



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

Delivery Area: Northern

Name of County: Northamptonshire

Year-end report for: 2018

TB Edge Area - NORTHAMPTONSHIRE



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Note: this report was republished in June 2020 with a data correction on p17, Figure 13: Summary of the weighted source of infection attributed for all incidents only.

Executive Summary

1. The Edge Area has a low but recently rising incidence of infected herds. **Northamptonshire** 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 Northamptonshire in 2018.
2. **Local cattle industry.** Beef herds predominate (65%) with the majority being small beef suckler herds followed by lower in number but larger in size fattening units. Herds of up to 50 cattle represent nearly half (48%) of the total. There is one livestock auction market (Thrapston Market) but substantial trade of cattle occurs through Rugby Market in Warwickshire and Thame Market in Oxfordshire.
3. **New breakdowns of TB.** In comparison with 2017, the number of breakdowns in 2018 increased by four, from 25 to 29. The number of Officially Bovine Tuberculosis Free Status Suspended (OTFS) breakdowns (where lesions at post-mortem or *M. bovis* in tissue samples have not been identified) rose by three (from 12 to 15) and the number of OTFW breakdowns (in which at least one animal had typical lesions of TB at post-mortem and/or *M. bovis* positive culture results) increased by one (from 13 to 14, plus one incident in an Approved Finishing Unit (AFU)). OTFW breakdowns were detected consistently throughout 2018, whereas in 2017 more than half of the OTFW cases (54%) were disclosed in the last quarter of the year. For comparison, in 2016 all OTFW breakdowns were detected within the first six months of the year.

The occurrence of cases in 2018 follows the same general pattern as in the equivalent periods in 2016 and 2017. The majority of breakdowns were again distributed in the areas with generally higher cattle and holding density in the western half of the county. Areas of endemic infection continue to be suspected along the border with Warwickshire. The cluster of OTFW breakdowns which formed during 2016 in Daventry parish, where the infection source of the majority of those breakdowns was attributed to wildlife, remained and expanded in 2017 and continued in 2018. These incidents were believed to be due to infection spread from east Warwickshire and north Oxfordshire possibly initially via both infected cattle movement and infected wildlife. However, it appears that holdings affected previously in Northamptonshire have managed to sustain and expand this spread by seeding infection and affecting wildlife in the locality. This now seems to be the key driver of the TB epidemic in the county.

4. **Risk pathways for TB infection.** Infected badgers were considered the most likely source of infection for 63% of the new breakdowns in the reporting period. Wild deer were the suspected source in 2.5% of the breakdowns. Infected cattle movements were deemed responsible for 32% of the breakdowns with the majority of them being OTFW. In 2% of the breakdowns the risk pathway remained unknown. Beef suckler herds had the highest number of breakdowns (n=18). Half this number (n=9) of the breakdowns occurred in fattening herds (with 4 out of these 9 having also part of the herd as suckler). Infected wildlife was deemed responsible for the majority of breakdowns among suckler herds. More than half of the breakdowns in beef finishing herds were due to infected cattle movement, which is consistent with this type of enterprise where usually store cattle are

purchased for fattening. Only two dairy herds experienced OTFS breakdowns, both attributed to wildlife. Wildlife source of infection has been implicated in all herd sizes.

5. **Role of other species.** There were no reports of laboratory confirmed *M. bovis* infection in other species. Previously anecdotal evidence of badgers acting as source of infection to cattle herds became more substantial. A Defra funded study into the prevalence of bTB in found-dead badgers in the northern counties of the Edge Area was conducted by the School of Veterinary Medicine and Science - University of Nottingham in 2016-2017. Results from this survey are still unpublished. The Daventry area had the highest number of cattle herd breakdowns, the majority of which were attributed to a wildlife source of infection. So far only one of the isolates has been spoligotyped (sp 17), which is different from the genotype usually found in this area (10:a). There is no systematic TB surveillance in place for wildlife, which could provide more reliable data regarding the incidence and prevalence of infection in badgers and other wildlife. There is anecdotal evidence of wild deer being seen on a weekly basis in cattle grazing fields in certain pockets around Daventry parish.
6. **Disclosing tests.** Over a third (n=11) of the breakdowns were disclosed at routine annual surveillance herd testing (WHT). The remaining breakdowns were disclosed by enhanced surveillance testing: radial testing (n=9), six months post breakdown test (n=2), twelve months post breakdown test (n=2), contiguous test (n=1) and a new herd check test (n=1). In 2018 there were 11 suspected slaughterhouse (SLH) cases reported by the Food Standards Agency (FSA) compared to 14 in 2017 and 5 in 2016. However, only three of the suspected cases in 2018 were confirmed by culture with one of them originating from an AFU and the other two triggering breakdown procedures. A third of the OTFS breakdowns and less than a quarter of the OTFW breakdowns began after an inconclusive reactor (IR) failed at re-test.
7. **Impact of TB and reactor numbers.** The total number of animals removed for TB control reasons in 2018 increased by 42 compared to 2017, when there was a substantial decrease in the number of interferon gamma test positive animals from the total detected in 2016 (see Appendix 3). The number of skin reactors removed over the last three years has remained relatively stable - 66, 66 and 63 for 2016, 2017 and 2018 respectively. The number of interferon gamma test positive animals has seen a significant fluctuation over the last three years with the highest number recorded for a decade in 2016 (119), which then dropped to 33 in 2017 and rose up again to 78 in 2018. The small number of interferon gamma test positives in 2017 was largely dependent on the time of disclosure of OTFW breakdowns in 2016. Overall, however, over the last two years the number of interferon gamma positives has been smaller, which implies that OTFW breakdowns are being detected earlier. There was an average of almost five reactors per breakdown in 2018, a slight increase from four in 2017. Still a significant improvement in comparison to 2016, when there were on average 10 reactors per breakdown. There were two reactors per 1000 animal tests in 2018 compared to 1.5 and 2.5 in 2017 and 2016 respectively (see Appendix 3).
8. **Risks to the Low Risk Area.** The risk of bovine TB spreading from Northamptonshire to the adjacent Low Risk Area (LRA), represented by Cambridgeshire and Bedfordshire, is currently low. Both of these counties have a low cattle and cattle herd density and border the parts of Northamptonshire where cattle density is the lowest too. Breakdowns in this eastern part of Northamptonshire are very rare and usually OTFS. No accurate estimate of TB suspected wildlife population is available for this area due to the lack of routine surveillance. There are no natural or man-made geographical features that could halt migration of potential wildlife reservoirs of TB. The only cattle market in Northamptonshire, Thrapston, is located close to Cambridgeshire and Bedfordshire and is likely to be used by LRA farmers. The risk of cattle bringing infection into the LRA counties is mitigated by the requirement for LRA holdings to conduct a post-movement test on

any animals moved from the Edge and High Risk areas. Thrapston market is not the predominant market used by Northamptonshire farmers.

9. **Risks from the High Risk Area and/or other adjacent Edge Area counties.** The main risk to Northamptonshire is from its western and southern boundaries with the six monthly testing Edge Area counties of Warwickshire and Oxfordshire respectively. Both infected cattle and infected wildlife contribute to the infection creep from these areas. Leicestershire and Buckinghamshire are the twelve-monthly testing neighbouring counties in the Edge Area and there is currently little to no evidence for infection to be propagating from that direction.

The risk from the HRA is mainly from the purchase of cattle frequently sold through auction markets in Warwickshire and Oxfordshire, the most commonly used by Northamptonshire's farmers.

10. **Forward look.** In the face of the year-on-year increasing herd incidence and prevalence in Northamptonshire over the last three years with a clear area of endemicity being established around Daventry, enhancement of wildlife control measures is urgently needed. This will require significant involvement from the industry with potentially badger vaccination programmes, working to develop farmers' awareness about badger ecology, and where possible, biosecurity improvements to be implemented. Ongoing engagement with farmers would be useful in order to further emphasise the need for careful sourcing of cattle, and making herd/holding TB history data more widely available to encourage industry ownership of disease control.

The TB policy changes introduced in January 2018 (six-monthly testing in certain parts of the Edge Area and annual surveillance testing supplemented by radial testing in the rest) have allowed for more infected herds to be detected. This should in theory tackle the disease more promptly at herd level and halt spread of bovine TB due to cattle movements. It is too early for the potential benefits of these newly introduced measures to be assessed fully, but the protection of wildlife from further infection is largely dependent on limiting the level of disease among cattle. Possibly the availability of government grants to support local groups with the costs of voluntary badger vaccination projects under Defra's Badger Edge Vaccination Scheme (BEVS) will encourage more local farmers to take up this option. Vaccination coverage in the whole endemic area of Northamptonshire (still small in comparison to other counties) would be the key if this is to have any substantial effect. This could lead to long-term savings in cattle compensation payments.

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 recently 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 Northamptonshire, which forms part of the Edge Area since its establishment in 2013. (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 Northamptonshire. 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 Northamptonshire

The overall cattle density in Northamptonshire is low. Over the last three years the cattle population has been steadily decreasing in size, by roughly 1000 animals a year. As illustrated in Figure 1, small holdings (less than 50 cattle) are predominant, accounting for 48% of the herds. The majority (85.5%) of this population is beef by breed definition (Figure 2). Dairy units account for 16% only. Beef herds are usually breeding suckler herds. However, many are finishing herds only and rely on the continuous supply of store cattle. The main flow for these is through Rugby Market in Warwickshire and Thame Market in Oxfordshire. A significant number of cattle originating from high TB risk areas enter the county through those markets. The predominant genotype found in Northamptonshire (10:a) is also the predominant genotype for those two neighbouring counties. It is perceivable that the infection expansion observed from those areas may have been initially facilitated by such cattle movements. The one livestock auction market in Northamptonshire (Thrapston Market) is located in the eastern part of the county, where the herd and cattle density is generally lower. It is subsequently less popular among cattle farmers and has smaller impact on cattle flow into the county.

Traditional farming practice in Northamptonshire is for cattle to graze from April until late October and then to be housed for the remainder of the year. During housing different management groups are frequently mixed and re-arranged.

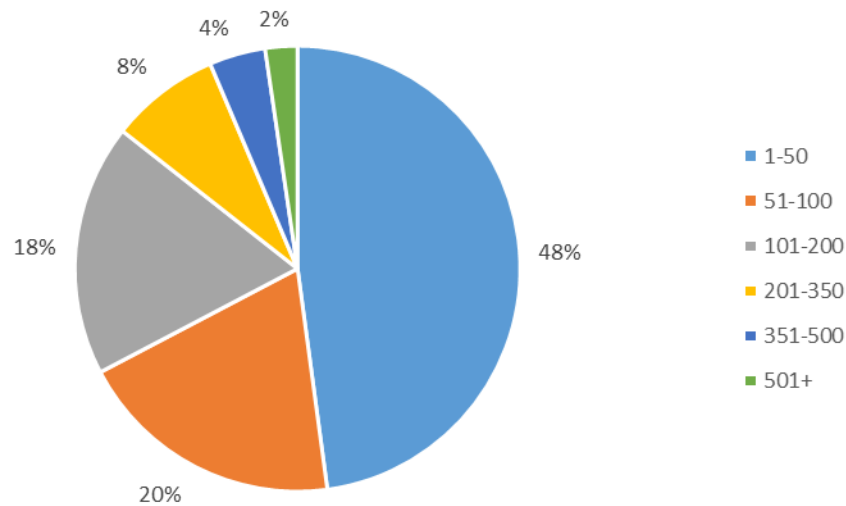


Figure 1: Proportion of cattle holdings by herd size in Northamptonshire in 2018 (n=515*)
 * One holding not included in this calculation due to having its herd size undetermined

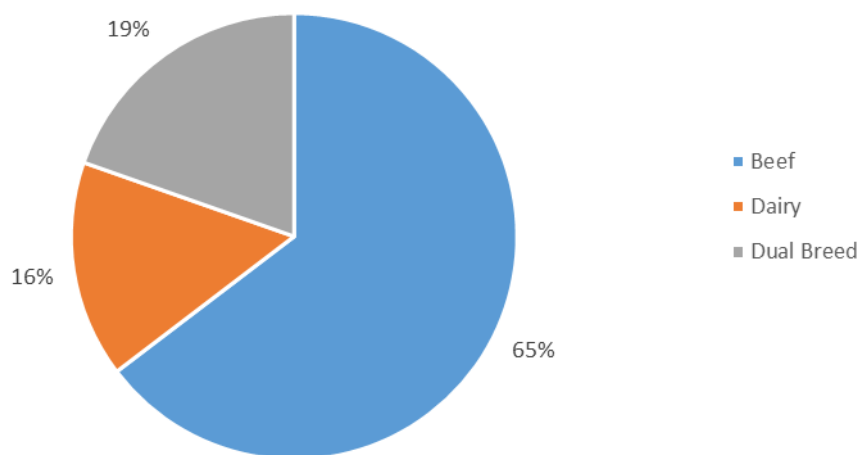


Figure 2: Proportion of cattle holdings by herd type in Northamptonshire in 2018 (n=744)
 (Note: the total number of holdings in Figure 1 varies from the total number of holdings in Figure 2 because holdings are counted more than once when cattle with different breed purposes are present.)

Overview of bovine TB epidemic in Northamptonshire

History of bovine TB in Northamptonshire

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

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

Secondly, the annual herd 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 not¹.

Thirdly, the annual end of year herd 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 in one or more animals (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 approved finishing units (AFUs) without grazing 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.

Firstly, Figure 3 below reveals the fluctuation in the number of new TB breakdowns over the last decade. A tendency for a continuous increase in that number can be observed over the last three years reaching its highest ever recorded (n=29) in 2018. The increase is mainly due to the detection of more OTFW breakdowns, which have doubled since 2016 and increased by one in 2018 compared with the previous year.

Secondly, the increase in the number of breakdowns is also reflected by the annual incidence rate illustrated in Figure 4. Following a significant drop in 2013 (to 1.5) compared to the rate recorded in the preceding year, Northamptonshire has shown low, relatively stable but growing incidence rate until 2017 when a rise of 30% was recorded. This was followed by an additional 13% increase last year meaning that there was an approximately 5% chance for any cattle herd in Northamptonshire to become infected with TB during 2018. In a significant number of incidents which were new in 2017 and 2018, especially in the south-west parts of the county, infection is thought to have originated in the local area, possibly with wildlife involvement, signifying a potential for endemicity. More focus is needed on preventing the infection from becoming established in the local wildlife.

Tighter disease control measures, such as radial testing (RAD) were introduced in January 2018 to help prevent the infection spread. Radial testing has led to the increased number of breakdowns and increased incidence rate recorded in 2018. The high number of breakdowns identified by radial testing is a very positive outcome of this measure as it has allowed earlier disease identification and more timely infection prevention control measures to be deployed in herds which were harbouring disease and potentially would have continued to move cattle without restriction, further propagating the spread of bTB.

Thirdly, the prevalence of bTB in Northamptonshire (Figure 5) represents the burden of disease. This has been relatively steady throughout the last decade with a notable improvement in 2016. This however was followed by a significant increase in 2017 with the prevalence soaring in 2018. In 2018, new breakdowns were detected monthly with the majority being detected in the last quarter. This explains the high number of restricted herds at the end of the year, leading to the high prevalence for 2018 (only the breakdowns which were detected in the first quarter of 2018 were able to be resolved

¹The 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>

by the end of 2018). In addition, three prolonged breakdowns contributed to the significant increase in prevalence.

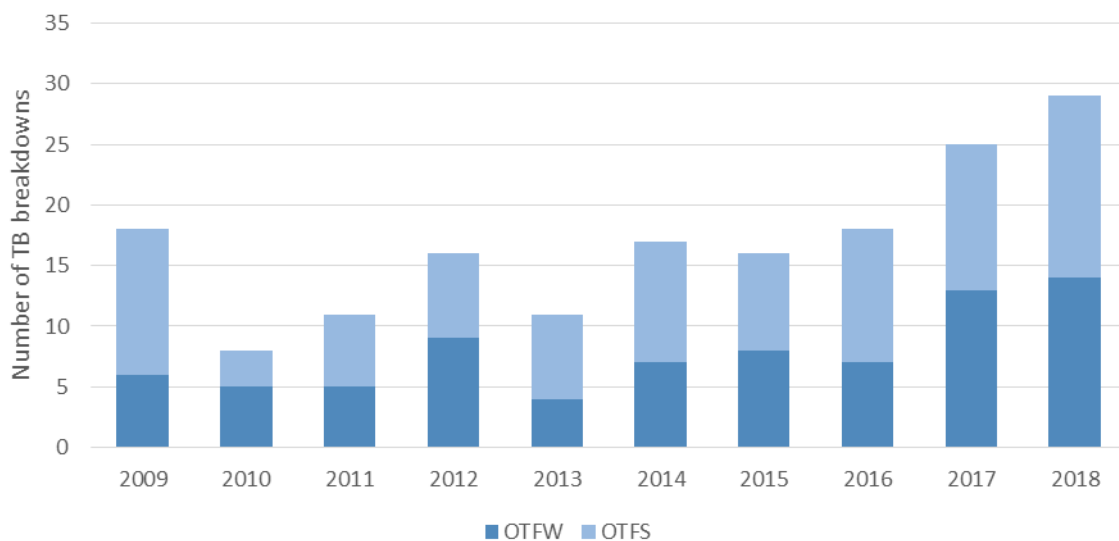


Figure 3: Annual number of new TB breakdowns in Northamptonshire, 2009-2018

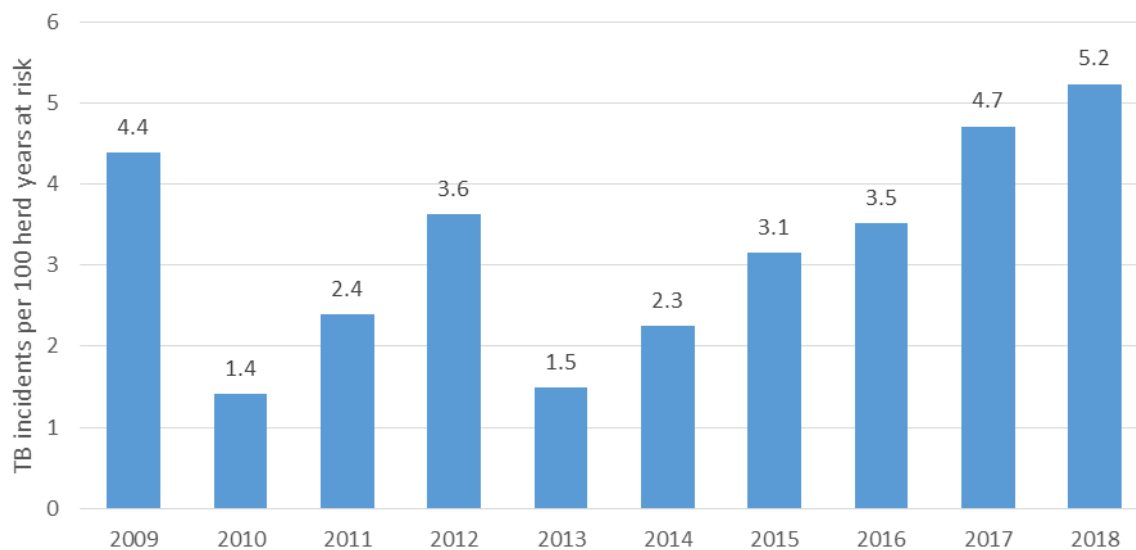


Figure 4: Annual herd incidence rate (per 100 herd-years at risk) for all new breakdowns (OTFW and OTFS) in Northamptonshire, 2009-2018.

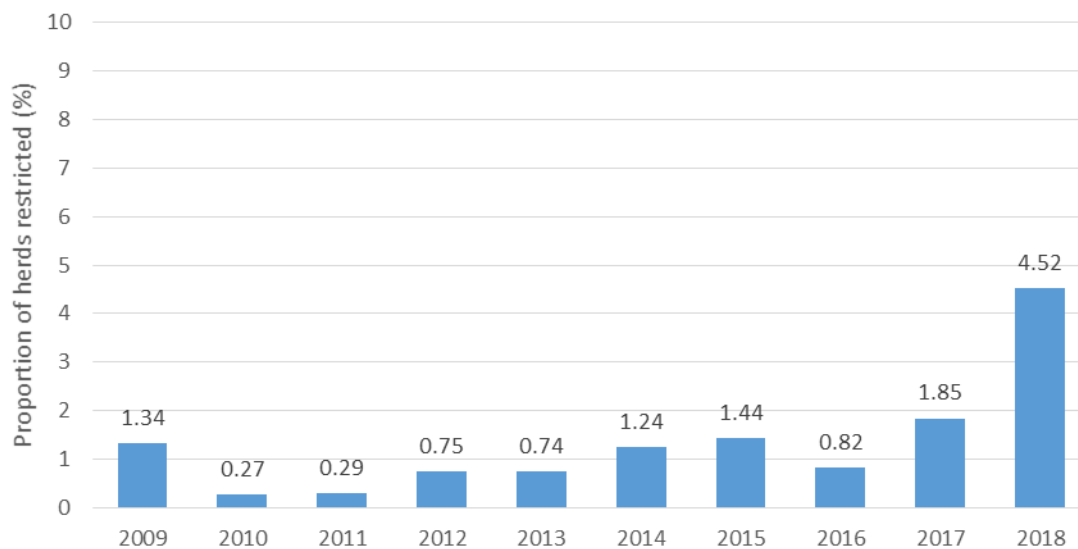


Figure 5: Annual end of year prevalence of restricted herds in Northamptonshire, 2009-2018.

Geographical distribution of TB cases (new and ongoing) in Northamptonshire

The occurrence of breakdowns in 2018 continues to follow the same general pattern as the last three years. The majority of breakdowns are again found in the west part of the county, particularly on the border with east Warwickshire. This is the area with higher cattle and cattle holding densities. The cattle herd density and proximity to endemic areas appears to play an important role. Closely located farms in the areas considered to be endemic often have a history of breeding cattle circulation between them along with occasional equipment sharing. This may have aided and accelerated the spill over effect of infection into wildlife, which now in turn appears to be the predominant source of infection in the county affecting even herds with no history of cattle purchasing.

In 2016 there was a reduction in the number of cattle holdings in the tip of the southwest of Northamptonshire - this has continued to decrease through 2017 and into 2018. A cluster of breakdowns had formed in 2015 in this specific area (Brackley). Since then a gradual north-west shift of the distribution of incidents was observed. The cluster in the Brackley area cleared in 2016 when a new cluster consisting of nearly half of the OTFW cases for 2016 formed further north, in Daventry parish (west Northamptonshire). Originally this was in proximity to a group of incidents in Southam, east Warwickshire (this cluster formed in 2015). The Daventry cluster of breakdowns has remained and expanded in 2017. In 2018 there was hardly any change in the distribution of breakdowns along the Warwickshire border. OTFW breakdowns, however, were detected further east from the border with Warwickshire, towards the centre of Northamptonshire. Wildlife is believed to be one of the main drivers of this ingress of the disease into the county. This hypothesis is supported by the repeated occurrence of the same genotype, the lack of evidence for disease spread by cattle movements in that specific area and the relative geographical proximity to the initial Daventry cluster. Genotype 10:a was isolated in three of the cases in the Southam area in 2015. Subsequently five of the seven OTFW cases in 2016 in Northamptonshire were caused by genotype 10:a of *M. bovis*, and one was genotype 10:j (previously reported as 10:7-5-6-4*-3-3.1 and closely related to 10:a). In 2017 there was an increase in the number of cases caused by the latter mentioned genotype. Both genotypes 10:a and 10:j were strongly associated with wildlife involvement in 2018. Figure 6 clearly demonstrates the clustering of these genotypes indicating local spread which at field epidemiology level has been assessed to be mainly due to wildlife. Both Figure 7 and Figure 8 further reinforce circumstantial evidence gathered over previous years for infection spread from the east of Warwickshire and the north of Oxfordshire.

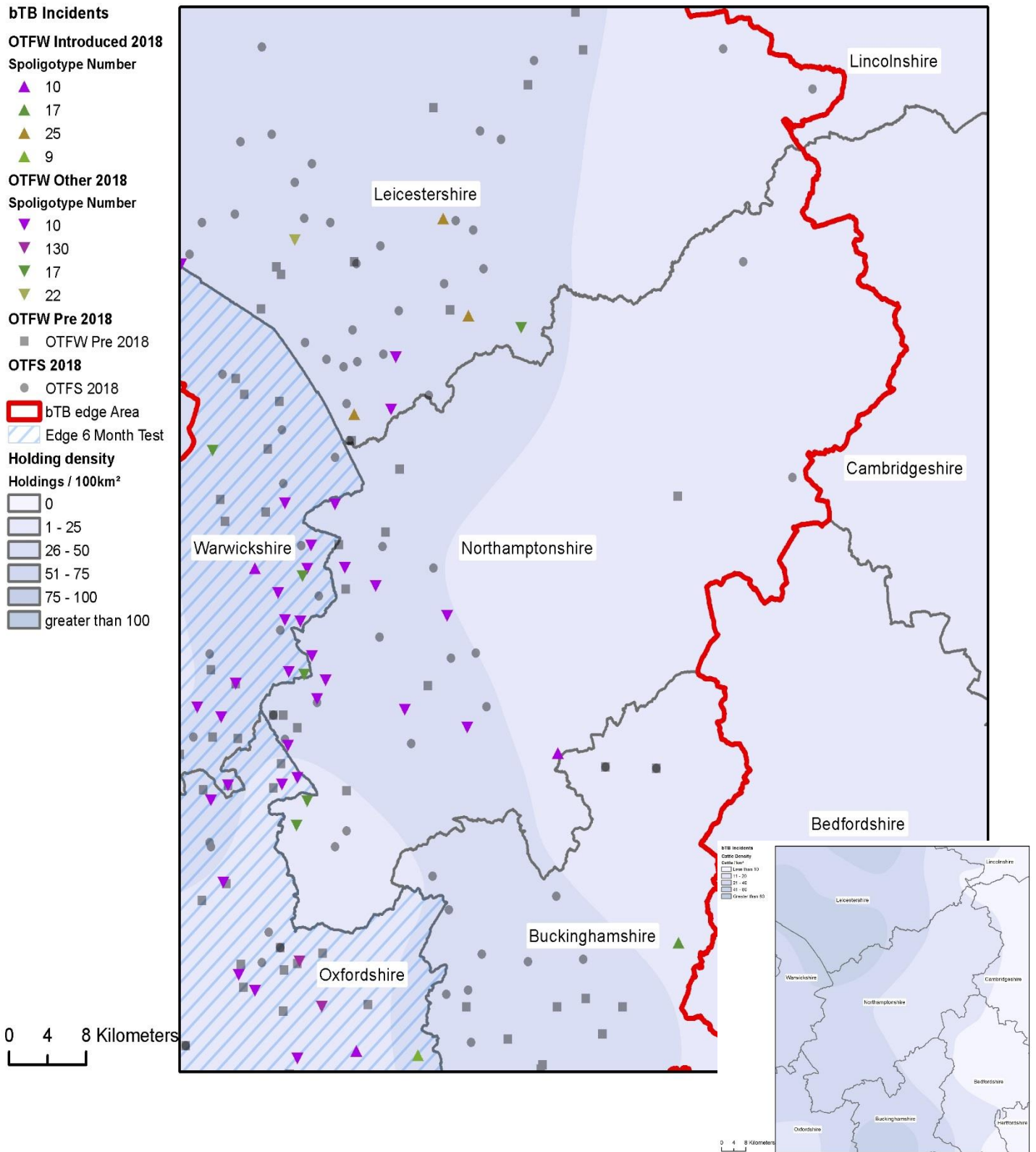


Figure 6: Geographical distribution of all new TB breakdowns (OTFW and OTFS) in 2018 and pre 2018 OTFW breakdowns still ongoing at the end of the report period overlaid on a cattle holding density map, with a cattle density map for the area inset.

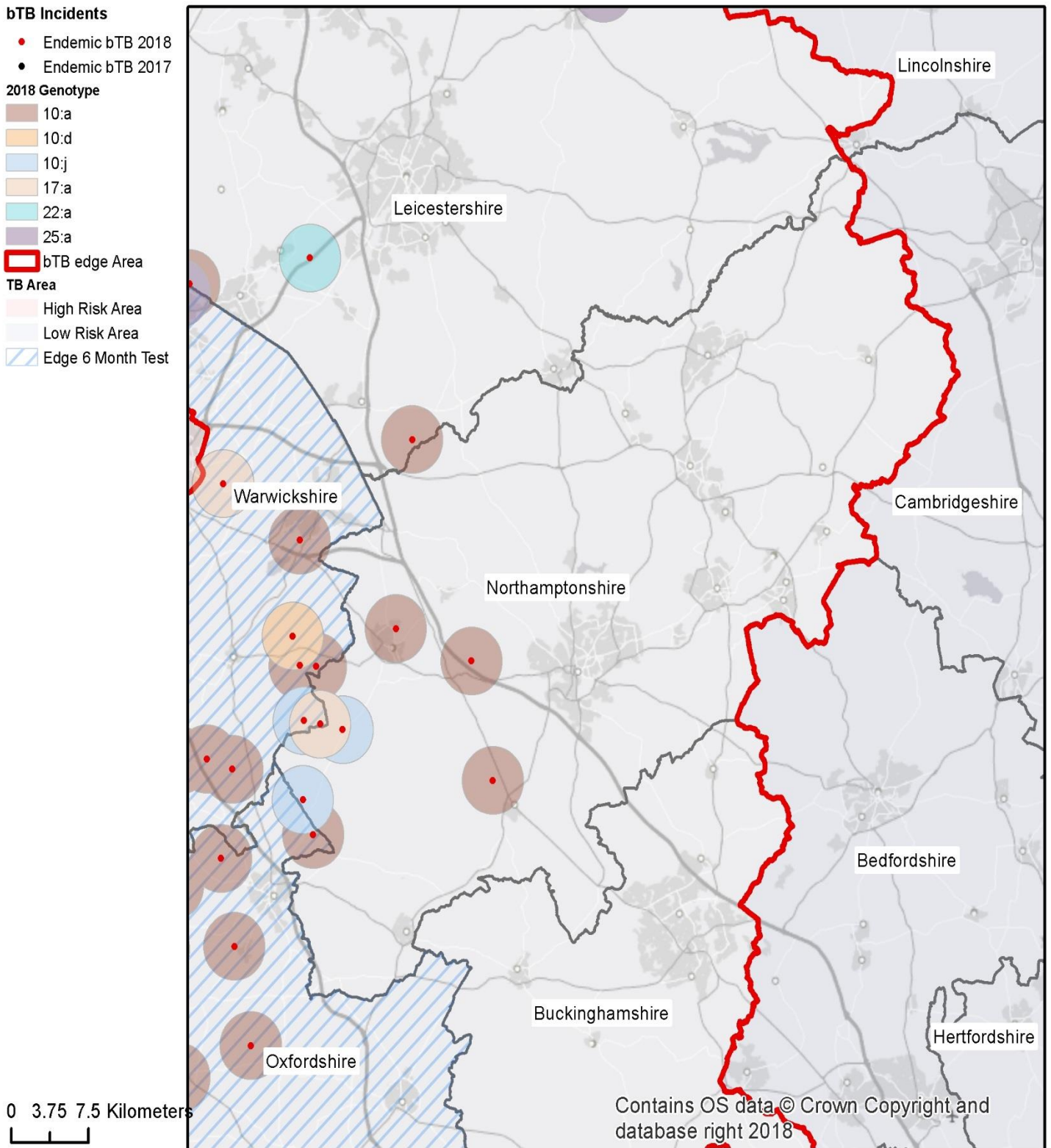


Figure 7: Genotypes of *M. bovis* detected in TB breakdown herds in Northamptonshire, where a wildlife source was attributed with a 75% certainty or above, as an indication of endemicity within local wildlife populations (OTFW breakdowns only).

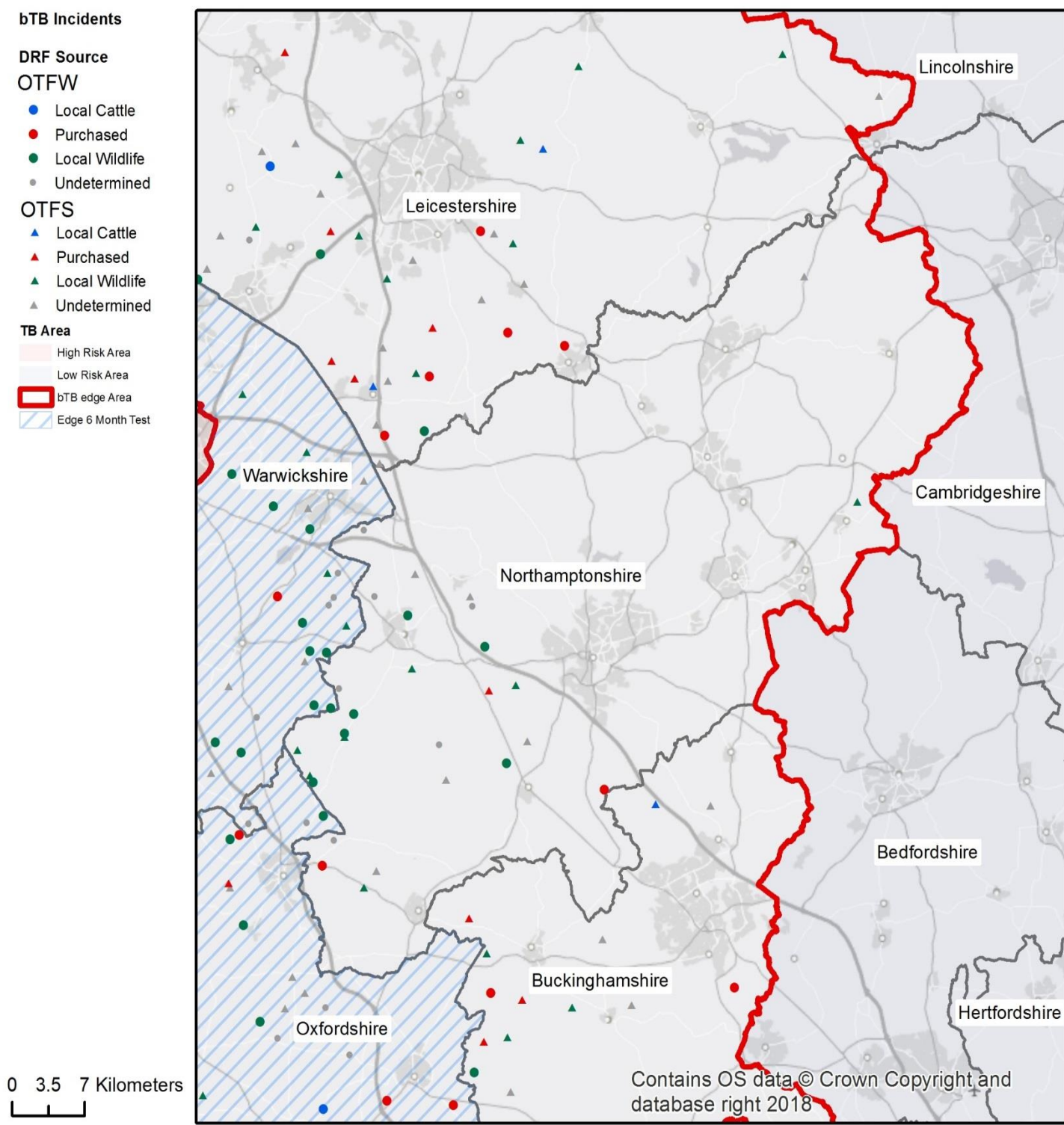


Figure 8: The source of infection recorded with the highest level of certainty, for all TB breakdowns (OTFW and OTFS) that started in 2018

Descriptive epidemiology of bovine TB in Northamptonshire

Characteristics of bovine TB in Northamptonshire

The majority of breakdowns (both OTFS and OTFW) have occurred in beef suckler herds, as shown in Figure 9. Generally, there is a positive correlation between herd size and the likelihood of experiencing a bTB breakdown, but in counties such as Northamptonshire where there are incipient pockets of endemicity and areas of very low incidence this principle does not always apply. Although nearly half

of the herds in Northamptonshire have fewer than 50 cattle, those with over 200 cattle were almost twice as likely to experience a TB breakdown. Only two dairy herds experienced breakdowns in 2018, both OTFS. Both farms had had another breakdown in the three years prior to the latest one.

Most premises in Northamptonshire conduct their routine TB testing in the first or last quarter of the year as this coincides with the winter housing period. A higher number of breakdowns has therefore tended to be disclosed during this six month period. In 2018 however this has slightly changed as shown in Figure 10. More than half of all new breakdowns (55%) started in the last quarter of the year. The majority of new OTFS breakdowns, (12 out of 15) were disclosed in that period.

The four different genotypes of *M. bovis* (10:a, 10:j, 17:a, and 25:a) detected in Northamptonshire in 2018 are uncommon in the county and therefore are outside their home-ranges. Figure 11 shows that half (n=6) of the isolates from OTFW breakdowns were genotyped as 10:a. Five of the breakdowns with genotype 10:a were assessed as having wildlife as the main risk pathway for disease introduction. A quarter of the breakdowns (n=3) were caused by genotype 10:j and they too were due to infected wildlife. The breakdowns with genotype 17:a, typical of Hereford and Worcestershire, and genotype 25:a, typical of Derbyshire and Cheshire, were associated with the movement of cattle with undetected infection.

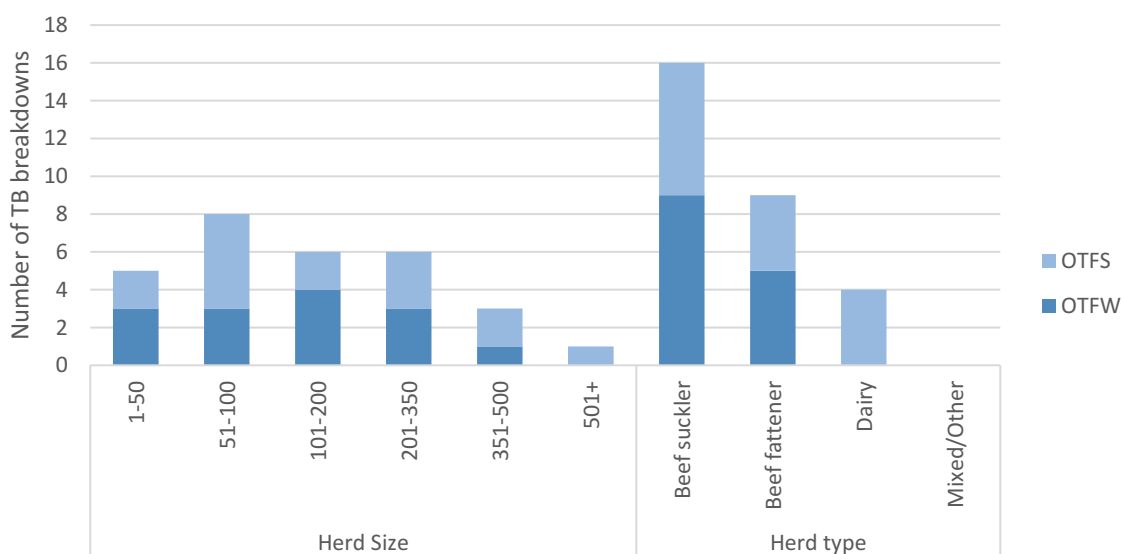


Figure 9: Number of new TB breakdowns (OTFW and OTFS) in Northamptonshire, by cattle herd size and type.

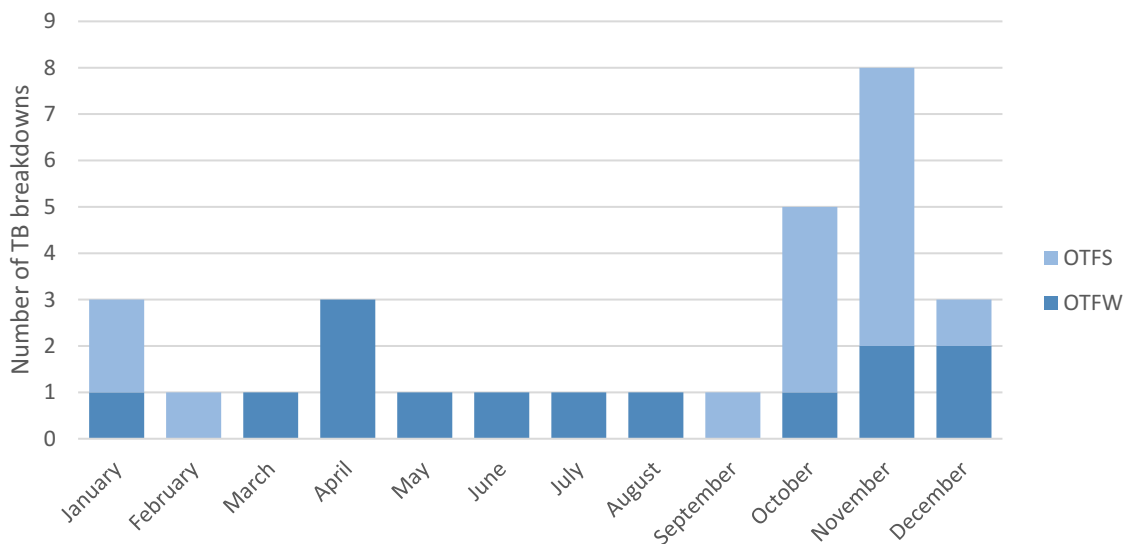


Figure 10: Number of new TB breakdowns (OTFW and OTFS) in Northamptonshire, by month of disclosure.

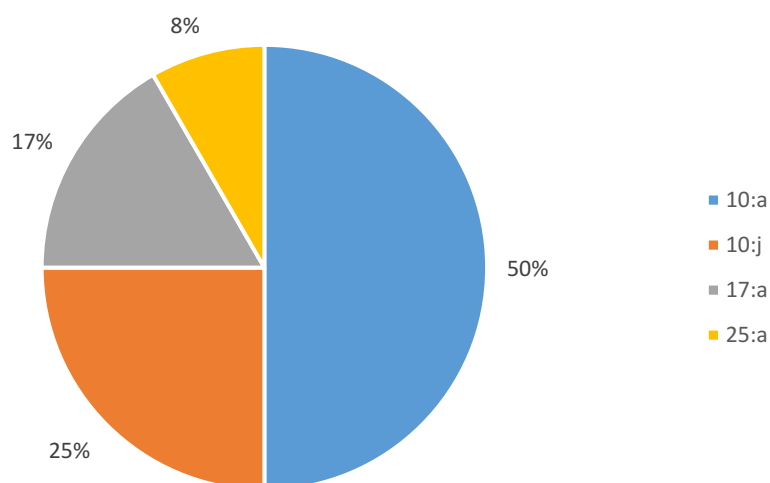


Figure 11: Genotypes of *M. bovis* identified in cattle herds with OTFW incidents in Northamptonshire in 2018 (n=12).

Significant numbers of breakdowns in 2017 had started in the last quarter of the year as mentioned earlier. Therefore the majority of breakdowns which resolved in 2018 were those which had started in the preceding year. The average length of a breakdown is between 151 and 240 days, which accounts for two mandatory Short Interval Tests (SITs) and any time elapsing for reactor removal. It can be seen from Figure 12 that most of the completed breakdowns fall into that category.

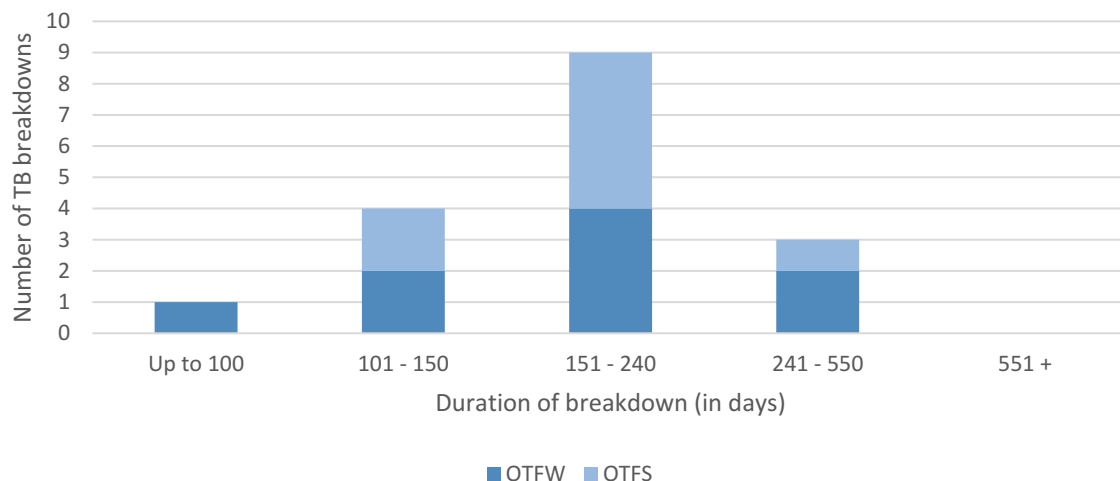


Figure 12: Duration of TB breakdowns (OTFW and OTFS) closed in Northamptonshire in 2018.

There were no persistent breakdowns (those lasting 551+ days) in the county for the reporting period. There were three longer than average breakdowns. One of them was OTFS and the reason for the longevity was the authorised delayed testing for part of the herd. Dairy herds were minimally affected by TB with short-lived breakdowns and low reactor numbers.

Risk pathways for bovine TB infection in Northamptonshire

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 Supplement¹.

Weighted by certainty, as shown in Figure 13, contact with infected badgers was the main source of infection (63%) for cattle herds sustaining a new TB incident in 2018 in Northamptonshire. Infected wild deer involvement was suspected in 2.5% of breakdowns and weighted as possible only. There have been no laboratory confirmed cases of infection in wild deer in Northamptonshire in the recent past and so infection of these species is not currently supported by scientific evidence. Infected cattle movement was deemed responsible for 32% of the breakdowns with the majority of them being OTFW. Not many cattle herds are completely closed (no inward cattle movement for at least three years).

Molecular analysis has been extremely useful in assessing genetic relatedness between different breakdowns. Anecdotal evidence of badger involvement is building, particularly in first time breakdown

herds with mainly homebred stock identified as reactors and in one particular occasion in a very high health status and enhanced biosecurity herd (but not completely wildlife proof).

In 2% of the breakdowns the source of infection remained unknown. This is the conclusion when there is no obvious explanation nor any clear evidence found to support any of the possible risk pathways. This is usually the case with OTFS breakdowns when there is no molecular data available to aid analysis.

Beef suckler herds had the highest number of breakdowns (n=18). Half this number (n=9) of the breakdowns occurred in fattening herds (with four out of these nine being mixed fattener/suckler herds). As shown in Figure 14, contact with infected wildlife was considered responsible for the majority of breakdowns among suckler herds while more than half of those in finishing herds were due to cattle movement. Only two dairy herds experienced OTFS breakdowns and they both were attributed to wildlife contact.

Wildlife source of infection has been implicated in all herd sizes. Cattle movement was the predominant pathway for medium size herds in 2018 whilst this was significantly more common in 2017 among very small (<50 cattle) herds.

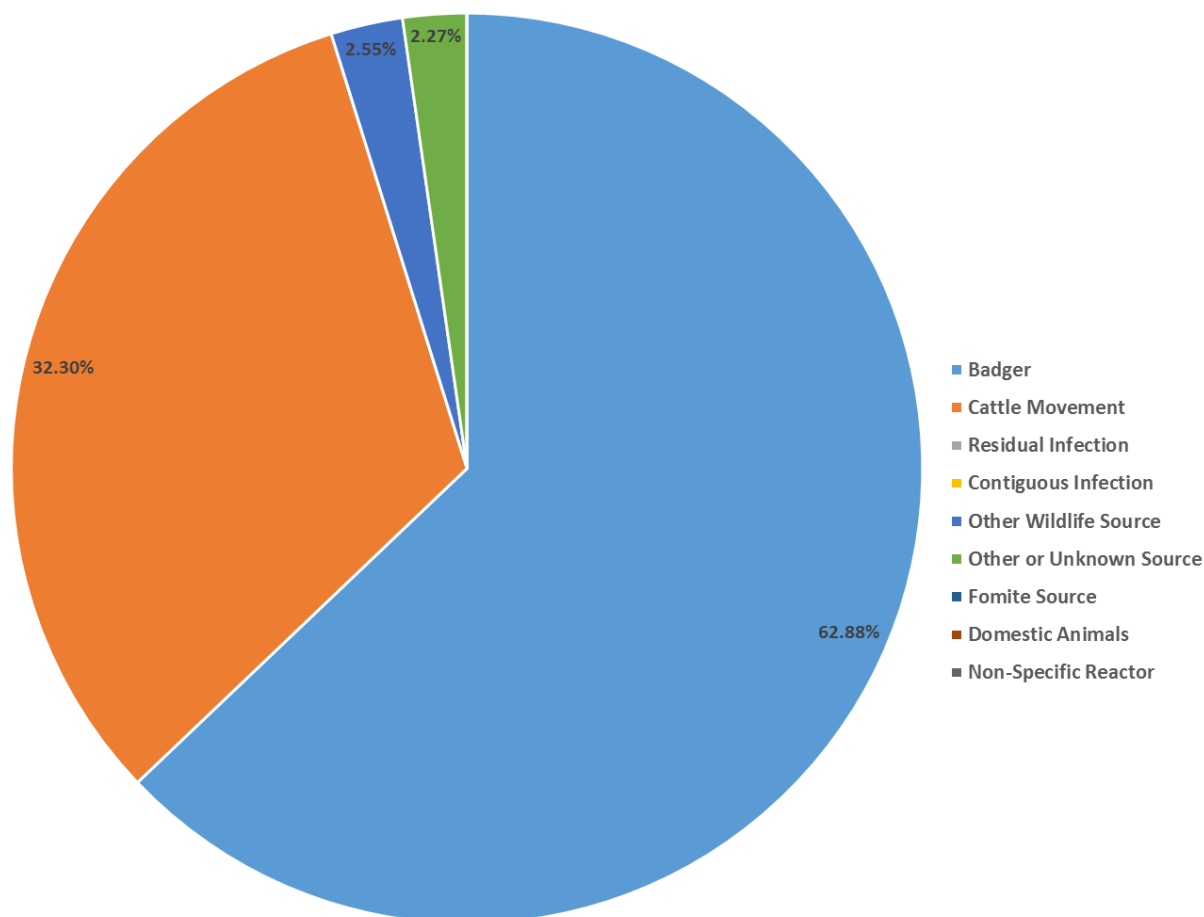


Figure 13: Summary of the weighted source of infection attributed for all incidents (both OTFW and OTFS) in Northamptonshire that started in 2018

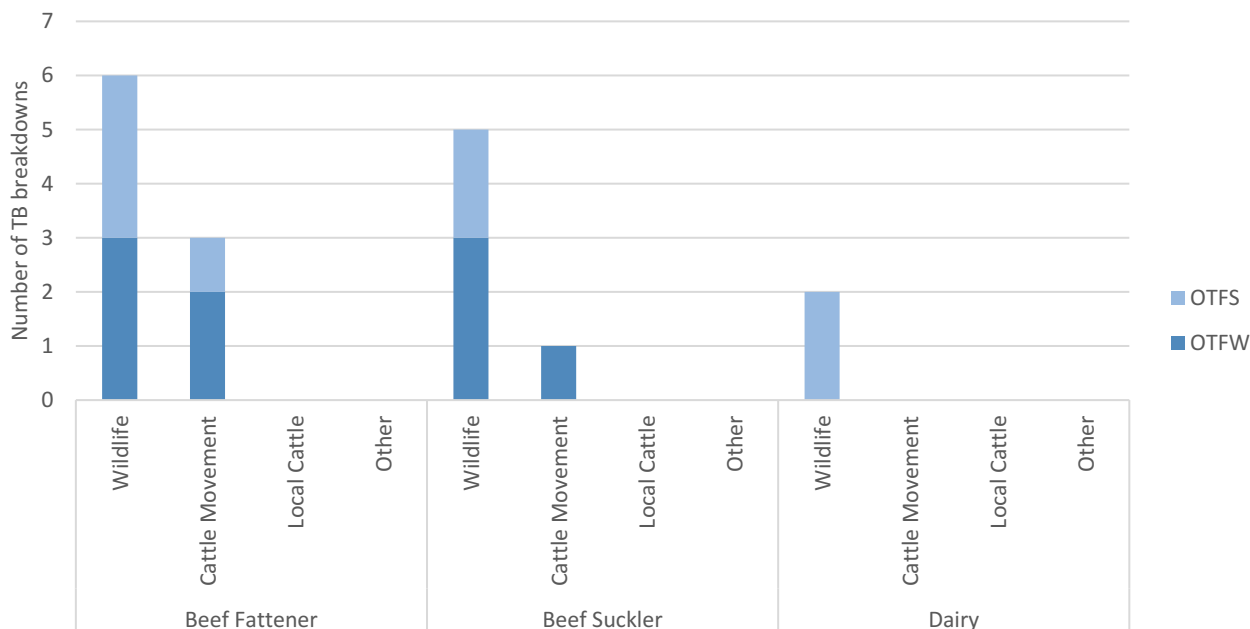


Figure 14: Source of infection recorded with the highest level of certainty for all TB breakdowns (both OTFW and OTFS) in Northamptonshire, by herd type.

Role of other species in Northamptonshire

Badgers and other wildlife

Reports from farmers suggest that there is a thriving badger population in certain areas of the county. The Daventry area is the worst affected by the disease and this is an area where badgers are abundant with clear evidence of their activity witnessed by both farmers and APHA inspectors. Many of the cattle farms in that area are bordering Warwickshire where multiple breakdowns associated with badger activity have occurred. The genotypes shared between these two areas in combination with evidence gathered from field inspections reinforces the importance of the badger's role in disease propagation.

Wild deer have become more frequently suspected as a potential infection source in many cases where evidence suggests wildlife involvement. There have been reports of frequent wild deer visits to grazing fields in Shuckburgh parish (Warwickshire) and crossing into Northamptonshire through Hellidon parish, an area with a large number of TB breakdowns. Muntjac deer have been reported in very large numbers in Hardwick parish, and red deer in Brigstock parish.

There have been no laboratory confirmed isolations of *M. bovis* in other wild animals such as wild deer or wild boar carcasses in 2018.

No badger BCG vaccination has been undertaken in Northamptonshire.

Other domestic species

There were no laboratory confirmed incidents of *M. bovis* in domestic non-bovine farm animals (camelids, goats, sheep, and pigs), pets, zoo animal collections, captive (farmed/park) deer holdings and captive wild boar farms in 2018.

Detection of cases in Northamptonshire:

Figure 15 shows that unlike in previous years, the majority of the breakdowns (n=14) in 2018 were detected by enhanced surveillance testing (6M, CON, CT-NH1 and RAD). Historically the majority of breakdowns were detected by routine annual surveillance testing (Whole Herd Test) which in 2018 accounted for 11 of the total 29 breakdowns. This is strong evidence of the efficacy of the additional infection control measures applied, addressing specifically more timely detection of residual and recently introduced or re-introduced infection. Three breakdowns were detected by passive surveillance applied at time of slaughter (slaughterhouse cases). One of these cases was in an AFU, which is usually the only way to detect TB in such premises, and the remaining two occurred in fattening herds where the animals in question were bought as store cattle.

Figure 16 shows that more than three-quarters (22 out of 29) of all breakdowns in 2018 occurred in herds with no previous history of TB. This is of particular concern and highlights that new areas are coming under increasing disease pressure. Additionally, a significant proportion of all first time breakdowns were considered to be as a result of infected wildlife, which could be an early indication of disease ingress within the Edge Area.

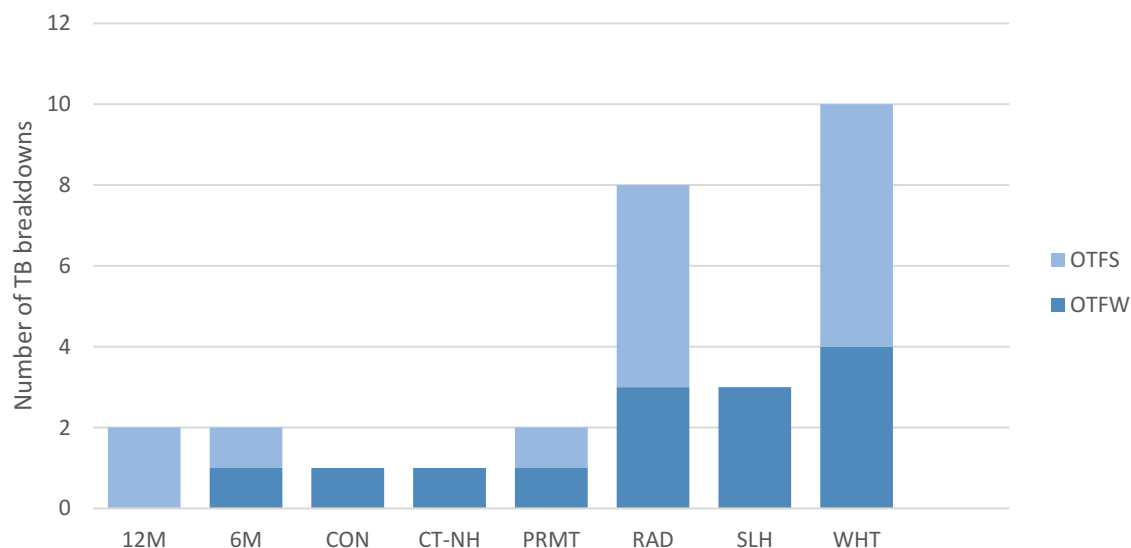


Figure 15: Number of TB breakdowns (OTFW and OTFS) in Northamptonshire in 2018, disclosed by different surveillance methods (surveillance method types are further described in the Explanatory Supplement¹).

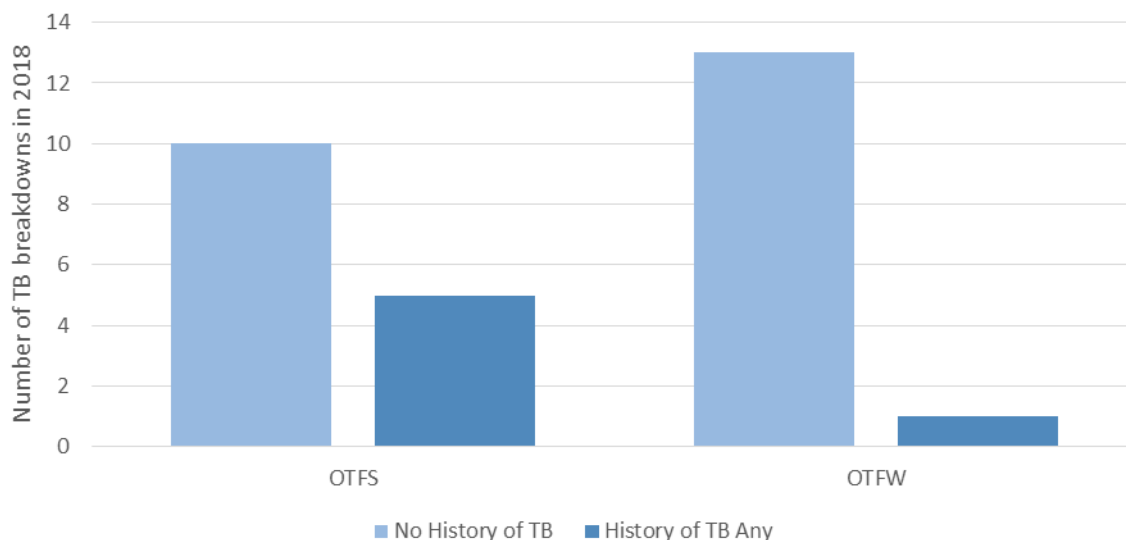


Figure 16: Number of herds with TB breakdowns (OTFW and OTFS) in Northamptonshire in 2018 which experienced a breakdown in the previous three years.

Burden of bovine TB

Over the last decade there has been significant fluctuation in the total number of reactors removed with those disclosed by interferon gamma test generally predominating (Figure 17). In 2018, there were 42 more cattle identified and removed as reactors in comparison to the previous year. In 2017 there had also been an increase in the number of breakdowns but the total number of reactors removed was 86 animals fewer than in 2016. The data in Appendix 3 demonstrates that over the last three years the number of skin test reactors has hardly changed despite the increasing disease incidence rate. Therefore the number of interferon gamma reactors is a better reflection of the burden of disease. The burden was significantly lower in 2017 due to the very low number of interferon gamma reactors being disclosed. A third of interferon gamma tests were completed for discretionary purposes (non-statutory interferon gamma test in one herd). This shows that disease was detected in a timely manner and well-controlled especially in the face of increased numbers of OTFW breakdowns in 2017. The increased number of interferon gamma reactors in 2018 is mainly due to two farms where large numbers of non-visibly lesioned reactors were disclosed, accounting for nearly half of the total number of gamma reactors in the county.

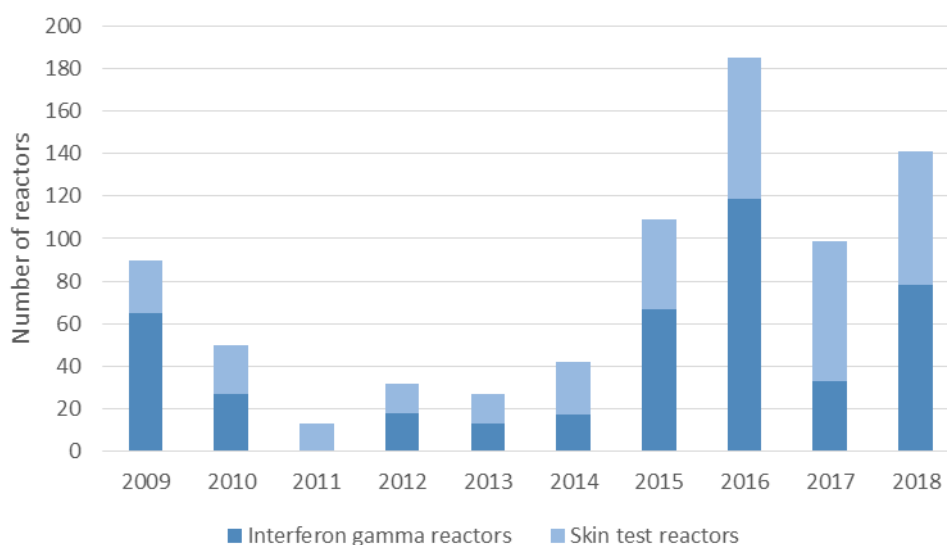


Figure 17: Number of reactors detected by interferon gamma and skin tests in Northamptonshire, 2014 to 2018

The number of reactors per breakdown has halved since 2016 from 10.3 to 4.9 in 2018 with a very slight increase since last year. This suggests an overall reduced burden at the individual farm level represented by a reduced need to restock, although these figures have to be interpreted with care in a county with relative low incidence where a small number of incidents with exceptionally high number of reactors can shift this measure upwards. The increased prevalence however suggests that more herds were under restrictions, probably for a longer time than in previous years.

The number of reactors disclosed per 1000 animal tests has remained stable over the last three years regardless of the great fluctuation in the total number of animals removed.

Key drivers of the bovine TB epidemic

Nearly two thirds of all TB breakdowns in the county were attributed to infected badgers and this appears to be the main driver of the epidemic in west Northamptonshire for 2018. Previous anecdotal evidence of badgers acting as source of infection for cattle herds has become more substantial due to the increased number of breakdowns in herds with no previous TB history with homebred stock being affected, positive correlation between geographical location of breakdown cattle herds and known badger setts, and the indirect information provided by molecular genotyping data.

Cattle movements were considered to be responsible for approximately a third of the breakdowns in 2018. Unsafe purchasing practices are at the core of this driver of disease spread. The reasons for unsafe purchasing of cattle in Northamptonshire are due to farmer's inexperience with the implications of TB infection, with this area having a traditionally low incidence, and the pursuit of maximum economic benefit in fattening units, which usually results in the purchase of animals from endemic higher risk areas of the country.

APHA field staff and the Northamptonshire TB Eradication Group remain key to ensuring the provision of information to farmers so that these trends can be reversed.

It is expected that infection of wildlife by cattle will be better controlled with the enhanced surveillance (radial) testing mainly through more timely detection and elimination of disease from the cattle population. This additional measure introduced in January 2018 has been met with mixed reactions from farmers because of the additional logistical challenges entailed by extra cattle testing whilst limited action has been taken to address the disease reservoir in badgers. Badger vaccination is currently one option at farmers' disposal and uptake could be encouraged by continued raising of awareness of the Defra-funded Badger Edge Vaccination Scheme (BEVS).

County summary

TB incidence and prevalence have been increasing over the last three years, which coincides with the time when the formation of an area of endemicity in Daventry parish was first suspected. The evidence suggesting that this is an endemic area has become more substantial (reappearing and repeating genotype, multiple first time breakdowns in the area among homebred stock, dense badger, and in some pockets, wild deer populations confirmed by farmers' reports and APHA field inspections). It is likely that the problem in this specific area has developed as a result of initial infection spread from the east of Warwickshire and the north of Oxfordshire, mainly through infected cattle movements. This may have allowed for infection spill-over into the abundant local wildlife, by contamination of the environment particularly at the time of grazing. This in turn is now the key driver of the TB epidemiology in the county.

Despite the increase in incidence and prevalence, Northamptonshire is still one of the Edge Area counties with relatively low values for these parameters. If the objective of achieving TB free status by

2025 in this county is to be achieved a focus is needed on the farming community's attitude towards bovine TB control. The reluctance to take ownership of the problem is a major obstacle. Many of the farmers have cattle farming as an additional/side enterprise which is reflected by the large proportion of small (<50 animals) herds. Many of them are more likely to give up cattle farming altogether, rather than invest in disease prevention due to it being difficult to justify the financial investment.

A significant proportion of breakdowns in 2018 has occurred in herds without previous TB history, finding farmers absolutely unaware of the risk of disease and the possible ways of controlling it.

APHA farm visits at the time of TB breakdown and their involvement in the local TB eradication group has provided an extremely good source of information for farmers. Advice on safer and risk-based trading is far more readily accepted than that involving investing in farm infrastructure. In order to halt the expansion of the endemic area in Northamptonshire, enhanced wildlife control measures are urgently needed. These are most likely to be through badger vaccination. The farming community, however, is again reluctant to invest without government funding. Potentially partial Defra funding would boost industry's confidence in this approach.

Newly introduced cattle TB control measures (six-monthly testing in some counties and RAD testing in others) should have an impact on the level of TB at the herd level but it is currently too early for this to be fully assessed.

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

The TB risk from Northamptonshire to adjacent LRA is currently low.

The LRA counties adjacent to Northamptonshire are Cambridgeshire and Bedfordshire. The endemic front in Northamptonshire is significantly distant from the neighbouring LRA counties with large areas of low cattle and cattle herd densities which provide an additional buffer. This is a mitigating factor for disease spread into the LRA from Northamptonshire.

The only cattle market in Northamptonshire is Thrapston and this is located close to the border with both of the LRA counties which would suggest that it is a market used by the cattle farmers in those areas. There is no evidence at present to suggest that this market poses a risk of disease spread. Both Cambridgeshire and Bedfordshire have overall low cattle and cattle herd densities with this being higher towards the boundary with Northamptonshire.

The levels of TB susceptible wildlife in the LRA boundary area is to a large extent unknown and due to the lack of breakdowns no field investigation data is available. The lack of breakdowns along this lower cattle density zone appears to indicate that the risk of disease spread due to wildlife involvement is likely to be very low. In terms of wildlife movement there are no man-made or geographical features that could be seen as potential physical barrier for movement into the LRA.

Both Cambridgeshire and Bedfordshire have had a very low number of breakdowns over the last three years with all of those being geographically distant from Northamptonshire.

Summary of the risk to the Edge Area from the HRA

Northamptonshire is surrounded by Edge (west, south and north) and LRA counties (east). There are no adjacent HRA counties. Therefore the risk from HRA is driven mainly through market purchased cattle, predominantly from Thame and Rugby market. Analysis of breakdown herds which have purchased cattle which originated from the HRA suggests that mainly finishing stock is sourced from these areas. Genotypes associated with HRA have been found in purchased animals and to date there is no evidence to have resulted in lateral spread within the county.

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

Coincidentally, the area in Northamptonshire with higher cattle and cattle herd densities are bordering the Edge counties of Warwickshire and Oxfordshire, both of which are six-monthly testing Edge areas with significantly higher incidence and prevalence. The two markets in each of these two counties are the ones mostly utilized by Northamptonshire farmers which facilitates cattle flow from those areas. The risk of moving cattle with undetected infection from these areas is always present and probably was the key driver of infection a few years ago. Infected wildlife is also suspected to be largely responsible for breakdowns along the boundaries with these counties, sustaining the infection spread.

Northamptonshire also borders the annually testing Edge counties of Buckinghamshire and Leicestershire with little evidence so far for any infection expansion from either.

Assessment of effectiveness of controls and forward look

Incidence rates have increased which is mainly due to lateral spread of disease. This is considered to be mainly through wildlife rather than cattle movement in the parts of the county where herd and cattle density is the highest. Despite the fact that the overall number of breakdowns has increased, 10 out of 29 were detected by radial testing, which is a very positive outcome. These breakdowns were all detected months earlier than would have been the case in prior to implementation of this policy. Timely detection of the infected animals and subsequent removal is one of the key steps in infection control. This is very likely to have played a significant role in the protection of the remaining susceptible cattle population. There is a continuing requirement to improve the control of the transmission routes.

Northamptonshire farmers recognise the risk posed by wildlife in certain areas but there is some reluctance to take any ownership of the problem. Biosecurity advice provided is often met with reluctance to implement due to the expense involved. As mentioned previously many herds are small in size with the cattle farming as an additional enterprise rather than being the main one and therefore it is frequently economically difficult to justify significant investments in farm biosecurity. Many consider that it will be better to cease operating as cattle farms altogether due to little profit generally made and difficulties coping with additional testing requirements. Therefore it is likely that cattle and cattle herd numbers will continue to decrease over the next few years. Advice on safer purchasing practices is better received. This too, however, is often hindered by the fact that farmers feel that they do not have the time to properly research the available information but would rather go to the nearest market or use local dealers. This significantly reduces the practical application of any safe purchasing practices.

With increasingly strong evidence of wildlife involvement and reluctance from farmers to take action it is difficult to predict if the objectives listed in Appendix 1 could be met. It is more likely that during the next two years the number of incidents will continue to increase but possibly with gradually reducing prevalence. In Northamptonshire TB is still a new problem and the more farmers are informed the more likely it is for the right preventative measures to be put in place. With the creation of the Northamptonshire TB Eradication Board and the active support from APHA it is expected that the right approach towards the problem will be communicated and implemented. It is paramount for farmers to understand that even minor changes in farming practices could have significant disease impact.

Badger vaccination may be an important step for consideration in the endemic area of Northamptonshire with the aim of protecting younger badger populations and halt propagation of disease among them. If this is combined with safer purchasing practices in a few years' time the disease spread could be slowed down and eventually reversed.

APPENDICES

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

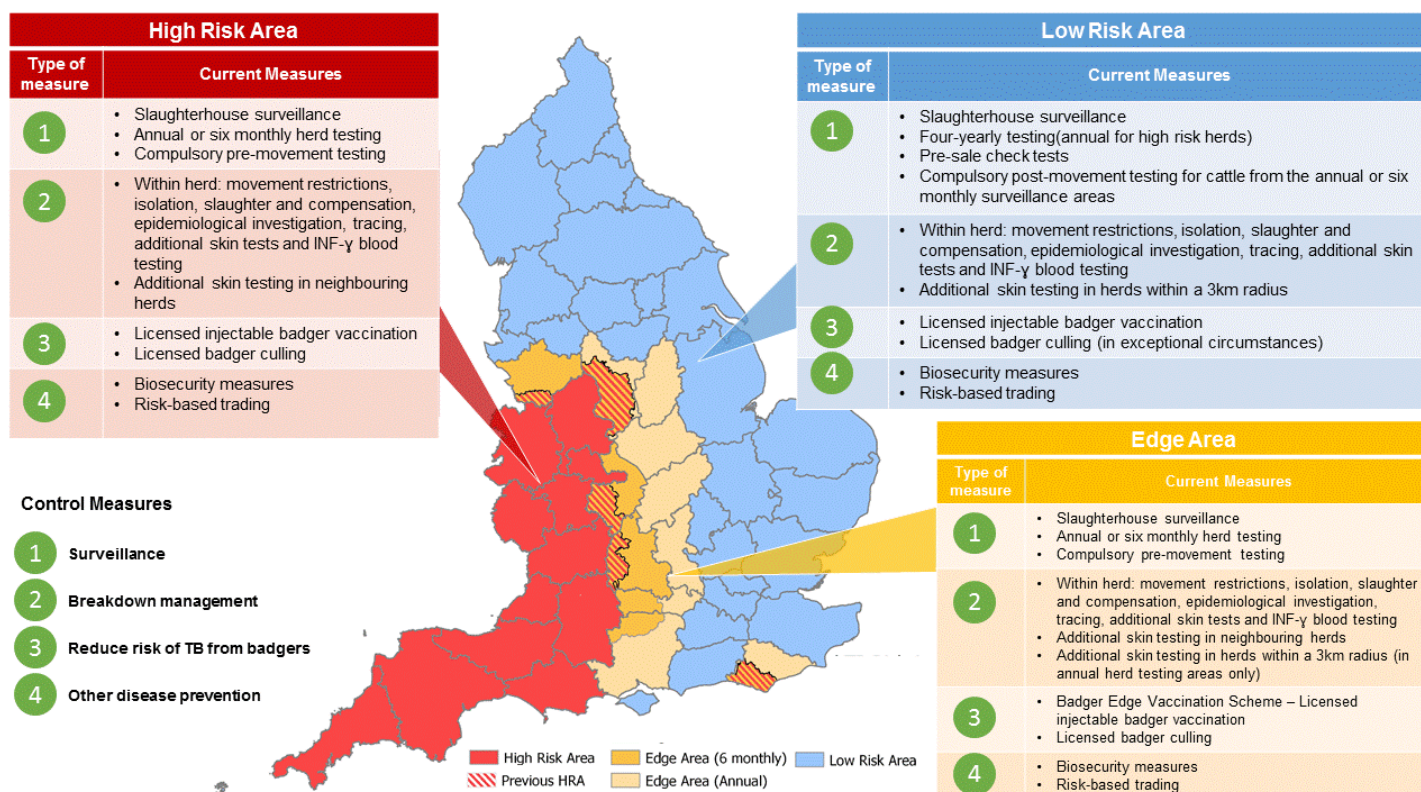


Figure A1: Bovine TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Tuberculosis-Free Status for England².

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.

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

- 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

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	246	100	94	41	21	12	515	102.6298	53.5

Finishing units registered in Northamptonshire:

	Grazing	Non-grazing
Number of Approved Finishing Units (AFUs)	0	12
Number of Pre-movement Testing Exempt Finishing Units (EFUs)	0	1

The number of AFUs has remained unchanged since last year. In the county no non-compliances with the operation of these units has been recorded.

Common land in the county: There are some small areas of common land in Northamptonshire but with low numbers of cattle grazed and no significant co-grazing by more than one herd. Spread of TB related to common land has not been reported and is unlikely in this county.

Cattle/herd purpose:

	Beef		Dairy		Dual purpose		Unknown		Total
	Number	%	Number	%	Number	%	Number	%	Number
Cattle	45408	85.8	5909	11.2	1636	3.1	0	0.0	52953
Holdings	481		117		146		0		

Appendix 3: Summary of the Northamptonshire 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	625	608	587
Total number of herd tests carried out in the period	572	545	623
Total number of OTF cattle herds TB tested during the period for any reason	504	487	498
Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB02 restrictions)	598	577	540
Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.	618	594	561
Total number of new TB breakdowns detected in cattle herds during the report period	18	25	29
OTF status suspended (OTFS)	11	12	15
OTF status withdrawn (OTFW)	7	13	14
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?	4	6	6
New OTFW breakdowns triggered by skin test reactors or 2xIRs at routine herd tests	5	5	4
New OTFW breakdowns triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)	0	2	7
New OTFW breakdowns first detected through routine slaughterhouse TB surveillance	2	6	4
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	5
OTFW	N/A	N/A	5
Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)	3	7	11
New confirmed (positive <i>M. bovis</i> culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0

Animal-level statistics (cattle)	2016	2017	2018
Total number of cattle tested in the period (animal tests)	73349	67390	71694
Reactors detected:			
tuberculin skin test	66	66	63
additional IFN-gamma blood test reactors (skin-test negative or IR animals)	119	33	78
Reactors per breakdown	10.3	4.0	4.9
Reactors per 1000 animal tests	2.5	1.5	2
Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs)	3	2	2
Private slaughters	1	2	10
SLH cases (tuberculous carcasses) reported by FSA	5	14	11
SLH cases confirmed by culture of <i>M. bovis</i>	2	6	4

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

Source of infection	Possible (1)	Likely (2)	Most likely (4)	Definite (8)	Weighted contribution
Badgers	4	10	9		62.9%
Cattle Movements	9	1	1	2	32.3%
Contiguous	0	0	0	0	0.0%
Residual Infection	0	0	0	0	0.0%
Domestic Animals	0	0	0	0	0.0%
Non-specific Reactor	0	0	0	0	0.0%
Fomites	0	0	0	0	0.0%
Other Wildlife	3	0	0	0	2.6%
Other or Unknown Source	2	0	0	0	2.3%

Appendix 5: Overview of the TB Control Programme in Northamptonshire

Summary of TB control measures specific to Northamptonshire:

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. In Northamptonshire this has proven very successful. Radial testing was able to detect 9 of 29 breakdowns. This allowed for very prompt infection control measures to be put in place on individual herd level, prevent further spread with cattle movement and potentially limit the risk of wildlife exposure.
- Compulsory interferon gamma testing is conducted in every OTFW breakdown. As an additional measure APHA is aiming to deploy this test as soon as a visible lesion is found or positive culture result obtained. Therefore the test is often decoupled from the statutory breakdown skin testing. The aim is to allow any exposed/infected animals missed by the skin test to be identified and removed as soon as possible.
- Discretionary interferon gamma testing in OTFS breakdown herds is an additional measure applied in the Edge area, but no such testing took place in Northamptonshire in 2018.

5.2 Unusual TB breakdowns

- It may be of interest to mention a breakdown which occurred in a herd that had been completely closed for the last 30 years and was located in the endemic area of the county. A quarter of the herd was removed as reactors to both interferon gamma and skin test, with multiple lesions found at slaughter.
- One finishing herd did not go through breakdown testing at all due to the farmer's decision to completely depopulate the premises.

5.3 Other Testing Measures

- Occasional incidents of overdue TB testing occurred in Northamptonshire in 2018, but all of those cases were resolved within 60 days of the test becoming overdue, before they reached enforcement stage. Therefore no particular involvement from Local Authority (LA) was required in 2018 in terms of TB control.
- There were no exemptions from routine herd testing sought in 2018. Such exemptions may be given to fattening herds only, upon meeting a specific set of criteria.

5.4 Other Control Measures

- Northamptonshire TB Eradication group was set up in 2017 with the support of local NFU. APHA has a representative on the steering group. The group has provided an opportunity for industry, private veterinary surgeons and APHA representatives to meet, discuss and work together towards reducing TB incidence in the county. Frequently guests are invited to the meetings, such as representatives from APHA wildlife ecologists research group, University of Nottingham (in relation to the found dead badger survey) and members of Defra TB Programme.

- A project funded by Defra and the EU through the Rural Development Programme for England, called the TB Advisory Service (TBAS)⁴, was introduced at the end of 2017. The aim is to offer one-to-one on-farm advice visits, where trained advisors can provide bespoke recommendations to reduce the risk of TB incursions in herds that are currently clear, whilst discussing trading options and measures to prevent repeated reinfection for farms that are currently under TB restrictions. Awareness of the existence of this service has increased through the industry engagement meeting mentioned above and by the case officers from APHA. Significant numbers of farmers have taken advantage of the service but levels of implementation of advice given are currently unknown.
- Robust quality control of skin testing delivered by Official Veterinarians (OVs) actively took place in 2018 across the Edge Area. The aim is to ensure that the TB skin test is consistently performed to the required standards. An alert system is in place which allows for an audit process to be triggered.
- Northamptonshire LA has suffered significant budget loss, which has led to reduction of the animal health team to two people. LA presence at Thrapston market has been very limited through the year.

APHA is an Executive Agency of the Department for Environment, Food and Rural Affairs and also works on behalf of the Scottish Government, Welsh Government and Food Standards Agency to safeguard animal and plant health for the benefit of people, the environment and the economy.

⁴ TB advisory service - <http://www.tbas.org.uk/>