059	(1.00)	7	(0.00)	3	(0.00)
	Breakdown	280	(1.00)	0	(0.00)	0	(0.00)
Breakdown in time period before consent change							
Mar 04—Mar 05	No breakdown	3814	(0.98)	58	(0.01)	17	(0.00)
	Breakdown	424	(0.97)	11	(0.03)	0	(0.00)
Mar 05—Mar 06	No breakdown	3807	(0.99)	48	(0.01)	9	(0.00)
	Breakdown	471	(0.98)	7	(0.01)	2	(0.00)
Mar 06—Jan 07	No breakdown	3897	(1.00)	6	(0.00)	3	(0.00)
	Breakdown	442	(1.00)	1	(0.00)	0	(0.00)

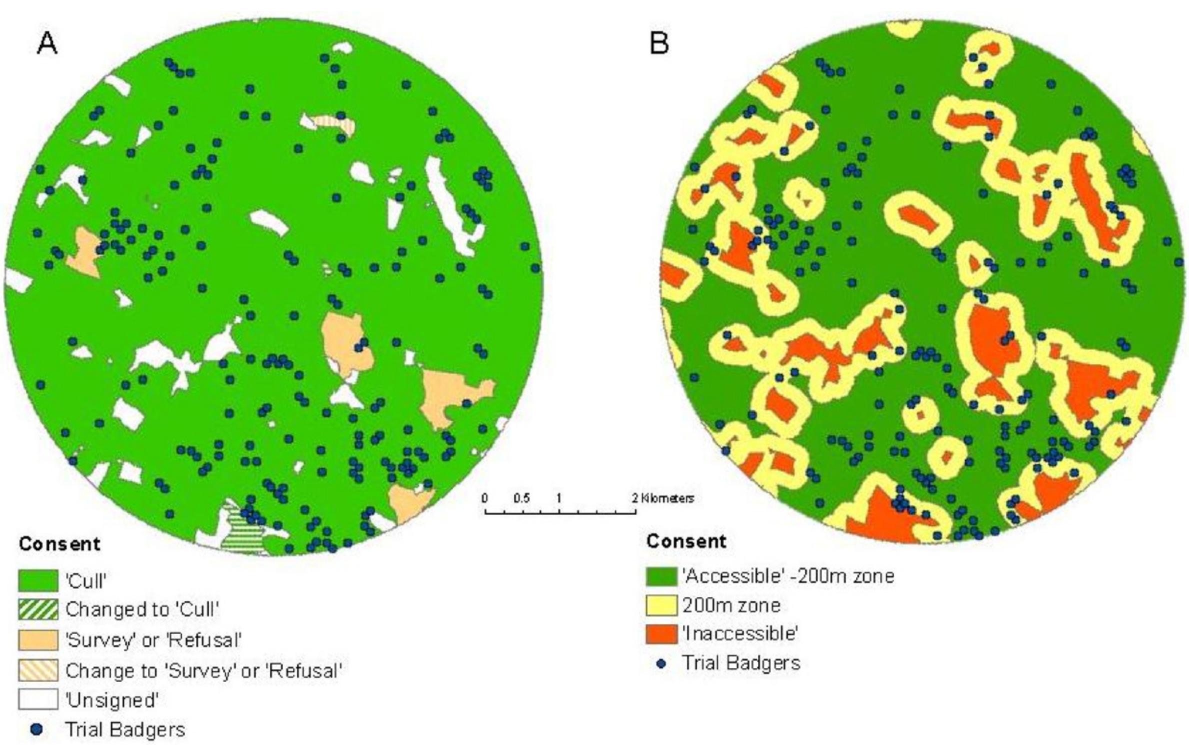

Figure S6 Example regions of a proactive RBCT area showing (A) five consent strata and (B) consolidated inaccessible land, 200 m zones, and remaining accessible land. (Some badger capture locations mapped to inaccessible land due to mapping inaccuracies or because consent to cull was later given for initially inaccessible land.)

Table S12 Estimated treatment effects based on *confirmed* TB breakdowns, as compared with survey-only trial areas, stratified by consent status and adjusted for triplet, baseline herds, and historic TB incidence (over *three years*) using cattle herd locations from the *VetNet* database

Consent status	Baseline herds (proactive/survey-only)	Proactive effect			Overdispersion	
		Estimate	95% CI	*p*-Value	Factor	*p*-Value
Accessible	812/817	−14.6%	(−28.3%, 1.8%)	0.078		
Inaccessible – 'survey' or 'refusal'	185/237	−12.6%	(−41.9%, 31.4%)	0.52	1.24	0.011
Inaccessible – 'unsigned'	224/222	−42.9%	(−61.5%, −15.2%)	0.005		

Table S13 Numbers of badgers trapped and setts identified on land inside *treatment area boundaries*[a] by consent

Triplet	Treatment area[a] (km^2)	Consent status	Area (km^2)	Setts identified in initial survey		Badgers taken in:		Badgers per km^2		Badgers per main sett	
				Main setts	Active setts	Initial cull	All culls	Initial cull	All culls	Initial cull	All culls
A	93.36	Accessible[b]	36.26	20	45	13	90	0.36	2.48	0.65	4.50
		200 m zone[c]	38.54	12	58	29	163	0.75	4.23	2.42	13.58
		Inaccessible	18.55	6	16	6[d]	48[d]	0.32[d]	2.59[d]	1.00[d]	8.00[d]
B	91.34	Accessible[b]	51.64	26	216	157	455	3.04	8.81	6.04	17.50
		200 m zone[c]	28.32	9	74	47	168	1.66	5.93	5.22	18.67
		Inaccessible	11.38	5	35	9[d]	63[d]	0.79[d]	5.54[d]	1.80[d]	12.60[d]
C	111.66	Accessible[b]	52.76	24	123	122	431	2.31	8.17	5.08	17.96
		200 m zone[c]	38.01	25	96	72	290	1.89	7.63	2.88	11.60
		Inaccessible	20.89	7	49	23[d]	89[d]	1.10[d]	4.26[d]	3.29[d]	12.71[d]
D	93.74	Accessible[b]	30.96	30	103	129	339	4.17	10.95	4.30	11.30
		200 m zone[c]	38.54	38	138	130	446	3.37	11.57	3.42	11.74
		Inaccessible	24.24	14	59	27[d]	166[d]	1.11[d]	6.85[d]	1.93[d]	11.86[d]
E	105.98	Accessible[b]	29.00	16	107	148	357	5.10	12.31	9.25	22.31
		200 m zone[c]	42.13	27	148	294	640	6.98	15.19	10.89	23.70
		Inaccessible	34.86	16	99	67[d]	237[d]	1.92[d]	6.80[d]	4.19[d]	14.81[d]
F	97.86	Accessible[b]	14.79	4	33	91	192	6.15	12.98	22.75	48.00
		200 m zone[c]	35.79	9	114	248	573	6.93	16.01	27.56	63.67
		Inaccessible	47.27	13	88	41[d]	206[d]	0.87[d]	4.36[d]	3.15[d]	15.85[d]
G	103.78	Accessible[b]	21.75	19	84	109	176	5.01	8.09	5.74	9.26
		200 m zone[c]	47.08	29	147	240	546	5.10	11.60	8.28	18.83
		Inaccessible	34.94	27	81	66[d]	203[d]	1.89[d]	5.81[d]	2.44[d]	7.52[d]
H	104.31	Accessible[b]	40.76	15	174	55	183	1.35	4.49	3.67	12.20
		200 m zone[c]	28.99	12	142	77	250	2.66	8.62	6.42	20.83
		Inaccessible	34.55	16	106	15[d]	82[d]	0.43[d]	2.37[d]	0.94[d]	5.13[d]
I	121.10	Accessible[b]	33.29	31	115	65	192	1.95	5.77	2.10	6.19
		200 m zone[c]	44.13	38	174	104	249	2.36	5.64	2.74	6.55
		Inaccessible	43.68	26	113	31[d]	172[d]	0.71[d]	3.94[d]	1.19[d]	6.62[d]
J	99.64	Accessible[b]	43.31	30	198	193	335	4.46	7.74	6.43	11.17
		200 m zone[c]	32.46	21	145	150	284	4.62	8.75	7.14	13.52
		Inaccessible	23.87	17	95	80[d]	171[d]	3.35[d]	7.16[d]	4.71[d]	10.06[d]
Total	1022.75	Accessible[b]	354.53	215	1198	1082	2750	3.05	7.76	5.03	12.79
		200 m zone[c]	373.99[e]	220	1236	1391	3609	3.72	9.65	6.32	16.40
		Inaccessible	294.23[e]	147	741	365[d]	1437[d]	1.24[d]	4.88[d]	2.48[d]	9.78[d]

[a] Land and badgers within 200 m of the treatment area boundary have been excluded.
[b] Accessible land more than 200 m from inaccessible land.
[c] 200 m zone is accessible land within 200 m of inaccessible land.
[d] Some badger capture locations mapped to inaccessible land due to mapping inaccuracies or because consent to cull was later given for initially inaccessible land.
[e] The expectation of 44% fewer badgers captured per km^2 of 200 m zones plus inaccessible land given in the main text was based on the proportion of the land area in 200 m zones plus inaccessible land that was inaccessible, i.e., 294.23/(294.23 + 373.99) = 44.0%.

Table S14 Numbers of badgers trapped and setts identified on land inside *trial area boundaries*[a] by consent

Triplet	Trial area (km^2)	Consent status	Area (km^2)	Setts identified in initial survey		Badgers taken in:		Badgers per km^2		Badgers per main sett	
				Main setts	Active setts	Initial cull	All culls	Initial cull	All culls	Initial cull	All culls
A	89.04	Accessible[b]	34.57	20	45	13	90	0.38	2.60	0.65	4.50
		200 m zone[c]	36.86	11	51	26	159	0.71	4.31	2.36	14.45
		Inaccessible	17.61	5	14	3[d]	40[d]	0.17[d]	2.27[d]	0.60[d]	8.00[d]
B	90.29	Accessible[b]	50.95	25	210	137	427	2.69	8.38	5.48	17.08
		200 m zone[c]	28.01	9	74	47	168	1.68	6.00	5.22	18.67
		Inaccessible	11.33	5	35	9[d]	63[d]	0.79[d]	5.56[d]	1.80[d]	12.60[d]
C	101.73	Accessible[b]	48.30	19	106	113	378	2.34	7.83	5.95	19.89
		200 m zone[c]	34.53	23	85	58	250	1.68	7.24	2.52	10.87
		Inaccessible	18.89	6	42	18[d]	69[d]	0.95[d]	3.65[d]	3.00[d]	11.50[d]
D	90.95	Accessible[b]	29.68	29	100	122	320	4.11	10.78	4.21	11.03
		200 m zone[c]	37.89	35	134	121	402	3.19	10.61	3.46	11.49
		Inaccessible	23.37	13	56	27[d]	163[d]	1.16[d]	6.97[d]	2.08[d]	12.54[d]
E	94.07	Accessible[b]	25.33	13	91	111	273	4.38	10.78	8.54	21.00
		200 m zone[c]	37.61	22	121	243	535	6.46	14.23	11.05	24.32
		Inaccessible	31.13	13	88	67[d]	204[d]	2.15[d]	6.55[d]	5.15[d]	15.69[d]
F	90.66	Accessible[b]	14.12	4	31	82	175	5.81	12.39	20.50	43.75
		200 m zone[c]	32.69	9	109	243	524	7.43	16.03	27.00	58.22
		Inaccessible	43.85	11	77	39[d]	182[d]	0.89[d]	4.15[d]	3.55[d]	16.55[d]
G	96.06	Accessible[b]	20.28	17	78	108	168	5.33	8.28	6.35	9.88
		200 m zone[c]	44.00	25	134	230	511	5.23	11.61	9.20	20.44
		Inaccessible	31.79	22	68	59[d]	171[d]	1.86[d]	5.38[d]	2.68[d]	7.77[d]
H	91.51	Accessible[b]	34.92	12	153	41	132	1.17	3.78	3.42	11.00
		200 m zone[c]	24.06	11	107	65	193	2.70	8.02	5.91	17.55
		Inaccessible	32.53	14	96	15[d]	72[d]	0.46[d]	2.21[d]	1.07[d]	5.14[d]
I	98.41	Accessible[b]	26.59	27	102	64	182	2.41	6.85	2.37	6.74
		200 m zone[c]	35.91	33	156	91	221	2.53	6.15	2.76	6.70
		Inaccessible	35.92	20	96	29[d]	133[d]	0.81[d]	3.70[d]	1.45[d]	6.65[d]
J	94.35	Accessible[b]	41.12	29	188	185	324	4.50	7.88	6.38	11.17
		200 m zone[c]	30.51	19	128	142	267	4.65	8.75	7.47	14.05
		Inaccessible	22.71	15	89	80[d]	169[d]	3.52[d]	7.44[d]	5.33[d]	11.27[d]
Total	937.08	Accessible[b]	325.87	195	1104	976	2469	3.00	7.58	5.01	12.66
		200 m zone[c]	342.07	197	1099	1266	3230	3.70	9.44	6.43	16.40
		Inaccessible	269.14	124	661	346[d]	1266[d]	1.29[d]	4.70[d]	2.79[d]	10.21[d]

[a] Land and badgers within 200 m of the treatment area boundary have been excluded.
[b] Accessible land more than 200 m from inaccessible land.
[c] 200 m zone is accessible land within 200 m of inaccessible land.
[d] Some badger capture locations mapped to inaccessible land due to mapping inaccuracies or because consent to cull was later given for initially inaccessible land.

Two strata of consent were used in the analyses presented in the main body of the text:

1. *Accessible* — herds with 'cull' consent since the start of the RBCT or those that had changed to either 'survey' consent or 'refusal' consent.
2. *Inaccessible* — herds with 'survey', 'refusal', or 'unsigned' consent status at the outset of the RBCT or that had changed to 'cull' consent.

These alternative stratifications were used in assessing proactive treatment effects.

The area within the treatment area boundaries accessible for culling is presented in Table S9. The proportion of inaccessible land within proactive treatment areas varied from 15% to 50% (30% overall; Table S9) with 73% of inaccessible land falling within 200 m of accessible land.

Similar data for land with trial area boundaries are presented in Table S10. As observed for the land within the treatment areas, most (95%) of the land inaccessible for culling was located within 500 m of land where culling could take place.

Relationship between breakdowns and changes to consent

A total of 1170 occupiers in all treatments listed as being cattle owners in the RBCT database experienced breakdowns

Table S15 Difference in removal rates between inaccessible land plus 200 m zones (or just the 200 m zones) relative to the remaining accessible land (95% confidence interval) using badgers from all culls. Analyses were also stratified by initial and follow-up culls for the comparison of inaccessible land + 200 m zones with remaining accessible land

Model	Within treatment area boundaries		Within trial area boundaries	
	Difference (95% CI)	Removal rate/cull type interaction p-value	Difference (95% CI)	Removal rate/cull type interaction p-value
Comparing inaccessible land + 200 m zones with remaining accessible land; log land area (km^2) covariate				
All culls	−12% (−29%, 9%)	0.014	−12% (−9%, 9%)	0.026
Stratified models				
Initial culls	−28% (−43%, −8%)	–	−27% (−43%, −7%)	–
Follow-up culls	−3% (−20%, 17%)	–	−4% (−21%, 16%)	–
Comparing 200 m zones with remaining accessible land; log land area (km^2) covariate				
All culls	11% (−6%, 32%)	0.29	11% (−7%, 33%)	0.34
Stratified models				
Initial culls	2% (−18%, 26%)		2% (−19%, 28%)	
Follow-up culls	18% (−1%, 39%)		17% (−2%, 40%)	
Comparing 200 m zones with remaining accessible land; log main setts covariate				
All culls	20% (−7%, 54%)	0.55	20% (−9%, 59%)	0.66
Stratified models				
Initial culls	12% (−17%, 50%)		14% (−18%, 58%)	
Follow-up culls	25% (−1%, 58%)		25% (−4%, 62%)	
Comparing 200 m zones with remaining accessible land; log active setts covariate				
All culls	14% (−4%, 36%)	0.47	17% (−5%, 45%)	0.53
Stratified models				
Initial culls	6% (−15%, 33%)		10% (−15%, 43%)	
Follow-up culls	19% (0%, 42%)		22% (−1%, 50%)	

(confirmed or unconfirmed) between March 1, 2003 and January 1, 2007. Of these, 68 (5.8%) changed consent during this time period: 14 (1.2%) increased consent (i.e., changed no access to either survey access or cull access or changed from survey access to cull access), and 54 (4.6%) decreased consent (i.e., changed from cull access to either survey access or no access or changed from survey access to no access). The proportions of herds changing consent (in either direction) did not differ between herds experiencing a breakdown and those not experiencing a breakdown (Table S11: Fisher's exact test, $p = 0.98$). Changes to consent were not correlated with whether the herd has breakdown in the same annual period (2003–2004: $p = 0.50$; 2004–2005: $p = 0.87$; 2005–2006: $p = 0.93$; 2006–2007: $p = 1.00$) or the previous annual period (2004–2005: $p = 0.11$; 2005–2006: $p = 0.49$; 2006–2007: $p = 0.66$).

Dependence of the effect of proactive culling on land access

In the main text of the paper we assessed the impact of consent on the proactive treatment effects using the two-strata 'accessible' and 'inaccessible'. Here, we assess the impact of consent when it was stratified into three categories for the VetNet analysis. To test whether consent to cull influenced the proactive treatment effect, all herds within the survey-only trial areas were regarded as the controls against which herds in each consent stratum of the proactive areas were compared. This approach maximized the precision in estimating the incidence rates in the control population, and analyses comparing herds in proactive and survey-only areas within each consent stratum gave similar conclusions.

The proactive treatment effect did not differ significantly by consent level when it was alternatively stratified by three levels (accessible, inaccessible – survey or refusal, and inaccessible – unsigned; accessible vs. inaccessible – 'unsigned' $p = 0.062$ and accessible vs. inaccessible – 'survey' or 'refusal' $p = 0.92$). Parameter estimates for these models are presented in Table S12. Similar results were obtained adjusting for one-year historic breakdowns.

Dependence of badger removal rates in proactive areas on land access

Badger removal rates per km^2 or per main sett from: (1) inaccessible land, (2) zones of accessible land within 200 m of inaccessible land, and (3) the remaining accessible land, are presented for each proactive area (see Figure S6 for an example map), based on treatment area boundaries in Table S13, and on trial area boundaries in Table S14. Badger capture locations could have been attributed to inaccessible land either due to measurement error in the recording of locations, or to changes in consent status that allowed culling on these lands. Badger sett locations could be attributed to inaccessible land either because consent was given for survey though not for culling, or due to measurement error in the recording of

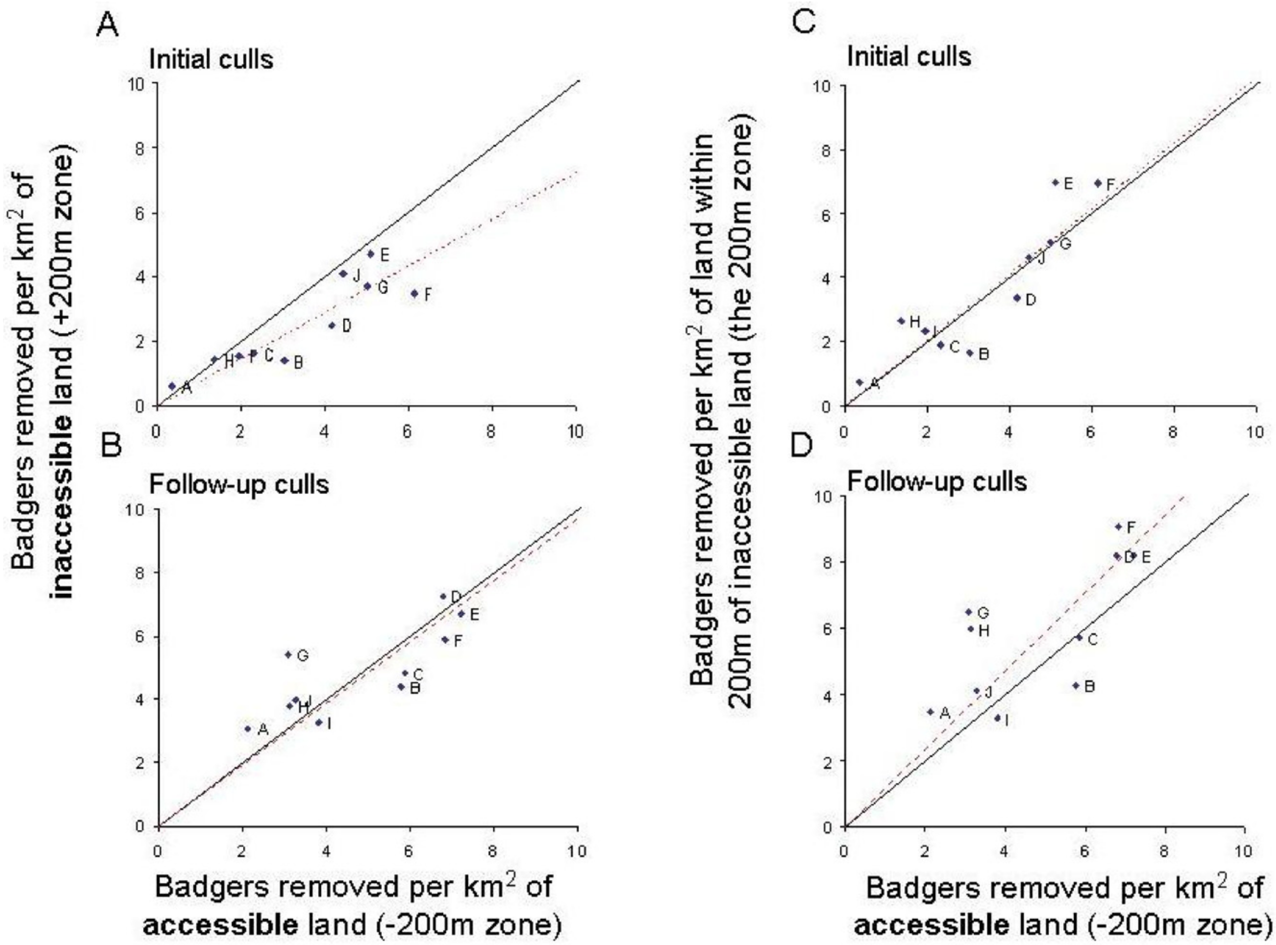

Figure S7 Badgers culled per km^2 in proactive treatment areas (A—J) from inaccessible land plus the 200 m zones compared to the remaining accessible land during initial (A) and all follow-up culls (B), and from the 200 m zones compared to the remaining accessible land during initial (C) and all follow-up culls (D). The solid black lines indicate equal badger removal rates on the different types of land; the dotted red lines indicate the overall differences, estimated from log-linear models.

locations. All land, badgers, and setts less than 200 m from the treatment area boundary were excluded to reduce effects of capturing badgers emigrating from land outside the treatment areas.

Log-linear models of the numbers of badger culled were used to compare badger removal rates. These models adjusted for triplet and either the log of the land area (km^2) or the log of the numbers of setts (main or active). All of the significance tests were adjusted for overdispersion. The chi-square statistic for the parameter estimate (calculated as (estimate/std error)^2) was corrected using the overdispersion factor and the resulting adjusted chi-square statistic was compared with the chi-square distribution with 1 degree of freedom.

To test for differences between initial and subsequent culls, data were stratified and an interaction term was tested. Results are given for the overall model unless the interaction term (between consent status and initial cull) was significant (or near significant) at the 0.05-level after adjustment for overdispersion.

There was a lower removal rate of badgers taken in initial culls on inaccessible land (+200 m zones) compared with remaining accessible land, but a non-significantly lower rate in all subsequent follow-up culls (Table S15). When only land or setts within the 200 m zone around the inaccessible land was considered, there were non-significantly higher removal rates in the 200 m zones compared with the adjoining accessible land (Table S15 and Figure S7).

Repeated field surveys conducted in proactive areas provide further evidence that culling influenced badgers resident on inaccessible land. Active badger setts identified on pre-cull surveys were much less likely to remain active on subsequent surveys if they were located in proactive, rather than survey-only areas. However, within proactive areas, setts on inaccessible land were no more likely to remain active than were those on land accessible for culling.[6] This suggests that culling reduced badger activity on inaccessible as well as accessible land.

All badger-trapping operations were carried out over at least eight nights. In some operations these were consecutive, but in many follow-up culls the eight trapping nights were spread over up to 12 nights. It was possible that badgers resident at the setts being targeted by trapping were taken in the early stages of the trapping period and badgers taken later in the trapping period were not necessarily from the land/setts being targeted. We assessed whether removal

Table S16 Numbers of badgers taken in initial culls and all culls by time in the trapping period when culled within *treatment area boundaries*[a]

Triplet	Consent status	Badgers taken during initial culls						Badgers taken during all culls					
		Day = 1	Day > 1	Day = 1–2	Day > 2	Day = 1–4	Day > 4	Day = 1	Day > 1	Day = 1–2	Day > 2	Day = 1–4	Day > 4
A	Accessible[b]	6	7	7	6	9	4	30	60	42	48	65	25
	200 m zone[c]	14	15	18	11	23	6	72	91	102	61	134	29
	Inaccessible	5	1	5	1	6	0	23	25	26	22	36	12
B	Accessible[b]	69	88	90	67	116	41	160	295	224	231	309	146
	200 m zone[c]	20	27	26	21	31	16	52	116	75	93	103	65
	Inaccessible	4	5	4	5	7	2	22	41	29	34	42	21
C	Accessible[b]	82	40	92	30	108	14	182	249	261	170	332	99
	200 m zone[c]	40	32	50	22	58	14	113	177	163	127	215	75
	Inaccessible	11	12	15	8	16	7	43	46	51	38	65	24
D	Accessible[b]	58	71	82	47	98	31	144	195	207	132	261	78
	200 m zone[c]	65	65	88	42	106	24	184	262	277	169	353	93
	Inaccessible	7	20	17	10	21	6	67	99	103	63	127	39
E	Accessible[b]	47	101	80	68	104	44	124	233	194	163	258	99
	200 m zone[c]	120	174	169	125	219	75	241	399	340	300	454	186
	Inaccessible	22	45	37	30	50	17	80	157	125	112	174	63
F	Accessible[b]	36	55	46	45	61	30	63	129	98	94	128	64
	200 m zone[c]	85	163	132	116	185	63	190	383	285	288	408	165
	Inaccessible	10	31	16	25	23	18	60	146	95	111	131	75
G	Accessible[b]	58	51	58	51	84	25	80	96	98	78	140	36
	200 m zone[c]	149	91	149	91	189	51	271	275	347	199	443	103
	Inaccessible	37	29	37	29	46	20	85	118	115	88	156	47
H	Accessible[b]	36	19	41	14	46	9	87	96	125	58	156	27
	200 m zone[c]	39	38	49	28	64	13	95	155	152	98	194	56
	Inaccessible	9	6	11	4	13	2	25	57	52	30	65	17
I	Accessible[b]	32	33	42	23	50	15	88	104	121	71	153	39
	200 m zone[c]	56	48	73	31	84	20	122	127	164	85	203	46
	Inaccessible	17	14	23	8	25	6	82	90	122	50	148	24
J	Accessible[b]	93	100	126	67	147	46	143	192	199	136	250	85
	200 m zone[c]	56	94	86	64	112	38	97	187	158	126	211	73
	Inaccessible	30	50	47	33	67	13	67	104	102	69	136	35

[a] Land and badgers within 200 m of the treatment area boundary have been excluded.
[b] Accessible land more than 200 m from inaccessible land.
[c] 200 m zone is accessible land within 200 m of inaccessible land.

Table S17 Numbers of badgers taken in initial culls and all culls by time in the trapping period when taken within *trial area boundaries*[a]

Triplet	Consent	Badgers taken during initial culls						Badgers taken during all culls					
		Day = 1	Day > 1	Day = 1–2	Day > 2	Day = 1–4	Day > 4	Day = 1	Day > 1	Day = 1–2	Day > 2	Day = 1–4	Day > 4
A	Accessible[b]	6	7	7	6	9	4	30	60	42	48	65	25
	200 m zone[c]	13	13	16	10	20	6	70	89	99	60	130	29
	Inaccessible	2	1	2	1	3	0	16	24	19	21	29	11
B	Accessible[b]	62	75	79	58	99	38	152	275	211	216	289	138
	200 m zone[c]	20	27	26	21	31	16	52	116	75	93	103	65
	Inaccessible	4	5	4	5	7	2	22	41	29	34	42	21
C	Accessible[b]	76	37	85	28	100	13	162	216	230	148	296	82
	200 m zone[c]	32	26	41	17	49	9	97	153	137	113	183	67
	Inaccessible	9	9	12	6	13	5	34	35	40	29	52	17
D	Accessible[b]	56	66	79	43	92	30	138	182	197	123	248	72
	200 m zone[c]	61	60	83	38	100	21	163	239	250	152	318	84
	Inaccessible	7	20	17	10	21	6	65	98	101	62	125	38
E	Accessible[b]	34	77	65	46	82	29	95	178	158	115	201	72
	200 m zone[c]	103	140	145	98	186	57	203	332	287	248	382	153
	Inaccessible	22	45	37	30	50	17	72	132	114	90	159	45
F	Accessible[b]	32	50	40	42	55	27	58	117	90	85	118	57
	200 m zone[c]	83	160	128	115	181	62	175	349	264	260	376	148
	Inaccessible	8	31	14	25	21	18	52	130	85	97	117	65
G	Accessible[b]	58	50	58	50	84	24	79	89	94	74	134	34
	200 m zone[c]	141	89	141	89	180	50	254	257	325	186	414	97
	Inaccessible	33	26	33	26	41	18	66	105	92	79	129	42
H	Accessible[b]	25	16	29	12	34	7	58	74	87	45	114	18
	200 m zone[c]	32	33	41	24	53	12	73	120	120	73	151	42
	Inaccessible	9	6	11	4	13	2	24	48	46	26	58	14
I	Accessible[b]	31	33	41	23	49	15	83	99	115	67	145	37
	200 m zone[c]	48	43	64	27	75	16	107	114	143	78	179	42
	Inaccessible	16	13	22	7	23	6	66	67	97	36	113	20
J	Accessible[b]	91	94	122	63	143	42	141	183	194	130	244	80
	200 m zone[c]	54	88	81	61	106	36	92	175	149	118	199	68
	Inaccessible	30	50	47	33	67	13	67	102	101	68	135	34

[a] Land and badgers within 200 m of the treatment area boundary have been excluded.
[b] Accessible land more than 200 m from inaccessible land.
[c] 200 m zone is accessible land within 200 m of inaccessible land.

Table S18 Interactions between the time when badgers were trapped within a cull and badger removal rates from 200 m zones around inaccessible land and accessible land. Three different definitions of 'early' and 'late' captures are explored. Figures denote overdispersion-adjusted *p*-values for chi-square tests of the interaction term; none are statistically significant

Model	Within *treatment area boundaries*		Within *trial area boundaries*	
	Initial cull	All culls	Initial cull	All culls
Log land area (km^2) as covariate				
Early = day 1, late = all subsequent days	0.88	0.82	0.80	0.70
Early = days 1—2, late = all subsequent days	0.83	0.98	0.96	0.86
Early = days 1—4, late = all subsequent days	0.60	0.92	0.65	0.91
Log number of main setts as covariate				
Early = day 1, late = all subsequent days	0.88	0.90	0.80	0.85
Early = days 1—2, late = all subsequent days	>0.99	>0.99	0.86	0.88
Early = days 1—4, late = all subsequent days	0.73	0.95	0.85	0.94
Log number of active setts as covariate				
Early = day 1, late = all subsequent days	0.91	0.98	0.86	0.80
Early = days 1—2, late = all subsequent days	0.93	0.95	0.97	0.87
Early = days 1—4, late = all subsequent days	0.64	0.98	0.72	0.90

rates at different points during the trapping period varied by consent, hypothesizing that if traps around the edges were trapping badgers from surrounding land more effectively, then removal rates later in the trapping period would be higher for these traps. In three separate analyses we used three different divisions of the trapping period:

1. Badgers taken on the first day, compared with those taken after the first day — typically 40% of the badgers were trapped on the first day.
2. Badgers taken on either the first or second day compared with those taken after the second day — typically 60% of the badgers were trapped in the first two days
3. Badgers taken up to and including the fourth day compared with badgers taken after the fourth day — typically 75% of the badgers were trapped in the first four days.

The numbers of badgers caught in these time periods are shown, for initial culls and all culls, in Table S16 (land within treatment area boundaries) and Table S17 (land within trial area boundaries). We fitted log-linear models to the numbers of badgers as before, and included an interaction term between the consent status of the land and whether the badgers were taken early in the trapping period or late. None of the models examined, whether for badgers taken in initial culls, or in all culls, demonstrated any evidence that removal

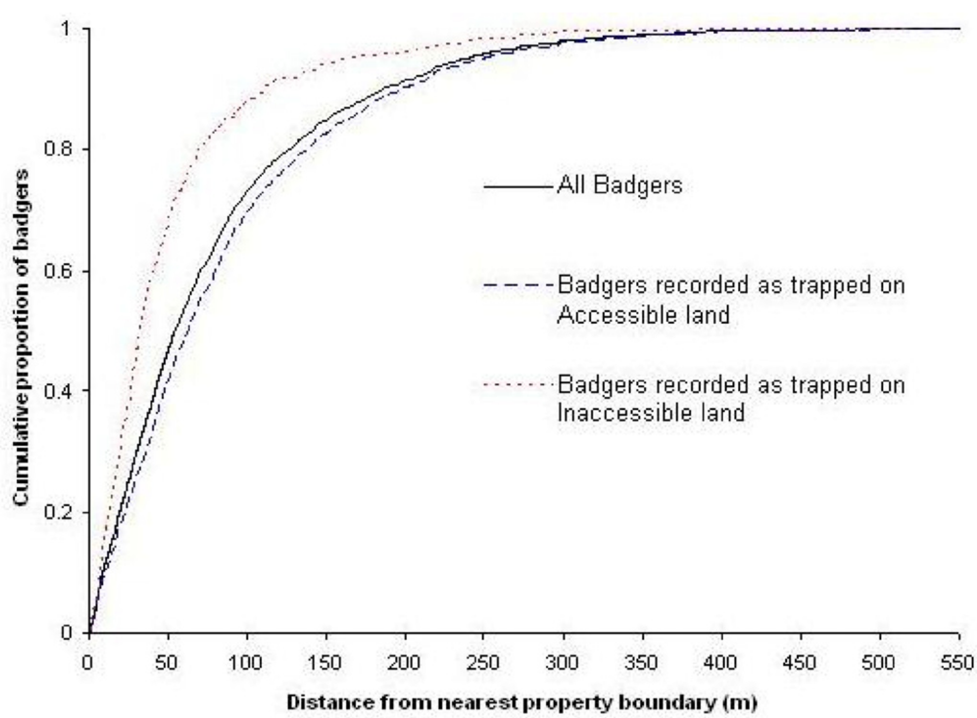

Figure S8 Cumulative distribution of badgers by distance from the nearest property boundary.

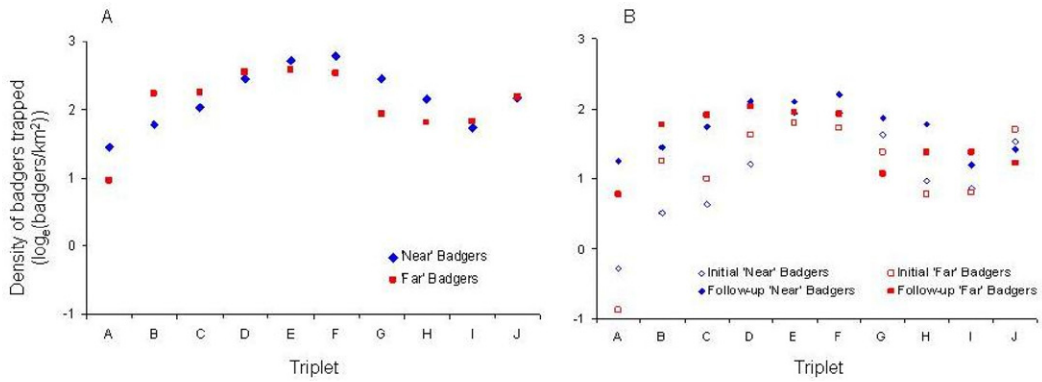

Figure S9 Density (log$_e$(badgers/km^2)) estimates for badgers trapped on accessible land within 200 m of both a landholder boundary and a boundary with inaccessible land ('near' badgers) and land within 200 m of a landholder boundary but more than 200 m from a boundary with inaccessible land ('far' badgers) for each of the 10 triplets. (A) Badgers taken in all culls, (B) badgers taken in initial culls and badgers taken in culls after the initial cull separately. For both graphs, the denominator (land area) is constant within a triplet, hence densities of badgers taken in initial culls and badgers taken in follow-up culls in panel B are both lower than the densities of total badgers in panel A. Land and badgers less than 200 m inside of the treatment area boundary have been excluded.

rates based on consent status varied by time of capture during the culling period (Table S18).

Badgers culled during proactive operations were trapped primarily near farm boundaries (irrespective of consent status) with 91% of badgers trapped within 200 m of a farm boundary (Figure S8). This was probably due in part to boundaries between farms being comprised of hedges and woodland, which are the preferred habitats for badger setts. To investigate whether the observed differences in removal rates at different distances from inaccessible land were simply a consequence of placing traps on or near boundaries, we compared the density of badgers within 200 m of a boundary between accessible and inaccessible land with the density of badgers within 200 m of any farm boundary.

The distance from every badger trapped to the nearest property boundary, and the nearest boundary between accessible and inaccessible land, was calculated using ArcGIS 9. The amount of accessible land (in km^2) and the numbers of badgers trapped on accessible land within 200 m of both types of boundary ('near' badgers) and within 200 m of a landholder boundary only ('far' badgers), were calculated for each trial area. Density estimates for 'near' and 'far' badgers (log$_e$ transformed) were then compared using a paired t-test considering each triplet as an independent pair.

Considering only land and badgers more than 200 m inside the treatment area boundaries, 'near' badger density estimates were higher than 'far' badger density estimates in five of the 10 triplets (Figure S9). The overall difference was not significant however; mean log$_e$ difference 0.09 higher density of 'near' badgers (95% CI 0.14 lower density to 0.31 higher density; $p = 0.40$).

When only badgers captured during initial culls were considered there was no difference in the density of 'near' badgers and 'far' badgers (mean log$_e$ difference 0.02 lower density of 'near' badgers; 95% CI 0.30 lower density to 0.26 higher density; $p = 0.86$). Considering only badgers taken during follow-up culls there was a non-significant tendency for the densities of 'near' badgers to be higher than that of 'far' badgers (mean log$_e$ difference 0.17 higher density of 'near' badgers; 95% CI 0.07 lower density to 0.42 higher density; $p = 0.15$).

There is not sufficient evidence to reject the null hypothesis that there is no difference in badger density between areas within 200 m of a boundary between inaccessible and accessible land, and any other farm boundary. However there is a trend for more badgers to be trapped on land near to the boundaries between accessible and inaccessible land following the initial culls. This corroborates the trends noted in the main body of the text, indicating that additional badgers, presumably from inaccessible land, appeared to be removed from the vicinity of inaccessible land following the initial culls.

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