

Science, TB and Badgers

(paper supporting the blog TB, Badgers and Cattle in The UK: A Campaign Ripe For A Re-boot, at <http://threeworlds.campaignstrategy.org>)

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Introduction

Before its discovery of in English badgers, bovine TB was primarily seen as an issue of public health and farming, and then as human TB rates fell, a farming problem. Once the government vets identified TB in badgers and started badger culling, it became a public controversy which successive governments have tried to frame as a scientific issue, as in policy being “led by” or “informed by” “the science”.

In reality, bovine TB policy has never been truly determined by science because politicians have been heavily influenced by the NFU, public opinion and cost. Introducing a [Wellcome Institute Review](#) of the history in 2014, Prof. Kier Waddington wrote:

As MAFF commented in 1986, since the 1970s, badger controls have been influenced by ‘practical and political expediency, field experience, research, public relations considerations, the perplexities and imponderable nature of TB badger/cattle relationships and much discussion among interested parties’.

John Montague, a former Defra Chief Vet who oversaw the government side of the RBCT (Randomized Badger Culling Trial) said at the Wellcome meeting:

‘I think Ministers ... had a gut feeling one way or other on badgers ... I had four administrations I think I dealt with, and they had a gut feeling for where they wanted to go on badgers and for à la carting the evidence to suit their political position one way or the other’

The politics of bovine TB have had many similarities to those of the contemporary coronavirus epidemic, where public health concerns have clearly been traded off against fears around the economic impacts of control measures.

Parting Company With the Science

To begin with ‘science’ in the form of scientists, were, like vets, mostly inside with government policy but after the ten year Krebs/Bourne investigation (a review and the 1997 - 2007 RBCT, and its reports), the two began to part company. In their history of the issue, [McCullough and Reiss](#) recorded:

As a former Labour Defra minister involved at the time reported: “When I arrived [at Defra] ... John Bourne’s ISG report basically was on the desk. And I suppose what it said was not quite what people, or some people, expected” [Former Defra Minister, Labour Party].

John Bourne (interviewed by McCullough and Reiss) had told them ‘that from the start of the trial it was expected future policy in Defra would be based on reactive culling’. He is quoted as saying:

‘There was a very definite view from the outset that future policy was going to be the reactive culling. That was it. And when it was shown that it was not gonna work there was all hell let loose’.

This led to an unusually public argument between on the one side, Professor John Krebs who had proposed the RBCT and Professor John Bourne who led the Independent Scientific Panel who oversaw and reported on the RBCT which concluded culling was unlikely to work, and on the other, David King, who had become the government Chief Scientist and at the request of the government, produced his own quicker, smaller review which supported culling.

The split between independent ‘science’ and government ‘science’ became very obvious in October 2012. On 14 October 2012, 30 senior scientists led by Professor Sir Patrick Bateson of the University of Cambridge and president of the Zoological Society of London signed a published in *The Observer*, opposing the cull (including Krebs and Bourne). It stated:

‘... we believe the complexities of TB transmission mean that licensed culling risks increasing cattle TB rather than reducing it.

Even if such increases do not materialise, the government predicts only limited benefits, insufficient to offset the costs for either farmers or taxpayers. Unfortunately, the imminent pilot culls are too small and too short term to measure the impacts of licensed culling on cattle TB before a wider roll-out of the approach. The necessarily stringent licensing conditions mean that many TB-affected areas of England will remain ineligible for such culling. We are concerned that badger culling risks becoming a costly distraction from nationwide TB control.

We recognize the importance of eradicating bovine TB and agree that this will require tackling the disease in badgers. Unfortunately, culling badgers as planned is very unlikely to contribute to TB eradication. We therefore urge the government to reconsider its strategy’.



Letter signed by: Professor Sir Patrick Bateson FRS, University of Cambridge and president of the Zoological Society of London, Professor Mike Begon, University of Liverpool ; Professor Tim Blackburn, Zoological Society of London ; Professor John Bourne CBE, former Chairman, Independent Scientific Group on Cattle TB; Professor William Sutherland, University of Cambridge; Professor Terry Burke, University of Sheffield; Dr Chris Cheeseman, formerly Food & Environment Research Agency; Professor Sarah Cleaveland, University of Glasgow; Professor Tim Clutton Brock FRS, University of Cambridge ; Professor Andrew Dobson, Princeton University; Dr Matthew Fisher, Imperial College London; Dr Trent Garner, Zoological Society of London; Professor Stephen Harris, University of Bristol; Professor Daniel Haydon, University of Glasgow; Professor Peter Hudson FRS, Pennsylvania State University; Professor Kate Jones, University College London; Professor Matt Keeling, University of Warwick; Professor Richard Kock, Royal Veterinary College; Professor Lord Krebs Kt FRS, University of Oxford Dr Karen Laurenson, Frankfurt Zoological Society; Professor Sir John Lawton CBE FRS, former chief executive of the Natural Environment Research Council; Professor Simon Levin, Princeton University; Professor Georgina Mace FRS, University College London; Professor Jonna Mazet, University of California, Davis School of Veterinary Medicine; Professor Lord May OM AC Kt FRS, University of Oxford; Professor Graham Medley, University of Warwick; Professor E.J. Milner-Gulland, Imperial College London; Professor Denis Mollison, former Independent Scientific Auditor to the Randomised Badger Culling Trial; Professor Pej Rohani, University of Michigan; Dr Tony Sainsbury, Zoological Society of London; Professor Claudio Sillero, University of Oxford; Professor Rosie Woodroffe, Zoological Society of London

So scientists said that culling could increase TB rather than reducing it, could become a 'costly distraction' from 'nationwide TB control' (ie including cattle farming measures), and was 'very unlikely' to 'contribute to TB eradication'.

'Transmuting Evidence-Based Policy Into Policy-based Evidence'

The Guardian [reported](#): 'Lord Robert May, a former government chief scientist and president of the Royal Society, saying: "It is very clear to me that the government's policy does not make sense." He added:

"I have no sympathy with the decision. They are transmuting evidence-based policy into policy-based evidence."

Krebs [called](#) the government policy "mindless" and said "The scientific case is as clear as it can be: this cull is not the answer to TB in cattle. The government is cherry-picking bits of data to support its case."

'5.7%'

A year later on 10 October 2013 two Imperial College researchers, Christl Donnelly (a member of the former ISP which oversaw the RBCT) and Pierre Nouvellet, published a [paper in the journal PLOS](#) re-analysing data on 'the contribution of badgers to confirmed tuberculosis in cattle in high incidence areas in England'.

It contended that while there was a possibility of badgers not being involved at all, transmission by badgers might be involved in about half and at least 38% of all cattle herds developing confirmed TB, only 5.7% of this was due to transmission from badgers to cattle, and the rest was onward transmission between cattle. This is the basis for a much quoted figure that badgers are 'responsible' for only 6% of cattle TB and the rest, 94%, is down to cattle-cattle transmission. In 2018 ZSL [interpreted](#) this analysis to mean that 'at least 75%, and possibly as many as 99%, of TB-affected herds acquire infection from other cattle herds'.

The pair also pointed out that the up-to-54%-reduction figure for confirmed TB incidence in cattle herds in areas proactively culled for five years, 'was only within RBCT trial areas for an 18-month time period between 12 and 30 months after the final annual proactive cull'. Longer-term estimates of 'over 9.5 years including 5 years of culling' for 'the average net impact of proactive culling of circular areas of 150km²' were 12% - 16%. (This cannot be compared to the current and low-cost 'free-shooting' policy for culling as the RBCT employed much more controlled cage-trapping and shooting methods).

The 'best fit' model used also yielded an estimate of new annual TB incidence in cattle herds in the absence of transmission from badgers of 3.4%, 'suggesting that herd-to-herd transmission was enough to sustain transmission' without badgers (although it was not possible to rule out the possibility that herd-to-herd transmission alone was insufficient to sustain bovine TB).

Ecologist Tom Langton takes a dim view of much of the science deployed to support or oppose badger culling (particularly from the Krebs report onwards) and details a series of concerns in a detailed July 2020 blog [Scientists, Disease and Communicating Uncertainty](#) in a blog at the website of The Badger Crowd. This group takes a particular interest in the quality of evidence as it has been [active](#) in pursuing legal challenges to Defra's bTB policies. Langton points out that the Donnelly-Nouvellet paper was based on modelling that included

a number of ‘incorrect assumptions’ including that infection of badgers by cattle ‘was negligible’. Nevertheless this ‘tenuous’ modelling was used to justify ‘the mass destruction of mostly healthy badgers’. [Langton also says (pers comm) that rather than 5.7%, correctly the paper should be quoted at 0-6% if you take in the adjustment for Foot and Mouth (see table 2 CI 0-100%)].

Langton [writes](#) that despite ‘appearances’, from a legal standpoint, Defra’s position is closer to the view that modelling based on the RBCT evidence is ‘too uncontrolled and speculative’ to support badger culling ‘than most realise’ and Defra is:

‘seeking de-stabilised badger populations at around 30% of a guesstimated starting density ... Since 2016, Defra have brought in prolonged or “supplementary” badger culling (SBC). This approach perpetuates badger killings to keep numbers down following four years of intensive culls depleting up to 90% of a population, with the hope of ‘keeping’ any theoretical benefit, whether or not it actually exists. Yet this is with recent (2019) senior scientific advice that there is no way of actually detecting any [direct](#) evidence of supplementary culling working at all and recognising that science even warns (2) that it might, in reality, increase the rate of herd bTB breakdowns’.

‘Badger Blame Game’

The government’s public rejection of the science back in 2012 was the obvious top-down sign of the divergence of science and policy but the de facto official assumption that badgers are the guilty party, has infused the approach of Conservative governments at every level and scale, ever since.

This ranges from making no effort to address structural issues arising from farm intensification, through to how individual farm inspections are done. It affects what is counted in and what is left out, how the issue framed when presented to the public, media and parliament, and what evidence is acted on and what is ignored. Some of this may be calculated but selecting evidence that supports existing beliefs and ignoring other evidence is also a largely unconscious tendency we all have, known as [‘confirmation bias’](#).

Farming lobbyist-turned-wildlife-campaigner Dominic Dyer refers to the ‘badger blame game’. He recalls in his 2016 book [Badgered to Death](#), that at a Welsh Government ‘TB summit’ in 2014, Defra Chief Scientist Ian Boyd was asked what his greatest regret was about bovine TB policy over the past 39 years. Boyd replied that it was “The Protection of Badgers Act”. Dyer says Boyd believed it ‘had allowed badger numbers to rocket’, and become a major reservoir of TB. Dyer wrote:

‘The fact that the Chief Scientific Advisor to Defra was willing to go on the record at an international conference with such a statement shows how ingrained this view had become within the tight cadre of senior policymakers in Defra’.

Given the weight of evidence that despite decades of research the case against badgers being the driving cause of TB infections in cattle was still far from proven, the efficacy of

culling was even less well established and that far less political attention was focused on cattle farming practices where the evidence was more or less uncontested (eg herd size), and the past criticisms made by eminent independent scientists, that may seem as strange thing for the Chief Scientific Adviser of a government department to say. But perhaps that's the point.

It's a well known psychological phenomenon that behaviour drives opinion: that is we rationalise a behaviour as 'making sense' once we've done it. So if you are paid in a role which requires you find evidence to support government policy, it's hard to retain self-respect without unconsciously convincing yourself that your advice made sense all along. I have no idea if that happened to Ian Boyd but it has often been demonstrated at a group or population level.

[Many](#) studies have shown such an effect with respect to climate change. For example a 2008 survey asked a wide range of mainly US earth scientists 'Do you think human activity is a significant contributing factor in changing mean global temperatures?', of over 3,000 responses, 82% said 'yes' but only 48% of those working as 'economic geologists'. The most obvious explanation was that if (happiness in) your job depends upon not believing something (it is damaging the planet), you are more likely to shape your opinions accordingly (resolution of 'cognitive dissonance').

With the exception of a few years under 'New Labour', the government in England has been committed to badger culling as a way to combat TB, relegating badger vaccination to a token effort, and repeatedly focusing politics on culling rather than cattle controls. So it would be surprising if long-standing officials did not come to accept that this policy was well-founded.

In 2020, Boyd (now retired from Defra) expressed his conviction that badger vaccination could not work. Taking part in a [Wildlife Trusts online panel](#), Boyd told Dyer:

"I don't think there are other viable methods [than culling] of getting rid of bovine TB from the countryside, you know I've looked in detail at vaccination and fundamentally it makes us feel good to do it ... it's not that we've shown it doesn't work, actually, you can tell on the back of a fag packet it's not going to work - sorry"

(Boyd himself went on to make a strong alternative argument for reducing cattle and sheep farming and thus the cattle population on health and environmental grounds, and 'living with TB' rather than culling).

Vets

On 17 April 2015 the BVA, British Veterinary Association, [dropped it's support](#) for the government's planned badger culls in Somerset and Gloucestershire because it employed 'free shooting' (also called 'controlled shooting') rather than the more humane cage-trapping system used in the RBCT. Until this point the BVA had been unequivocally supportive of culling (it remained supportive – only not by free-shooting which was shown to increase the chances of a wounded badger experiencing a long and painful death).

Vets are not a unified group in England. As Dominic Dyer points out in *Badgered to Death*, ‘in normal circumstances such a statement ... would have brought an end to free-shooting for all future culling operations’ but not in this case. He says this was due to lobbying of Minister Liz Truss by the NFU.

Within the BVA, opinion on badger culling has been divided. In their 2017 survey of the issue, McCullough and Reiss [write](#) that [after the 2015 statement] ‘As a result of internal disagreement in the BVA, it’s Ethics and Welfare Group was disbanded and replaced by a weaker Ethics and Welfare Advisory Panel’. Dyer describes how ‘livestock vets are largely dependent on their farm clients for an income and as such few are willing to speak out against badger culling’. He identifies the influence of the BVCA or [British Cattle Veterinary Association](#) and accuses the veterinary profession of being a ‘shield to the government and NFU for the continuation of culling’. The BVA also has an Ethics and Welfare Advisory Panel. The BVA’s website [currently says](#) that ‘Having accepted the [scientific evidence \(25 KB PDF\)](#) that bTB is transmitted from badgers to cattle, and having accepted a need to eradicate bTB, culling to reduce the weight of infection in the badger population can be justified’.

In September 2020 vets headed by veterinary surgeon [Iain McGill](#), and including [Alick Simmons](#), former deputy chief veterinary officer, along with [Chris Cheeseman](#), former head of APHA Wildlife Disease Research and government adviser on bovine TB and prominent nature conservationists [signed an Open Letter](#) to the Prime Minister in the BVA’s *Veterinary Record*. It called on him not to continue culling but to support badger vaccination. It made a list of referenced criticisms of the current policy in England including that:

‘1. Badger killing is ineffective

... data released by APHA demonstrated that both the prevalence and incidence of disease in cattle herds in the Gloucestershire pilot cull zone were higher following five full years of culling than before culling began. While incidence had fallen in the Somerset pilot cull zone, prevalence among cattle herds remained static over this period, and in the Dorset pilot cull zone the prevalence increased by 20 per cent over three years of culling.

2. Badgers are not heavily infected.

In spite of consistent calls for killed badgers to be tested for bTB, very little such testing has taken place.

... in Cumbria in 2019, 317 badgers were culled in the ‘minimum infected area’ and an outer buffer zone, 313 of which were tested post-mortem. Only three badgers tested positive and one of these was infected with a strain unrelated to herd breakdowns, indicating that the prevalence of infection in badgers in this area is below 1 per cent.

3. The attribution of sources of infection for cattle is not rigorous.

No formal disease risk analysis (DRA) for the bTB policy has ever been conducted, contrary to best practice. The manner in which veterinary disease report forms have been used to identify risk pathways has been called into question. This process has been used to attribute a high proportion of cattle herd breakdowns to badgers – vastly greater than is supported by published epidemiological evidence ...’

It went on to describe the routine SICCT skin test in cattle as ‘direly’ insensitive and cited it as ‘the main reason for Defra’s failure to control bTB’, as it ‘leaves a huge occult burden of tens of thousands of infected cattle in the high risk area (HRA) alone’. Adding: ‘If Defra were serious about getting bTB under control, it would immediately introduce appropriate testing methodology – most urgently to enable effective pre- and post-movement screening for cattle. Its failure to do so ensures that bTB continues to spread throughout the UK by the movements of infected cattle’.

Built in Bias In Official Surveys: The Case of Derbyshire

A micro-scale example of attention/reporting bias with respect to badgers was the [APHA 2018/19 report on TB in Derbyshire](#), critiqued in detail (see report) by E Wright and S Mayer for the Derbyshire Wildlife Trust (DWT), in ‘[Critical evaluation of the Animal and Plant Health Agency report: ‘Year End Descriptive Epidemiology Report: Bovine TB Epidemic in the England Edge Area – Derbyshire 2019’](#)’.

Introducing the study, Tim Birch of DWT explained that the Trust had been prompted to investigate how Defra was assigning TB infection of cattle to badgers, because it’s Animal and Plant Health Agency (APHA) had [reported](#) ‘77% of new cases of TB in cattle in Derbyshire in 2018 were caused by badgers’. This ‘was used to call for a cull of badgers in Derbyshire’ but ‘the figure of 77% is much larger than any estimate in the peer reviewed scientific literature ... which ranges from 5-36%’.

Wright and Mayer had to resort to Freedom of Information requests to make their analysis because key information was not included in the APHA publication. They found that the risk assessments of the APHA took largely subjective judgements by visiting vets and converted them into numerical ranking, giving a spurious impression of evidence-based objectivity. This was key to generating the 77% figure. In effect it was an opinion poll.

‘The risk assessments used within the APHA report involve the investigating officers’ judgements and opinions and therefore a degree of subjectivity is inherent in the methodology’

They also pointed out that:

- as there was no detailed data available on the badger population, vets had assigned the risk of badgers exposing cattle to TB ‘based solely on the presence or absence of badger activity in the vicinity’ (eg latrines, setts) and ‘have to make a large and unsupported assumption that badgers are a source of disease on essentially any farms where they are present’.
- actual TB infection of badgers was not checked
- Some of the vets may not have received appropriate training in badger ecology
- The APHA assumed TB was endemic in badgers in the area but a road casualty survey found only 4% were infected
- The headline finding in the Executive Summary used to justify culling was that the most likely source of herd infection was ‘wildlife’ at 77% but it left out a caveat buried in the detail of the report stating ‘the relative proportions of each risk

pathway are very approximate' and only 'broad generalisations' ... 'can be made from these data'

- Reporting of detailed information on slurry and manure production and handling was not required, although attention was directed to a long list of other factors including signs of wildlife (badgers)
- 'The APHA risk assessments use ROC* in a novel way and previous similar applications could not be found in open published literature' (* Rank Order Centroid – a statistical method to quantify a ranking process)
- 'Of the 120 herds analysed ... the hazard associated with badgers was the sole allocation in 35 (almost 30%) of them i.e. the investigating officer decided there was sufficient evidence to positively exclude all other risk pathways except one. The certainty "Definite" is used once in the 120 breakdowns in Derbyshire and this was a risk pathway attributed to badgers. Where the hazard of both 'badgers' and 'cattle' were assigned to a herd (53 herds), in 70% of these cases the risk pathways associated with badgers were ranked higher than those associated with cattle. In fact, risk pathways associated with badgers account for 148 of a total of 234 of the final risk pathways allocated. Risk pathways associated with cattle occur only 73 out of the 234 allocations. These proportions seem unlikely given the uncertainties and assumptions made about wildlife attribution.'

It concludes:

'The APHA report relies on a risk assessment which depends upon accurate hazard identification and risk pathway analysis, but in all of these areas there is a neglect of uncertainties and unknowns coupled with an unsupported bias towards badgers and neglect of cattle-based risk factors. These include the use of 'circumstantial evidence' regarding a spike in TB incidents in 2015, the suggestion of endemicity of TB in the badger population and the prominence given to the numerical risk assessments which give a spurious sense of precision'.

Wright and Mayer don't mention this but if the official reporting protocol directs attention of inspectors to look for particular cues including signs of badgers, and not requiring them to look at other signs including for example slurry leaks, the system invokes a cognitive bias known as [WYSIATI](#) or 'what-you-see-is-all-there-is'. This is the innate human tendency to construct a story of meaning from incomplete information, described by Daniel Kahneman and others.

Coincidentally, the Frameworks Institute uses an example of sick cows in training clients (page 16 [here](#)) in how 'framing' works (the unconscious process of categorizing something, along with the 'rules' of that category):

CONTEXT

WHAT RESEARCH SUGGESTS ABOUT THIS ELEMENT OF THE FRAME

- Context establishes the cause of the problem and who is responsible for solving it.
- Context can further systems thinking and minimizes the reduction of social problems to individual solutions.
- Context must be built into the frame with the introduction of the problem.

Context is one of the most difficult elements of the frame to describe, and one of the most important to get right. In FrameWorks trainings, we explain context by first showing the group a picture of cows chewing grass in a field. We explain that some cows are getting sick, and we ask the group to speculate about the cause. Invariably, people work within the frame that has been given them; they ask if the farmer gave the cows bad feed, or if the farmer is experienced, or if the cows have wandered into an adjacent field, or if the cows caught a disease from other cows. We then add a backdrop that shows an urban landscape, with smoke stacks belching fumes just over the cows' heads, and we ask the group again: Why do you think the cows are getting sick? This time, of course, they are able to broaden the scope of their speculation to include environmental causes, and to ask about the relationship of the cows to their air, water and soil. This exercise brings home the importance of getting context into the initial definition of the problem.

From Frameworks Institute [‘Framing Public Issues’](#)

With no other cues, people guess that the reason for sickness might be something like the grass they are eating or catching a disease from another cow. Here's a version I use in training people about framing:

These cows are unhealthy -
why might that be ?



Then with a factory added:

These cows are unhealthy -
why might that be ?



Now with a smoking factory the 'obvious' explanation is pollution. And here's what might be the APHA version with signs of badger activity:

These cows are unhealthy -
why might that be ?



Although farmers and vets are not uninformed viewers of cows, in the APHA case they were already aware of the cows having bTB which may have put badgers in mind. Farmers and vets can draw on their expert knowledge (in Kahneman's terms, analytical thinking or System 2, rather than just relying on System 1 or intuitive thinking – see an [explanation here](#)).

But this does not make farmers and vets (or any other 'expert') immune to unconsciously flipping to System 1 if analysis is difficult, or to 'join the dots', and 'jumping to conclusions' (what's known in communications as 'substitution', of intuition for analysis). As this is an unconscious process it's hard to even identify in one's self. Plus as Wright and Mayer suggested, in the Derbyshire case, APHA vets lacked the necessary information to conduct a proper evidence-based analysis, so they had to fall back on 'judgement', aka impressions.

These cows are unhealthy -
why might that be ?



↓
the grass?



↓
pollution?



↓
badgers?

Importance of cues in initial
framing (context)

WYSIATI - used
to draw
conclusions,
triggers frame

Prevalence of TB In Badgers

There is no systematic sampling programme in England to show how much TB there is in the wild badger population, although this information is critical to interpreting many of the surveys and studies of bovine TB in cattle and badgers. In the controversial Derbyshire 'edge Area' case for example, government vets assumed it was 'endemic' but the DWT cited unpublished evidence from badgers killed by traffic that it was only present in 4% of badgers. (The significance of prevalence is another question – infected badgers may only be infectious, that is actively able to infect other animals, if the disease progresses to a severe stage).

In November 2020 government figures for the BFDS – the 'Badgers Found Dead Survey - commissioned by DEFRA in 2016, were [finally published](#). The website Brockbase [reported](#) that this:

*'investigated the prevalence of bTB in 'found dead' badgers in Edge Areas** of England, covering the northern counties of Cheshire, Derbyshire, Warwickshire, Nottinghamshire, Leicestershire and Northamptonshire; and in the southern counties of Oxfordshire, Hampshire, East Sussex, Buckinghamshire and Berkshire'.*

372 dead badgers were examined. In the southern counties only three positive cases were identified, all from Oxfordshire, giving an overall prevalence of 1%.

In the northern counties approximately prevalence ranged from 13.5% in Cheshire to Derbyshire, the lowest, at 4%. The University of Nottingham Final Report stated that 92%

TB infected badgers were ‘latently’ infected, that is not showing symptoms and non-infectious.

Jo Bates-Keegan, Chair of the Badger Trust, said: ‘The BFDS data supports our view that badgers are not in fact a reservoir host for bovine TB, but instead simply a spillover host. The government’s justification for culling in Edge areas such as Derbyshire is based on highly inaccurate estimates of the number of new herd breakdowns (where a herd loses its officially TB free status due to bovine TB being suspected or confirmed) to have been caused by badgers’ and ... ‘The APHA Risk Pathway Assessments (intended to determine the route by which infection may have entered the herd) are entirely subjective and unscientific as an approach and cannot be relied upon’.

The ‘real issues’ she said, were “an ineffective cattle test that leaves infected cattle in the herd, and a complete lack of emphasis by DEFRA and the APHA on any number of other potential factors – from a lack of biosecurity measures to infected slurry or watercourses”.

Silos and Science Focus

Numerous political and social scientists who have looked at the badger-TB-cattle issue have pointed to the political influence in how ‘science’ has been used, or as Krebs said, how ‘evidence-based policy’ was transmuted into ‘policy-based evidence’. Funding for research, much of which is controlled by politicians, as well as direct briefing (eg setting the Terms of Reference of ‘reviews’) and selective use of findings have played a big part. That’s not a new problem. In 1910 the poet Andrew Lang famously [said](#), “Politicians use statistics in the same way that a drunk uses lamp-posts—for support rather than illumination”.

But my impression is that there are two other problems with the ‘scientific evidence’ related to the bovine TB issue in England. The first is a lack of effective focus on cattle-related TB control measures, the second is ignoring the possible effects of widespread agricultural intensification.

Cattle Disease Control Measures

This issue is mentioned in a lot of formal reviews, scientific reviews and inquiries, and by many practitioners, including some farmers themselves. These measures include better use of controls over cattle movements, better biosecurity, and limiting herd size on farms, and the weak testing regime which is solely in the control of the Government. You could also add the very slow pace of development of a cattle vaccine – something called for by Krebs in 1997 and still not available in 2020.

In 2007, after nearly a decade examining the issue with the ISP, John Bourne concluded that ‘badger culling cannot meaningfully contribute to the future control of cattle TB in Britain’.

He then emphasised the importance of tackling cattle-cattle transmission:

The research programme on cattle pathogenesis [cattle getting ill with TB] ... has been particularly rewarding and informative in providing the basis for more effective future

control policies ... undiagnosed, TB-infected, cattle frequently remain following tuberculin testing, particularly in some heavily infected herds. This has serious implications for the maintenance and persistence of disease in infected herds, and for the spread of the disease to neighbouring herds and to other parts of the country. Improving ability to diagnose M. bovis infection in cattle is crucial if future control policies are to succeed. In this respect, the value of the interferon (IFN) test to complement the tuberculin skin test in some situations has been clearly established...

Priority should be given to the adoption of wider strategic use of the IFN test, and enhanced control of cattle movement. We advise that the highest priority should be given to avoiding further geographical spread ... Efforts in these high risk areas should focus in particular on the prompt and effective detection of positive animals and on rigorous movement testing with the objective of achieving a major reduction in incidence.

... while badgers contribute significantly to the disease in cattle, cattle-to-cattle transmission is also very important in high incidence areas and is the main cause of disease spread to new areas. The key aspects of reducing cattle-to-cattle transmission are improved surveillance through more reliable, and possibly more frequent, testing and control measures limiting spread through the movement of cattle between herds.

... implementation of cattle control measures outlined in this report are, in the absence of badger culling, likely to reverse the increasing trend in cattle disease incidence ... [and] It is also possible that more effective cattle controls will lead to a decline of the disease in badgers ...

Over ten years later in 2018, the Godfray Review reported (technically it was a review of the government's long-term strategy for bTB, published in 2014). By this time the problem had got worse, badger culling had continued and there was still no cattle vaccine. However Godfray effectively sustained the policy, stating that badger culling could have a 'modest' effect, while also stressing the need for cattle controls:

'A very unfortunate consequence of the controversy around badger culling and the politicisation of the debate has been a deflection of focus from what can be done by the individual farmer and by the livestock industry to help control the disease. In particular, the poor take up of on-farm biosecurity measures and the extent of trading in often high-risk cattle is, we believe, severely hampering disease control measures.

... Implementing better control measures on the livestock side will mean short- to medium-term costs to the industry to achieve the greater goal of bovine TB elimination ... it is wrong, we believe, to over-emphasise the role of wildlife and so avoid the need for the industry to take measures that have in the short-term negative financial consequences.

Policy makers need to balance the disadvantages of low specificity (more cattle sent to slaughter and herds placed under provisional restrictions) and low sensitivity (infections going unrecognised). We see a strong argument for moving to a more sensitive test (probably the SICT) for surveillance in the High Risk Area (HRA) and Edge Area (EA) to enable the detection of infections in these regions as early as possible. In the Low Risk Area (LRA)

the numbers of new infections detected would not justify the increased number of false positives.

...

The test we use in the United Kingdom (UK) and the Rol (the Single Intradermal Comparative Cervical Test, SICCT) has high specificity but lower sensitivity than that used in continental Europe (the Single Intradermal Cervical Test, SICT)'.

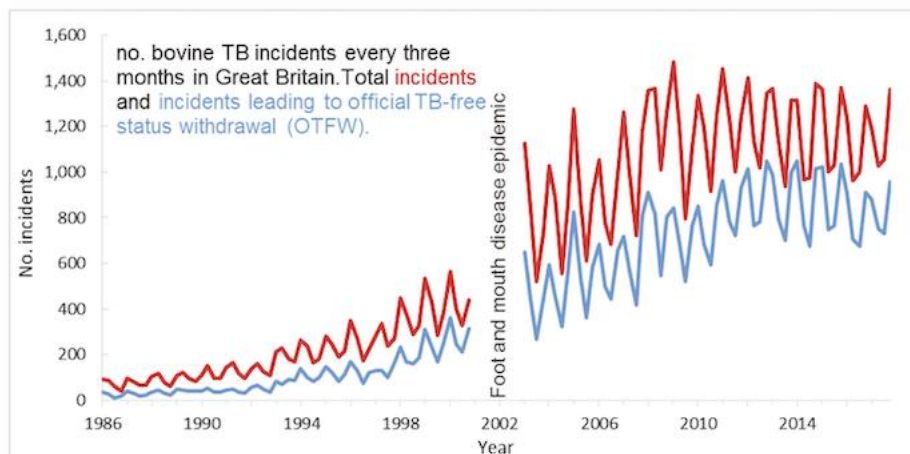
The BBC [reported](#): 'Prof Lord John Krebs from Oxford University, who led the Randomised Badger Control Trials, said that the [Godfray] report indicated that Defra and farmers need to do more if cattle TB is to be stamped out'. Krebs was quoted as saying:

"Currently, much of the spread of TB in cattle arises from a combination of disappointingly low uptake of measures to prevent cattle coming into contact with badgers, trading of infected cattle, and the low sensitivity of the standard skin test for TB, which means that there is likely to be a hidden reservoir of infection in many cattle herds in high risk areas".

"Unless the government and the farming industry tackle these problems now, TB will not be eradicated or controlled."

Figure 1.2: Changes in incidence and distribution of bovine TB in Great Britain 1986–2012. (a) Changes in incidence, which varies seasonally. Bovine TB testing was interrupted during the foot and mouth epidemic. (b) Increase in the geographical area affected by bovine TB, 'hot' colours indicating higher densities of farms where disease has been confirmed (official TB-free status withdrawal). Herd density is measured as the number of herds per square kilometre.

(a)



Source: Godfray report

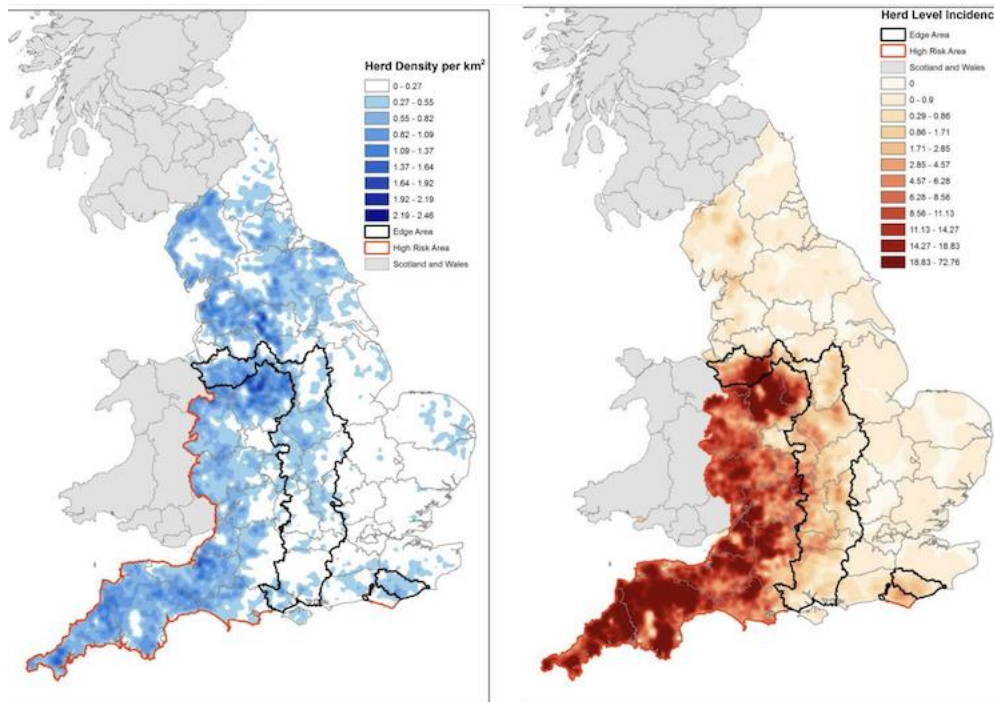


Figure 4.1.6 Herd density (a) and herd level incidence (b) of TB in England in 2017
 Herd density is measured as the number of herds per square kilometre; herd incidence is the average incidence in the 100 closest herds to each herd location which ‘smooths’ the effect of political boundaries
TB in cattle incidence (new cases) in 2017 Source Godfray Report

The government [responded](#) to the Godfray Review another two years later, [in 2020](#).

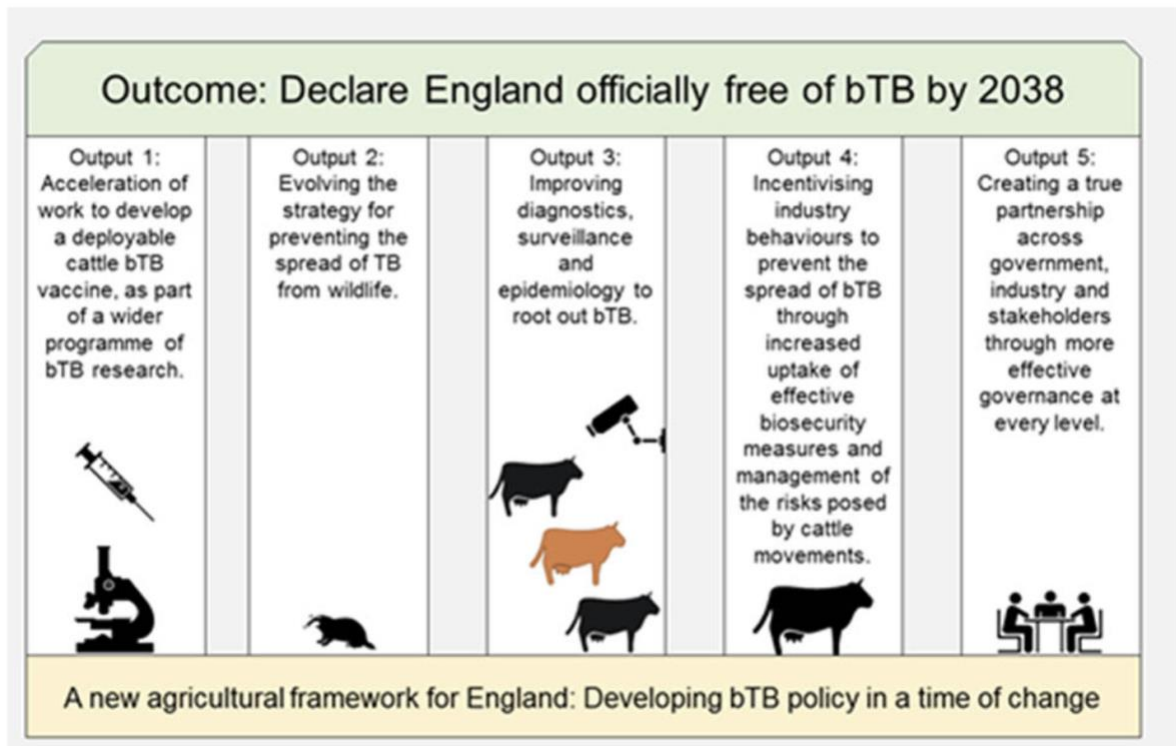
Environment Secretary George Eustice framed it as about the impact of badgers on farmers, not the need to clamp down on cattle-cattle transmission:

Bovine TB is a slow-moving and insidious disease leading to the slaughter of over 30,000 cattle every year and considerable trauma for farmers as they suffer the loss of highly prized animals and valued herds.

“The badger cull has led to a significant reduction in the disease as demonstrated by recent academic research and past studies. But no one wants to continue the cull of this protected species indefinitely so, once the weight of disease in wildlife has been addressed, we will accelerate other elements of our strategy including improved diagnostics and cattle vaccination to sustain the downward trajectory of the disease”.

The Chief Vet was then quoted talking about cattle vaccine development. The [details](#) of the strategy which formed the ‘response’ (5 March 2020) put a deployable cattle vaccine first and then, ‘Evolving the badger control policy with increased support for badger vaccination’.

Unfortunately this significant change of tack was contradicted when a major and expanded badger cull was introduced in September 2020.



The current UK government (England) TB strategy - [graphic](#) from Defra March 2020

Cattle movements and biosecurity languished at output 4, whereas badgers were at output 2, and as Defra's media operation announced:

'Today there is widespread media coverage on Defra's publication of the next stages of its strategy to tackle the damaging animal disease bovine TB.

This was covered widely included by [the Guardian](#), the [Telegraph](#), [Sky News](#), [Times](#), [Daily Mirror](#), the [i](#), [Daily Mail](#) and [BBC News](#). The announcement was also discussed on BBC Radio 4's Today and Farming Today programme's this morning.

This came as [the government responded to an independent review](#) of its 25 year bTB strategy for England, led by Professor Sir Charles Godfray.

Much of the coverage focussed on badger culling ...'

Which is not surprising, and simply reinforced the problem that Godfray and others had repeatedly highlighted, of government fixation on badgers.

What nobody appears to have ever satisfactorily explained is why TB in cattle was so dramatically reduced from the 1930s to the 1960s and 1970s using only cattle control measures, before growing to such high levels in England after that. It's not as if we had a vaccine for cattle and then stopped using it.

We know from many scientific studies that cattle movements, most notably during and after FMD Foot and Mouth Disease in 2001, escalated the problem. We know that herd size

magnified the systemic weakness in the test-and-slaughter system caused by the low sensitivity of the SICCT test but those factors only explain some of how it happened, not why TB in cattle resurged from the 1970s onwards. If it was due to relaxation of cattle-cattle transmission controls then it would make sense to tighten and improve those, rather than trying to disentangle the scientific gordian knot of cattle – badger TB dynamics.

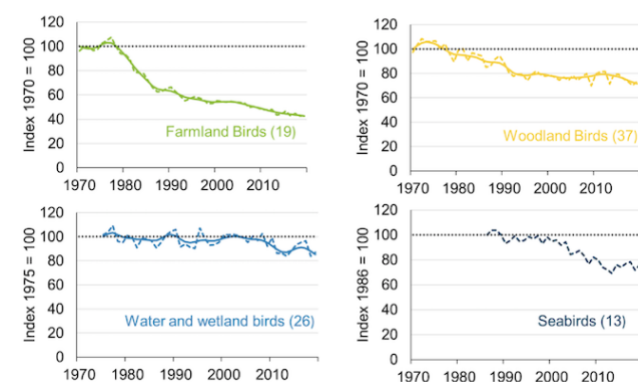
Like Covid-19, TB is an infectious respiratory disease and for bTB, cattle are the primary host. Close contact, mixing and movement all increase the spread of the disease. There were 4,643,159 cattle movements in England in 2019. There were also 104,521 cattle movements on to the Low Risk Area from Wales and higher risk areas of England in 2019. A small proportion of these will have TB that is not detected by pre-movement tests. The average size of the dairy herd in the UK has almost doubled between 1998 and 2018 from 77 to 144. Zero grazing systems for dairy cattle where cows are housed and grass cut and brought to them inside are also increasing as part of intensification.

Agricultural Change

There is evidence that badger numbers increased in the 1980 and 1990s and some suggestion that the cattle blood-lines recently favoured in dairy farming may be more susceptible to TB than those common before the 1970s but in general, cattle and badgers have not changed much over this period. What has changed enormously is farming.

Intensification took off rapidly once Britain joined to European Community in 1973, with its system of price support for farming (see for more detail, the following section Farm Intensification). First it destroyed many wildlife habitats (ancient grasslands, old banks, meadows, fens, marshes, downland, hedgerows, old trees etc) and then progressively sterilised the countryside, with impacts of farm nitrogen and agrochemicals such as pesticides permeating rivers, streams, groundwater, air, living plants (eg neonicotinoids circulating through soil and water into hedgerow plants and thus into nectar in blossom). The result of this has been a catastrophic decline in nature from birds to bees and wildflowers, taking place at exactly the same time as cattle TB grew to its present heights.

Figure 1a: Populations of wild birds in the UK by habitat, 1970 to 2019



Declining wild birds in the UK 1970 – 2019 source: [Defra 2020](#)

If cattle-cattle measures have been consistently acknowledged but not received the priority they deserve, the effects of agricultural intensification on the cattle TB problem seem to have been almost entirely ignored.

This strange fact is probably down to the agro-centric thinking of government vets and policy-makers [pursuing policies that the farming lobby likes], and siloed thinking within British research, whereby even today, animal (and indeed human) diseases are often evaluated with almost no connection to factors like pollution or poverty affecting living conditions and behaviours.

A partial exception to this is the 'animal welfare' issue of stress-related disease, particularly high-yielding dairy cattle kept indoors with no exercise but most studies are narrowly framed in terms of suppressing disease rather than redesigning systems to make them less stressful if lower-yielding. The economic policy assumption behind this, which is somewhat shaky, is that successful farming must produce low-cost high-volume dairy and meat products.

So a huge amount of political attention and research effort has gone into studying cattle/badger interactions but very little has been devoted to the overall effect of the nexus of intensification-factors such as growing maize, converting from hay to silage, mechanised slurry spreading onto pastures and arable fields, and concentration of dairy cattle in larger and larger herds. This is explored further in the following section (Farm Intensification).