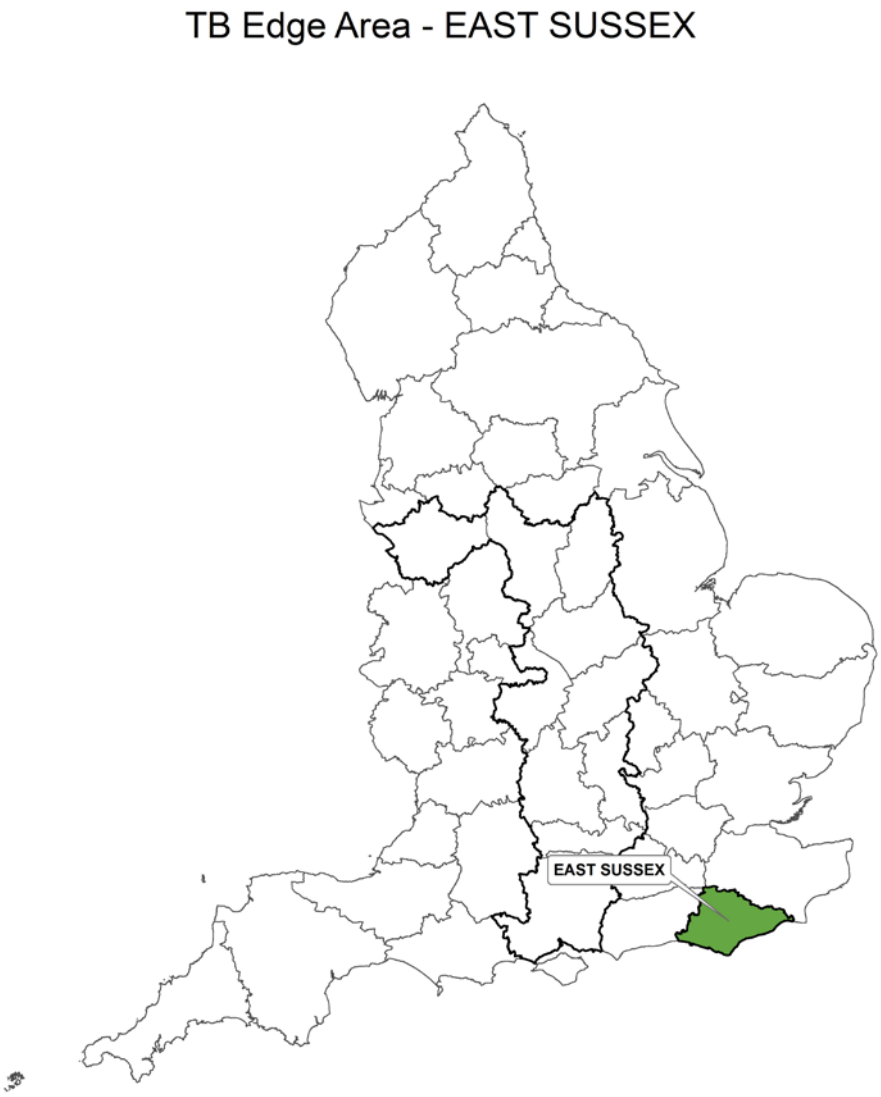
Animal & Plant Health Agency

Year-end descriptive epidemiology report:

Bovine TB in the Edge Area of England

County: East Sussex

Year-end report for: 2019



Contents

Executive summary

Reporting area

East Sussex is part of the Edge Area that was established in 2013. The following year, the bovine tuberculosis (TB) surveillance strategy for this area was incorporated into the Government's strategy to achieve Officially Tuberculosis Free (OTF) status for England by 2038. The Edge Area has an overall moderate but recently rising incidence of infected herds with substantial variability from county to county. This end of year report describes bovine TB in East Sussex.

Local cattle industry

East Sussex has a relatively low cattle density and is predominantly made up of small beef herds with a mean of 88 cattle per holding. There are only 12 herds with over 501 cattle and these are mostly dairy herds.

New incidents of TB

There were only four new Officially Bovine Tuberculosis Free Status Withdrawn (OTF-W) and 19 new Officially Bovine Tuberculosis Free Status Suspended (OTF-S) incidents in 2019. This compares to 14 OTF-W and 13 OTF-S incidents in 2018. The annual herd incidence rate (incidents per 100 herd-years at risk) is slightly lower than in 2018: 4.6 in 2019 compared to 5.1 in 2018.

Suspected sources and risk pathways for TB infection

The most likely source of TB infection for cattle in both the former High Risk Area of England (HRA) part of East Sussex and in the original Edge Area was contact with infected wildlife, but with undetermined source and cattle movements also featuring highly.

Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement to the 2019 bovine TB epidemiology reports.

Disclosing tests

The majority of incidents in 2019 were disclosed by annual routine whole herd surveillance tests (57%), radial testing (22%), six month post-incident tests (9%) and slaughterhouse case tests (9%), and one incident (4%) was disclosed by a pre-movement test.

Reactor numbers

Less skin test reactors were removed in 2019 (78) representing a decrease from 146 in 2018. Less interferon-gamma (IFN-y) reactors were removed in 2019 (133) compared to 2018 (150). The mean number of reactors per incident also decreased to 9.2 in 2019 compared to 11.0 in 2018 and the number of reactors per 1000 animal tests has decreased to 2.8 in 2019 from 3.7 in 2018. These decreases are most likely explained by the reduction in the number of new incidents and lower proportion of OTF-W incidents.

Risks to the reporting area

East Sussex is bordered by Low Risk Area (LRA) counties, so cattle movements from higher incidence areas are the main threat of incursions of TB into East Sussex.

Risks posed by the reporting area

The endemic areas in East Sussex remain stable with little threat to adjacent LRA counties by spread of infection in wildlife, although whole genome sequencing (WGS) has shown that *M. bovis* genotype 13:a is likely to be circulating in wildlife found just north of the A27. The main threat to the LRA is from cattle movements from the Edge Area and by a few TB incidents that straddle the borders. These risks are mitigated somewhat by statutory pre- and post-movement TB testing and farms spanning the border taking on the annual testing regime of the Edge Area.

Forward look

There has been a decline in the number of new TB incidents in 2019, especially in the number of OTF-W incidents. However, the number of OTF-S incidents has increased and these are spread throughout the county. These could be an indicator of an undetermined low level of background infection and must be monitored. The lack of genotype data associated with OTF-S incidents makes the source of infection for those with no obvious link to purchases difficult to assess. The uptake of badger intervention, improving on-farm biosecurity and taking advantage of the free advice available to cattle farmers in the Edge Area from the TB Advisory Service is to be encouraged.

Introduction

This report describes the level of bovine tuberculosis in cattle herds in East Sussex in 2019. Bovine TB is caused by the bacterium *Mycobacterium bovis* (*M. bovis*), and will subsequently be referred to as TB. This report explores the frequency and geographical distribution of TB in cattle herds. It examines what is likely to be driving TB in East Sussex, and the risks the disease in this county may pose to neighbouring cattle. Although other sources may refer to TB 'breakdown(s)', this report will use the term 'incident(s)' throughout. This report is intended for individuals involved in the control of TB, both in the local area and nationally. This includes, but is not limited to: farmers, veterinarians, policy makers and the scientific community.

In 2014 the Government published its Strategy to achieve Officially TB Free (OTF) status for England by 2038. A key action 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 areas were established (refer to Appendix 1). East Sussex forms part of the Edge Area. Overall, the Edge Area has a moderate but recently rising incidence of infected herds with substantial variability from county to county. Control efforts are seeking to slow down and reverse geographic spread, and to reduce the incidence rate. The aim is to obtain OTF status for the Edge Area as soon as possible.

Changes to the Edge Area in 2018

On 1 January 2018 the Edge Area boundary was expanded westwards to absorb the former High Risk Area (HRA) parts of the five previously split counties. Cheshire, Derbyshire, Warwickshire, Oxfordshire and East Sussex all moved fully into the Edge Area. Furthermore, the routine TB testing frequency of herds in the counties in the west of the Edge Area adjoining the HRA (or parts thereof) was increased from annual to six-monthly. The respective descriptive TB epidemiology reports for those five counties of the Edge Area will focus on the whole county and key differences between the old and new parts will be highlighted where relevant.

From January 2018, Defra introduced radial skin testing of herds located within a 3km radius of a new OTF-W incident in East Sussex and all other annual testing parts of the Edge Area to enhance the cattle TB surveillance regime.

Cattle industry

Herd Types

There was a slight decline in the number of cattle holdings in East Sussex from 561 in 2018 to 543 in 2019. As shown in Figure 1, the majority of holdings (58%) have a small number of cattle (1-50). Only 5% (29 holdings) have over 350 cattle, as in 2018. However the mean number of cattle per holding has increased, with 88 cattle per holding in 2019 compared to 84 in 2018. Beef suckler herds are the predominant farm type although dairy herds tend to be the larger herds. 64% of all cattle in East Sussex were beef breeds, 32% dairy and 3% dual purpose (Appendix 2, Table A2.2). An area of higher cattle density (21 to 40 cattle per square kilometre) is concentrated in the centre of the county with a surrounding band of low cattle density. There was a small central area of 41-80 cattle per square kilometre in 2019 that was not seen in 2018. Neighbouring LRA counties of West Sussex and Surrey have a similar pattern of higher cattle density in the centre of the counties surrounded by an area of lower cattle density, with Kent generally having lower cattle density.

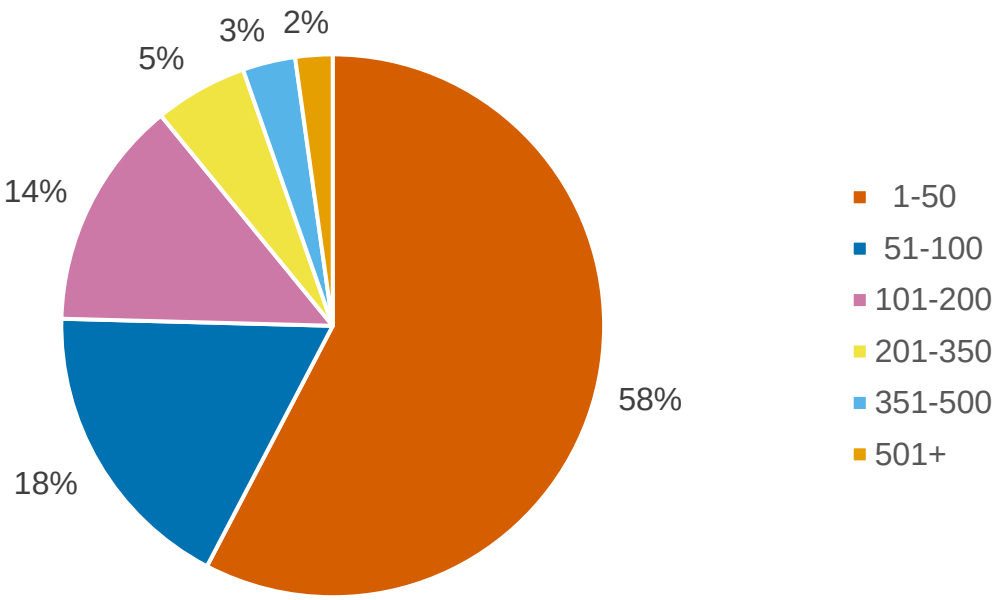


Figure 1: Proportion of cattle holdings by herd size in East Sussex in 2019 (n=541).

Markets and abattoirs

There are two main cattle markets that provide a valuable outlet for cattle and selling of stores; Hailsham Market in East Sussex and Ashford market in the neighbouring LRA county of Kent. These markets are relatively low volume so the larger dairy and beef finishing herds have to source their cattle for restocking from further afield. This poses a risk of introducing TB infection into East Sussex from the HRA and from Wales where the cattle density is much higher.

There are several small slaughterhouses for cattle, one located in Tottingworth in East Sussex and others in the neighbouring LRA county of Kent at Charing and Tunbridge Wells. A larger abattoir is located in the neighbouring LRA county of Surrey.

Approved Finishing Units

There is one AFU (without grazing) in operation in East Sussex.

Common land

There are small areas of common land in East Sussex, but there have been no TB incidents associated with cattle grazing this land in 2019.

Descriptive epidemiology of TB

Temporal TB trends

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

1. The number of new herd incidents that were disclosed in each year.

2. 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 herd tests that other incidence measures do not (such as new TB incidents per number of herds or tests).

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

All three measures include Officially Tuberculosis Free Status Withdrawn (OTF-W) incidents, and Officially Tuberculosis Free Status Suspended (OTF-S) incidents. OTF-W incidents are those in which at least one animal was identified with typical lesions of TB at post mortem (PM) inspection, and/or positive for *M. bovis* on culture from tissue samples. OTF-S incidents are those with one or more reactors to the Single Intradermal Comparative Cervical Tuberculin (SICCT) skin test, but without full confirmation of *M. bovis* infection by PM inspection or bacterial culture. TB incidents in non-grazing AFUs are not included in the prevalence and incidence calculations in this report due to the limited epidemiological impact of these cases. Furthermore, herds restricted because of an overdue test rather than a TB incident are also excluded from calculations. Measures of incidence and prevalence in this report may be lower than those reported in the official TB statistics.

The county of East Sussex was previously split between the Edge Area and HRA. The former HRA portion of East Sussex was bounded by the A22 road in the north and east and by the county border in the west. This area is considered to be endemic for the *M. bovis* genotype 13:a and its associated mutations 13:c and 13:d to the east of the river Ouse but south of the A27 road. The rest of the county, which is comprised of mostly the original Edge Area, is regarded as non- endemic for *M. bovis* and the sources of the TB incidents are mostly attributed to movements of undetected infected cattle. At the beginning of 2018 the Edge and HRA parts of East Sussex were combined into the new Edge Area comprising the whole of East Sussex.

Over the last six years (2014-2019), the number of new incidents per year in East Sussex has been similar. Figure 2 illustrates the annual number of new TB incidents in the whole county of East Sussex and shows a decrease over the last year from 27 to 23, which is the same total recorded in 2015 and 2017. The number of OTF-W incidents has declined from 14 in 2018 to only four in 2019. 2015 was the only year in the last decade to have a figure lower than this of just one OTF-W incident.

When the original Edge Area and the whole county are compared, over the last year there has been a small decrease in the number of new incidents in the original Edge Area from 14 to 11. However, the numbers are relatively small and the highest annual number of new incidents in the original Edge Area (15) occurred in 2015.

In 2019, the ratio of OTF-W compared to OTF-S incidents was four OTF-W and 19 OTF-S compared to 14 OTF-W and 13 OTF-S in 2018. The number of OTF-W incidents in the original Edge Area has also declined from three in 2018 to none in 2019. Over the last 10 years this ratio has varied greatly and a trend is difficult to ascertain especially with the small numbers involved (Figure 2).

The annual herd incidence rate of TB in the whole county is slightly lower than in 2018: 4.6 compared to 5.1 incidents per 100 herd-years at risk (100 HYR) in 2018 (Figure 3). It was also 4.6 in 2017. Figure 3 also illustrates the annual herd incidence rate (100 HYR) for all new incidents comparing the original Edge Area with the whole county. The shape of the two curves follow each other showing that the change in incidence rate appears to be driven by the original Edge Area with the incidence rate in the former HRA part of the county remaining fairly stable although gradually increasing.

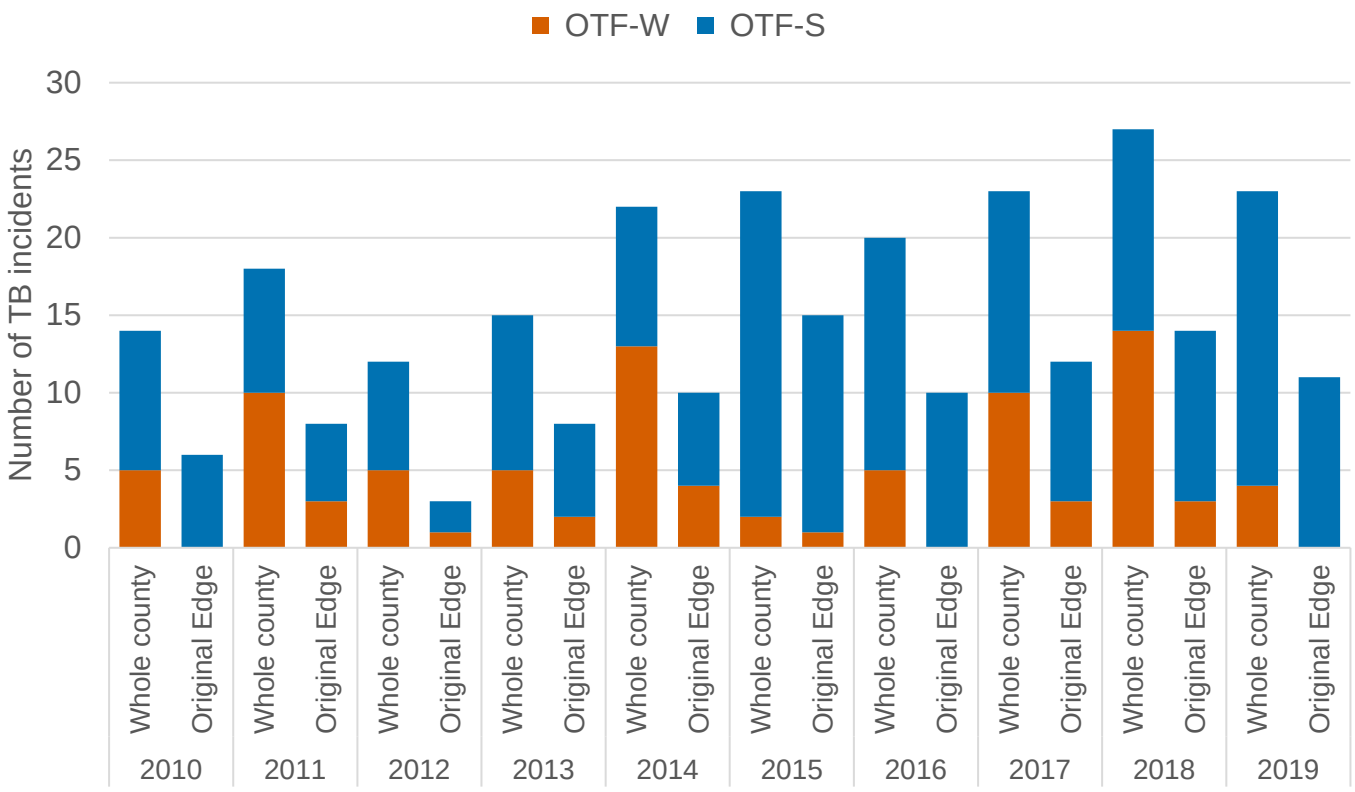


Figure 2: Annual number of new TB incidents in East Sussex, 2010 to 2019, showing incidents for the whole county and the original Edge Area.

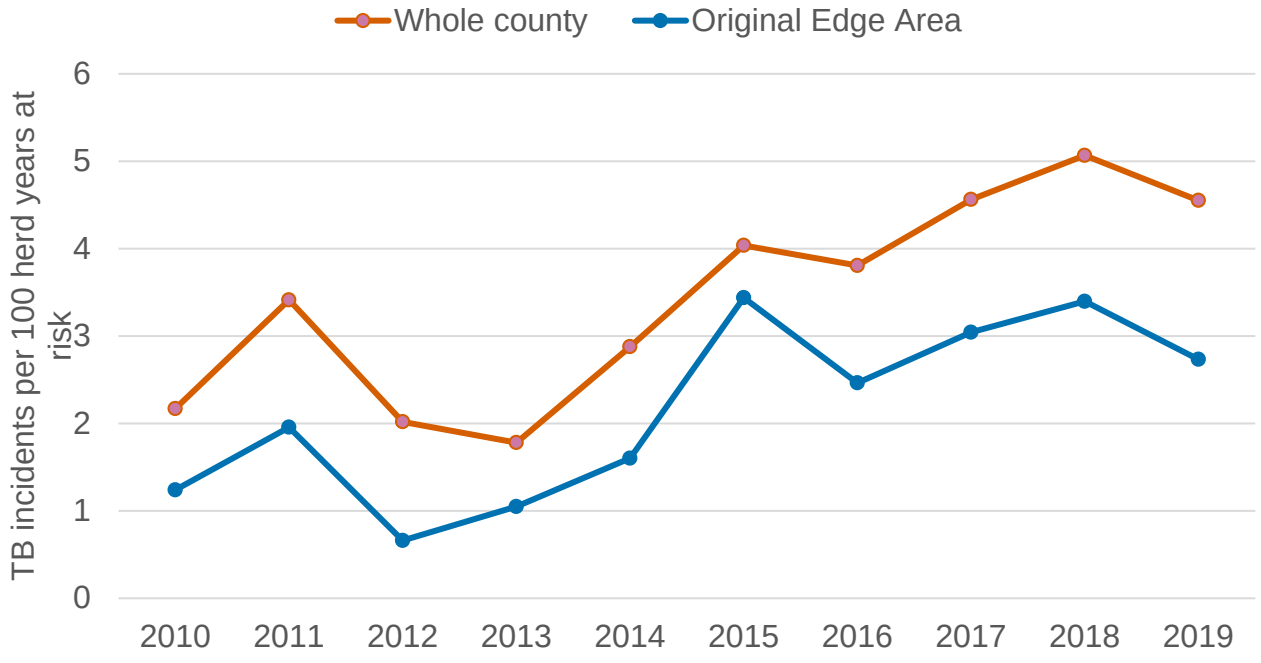


Figure 3: Annual herd incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in East Sussex, 2010 to 2019, showing data for the whole county and for the original Edge Area.

The end of year prevalence has declined slightly for the whole county but remained stable for the original Edge Area (Figure 4). It has been noted that there appears to be a cyclical increase in TB incidence every three to four years but the overall level is gradually increasing. This cyclical pattern is also seen in other Edge Area counties and may reflect the introduction of new policy control measures.

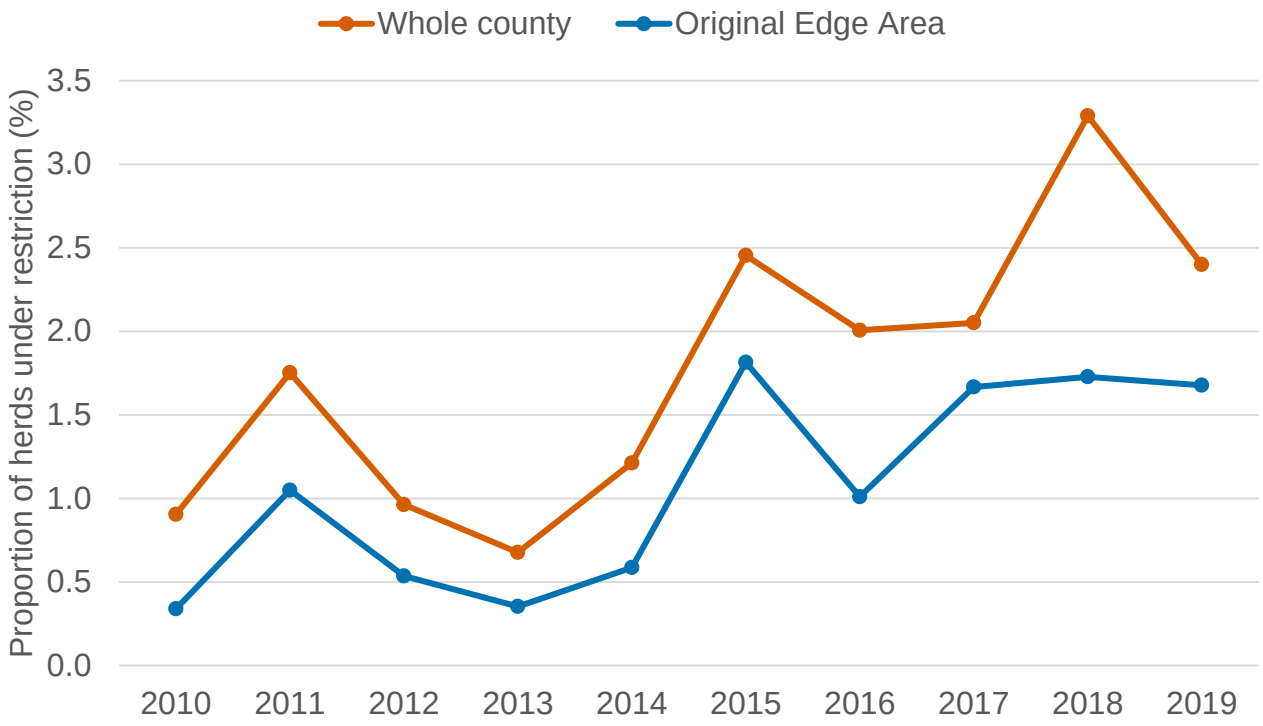


Figure 4: Annual end of year TB herd prevalence in East Sussex, 2010 to 2019, showing data for the whole county and for the original Edge Area.

Geographical distribution of TB incidents

East Sussex is one of the Edge Area counties with the lowest incidence rates; only two other counties in the HRA and Edge Area have a lower incidence (Nottinghamshire and West Midlands). East Sussex is unique amongst the Edge Area counties in that it is surrounded by LRA counties and is not adjacent to any HRA counties. East Sussex has the lowest incidence rate of all other Edge Area counties in the southern region at 4.6, which is well below the national average of 9.9 for the Edge Area counties (Figure 5).

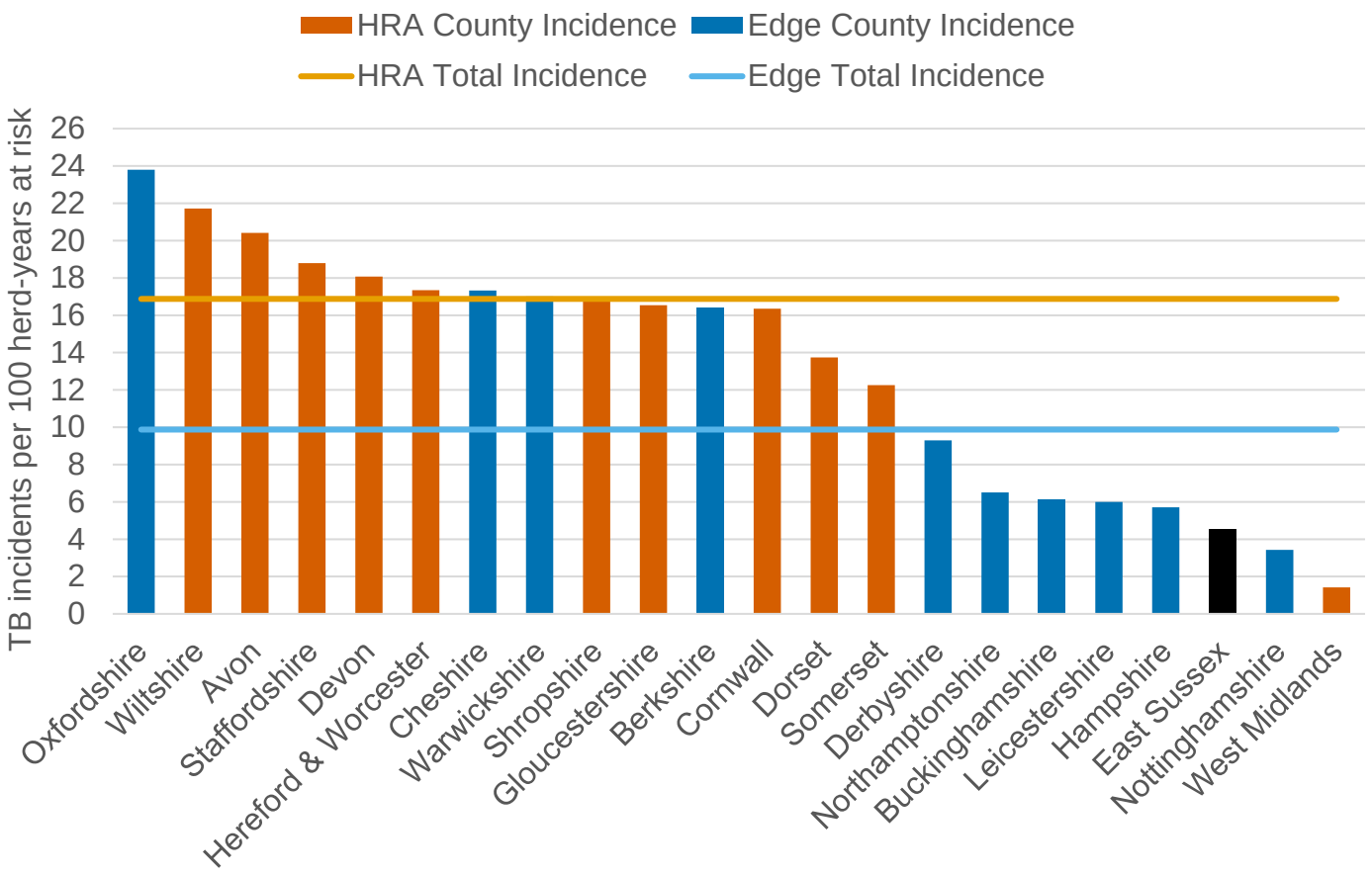


Figure 5: Incidence rate (per 100 herd-years at risk) for all new incidents (OTF-W and OTF-S) in 2019, by HRA and Edge Area County.

Figure 6 shows the distribution of new OTF-W incidents in 2019 in East Sussex and new OTF-S incidents overlaid on cattle population maps. The pre-2019 OTF-W incidents that were open at the beginning of 2019 are also shown. All except one of these pre-2019 incidents were concluded during the report period. There are more incidents in the south of the county. In this area of lower cattle density, this distribution may be explained by the presence of *M. bovis* infected badgers. All four new OTF-W incidents and the one ongoing OTF-W incident are located in the former HRA part of the county. The OTF-S incidents are spread throughout the county with no obvious pattern. There are 11 new OTF-S incidents in the original Edge Area of East Sussex and eight in the former HRA part of the county. Almost all new incidents in East Sussex in 2019 (20 out of 23) are located in the areas with a cattle density of over 21 cattle per square kilometre which also corresponds to the areas with higher cattle holding density.

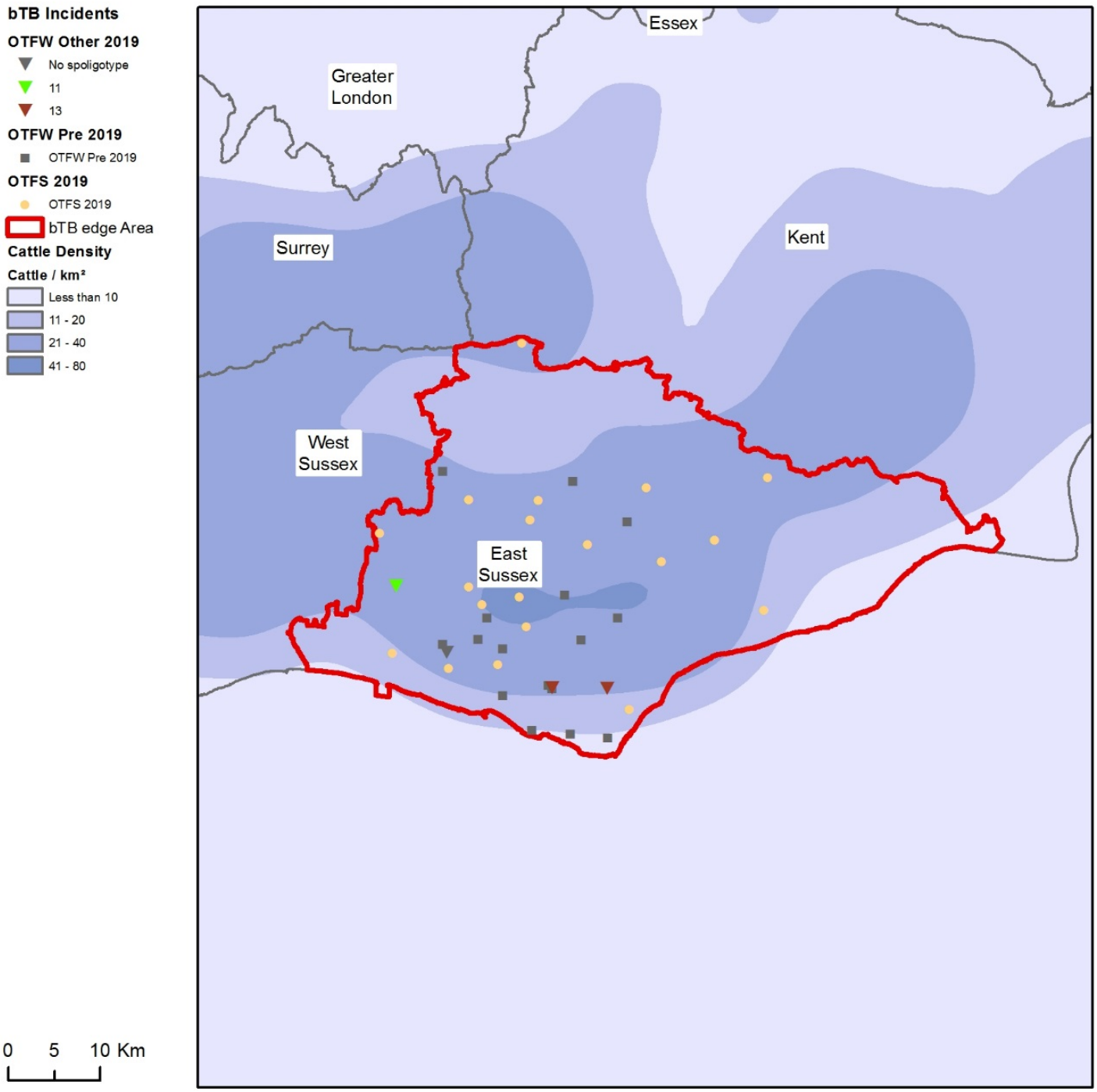


Figure 6: Location of cattle holdings in East Sussex with new TB incidents (OTF-W and OTF-S) in 2019 and cattle holdings with pre-2019 OTF-W incidents that are still ongoing at the beginning of 2019, overlaid on a cattle density map. To note, 'OTF-W Introduced 2019' refers to OTF-W incidents in which introduction of infection through cattle movements was the most likely source identified.

The OTF-W incidents in East Sussex, where wildlife were considered as a source with 75% or greater certainty, were all located within the former HRA portion of the county (Figure 7). This suggests that the area of endemic *M. bovis* infection is not expanding, with the total number of new

incidents in this former HRA slightly declining from 14 in 2018 to just 11 in 2019 (four OTF-W and seven OTF-S).

As can be seen from Figure 8, the majority of incidents in the former HRA portion, and therefore endemic area in the south of the county, had contact with infected wildlife recorded as the most likely source. There was one OTF-S incident in the former HRA part of the county that was most likely attributed to purchased infection. This herd previously had many movements of cattle into the herd although there was no direct epidemiological link with a herd with known TB history. There were two OTF-W incidents where the source was unclear: one where there was no genotype result available and one with genotype 11 (out of homerange) but the reactor was homebred with no obvious epidemiological link with farms in the south-west (homerange of genotype 11). Infected wildlife was considered to be the likely cause of infection for two OTF-S herds in the original Edge Area of the county and locally acquired infection from residual infection in the herd for another incident. Purchased infection in two OTF-S herds in the original Edge Area of the county account for two incidents and the other four incidents having undetermined source of infection.

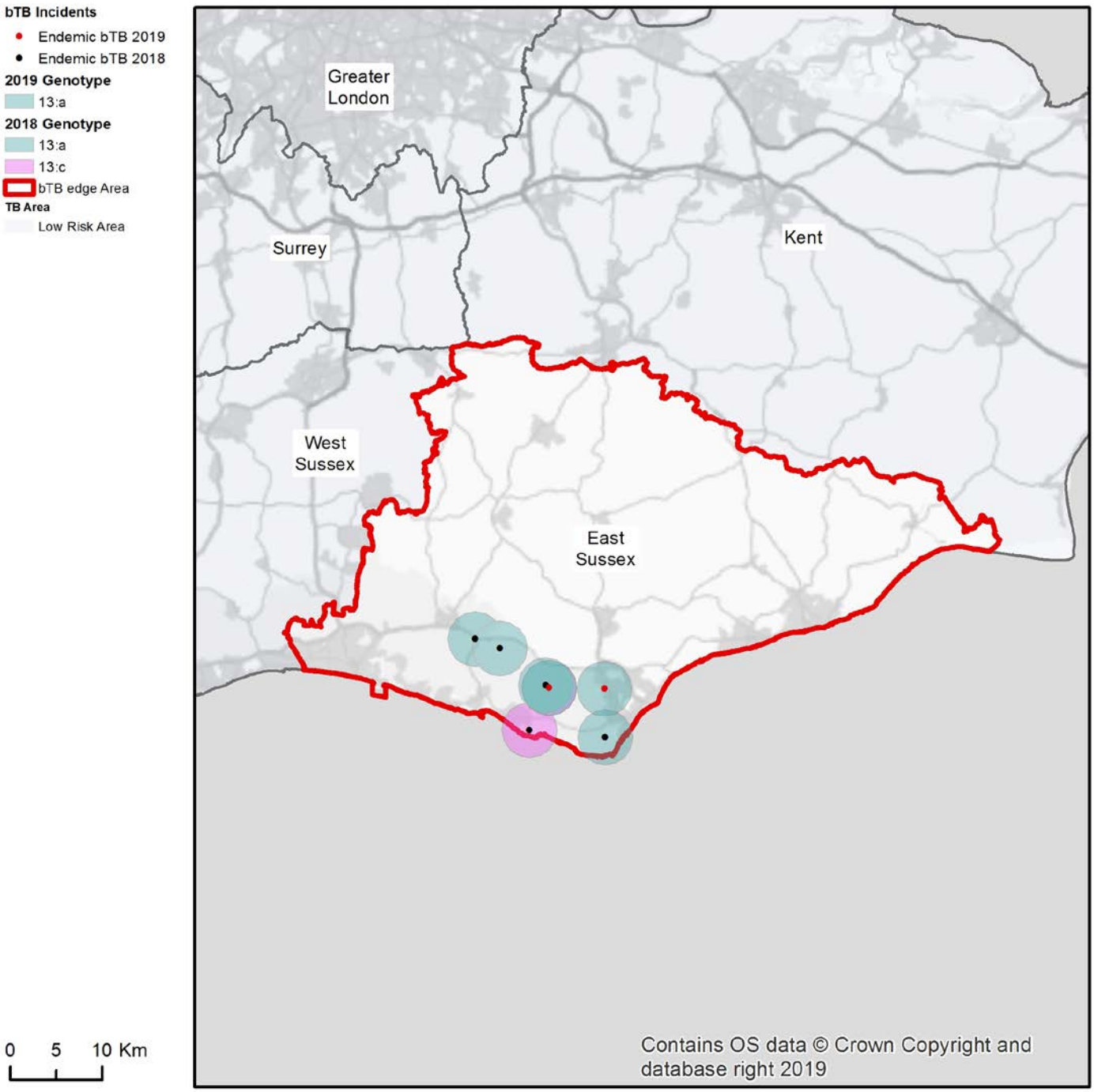


Figure 7: Genotypes of *M. bovis* detected in East Sussex in 2018 and 2019, where a wildlife source was attributed with a 75% certainty or above, as an indication of endemic infection within local wildlife populations (OTF-W incidents only).

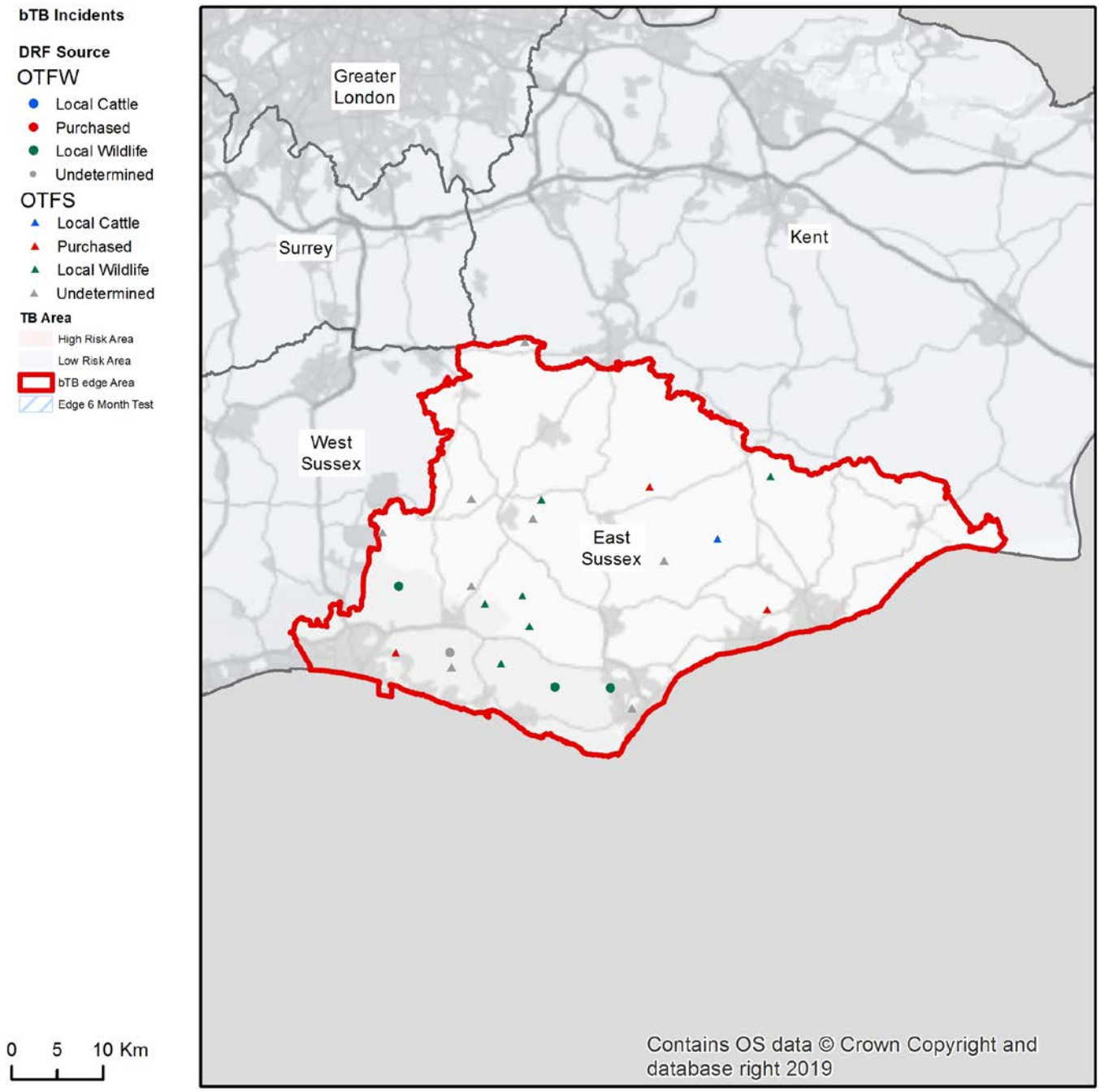


Figure 8: Map of the source of infection pathway recorded with the highest level of certainty for all TB incidents (OTF-W and OTF-S) in East Sussex, and its adjoining Edge Area counties, which started in 2019.

Other characteristics of TB incidents

Incidents by herd types

There appears to be no association with TB incidents and herd types. The percentage of TB incidents for each herd type correlates approximately with the percentage of cattle in the county for that type. For instance, eight incidents were in dairy units (Figure 9), which equates to 35% of the incidents being in dairy herds and approximately corresponds with the 32% of cattle in the county being dairy (Appendix 2,Table A2.2).

The larger the cattle herd the greater the likelihood of the herd experiencing a TB incident. Figure 9 shows the number of TB incidents in each herd size category and Table A2.1 shows how many herds of these sizes are in East Sussex. There are 59 herds with over 200 cattle and 20% of these had a TB incident in 2019 (12 incidents). There were 482 herds with 200 or less cattle and only 1.2% of these herds had a TB incident in 2019 (six incidents). The effect of herd size is even more marked when you consider herds of over 500 cattle. There were only 12 herds with over 500 cattle and five of these had an incident in 2019 which is 42% of these larger herds.

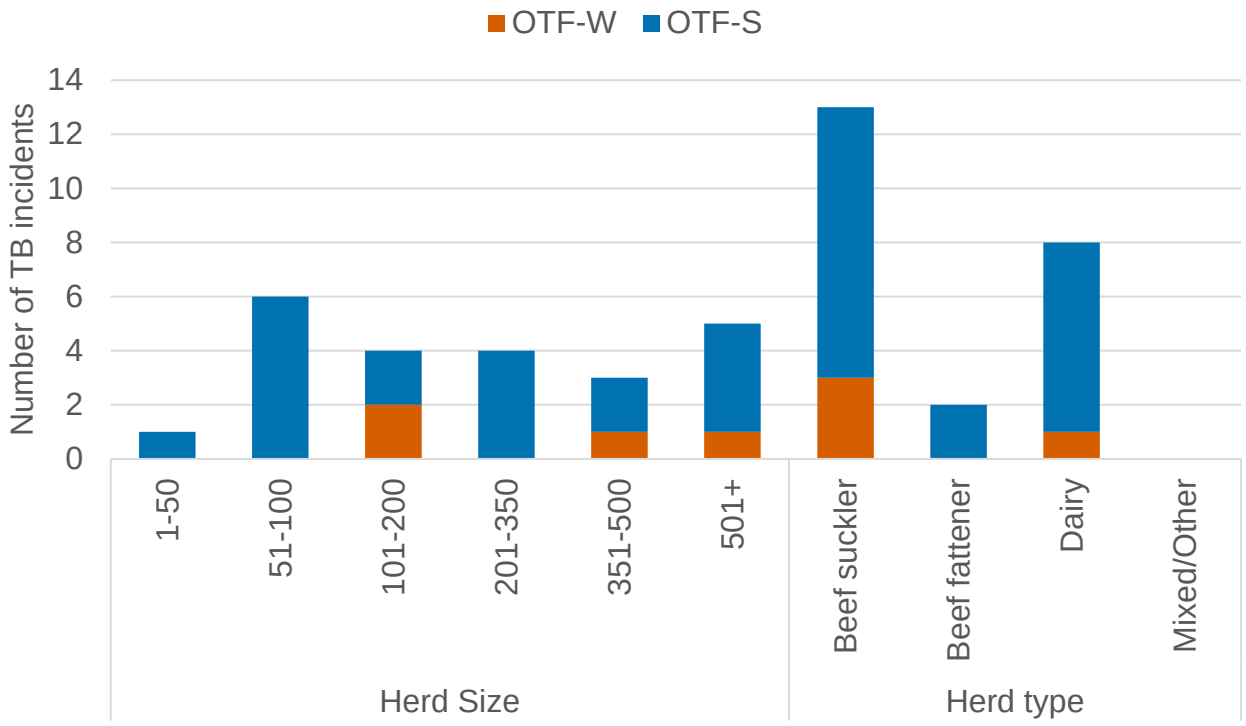


Figure 9: Number of new TB incidents (OTF-W and OTF-S) in East Sussex in 2019, by cattle herd size and type.

Incidents by month of disclosure

More incidents were disclosed in November than any other month in 2019 (Figure 10). This may be due to the delayed effect of cattle contracting infection at grazing in the summer months resulting in more incidents in November, and close confinement of cattle during the housing period enabling the spread of infection contracted during the previous grazing period. However this is based on a relatively small number of incidents.

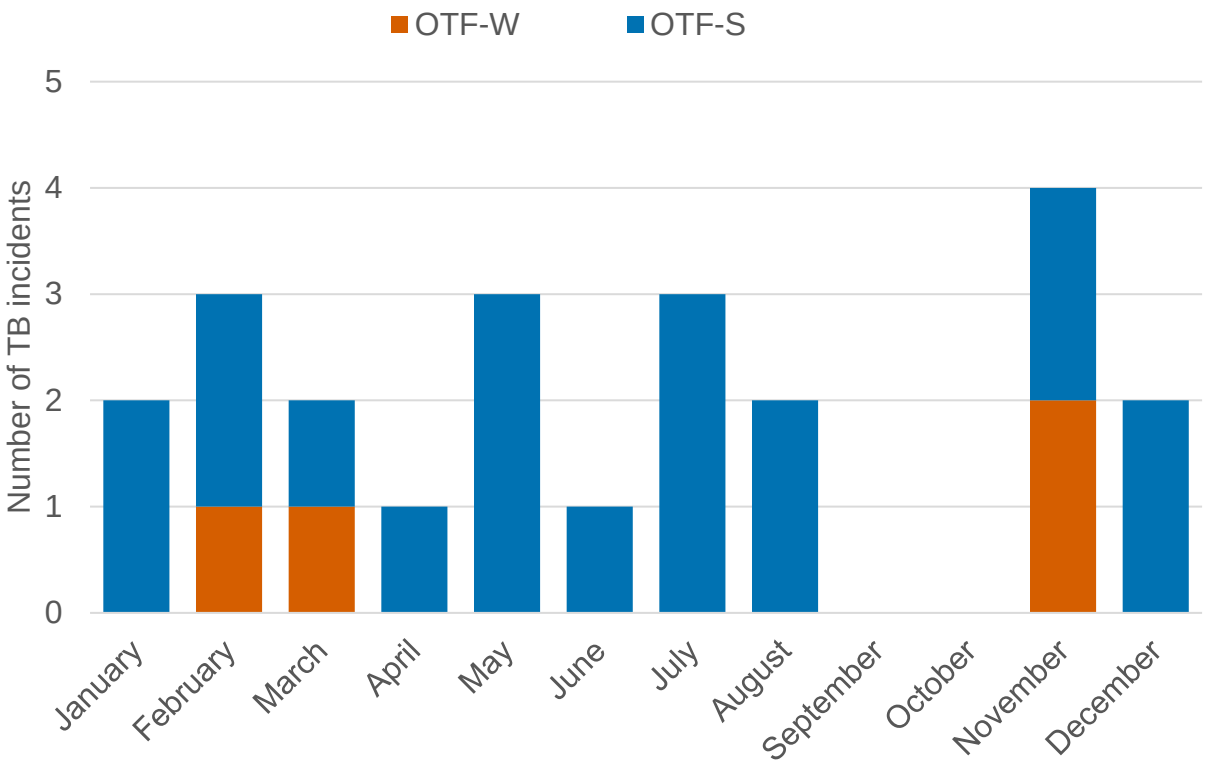


Figure 10: Number of new TB incidents (OTF-W and OTF-S) in East Sussex in 2019, by month of disclosure.

Genotypes of *M. bovis* isolated

Of the four new OTF-W incidents disclosed in 2019, *M. bovis* was cultured in only three of them, two with genotype 13:a which is local to this area and within its homerange. In 2018, there were two contiguous incidents with *M. bovis* genotype 13:c which is a mutation of 13:a and these two farms were located within the homerange of 13:a. No spread of 13:c was detected in 2019. One of the farms that had a TB incident with genotype 13:c in 2018, had another OTF-W incident in 2019 but with 13:a, suggesting a new infection from wildlife was more likely than residual infection from the previous incident. This is supported by WGS analyses of the *M. bovis* isolates which shows that of all the cattle samples sequenced since June 2017 ,the 13:a isolate's nearest relative is 12 single nucleotide polymorphism (SNP) distance, suggesting that the strain has been circulating in a non-monitored population such as wildlife before re-infecting cattle. One of the OTF-W incidents, which was located outside the typical homerange for 13:a and 13:c, had *M. bovis* cultured with genotype 11,

for which the homerange is in south-west England. The source of the TB infection in this herd is not clear because the animal was homebred. WGS data were not available at the time of writing this report to help determine the source.

Duration of incidents

The duration of TB incidents in East Sussex is generally between 151 and 550 days (Figure 11). The mean length of an incident is 209 days for OTF-S incidents and 401 days for OTF-W incidents. All incidents will last at least 120 days as all infected herds in the Edge Area require at least two consecutive herd tests 60 days apart (short interval testing). OTF-W incidents tend to last longer, partly because these herds also require a mandatory herd IFN-γ test which increases the likelihood of disclosing further reactors. Any additional visible lesion and/or culture positive reactors trigger two further short interval tests at severe interpretation, again increasing the likelihood of disclosing further reactors and the herd requiring further rounds of testing.

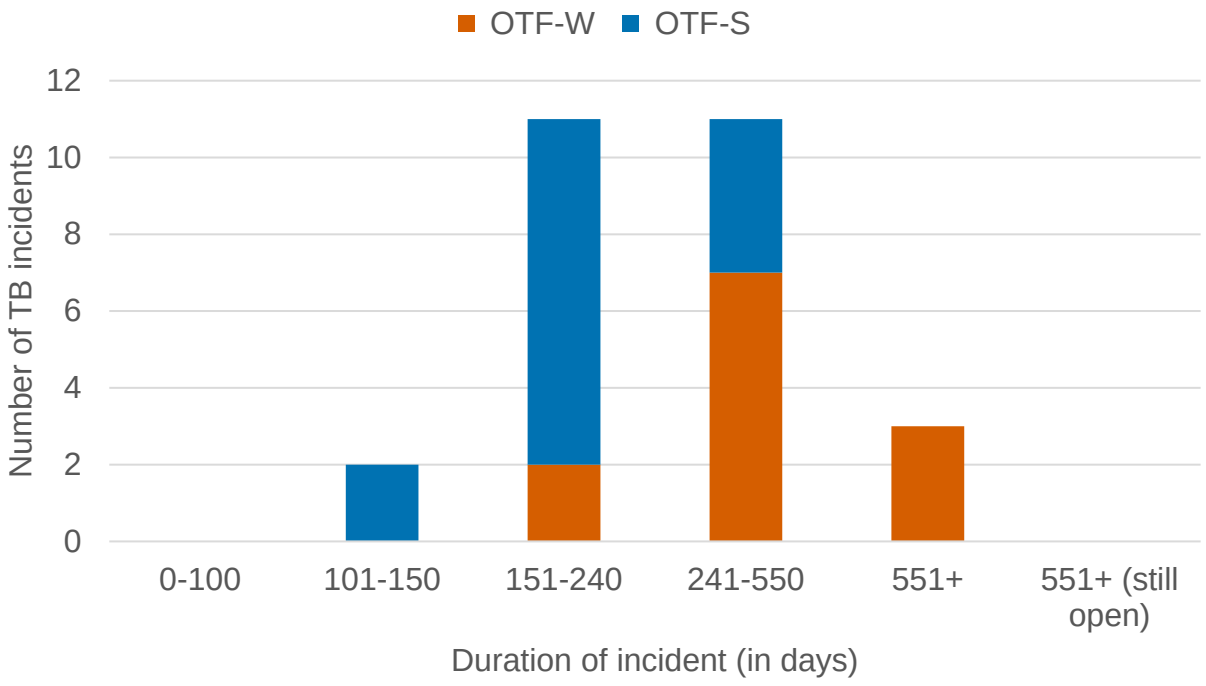


Figure 11: Duration of all TB incidents (OTF-W and OTF-S) that ended in 2019, and the number of persistent TB incidents (551+ days) that were unresolved at the end of 2019 in East Sussex. Note that Approved Finishing Units (AFUs) have been excluded.

Suspected sources, risk pathways and key drivers for TB infection

It can be challenging to retrospectively establish the route of infection for a TB incident herd. The Animal and Plant Health Agency (APHA) aims to complete an epidemiological assessment for all TB incidents in the Edge Area (both OTF-W and OTF-S). This includes a thorough on-farm investigation and scrutiny of routinely collected data; such as cattle movement records, and the results of molecular analyses where available.

During the assessment up to three risk pathways of infection are selected for each herd. Each risk pathway is given a score that reflects the likelihood of that pathway bringing TB into the herd. The score assigned has been updated this year to reflect developing understanding of how likelihood is being assessed in practice. It is recorded as either definite (score 8), most likely (score 6), likely (score 4) or possible (score 1). The source(s) for each incident are weighted by the certainty ascribed. Any combination of definite, most likely, likely or possible sources can contribute towards the overall picture for possible routes of introduction in to a herd. If the overall score for a herd is less than six, then the score is made up to six using the 'Other/Unknown Source' option. Buffering up to six in this way helps to reflect the uncertainty in assessments where only 'likely' or 'possible' sources are identified.

The weight of infection outputs in Appendix 4 are produced by combining the data from multiple herds and providing the proportion of pathways in which each source was identified, weighted by certainty that each source caused the introduction of TB. The outputs do not show the proportion of herds where each pathway was identified (this is skewed by the certainty calculation). Genotyping of *M. bovis* isolates can be a powerful tool in identifying a likely source of infection, however genotypes are not determined for OTF-S herds. The inclusion of OTF-S herds in these calculations increase the uncertainty in the outputs. As a result, the relative proportions of each risk pathway is very approximate and only broad generalisations should be made from these data. A more detailed description of this methodology is provided in the Explanatory Supplement for 2019 (https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2019).

Key drivers of infection

The key drivers of the TB epidemic in East Sussex in 2019 are as follows:

- Infection from wildlife
- Cattle purchasing practices
- Recurrent/residual infections

Farmers need to be encouraged to increase on-farm biosecurity and reduce interaction between cattle and wildlife. Simple measures such as wildlife proofing of feed stores including maize and whole crop silage, and raising water and feed troughs could have a positive impact on increasing herd resilience to TB.

Purchasing cattle from areas of the country where undisclosed *M. bovis* infection is more likely. Pre-movement testing helps mitigate this but is not mandatory for cattle purchased from the LRA which represent a potential but much less likely source of infection. Although not required in the Edge Area counties, post-movement testing could potentially detect undisclosed infection earlier than at annual surveillance testing if routinely carried out, especially for cattle from high risk herds and the HRA. The use of the interactive mapping tool, ibTB (www.ibtb.co.uk) may help with informed purchasing.

Recurrent infections from either undisclosed infection in cattle or re-infection from the environment. Cleaning and disinfection after each round of reactor removal and the deployment of mandatory IFN-y testing in OTF-W incidents should continue to have an impact on reducing recurrence.

Sources of infection and risk pathways

Badgers accounted for 81% (Figure 12a) of the weighted source pathways recorded for the four new OTF-W incidents in 2019. However, this data set is very small, so any uncertainty will have a large impact on interpretation. All were in the former HRA portion of the county. There is some uncertainty in the sources of two of the incidents: a genotype result was not available for one and an out of homerange spoligotype 11 was isolated for another without a clear epidemiological link with the homerange of spoligotype 11. However, for the two incidents attributed to genotype 13:a (within homerange), WGS analyses supported the conclusion that wildlife was the source of the infection. Contiguous spread is also a possibility for one of these herds. This is not unexpected considering the higher frequency of herd incidents in the area.

Figure 12b shows that a wider variety of sources for infection were attributed to OTF-S incidents in 2019. This is explained by the larger data set (19 incidents) and the higher uncertainty for source of infection as there was no genotype or WGS data to help determine the source. Badgers still accounted for 38% of the weighted source pathways recorded for the OTF-S incidents overall with 22% of unknown source, 16% from cattle movements and 12% attributed to non-specific reactors or false positives. However, this latter category was not considered to be the "most likely" source of the TB incident for any of these incidents (Appendix 4).

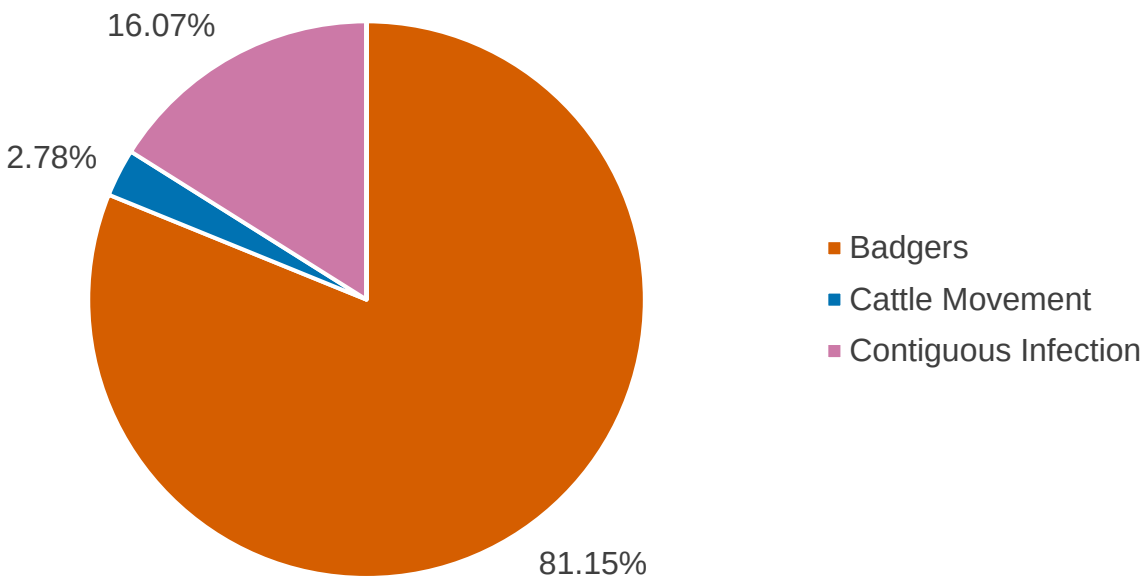


Figure 12a: Summary of the weighted source of infection pathways attributed for all OTF-W incidents in East Sussex that started in 2019, that had a completed DRF (4).

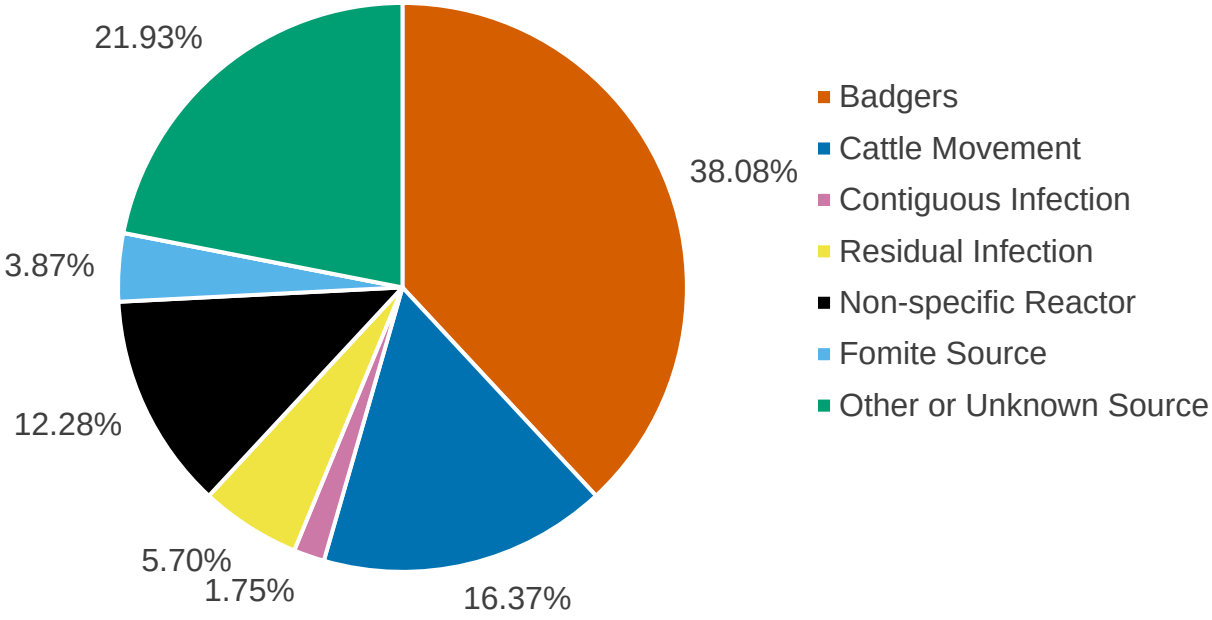


Figure 12b: Summary of the weighted source of infection pathways attributed for OTF-S incidents in East Sussex that started in 2019, that had a completed DRF (19).

As shown in Figure 13, there were only two incidents in beef fattener herds, with cattle movement regarded as the source of these incidents. This is not surprising as these herds source cattle from many different areas, often outside the south-east, to fatten for slaughter. Beef suckler herds comprised most of the incidents but this is consistent with the fact that beef suckler herds are the most prevalent type of cattle farm in East Sussex. Infected wildlife was thought to be the source of infection in four of the OTF-S suckler herds but was mentioned as possibilities in several other incidents.

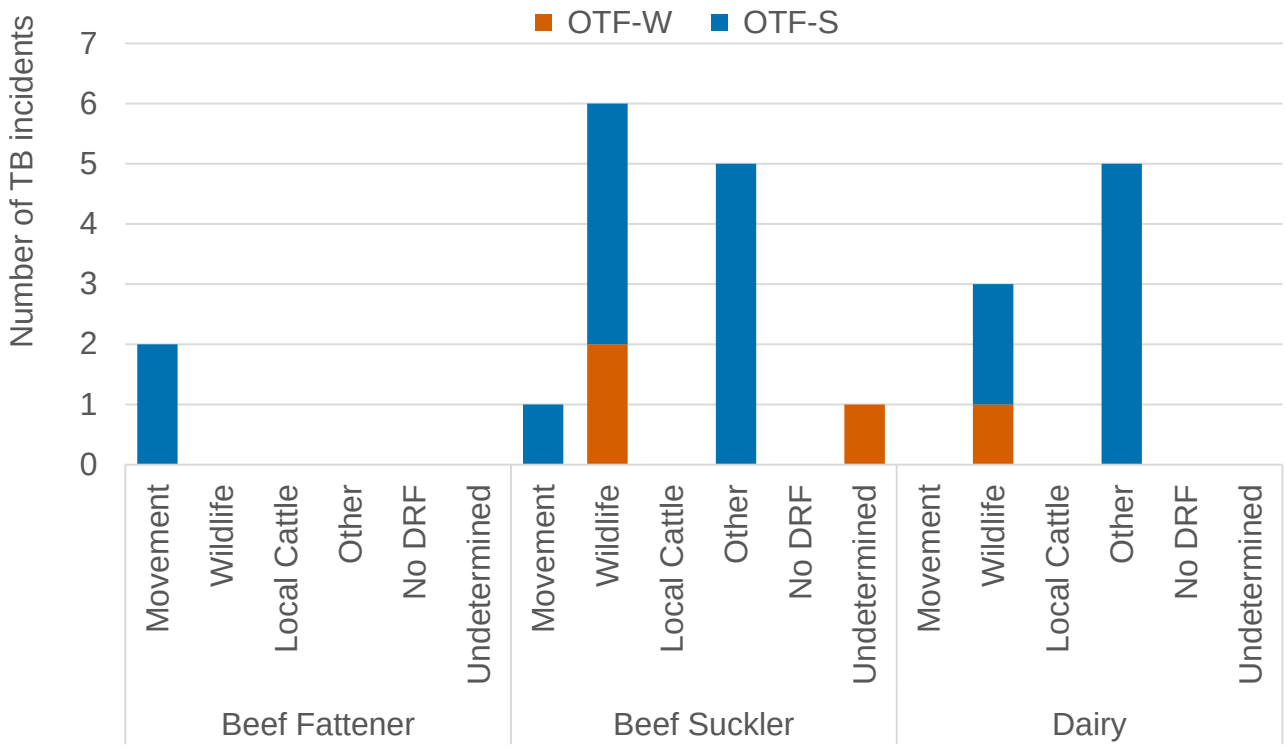


Figure 13: Source of infection recorded with the highest level of certainty for all TB incidents (both OTF-W and OTF-S) in East Sussex in 2019, by herd type. Note that the categories ‘movement’, ‘wildlife’, and ‘local cattle’ are comprised of incidents where these were the most likely single source of infection recorded. Incidents where the most likely single source was stated as ‘unknown’ were assigned to the category ‘undetermined’. ‘Other’ includes incidents where there was equal weighting between the most likely sources of infection as well as other pathways not categorised elsewhere.

TB in other species

There is no statutory routine TB surveillance of non-bovine species, apart from post mortem examination (PME) of suspected clinical cases reported to APHA and post mortem meat inspection of animals (e.g. sheep, goats, pigs) slaughtered for human consumption.

There have been no confirmed cases of *M. bovis* in other species in East Sussex during 2019.

Detection of incidents

With reference to Figures 14a and 14b, routine surveillance testing (whole herd test, WHT) disclosed most of the TB incidents in East Sussex in 2019. In comparison with 12 incidents disclosed by WHT in 2018, a similar number (13) were disclosed by WHTs in 2019. However, radial testing (RAD) of herds located within 3km of OTF-W incidents was introduced in 2018 and disclosed five incidents in 2019 compared to eight in 2018. It is not clear if radial testing has increased the total number of TB incidents disclosed in 2019 because the incidents were likely to have been disclosed at the WHT, albeit at a later date and perhaps with more reactors and chance for more onward spread. Pre-movement tests accounted for one incident in 2019 compared to three incidents in 2018. Two TB incidents were disclosed by six month post-incident tests (6M) thereby identifying reactors before the next annual surveillance test. Two herd check tests instigated by detection of *M. bovis* in carcase surveillance in abattoirs (SLH) disclosed reactors despite these slaughterhouse cases being culture negative. This illustrates the importance of continuing with these types of test to disclose TB infection at the earliest opportunity and thereby minimising disease spread.

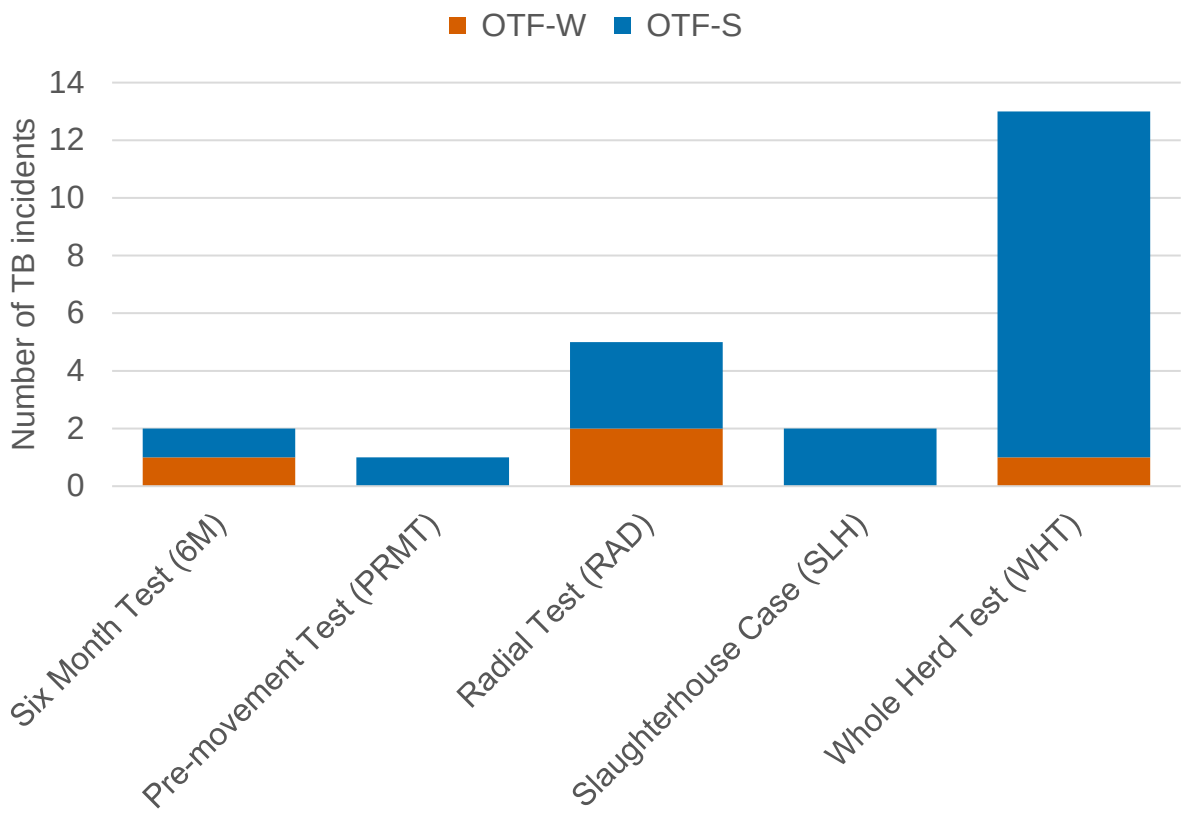


Figure 14a: Number of TB incidents (OTF-W and OTF-S) in East Sussex in 2019, disclosed by different surveillance methods.

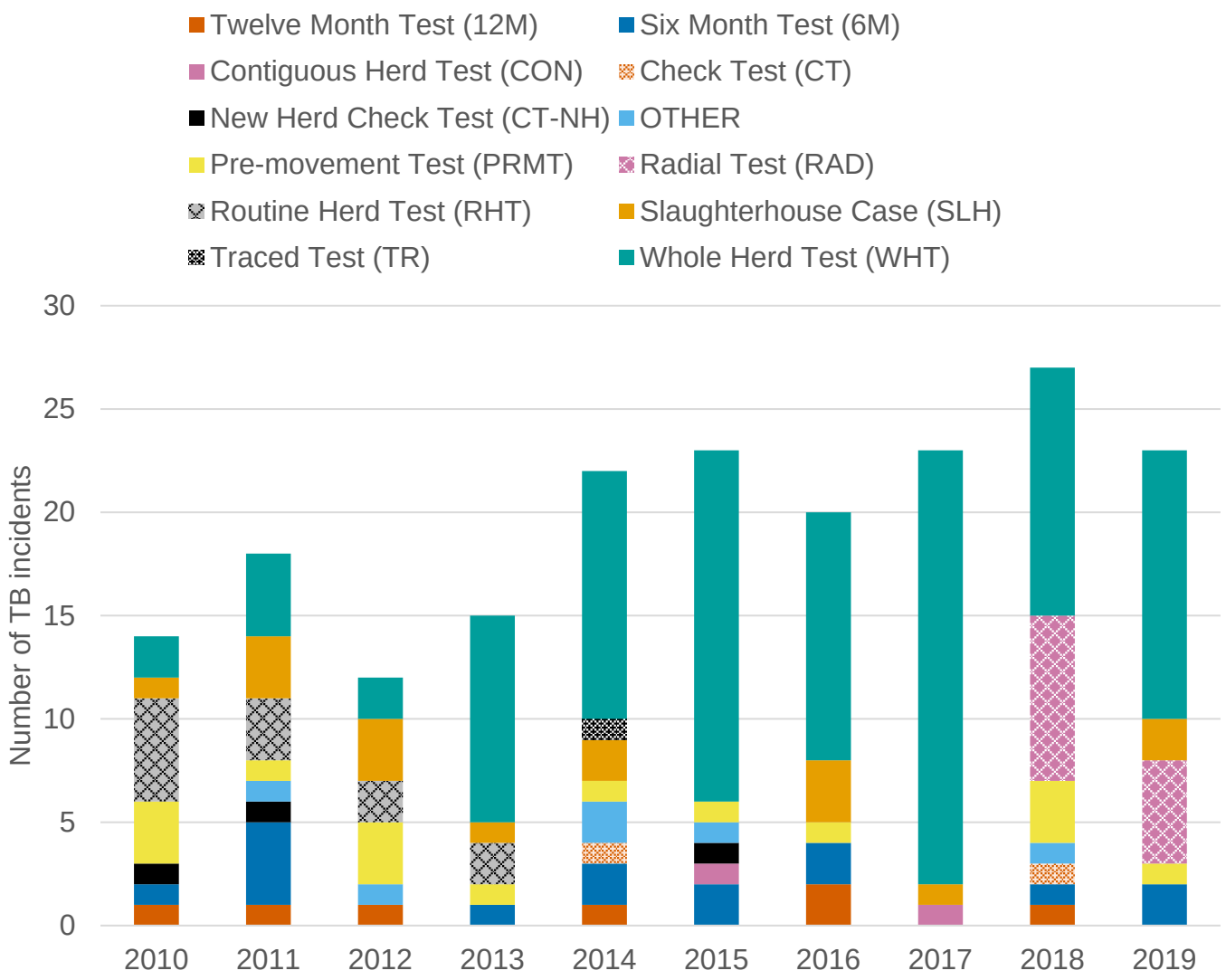


Figure 14b: Number of TB incidents (OTF-W and OTF-S) in East Sussex, 2010 to 2019, disclosed by different surveillance methods by year.

As shown in Figure 15, six of the 19 OTF-S incidents in 2019 had a history of a TB incident in the previous three years compared to one of the four OTF-W incidents. As there were so few OTF-W incidents in 2019 it is difficult to make comparisons. The recurrence was more likely to be correlated with the location of these herds, and whether they are located in the endemic (former HRA) part of East Sussex and so more likely to be re-infected from wildlife; or with their purchasing policies especially beef fattening herds that are more likely to purchase infected stock.

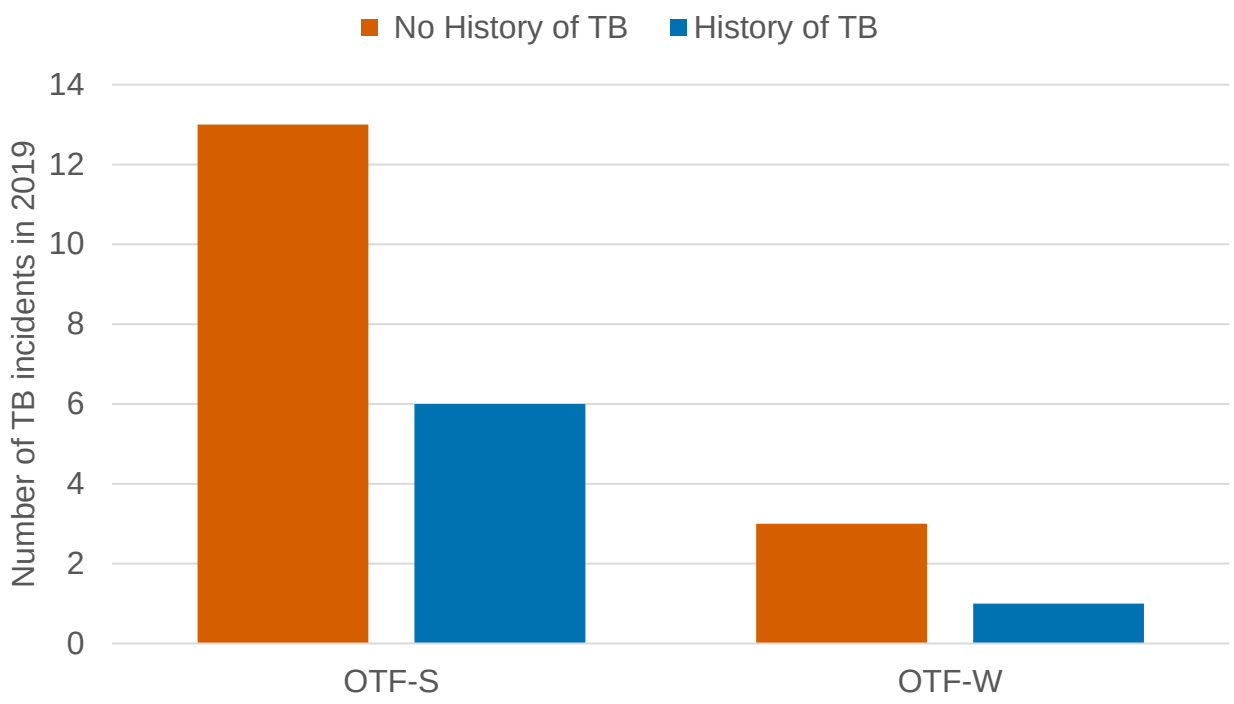


Figure 15: Number of TB incidents (OTF-W and OTF-S) in East Sussex in 2019 on holdings that have suffered an OTF-W incident in the previous three years, and holdings with no history of TB in the previous three years.

Skin test reactors and interferon gamma test positive animals removed

In line with the decrease in TB incidents in 2019 compared to 2018, there has also been a decrease in the number of skin test reactors and IFN-γ test positive animals. The number of test-positive animals detected by IFN-γ testing has decreased from 150 in 2018 to 133 in 2019 (8.6% reduction). The number of skin test reactors has decreased from 146 in 2018 to 78 in 2019 (46% reduction) (Figure 16). This decrease is largely explained by the reduced total number of incidents and the low proportion of OTF-W incidents which tend to have higher levels of herd infection than OTF-S, and for which IFN-y testing is compulsory.

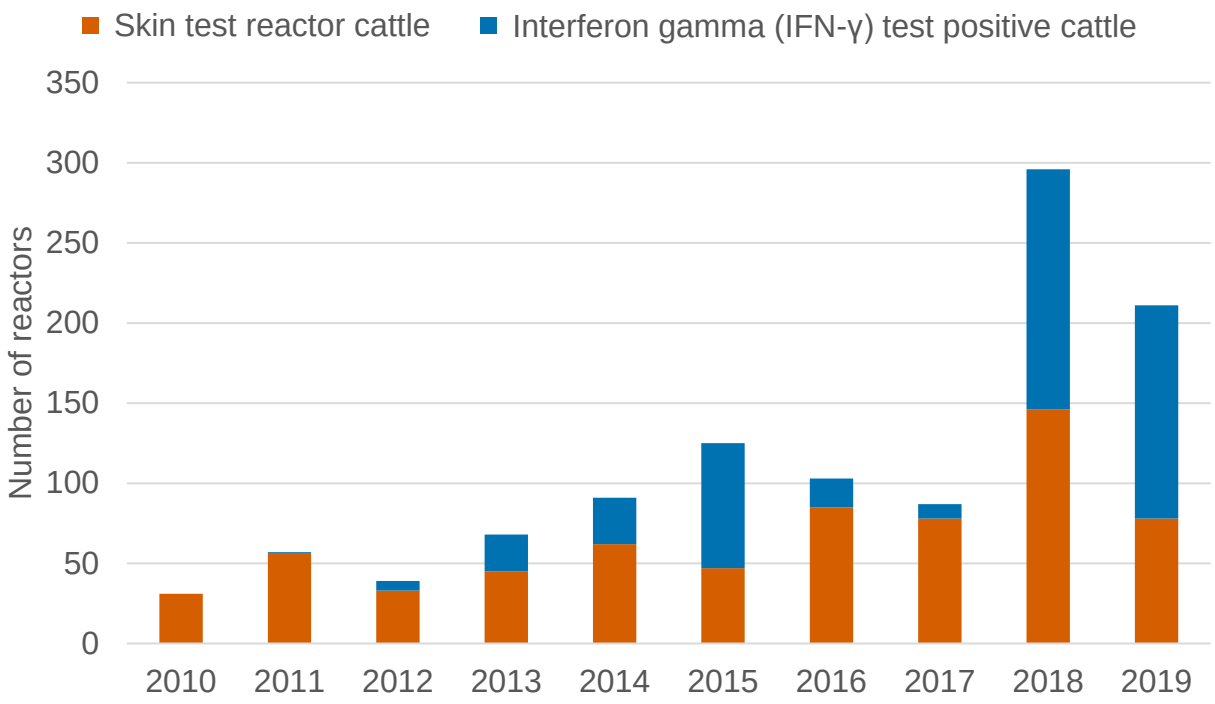


Figure 16: Number of Skin test reactors and Interferon gamma (IFN-γ) test positive cattle removed by APHA for TB control reasons, in East Sussex, 2010 to 2019.

Summary of risks to East Sussex

There is no HRA adjacent to East Sussex now that the whole of East Sussex is part of the Edge Area as of January 2018. There are risks from purchasing cattle from the HRA and higher risk parts of the Edge Area. Informed purchasing of cattle must be encouraged and on-farm biosecurity measures implemented to mitigate against these risks. Long distance movements of cattle will continue as there is a paucity of cattle available locally to supply the beef fattening units in the county.

Summary of risks from East Sussex to surrounding areas

East Sussex is unique in that it is surrounded by the LRA and so could pose a risk to the bordering counties of West Sussex, Surrey and Kent. In West Sussex in 2019, there were 12 OTF-S incidents and one OTF-W incident that was attributed to undetected infection in purchased cattle involving a genotype not found in East Sussex. None of these 13 herd incidents were located on the border with East Sussex. There was one OTF-W incident in Surrey in 2019 that was attributed to residual infection, and five OTF-S incidents. None of these incidents were located near the East Sussex

border. There was one OTF-W incident in Kent in 2019 and this was attributed to undetected infection in purchased cattle from East Sussex. An animal that was an inconclusive reactor at the post-movement test subsequently tested negative however it then became a reactor 18 months later at a routine herd test (RHT). There were six OTF-S incidents in Kent in 2019.The risks to the LRA surrounding East Sussex do not appear to be related to movements of infected wildlife as the endemic area of genotypes 13:a, 13:c and 13:d remains stable. There were no incidents in East Sussex in 2019 with genotype 9:l, so there is again no evidence to support that wildlife infected with this genotype are a threat to the adjacent LRA. The spread of disease from the endemic area towards the LRA border is also mitigated by the lower cattle density in the areas around the borders of the county thereby reducing the chances of cattle to cattle interactions, and badger to cattle interactions. Post-movement testing of cattle moved into the LRA from East Sussex also helps to mitigate against introduction of TB through movements of cattle, although this cannot always be a guarantee, illustrated by the movement of an animal from East Sussex to Kent as described above.

There are some herds that straddle the borders with West Sussex in the west or Kent in the east. However if a herd does straddle a border it will take on the testing frequency of the higher risk area therefore mitigating this risk. There was one OTF-S incident in 2019 that involved a herd on the north border of East Sussex with Kent however there was no clear source for the incident. The area of endemicity in East Sussex is in the south-west of the county, near to the border with West Sussex but is separated by the city area of Brighton thereby making local spread of infection by wildlife movements less likely.

Assessment of effectiveness of controls and forward look

The endemic area of East Sussex remains relatively stable and there is no conclusive evidence to suggest that this area has expanded during 2019. The endemic area, supported by genotype results remains confined to the south of the county where there is a relatively low density of cattle. There are no recent data for TB prevalence in wildlife in the area. Therefore this report is reliant on cattle data as an indicator of the likelihood of the endemic genotypes 13:a, 13:c and 13:d becoming more established outside their homerange in herds where cattle movements are not considered to be a source of the incident. There were only two cattle isolates of genotypes 13:a in 2019 and these were both within the former HRA portion of the county. One of the farms was just north of the A27 road which was traditionally regarded as a barrier for the spread of wildlife infection, however WGS indicated that the source of this incident was most likely infected wildlife suggesting that the endemic area for 13:a now extends just north of the A27 road. This is slightly concerning as there is no physical barrier to prevent further northward and eastward spread. However we have no evidence apart from this one incident to show that this has continued during 2019. The incident rate has declined during 2019 and in particular the number of OTF-W incidents. The OTF-S incidents are spread evenly throughout the county which is consistent with cattle purchasing as the source of infection. As the demographic of the cattle herds changes from many small farms to larger herds it is to be expected that the likelihood of a TB incident will increase.

A large proportion of OTF-S incidents do not have obvious epidemiological links with purchased cattle, and for two incidents in the original Edge Area of the county, wildlife is considered to be a likely source of infection. There is high uncertainty associated with conclusions made for OTF-S incidents because of the lack of genotype or WGS information. However, these areas should be monitored for any long term trends that might suggest endemicity. The primary purpose for the establishment of radial zones around OTF-W incidents is to detect source and spread from them but they also detect unrelated infections at an earlier stage compared to the annual routine test. However, as radial zones are not established and tracings not undertaken for OTF-S incidents, any associated infection can remain undetected. The use of severe interpretation and requirement for a minimum of two short interval skin tests before releasing movement restrictions in OTF-S incidents in the Edge Area helps to remove infection from the herd. Discretionary use of IFN-y testing where there is evidence of within-herd transmission in OTF-S incidents may also help to prevent spread and protect the adjacent LRA.

Since movement of cattle with undetected infection is an important source of TB incidents in this county, informed purchasing and use of the tools available such as the interactive mapping tool, ibTB (www.ibtb.co.uk) can be very informative for decision making. The employment of effective on-farm biosecurity measures to reduce cattle-to-badger interactions and the uptake of badger vaccination schemes are to be encouraged. The availability to farmers of free advice on prevention and management of TB in their herd from the TB Advisory Service (TBAS, www.tbas.org.uk/) is also welcomed and to be encouraged.

The overall incidence rate and the total number of incidents has declined in 2019 and there is no hard evidence to show that the endemic area is expanding therefore the short term policy objectives listed in Appendix 1 are being met. The longer term objectives are ambitious and it is difficult to assess the effectiveness of additional controls when they have only been in place for a relatively short period of time. However, despite enhanced control measures it seems unlikely that East Sussex will be OTF by 2025 because although a decline in prevalence and incidence has been seen in 2019, the overall trend over the last decade is for an increase in these parameters possibly due to the lack of TB infection control in wildlife.

Appendices

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

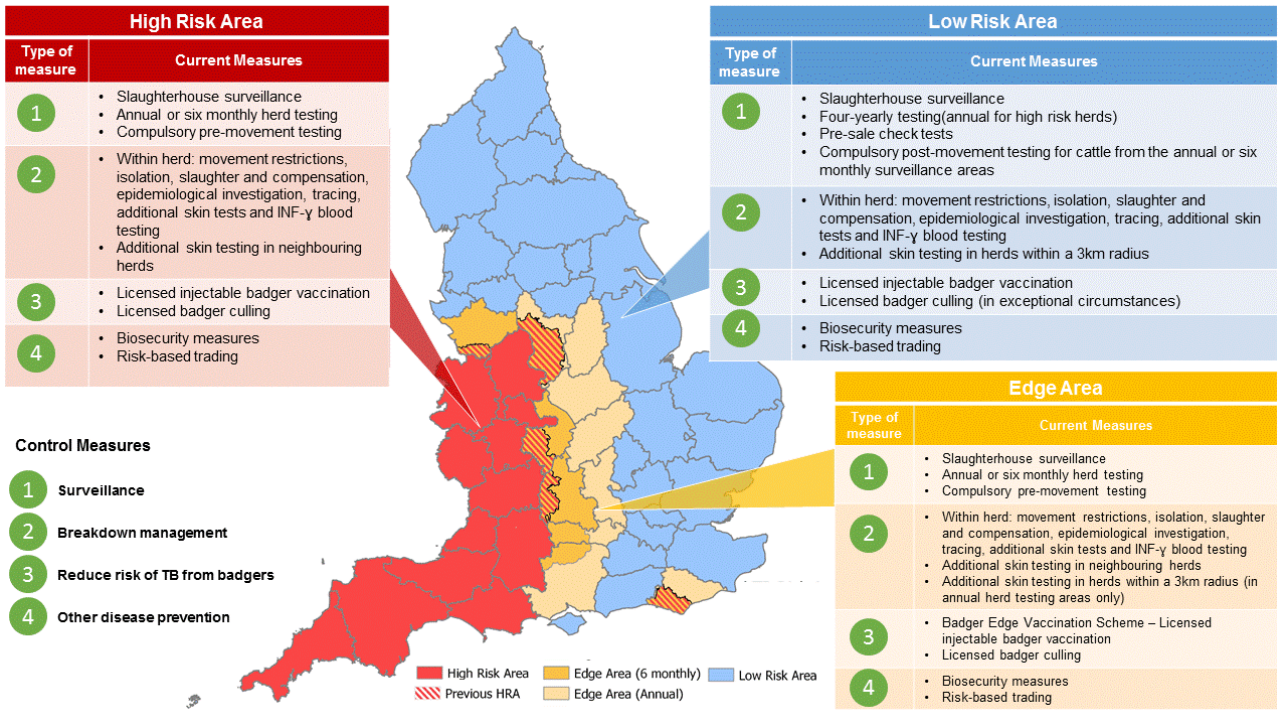


Figure A1.1: TB risk and surveillance areas of England effective since January 2018, as set out in the Government's Strategy for Achieving Officially Bovine Tuberculosis Free status for England. Map based on information published on www.tbhub.co.uk.

Policy objectives for the Edge Area

Short to medium term:

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

Longer term:

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

For more information about the governments approach to controlling TB, visit the strategy for achieving Officially Bovine Tuberculosis Free status for England, published in 2014 and independently reviewed in 2018, see:

https://www.gov.uk/government/publications/a-strategy-for-achieving-officially-bovine-tuberculosis-free-status-for-england

https://www.gov.uk/government/news/government-sets-out-next-phase-of-strategy-to-combat-bovine-tuberculosis

Key control measures

Surveillance:

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

Management of cases ('incidents'):

- increased sensitivity of incident herd testing:
- all incident herds must pass two consecutive short interval skin tests at severe interpretation to regain OTF status, irrespective of PM and bacteriological findings
- mandatory IFN-γ parallel testing of herds with OTF-W incidents
- enhanced management of herds with persistent incidents
- enhanced epidemiological investigation and data analysis
- information sharing - location of incident herds publicly available (using ibTB online (www.ibtb.co.uk) interactive mapping tool)
- restriction for life of all inconclusive reactors (IRs) that give a negative result on a re-test was introduced in November 2017. The only permitted movements of these animals are to slaughter or an Approved Finishing Unit

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 incidents

Summary of enhanced TB control measures in East Sussex

Edge Area testing policy:

- No discretionary IFN-y testing was employed in OTF-S incidents in 2019
- No exemptions were given to deployment of IFN-y testing in OTF-W incidents
- No issues with radial testing, and none of the new four zones set up in 2019 have disclosed any reactors or IRs yet but the zones are recent and testing only just commenced in one. A cattle holding was exempt from radial testing following a veterinary risk assessment

Other testing measures:

- No new potential TB hotspots were identified in 2019, although the OTF-W herd with an out-of-range genotype 11 in a homebred animal with no obvious epidemiological links with premises from the homerange in the south-west, will be monitored closely. The results of radial testing will be interesting. As this incident only commenced in December 2019, the RAD6 tests have not yet been performed.
- There were 35 herds with overdue skin tests in 2019. 24 were only slightly overdue (0-30 days), three were 31 to 60 days overdue, five were 61 to 90 days overdue, one was 91 to 120 days overdue, and one herd over 150 days overdue. This latter herd, overdue from 2016, was tested in 2019 but three cattle remained untested. Two herds with the longest overdue tests were of small size and probably of limited disease significance.

Other control measures:

- A local meeting with the National Farmers Union (NFU) and farmers, TB Advisory Service (TBAS, www.tbas.org.uk/) and private veterinarians was held in Surrey to discuss TB controls and the current TB situation in the South East. It was very well attended and biosecurity advice for prevention was given.

Appendix 2: cattle industry in East Sussex

Table A2.1: Number of cattle premises by size band in East Sussex at 1 January 2019. (RADAR data)

Size of Herds	Un*	1-50	51-100	101-200	201-350	351-500	501 +	Total Number of Herds	Mean Herd Size	Median Herd Size
Number of Herds	2	312	96	74	30	17	12	543	88	39

*The number of herds with an undetermined size.

Table A2.2: Number of animals by breed purpose in East Sussex at 1 January 2019.

Breed purpose	Beef	Dairy	Dual purpose	Unknown	Total
Number of Cattle	30,628 (64%)	15,518 (32%)	1,496 (3%)	15 (<0.01%)	47,657

Appendix 3: summary of headline cattle TB statistics

Table A3.1: Herd-level summary statistics for TB in cattle in East Sussex between 2017 and 2019.

Herd-level statistics	2017	2018	2019
(a) Total number of cattle herds live on Sam at the end of the reporting period	635	609	626
(b) Total number of whole herd skin tests carried out at any time in the period	570	647	616
(c) Total number of OTF cattle herds having TB whole herd tests during the period for any reason	507	516	524
(d) Total number of OTF cattle herds at the end of the report period (i.e. herds not under any type of Notice Prohibiting the Movement of Bovine Animals (TB02) restrictions)	606	578	597
(e) Total number of cattle herds that were not under restrictions due to an ongoing TB incident at the end of the report period	621	588	610
(f) Total number of new TB incidents detected in cattle herds during the report period, (including all FUs)	23	27	23
• OTF-S	13	13	19
• OTF-W	10	14	4
(g) Of the OTF-W herd incidents:			
• How many can be considered the result of movement, purchase or contact from/with an existing incident based on current evidence?	2	4	0
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at routine herd tests	3	4	1

Herd-level statistics	2017	2018	2019
• New OTF-W incidents triggered by skin test Reactors or 2xIRs at other TB test types (forward and back-tracings, contiguous, check tests, etc.)	0	4	1
• New OTF-W incidents first detected through routine slaughterhouse TB surveillance	1	0	0
(h) Number of new incidents revealed by enhanced TB surveillance (radial testing) conducted around OTF-W herds			
• OTF-S	3	2	3
• OTF-W	2	6	2
(i) Number of OTF-W herds still open at the end of the period (including any ongoing OTF-W incidents that began in a previous reporting period, but not including non-grazing Approved Finishing Units)	5	12	4
(j) New confirmed (positive *M. bovis* culture) incidents in non-bovine species detected during the report period (indicate host species involved)	0	0	0
(k) Number and type of finishing units active at end of the period:			
Approved Finishing Units: Grazing	0	0	0
Approved Finishing Units: Non Grazing	1	1	1
Exempt Finishing Units: Grazing	0	0	0
Exempt Finishing Units: Non Grazing	1	2	2

Table A3.2: Animal-level summary statistics for TB in cattle between 2017 and 2019.

Animal-level statistics (cattle)	2017	2018	2019
(a) Total number of cattle tested in the period (animal tests)	61,896	79,091	75,704
(b) Reactors detected in tests during the year:			
• Tuberculin skin test	78	146	78
• Additional IFN-γ blood test reactors (skin-test negative or IR animals)	9	150	133
(c) Reactors detected during year per incidents disclosed during year *	3.8	11.0	9.2
(d) Reactors per 1000 animal tests	1.4	3.7	2.8
(e) Additional animals slaughtered during the year for TB control reasons:			
• DCs, including any first-time IRs	13	0	10
• Private slaughters	1	3	12
(f) SLH cases (tuberculous carcases) reported by Food Standards Agency (FSA)	7	2	4
(g) SLH cases confirmed by culture of *M. bovis* **	2	1	0

* Note: reactors may be from incidents disclosed in earlier years, as any found through testing during the report year count here.
** Note: not all cases reported are submitted for culture analysis. All cases reported are from any period prior to or during restrictions. Two OTF-S incidents were initiated by reactors disclosed at the CT triggered by the SLH case even though the initial SLH case was culture negative. This explains the two OTF-S SLH cases in Figure 15a.

Appendix 4: suspected sources of *M. bovis* infection for all of the new OTF-W and OTF-S incidents identified in the report period

Table A4.1: Suspected sources of *M. bovis* infection for all of the new OTF-W and OTF-S incidents identified in East Sussex, in 2019.

Source of infection	Possible (1)	Likely (4)	Most likely (6)	Definite (8)	Weighted contribution
Badgers	17	11	1	1	45.6%
Cattle movements	8	3	0	0	14.0%
Contiguous	3	1	0	0	4.2%
Residual infection	2	0	1	0	4.7%
Domestic animals	0	0	0	0	0.0%
Non-specific reactor	2	3	0	0	10.1%
Fomites	5	0	0	0	3.2%
Other wildlife	0	0	0	0	0.0%
Other or unknown source	3	1	0	0	18.1%

Please note that each TB incident could have up to three potential pathways so totals may not equate to the number of actual incidents that have occurred. Details of the methodology used to calculate the weighted contribution of the different suspected sources of *M. bovis* infection for all new incidents can be found in the main body of the report and in the Explanatory Supplement for 2019 (https://www.gov.uk/government/publications/bovine-tb-epidemiology-and-surveillance-in-great-britain-2019).

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