Beekeeping Expertise as Situated Knowing in Precarious Multispecies Livelihoods

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Abstract

In this article I analyse beekeeping expertise as situated knowing in the precarious conditions of multispecies livelihoods. Beekeeping is knowledge-intensive: distinct expertise is required to keep colonies alive and thriving, to produce honey, and to support pollination – that is, to maintain livelihoods. The conditions in which beekeeping expertise is developed and enacted are precarious due to close entanglements with ultimately unintelligible non-human others and their changing habitats. Using ethnographic and interview data collected among urban beekeepers in Finland, I first describe the precariousness embedded in beekeeping as sharing lifeworlds and becoming with non-human others, particularly in an epoch characterized by severe environmental disturbances. Second, I analyse learning and practising beekeeping as the development and enactment of beekeeping expertise as situated ways of knowing. From beekeeping courses, books, and social relationships, beekeepers learn not only the necessary skills but also ways of knowing that value diversity and variability. By practising and observing in the hive yard, they further learn to be affected by bees and their multispecies habitats, attuning their practices and perceptions in accordance with them. Beekeeping expertise therefore entails ways of knowing that are local, relational, practical, and open to changes and even surprises, recognising the incompleteness of knowledge as well as the unprecedented agency of non-human others. Such situated knowing enables beekeepers to acknowledge and act upon the complex interdependencies of multispecies livelihoods in changing socio-ecological conditions.

KEYWORDS: beekeeping, expertise, multispecies livelihoods, precariousness, situated knowing

Introduction

Knowledge and skills are at the core of successful beekeeping. Knowledge about bee behaviour and local environments, as well as skill in beekeeping practices, is essential for healthy bee colonies, abundant honey yields, and effective pollination. The knowledge and skills that distinguish beekeepers from non-beekeepers – that is, beekeeping *expertise* (see Ericsson 2018, 3–4) – are entangled not only with the survival and well-being of beekeepers and their colonies, but also – through pollination – with a wider community of plants and the animals that depend on them, including human food producers and consumers (Potts et al. 2010).

In this article, I argue that beekeeping expertise not only contributes to but is also constituted within everyday livelihood practices. Following Gloria Dall'Alba's (2009, 2018) phenomenologically informed approach, I explore beekeeping expertise as "enacted and embodied rather than possessed or applied as independent entities" (Dall'Alba 2018, 35). Dall'Alba calls into question the assumed separateness of experts, their knowledge, and their domains of expertise. Instead, she suggests that we explore them as "an inescapable entwinement", calling for a recognition of the relationship between "persons and the world" in expertise research (Dall'Alba 2018, 34; see also Dall'Alba 2009). This entails an ontological turn in research on expertise and expert performance: knowledge and skills are integrated into expert ways of being, and the development of expertise is therefore a continuing process of becoming (Dall'Alba 2018, 35).

This onto-epistemological conceptualisation of expertise is based on an understanding of knowledge as *situated* (e.g. Dall'Alba 2009, 11, 23). Situated ways of knowing are embedded in local and particular relations and refuse to presuppose a metaphysical or transparent knowing subject (Haraway 1988). Although practice-oriented and place-based, situated knowledges are not detached from translocal material-semiotic arrangements; rather, it is essential to recognize their situatedness *in* the global and embodied relations where they are constituted (Haraway 1988; see also Alhojärvi 2017; Vehviläinen 2017). In situated knowledges, these relations include both humans and non-human entities: the world in all its more-than-human diversity is understood as an active actor and agent in knowledge production (Haraway 1988, 592–593). Therefore, this approach can also be seen as engendering openness to contingency and surprise, whether serendipitous or dreadful (Alhojärvi 2017; Haraway 1988; see also Sedgwick 2003).

Situated ways of knowing are characteristic of small-scale food production (Gonzlez 2001; Hyvärinen 2017; Vehviläinen 2014; see also Le Heron et al. 2016), and beekeeping is no exception. Emily Caroline Adams (2018) has described learning beekeeping as a contextualized enskilment process, highlighting the practical and social ways in which beekeeping expertise is developed. Siobhan Maderson and Sophie Wynne-Jones (2016) in turn understand beekeepers as producing citizen science by making observations and keeping records, but they also see beekeeping as entailing "other ways of knowing" (Maderson and Wynne-Jones 2016, 92), including intuitive elements, emotions, and a holistic engagement with the bees. Accordingly, and especially in the context of urban small-scale beekeeping, Lisa Jean Moore and Mary Kosut (2013) stress corporeality and intimacy as constitutive parts of the embodied and experiential knowledge of beekeeping.

As these studies suggest, the expertise relationship between "persons and the world" (Dall'Alba 2018, 34) is particularly intense in beekeeping. As with other forms of food production, the most substantive material conditions of survival and well-being are at stake in beekeeping. The process of becoming an expert in food production is intertwined with processes of reproduction – that is, processes of becoming in its most fundamental form, going all the way down to the materiality of the body and the soil (see Haraway 2008; Vehviläinen 2014). Following Donna Haraway (2008), food production can be understood as a continuous process of *becoming with* in the mutually constitutive networks of companion species (Haraway 2008, 17–19, 244; see also Hyvärinen 2017; Vehviläinen 2014). The practices involved in fulfilling subsistence needs are always already entangled with the lives and livelihoods of non-human others: there is nothing preceding the multispecies mesh we are (in).

In order to conceptualize these processes of becoming with as embedded not only in biophysical cycles and conditions but also in social, cultural, and political institutions and arrangements, I have developed the concept of *multispecies livelihoods*.[1] As an economic category without the historical baggage or disciplinary power of *economy* or *economics*, the concept of *livelihood* is open to a diversity of activities, skills, knowledges, sites of action, and relations that, unlike hegemonic capitalocentric economic discourses, "cannot be captured by a generality" but instead are "linked to particular contexts, stories and strategies" (Miller and Gibson-Graham, forthcoming; see also Miller 2019). Multispecies livelihoods can be defined as the diverse and particular practices of securing the necessities of life through sharing lifeworlds with human and non-human others.

Beekeeping is a particular example of multispecies livelihoods. Not only do beekeepers partially support themselves[2] through a close engagement with *Apis mellifera* and the various other species involved, but beekeeping also contributes to survival and well-being far beyond its immediate participants. At the same time, beekeeping is also seriously affected by changes in bee habitats, which are often – ironically – caused by other practices of food production in its industrialized forms, as well as by rapidly advancing climate change (Potts et al. 2010). As is detailed below, the intimacy and complexity of these multispecies networks render beekeeping a *precarious* livelihood, not (only) in terms of unstable incomes and material welfare, but rather, following Anna Lowenhaupt Tsing (2015), as embedded in unprecedented encounters between species, and in existential instability in the face of environmental disturbances on a planetary scale.

In order to explore the intense and unstable relations of expert knowledge in beekeeping, in this article I ask *how expertise as situated ways of knowing is developed and enacted in the precarious multispecies livelihoods of beekeeping*. The article is organized as follows. In the next section, I describe my research data and methods. In the analysis that follows, I first explore beekeeping as a precarious multispecies livelihood characterized by the uncertainties embedded in multispecies encounters and changing socio-ecological conditions. Second, I examine how beekeeping expertise is developed not only as skills and practices, but also as ways of knowing, and how it is further enacted in the various relationalities of the hive yard and beyond. As a conclusion, I discuss what it means to foster ways of situated knowing that are grounded in the everyday practices and interdependencies of multispecies livelihoods.

Research Data and Methods

My research methods include focus group interviews and ethnography, combined with thematic analysis. In addition to the theoretical approaches described above, the research methodology is inspired by multispecies ethnography, where the interdependencies of humans and non-human species are brought into the centre of enquiry, challenging the dualisms and hierarchies inscribed within human-centred ethnography (Kirksey and Helmreich 2010). The research data was mainly collected in 2017 in two major cities in southern Finland. In addition, supplementary autoethnographic material was gathered throughout 2018 and in early 2019.

1 In a previous article published in Finnish, I used a similar concept, *keskinäinen toimeentulo*, to indicate the entanglement of material subsistence and relational multispecies ethics (Hyvärinen 2017).

2 In Finland, most beekeepers define themselves as either hobbyists or part-time beekeepers; only 1–3% declare beekeeping as a full-time job (Ruottinen et al. 2003, 51). However, even small-scale beekeepers earn income by selling their honey (see Hyvärinen, forthcoming).

Two group interviews, of two hours each, were conducted with a total of 14 beekeepers from urban or semi-urban areas. The interviewed beekeepers were women and men aged between 35 and 77. They mainly tended colonies in their own domestic gardens in suburban areas, and their length of experience of beekeeping ranged from two to 47 years. The number of colonies per interviewed beekeeper varied from zero[3] to around 50, and the amounts of honey produced during the previous year ranged from seven kilos to over 800. The interviews were recorded and transcribed, and I translated the extracts used in this article myself. Background data was collected through a short questionnaire. In this article, numbering is used within each individual extract to indicate interviewees where necessary.

My autoethnographic data consists of recorded dialogues and a beekeeping diary from 2013 to 2019. I have kept bees with my father since 2013; currently we have nine colonies in two apiaries. Our apiaries have been located on the outskirts of a public park, in a semi-public community garden, and in a domestic garden near the city centre. The autoethnographic dialogues (seven recordings, varying from 18 to 105 minutes) loosely followed a mind map of different beekeeping practices, and they took the form of performance appraisals, evaluating previous years and suggesting improvements. The beekeeping diary (which currently runs to 40 pages) is completed by both of us on an online platform after every hive visit.

Ethnographic participant observation took place during a three-day urban beekeeping course with around 10 participants, organized by an urban beekeepers' association in spring 2017. The course provided basic information on bees and beekeeping, with an emphasis on urban specificities such as city bee pastures, neighbours, and licences. Two days of the course were devoted to indoor lectures (three hours each day), and the third day was a field trip to the teacher's home apiary (around two hours). The lectures were recorded and loosely transcribed, and field notes were written after the field trip day. Only the course teacher is quoted in the analysis.

The data was classified following an initial thematization made before and during the data collection. Knowledge was one of the themes from the beginning, and a question related to learning and knowing was posed in both of the group interviews. However, the issue of knowledge and skills also appeared to be widely discussed in other parts of the interviews as well as during the beekeeping course and in the autoethnographic dialogues. Sections of interview and observation data that included discussions about knowledge, skills, and related issues were extracted and further analysed inductively from initial conceptualisations of multispecies livelihoods, decoding the data from the perspective of interspecies relations and diverse economic practices.

Precarious Multispecies Livelihoods

Beekeeping can be described as troublesome engagements with honeybees and their lifeworlds. It is sometimes argued that bees occupy a subordinate position similar to that of other production animals in relation to their keepers, who are in principle capable of deciding their future. However, bees are not confined and controlled in the way that domesticated animals are, nor are their bodies usually consumed, as in the case of livestock (Nimmo 2015, 187–190). Due to bees' relatively independent agency – with which the beekeeper has to comply in order to maintain colonies and produce honey – their activities are often de-

3 The interviews took place in spring, and one beekeeper had lost all her colonies during the winter.

scribed in social terms, as work or labour (see Sjödin 2016), and human-bee relations are therefore described as a sort of collaboration or cooperation (e.g. Chandler 2010). However, working with bees does not imply mutual understanding or even recognition. Bees, like any insect, remain ultimately unintelligible from a human perspective (Raffles 2011, 44), and this means that beekeeping is always potentially surprising (cf. Nimmo 2015, 191):

> BEEKEEPER: The elegance lies in the fact that when you then go to the hive yard, you don't know at all what to expect […]. Bees are so unpredictable, but then you can always find your way.

Bees appear to be capricious, not only in the hive yard but also in their interactions with their surroundings: for example, it is not easy to predict in detail where bees will forage even though in general it is known which plants they favour:

> BEEKEEPER 1: Once we took [the hives] to [a place nearby], beside a buckwheat field, but we didn't get any buckwheat honey, maybe a little multicoloured hemp-nettle.
>
> BEEKEEPER 2: Yes, it was a weed in the buckwheat, and there were huge amounts of it [laughs]. It was quite fine, flowery, kind of very liquid, light in colour, but buckwheat we didn't get.

The honey was not what was expected, but it was a pleasant surprise with its fine taste and appearance. However, bees' unpredictable behaviour can also have outcomes that are more problematic. When bees share a water source with children, this can cause controversy in the neighbourhood, given the bees' ability to protect themselves with painful and even lethal[4] stings:

> BEEKEEPER: We had a beach nearby, and the sand then, it was an awfully good drinking place, even though I had all kinds of contraptions for water sources that I had made near the apiary, but they went there […], but the children did not learn to beware of them, but they went there [for water].

As illustrated by the interview extract above, it is often not the bees themselves, but rather their unintentional interactions with humans in their habitats that cause disquiet and concern. This type of uncertainty is particularly present in urban contexts, where relations with neighbours and passers-by are often an inseparable part of beekeeping. Thus, swarming[5] is often considered more of a problem in urban than in rural environments: bees find many human-made cavities to be suitable places for new hives, causing various problems by blocking chimneys and ventilation pipes and possibly even leading to structural damage in buildings:

> BEEKEEPER: Yeah, they are not nice inside the wall, a hundred kilos of honey and pollen and bee mould in there, you'll get moisture damage with less than that.

Swarming is extensively discussed in the data and can be considered as exemplifying the unpredictability of bees: during swarming season, one can rarely be sure the bees are *not* going to swarm. Swarming symptoms can be monitored and precautions taken, but none of the existing techniques for preventing swarming is absolutely certain. Furthermore, catching a swarm can be an adventure, as beekeepers often vividly describe, and if the swarm in question is not from the beekeeper's own colonies, one cannot know for sure what breed the bees are or what diseases and parasites they might carry.

4 Bee stings can cause systemic allergic reactions, including anaphylaxis, in 0.3–7.5% of the population, according to various studies (Bilò and Bonifazi 2009).

5 Swarming is a way for bee colonies to reproduce: up to half of a colony's bees – amounting to tens of thousands – leave the hive in order to find a place for a new one.

Swarming is not only inconvenient and counterproductive in terms of diminishing honey yields; it is also risky for the bees, as most feral colonies do not survive the winter, partly due to human-induced changes in bee lifeworlds. Honeybees are not native in Finnish latitudes, and maintained colonies are usually prepared for the winter: most beekeepers feed the bees with sugar syrup, and all try to make sure that the colony can stay warm, dry, and undisturbed by birds or mice in the hive. Moreover, even in areas where honeybees are native, feral colonies nowadays also struggle to survive due to the spread of the varroa mite (Locke 2015). This mite was originally a parasite of the Eastern honeybee (*Apis cerana*), but through the international bee trade it has spread during recent decades to Western honeybee (*Apis mellifera*) colonies almost worldwide (Oldroyd 1999).

As another prevalent multispecies precariousness in beekeeping, the varroa mite was also comprehensively discussed in the data. In managed colonies too, varroa is often involved in winter losses (Guzman-Novoa et al. 2010), which in Finland affect between 10% and 15% of colonies annually (Ruottinen et al. 2003, 110). Varroa itself does not kill the colonies, but it weakens the bees and makes them vulnerable to bacteria and viruses, such as the deformed wing virus (Wilfert et al. 2016). Although the mites cannot be totally eradicated from infected colonies, their numbers can be monitored and controlled.[6] However, uncertainty prevails:

> BEEKEEPER 1: With that varroa there should be some better way. […]
>
> BEEKEEPER 2: I have been astonished that so many experienced beekeepers have encountered enormous losses during the last few years.
>
> BEEKEEPER 1: It is difficult, so difficult.
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> BEEKEEPER 3: It is surprising.
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> BEEKEEPER 1: And it is so complicated: one year, in the outermost hive there was a terrible amount of mites, in the others – none. But in the following spring they were all over again.

The varroa mite is said to surprise beekeepers with its unexpected behaviour, but the unsuccessful application of chemical treatments can also result in a continuous increase in mite populations, therefore contributing to winter losses. In turn, chemical techniques themselves can have adverse effects on bee colonies, especially if applied incorrectly. Thus it is not only the mite itself but also the treatments that evoke uncertainty among beekeepers.

As is illustrated by the case of the varroa mite, the precariousness of beekeeping is not unrelated to diverse translocal formations of global economies and ecologies (see Phillips 2014; Suryanarayanan and Kleinman 2013, 223–224, 232). The contamination of bee habitats by pollution and pesticides serves as another example. Bees have a "finely calibrated interrelationship with the local environment" (Nimmo 2015, 191), which makes them particularly susceptible to environmental changes. Beehives can be exposed to various hazardous substances, such as heavy metals in urban areas (Perugini et al. 2010), or agricultural pesticides, especially when located close to intensive farming (Calatayud-Vernich et al. 2018). The pervasiveness of toxins in bee lifeworlds is no surprise to beekeepers:

> BEEKEEPER: Of course, there are all sorts of residues [in nectar], but they are different toxins in the countryside than in the city.

6 In Finland, annual use of oxalic acid is nowadays considered the bare minimum for varroa treatment; if monitoring reveals the number of mites to be too high, additional measures are recommended, such as treating the colony with formic acid or thymol, or removing drone brood (see Seppälä & Ruottinen 2003, 43).

Lastly, the climate emergency – which epitomizes the precariousness of the current epoch – is changing weather conditions and flowering seasons around the world, affecting bees and beekeeping practices alike. My research data was collected primarily in spring 2017, which in northern Europe was exceptionally cold. In spring, weather-related troubles in beekeeping are at their most severe: food stores are running dry, and colonies can die of hunger or fall behind in raising the new generation of bees if the weather is not good enough for spring blossoms and forage. The exceptionally warm summer during the previous year had been similarly unsettling, as plants had bloomed way too early for the bees to forage, affecting honey yields substantially (SML 2016).[7]

Beekeeping is about relating to unintelligible others – particularly bees – in different localities and conditions and producing livelihoods in and through that relating. This renders beekeeping inherently indeterminate and uncontrollable. Furthermore, human-induced environmental uncertainties ultimately entail an existential precariousness, at least for the bees themselves: there have been severe regional declines in both wild and managed bees, not only for the reasons presented above but also due to habitat loss and fragmentation, and especially because of the interaction between these drivers.[8] Not only do bee declines directly affect the livelihoods of their keepers, but uncertainties in beekeeping are also entangled with the overall precariousness of the current epoch, given the significance of pollination for food production, and of insects in general for functioning ecosystems (Potts et al. 2010).

Developing and enacting beekeeping expertise

Precarious multispecies livelihoods form the unstable ground on which beekeepers operate and on which expertise is developed and enacted. In this section, I first explore the process of becoming an expert in beekeeping by analysing how beekeeping is learned on courses, through books, and in social relations, not only in terms of skills and practices but also as ways of knowing. Second, I examine how beekeepers enact expertise in the hive yard and its surroundings by relating with the bees and their multispecies habitats.

My way, your way, and the correct way

Beekeepers-to-be usually start by attending a beekeeping course led by an experienced beekeeper, which provides basic information on bee behaviour and beekeeping practices. Most of the beekeepers I interviewed had attended one course or several, and many had also studied beekeeping through books, particularly the two-volume *Mehiläishoitoa käytännössä* ("beekeeping in practice", Ruottinen et al. 2003, Ruottinen 2005), which is considered the basic textbook for modern Finnish beekeeping. This book is published by the Finnish Beekeepers' Association (Suomen Mehiläishoitajain Liitto, SML), which also provides online educational materials for both beginning and advanced beekeepers, as well as a bimonthly magazine for its members, who are estimated to comprise 80% of all beekeepers in Finland (SML 2019). Even though there is a plethora of other resources on bees and beekeeping, especially online, it can be argued that the SML plays a significant role in the formation of

7 Interestingly, climate change was not explicitly discussed in either the beekeeping course or the interviews, although local weather conditions were commented upon. It is to be noted, however, that the interviews were conducted before the publication of the Intergovernmental Panel on Climate Change's report in autumn 2018, which can be seen as a turning point in public discussions of climate change.

8 In Finland, declines of managed honeybees have not yet been reported, but populations of native pollinators have declined (Hokkanen, Menzler-Hokkanen, and Keva 2017).

beekeeping expertise in Finland (cf. Adams 2018; Maderson and Wynne-Jones 2016).

Through basic courses and SML materials, beekeeping beginners are familiarized with a roughly uniform way of keeping bees that can be described as a honey-centred – or at times, even close to productivist – approach, characterized for example by the use of frame hives[9] and a preference for sugar rather than honey as winter food. However, there is still room for experiential knowledge and diverse practices. For instance, every issue of the SML members' magazine includes a column by the "beekeeper of the year", covering the beekeeper's thoughts and describing their everyday practices; and at the end of the beekeeping manual (Ruottinen et al. 2003) there are three different real-life descriptions of "beekeepers at work". Similarly, teachers on beekeeping courses often share their own experiences, views, and practices, in addition to more formal knowledge about bee behaviour, beekeeping, and honey production. On the urban beekeeping course I attended, the teacher straightforwardly distinguished their own small-scale practices from those of "honey producers":

> TEACHER: When I move from one hive to another, I wipe the gloves and the hive tool with lemon balm, because it erases the smell of the previous hive. […] If I was a honey producer there wouldn't be time for this kind of thing, I wouldn't think, but as they are there in my yard, I can do what I want. I think this is pleasant.

It is not only teachers or beekeepers selected by the SML who get to share their personal experiences and practices with others. Peer learning is common at beekeepers' social events, such as seminars and local meetings, and on online platforms, especially social media, resulting in the further diversification of possible beekeeping practices and knowledges. Whereas beekeeping beginners often lean on books, instructions learned on courses, and advice from more experienced beekeepers, they subsequently tend to develop their own ways of doing – as the saying goes, there is my way, your way, and the correct way of keeping bees. Often the variation is in the detail: to settle the bees during a hive inspection, one can use either smoke or water spray; if it is necessary to feed colonies in the spring, one can give them either (ready-made or home-made) sugar paste, sugar syrup, dry sugar, or honey. Sometimes, however, beekeepers also invent and experiment with novel practices, such as keeping the queen at the top of the hive instead of in the bottom box or attempting to prevent swarming by maximising honeycomb-building with empty frames. Also, new devices are invented – for example, bags and boxes for swarm-catching, and solar- or steam-powered beeswax smelters. These inventions may be adopted by other beekeepers and may even gain a more formal position in beekeeping publications, if they prove useful. However, they might also prove to be inoperative: "it works in theory", as one beekeeper said of a wax smelter built out of an old dishwasher.

Whether they work or not, these extensive variations, experimentations, and developments of new practices and devices pointedly exemplify the heterodox and open-ended nature of beekeeping knowledge. In its diversity, curiosity, and creativity, beekeeping expertise arguably has the potential for adaptation with respect to the precariousness described in the previous section. The ongoing process of learning to live with the varroa

9 Different beekeeping approaches are often distinguished by the use of different hive types. In Finland, the default hive type is vertical frame hives, either wooden or styrofoam. With moveable honeycomb built into the frames, they enable easy inspection and management practices, as well as efficient honey extraction with centrifuges, which has in turn made industrial honey production possible (see Spiers and Lewis 2016).

mite is an example of such adaptation. Different treatments to reduce the number of mites in hives have been and are still being experimented with, alongside both scientific and lay attempts to breed varroa-resistant bees. Beekeepers who have been following the field for decades remember not only the treatments that were later rejected but also how easy beekeeping was before the arrival of varroa:

> BEEKEEPER 1: But this mite, we haven't discussed it much, but it is such a nuisance for decades now, and they were medicated then, whatever, mycin there was, and then they had to, it was prohibited because there were residues of it in honey. Now we have this oxalic acid and...
>
> BEEKEEPER 2: At that time there was no mite at all, at the beginning, there have been such times as well in Finland with the bees. In the '80s the mite arrived.
>
> BEEKEEPER 3: Beekeeping was so easy back then [laughter].
>
> BEEKEEPER 2: Without any concerns one could add antibiotics, there was no harm [laughter], and in the autumn the honey was harvested.
>
> BEEKEEPER 3: But especially the mite was nothing to worry about, there was hardly any winter loss.

The beekeepers above recall not only the time when the varroa mite had yet not spread to Finland, but also the period when chemical use was only loosely regulated. Easiness is therefore linked not only to the absence of the parasite, but also to the absence of knowledge about the adverse effects of chemicals or policies regulating their use. Seen in this context, the spread of the mite almost appears to be just another of the changes that occur in beekeeping practices over time: despite the mite, beekeeping continues, albeit with the inclusion of a set of new practices. In relation to the mite, beekeeping expertise is thus enacted as the ability to incorporate new knowledges and to transform existing expert ways of being.

Nevertheless, the precariousness of multispecies livelihoods cannot be wholly managed, even by diligently keeping up with the newest developments in the field. It is a commonly shared view among beekeepers that beekeeping can never be fully mastered, and that learning beekeeping is an ongoing process. Knowing beekeeping can even become more complicated the more experience one gains:

> BEEKEEPER 1: You can spend 24 hours per day on one hive, marvelling at everything. And all the time feeling more and more stupid.
>
> [...]
>
> BEEKEEPER 2: [A former chair of the SML] says that when the course is over, then the beekeeper knows the most about bees after three years, and then it becomes different, the knowledge, because you can keep them differently as well.

Even experienced beekeepers rarely claim the position of all-knowing experts. The possibility of making mistakes, or being surprised by the bees or other actors involved, is made visible by sharing experiences of unsuccessful beekeeping. Beekeepers(-to-be) are therefore familiarized with a culture where one inevitably makes mistakes and also shares those mistakes – and learns from others' blunders. Again, swarming is a case in point: even though experience can bring some advantages, swarming is a potentially inescapable trouble for any beekeeper. Beekeepers' discussions around swarms are often full of dark humour, which can be understood as a way of dealing with the shared

experience of uncertainty and unsuccessful attempts to prevent swarming:

> BEEKEEPER 1: I also warned [the neighbours] about it, that if there are swarms in your chimney someday, I'll come and get them. I probably wouldn't go myself, but I promised altogether.
>
> BEEKEEPER 2: Although they are not your bees.
>
> BEEKEEPER 1: Alth- they are not. My bees are all in the hive.
>
> BEEKEEPER 2: You can see yourselves, there they are.

The humour here is based on the assumption that unlike the beekeepers, the neighbours do not know the details of bee behaviour: despite their apparent failure to prevent swarming, the beekeepers still enact an expertise that distinguishes them from non-beekeepers. Failures do not appear to undermine a beekeepers' expertise; rather, the embrace of uncertainty serves as a site for developing it. Becoming an expert beekeeper therefore entails developing ways of knowing that not only value the diversity and changeability of practices and knowledges, but also engender openness to surprises – even troublesome ones.

"One Should Aim at Understanding"

Beekeeping is substantially learned by doing: however important the courses, books, and on- and offline social relations may be, the most essential place for the development of beekeeping expertise is the hive yard (Adams 2018). On entering the hive yard, novice beekeepers soon realize that beekeeping requires more than a meticulous adherence to instructions from courses or books:

> BEEKEEPER 1: My first summer, and well into the second as well, went quite panicky somehow, that in the course it said that, and in the book it says this, and this is not quite like that. I remember that with [a friend] we kept bees, and both were there like, luckily we are not alone, we ponder there over something like that, and all terrified to do anything, because if I do something wrong, and then little by little realising that, well, we'll see then.
>
> BEEKEEPER 2: I can vividly recall that stage, the few first years when there is the beekeeper's manual open on the side and another one, Tuomanen's, what was it, a book from the '40s where it says what has to be done during raspberry flowering, and I don't even know when raspberries flower, and then blackcurrant flowering [laughs]. Then I open the hive and I'm all baffled, like, then what, but in the course of the years it eventually became clearer.

Following instructions in practice can seem terrifyingly complex for beginners. This is not solely due to their lack of expertise, however. For experienced beekeepers too, even relatively unambiguous instructions are not always straightforward to carry out in practice. For example, it is recommended nowadays that frames with old, dark honeycomb should not be placed in the hive,[10] in order to prevent disease; instead, they should be melted to collect the valuable beeswax. However, bees' tendency to collect pollen in the dark combs complicates the decision-making regarding which frames are to be placed in the hive. When the comb is melted, the pollen is wasted – but if the dark comb is placed in the hive, the queen might lay eggs on it, which will prevent the beekeeper from removing the comb.

10 When using frame hives, most beekeepers reuse the frames from previous years: when new brood boxes or honey supers are added to the beehive in spring or summer, they often include a combination of old frames with ready-built honeycomb and new frames with a wax foundation. Fresh honeycomb is white, but it gets darker over time because of brooding and pollen stains.

INTERVIEWER: What do you do with the dark honeycomb then? […]

BEEKEEPER 1: There is probably some amount of pollen usually, which would be nice to put back in the hive. Full pollen frames, I don't really melt them before the pollen is eaten.

INTERVIEWER: Isn't it then a problem when they start to use them again, and then brooding also comes there?

BEEKEEPER 1: Yes, they have to be placed near the walls or somewhere so that you can get them from there. It just has to be planned, I don't really know how but […] if for example now one is taking dark frames out of the hives, I don't dare to take full pollen frames out.

BEEKEEPER 2: Well, they are not worth melting either.

Deciding which comb is to be placed in the hive requires one to understand how pathogens and bees behave as well as to take account of local conditions, such as low temperatures during the spring in question. The recommendation not to place dark combs in the hive is therefore combined with the perceived needs of a particular colony in particular conditions: instead of straightforwardly obeying formal instructions, one contextualizes those instructions in relation to the bees and their lifeworlds.

Reflecting on instructions with respect to one's own colonies, local ecologies, and particular beekeeping practices can be understood as actively and purposefully relating with the bees and their multispecies habitats – which I argue is an essential part of beekeeping expertise, and entails ways of knowing that are situated in the local particularities of the bee colony in question. In practice, and as described above, relational expertise is enacted in how beekeepers carefully shape conditions for the bees in light of their desired outcome (Nimmo 2015, 189) – or, if efforts prove futile, in how beekeepers respond to the unexpected, adapting their plans and actions in accordance with the bees. This is shown in these extracts from bee diary notes on less successful hive inspections over the years:

8 June 2014: We were thinking about making a nucleus hive from hive number one for raising queens, but as there were no larvae, there was probably no queen either. We did not make the nucleus.

26 June 2015: In [another] apiary, raising a queen did not succeed on top of hive number three. […] We made a nucleus for raising a queen on top of hive number two.

1 July 2018: When we made an artificial swarm [last time], the queen ended up in the hive with the foraging bees, and there were eggs. We added another brood box there.

12 July 2018: [In this] apiary, the colony on which the artificial swarming method was performed tried to swarm again but returned to the hive. We made another artificial swarm.

As the beekeepers' most direct encounters with the bees, regular hive inspections are particularly intense in terms of producing local and relational knowledges. During hive inspections, bee colonies are observed in terms of flight rates and routes, egg-laying, brood, honey, and pollen, as well as possible symptoms of swarming or disease. The observation is multisensory: good eyesight is essential, but the weight, smell, and sound of the colony are often noted too (see Moore and Kosut 2013). In addition to hive checks, the urban beekeeping course I attended encouraged us to observe bees by just sitting beside a beehive, as a way of developing beekeeping expertise:

TEACHER: If you want to learn how the bees act, you should take a chair and put it near the hive, […] and just sit there and look at the bees. You can learn a lot when you see how they fly and what are they busy with there. At first it all looks the same, but then you start to kind of understand what happens. And then you can also sort of figure out gradually what happens inside from what happens outside. In that way, one should aim at understanding.

In the process, beekeepers themselves are subject to change: careful observation makes them more receptive to the signals of bee behaviour and increases their understanding of bee lifeworlds. The effects of such relating can extend beyond the hive yard, as beekeepers might start to perceive the weather and plants from a perspective affected by the bees (Maderson and Wynne-Jones 2016, 93; Moore and Kosut 2013): a cold spring means there is not enough willow pollen to feed the larvae; rain during the raspberry flowering period means the loss of a considerable portion of honey yield; strong winds risk displacing hive roofs. Beekeeping, then, is about relating not only with the bees themselves but also with their habitats. The relationship can become affectionate, as is illustrated by the words of a beekeeper who had lost all of her colonies during the winter. By losing colonies, she had also lost the particular way of relating with the environment and changing seasons, as well as the habit of visiting the hives.

BEEKEEPER: Now this has been all torture this spring, as I look at nature, and I cannot look to see if my bees are flying or not, and there is no reason to go to the hives, except to dead hives.

Bees' close attachment to local ecologies means that beekeeping practices differ geographically. Beekeeping in the northern latitudes is characterized by a short intensive period of honey production and a long winter, and when it comes to colony development and flowering seasons, even a relatively small distance of few hundred kilometres can make a difference that affects beekeeping practices. In addition, the varying microclimates of hive yards and the quality of local bee pastures – that is, plant species and their abundance – play a role. For example, in some areas bee colonies forage for honeydew[11] every year, whereas in other places it is a rare delicacy – or a trouble. Beekeepers with such pastures have to adjust their practices to take account of honeydew foraging, and this even results in the contestation of instructions given by the SML or experienced beekeepers:

BEEKEEPER 1: It must be done in August, the autumn [varroa] treatment with the poison. And I have supposedly done, [the SML beekeeping adviser] said that one mistake that I have made is that I have done it too late.

BEEKEEPER 2: And it's not true.

INTERVIEWER: The August treatment or that…?

BEEKEEPER 1: August treatment, because I haven't done it in August but in September, as I get so much honeydew every year, and I have to get it out of the hive, understandably, and then it has been too late. But I cannot start harvesting in the middle of August, the final harvest.

[…]

BEEKEEPER 3: [The beekeeping teacher] was terrified that good grief, you are really not making winter preparations until September, giving

11 Honeydew is a sugary liquid secreted by aphids and some other insects as they feed on plant sap. It is occasionally collected by honeybees in early autumn. Honeydew honey is valued but is often considered poor winter food for bees.

> winter food then, whereas I should have been at the beginning of August, according to [the teacher].

Local bee-related ways of knowing might also contest other hegemonic ways of knowing. Bees forage a variety of plants, including some that are considered harmful invasive species from a mainstream conservationist perspective. However, a beekeeper might perceive non-native plants such as Canadian goldenrod (*Solidago canadensis*) and Himalayan balsam (*Impatiens glandulifera*) as valuable sources of late autumn pollen and nectar:

> BEEKEEPER: I have been bemoaning a bit that nowadays these invasive species are disapproved of so much and everyone wants to weed them out. The Himalayan balsam, that is, even though it has of course spread all over, but it is a good extension to the forage season.

The problematics of invasive plant species are contextualized and examined from a situated beekeeping perspective, suggesting the possibility of mutual benefit. Similarly, when examined from a local and particular perspective, even such severe environmental concerns as pollution can be framed as something to get along with:

> BEEKEEPER 1: And then it needs to be remembered that the life span of a single bee is so short that not so much accumulates in it.
> BEEKEEPER 2: Yes, and it sacrifices itself, the bee, it uses them…
>
> BEEKEEPER 3: It filters them itself. […] Only thing that one could worry about [in the city] maybe is how those heavy metals get into pollen, it is of course when the production of pollen is emphasized, I myself haven't felt like selling [pollen] from urban areas to anyone. Myself I have then selectively eaten the pollen from my own hives, but.

The beekeepers quoted above are referring to studies which indicate that bees' bodies act as filters, absorbing harmful substances from the nectar and reducing their concentration in the honey. When it comes to pollen, one of the beekeepers above deals with the trouble by selecting which products are suitable for sale and which are only to be used by himself – which can also be understood as a sort of filtering. Furthermore, in the discussion, customers' concerns about possible residues in the honey are framed as not being exclusive to bee products from urban areas, and even as less of a problem in cities. While the air and soil might be polluted in cities, in rural areas plants are "poisoned", that is, treated with pesticides:

> BEEKEEPER 1: Well, I have always told [honey customers] that in France they did a study that honey produced in Paris is much cleaner than that produced in the countryside, I have always told them that, and [the customers] then do believe it's the case.
>
> BEEKEEPER 2: In the countryside they spray with poison anyway, the plants.

Pollution is thus not understood as an overwhelming obstacle to beekeeping that will inevitably lead to unliveable futures. Instead, it is discussed and known by relating with the bees – which are capable of filtering harmful substances so that colony health is not affected – or by relating with bee products, which can be selected for sale and appear relatively pure compared with products from other areas. Beekeeping expertise is therefore enacted as s*taying with* the trouble of pollution (cf. Haraway 2016), as well as with the troubles of mites, pathogens, swarms, and invasive plant species described above: this expertise is situated not only in relation to the needs of particular bee colonies, but also within the wider

relations and arrangements of precarious multispecies livelihoods.

Conclusions

Beekeeping is a process of multispecies becoming. Bees' relations to their environment are co-constitutive, particularly through foraging for nectar and pollinating plants[12]. Therefore, relating with bees also means maintaining and producing livelihoods far beyond the beekeeper's personal sphere. These processes and practices of co-constitution are characterized by precariousness, as the shared lifeworlds and livelihoods of humans, bees, plants, and various others are inescapably and irreparably defined by climate change, pollution, pesticides, and invasive parasites, which add to and mix with the uncertainties inherent to relations with unintelligible non-human others. Thus, beekeeping can be thought of as analogous to the matsutake foraging examined by Tsing (2015): it too might "allow us to explore the ruin that has become our collective home" (Tsing 2015, 3). As a multispecies livelihood practice, beekeeping can be understood as a cohabitation, and as a continuous exploration of changing relations and relationalities between actors of different species (cf. Haraway 2008). Honeybees, co-constitutively with their keepers, have so far proved sufficiently adaptive to continue to maintain their own and others' livelihoods in disturbed environments, at any rate in the least affected areas of the world.

Relations with significant but indifferent others in these ruins that we now inhabit offer a staggering stage for the development of expertise. In this article, I have analysed the development of beekeepers' expertise as an ongoing and open-ended process, where formal instructions are layered with personal and shared experiences, and observations of particular bee colonies and their localities. Beekeeping expertise is enacted in close relation with bees, but also with their multispecies habitats: beekeeping cannot be learned or known without sharing one's lifeworld with bees and being affected by them. Such close engagement has transformative potential in terms of fostering new practices and knowledges – ways of relating with bees and beyond (see Tsing 2015, 20). Becoming an expert beekeeper therefore means not only managing beekeeping skills but also developing relational expert ways of being (see Dall'Alba 2009, 2018).

Beekeeping expertise can be understood as situated knowledge production organized around various everyday troubles of beekeeping in varying socio-ecological conditions. In situated knowledges of beekeeping, the precariousness of multispecies livelihoods is recognized and acted upon in local and particular ways. It is not knowing from above, but requires active participation and diligent engagement with mundane minor details and variable particularities, which are also constantly being constituted in relation to complex translocal socio-economic and ecological networks. Therefore, situated knowing in beekeeping is always incomplete and constantly in flux: local conditions vary, new techniques are developed, formal instructions change and can be contested. In its openness to change and its orientation towards variation, situated knowing in beekeeping is curious and creative, and potentially transformative in relation to existing knowledges.

Mundane attempts to recognize and act on the precariousness of multispecies livelihoods are often complicated, and even bound to fail from time to time. But although troublesome or even

12 As was elaborated on the beekeeping course, there is also a plethora of other co-constitutive relations arranged around a beehive, from the spreading of fertilising manure and genes by bees, to the establishment of social bonds through sales of bee products and collaboration with other beekeepers.

tragic at times, beekeeping is performed as informed action throughout the seasons, year in, year out. Exploring the possibilities of life and livelihoods with bees and their various others is an engagement that beekeepers often meet with such joy that it "almost feels like remembering the possibility of future" (Alhojärvi, forthcoming). After all, as Haraway (2016, 55) reminds us, in precarious times "the world is not finished and the sky has not fallen – yet", and the world still fosters "modest possibilities of partial recuperation and getting on together" (Haraway 2016, 10). In addition to clearly being a practice of becoming *with,* perhaps beekeeping also is or can become a practice of the possibility of composing a liveable world, given its response-able and surprise-able ways of knowing: it leaves a space open both for care and response (Haraway 2016, 105), and for unprecedented possibilities of coexistence within environmental disturbances (Haraway 2016, 10, 98; Tsing 2015). Developing expertise as an inescapable entwinement in precarious multispecies livelihoods is at least a meaningful engagement with more-than-human worlds, and situated knowing in beekeeping engenders good enough ways of living with others in conditions of precariousness: possibilities of getting along with non-human and human others, in complex networks of interdependencies that are both vulnerable and resilient. Such knowing may prove useful in the era of socio-ecological emergencies, invoking different epistemologies and fostering different futures.

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