



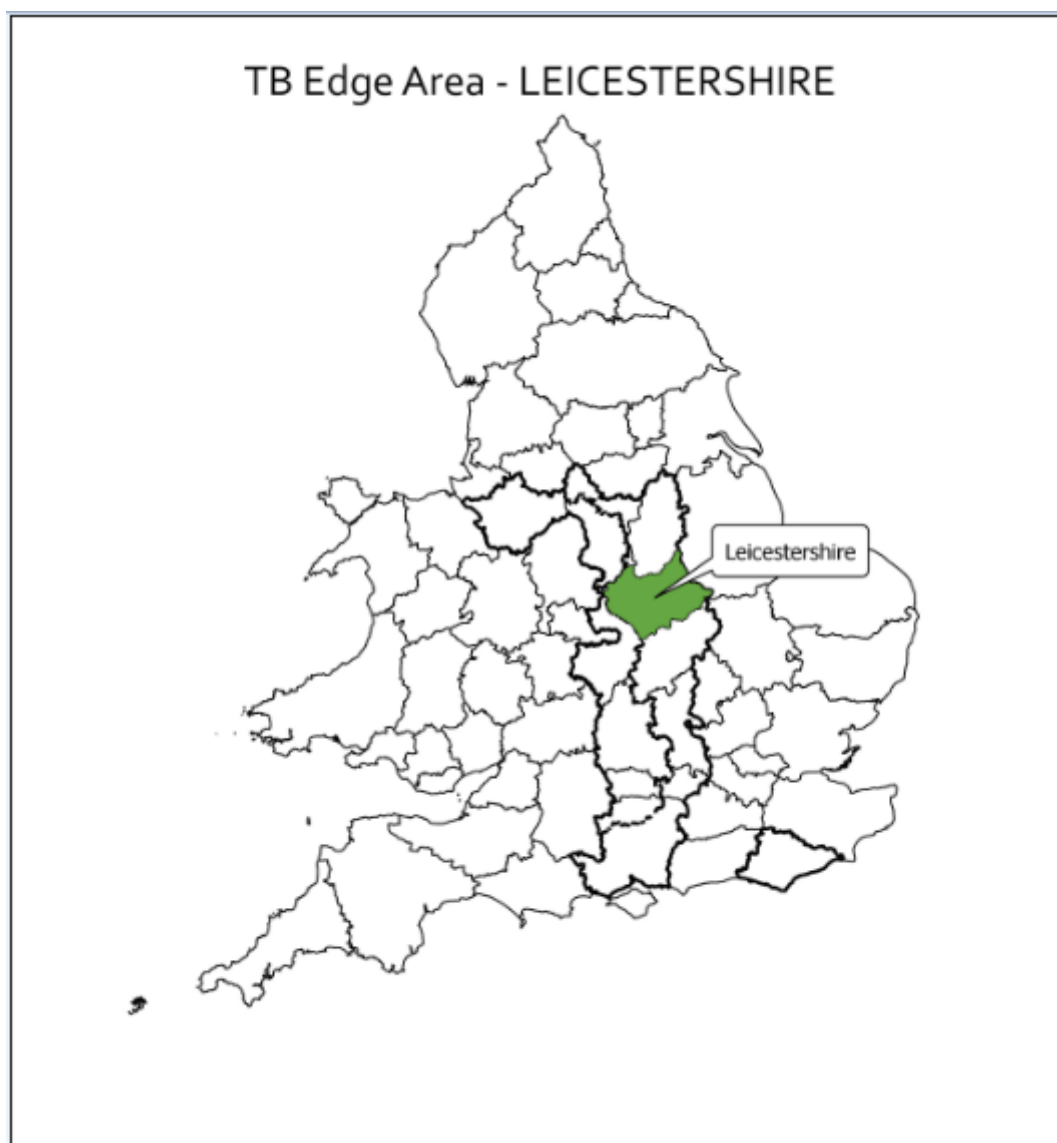
## Year End Descriptive Epidemiology Report: Bovine TB Epidemic in the England Edge Area

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**Delivery Area:** Northern

**Name of County:** Leicestershire

**Year-end report for:** 2018



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## Executive Summary

1. The Edge Area has a low but recently rising incidence of infected herds. **Leicestershire** 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 Leicestershire in 2018.
2. **Local cattle industry.** Small family run beef herds predominate in Leicestershire, however there is a significant number of large dairy herds in the county.
3. **New breakdowns of bovine TB.** During the reporting year 59 new TB breakdowns were disclosed, up from 46 breakdowns in 2017. However, the number of Officially Bovine Tuberculosis Free Status Withdrawn (OTFW) breakdowns only increased by one from 21 in 2017 to 22 in 2018. The herd incidence rate in 2018 (6.3%) increased from 5.0% in 2017. Following the introduction in January 2018 of radial testing to supplement annual surveillance testing of herds in Leicestershire, the number of cattle herds tested for TB increased by approximately 150 compared to 2017. This may be one of the reasons why more Officially Bovine Tuberculosis Free Status Suspended (OTFS) breakdowns have been disclosed (25 OTFS in 2017 and 37 in 2018), indicating that TB-infected herds have probably been disclosed in earlier stages of disease than has been the case in previous years.
4. **Risk pathways for bovine TB infection.** There was an almost 10% reduction in the number of breakdowns attributed to wildlife relative to 2017. However, the majority of breakdowns attributed to wildlife were located in the north east of the county, where *M. bovis* infection could be becoming endemic.
5. **Role of other species.** There were no laboratory confirmed isolations of *M. bovis* in other species in Leicestershire. Submission rates are extremely low in other domestic species. There is no systematic surveillance that would reveal such infection in badgers and other wildlife. The Defra-funded Edge Area Badger Survey has now been completed and awaiting publication.
6. **Disclosing tests.** Almost 45% of all TB breakdowns were disclosed by routine annual surveillance herd testing. Only 3.3% of all breakdowns in 2018 were initiated by slaughterhouse surveillance (post-mortem meat inspection) during commercial slaughter of non-reactor cattle. This may be an indication that disease is being disclosed at an earlier stage through on-farm testing, with animals being removed as reactors to a TB test.
7. **Impact of bovine TB and reactor numbers.** The number of animals slaughtered for TB control reasons increased from 377 in 2017 (mostly skin test reactors and interferon gamma test positives, with 15 direct contacts removed) to 401 in 2018 (all of them skin test reactors or interferon gamma test positive animals). However, there was a decrease in the number of skin test reactors and interferon gamma test positive animals detected per breakdown, from 7.6 in 2017 to 6.3 in 2018. Additional testing (statutory interferon gamma testing) is applied to fully confirmed breakdowns in the TB Edge Area. This test method identified almost 50% of all animals removed for TB control reasons in 2018.
8. **Risks to the Low Risk Area (LRA).** The cluster of OTFW TB breakdowns in the north east of Leicestershire and on the boundary with Lincolnshire share a common genotype (25:a). This cluster is associated with wildlife infection and poses a risk of TB spread into the LRA. APHA has identified

a potential TB Hotspot Area (HS23) and additional cattle and wildlife TB surveillance measures are being implemented.

9. **Risks from the High Risk Area (HRA) and/or other adjacent Edge Area counties.** Risks from the Edge Area counties adjacent to Leicestershire remain the same as for the previous years. Several OTFW breakdowns associated with wildlife, identified in the north east of Warwickshire and south east of Nottinghamshire (both Edge Area counties), are adjacent to the boundaries with Leicestershire and could pose a risk of TB spread into that county.
10. **Forward look.** Emphasis on more careful sourcing of cattle, making herd/holding TB history data available more widely to encourage industry ownership of disease control. Enhancement of wildlife surveillance and control measures needed.

## **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 Leicestershire which forms part of the Edge Area since its establishment in 2013 (see Appendix 1).

## **Changes to the Edge Area in 2018**

On 1<sup>st</sup> 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 Leicestershire. 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 Leicestershire**

### Herd Types

There is a predominance (45% of all herds) of mainly small herds of up to 50 cattle as shown in Figure 1, and it would be reasonable to assume that the majority of these are beef cattle. There are some herds of over 500 cattle, accounting for 6% of all herds in the county. The majority of these large herds are dairy.

As shown in Figure 2 below, there is a predominance of beef cattle (almost 60%), although dairy cattle continue to exist in significant (but decreasing) numbers (23% in comparison with 37% in 2017).

The majority of these herds practise traditional husbandry based on winter housing and summer grazing.

## Markets

There is one livestock auction market in Leicestershire for cattle – Melton Mowbray Market – which as well as the standard store sales was licensed to hold Dedicated Sales for TB Restricted Cattle, commonly known as 'Orange Markets' in 2018.

## Approved Finishing Units

There are 13 Approved Finishing Units (AFU). The cattle on these approved premises are permanently under movement restrictions, housed under strict biosecure conditions and exempt from routine surveillance testing. Cattle kept in these units in the Edge Area do not have access to grazing and if correctly operated they are not considered a risk for introduction or spread of TB into the surrounding areas.

There has been an increase in the number of these units with six registered in 2017 and a further new one in this reporting year.

## Common Land

There are some small areas of common land in Leicestershire, with low numbers of cattle grazed and no significant co-grazing by more than one herd. Spread of TB related to cattle usage of common land is unlikely in this area.

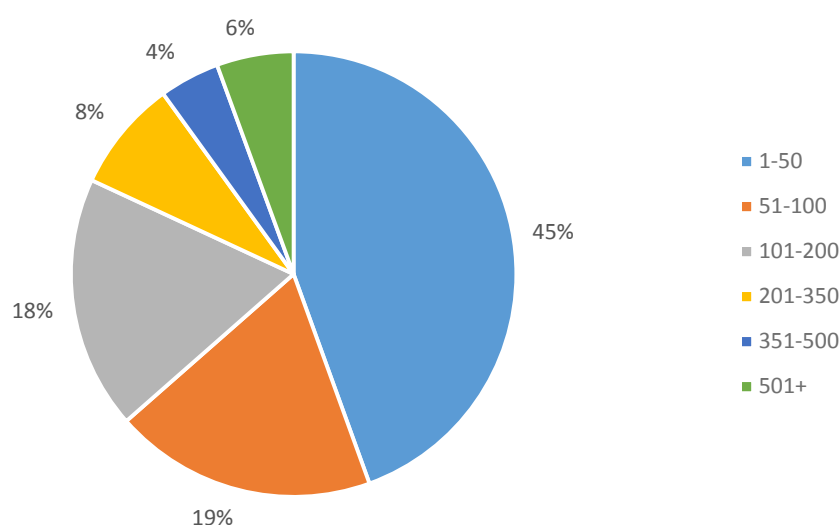


Figure 1: Proportion of cattle holdings by herd size in Leicestershire 2018 (n=917)

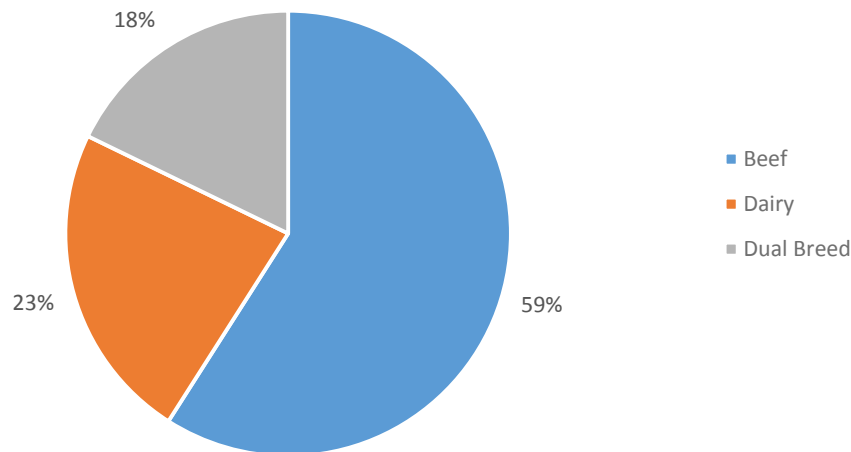


Figure 2: Proportion of cattle holdings by breed purpose in Leicestershire in 2018 (n=1462)

(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.)

For further information on cattle industry in Leicestershire please see Appendix 2.

## Overview of the bovine TB epidemic in Leicestershire

### *History of bovine TB in Leicestershire*

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 not<sup>1</sup>.

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 snapshot 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.

<sup>1</sup>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>

## Number of new breakdowns

The number of breakdowns detected yearly since 2009 is displayed below in Figure 3. A clear gradual increase in the number of new breakdowns disclosed from 2013 can be observed with a peak in 2016 with 53 breakdowns. This increase can be partially attributed to changes to the surveillance testing policies resulting in more frequent and the more sensitive TB testing, including the use of the interferon gamma test.

It is important to mention that in 2016, when there was a peak of disease, despite the big increase in the number of TB breakdowns there was a 21% reduction in OTFW cases as well as a 38% reduction in the number of reactors from 2015 to 2016.

For the last five years the number of OTFS and OTFW breakdowns has increased gradually, from 34 total cases in 2013 to 59 in 2018. In 2017 there was a reduction in the number of cases from the previous year although there was a 12.4% increase in OTFW cases compared to 2016.

Compared to the previous reporting year there was an increase of 13 bovine TB breakdowns from 46 to 59. In 2017 there were 21 OTFW breakdowns (45% of total TB breakdowns) compared to 22 OTFW breakdowns (37% of total TB breakdowns) in 2018. Therefore, although there has been an increase in the total number of bovine TB breakdowns in 2018, the number of OTFW breakdowns was virtually unchanged. This change could be attributed to the increase in surveillance as a result of the introduction of radial testing around herds suffering OTFW breakdowns from January 2018 and consequently leading to earlier detection of disease in neighbouring herds.

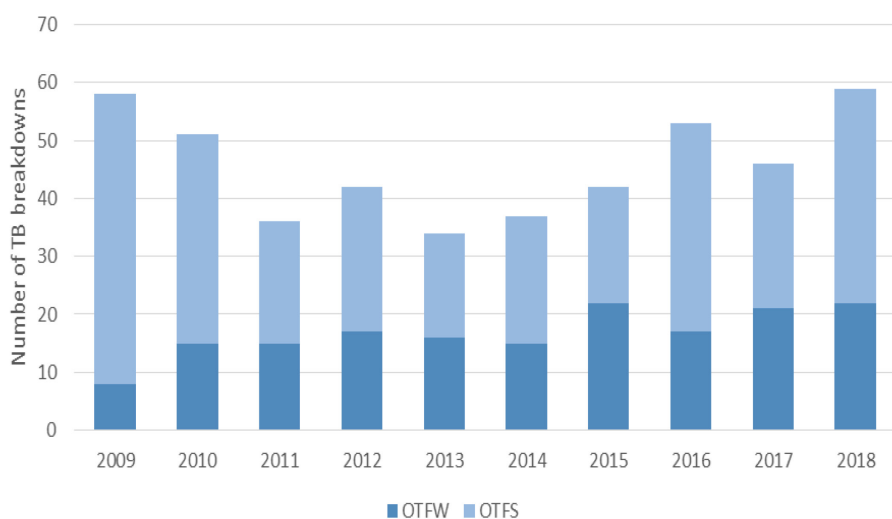


Figure 3: Annual number of new TB breakdowns in Leicestershire, 2009-2018

## Herd incidence rate

The herd incidence rate of TB in Leicestershire calculated from 2009 to 2018 is shown in Figure 4 below. From 2009 to 2013 there was a reduction in the incidence rate, but from 2013 there has been a trend of increasing incidence rate to 6.3% in 2018. This represents an increase of 1.3% from 2017. This rise could be partly attributed to the greater number of TB breakdowns detected as a result of the increase in the number and frequency of surveillance tests carried out since 2013, including the introduction of statutory radial testing in January 2018.

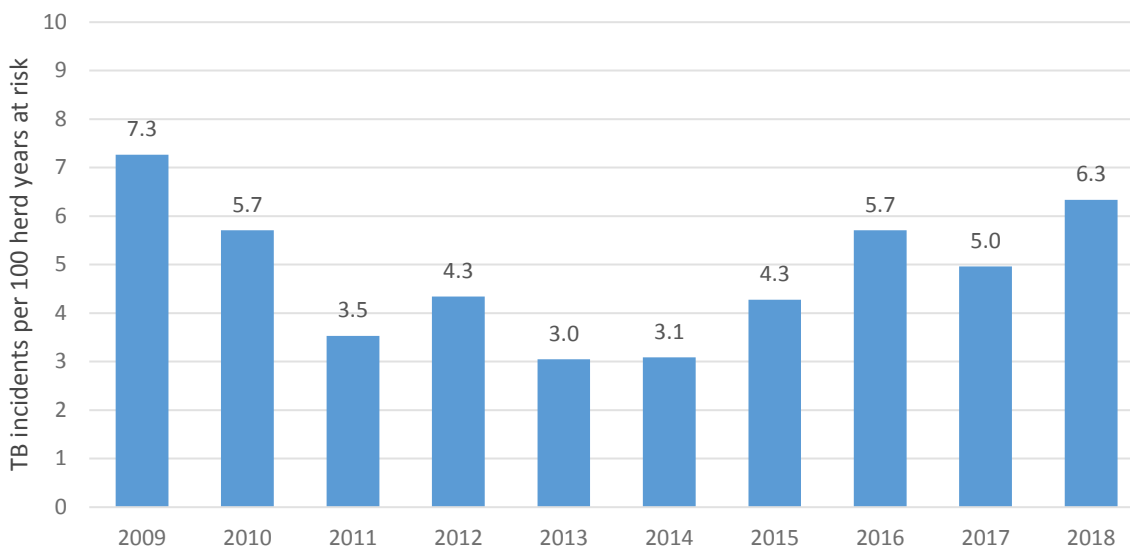


Figure 4: Annual herd incidence rate (per 100 herd-years at risk) for all new breakdowns (OTFW and OTFS) in Leicestershire, 2009-2018.

### Herd prevalence

Herd prevalence is calculated for all new breakdowns (OTFS and OTFW) under restriction at the end of the reporting period as a percentage of total herds live at that time.

Whereas the incidence rate takes into account all new cases for a particular period, prevalence takes into account existing and new cases, hence any previously infected herds still restricted are taken into account in the reporting period. The prevalence data therefore demonstrate the burden of disease.

The herd prevalence of bovine TB in Leicestershire was calculated for 2009 to 2018 and this is shown in Figure 5 below.

From 2009 to 2014 there was an overall trend of decreasing prevalence to 1.42%. From 2015 there has been an increase in the prevalence to 3.77% in 2018.

The increased prevalence is related to endemicity of the disease in some areas of Leicestershire. Difficulties in breaking wildlife related risk pathways often results in constant reinfection of cattle and prolonged breakdowns.

This increase in herd prevalence could also have resulted from the implementation of stricter breakdown control policies such as enhanced cross checks completed in the Cattle Tracing System (CTS) before TB restrictions are lifted or the late submission of Cleansing and Disinfection declarations (BT05) from farmers. In addition short interval testing following disclosure of reactors is now being completed a minimum of 60 days from the reactor removal date rather than 60 days from the date of



effective isolation of reactors. This delay is a potential contributor to the lengthening of breakdown duration which in turn could have an effect on herd prevalence.

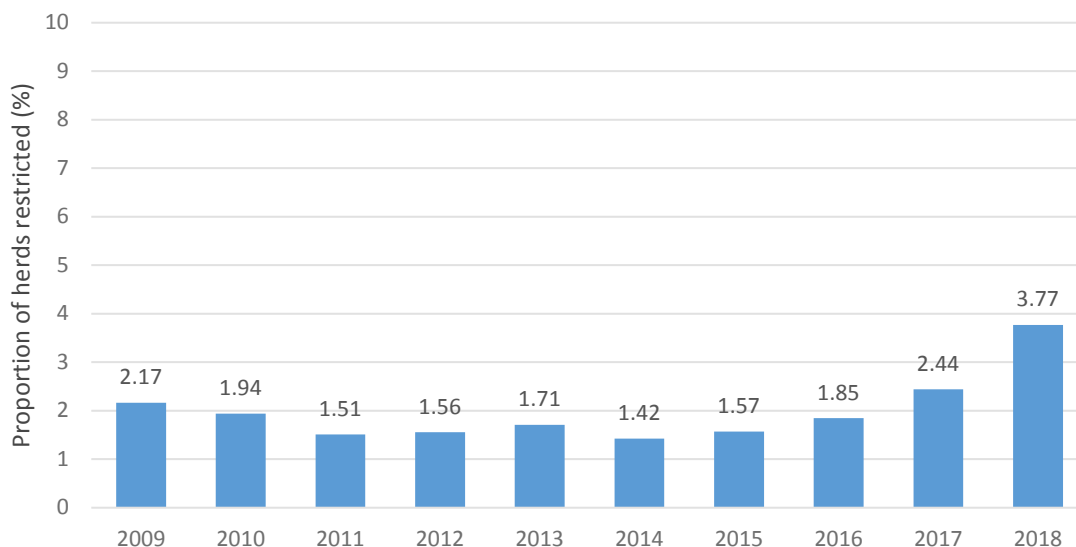


Figure 5: Annual end of year prevalence of restricted herds in Leicestershire, 2009-2018.

### ***Geographical distribution of bovine TB cases (new and ongoing) in Leicestershire***

The geographical distribution of OTFS and OTFW cases in 2018 was similar to that in 2017 as shown in Figures 5a and 5b below. Breakdowns were detected all over the county, apart from the south east where disease is hardly present. There was a decrease in the number of cases in the north west of the county on the boundary with Derbyshire. There is no evidence of infection from Derbyshire.

**interferon interferon interferon interferon interferon interferon interferon Total incidents during 2017**  
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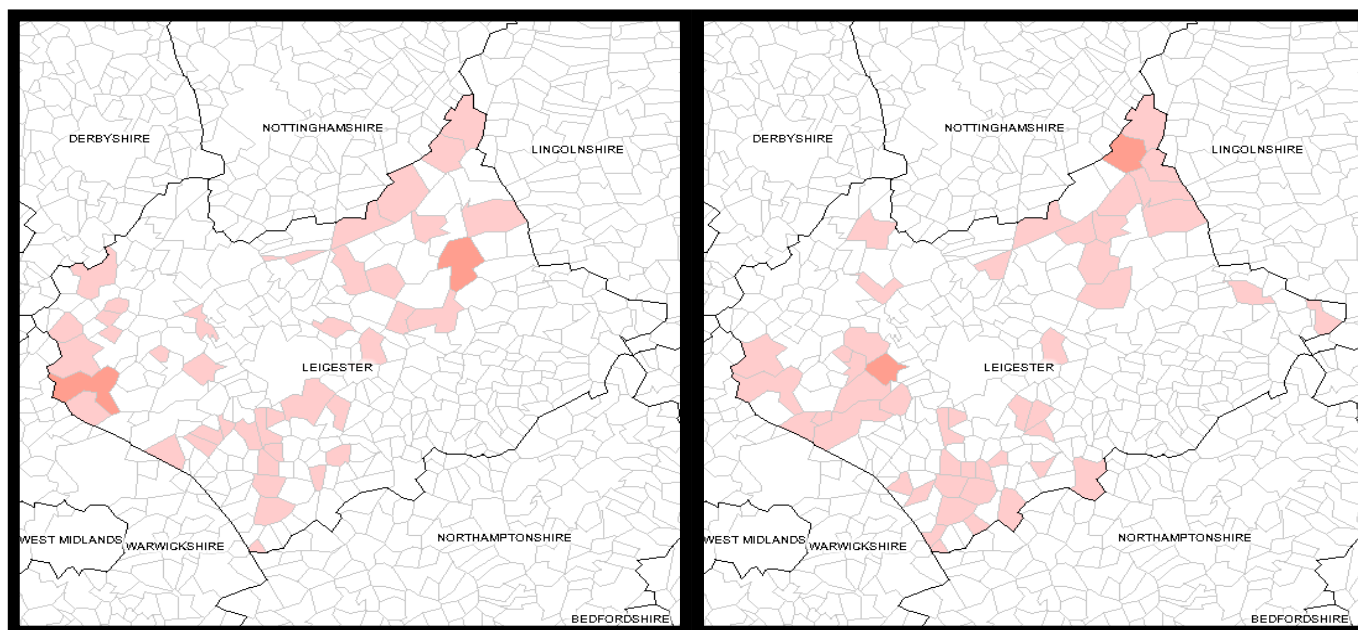


Figure 5a: Total new TB herd incidents in Leicestershire in 2017 and 2018 respectively.

The majority of the OTFS cases occurred in the south west of Leicestershire with a similar distribution to the previous year. The distribution of OTFW breakdowns was also similar to 2017 with the majority

of these cases in the north east of the county, where emerging infected areas have been identified in a cluster of TB breakdowns. A more comprehensive description of this cluster and mitigating factors is provided in Section 7 (Summary of risks to the Low Risk Area).

There is also an increase in the number of OTFW TB breakdowns in the south west of Leicestershire along the boundary with Warwickshire as shown in Figure 5b below.

**OTFS incidents during 2018**  
**OTFW incidents during 2018**

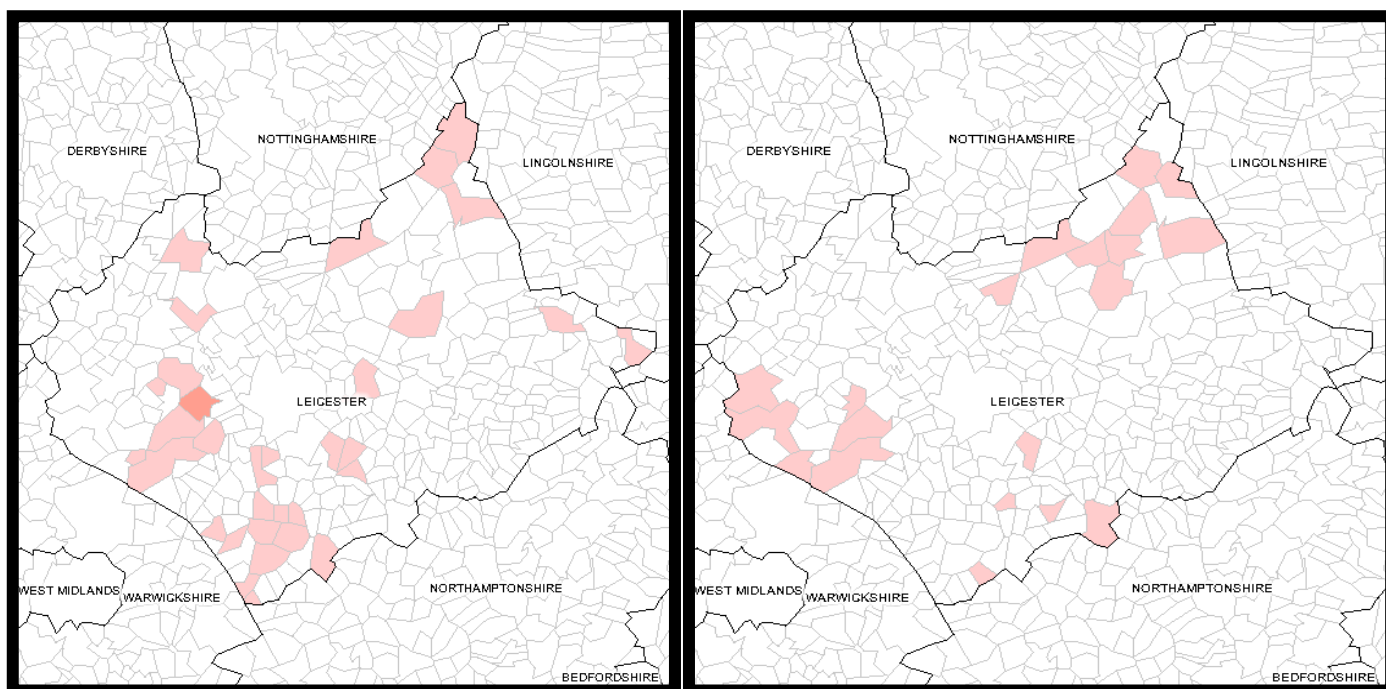


Figure 5b: Comparison of OTFS and OTFW incidents in Leicestershire in 2018

The 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 is shown below in Figure 6. The distribution map is overlaid on the cattle holding density map (with cattle density inset). It can be seen that the distribution of cases in 2018 (similar to that in 2017) correlates with the cattle holding and cattle densities.

The majority of OTFS incidents are still in the south west of Leicestershire while OTFW incidents predominate in the north east of Leicestershire on the boundaries with Lincolnshire and Nottinghamshire. This emerging infected area has been identified as a cluster of fully confirmed (OTFW) breakdowns in the north east of the county next to the LRA county of Lincolnshire, with a similar distribution to 2017 and 2016. This cluster, around Melton Mowbray, has a relatively high proportion of fully confirmed breakdowns attributed to a wildlife origin with genotype 25:a. A potential TB Hot Spot Area (HS23) was identified and implementation of additional wildlife and cattle surveillance measures commenced in 2018.

There were no cases of TB in the north west of the county along the boundary with Derbyshire in 2018. There has been a decreased number of TB breakdowns in this area since 2016 with no cases in 2018.

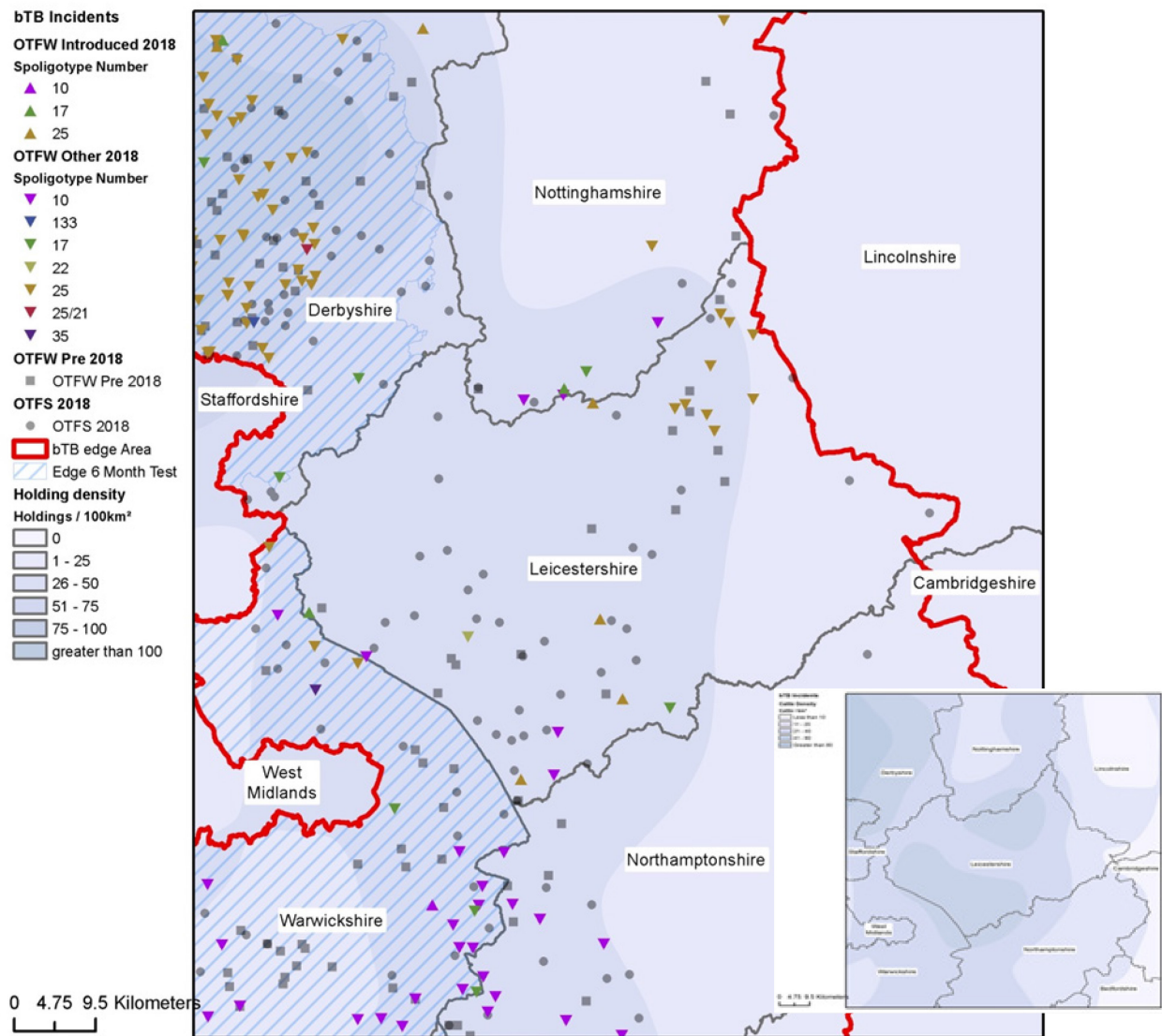


Figure 6: Geographical distribution of all new TB breakdowns (OTFW and OTFS) in 2018 and pre 2018 OTFW breakdowns still ongoing at the end of the report period, overlaid on a cattle holding density map, with a cattle density map for the area inset

The genotypes of *M. bovis* isolated from OTFW breakdown herds in Leicestershire in which the source of infection was attributed with a 75% certainty to wildlife are shown in Figure 7 below.

In 2015, a TB cluster sharing the same genotype 25:a was detected in a parish in the north east of Leicestershire. All breakdowns in this area were associated with wildlife infection. Since 2015 there has been an emerging area where the cluster of TB breakdowns associated with wildlife sharing the same genotype 25:a has increased mainly moving north east of the county towards the boundaries with Lincolnshire.

The map at Figure 7 shows the breakdown distribution during 2018 within the cluster northeast of Melton Mowbray, providing evidence that disease is potentially endemic in this area. It also reflects the proximity to the LRA county of Lincolnshire. The genotype 25:a cases potentially associated with wildlife appeared clustered with similar cases in Lincolnshire and Nottinghamshire in the new potential hotspot (HS23) in the bordering Lincolnshire LRA.

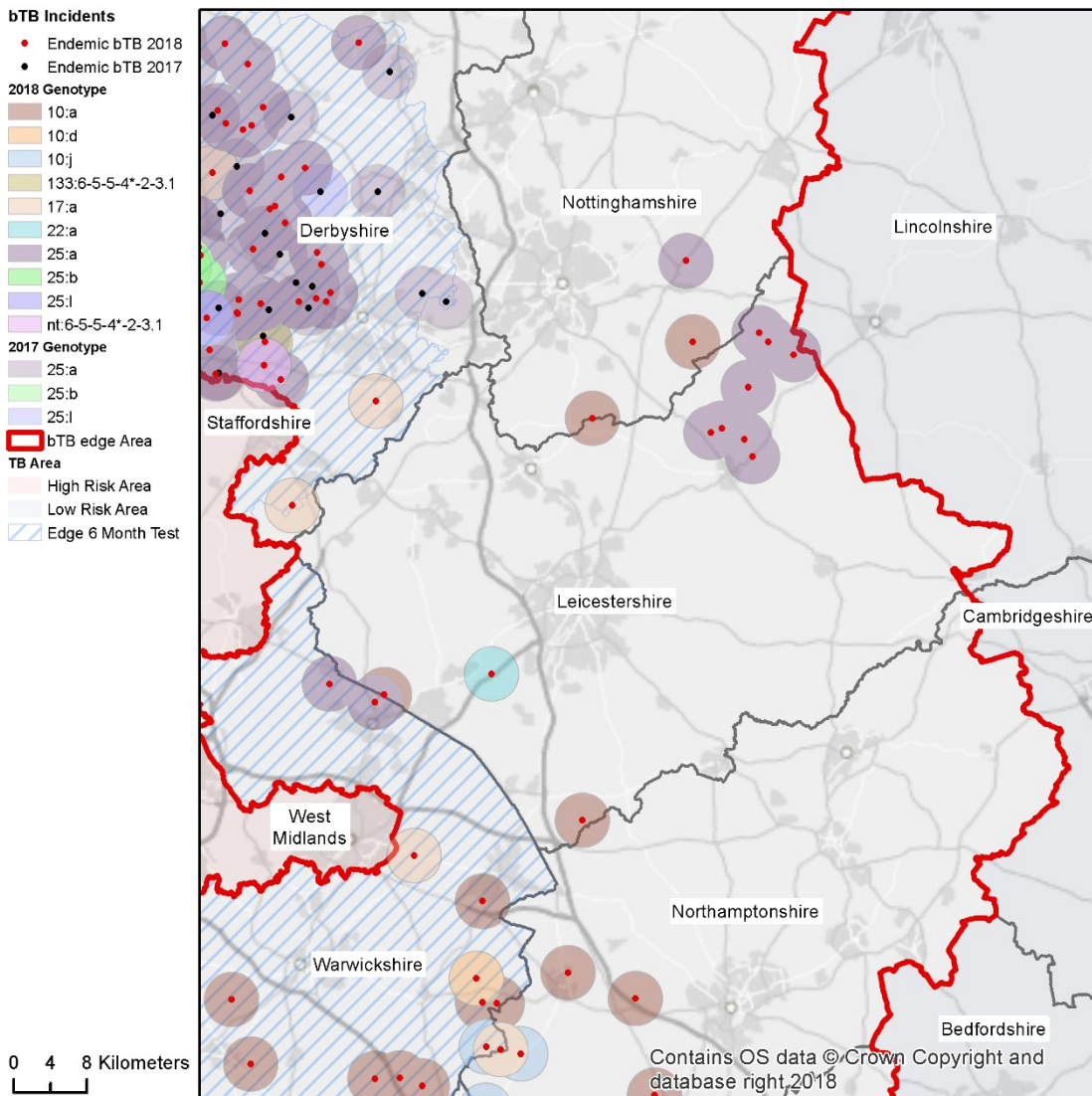


Figure 7: Genotypes detected in Leicestershire, where a wildlife source was attributed with a 75% certainty or above, as an indication of endemicity within local wildlife populations (OTFW breakdowns only).

The most likely source of infection recorded for all TB breakdowns (OTFW and OTFS) which started in 2018 is shown in Figure 8 below. Despite the reduction in the number of TB breakdowns associated with wildlife in all of Leicestershire, there has been an increase in the number of incidents attributed to wildlife in the north east of the county. It is significant that all OTFW cases in the north east of Leicestershire have been attributed to wildlife. This is the area where there is evidence of disease becoming endemic. The assessment of the source of infection is more accurate in OTFW cases where *M. bovis* genotyping data are available. Genotyping is an important tool to assess and support the analysis of specific transmission pathways.

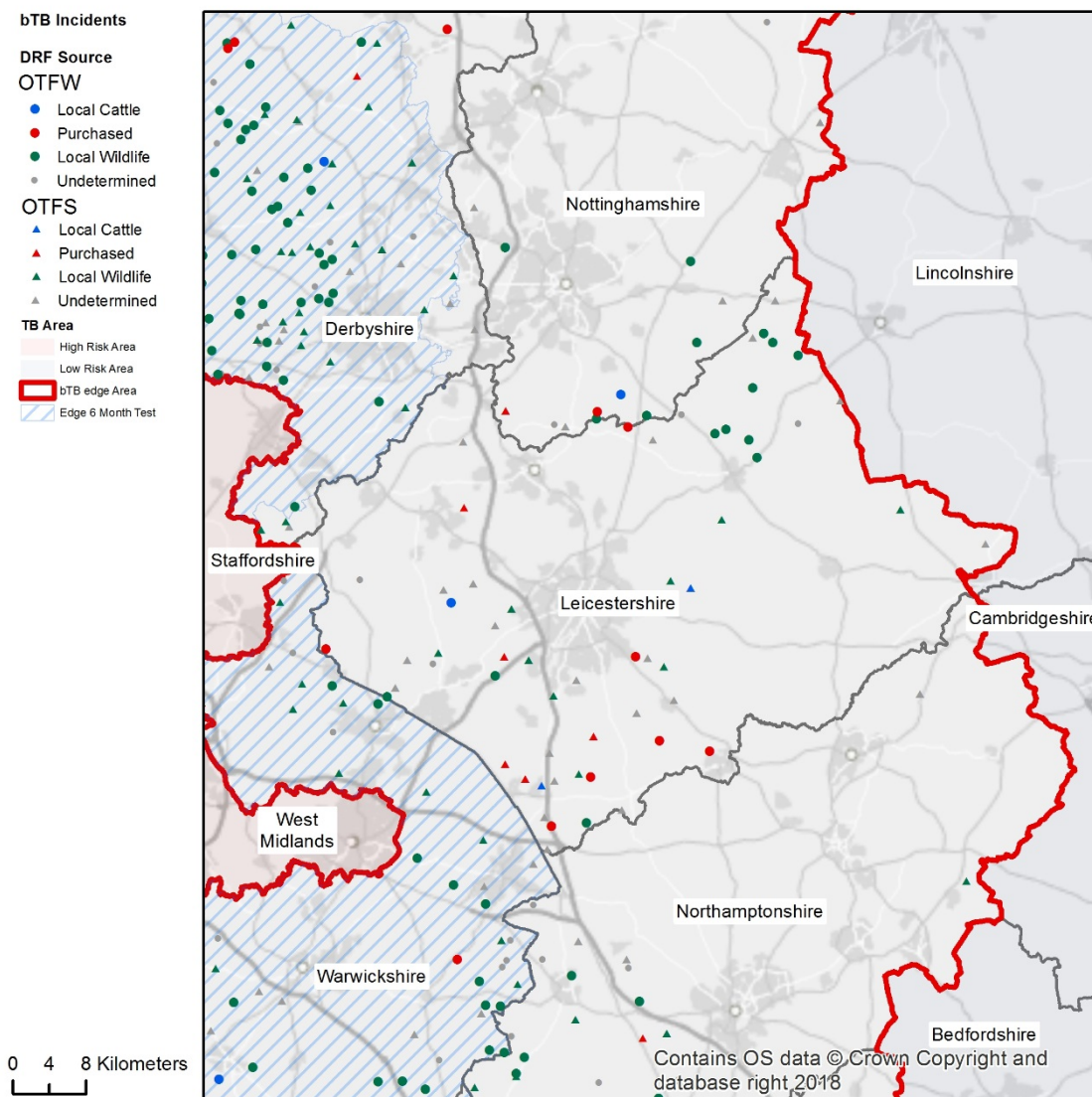


Figure 8: The source of infection recorded with the highest level of certainty, for all TB breakdowns (OTFW and OTFS) that started in 2018

## Descriptive epidemiology of bovine TB in Leicestershire

### *Characteristics of bovine TB in Leicestershire*

Figure 9 below shows the total number of TB breakdowns in 2018 in Leicestershire by cattle herd size and type.

- **Beef suckler:** 25% of all TB breakdowns in 2018 occurred in this sector. A total of 15 breakdowns out of 59. Of these breakdowns, almost 50% were OTFW, making this the sector with more fully confirmed breakdowns in 2018 in comparison to 2017. This could be as a result of the increase of OTFW incidents associated with wildlife infection as the main risk pathway.
- **Beef fattener:** 31% of all TB breakdowns in 2018 occurred in this sector. A total of 18 breakdowns out of 59. Of these TB breakdowns 33% were OTFW.
- **Dairy sector:** This sector had the biggest number of TB breakdowns in the reporting year with 25 of 59, 42% of all the TB breakdowns. Of these breakdowns, 32% were OTFW.

- **Mixed-other:** This sector has had one confirmed breakdown in 2018. This sector only represents 18% of all herd types in Leicestershire and therefore is likely to have very few breakdowns.

The occurrence of TB breakdowns by herd size appears to be equally distributed among categories. However, if the percentage of herds by size is taken into consideration, herds with more than 500 cattle represent only 6% of all herds, but 20% of all TB breakdowns occurred within this group.

Herd size has been consistently and positively associated with the probability of a TB breakdown; the number of contacts and hence the probability of transmission increases with the number of animals in an epidemiological group.

- **1-50 herd size** represents 45% of all the herds in Leicestershire and 11 of the 59 total breakdowns (19%) were disclosed within this group in 2018.
- **51-100 herd size** represents 19% of all the herds in Leicestershire and 7 of the 59 total breakdowns (11%) were disclosed within this group in 2018.
- **101-200 herd size** represents 18% of all the herds in Leicestershire and 11 of the 59 total breakdowns (19%) were disclosed within this group in 2018.
- **201-350 herd size** represents only 8% of all the herds in Leicester and 12 of the 59 total breakdowns (20%) were disclosed within this group in 2018.
- **351-500 herd size** represents only 4% of all the herds in Leicester and 6 of the 59 total breakdowns (10%) were disclosed within this group in 2018.
- **501+ herd size** represents 6% of all the herds in Leicester and 12 of the 59 total breakdowns (20%) were disclosed within this group in 2018.

In summary, in 2018 fewer than 4% of herds with <100 cattle experienced a TB breakdown compared to 24% of herds with more than 500 cattle.

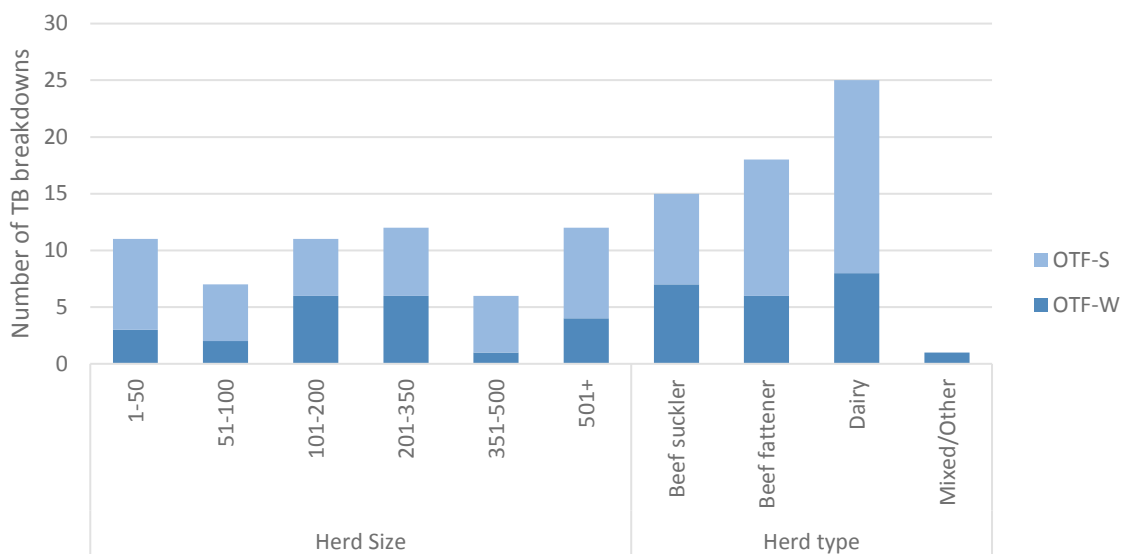


Figure 9: Number of new TB breakdowns (OTFW and OTFS) in Leicestershire, by cattle herd size and type.

Figure 10 reflects the distribution of all bovine TB breakdowns by month from January to December 2018. The chart shows a peak of bovine TB breakdowns in the winter period from November to January and the biggest number of TB breakdowns during the summer period occurred in April and July. This could be associated with an increase in TB testing before and after turning animals out for the grazing period. No data are available to show the distribution of whole herd tests throughout the year and whether the breakdown distribution correlates with levels of testing.

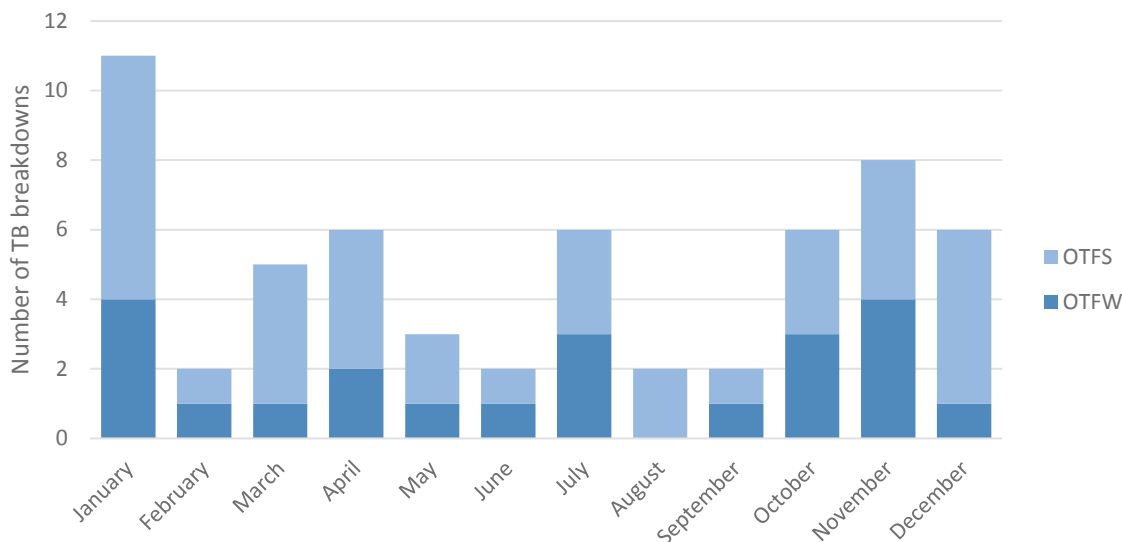


Figure 10: Number of new TB breakdowns (OTFW and OTFS) in Leicestershire, by month of disclosure.

Figure 11a below shows the distribution of genotypes of *M. bovis* identified in cattle herds that sustained new OTFW breakdowns in 2018. Genotype 25:a was identified in 11 of the 18 isolates obtained in 2018; this represents over 60% of all genotypes identified in Leicestershire. Genotype 25:a is endemic in parts of the neighbouring counties of Staffordshire (HRA) and Derbyshire (Edge Area). This genotype has also been increasingly identified in Leicestershire in the preceding years: 35% of all OTFW cases in 2016, 55% of all OTFW cases in 2017.

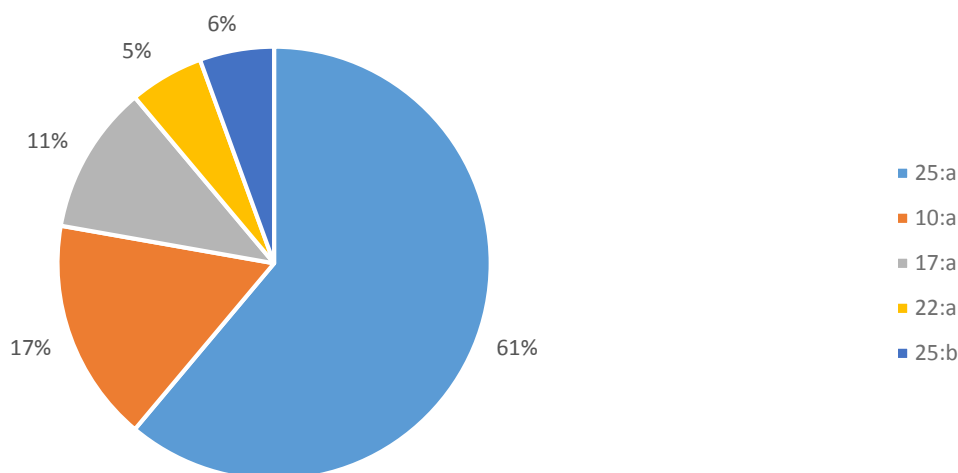


Figure 11a: Genotypes of *M. bovis* identified in herds affected by new OTFW breakdowns in Leicestershire in 2018 (n=18).

The geographical distribution of genotype 25:a in Leicestershire this reporting year is similar to 2017 as shown in Figure 11b below. Most breakdowns with this particular genotype were disclosed in the north east of Leicestershire near the boundaries with Nottinghamshire and the LRA county of Lincolnshire. The only two 25:a genotypes isolated in breakdowns in the south of Leicestershire are associated with introduction of infection by purchased cattle. There is no evidence of disease being endemic in this area of Leicestershire.

interferon interferon interferon **Genotype 25:a occurrence during 2017**interferon interferon interferon interferon  
interferon interferon interferon interferon **Genotype 25:a occurrence during 2018**

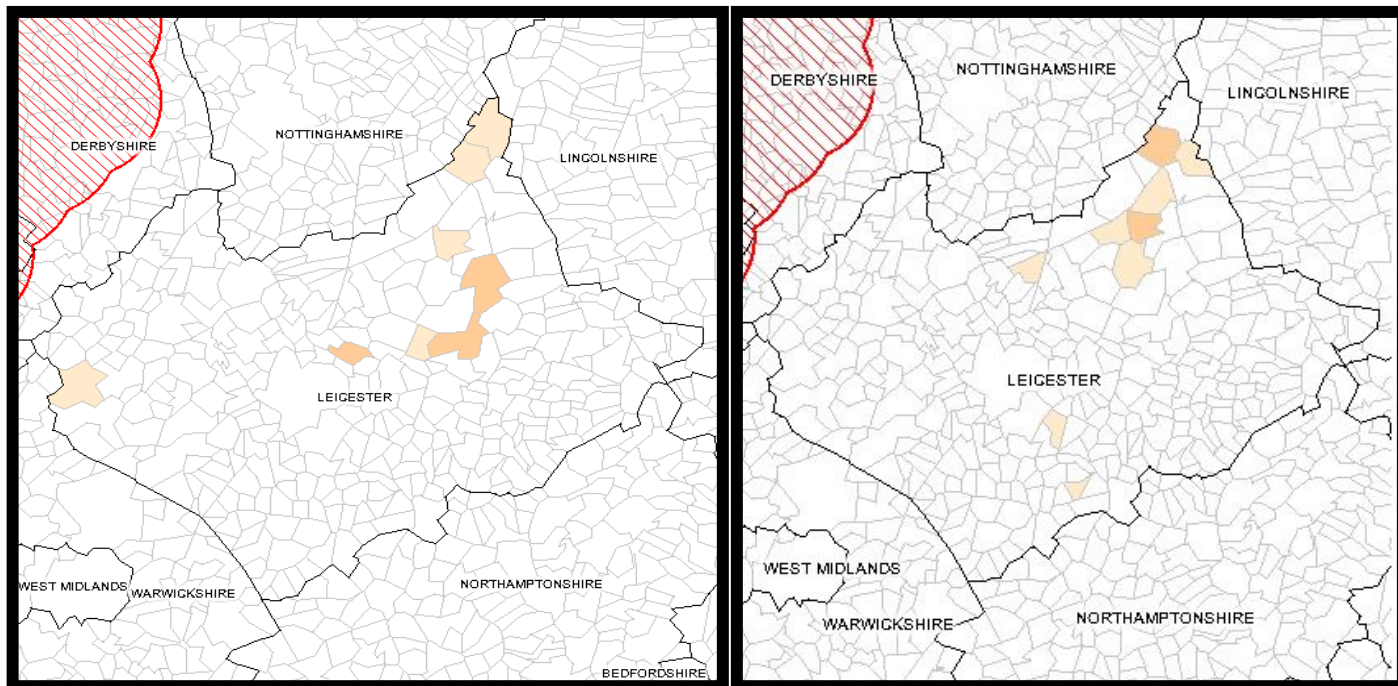


Figure 11b comparing the distribution of genotype 25:a in Leicestershire in 2017 and 2018.

Figure 12 below shows the duration of TB breakdowns and reflects that the majority of all TB breakdowns resolved in 2018 had a duration of 151 to 240 days. There were two reports of persistent breakdowns (those with a duration of over 18 months) that were resolved in 2018. One of these herds experienced a recurrence of infection following disclosure of reactors at the enhanced surveillance test carried out six months post breakdown resolution.

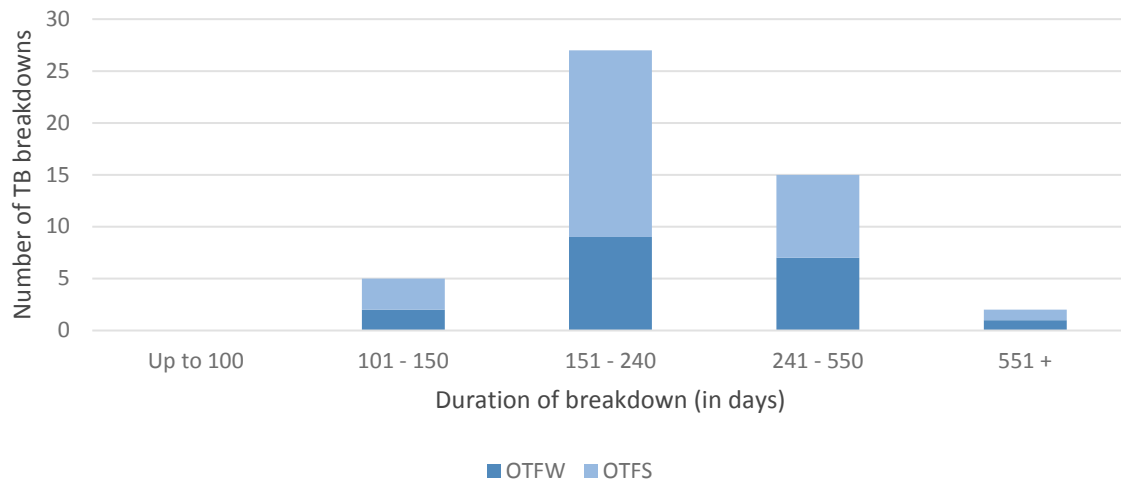


Figure 12: Duration of TB breakdowns (OTFW and OTFS) closed in Leicestershire in 2018.



### ***Risk pathways for bovine TB infection in Leicestershire***

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.

Figure 13 below shows the likely source of infection for all new breakdowns in 2018. In 2018, 51% of infection sources were attributed to badger infection whereas almost 60% were attributed to wildlife in the previous year. In contrast 30% of all TB breakdowns were attributed to cattle movements and this represents an increase from 2017, when 24% were attributed to purchase of infected cattle as the likely source of infection. There has been an increase from 0% in 2017 to almost 8% this year in incidents where the likely source was residual cattle infection in the herd.

Despite the apparent reduction of TB breakdowns associated with cattle exposure to infected wildlife reservoirs, in all Leicestershire as a whole, there has been an increase in the number of breakdowns in the north east of Leicestershire attributed to this source, as previously shown (Figure 8).

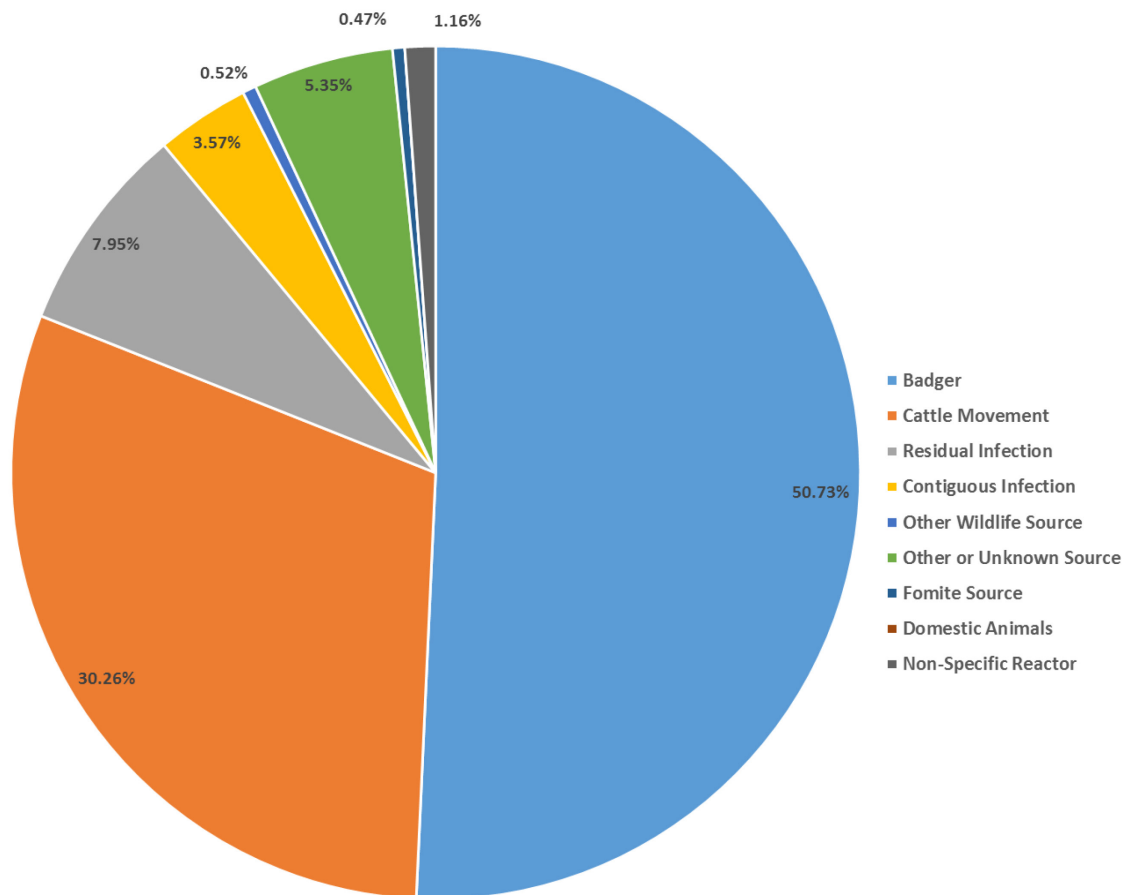


Figure 13: Summary of the weighted source of infection attributed for all incidents (both OTFW and OTFS) in Leicestershire that started in 2018

The source of infection recorded with the highest level of certainty for all TB breakdowns (both OTFW and OTFS) in the county by herd type is shown in Figure 14a below.

1. **Beef fattener sector:** Only one TB breakdown in 2018 was associated with wildlife within this sector. The increase in the number of AFUs (without grazing) in the area will somewhat reduce this risk, providing that they operate as per the licence conditions - hence the importance of routine unannounced visits to these units.
2. **Beef suckler sector:** Over 60 % of breakdowns in beef suckler herds were attributed to infection via contact with wildlife and only 11% to cattle movements. There was a slight increase in the number of breakdowns associated with wildlife in this sector in comparison with the previous year's figure of 57% of cases associated to wildlife origin.
3. **Dairy sector:** Almost 82% of the OTFW breakdowns in 2017 were considered to be from wildlife origin, which is very similar to 2018 figures where 88% of TB breakdowns were associated with a wildlife infection source.

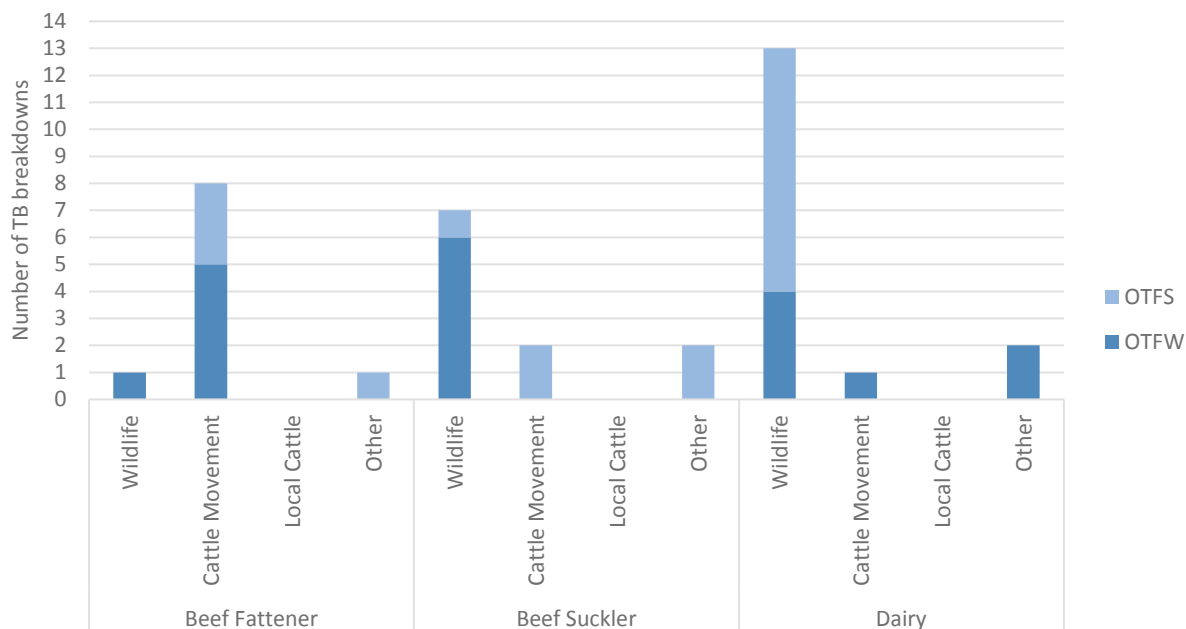


Figure 14a: Source of infection recorded with the highest level of certainty for all TB breakdowns (both OTFW and OTFS) in Leicestershire by herd type.

## Role of other species in Leicestershire

### Badgers and other wildlife

There is a thriving and, in some specific areas, dense badger population in this county, with many livestock farmers reporting an increase in badger activity on their holding or neighbouring land. The north east of Melton Mowbray is the worst affected by TB and this is an area where badgers are abundant, with clear evidence of their activity. The genotypes of *M. bovis* shared between these OTFW breakdown herds, in combination with evidence gathered from field inspections, reinforces the importance of the role badgers may be playing in disease propagation. Multiple holdings have experienced breakdowns for first time in 2018, with homebred animals being affected. This area had the highest number of cattle herd breakdowns and is where the majority of incidents in cattle were attributed to wildlife.

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

The epidemiological investigations carried out in 2018 in north east Leicestershire contributed to the establishment by APHA of a new potential TB hotspot area straddling northeast Leicestershire (Edge Area) and west Lincolnshire (LRA). Figure 14b below represents the area (known as 'HS23') where APHA is applying potential TB hotspot procedures, including enhanced levels of surveillance in cattle and wildlife.

A 'potential bovine TB hotspot' area is identified when one or more lesion and/or culture positive TB breakdowns of obscure origin occurs in the Low Risk Area. 'Obscure origin' means that, following investigation by APHA, the breakdown cannot be attributed to purchased/brought-in cattle or to spread from other cattle herds or non-bovine livestock in the locality. The potential hotspot area will usually be

defined by distinct boundaries such as rivers or roads to facilitate identification of whether wildlife found dead are eligible for inclusion in the wildlife survey.

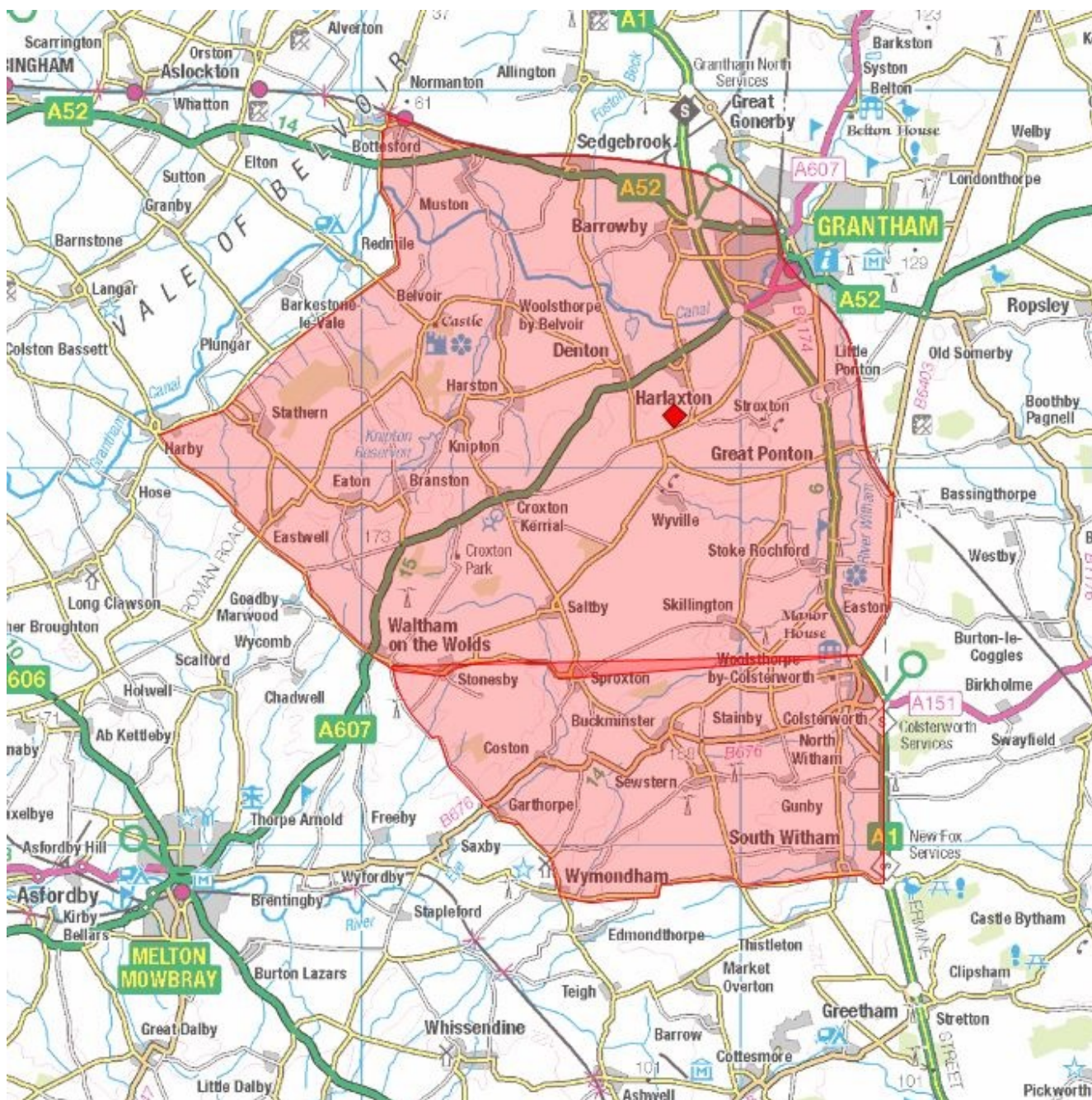


Figure 14b: Leicestershire/Lincolnshire area (in red) where potential TB hotspot surveillance measures are being applied.

### Other domestic species

There have been no laboratory confirmed isolations of *M. bovis* in other species in Leicestershire. Submission rates are extremely low in other domestic species.

### **Detection of cases in Leicestershire**

The chart in Figure 15 below shows the proportion of new herd breakdowns that were disclosed by different surveillance types in 2018. Most notable for Leicestershire is that 44% of those breakdowns were disclosed by routine annual herd surveillance testing. In addition to this, only 3% of breakdowns were disclosed by post mortem meat inspection of OTF cattle in the slaughterhouse. This could be an indication of improved application of TB skin testing leading to earlier detection of infection within a herd with consequently fewer breakdowns being identified by passive surveillance in the slaughterhouse.

Radial testing (RAD) was implemented in 2018 for the first time in Leicestershire and nine (15%) of the 59 breakdowns were disclosed by this surveillance testing method.

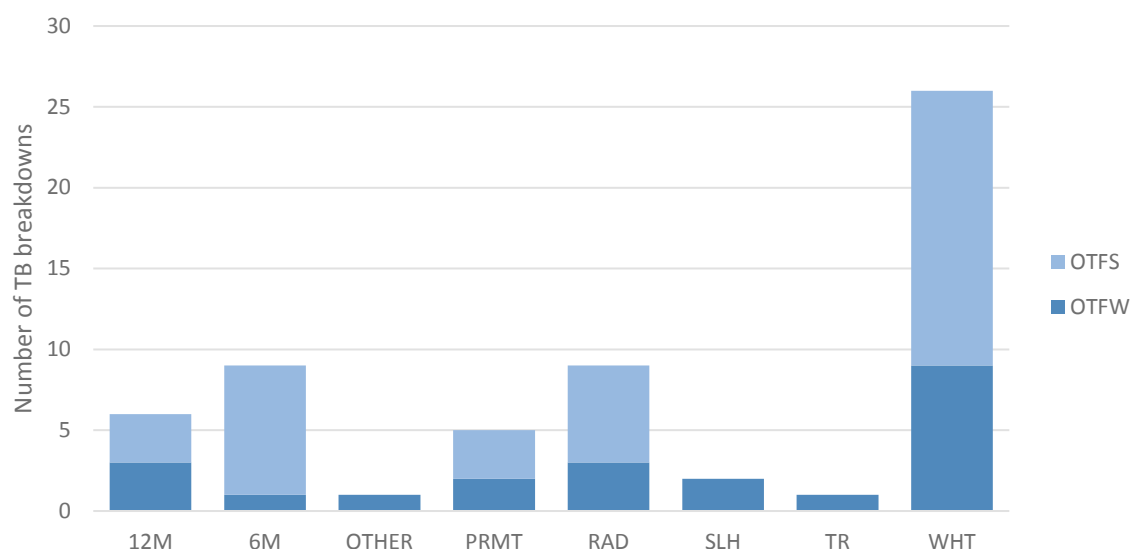


Figure 15: Distribution of the number of TB breakdowns (OTFW and OTFS) in Leicestershire in 2018, according to the surveillance methods that led to their detection (surveillance method types are further described in the Explanatory Supplement<sup>1</sup>).

Figure 16 represents the proportion of breakdowns in 2018 that had experienced a TB breakdown (OTFS or OTFW) in the previous three years. Over one third (35%) of all OTFS breakdowns in 2018 occurred in herds which had experienced a TB breakdown in the previous three years. This figure is lower for OTFW breakdowns, with 24% of herds having had a TB breakdown in the previous three years.

This could indicate in some cases either reinfection or residual infection in cattle from previous breakdowns. No ante mortem test for TB in cattle is perfectly sensitive despite the repeated use of the skin test at short intervals and with a severe interpretation, sometimes supplemented by the interferon gamma blood test. Therefore undisclosed infected animals can sometimes remain after a breakdown herd regains OTF status and this could cause further breakdowns in that herd.

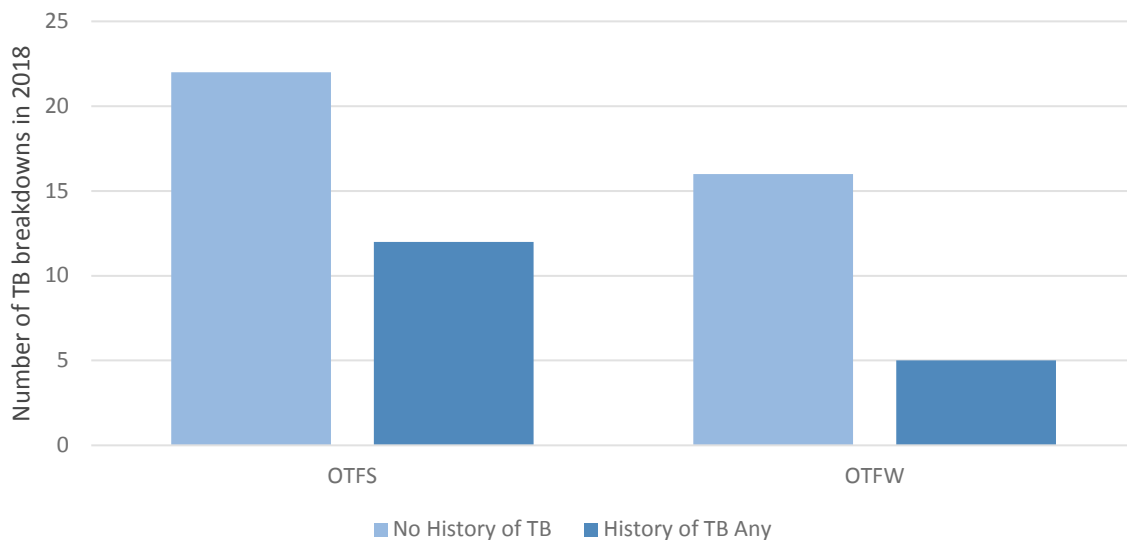


Figure 16: Number of TB breakdowns (OTFW and OTFS) in Leicestershire which experienced a breakdown in the previous three years.

### ***Burden of bovine TB***

The number of reactors disclosed by different tests types in TB breakdowns from 2009 to 2018 is shown in Figure 17 below.

The total number of skin test reactors and interferon gamma test positive animals has increased since 2016, when 262 of those animals plus six direct contacts were slaughtered for TB control reasons in Leicestershire. The following year 362 skin and interferon gamma positive animals (plus 15 direct contacts) were identified and in 2018 there was an increase of 39, resulting in the identification and removal of 401 skin test reactors and interferon gamma test positive animals (no direct contacts). For more information see Appendix 3.

In the reporting year 50% of all the reactors were identified by the skin test. From 2016 the number of reactors identified by interferon gamma testing has gone up from 35% to 50% in 2018. The interferon gamma blood test is usually only applied in OTFW cases in the Edge Area. The small increase in the number of OTFW breakdowns between 2016 and 2018 could explain the increase in skin reactor numbers over the same time period, particularly when large herds are involved.

The burden of TB in Leicestershire is considerable in terms of numbers of breakdowns at any one time, the number of cattle being slaughtered, the economic effects on both the farming business associated agricultural businesses, trade, the impact to the taxpayer and the emotional impact on affected farmers and veterinarians.

TB impacts on the ability to move cattle off the breakdown premises which can have considerable consequences for breeding stock (bulls, cows and heifers), for weaned beef calves, stores and for dairy calves not normally reared on farm. Likewise, replacement stock for reactors which have been slaughtered can prove difficult in the case of pedigree or organic herds especially for large numbers of reactors at disclosing tests when no stock is allowed to move on before the first breakdown test. The duration of TB movement restrictions is another burden associated with this disease.

The average duration of TB breakdowns has been shown to be just less than six months, but there will be a significant number of farms under TB restrictions for much longer and some into many years depending on location and likely source of disease.

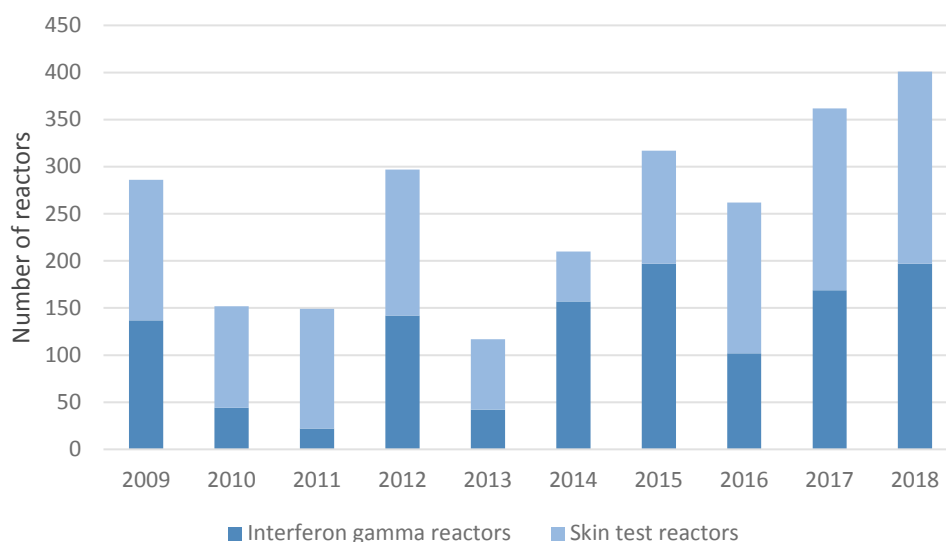


Figure 17: Number of reactors detected by interferon gamma and skin tests in Leicestershire 2014 to 2018

## Key drivers of the bovine TB epidemic

### Infected badgers

In 2015 a TB cluster in the north east of Leicestershire was detected in a single parish, all sharing the same genotype of *M. bovis* (25:a). Neighbouring parishes have seen the same genotype in closed herds.

The cluster still has active breakdowns and there has been an increase in genotype 25:a breakdowns associated with wildlife in 2018, with evidence of disease becoming endemic as shown previously in Figure 8.

The map in Figure 11b above shows the distribution of breakdowns with genotype 25:a in 2017 and 2018 within the cluster providing evidence that disease is potentially endemic in this area. It also reflects the proximity of this cluster to the LRA county of Lincolnshire. Spill over of disease into wildlife could have potentially serious consequences for this county.

There have been 11 cases of genotype 25:a isolated in Leicestershire in 2018. Two of these cases in the south of Leicester were both associated with the movement of cattle from herds with undetected infection. The rest of the cases were located in the north east of the county and in eight of these cases infected wildlife reservoirs were assessed as the most likely origin. One was possibly associated to the purchase of an animal with undetected infection, although wildlife infection could not be ruled out.

Results from the Defra-funded survey of found dead badgers in the Edge Area are still awaiting publication, but should provide, when available, an indication of the apparent prevalence of *M. bovis* infection in the local badger population.

Part of the Vale of Belvoir is included in the Defra-funded Badger Edge Vaccination Scheme (BEVS). In 2018 there was re-engagement with existing landowners in the BEVS scheme area and three new landowners were brought into the scheme.

Scheme data for 2018 show that:

- 8310 ha (83.1 km<sup>2</sup>) comprises total project area
- 5976 ha (59.7 km<sup>2</sup>) of land (72% of project area) where there has been contact with landowners
- 15 different landholdings within the scheme
- 1986.46 ha (19.8 km<sup>2</sup>) comprises vaccinated landholding
- 84 badgers vaccinated
- 20 badgers re-trapped at 30 setts

### Cattle movement

The inward movement of undetected infected cattle was the likely origin of 30% (n=7) of all new breakdowns in 2018. This is a similar figure from the previous reporting year, when inward cattle movement was thought to have been responsible for the source of infection in 26% of all the TB breakdowns.

A new industry-led scheme set up nationally by the Cattle Health Certification Scheme (CHeCS) was established in 2016 to try to encourage farmers to minimise the risk when buying cattle. However, further collaboration between industry, government and private veterinarians could encourage uptake of these schemes.

The Farm Level TB reports issued by APHA during a breakdown have proven useful and of interest to farmers.

### Recurrence and persistence

There were two reports of persistence of infection in 2018 and none in 2017. This is a significant change as persistence was not an issue in Leicestershire in the previous reporting year. One of the breakdowns concluded during 2018 and the other in February 2019 after a duration of 540 and 543 days respectively.

### ***County summary***

The apparent establishment of a TB endemic area in this county suggests that it would not be a candidate for achieving OTF status in the near future.

### **Summary of the risk to the Low Risk Area (LRA) from Leicestershire and any mitigating factors**

The summary of risks to the LRA is unchanged from 2017. Specifically, the north east Leicestershire cluster continues to be of concern because of its persistence and its contiguity to the LRA county of Lincolnshire. Genotype 25:a has been identified in several TB breakdowns in this cluster as well as in the south of Nottinghamshire and the neighbouring Lincolnshire parishes. In the north east Leicestershire cluster the majority of these cases are associated with wildlife infection.

Only two of these OTFW incidents which share genotype 25:a are clearly associated with the introduction of infected cattle and both farms are situated in the south of Leicestershire as per maps in Figure 17a below.

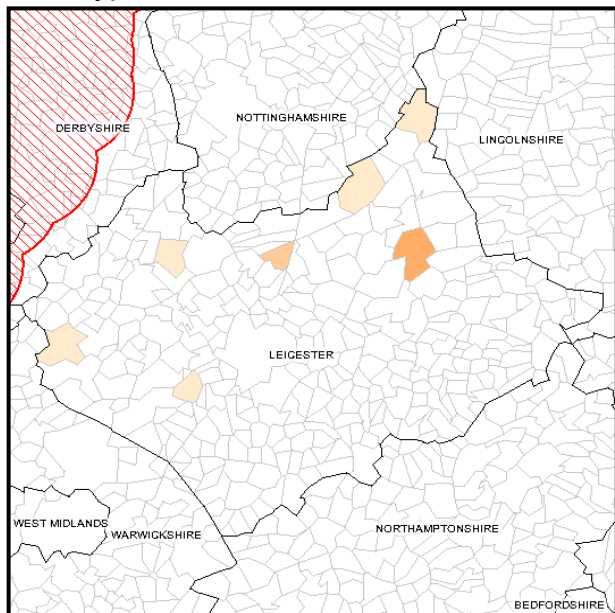
Figure 17a below shows the distribution of OTFW cases confirmed with genotype 25:a in Leicestershire from 2015 to 2018. These maps show that the biggest increase of this particular genotype has been in the north east of the county. In 2015 this particular genotype was evenly distributed in comparison with



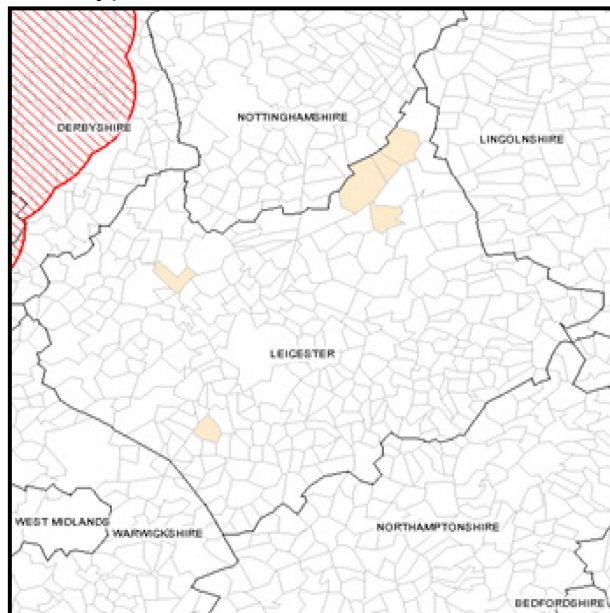
2018 where the majority of confirmed breakdowns with genotype 25:a have been disclosed in the north east of the county.

This could be an indication that the disease is becoming endemic in the north east of the county, hence the proposal to carry out *ad hoc* whole genome sequencing of all *M. bovis* isolates from this area to provide further detail on the patterns and likely pathways of infection for the affected herds.

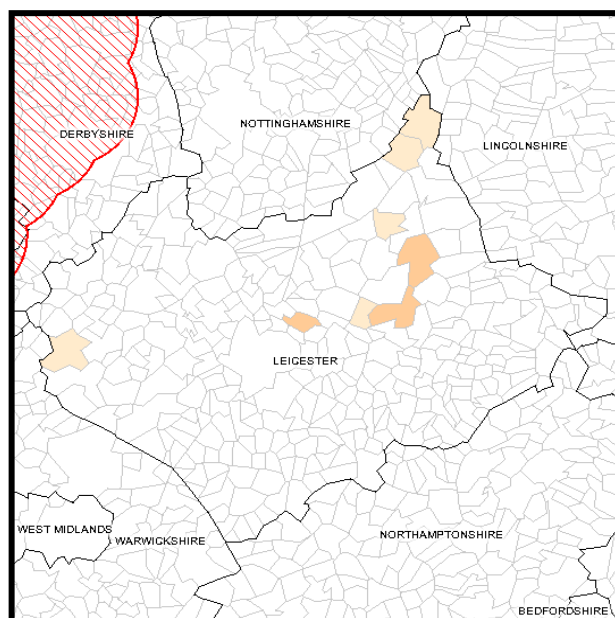
Genotype 25: a 2015



Genotype 25: a: 2016



Genotype 25: a: 2017



Genotype 25: a: 2018

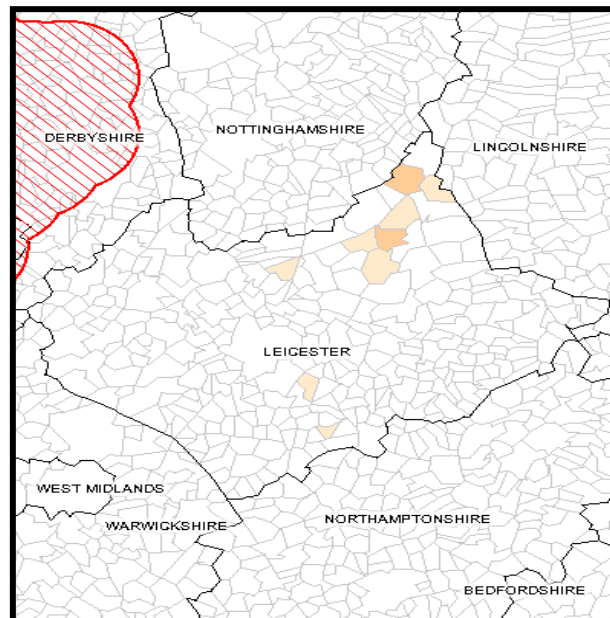


Figure 17a: Distribution of OTFW cases with genotype 25:a in Leicestershire from 2015 to 2018

### Summary of the risk to Leicestershire from the HRA

The summary of risks to Leicestershire is unchanged from those detailed in the 2017 report, noting in particular the ongoing risk posed by the movement of cattle from higher risk herds into the county. There has been an increase in the number of beef fattener units converting their premises into AFUs.

These units are non-grazing and if correctly operated are not considered to be a risk for introduction or spread of TB into the surrounding areas.

### **Summary of the risk to Leicestershire from the adjacent Edge Area counties**

The other counties within the Edge Area adjacent to Leicestershire are Northamptonshire, Warwickshire and Derbyshire.

The risk of disease spread from Northamptonshire appears to be low, considering that the north of this county has a low cattle density and few TB breakdowns as can be seen from Figures 6, 7 and 8 above.

There are several wildlife-associated OTFW breakdowns that have been identified in neighbouring Edge Area counties that could pose a risk for Leicestershire. These breakdowns are located in the north east of Warwickshire and south east of Nottinghamshire.

In Nottinghamshire, the 25:a genotype cases potentially associated with wildlife appeared clustered in the south east of the county, with similar cases, including those associated with the new potential hotspot (HS23) in the bordering area of Leicestershire.

In the north east of Warwickshire there appear to be cases of wildlife origin close to the border with Leicestershire.

There are strong epidemiological indications of disease becoming endemic around these two areas and, therefore, the risk of disease spread is considerable taking into account that cattle density is high in these two areas as shown in Figure 6.

### **Assessment of effectiveness of controls and forward look**

Further active surveillance of wildlife would support the assessment of the extent of wildlife involvement in the spread of TB, particularly in the north east and south west of the county. The epidemiological investigations carried out on farms include some assumptions when disease is attributed to wildlife infection and there would be benefit in post-mortem examination and sampling of wildlife.

Parallel interferon gamma testing has been useful in the improved detection of infected cattle. The interferon gamma test has higher sensitivity than the skin test, and especially when both tests are used together the chances of leaving infected animals in a herd are reduced. This has been effective in reducing within herd and lateral spread but other measures are still required to address the sources and pathways of infection to prevent recurrence or introduction of new infection once testing and slaughter has removed disease.

It is difficult to provide an opinion on the course of the epidemic over the next two years, partly due to the cyclical component of the TB epidemic and partly because of its multifactorial nature and the constantly evolving control policy, whose assessment over time is very complex (for the reasons mentioned) and can only be done retrospectively.

Generally, the epidemic appears currently to be increasing in Leicestershire, with some worrying signs, mainly the suspicion that wildlife reservoirs could be playing a larger role than previously thought.

## APPENDICES

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

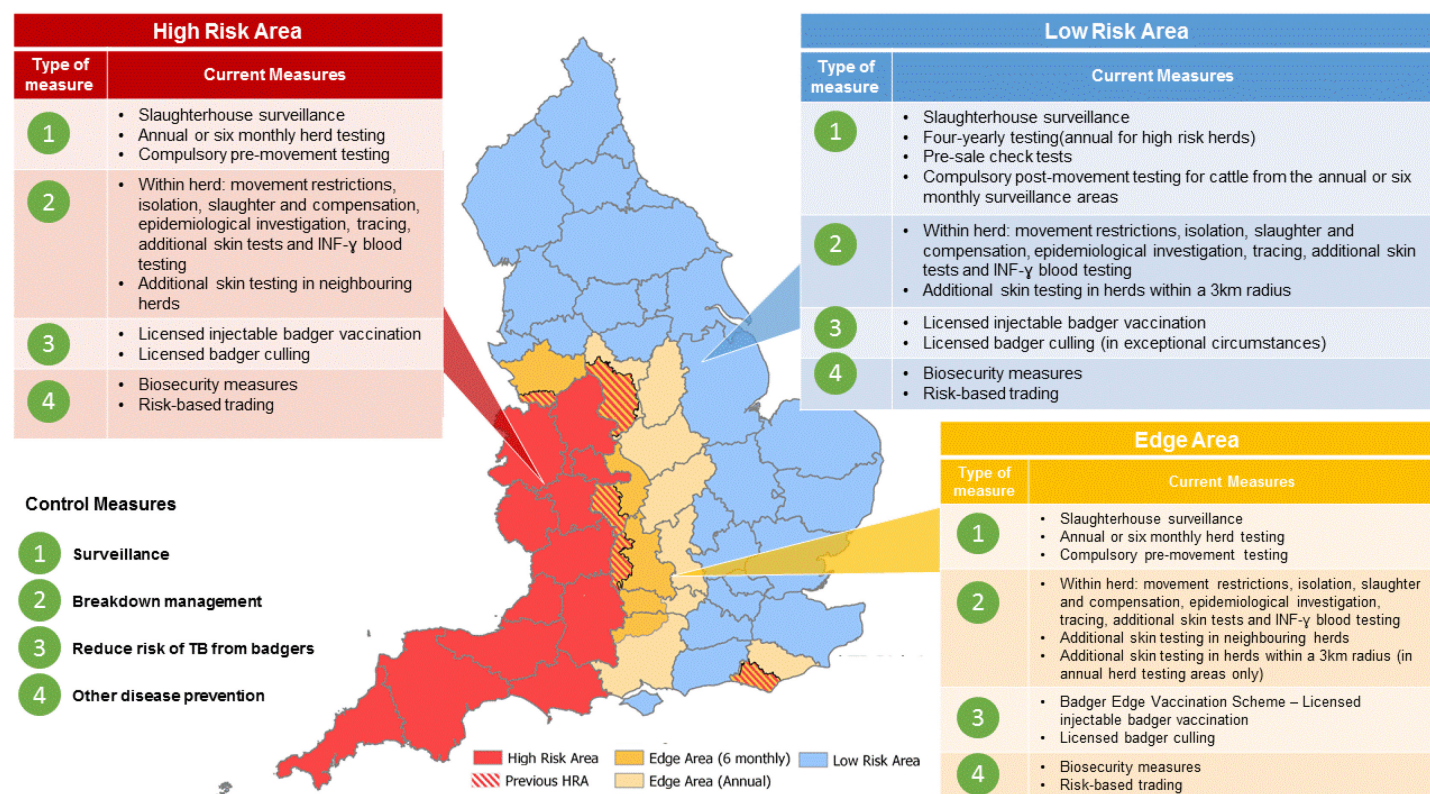


Figure A1: Bovine TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Tuberculosis-Free Status for England<sup>2</sup>.

#### 1.1. Policy objectives for the Edge Area:

Short to medium term:

- Slow down geographic spread of disease.
- 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

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

- 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)<sup>3</sup>

#### 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

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<sup>3</sup> TB interactive mapping tool - <https://www.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  | 406  | 174    | 168     | 74      | 40      | 51   | 917 | 131.5 | 63     |

Finishing units registered in Leicestershire:

|  | Grazing | Non-grazing |
|--|---------|-------------|
| Number of Approved Finishing Units (AFUs)                    | 0       | 13          |
| Number of Pre-movement Testing Exempt Finishing Units (EFUs) | 0       | 0           |

Cattle/herd purpose:

|          | Beef   |      | Dairy  |      | Dual purpose |     | Unknown |     | Total  |
|----------|--------|------|--------|------|--------------|-----|---------|-----|--------|
|          | Number | %    | Number | %    | Number       | %   | Number  | %   | Number |
| Cattle   | 73351  | 60.8 | 42970  | 35.6 | 4301         | 3.6 | 11      | 0.0 | 120633 |
| Holdings | 859    |      | 337    |      | 259          |     | 7       |     |        |

**Appendix 3: Summary of the Leicestershire headline cattle TB statistics**

| <b>Herd-level statistics</b>  | <b>2016</b> | <b>2017</b> | <b>2018</b> |
|---|-------------|-------------|-------------|
| Total number of cattle herds live on Sam at the end of the reporting period   | 1090        | 1078        | 1048        |
| Total number of herd tests carried out in the period  | 1093        | 1037        | 1180        |
| Total number of OTF cattle herds TB tested during the period for any reason   | 929         | 907         | 885         |
| Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of TB02 restrictions)   | 1040        | 1013        | 971         |
| Total number of cattle herds that were not under restrictions due to an ongoing TB breakdown at the end of the report period.   | 1067        | 1049        | 1009        |
| Total number of new TB breakdowns detected in cattle herds during the report period   | 53          | 46          | 59          |
| - OTF status suspended (OTFS)   | 36          | 25          | 37          |
| - OTF status withdrawn (OTFW)   | 17          | 21          | 22          |
| 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?                                       | 7           | 7           | 11          |
| - New OTFW breakdowns triggered by skin test reactors or 2xIRs at routine herd tests  | 14          | 18          | 18          |
| - New OTFW breakdowns triggered by skin test reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)                          | 0           | 0           | 2           |
| - New OTFW breakdowns first detected through routine slaughterhouse TB surveillance   | 4           | 2           | 2           |
| 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) | N/A         | N/A         | 9           |
| - OTFS  | N/A         | N/A         | 6           |
| - OTFW  | N/A         | N/A         | 3           |
| Number of OTFW herds still open at the end of the period (including any ongoing OTFW breakdowns that began in a previous quarter)   | 9           | 13          | 16          |
| 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           |

| <b>Animal-level statistics (cattle)</b>  | <b>2016</b> | <b>2017</b> | <b>2018</b> |
|--|-------------|-------------|-------------|
| Total number of cattle tested in the period (animal tests)   | 163057      | 150357      | 178987      |
| Reactors detected:   |             |             |             |
| - tuberculin skin test   | 160         | 193         | 204         |
| - additional IFN-gamma blood test reactors (skin-test negative or IR animals)                          | 102         | 169         | 197         |
| Reactors per breakdown   | 4.9         | 7.9         | 6.8         |
| Reactors per 1000 animal tests   | 1.6         | 2.4         | 2.2         |
| Additional animals identified for slaughter for TB control reasons (DCs, including any first-time IRs) | 6           | 15          | 0           |
| SLH cases (tuberculous carcasses) reported by FSA  | 11          | 16          | 10          |
| SLH cases confirmed by culture of <i>M. bovis</i>  | 5           | 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 | Likely | Most likely | Definite | Weighted contribution |
|--|----------|--------|-------------|----------|-----------------------|
| Cattle movement (e.g. purchase) of infected animal(s)                  | 12       | 0      | 7           | 3        | 30.3%                 |
| Local contiguous infection - lateral spread from neighbouring holdings | 3        | 2      | 0           | 0        | 3.6%                  |
| Exposure to infected wildlife  | 10       | 7      | 21          | 1        | 50.7%                 |
| Exposure to other farmed species                                       | 0        | 0      | 0           | 0        | 0%                    |
| Residual infection from a previous TB breakdown                        | 4        | 0      | 2           | 0        | 7.9%                  |
| Infected human source  | 0        | 0      | 0           | 0        | 0%                    |
| Fomite source  | 1        | 0      | 0           | 0        | 0.5%                  |
| Domestic animals   | 0        | 0      | 0           | 0        | 0%                    |
| Undetermined/obscure   | 2        | 0      | 2           | 0        | 5.3%                  |
| Other (explain)  | 0        | 0      | 0           | 0        | 0%                    |



## **Appendix 5: Overview of the bovine TB Control Programme in Leicestershire**

Summary of TB control measures specific to Leicestershire:

### 5.1 Edge Area cattle 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.
- Several OTFW herds in Leicestershire have been partially exempted from the compulsory IFN-gamma test. The exemption has been applied only in certain groups where there was no evidence of infection and clear separation from the infected portion of the herd could be ascertained after satisfactory Veterinary Risk Assessment (VRA).
- There has been no discretionary use of the IFN-gamma test in OTFS breakdowns in Leicester
- Enhanced case management procedures were not applied in 2018 in any persistently infected herds.

### 5.2 Unusual TB breakdowns

- Non-specific reactor procedures were applied to a herd in Leicestershire maintained under prolonged movement restrictions where none of the test positive animals removed had visible lesions of TB at post-mortem inspection and *M. bovis* could not be isolated in laboratory cultures. Serial interferon gamma testing of skin test reactors subsequently allowed resolution of this breakdown, which was believed to be due to non-specific reactions to the tuberculin test.
- One breakdown occurred involving a producer–retailer of unpasteurised milk. The breakdown was OTFS and Public Health England was informed.
- In November 2018 in a closed herd of 203 animals which had no history of TB, the WHT disclosed 25 skin test reactors and 3 inconclusive reactors. Eleven of the reactors had lesions visible at post-mortem inspection. Further testing revealed 14 interferon gamma reactors and one skin reactor with post mortem lesions.
- One breakdown in a bison herd where interferon gamma testing was applied and 10 reactors were disclosed, two of which with visible lesions at post mortem, but subsequently negative on culture.
- Two OTFW cases in which the only visible lesions were found in the liver. Both yielded negative culture results.

### 5.3 Other testing measures

- A herd with a longstanding overdue routine surveillance test (WHT) and also overdue for an enhanced surveillance (radial) test was compulsorily slaughtered, thereby eliminating the disease risk posed by that untested herd. This was a measure with a significant impact on the taxpayer due to:

- Significant proportion of time and effort invested with multiple agency involvement (Rural Payment Agency, Local Authority (LA), police, Local Council and Environment Agency)
- Animals killed under the TB (England) Order 2014 and Animal Health Act 1981 for disease control purposes, therefore none of the expenses incurred could be recouped from the farmer
- Measure considered necessary due to the repetitive nature of the overdue testing of that herd and significant effort and money invested previously for enforced actions, which did not seem to lead to any change in the farmer's behaviour.
- An overdue WHT of another herd had to be completed by enforcement action involving the hiring of a contractor by APHA and liaison with the LA. This too had an impact on the taxpayer as the farmer was diagnosed with mental health problems and the costs of the enforcement action could not be recouped from him.

#### 5.4 Other control measures

- OV quality control and APHA audits carried out in Leicestershire, with only minor non-compliances identified and addressed
- Regional meetings held with farmers in the TB eradication group of the Vale of Belvoir area (straddling South Nottinghamshire and North Leicestershire), led by the NFU.
- TB Advisory Service (TBAS) engagement meetings providing biosecurity and other TB related advice in the Edge Area
- Badger survey in Edge Area completed (results pending)
- Badger vaccination project (see above)

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.