The discovery of tuberculous badgers in the early 1970s required Ministry for Agriculture, Fisheries and Food’s (MAFF) animal health researchers, veterinarians and policymakers to rapidly form new working partnerships in and outside of government. As recounted in Chap. 2, the first of these were colleagues within MAFF—the scientists and field officers of the Infestation Control Division (ICD). ICD was responsible for researching and controlling pest animals and other organisms which destroyed crops and stored food, threatening agricultural productivity and what we now describe as ‘food security’.¹ For these reasons, even though ICD officers were co-located with veterinarians in MAFF’s regional offices, they were usually involved with arable rather than livestock farming. Like the State Veterinary Service (SVS), ICD comprised a partnership of scientists in centralised research facilities—the Pest Infestation Control Laboratory (PICL)—and field-based Pests Officers located across the country. ICD was responsible for coordinating government ‘pest control’—killing or preventing animals like rodents, birds and insects from eating, contaminating or damaging crops and food supplies. Unlike MAFF’s veterinarians, ICD already knew badgers: as designated government experts on awkward animals, it was their job to decide which were officially ‘pests’ and what to do about them. From the late 1950s, ICD had received a steady stream of complaint letters about ‘badger trouble’. When ICD investigated these complaints, they often found them to be overstated, and learned that badgers were very difficult to remove, leading them to conclude that the animals
should be left alone whenever possible. Therefore, when MAFF Veterinary Officer Roger Muirhead started finding tuberculous badgers in Gloucestershire, he immediately turned to his local counterparts in ICD for help. This initiated a contested but enduring partnership between the SVS and ICD. When MAFF launched their expanded bTB research programme in 1975, it was under the aegis of ICD that a new field station devoted to studying badger ecology and behaviour was established. The new group deployed state-of-the-art field biology techniques and collaborated extensively with colleagues outside of MAFF to find, follow and make sense of the traces left behind by badgers. Despite the ongoing upheavals of government reorganisation and privatisation, the field ecology group thrived, and still exists as part of the National Centre for Wildlife Management, within Defra’s Animal and Plant Health Agency (APHA). The badger communities living in and around this site have now been involved with biological research (including intermittent TV appearances) for over forty years.

This chapter will tell the story of how badgers and ‘pest control science’ came to play surprisingly significant roles in the professionalisation of biology and natural history in Britain during the late twentieth century. It will explore how the work of ICD and PICL was bound up with key developments in field biology, disease ecology and animal welfare science at this time. As PICL scientists investigated whether and how to ‘control’ pest animals while minimising suffering, they developed cross-disciplinary collaborative networks, building new theoretical and empirical knowledge via applied problems such as crop damage and wildlife disease. As they engaged with badger/bTB, ICD scientists and officers drew upon prior knowledge as well as that of new partners in animal health, academia and conservation: in the process they formed a new epistemic community oriented around disease ecology. Ideas about the ‘cultures of care’ that form as people work together will be used to help us understand the knowledge and working practices of these scientists, just as has already been done with animal health in Chap. 3.3

These ideas—of good care for humans and animals; of good science, which builds reliable knowledge via ethical research practices; and of good choices made under economic constraints—have been weighed against one another differently by the various actors involved in badger/bTB. Research on scientific care has investigated the emotional labour of caring for and with colleagues, as well as the continually negotiated necessities of care for human and animal research participants. Scientists working with animals
have often found it necessary to standardise and distance themselves from their research ‘subjects’, while also caring for and connecting with those self-same animals.\(^5\) During the 1950s the newly emerging field of animal welfare science sought to understand this paradox and develop guidance for good ethical practice for other laboratory researchers. Along the way, they developed the idea that good care for animals constituted a core aspect of ‘good science’.\(^6\) While such research has often involved productive and harmonious collaborations between scientists and veterinarians, the overall cultures of care developed by each group do differ. While both prioritise minimising animal suffering over preserving life, for scientists the pursuit of knowledge is an end in itself, at times justifying the ‘sacrifice’ and suffering of animals in ways which would not be countenanced in other contexts.\(^7\) In research involving clinical (human) medicine, veterinary practice and biomedical science, these contrasts are revealed as animal subjects find themselves occupying multiple, often contradictory roles, particularly as logics of care, suffering, death and knowledge are weighed up during working practice on a day-to-day basis.\(^8\)

While the literature on scientific care has tended to focus on the work of laboratory scientists, field biologists have also faced similar dilemmas as they conduct their research about animals, plants and wider environments. The tensions between knowledge, care, life and costs play out differently as these biologists dealt with the additional ethical and logistical complexities of working with wild animals, in the far less controllable spaces of field science. This chapter will explore how the scientists of PICL helped develop new working practices and ethical ‘best practice’ for researching and controlling wild animals in farms, forests and beyond. By the time that government vets were making connections between badgers and bTB, ICD already had well-formed ideas about badgers; about the possibilities for controlling infectious diseases in wildlife; and about ethical practice in field biology, which immediately informed MAFF’s decision-making. While the research collaboration between ICD and the SVS proved to be highly productive, over the course of the 1970s and 1980s the scientific and ethical worldviews of the two groups diverged. As the controversy entered its second decade, MAFF’s ecologists helped to forge a new consensus amongst field biologists, conservationists, animal advocates and politicians across party lines. While those involved with badger/bTB knew a great deal more about the problem than they had in 1971, bTB rates in cattle were steadily climbing. This coalition of disease ecology scientists, badger protection advocates and sympathetic politicians argued that the
problem needed to be investigated through a ‘proper experiment’ directly testing the effects of badger culling on bTB in cattle.

4.1 ECOLOGICAL SCIENCE AND THE STATE

To understand ICD’s approach to badger/bTB, we need to put them into the broader contexts of relations between the British state and the sciences of agriculture, animals and environments in the second half of the twentieth century. As we have already seen, veterinarians benefited from state concerns over the productivity of livestock farming, initially during the late nineteenth century, then in the interwar period when they took on scientific roles. Following the Second World War, these and broader agricultural productivity agendas were boosted by the creation of international organisations for improving human health, animal health and food supplies. Doctors, veterinarians and scientists from many disciplines benefited from knock-on effects at the national level, directly from increased research funding and indirectly via the creation of new policies designed to further these goals. Examples included the creation of new strains of plants and animals; the development of new technologies for planting, harvesting and processing crops; and the creation of new chemical fertilisers and pesticides.9 Across the British countryside, food production, the work of farmers and the lives of plants, animals and people were utterly transformed as the agricultural system intensified and modernised. The UK state also became more involved in the protection and conservation of wildlife, landscapes and forests at this time, creating new policy and organisational and legal structures in the process.10 The emergence of what environmental historian Matthew Kelly and colleagues have characterised as the post-war ‘nature state’ brought to the fore the idea that natural environments and wildlife were limited resources to be protected. It also generated new tensions between the state’s interventionist role in conservation and its equally interventionist role in boosting agricultural production and the wider economy.11 In Chap. 5 we will explore the intertwined worlds of governmental, non-governmental and public actors committed to protecting animals and the natural environment (including badgers). This chapter will focus instead on those scientists charged by government with investigating wildlife not to protect them, but instead to prevent them interfering with human activities and interests—the animals we call ‘pests’.

Over the past two centuries, the life sciences have transformed themselves—from descriptive, ‘natural history’ practices of observing, collecting
and classifying organisms (conducted by a wide range of people)—into today’s theoretically driven and specialised biological sciences (mostly conducted by paid professionals). As the sciences professionalised through the twentieth century, new laboratory-based biosciences such as genetics and molecular biology built up their reputations by contrasting themselves as modern and scientific against ‘old-fashioned’ natural history. Similarly, evolutionary biologists built their professional legitimacy by generating new theoretical insights—and contrasting this with the descriptive practices of natural history. Field sciences such as animal behaviour, ecology and agricultural science have found it even more difficult to establish their legitimacy. Building reliable knowledge outside of the easily controlled conditions of the laboratory poses particular challenges, particularly for experimental design, and so field scientists have developed new methodological and statistical tools designed to help them establish cause and effect in the wider world. While field scientists have adopted a plethora of new technologies, their work is still fundamentally bound up with older techniques of collection, observation and deep engagement with wildlife and landscape. They can struggle to be regarded as fully ‘scientific’, with knock-on effects to their ability to gain funding. As such, relationships between ‘professional’ and ‘lay’ scientists have been more porous than in other areas of biology, with sites such as natural history museums creating essential spaces for interaction. This porosity continues into the present day, where field biology is a richly productive site for citizen science and other forms of participatory research.

These tensions have been particularly manifest in the history of ecology: ‘the study of organisms in relation to their [changing] environment’. Ecologists are interested in conserving stable ecological systems, but also in the dynamics of change in these systems, including the roles played by humans. As such, the influence of ecological thinking upon contemporary environmental politics and policy has been profound. The history of ecology tells a broader story of under-resourced yet canny scientists conducting applied research which helped them further their own theoretical and disciplinary agendas. Ecologists have also gained state support for their research by appealing to more immediate anthropocentric interests such as political advantage, economic gain and state national interests. In the USA, this became apparent during the Cold War, when ecological research was supported by the need to better understand the impacts of nuclear fallout on humans, animals and environments, including a drive to improve surveillance technologies (satellites
and radio tracking). In Canada, ecologists carved out roles in fisheries research, helping with the recovery of collapsed populations following overfishing. Ecologists interested in relationships between pathogens and their hosts found congenial homes working in public health, tropical medicine and parasitology—an important space for collaborating with doctors and veterinarians. Ecologists have been able to provide governments with this kind of ‘useful knowledge’ in part because of their ability to build reliable knowledge in the wider world: in turn governments have provided resources and professional legitimacy. Through the twentieth century ecologists have been involved with the constitution of the ‘nature state’, but also, when it suited them, the ‘warfare state’, while in the UK the ‘agricultural state’ has also been central to the development of the discipline. We will now explore how, as part of this agenda, British ecologists have benefited from state interactions with awkward animals (pests) in general and badgers in particular.

4.2 MAFF’s Ecologists: Pest (Infestation) Control Laboratories

The mutual constitution of British ecology and policy has its roots in the 1920s, when plant ecologist Arthur Tansley convinced government that field biologists could contribute to national productivity via improving scientific understandings of forestry and agriculture. While these connections with plant ecologists have been extensively investigated, the mammal ecologist Charles Elton was also a key player. Elton combined ideas from zoology, evolutionary biology, epidemiology, plant ecology and mathematics to create new insights into mammal populations, establishing the Bureau of Animal Population at Oxford University in 1932. Elton’s group was the source of many foundational concepts in modern ecological science, including the term ‘ecosystem’; the niche concept (the role that an organism occupies within an ecosystem) and the idea of ‘invasive species’. From the start, Elton gained funding for his research group by applying their ideas to practical problems such as game management, forestry and pest control, while elaborating and building empirical support for their theoretical ideas. During the Second World War the Bureau supported the war effort by focusing on questions of controlling mammal pests—principally rats, mice and rabbits—and preventing damage to food supplies, successfully lobbying government for funding. In 1939 the government established two in-house research laboratories devoted to the
problems of pest control. The Pest Infestation Laboratory (PIL) in Slough, founded by a group of entomologists, agricultural scientists and plant ecologists at Imperial College London specialised in invertebrate and fungal infestations of crops and food supplies: following the war PIL was run by the Agricultural Research Council (ARC). The Infestation Control Laboratory (ICL) specialised in pest control of rodents and other vertebrates: following the war ICL was taken into MAFF and was initially co-located with the SVS on the outskirts of London. As with animal health, government interest in pest control extended across research and policy: to this end they also established a Directorate of Infestation Control in 1943, employing a regional network of field officers.

MAFF soon consolidated pest control research and policy into a single Infestation Control Division (ICD). New legislation supported this agenda, with Parliament passing the Agriculture Act (1947) and the Prevention of Damage by Pests Act (1949), creating a legal framework making it not just allowable but compulsory for landowners to take action against certain species. Following the war Charles Elton’s research group returned its attention to fundamental ecological research, passing on their responsibilities for pest control research to MAFF’s ICL. As part of this transition, Harry V. Thompson, one of Elton’s postdocs, was recruited by MAFF. While he was initially engaged as one of many scientific officers at ICL, Thompson soon established his own research group continuing the Bureau’s wartime work. By 1959, the group had grown and diverged into specialist ‘Rodent Research’ and ‘Land Pests and Birds’ departments: the latter was relocated to a new field station further out of London. Like the SVS, ICD was deeply affected by successive waves of government institutional change and restructuring, initially associated with the 1971 Rothschild report (as described in Chap. 3). Given that concerns had already been raised about the responsiveness of government research to the needs of policy and business, as well as over duplication of activities, ICL and PIL were an obvious target for consolidation. It was decided to transfer most of PIL’s ‘applied’ research on invertebrate pests from ARC into MAFF, merging it with ICL to create a new Pest Infestation Control Laboratory (PICL). During the 1970s PICL was moved into a new umbrella organisation—the Agricultural Development and Advisory Service (ADAS), which would oversee the SVS and bring the rest of MAFF’s non-veterinary researchers into a single Agricultural Science Service. The importance of PICL at the time is indicated by the public information booklet in Fig. 4.1, which summarised its status and
role as a government research institute, alongside peers such as the Central Veterinary Laboratory (CVL) and the National Institute of Agricultural Botany (NIAB).36

By the early 1970s, PICL comprised five research departments (Biology; Chemistry; Insecticides and Storage; Land Pests and Birds; and Rodents). It produced biennial reports for MAFF detailing all their research, policy and collaborative activities, including a list of journal publications.38 Like the SVS, ICD’s work was built upon strong partnerships between laboratory scientists and field officers, described as follows: ‘they play an important part in identifying problems and in the application of research results, as well as by taking part in some of the Laboratory’s research projects’.39 Unlike the SVS, which persisted as a distinctly veterinary body until well into the 2000s, ICD underwent further rounds of reorganisation, during which it lost its institutional identity. The various departments of PICL were further merged into the Agricultural Science Service, and the reports became shorter, focusing on concrete, applicable research findings, without referencing journal publications.40 While the research

Fig. 4.1 PICL public information leaflet. Source: Pest Infestation Control Laboratories (1975)37
continued, ICD disappeared from MAFF records and field-based pest control services appear to have been privatised during the early 1980s. In 1987, the various laboratories and institutes of the Agricultural Science Service (now sans the veterinarians) were rebranded as the Central Science Laboratory (CSL). These processes of institutional reorganisation and privatisation have continued: in 2009, CSL was merged with plant health and food research to form the Food and Environment Research Agency (FERA). In 2014, some parts of FERA were privatised, while the rest was merged back into veterinary services and animal health policy to create the APHA.

Thompson’s ‘Land Pests’ group (formally established in 1959) was responsible for dealing with all non-rodent awkward mammal and bird species. This agenda was deeply entangled with another of Elton’s core interests: the problem of invasive species. Policy decisions about what should be done to control which animals were largely contingent upon economic circumstance, often in combination with the strength of public feeling. However, policy was also formed using PICL’s expert advice: in the case of animals like rats and mice this was on how best to control them, but for other species this was on whether to take any action at all. Researchers assessed the damage the animals in question were causing, to human assets (e.g. crops), but also to ecosystems and landscapes. In the 1930s, when Elton made the case to government for applied ecological research, he had also convinced them that animals introduced from other countries were highly likely to be pests, leading to new legislation and early state attempts at eradicating muskrats. Elton’s case was based upon the argument that rats, mice and muskrats posed particularly severe threats to the national food supply because they were from other countries and were out of balance with the ‘native’ ecology of Britain. While Elton later popularised invasion biology to great effect, MAFF’s scientists and field officers quietly got on with applying it in agricultural policy. Between the 1930s and the 1990s, MAFF’s ecologists directed many eradication campaigns, although only two—the muskrats and a later, long-term campaign to remove coypu (large aquatic rodents)—were successful. The scientists also researched the ecology and behaviour of a wider menagerie of introduced species, including rabbits, hamsters, porcupines and deer. ICD’s expertise in lab and field placed them as key arbiters in whether the UK state officially classified an animal as a ‘pest’—a decision with serious consequences for the animals in question.
In 1953, an international epidemic of myxomatosis (a highly infectious, painful and lethal viral disease of rabbits) reached the UK. The history of myxomatosis in Britain demonstrates ICD’s multiple roles as policy adviser, participant in international research networks and arbiter of wildlife–human relations in British society. It would also profoundly shape many of the decisions MAFF would take when responding to tuberculous badgers twenty years later. Contrary to popular belief, Ministry officials did not introduce myxomatosis to Britain on purpose, even making an initial, unsuccessful attempt at containing the outbreak. Harry Thompson, ‘MAFF’s rabbit specialist’ was one of the first government officials on the scene when reports of rabbits dying in Kent appeared. While some saw myxomatosis as a convenient way of getting rid of a damaging pest, the unsightly and clearly painful symptoms also led to widespread concerns about the animals’ suffering and demands for disease control for ‘humanitarian’ reasons. In Australia the virus had been deliberately introduced—as a method of pest control, in a country where invasive rabbits were causing acute environmental and agricultural damage. This created an ideal opportunity for scientists there, including Francis Ratcliffe (another alumni of Elton’s Bureau) and the virologist Frank Fenner, to study the ecology of pathogens in the wider environment. The Australian scientists found that, despite their intention to wield the pathogen as a biological weapon, the myxoma virus and rabbits had other ideas, adapting to each other’s presence and creating less lethal versions of the disease. Myxomatosis in Australia was furthering scientific understandings of the co-evolution of viruses with their hosts, building careers in disease ecology, and contributing to broader cultural narratives of infectious disease and biological warfare in the Cold War era.

In Britain, the arrival of myxomatosis was also seen by scientists as ‘an extraordinary opportunity for fundamental ecological research’—academics with relevant interests rapidly obtained government funding, while MAFF further invested in ICD. Scientists investigated the ecology and behaviour of rabbits, transmission, effects upon agriculture and landscapes, and methods for ‘rabbit control’. Frank Fenner visited the UK and met with MAFF’s scientists, creating a long-standing international collaboration. Thompson and his colleagues rapidly concluded that it would not be possible to contain the spread of myxomatosis and argued that the consequent decimation of rabbits would be good for agriculture, meriting further research. Responding to public concerns over animal welfare, they presented a simple, standardised technique for killing infected
rabbits—‘gassing’ them underground via the application of a new product called ‘Cymag’ (sodium cyanide powder, which generates hydrogen cyanide gas on contact with moisture in the air). This made it possible for MAFF to fashion a policy acceptable to all sides of the debate. A ‘Myxomatosis Advisory Committee’ was appointed (comprising key experts and organisations), which consulted with all interests involved in the rabbit debate. The Committee concluded that myxomatosis could not be ‘ stamped out’ and should instead be left to run its course. They recommended a policy of ‘mopping up’: culling surviving rabbits, further reducing their numbers and thereby addressing the pest problem. Government acted swiftly, passing a second ‘Pests Act’ in 1954, creating legal requirements for landowners to cull rabbits and providing subsidies for gassing equipment to do so. While a resulting network of ‘rabbit clearance societies’ was established with enthusiasm, ultimately neither rabbits nor myxoma were eradicated.

Myxomatosis created further resources and legitimacy for ICL’s research at a time when post-war productivity agendas were losing their immediate urgency. It advanced Harry Thompson’s career, expanding his department within MAFF and making his scientific reputation—the group published a series of several high-profile journal articles about myxomatosis and two major monographs on the ecology and behaviour of rabbits. As Thompson’s career blossomed, he worked with British mammal biologists to form the Mammal Society of the British Isles, still an important meeting space for professional and ‘amateur’ field biologists. The founder members included Thompson, Harry Southern (also of Elton’s group at Oxford), ex-ICL colleague Peter Crowcroft, toxicologist Alistair Worden and badger naturalist Ernest Neal. This foundational group links PICL directly into British networks of mammal ecology and natural history. It also reveals a more unexpected connection—with the Universities Federation for Animal Welfare (UFAW), a science-based campaign group. As well as being an enthusiastic naturalist, Alistair Worden was a significant figure in laboratory animal research. He founded the Huntingdon Research Centre (now Huntington Life Sciences) in Cambridge and was editor of the first edition of UFAW’s highly influential Handbook, providing guidance for ethical research practice in animal research. While UFAW are best known for their work with laboratory scientists, they were also involved with farm animal welfare and pest control from early in their existence. Between them, myxomatosis and the founding of the Mammal Society made the connections between ecology,
ethology, natural history and the new science of animal welfare directly traceable, if not more widely understood.\textsuperscript{59}

The rapid presentation of Cymag as a policy solution for myxomatosis was made possible due to a longer collaborative history dating back to the 1920s, when debates over the social role of the rabbit in Britain (whether they should be regarded as an affordable source of food and fur or a serious agricultural pest) had come to the fore. Animal protection campaigners had argued that the ‘gin trap’ (a spring-loaded trap which catches an animal’s leg in steel jaws)—widely used on rabbits—was cruel and campaigned for the devices to be made illegal.\textsuperscript{60} Between the 1920s and the 1950s campaigners made several unsuccessful attempts to restrict the use of gin traps, and while they were abandoned by many during the war years, it was not until 1954 that the devices were finally outlawed.\textsuperscript{61} During the 1930s UFAW funded a collaboration between scientists in ICL, at Oxford University and in the chemical industry to research alternatives to the gin trap. Building on broader developments in research on using cyanide compounds in mining, pest control and chemical weapons, they developed and tested new technologies for poisoning mammals underground.\textsuperscript{62} This included Cymag, which killed rabbits quickly with minimal suffering. For animal welfare agendas this was the primary criteria for ‘humane’ methods of killing, meaning that UFAW and the RSPCA put the broader political context to one side and rapidly approved and recommended the new product to government.\textsuperscript{63} Responding to wider debates about wildlife welfare and the politics of hunting, the Home Office appointed a committee in 1949 (chaired by barrister John Scott Henderson) to enquire into ‘Cruelty to Wild Animals’. The group drew upon UFAW’s research evidence to condemn the use of gin traps and concluded that Cymag was the most ‘humanitarian’ technique for controlling underground pests.\textsuperscript{64} UFAW’s broader strategy for improving animal welfare across laboratory, farm and wildlife contexts involved working in and with social and policy structures enacting human–animal relations, rather than challenging them from the outside. When engaging debates over rabbits and myxomatosis, they effectively used agricultural productivity agendas to make a case for ‘humane’ rabbit control. Together UFAW and ICL facilitated collaborative research exchanges which created new knowledge, built scientific careers and brokered policy solutions which were widely acceptable while also furthering the agenda of outlawing the gin trap.
The connections between UFAW, ICL and Elton’s Bureau preceded even these collaborations. Before joining MAFF or Elton’s group, as an undergraduate student at University College London, Harry Thompson had been mentored by Charles Hume, the founder of UFAW. Animal welfare was a lifelong commitment for Thompson: following the rabbit research at Oxford, he joined UFAW’s scientific advisory group in 1947 and was a member of UFAW Council during the 1960s and again in the 1980s. After his retirement from MAFF, Thompson took up the position of President of UFAW from 1986 to 1996, continuing as President Emeritus until his death in 2004. In this role, Thompson wrote of the ‘moral obligation and human responsibility towards animals; not only those species which have been bred and reared to be of service to man, but also those which have been affected by man’s environmental modifications’. In his view, people should be morally committed to improving and taking responsibility for animal welfare precisely because of humanity’s power over non-human animals and the natural world—just as when farmers talk of ‘stewardship’ care. This is typical of the culture of care that developed out of—and in turn drove—ICD and UFAW’s approach to pest control research and policy from the post-war years onwards. This culture was fundamentally anthropocentric and deeply pragmatic, but as the other lives of many of these scientists (as natural history ‘enthusiasts’) suggests, was also aesthetically and morally committed to improving the lives of non-humans for their own sake.

4.3 Defining and Redefining the Badger

In the National Archives, there is a folder entitled Badgers—proposals for control (MAF 131/70), dated 1959–1967, but including data going back to 1948. This folder is one of several created by ICD to keep records of exchanges between PICL’s scientists, regional Pests Officers, colleagues in other ministries and members of the public—all about badgers. As we have seen, while the primary purpose of ICD was to further agricultural productivity by improving pest control, this made them arbiters of which animals should—and should not—be classified as ‘pests’. To this end, after the war MAFF published two lavishly illustrated public information booklets, Wild Birds and the Land and Wild Mammals and the Land, through which they tried to convey to public audiences which creatures the Ministry considered to be ‘harmful’ and which were ‘beneficial’ to agriculture. The latter volume declared the badger to be beneficial, highlighting its role in
‘destroying pests of various kinds’ and condemned the ‘unjust persecution that had been its lot for centuries’. This view would have been informed by the scientists of ICD, as can be seen in their badger files, consisting of internal and external debates over the behaviour of badgers and what (if anything) government should do about it. From the late 1950s, ICD recorded reports of ‘damage by badgers’, often following public complaints. These included accounts of badgers damaging grain and vegetable crops; predating poultry, piglets and even lambs; undermining riverbanks and breaking down fencing. Upon investigation, ICD officers often found that such cases were overstated, or implicated other animals such as foxes. Given this information, the fact that badgers were native to the UK, and that they were in the habit of hunting rabbits (a key invasive target), ICD scientists decided that that badgers should not be regarded as pests. They did acknowledge that in exceptional cases so-called ‘rogue’ badgers could cause problems: this was a commonly held view amongst field biologists. The ‘old rogue badger’ was described by R. J. King of the Forestry Commission as follows: ‘an old badger, usually an old boar, turned out of his sett by young pairing cubs, may become a rogue and may make many enemies among neighbouring poultry and sheep farmers’. Under these circumstances, ICL scientists explored what action should be taken, particularly once it emerged that some regional Pests Officers were using Cymag on badgers even though this was illegal. Options including the use of strong-smelling repellents and using excavators to remove entire setts were explored, but found to be either ineffective or laborious and expensive. The alternatives were not promising: ‘digging out and killing by violence—usually impracticable; snaring—legal but cruel; shooting on emergence from the set—required much patience and is complicated by dusk or darkness’. By the late 1960s, ICD had settled upon the last of these options, based upon the assumptions that the law could not be changed, and shooting would only need to be deployed under the exceptional circumstances of a ‘rogue’ animal. In general, ICD’s advice was to leave badgers alone, emphasising the positive attributes of the animals: they reminded members of the public that gassing was illegal.

Policy scholar Wyn Grant has argued that MAFF officers held this ‘benevolent view’ of badgers partly because of a lack of knowledge, but also because of British cultural constructions of the creatures as ‘a cherished species endowed with elements of magic and mystery’. While ICD scientists were well aware that relatively little was known about badgers—hence their frequent requests for detailed information from field officers—a close
examination of their correspondence reveals their motivations to be more complex and pragmatic than simple sentimentality. It was during the 1960s that badgers became, in the words of environmental historian Robert Lambert, ‘a mammal of interest’, not only to ICD, but also to animal protection campaigners, mass media and, judging by the increasing volume of reports and letters in the ICD files, to landowners, farmers and other members of the public. By the mid-1960s, the Home Office was consulting with ICD in response to burgeoning badger protection campaigns. As we will explore in the next chapter, this decade saw the reopening and further renegotiation of the long history of conflict in Britain between humans about badgers as well as between humans and badgers. As such, the adoption of the ‘old rogue badger’ by ICD officers (and a consequently limited control policy) can also be understood as an elegant way of steering a relatively neutral policy course between increasingly visible pro- and anti-badger interests. The idea of the ‘rogue’ animal had been applied to many other wild animals, so would have had broader currency with conservationists and wider publics.

By the time that tuberculous badgers were documented in the early 1970s, ICD already had considerable and much-needed expertise—in disease ecology, from dealing with myxomatosis—and from negotiating Britain’s long-standing but newly reignited badger debate. They appear to have initially experienced the rapidly unfolding bTB situation as an extension of routine pest control work with the animals—the news from Gloucestershire is filed amongst complaint letters about badger damage, which continued throughout the 1970s and beyond. Some members of the public clearly also interpreted the news in these terms, as seen in the following letter to ICD from a resident of Dursley, Gloucestershire—within a few miles of the first tuberculous badger.

I'm usually very fond of animals, but not badgers. So destructive, waste of time to plants, real loss. So if you can come & fish them out [unclear]—TB. I hope which is serious as you say for Cattle. We are in a farming district—cattle, sheep, pigs, etc. Thinking you can do something soon to ease our anxiety.

All this would have contributed to ICD’s initially sceptical reaction to the news from their veterinary colleagues, even though they were then persuaded. PICL’s overall approach to bTB was fundamentally shaped by their past experiences—of the badger debate, of myxomatosis and of creating caring practices for working with wildlife.
Woodchester Park. In 1975 MAFF launched their new approach to badger/bTB, comprising a state-led culling policy, a new Consultative Panel including all parties in policy processes, and a major research programme involving both the SVS and ICD. PICL’s report of 1974–1976 gives an excellent insight into the institution’s perspective on the events recounted in Chap. 2:

The badger, which has often been the subject of persecution, is a popular member of our wild fauna and it was unfortunate when, in 1971, it was shown to harbour bovine tuberculosis ... Although some naturalists have cast doubt on the findings and have possibly quite reasonably suggested that there may be other associations, the evidence is convincing and the Laboratory has co-operated with the Ministry’s Veterinary Services in undertaking control measures. This has required the inauguration of a new research programme, and importantly there has been a need for the establishment of good public relations. All the work done so far has been in the Ministry’s South Western region and the brunt of this activity has fallen on the Regional Pests Officer, RJ Clark and the Chief Regional Officer, K Harrison Jones, who have greatly helped beyond the Laboratory. It is impossible also to over-estimate the contribution to good public relations made by HV Thompson, the late Charles Armour and CA Swan, to none of whom had badger control been a particularly welcome occupation.81

Despite this ambivalence, PICL benefited from MAFF’s interest in badgers, as well as more widely from the increased resources directed into agricultural research following the Rothschild report.82 This had resulted in the recruitment or promotion of SVS staff: mostly researchers with some experience but who had not yet made their names, including specialists in wildlife pathology (Gallagher), veterinary epidemiology (Wilesmith) and field epidemiology (Sainsbury). There was a parallel expansion in ICD, including the recruitment of field officers to implement the culls, and researchers who could devote their whole attention to badgers. Thompson and his allies in the Nature Conservation Council (NCC) had lobbied for the recruitment of Hans Kruuk, a badger ecologist then working for NCC’s Institute of Terrestrial Ecology.83 While this effort was not successful, Kruuk’s field assistant Peter Mallinson was persuaded to join MAFF, to work with Chris Cheeseman, a PICL researcher who had just received his doctorate for studies of mammal plague in Uganda and a small group of assistants. Initially engaged on a three-year contract, the new PICL field team immediately started studying the badger ‘clearance
trials’ in Thornbury and elsewhere, while looking for a field study site in the South West.

Given PICL’s involvement with international research networks and Harry Thompson’s own links with UFAW and the Mammal Society, MAFF’s immediate enrolment of schoolteacher Ernest Neal—recounted in Chap. 2—makes much more sense. Neal was a co-founder of the Mammal Society and by 1971 was known as the UK national expert on badgers—an animal which, unlike birds, primates, big cats or rodents, had received relatively little attention from professional biologists. Following his contributions to MAFF’s investigations into bTB, Neal served on the Ministry’s Badger Consultative Panel for fifteen years, acting as a key ‘knowledge broker’ connecting policy, agricultural science, field biology, conservation and badger protection. While Neal and Thompson were by this time fully established experts of some renown, the young field biologists recruited by MAFF were coming into a discipline being transformed by technological and theoretical changes. The period between the 1950s and 1980s saw huge advances in the abilities of scientists to observe, theorise and understand wild animals in the field. These included developments in photography, film-making, tracking and computing technologies; the adoption of mathematical modelling; theoretical developments such as sociobiology and behavioural ecology; improved understandings of animals’ own motivations, and changes in field research practice. By the early 1970s, PICL’s research had already contributed to these developments, particularly in population biology, pest control science and disease ecology, but more was on the way. PICL’s new badger ecology research team was forming at an exciting time.

After a short search, the new group settled upon a field site near Woodchester Park—an abandoned Victorian mansion-folly in Gloucestershire—to conduct their new studies of badger ecology and behaviour. A field studies centre had been run at Woodchester by science teachers Miriam and Roger Kelly since the 1950s, making it a well-established site for doing field biology research. The Kellys’ local knowledge, resources and connections with field biology were instrumental to the quick and successful establishment of the new MAFF station:

He [Kelly] was the perfect person really to sort of liaise with. And when I said what we were doing, he was firstly very suspicious of me, of you know somebody from the government. When he saw I was bona fide and had no axe to grind and no sort of preconceived ideas, just wanted a place where I
could quietly get on with the job, he got really very enthusiastic and really helpful, very co-operative. And in fact, wanted us to go there. He said ‘A lot of universities come here, we do field courses, you could have students attached to your projects and you know collaborate with them.’ He was right, it was perfect in that respect.  

Drawing on this local knowledge, MAFF researchers immediately started following and observing the resident badgers and mapping their territories in what PICL reports described as ‘a typical Cotswold valley’, with the mansion in the centre, surrounded by steeply wooded hillsides. The core study area ran around the edge of the valley, covering about 11 km² and involved around twenty-five social groups—an unusually high density (see Figs. 4.2 and 4.3). The site is more or less unchanged, meaning

**Fig. 4.2** Woodchester Mansion, viewed from the side of the valley (photo—author’s own)
that the badgers of Woodchester have now been continually involved with scientific research for over forty years.⁹⁰

Initially the group were based in a caravan parked down by the mansion, before moving into a nearby site which eventually acquired its own permanent offices, laboratories and veterinary clinical facilities. To follow badgers more effectively, the scientists initially focused on the practicalities of working with a large, strong, nocturnal and notoriously elusive wild animal in the field. The PICL scientists worked with UFAW and their veterinary counterparts in the SVS to find the best anaesthetics for badgers and explored how to effectively restrain and catch the animals using hand nets and snares. They also adapted an earlier design—developed by UFAW member and badger campaigner Ruth Murray—to create a cage-trap for use in the field.⁹¹ The trap was tested by UFAW in 1974, and while it was considered to be impractical for policy, it was used by researchers to catch and release the animals without harming them.⁹² Much of this work was done in partnership with veterinarian John Gallagher and the SVS officers in Gloucestershire, who provided expertise and resources for conducting clinical diagnoses, sampling and post-mortems, as well as the laboratory skills and resources to culture and identify *M. bovis* from the badger traces taken from animals in the field.⁹³ Elsewhere in the South West,
PICL continued collaborating with SVS on the badger clearance trials, at one point excavating and mapping an entire badger sett. Even equipped with the newly legalised tool of gassing, it proved to be hard work to fully remove badgers: one sett in Thornbury had to be gassed and blocked nineteen times during a single year, while the extensive use of repellents such as creosote failed to prevent new animals from reopening others.94 Badgers’ resistance to human attempts to get rid of them, and their tendency to move around and recolonise emptied setts would have already been familiar to ICD officers.95 Given these difficulties, field tests were conducted on the dispersal of cyanide into badger setts. While the researchers found that Cymag was working and all the animals in these tests were killed, concentrations of cyanide in the furthest ‘blind tunnels’ were low. They therefore recommended the reapplication of ‘larger quantities’ of Cymag powder in difficult cases.96 The clearance trials and routine culls involved surveying ‘the locations of infected badgers and cattle and positions of sets and other badger traces’, adding to a growing body of data informing the work of PICL and SVS scientists alike.97

The PICL scientists at Woodchester concentrated on researching the ‘range size, movement, and population density of badgers in connection with their role in the transmission of tuberculosis to cattle’.98 They surveyed the area, adopting new field biology techniques to observe and understand the badger communities they encountered. They also drew upon, collaborated with and contributed to networks of British mammalogists, starting with the vital experience Mallinson had brought from his earlier fieldwork with Hans Kruuk. Kruuk was another member of Oxford field biology networks, having trained with Niko Tinbergen during the 1960s, making his name researching hyenas.99 Kruuk had already started studying badgers in Wytham Woods (also the site of Elton’s fieldwork), investigating how food density affected badger behaviour. A second Oxford biologist, David Macdonald, collaborated with the Woodchester researchers on adapting newly available ‘telemetry’ (remote data collection) equipment, making it possible to follow animal movements more precisely than ever before.100 Finally, MAFF scientists worked with Stephen Harris, a lecturer at the University of Bristol, on further field techniques.101 This collaboration continued into the 1980s, as Harris took over the Mammal Society’s National Badger Survey from Ernest Neal, eventually replacing him on MAFF’s Consultative Panel.102 The PICL researchers adapted Kruuk’s technique of ‘bait-marking’ (mixing coloured plastic pellets into food, which is then distributed across a group’s territory
as the animals eventually excrete it), which was deployed to map the badger social groups on the site. This was combined with telemetry: the PICL scientists designed and built their own radio tracking equipment suitable for use with recalcitrant badgers. These techniques were combined with tagging and close field observations to produce intricate maps of the Woodchester badgers’ territories, enabling comparisons to be made over time, space and species (see Fig. 4.3).

It was not long after establishing the Woodchester field station that the spreading problem of \( M. \text{bovis} \) became dramatically apparent via the traces it left on the bodies and behaviour of local badgers. In May 1977, a BBC Natural History Unit outside broadcast team visited the site to film \textit{Badger Watch}, a pioneering programme in which the animals were filmed at night and broadcast ‘live’ to the nation, with expert commentary from MAFF researchers and external naturalists including Ernest Neal. While the broadcast programme showed badgers pottering about their home range and peacefully feeding, behind the scenes a much darker drama was unfolding, as the following internal memo recounts:

On 6th May a badger died at one of the entrances to the beech-tree set upon which the television series was centred. Although this occurred 3 days before the first of the transmissions the BBC staff were in fact on the site for about 2 weeks before and knew of the finding of this carcase. The occurrence was filmed by the BBC.

A second animal died the following week, and soon after the film crew left the whole social group was ‘eliminated’ by ICD officers using cage-trapping. The Consultative Panel was immediately notified, and the developments were discussed at their next meeting. While MAFF did discuss the \textit{Badger Watch} deaths in their next annual ‘TB in Badgers’ report, the footage was never broadcast, apparently by the mutual consent of all parties.

Given the mass audience of \textit{Badger Watch} and its subsequent role as a minor milestone in wildlife film history, it is tempting to speculate what impact the film of sick and dead wild badgers might have had on wider public debates. The deaths brought a new immediacy to the Woodchester group’s research, particularly as more animals were found suffering from advanced TB that summer: over the following eight years the researchers estimated that approximately 10% of badger deaths in the area were due to \( M. \text{bovis} \) infection. The researchers followed and observed several other
infected badgers, finding their movements to be erratic, more wide-ranging and encroaching more on farmed space than healthy animals. It looked rather like the ‘old rogue badger’ of the 1950s might turn out to be tuberculous.\textsuperscript{108} These events provided a further opportunity to study a long-standing problem in badger control: the tendency of the animals to ‘recolonise’ emptied setts.\textsuperscript{109} Scientists in and outside of MAFF had recognised this phenomenon from early on, with wildlife and farming groups also expressing concerns that uninfected badgers moving into ‘contaminated’ setts cleared by culling could spread disease.\textsuperscript{110} When the arrival of \textit{M. bovis} became known locally, the PICL research was supported by their nearest farming neighbour, even when his own cattle became infected. Despite this, SVS staff argued that all the badgers in the area should be culled—effectively ending the field ecology research at Woodchester. Therefore MAFF conducted an internal review of PICL’s badger research programme.\textsuperscript{111} Harry Thompson defended the work, arguing that MAFF would lose the advantage of over four years’ work in identifying and understanding the resident badgers. To propose a move could also underestimate the very real problems of finding another site where the work would meet with an equivalent degree of understanding and security.\textsuperscript{112}

This latter point was particularly important, as by this time MAFF was facing widespread criticism for its culling policy and even the clearances at Woodchester had been beset by ‘interference’ from members of the public destroying traps and snares.\textsuperscript{113}  

\textit{Consolidating Field Ecology in MAFF.} As discussed in Chap. 3, instead of calming the growing criticisms of MAFF’s culling policy as anticipated, the Zuckerman report opened up a wider public controversy over badger/bTB in the early 1980s. The harshest scientific critiques of the report’s conclusions had come from the Mammal Society and academic biologists and ecologists, including Kruuk, Macdonald and Harris. Given Zuckerman’s long-standing negative opinions of field biology, his dismissal of their submitted evidence and the ensuing hostile public, dispute between Zuckerman and the ecologists makes more sense.\textsuperscript{114} Despite this, Zuckerman spoke highly of the Woodchester scientists and supported PICL’s badger research, recommending the expansion of the work in his report. He appears to have been unaware of (or unwilling to acknowledge) the deep interpenetration of professional field biology with ‘natural
history’; the theoretical and practical connections between field ecology, epidemiology and animal welfare that had been forged by myxomatosis; or the developing collaborations between PICL and academics like Harris. It seems that Zuckerman had not only missed a ‘sea-change’ in science–society relationships (as evidenced by his surprise at the public controversy), but also within his own discipline of zoology.\footnote{115}

Zuckerman’s support helped PICL win the internal MAFF debate over Woodchester, keeping the field stations open. Following this triumph Thompson laid out an ambitious new research agenda. This was fourfold: continuation of the long-term field research at Woodchester; joint SVS/PICL studies of the epidemiology of bTB in badgers; development of a test for the disease in living badgers; and finally, an experimental study. Thompson argued that ‘it is necessary to compare “undisturbed” areas (where TB infected badgers are not killed) with “disturbed” areas (where infected badgers are killed, i.e. the general statutory control areas)’. He also proposed two rounds of comparison: between Woodchester and the surrounding area; and between new ‘undisturbed’ and full clearance areas in Cornwall. In effect, Thompson was arguing that MAFF’s culling policies be suspended in places, to create experimental ‘controls’ against which these interventions could be compared.\footnote{116} While the first three research proposals were approved by MAFF, the idea of ‘undisturbed’ comparison areas was vehemently opposed by SVS officers (citing the concerns of farmers) and was quietly dropped.\footnote{117} The 1982 finding that badgers were unusually resistant to cyanide poisoning further reinforced the utility of PICL’s research for MAFF. While the Porton Down scientists had argued that MAFF’s policy of gassing badgers was ‘inhumane’, policymakers urgently sought the opinion of PICL’s scientists before deciding what to do. PICL scientists were summoned to Porton to confidentially view a recorded film of the cyanide experiments:

\[\ldots\] the gas was sort of introduced and they started to get really agitated. And then they really got upset, really distressed, you could see that they were distressed, they were retching and vomiting and actually kekkering with a call that I recognised as a distress call \ldots\] I just said \([to\ MAFF\ superiors]\): ‘All of those assurances that you have given … about the humaneness of gassing have just gone out the window.’\footnote{118}

It was following this consultation that the decision was made to suspend gassing, whereupon PICL’s earlier explorations of how to catch and kill
badgers came into their own, enabling a rapid mobilisation of the alternative technology of cage-trapping. A new procedure was developed involving setting traps (checking them regularly to prevent undue stress and suffering), then dispatching trapped badgers quickly with a shot to the head. This was codified by MAFF in a *Badger Control Manual* by 1983 and remains a standard procedure for Defra today. These developments once more underlined the importance of PICL’s field ecologists to MAFF and secured the future of the Woodchester research programme.

As we have already seen, the PICL/SVS collaborative research on badger/bTB epidemiology was highly productive, giving rise to a string of joint publications. While it took a lot of work to remove badgers from a ‘clearance trial’ area such as Thornburgh and keep them out, the effort appeared to be paying off. BTB incidence in cattle was dropping in these areas, particularly when compared to ad hoc ‘fire brigade’ culling, and SVS argued that these interventions were proving to be successful. Unlike Thompson’s fourth proposal, the removal trials started as policy interventions: as such, comparisons were made after the fact, meaning that other, uncontrolled factors may have affected the outcomes. In line with traditions of human public health research, where direct experiments (e.g. testing the effects of smoking) would not be considered, MAFF’s veterinarians argued that suspending bTB controls would be similarly unethical and unacceptable to farmers, whose cooperation was essential. Instead, they took the view that associations between their interventions and drops in bTB could be established statistically, as is long-standing practice in much epidemiological research. Despite these disciplinary differences, the findings were used by a group of theoretical ecologists—members of the ‘Silwood Circle’ of Imperial College London—working on new mathematical models of relationships between pathogens, hosts and methods of disease control. This body of work had already led modellers and field biologists to argue that in the case of rabies (which also transmits between humans, wild and domestic animals) vaccination was more effective than culling. Core to this argument was the idea that culling disrupts the social and territorial systems of wild animals, creating unstable populations that move around more and potentially spread disease. The modelling of bTB suggested similar dynamics might be at work, and that (as seen in the clearance trials), badger culling would have to be systematically and repeatedly applied for a long time to have much effect.
The badger field research continued through the 1980s and 1990s, further benefiting from the 1986 Dunnet review and becoming increasingly sophisticated as the group grew and developed new skills—particularly in clinical veterinary procedures such as anaesthesia and taking biological samples. Woodchester became the centre of a wide research network, involving veterinary epidemiology, ecology, mathematical modelling, field biology and newer biomedical technologies such as DNA analysis. In the late 1980s and early 1990s MAFF’s pest control researchers became part of a new government ‘executive agency’ of the CSL. Despite ongoing reorganisations and semi-privatisation of government research, the Woodchester group flourished, as their connections with university scientists enabled them to participate in co-supervision and research proposals, bringing them income from sources beyond MAFF. While the modelling suggested that MAFF’s traditional approach to ‘stamping out’ disease might not work so well when wildlife was involved, the empirical evidence was drawn from observations, statistical correlations, single interventions such as the clearance trials, and veterinary field experience. A consensus was forming across the ecologists and their allies in animal welfare and conservation that a new approach to bTB research was needed: one involving the kind of direct experimental comparison that first NCC and then ICD had advocated for many years. Crucially, this not only involved establishing ‘undisturbed’ areas to act as a control condition, but also applying a randomised experimental design (widely used across the agricultural and clinical sciences) to the problem. Their position was summarised by Harry Thompson in 1990:

At the urging of the Consultative Panel on Badgers and Tuberculosis, of which UFAW is a member, authority is now being sought to carry out a proper, randomized trial to compare the effects of TB in cattle, of control of badgers versus no control, on farms where a cattle TB breakdown is attributed to the presence of the disease in badgers—not before time, it could be said.

When the Thatcher government fell in 1990, the change in administration initially made little difference to badger/bTB, where MAFF’s policies continued as before. Over the previous few years, the unfolding BSE crisis had demanded the lion’s share of MAFF’s time, resources and attention, leaving bTB neglected by policymakers, politicians and scientists
alike. Following the re-election of the Conservatives in 1992, government approaches to badger/bTB began to change. The 1973 Badgers Act was revised and extended, offering the animals more extensive legal protections than before. MAFF’s new farming minister (Nicholas Soames) took a direct interest in the problem, visiting Woodchester, organising a scientific symposium, and instituting a new programme of research re-exploring the possibility of controlling bTB with vaccination. Soames was advised of the need for experimental interventions, and provisional plans were made for field trials to test a new ‘live’ blood test for bTB in badgers. In the wake of this renewed interest, both ecological and veterinary research on bTB continued to thrive, with scientists now finding themselves able to consolidate their ideas and publish their long-term studies. However, the results of this work were disappointing for politicians and policymakers expecting new solutions, with the anticipated test and new vaccine research failing to deliver. On 23 July 1996, the beleaguered Agriculture Minister (John Gummer) announced a new ‘Independent Scientific Review of TB in Cattle and Badgers’, to be chaired by behavioural ecologist Professor John Krebs. Less than a year later, the Conservatives lost the 1997 General Election, and Krebs’s team reported their findings (including the recommendation that badger culling be tested using a controlled experiment) to a newly elected Labour government in June 1997.

4.4 MANAGING BADGERS THROUGH SCIENTIFIC CARE

In this chapter, we have explored the development of a new epistemic community around badger/bTB. While this can be broadly characterised as disease ecology, as we have seen with all these epistemic communities, it involves scientists from multiple disciplines alongside ‘lay’ naturalists working with badgers. This grouping centred upon a counterpart to the SVS, ICD, responsible for researching and managing wild animals making ‘pests’ of themselves. ICD originated in the ability of ecologists to reorient their work towards wartime and post-war agricultural productivity agendas, initially gaining funding from funding and then moving scientists into government positions, establishing new groups dedicated to ‘pest control’. The scientists of ICD maintained close links with academic colleagues, drawing upon and contributing to critical developments in population ecology at this time. PICL scientists also contributed to the emerging science of animal
welfare, collaborating with the scientific campaign group UFAW to create new ‘cultures of care’ for wildlife biology and pest control. PICL were also at the forefront of attempts to control and understand the international epizootic of myxomatosis when it reached the UK in the 1950s, contributing to scientific understandings of disease ecology during these decades. PICL’s scientific care for wildlife and their role as government arbiters over awkward animals was seen in action during the 1960s, when badgers became a ‘mammal of interest’ to farmers and animal protection campaigns. While the former accused the animals of predating livestock and damaging crops, the latter argued that badgers were instead victims of human persecution and cruelty. As with the earlier wildlife conflict over rabbits and myxomatosis, ICD investigated these claims and brokered a policy compromise in which the animals were not regarded to be pests but did not merit special protection either.

When the news emerged of tuberculous badgers in the early 1970s, Britain’s long-standing badger debate was reignited and PICL scientists were rapidly called upon to help their veterinary counterparts investigate the situation. Once the scale of the problem became clear, MAFF commissioned a major research programme involving both SVS and ICD, and PICL opened a new field station at Woodchester Park devoted to researching the ecology of badgers and bTB. Over the next ten years, PICL scientists developed ‘humane’ techniques for working with wild badgers, research which proved its worth to MAFF when it found that the animals were unusually resistant to cyanide ‘gassing’. PICL’s approach to scientific research and care was central to the formation of bTB control policies throughout this period, and they were repeatedly consulted on how to cull badgers with minimal impacts on animal suffering and wider public opinion. Unlike the (domestic) animal health-oriented SVS, PICL scientists were primarily motivated by a desire to build reliable knowledge motivated by and feeding into agricultural policy. Like their counterparts building animal welfare science in the laboratory, for these scientists good care for the wild animals they worked with was an intrinsic part of their practices of good science. Developed in collaboration with laboratory colleagues and organisations such as UFAW, this version of good care was similar to the cultures of care of government animal health, prioritising populations over individuals, lack of suffering over preserving life, and integrating anthropocentric priorities in relation to boosting food production and minimising economic losses. As we will explore in the next chapter, the logics of care developed by conservationists and animal protection
campaigners would become increasingly at odds with those held by MAFF’s veterinarians and research scientists from the 1960s onwards.

PICL’s early field investigations of badger movements, behaviour and ecology involved similar techniques (of mapping) and ideas (relating to the spatial movement of animals and pathogens) to those employed by their colleagues in animal health. However, as MAFF’s veterinary and ecological research programmes proceeded, expanded and became increasingly sophisticated, their epistemologies—frameworks for researching and understanding—badger/bTB gradually diverged. Veterinary epidemiologists in the SVS interpreted the outcomes of badger clearance trials in terms of public health ‘natural experiments’, arguing that these interventions led to long-term reductions in the incidence of bTB in cattle. ICD’s field officers and scientists were instead alerted to the sustained effort required to clear badgers and prevent ‘recolonisation’, following the traces of the animals as they established and re-established group territories. Ecologists and field biologists saw the single interventions as scientifically inadequate, as it was not possible to directly compare the effects of badger culling with fully ‘undisturbed’ areas. By the 1990s, ecologists in and outside of government had formed a consensus with allies in UFAW, conservation bodies and naturalists that a controlled experiment testing the effects of badger culling on bTB rates in cattle was necessary. Following the fallout from the BSE crisis, and the collapse of the ‘live test’ trial in the early 1990s, the new disease ecology epistemic community was able to successfully lobby ministers that a new approach to the science of badger/bTB was needed. This resulted in the appointment of the Krebs review team in 1996 and ultimately in the commissioning of the Randomised Badger Culling trial by Tony Blair’s incoming New Labour government in 1998. The Krebs report opened a new chapter in the history of the badger/bTB controversy, which we will investigate in the final part of this book.

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12. Nyhart, *Modern Nature*. 

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26. Crowcroft, Elton’s Ecologists, 2; Matthew K. Chew and Andrew L. Hamilton, ‘The Rise and Fall of Biotic Nativeness: A Historical Perspective’, in *Fifty Years of Invasion Ecology*, ed. David M. Richardson (Chichester, Sussex: John Wiley & Sons, Ltd, 2010), 35–47.

27. John Sheail, ‘Wartime Rodent-Control in England and Wales’, in *The Front Line of Freedom: British Farming in the Second World War*, ed. Brian Short, Charles Watkins, and John Martin (Exeter: British Agricultural History Society, 2006), 55–66; Daniel Simberloff, ‘Charles Elton: Pioneer Conservation Biologist’, *Environment and History* 18(2) (2012): 183–202; Karen Sayer, ‘The “Modern” Management of Rats: British Agricultural Science in Farm and Field during the Twentieth Century’, *BJHS Themes* (January 2017): 1–29.

28. Sheail, ‘Wartime Rodent-Control in England and Wales’, 57–59.
29. John Sheail, ‘Government and the Management of an Alien Pest Species: A British Perspective’, *Landscape Research* 28(1) (2003): 101–11; Sheail, ‘Wartime Rodent-Control in England and Wales’; Sayer, ‘The “Modern” Management of Rats’, 19.

30. Crowcroft, *Elton’s Ecologists*, 25, 43, 151; John Sheail, ‘The Mink Menace: The Politics of Vertebrate Pest Control’, *Rural History* 15(2) (2004): 4.

31. Crowcroft mentions that several other Bureau researchers joined Thompson at ICL, including himself for a time. Crowcroft, *Elton’s Ecologists*, 43–44.

32. MAFF, ‘Pest Infestation Control—Combining the Report of the Infestation Control Laboratory 1968–1970 and Pest Infestation Research 1970’ (London: Ministry of Agriculture, Fisheries & Food: HMSO, 1973); Sayer, ‘The “Modern” Management of Rats’.

33. Roger Williams, ‘Some Political Aspects of the Rothschild Affair’, *Science Studies* 3(1) (1973): 32–36; Thirtle, Palladino and Piesse, ‘On the Organisation of Agricultural Research in the United Kingdom, 1945–1994’, 564.

34. MAFF, ‘Pest Infestation Control—Combining the Report of the Infestation Control Laboratory 1968–1970 and Pest Infestation Research 1970’, vii–4; W. Henderson, ‘Continued Growth’, in *Agricultural Research 1931–1981: A History of the Agricultural Research Council and a Review of Developments in Agricultural Science during the Last Fifty Years* (London: Agricultural Research Council, 1981), 73–74; L. M. Gosling and S. J. Baker, ‘The Eradication of Muskrat and Coypus from Britain’, *Biological Journal of the Linnean Society* 38 (1989): 39–51.

35. Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1974–1976’ (London: HMSO, 1978).

36. For histories of other parts of the Agricultural Science Service, see, e.g. Thirtle, Palladino and Piesse, ‘On the Organisation of Agricultural Research in the United Kingdom, 1945–1994’; Paolo Palladino, *Entomology, Ecology and Agriculture: The Making of Science Careers in North America, 1885–1985* (New York: Routledge, 2013); Dominic Berry, ‘The Resisted Rise of Randomisation in Experimental Design: British Agricultural Science, c.1910–1930’, *History and Philosophy of the Life Sciences* 37(3) (2015): 242–60; Giuditta Parolini, ‘Charting the History of Agricultural Experiments’, *History and Philosophy of the Life Sciences* 37(3) (2015): 231–41.

37. Pest Infestation Control Laboratory, ‘Pest Infestation Control Leaflet’ (London: HMSO, c. 1975).

38. Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1971–1973’ (London: HMSO, 1975), 3.
39. J. A. Freeman, ‘Research in Progress at the Pest Infestation Control Laboratory’, *EPPO Bulletin* 4(3) (1 September 1974): 291–294.
40. While the ‘PICL’ name was officially abandoned in the early 1980s, I will use it throughout this text to make the story easier to follow.
41. For guidance through MAFF’s reorganisations during the 1980s and 1990s, see Ingram, ‘THE UNITED KINGDOM EXPERIENCE IN THE PRIVATIZATION OF EXTENSION’; Thirtle, Palladino and Piesse, ‘On the Organisation of Agricultural Research in the United Kingdom, 1945–1994’, 566–67; Phillips, Bridgeman and Ferguson-Smith, ‘The Inquiry into BSE and Variant CJD in the United Kingdom’, 85–112; Food and Environment Research Agency. Central Science Laboratory: Our History (graphic) (16 September 2009), hosted by Wikipedia at: https://en.wikipedia.org/w/index.php?title=File:CSL_timeline.PNG&oldid=468477845.
42. See, e.g. John Sheail, ‘The Management of an Animal Population: Changing Attitudes towards the Wild Rabbit in Britain’, *Journal of Environmental Management* 33(2) (1991): 189–203; John Sheail, ‘The Grey Squirrel (Sciurus Carolinensis)—A UK Historical Perspective on a Vertebrate Pest Species’, *Journal of Environmental Management* 55(3) (March 1999): 145–56; Sheail, ‘The Mink Menace’.
43. Crowcroft, *Elton’s Ecologists*; Sheail, ‘Government and the Management of an Alien Pest Species’, 103.
44. While Matthew Chew describes Elton’s ideas as ‘plainly alarmist Cold War popularisation’, the history of PICL and the Bureau of Animal Population demonstrates the deep roots of invasion biology in the inter-war period. Matthew K. Chew, ‘A Picture Worth Forty-One Words: Charles Elton, Introduced Species and the 1936 Admiralty Map of British Empire Shipping’, *The Journal of Transport History* 35(2) (2014): 226.
45. Gosling and Baker, ‘The Eradication of Muskrat and Coypus from Britain’.
46. Simon J. Baker, ‘Escaped Exotic Mammals in Britain’, *Mammal Review* 20(2–3) (1 June 1990): 75–96.
47. Bartrip, *Myxomatosis*, 44–59.
48. Peter W. J. Bartrip, ‘Myxomatosis in 1950s Britain’, *Twentieth Century British History* 19(1) (2008): 83–105; Bartrip, *Myxomatosis*.
49. Frank Fenner, *Nature, Nurture and Chance: The Lives of Frank and Charles Fenner* (Canberra: ANU E Press, 2006); Anderson, ‘Nowhere to Run, Rabbit’.
50. Sheail, ‘The Management of an Animal Population’, 200.
51. Fenner, *Nature, Nurture and Chance*, 87–88.
52. For a comprehensive description of the chemical properties and industrial uses of sodium cyanide, see Centres for Disease Control and Prevention,
‘CDC—The Emergency Response Safety and Health Database: Systemic Agent: SODIUM CYANIDE—NIOSH’, CDC—The Emergency Response Safety and Health Database, 27 September 2018. This chemically differentiates Cymag from its notorious cousin, Zyklon-B, the hydrogen cyanide product used by Nazi Germany to commit genocide during the Holocaust, developed in the 1920s. Scott Christianson, [*Fatal Airs: The Deadly History and Apocalyptic Future of Lethal Gases That Threaten Our World*](Santa Barbara, CA: ABC-CLIO, 2010), 61–73. Cymag was banned in the UK in 2004—until then it was licenced for rodent control, but appears to have also been used to poison wildlife; Advisory Committee on Pesticides, ‘Pesticide Poisoning of Animals in 2004: Investigations of Suspected Incidents in the United Kingdom’ (London: Defra, 2005).

53. Bartrip, ‘Myxomatosis in 1950s Britain’, 78–94.
54. E.g. K. M. Backhouse and H. V. Thompson, ‘Myxomatosis’, *Nature* 176(4494) (1955): 1155–56; H. V. Thompson, ‘The Rabbit Disease—Myxomatosis’, *Annals of Applied Biology* 41(2) (1954): 358–66.
55. H. V. Thompson and A. N. Worden, *The Rabbit*, New Naturalists Monographs 13 (London: Collins, 1956); H. V. Thompson and Carolyn M. King, eds, *The European Rabbit: History and Biology of a Successful Colonizer* (Oxford: Oxford University Press, 1994).
56. Anon., ‘The Mammal Society of the British Isles’, *Nature* 173 (22 May 1954): 980.
57. A. N. Worden, ed., [*The UFAW Handbook on the Care and Management of Laboratory Animals: With an Appendix on Statistical Analysis*] (Baltimore: Williams and Wilkins, 1947). The UFAW Handbook is now in its 8th edition, covering a range of species and research contexts, including a chapter on wildlife authored by Defra biologists Julie M. Lane and Robbie A. McDonald, ‘Welfare and “Best Practice” in Field Studies of Wildlife’, in [*The UFAW Handbook on the Care and Management of Laboratory and Other Research Animals*], ed. Robert Hubrecht and James Kirkwood (Chichester, Sussex: Wiley-Blackwell, 2010), 92–106.
58. Kirk, ‘Between the Clinic and the Laboratory’; ‘The Invention of the “Stressed Animal” and the Development of a Science of Animal Welfare, 1947–1986’, *Animal Welfare* 1947 (2014): 86.
59. Kirk, ‘Between the Clinic and the Laboratory’; Kirk, ‘A Brave New Animal for a Brave New World’; Kirk, ‘The Invention of the “Stressed Animal” and the Development of a Science of Animal Welfare, 1947–1986’; Kirk, ‘Recovering the Principles of Humane Experimental Technique: The 3Rs and the Human Essence of Animal Research’, *Science, Technology, & Human Values* 43(4) (2018): 622–48.
60. Bartrip, ‘Myxomatosis in 1950s Britain’.
61. Bartrip, *Myxomatosis*, 36–43.

62. As suggested by the parallel invention of Zyklon-B around this time (also originally developed as a pesticide), historical research into the drivers, research practices, industrial applications and public marketing of these chemicals has revealed the deep interpenetration of agricultural pest control (primarily but not exclusively directed at insects), chemical warfare, (post)colonial control of human populations, and genocide. See Christianson, *Fatal Air*; Edmund P. Russell, “‘Speaking of Annihilation’: Mobilizing for War against Human and Insect Enemies, 1914–1945’, *The Journal of American History* 82(4) (1996): 1505–29; Edmund P. Russell, *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring* (Cambridge: Cambridge University Press, 2001); Lance van Sittert, ‘Routinising Genocide: The Politics and Practice of Vermin Extermination in the Cape Province c.1889–1994’, *Journal of Contemporary African Studies* 34(1) (2 January 2016): 111–28; Adam M. Romero, ‘Commercializing Chemical Warfare: Citrus, Cyanide, and an Endless War’, *Agriculture and Human Values* 33(1) (March 2016): 3–26.

63. Sheail, ‘The Management of an Animal Population’; John Martin, ‘The Wild Rabbit: Plague, Polices and Pestilence in England and Wales, 1931–1955’, *Agricultural History Review* 58, no. 2 (2010): 255–76.

64. Scott Henderson was later cited by MAFF to support badger gassing in 1975, and by Zuckerman in 1980; Henderson, ‘Report of the Committee on Cruelty to Wild Animals’, Cmd 8266, June 1951’; Michael Tichlar, “‘Putting Animals into Politics’: The Labour Party and Hunting in the First Half of the Twentieth Century’, *Rural History* 17(2) (October 2006): 213–34; Griffin, *Blood Sport*.

65. UFAW, ‘Obituaries: Harry V. Thompson’, *Universities Federation for Animal Welfare News-Sheet* (2004), 2.

66. H. V. Thompson, ‘Animal Welfare and the Control of Vertebrates’, in *Proceedings of the Fourteenth Vertebrate Pest Conference* (Vertebrate Pest Conference, Sacramento, California, 1990), 5.

67. See Sect. 3.1.

68. F. Howard Lancum, *Wild Birds and the Land*, MAFF Bulletin 140 (London: Ministry of Agriculture, Fisheries & Food: HMSO, 1948); F. Howard Lancum, *Wild Mammals and the Land*, MAFF Bulletin 150 (London: Ministry of Agriculture, Fisheries & Food: HMSO, 1951). Both volumes went through multiple reprints over the following decade and in 1959 MAFF reported having sold almost 100,000 copies of *Wild Birds* (Hansard, 26 January 1959, vol. 598).

69. Lancum, *Wild Mammals and the Land*, 13, 10.
70. A. V. Neal, ‘Damage by Badgers in Rotherfield Area’, ‘Badger Control’ report, 18 August 1959, NA MAF 131/70, item 16; M. Neve, ‘Letter to C.J. Armour: Badgers’, 18 March 1963, NA MAF 131/70, item 68; ‘HPC Bi-monthly report. Welsh region’, March/April 1961, NA MAF 131/70, item 39; D. Imrie, ‘Round the Game Preserves’ (extract from *The Shooting Times and Country Magazine*), 3 June 1960, NA MAF 131/70, item 14.

71. C. J. Armour, ‘Letter to G.H. Hill re Badgers’, 27 July 1960, NA MAF 131/70, item 19.

72. R. J. King, ‘The Badger Gate’, *Quarterly Journal of Forestry* 58(4) (1964): 318. See also Lancum, *Wild Mammals and the Land*, 13; F. Burden, ‘Paper prepared by Mr. F. Burden MP’, 23 June 1965’ NA HO 285/39; W. E. Rivers, ‘Letter to J.R. Austin, Esq, Federation of Rabbit Clearance Societies’, 2 February 1967, NA MAF 109/381, item 4.

73. G. R. Hill, ‘Circular Letter No. 59/7: Badger Control’, 28 June 1959, NA MAF 131/70, item 7; Imrie, D. ‘Round the Game Preserves’, 3 June 1960, NA MAF 131/70, item 14.

74. Anon., ‘Minutes of the Divisional Pests Officers Conference’, 25–26 May 1960, NA MAF 131/70, item 10/2.

75. W. E. Rivers, ‘Letter to J.R. Austin’, 2 February 1967, NA MAF 109/381, item 4.

76. Grant, ‘Intractable Policy Failure: The Case of Bovine TB and Badgers’, 563.

77. Lambert, ‘The Grey Seal in Britain’, 50.

78. For example, similar debates about ‘rogue’ seals were taking place at around the same time; see Lambert, ‘The Grey Seal in Britain’, 456. Indeed, conservationists are still debating whether ‘rogue’ animals exist; see Mara J. Goldman, Joana Roque de Pinho and Jennifer Perry, ‘Beyond Ritual and Economics: Maasai Lion Hunting and Conservation Politics’, *Oryx* 47(4) (October 2013): 490–500; George J. F. Swan et al., ‘Ecology of Problem Individuals and the Efficacy of Selective Wildlife Management’, *Trends in Ecology & Evolution* 32(7) (July 2017): 518–30.

79. R. G. Symes, ‘Badger Damage: Fact or Fiction?’ in *Mammals as Pests*, ed. Rory Putman (London: Chapman and Hall, 1989), 196–206.

80. S. L. Woolridge, ‘Letter’, 11 April 1972. NA MAF 109/381, item 40a.

81. F. H. Jacob, ‘Director’s Introduction’, in Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1974–1976’, 11.

82. Thirtle, Palladino and Piesse, ‘On the Organisation of Agricultural Research in the United Kingdom, 1945–1994’.

83. J. M. Seymour, ‘Memo: TB-Badgers’, 30 August 1974, NA MAF 109/295, item 80; H. V. Thompson, ‘Memo: TB-Badgers’, 6 September
1974, NA MAF 109/295, item 82. For further background on ITE and the NCC’s navigation of the post-Rothschild research and policy landscape, see John Sheail, ‘The Management of Wildlife and Amenity: A UK Post-war Perspective’, Contemporary Record 7(1) (1993): 44–65.

84. For Neal’s service on the Badger Panel, see MAFF, ‘Bovine Tuberculosis in Badgers. Fifteenth Report by the Ministry of Agriculture, Fisheries and Food’ (London: Ministry of Agriculture, Fisheries & Food: HMSO, 1991), 6; for knowledge brokers, see Morgan Meyer, ‘The Rise of the Knowledge Broker’, Science Communication 32(1) (March 2010): 118–27.

85. Gail Davies, ‘Science, Observation and Entertainment: Competing Visions of Postwar British Natural History Television, 1946–1967’, Cultural Geographies 7(4) (2000): 432; Jon Agar, ‘What Difference Did Computers Make?’ Social Studies of Science 36(6) (December 2006): 869–907; Benson, Wired Wilderness; Gouyon, ‘Science and Film-Making’.

86. For post-war ethology, see Burkhardt, Patterns of Behavior; for evolutionary biology, Mason Dentinger, ‘Patterns of Infection and Patterns of Evolution’; Smocovitis, Unifying Biology; for ecology, Bocking, Ecologists and Environmental Politics; for sociobiology, behavioural ecology and modelling in the 1960s and 1970s I would suggest Paolo Palladino, ‘Ecological Theory and Pest Control Practice: A Study of the Institutional and Conceptual Dimensions of a Scientific Debate’, Social Studies of Science 20(2) (May 1990): 255–81; Beale, ‘Tinbergenian Practice, Themes and Variations’; Amanda Rees, The Infanticide Controversy: Primatology and the Art of Field Science (Chicago: University of Chicago Press, 2009).

87. For further information on the Woodchester site, see www.woodchester-mansion.org.uk. The park is now managed by the National Trust and was designated an SSSI in 1987. For more information on the Kellys, see Duff Hart-Davis, ‘Country Matters: Guardians of the Haunted House’, The Independent, 11 June 1994; Liz Wright, ‘Obituary: Miriam Kelly’, The Guardian, 28 August 2008. For Woodchester as a site for field biology, see Roger Ransome, Natural History of Hibernating Bats (London: Christopher Helm Ltd./Mammal Society, 1990); D. W. Yalden and R. F. Shore, ‘Yellow-Necked Mice Apodemus Flavicollis at Woodchester Park, 1968–1989’, Journal of Zoology 224(2) (1 June 1991): 329–32.

88. Anonymous interview source, 13/05/15.

89. Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1977–1979’ (London: HMSO, 1981), 111.

90. The badgers at Oxford University’s Wytham Woods field site just about claim priority here, as they have been working with field biologists since 1972: Christina D. Buesching et al., ‘The Mammals of Wytham Woods’,
in *Wytham Woods: Oxford’s Ecological Laboratory* (Oxford: Oxford University Press, 2010), 187–89.

91. C. J. Armour, ‘Letter re Swan Trap’, 17 April 1974, NA MAF 109/383, item 60; Universities Federation for Animal Welfare, ‘UFAW Annual Report, 1973–1974’ (South Mimms: Universities Federation for Animal Welfare, 1974), 17; Universities Federation for Animal Welfare, ‘UFAW Annual Report, 1974–1975’ (South Mimms: Universities Federation for Animal Welfare, 1975), 11–12. For Ruth Murray’s cage-trap, see Ruth R. Murray, ‘Live Trapping of Badgers, Their Removal, Release and Rehabilitation in a New Area’, *Mammal Review* 1(3) (1 September 1970): 86–92; for Murray herself, see Chap. 5.

92. Universities Federation for Animal Welfare, ‘UFAW Annual Report, 1974–1975’; MAFF, ‘Bovine Tuberculosis in Badgers. Report by the Ministry of Agriculture, Fisheries and Food’; C. L. Cheeseman and P. J. Mallinson, ‘Radio Tracking in the Study of Bovine Tuberculosis in Badgers’, in *A Handbook on Biotelemetry and Radio Tracking* (Oxford: Pergamon, 1980), 649–56. See also MAF 109/384, items 109–13.

93. See, e.g. C. L. Cheeseman et al., ‘The Population Structure, Density and Prevalence of Tuberculosis (Mycobacterium Bovis) in Badgers (*Meles Meles*) from Four Areas in South-West England’, *Journal of Applied Ecology* 18(3) (1981): 795–804.

94. MAFF, ‘Bovine Tuberculosis in Badgers. Report by the Ministry of Agriculture, Fisheries and Food’, 6; Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1974–1976’, 173–74.

95. See MAF 131/70; also in MAF 109/383, e.g. items 48, 104, 165.

96. MAFF, ‘Bovine Tuberculosis in Badgers. Third Report by the Ministry of Agriculture, Fisheries and Food’, 26.

97. Pest Infestation Control Laboratory, ‘Pest Infestation Control Laboratory Report, 1974–1976’, 174.

98. Ibid., 176.

99. Hans Kruuk, *The Spotted Hyena: A Study of Predation and Social Behavior* (Chicago: University of Chicago Press, 1972); N. Tinbergen et al., ‘Egg Shell Removal by the Black-Headed Gull, Larus Ridibundus L.; A Behaviour Component of Camouflage’, *Behaviour* 19(1/2) (1962): 74–117.

100. David W. Macdonald, ‘Radio-Tracking: Some Applications and Limitations’, in *Animal Marking* (London: Palgrave, 1978), 192–204; Charles J. Amlaner and David W. MacDonald, eds, *A Handbook on Biotelemetry and Radio Tracking: Proceedings of an International Conference on Telemetry and Radio Tracking in Biology and Medicine, Oxford, 20–22 March 1979* (Oxford: Pergamon Press, 1980); Benson, *Wired Wilderness*. 
101. Zuckerman, ‘Badgers, Cattle and Tuberculosis’; C. L. Cheeseman and Stephen Harris, ‘Methods of Marking Badgers (Meles Meles), Notes from the Mammal Society—No. 44’, Journal of Zoology 197(2) (1 June 1982): 289–91.

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103. Cheeseman and Mallinson, ‘Radio Tracking in the Study of Bovine Tuberculosis in Badgers’, 68.

104. For more information see Peter Bale, ‘Badger Watch’, The Radio Times (BBC Television, 5 May 1977); Wildscreen, ‘WildFilmHistory—Badger Watch (1977)’, WildFilmHistory, 2008.

105. ‘MAFF Consultative Panel on Badgers and TB: Badger Watch—BBC Television’, June 1977. NA FT 41/92.

106. MAFF, ‘Bovine Tuberculosis in Badgers. Second Report by the Ministry of Agriculture, Fisheries and Food’, sec. appendix 7.

107. C. L. Cheeseman et al., ‘Dynamics of Tuberculosis in a Naturally Infected Badger Population’, Mammal Review 18(1) (1988): 61–72.

108. For descriptions of this behaviour, see C. L. Cheeseman and P. J. Mallinson, ‘Behaviour of Badgers (Meles Meles) Infected with Bovine Tuberculosis’, Journal of Zoology 194(2) (1 June 1981): 284–89.

109. MAFF Badger Group Research Programme 1981. MAFF, Agricultural Science Service, Worplesdon Laboratory, ZUEA S2 PUBS 4255.

110. A. Warne, ‘Memo re Badger killing in Areas with bTB’, May 1974, NA MAF 109/383, item 104; A. McDiarmid, ‘Comments on report concerning TB in badgers’, 12 January 1972, NA MAF 287/752, item 10; see also Eunice D. Overend, ‘Badgers and TB—Does Gassing Spread the Disease?’ Oryx 15(4) (August 1980): 338–40.

111. B. E. Camp, ‘Memo re Zuckerman Review: Future Programme of Work at Woodchester Park’, 29 May 1980. ZUEA S2PUBS 115, folder Badger Report 1980 Minutes of Enquiry.

112. ‘Lord Zuckerman’s visit to Woodchester Park’, 26 March 1980; ‘Lord Zuckerman’s meeting with Mr. Curwen (Woodchester, Glos.)—27 March 1980’; ‘Memo from B.E. Camp re Zuckerman Review: Future Programme of Work at Woodchester Park’, 29 May 1980. All in ZUEA S2PUBS 115, folder Badger Report 1980.

113. ‘MAFF Consultative Panel: Progress Report on Operational and Investigational Work in the SW Region, Sept–Dec 1979’, in ZUEA S2PUBS 115, folder Badger Report 1980.

114. For Zuckerman’s earlier hostile interactions with field ecology and ethology see Burt, ‘Solly Zuckerman’; Kirk, ‘Between the Clinic and the Laboratory’.
115. Agar, ‘Transition’.
116. H. V. Thompson, ‘Memorandum. Badgers, Cattle and Tuberculosis: Some Research Proposals’, 30 January 1981. NA MAF 459/8, item 1.
117. J. W. Davies, ‘Re: Badgers, Cattle and Tuberculosis: Some Research Proposals’, 16 February 1981, NA MAF 459/8, item 2; ‘Notes on a Meeting held at Tolworth Tower’, 26 February 1981, NA MAF 459/8, item 4b.
118. Anonymous interview source, 13/05/15.
119. MAFF Badger Control Manual and Code of Practice, MAF 459/24; for Defra’s most recent Best Practice guidelines, see Defra, ‘Cage-Trapping and Dispatch of Badgers under Licence to Prevent the Spread of Bovine TB in Cattle’, 26 August 2014.
120. Stuart and Wilesmith, ‘Tuberculosis in Badgers’.
121. Clifton-Hadley et al., ‘The Occurrence of Mycobacterium Bovis Infection in Cattle in and around an Area Subject to Extensive Badger (Meles Meles) Control’, 191–92.
122. ‘MAFF Badger Group Research Programme, Agricultural Science Service, Worplesdon Laboratory’, ZUEA SS2PUB425, see also MAFF, ‘Bovine Tuberculosis in Badgers. Sixth Report by the Ministry of Agriculture, Fisheries and Food’; R. M. Anderson and Robert M. May, ‘Population Biology of Infectious Diseases: Part I’, Nature 280(5721) (2 August 1979): 361–67; R. M. Anderson et al., ‘Population Dynamics of Fox Rabies in Europe’, Nature 289(5800) (26 February 1981): 765–71; R. M. Anderson and W. Trewhella, ‘Population Dynamics of the Badger (Meles Meles) and the Epidemiology of Bovine Tuberculosis (Mycobacterium Bovis)’, Philosophical Transactions of the Royal Society B: Biological Sciences 310(1145) (1985): 327–81. For further information on Roy Anderson, Bob May, John Krebs and the ‘Silwood Circle’ of ecologists, see Hannah Gay, The Silwood Circle: A History of Ecology and the Making of Scientific Careers in Late Twentieth-Century Britain (London: Imperial College Press, 2013), 151–64; 204–12.
123. David W. MacDonald, Rabies and Wildlife: A Biologist’s Perspective (Oxford: Oxford University Press, 1980); Anderson et al., ‘Population Dynamics of Fox Rabies in Europe’.
124. See footnote 39 for MAFF’s ongoing processes of reorganisation and privatisation.
125. Berry, ‘The Resisted Rise of Randomisation in Experimental Design’.
126. Thompson, ‘Animal Welfare and the Control of Vertebrates’, 6.
127. D. G. Newell and R. Glyn Hewinson, ‘Control of Bovine Tuberculosis by Vaccination’, Veterinary Record 136(18) (6 May 1995): 459–63; C. L. Cheeseman, ‘Why a Badger Cull Won’t Work’, Badgergate, 9 June 2013; Overy and Tansey, A History of Bovine TB c.1965–c. 2000, 55: 59–60.
128. J. A. Brown, C. L. Cheeseman and S. Harris, ‘Studies on the Spread of Bovine Tuberculosis from Badgers to Cattle’, *Journal of Zoology* 227(4) (August 1992): 694–96; R. S. Clifton-Hadley, J. W. Wilesmith and F. A. Stuart, ‘Mycobacterium-Bovis in the European Badger (*Meles Meles*)—Epidemiologic Findings in Tuberculous Badgers from a Naturally Infected Population’, *Epidemiology and Infection* 111(1) (August 1993): 9–19; MAFF, ‘Bovine Tuberculosis in Badgers. Seventeenth Report by the Ministry of Agriculture, Fisheries and Food’ (London: Ministry of Agriculture, Fisheries & Food: HMSO, 1994), 13–18; Clifton-Hadley et al., ‘The Occurrence of Mycobacterium Bovis Infection in Cattle in and around an Area Subject to Extensive Badger (*Meles Meles*) Control’.

129. Krebs et al., ‘Bovine Tuberculosis in Cattle and Badgers’; Select Committee on Agriculture, ‘House of Commons—Agriculture—Fifth Report’ (London: House of Commons, 27 April 1999), sec. III. THE KREBS REPORT.

130. Druglitrø, “Skilled Care” and the Making of Good Science’.

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