

## Effectiveness of Biosecurity Measures in preventing badger visits to farm buildings

The Wildlife and Emerging Diseases Programme at the Food and Environment Research Agency provides research, advisory and operational services in relation to diseases of wildlife, livestock and zoonotic infections of humans. It contributes to disease control by developing effective wildlife management options and by helping implement these. Research into badger ecology, the role of badgers in the transmission and maintenance of bovine TB and methods to manage the disease in badgers has been carried out by Fera (formerly the Central Science Laboratory) at Woodchester Park in Gloucestershire since the mid 1970s. The team based at Woodchester Park includes the leading scientific experts in the field of badger and bovine TB research.

1. Bovine tuberculosis caused by *Mycobacterium bovis* is a serious and economically important disease of cattle in the UK, and a potential source of zoonotic infection. Badgers have been implicated in the transmission and maintenance of the disease since the 1970s and until recently it was thought that spread from badgers to cattle was most likely to occur at pasture. However, recent studies have provided substantial evidence of widespread and frequent visits by badgers to farm buildings during which there is the potential for close direct contact between badgers and cattle and contamination of cattle feed with infected badger faeces, urine or sputum.
2. This study evaluated the effectiveness of simple practical measures in preventing badger visits to farm buildings. In the first phase of the study, 40 farms were surveyed using motion-triggered infrared cameras on potential entrances to farm buildings to determine the background level of badger visits experienced by each farm. Thirty-two farms progressed to the second phase, where they were divided into four treatment groups; Control = no exclusion measures were installed, Feed Storage = exclusion measures were installed on the feed storage areas only, Cattle Housing = exclusion measures were installed on the cattle housing areas only and Both = exclusion measures were installed on both the feed storage areas and the cattle housing. Badger exclusion measures included solid metal gates, gates with adjustable solid metal panels, solid metal fencing, feed bins and electric fencing. Cameras were deployed for at least 365 nights in each phase on each farm.
3. In Phase 1, badger visits were recorded on 19 farms (48%), and on between 0.3% and 71% of the total number of surveillance nights on each farm. Of the ten farms where badger visits were recorded on more than ten nights, feed storage areas were visited on all farms, and cattle housing on eight. In general, badgers visited feed storage areas more often than cattle housing. The frequency of badger visits to farms varied throughout the year. The highest numbers of nights with recorded badger visits were in April, May and June and the lowest in December and January. Badger visits were negatively correlated with the amount of rainfall in the preceding 24 hours.
4. When badger exclusion measures were applied, the number of visits to those farm buildings was significantly reduced ( $p < 0.001$ ). Badgers were only able to access buildings if the exclusion measures were either not used or improperly maintained. Where exclusion measures were consistently employed and adequately maintained they were 100% effective in preventing badger access to buildings. However, they did not prevent visits to the wider farmyard.
5. For farms that had exclusion measures installed during the second phase of the study, the level of badger visits diminished ( $p < 0.001$ ), despite an overall significant increase in the level of badger visits between the first and second phases ( $p < 0.001$ ). Installing measures on cattle housing did not reduce visits to feed storage areas or *vice versa*.
6. Our estimates of levels of farmer compliance in the use and maintenance of exclusion measures varied widely amongst farms (range = 12 - 98% of nights, mean = 60%). Measures that were installed in place of existing gates were used most often by farmers, whereas those that required deployment or maintenance (e.g. retractable or permanent electric fences) were the least likely to be used. When a farmer failed to maintain the building structure itself (e.g. damage to walls resulting in new potential entrance points) this could have negated the effectiveness of any exclusion measures.

7. Badger exclusion measures were individually tailored to fit each potential entrance point on each farm. The number and type of measures also varied widely between farms depending on their size and construction. Costs per farm ranged from £604 to £12,482, with an average cost of £4045. The average cost of applying exclusion measures to both cattle housing and feed store areas was £3840 per farm, although this is derived from a relatively small sample size (8 farms). For comparison, the average cost of a cattle herd breakdown has been estimated at £27000.
8. Properly installed and maintained badger exclusion measures can be a highly effective means of reducing direct and indirect contact between badgers and cattle in farmyards. This may, in turn, have the potential to reduce disease transmission risks.