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Beekeeping, stewardship and multispecies care in rural contexts

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Abstract

Rural society consists of both humans and other-than-human species, whose needs may appear to contradict each other. There is a growing awareness of the shared ecological fate of all members of this interspecies community and the importance of transitioning to more caring, sustainable relationships between species. Various rural activities, and relationships with other species, are considered to be avenues for promoting care and stewardship of other-than-human species. Using interviews, archives and ethnographic research, this article explores how beekeepers navigate multiple and interrelated challenges as they care for their bees and the implications of this care for other species. The beekeeping community is heterogeneous and experiencing dramatic changes. This article finds that beekeepers have different motivations underpinning their diverse practices, yet all share a sense of stewardship for their own bees and for the wider physical environment; this manifests in their understanding of and interactions with other members of rural society. We propose that interspecies understandings and caring relationships, as exemplified within beekeeping, can support efforts towards sustainable socio-ecological transitions.

KEYWORDS
beekeeping, care, interspecies relationships, multispecies ethnography, rural society, stewardship

INTRODUCTION

Rural society is socially diverse and complex (Woods, 2010). This social complexity is not limited to humans; animals, and their relationships with humans in these spaces, are central to our understanding of rural society (Buller, 2013; Philo, 1995; Philo & Wilbert, 2000). Recent years have seen growing engagement with rural human societies' shared lives with the other-than-human societies in these spaces (Sutherland et al., 2019; Wadham et al., 2022). Attention frequently focuses on archetypal rural animals—but less visible life forms are also central to rural society. This is particularly relevant when considering agriculture, a practice that for many is an inherent hallmark of 'the rural' (Riley & Harvey, 2007). Whether we are considering the dynamic ecosystems of healthy soils on which all societies depend (Pigott, 2021), the political ecology of bovine tuberculosis (TB) (Robinson, 2017) or Scottish crofters' relationships with varied bird species (Fry, 2023), it is clear that rural societies fundamentally consist of myriad species interlinked in diverse ways, that impact and are impacted by anthropogenic behaviours within and beyond rural spaces. This is particularly relevant for wild and managed pollinators (Brown et al., 2016; Phillips, 2014).

In recent years, the welfare of bees and other pollinators has become a focus of interest linked to key rural issues such as the agricultural economy and biodiversity (Breeze et al., 2011; Gill et al., 2016). Beekeeping is an ancient practice (Crane, 2004; Walker & Crane, 2001) deeply embedded in rural society (Miller, 1911; Phillips, 2014). Since the early 2000s, dramatic and unusual levels of honey bee colony deaths in North America (vanEngelsdorp & Meixner, 2010) and Europe, including the UK (Potts et al., 2010), have driven increased scientific research into the causes of the decline of this key animal member of rural society. An initial focus on the plight of *Apis mellifera*—honey bees—has broadened into debates on the negative implications of modern agricultural practices on diverse insect groups and the implications of these declines for both food production and rural agricultural communities (Cilia, 2020; Sánchez-Bayo & Wyckhuys, 2019; Sanchez-Bayo et al., 2016).

As farmers and rural land managers aim to maintain the environment to support both human and pollinator wellbeing (Burkle et al., 2017; Tamburini et al., 2020), it is proposed that the earlier scientific focus on pollinator population declines needs to draw on a broader understanding of health that addresses socio-ecological factors (Cilia, 2019) and landscape management (Ellis et al., 2020; Marshman, 2019). Lezaun (2011) emphasises that honey bees are embedded in a complex web of interspecies dynamics with diverse human actors, including beekeepers, agrochemical retailers, policymakers, the media and environmental campaigners, amongst others. Beekeepers are recognised as monitors and stewards of bee health and, by extension, of pollinator wellbeing (Maderson & Wynne-Jones, 2016). While beekeepers hold differing views of what it means to care for bees, and what practices underpin stewardship (Thoms et al., 2019), all note the vulnerability of bees and the importance of exercising care for their wellbeing. There is, however, limited knowledge about the nature and complexities of the care that is given to this very different sort of livestock in a rural environment. Further exploration of its interspecies nature, and the

relationships between humans and other community members, is central to understanding rural society (Tovey, 2003) and enhancing socio-ecological sustainability (Wadham, 2020).

This article argues that beekeepers' knowledge and practices are relevant to other actors engaged in supporting interspecies relationships of care in rural society. It explores how beekeepers care for their bees, notions of what it means to care and who is responsible for challenges to bee—and other species'—wellbeing. We show how beekeepers develop a deeply empathetic sense of bees and wider environmental vulnerability, which influence how they enact differing forms of care. Through their care for bees, beekeepers are embedded within rural societies, developing and applying a distinct knowledge and identity within their communities. We explore beekeepers' engagement with landscapes and landowners and the relationships and tensions within the beekeeping community and with other members of the rural community. We argue that beekeepers' engagement with a specific semi-wild non-human species promotes human engagement with multiple species, as well as hitherto undervalued forms of knowledge about animal species. This is pertinent to contemporary questions surrounding rural landscape management, including concerns about the impact of agrochemicals used in the food system (Cilia, 2019; Durant, 2020) recent shifts in agricultural production to reflect the importance of non-honey bee pollinator species (Breeze et al., 2011) as well as wider negotiations surrounding other species in an increasingly technocratically understood and managed rural landscape (Rose et al., 2021).

CONTEXTUAL FRAMEWORK

Bee health as a proxy indicator for rural ecological wellbeing

Rural societies, including humans and the wider natural world, face a plethora of novel socio-ecological challenges; many of which necessitate a reappraisal of our understanding of, and relationships with, other species (Biermann, 2021; West et al., 2018). The recent Values Assessment from the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services emphasises the importance of a reconsideration of the values that underpin human relationships to the rest of the environment and the myriad species with which we cohabit the earth (IPBES, 2022). While multispecies ethnographies have explored human relationships with companion animals (Coulter, 2016; Cudworth, 2021), horses (Wadham, 2020) and charismatic megafauna (Lorimer, 2015), many of the species central to stable ecosystem functioning are less visible, creating significant obstacles to direct engagement and study. As a result, less charismatic, particularly non-mammalian, species are generally underrepresented in multispecies ethnographies and rural sociology (Maderson & Elsner-Adams, 2023).

Honey bees occupy a unique place in biological and ecological circles: Highly charismatic, closely monitored by beekeepers and (unlike other livestock species) dependent on their environment for nutrition, they can act as indicators of the overall health or ill-health of interspecies relationships and the environment (Gross, 2014; Kevan, 1999). In many regards, they meet the criteria of 'charismatic non-humans' as outlined by Lorimer (2007). They also function as 'flagship species', understood here as 'popular, charismatic species that serve as symbols and rallying points to stimulate conservation awareness and action' (Leader-Williams & Dublin, 2000, p. 60). Yet arguably, the response to their decline has been predominantly framed through the lens of the risk of the loss of the ecosystem service (ES) of pollination and the consequences for human wellbeing (Gill et al., 2016). The response has been a sharp increase in biologically focused research into the many challenges faced by the species, such as viruses (Budge et al., 2020; Wilfert et al.,

2016), complex interactions between multiple stresses and pathogens (Little et al., 2016; Sandrock et al., 2014; Youngsteadt et al., 2015) and environmental challenges, including declining quality and quantity of forage and climate change (Brown et al., 2016). Many of these challenges are also problematic for other pollinator species (ibid.). Mirroring this dominant epidemiological model (Suryanarayanan & Kleinman, 2013), the range of possible solutions to honey bee ill-health has been particularly technocratic and detailed, such as increasing in-hive bee health management and behaviour monitoring technology (Ai & Takahashi, 2021; Henry et al., 2019). Beekeepers are increasingly encouraged to utilise technological developments to maintain the health of their bees (Cilia, 2020).

While great advances in knowledge of bee health have been made, reliance solely on conventional scientific inquiry as a method for understanding this species has significant limitations (Maxim & van der Sluijs, 2007; van der Sluijs et al., 2013; Suryanarayanan, 2013). Crucially, what has been lost is the systemic environmental perspective beekeepers develop and use throughout their practice (Coh-Martinez et al., 2019; Phillips, 2014), which is potentially valuable in understanding the complexity of pollinator decline. Ecological discussions of how best to secure ESs and biodiversity increasingly note the need for more systemic approaches that forefront the knowledge of diverse communities, whose lives are often enmeshed with those of other species (Hill et al., 2020; Tengo et al., 2017). This will require equitable engagement with the knowledge and perspective of diverse communities, who are frequently overlooked due to imbalances in power and privilege (Turnhout et al., 2020).

Pollinator decline is happening in the countryside that is often understood by rural societies using embodied knowledge where 'mind is body, consciousness is corporeal, and thinking is sensuous' (Carolan, 2008, p. 409). This embodied knowledge is a valuable component of understanding environmental challenges and complexities (Brace & Geoghegan, 2010). Beekeepers occupy a unique position in rural society, generating temporally rich, site-specific understanding of changes within rural socio-environments that impact bees and the wider community of humans and other actors (Maderson, 2023a). This knowledge is often informed by formal scientific study, but also enriched by tacit experiential knowledge (Maderson, 2023b), and infused with an ethic of care that is borne of a deep interspecies relationship.

Care within multispecies relationships

Care for other rural species is often framed as a suite of particular actions centred on a specific human–animal relationship that ensures animal welfare (Broughan et al., 2016). In contrast, landscape-level systemic care is increasingly seen as necessary for ensuring bees' wellbeing (Cilia, 2019; Ellis et al., 2020). Individual and community connection to place is a key factor underpinning care and stewardship of these spaces (Murphy et al., 2019; Uhlmann et al., 2018). For many rural communities, the rural lifestyle is epitomised by their relationships with other species who co-exist in these spaces (Sutherland et al., 2019). Many rural residents find their relationships with animal species transformative in their understanding of, and sense of responsibility for, both the animals themselves and the wider environment in which we are all immersed (Wadham, 2020). 'Lifestyle-oriented rural landowners' (Gill et al., 2010) are frequently driven by values and a sense of stewardship for the rural environment, which are transforming the ecosystems they share with other species. The sensory and practical experience of dwelling within the rural environment leads to a specific understanding of the world, which transcends a comparatively abstract and disconnected knowledge (Ingold, 2002). A desire to reconnect with the natural world,

and the other-than-human species who inhabit it, is a significant factor for many seeking a rural lifestyle (Benessaiah & Eakin, 2021). Rural activities, particularly agriculture, are being reassessed within the context of care. As mainstream agricultural practices have led to devastating losses of invertebrate life and soil quality, a reconceptualised sense of interspecies relationship is promoted as a way to restore damaged lands (Pigott, 2021). Similarly, the ethos of eco-villages seeks to incorporate plants and animals into the social sphere, acknowledging their intrinsic value and prioritising human relationships with other species; these caring multispecies encounters are seen as contributing to sustainable socio-ecological transitions (Brombin, 2019).

The embedded interspecies knowledge of rural societies, including amateur naturalists and those whose 'serious leisure' centres around their relationships with other species, has the potential to support efforts to renegotiate human relationships with the wider environment in a way that embodies care and respect for all species (Ellis & Waterton, 2004; Heley & Jones, 2013). For some, these include pro-environmental behaviours associated with a sustainable lifestyle, which are central to their identity, and require a high level of commitment and development of skills (Miller, 2018). Yarker et al. (2020) note the role of voluntary organisations in rural communities, including environmental monitoring. For many, their environmental stewardship is a form of moral and civic duty, expressing their responsibility to the rural environment and community. Beekeepers exemplify this form of environmentally engaged 'serious leisure', with some practitioners describing it as a 'virtuous hobby' and as a way of responding to anthropogenic environmental challenges (DiDonato & Gareau, 2022). Beekeepers' practice leads to growing environmental awareness amongst its participants. Many of the challenges affecting bees are rooted in wider socio-ecological problems, which require a more systemic response that reflects the complex assemblages of humans and other species in wider landscapes (DiDonato & Gareau, 2022). Beekeepers therefore have a role in observing and documenting environmental change, as well as caring for and stewardship of bees, and the wider pollinator community. Further challenges arise from differing motivations for the practice of beekeeping.

Beekeepers are a notably heterogeneous community (Moore & Kosut, 2013). In the UK, two dominant perspectives can be identified in terms of their concepts of bee stewardship and how care manifests in beekeeping (Thoms et al., 2019). The 'traditional' perspective has a strong emphasis on biosecurity (Phillips, 2020), while a growth in 'natural beekeeping' advocates a let-alone husbandry approach (Green & Ginn, 2014). The difference between 'traditional' and 'natural' beekeepers is well-demonstrated by responses to infestations of *Varroa destructor* ('varroa'), a parasitic mite of honey bees that transmits viruses that weaken and eventually destroy colonies, leading to devastating colony losses since the late 20th century. Those who actively manage their bees and treat for various ailments—in particular, infestations of varroa—see the non-interventionist, 'natural' perspective as potentially threatening bee health and wellbeing because infected bees will spread varroa by robbing other colonies as their own succumbs to infection (Peck & Seeley, 2019). Chemical miticides are recommended to kill varroa mites, although some beekeepers are concerned about the negative impact of miticides on bee health and prefer to not apply these to their bees. Beekeepers' definitions and practices of care towards their bees shape concepts of care and stewardship.

Some question 'traditional' beekeeping practices, such as importing queen bees, restricting swarming and applying chemical interventions as deleterious to bee health (Green & Ginn, 2014). There is growing scientific confirmation suggesting that these practices are counter to the long-term biological integrity and wellbeing of honey bees and limit natural selection (Neumann & Blacquière, 2017).

While the rural practice of beekeeping reflects, and generates, environmental care and knowledge, there are complex and often contradictory questions as to how best to practice care—and who is ultimately responsible for bee, and wider pollinator welfare. Crucially, this raises the question about what a 'good beekeeper' looks like, and how this aligns with discussions around care and interspecies relationships (Gustavsson et al., 2017; Naylor et al., 2018; Riley et al., 2018). This article explores beekeepers' relationships with rural communities and landscapes, as well as within the heterogeneous beekeeping community. It addresses three questions:

1. How do beekeepers conceive of care in the context of managing honey bees?
2. How is beekeepers' care for their bees affected by wider factors in rural society?
3. Can beekeeping provide an example of navigating interspecies relationships that support the development of caring, resilience-oriented relationships in rural interspecies societies?

METHODS

Data for this article were generated within two independent research projects, whose findings were then re-analysed in conjunction within the context of this article. Both authors - SM and EE- carried out research into honey bee health and the beekeeper communities that care for them in the UK. Both used mixed methods in their research to develop a broad and historically rich understanding of the interspecies relationships between humans, honey bees and other species in the rural landscape. We used interviews and ethnographic work with beekeepers, archival analysis of beekeepers' memoirs and beekeeping association histories, discourse analysis of media coverage and government policy documents and literature reviews of natural science's research findings on bees and pollinators to understand the interspecies dynamics between honey bees and humans. SM also began beekeeping during her research period, taking an introductory beekeeping course and then keeping several colonies, whilst EE was a beekeeping assistant to several beekeepers over 3 years. The authors thus gained a deep first-hand understanding of the practices of beekeepers in addition to the other methods.

EE worked primarily with hobby beekeepers in north-west England. She carried out ethnographic research by joining beekeeping clubs, becoming an apprentice beekeeper via a beekeeping course and by regularly assisting a few beekeepers with their weekly hive inspections over 3 years. She interviewed 53 members of local beekeeping clubs (predominantly in rural areas or semi-rural settlements), six civil servants who were engaged in promoting or monitoring bee health, five commercial beekeepers and beekeeping equipment suppliers, and five UK national beekeeping association members. She also collected data via research diaries and surveys and ran ecological experiments on nutrition and foraging with colonies from her participant group.

SM carried out archival research of the Bee Farmers Association (BFA), which was originally known as the Honey Producers Association (HPA), and the International Bee Research Association. Interview themes were developed based on archival findings and were the basis of semi-structured interviews with 39 long-term beekeepers (20 years' practical experience or more). Some interviewees were contacted via ethnographic research at beekeeping meetings, where the author was also an attendee at various lectures and presentations on beekeeping. Others were contacted via snowballing, requests in widely read beekeeping magazines and personal contacts. Respondents were a mix of hobby and professional beekeepers. Many were active in local beekeeping associations as trainers and lecturers.

To reflect the experience and characteristics of our interviewees, all of whom are beekeepers, quotes are anonymised as follows: Gender (M/F), geographical location (England, Wales or Ireland—E/W/I), a letter used by researchers for anonymisation and organisation of datasets, and then a number to denote years of beekeeping experience. So, for example, *MED70* denotes a male beekeeper in England, organised for research purposes and anonymised by the letter D, who has kept bees for 70 years. Data were analysed with Nvivo; initial themes were used for parent nodes, which then generated further child nodes for detailed analysis (Lewins & Silver, 2014).

Our two bodies of data, whilst collected separately and with different segments of the British beekeeping community, reflect similar areas of knowledge and concern amongst beekeepers, as well as a sense of their position within rural society, and how this is resultant of their relationship with their bees. The authors were connected via mutual research contacts, and this article emerged inductively from discussions about data analysis. The theme of care—for bees, for other species and for the landscape that they are located in—emerged inductively from both datasets; this article is based on an analysis of overlapping findings from both empirical datasets.

RESULTS AND DISCUSSION

Before presenting the results, it is important to understand that honey bees are social insects, living in colonies sheltered within hives (wooden or polystyrene boxes or, traditionally, hollow segments of tree trunk). An individual bee cannot survive for long without its nestmates due to 'temporal polyethism' or age-dependent division of labour. Thus, when discussing the management, reproduction or behaviour of honey bees, it is the colony that is being considered, not the individual bee. Managing honey bees is challenged by their embodying aspects of both manageable livestock and wild species. While beekeepers can apply a range of interventions to improve the health and wellbeing of their bees, ultimately bees rely on access to the landscape for food and mating and have a regular foraging range of 2 km and up to 10 km (Tautz, 2008). This brings them into direct contact with factors beyond the control of the individual beekeeper, raising complex questions and challenges in caring for their bees.

Our archival and interview findings document a long history of beekeepers being practically and emotionally enmeshed within a complex web of intraspecies rural relationships. These were often underpinned by tacit or hybrid environmental knowledge, resulting from practical experiences. Such knowledge is central to smallholders (Šūmane et al., 2018) and rural practitioners (Carolan, 2008). Our data suggest that the interspecies relationships of beekeepers manifest in two primary realms: amongst landscapes and landowners and within the heterogeneous beekeeping community. Throughout beekeepers' efforts to embody care and stewardship in these relationships, their knowledge of, and engagement with, the complex species diversity within the beehive also comes into play. Beekeepers' environmental knowledge, and their sense of care and duty to their bees and other species, guides their relationships with other members of rural society—both human and non-human.

Heterogeneous beekeeping communities and contrasting concepts and practices of care

Beekeepers have traditionally been part of, as well as observers of, the agricultural community and landscape. Archival resources and interviews show beekeepers often come from farming

backgrounds and practised beekeeping as part of a mixed-income stream, frequently over generations. Many came from families of long-term beekeepers, who had worked amongst other members of the agricultural community for generations.

The community of beekeepers is diverse, encompassing hobbyists, commercial bee farmers and expert beekeepers providing government health inspection services. The UK beekeeping community as a whole has come under pressure through recent increased interest in beekeeping inspired by well-publicised dramatic losses in honey bee populations of the early 2000s. Interviews from both datasets show a generational shift as well as a motivational shift occurring throughout the beekeeping community, with a new emphasis on environmental concerns and stewardship as a primary motivation for keeping honey bees, in comparison to a traditional interest in honey production and beekeeping as an activity in and of itself. Contrasting visions of care are found amongst these subdivisions of the beekeeping community, illustrating important questions about how best to care for other species in an anthropogenic rural environment and which species remain vulnerable as they remain outside the frameworks of care.

Recent changes in how new beekeepers learn to care for their bees have been marked by a move from informal apprenticeship to more formal class-based tuition (Adams, 2018). As the beekeeping community has struggled to develop and deliver training to an influx of new practitioners, this has led to reflection on past and present methods of teaching and training and the relative importance of different aspects of beekeepers' hybrid knowledge.

Beekeeping is an inherently tacit practice. Observation of specific factors within the hive—the presence of the queen; appropriate proportions of eggs, larvae, food stores and worker bees; signs of disease and/or varroa infestation—is just one element of successful beekeeping. Interviewees who have decades of experience, and sometimes come from generations of practitioners, emphasise the central importance of experience in becoming a beekeeper—which is seen as a lifelong process of continual development through engagement with the bees: *'you're always learning'* (MED70)*; 'the bees are always teaching you something'* (MEB60). Learning the craft of beekeeping has traditionally been done via working with a more experienced practitioner; this is still encouraged, but is not always feasible, for many reasons. The rapid influx of new practitioners, coupled with the complex time demands experienced by both trainer and apprentice at a time when more information is available online, has led to significant changes in how the beekeeping community is organised, and how knowledge is transmitted. New beekeepers are encouraged to undergo basic training and learn a range of fundamental skills that are central to the practice. These emphasise formal husbandry, such as disease recognition and treatment and avoiding swarming. While many beekeepers value this knowledge, and interviewees in both datasets were actively involved in teaching and learning these fundamentals, others prioritise wider environmental factors they see as underpinning care for bees. This divergence increasingly manifests in the context of differing styles of beekeeping.

Both 'traditional' and 'natural' beekeepers (Thoms et al., 2019) focus on 'caring for bees', but the focus of the practices is quite different. Traditional beekeepers spend a lot of time 'in the bees'—visiting the hives, checking combs for signs of diseases and ensuring that bees are well-fed and given medical treatments for parasites. Many are very skilled handlers of this communal, stinging insect, able to spot tiny variations in their colonies that indicate problems such as disease outbreaks (Adams, 2018; Phillips, 2020). In this context, 'good beekeeping' resembles classic animal husbandry, with a close relationship between the beekeeper and bees. From a care perspective, beekeepers are important, or see themselves as important, for the health of their bees:

> *'when we started beekeeping, bees looked after themselves—all we had to do was look at them occasionally… Now that has all gone—you have to manage your bees, you have to check them—disease is the biggest problem now'* (FWS45).

In contrast, 'natural' beekeepers (Thoms et al., 2019) primarily perceive bee health as far more dependent on the condition of the wider landscape: They believe pollinator decline must be understood, and ultimately addressed, within the context of a problematic industrialised agri-environment, which has led to decreases in available forage, and an excess of agrochemicals that can produce multiple and varied negative synergies (Scott, 2013). '*Until we stop pumping these things in by the ton, we're going to have problems. And this is too radical for a lot of people'* (MEP20). Many who self-identify as 'natural' beekeepers have come to the activity inspired by concern over pollinator decline and often have a personal background in other 'green' activities and political movements (Maderson & Wynne-Jones, 2016). However, one respondent noted '*The bit I dislike is the term "natural beekeeping"—with the connotation that, if you are at another end, then it's unnatural'* (FWS20). This comment reflects the tensions that can arise between beekeepers following different approaches.

Another key area of tension surrounds disease management, which can impact other beekeepers in an area, as bees fly freely and can share diseases and pests with other colonies. Many beekeepers promote, and breed, subspecies (ssp) of honey bees that they believe have different traits. The mid-20th century saw a UK trend for importing southern European ssp of *A. mellifera*, due to their comparatively high levels of honey production. In contrast, *A. m. mellifera (Amm)*, or the 'British Black Bee', is considered by many beekeepers to be a less prolific honey producer but more resilient to the UK climate: '*So we have bees being imported who are not adapted to our climate, so you have failure'* (MEP45). While there are many UK beekeepers who work to breed *Amm*, and encourage the local beekeeping community to avoid importing bees from other regions and to work with bees from the immediate area, the lure of high profits and a comparatively easy trade encourages many importers to continue this practice. There is a growing trend to try and breed bees that are adapted to local climatic conditions and/or which beekeepers believe to be resistant to varroa. Such efforts can be easily undermined by importing bees from other places. This creates tensions within the beekeeping community, as it is highly challenging to control bee breeding and requires community commitment to developing local strains of bees:

> '*We're worried because a commercial bee supplier on the other side of the town—she imports a lot of bees from Greece. She wants to move into our territory because she's heard we have bees that are varroa-resistant. What happens when she moves all these Italian things in, and they start to cross? See what I mean?'* (MEH20) *The informant was referring to the subspecies A. m. ligustica, frequently bred in the Mediterranean region and famed for gentleness and high honey production.*

This generates further complications in caring for bees. While the movement of other rural livestock species can be—and, indeed, *is*—more carefully managed, bees are small, easy to transport and ultimately wild, sharing genes and diseases with comparative ease.

While some beekeepers seek to care for bees by promoting locally resilient strains, others are concerned about the density of colony numbers within the landscape. Both scientific research (Neumann & Blacquière, 2017; Seeley & Smith, 2015) and beekeepers' observations support the belief that controlling hive density helps bees maintain better health and wellbeing by reducing pressure on forage resources. There can be a conflict between beekeepers who aspire to a lower

hive density and those driven to maximise production at all costs: They are all working in a common landscape where there is no legal limit to hive numbers, and placement of hives is managed solely by individual agreements between landowners and beekeepers:

> *'I've found that when I run my small apiaries, which are jogging along happily with a couple of hives, and I then find that some commercial beekeeper has moved in 20 nationals, or commercial hives… And they rob—they literally just cleaned out my three hives'* (MEH20).

CARING FOR HONEY BEES WITHIN THE RURAL LANDSCAPE: MANAGING AGROCHEMICALS AND FORAGE

While beekeepers are a heterogeneous community, the challenge all beekeepers experience is how to exercise care for their bees within a complex multispecies rural society. This manifests especially visibly in their efforts to manage their exposure to agrochemicals and their access to healthy forage. While these environmental challenges are commonly addressed via the life sciences, historical records and contemporary studies of rural societies can shed important light on how beekeepers apply their tacit knowledge, and embedded elements of care and stewardship, in their practice.

Observational, tacit knowledge is an important source of rural environmental understanding and subsequent management. Farmers' oral histories can offer rare insights into agro-ecological changes (Riley & Harvey, 2007) and support efforts to improve landscape understanding and management. Likewise, many interviewees' family experience of beekeeping generates decades of continual experiential knowledge of the landscape and conditions affecting bee health and the wider environment. Both professional bee farmers and many amateur beekeepers site their colonies amidst the wider agricultural landscape, leading them to cultivate often long-running relationships with landowners. This puts beekeepers in a strong, indeed perhaps unique, position of observing significant changes in the agri-environment and the socioeconomic factors driving changes, and understanding interspecies relationships and wellbeing within this landscape. Archival analysis for this article documents a persistent concern about the impact of agrochemicals, with some beekeepers refusing to carry out contract pollination (i.e., being paid to bring bee colonies to a specific crop to support its pollination) and/or avoiding sites due to their concerns about the impact of agro-chemicals on their bees. Beekeepers have long played a key role as 'first responders'—providing early evidence of the impact of agrochemicals on invertebrates and the wider ecosystem, supplying crucial data to entomologists in the mid-20th century, which subsequently led to restrictions on hazardous pesticides (Bulletin 41, 8/58; 150, 9/73).[1] The editorial of the very first edition of the HPA bulletin stated that 'the greatest danger to our profession is with the ever-increasing toxicity of insecticidal sprays' (Bulletin 1: 4/53). Conflicts between farmers, beekeepers and the government over the issue of pesticide use and its risk to bees were a key issue in the HPA and BFA bulletins, particularly between the 1950s and the 1980s, and continues today.

The struggle by beekeepers to get farmers to agree to and/or abide by voluntary agreements to restrict spray use or for government compensation for colony loss due to spray exposure highlights an important imbalance between different sorts of rural species occupying different ecological and economic roles. Less visible and/or obviously ecologically significant species are perhaps less valued than those that are more noticeable. However, it is important to note that

many respondents successfully cultivated positive working relationships between themselves and landowners: '*It's the individual. It's how you work with them. Making them understand your problems, and you understanding theirs'* (MEB60).

Current developments in pollinator policies have led to voluntary initiatives designed to inform beekeepers about the planned application of agrochemicals (Hillocks, 2012; Stout & Dicks, 2022). This gives beekeepers the opportunity to move or relocate their bees. In this approach to managing honey bee health, interspecies rural relationships are positioned as something that is best managed via individual actions rather than a systemic reappraisal of environmental management. The logic underpinning this attitude is problematic: Harrison (2006) discussed agricultural worker pesticide exposure and noted that exposure was seen as the result of occasional 'bad actors' rather than an inherent problem in rural society. Similarly, whilst pesticide schemes might help ensure honey bee welfare, it is not clear how far they can protect non-managed pollinators and the assumptions about interspecies and human–environmental relationships, which underpin rural societies and economies.

The challenges of avoiding contact with damaging agrochemicals parallel efforts to ensure access to a suitable quality and quantity of forage. Beekeepers' practice generates, and relies upon, a distinct, more-than-human perspective on the landscape:

> '*These areas were once good bee areas … (In Ireland) we used to have one of the best hedgerow networks in Europe. Up to very recently. A lot of them have been absolutely butchered. Just in the last 10 years*' (MIM50).

Successful habitat protection and restoration for pollinators and biodiversity requires regular monitoring, regardless of whether programmes are voluntary or statutory. Beekeepers can provide significant information on landscape transformation and restoration, often noting the limited scale and/or actual forage benefits of schemes currently promoted as landscape/forage enhancement:

> *'I've been to projects that have won biodiversity awards… for people who have ripped up blackthorn scrub festooned with lichens in order to plant some ornamental shrubs.…People are very good at spinning the concept of biodiversity for what they want to do, which is often gardening, which is not necessarily the most biodiverse thing they could do*' (MWS20).

As beekeepers assess potential sites for their colonies, they note forage variability, as well as microclimates and land management practices that can help or hinder their bees and other pollinators: *'Pollinators are often far more reliant on some willow scrub, or something that produces tree pollen early in the season, than a small patch of some flowers in the summer'* (MWS20). While these observations can be of wider benefit to understanding rural conditions for other species, beekeepers ultimately prioritise their bees' needs. This can lead to contradictory opinions on what a 'good' landscape looks like, with beekeepers favouring habitats that others regard as problematic for stable, resilient, diverse ecosystems. Beekeepers can hold views on different sources of forage that support honey bees whilst actively affecting other valuable insects and pollinators. For example, interview data found that beekeepers are frequently very positive about oil seed rape (OSR, also called 'canola') cultivation: '*Oil seed rape has had a significant impact on beekeeping. It gets colonies ready for spring'* (MEST40). With careful management, colonies can benefit from being placed near, or amidst, OSR. In contrast, this crop often holds risks for other species due to the high level

of neonicotinoids and other agrochemicals associated with its cultivation (Schürch et al., 2015; Woodcock et al., 2017). It has also been critiqued due to the tendency for its monocrop cultivation, creating a 'boom and bust' forage source that can be difficult for honey bees if not managed carefully: '*If you go to a hive and the oilseed rape flow has stopped, for a few days afterwards they are not in good humour!*' (MIB60). Some beekeepers also view invasive species positively: One beekeeper admitted to deliberately spreading seeds from the invasive Himalayan balsam plant on her land, and numerous beekeepers kept patches of it in their gardens, although other beekeepers did make efforts to control it where it impinged on pasture land or caused damage to waterways on their land. Individuals often commented that they knew it was an invasive species and thus problematic but that it was so useful for their bees that they did not mind its presence. Thus, by focusing on the wellbeing of their bees, beekeepers are not necessarily the 'environmental stewards' that those rural actors focused on biodiversity and nature conservation might expect.

Certain vulnerabilities within the landscape are shared by bees and other species and require a broader sense of care and stewardship. Most beekeepers do favour more diverse habitats. Experienced bee farmers report being on a constant lookout for organically cultivated sites, and/or those with a diverse range of wild forage sources, protected from the elements.

> '*I am looking for … heather and brambles, Himalayan balsam—you know, fairly wild landscape. (I am also) looking for the little fields. … Stone walls covered in ivy. Trees and hedges and bits of wild in between sort of thing. What I'm not looking for is huge great fields full of Italian ryegrass and hedges all grubbed out, because that's just green concrete you see. … We're seeing more and more of that, unfortunately*' (MWH40).

Such diversity in the landscape is beneficial for multiple species (Wood et al., 2015).

While beekeepers can often protect their bees from agrochemicals, or move colonies to a site that has more abundant and/or varied forage, this clearly privileges honey bees above other pollinator species that are not managed and that do not have humans to protect them from environmental hazards. Ultimately, beekeepers are primarily focused on the work of caring for their bees in an increasingly challenging multispecies environment. While their observations encompass landscape-level information, their efforts are focused on maintaining colony health within the hive.

Hive health and multispecies relationships

Beekeeping is a craft focused on helping one species (the honey bee) balance its relationships with other species that parasitise or co-habit in their hives. Much beekeeping practice focuses on observing the direct and indirect effects of these co-habitors on honey bee colonies and deciding whether to take action (such as applying in-hive health treatment) to restore equilibrium (Donkersley et al., 2020). Many beekeepers interviewed emphasised the central importance of their physical and emotional engagement with bees in understanding their health and needs. Throughout the beekeeping season, most beekeepers regularly open up their hives to carry out inspections. Examining a frame of bees when looking for the queen or checking for signs of diseases requires calm, still concentration, described as 'intra-species mindfulness' by Moore and Kosut (2013). A relationship is generated, which affects all participants, where an anxious or nervous beekeeper will cause the bees to become agitated and possibly sting:

> *'People say "they were really feisty but I battled on" and I think why didn't you leave them and put them back to bed and come back another day when the sun is shining and they will be different again?' (FEL60).*

Such reflection on the conditions affecting bees' behaviour serves to heighten human sensitivities to the lived experience of other species. 'Skilled vision' in beekeeping takes time to develop (Adams, 2018), yet it is powerful in bridging the divide between species to the extent that a disease outbreak can be observed even in a swarm (a colony that has recently left the hive for a new destination):

> '*The thing about keeping bees is you get to know when they aren't just right, and these didn't seem to be just right, and I thought they might have foulbrood, so I rang [the bee inspector]'* (MEJ15).

In this context, care extends to a community level. The beekeeper in the quote recognised a notifiable disease, which must be reported to government authorities and managed officially, and the immediate consequence was that his colony was destroyed. This was done to protect the wider honey bee community from a highly contagious disease.

Beekeepers, especially those involved in bee health, have to constantly move their focus between the individual bees and hives to the wider community in which they are located. This transition from a close attention to interspecies relationships inside the hive, to a community-scale awareness extends, for many people, beyond honey bees. The close interaction with honey bees, their needs and different lifeways, has a significant impact on how beekeepers engage with the landscapes around them. One beekeeper mentioned,

> *'how much more aware I became of which way the wind was blowing, how many hours of sunshine there were, what was out, what was coming into bloom, how much rain we have had'* (FWD20).

Interviewees also spoke of how their hobby had led them to subsequently study other pollinators and invertebrates, and change how they managed their gardens, prioritising these as species habitats. For many, beekeeping served as an entry point to developing a profound interest in, and a sense of responsibility towards, other species in rural spaces.

This consistent deep engagement with multiple species results in beekeepers having a heightened understanding of past and present environmental conditions and concerns about future challenges—for their bees and for other species. Interviewees expressed concern that the challenges faced by their bees, such as a changing climate and a challenging agri-environment, were indicative of wider problems faced by multiple species in the rural environment.

Since the 1980s, bee health has been severely undermined by the devastating impacts of the varroa mite and the associated diseases of which it is a vector (Le Conte et al., 2010; Thoms et al., 2019). Many beekeepers in the UK are concerned about other predicted invasive species that will affect honey bees: invasive species such as Asian hornets and small hive beetles brought new challenges for some European beekeepers as they expand from their current range to new areas. These are projected to continue expanding as time goes on, with beekeepers encouraged to take firm, immediate action, including the destruction of infested colonies (Schäfer et al., 2019). These, and other new challenges to in-hive balance are predicted to intensify as the climate changes (Vanbergen & The Insect Pollinators Initiative, 2013). Dramatic changes in insect numbers, varieties and range

are set to be ubiquitous as global temperatures increase, with some species declining in number and range, and others rapidly expanding, causing multiple challenges to ecosystem stability and species wellbeing (Deutsch et al., 2018).

Interviewees across both datasets frequently referred to beekeeping today as being far more challenging than it had been in the past. Trade-offs in species wellbeing are common, with some beekeepers concerned that official guidance on treating varroa infestation with chemicals called miticides generates its own risks to bee health: *'Research is being done on the impact of miticides on drone sperm viability. This is why the Queens are not lasting'* (MEH70). Beekeepers are actively debating how best to manage parasitical infections, with many exploring alternative treatments and learning how to manage colonies differently, for example, by breeding bees to be resistant to the effects of pests: '*If we can breed bees better, either tolerant of or resistant to varroa, that would make a huge difference*' (MEP45). These debates mirror wider discussions surrounding care and vulnerability throughout rural society, such as those surrounding antibiotic use in farming, which may present significant public health challenges (Tang et al., 2017). Ultimately, there are questions as to where responsibility lies, and whether challenges should be addressed via an individual response—by beekeepers and other practitioners in the rural landscape—or wider systemic transformations, requiring radical shifts in governance, economies and everyday life.

CONCLUSION

This article highlights a hitherto underexplored important interspecies relationship in rural society: that of honey bees and beekeepers. Beekeepers are constantly navigating complex interspecies relationships through their practice, generating important insights into social tensions and challenges surrounding the need to manage agricultural land whilst caring for multiple species in a changing rural environment. Their historical and contextual understanding of multiple evolving socioeconomic and environmental factors affecting bee health positions them as highly informed contributors to stewardship of multispecies wellbeing. The experiences of beekeepers in navigating these relationships as well as the solutions proposed by different actors highlight the need for a more systemic and stewardship-oriented approach to multispecies contexts and the wider environment within which we are all enmeshed.

Although beekeepers are a heterogeneous community, they are united by a sensibility that encompasses notions and practices of care for many species that are easily overlooked within conversations about rural interspecies societies. As we consider how to increase environmental care within society, the sense of stewardship that beekeepers develop and apply throughout their practice highlights the potential for rural activities such as beekeeping to generate a sense of human commitment to the wellbeing of other species, including those that may be less visible and less commonly associated with human communities.

This article positions beekeepers as a community that shares a culture of care and stewardship that is rooted in, but extends beyond, knowledge of honey bees. The relationship of beekeepers with their bees embodies multiple values of nature, often moving beyond a technocratic, service-provision attitude towards empathetic bonds with other-than-human species. Deep relationships between humans and insects are unusual, and beekeepers rely on a constant learning process, which often combines tacit and formal elements, resulting in a hybrid knowledge of bees and other species in rural societies.

As rural societies move towards interspecies relationships that are marked by more than a utilitarian focus on food production, and towards a wider stewardship of the natural environment, beekeepers' tacit sensibilities can serve as a model of careful negotiations between complex and seemingly contradictory demands upon the 21st-century rural landscape and its inhabitants.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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ENDNOTE

[1]The HPA/BFA produced bulletins for its members on an approximately bi-monthly schedule from the 1950s to the early 2000s. Each bulletin was numbered, with its publication date listed. Editions of the bulletins are referred to in this article by their number and publication date—for example, 108: 10/67 was edition 108, published in October 1967.

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