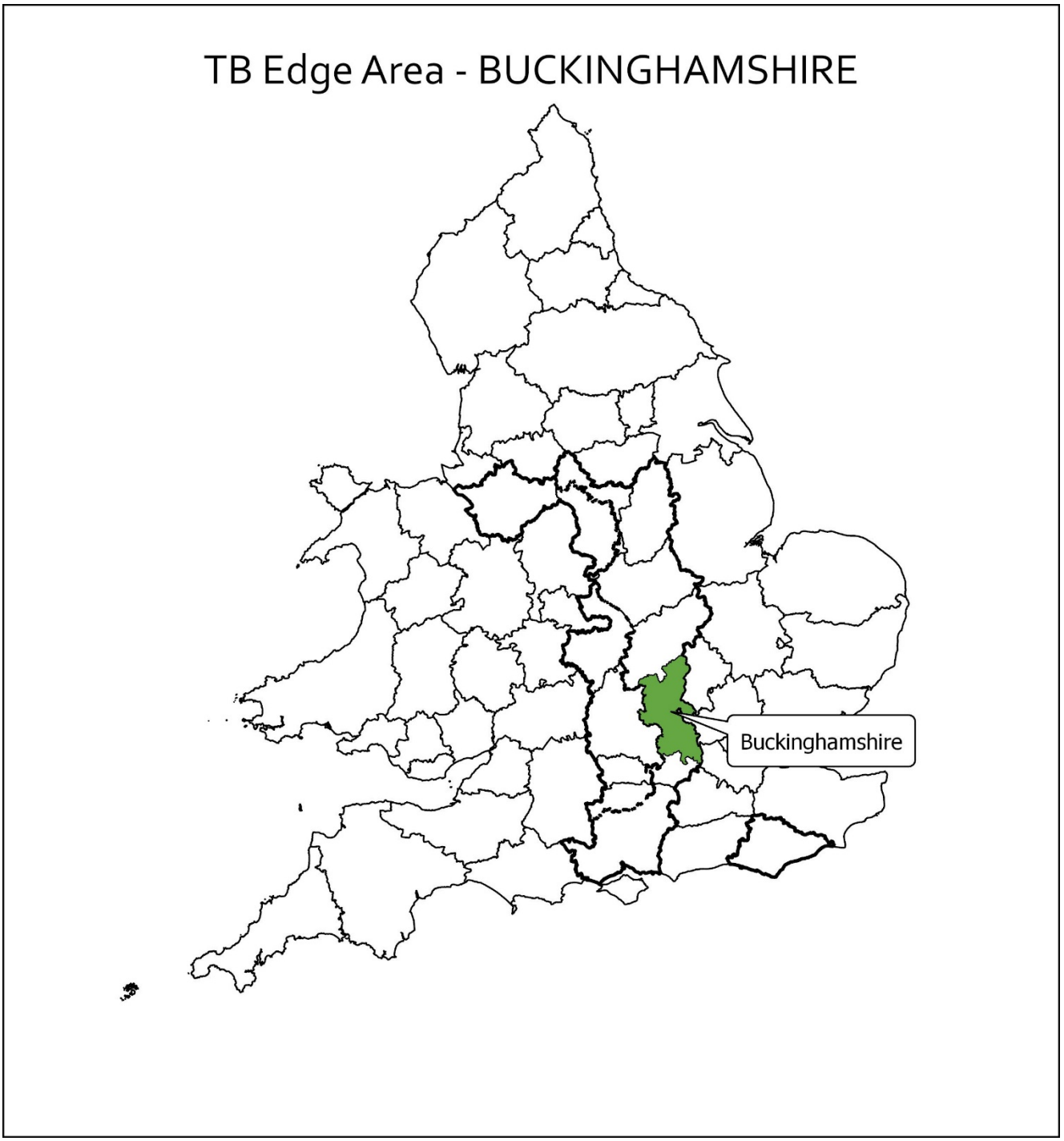
Animal & Plant Health Agency

Year End Descriptive Epidemiology Report: Bovine TB Epidemic in the England Edge Area

Delivery Area: Southern

Name of County: Buckinghamshire

Year-end report for: 2018



Contents

Executive Summary

1. The Edge Area has a low but recently rising incidence of infected herds. **Buckinghamshire** is part of the Edge Area that was established in 2013 as part of the Government's strategy to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038. The whole county has been part of the Edge Area since it was established in 2013. This end of year report describes the bovine tuberculosis (TB) epidemic in Buckinghamshire.

2. **Local cattle industry.** Predominantly a beef rearing county with a large proportion of small farms (fewer than 50 cattle). Many farms purchase cattle through the local Thame Market on the Oxfordshire/Buckinghamshire border, channelling cattle into the county mainly from the Edge Area and Low Risk Area (LRA).

3. **New breakdowns of bovine TB.** Most TB breakdowns were in the north west of Buckinghamshire where there is the highest density of both cattle and cattle holdings. There were no clusters or emerging endemic areas that became apparent during 2018. Annual incidence rate of TB reduced slightly from 7.6% in 2017 to 6.9% in 2018 and the number of Officially Bovine Tuberculosis Free Status Withdrawn (OTFW) incidents decreased from 19 in 2017 to 6 in 2018. Despite this reduction, there were still more TB incidents in 2018 than in 2016 and earlier years.

4. **Risk pathways for bovine TB infection.** The most significant risk pathway for introducing TB into this county remained the purchase of cattle with undisclosed infection from the Edge and High Risk Areas (HRA).

5. **Role of other species.** Infection in wildlife has not been proven in Buckinghamshire. There has been no evidence of cluster developments during 2018. The genotype 17:b cluster north of Aylesbury, noted in 2017, has since resolved although whole genome sequence analysis suggested a common source for a portion of this cluster which could be infected wildlife.

6. **Disclosing tests.** Routine herd surveillance tests disclosed 60% of breakdowns with the remainder being disclosed by enhanced surveillance tests (12M, 6M, pre-movement and radial tests). One slaughterhouse case was disclosed in an Approved Finishing Unit (AFU).

7. **Impact of bovine TB, reactor numbers.** A total of 283 reactor cattle were detected during 2018. This was an increase of 63 reactor cattle from 2017 despite the total number of TB breakdowns decreasing from 36 in 2017 to 31 in 2018.

8. **Risks to the Low Risk Area (LRA).** There was no evidence from cattle breakdowns occurring in 2018 to suggest any spread of endemic infection. Therefore Buckinghamshire appeared to represent a low risk of TB infection to the LRA.

9. **Risks from the High Risk Area (HRA) and/or other adjacent Edge Area counties.** Oxfordshire is the Edge Area county which presents the greatest risk of TB spread into Buckinghamshire. The risk is twofold: via the cattle movement hub of Thame Market (located on the Buckinghamshire border) and via wildlife endemically infected with TB (believed to be present in most of Oxfordshire). The movement of a TB 'infection front' from the HRA into Oxfordshire has continued eastwards since the early 2000's and now appears to have reached the border with Buckinghamshire.

10. **Forward look.** Based on the current trends, the county is unlikely to achieve its target of a <2% OTFW herd prevalence by 2019. If the practice of purchasing cattle from herds with undisclosed TB infection can be changed, Buckinghamshire could be on track to achieve the target of <1% OTFW herd incidence by 2025. However, this is conditional on the introduction of effective wildlife interventions preventing spread from Oxfordshire.

Introduction

A key action in the implementation of the Government's objective to achieve Officially Bovine Tuberculosis Free (OTF) status for England by 2038 was to recognise the different levels of TB in different parts of the country and to vary the approach to control accordingly. To this end three management regions or zones have been established. Overall, the Edge Area has a low but rising incidence of infected farms and control efforts are seeking to slow down and reverse geographic spread, and reduce the incidence rate, with the aim of obtaining OTF status for this area as soon as possible. This report describes the epidemiology of bovine TB in Buckinghamshire which forms part of the Edge Area (see Appendix 1).

Changes to the Edge Area in 2018

On 1st January 2018 the Edge Area boundary was expanded westwards to absorb fully into the Edge Area the former HRA parts of the five previously split counties of Cheshire, Derbyshire, Warwickshire, Oxfordshire and East Sussex. The reports for those five counties will focus on incidents of bovine TB in the whole county, but noting key differences between the old and new parts where relevant.

Annual surveillance testing continued in the whole county of Buckinghamshire. From January 2018, herd surveillance was enhanced with the introduction of targeted testing of herds within a 3km radius of OTFW breakdown herds.

Cattle industry in Buckinghamshire

There is a large proportion of small cattle farms (fewer than 50 cattle) in Buckinghamshire (Figure 1) which are less likely to purchase cattle in high numbers. This results in fewer breakdowns being disclosed on such premises. Buckinghamshire is predominantly a beef county (Figure 2) with finishing units being the most popular enterprise. A common practice is to house the cattle in barns during the winter months (October to March) and put them out to grass for the remainder of the year.

Many farms purchase cattle through the local Thame Market on the Oxfordshire/Buckinghamshire border, channelling cattle into the county mainly from the Edge Area and LRA. However, a small proportion of cattle are also purchased from markets within the HRA of England and Wales.

One new Approved Finishing Unit (AFU) was approved in Buckinghamshire during 2018, which makes a total of six AFUs in the county.

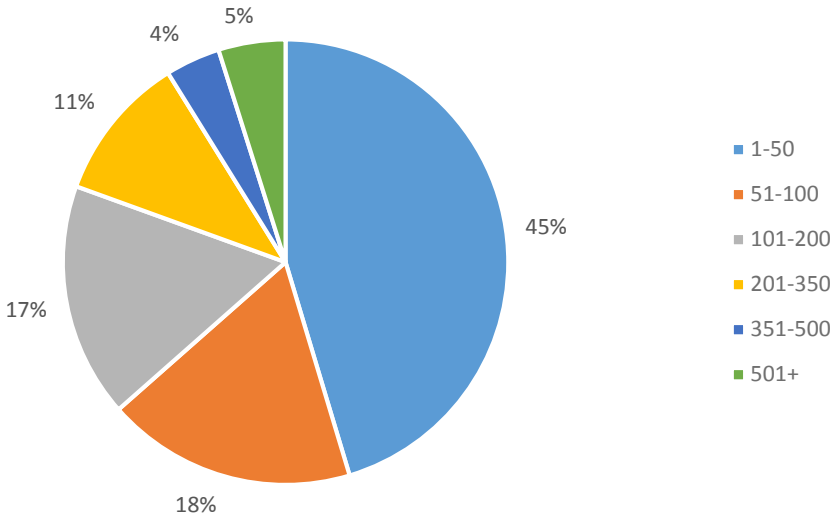


Figure 1: Proportion of cattle holdings by herd size in Buckinghamshire in 2018 (n=454)

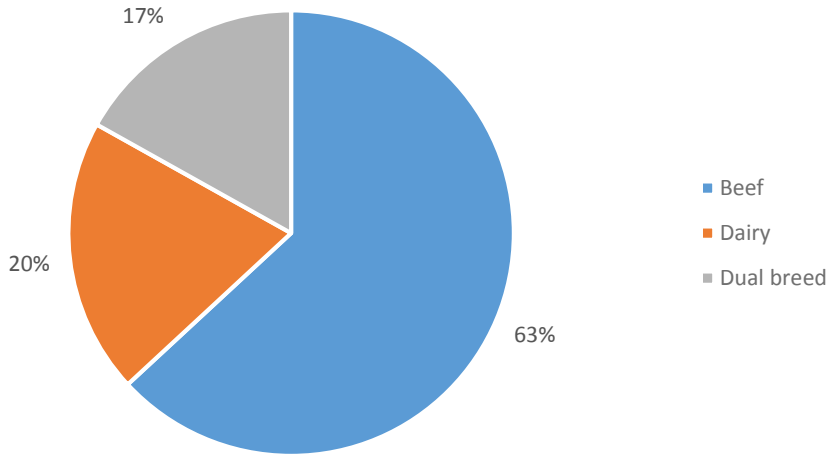


Figure 2: Proportion of cattle holdings by breed purpose in Buckinghamshire in 2018 (n=677).

NB: (Holdings having cattle with more than one breed purpose are counted more than once resulting in an apparently greater number of holdings in the county.)

Overview of the bovine TB epidemic in Buckinghamshire

History of bovine TB in Buckinghamshire

Three measures are used to explore the level of bovine TB in this report.

Firstly, the number of new herd breakdowns that were disclosed in each year.

Secondly, the annual incidence rate, reported as the number of new incidents per 100 herd-years at risk (100 HYR). This is the number of new TB incidents detected in the year, divided by the time those herds were at risk of contracting TB. The 100 HYR incidence rate is used in this report as it accounts for different intervals between tests in herds that other incidence measures, such as new TB incidents per number of herds or tests do not[1].

Thirdly, the annual end of year prevalence. This is the number of herds under restriction due to a TB incident at the end of the reporting year, divided by the number of active herds at that same point in time, and provides a snap shot of the burden of TB on the local cattle industry.

For all three measures, both breakdowns where lesions at post-mortem or *M. bovis* in tissue samples have been identified (officially tuberculosis free status withdrawn, OTFW) and breakdowns where lesions at post-mortem or *M. bovis* in tissue samples have not been identified (officially tuberculosis free status suspended, OTFS) are included. However, TB incidents in non-grazing AFUs are not included in the prevalence and incidence calculations in the Edge Area reports due to the limited epidemiological impact of these cases. Furthermore, herds restricted due to an overdue test rather than a TB incident are also excluded from calculations.

[1]The 100 HYR incidence rate measure is described further in 'Bovine tuberculosis in Great Britain in 2018: Explanatory Supplement to the annual reports' https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2018

The number of new TB breakdowns and annual incidence rate in Buckinghamshire slightly decreased in 2018 following the marked increase in cases noted during the previous year of 2017 (Figures 3 and 4). Prior to this, the county had had a period of relative stability (2013-2016). The end of year prevalence of restricted herds increased in 2018 (Figure 5) which may be partly explained by breakdowns lasting longer.

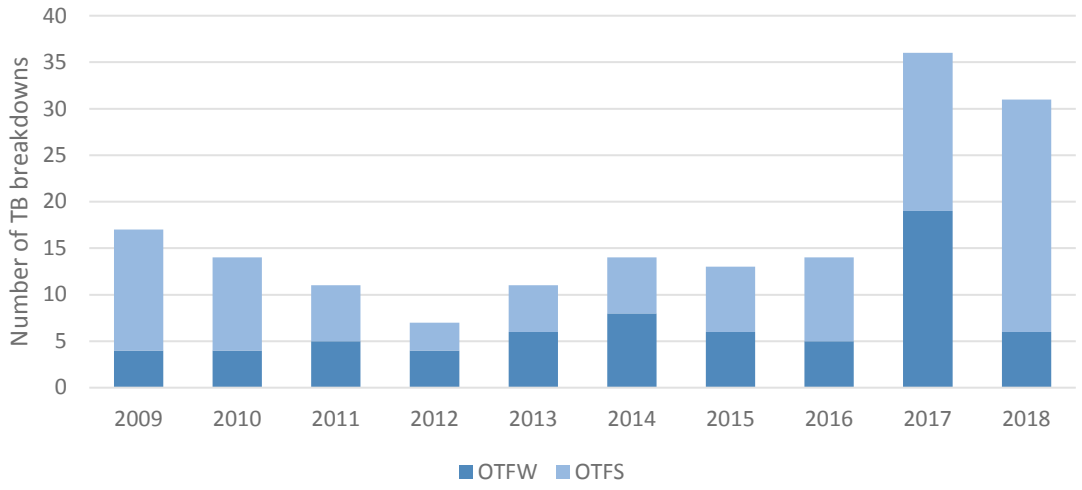


Figure 3: Annual number of new TB breakdowns in Buckinghamshire, 2009-2018

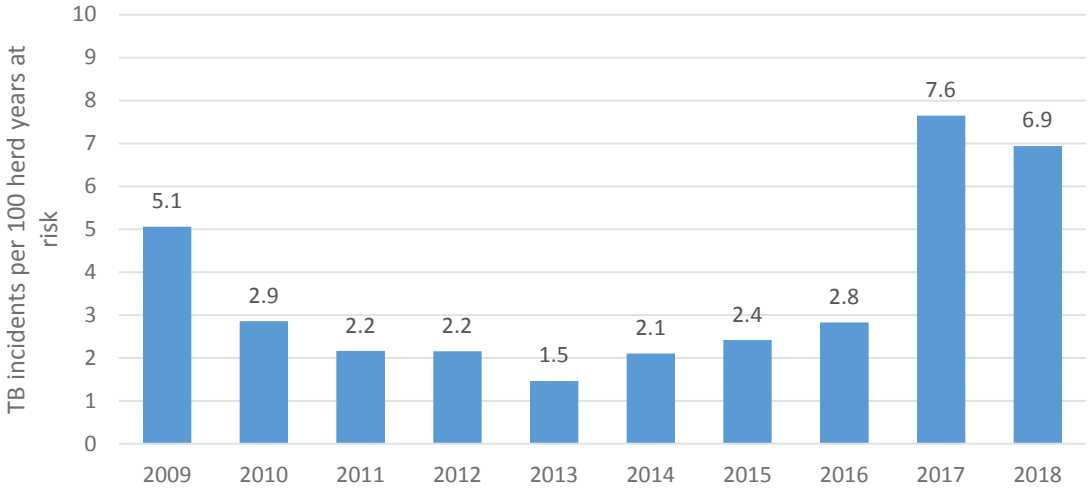


Figure 4: Annual incidence rate (per 100 herd-years at risk) for all new breakdowns (OTFW and OTFS) in Buckinghamshire, 2009-2018.

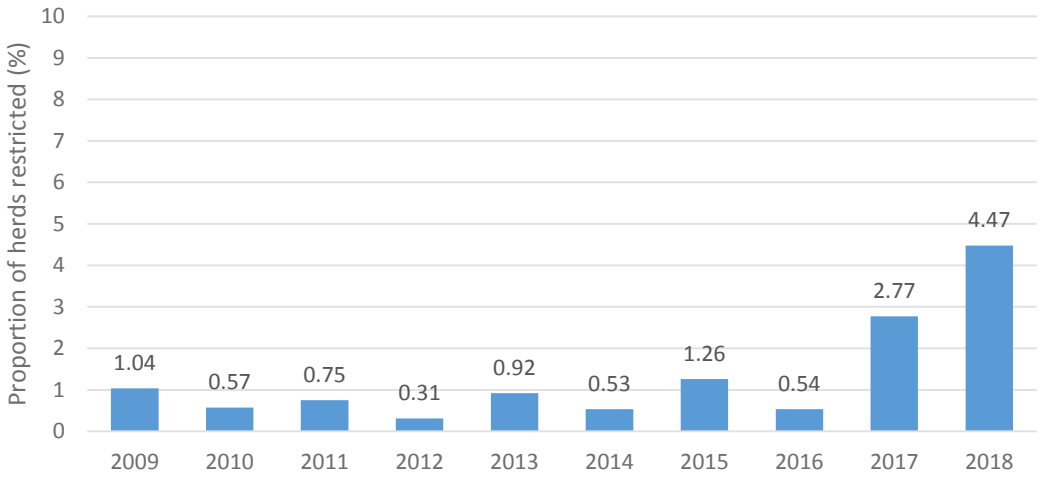


Figure 5: Annual end of year prevalence of restricted herds in Buckinghamshire, 2009-2018.

Geographical distribution of bovine TB cases (new and ongoing) in Buckinghamshire

A significant number of TB breakdowns were in north west Buckinghamshire where there is the highest density of both cattle and cattle holdings (Figure 6). The geographical distribution of cases is similar to 2017 but the total number of new TB breakdown incidents reduced from 36 to 31. Between 2017 and 2018 the number of OTFW TB incidents decreased from 19 to 6 and the number of OTFS cases increased from 18 to 25.

There were no confirmed non-bovine TB cases in domestic animals or wildlife during 2018.

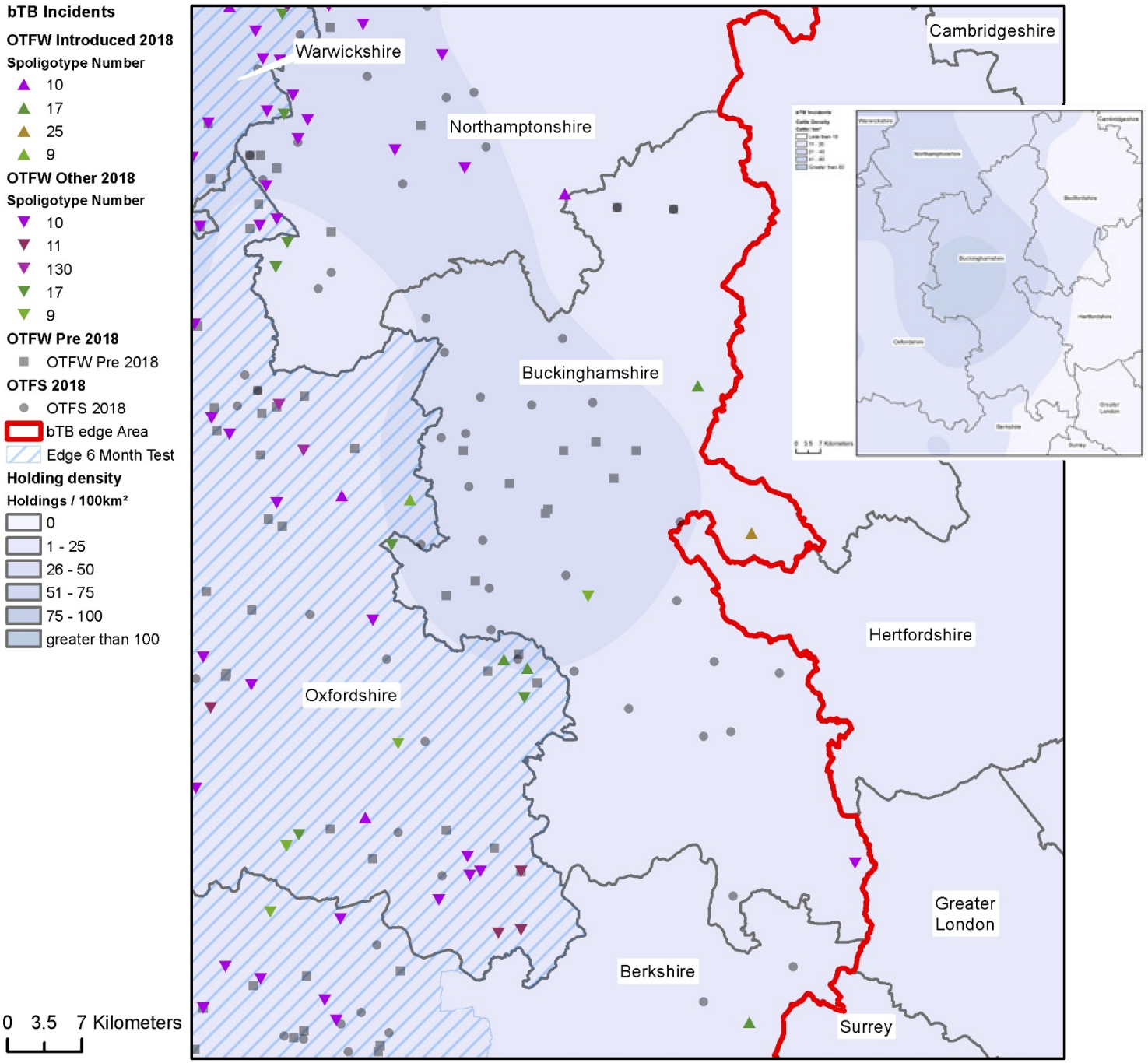


Figure 6: Geographical distribution of all new TB breakdowns (OTFW and OTFS) in 2018 and pre 2018 OTFW breakdowns still ongoing at the end of the report period overlaid on a cattle holding density map, with a cattle density map for the area inset

During 2018 no genotypes were detected in Buckinghamshire where a wildlife source was attributed, with high certainty, to an OTFW breakdown (Figure 7). The nearest endemic genotypes of possible significance are 10:a (Oxfordshire and Northamptonshire) and 17:g (Oxfordshire). Spread of endemic TB from the west must be prevented in order to reach OTF status.

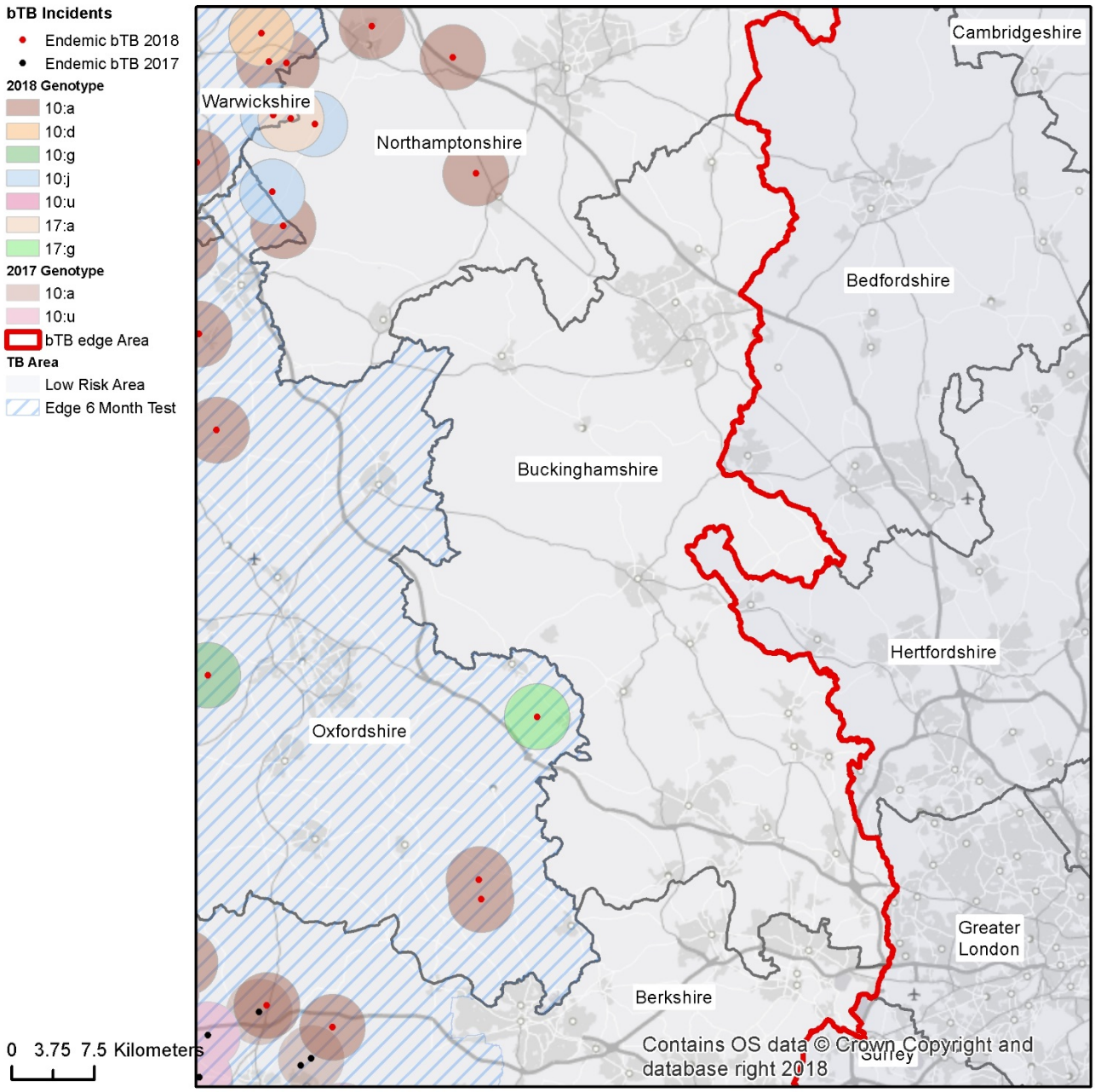


Figure 7: Genotypes detected in Buckinghamshire where a wildlife source was attributed with a 75% certainty or above, as an indication of endemicity within local wildlife populations (OTFW breakdowns only).

As in previous years, the purchase of undisclosed infected cattle remains the highest driver for the spread of bTB within Buckinghamshire (Figure 8). Local cattle (residual and contiguous) and wildlife were recorded as a potential sources of infection in around 20% of new cases, but the links were weak and the level of certainty was low. There was no evidence of endemic infection in badgers or other wildlife in Buckinghamshire from the 2018 breakdown data.

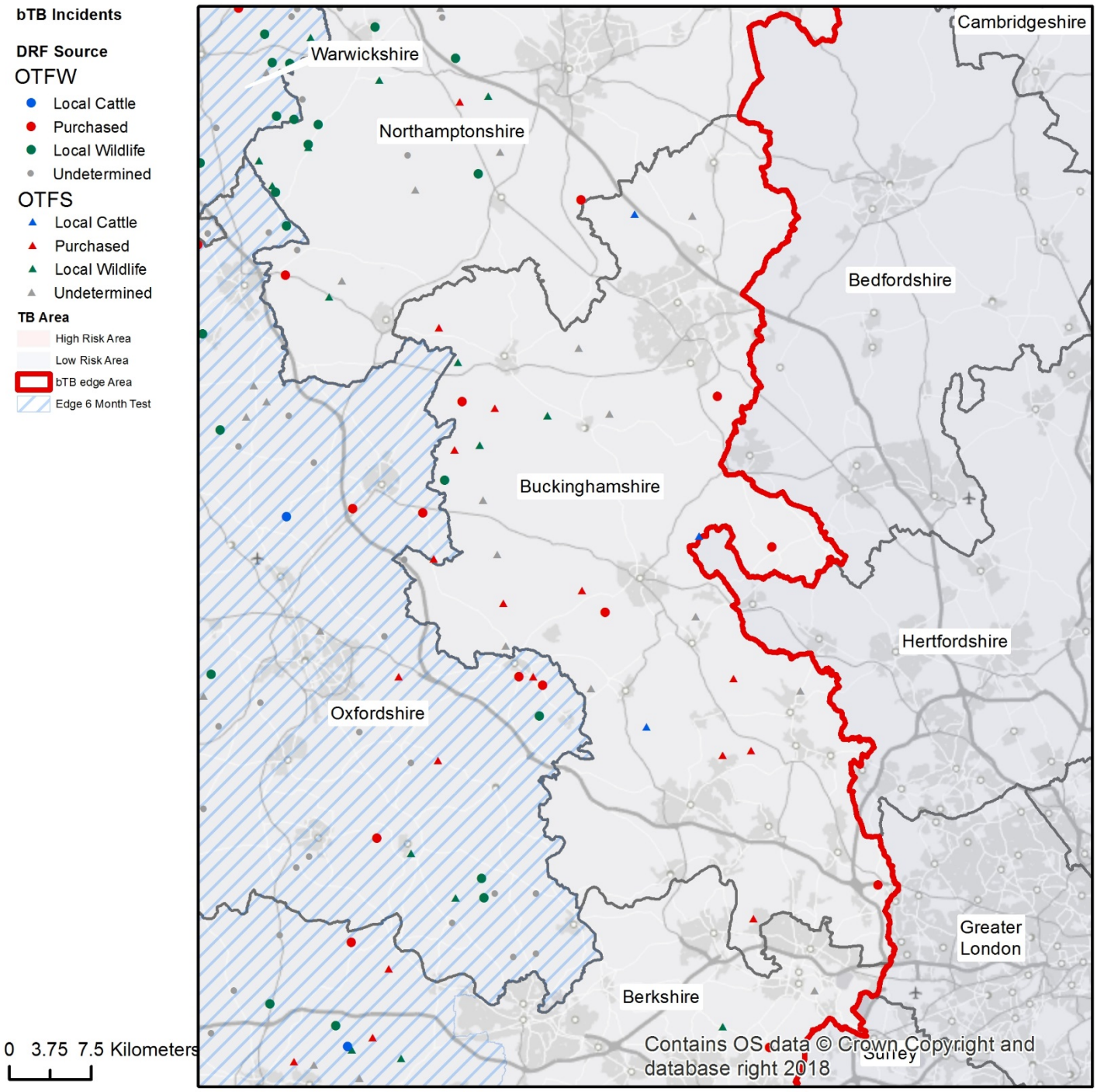


Figure 8: The source of infection recorded with the highest level of certainty, for all TB breakdowns (OTFW and OTFS) that started in 2018

Descriptive epidemiology of bovine TB in Buckinghamshire

Characteristics of bovine TB in Buckinghamshire

Out of the six OTFW breakdowns, four were on beef suckler units, one on beef fattening units and one was on a dual dairy/beef suckler unit. The OTFS breakdowns occurred on both beef and dairy farms (Figure 9). Only three new breakdowns occurred on small farms (fewer than 50 cattle) with the remainder at a steady level across the medium and larger herd sizes (Figure 9).

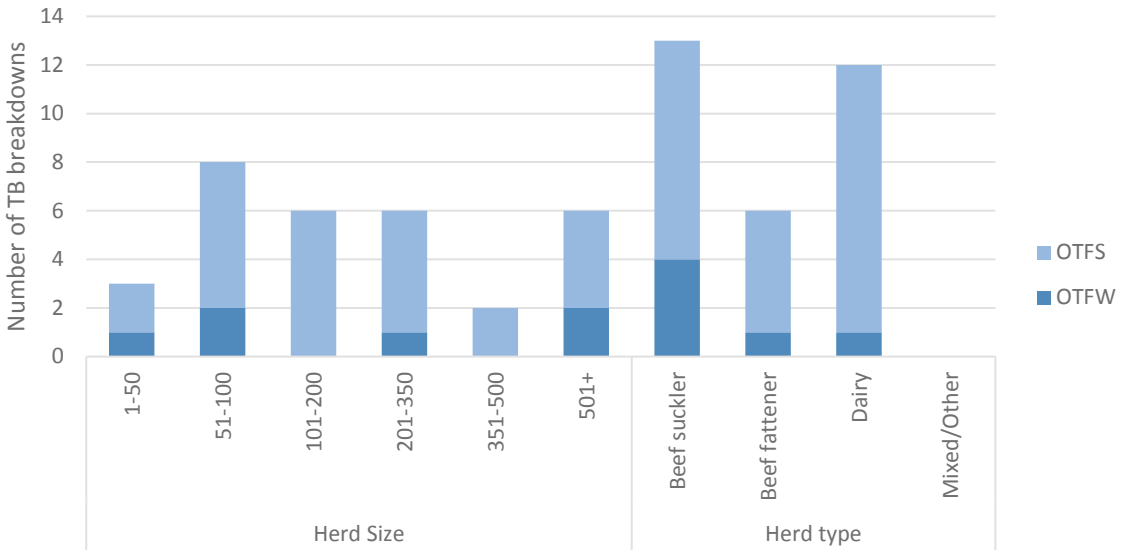


Figure 9: Number of new TB breakdowns (OTFW and OTFS) in Buckinghamshire, by cattle herd size and type.

Fewer breakdowns began during the summer months (Figure 10) which may be more a reflection of the higher rate of testing carried out in the winter rather than a seasonality resulting from exposure to infection at grazing.

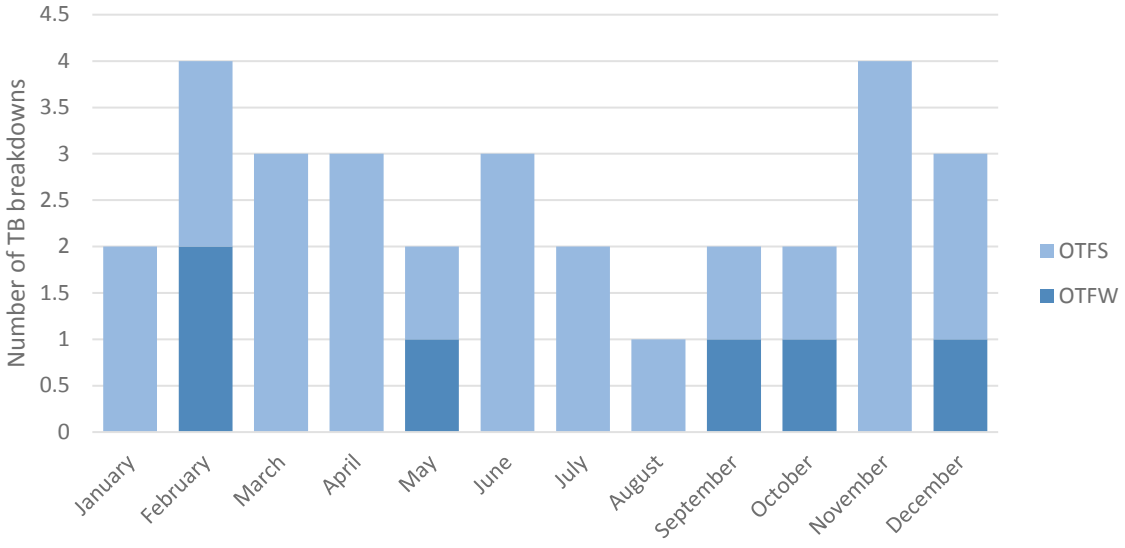


Figure 10: Number of new TB breakdowns (OTFW and OTFS) in Buckinghamshire, by month of disclosure.

Only three genotypes and one spoligotype were identified in the six OTFW cases in Buckinghamshire during 2018 (Figure 11) compared to the eight different genotypes that were identified in 2017. There was also no evidence of a continuation of the genotype 17:b cluster of cases, identified north of Aylesbury, during 2017.

The genotypes identified in 2018 were 10:6-5-5-203-3-3.1 (one case); 25:a (one case); 9:d (one case); and spoligotype 17 awaiting genotyping (one case). These cases are all attributable to the purchase of cattle with half associated with the purchase of cattle from the HRA and half to the purchase of cattle from the Edge Area.

Genotype information is not available for the other two OTFW cases as the culture was negative in both incidents. There is no clear origin in these two cases and residual infection, purchase of infected cattle and infected badgers are currently being considered as possible sources.

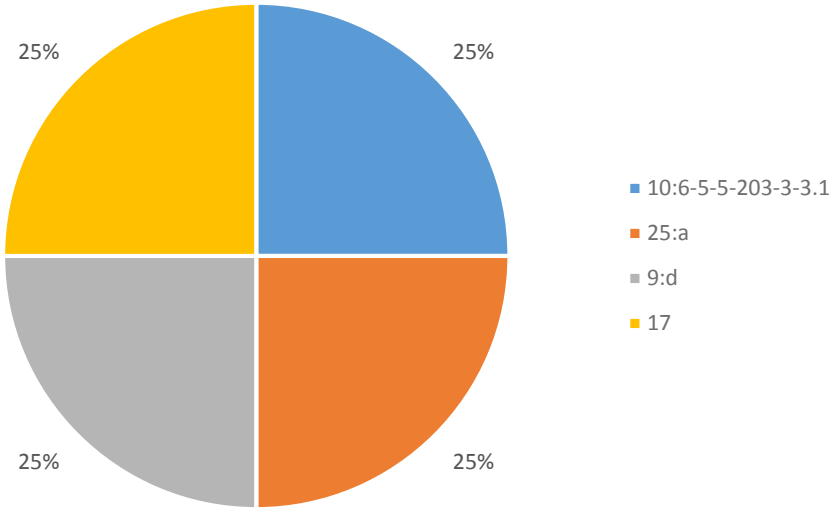


Figure 11: Genotypes and one spoligotype of *M. bovis* (OTFW only) identified in Buckinghamshire in 2018 (n=4).

Two thirds of breakdowns in Buckinghamshire in 2018 lasted between six and seven months (Figure 12). One breakdown became persistent (greater than 18 months duration) during 2018. This OTFW breakdown started in February 2017.

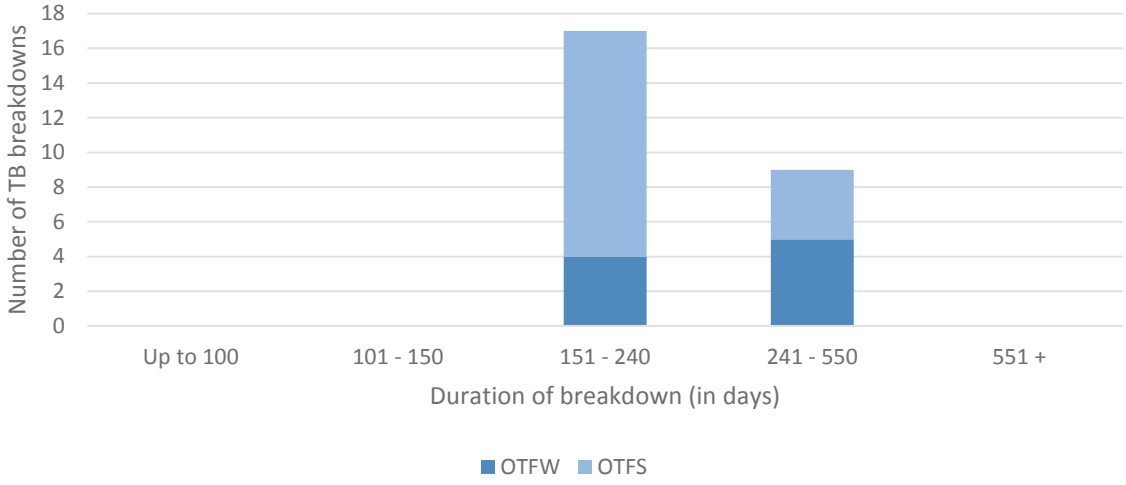


Figure 12: Duration of TB breakdowns (OTFW and OTFS) closed in Buckinghamshire in 2018.

Risk pathways for bovine TB infection in Buckinghamshire

Establishing the route of entry of infection into a herd experiencing a new TB incident can be challenging. The Animal and Plant Health Agency (APHA) aims to complete an epidemiological assessment of all TB incidents in the Edge Area (both OTFW and OTFS), including a thorough on-farm investigation. However where resource constraints exist, as many new incidents as possible are randomly selected or triaged for an investigation visit. Scrutiny of routinely collected data such as cattle

movements and *M. bovis* genotypes (available for OTFW incidents only), combined with data from the on-farm investigation and knowledge of the local area epidemiological situation provides information which enables APHA case vets to assess and then rank the possible disease pathways.

A mathematical algorithm based on risk pathway data was used for the 2018 period to determine the relative contribution of different sources for each breakdown herd. However, this methodology also included those incidents where certainty about risk pathways was lower because of gaps in the epidemiological evidence. The effect of uncertainty has been increased by the inclusion of OTFS herds, where by definition, no genotype was determined. Therefore the relative proportions of each risk pathway are very approximate, and broad generalisations only can be made from these data.

A more detailed description of this methodology is provided in the Explanatory Supplement.

Out of the six confirmed (OTFW) TB cases in 2018, all were sporadic 'one-off' breakdowns with no previous infection history in the herds. Out of those, of the four which have genotype or spoligotype available, all were due to the introduction of TB through the purchase of cattle with undisclosed infection from the HRA and Edge Area (Appendix 4). In the remaining two OTFW incidents, it was possible that TB infection was introduced through the purchase of cattle but the level of uncertainty with this risk pathway was high and the possibility of indigenous infection (through wildlife or residual infection) could not be excluded (Figure 13).

Risk pathways for OTFS breakdowns are more difficult to attribute when there is not a clear link to the purchase of infected cattle. Some residual infection may explain these breakdowns but in many of these incidents the origin remains unknown. Infected badgers remain as a potential source for farms close to the borders of Oxfordshire or those contiguous to the 2017 Aylesbury cluster of 17:b but there was no evidence from the 2018 data alone to suggest endemic infection in badgers is present.

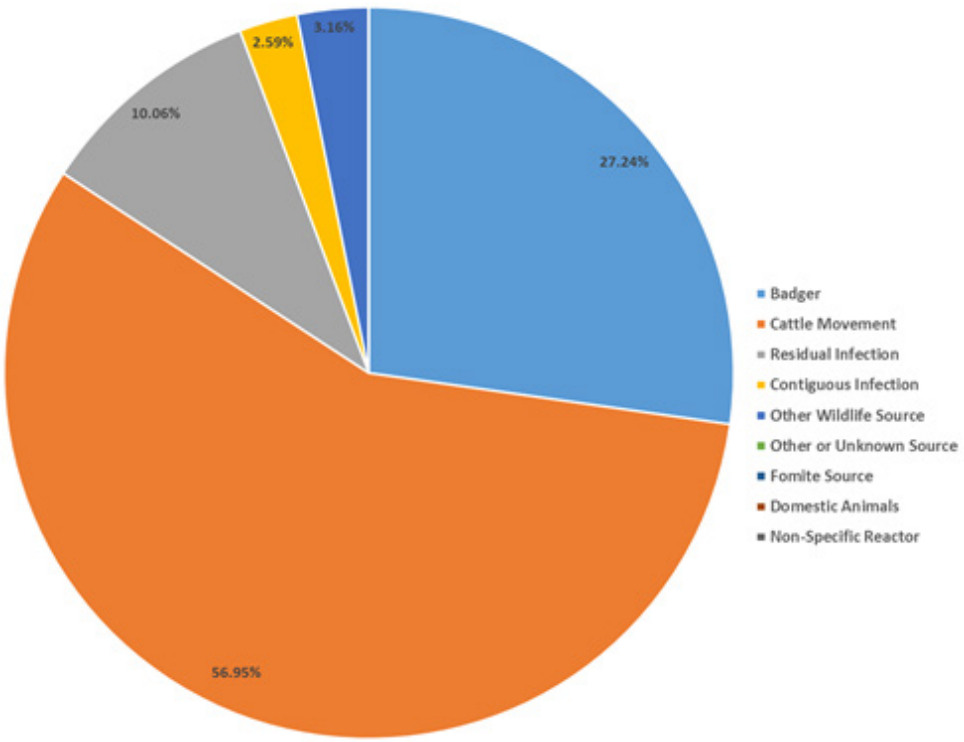


Figure 13: Summary of the weighted source of infection attributed for all incidents (both OTFW and OTFS) in Buckinghamshire that started in 2018

Out of the 2018 OTFS and OTFW breakdowns that could determine a source of infection with the highest level of certainty, 100% of those on beef units (fattener and suckler) recorded the movements of infected cattle as the most likely source (Figure 14a). Beef fattener units were three times more likely

to have a ‘purchased’ breakdown than a suckler unit, which reflects the nature of the enterprise in which large numbers of cattle are required to be purchased in order to maintain the business. Dairy units had less obvious sources of TB infection with wildlife and purchased cattle being considered.

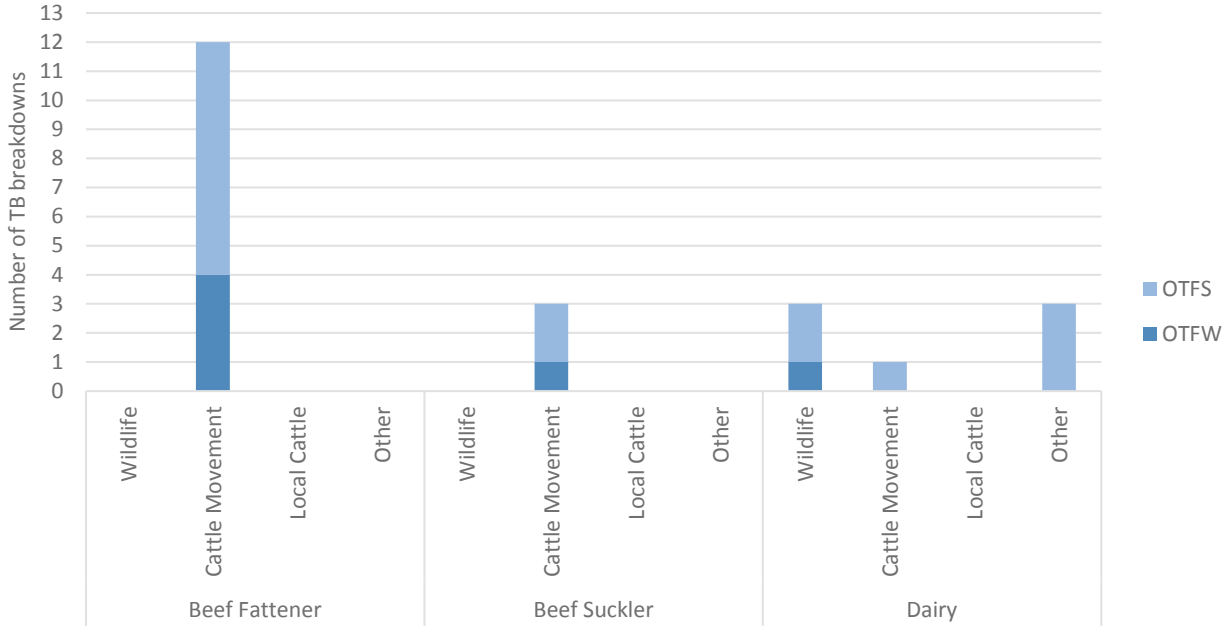


Figure 14a: Source of infection recorded with the highest level of certainty for all TB breakdowns (both OTFW and OTFS) in Buckinghamshire, by herd type.

Role of other species in Buckinghamshire

Badgers and other wildlife

There was no evidence in 2018 for endemic TB infection in wildlife in Buckinghamshire. The nearest endemic area was an area of genotype 10:a infection thought to be present in the neighbouring county of Oxfordshire (Figure 14b). There was no evidence of endemic infection moving from the border with Oxfordshire although this is something which needs to be monitored.

In 2017, a cluster of five confirmed cases (Figure 14b) with genotype 17:b located north of Aylesbury suggested the onset of a possible area of endemic wildlife infection in the county. There is no evidence that this potential endemic area has continued or expanded during 2018. Out of the four OTFW incidents in the county with known spoligotypes in 2018, only one had a spoligotype of 17 (with a genotype still pending). This farm is around 15 kilometres, from the nearest of the five genotype 17:b cluster breakdowns in 2017 suggesting that there is unlikely to be a wildlife link between the two. Out of the five 2017 genotype 17:b cluster incidents, three were closed within 12 months, one was depopulated and one has become a persistent TB breakdown and is still undergoing breakdown testing at the time of writing.

Whole genome sequences (WGS) were obtained for four out of the five in the 2017 genotype 17:b cluster. Three of these were identical and the fourth was only one SNP (single nucleotide polymorphism) different. Although two farms were connected by cattle movements, the WGS data suggested that the others appeared to have shared a common source not related to cattle movements. APHA will continue to monitor this area for further breakdowns that are genetically related which could point to potential infected wildlife sources in the area.

Results from the Defra-funded ‘found dead’ badger survey carried out during 2016/17 have not been published at the time of writing.

There are currently no licensed badger vaccination areas in Buckinghamshire.

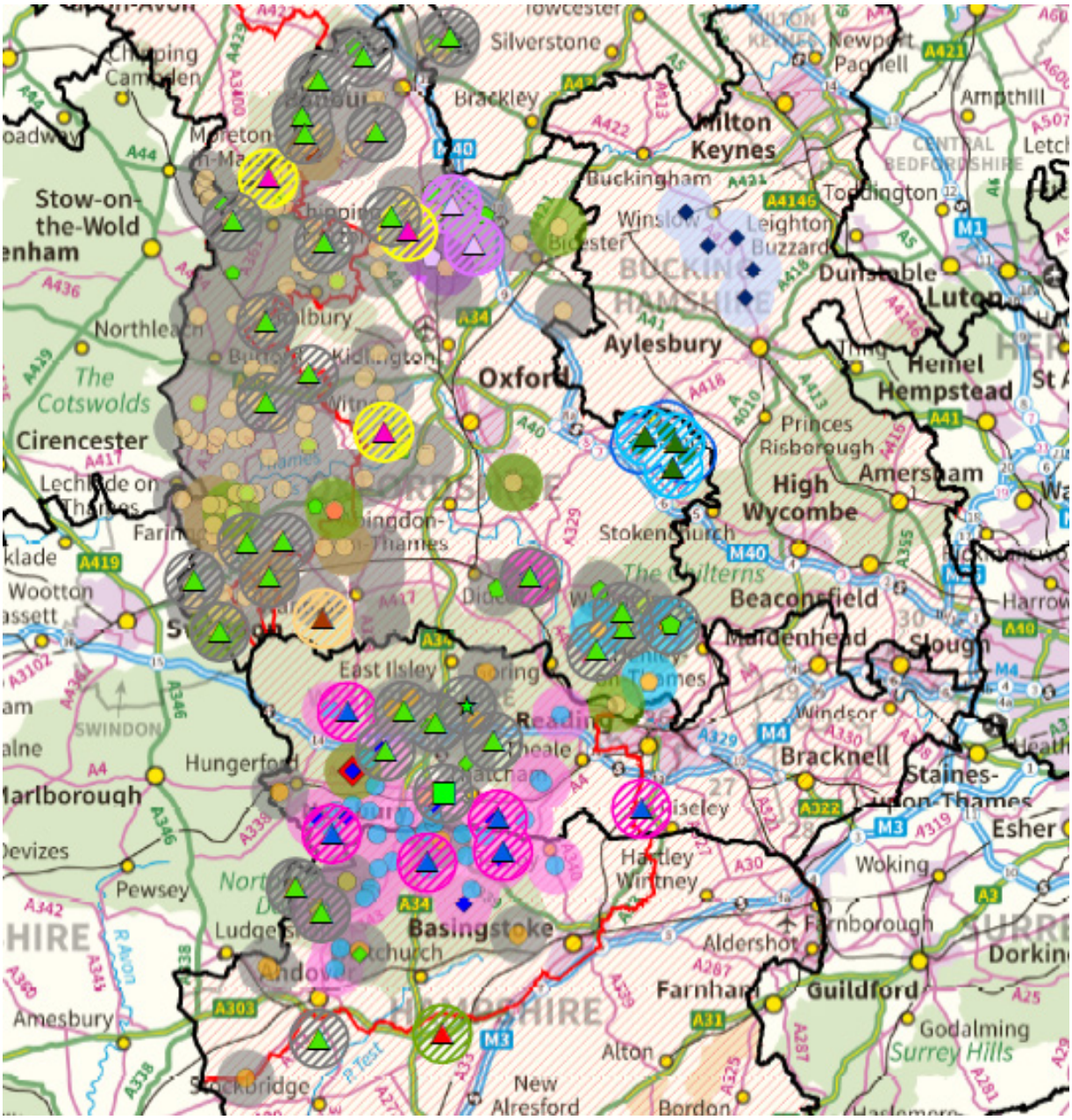
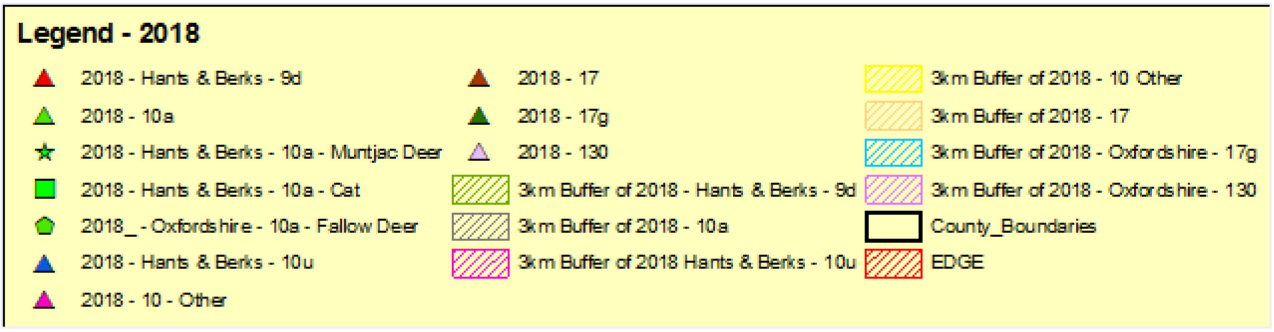


Figure 14b (legend below): Overview map showing presumptive endemic infection areas in Oxfordshire, Berkshire, Hampshire and Warwickshire to illustrate proximity to Buckinghamshire.

Note – cluster of blue diamonds with light-blue circles in north Bucks represents 2017 cluster of 17:b - of uncertain origin but maybe wildlife connected. Grey circles (including those hatched representing 2018 cases) represent 10:a, pink - 10:u, light blue - 17:g, yellow – genotypes related to 10:a.



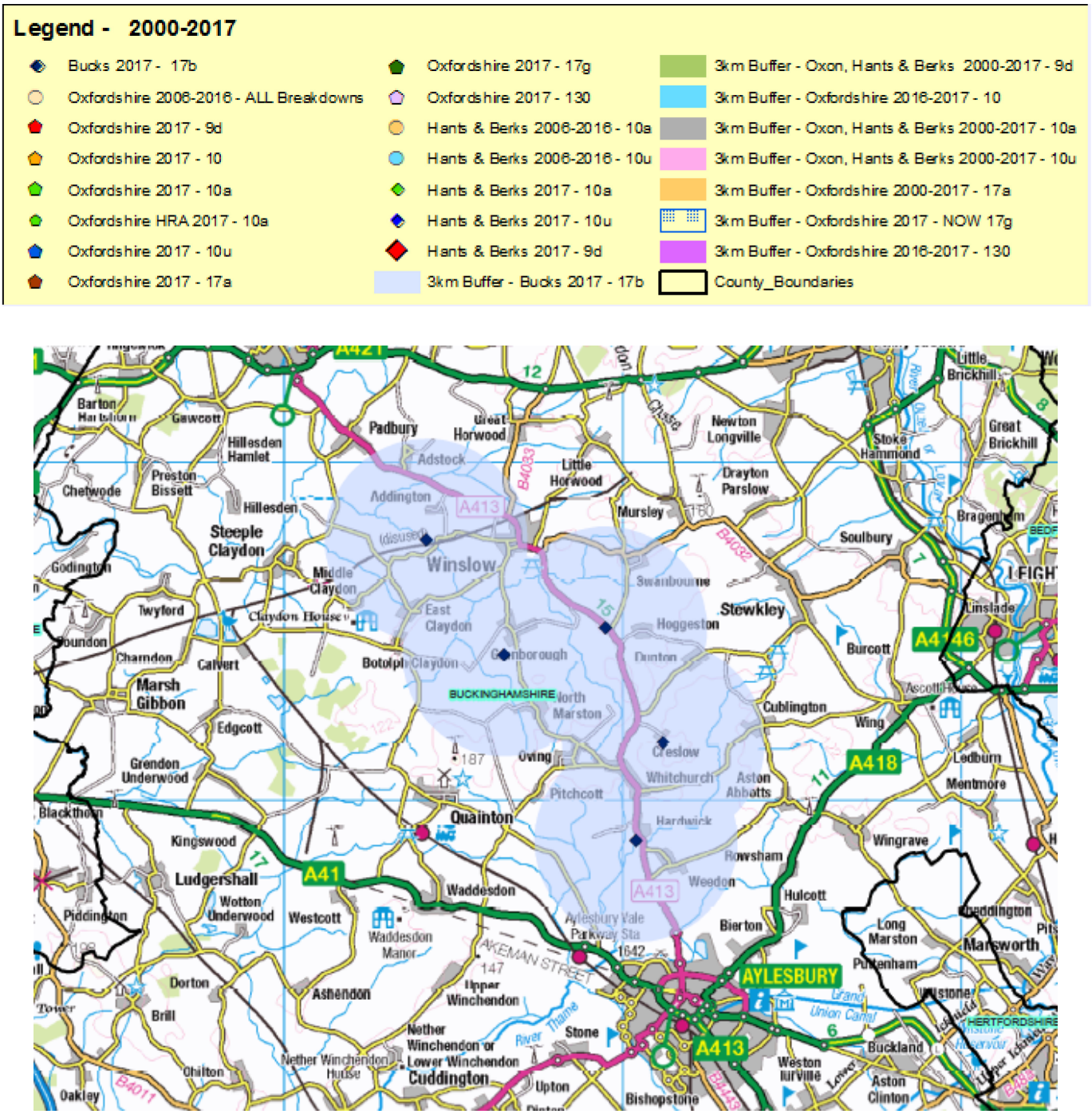


Figure 14c: In detail: 2017 cluster of 17:b genotype breakdowns (blue diamonds) with 3km radial zones (light blue)

Other domestic species

There was no evidence of TB (*M. bovis)* in any other animal species in Buckinghamshire during 2018.

Detection of cases in Buckinghamshire

A large portion (61%) of cases were detected at the annual whole herd test (Figure 15). This is a similar pattern to 2017. Only four cases were disclosed at the 6 or 12 month check test post-breakdown, suggesting that TB infection was cleared effectively from most herds by statutory short interval testing. One case was disclosed at a slaughterhouse, from an Approved Finishing Unit (AFU). Such units are exempt from routine skin testing because all cattle go direct to slaughter and strict biosecurity measures are in place to prevent infection of cattle and other susceptible species outside the unit.

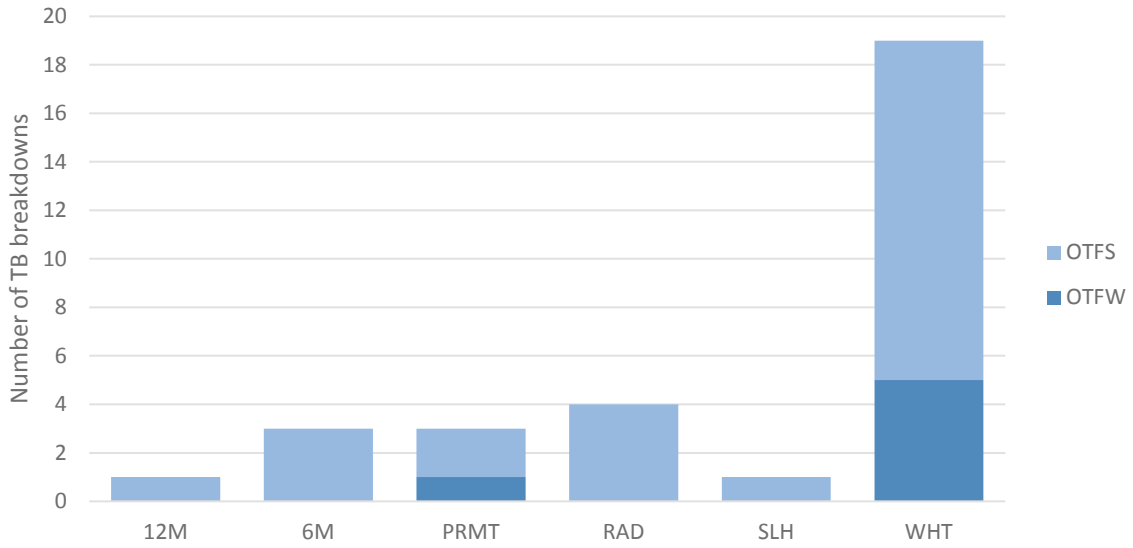


Figure 15: Number of TB breakdowns (OTFW and OTFS) in Buckinghamshire in 2018, disclosed by different surveillance methods (surveillance method types are further described in the Explantory Supplement[1]).
(Note that the one OTFS SLH case which was culture negative, disclosed a non-visible lesion reactor at the check test – hence inclusion as a breakdown).

None of the six OTFW incidents disclosed in 2018 had experienced a TB breakdown within the previous three years, suggesting that these are not recurrent cases (Figure 16). However, one-third (eight) of the OTFS breakdown farms had experienced an incident in the previous three years, six of which were previously OTFS. This finding is attributed to either a recurrent infection in the herd or, more likely, the continued purchase of cattle from higher risk areas.

It may be more likely for recurrence to occur on previous OTFS breakdown farms due to the fact that herds with an OTFS breakdown do not qualify for parallel interferon gamma testing. This test increases the likelihood of detection of infected cattle compared to skin testing alone.

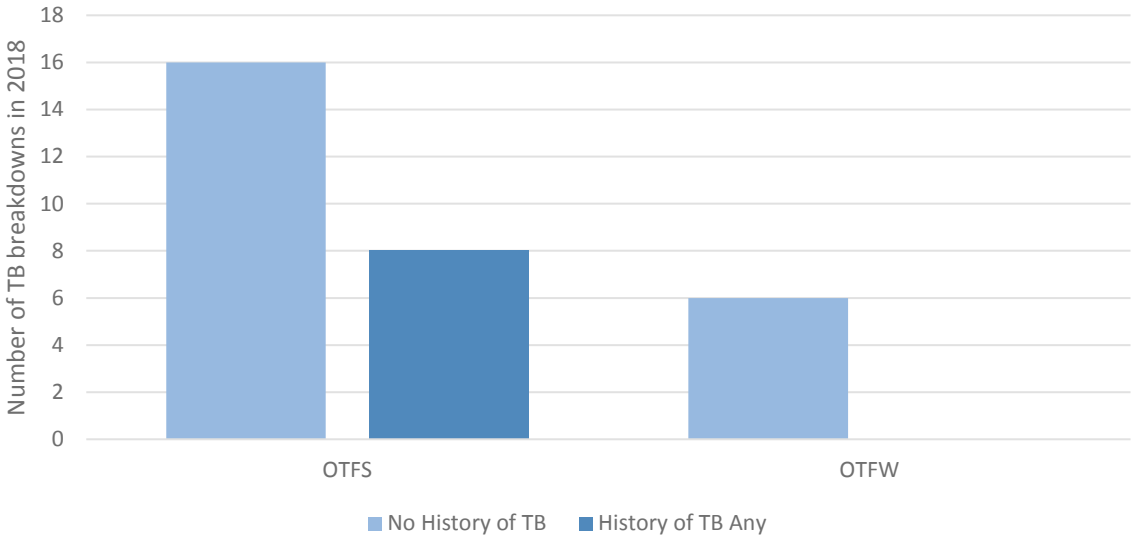


Figure 16: Number of TB breakdowns (OTFW and OTFS) in Buckinghamshire which experienced a breakdown in the previous 3 years.

Burden of bovine TB

In total, 283 reactor cattle were detected during 2018 (Appendix 3), of which 92 were detected by the skin test and 191 by interferon gamma (Figure 17). This is an increase of 63 reactor cattle from 2017 despite the total number of TB breakdowns decreasing from 36 in 2017 to 31 in 2018. This resulted in an increase in the average number of reactors per breakdown from six to nine between 2017 and 2018. However, it should be noted that the average number of reactors per breakdown was increased by reactors taken in 2018 from breakdowns ongoing from the previous year. The proportion of skin (around 30%) to interferon gamma (around 70%) test reactors remained similar to 2017.

One persistent TB breakdown was present in Buckinghamshire throughout 2018, with infection having first been detected in February 2017. This incident disclosed 74 reactors throughout 2018, of which 70 were interferon gamma reactors and four skin test reactors. This was a quarter of the total number of reactors in the county in 2018 and was a big contributor to the increase in average number of reactors per breakdown in Buckinghamshire in 2018 compared to 2017. The breakdown was one of the five making up the previously discussed genotype 17:b cluster that was noted in 2017.

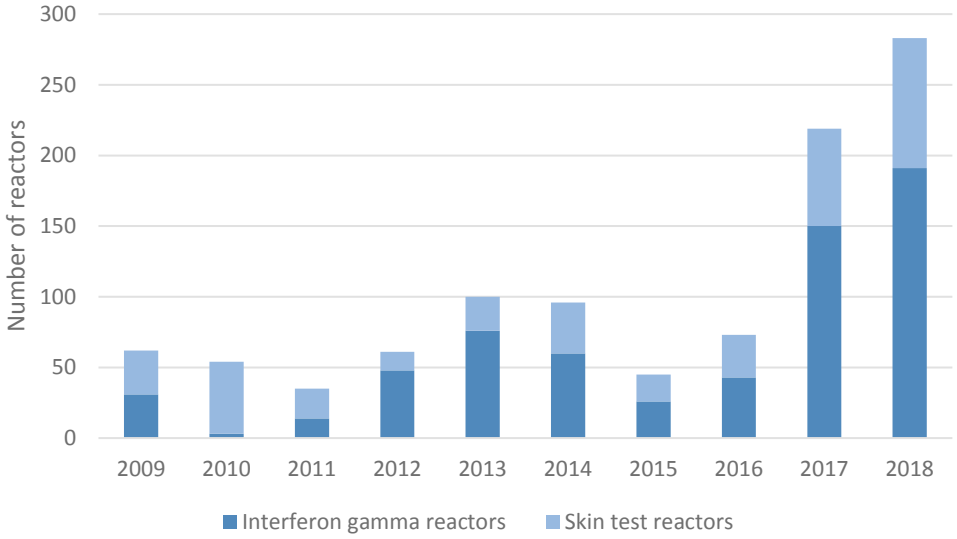


Figure 17: Number of reactors detected by interferon gamma and skin tests in Buckinghamshire, 2014 to 2018

The current TB control policy requires the imposition of cattle movement restrictions on the affected farm for a minimum of four months following the identification of a reactor on the farm (two clear short interval tests with 60 days between each test). Two thirds of breakdowns in Buckinghamshire in 2018 lasted between 6-7 months. TB control measures can be a significant burden for farmers, particularly those whose business model relies on the movement of cattle between farms.

TB surveillance testing can be logistically challenging for farmers. This is particularly true in large herds of beef cattle where animals are often not accustomed to being handled and which, particularly during the summer months, may be located on parcels of land away from the home farm.

Key drivers of the bovine TB epidemic

Purchase of cattle with undetected infection remained the single highest driver of the TB epidemic in Buckinghamshire and was likely responsible for well over half of the 31 breakdowns in 2018. As in 2017, the purchased cattle came in similar proportions from both the HRA and Edge Areas (markets, dealers and direct from farms). A complete genotype or spoligotype, available for four of the six

OTFW incidents, enabled confirmation that the source farms were the origin of infection because of matching genotypes or spoligotype (two from the Edge Area and two from the HRA).

Buckinghamshire has a large beef finishing component in which farms are dependent on frequent purchases of cattle from both high cattle density and higher risk areas which results in the potential spread of TB from the west of the country. Moving these finishing cattle to non-grazing AFUs would reduce the risk considerably by preventing exposure of infected cattle to cattle on other farms and wildlife.

Just over a quarter of cases were attributed to infection through contact with potentially infected badgers. There is currently no proven reservoir of TB in wildlife in this county. However in incidents close to the Oxfordshire border and with weak links to purchased/residual infection, infected badger sources could not be ruled out.

Radial (RAD) testing was introduced in January 2018 which has resulted in OTFW breakdowns triggering a 3km radial testing zone around the breakdown premises. RAD testing disclosed four OTFS breakdowns during 2018.

County summary

The decrease in the incidence of TB in Buckinghamshire is encouraging and this trend must continue if the county is to achieve its target for OTF status. The increase in total number of reactors per breakdown and end of year prevalence of restricted herds is disappointing. However,as explained above, the former was influenced by ongoing breakdowns from 2017. Movement of cattle, from both the HRA and Edge Areas, into the county continues to be the most significant risk pathway for the introduction of TB.

There is no conclusive evidence of TB infection in wild animals (e.g. badgers) in the county although spread from the endemic county of Oxfordshire remains a threat. The exposure of wildlife to TB and subsequent development of a reservoir of infection must be avoided as it would significantly hinder TB control in the county. If this can avoided, along with measures to prevent continued introductions through the purchase of undisclosed TB infected cattle, there is a potential for Buckinghamshire to achieve OTF status by 2025.

Summary of the risk to the Low Risk Area (LRA) and any mitigating factors

Buckinghamshire is a buffer zone between the LRA and other Edge Area counties where endemic wildlife infection is believed to be present such as Oxfordshire. Despite infected badgers remaining as a considered source of TB infection in some Buckinghamshire breakdowns, there was no clear evidence in 2018 to suggest that endemic infection is present and therefore it may represent a low risk of TB to the LRA. However, the speed of movement of the presumptive wildlife infection front from the west of Oxfordshire to the eastern border with Buckinghamshire in about 15 years suggests a serious threat to the county and the LRA beyond it.

The highest density of cattle and cattle holdings are in the north and west of Buckinghamshire. This geographical separation reduces potential exposure from infected cattle to the LRA. Thame market, because of its location on the border between Buckinghamshire and Oxfordshire, predominantly trades in cattle between Edge Area counties, thereby mitigating the risk to the LRA.

Summary of the risk to the Edge Area from the High risk Area (HRA)

The local pool of animals into Thame market, as previously discussed, is made up of cattle mainly from Edge Area which includes the high incidence county of Oxfordshire.

A more significant risk comes from the movement of a TB 'infection front' from the HRA, since the early 2000's, into Oxfordshire which has continued moving eastwards and appears to have reached the border with Buckinghamshire. It is possible that this front has encroached into the county at points along the county line.

Summary of the risk to Buckinghamshire from the adjacent Edge Area counties

Buckinghamshire is bordered by three adjacent Edge Area counties: Northamptonshire, Oxfordshire and Berkshire. The knowledge that endemic TB is believed to be present in wildlife in Oxfordshire, along with Thame Market being on the border of Buckinghamshire, makes Oxfordshire the county which presents the main risk of TB spread into Buckinghamshire. However, there is no clear evidence from 2018 to suggest a spread of TB infection in wildlife from Oxfordshire to Buckinghamshire near the border, and TB breakdowns remain sporadic and mainly attributed to purchased cattle.

Assessment of effectiveness of controls and forward look

Despite the current controls, there is continued introduction of TB into the county through the purchase of cattle with undisclosed TB infection. There is no new evidence in 2018 to suggest the presence of a wildlife reservoir of infection in the county and the cluster of genotype 17:b incidents, north of Aylesbury, seen in 2017 has since resolved. Targeted active surveillance for TB infection in wildlife would be valuable to monitor the presence or absence of endemic infection in Buckinghamshire.

Based on the current trends for the measures of TB in cattle, the county is unlikely to achieve its target of <2% OTFW herd prevalence by 2019. The radial testing policy, which commenced in January 2018, should help to reduce the risk of lateral spread of TB and increase the likelihood of detection of areas of endemic infection should they emerge. If the trend for purchasing cattle with undisclosed TB infection can be overcome Buckinghamshire could be on track to achieve the target of <1% OTFW herd incidence by 2025. However, wildlife interventions will be required to stop movement of infection in wildlife from the adjacent county of Oxfordshire.

APPENDICES

Appendix 1: Overview of risk and surveillance areas of England and Edge Area objectives and controls

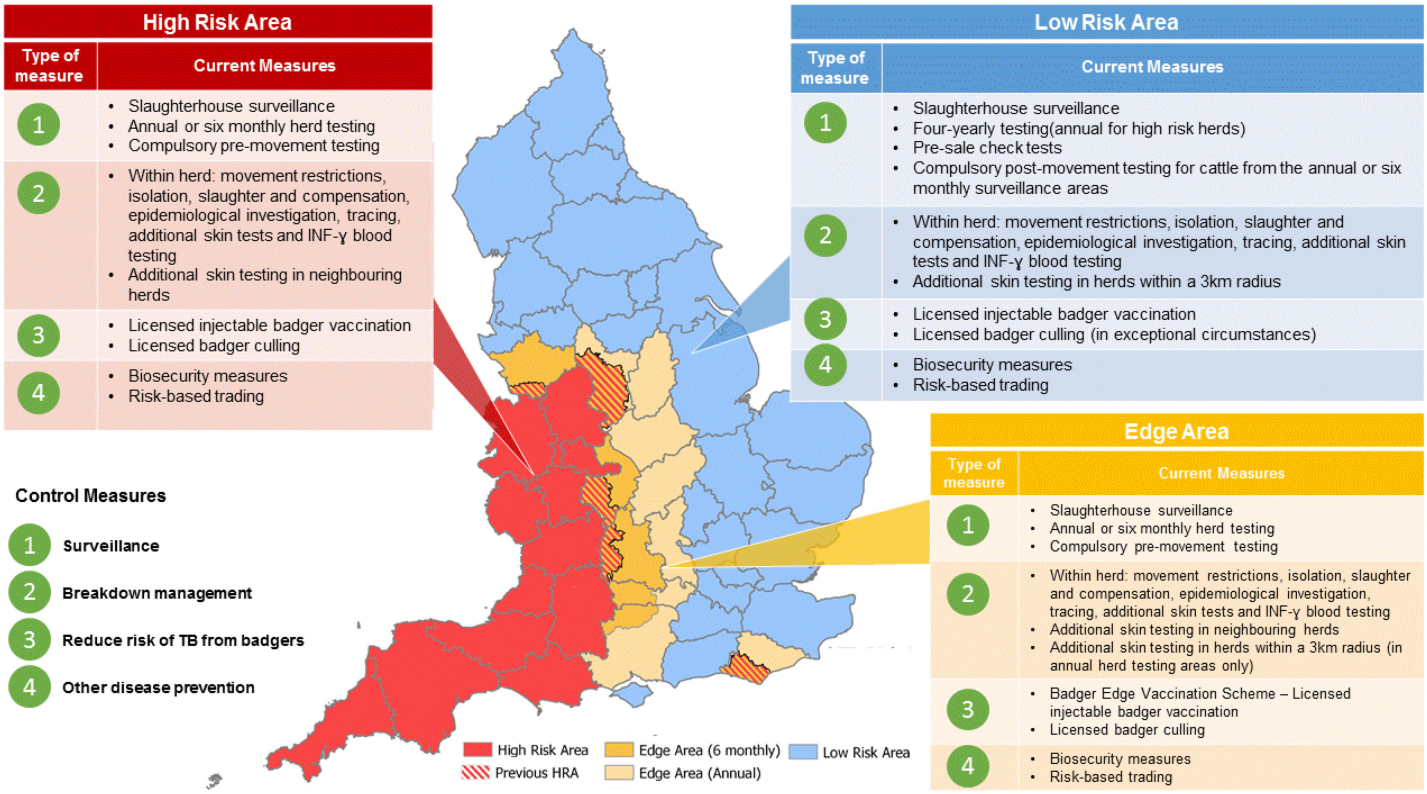


Figure A1: Bovine TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Tuberculosis-Free Status for England[2].

1.1 Policy objectives for the Edge Area:

Short to medium term:

- slow down geographic spread
- maintain crude herd incidence of OTFW breakdowns <2% overall by 2019
- begin to reduce the incidence rate

Longer term:

- reduce geographic spread of bTB and push the Edge Area boundaries westward
- reduce OTFW herd incidence to <1% by 2025
- attain OTF status (crude incidence of indigenous OTFW herd breakdowns <0.1%) for the lowest incidence counties in the Edge Area.

1.2 Key Control Measures

Surveillance:

- six monthly or annual routine herd testing
- additional targeted surveillance of cattle herds located within a 3km radius of new OTFW breakdowns in annual testing sections of the Edge Area (radial testing)
- slaughterhouse surveillance

[2] http://www.tbhub.co.uk/wp-content/uploads/2017/09/infographic-TB-measures.pdf

Management of cases ('breakdowns'):

- increased sensitivity of breakdown herd testing:
  - all breakdown herds must pass two consecutive short interval skin tests at severe interpretation to regain OTF status, irrespective of post-mortem and bacteriological findings
  - mandatory IFN-gamma parallel testing of herds with OTFW breakdowns
  - enhanced management of herds with persistent breakdowns
- enhanced epidemiological investigation and data analysis
- information sharing - location of breakdown herds publicly available (via ibTB interactive mapping tool)[3]

TB controls in the wildlife reservoir (badgers):

- licensed badger culling in high incidence sections of the Edge Area
- Government grants for licensed voluntary badger vaccination projects using injectable badger BCG (Badger Edge Vaccination Scheme - BEVS)

Other measures:

- compulsory pre-movement skin testing of cattle moved between herds
- promotion of herd biosecurity measures to reduce the risk of new breakdowns

[3] ibTB interactive mapping tool - https://ibtb.co.uk/

Appendix 2: Cattle industry in the Edge Area of the region

Number of cattle premises by size band in the Edge Area of the region at 1 January 2018

(RADAR data)

Cattle per premises	1-50	51-100	101-200	201-350	351-500	501+	All	Mean	Median
Number of premises	205	82	77	48	18	22	454	124.9449	58.5

Finishing units registered in Buckinghamshire:

	Grazing	Non-grazing
Number of Approved Finishing Units (AFUs)	0	6
Number of Pre-movement Testing Exempt Finishing Units (EFUs)	0	0

Common land in the Buckinghamshire: No common land.

Cattle/herd purpose:

	Beef		Dairy		Dual purpose		Unknown		Total
	Number	%	Number	%	Number	%	Number	%	Number
Cattle	44041	77.6	11487	20.3	1195	2.1	2	0.0	56725
Holdings	426		135		114		2		

Appendix 3: Summary of the Buckinghamshire headline cattle TB statistics

Herd-level statistics	**2016**	**2017**	**2018**
Total number of cattle herds live on Sam at the end of the reporting period	565	546	519
Total number of herd tests carried out in the period	516	530	563
Total number of OTF cattle herds TB tested during the period for any reason	469	451	425
Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB02 restrictions)	543	523	479
Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.	559	528	496
Total number of new TB breakdowns detected in cattle herds during the report period	14	36	31
OTF status suspended (OTFS)	9	17	25
OTF status withdrawn (OTFW)	5	19	6
Of the OTFW herd breakdowns:			
How many can be considered the result of movement, purchase or contact from/with an existing breakdown based on current evidence?	3	16.5	4
New OTFW breakdowns triggered by skin test reactors or 2xIRs at routine herd tests	2	15	6
New OTFW breakdowns triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)	2	3	0
New OTFW breakdowns first detected through routine slaughterhouse TB surveillance	1	2	0
Number of new breakdowns revealed by enhanced TB surveillance (radial testing) conducted around those OTFW herds (may not be applicable to every county in the Edge Area)			
OTFS	n/a	n/a	4
OTFW	n/a	n/a	0
Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)	2	9	6
New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	1	0	0

Animal-level statistics (cattle)	**2016**	**2017**	**2018**
Total number of cattle tested in the period (animal tests)	75827	82055	87470
Reactors detected:			
tuberculin skin test	30	69	92
additional IFN-gamma blood test reactors (skin-test negative or IR animals)	43	150	191
Reactors per breakdown	5.2	6.1	9.1
Reactors per 1000 animal tests	1.0	2.7	3.2
Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)	4	2	1
Private slaughters	3	4	9
SLH cases (tuberculous carcases) reported by FSA	8	4	7
SLH cases confirmed by culture of *M. bovis*	1	2	0

Appendix 4: Suspected sources of M. bovis infection for all the new OTFW and OTFS breakdowns identified in the report

Source of infection	Possible (1)	Likely (2)	Most likely (4)	Definite (8)	Weighted contribution
Badgers	20	2	0	0	27.2%
Cattle movement (e.g. purchase) of infected animal(s)	19	12	4	0	57.0%
Local contiguous infection - lateral spread from neighbouring holdings	2	0	0	0	2.6%
Exposure to infected wildlife	3	0	0	0	3.2%
Exposure to other farmed species	0	0	0	0	0
Residual infection from a previous TB breakdown	3	3	0	0	10.1%
Infected human source	0	0	0	0	0
Fomite source	0	0	0	0	0
Domestic animals	0	0	0	0	0
Undetermined/obscure	0	0	0	0	0
Other (explain)	0	0	0	0	0

Appendix 5: Overview of the TB Control Programme in Buckinghamshire

Summary of TB control measures specific to Buckinghamshire:

5.1 Edge Testing Policy

- Annual whole herd surveillance testing (no change from previous year).
- A new radial testing policy commenced on 1st January 2018. This provides additional targeted surveillance of cattle herds located within a 3km radius of new OTFW breakdowns.

5.2 Unusual TB breakdowns

- None

5.3 Other Testing Measures

- The number of overdue tests in the county continues to be very low. Enforcement is achieved in association with the county local authority, police and local contractors.

5.4 Other Control Measures

- The Berkshire, Buckinghamshire and Oxfordshire TB eradication group has continued to meet and discuss TB eradication initiatives.