



Wildlife conservation, multiple biopolitics and animal subjectification: Three mammals' tales



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1. Introduction

Drawing on but departing from recent writings about more-than-human biopolitics, this paper draws attention to the multiplicity of biopolitics in practices of wildlife conservation. This claim goes beyond recognising the longstanding coming-together of varied values, motivations and politics in wildlife conservation, to illuminate how multiple forms of biopolitics enact the beneficial populations, subjects and objects of political action in multiple (and sometimes conflicting) ways. Specifically, through attending to conservation practices that target woodland mammals in England and Wales, the paper identifies several modes of conservation biopolitics that co-exist in particular situations. Drawing heavily on Foucault's original work, as well as subsequent developments, it shows how 'populations' are enacted as singular species or multi-species, and in ecosystemic and anthropocentric ways. How these multiple forms of biopolitics cohere has significant political and ethical implications for the various animals involved, notably: (i) how animals are figured as subjects and objects in a more-than-human politics marked by its multiplicity; (ii) the forms of governance made possible through such categorisations; and (iii) the ways in which contemporary governance enrolls animals to enact anthropocentric goals through forms of 'animal self-government'.

Empirically the paper will trace conservation actions in England and Wales relating to a trio of mammal species: red squirrels, grey squirrels, and pine martens. It draws on a study of conservation practices relating to all three conducted in 2013, involving six months of observant participation working full-time in the field with relevant conservation groups, alongside supporting interviews, textual analyses and archival work. The precipitous decline of red squirrel populations in England and Wales over the past century has been blamed on the historical human-assisted translocation of very competitive, disease-carrying grey squirrels from North America (Yalden, 1999). Despite significant conservation action, grey squirrels continue to spread. The scarcity of pine martens is also linked to human-action, but this time relating to deliberate persecution and habitat loss (Birks and Messenger, 2010). There is a possible future in which an augmented population of predatory pine martens might also help red squirrels to recover by controlling populations of greys – evidence suggests, given

the right circumstances, this can occur (Sheehy and Lawton, 2014; Stokstad, 2016). But controlling greys has 'multiple benefits', to use the language prevalent in the contemporary discourse of ecosystem services; greys are a scourge of forestry operations as well as red squirrel populations, as their bark stripping habits can devastate commercial plantations. Thus moves to support pine marten recovery find support in the logics of traditional species conservation, but also through being enrolled in a (eco)systemic biopolitics of silviculture.

Although modes of conservation biopolitics differ, they are all enacted through spatial practices (Whatmore, 2002; Lorimer, 2015). Attending to these practices can therefore aid analysis of how different modes of governance operate. In particular, the paper focuses on three techniques that are important in contemporary conservation: (i) place-making, (ii) facilitating connectivity; and (iii) managing more-than-human mobilities. After an introductory discussion of recent developments within more-than-human biopolitical theory, the paper begins by considering how pine marten conservationists promote ecological connectivity through the (co)production of 'potential' places. Drawing on recent engagements with Foucault, this is conceptualised as a form of biopolitics directed at the population of martens through interventions in their 'milieu' (understood in terms of the supportive socio-material environment in which life might be lived). Second, the modes of dis-connectivity enacted in practices of red squirrel conservation are demonstratively linked to the (attempted) enforcement of prescriptive places. Here, disciplinary techniques that target the mobility of individual squirrels are combined with modes of (bio)security that manage the circulations of various populations (of both squirrels and viruses), combining to enact a more lethal mode of governance. By contrast, the paper concludes by speculating on the possibilities of an emergent future for both squirrels and martens, enacted through animal mobilities and place-making activities. Through reflecting on how these situations come together, it is possible to illuminate the multiple modes of biopolitics that infuse these conservation practices and the ethical stakes involved.

2. Biopolitics and animal geographies

Foucault's conceptualisations of government power have been utilised, critiqued and extended through diverse geographical analyses. Although varied in their foci, such work is united by an

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attention to the ways power is enacted spatially through multiple logics, techniques and strategies. In particular, the dual concepts of disciplinary power and anatamo-politics (concerning the governance of bodies) and biopower and biopolitics (relating to populations) developed by Foucault in the *Society Must be Defended* lecture series and elsewhere (Foucault, 1998, 2004, 2007), have proven useful for theorising all sorts of contemporary governance situations. As Schlosser (2008) notes, however, these terms have not been interpreted or applied consistently, with Schlosser preferring to conceptualise both the anatamo-politics of the body (and its correlate disciplinary power) and the biopolitics of populations as different forms of 'biopower'. Either way, rather than the teleological progression from sovereign power, through disciplinary power and finally to biopower sometimes misattributed to Foucault, most of this work instead focuses on the ways in which these different forms of power coalesce in particular contexts and situations (Schlosser, 2008; Dalby, 2013: 186). Power is theorized as multiple.

These Foucaultian theories of power have increasingly been utilised in conversations about animals. Various scholars have drawn on both the more-than-human sensibilities of the 'new' animal geographies (Philo and Wilbert, 2000), and the theorisations of disciplinary and biopower developed in and after Foucault, to interrogate how, where and why animal lives are made to live, and made to or let die. The concept of 'biopolitics', in particular, has proven increasingly useful for theorising management practices that govern the 'more-than-human' parts of social life (Cavanagh, 2014). Foucault was concerned with the ways in which particular governmental practices make life itself governable – and 'biopolitics' relates specifically to actions working at the level of populations (Foucault, 2007; Holloway et al., 2009). For animal geographers, the question of how the 'population' gets defined is thus crucial: whether this be as single species, multiple species, or even ecosystems, for example (Biermann and Mansfield, 2014). But the concept of biopolitics has also been reworked in significant ways through a series of influential interventions, most notably: Agamben's distinction between political and 'bare' life; Hardt and Negri's reading of how commodities and identities are produced through capitalism (and their later work on violence); Dillon's re-emphasis of sovereign power and territory; Esposito's understanding of biopolitics through immunity; Hannah's focus on governing contingency; and Haraway's notions of companionship and "living with"; all of which have been well summarized elsewhere (see reviews in Hinchliffe and Bingham, 2008; Schlosser, 2008; Rutherford and Rutherford, 2013a,b). Furthermore, these various readings of biopolitics have been utilised as theoretical resources to re-think a diversity of governance practices stretching from analyses of state security in the context of geopolitics and environmental change (e.g. Baldwin, 2013; Dalby, 2013) to the environmental and ecological concerns addressed in this paper. Biopolitics is thus both currently fashionable and increasingly difficult to define (Rutherford and Rutherford, 2013a). Indeed, in some contemporary theorisations, the distinction between biopolitics and anatamo-politics seems to be dropped and replaced with a general concern for the governance of both 'life' and 'lives'.

Although diverse and not always conceptually commensurable, such work has proven an excellent resource for scholars investigating contemporary forms of wildlife conservation; particularly insofar as a Foucaultian approach focuses attention on the discursive understandings that shape and are shaped by much conservation action. Thus Biermann and Mansfield (2014:257) utilise the conceptual framework of biopolitics to highlight the ways in which the science of conservation biology follows a "racialized logic of abnormality" in distinguishing between species that are favoured, and those it 'lets die'. And on similar lines, Lorimer and Driessen (2011) draw attention to how the biopolitics of wildlife conservation differs to that of agriculture, animal welfare, and

biosecurity (respectively) in their work on the "bovine biopolitics" of Heck cattle in Dutch "rewilding" schemes. Srinivasan's recent work has a similar conceptual basis, but also pays greater attention to the spaces where different logics and practices overlap – demonstrating how the conservation practices surrounding Olive Ridley turtles in India, and management practices relating to street dogs in India and stray dogs in the UK, are all infused with an inherent tension between conservation logics relating to 'population' health and welfare logics concerned with 'individual' animals (Srinivasan, 2013, 2014). Conservation biopolitics, she suggests, can be understood as an entanglement of 'harm and care'. In this paper I extend this line of thinking to illuminate the multiple forms of conservation biopolitics enacted in particular conservation practices: where conservation logics do not only coexist and interact with concerns about welfare, biosecurity, and agriculture, but are also multiple in themselves. This biopolitical multiplicity, I will go on to suggest, has important ethical implications, as various actors are made into political subjects and objects in competing, potentially conflicting, ways.

Whilst Foucault's work serves as a touchstone for much of this recent work on more-than-human biopolitics, several of the key subsequent interventions noted above have also proven influential. Indeed, Lorimer and Driessen note how the, "*biopolitical turn ... has expanded from a Foucauldian interest in the ways in which life is spaced, to a vital materialist concern for the lively potentials of nonhuman forms and processes to make places and unsettle such orders*" (2011:2). In their own work, they turn to the writings of both Esposito and Haraway in an attempt to trace a more affirmative biopolitics of 'living with' nonhuman life. Similar moves have been made in wider more-than-human work. For example, Hinchliffe and Ward (2014) consider the promise, but also limitations, of adopting Esposito's notion of immunity in order to theorise the implications of moving beyond geographies of biosecurity that rest on practices of spatial segregation. Nevertheless, Foucault's original ideas still have much to offer in conceptualising contemporary regimes of animal management; in particular, his attention to the ways in which various forms of biopolitics operate through governing the 'circulations' essential to the health of populations (Foucault, 2007; see later discussions). But there is a significant hurdle: how to navigate the space between Foucault's explicit humanism, and more-than-human geography's assertion of non-human agency (Cavanagh, 2014).

Noting the difficulty of extending Foucault's ideas about self-governance to the nonhuman, Srinivasan develops the concept of "agential subjectification" to explain how humans concerned with the plight of turtles, "act upon and for turtles on the basis of truth discourses about turtle flourishing" (2014:509). It is the humans who are subjectified, as they 'self-govern' their own conservation practices for the benefit and wellbeing of valued nonhumans (Srinivasan, 2014). In developing this line of thought, she explicitly and persuasively suggests that whilst animal agency should not be overlooked, it is human (discourse-)practice that is most significant in regimes of animal governance. To a large extent, I concur. However, herein I also suggest that certain long-standing modes of conservation practice rely on forms of 'animal self-governance' of a type not wholly recognisable to Foucaultian approaches, yet also more in keeping with the increased attention given to non-human agency in much of the new animal geographies (Urbanik, 2012). Whilst these forms of self-governance may appear unfamiliar in the context of traditional accounts of subjectification, they nevertheless operate through shaping the internal behaviours and perception of choices in individual animals, so as to achieve particular outcomes that in turn benefit a 'population' – as I explain in detail later.

In this paper I thus seek to draw on and develop recent work extending Foucaultian insights in animal geographies in two

complementary directions. First, I demonstrate how conservationists enact multiple forms of biopolitics within seemingly singular situations. That conservation draws together various actors with diverse motivations is by no means a new idea. The varied political, economic, legal, and moral logics on which wildlife conservation has been (often simultaneously) based have been well documented (Adams, 2004). However, making sense of these multiple logics and practices in biopolitical terms serves an important purpose: it highlights the different ways in which political subjects are constituted, governed, and made to live, and let (or made) die. Second, therefore, I argue that extending Foucault's notion of biopolitics within a framework of animal geography – in which the political status of animals is significantly reconfigured (Hobson, 2007) – draws attention to how animals are simultaneously objectified and subjectified through multiple biopolitical practices in ethically significant ways. Herein I identify specific instances of disciplinary power directed at individual animals, enactments of security that have as their aim the health of a 'population' of animals (configured in species terms), and different modes of biopower that instead have as their target the 'ecosystem' (or particular, economically valuable parts of it). Each of these enactments of power formulates (political) subjects differently, and with important consequences for the more-than-human politics they generate.

3. Biopolitics and spatial practices: place-making, connectivity, animal mobilities

Different modes of more-than-human biopolitics are enacted through spatial practices (see Whatmore, 2002); in particular those relating to (i) places, (ii) connectivity, and (iii) mobility. Wildlife conservation has a long history of place-making through a diversity of protective designations (nature reserves, national parks, and the like) and habitat management schemes (Adams, 2004). Indeed, the preservation of particular places is a cornerstone in conservation theory; albeit one increasingly challenged by changing climates, shifting species assemblages, and ideas about connectivity (see below). The notion of 'place' has, of course, been exhaustively theorized in geographic theory (Cresswell, 2004). Rather than repeat existing reviews, herein three specific sets of ideas are utilised: (i) places as relational achievements; (ii) by contrast, as discrete and bounded; and (iii) somewhat differently, as more-than-human. The first draws on Massey's (2005) sense of relational and de-centred places, and related post-structural and non-representational work (Thrift, 2008), to conceptualise places as a contingent set of possibilities rather than a final achievement. The second is Cresswell's (2004) elucidation of the ways in which constructions of places facilitate judgments that people and things can be 'in place' and 'out of place', the power relations involved in these constructions, and the subsequent derivation of moral geographies. The third is a post-humanist take on places, in which more-than-human agencies are explicitly recognised; albeit exploring these 'beastly places' (Philo and Wilbert, 2000) poses distinct epistemological challenges (Buller, 2014; Hodgetts and Lorimer, 2015). Common to all three is an understanding that place-making practices are always political.

Approaches to wildlife conservation based on the protection of static places have, in recent decades, been increasingly challenged through ideas about "connectivity" developed in conservation science and landscape ecology (Jongman and Pungetti, 2004; Crooks and Sanjayan, 2006). Specifically, two broad sets of understandings have emerged: (i) structural connectivity; and (ii) ecological (or functional) connectivity (Lindenmayer and Fischer, 2006). The first applies to the extent to which habitats are spatially linked and/or contiguous (Forman, 1995). The second instead grants conceptual priority to species' movements. Both ideas are

important in the following analysis. Yet talking simply of animal 'movements' (understood as shifts in coordinates) does not take nonhumans seriously in the way that contemporary animal and more-than-human geographies seem to demand. Third, then, the concept of 'mobility' is also developed herein in a more-than-human direction (Lorimer, 2015:177). Again diversely theorized, the various iterations of mobility in contemporary theory are linked by a commitment to go beyond 'movement': mobility is understood in terms of movement as always entangled with power and meaning (Cresswell, 2010). Expanding the concept of "animal mobilities" in the same way illuminates how ecological connectivity is generated through movements that are always more than shifts of matter through spatial co-ordinates, but rather entangled with diverse agencies and more-than-human meanings (see Lulka, 2004; Buller, 2012). Attending to animal mobilities thus illuminates the various exercises of power that enact or frustrate animal movements, the multiple logics supporting such actions, as well as the diverse implications for those involved.

4. Pine martens: spatial practices

Fieldwork stories (2013).

"Nearly there!" shouted Pete, grinning at us from the top of the ladder. He tied the washing line holding the den-box to the tree, and cut off the loose ends.

This was the second box of the day, and it had been hard work. We were deep inside a nature reserve, a steep-sided deciduous woodland in the Cambrian mountains of Wales. Amongst other things, this area contained an important assemblage of lichens, and we were under orders not to disturb or damage them. Carrying the box, ladder and climbing equipment up the hill-side had been a complicated affair, as our chaperone – the local reserve manager – ensured we kept our hands and feet away from the rarities. Keeping balance on the uneven ascent was not helped by the constant assault of midges, intent on sharing our blood.

"Okay, try it now". I eased the tension on the winch-line, letting the den-box settle into place. It was square on the tree, and tightly-mounted. Perfect.

"Happy Rhondda?" Pete asked the reserve manager.

"Yes. But be careful on the way down!"

Pine martens, carnivorous cat-sized mustelid relatives of stoats, weasels and polecats, are thought to be very rare in England and Wales, stemming from a history of habitat loss, hunting for fur, and particularly persecution by gamekeepers (Harris and Yalden, 2008). Indeed, since the 1990s there has been some debate as to whether there are any 'viable' populations remaining in the two countries at all (Birks and Messenger, 2010). Significant efforts by a procession of ecologists in England and Wales have failed to establish the precise locations of any extant populations. Instead, conservation professionals are forced to rely on lay knowledges. Possible and probable sightings have been collated to produce potential distribution maps; these suggest that pine marten refugia in Wales might be located somewhere in the Cambrian mountains, with three areas of possible concentration towards the north, middle, and south of the range (Birks and Messenger, 2010). Connectivity, conservationists suggest in both conversation and written reports, is crucial if these pine martens are going to survive; isolated populations face the universal threats of in-breeding depression and stochastic extinction.

Conservation action is complicated when species presence is uncertain, places cannot be specified, and locations become vague (Lorimer, 2008). Hinchliffe (2008) has written of how conservation in practice (compared with theory) often revolves around the 'making present' of elusive and rare creatures; similar problems of 'making present' apply within pine marten conservation. In

2013, when this research took place, there was not an identifiable nature reserve, woodland, or mixed habitat in either England or Wales where enthusiasts could focus their attention in the knowledge that pine martens were present.

A traditional and widespread approach to producing presence in conservation has been the production of conservation-places (Adams, 2004). This form of place-making can confirm likely presences as well as establish new inhabitations. It often involves the creation of structures for nesting or denning; or sometimes wider habitat construction schemes. Place-making seems of a similar hue in pine marten conservation. It revolves around the installation of den-boxes throughout the landscape. These boxes are reminiscent of those for large birds such as owls (albeit with different entrance designs and size specifications), constructed from sheets of marine-grade plywood and hoisted into suitable trees to provide denning sites for any pine martens that might be in the vicinity. Den-boxes are required because of the history of commercial timber extraction in the Welsh uplands that has left many areas bereft of old, gnarly trees – the sort that develop holes and crevices through long-lived histories, and in which martens prefer to make their homes (safe from goshawk above, and foxes below). Through installing many such boxes throughout western Wales, conservationists hope to produce a range of possible places for martens – and thus also facilitate the movement of organisms through this range. They thus work on ecological, rather than spatial, logics of connectivity: as marten habitats are connected not through planting corridors of trees, but through the provision of wayside lodgings. Indeed, whilst pine marten conservationists have limited options if attempting to facilitate spatial connectivity (given competing land uses, fragmented tenure, and expensive real estate), den-boxes are cheap and (relatively) easy to install. By the end of 2013, over fifty of these boxes had been positioned throughout west Wales, from the Tywi in the south to Snowdonia in the north. They were erected by a combination of professional conservationists and volunteers; in commercial plantations, private woodlands, in Forestry Commission estates and in nature reserves; in areas where pine martens are suspected to reside as well as the areas in-between.

Providing den-boxes in (expert designated) ‘suitable’ habitat addresses absence through making places; yet in departure from traditional modes of place-production found in ‘protected area’ conservation (i.e. designating reserves), it does so in a non-prescriptive manner. The aim is not to demarcate particular sites; rather, it is to improve the possibilities and permeability of a huge area that stretches more than a hundred miles from north to south. After all, conservationists do not know exactly where martens reside, and therefore don’t know which boxes are more or less likely to be used. If the installation of a den-box is understood as the making of a ‘potential’ place, then it is only through inhabitation that such potential can be fulfilled. Thus, whether conceived in terms of place-making, or through the related geographic concept of territorialisation which is perhaps more applicable to the wider scale of movement facilitated through multiple boxes (see Peluso and Lund, 2011: 673), it is through animal mobilities that the potential is realised. Indeed, as Metzger has argued, understanding animal territories as more-than-human achievements leads, “to the insight that the phenomenon of place is in no way exclusive to human existence” (2014:1002). However, of the boxes installed in Wales, none had been confirmed as inhabited during 2013. These more-than-human places or territories are thus best understood not in terms of bounded specificities but possibilities; in Massey’s terms as, “an ever-shifting constellation of trajectories” (2005:151), where the agency of conservationists can combine with the mobilities of martens and more besides.

There is, therefore, a particular form of biopolitics being enacted here. Indeed, the distinction made by Foucault, in the 1977–78

Security, Territory, Population lectures at the Collège de France (Foucault, 2007) between ‘discipline’ and ‘security’ as modes of power is particularly relevant. Discipline, he suggests, “structures a space and addresses the essential problem of a hierarchical and functional distribution of elements”, whilst security, “will try to plan a milieu in terms of events or series of events or possible elements ... It refers to the temporal and the uncertain, which have to be inserted within a given space” (2007: 20). Following these logics, traditional protected area-style approaches to conservation can be conceived as operating through apparatuses of discipline, since their mode of operation is exactly this form of spatial structuring and imposition of various (often taxonomic) hierarchies. Indeed, within the boundaries of protected areas, organisms are required to enact particular performances. By contrast, the creation of potential den-sites for martens throughout a mixed landscape operates, instead, through techniques of security – and specifically the composition of a particular milieu. Foucault continues to explain that, “the milieu appears as a field of intervention in which ... one tries to affect, precisely, a population. I mean a multiplicity of individuals who are and fundamentally and essentially only exist biologically bound to the materiality within which they live” (2007: 21). The milieu, for Foucault, is thus something upon which governmental action can intervene; it can be regulated, “which involved not so much establishing limits and frontiers, or fixing locations, as, above all and essentially, making possible, guaranteeing and ensuring circulations: the circulation of people, merchandise, and air, etcetera” (2007: 29). Such regulatory actions often operate through affective means (Anderson, 2012); and thus Braun (2014) has suggested that milieu can be intervened upon through technologies and landscape interventions that alter the affective experience of those involved. This then is a form of governance that operates on subjects through actions that shape their milieu (Gabrys, 2014). Again, the concepts travel well in more-than-human terrain. The spatial practices of pine marten conservationists can thus be understood as operating through techniques of security that seek to manipulate the marten milieu so as to shape possibilities for mobility and inhabitation; the ‘circulations’ in question being mobile martens.

The striking facet of the marten situation is that techniques of security are used to facilitate an affirmative biopolitics wherein the co-production of potential places works to facilitate the lives and mobilities of martens collectively and individually. In a move similar to much wildlife conservation practice, the ‘population’ is constituted by martens as a species (Biermann and Mansfield, 2014); they are the subjects in and of these biopolitical practices. Yet also, following Haraway (2008), this situation might be additionally be theorized as a biopolitics of ‘living with’ (see Lorimer and Driessen, 2011); enacted deliberately through specific practices in which humans and pine martens join as subjects in a multi-species population. But either way, the martens are figured as both the *subjects* of a more-than-human politics and thus – in meaningful way, albeit not in the classical liberal sense – as ‘political subjects’. This notion of political subjecthood thus applies inasmuch as they are treated as the ‘ends’ of politics rather than as the ‘means’ to achieving other ends; i.e. they are the intended political beneficiaries in their own right.

In this situation, then, the multiplicity of conservation biopolitics does not engender much friction: there is no denial of subject-status by different modes of power, but a coincidence and affirmative widening of status. In many ways, it is representative of a widespread mode of affirmative biopolitics in conservation action, in which places are made by humans for nonhumans, and connectivity and mobility encouraged at a range of scales: from garden birdboxes to international wetland networks. Yet by no means all conservation action follows the same path. For example, whereas the affirmative practices of pine marten

conservationists open up space for connectivity and mobility, by contrast much of the work carried out in aid of red squirrels in England and Wales explicitly aims to close them both down – as the next section explains.

5. Squirrels: spatial practices

Fieldwork stories (2013).

“Over here!” called Susan, in tones of hushed urgency. “We’ve got one”.

One, in this context, was a red squirrel, lured by corn kernels and hazelnuts into a well-hidden trap. Gareth and I hurried over from our side of the forest track to have a look. Susan proceeded to cajole the squirrel into a measuring device (somewhat reminiscent of a bird feeder) so that it could be scanned, measured and weighed. If this squirrel had been encountered before, it would have been fitted with a PIT (Passive Integrated Transponder) tag: a sub-skin microchip that can be read by a hand-held scanner. It turned out that this squirrel was indeed a repeat visitor – the week before, it had been munching hazelnuts on the other side of the ravine; quite a traverse, we all remarked, from there to here. Susan was efficient, completing the necessary audit as quickly as possible so as to minimise any distress to the animal. Soon it was loose again, scampering a few metres across the forest floor to the nearest lodgepole pine before taking off into the upper canopy. I found myself reflecting on the thought that if the squirrel in this trap had been grey, not red, its fate would have been very different. It is illegal to release grey squirrels in the UK, and that includes those caught whilst surveying. In practice, whilst this red was handled with care and quickly released, the greys are usually culled.

In red squirrel conservation in England and Wales, the situation is usually presented by conservationists thus: the native red squirrel, *Sciurus vulgaris*, is threatened with local extinction by the spread of the invasive grey squirrel *Sciurus carolinensis*. The larger greys outcompete the native reds (Gurnell et al., 2004), but more important is their role as a vector of disease, and in particular the squirrel poxvirus. This virus has very little impact on the greys carrying it, but devastates populations of reds, with mortality usually occurring within around 14 days of transmission (Rushton et al., 2006). As a result, it is thought that red squirrels have been wiped out from large areas of England and Wales through an advancing wave of disease, and the lively colonists following in its wake. Total eradication of the greys, often a preferred management option where invasive species are concerned, does not appear feasible throughout all of England and Wales. Greys are too widespread, the resources necessary for eradication are not available; and also there are significant questions over the level of public support a full-scale cull would have (Dandy et al., 2012). Thus, whilst a century ago red squirrels were widespread across Wales and England, current populations are limited to a few islands, a few small areas in mid-Wales, and a larger area in the north of England, centred on blocks of coniferous forest in Cumbria and Northumberland. Given the situation, connectivity is held to be a bad thing; indeed, conservation action largely involves efforts to prevent (possibly infected) grey squirrels from reaching the few areas where red squirrels remain.

In the north of England – which is largely representative of action across both England and Wales – conservationists seek to protect red squirrels through controlling ecological, rather than structural, connectivity. Northern reds tend to be found in or near upland conifer plantations, but not necessarily because these are prime habitat for the species. Instead, the conservationists involved suggest that the larger greys struggle to colonise resource-poor coniferous woodlands (particularly those dominated by tree species like sitka spruce), whereas low-density populations

of the smaller reds can subsist, leaving these reds less affected by incoming competition or disease. Controlling connectivity does not, in this case, imply implementing spatial habitat disconnection; there is no action to make the woodlands of the north of England more isolated, or more fragmented. Instead, ecological connectivity is controlled at a species-level. In the mixed and deciduous woodlands between the conifer islands, greys are held back through an extensive extirpation programme. The aim is to create virtual barriers through enacting trapping zones that reduce the landscape permeability to as near as zero as practically possible.

Ecological disconnectivity is enacted by a collective of actors willing to support, fund or carry out culling of the greys. Until recently the control work was conducted almost exclusively by a loose alliance of local voluntary groups; but in the last decade action has become increasingly co-ordinated at a regional scale through volunteer forums, driven by the realisation that controlling squirrel movements locally can be undermined by a lack of action in neighbouring areas. This co-operation has been further bolstered since early 2012 by the establishment of Red Squirrels Northern England (RSNE), a new regional body with professional conservation staff set up with funding from both public and private sources. RSNE's aim is to protect red squirrels through preventing the ingress of greys; and they employ a number of ‘rangers’ (15 at the end of 2012) whose primary role is grey squirrel control. The conservation strategy centres on the defence of 17 key ‘strongholds’ (comprising a core reserve and a buffer zone) where red squirrel populations still exist, and the prevention of grey squirrels from reaching these areas through a programme of trapping both inside and in the adjacent buffer zones. The strongholds are located in (largely commercial) conifer plantations around 200 ha in size, and were designated by the Forestry Commission in conjunction with the UK Red Squirrel Group (an umbrella group of involved agencies and scientists). In practical terms, this reserve-style designation simply means that government funding is available in these areas for grey squirrel control. Although there is no obligation on land managers to apply for or implement control activities, commercial foresters tend to utilise the scheme as grey squirrels can cause extensive and expensive damage to plantations; the financial impact of grey squirrel damage on UK forestry has been estimated as over £6 million each year (Williams et al., 2010).

The predominant regional strategy is thus bounded and prescriptive. The various groups seek to prevent the incursion of greys, and to retain and defend purified places in which reds (and timber crops) can survive. It entails a constant battle, in which the agency of red and grey squirrels alike must be contended with – for, as much as grey squirrels may attempt to transgress ‘red areas’ and ‘strongholds’, so the red inhabitants of these areas may venture outside and come into contact with pox-transmitting greys. In so doing, the reds may bring an unwanted viral passenger with them on their return. Thus, these borders, despite the best efforts of those who police them, are never bio-secure: grey squirrels can be stopped in their tracks, but viruses are more elusive immigrants. Both greys and reds can be ‘out of place’; disease outbreaks occur on both sides of the human-demarcated borders. Turning to the viral scale opens possible alternative futures involving immunoccontraceptives, vaccines or other pathways to immunity, but with research years from completion these remain opaque at present. For now, squirrel conservation appears locked into a particular groove of disciplinary control.

Squirrel conservation operates according to the familiar anatomo-political (relating to bodies) and biopolitical (relating to populations) logics of nativeness, invasion, and biosecurity. Red squirrels, constructed and understood as a ‘native’ population, are valued over the ‘invasive’ (and economically damaging) grey. Greys are judged ‘abnormal’: as ‘threats’ (see Biermann and

Mansfield, 2014). Rhetorical tactics reify the native; vilify the invader. There is some disagreement amongst conservation biologists around the exact definitions of both ‘invasive’ and ‘alien’, and the important differences between the two, but as Fall (2013: 170) notes, “invasiveness generally refers to the behaviour of an organism, while alienness (and, conversely nativeness) refers to its belonging in a certain place”. The assignment of place and value to forms of life is, of course, far from being an objective act (Davis et al., 2011); and attending to the politics at work in the biology of invasive species has enabled the articulation of powerful critiques of the notions of ‘natives’, ‘aliens’, ‘invasives’, and the uncomfortable and oftentimes xenophobic discursive echoes they engender (Comaroff and Comaroff, 2001; Warren, 2007; Fall, 2013; Gibbs et al., 2015). Yet despite such concerns, logics of nativity and invasion remain strongly influential in contemporary conservation practice. In continental Europe the red squirrel is not currently endangered; indeed, they continue to flourish in many countries although some ecologists fear this may change with the spread of grey squirrels already established in areas of Italy (Bertolino and Genovesi, 2003). But it matters to those involved in conservation activities that the species is both ‘native’ and at risk of extinction in England and Wales, despite this contemporary abundance overseas. Individual squirrels are thus subsumed into nationalised concerns about the survival of specific located populations (understood along species lines).

Braun, amongst others, has usefully conceptualised biosecurity practices in terms of biopolitics, suggesting that “biosecurities can be seen to invest in life through making cuts into the fabric of life as a whole, whereby those forms of life deserving of protection are separated from those that can be sacrificed” (2013: 46). There is such a mode of biosecurity at work in squirrel conservation, where the populations of red squirrels are secured through policing the vitality of greys and the viral pathogens that accompany them. Yet unlike the mode of security operating through the marten milieu (see earlier), red squirrel conservation is practiced through techniques of discipline as well as security: attempts at structuring space (through reserves, islands and peninsulas), requiring particular individual performances (not transgressing boundaries) and imposing hierarchies (through selective culling of greys to protect reds). The forms of power being enacted are evidently multiple.

Despite these efforts at control, there is a tension between imaginaries of purified space/place (where native ecologies flourish free from the impact of invasive competitors and disease) and the materialities of porous borders (where red and grey squirrels, and viruses, repeatedly transgress). As Hinchliffe et al. (2013: 531) have recently suggested, biosecurity in practice is more concerned with “borderlands” than “borderlines”; spatial ideas about segregation are thus better re-imagined as “topologies of infected life”. This reading of connectivity moves way from the iron-grid of “extended” space, and instead emphasizes, “a topological landscape of embeddings and disembeddings, where disease registers its presence through the density of its intra-actions” (2013:538). Barker (2008:1600) makes a similar point with respect to biosecurity practices and invasive species in New Zealand, noting, “boundaries that are blurred, that move around, that fold”. Red squirrel conservation is perhaps better understood in such topological terms. In practice, actions are not limited to securing the barriers of reserves. Biosecurity is achieved (if at all) through preventing ecological connectivity in the wider landscape for invasive greys. It is lands, not lines, which are policed for transgressions; but the achievement is never final, never complete.

By analogy, squirrel conservationists are thus also faced – like pine marten conservationists – with problems of ‘circulation’; except this time the value of such circulations is not always positive, but judged through binary logics of desirability. As Foucault notes, in the historical shift from singular modes of sovereign rule

towards multiple modes of governance that additionally utilise apparatuses of security, “we see the emergence of a completely different problem that is no longer that of fixing and demarcating the territory, but of allowing circulations to take place, of controlling them, sifting the good and the bad, ensuring that things are always in movement, constantly moving around, continually going from one point to another, but in such a way that the inherent dangers of this circulation are cancelled out” (Foucault, 2007:65). Selectively managing circulations is fundamental to practices of biosecurity (Hinchliffe and Lavau, 2013; Hinchliffe and Ward, 2014). The techniques required to manage squirrel ‘circulations’ thus include spatial practices of both discipline and security; as the squirrel milieu is planned and managed through techniques of trapping and selective culling that operate across the borders and boundaries of disciplinary spaces targeted at species populations and enforced through individual bodies.

By contrast to pine marten conservation, it is difficult to trace an affirmative biopolitics in squirrel conservation, operating as it does through the practice of imposing death on some woodland mammals (disciplined as individuals) in order to facilitate the lives of others (securitised as a population). Whilst red squirrels are treated as ‘subjects’ in this binary politics and ‘protected’ for their own sakes, the framing of greys as ‘invasive’ and ‘alien’ allows for them to be treated quite differently: as objects rather than subjects, to be forcibly removed and killed (albeit in accordance with strict animal welfare laws). Yet this reading is problematic because, for the people involved, culling greys is seen as an ethical necessity: necessary to protect red squirrels from extinction in the UK. Indeed, for those involved, not acting to protect red squirrels would be morally objectionable. An affirmative biopolitics of ‘living with’ that allowed for the continuing flourishing of grey squirrels, according to such logics, would not be affirmative for long when considering the position of reds. The conservation public assembled here is thus committed to making difficult decisions about the ‘sacrifices’ (to re-iterate Braun’s terminology) that need to be made in order to protect particular kinds of life. Indeed, biopolitics in the Foucaultian sense recognises this inextricable connection between making live and making die; and thus needn’t be collapsed solely into the latter (Anderson, 2012:30). As noted earlier, Srinivasan suggests that conservation biopolitics often thus entangles practices of both “harm and care” (2014:501). Nevertheless, it is the differential ascription of political status (subject/object) that allows for and is enacted through the binary treatment of the two squirrel species.

6. Animal places, self-governing, and subjectification

Returning to pine marten conservation, the paper has already described how den-boxes have been utilised to enable marten mobilities. However, given the very small number of martens thought to remain, more radical action has been deemed necessary to safeguard the species (VWT, 2014). Augmenting the remaining population with trans-located pine martens from the resurgent Scottish population has been periodically suggested in recent decades, and in the Autumn of 2015 the first such martens were officially released (twenty in all, with more planned for 2016). Some have already taken up residence in the den boxes discussed earlier, much to the delight of those who had lugged the boxes into place (the author included). ‘Reinforcing’ an existing population plays to a different discursive register, legal and otherwise, than the idea of a species reintroduction; and the contemporary (albeit elusive) presence of pine martens matters here. Facilitating recovery is a more traditional, less controversial, mode of conservation compared to ideas about ‘rewilding’ (Lorimer and Driessen, 2011); but there were still ecological and social issues that conservationists

had to consider, which included contemporary habitat suitability for martens, the possible effects on existing population genetics, and the potential impacts of higher pine marten populations on prey species, both captive and wild-living.

This is where the stories of squirrels and martens meet. Ecological research conducted in Ireland has begun to offer scientific support for the idea (locally, and more widely, held) that the presence of pine martens in an area can drive out grey squirrels, and also thus allow red squirrel populations to recover or re-colonize (Stokstad, 2016). The precise ecological mechanisms are yet to be fully demonstrated, but the decline of grey squirrels is suspected to be due to a mixture of direct predation by martens, and resulting predator avoidance behaviour by the greys. By contrast, and perhaps surprisingly, red squirrels (much smaller than their grey counterparts) seem to be much less perturbed by the presence of pine martens, and have been recorded (re)inhabiting overlapping spatial areas (Sheehy and Lawton, 2014). As such, and as explained to the author in a series of interviews and meetings in 2013/4, local support for augmenting the Welsh marten population is increasing amongst some forestry operators for whom the damage inflicted on plantations by grey squirrels can be a significant economic cost. Some conservationists also speculate in conversation that augmenting pine marten populations *might* be beneficial for the conservation of red squirrels. However, there are significant caveats regarding the applicability of the Irish research to the Welsh or English contexts, not the least of which relates to differences in forest composition, and significant divergence of opinion surrounds the idea of utilising martens to control greys. Memories are long in conservation, and the introduction of predators to control invasive species has a controversial track record (Buller, 2013); albeit the difference in this case is that the predator is already part of the region's historic ecology. The marten augmentation project, therefore, is categorically not justified in terms of either grey squirrel control or red squirrel conservation; martens are considered on their own terms; yet there is hope amongst some red squirrel enthusiasts and some foresters (far from mutually exclusive categories) about what an augmentation of pine martens might augur. And the politics of hope is important in this situation.

The possibilities sparked through re-stocking point towards additional modes of spatial biopolitics enacted in this coming-together. Alongside the biopolitics of species conservation and invasive control is another form of political rationality that focuses on wider eco-systemic functions – or ‘ecological processes’, in the terms of conservation science (Pressey et al., 2007). To be specific: despite the official justifications, some of the political and economic support for marten augmentation comes not from a concern for either martens or squirrels (as species), but from targeting particular ecological processes as essential to achieving desirable system properties (i.e. released pine martens driving out grey squirrels, leading to the flourishing of plantation forestry). Thus whilst the required practices to enact conservation goals may appear singular in this situation (releasing more pine martens into the area), the modes of biopolitics in action are again multiple.

Baldwin's (2013) concept of “vital ecosystem security” is helpful here. He draws on Collier and Lakoff's analysis of “vital systems security” in the management of emergency, to describe a mode of biopolitics that targets the wider ecosystems that support (human) life rather than the familiar form of ‘population’ biopolitics directly and solely concerned with the health of specific (human) populations. Introducing pine martens with a hope that they may predate grey squirrels and thus protect commercial forestry enacts such a form of eco-systemic biopolitics on behalf of human foresters (and also, it should be clear, red squirrels) – not simply protecting the health of (multi-species) populations directly, but encouraging particular ecological processes to inflect and shape the wider ‘vital’ system towards human ends. This is a biopolitical logic that

resonates with and in turn supports the growing discourse of ‘ecosystem services’ in wildlife conservation, a discourse that promulgates a particular economic approach to the longstanding practice of managing and valuing ecosystems for their contribution to human wellbeing (Barnaud and Antona, 2014). The operative technique works with rather than against contingency (see Dalby, 2013), as ecological systems are understood in terms of processes rather than fixed arrangements. Thus Braun has recently argued for recognising a similar “dispositif”, or “apparatus of government” in environmental management more broadly. “Of course, acting on nature to protect society is nothing new”, Braun suggests; “What is new is that one acts on nature not to change or stop natural processes, but rather to allow natural processes to occur” (2014:59).

In this multi-species population or ‘biosocial collectivity’ (Rabinow and Rose, 2006), wherein membership is not limited by species but still biopolitically governed on species-lines, a form of animal self-government is apparent. Sure, neither pine martens nor squirrels have internalised the discourse of ‘ecosystem management’ in the way usually understood in Foucaultian analyses; this is not self-government as understood in Agrawal's influential formulation (Agrawal, 2005). But neither is this simply a case of the internalisation of such discourses by human actors involved in animal management on their behalf, as theorized in Srinivasan's (2014) concept of agential subjectification. Instead, these modes of biopolitics are internalised in animal bodies and enacted through various animal mobilities and place-making activities. If a pine marten establishes a new territory; if doing so causes a grey squirrel to move, perhaps because of a newly perceived risk of predation – or perhaps actual predation; if in turn this re-makes landscapes of opportunity for red squirrels; then these various individual actions serve to further the spatial ordering and regulatory objectives of the biopolitical regime of ecosystem management. The culling of grey squirrels by human agents is thus replaced by a series of animal interactions through which various species in the multi-species population are securitised. Three ‘ifs’ might not seem solid ground for such an argument, but they are plausible ‘ifs’ based in emerging ecological data; and furthermore, this type of ecological cascade is exactly the strategy enacted time and again through habitat management and species reintroduction schemes enacted by conservationists the world over. As Sparke (2006:157) noted, “Biopolitics for Foucault included both discourses about the self-governing subject *and* the actual production of self-governed life within particular modern spaces. Some of the governmentality literature ... has not always addressed both these aspects of biopolitics”.

Yet this is not a simple tale that naively celebrates animal agency; far from it. The techniques of self-government in this mammalian triad do not make political subjects equally. In Srinivasan's terms, biopower in these human-animal interactions remains obviously “asymmetric” (2014:501; see also Cavanagh, 2014). The species-based exceptions and exclusions, based in problematic logics of nativity and invasion, remain: red squirrels are still celebrated and greys still vilified. And if support for marten augmentation comes, in part, from red squirrel conservation constituencies, then the ethical challenges relating to culling are not fully displaced through replacing traps and sacks with pine marten proxies; action-at-a-distance remains morally considerable; yet neither is this precisely the same ethical dilemma – the entrance of martens changes the relevant relations. But more importantly, this form of biopolitical logic also serves to re-make the status of even the preferred species. Under the logics of “biodiversity conservation” (and beforehand to some extent), threatened species have been identified and valued as ends in themselves. Thus, under the Biodiversity Action Plan regime that dominated UK conservation in the 1990s and early 2000s, both red squirrels and pine

martens were identified as priority species and explicit action plans were developed within government wildlife policy. They were both, in an important sense, political ‘subjects’; unlike, of course, the grey squirrels that were branded as ‘invasive’ and objectified accordingly. Contrast this to the logics at work in emerging regimes that instead emphasize the value of ‘ecosystem services’. Therein, both red squirrels and pine martens become the means through which particular (human-centric) goals are achieved. Red squirrels contribute to local economies through tourism, according to their supporters. Pine martens might protect commercial plantation forestry from the ravages of grey squirrels, or so it is hoped (according to several influential UK foresters in conversation with the author). In both cases, but particularly the latter, the animals are valued not as ends in themselves, but as the means towards anthropocentric (economically-rendered) goals. The biopolitical division is no longer between species that help or hinder the flourishing of biodiversity (as in [Biermann and Mansfield, 2014](#)); but instead, between species that help or hinder environmental management that serves human ends. This is not so much a collective ontology pertaining to the health of the ecosystem, but a human-focussed ontology secured through the ecosystem (see [Baldwin, 2013](#)). So the pine martens and (red) squirrels involved are simultaneously enrolled as political subjects (in the sense of self-government outlined above), and as political objects (as mechanisms to achieve systemic goals for the benefit of human populations).

The partial objectification of animals found in this nuanced account of ‘animal subjectification’ is of course neither new nor exclusive. Not new because animals have long been objectified in and by Western culture, and because multiple logics have long coalesced in conservation practice. Despite long-running and often binary debates in environmental ethics about valuing nonhumans as ends or means, in terms of intrinsic or instrumental values (see [Sagoff, 2009](#)), conservation in practice has often occurred through the coming-together of differently motivated actors with diverse and sometimes conflicting affiliations and worldviews. Conservation benefits have often been judged simultaneously in ecological and economic terms ([Adams and Hutton, 2007](#)). And not exclusive because this coming-together can result in a biopolitical multiplicity of the sort narrated herein: in which animals are multiple, made into both subject and object through processes of subjectification. And therein lies the challenge for wildlife futures: how to reconcile this ontological multiplicity in cases of friction. This is by no means a new challenge for conservation but it is, in the contemporary moment, a pressing one.

7. Conclusion

Demonstrating the multiplicity of conservation politics is not a punchline but a starting point. Wildlife conservation has long occurred through the coming together of diverse agencies, motivations and worldviews (human and nonhuman). However, attending to the ways in which different forms of (bio)power combine together in particular contexts ([Schlosser, 2008](#)) makes apparent the underlying processes by which animals are made into both political objects and political subjects. These categories are sometimes enacted as exclusive demarcations, and allow for the binary forms of governance demonstrated with respect to different species of squirrel in England and Wales. In such situations, the binary subject/object assignation leads to very different forms of political protection: subjects are made to live; objects are excluded, removed, and ‘dispatched’ (in the language of the cull). But extending Foucaultian understandings of biopolitics to conservation situations allows for a more nuanced reading of animal subjectification: in which animals are enrolled through techniques

of ‘self-government’ that shape their mobilities to achieve wider ecosystem goals, and often for the ultimate benefit of human societies. Animals are accorded an ambiguous ethical and political status in such schemes; no longer simply the ‘subjects’ of conservation schemes justified in their own names, the involved animals are instead simultaneously subjectified through biopolitical techniques of government, and objectified as components in a system valued on anthropocentric terms. The ways in which the tension between these various forms of biopolitical subjectification are worked out in specific practices is crucial to how animals are treated in contemporary forms of wildlife governance: where and how they are made to live and die. Of course, in some ways the categories developed in this paper are too stark. There is a sense in which all conservation practices are based in diverse anthropocentric desires for encouraging particular forms of favoured life. Yet such a reading leaves little room for valuing nonhumans more on their own terms, and less on ours (see debate in [Sagoff, 2009](#)).

This reading of biopolitical animal subjectification has particular relevance to one long-standing and two emerging trends in contemporary wildlife conservation: (i) the conservation of animals for ‘multiple benefits’; (ii) the increasing influence of the ‘ecosystem services’ discourse in western conservation policies, and (iii) the emerging rewilding movement. The first and second have been touched on herein, but the implications for the political treatment of involved animals run wider: organising conservation action according to economically-figured human-focussed objectives might make tactical sense in a policy world dominated by neoliberal logics, but it also engenders an ambiguous subject-status for species that are seen as redundant in terms of ecosystem function, or that lose out in the shifting calculus of costs and benefits. The third relates to the ways in which increasingly popular and prevalent practices of ‘rewilding’ in conservation utilise animal species to enact specific ecological functions. Insodoing, such schemes ‘subjectify’ specific animals in ways concurrent with those outlined here: they are politically rendered as self-governing subjects, but simultaneously rendered as objects with ambiguous political status. For example, the infamous rewilding scheme at the Oostvaardersplassen in the Netherlands, where ‘wild’ horses were enrolled to enact ecological process but let die through starvation for the benefit of the ecosystem, led to public outcry and – ironically – the development of a human implemented culling system ([Lorimer and Driessen, 2014](#)). Attending to the ways in which animals are biopolitically subjectified thus illuminates such moments of controversy through clarifying the status of nonhuman actors in specific practices.

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References

- Adams, W., 2004. *Against Extinction: The Story of Conservation*. Earthscan, London.
- Adams, W., Hutton, J., 2007. People, parks and poverty: political ecology and biodiversity conservation. *Conserv. Soc.* 5 (2), 147–183.
- Agrawal, A., 2005. *Environmentality: Technologies of Government and the Making of Subjects*. Duke University Press, Durham NC.
- Anderson, B., 2012. Affect and biopower: towards a politics of life. *Trans. Instit. Br. Geogr.* 37, 28–43.
- Baldwin, A., 2013. Vital ecosystem security: emergence, circulation and the biopolitical environmental citizen. *Geoforum* 45, 52–61.

- Barker, K., 2008. Flexible boundaries in biosecurity: accommodating gorse in Aotearoa New Zealand. *Environ. Plann. A* 40, 1598.
- Barnaud, C., Antona, M., 2014. Deconstructing ecosystem services: uncertainties and controversies around a socially constructed concept. *Geoforum* 56, 113–123.
- Bertolino, S., Genovesi, P., 2003. Spread and attempted eradication of the grey squirrel (*Sciurus carolinensis*) in Italy, and consequences for the red squirrel (*Sciurus vulgaris*) in Eurasia. *Biol. Conserv.* 109, 351–358.
- Biermann, C., Mansfield, B., 2014. Biodiversity, purity, and death: conservation biology as biopolitics. *Environ. Plann. D: Soc. Space* 32, 257–273.
- Birks, J., Messenger, J., 2010. Evidence of Pine Martens in England and Wales, 1996–2007. Vincent Wildlife Trust, Ledbury, Herefordshire.
- Braun, B., 2013. Power over life: biosecurity as biopolitics. In: Dobson, A., Barker, K., Taylor, S. (Eds.), *Biosecurity: The Socio-Politics of Invasive Species and Infectious Diseases*. Routledge, London, pp. 45–58.
- Braun, B., 2014. A new urban dispositif? Governing life in an age of climate change. *Environ. Plann. D: Soc. Space* 32, 49–64.
- Buller, H., 2012. One slash of light, then gone. *Etudes Rurales* 1, 139–153.
- Buller, H., 2013. Individuation, the mass and farm animals. *Theory, Cult. Soc.* 30, 155–175.
- Buller, H., 2014. Animal geographies II: Methods. *Prog. Hum. Geogr.* 39 (3), 374–384.
- Cavanagh, C., 2014. Biopolitics, environmental change, and development studies. *Forum Dev. Stud.* 41, 273–294.
- Comaroff, J., Comaroff, J.L., 2001. Naturing the nation: aliens, apocalypse, and the postcolonial state. *Soc. Identities* 7, 233–265.
- Cresswell, T., 2004. *Place: A Short Introduction*. Blackwell, Malden, MA.
- Cresswell, T., 2010. Mobilities I: catching up. *Prog. Hum. Geogr.* 35, 550–558.
- Crooks, K., Sanjayan, M., 2006. *Connectivity Conservation*. Cambridge University Press, Cambridge.
- Dalby, S., 2013. Biopolitics and climate security in the Anthropocene. *Geoforum* 49, 184–192.
- Dandy, N., Ballantyne, S., Moseley, D., Gill, R., Quine, C., Van Der Wal, R., 2012. Exploring beliefs behind support for and opposition to wildlife management methods: a qualitative study. *Eur. J. Wildl. Res.* 58, 695–706.
- Davis, M., Chew, M., Hobbs, R., Lugo, A., Ewel, J., Vermeij, G., Brown, J., Rosenzweig, M., et al., 2011. Don't judge species on their origins. *Nature* 474, 153–154.
- Fall, J., 2013. Biosecurity and ecology: beyond the nativism debate. In: Dobson, A., Barker, K., Taylor, S. (Eds.), *Biosecurity: The Socio-Politics of Invasive Species and Infectious Diseases*. Routledge, London, pp. 167–182.
- Forman, R., 1995. *Land Mosaics: The Ecology of Landscapes and Regions*. Cambridge University Press, Cambridge.
- Foucault, M., 1998. *The Will To Knowledge*. Penguin, London.
- Foucault, M., 2004. *Society Must Be Defended*. Penguin, London.
- Foucault, M., 2007. *Security, Territory, Population*. Palgrave MacMillan, New York.
- Gabrys, J., 2014. Programming environments: environmentality and citizen sensing in the smart city. *Environ. Plann. D: Soc. Space* 32, 30–48.
- Gibbs, L., Atchison, J., Macfarlane, I., 2015. Camel country: assemblage, belonging and scale in invasive species geographies. *Geoforum* 58, 56–67.
- Gurnell, J., Wauters, L., Lurz, P., Tosi, G., 2004. Alien species and interspecific competition: effects of introduced eastern grey squirrels on red squirrel population dynamics. *J. Anim. Ecol.* 73, 26–35.
- Haraway, D., 2008. *When Species Meet*. University of Minnesota Press, Minneapolis.
- Harris, S., Yalden, D., 2008. *Mammals of the British Isles: Handbook*. Mammal Society, Southampton.
- Hinchliffe, S., 2008. Reconstituting nature conservation: towards a careful political ecology. *Geoforum* 39, 88–97.
- Hinchliffe, S., Bingham, N., 2008. Securing life: the emerging practices of biosecurity. *Environ. Plann. A* 40, 1534–1551.
- Hinchliffe, S., Allen, J., Lavau, S., Bingham, N., Carter, S., 2013. Biosecurity and the topologies of infected life: from borderlines to borderlands. *Trans. Instit. Br. Geogr.* 38, 531–543.
- Hinchliffe, S., Lavau, S., 2013. Differentiated circuits: the ecologies of knowing and securing life. *Environ. Plann. D: Soc. Space* 31, 259–274.
- Hinchliffe, S., Ward, K., 2014. Geographies of folded life: how immunity reframes biosecurity. *Geoforum* 53, 136–144.
- Hobson, K., 2007. Political animals? On animals as subjects in an enlarged political geography. *Polit. Geogr.* 26, 250–267.
- Hodgetts, T., Lorimer, J., 2015. Methodologies for animals' geographies: cultures, communication and genomics. *Cult. Geogr.* 22, 285–295.
- Holloway, L., Morris, C., Gilna, B., Gibbs, D., 2009. Biopower, genetics and livestock breeding: (re)constituting animal populations and heterogeneous biosocial collectivities. *Trans. Instit. Br. Geogr.* 34, 394–407.
- Jongman, R., Pungetti, G., 2004. *Ecological Networks and Greenways: Concept, Design, Implementation*. Cambridge University Press, Cambridge.
- Lindenmayer, D., Fischer, J., 2006. *Habitat Fragmentation and Landscape Change: An Ecological and Conservation Synthesis*. Island Press, Washington.
- Lorimer, J., 2008. Counting corncrakes the affective science of the UK corncrake census. *Soc. Stud. Sci.* 38, 377–403.
- Lorimer, J., 2015. *Wildlife in the Anthropocene: Conservation After Nature*. University of Minnesota Press, Minneapolis.
- Lorimer, J., Driessen, C., 2011. Bovine biopolitics and the promise of monsters in the rewilding of Heck cattle. *Geoforum* 48, 249–259.
- Lorimer, J., Driessen, C., 2014. Wild experiments at the Oostvaardersplassen: rethinking environmentalism in the Anthropocene. *Trans. Instit. Br. Geogr.* 39, 169–181.
- Lulka, D., 2004. Stabilizing the herd: fixing the identity of nonhumans. *Environ. Plann. D: Soc. Space* 22, 439–463.
- Massey, D., 2005. *For Space*. SAGE, London.
- Metzger, J., 2014. Spatial planning and/as caring for more-than-human place. *Environ. Plann. A* 46, 1001–1011.
- Peluso, N., Lund, C., 2011. New frontiers of land control: introduction. *J. Peasant Stud.* 38 (4), 667–681.
- Philo, C., Wilbert, C., 2000. *Animal Spaces, Beastly Places: New Geographies of Human-Animal Relations*. Routledge, London.
- Pressey, R., Cabeza, M., Watts, M., Cowling, R., Wilson, K., 2007. Conservation planning in a changing world. *Trends Ecol. Evol.* 22, 583–592.
- Rushton, S., Lurz, P., Gurnell, J., Nettleton, P., Bruemmer, C., Shirley, M., Sainsbury, A., 2006. Disease threats posed by alien species: the role of a poxvirus in the decline of the native red squirrel in Britain. *Epidemiol. Infect.* 134, 521–533.
- Rabinow, P., Rose, N., 2006. Biopower today. *BioSocieties* 1, 195–217.
- Rutherford, P., Rutherford, S., 2013a. The confusions and exuberances of biopolitics. *Geogr. Compass* 7, 412–422.
- Rutherford, S., Rutherford, P., 2013b. Geography and biopolitics. *Geography. Compass* 7, 423–434.
- Sagoff, M., 2009. Intrinsic value: a reply to Justus et al. *Trends Ecol. Evol.* 24, 643.
- Schlosser, K., 2008. Bio-political geographies. *Geogr. Compass* 2 (5), 1621–1634.
- Sheehy, E., Lawton, C., 2014. Population crash in an invasive species following the recovery of a native predator: the case of the American grey squirrel and the European pine marten in Ireland. *Biodivers. Conserv.* 23 (3), 753–774.
- Srinivasan, K., 2013. The biopolitics of animal being and welfare: dog control and care in the UK and India. *Trans. Instit. Br. Geogr.* 38, 106–119.
- Srinivasan, K., 2014. Caring for the collective: biopower and agential subjectification in wildlife conservation. *Environ. Plann. D: Soc. Space* 32, 501–517.
- Sparke, M., 2006. A neoliberal nexus: economy, security and the biopolitics of citizenship on the border. *Polit. Geogr.* 25, 151–180.
- Stokstad, E., 2016. Red squirrels rising. *Science* 352 (6291), 1268–1271.
- Thrift, N., 2008. *Non-representational theory: space, politics, affect*. Routledge, Abingdon.
- Urbanik, J., 2012. *Placing Animals: An Introduction to the Geography of Human-Animal Relations*. Rowman & Littlefield, Lanham.
- VWT, 2014. *Pine Marten Reinforcement Feasibility Study*. Vincent Wildlife Trust, Ledbury.
- Warren, C., 2007. Perspectives on the 'alien' versus 'native' species debate: a critique of concepts, language and practice. *Prog. Hum. Geogr.* 31, 427–446.
- Whatmore, S., 2002. *Hybrid Geographies: Natures, Cultures, Spaces*. SAGE, London.
- Williams, F., Eschen, R., Harris, A., Djedjour, D., Pratt, C., Shaw, R., Varia, S., Lamontagne-Godwin, J., et al., 2010. *The Economic Cost of Invasive Non-Native Species on Great Britain*. CABI, Wallingford.
- Yalden, D., 1999. *The History of British Mammals*. T. and A.D. Poyser, London.