

Nature Reserves Badger Vaccine Deployment Programme 2011

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Badger in live trap, Greystones Farm Nature Reserve, August 5th, 5.49 am



Auditing of vaccination process by FERA vet, Greystones Farm nature reserve, August 5th, 2011



Repeat catch, badger cubs trapped on consecutive nights, August 4th and 5th, 2011

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Executive Summary

1. Vaccination has the potential to reduce bTB without the negative impacts of perturbation arising from a badger cull. Since 1998, the Government has invested £30 million in developing TB vaccines for cattle and badgers.
2. The Trust decided in 2010 that it would pursue the deployment of BadgerBCG on its nature reserves subject to three criteria:
 - Evidence of badgers present on site
 - Grassland, on site or immediately adjacent, where cattle were present
 - Recent presence of bTB in cattle in the neighbouring area
3. The seven sites selected for inclusion in the vaccination programme:
GROUP A – *The Stroud Valleys*; Daneway Banks, Elliott, Frith Wood, Siccaridge Wood, Snows Farm and Strawberry Banks.
GROUP B – *Greystones Farm*.
4. Training was purchased from the Food & Environment Research Agency (FERA) for Vaccinator A in late 2010 and B in 2011.
5. Considerable staff time was put into the planning and design of the vaccination programme. However, much of this was a consequence of the unavailability of published information on the practical private application of bTB vaccination.
6. The nature of the work of a Wildlife Trust involves a considerable amount of liaison with members, stakeholders and the media. This time has not been included as it does not relate directly to the practical application of the veterinary medicine.
7. The Trust was able to seek advice from the training course providers, FERA.
8. If field vaccination using injectable BadgerBCG is to be more widely deployed a free Advisory Service would make the uptake of the technique easier, more efficient and potentially cheaper.
9. In view of the formal training process the Annual Certificate of Competence adds an additional cost barrier to uptake.
10. Gloucestershire Wildlife Trust's programme was carried out on seven nature reserves. Six of these were clustered and one (Greystones Farm) consisted of a traditional small dairying unit of 66 hectares.
11. The average cost per hectare (Group A plus Group B) is £51.
12. The six Stroud Valleys reserves are located in Cotswold Valleys with steep banks, high levels of woodland cover, thick hedges and small pastures – high density badger habitat.
13. The cost per hectare range using the average hourly rate unit cost is £56 for Group A nature reserves (85.5 hours at an hourly rate of £68 covering 104ha). It is considered that this is the most accurate cost projection for Cotswolds valleys nature reserves in the size range of 5 to 24 hectares.
14. The cost per hectare range using this average unit cost is therefore £41 for Group B nature reserves (40 hours at an hourly rate of £68 covering 66ha). It is considered that this is the most accurate cost projection for this small agricultural unit located in a Cotswold river valley with good vehicular access.
15. Programme costs:
Annualised 5 year cost – £8,656
Per hectare (Groups A + B) – £51
Per field hour – £68
Per hectare (Stroud Valleys, Group A) – £56
Per hectare (Greystones Farm, Group B) – £41
Per farm holding (Greystones Farm) – £2,856

1. Bovine TB – a disease that afflicts cattle and badgers

Gloucestershire Wildlife Trust is very conscious of the hardship that bovine TB (bTB) causes in the farming community and the need to find the right mechanisms to control the disease. Our involvement with this issue over a long period of time has led us to the firm conclusion that vaccination and biosecurity measures would be the most effective means of controlling bTB.

Vaccination has the potential to reduce bTB without the negative impacts of perturbation arising from a badger cull. Since 1998, the Government has invested £30 million in developing TB vaccines for cattle and badgers. The current status of vaccine development is:

- **Injectable badger vaccine** available since March 2010;
- **Cattle vaccine** expected by the end of 2012 but not available for deployment due to EU regulation;
- **Oral badger vaccine** will not be available before 2015.

Vaccination has potential benefits in reducing the prevalence, incidence and spread of bTB. Vaccinating uninfected badgers with the BCG badger vaccine (based on the human vaccine BCG) resulted in a four-fold (74%) reduction in

the proportion of wild badgers testing positive to the antibody blood test for BCG (Chambers *et al* 2010, Appendix 1). BadgerBCG is currently being used by Gloucestershire Wildlife Trust, The National Trust and as part of a reduced Government funded deployment trial in Gloucestershire. The effectiveness of BadgerBCG in reducing TB in cattle has not yet been measured.

In their submission to the Government's last two public consultations on tackling bovine TB, The Wildlife Trusts continue to urge Defra to pursue the following as a matter of priority:

- Support landowners to improve on-farm biosecurity and the deployment of the injectable BadgerBCG vaccine;
- Continue to develop an oral vaccine for badgers;
- Complete the development of a licensed bTB vaccine for cattle;
- Secure change to EU regulation to permit the commercial deployment of a bTB cattle vaccine and the entry of meat from vaccinated cattle into the human food chain.

2. Deploying BadgerBCG – a vaccine for badgers against bovine TB

The first badger found infected with bovine TB was a road casualty animal in Gloucestershire in 1972. Over the intervening 40 years there has been a remorseless increase in the number of cattle that have been tested positive for the disease not just in the South West of England but also in Wales and in the Midlands. The consequence of the disease for affected farmers has been financial disruption, unwanted distraction and psychological pressure.

The deployment of bTB vaccines is in its early phases. Injectable badger vaccine is only just available and an oral vaccine is not likely to be available for badgers for another few years. But the Trust strongly believes that vaccination against bTB should play an essential part in controlling a very difficult farm animal disease.

Peer reviewed research (Appendix 1) has demonstrated that vaccinating uninfected badgers with BCG resulted in a 74% reduction in the incidence of badgers testing positive to the antibody blood test for bTB. The Trust's five year vaccination programmes should achieve a level of immunity within the badgers that it captures and treats on its nature reserves.

It was decided in 2010 by the Trust that it would be the first voluntary organisation to pay for the deployment of the new bTB badger vaccine. This vaccination work began in mid June 2011 by trained and skilled Trust staff on a set of nature reserves where it was felt that badger vaccination could be used practically and to the benefit of the Trust's and its neighbour's cattle.

Gloucestershire Wildlife Trust is well placed to undertake a vaccination deployment trial as it is already engaged with the process, having previously volunteered its reserves for vaccination trials and research, and having funded training for a staff member with FERA.

Bovine TB is not easily detected in cattle and there is no single test for its presence that is totally accurate. The disease can lie dormant in

infected cattle and thereby bypass testing programmes (false negative). Moreover, significant numbers of 'positive reactor cattle' show no disease even after slaughter and post mortem (false positive).

In badgers there are also factors that make the detection and treatment of bTB difficult. It is not possible to detect bTB in live badgers without trapping animals and removing them to a laboratory for tests or post mortem analysis. Badgers too can also carry the disease without expressing any symptoms or otherwise revealing its presence. Moreover with an average life expectancy of five years, and the slow and unpredictable development characteristics of bTB disease, even infected badgers rarely die solely as the direct consequence of bTB.

The view of the National Farmers Union (NFU) and of many farmers remains that culling badgers must form the key part of any future government control programme for bTB. This was the NFU and Country Land & Business Association (CLA) view submitted on behalf of the farming industry to Defra in its consultation on badger culling in autumn 2010. This might seem to be the common sense approach to the disease but there is a fundamental aspect of badger ecology that results in badger culling making the problem worse in practice. Nevertheless, at the time of writing Defra had again consulted on trialling the shooting of free running badgers as part of its control strategies.

Badger social groups are stable and even infected badgers stay mostly within their restricted social territory. Disruption of social groups through culling may result in badgers wandering into adjacent territories potentially taking bTB with them or contacting animals already infected with bTB; an effect called perturbation.

The Independent Scientific Group (ISG) on Cattle TB set up by Government to research the effectiveness of culling concluded that culling

disrupts badger social groups, resulting in the spread of the disease to cattle in land adjacent to the cull. Over almost a decade of the trial, the ISG showed that one farmer's gain from culling could result in adjoining farmers' losses due to the effect of perturbation.

BadgerBCG, as the vaccine is called, does not cure badgers of the disease but at the end of our five year programme the social groups that we will have treated should have a high level of resistance to the bTB disease. The human analogy for this approach is that of vaccinating children who thereby acquire immunity against diseases, including TB, as a preventative measure, rather than trying to deal with disease solely with reactive treatments. It is equally valid to vaccinate badgers in areas of existing infection rather than only targeting 'clean' places with 'no disease'.

A bTB vaccine for cattle is still some way off and awaits the completion of the full veterinary medicine testing protocols and the formal licensing of a usable product. But one more barrier would then still exist – the agreement of the EU that vaccinated cattle that had been inoculated with a bTB vaccine could enter the European food chain. This stage of the process will not involve laboratories or farmyards, but skilled negotiations to enable our farmers to trade in beef and dairy products from vaccinated cattle across Europe.

Gloucestershire Wildlife Trust is the first organisation to spend its own money to vaccinate badgers against bovine TB and therefore the first organisation to study the true costs of a programme.

BadgerBCG alone is not the solution to bTB, but it does have an immediate effect with no known associated negative impact other than cost. Culling, as even its most vocal supporters admit, will produce an increase in bTB in neighbouring herds through perturbation. It is arguable whether this negative effect declines over time.

Indeed, the Independent Scientific Group research concluded that culling should not be part of the government 'toolbox'.

In the meanwhile, Gloucestershire Wildlife Trust is following in a strong Gloucestershire tradition set by the Reverend Jenner who coined the word vaccine from the latin; *vacca* a cow. We are contributing to solving a serious and long established disease of cattle and badgers by vaccinating badgers on a selection of our nature reserves at our own cost. The Trust believes that this is a worthwhile contribution towards solving a very difficult problem.

3. Organisation

The Trust decided in 2010 that it would pursue the deployment of BadgerBCG on its selected nature reserves over a five year programme subject to three criteria:

- Evidence of badgers present on site
- Grassland, on site or immediately adjacent, where cattle were present
- Recent presence of bTB in cattle in the neighbouring area

2010

Preparation

An initial desk survey using data from the Gloucestershire Centre for Environmental Records (GCER) indicated that badgers were present on 26 Trust nature reserves. However, little or no information was available on the number and type of setts on each reserve. On-site surveys were then undertaken by Trust staff.

The seven sites selected for inclusion in the vaccination programme were:

- GROUP A – The Stroud Valleys; Daneway Banks, Elliott, Frith Wood, Siccaridge Wood, Snows Farm and Strawberry Banks
- GROUP B – Greystones Farm where bTB was known to be present

FERA training was purchased for Vaccinator A in late 2010.

2011

Preplanning of the vaccination programme involved:

- locating necessary equipment and supplies
- obtaining the cooperation of a local vet to ensure supply and storage of BadgerBCG vaccine
- locating manufacturer for two wickets (used to isolate active badgers within trap for injection)
- detailed site survey of setts to determine best locations of live traps
- applying for Certificate of Competence

- arranging supply of vaccine for planned vaccination programme
- agreeing target dates for each site and informing FERA as the auditing of the planned action
- obtaining Natural England licence to proceed with vaccination.

A second individual (Vaccinator B) was trained by FERA for Group B site – Greystones Farm.

As the Trust had already agreed that Greystones Farm would form part of the FERA Oral Vaccine research programme, Group B covered only two of the three social groups on this site. The third group formed part of the research and was vaccinated by the FERA research team in 2011 but will be included in the Trust's programme in 2012 and subsequent years.

Deployment activities at each site during the vaccination programme consisted of:

- Careful location of recorded, numbered traps (soil covering flooring, trap discretely located)
- Traps locked open and pre-baited with peanuts for several nights prior to vaccination
- Traps visited on morning of vaccination between 4.00 and 8.00 am
- Badgers vaccinated, stock-marked, recorded and released
- Traps reset and pre-baited that evening after 3.00 pm
- Traps revisited next morning between 4.00 and 8.00 am
- Unmarked (ie not previously vaccinated) badgers vaccinated, stock-marked, recorded and released
- Previously vaccinated badgers, ie stock-marked, recorded and released
- Traps removed, cleaned, disinfected and either relocated or returned to store.

Table 1: Nature Reserves – Group A and B

Snows Farm – Group A

Area (ha)	21.3	
No. Traps	12	
Catch	6	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting	13	
Vaccination	3.5	
Cleaning	1	
Transport	1	
Total	19.5	

Strawberry Banks – Group A

Area (ha)	5.3	
No. Traps	5	
Catch	1	
		<i>Hrs</i>
Loading traps		0.5
Digging in and prebaiting	6	
Vaccination	1	
Cleaning	1	
Transport	1	
Total	9.5	

Frith Wood – Group A

Area (ha)	24	
No. Traps	12	
Catch	4	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting	10	
Vaccination	3.5	
Cleaning	1	
Transport	1	
Total	16.5	

Siccaridge Wood – Group A

Area (ha)	26.6	
No. Traps	16	
Catch	6	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting	11	
Vaccination	3.5	
Cleaning	1	
Transport	1	
Total	17.5	

Elliott – Group A

Area (ha)	10	
No. Traps	3	
Catch	4	
		<i>Hrs</i>
Loading traps		0.5
Digging in and prebaiting	8.5	
Vaccination	2	
Cleaning	1	
Transport	1	
Total	13	

Daneway Banks – Group A

Area (ha)	17	
No. Traps	5	
Catch	0	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting	5.5	
Vaccination	1	
Cleaning	1	
Transport	1	
Total	9.5	

Greystones Farm – Group B

Area (ha)	66	
No. Traps	20	
Catch	17	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting	26	
Vaccination	8	
Cleaning	3	
Transport	2	
Total	40	

Overall Total Hours 125.5

4. Costs

a. Planning

Considerable staff time was put into the planning and design of the vaccination programme. However, much of this was a consequence of the unavailability of published information on the practical private application of bTB vaccination.

Management costs relating directly to the preparatory phase of the vaccination programme have been included in the relevant section. Survey and assessment time costs of badger setts on nature reserves have been estimated because it was a combination of routine daily nature reserve management activity, volunteer contributions and planned effort.

The nature of the work of a Wildlife Trust involves a considerable amount of liaison with members, stakeholders and the media. This time has **not** been included as it does not relate directly to the practical application of the veterinary medicine.

b. Capital Items

Traps are a significant capital item and this is one of the types of equipment which could be used by syndicates. This is discussed further in Section 6.

Capital items are shown in the year one set up costs. For the purpose of further calculations, capitalised items have been amortised over five years. Year one capital and set up costs totalled £6,958.

c. Implementation

Items such as face masks, protective gloves, needles, disinfectant etc have been shown as annual cost items.

Staff time costs relating to education, internal seminars with Wildlife Trusts and Public Relations (PR) **have not been included**.

Costs relating directly to the training of the two field inoculators A and B have been included.

Time sheets were maintained by the two staff who carried out the field inoculation work. Year one implementation costs totalled £7,110.

Table 2: Full Year 1 Costs – including capital and loaned items

No#	Category	Item	Hours	Number	Cost	Year 1 Costs	Sub totals
Capital							
1	Holding cages			2	£132	£264	
1	Traps			30	£100	£3,000	
2	Peli Case			1	£102	£102	
2	Pressure Washer			1	£110	£110	
2	Data Logger			1	£68	£68	
2	Vaccine fridge			1	£838	£838	
2	Wickets			2	£100	£200	
3	Training Course A	£810		1	£810	£810	
3	Training Course B	£710		1	£710	£710	
3	Training A staff time	£21.4	20	1	£428	£428	
3	Training B staff time	£21.4	20	1	£428	£428	
							£6,958
5	Certificate of Competence	1		1	£2,065	£2,065	£2,065
Consumables							
	Needles, syringes etc			1	£28	£28	
	Sprayer and crate			1	£20	£20	
	Misc.			1	£57	£57	
	Vaccine			40	£3.50	£140	
	Respirators			2	£30	£60	
	Misc small items			1	£50	£50	
	Peanuts			2	£25	£50	
							£405
Staff Costs							
	Sett Surveys	£21.4	25	1	£535	£535	
	Loading traps	£21.4	5	1	£107	£107	
	Digging in and prebaiting	£21.4	54	1	£1,156	£1,156	
	Vaccination	£21.4	12	1	£257	£257	
	Cleaning	£21.4	8.5	1	£182	£182	
	Transport	£21.4	6	1	£128	£128	
	Loading traps	£21.4	1	1	£21	£21	
	Digging in and prebaiting	£21.4	26	1	£556	£556	
	Vaccination	£21.4	8	1	£171	£171	
	Cleaning	£21.4	3	1	£64	£64	
	Transport	£21.4	2	1	£43	£43	
	Travel	£250.0	1	1	£250	£250	
	Meetings, etc	£21.4	21	1	£450	£450	
4	Direct Management	£51	14	1	£720	£720	£4,640
FULL UNAPPORTIONED YEAR 1 COSTS							£14,069
Yr 1 costs							£14,069
Annual costs yr 2–5							£29,212
							£43,281
Average annual cost							£8,656
Average cost per hour							£68
Average cost per ha per annum							£51
Cost of group A nature reserves per ha							£56
Cost of group B nature reserves per ha							£41

5. Discussion

a. Planning

The Trust's long involvement with the FERA research team at Woodchester Park enabled it to benefit from quality advice. Additionally, before deciding to progress its own vaccination programme, the Trust had sought an independent professional quotation for vaccination work at Greystones Farm.

In proceeding to use its own staff, there were uncertain practical issues that had to be solved. This field experience that Gloucestershire Wildlife Trust has since obtained, combined with the programme that the National Trust is about to commence, will considerably increase the body of knowledge concerning small scale field deployment. Therefore, if field vaccination using injectable BadgerBCG is to be more widely deployed, a **free Advisory Service would make the uptake of the technique easier, more efficient and potentially cheaper.**

b. Training and Licensing

Feedback from the two staff (both experienced and knowledgeable practical land managers) was that the training provided by FERA was of high quality and practically relevant.

The licensing process was slow and the additional cost of an annual Certificate of Competence issued by FERA (£2,065 for five licensees) was concerning.

The Annual Certificate of Competence adds a potential cost barrier to uptake.

c. Costs

The figures presented in Table 2 show all of the expenditure relating to the set up and deployment of the programme. However, there are five categories of costs that require special explanation:

1. **Traps – if used in a group exercise, this capital item could be greatly reduced.**
2. Pressure Washer, Data Logger, Vaccine Fridge and Wickets – these would have a five year life span and have been amortised.

3. Training Courses – Operators A and B were trained specifically for this exercise and were licenced for a five year programme.
4. Direct management costs – these are high for year one and relate to my direct supervisory input to the programme. I anticipate that in years two to five the input cost will be lower.
5. Certificate of Competence – issued annually and covering five operators. The cost per operator per year is therefore £413. However for small scale implementation this represents a significant cost.

Projected costs for years one to five is £43,281. This is the cost figure that I believe to be the most realistic for **future** annual programme expenses and is the figure that Gloucestershire Wildlife Trust will use as its reference. The total hectareage of both groups of nature reserves is 170. This indicates an annual per hectare cost of £51.

In total the aggregated sum of actual field operator hours is 126 indicating an average field vaccination cost of £68 per hour. This figure gives an indicative field cost of £5,814 for the Stroud Valleys nature reserves (Group A) and £2,856 for Greystones Farm (Group B).

d. Field Deployment

Gloucestershire Wildlife Trust's programme was carried out on seven nature reserves. Six of these were clustered and one (Greystones Farm nature reserve) consisted of a traditional small dairying unit of 66 hectares.

The six Stroud Valleys reserves are located in Cotswold Valleys with steep banks, high levels of woodland cover, thick hedges and small pastures – high density badger habitat. Table 3 shows the key deployment parameters relating to the grouping of sites A.

The cost per hectare using this average unit cost is therefore £56 for Group A nature reserves (85.5 hours at an hourly rate of £68

covering 104ha). It is considered that this is the most accurate cost projection for Cotswolds scarp and valleys nature reserves in the size range of five to 24 hectares.

Table 3 Group A summary

Nature Reserves – Group A

Area (ha)	104.2	
No. Traps	53	
Catch	21	
		<i>Hrs</i>
Loading traps		4
Digging in and prebaiting		13
Vaccination		54
Cleaning		8.5
Transport		6
Group A	Total	85.5

Greystones Farm (Group B) lies in the Windrush valley and conforms to a typical Cotswold plateau valley system with easier access and accordingly lower physical deployment costs relating to trap setting, baiting, inspection and vaccination.

Table 4 Group B

Greystones Farm – Group B

Area (ha)	66	
No. Traps	20	
Catch	17	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting		26
Vaccination		8
Cleaning		3
Transport		2
	Total	40

Table 4 shows that same analysis for Site B. The cost per hectare range using this average unit cost is therefore £41 for Group B nature reserves (42 hours at an hourly rate of £68 covering 66ha). It is considered that this is the most accurate cost projection for this small agricultural unit located in an area with ecological conditions highly suited to badgers.

In terms of field deployment at agricultural level, Gloucestershire Wildlife Trust’s experience at Greystones Farm is more applicable. An additional cost item will be encountered in years 2012 – 2015 for this site once the FERA oral vaccine team research has been completed. In 2011 the badger social group that formed part of the FERA oral vaccine trial was inoculated at no cost to the Trust. A figure has been included in the revised projected time costing for Greystones Farm for 2012 – 2015 based on a putative annual catch of 10 badgers from this social group (Table 5). Ten additional vaccines would also be required.

The overall costs for Greystones Farm for the period 2012 – 2015 are therefore taken as £2,856 per year.

Table 5 – Projected costings for Greystones Farm 2012 onwards

Greystones Farm – Group B

Area (ha)	66	
No. Traps	26	
Catch	27	
		<i>Hrs</i>
Loading traps		1
Digging in and prebaiting		27
Vaccination		9
Cleaning		3
Transport		2
	Total	42

6. Key Recommendations

a. Advisory Service

The availability of a free advisory service would have been of assistance in the planning and deployment stage of the programme. Although much help was provided by FERA personnel, this was provided as a follow up to training and through auditing.

b. Certificate of Competence – Annual

This is an additional cost that adds significantly to the programme that the Trust has run. As operators must be certificated and audited in the field, its inclusion is significant.

c. Group Working

- i. Gloucestershire Wildlife Trust learned much during field season 1. It is hoped that its learning, combined with that of the National Trust, will be used widely to assist other programmes.
- ii. The Trust could theoretically have combined its operations with adjacent programmes with considerable joint savings. Capital items such as fridges, traps etc would have been more cost effective if shared with other programmes. A central coordination service could make such group working much more effective over a May to November vaccination season.

d. Accessible Information

It is important that figures quoted for or against the costs of badger vaccination are accurate.

The Trust costs have been:

Annualised 5 year cost – £8,656

Per hectare (Groups A + B) – £51

Per field hour – £68

Per hectare (Stroud Valleys, Group A) – £56

Per hectare (Greystones Farm, Group B) – £41

Per farm holding (Greystones Farm) – £2,856

e. Badger Vaccination

Whilst badger vaccination is still unproven as an effective bTB preventative within commercial agriculture, Gloucestershire Wildlife Trust's experience supports its view that businesses and organisations that wish to see a resolution to the bTB disease issue should actively consider its deployment. For environmental, wildlife and animal welfare organisations that are active within the agricultural community, deployment of BadgerBCG is recommended.

7. Badger Vaccination Deployment Sites

Group A

Daneway Bank nature reserve

a wonderful example of SSSI limestone grassland.

Difficult access

OS grid ref: SO 937034, 17 hectares

Elliott nature reserve at Swift's Hill

unimproved SSSI limestone grassland, home to over 130 species of wildflowers and 13 different orchids including the frog, bee and early purple orchid.

Steep site

OS grid ref: SO 877067, 10 hectares

Frith Wood nature reserve

a SSSI spanning the Painswick and Slad Valleys with tall beech trees offering spectacular displays of bluebells in spring.

Good access

OS grid ref: SO 875085, 24 hectares

Siccaridge Wood nature reserve

a beautiful ancient coppiced woodland.

Good access

OS grid ref: SO 935035, 26.6 hectares

Snows Farm nature reserve

a steep sided reserve at the head of the Slad Valley, immortalised by Laurie Lee in his novel *Cider with Rosie*.

Difficult access, off-road vehicle

OS grid ref: SO 887081, 21.3 hectares

Strawberry Banks nature reserve

forms part of a larger block of ancient Cotswold beech wood and grasslands. Strawberry Banks SSSI is the only place marsh fritillary butterfly is found in Gloucestershire.

Access on foot only

OS grid ref: SO 910033, 5.3 hectares

Group B

Greystones Farm nature reserve

SSSI lowland meadows and a scheduled ancient monument dating back to the Neolithic age with visible iron age ramparts.

The River Eye runs through the reserve.

Good access by vehicle

OS grid ref: SP 173209, 66 hectares

8. Appendix 1

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Bacillus Calmette-Guérin vaccination reduces the severity and progression of tuberculosis in badgers

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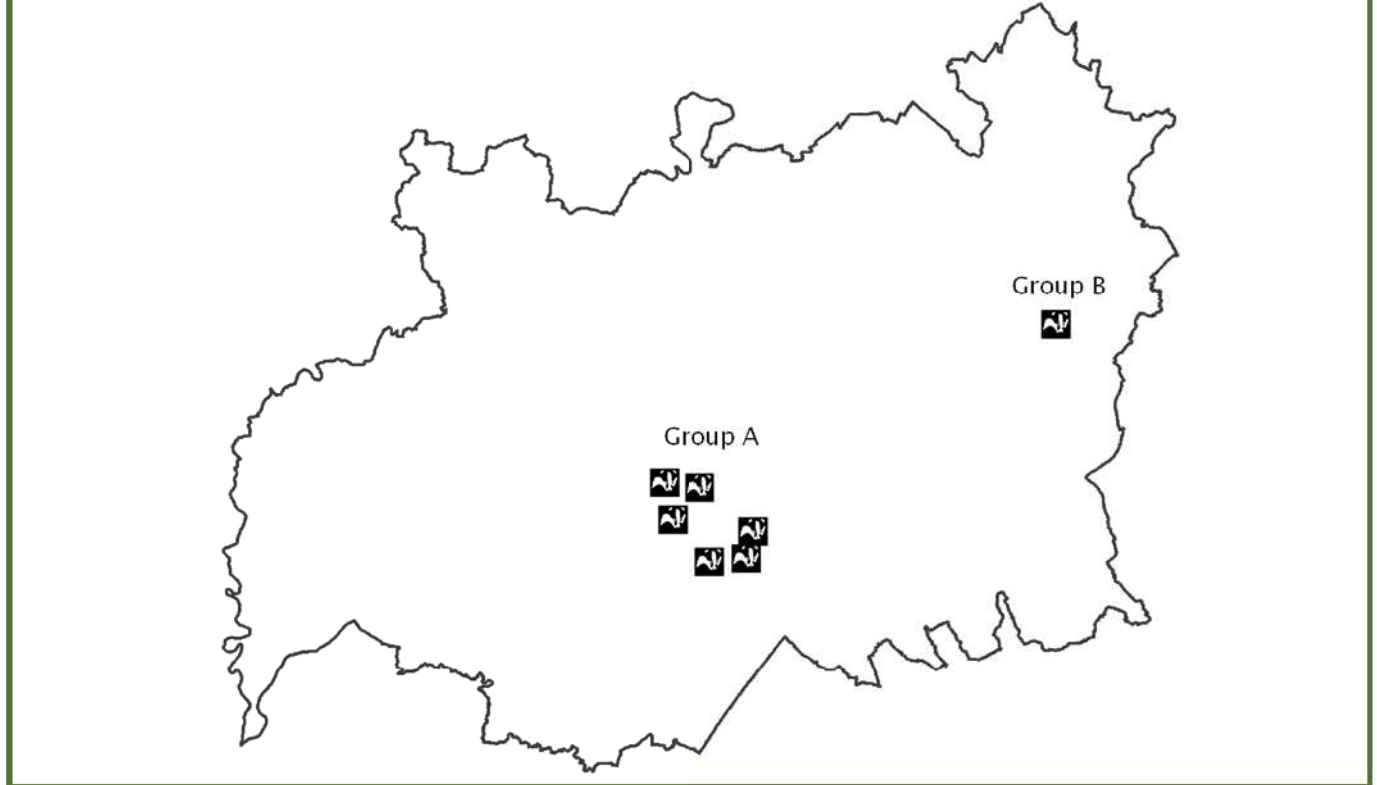
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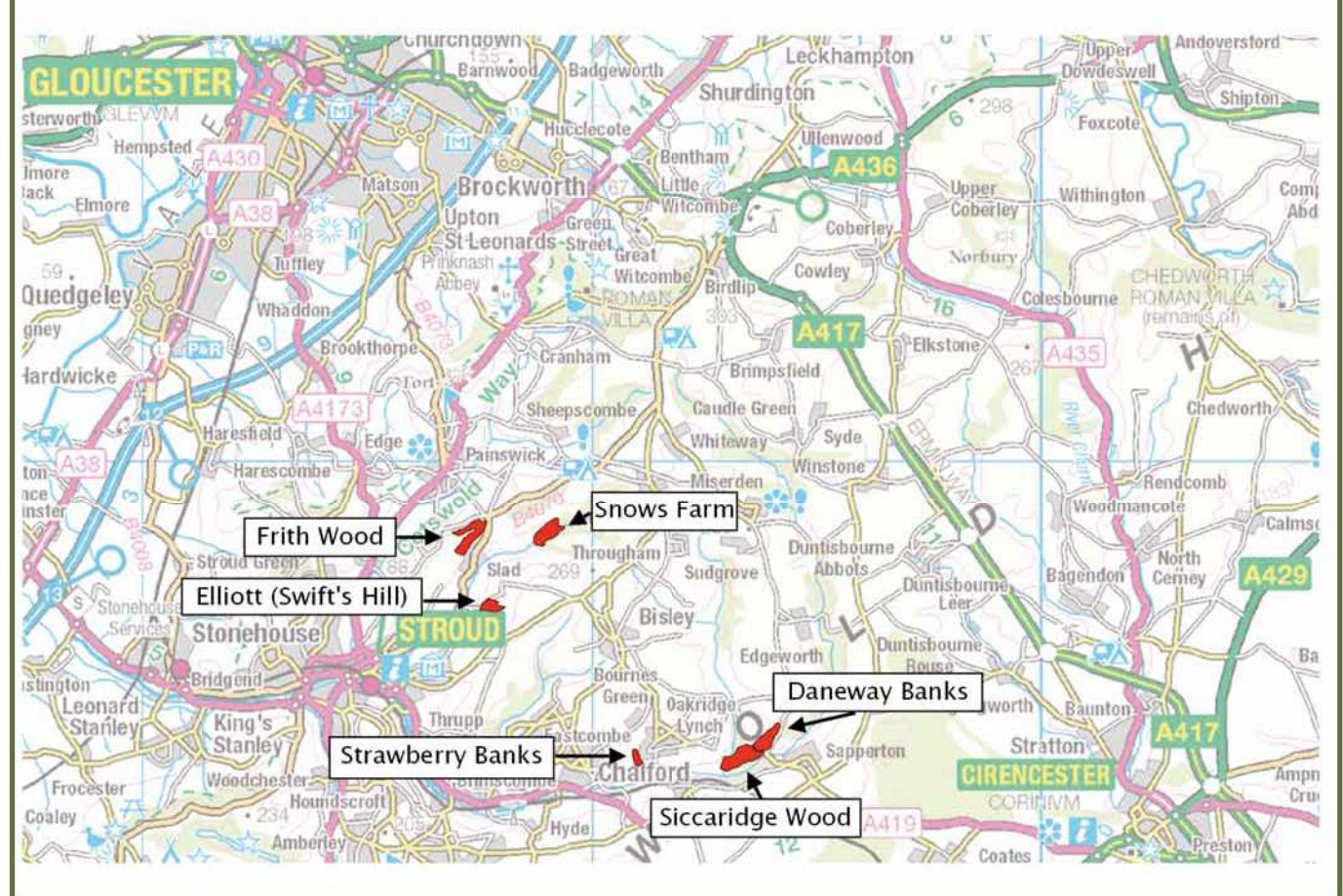
Control of bovine tuberculosis (TB) in cattle has proven particularly challenging where reservoirs of infection exist in wildlife populations. In Britain and Ireland, control is hampered by a reservoir of infection in Eurasian badgers (*Meles meles*). Badger culling has positive and negative effects on bovine TB in cattle and is difficult, costly and controversial. Here we show that *Bacillus Calmette-Guérin* (BCG) vaccination of captive badgers reduced the progression, severity and excretion of *Mycobacterium bovis* infection after experimental challenge. In a clinical field study, BCG vaccination of free-living badgers reduced the incidence of positive serological test results by 73.8 per cent. In common with other species, BCG did not appear to prevent infection of badgers subjected to experimental challenge, but did significantly reduce the overall disease burden. BCG vaccination of badgers could comprise an important component of a comprehensive programme of measures to control bovine TB in cattle.

Keywords: bovine tuberculosis; vaccination; badger; wildlife; *Bacillus Calmette-Guérin*

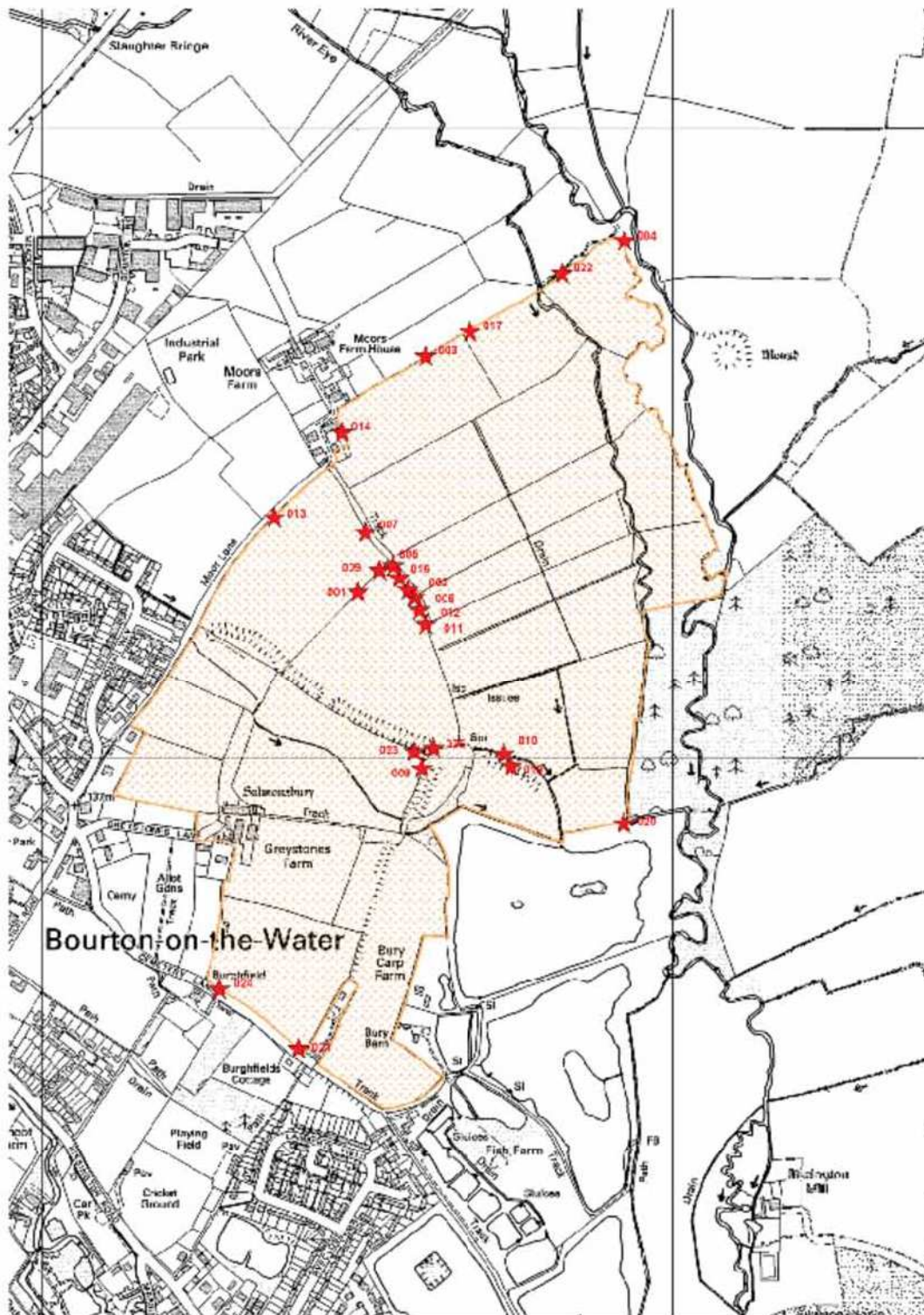
Map 1: location of Gloucestershire Wildlife Trust BadgerBCG vaccination sites



Map 2: location of Gloucestershire Wildlife Trust BadgerBCG vaccination sites, Group A



Map 3: Plan of Greystones Farm and 2011 trap locations





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