Farming bees in a dynamic social-ecology

An ethnographic exploration of knowledge practices among commercial bee farmers in the Western Cape, South Africa

A dissertation submitted in fulfilment of the requirements for the award of the degree of Master of Arts

Zoë Visser BSHZOE001

Faculty of the Humanities

University of Cape Town

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COMPULSORY DECLARATION

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

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Abstract

In recent years theorists have challenged the certainty that there is one universally 'right' system of knowledge, arguing that there exists a diversity or plurality of ways of knowing the world (Turnbull 1997; Green 2008). Western scientific research has been reframed by these 'relational ontologists' as a set of knowledge practices that tend to produce and reinforce a dualistic view of the world. In particular, 'scientific', positivist accounts of nature have historically positioned mind and body, human beings and nature, humans and non-humans as essentially different or separate from each other (Thrift 2004; Haraway 2008). The methodological recommendation is that, as social theorists, we carefully observe knowledge practices and allow ourselves to be surprised or challenged by what we find rather than constantly performing these preconceived ways of knowing the world through our research (Law 2004; Lien & Law 2010). Farming bees commercially in the Western Cape, South Africa involves a high degree of skill and intimate daily engagements with plants, animals, landscapes and weather-worlds. As such it is an ideal case study for interrogating dualistic framings of human-environment relations through an ethnographic exploration of environmental knowledge practices. Commercial bee farmers that participated in this study raised a range of concerns about complex dynamics influencing their businesses, including challenges accessing viable land for bee sites and accessibility and security of the flowering plants upon which bees depend for food. I argue that, in practice, these challenges involved relational entanglements of farmers and other 'more-than-human' actors (Whatmore 2006) in what I refer to as a dynamic social-ecology (Ingold 2000; Berkes & Jolly 2001; Ommer et al. 2012). I argue that pollination and honey were co-produced by meshworks of more-than-human actors (Ingold 2011; Cohen 2013) and that knowledges were grounded in farmer's physical bodies and performed through practical skills. Farmers embodied multiple roles (such as farmer-businessman and farmer-researcher) and were able to move fluidly between different assemblages of skilled practices and ways of knowing in their engagements with plants, bees and other people (Turnbull 2000; Mol 2002). These insights are used to interrogate dualistic framings of inter-species relationality as well as to critically develop a relational understanding of environmental knowledge practices.

Glossary of Terms

Apiary site: an area in which a bee farmer chooses to place a group of bee hives.

Langstroth beehive: a beehive designed by Lorenzo Langstroth. This is the most commonly used beehive in South African commercial beekeeping (Du Preez 2011). These hives are usually made from treated wood (see Appendix A).

Brood: developing bee eggs, larvae and pupae.

American Foul Brood (AFB): a spore forming bacteria that affects bee larvae (AFB Joint Operations Centre 2012).

Brood box: the bottom box of a Langstroth bee hive in which the queen bee reproduces (see Appendix A).

Supers: removable boxes placed above the brood box in which worker bees store honey and pollen in wax cells (see Appendix A).

Frame: multiple wooden or plastic frames that are fitted into the brood box and super (see Appendix A). Bees build their wax comb directly onto these frames. Frames can be removed individually during hive management and honey harvesting.

Queen extruder: lattice that prevents the larger queen bee from moving out of the brood box and into the supers, but which has large enough openings for the worker bees to move freely throughout the hive.

Cappings: during honey extraction the wax coating that encloses the honey in the cells of the honey comb is cut off with a knife. These wax cappings are often melted down and reused.

Propolis: sticky, resinous substance collected by bees and used to insulate the hive against weather and pests. Propolis is prized by some for its medicinal properties, and is a fruit of the hive (Department of Water and Forestry 2005).

Hive tool: metal lever used to pry open parts of the bee hive and scrape away propolis.

Smoker: metal container of smouldering kindling attached to a small bellows, used to blow smoke onto the bees in order to calm them.

Bakkie: Colloquial South African term for a two or four door utility vehicle that often has off-road capabilities. Bee farmers often convert the back of their *bakkies* to flatbeds so that they can transport bee hives more efficiently.

Forage: Flowering plants that provide nourishment for bees.

Chapter 1 - Introduction

There is currently a lively debate within the social sciences around different ways of theorising environmental knowledge (Ingold 2000; Turnbull 2000; Law 2004). One powerful strand within these conversations is concerned with knowledge practices: theorists assert that knowledge and practice are intrinsically linked (people do what they know) and that we can 'see' what people are thinking by observing their actions (Lien & Law 2010; Verran 2001). Furthermore, these theorists argue that our ways of knowing do not precede our actions, but emerge from our engagements with people, plants, insects, animals, machines, weather, etcetera. That is to say that we produce or perform different 'natures' and 'realities' through our ways of thinking and being in the world (Thrift 2004; Lien & Law 2010). Lesley Green (2012) articulates this position in relation to fisher knowledges, saying that:

> '[T]he 'natures' that are in play are not based on someone's cultural (or 'stakeholder') identity, but on their actual interactions with sea and fish. 'An object does not stand by itself,' write Marianne Lien and John Law, 'but emerges in the relations of practice'. The shorthand term for this insight is that of a 'relational ontology' (Green 2012a).

Inspired by this emerging relational approach to knowledge, this dissertation takes up the challenge of exploring knowledge practices amongst a handful of commercial bee farmers in the Western Cape, South Africa. This introduction clarifies the aim and objectives of the dissertation as well as justifying why an analysis of this particular case study is well suited to meeting them.

Social research into different ways of knowing and being with the environment is theoretically important. Relational thinkers argue that different environmental knowledge practices, revealed through ethnography, have the potential to challenge rationalist and empirical, positivistic ways in which Western academia has historically framed knowledge (Turnbull 1997; Verran 2001; Green 2008; Green 2012). For example, Helen Verran discovered a different way of conceiving of length and numbers while observing a Nigerian math teacher give a lesson in measurement (2001). This moment of 'cognitive dissonance', as she calls it, lead her to interrogate her own, seemingly common-sense way of knowing the world. Through this kind of analysis,

ethnographic explorations of knowledge practices have the potential to challenge and develop our understanding of what knowledge is and how it plays out in the world.

Lien and Law make a methodological suggestion for this process of ontological exploration, writing that:

> 'through attention to practices and performativity, we may contribute to an anthropology which is more sensitive to relations between humans and other living beings than is possible in a more anthropocentric approach. Most importantly, it helps us approach dualisms of nature and society empirically, without making the same dichotomies part of our analytical toolkit' (2010:5)

The idea that knowledge is performed is a radical departure from the idea that there is one finite reality which people look at from different perspectives. If knowledge is performed then it means that people act out meanings through their engagements in the world and with other 'actors', and that as researchers we can observe these performances and practices. Says Nigel Thrift of performative approaches to knowledges:

> 'Such approaches are unlikely to have much truck with 'natural' boundaries and relationships, will refuse to deal in fixed warrants such as 'nature' or 'reason', and are wary of predetermined lines of knowing' (2004:132)

This dissertation uses this concept of performed knowledge to interrogate dualistic performances of human-environment relations, with particular attention to commercial bee farmers' practices and discourse.

This research tests the relational assertion that human and natural systems do not operate separately, but are meshed together in an ever-changing social-ecology in which human beings and all other things are embedded (Ingold 2000; Berkes & Jolly 2001; Ommer et al. 2012). In studies of people who work and live closely with plants and animals, entanglement between people and environments has been shown to be particularly evident, with implications for practice (Turnbull 2000; Green 2009; Rogerson 2011; Duggan 2012). For example, accounts of small scale South African fishers showed that they engaged with the ocean as a partner with whom they could communicate, rather than as an ecosystem service or an inanimate body of water (van Zyl 2008; Rogerson 2011; Anderson 2011). Tim Ingold articulates this entanglement

between people and environments when he calls for an ecological approach that situates practitioners 'in the context of an active engagement with the constituents of their surroundings' (Ingold 2000:21). Hearing this call, this research takes a situated approach to knowledge practices that a) pays attention to the linkages between social and ecological dynamics within the case study and b) considers the ways in which participants' knowledge emerged from engagement with physical environment and other species such as plants and insects (Lien & Law 2010).

The aim and objectives of this study can be articulated as follows:

Aim: To explore environmental knowledge practices among commercial bee farmers in the Western Cape, South Africa, using a relational theoretical framework, in order to interrogate dualistic framings of human/environment relations.

Objectives:

- To understand the social-ecological relations between bees, plants and farmers
- To understand how knowledge is performed through practice in bee farming
- To understand how bee farmers are entangled in social-ecological realities

Bee farming in the Western Cape, South Africa is an excellent case-study through which to explore this aim. Bee farming in South Africa is largely a manual, un-mechanised practice in which the business owner is physically involved in some way on a day to day basis. Whereas in other countries hives are moved around on pallets by forklifts[1], in South Africa hives are transported on the back of flatbed trucks or converted *bakkies* between apiaries, and then lifted on and off the truck by hand. Each hive is also maintained and its honey harvested by the bee farmer or one of his or her employees using relatively simple implements such as the hive tool, a brush and smoker (which were introduced in the glossary and which are described further in the body of the thesis).

[1] The use of pallets was explained to me by the bee farmer Ben who was spent a year farming bees in Canada (18/05/2012). Use of pallets and fork lifts as a means of transporting bees commercially is also referenced elsewhere in research into commercial bee farming in New Zealand (Scarlette 2011).

Bee farmers can therefore be easily observed 'in the act' of applying their knowledge in real time. Their knowledge practices were visible to me in a way that Annemarie Mol, for example, was able to observe the knowledge practices of doctors and nurses whilst they operated on patients in her relational study of atherosclerosis (2002). Farming potentially dangerous livestock at a commercial scale involves a high degree of technical skill and ability (as demonstrated throughout the substantive chapters of this dissertation). This makes bee farming a good example of an agricultural practice that requires a range of specialised skills, and a particularly interesting example of human/animal and human/plant relationships.

Bee farmers in this study worked on what I refer to as 'commercial' scale with their bees. The category of 'commercial' bee farming is a subjective one as no one definition is legislated or widely accepted in South Africa. In one report the Department of Water and Forestry distinguishes a commercial bee farmer from a hobbyist by the number of hives under management: a business with more than 200 hives is considered a commercial operation (Department of Water and Forestry 2005). For this qualitative study of 'commercial' practitioners I included in the category those who farmed bees at scale (above 200 hives) and for whom honey and/or pollination were a central part of their livelihood strategy[2]. In addition to (and sometimes instead of) pollination, commercial bee farmers produce and trade in honey and other 'fruits of the hive' such as propolis and bees wax. Some bee farmers also specialise in equipment production, honey extraction and training and education in addition to their pollination and honey production activities. This conceptualisation of 'commercial' is more inclusive than some of the defined categories suggested to me by other bee researchers[3], which is appropriate for a qualitative study of a range of knowledge practices. Where scale is particularly

[2] Some people moonlight as pollinators and honey producers to augment their main income and they were not the focus of this study

[3] Mr. Allsopp, for example, gave his own criteria in his comments on my draft dissertation: 'Hobbyist - doesn't sell his bee products. Small-scale - sell only locally; commercial - sell in markets, and to bottlers, but for whom beekeeping is not their majority income; professional - those for whom beekeeping in their majority income. Your thesis should focus on both the professional and commercial' (personal communication 14/02/2013).

relevant to an ethnographic example I have contextualised quotations or anecdotes in terms of the breakdown of activities and scale of operation of the farmer in question.

Both the term 'bee farmer' and 'bee keeper' are current amongst practitioners, with 'bee farmer' being a direct translation of the Afrikaans term *bye boer*. The term 'farmer' describes the work that pollination specialists do: they ensure that their bees are cared for, fed and transported to where they are needed for pollination. Honey is farmed in the sense that farmers move the bees to different 'grazing' sites so that bees can feed on flowering plants (also known as forage) in the vicinity and produce a surplus of honey. The term 'bee keeper' is also a telling title: in South Africa bee farmers entice wild swarms of bees into their equipment to build up their livestock and as such there is constant interchange between wild and managed bee stocks (Jaffé et al. 2010). In order to 'keep' wild bees a farmer needs to provide them with adequate shelter and food: if they are not properly looked after they will sicken, die or the swarm will abscond to better accommodation. I have chosen to use the term 'bee farmer' throughout this dissertation, reflecting the commercial focus of the research.

Given the vital importance of bee farming within South African agriculture it is surprising that very little social research has been undertaken to document and explore different South African bee farming practices. Mr. Allsopp and Michael Cherry explain the economic importance of bee farming in the Western Cape region, saying:

> 'Commercial honeybees are used to pollinate at least 26 crops in the Western Cape in particular the deciduous fruit industry, an industry with export earnings of about R5 billion per annum and supporting 170 000 jobs. It is not an exaggeration that the economy of the Cape metropole is heavily influenced by the deciduous fruit industry, which in turn needs honeybees for the pollination of its crops.'(Allsopp & Cherry 2002:6)

The cost of replacing honey bee pollination with manual pollination is considerable, making it a valuable service for farmers in the area (Allsopp et al. 2008). Current research projects in South Africa, such as the Honeybee Forage Project, are focussed on identification and quantitative assessment of the different indigenous and non-indigenous forage types utilised by bee farmers. Although this study is tailored to a reader with a theoretical social science background, it does also make a contribution to agricultural bee research in that it gives a nuanced, ethnographic

analysis of the relationality between bee farmers, plants and trees. This dissertation also reflects on some of the research politics taking place in South African bee farming, which would be methodologically useful to researchers from any disciplinary background working with such bee farmers.

Another body of literature to which this dissertation speaks is that of interdisciplinary research into local or 'indigenous' knowledges and social-environmental change. There has been much discussion about ways in which fisher and farmer knowledges and scientific knowledges could or should be productively integrated in local, national and even global management and planning processes (Roncoli et al. 2002; Wilson et al. 2006; Avis 2010; Ommer et al. 2012). One example of this kind of work is an interdisciplinary project at the University of Cape Town, run jointly between Dr. Lesley Green in the Social Anthropology Department and Professor Astrid Jarre in Marine Research, which focussed on small scale fishers' knowledge practices on the south and west coasts of South Africa (van Zyl 2008; Anderson 2011; Rogerson 2011; Duggan 2012; Ragaller 2012). In this fisheries study, researchers put local environmental knowledge into conversation with more scientific knowledge as a means of tackling the challenges of managing a complex and pressured ecosystem. My dissertation contributes to this body of knowledge on applied local environmental knowledges by taking seriously, through a focussed relational analysis, bee farmers' knowledge practices in a dynamic social-ecological context.

This introduction is followed by a conceptual framework which introduces main concepts and further situates the dissertation within a canon of research and writing. The methodology section justifies my ethics and research practices, but also gives richer detail about the case study and the reasons for selecting the geographical area and the participants with whom I have chosen to work. The fourth chapter explores matters of concern that were raised by participants, showing connections between plants, insects and different human role players. The fifth chapter argues that bees and plants are 'enacted' or 'performed' by bee farmers, and that these multiple performances have implications for their bee farming practices (Mol 2002; Law 2004; Lien & Law 2010). The sixth chapter explores the relationship between knowledge and practice, paying particular attention to the role of the body in farming bees. The dissertation concludes with a discussion of the relevance of the case study to particular writings and concepts from relational

ontology. It also makes suggestions for future research on knowledge practices, and for interdisciplinary research into bee farming more generally.

Chapter 2 - Conceptual Framework

This dissertation explores environmental knowledge practices in a particular ethnographic instance by working critically with concepts from relational ontology. The purpose of this chapter is to briefly introduce relevant theorists and concepts within this body of theory, contextualising this study within the currently available cannon of local and international research. As such this overview prepares the reader for a deeper engagement with primary theoretical concepts in the substantive chapters of the dissertation.

Relational ontology

Bruno Latour (1993; 1997a and b; 2004; 2005) and other key theorists such as Michel Callon (1986; Callon & Law 1997) and Law (Law & Urry 2001; Law 2004; Lien & Law 2010) are among the pioneers of the interdisciplinary movement that I refer to throughout this dissertation as relational ontology. This emerging theory is exciting in that it challenges dominant ways of 'knowing' and theorising about the environment and about human beings (Mol & Law 1994; Mol 2002), animals (Haraway 2008; Hayward 2010), insects (Raffles 2010) and technology (Haraway 1990; Ingold 2000). As Latour outlines in his book 'Pandora's Hope: Essays on the reality of Science Studies' (1999) relationality challenges scientific disciplines in which clear differences between nature and culture are taken for granted and in which scientific knowledge is represented as a 'true' or objective account of natural phenomena. Where the environment was once considered the domain of the natural sciences, social theorists increasingly critique the entrenched hegemony of positivist explanations of the world and highlight the construction of scientific knowledge (Turnbull 1997; Latour 1999). In this way scientific knowledge is stripped of its badge of objectivity and reframed as 'indigenous' knowledge of a particularly powerful kind (Turnbull 1997). Simultaneously 'other' ways of knowing, learning, researching and decision making are being considered as valid counter-narratives to modernity (Escobar 1998; Green & Green 2009).

A trend in environmental studies has been to differentiate between rational and irrational ways of knowing. Neville Nicholls explains the lack of 'rationality' in an individual's decision making process in terms of 'cognitive illusions'. These he describes as 'analogous to optical illusions in leading to errors we commit without knowing we are doing so, except they arise from our difficulties in quantifying and dealing with probabilities, uncertainty, and risk' (Nicholls 1999: 1386). Jonathan Baron describes rational thinking as 'whatever kind of thinking best helps people achieve their goals' (Baron 1994: 588). Knowledge from this perspective is judged to be rational or irrational, successful or unsuccessful, depending on the alignment of resulting behaviour with a particular goal or agenda[4]. The problem here is that different people might hold different agendas as well as entirely different conceptualisations of the issues at hand. Another polarising trend relates to scientific and indigenous knowledge being presented as essentially different from each other. Local or indigenous ways of knowing the world have often been either romanticised or dismissed as irrational, incomplete, emotional and non-technical (Agrawal 1995; Green 2012a). Western scientific knowledge, in contrast, has historically been framed as a true and rational account of reality against which other accounts are measured (Law 2004). Relational and particularly performative approaches to knowledge have a democratising effect on knowledge studies in that all ways of knowing, however dominant or powerful, are viewed as performances of reality (Thrift 2004).

Ontological research of this nature ultimately contributes to a more nuanced understanding of why and how people behave as they do in a dynamic world - it is interested in the ways in which knowledge is produced, reproduced and performed in the world (Mol 2002; Lien & Law 2010). Rather than being something fixed or finite outside of ourselves that we can draw on when making decisions, knowledge is described as being embodied (Thrift 2004; Ingold 2007) and multiple (Mol & Law 1994; Mol 2002; Lien & Law 2010; Duggan 2011). That is not to say that these theorists claim that humans are all irrational beings, but rather that 'the ways in which humans perform and practice knowledge are emergent, contingent, complex and circumstantial'

[4] In much of the climate change adaptation literature, irrational decision making is attributed to the inability of a human mind to appropriately process risk and uncertainty (O'Connor et al. 1999; Patt & Schroter 2008; Tucker et al. 2010), or as a result of partial knowledge (World Meteorological Organization 2009; Waagsaether & Ziervogel 2011).

(Duggan 2011:80). In other words, knowledge is not a finite, static library of verifiable information, but rather a complex and emergent assemblage of multiple, overlapping ways of knowing the world (Turnbull 2000; McFarlane 2011).

Performance: embodiment and multiplicity

Within relational ontology, this dissertation engages most strongly with a body of literature concerned with the performance of knowledge. The idea of performance centres on the assertion that as human beings we create and recreate our world through the performance of knowledge (Turnbull 2007). Turnbull writes that 'performance of knowledge practices and their attendant knowledge spaces and artefacts simultaneously structure and shape our socio- cultural world in a process of coproduction'(2007:142). The way that we think and the way that we behave are interconnected, and the resulting knowledge practices shape and produce realities in different ways. This generative understanding of knowledge is a departure from a perspectivist approach where there is one fixed external truth or 'reality' which people consider from different points of view.

Lien and Law (2010) give an example of a relational analysis of social-ecological knowledge in a paper that explores some of the ways that wild salmon are 'done' or performed differently from farmed salmon in Norway. This piece of writing provided me with an example of a nuanced engagement with the tension between wildness and domestication in a 'farmed' creature, with interesting parallels for studies of bee farming. The underlying premise is that knowledge practices such as scientific classification are 'done' or performed through practice rather than having any essential value or meaning.

It was Mol who inspired this concept of multiplicity in her ground breaking book 'The body multiple: Ontology in medical practice' (2002). This medical ethnography describes how what is classified by science as one disease is in fact performed differently at different times and in different situations, even within the same hospital or by the same doctor. This multiplicity happens through performance or enactment. Mol says of enactment that:

> 'like (human) subjects, objects (natural) are framed as parts of events that occur and plays that are staged. If an object is real this is because it is part of a practice. It is a reality *enacted*' (Mol 2002:44)

Mol shows us that knowledge is enacted through practice, often in multiple ways. In this dissertation I draw on this language of 'doing' knowledge (Lien & Law 2010), as well as the language of enactment and performance (Mol 2002; Law 2004) in order to make my argument.

If knowledge is multiple, it makes sense that conflict or contestation might arise between different ways of knowing the world. Whatmore suggests that knowledge controversies are uncomfortable, often hotly debated issues which disrupt our understandings of the way things are in the world (2002). Helen Verran writes about these moments as 'disconcertments', encouraging us as researchers to take seriously the moments in which we are surprised or made uncomfortable with a knowledge practice that we encounter in the field (2001). Instead of smoothing away differences, she models in her own work the practice of expanding on these unsettling encounters in order to generate new insights through dialogue.

Another cornerstone of performativity is the assertion that knowledge and understanding is rooted in the body, and therefore in embodied practices (Turnbull 2007). Ingold encourages us to think of human beings 'not as a composite entity made up of separate but complimentary parts, such as body, mind and culture, but rather as a singular locus of creative growth within a continually unfolding field of relationships' (Ingold 2000:4)[5]. Haraway puts forward a dynamic conceptualisation of embodiment when she writes that embodiment is 'always in formation' (Haraway, 2008:249). The body, in other words, is not a completed thing, but rather unfolds through its engagements in the material world.

[5]Ingold clearly distinguishes his own philosophy from Actor Network Theory by giving it the acronym of SPIDER: Skilled Practice Involves Developmentally Embodied Responsiveness, writing that 'SPIDER is not on the interactive convocation of existing entities but on the co-responsive movement of concurrent things along their manifold lines of becoming' (2012: 431). Thus the focus is on entanglement and becoming rather than relationality between objects.

Thrift describes embodiment, saying:

> '[E]mbodiment is a set of spatially and temporally distributed series: body a-where- ness rather than body awareness. It consists of the differential flow of a particular kind of constantly moving carnality which has its reasons and its modes of reasoning, but these are not necessarily cognitively framed.'(Thrift 2004:126)

To be embodied then is to be sensual, to have ways of being and doing, and to be part of and moving within the physical world and through time. Knowledge or reason is not seated only in the abstract mind, but is rooted in and possessed by the body (Palsson 1994; Ingold 2000; Mol & Law 2004; Ingold 2009; Rogerson 2011; Duggan 2012). For example, Gili Palsson writes about Icelandic fishers using the idea of 'getting their sea legs' to language a process of slow, accumulative enskilment at sea (1994). This stands in contrast to a model of learning which frames enskilment as a transfer of cultural knowledge through a process of education.

Performance, multiplicity and embodiment are three complex relational concepts that are critically engaged with throughout this dissertation to meet the aim of interrogating human/environment, human/non-human and mind/body dualisms (Thrift 2004).

Social-ecology

Recent interdisciplinary literature within agriculture and fisheries highlights that practitioners are challenged to negotiate a complex web of social-environmental changes in their daily work (Adams 1989; Berkes & Jolly 2001; Ommer et al. 2009; Leichenko et al. 2010; Ommer et al. 2012). In environmental studies more generally, the term 'social-ecological' has gained currency, signifying a movement away from the institutionally entrenched conceptual binary between nature and culture and towards an understanding of human systems as part of or integrated within ecosystems (Adger 2000; Berkes & Jolly 2001; Olsson et al. 2006; Perry et al. 2011). Deepening this idea of social-ecological integration I looked to the writings of relational theorists such as Ingold and Haraway, who offer an account of human relationality with other species, landscapes and weather which demonstrates and offers a language for describing social-ecological entanglement (Ingold 2000; 2005; 2007 and Haraway 2008).

In his article 'Earth, sky, wind and weather' (2007) Ingold challenges bounded notions of space and weather that separate earth from sky, and shows how human beings are in a relationship with weather. He argues that wind, fire, rain and snow are fluctuating mediums that shape and mingle with bodies and with the substances of the land. We are immersed in the medium of weather. We move through the land, rather than walking around on top of it while navigating its 'furnishings'(2007:28). Ingold writes that:

> 'This immersion, in turn, underwrites our capacities – respectively – to see, hear and touch' (2007:30).

Rather than being a separate entity that can be observed and navigated, the fluctuations of weather inform our embodied experiences of life and our ability to move through what he calls 'weather-worlds'.

Haraway's ground-breaking book 'When Species Meet' (2008) opens up a more-than-human approach to embodiment and inter-species relationality. Haraway illustrates how the human body is in fact a network of creatures, rather than a singular, self-contained thing. She points out that in fact the body is a 'symphony' (2008: 42) of bacteria and fungi, which play a vital role in keeping us alive. Her book is concerned with unpacking the dynamic of 'companion species' which she explores as 'a knot of species coshaping one another in layers of reciprocating complexity all the way down' (2008:42). Deepening the insight of social-ecological entanglement is the assertion that social-ecologies are constituted through knots of relationality between human and more-than-human actors (Haraway 2008).

Conclusion

Within the relational ontology literature, I have found writings on performance, embodiment and social-ecological integration to resonate most strongly with the results of the research into commercial bee farmers' knowledge practices in the Western Cape, South Africa. This conceptual framework is intended to orient the reader within this body of theory which I will critically engage with in greater depth in the substantive chapters of the dissertation.

Chapter 3 - Methodology

The following chapter describes and contextualises the methodological practices that I employed in generating data for this project, making reference to the theory that I engaged with critically in shaping the methodological approach taken in this study. Producing this ethnography was a learning process, and I use this chapter to critically reflect on my challenges and learning as a researcher, as well as on the ethical approach taken in the process of research and writing over the course of the study.

Ethnography and relationality

This qualitative study required in-depth engagement with participants as a means of describing their daily bee farming practices. My social anthropology honours research required a month of ethnographic fieldwork in a shelter for elderly people (Boshoff 2007). This experience taught me that showing an interest in the details of daily life, listening empathetically and helping participants with tasks are effective ways of gathering rich and multi-layered data about ways of knowing and being within a physical space. Traditionally the two research methods best suited for generating 'thick' data of this kind are in-depth ethnographic interviews and participant observation (Bernard 1994; Falzon 2006). Methodological theorist Mark-Anthony Falzon explains that ethnography entails:

> 'the situational combination of field techniques (note taking, audio-/visual recording, interviews, examination of indigenous literature, observation, and such) rooted in the ideal of participant observation (to live, to some extent, as the 'natives' themselves do), itself based on relations of trust and a belief that data are produced in and of 'thick' interaction between researcher/s and researched.'(2006:1)

Simply put, ethnographic research requires time and effort to enrol people into becoming participants and then slowly gaining their trust over time in order to produce rich data about their ways of being and knowing in the world.

Ethnography remains a much loved methodology across multiple academic disciplines in postcolonial academia. Steve Herbert makes a compelling case for the use of ethnography in human geography research in that it 'uniquely explores lived experience in all its richness and complexity' (2000:551). As experts in ethnographic research methods have pointed out, the technology for capturing this complexity is the researcher herself, through immersion in her field of study and careful recording of observations and reflections during this process (Vidich 1955), always mediated by her own subjectivity (Tedlock 2011).

An ethnographic approach has been used extensively in studies of environmental knowledge practices (Roncoli 2006; Green 2009; Lien & Law 2010). Participant observation and ethnographic interviews are well suited to studies of this kind in that they produce rich, in-depth data about ways of knowing and doing in the world (Green 2012a). Lesley Green reviews programmes of research 'that look for generative dialogues across knowledge traditions' saying that '[i]n order to pursue this kind of innovation, the methodology is ethnographic: detailed, careful attention to how people know what they claim'(Green 2012a:7).

In his book 'After Method: mess in social science research' (2004) Law argues that realities 'are not necessarily independent, anterior, definite and singular' and that 'if they appear to be so (as they usually do), then this itself is an effect that has been produced in practice, a *consequence* of method' (2004: 38). This means that there is not one single reality which the scientist can strive to objectively capture and convey. Yet scientists have historically portrayed and engaged with the world as such, enacting 'reality' as singular, definite and measurable (Latour 2004). Law and other philosophers of science argue that researchers actively produce realities through their 'hinterland of methods' (Law 2004:34) rather than objectively reflecting it (Whatmore 2009; Haraway 2012). The implications of this thinking are to destabilise the authority that scientific research has had since the enlightenment, making room for other accounts of the world and of nature. In this sense any account of the world is inherently partial. A relational approach to research also emphasises the generative role of the researcher, who is shown to be producing a version of reality through his or her work (Verran 2001). Acknowledging that our work as researchers is generative (Verran 2001) and partial (Law 2004) opens the door to new ways of approaching ethnography.

Law sets social scientists a challenge to think differently and more creatively about method so as to overcome the limits that we have historically placed on knowing the world. Law says:

> '[I]n this way of thinking the world is not a structure, something we can map out with our social science charts. We might think of it, instead, as a maelstrom or a rip tide. Imagine that it is filled with currents, eddies, flows and vortices, unpredictable changes, storms, and with moments of lull and calm.' (2004:7)

Law and other philosophers of science (Latour 2004; Whatmore 2009; Haraway 2012), offer us a new vocabulary that strives to capture the 'fluidities, leakages and entanglements that make up the hinterland of research' (Law 2004: 40). What I understand this to mean is that researchers are being challenged to capture the world in all its dynamic complexity, rather than imposing artificial order or logic through an overly structured research or writing process.

Much has been written in recent years about reframing research as a process of co-production and mutual learning between participants and researchers (Martin 2010; Tedlock 2011). In his forthcoming chapter on medicinal use of indigenous plants in Namaqualand, Joshua Cohen skilfully describes his own embodied engagements with plants during fieldwork (2013). Rather than positioning himself as an external observer studying plant use within a community, his analysis describes how, through his work as an ethnographer, he entered into a transformative physical and emotional relationship with medicinal plants. Taking his work as inspiration, I set out to document my own reflexive experiences as a generative part of the research process.

My relationship with bees was transformed through the two years that it took to produce this dissertation. Before starting this research I had had very little contact with honeybees. My husband Leon often told me about his aspiration to keep a few swarms of bees near our home in Noordhoek, Cape Town. For him bee farming seemed a romantic way for our family to enjoy the 'fat of the land'. When I began the process of choosing a type of agriculture to explore through my Masters research I remembered Leon's excitement about keeping bees and, after a short detour into potato farming, I decided to focus my project on commercial bee farming. Suddenly bees, which before had only featured marginally in my thoughts, snapped into focus. When I told my grandmother about my intention to study bees she told me that my great-grandfather used to keep bees at the back of their house in Kent, England. His wife, my great-grandmother, used to

refuse to mend his bee suits, and he was often stung by bees that climbed in through the holes under his arms. I thought sympathetically of my great-grandfather whenever I was stung in the field.

My encounters with bees became even more intense after I completed my fieldwork and began to write this dissertation. I began to notice that a live bee would make an appearance when I was particularly distracted from my studies, and would sometimes even buzz insistently around my head for a few minutes before flying out the window again. Once a bee spent ten minutes flying around me and bumping into me in the university library - it left the building tangled in my hair. After I spent a writing weekend away in the country my hosts e-mailed me to say that the bee that had been pestering me all weekend had been found dead under my writing chair at their home. The visits were so frequent and the bees so insistent that I secretly started to believe that the bees were encouraging me to get back to work on my dissertation.

Whether the bees were really communicating any particular message to me or whether I had become increasingly aware of the pre-existing presence of bees in my life (had I been swatting them away in years before, thinking that they were flies?) what is important is that as my way of knowing bees expanded and changed, my way of co-habiting the world with them changed also.

Overview of fieldwork

The research for this dissertation was conducted over a period of six months in varying degrees of intensity. Timing of interviews and participant observation were dictated by the seasonal availability of participants. I had intended to start my research in October 2011 and was disappointed when my first two enthusiastic attempts to enrol farmers into my research were met with rejection. I soon realised that this was related to the concentration of their spring pollination workload. The first intensive phase of expert and bee farmer interviews and participant observation therefore took place in November and early December of 2011. I managed to engage two primary participants during the slower time of November who were willing for me to spend time working alongside them – one in Cape Town and one in Bushbuckridge near the Kruger National Park. I also interviewed five industry experts in order to get a sense of the major issues

and concerns in the industry and also to familiarise myself with important terms so as to be better prepared for interviews with the farmers themselves.

The Christmas period and early January were spent analysing and coding my initial findings and shaping the remainder of my research time. I then continued with interviews and participant observation for the first three months of 2012. It sometimes took me a few weeks to set up an interview, and a significant amount of time was therefore spent emailing and telephoning farmers.

Bee farming in South Africa is governed by various representative bodies, the largest and longest established of which is the South African Bee Industry Organisation (SABIO). Annually SABIO puts together an industry conference called BEECON where international and local speakers address core issues and where debate takes place between role players, and I was able to attend this conference in 2011. I was also able to attend a local industry association annual general meeting (AGM). Lively conversation also took place on a daily basis between bee farmers in two public online industry chat rooms. I was introduced to industry chat groups by a participant in early in 2012 and continued to monitor these online discussions until October 2012.

My fieldwork activities are summarised in the following table, with a brief reference to the benefits and challenges of each method.

Method	Amount of time allocated to activity	Challenges	Benefits
Ethnographic interviews with bee farmers	Ten longer interviews were followed up in several cases with informal interviews and telephone conversations.	In several cases it required perseverance to schedule a meeting with a busy bee farmer. Research therefore needed to be planned in accordance with seasonal activities.	Telephonic and in-person interviews often lasted several hours, and sometimes included tours of facilities. Farmers seemed to enjoy sharing their opinions and concerns with me, and were generally very forthcoming.
Participant observation	These eighteen days included: - attendance of industry meetings - informal conversations and email exchanges with retailers, experts and other relevant actors - participation in workshops and courses - working in the field with bee farmers - working with my own bees	Some activities (such as commercial pollination) would have been too strenuous for me to assist with, making my presence at this time inconvenient for the farmer and therefore not a good time to conduct participant observation. Working with bees was sometimes physically uncomfortable and I needed to develop a level of knowledge and skill in order to avoid being stung.	Attending industry meetings allowed me to meet and enrol new participants. Referrals from other bee farmers proved to be an effective way of enrolling new participants. My own physical engagement with bee farming gave me insights into the embodied experience and skill of bee farming.

Method	Amount of time allocated to activity	Challenges	Benefits
Interviews with industry experts	These five interviews were followed up in several cases with extended email conversations over the course of research.	I had to keep in mind that industry experts did not exist outside of the politics of the commercial bee industry, and that their advice and recommendations needed to be considered in this political context.	Industry experts in several cases referred me to bee farmers who then became participants in my research.
Desktop research	This research included: - daily monitoring of online Google chat groups - monitoring of relevant local agricultural publications	I grappled with the ethics of observing and not participating in these public chat groups, and chose to mainly use this data to inform conversations with consenting participants rather than as primary data.	Monitoring the Google chat groups allowed me to quickly pick up on issues as they arose, allowing me to tailor interviews to issues at hand in a fast-changing context.

Table 1: Summary of fieldwork activities

Sampling

I was introduced to commercial bee farmers through an informal process of snowballing – I met one person through the recommendation of another, and so on (Streeton & Cooke 2001). My friend Catherine Hutton-Squire had just completed her own research for a design diploma at the Cape Peninsula University of Technology and she was able to introduce me to Dylan, who became a key research participant (Hutton-Squire 2011). Dylan gave me the contact numbers of several other commercial bee farmers. I also met several other participants at industry meetings, where I chatted to them about my research and enrolled them into allowing me to spend time

with them in the field. They in turn pointed me in the directions of new farmers that they thought would be open to speaking to me. It was far more effective to call a farmer and tell him that I had been recommended by one of his friends than to cold call him and make a request for an interview (my first attempt at a cold call was met with suspicion and did not result in the farmer's participation in my research).

As justified in the introduction of this dissertation, for this qualitative study of 'commercial' practitioners I included in the category those who farmed bees at scale (above 200 hives) and for whom honey and/or pollination were a central part of their livelihood strategy. The table below gives a breakdown of the gender, age bracket, number of hives[6] and region for each of the ten participants that I worked with over the course of the study. I interviewed two retired bee farmers who had sold their commercial operations in recent years. Laura, one of these retired farmers, had less than 200 hives under management at the time that her honey production, bottling and retail business was active. She augmented her own honey stocks with honey from other producers, which she then sold through local markets. I still feel comfortable including her in this study of commercial bee farmers in that she ran her operation as a full-time business concern.

[6] These are the numbers that farmers provided me, often using general phrasing, for example: 'I have about 1000 hives at the moment'

Gender	Hives	Area	Age(s)	Pseudonyms	Interviews and field notes
Male	1000+/-	Western Cape	30-40	Dylan	7/11/2011 15/12/2011 23/11/2011 17/05/2012 13/12/2011
Couple (male and female)	1000+/-	Western Cape	40-50	Peter and Sylvia	2/05/2012 12/05/2012
Couple (male and female)	500 +/-	Western Cape	40-50	Fred and Rose	11/11/2011
Female	>100	Western Cape	60-70 (retired)	Laura	17/05/2012
Male	1000+/-	Western Cape	40-50	Chris	20/04/2012 11/05/2012
Male	1000+/-	Western Cape	30-40	Ben and Melissa	18/05/2012
Male	1000+/-	Western Cape	50-60	Simon	21/05/2012
Male	1000+/-	Western Cape	50-60	Joe	4/18/2012
Male	>100	Western Cape	60-70 (retired)	Jan	17/04/2012
Male	6000+/-	Gauteng	40-50	Kyle	02/12/2011
Male	1000	Limpopo	40-50	Cedric	05/11/2011 27/11/2011 28/11/2011

Table 2: breakdown of research participants (bee farmers only)

Participant observation

Figure 1: Proudly bringing home my first bee hive

Figure 2: Processing our own honey by hand in our kitchen at home

Figure 3: Extracting honey from the comb by hand

In the early stages of the fieldwork process I interviewed a commercial bee farmer, Fred, who had committed most of his time to bee education. After hearing my intention to work with the bees during fieldwork the farmer offered me a free place on a three day novice beekeeping course. Part of the exchange was that I present my research proposal to participants and help out wherever I was needed. The course proved to be an excellent grounding for the participant observation to come in that it familiarised me with important beekeeping equipment, basic bee entomology as well as safety measures for dealing hands on with bees. I took the opportunity to purchase protective clothing and basic equipment which were essential for participant observation. This course proved invaluable as an introduction to fieldwork - I found that dropping significant terms in interviews reassured farmers in that I was not a complete novice and therefore would not be a hazard or a hindrance should they choose to take me into the field.

A second way in which I began to familiarise myself with basic beekeeping was to go through the process of establishing my own bee hive. I was lent a research hive by Mr. Allsopp at the Agricultural Research Council (shown in figure 1) and went through the process of finding bees to populate it and land on which to put it in the area where I live. Through a series of events I ended up managing an apiary site of two bee hives in a residential estate near my home. Over the

course of six months I cropped and processed honey (shown in figure 2 and 3) and also spent time working on rehabilitating an ailing swarm of bees. I documented this process in detailed field notes which recorded the physical process of working with the bees, as well as my own decision making processes.

The following extract from my field notes from the day that I harvested honey for the first time illustrates how the experience helped to develop my embodied understanding of the practice of bee farming:

> 'The swarm is very strong and feisty, and in fact many of the bees were awake and making honey at 8.30pm when we arrived at the hive in the dark. Thinking that they would be very passive and mild at that time of day I neglected to wear gloves and was immediately stung three times on my right hand when I touched the hive. This was the first indication of how challenging it was going to be to harvest the honey. The torch we had brought was much too small and weak. The smoke seemed somehow to make the bees more rather than less agitated. I got a huge shock when I finally managed to pry off the top super and lifted the full super - it must have weighed at least 10 kilograms. It was also covered with angry bees. By this time I was sweating, covered in honey and starting to panic.' (Field notes 19/02/2012)

On long car drives with farmers I often brought up my own bees as a topic of conversation, sometimes asking advice about a practical issue relating to hive management. I found that farmers were impressed that I was committed and interested enough to have my own bees and were very happy to give me practical advice as from a mentor. Having my own bees thus became a useful tool for deepening my engagement with farmers as well as with the bees[7].

Finding farmers to interview was far easier than finding farmers with whom to spend longer periods of time in the field. There is only one extra seat in a single cab *bakkie* (popular two or four seat heavy duty vehicle) and since farmers need that to be taken up by a hard working *handlanger* (person who 'gives a hand') who is willing to help with the heavy lifting of bee hives, they are therefore reticent to take along an observer. My lucky break came in the form of

[7] One of the mistakes that I made was not wearing gloves and, after a visit to the doctor for multiple bee stings, I revised my approach and I looked after my health more carefully going forward.

Dylan – a younger bee farmer with a generous temperament and a history of working with researchers – who agreed to take me out on the road with him. I was determined to earn my seat in the *bakkie* and on the four days that I worked with Dylan I returned home physically exhausted. Of the four bee farmers with whom I did participant observation, three commented on my willingness to get stuck into tasks, and I believe that this engaged approach served my research.

I soon learned other tricks for endearing myself to my busy hosts. After over-packing embarrassingly on my first day of fieldwork (the farmer laughed when he saw my bursting survival pack) I soon learned to bring as little as possible so as to make changing into and out of protective gear and moving in and out of the *bakkie* as easy as possible for us. I always brought extra lunch with me and although it was only accepted once or twice, it did make it less awkward to eat while we were on the road. An inexperienced person can be costly to have around for a fast-paced commercial bee farmer. I once lost a farmer's hive tool when I did not put the equipment away properly at an apiary site and thereafter looked after equipment much more carefully. I also learned how to be quicker in my tasks as a helper – following the farmer's every move so that I could anticipate when he would need me to blow smoke on the hive to calm the bees, take away or hand him equipment. After stepping on a pile of live bees that had just been shaken from a super I also learned to watch much more carefully where I was walking when in an apiary site – stepping on the queen bee would have meant the collapse of valuable bee colony. These hands-on experiences were particularly valuable for my analysis of embodied knowledge in chapter five.

Analysis

I used the NVivo qualitative data analysis software to manage my data. On my return from the field I would type up field notes from my written notes or recordings, and then upload these Word documents into NVivo. After the first phase of field work I conducted an analysis to pull out key themes that had started to emerge from the research (issues that were raised repeatedly in different ways by bee farmers). I then created a coding system, which I applied to all my field notes, and which I added to where new trends became apparent. I also uploaded and coded photographs that I took in the field, making them easier to search through.

What I found most useful about NVivo is that it allowed me to search for key words in all my field notes simultaneously, quickly confirming patterns that I saw emerging in the data as I read through my notes again and again. I approached NVivo as a sophisticated tool for 'eyeballing' my notes (Bernard 1994), which was more effective than the technique that I used in my honours year which involved printing out my field notes, cutting them up and manually arranging and rearranging them into different patterns on the floor in order to generate new insights and see linkages and patterns.

The disadvantage of using NVivo is that it was quite costly to purchase a licence, and once my licencing ran out I no longer had access to the coding system that I had used throughout research. If I want to write academic papers in future and I want access to my notes in that format I will need to pay for another software licence.

Research ethics

At the outset of research I was warned by several industry experts that commercial bee farmers in South Africa were secretive and unwilling to cooperate with researchers (personal communications 1311/2012 and interview 10/11/2011). They explained that farmers had concerns about their intellectual property being made available to their competitors through the research process; thereby disadvantaging them – an issue I explore in some depth in Chapter Four. At the outset of each interview I gave participants my contact details and told them that if at any stage they felt uncomfortable about anything they had said to me they could contact me and ask for it to be withdrawn from my data. Often farmers would let me know in the interview that what they were saying was off the record and not to include it in my project. On several occasions I myself decided that information was too commercially sensitive to include and elected to withhold it in the written version of the dissertation, or emailed the farmer in question to negotiate its use.

I was not able to promise participants total anonymity in my research. The bee industry in the Western Cape has a relatively small number of role players - even basic descriptive details such as the location of apiary sites and the amount of bees a farmer owns could identify him or her to

other bee farmers. I substituted participants' real names for aliases in my writing. Most farmers that I spoke with said that they did not mind being identified, but it was my experience that they shared more information with me when they knew that their names would not be mentioned in the dissertation. I have also decontextualized farmers by leaving out the particulars of the locations where they keep their bees, and also avoided clustering too much contextual information together in the text (such as age and gender in conjunction with affiliation to organisations and amount of hives and telling quotations) that would paint a clear picture of who was being written about. As much as possible I tried to verbally manage expectations around anonymity by explaining the challenges of doing research in a small industry.

I started research using a disclosure form which participants signed, allowing me to use their interviews for my project. My initial two attempts to use the forms were unsuccessful: both participants insisted that they did not mind if their information was used in the project, and neither returned the forms to me. I believe that they shared more with me when they knew that their names would not be associated with this information, however freely given. I decided to scrap the consent form and used a method of ongoing verbal consent with participants, checking in with them at different occasions to ensure that they were still comfortable with being a part of the project.

One of the biggest challenges that I faced ethically was that farmers were very interested to know who else I was working with in the industry. There is conflict and tension between farmers in the Western Cape bee industry for various reasons. I had to make a firm decision not to become a conduit for gossip and possibly exacerbate tense interpersonal relationships. Bee farmers commented on the fact that I wouldn't talk about anyone else that I was working with, and I got the sense that they felt more comfortable talking openly to me because of this. It was sometimes tempting to name drop in order to network more easily amongst farmers, but aside from one or two slip ups I managed to avoid doing this.

Conclusion

This methodology chapter demonstrates that an ethnographic approach was taken in producing this dissertation. Thirteen commercial bee farmers participated in the research - four of these farmers were paired together as husband and wife teams and another two farmers were retired from full time farming. Research included ten ethnographic interviews with bee farmers, five interviews with industry experts, eighteen days of participant observation, and ongoing monitoring of online industry discussion forums.

The process of research and analysis in this case was neither designed nor executed to be linear (a clearly laid out process to test a singular hypothesis) or unidirectional (a researcher studying subjects from an objective distance). Research involved developing relationships of trust with participants over time through informal and sometimes more formal conversations, and new questions emerged through these engagements. My own experiences and reflections as an ethnographer were used as research data, clearing demonstrating my own role as an active participant in my own research. Ethics were a central consideration in conducting this study, and had to be carefully negotiated in order to protect the commercial and personal interests of the participants.

Chapter 4 -

Farming with bees in a dynamic social-ecology

According to writers like Ingold (20011), Thrift (2004) and Haraway (2008), people cannot be separated from the relationships and circumstances within which they are entangled. Haraway writes:

'Always in formation, embodiment is ongoing, dynamic, situated, historical.'(2008:249). What this suggests is that ethnography needs to acknowledge the emergent nature of knowledge: circumstances and actors are always changing, and it is misleading to approach ways of knowing and doing as fixed, or as a response to a static context. At the same time as life is unfolding, it is also grounded or situated in bodies and places, and so the challenge of this chapter is for me to write about bee farming in such a way as to acknowledge instability and change while also grounding the analysis in what I observed, smelled, saw and heard at a particular moment in time in the field.

Cohen, applying the ideas of Ingold, describes the dynamic intersections of ideas, plants, practices and substances in his ethnography of medicinal plants in Namaqualand as 'a 'meshwork' consisting of the intersecting and merging of the lines that trace organisms' 'movements through, and mutual forming of, the world-in-becoming' (2013:6). The argument of this chapter is that the applied practices of commercial bee farmers formed part of and emerged from complex social-ecological meshworks (Ingold 2007; Cohen 2013) or entanglements (Haraway 2008) involving bees, plants, landscapes and practices. The first section of this chapter begins to trace farmers' engagements with weather worlds, showing how farmers moved through and also helped to shape the world around them (Ingold 2007).

In the second section of the chapter I have chosen to address this analytical challenge through attention to two pressing and (I argue) intermeshed matters of concern[8] that were under discussion by bee farmers at the time of this research: their struggles to access bee sites and bee forage (particular flowering plants). In the Western Cape bee forage plants can be loosely grouped into indigenous plants (such as *fynbos*), agricultural crops and non-indigenous plants. Simplifying a complex ecological relationship, the amount of forage in an area and the timing of flowering as well as a range of other biological and land use factors affect the number of bees that can be supported in an area (Murray et al. 2009). All but one of the bee farmers that I worked with practiced a mobile, migratory form of bee farming which involved moving hives from site to site on flatbed trucks or converted *bakkies* as a means of ensuring that bees were always proximal to forage[9]. None of these farmers owned large tracts of land themselves (although there are bee farmers in the Western Cape who do own plantations (Allsopp & Cherry 2004)). Instead they relied on other landowners to accommodate their bees when they were not employed in agricultural pollination. Bee farmers explained to me that in most cases their relationships with landowners were flexible and non-contractual: landowners were generally paid site rental in honey, but some did ask for additional cash payments.

Bee forage plants form an essential part of an managed ecosystem service provided by bee farmers to society (Allsopp et al. 2008). Between early August and the end of October bee farmers in the Western Cape are contracted to bring swarms of bees onto farms to pollinate agricultural crops. Dylan explained that during pollination 'there is a different period per cultivar, normally two to three weeks if the conditions are right, weather and so on'(telephone conversation 11/07/2012). An example of this in the Western Cape is that farmers put their hives

[8] The term 'matters of concern' is used by Latour (2004) in reference to particular knowledge controversies taking place in academia. This chapter is more concerned with situating bee farmer's concerns and practices, but the chapter does lay the groundwork for a conversation about multiple (Mol 2002), sometimes contested and controversial ways of knowing (Verran 2001; Whatmore 2009) that is developed in Chapter Five.

[9] Some farmers used syrups and pollen substitutes to strategically bolster their bees' health and strength. One honey producer working on a community project in the Limpopo region established permanent apiary sites in communities by sustaining his bees almost entirely on artificial foods during parts of the year when very little forage was available.

into plums for a few weeks in August, then moved them to pears in September and finally into apple orchards in October. In order to prepare to sustain their bees throughout the year farmers rely on a range of forage sources growing around the Western Cape.

Allsopp et al distinguish between an ecosystem service and a 'managed service', saying:

> 'Here we define an ecosystem service, as an ecosystem function with benefits for human life, while we define any man-made input(s) that substitute natural ecosystem services, as managed services, i.e. managed pollination services.'(Allsopp et al. 2008:2)

By making this distinction these researchers highlight that human involvement (or 'input') in pollination processes is essential. Henrik Ernstson addresses the social production and mediation of ecosystem services when he writes that 'the benefits humans and society can derive from biophysical cannot be viewed as objectively existing 'out there', but as entangled in social and political processes' (Ernstson 2013:8). In this chapter I show how commercial bee farming is an excellent illustration of an 'ecosystem service' or 'managed service' that is co-produced by humans, plants and insects (Allsopp et al. 2008).

Ernstson writes that an 'entry point to understand the social production of ecosystem services is to move between broader views of distributive patterns of biophysical benefits, and analysis of place-based struggles' (2013:10). In order to grapple with the issue of land and forage access for bee farmers, attention to the distribution of forage species is essential: this important work is currently being conducted by the Honey Bee Forage Project (run by the South African National Biodiversity Institute) who are identifying, mapping and quantifying forage species throughout the country. With this quantitative research still in progress, my analysis is focussed on providing a nuanced qualitative view of how forage, landscapes and people are entangled in material realities and practices in the Western Cape, with a view to expanding understanding of the complexities of these 'place-based struggles' for bee sites and bee forage (Ernstson 2013:10).

Farming in dynamic 'weather worlds'

Figure 4: A bee farmer examining eucalyptus tree buds

Plants were a favoured topic of conversation with the bee farmers with whom I spent time. As we drove between bee sites, participants often spoke to me about the different species of bee forage that we passed growing beside the road. They commented on the flowering timing and the number of flowers currently in bloom. Farmers were keen for me to appreciate the value of plants, and on several occasions stopped the car on the side of the road to give me a closer look, as these field notes describe (and as is shown above in figure 4):

> 'As we drive into Perdeberg Dylan points out the river gums which are beginning to flower – long, droopy branches and pretty white puffs of flowers. He pulls over to the side of the road and picks one for me to look at and smell – the flowers have a strong sweet smell, like children's breakfast cereal. I add the sample to the day's growing collection of cuttings in the *bakkie's* glove box.' (Field notes 13/12/2011)

On this trip and on other occasions Dylan encouraged me to smell, touch and look closely at examples of flowering plants that bees feed on. He also taught me the names of the different species of eucalyptus trees, identifying them as we drove past stands of trees beside the road and later testing me to see if I could identify one species from another. If a plant that he was

unfamiliar with was blooming in profusion Dylan wondered out loud if the bees were feeding on it. I would like to suggest that he related to plants with curiosity and in a tactile way, revising and adding to his knowledge about viable forage plants growing in the geographical areas that he worked with his bees both by examining plants up close and observing bee behaviour. As his apprentice, this same mode of learning was extended to me: Dylan engaged me in informal, demonstrative, on-site lessons in plant classification.

I saw more evidence of curiosity about the natural environment when I joined a honey extraction expedition along with three researchers from the Honey Bee Forage Project and the Global Pollination Project (also administered locally through the South African National Biodiversity Institute). I noticed the degree to which our guide Chris (the bee farmer) was engaged with and curious about plants and animals in the area surrounding the apiary sites:

> 'We drive up the precarious hillside to reach the bee site at the top. I drive in the front of the old *bakkie* carrying the empty hive boxes and Chris drives ahead of us with the government research team. It takes us about twenty minutes to carefully drive up the mountainside, navigating pot holes, erosion of the road, tree branches fallen down in the path and narrow way through the vegetation. The area is beautiful – a breath-taking view as we ascend. There is a mixture of eucalyptus trees, pines and indigenous *fynbos*. The proteas are flowering. Chris walks around a strange looking tree at the bottom apiary site – he is concerned that he doesn't know what species of tree it is. He plucks of a branch and gives it to one of the other researchers, saying – 'now you can identify it'. He points out similar trees as he moves down the mountainside in the car. He also stops the car to look at a large death head moth lying in the pathway as well as at many other points on the descent.' (Field notes 11/5/2012)

These field notes illustrate that bee farming takes place outdoors, often in very remote, rural landscapes. On this extraction trip Chris did not focus only on his bees, but kept a keen eye on plants and animals in the vicinity of his apiary site. He was willing to share his knowledge and observations of changes in the environment with researchers - in this case he pointed out a new species of tree that had started growing around his apiary sites. He was also eager to expand his knowledge about potential forage in the area, deferring to their scientific expertise when he wasn't able to identify a plant himself.

Ingold (2007) argues that people do not move around on top of the earth and underneath the sky, as actors about on a stage. Rather he attempts to formulate a new understanding of what it means to be 'in the open', writing that:

> 'Instead of thinking of the inhabited world as composed of mutually exclusive hemispheres of sky and earth, separated by the ground, we need to attend, as I shall show, to the fluxes of wind and weather. To feel the wind is not to make external, tactile contact with our surroundings but to mingle with them. In this mingling, as we live and breathe, the wind, light, and moisture of the sky bind with the substances of the earth in the continual forging of a way through the tangle of life-lines that comprise the land.' (2007: 1)

Farmers like Dylan and Chris worked with their bees 'in the open', exposed to the elements and moving through different physical environments. They 'foraged' through the land in the sense that they regularly paused to examine, touch and smell the world around them, interested not only in their bees, but in plants and other insects to be found in and around their apiary sites.

Dylan was interested in the buds as well as the flowers, particularly in the case of eucalyptus trees. In establish the state of the buds, he would examine trees closely as we walked or drove through an area, as shown in figure 4. Dylan explained the importance of this close scrutiny:

> 'Trees plan three or four years in advance. They set buds two to three years before they flower - you can see the three stages of flowers on one tree at the same time. There are also different cycles according to the variety of tree.'(Interview 7/11/11)

Dylan had an in-depth knowledge of the flowering cycles of different trees which he had developed through his observations over time. By monitoring the buds (which can be seen in figure 4) Dylan was able to take advantage of what he called a 'honey flow' or 'nectar flow' in a particular area by putting extra equipment onto bee hives when flowers started to blossom and thus creating room for bees to store the extra honey that they were able to produce.

Dylan expressed concern about the links between changes in bee forage and reduced honey production in the Western Cape:

> ‘Bee farmers in this area used to harvest 30kgs average per colony, and are now down to 10kgs average. In part I would put this down to climate change. There is also a disease affecting the trees which causes them to produce less nectar than they used to. I would attribute half of the change to climate change. Less rain equals less nectar. South Africa is a crap climate for honey production. It is a marginal environment, which can only get worse.’ (Interview 7/11/11)

Here Dylan related a tangle of factors that he saw as causative of a significant drop in honey production in the Western Cape. He linked a drop in rainfall in the area to climate change in South Africa at large – he was concerned that honey production would become increasingly untenable in the years to come due to increased aridity. In his narrative less rain results in flowers producing less nectar, leading to less food for the bees and consequently less honey for the market. Examining the buds of eucalyptus flowers was therefore also a means of assessing the future health and productivity of trees in a particular area in relation to disease and regional rainfall.

One causative factor that Dylan identified for the drop in honey production in the Western Cape was an increase in southerly wind:

> ‘The wind in summertime dries everything out so badly. The southerly wind is getting worse. In general, the wind dries out the flowers on the trees, and the trees become wind burned’ (Interview 7/11/11)

Kyle, who worked with African honey bees (*apis mellifera scutellata*) and was based in Johannesburg, gave a different reason for the change in nectar availability, saying:

> ‘We have a saying that the rain washes the nectar out of the flowers. The sugar content of nectar changes in the rain. It is just something we have noticed – in dry seasons we do better. While farmers are complaining of drought we get a bumper crop.’ (Interview 2/12/2011)

It was evident from these exchanges that farmers were acutely aware of weather conditions, and that they had drawn conclusions over time about the relationality between wind, temperature, rainfall and the quantity of honey that their bees were able to produce in different regions of the country.

What this section has illustrated is that farmers were curious about the impact that plants and weather might have on the bees and on honey production. Farmers foraged through the land, engaging thoughtfully with what they observed around them. One way in which weather was 'bound to the substances of the earth' (Ingold 2007: 1) was in the eucalyptus trees which held so much importance for bee farmers like Dylan. The buds of these trees became, under the experienced eyes of bee farmers, barometers of changes in climate and gauges of future honey production in an area.

Access to bee sites and bee forage

Farmers in the Western Cape were worried about future forage security, given that they already worked long hours and drove considerable distances in order to ensure that their bees had access to forage. In one sense a bee farmer's ability to migrate bees is an advantage, but as agricultural bee researcher Mr. Allsopp pointed out in an interview, this flexibility has its limitations:

> 'The Western Cape region is logistically and financially constrained. Petrol prices, legislation, type of bees. There is a finite amount of forage.'(Interview 10/11/11)

One bee farmer emphasised the importance of transport in accessing forage, saying: 'the best food for our bees is diesel' (field notes 2/12/2011). In other words, being able to move bees from place to place ensured that they were well fed. Another retired farmer explained that he had been struggling to cope with hikes in the price of diesel when he was in business - over one busy December harvesting period his diesel costs had exceeded R20 000. In this way a bee farmer's ability to adjust to a change in availability or occurrence of forage was influenced by the fluctuating cost of transportation.

The legislation to which Mr Allsopp is referring in the above interview quotation relates to two different species of bees in South Africa: the Cape bee, known to scientists by the Latin name *apis mellifera capensis* (and in the short hand by bee farmers as simply *capensis* or the Cape bee), and the African honey bee, *apis mellifera scutellata*. Bee farmers working in more northerly parts of the country explained to me that in the 1990s a significant number of bee farmers went out of business when Cape bees, thought to be brought into the region by an enterprising farmer, colonised the hives of local African honey bees. Cape bees are unique in the world because their worker bees are able to produce females from unfertilized eggs – a role

normally performed exclusively by the queen bee (Lubbe 2005). This behaviour caused confusion in African bee hives, resulting in colonies collapsing and bees absconding. The government issued a proclamation and hundreds of 'infested' hives were destroyed to try to halt the infestation of Cape bees (National Department of Agriculture and ARC-Plant Protection Research Institute 1998). In order to halt the spread of the Cape bee outside its original habitat, legislation was passed (Department of Agriculture 1999) that made it illegal to transport bees from one side of the country into the other (shown on the map in Appendix B). In the Western Cape, bee farmers' movements were constrained by law to a particular geographical area, limiting access to forage occurring near to or beyond the legal boundary between the north and the south of the country.

As mentioned in the introduction of this chapter, another significant challenge to accessing forage was that bee farmers mostly did not own large enough tracts of land to sustain their bees between pollination seasons, and were therefore reliant on private landowners to accommodate their bees. Jan, a retired bee farmer, reminisced dryly about his career, saying:

> 'What is a beekeeper overall? A beekeeper is a beggar. You drive up to the security gate – "May I please keep bees on your land?"'

Jan expressed this landlessness as a form of vagrancy: like a beggar, he was reliant on other people to provide him with the means of making a living - acquiring new bee sites in some cases required door to door visits. Without formal contracts, land owners were not obligated to remain loyal to a particular bee farmer over time. A farmer might be granted access to a forage site only to return from pollination or from another bee site to find that he was no longer welcomed by the landowner or that another bee farmer had capitalised on his absence and manoeuvred his own bees onto the land. There was therefore a degree of uncertainty and instability involved in finding and retaining bee sites in the Western Cape.

The importance of longstanding relationships between bee farmers and land owners also influences the racial profile of large scale commercial bee farmers in the Western Cape, who are

mostly white[10]. Fred, a bee farmer and educator, was particularly concerned about racial inequality in South African bee farming, saying:

> 'Bees are politicised in a way that is unique in South Africa. To have bees on a commercial level you have to put them on someone else's land – you are farming without a farm. This depends on white farmers. In the past black beekeepers had no access to land. Beekeeping is racialised and gendered in nature. With the whole industry in the hands of white people, who is going to train black people?'(Interview 13/11/2011)

In this interview Fred stressed that in order to 'farm without a farm' bee farmers rely on relationships that have historically existed between white men in the context of South Africa. He also indicates unwillingness on the part of white commercial bee farmers to assist in the transformation of the industry through training of black bee farmers, who some farmers believed would represent a commercial threat in what they believe to be a capacitated (or over-capacitated) pollination market in the Western Cape (field notes 1/05/2012 and 17/04/2012) .

While relationships between white commercial bee farmers and white landowners (also in most cases farmers themselves) may have begun under apartheid, I saw evidence of race mediating access to land when out in the field with Ben, who told me that some farmers only allowed him to use their land if he accompanied his black employees at all times (18/05/2012). They feared that unaccompanied workers would steal from them if allowed to access the property unsupervised. Ben himself had married into a second generation bee farming family with long standing ties to landowners with profitable bee sites, and it was his father in law's reputation that in many cases opened doors for Ben and Melissa as they started out in the industry. This is the kind of social currency is not likely to be at the disposal of black individuals aspiring to work in the close-knit commercial bee farming industry in the Western Cape. These examples demonstrate that the issue of race and bee farming is a complex one. While it is not the focus of this dissertation, what is important to note in this discussion of social ecological dynamics is that race is entangled with the issue of land in that race can limit or enable access to land, and therefore to commercial bee farming, in powerful ways in a modern day South African context.

[10] There may be black bee farmers working at a commercial scale in the Western Cape, but I never met or heard of such an individual during my research.

One way in which land issues were frequently articulated to me by bee farmers was in terms of carrying capacity. Dylan expressed this concern in the following way:

> 'The biggest issue that bee farmers face is places to keep bees. There are no bee sites around the Western Cape – we are piggy-backing on other people's bee sites, which reduces everybody's yield. The Western Cape just does not have the carrying capacity for more bee keepers.' (Interview 7/11/2011)

When I asked Jan about his biggest concerns as a bee farmer he immediately responded that: 'the first problem at present is that there are too many beekeepers'(17/04/2012). Fred commented on a community development project that wanted to establish stationary apiary sites throughout the Western Cape, saying of its director:

> '[He] is confusing bees with bicycle factories, which can be put anywhere in the world. It depends on the science versus the reality of beekeeping. Overgrazing the bees means less production.' (Interview 13/11/2011)

Unlike producing bicycles, honey production is affected by an apiary site's placement in relation to other apiary sites and to forage sources. Bee farmers like Dylan and Jan were very concerned about the limitations being placed on business growth and productivity by competition over bee sites and therefore forage resources within a finite geographical area.

What the issue of carrying capacity illustrates is that pollination is indeed 'entangled in social and political processes' (Ernstson 2013:8). Bee farmers were not at liberty to place their bees anywhere they wanted to but rather, like shepherds, had to move their bees amongst accessible and viable grazing lands. Complicating this shepherding process were legislated geographical boundaries, the cost of diesel, and the necessity of ongoing negotiation with landowners involved in securing and retaining sites over time. In this way the practice of farming bees emerges from social-ecological and historical South African landscapes and is also shaped and limited in different ways by these landscapes.

I discovered that farmers employed different tactics and practices for securing bee sites in this atmosphere of competition. As Ben and I drove onto a property where he had bee sites he pointed out some hives that had been placed near the gate, saying wryly: 'If you can't put bees

on a farm then you put it on their fence' (Field notes 18/05/2012). Jan reflected on these territorial politics within commercial bee farming, saying:

> 'The first problem at present is that there are too many beekeepers. There is not enough nectar for all these beekeepers now. If you put hives next to a neighbour with gum trees, you are robbing nectar from the beekeeper on that property. But there is no argument. You have to go to the land owner to resolve it in a friendly manner. It is really what you would call a 'marginal argument'.'(Interview 17/04/2012)

Bees moved across imagined boundaries between properties, and could therefore 'plunder' or 'rob' the nectar from forage in an adjacent property, leaving less food for bees already in the area. One creative and unpopular strategy for accessing forage when a farmer was denied access was therefore for farmers to allow their bees to fly over the fence. In this example the collaboration between bees and bee farmers to secure sufficient 'fuel' for honey production and pollination is particularly evident: the farmer encourages his bees to transgress a social boundary that he cannot or dares not breach himself.

Jan explained that, in his experience, the only way to manage this kind of territorial clash of interests was to appeal to the landowner to intervene on one's behalf. I observed an example of this kind of 'marginal argument' when out in the field with Dylan one day:

> 'During the course of the day Dylan gets a call on his mobile phone from a staff member. Recently they have asked for and received permission to place bees in a small canyon. They moved 70 hives into the area. A local man, probably the bee farmer himself, had apparently stopped Dylan's workers and was rude to them, telling them that they had to move their bees because there were already 250 hives in the valley. Dylan spent quite a bit of time thinking and talking through what he was going to do. Initially he said that he would move the hives out of the area (or at any rate he would move the hives that had been spotted and counted by the complaining individual). He explained that this was 'the right thing to do. It is not worth making enemies – I can't go around having people dislike me. Some people might not move them [the bees] but it's the right thing to do. 'Site politics is one of those things. If I had been hard arsed it would have ended in a huge fight.' (Field notes13/12/2011)

Later on in the day Dylan and I visited another bee farmer to collect some equipment. Dylan asked her advice about the situation and she advised him to call the main role players and confirm that there were really 250 hives in the valley rather than making a rash decision. When I asked Dylan a few weeks later if he had in fact removed the hives, he told me that he had spoken to the landowner who told him to keep his bees on the land. If anyone else in the area complained, Dylan was to refer them to the landowner. After talking the decision over with his wife he had decided to keep the hives where they were.

Dylan went through a complex process of consultation and reflection in order to make the decision to keep his bees in the valley. Initially he took a diplomatic approach, prioritising his reputation as a likable, reasonable person as well as his desire to avoid conflict by deciding to remove the hives from the area. He discussed this initial decision with another bee farmer and with his wife (who was also his business partner); unsure of whether it was the right course of action. His decision was renegotiated in his conversation with the landowner: Dylan chose to keep the bees on the land and to trust the landowner to mediate any potential conflict that might arise with the other bee farmer working in the area. It is possible that this decision has since been renegotiated. Dylan's decision making process illustrates that an ongoing process of consultation and negotiation was needed in a seemingly simple management decision. Multiple relationships and considerations were involved in Dylan's choice to leave the bees where they were. In this sense Dylan's management strategies were entangled in and shaped by different interpersonal dynamics (or relationalities) and not by a clear division between 'right' or 'wrong' as he originally indicated.

Ben told me about flexible risk management practices that he employed in order to manage his tenuous, vulnerable relationship with land and forage. Ben took me to visit his prime bee site: a eucalyptus plantation inherited from the previous owner of the business. He explained his reliance on that particular site, saying:

> 'There is no competition here – they are loyal to us. But the farm is for sale. We keep 200 hives on the farm – that is one fifth of our bees. If they sell it and the next owner gives the site away then we will have trouble. The farm is selling for R11 million – it is a blue gum plantation. To lose this farm would be catastrophic.' (Field notes 18/05/2012)

Later that day he added:

> 'This farm can take 600 hives but you don't want to piss off the farmer or keep all your eggs in one basket'

Ben and his partner Melissa were heavily dependent on one bee site. Their relationship with the landowners had been established when they bought out a farmer with an existing relationship and informal agreement in place. They explained to me that the main reason that they had bought the business was because of its well-positioned bee sites (the equipment and bees that they purchased with the business were in fairly poor condition and of less value). This particular site was an excellent source of forage for their bees, and they enjoyed sole access to the large plantation of trees. Despite this advantage, Ben and Melissa limited the number of bees that they kept on the site. They did this in order to contain their dependence on it in the case of a sudden change of ownership. Ben also did not want to 'piss off' the landowner by pushing the boundaries of their informal rental agreement. Another strategy that Ben used to manage the risk of losing the land was to stage 'fake' apiary sites of empty hives near the entrance of the plantation when his bees were in pollination. He felt that this was the best way to send a clear territorial message to any other bee farmer who might consider approaching the landowner.

Based on these examples it could be argued that both Ben and Dylan spread or averted risk as much as possible to accommodate the uncertainty associated with keeping livestock on other people's land. This risk management strategy allows him to survive the vagaries of 'farming without a farm' in a highly competitive commercial environment, while retaining good will with other bee farmers with whom a friendly (or at least collegial) relationship was advantageous.

This ethnography shows that there were various other entanglements in the plant-pollinator relationship. A swarm's access to forage was mediated over time by complex and unstable encounters between bee farmers and land owners. It was also directed by bee farmers as they shepherded bees between apiary sites and forage sources. The examples also show that farmers were in 'active engagement with the constituents of their surroundings' (Ingold 2000): through informal, sometimes silent negotiations (such as Ben showing his territorial dominance through a display of mock apiary sites on the boundary of a plantation) with land owners and other bee

farmers, participants worked hard to gain and maintain access to land and forage of which they themselves had legal ownership.

Another knot (Haraway 2008) or mesh (Ingold 2005; Cohen 2013) of relationships that mediated bee farmers' access to forage was among the bees, the land, the trees, the farmers and the general public. Safety challenges were involved when working bees commercially in a residential environment. Laura kept her bees on the large grounds of her smallholding in an industrial/residential area, but feared for the safety of neighbours and passers-by. She told me how one day a friend, helping out with her business, had opened up a 'twitchy' (tendency to be feisty and defensive) hive of bees, with nearly disastrous consequences:

> 'He opened up the hive [….] and the bees decided that they didn't like that. We had to close all the doors and windows, bring all the animals inside. Anything that moves they will kill. We've had a couple of things happen. Mowing the lawn – they don't like the smell of cut grass' (Interview 17/05/2012)

Dylan keeps bees on a few residential sites, but prefers to work in less populated areas, saying:

> 'Urban beekeeping is tricky. It is much easier to keep them out in the countryside, where there are no people getting stung.' (Field notes 15/12/2011)

When I visited a residential apiary site with Dylan he used a lot of smoke on the bees to calm them after opening the hive, but was still anxious about leaving the property. He took the time to walk up to the house and ask the gardener and the domestic worker to head quickly inside the house should the bees begin behaving defensively ('bumping' into or stinging people). I noticed that our visit to this apiary site took longer than visits to sites in more remote areas, where we were able to pack up quickly and leave the bees in a more agitated state.

Bees are in some cases unwelcome participants in urban spaces: while some people were excited to allow commercial farmers to put bees on their land I was told about instances in which residents used domestic insecticides like 'Doom' to eradicate swarms of bees on their property, concerned for their families safety. Bee farmers were also often called out to remove wild bee swarms from people's homes and gardens. In this way wild bees were often removed from the city space by bee farmers and relocated to more agricultural areas as part of managed apiary sites. Thrift articulates this tension between human and animal interests, saying:

> ‘If moves have been made for over a decade to recognize ‘nature’ as a cultural construct, the emphasis is now shifting towards drawing out the many ways in which the nonhuman, both animate and inanimate, is inextricably connected with and partly constitutive of human societies’(2004:29)

Dylan articulated this spatial entanglement between humans and insects as a ‘tricky’ relationship for bee farmers to manage in practice. Safety issues were a consideration for some bee farmers when choosing and getting permission to use land within the city. There was also a time issue linked to working in a residential area: farmers were obligated to spend extra time ensuring that bees were calm and that people were safe before leaving an apiary site, which impacted on the number of hives that they were able to manage in a day.

Other matters of concern that demonstrated how farming bees was embedded in social landscapes were those of theft and vandalism of bee hives. Peter spoke about vandalism as arising from different value systems:

> ‘Vandalism - this one word conveys huge amounts of issues. The whole socio-political concept of ownership comes up. I was exposed in one of my projects to a huge criminal element. I interviewed these guys informally. If it’s not in use, like for example a fridge standing in someone’s house, then you can take it. Everybody is appropriating or breaking our stuff. The youngest I caught was four years old. Closing up the hive with *mielie pap*[11], waiting for the bees to die. Or tipping it into the river’ (Interview 2/05/2012)

Peter diagnosed vandalism as a symptom of a more pervasive way of thinking about property. He believed that there were people who saw a hive as ‘fair game’ in that it appeared unattended or out of use. People of all ages broke into Peter’s bee hives to get access to the honey, sometimes suffocating or drowning the bees in order to remove the honey without being badly stung. Jan’s explanation for destruction of property was framed in terms of labour politics:

> ‘When people sell their farm and move out without giving staff remuneration or a bonus, they often knock the hives to pieces. That has been the most expensive form of vandalism for me.’(Field notes 17/04/2012)

[11] Maize porridge

Jan's property was seen as an extension of the property against which workers had feelings of resentment, and therefore became a target for emotive demonstrations of discontent. These different accounts indicate that bee farmers had thought deeply about the underlying relationship dynamics and conflicts of interest at play in their struggle with vandalism. Kyle, who has to find sites for over 6000 hives, lamented that 'There are huge areas where I cannot work because of theft' (Interview 2/12/2011). The viability of bee sites were clearly influenced by how accessible they were to members of the public who might think differently about ownership of honey or see bee hives as an extension of a landowner's property.

Urban ecologists have written about how the city is embedded in ecosystems, and how these ecosystems are in use by a range of practitioners who do not always harmoniously and flexibly co-exist (Ernstson 2013). The point that I am making with these examples of vandalism and conflict with the general public is not that bee farming in publicly accessible spaces and urban environments is untenable. Rather I am pointing out that bee farming is situated in 'living' landscapes (Whatmore 2006), with implications for practice. Whatmore argues that emergent ways of thinking about landscapes 'puts the onus on 'livingness' as a modality of connection between bodies (including human bodies) and (geo-physical) worlds' (2006:603). In other words: bee farmers, flowering plants, hungry or bored children, disgruntled farm workers, honeybees and worried residents sometimes participated in the same physical landscape. Their interactions are not always comfortable – sometimes bees were drowned and exterminated, people were stung and farmers were out of pocket because valuable equipment and livestock needed to be replaced.

Concerns about vandalism and 'site grabbing' were evident in some engagements between members of the bee industry and the academic community. Various questionnaires sent out by researchers through SABIO and the apiculture group had garnered a poor response rate from commercial bee farmers. One reason that established bee farmers gave for not wanting to respond to questionnaires was that if their bee sites were identified they would be more vulnerable to robbery and vandalism. This latter point was illustrated by a comment on the online discussion forum *apiculture-sa* under the discussion thread 'stolen hives':

> ‘Sorry to hear about your stolen hives [name]; now you understand why we should never give out our site information to anyone!’ (*apiculture-sa* 20/09/2012)

This comment was followed by a debate about whether the thief was another bee farmer or not. Bee sites were left unattended for long periods of time between visits and were challenging to secure - bee hives, though marked with a farmer’s SABIO registration number (if they had one), were sometimes stolen for use by another bee farmer. I was told to look out for hives with a large area sanded on one side where the registration used to be deeply carved as these were probably stolen property (field notes 23/11/2012). Whether they were protecting their sites from each other or from members of the public, one form of risk aversion utilised by bee farmers was to keep site locations to themselves.

Secrecy amongst bee farmers was not the rule, I discovered. Peter, for example, felt that secrecy about site locations was a waste of time, saying:

> ‘Not identifying sites is nonsense. We all know where other people’s bees are’. (Interview 2/05/2012)

There are several bee farmers that I know of who have worked closely with researchers over the years and others who have given a great deal of time to mentoring aspiring bee farmers in various ways. Dylan, allowed me to spend several days working with him at a very busy time of the year, patiently teaching me the basics of his practice. During fieldwork I found out from other researchers and bee farmers that Dylan had also helped them out by sharing knowledge or lending a hand with their bees at a busy or difficult time. When I asked him why he was so willing to give time to my research he commented:

> ‘I believe in helping other people. The good luck comes back one way or another.’ (Field notes 23/11/2012)

Indeed this strategy of reciprocity and friendliness to all seemed to serve Dylan well: through a healthy network of relationships he had recently secured a honey house in a prime area near his home which he paid rental for in honey rather than in cash. He also kept his bees in well-placed sites around the Cape Peninsula, and was often allowed access to private property in order to take advantage of otherwise hard-to-reach forage sources. In this sense Dylan’s engagements with researchers, landowners and other bee farmers were characterised by openness and willingness to support: a strategy that paid dividends in terms of access to land and forage.

Another important and complex issue affecting forage access and security in the Western Cape at the time of research was government sanctioned eucalyptus tree removal in the region. According to bee farmers particular species of eucalyptus trees are a major forage source for managed bee populations (Allsopp & Cherry 2002). Eucalyptus or 'gum' trees are also classified by the South African government as alien tree species, as Allsopp and Cherry explain in more detail:

> 'The gums in question are listed by category of environmental destructiveness in the Conservation of Agricultural Resources Act (CARA) and include seven species. One, Eucalyptus lehmanni or Spider Gum ('most destructive' category on the list), is regarded as sufficiently damaging to the environment to warrant its unconditional removal. The others, which include Eucalyptus cladocalyx or Sugar Gum, a major nectar source, may be retained in a non-sensitive ecosystem under permit ('demarcation') provided that the landowner assumes full responsibility for any environmental damage (invasion, fire, water removal) that could be caused by the trees.'(2004:i)

As this quotation indicates, an alien tree removal programme targeting particular species of eucalyptus was underway at the time of this research, administered by the government's Working for Water Programme (as well as other related or similar programmes). Eucalyptus trees are particularly good sources of nectar because they flower in summer when there is little other forage (aside from exotic weeds) available in the Western Cape (Johannsmeier in Allsopp and Cherry 2004). The issue of eucalyptus removal is explored in more detail in Chapter Five, but at this point it should be mentioned that a decline in eucalyptus was a pressing matter of concern for bee farmers at the time of research because of the further limitations that it would place on forage access and security.

Farmers explained how they also strategically leveraged the benefits of other forage sources in the Western Cape. One agricultural crop upon which they relied for augmenting the amount of swarms under their management was the winter oil crop canola:

> 'As we pass a canola field Dylan tells me that he builds up his hives on canola. He says that he puts 1000 hives in canola annually. 'The bees get fierce – very aggressive'. When we collect hives from the honey room and from some of the bee hives we check, Dylan points out the canola honey which has crystallised in the combs. This is very challenging

> to get out of the combs, which have to be scraped down to the base comb in order to get the honey out, and allowed to separate. Dylan also says that it has a 'cabbagey' aftertaste (which I was not able to detect).' (Field notes 23/ 11/ 2011)

Canola produces great quantities of sugar rich nectar, causing swarms to swell in number and eventually to 'split' into multiple swarms. If a farmer leaves empty equipment in canola then in all likelihood swarms will take residence, and can then be added to his 'workforce'. While fruit and seed farmers usually have to pay to have pollination units on their land during pollination season, bee farmers actually compete for canola sites and often have to give canola farmers honey in exchange for the privilege and to secure the site for the following season.

Farmers also tailored their management techniques to better deal with the safety challenges of working with this particular forage type. One bee farmer explained that he wore two bee suits, one on top of the other, when he was 'doing splits' in canola, helping to minimise the amount of stings he received from his bees. The honey produced in canola was also challenging to work with, as Kyle explained:

> 'People say that honey from other countries is of a poor quality. In fact South African honey is of a poorer quality. Canola and sunflower honey crystallise very fast.' (Interview 2/12/2011)

One way in which farmers dealt with canola honey (and sunflower honey in the northern, summer rainfall area) was to mix it with other, tastier and more liquid honeys before selling it as a blended honey. Kyle believed that this mixing resulted in a lower grade of honey in South Africa than could be found elsewhere in the world.

Fynbos (which translates directly from Afrikaans 'fine bush') is indigenous forage occurring in the Western Cape that was also used to sustain managed bees and produce honey. While some bee farmers produced large volumes of *fynbos* honey, others used it exclusively to build up the immunity of bees in preparation for the wear and tear of agricultural pollination:

> 'When I ask Dylan why he does not produce more fynbos honey, he responds: '*Fynbos* is unreliable for honey production. I use it for maintenance, as it keeps the bees healthy. But I shut them down and don't put on a super when they are in *fynbos*'. (Field notes 23/11/2011)

Dylan's business relied on the production of large volumes of honey, and he found *fybos* to be an unreliable nectar source. Instead he used *fynbos* to build up the health strength of his swarms during winter in preparation for the stresses of spring pollination. He chose to put only brood boxes into *fynbos*, using his additional supers in forage which in his experience was more reliable honey production.

A further complication with farming *fynos* honey, farmers explained to me, was that the risk of losing one's equipment to fire is very high due to the fact that *fynbos* has a natural tendency to burn (Lindley et al. 1988). Dylan explained the risk of working in *fynbos*, saying:

> 'I lost 80 hives this past season to fire. Unlucky. These are calculated risks. I used to have insurance, but I'm not insured anymore.' (Interview 7/11/2011)

Dylan and other farmers explained that insurance came at an untenably high cost to the business. Rather than insuring his equipment, Dylan managed his fire risk by using only his oldest equipment in *fynbos*, and also cutting down on the amount of equipment used on each hive in those areas. In the same conversation Dylan contextualised fire amongst other risks to his business, saying that:

> 'Eighty per cent of my losses are from fire, which is stimulated by a change in the climate.'

Here Dylan linked vegetation fires with changes in the climate. He was concerned that he was losing more equipment or livestock to fire because of climate change, and that this was raising the risk profile of his business.

What is evident in the use of these two different forage types is that farmers were conscious of the benefits and drawbacks of different agricultural, indigenous and non-indigenous plant species, and that they utilised plants strategically in order to meet the changing needs of their business throughout the year. Canola, while it produced sub-standard honey, was rich in carbohydrates. This encouraged bees to reproduce rapidly, causing swarms to 'split' and thus allowing for them to be 'caught' in empty equipment and added to a farmer's workforce of bees. When in canola, farmers know to expect more aggressive behaviour from their bees, and they respond accordingly, wearing extra protective clothing. *Fynbos* created delicious honey inconsistently, but with the benefit of immunity boosting pollens which were excellent sources of

protein during the winter flowering period. Fire was an added hazard in *fynbos*, and Dylan took precautions to contain the damage to property should their apiary sites burn. A detailed knowledge of bee behaviour, plant properties and the particular effects of different plant species on honey production and reproduction also supported farmers to skilfully direct the behaviour of swarms along a course of their choosing as a means to a commercial end.

Conclusion

This chapter establishes the interconnectedness of the social and the ecological in commercial bee farming in the Western Cape. Relational approaches discourage us from thinking about global forces such as markets or climate change as external frameworks or contexts that shape the experiences and possibilities of human actors (Chakrabarty 2009). In the case of commercial bee farming in the Western Cape I have argued that it is more accurate to think of the world in terms of networks, meshworks or knots of mutually influencing humans, insects, plants, landscapes and weather worlds (Haraway 2008; Ingold 2011; Cohen 2013). There was no clear distinction between human and natural systems and as such I frame my analysis instead in terms of a dynamic social-ecology of which bee farmers are an active part (Ingold 2000; Berkes & Jolly 2001; Ommer et al. 2012) rather than in terms of a social or an environmental 'context'.

The chapter mapped out some of the ways in which farmers responded to the challenges presented to them through the dynamic 'weather worlds' (Ingold 2007) and 'living' landscapes (Whatmore 2006) in which they were necessarily embedded as part of their work 'in the open'(Ingold 2007). What the ethnography shows is that bee farmers were highly responsive to landowners and other bee farmers, managing these relationships innovatively and with care in order to secure or retain access to bee sites and through bee sites to bee forage. For example, Ben discouraged other bee farmers from 'poaching' his prime bee site on a eucalyptus plantation by staging fake apiary sites in locations visible to anyone approaching the farm by road, letting the competition know that the land was in active use by another bee farmer. When Dylan was asked to remove his bees from an area already in use by another bee farmer, he went through a dynamic process of reflection and informal consultation with other bee farmers, his business partner and the landowner in order to come to his decision to stay on the land. He also used older equipment when he worked in *fynbos* to manage his losses in the event of a wild fire. In this way

farmers managed reputational, relationship and material risks proactively through a range of practices as they moved through life.

In Fikret Berkes and Dyanna Jolly's paper on adapting to climate change and social-ecological resilience amongst peoples of the West Arctic they write that '[t]he range and extent of both the short-term and long-term responses define the resilience of the community in the face of change' (Berkes & Jolly 2001:14). I would argue that the flexibility and responsiveness of bee farmers to changes in the social-ecology (and the challenges these changes present to productivity and mobility) contributed to their ability to weather disruptions as individual businesses in both the short and medium term. For example, Dylan was highly sensitive to the flowering time of forage, carefully observing the buds to predict productivity in an area in order to 'shepherd' his bees accordingly in order to make the most of 'nectar flows' in different areas. This chapter indicated that farmers were also highly conscious of long term and short term changes in weather, forage availability and general productivity of their hives spread across different areas. Given the limited options on bee sites in the Western Cape and the pressures on bee forage availability (such as the ongoing legislated removal of particular eucalyptus trees in the region) I would suggest that 'place-based struggles' (Ernstson 2013:10) might soon unfold that bee farmers might be challenged to adapt to, even with their skills, mobility and creativity as practitioners. Race is likely to become a contentious factor in future if racial transformation is to take place within commercial pollination markets in the Western Cape. In order to understand the complexity of these struggles, a nuanced understanding of the dynamic social-ecological entanglements of which commercial bee farming is a part, is the appropriate base for appreciating the issues.

Chapter 5 -

'Doing' bees, plants and bee farming

This chapter analyses practices and discourses using a relational framework in order to better describe the complex relationality amongst bees, bee farmers and trees that was introduced in the previous chapter. The particular claim made in this chapter is that knowledge is performed, enacted (Mol 2002) or 'done' (Lien & Law 2010) through practice and discourse, rather than being a fixed constellation of rational ideas, skills and facts which people assimilate through a process of learning (Palsson 1994). Relating back to the aims of the dissertation, this analysis of bee farmers' knowledge practices is concerned with rethinking the engagements between humans and animals through an empirical case study - it does this in order to interrogate the human/non-human human/environment dualisms that have been identified in Western academic thinking (Thrift 2004).

In a relational ontology the term 'actor' can be used to refer to any material or immaterial 'thing' that has influence in the world (Harman 2009). People, plants, insects, concepts, machines and tools can all be considered actors, for example. The unfolding encounters and connections between these actors bring different realities into being: realities can therefore be understood as knots (Haraway 2008) or meshes (Ingold 2011; Cohen 2013) of species, machines, weather and landscapes: a conceptual framing put forward in the previous chapter. Chapter Five deepens this account of social-ecological complexity and interconnectivity by taking a closer look at ways in which farmers brought to life different versions of bees, plants and themselves through their words and deeds.

Haraway suggests that we consider the entangled or knotted engagements between species as relationships of 'significant otherness' (Haraway 2003) explaining that: 'through their reaching into each other, through their 'prehensions' or graspings, beings constitute each other and themselves' (2003:6). The analysis is framed as explorations or 'encounterings' (Haraway, 2008: 287) between farmers, bees and plants. Spending time exploring commercial bee farming

through the lens of bees and trees allows me to reveal nuances and complexities in the knowledge practices and politics of bee farming that might be overlooked in a more human-centred analysis. The practice of reckoning in this sense is a form of storytelling that explores ways of knowing and doing related to bees and plants, emerging as they do from dynamic geographical, political and ecological contexts or mesh-works (Ingold 2011; Law & Urry 2001).

'Doing' bees, plants and bee farming

Figure 5: Bee farmer cropping honey

Figure 6: A catch hive in a forage-rich area left to attract a wild swarm of bees

Figure 5 depicts a bee farmer lifting a frame of honey out of a bee hive. The waxy white layer on the comb indicates that the honey is ready for harvesting - the bees only close up or 'cap' the cells with wax when the nectar has been dehydrated to the right consistency. The farmers that I worked with did not remove the honey from the brood box where the queen and the young can be found (as depicted in Appendix A) as when too much honey is removed the swarm becomes vulnerable to starvation in leaner times. Bee farmers added extra boxes or 'supers' onto the brood box of the hive: honey produced in these uppermost layers could be easily harvested by simply swapping the full supers with empty supers, or by lifting full frames out of the top super and replacing them with empty ones. Next to the hive at the bottom left hand corner of figure 5 a smoker is visible. A smoker is a metal container of smouldering kindling attached to a small bellows, used to blow smoke onto the bees in order to calm them. The farmers explained to me that the smoke simulates the conditions of a veld fire and that the bees respond to this threat by filling their stomachs with honey. The activity of eating as well as a full stomach calms the bees and allows the farmer to work with them more safely and easily.

This harvesting process hints at the complex relationality between bees and bee farmers. Although bees are put to work as livestock, in South Africa they are not entirely the property of bee farmers. If bees are unhappy with their living conditions they can abscond on mass and relocate to a new home. Farmers mentioned pest infestations, disease, cramped living conditions and over-smoking as reasons why bees sometimes abscond. Conversely, bee farmers replenish their bee stocks by tempting wild bees into empty equipment, or actively removing them from a natural hive (such as a hollow tree or the eaves of a house) and placing them into a constructed wooden hive, as shown in figure 6. Another sign of autonomy is that bees will sting a farmer if they feel threatened. I was told by several farmers of occasions where they had been chased out of apiary site by a swarm of bees and was warned that I should always calm the bees sufficiently with the smoker before opening a hive. Between visits from the bee farmer, which can be weeks or even months apart, the bees fend for themselves and regulate their own environments as they would do if they were located in a hollow tree. In this sense they are unlike livestock farmed en mass (such as battery chickens or dairy cows) and which live under intensively managed and contained conditions.

There are some ways in which bees are at once wild and domesticated. Firstly, their homes and larders are managed externally by farmers to a large extent. A swarm will allow the farmer to remove large amounts of their stored food on a regular basis, and will refill the new supers again and again, as a domesticated cow will continue to produce milk even when it has no young to feed. Honey is in this sense both a mass- produced agricultural product like milk and a form of 'wild' or gathered food, like truffles, crayfish or mussels. Secondly, swarms of bees also allow themselves to be removed from one hive (such as a hollow tree) and will take up residence in the hive where they are placed by the farmer. These hives are then transported sometimes long distances from site to site in order to do the work of pollination and honey production. In one sense bees are 'put out to pasture' in areas where farmers know there is sufficient forage to sustain them. Thirdly, when a disease called American foul brood broke out on the Western Cape (AFB Joint Operations Centre 2012) and when the '*capensis* problem' (described in Chapter Four) became an issue in the north of the country, many farmers killed infected or infested swarms as a means of halting the spread of the disease, in the same way that cattle, pigs and sheep have been culled historically as a means of controlling foot and mouth disease.

What are the theoretical implications of the simultaneous wildness and domestication *of apis mellifera capensis* (or the Cape bee, as I will refer to it henceforth)? William Cronon writes about the trouble of distinguishing between wildness and culture, moralising that we should:

> 'abandon the dualism that sees the tree in the garden as artificial – completely fallen and unnatural – and tree in the wilderness as natural – completely pristine and wild'(1996:24)

One could say that in a practical sense bee farmers are stewards rather than owners of bee swarms. In the South Africa context, where wild bee populations are still relatively strong and active (Jaffé et al. 2010), swarms move across the imagined boundary between wild and natural, undermining this conceptual binary. In this way bees can be seen as marginal creatures that challenge our historical constructions of nature and culture as separate realms.

The more that I was taught about bees through my work with farmers, the more complex and multi-facetted bees became for me. As described in the methodology chapter, I developed an intimacy with bees through writing and fieldwork that I could never have anticipated. I was also involved in different 'performances' of bee-ness and plant-ness during fieldwork. What I mean by this is that I observed and participated in 'doing' bees and plants in particular ways. Lien and Law write that:

> 'If an object does not stand by itself (Mol 2002, 31-32) but emerges in the relations of practice, then we need remember that there are many practices' (Lien & Law 2010:6)

The rest of this section draws attention to the multiplicity of ways in which bees and plants were 'done' in practice and through discourse.

During fieldwork I attended a training course run by a commercial bee farmer for aspiring hobbyist beekeepers. This day turned out to be a watershed in my understanding of knowledge, practice and performance. Standing in the front of a lecture hall of attentive students, bee farmer and educator Peter explained to us that 'the bee is cold blooded, but the entire colony reacts like a warm blooded animal.' Confused by this statement, I asked that he explain further what he meant by it. He responded:

> 'We work with the animal of the colony. Just like the human body has different organs, the hive has different systems in it.' (Field notes 28/11/2011)

I looked around the lecture hall and saw heads nodding in understanding at Peter's words.

The ‘animal of the colony’ can be used as an example of what Turnbull calls ‘connectivity and equivalence’: ‘the linking of disparate or new knowledge and the rendering of knowledge and context sufficiently similar as to make the new knowledge applicable (2000:20). In this narrative bees form something more than a grouping of single creatures functioning together. The colony is itself a creature with particular behaviours and responses. During the lecture Peter told us that while a bee is cold blooded, the inside of a bee hive is kept constantly warm, allowing the bee brood to develop and stopping honey from crystallizing inside the cells. From this I understood that honey is kept liquid and warm inside the bee hive, in the same way that blood in a mammal’s body is warm. Another way in which a colony of bees reacts in the same way as a mammal does - Peter explained - is that it responds to outside threats in order to protect itself. When one is stung by a single bee, the sting releases a chemical which alerts other bees to sting in the same place so that they have a greater chance of defending the hive collectively. In this sense a collective of bees is both a network of individual insects, meshed together to form a new creature: the animal of the colony.

As Peter discursively brought to life a new animal, ‘the animal of the colony’, it took on form and became a powerful teaching tool. What I am arguing here is that there is a link in this instance between a conceptualisation of bee behaviour and the way in which we were instructed by our trainer to ‘do’ bee farming (Lien & Law 2010). As such there was relationality between knowledge and practice: by knowing the colony as an animal we were taught a particular way of managing it – tending its inner workings through feeding and maintenance, as one would a domesticated mammal.

Just after explaining the ‘the animal of the colony’ Peter shifted his focus onto the anatomy of a singular bee. The following extract is from field notes taken during Peter’s bee course:

> ‘After a morning of learning about the basic ins and outs of beekeeping, the PowerPoint presentation takes us inside the body of the bee. Grainy black and white anatomical drawings show the bisected creature again and again, zooming in on different parts of its anatomy. Our educator slides to a close up of the stomach sphincter, explaining that this tiny valve is able to pick out and reject impurities in the nectar. ‘To have a little device

> inside my stomach that chooses what I eat – I've got an alien inside my stomach!' he marvels. He explains that the bee is in fact 'a veritable flying tool box', equipped with glands for producing royal jelly, wax and pheromones, pollen baskets, a honey stomach and of course, its sting. We are shown a luminous x-ray image of tracheal mites, packed one on the ether inside the windpipe of a bee. Finally our lecturer shows us slides depicting the genetic material of the honey bee. Overwhelmed with information I stare at the little squiggles of DNA, struggling to connect this image to the bee sting on my leg, still red and itching from yesterdays' field work.' (Field notes 12/05/2012)

Peter's slide show revealed a complex universe of interacting body parts inside the seemingly singular body of the honey bee. We discovered an unexpected cluster of creatures living inside the bee's body - the trachea for example is home to insects which live and reproduce inside an already microscopic body part, sometimes causing breathing problems for the bee. It is not only other creatures that have 'a life of their own' inside the bee. The bee farmer marvelled at how the stomach sphincter operates with so much discernment that it is almost 'an alien' entity inside the bee's body, picking impurities out of the nectar. Peter described how each body part has a separate purpose, but also how the body parts function together, turning the bee into a 'flying tool box'. At an even more microscopic level Peter showed us the DNA chains that powerfully determine a bee's genetic destiny and its role within the larger swarm. In this way a world within a world was revealed to us in the complex minutiae of a seemingly singular insect.

The point that I would like to make next relates to Peter's description of a single bee as being a 'flying tool box'. Sitting in the lecture hall I was reminded of an experiment that bee researcher Mr. Allsopp described to me in an interview (10/11/2011). He had dissolved a different quantity of sugar into three dishes of water. He then left the dishes in a place where the bees could find them. After some time a bee arrived at the dishes and tasted each dish of water in turn. It then flew away, sometimes returning with other bees, but would only collect water from the dish with the most sugar in it. Mr. Allsopp explained this behaviour, saying that:

> 'Bees are like flying calculators and mass patrometers – calculating the sugar content of nectar'

Here Mr. Allsopp described a bee as a device that can precisely gauge the sugar content of a substance. Further reading informed me that this tiny creature would have travelled up to four

kilometres from its hive in order to seek out a source of nectar. It would then have flown back to the hive and performed a 'dance' that communicated to the other bees in the hive the exact position and quality of the food source it had discovered (Raffles 2010).

What links Peter and Mr. Allsopp's descriptions is that they both enact a mechanical version of bee-ness. Whatmore and Lorraine Thorne write about ways in which the wildness of animals has been constructed through history, saying that:

> 'Through their depiction as organic machines, disassembled and mapped anatomically (as heads, transections, skeletons, embryos, etc.) in zoological illustrations, animals became mobilized as species through the expanding networks of science' (Whatmore & Thorne 2012: 443)

Peter's slide show of anatomical drawings and photographs maps the deconstruction of the bee into a disassembled universe of organic actors. Together, when reconstructed, these actors form an 'organic machine', programmed with DNA – an organism that Mr. Allsopp and Peter described in mechanical terms as a flying 'calculator' or 'tool box'. In the industry of pollination and honey production these machines are put to work, mobilised as a species through a network of factories, honey houses, apiary sites and bee hives. It could be argued that on these two occasions bees were 'done' as insect cyborgs (Haraway 1990): hybrid creature/machines composed of glands, organs, and genetic material, which were in turn functional parts of the honey and pollination producing 'animal of the colony'.

As mentioned in the previous chapter, eucalyptus trees are important forage sources in the Western Cape. They also have an ambiguous, controversial and I would argue 'multiple' (Mol 2002) status. While government alien tree removal programmes such as Working for Water were mandated to control and minimise particular species of eucalyptus trees in the Western Cape, bee farmers treasured different eucalyptus species for their role in summer nectar provision and were overwhelmingly concerned about their vulnerable status (Allsopp & Cherry 2004). The government's 'Working for Water' website features the following description of alien plants:

> 'Invasive alien species are causing billions of Rands of damage to South Africa's economy every year, and are the single biggest threat to the country's biological biodiversity. Invasive alien species are plants, animals and microbes that are introduced

> into countries, and then out-compete the indigenous species. Invasive alien plants (IAPs) pose a direct threat not only to South Africa's biological diversity, but also to water security, the ecological functioning of natural systems and the productive use of land. They intensify the impact of fires and floods and increase soil erosion.'
> (http://www.dwaf.gov.za/wfw/ accessed on 26/ 03/ 2013)

This description enacts 'invasive alien species' of plants and animals as degrading, disruptive and extractive influences in the South African landscape, presenting a 'threat' to biodiversity and productive land use.

Bee farmers expressed their objections to the removal of eucalyptus trees in different ways. Laura, a retired bee farmer, mirrored these concerns when she spoke about eucalyptus removal in the coastal town where she lived and had farmed honey. She felt that her retirement from bee farming had been well timed, as since closing her business many of her bee sites had become untenable due to eucalyptus removal, saying:

> '[T]he eco-freaks (*Laura laughs dryly*) object to anything that isn't indigenous. A heck of a lot of eucalyptus trees in the area have been chopped down. That's something that drives me insane because there is very little that will grow here to anything like that height. This is a windy area and the soil is poor and there is not much water around. But the eucs do very well – you can see, they grow big. This whole road used to be full of trees, but they've taken them down.'(Interview 17/05/2012)

Laura saw 'eucs' as particularly valuable because they were able to grow tall in a windy, arid area in sandy coastal soil. She was angry because this ecological wealth was being stripped from her area because of their non-indigenous status by 'eco-freaks': people who were unable to see value in the trees that she had built her honey production business around. After our interview she took me outside and pointed out to me the places where eucalyptus trees had been cut down by government tree removal programmes, shaking her head in disapproval.

Chris diagnosed tree removal as a form of institutionalised prejudice, saying: 'tree apartheid is here'. By using this political metaphor Chris showed his disgust for the clear distinctions being drawn in law between indigenous and 'alien' trees, and the practices of selective tree removal being implemented, in Chris' opinion, for the commercial gain of the South African government

and other parties. Dylan's critiqued the Working for Water's 'blanket' attitude towards alien tree removal, recommending a more measured approach:

> 'They create propaganda that eucalyptus trees are the devil, but the species is only invasive under ideal conditions. Don't put a blanket on the whole country on species only invasive in certain areas, and move a bee fodder source unnecessarily.'
> (Interview 7/11/2011)

An issue that Dylan and Chris had with the government's way of 'doing' eucalyptus trees was that the legislation was too harshly implemented in practice, without sufficient consideration of the particulars of each 'stand' of trees considered for removal. On multiple occasions farmers told me of times when they had come across groups of government workers removing unlisted species of eucalyptus trees, or removing listed trees in areas that were not ecologically sensitive.

Peter highlighted an underlying different 'mind sets' underling the decision to remove non-indigenous trees in the Western Cape:

> 'It is politically motivated. They change people's mind-sets to eradicate bees for political purposes. They say trees drink water, so trees are the enemy. This is the philosophy – part of a mind-set. Trees do the opposite – they produce oxygen, remove carbon dioxide. The provide honey, oils, shelter. A tree cycles water, it doesn't use water. It is a cleansing system, part of this earth's lung system. I have a spread sheet of eucalyptus trees. Everything under trees is cool. It actually rains under trees, even when it's not raining outside. There is an important link between food security and eucalyptus. Trees need to fill the gaps – if we don't have trees there are no bees, no fruit.' (Interview 2/05/2012)

Peter described to me a tree that is inherently valuable to society, providing different services as 'part of this earth's lung system'. Most importantly, trees 'cycled' water, and by doing so cleaned the water and cooled and moistened the land. In this sense Peter enacts the relationality between land, water and tree as cyclical, iterative and mutually supporting. As mentioned in Chapter Four, eucalyptus trees sustain commercial bees over the summer months when few other plants are flowering, enabling commercial bee farmers to do the valuable work (Allsopp et al. 2008) of pollinating important food crops in the Western Cape. This stands in contrast to what Peter saw as the government's approach to eucalyptus trees, which is that they 'drink water' and are therefore 'the enemy': a unidirectional and extractive account of the relationality between

trees, land and water in which trees take valuable resources away from other indigenous plants and from society. It also contrasts with the description on the Working for Water website which describes 'alien invasive' plant species as a 'threat' to biodiversity, water security and the national economy.

Whatmore writes about knowledge controversies as:

> 'moments of ontological disturbance in which the things on which we rely as unexamined parts of the material fabric of our everyday lives become molten and make their agential force felt. Such situations, matters or events render what we think we know or, more usually, what 'experts' claim to know about something the subject of intense public interrogation.' (2009:2)

What I understand this to mean is that knowledge controversies are uncomfortable, often hotly debated issues which disrupt our understandings of the way things are in the world. The removal of eucalyptus trees in the Western Cape was a good example of just such a knowledge controversy, with the value of 'alien' trees being contested by different parties. Given the linkages between honeybee pollination and food security (Klein et al 2007;Allsopp et al 2008) and between pollination and eucalyptus trees (Allsopp and Cherry 2004), it is clear that there is a lot at stake in this controversy over the value of eucalyptus to society. There is not sufficient space in this dissertation on knowledge practices to do more than introduce this important controversy, but it does provide a good illustration of different 'tree multiples' that are being 'done' differently (Lien and Law 2010) by farmers and government conservation organisations.

'Doing' tough bees and tough bee farmers

This section considers the subtle linkages between the practical realities of a bee farming practice and the choice to 'do' (Lien & Law 2010) bee farming in a particular way. Through the use of different ethnographic examples I argue that a certain degree of physical toughness was required to work hands-on with bees, and also that toughness was performed in many cases as a hallmark of bee farmer-ness, resulting in particular management strategies and decisions taken. As such, this section of the chapter tests some of the concepts introduced in the previous section in a particular empirical example.

'Toughness' and gender intersected in practical ways in a few of the commercial bee farming practices that I encountered. Ben and Melissa, a young couple going into the second year of running their business, spoke about a very clear division in their partnership. Melissa stayed at the honey house, fixing equipment and attending to the bulk retail of their honey. Ben spent most of his day on the road, driving between apiary sites, and working with the bees. They seemed puzzled when I asked them why they would organise their business in this way:

> 'When I ask if Melissa is able to help to move equipment Ben and Melissa scoff at the idea. Ben says: 'When we are cropping honey, some of that equipment is nearly as heavy as Melissa is'. Later Melissa brings me an empty deep super and encourages me to hold it to see how heavy it is even without honey in it' (Field notes 18/05/2012)

Melissa was very petite while Ben was much taller and well built: the couple therefore decided that Ben would be better suited physically to working with the bees in the field. When I interrogated this logic Melissa demonstrated to me that it would be impossible for her to do the heavy lifting that her husband did on a daily basis. It seemed to me at the time that she was almost defensive of the division of labour in their business relationship: it was not that she was unwilling to do hard work, she told me, but rather that she had to respect her physical limitations and spend her time more effectively on other tasks.

Melissa's days were spent in the large workshop that they used as a honey house, as the following field notes describe:

> 'As Ben loads the *bakkie*, Melissa shows me the small machine which she uses to 'hot wire' the wax into the frames – electrodes attached to either side of a wire create a circuit to heat the wire briefly, embedding it in the malleable wax. Melissa hot wires hundreds of frames in a day. She also shows me with some pride the recuperation of boxes that she has been working on. When they bought the business the boxes were in a bad state of disrepair, she laments. There was not a standard type of box or box colour, which meant that the boxes looked untidy. Melissa is now working on the repainting of the boxes and, stacked up, the freshly painted boxes do look quite smart and attractive. Given the chill in the workshop, I am amazed that she can spend all day there in only a thin jersey, jeans and wellington boots. With her petite frame and quiet gentleness she seems almost out of place among the enormous silver machines. Ben tells me later that Melissa 'loves to

> spend time at the workshop'. When we return from fieldwork later we find her moving around happily to music, having done a great deal of work on the frames, kept company only by the two dogs and their one quietly spoken employee. She is not in a hurry to leave the workshop and come home, but takes her time tidying up and packing things away before making an exit.' (Field notes 18/ 05/ 2012)

My impression of Melissa was that she was just as willing to throw herself into hard work as her husband despite being smaller and unable to lift heavy loads. Though the labour was divided between the two businesses partners both roles required long hours working alone performing demanding tasks with Melissa spending long hours doing repetitive tasks such as painting hives and hot wiring frames in a cold workshop. Returning home in the *bakkie* with Melissa and Ben after a long day of work I was amazed that they still seemed fresh and cheerful as I slumped, exhausted, in the back seat of the vehicle.

Age as well as gender has an impact of a farmer's ability to perform certain tasks. The physically taxing aspects of her practice were an important factor in Laura's decision to retire from her commercial bee farming business in her sixties:

> 'It was lovely while it lasted, but I was doing all the work – hauling 30kg buckets, running around, up and down, up and down, standing, labelling, bottling. It messed up my back, messed up my legs completely. All the standing and carrying of the heavy things - it was getting too much' (Interview 17/05/2012)

'Beekeeper's back' is a well-known malady – the result of bending down countless times a day to lift heavy wooden equipment. Laura found the standing and lifting involved in her practice to be 'too much' for her body and ultimately decided to sell her bees. Without the support of another physically strong and energetic assistant, Laura's work with bees became less tenable over time. As such, age, if it is associated with a decline in fitness or wellness, can be a compromising factor in a physically demanding commercial bee farming operation. The reason that I have spent time on these two examples is to demonstrate that there are real physical demands involved in farming bees commercially, which can sometimes be linked to age and gender[12].

[12] Most of the women that I met in the bee industry did not, however, consider these physical challenges to be barriers to involvement in the industry, as evident in Melissa account here and Sylvia's account in Chapter Six.

Another physical challenge associated with commercial scale bee farming was the extent to which practitioners get stung by their bees. Most of the bee farmers that I worked with preferred not to wear gloves, and initially I copied this behaviour. I was stung for the first time on a day out with Dylan. My response was to yelp loudly, freeze in shock and then bolt away from the hive like a wounded animal, the sting still embedded in my flesh. For me the sensation was similar to being burned with a cigarette. After my first sting I noticed that while he worked Dylan was stung quite frequently on his bare hands. His response was to swiftly flick the still pulsing bee sting out of his flesh, sometimes smoking the sting (with the smoker) to discourage other bees from being attracted to the smell of venom. Rather than stopping or slowing down he seemed to work faster after he had been stung, discerning that the swarm was becoming 'twitchy' and should be left alone as soon as possible.

Figure 7: Bee farmer wearing a protective bee suit, working bare handed and using a smoker

Haraway asserts that she prefers 'the word *infolding* better than *interface* to suggest the dance of world making encounters' adding that 'what happens in the folds is what is important' (2008:249). A bee sting is an example of one species infolding with another. A bee thrusts its barbed sting into another creatures flesh. And when it flies away the sting tears off, disembowelling and ultimately killing the bee. The stinger, containing a venom sack, stays caught in the flesh. In this way part of the bee remains in the creature it stings (Visscher et al. 1996). Even after the sting has been removed the venom can cause the skin to itch and burn for days, depending on the tolerance to bee venom of the creature being stung (Eich-Wanger & Muller 1998). In cases where there is sensitivity to bee venom a sting can result in a severe allergic reaction and even cause death. The point that I am making here is that, despite a bee's relatively small size, it still has the power to penetrate the human body, inject venom and have an enduring effect on human flesh (Eich-Wanger & Muller 1998). This is an example of one kind of encountering that can take place 'in the folds' between a honey bee and a human being.

For bee farmers like Dylan, who prefer to work bare handed (as in figure 7), encounters with bees involved regular injections (or 'infolding' (Haraway 2008)) of bee venom into their bodies. After being stung several times during fieldwork I told Dylan that I was distressed that he felt this kind of pain on a regular basis. He reassured me, saying: 'I have been stung so many times I have a different relationship with pain'. Later he added:

> 'You have to be strong to be a bee farmer. You can't be a wussy guy sitting behind a computer screen all day'.

Here Dylan suggested that physical toughness and successful bee farming were intrinsically connected. Unlike more passive, sedentary jobs, bee farming required physical strength. More than this it required not only an ability to endure pain but to have an entirely different relationship with pain. As a newcomer to bee farming I responded to the pain of a bee sting instinctually. Every part of my body, including my brain, wanted to get away from the creatures that were hurting me. Over many years of working with bees Dylan had taught himself to override this instinctual desire to run from pain – he 'leaned into' pain instead, working with more speed and efficiency in order to get the job done.

Extending this idea I would argue that Dylan has also developed a 'different relationship' with bee venom. When Dylan discovered that his daughter was allergic to bee venom, he and his wife decided to take her to hospital for desensitising injections. Soon after completing her series of treatments she was stung playing near the hives on the family property. Rather than rushing her to the doctor Dylan sat with her on the couch at home while she rode out her allergic reaction. He could not afford for a member of his family to have a potentially life threatening allergy to bees given that they lived in close proximity to occupied bee hives. He therefore did not shy away from his daughter's allergy but rather leaned into it, intentionally exposing her to venom through desensitising injections as a means of developing her physical level of tolerance.

I put forward here a relational analysis of Dylan's decision to relate in these ways to bees, pain and venom in his daily work. I would argue that by intentionally infolding pain and poison into his body through bee stings (and the body of one of his children in the form of desensitising injections) he performs the importance of physical toughness and endurance in the work of bee farming. Dylan's account of the 'wussy guy', working passively at his desk creates an opposite or binary of the tough and brave bee farmer. Bee farmers should be active and physical rather than passive and cerebral. They should be brave rather than 'wussy' or cowardly. Dylan's engagements with bees, pain and venom shape his experience of being a bee farmer. Iteratively, the tough, brave bee farmer is an enactment or version of himself that he brings into being (or performs) through his words and deeds.

Mol (2002) and Law (2004) point out that enactments are not static: people can act out different versions of themselves at different times (or even multiple versions at the same time). Ben, newer to the bee farming business, illustrated a shift between one state of being and another when he spoke about his dislike of being stung:

> 'I hate being stung. Sometimes I wear two suits – when I'm cropping honey or doing splits. If I get stung I am being reckless. I have been stung twenty or thirty times in a day. One day I got stung and just decided - 'I'm not going to farm bees any more'. Then I realised 'nobody else is going to pick up this box' and I just carried on.'

Initially Ben asserted that being stung by bees was a part of his job that he disliked intensely. He went to great lengths to avoid being stung, even wearing two protective suits in circumstances

where bees tend to be particularly aggressive. Unlike Dylan, Ben initially stated that being stung was a consequence of reckless behaviour on his part, rather than an intrinsic part of the act of bee farming. He performed a bee farmer who benefits from being careful and safety conscious and suffers when he is reckless and irresponsible. The latter part of his narrative tells a slightly different story: after being stung one day Ben put down the bee hive he was carrying and decided that he wanted to walk away from his practice. In the next moment he revised his decision because 'nobody else is going to pick up this box'. It could be argued that he picked the hive up again because, no matter how safety conscious and responsibly he behaves, bee farming for Ben at that moment meant a willingness and a choice to 'infold' with another species (Haraway 2008). In order to relate to his bees he had to behave tough and brave, even if at other moments he behaved fearfully or went to great lengths to avoid pain.

To articulate my argument thus far: the 'tough bee farmer' is a version of bee farmer-ness to which farmers sometimes subscribed. When acting out this version they behaved accordingly, acting tough and enduring pain when it couldn't be avoided (and in Dylan's case, even when wearing gloves could lessen the chance of getting stung). Ben showed us that, even in one narrative, a person can move between different enactments of 'bee farmer-ness'. As such, the analysis suggests that 'bee farmer' should not be considered a static category. Instead it can be productively viewed as a powerful 'performance' of a particular way of being in the world.

Figure 8: Farmer testing for the presence of American foulbrood disease (AFB) in his bee hives

Figure 9: AFB infected hives wrapped in plastic and ready to be transported to an irradiation facility

Toughness or resilience is a quality Dylan expected from his bees as well as from himself. This was evident in his approach to dealing with a bee disease that emerged in South Africa three years ago. American foul brood (AFB), as its name suggests, is a bacteria that infects and kills the bee brood. The swarm is weakened by the effects of contamination, often to the point of collapse (AFB Joint Operations Centre 2012). In the Western Cape, Dylan was one of the bee farmers worst affected by AFB – he lost 30% of his hives over the course of a few months. AFB is highly contagious, and can easily be transmitted through equipment and honey – Dylan explained that only by killing the swarm and by heat treating or irradiating affected equipment could the spores be eradicated and the spread of the disease between apiary sites and bee colonies be curtailed.

With little instruction or financial compensation from government, Dylan developed a strategy of his own to deal with the problem of AFB:

> ‘On the internet I read about hygienic bees – Maria Spivak reckoned that 10% of all honey bees would be tolerant of AFB. It was a starting point, and there was hope. My goal was to try and thin them out to AFB resilient ones - those with subclinical rather

than clinical symptoms. That become my approach – I had to develop a protocol to deal with it. I identified AFB hives and killed them, because they can't handle the disease.'

The idea of tolerance or resilience was central to Dylan's decision to kill off hives showing visible symptoms of AFB. Only the disease-hardy bee survived the rigorous process of manual hive inspection. Dylan examined the brood in each hive for signs of infection: perforated cell coverings (known as cappings) that, when probed with a stick, revealed the sticky brown remains of bee larvae (as depicted in figure 8). Swarms showing signs of AFB were killed with insecticide and the hives were wrapped in plastic to prevent contamination and sent for irradiation (as depictured in figure 9). Without sentimentality Dylan pared away the weaker, more vulnerable swarms until he was left with genetic stock that could endure a future with AFB. As such his strategy was not to completely eradicate the presence of AFB spores, but to identify and nurture the 'hygienic' swarms that could live with AFB without succumbing to clinical symptoms, such as brood death.

It could be argued that in executing this disease management strategy Dylan performed the Cape bee as either resilient (able to adapt to a disease that has devastated bee stocks elsewhere in the world) or weak and genetically extraneous. In Dylan's performance a resilient bee emerged through the intervention of the bee farmer: using his senses the farmer was able to discern which bees needed to be culled and which should be allowed to live. Bees that showed signs of tolerance were nurtured and supported. Bees that show signs of intolerance were removed in order to slow down the spread of the disease and liberate equipment for healthier bees.

The analysis suggests that there was a connection between what Dylan demanded from his bees and what he demanded from himself as a farmer, yet the relationality between these two behaviours is complex and murky. Did Dylan's observations of his bees influence the way he behaved towards himself? Or did he mirror his belief in his own physical toughness in his belief that his bee stock was essentially tough and able to survive the pressure of disease? I would argue that in this instance enactment was an iterative process - there was a flow between this actor's way of seeing his own work and the work of his bees (Duggan 2012). The way that the bees behaved influenced the way that Dylan behaved. The way that Dylan 'knew' the bees also changed the way that he 'knew' himself as a bee farmer.

Conclusion

In this chapter the analysis shows that there were bee and plant 'multiple' involved in commercial bee farming in the sense that these actors were performed or 'done' differently through a range of discourses and practices (Lien & Law 2010). These 'enactments' in turn influenced bee farming practices in different ways, demonstrating an iterative or cyclical relationality between knowledge and practice (Duggan 2012). For example, by bringing to life the 'animal of the colony' through his lectures, Peter gave his class insights into the workings of bees in the collective, encouraging us to treat the hive as one would a warm blooded mammal.

One effect of this ambiguous, nuanced approach is that it describes a world-in-becoming in which realities are emergent rather than fixed. Law and Mol write that:

> 'Things add up *and* they don't. They flow in linear time *and* they don't. And they exist within a single space *and* escape from it. That which is complex cannot be pinned down. To pin it down is to lose it.' (Law & Mol 2002:20)

As addressed in the methodology chapter, multiplicity presents a challenge to us as practicing researchers to describe a world in flux or becoming (Cohen 2013) in which identity and meaning is unstable. In one example the toughness of the Cape bee and the Cape bee farmer emerged through and from the hard labour of bee management, the frequency of bee stings and the bacterial invasion of American Foul Brood, and were also acted out by some as essential characteristics or hallmarks of Cape bees and bee farmers. I found it a challenge to language this kind of fluid relationality without pinning it down and therefore losing it, as Law and Mol warn us not to do (2002). In writing this chapter I had to stretch the boundaries of grammar and diction to accommodate these new ways of thinking (for example, adding 'ness' on the end of a noun to turn it into an adjective, as in 'bee-ness').

Another effect of a performative approach is to shake loose the entrenched influence of human/non-human, nature/environment and knowledge/practice binaries. Says Lien and Law:

> 'We learn that, like salmon, it shifts its shape and form from practice to practice. It is done multiply. Does this mean, then, that the nature/culture divide is no longer foundational? The answer is: it depends what you mean by foundational. If foundations

> are invariant and immovable structures then the answer is: these do not exist. If, on the other hand, foundational dichotomies are forms that reappear, in different but related ways in endless practices, then the answer is yes: these do exist. The nature/culture divide is messy, it is heterogeneous, it is complex, and it isn't coherent.'(Lien & Law 2010)

One place in which foundational dichotomies appeared in practice was in the felling of eucalyptus trees which are classified as invasive alien species. The application of this legislation is, in practice, complex and in need of further study. What is relevant for the aims of this dissertation is that some farmers saw eucalyptus removal as a form of 'apartheid' between alien and indigenous trees: a fascist programme of division and removal that they protested against. What this indicates is that, while this research challenges dualistic approaches that distinguish between humans and environment, human and non-human, dichotomies between indigenous and alien had practical implications for the security of bee forage and were contested (Whatmore 2009) by bee farmers in different ways.

Chapter 6 -

Embodied knowledge practices

This chapter explores the linkages between knowledge and practice. Chapter Four demonstrated that farmers were situated in entangled unfolding social-ecological realities, and that they responded to these dynamics in creative and flexible ways. Chapter Five argued that physical and emotional toughness was not just a necessity for bee farmers but was also actively performed as a hallmark of bee farmer-ness, with implications for bee farming practices. In other words, knowledges were acted out through the body in different ways (Thrift 2004). This chapter brings together and deepens these arguments by asking the questions: what ways of knowing were visible to me as a researcher through participants' actions and, iteratively, what knowledges emerged from participants' embodied experiences?

The first section of this chapter explores three ethnographic examples in which entanglements between knowledge and practice are visible. These examples tie together some of the ideas that have been surfaced in the previous chapters, making the point that knowledge and practice are tangled together and emerge from each other (Palsson 1994; Lien and Law 2008; Duggan 2012). The second section argues that there was also an intrinsic connection between mind and body in the practice of bee farming that could be seen in farmers' ability to move between multiple skills assemblages according to the needs of the moment.

Entanglements: knowledge and practice

Peter had upgraded his beekeeping hobby into a commercial operation in the early 90's after leaving a job at an information technology (IT) company. At the time of our meeting he had five hundred bee hives around the Western Cape. He explained why five hundred was a 'magic number' of hives for his business, saying:

> 'It has been that way for many years. I buy bees in [to keep this number] – it just works. Especially because I am doing so many other things.' (Interview 2/05/2012)

As well as selling honey and providing pollination services, Peter and his family also farmed sheep and cattle and provided services and products to other beekeepers, and Peter ran beekeeping workshops for aspiring beekeepers. Peter considered this diversification of income streams to be important to the financial health of his business. He explained that in the past the fierce competition for pollination contracts in the Cape lead to a situation where some bee farmers were offering pollination rates well below suggested industry rates[13]. Instead of dropping his prices in Peter was able to fall back on other revenue generators, such as his cattle and sheep farming.

Peter explained his diversified livelihood strategy in terms that reflect his background in IT as well as his wealth of knowledge about bees:

> 'Z (the author): So beekeeping is your main source of income?
>
> P (Peter): It's mixed – that the nice thing about having eggs in many baskets. I was doing very well until last year when other beekeepers came in at ridiculously low prices [for pollination]. So I also do sheep, cattle and honey. I wasn't prepared to go below cost.
>
> Z: What happened?
>
> P: They are drastically desperate. I am not that desperate. I have better capacitance.
>
> Z: Tell me a bit more what you mean by capacitance…
>
> P: Capacitance is when part of an electronic circuit absorbs energy and releases it later. Bees work in the same way – they store honey and release it later. That's why they store honey. It's an energy source, like a battery, like fat in our bodies' (Interview 2/05/2012)

Peter explained that his multiple revenue stream livelihood strategy allowed him 'capacitance' – a term that emerged from his background in electronics and which refers to the ability to absorb energy and release it later on when it is needed. Capacitance is also a strategy that Peter had observed in the way that bees store food energy in the form of honey.

Peter's capacitance strategy can be viewed as an example of what Turnbull refers as 'connectivity and equivalence', by which he means 'the linking of desperate or new knowledge and the rendering of knowledge and context sufficiently similar as to make the new knowledge applicable (Turnbull 2000:20). In his explanation of 'capacitance', Peter drew a metaphorical

[13] This issue is explored in more detail in Chapter Five

connection between honey and batteries: both of these substances act as an energy source. The bee hive is similar to a machine in that honey acts as a battery that can be drawn on as a source of energy for the bees over time. Honey also functions within the hive in the same way that fat functions in the human body: both substances insulate against hunger. In this account Peter moved fluidly between his recollected knowledge from his days in an IT practice and his current work with honey bees. He consciously applied these complex insights in a business strategy that allowed him to weather market-related changes in the cost of pollination units. Peter's 'energy storage' or 'capacitance' livelihood strategy provided his family with food and nourishment just as the bees provide food for the lean times through the storage of honey.

The flow of energy (in this case time and effort) between domestic and business spheres was a critical aspect of Peter's capacitance strategy. Peter's seven children were being (or had been) home schooled by their mother, Sylvia, who was also closely involved in the administration of the business. Sylvia explained to me that 'schooling the children, the business, 'me time' is all integrated together in this family' (Field notes 12/05/2012). Family life was not confined to a five day a week or nine to five schedule: all family members collaborated to get high-priority domestic and business tasks done. On the Saturday that I attended Peter's bee workshops, Sylvia spent the day at the venue, making coffee for the participants and working with the children as they played with Lego and other educational toys. Workshop participants ate a lunchtime meal that we were told was prepared by the whole family the night before. During our first interview, Peter's son sat in the honey truck and did his homework – he had been helping his father with deliveries that morning. Sylvia considered this collaborative approach to be essential:

> 'If you have a small business and don't get the whole family involved, you won't survive'. (Field notes 12/05/2012)

In this account, family and business were strategically organised as a closed circuit, each family member a source of potential energy for fulfilling the larger purposes of the family/business under Peter's and Sylvia's leadership.

Sylvia was pregnant at the time of our meeting and I asked her whether the new baby would hinder her work in the business. She told me that although she 'takes it easy' after the birth she would not need to stop working, reminding me that 'childbirth is not a disease'. She explained

that all her children were introduced to the bees as tiny babies, quickly learning not to fear them. When the bees were moving from one hive to another (a time when they are in a non-defensive state and unlikely to sting) she and Peter carried the infants out into the swarm and allowed the bees to surround them – a beautiful bonding ritual which she and Peter had repeated with all seven of their children. In this ritual one could argue that the child was being shown that the swarm was a benign force in its life. Another interpretation of is that the new child was being initiated into the family business through its immersion in the bee swarm.

Figure 10: Part of Peter's archive of bee information on display at his bee keeping course

Accumulation or storage was also evident in Peter's approach to knowledge and learning. At the entrance of the bee workshop the family had laid out a table with thick lever arch files, each containing years of research into a particular topic related to bee farming (depicted in figure 10). A self-confessed 'bibliophile' Peter explained that he had been collecting articles and documents for years, and had even more files at home in his collection. Each file was carefully organized: a sophisticated archive of written information that Peter had debated and internalized over the years. His interests were not confined to bees: 'I am extremely passionate about learning. I went to Cape Tech and read every book in the library'. This passionate interest saw him through various career changes: 'I didn't know what I wanted, but I had a quest for knowledge' (Interview 2/05/2012). Like Dylan, Peter was happy to share this information with other people, and did so through various forums. Knowledge in this instance was a resource that could be collected, stored, re-digested and shared with others.

Practitioners have sometimes been approached in the literature as recipients of models and texts, almost as if they were empty containers that could be filled with knowledge through an education process (Palsson 1994). What this analysis suggests is that knowledge emerges through embodied practices and that people therefore should not be separated into two separate realms: mind and body (Thrift 2004). In the example of Peter and Sylvia's bee farming business, knowledge and practice were entangled together in the idea of capacitance. Through Peter's past practices in IT he'd worked closely with electrical circuits and batteries, developing an understanding of how energy was stored and then released when it was needed. This way of knowing which Peter called 'capacitance' translated into other parts of his life and was taken up by Sylvia and other members of his family, reinforcing an ethos of work/family integration. It was also evident, I argue, In Peter's archive of articles about honey bees, collected over many years and shared with students and researchers. In this sense the idea of capacitance did not precede practice, but unfolded and developed in different areas of Peter and Sylvia's work/family dynamic.

Figure 11: Piles of standard sized supers awaiting repair

Figure 12: Farmer placing a ‘deep’ super onto a brood box containing a swarm of bees

The different ways that bee farmers retrofitted the design of their bee hives and apiary sites further demonstrates entanglement between knowledge and practice. Some issue related to bee farming equipment was raised in every interview that I conducted with a bee farmer during fieldwork. The amount brood boxes and supers a bee farmer had at his disposal was an important concern in that it limited or enabled his productivity in honey production and pollination. All the bee farmers that I worked with used a basic Langstroth hive, as depicted in Appendix 1 and figure 12. The bottom brood box is the heart of the bee hive and contains the bee offspring (brood) and the queen, which are prevented from moving up into the honey boxes (known as supers) by a mesh only wide enough for worker bees to move through freely. Extra boxes or 'supers' are stacked on top of the brood box and easy to remove when honey is 'cropped'. Chris, whose business focussed exclusively on honey production, spoke about the importance of timing management practices according to nectar flow, saying:

> 'Bees are complicated. It's all about timing. You have a window of about six days to run through 1000 hives. The first super you take off is mixed. The second super is high quality raw honey. We have 200 additional deep supers to take honey off. It still isn't enough. The saving grace is that that window opportunity moves one week as you move eastwards. You lose R1800 for each super you don't get off. But once you get the first round off you can cool it.'(Interview 20/04/2012)

In this way the timing of a honey crop was critical to the amount and quality of the honey produced. No matter how much equipment a farmer had at his disposal he needed to be aware of where and when plants are blossoming and move his bees around accordingly in order to take full advantage of a nectar flow.

Chris explained that problems with equipment design would bother him until he worked out a solution: 'I would lie awake at night thinking – I have to solve my problem' (Interview 20/04/2012). Finding the equipment available on the market to be unsatisfactory, Chris began to design and build equipment that met his needs and lasted a long time in the elements. One adaption that he felt particularly strongly about was that he used brood box sized supers only to crop honey (shown in figure 10), rather than the standard super which was shallower and therefore lighter to carry to and from the *bakkie* (shown stacked up awaiting repair in figure 11). Chris felt that using deep supers was a badge of an experienced bee farmer, saying: 'I only use

deep supers. You cannot farm honey commercially if you don't use deep supers'. On another occasion I heard Ben say that he had been worried that another bee farmer had put down hives on the same farm where he kept bees. He had been relieved to see that the new farmer had been trying to use small 'catch hives' (intended only for the capture of wild bees) to produce honey (Field notes 18/05/2012). He had interpreted this practice to mean that the new farmer was a novice and not a significant threat to business in the area. In this way farmers like Chris and Ben 'read' other farmers' equipment for signs of skill or inexperience.

Figure 13: Farmer using a drill to 'lock' his hive

Figure 14: Apiary site surrounded by fencing and barbed wire

Over years of working with bees in a South African context Chris and other bee farmers had become increasingly resourceful in dealing with the problem of vandalism (introduced as a matter of concern in Chapter Four). This resourcefulness was illustrated to me on a honey harvesting expedition with Chris during which we visited an apiary site far up a mountain pass (Field notes 11/05/2012). The farm we were on was full of a particularly valuable type of bee forage: ironbark trees[14], yet the remote location of the uppermost site left it particularly vulnerable to vandalism. It became evident that various steps had been taken to ensure that vandals did not kill the bees and steel the honey. Chris and his team had erected a razor wire topped fence around site (shown in figure 14). In order to gain entrance the narrow gate to the site had to be screwed open with an electric drill. Each hive was nailed shut, and Chris and his assistants used their hive tools to pry out the nails before they could open the lid.

Retrofitting of standard materials as a way of dealing with specific contextual needs was approached differently by individuals according to preference, cost and availability of materials (Hutton-Squire 2011). Dylan had a different technique for protecting hives which involved binding the hive with a chain and using a drill to tighten the chain so that it could not be opened manually, as shown in figure 11. Another common strategy was to use a tough fabric strap to winch the hive shut. Although fairly easy to cut or burn through, straps were still useful as a

[14] Ironbark are a species of eucalyptus tree that bees feed on to produce a much sought after honey.

means of discouraging honey thieves such as children, baboons and badgers. A further adaptation of equipment for dealing with badgers was to raise the hive off the ground with a metal stand, making it harder for the animals to reach and rip open the hive to get at the honey.

On closer inspection of Chris's hives at the ironbark site I noticed that bees were clustered around a small hole drilled into the back of the brood box. Chris explained to me that vandals often attempted to suffocate bees by closing up the front part of the hive. When the bees were dead they could extract the honey without being stung. With his innovation, Chris told me gleefully, vandals were painfully surprised by a stream of angry bees pouring out of the back of the hive in its defence. As part of this mix of designs Chris collaboratively partnered with his bees in protecting their joint interests – a drilled escape hole ensured that the bees could protect the honey on which both Chris and the bees depended. Through a process of ongoing experimentation he found ways to access productive areas that would otherwise be untenable for bee farming. As such he was able to overcome a barrier to honey productivity through adaptation of standard equipment and conventional apiary site layout.

As shown in Chapter Four, vandalism is a factor that influenced the viability of bee sites: places that were remote, unmonitored or accessible to the public tended to be more vulnerable to theft by animals and people who have a taste for honey. By closing up hives with straps, nails and chains farmers made them harder targets for honey thieves, who, farmers told me, were often opportunistic in their raids and therefore unlikely to be wearing protective clothing. Cape bees have finely tuned defences of their own: I learned that there are bees within the swarm tasked only with sitting at the mouth of the hive and warning the swarm of imminent danger. Unlike European bees, the Cape and African honey bee have very painful stings which necessitate a speedy getaway should the swarm become defensive, made more difficult if a hive is 'locked' in some way (a fact that farmers were well aware of having worked with bees for many years). Chris' adaptation demonstrated his understanding of both the behaviour of vandals and of bees: he knew that one strategy for stealing honey was to seal up the mouth of a bee hive with a stick substance such as *mielie pap* (maize porridge) and wait for the bees to suffocate, and he knew that his bees would defend themselves if they felt threatened. In this way bee farmers were able

to use their knowledge of people and of bees to creatively access areas that would otherwise remain untenable due to vandalism.

Embodiment: a fine feel for bees

I learned through fieldwork that bodily sensations such as smell and touch, sight and taste were intrinsic to the physical practices of commercial bee farming. Laura, a retired bee farmer, reminisced about the man who mentored her when she started her business:

> '[Some] people, they just have a natural flair. Harold could sense how the hive was feeling that day. If he opened it up he would smell it, when he handled it the bees were almost invariably calm. He had a way of handling them. He definitely had a fine feel for it, you could just see the way he handled them. It's difficult to explain.'
> (Interview 17/05/2012)

What made Harold's relationship with bees so harmonious? Here Laura explained that he engaged with the bees using his bodily senses - he used his smell and touch to pick up on sensory signals that he interpreted to gauge the mood of the swarm. An example of this that I encountered was that some bee farmers were able to stand at the outskirts of an apiary site and smell that the bees were making honey and might therefore need more space to stockpile their food. If the bees were making a loud, angry buzzing sound rather than a warmer, softer buzzing sound a farmer might respond by working with the bees at speed, getting in and out before they became defensive. If a lid was difficult to pry open because it was gummed shut with lots of propolis[15], a famer once explained to me, it probably meant that the bees inside would be relatively healthy and productive (field notes 5/12/2011).

[15] Propolis is a sticky, resinous substance that bees collect from trees and plants and use to weatherproof and pest proof their bee hive. Propolis is known to have antibacterial and immune boosting qualities, and is sometimes harvested by bee farmers and sold for use in medicinal products.

Figure 15: Bee farmer assessing an apiary site from a short distance away

Figure 16: Using the hive tool to pry a frame out of the super

Figure 17: A farmer using a bare finger to scoop honey out of the comb

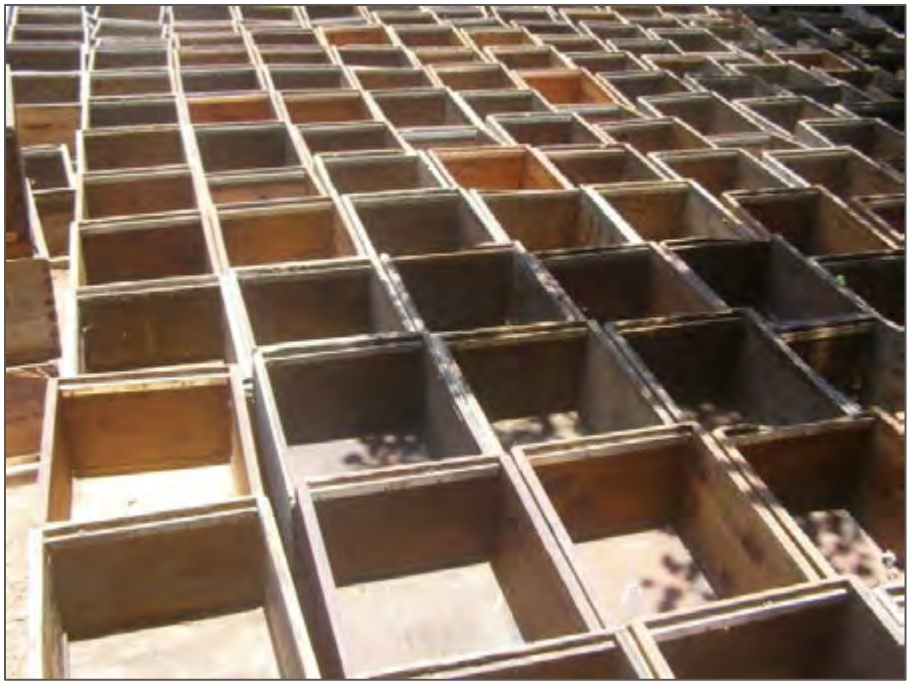

Figure 18: Equipment being stored at Kyle's base of operations

Figure 15 depicts a farmer standing with his hands on his hips, watching his bees work. In this case he stood watching the bees for several minutes before putting on his bee suit and approaching the hives. This bee farmer was able to gauge the mood, health and productivity of a swarm before looking inside the bee hive and was able to take pre-emptive action accordingly.

Eva Shawn Hayward refers to the ability of sensory organs to probe into the materiality of the living world, saying: 'Fingery eyes literally plunge the viewer into materialised perceptions' (Haraway 2008 and 2010). Harold and other bee farmers used their sense of sight, smell and hearing like fingers, probing into the secret darkness of the hive before even opening the lid, giving them a 'fine feel' for what was taking place inside. My observations of bee farmers working with their bees in the field resonate with Hayward's assertion that:

> Embodied vision is necessarily accreted by the other senses and their amplification. In this way, sight is of the body, not just in the body, and this effects a distributed sensuousness.' (2010: 582)

My understanding of Hayward's statement is that a person sees with their whole body, not just with the eyes. The Oxford dictionary explains that the verb accreted means to 'grow by accumulation or coalescence' or to 'form (a composite whole) by gradual accumulation' (Oxford Dictionary Online, 2012). One explanation for participants' fine feel for bees is that they accumulated a sense of how to work with the bees over in some cases years of embodied experience. They were then able to apply this accumulation of embodied knowledge as refined skills. In this sense knowledge can be conceptualised as 'embodied vision' and the practice of that knowledge as a sensuous application of that vision by the whole body – an octopus of 'finery eyes' working together in unison (Hayward 2010).

The technology farmers use to 'feel finely' are parts of their physical bodies. While Dylan covered the rest of his body with protective clothing he mostly worked with the bees bare-handed (as in figure 12 and 17). Although he did keep a pair of gloves in the *bakkie* he explained that he generally found himself able to work more quickly and efficiently without his gloves on – a practice shared by the majority (but not all) of the bee farmers that I encountered over the course of the study. Along with the metal hive tool (depicted being used in figure 16) they used their fingers to pull frames away from the sticky propolis that cemented them into the super.

Fingers were also used to carefully separate the frames within the brood box – this created evenly spaced honey comb that is easy to extract en masse later on. When I emulated a bare handed practice I found that I was able to work more carefully and squash fewer insects unencumbered with bulky gloves. Bare fingers and hands became fine tools that were more skilful, gentle and efficient when in direct contact with bees and equipment.

While in the field and the honey house a farmer's body was also used in some cases as a mobile and highly sensitive laboratory. While we were working, a bee farmer would sometimes scoop some honey out of a frame with a bare finger (as in figure 17), pull aside his veil and taste it in order to discern which type of forage it was from. Peter told me longingly of an unexpected bumper crop of red coloured honey from a eucalyptus stand that had all tasted 'like cigarettes' (Interview 2/05/2012). In this way sensory organs such as the tongue and the nose were used as technology to discern the important information about the origin or quality of a particular honey[16]. Fingers acted as sensory probes that could be licked, smelled and rubbed together to yield information about the substances with which they come into contact.

A bee farmer's highly attuned senses had practical applications for marketing and retailing and the fruits of the hive. Laura used her fine sense of smell and taste strategically as a means of differentiating herself as a honey producer and retailer:

> 'I used to go in for varieties in that I thought, and I turned out to be completely correct, that I would do well by labelling the honeys as much as I could with the source as well as the area. Lucerne for example would taste totally different from eucalyptus from this area. You would taste eucalyptus from another area and it would be different. I had, at one stage, ten to twelve varieties of honey. They tasted very distinct, certainly to me. I could just open the jar and smell it.'(Interview 17/05/2012)

Laura used her sense of smell and taste to develop unique harvests of honey as a tastevin (or wine taster) would differentiate between wines from different vintages. She discovered that forage flowering in a particular area would produce a particular flavour of honey and structured her business around capturing and branding these different vintages.

[16] Honey with an unappetising flavour might be blended with another, finer tasting honey back at the honey house.

Laura elaborated on the distinct differences that she notices between the different vintages of honey that she cultivated:

> 'That approach definitely worked. I found it so interesting – the honey really did taste so different, and people had different tastes. At Cape Point we got a bitter *fynbos* – we got a dark, dark brown, almost black coloured honey. The taste of it was quite bitter. I used to get a lot of people that would absolutely kill for it. I used to sell some of it like that, and some of it I used to mix, anything that wasn't so great. It would make a honey not nearly so bitter, not nearly so strong. People still ask for it.' (Interview 17/05/2012)

Her clients became fond of particular varieties of her honey and she had people knocking on her door begging for their favourite flavour, as one would request a particular vintage of wine from a vintner (wine merchant). In this way she used her 'fine feel' to distinguish herself from other honey retailers who sold blended honeys or a less diverse variety of honey types. Laura's built in and finely tuned laboratory equipment translated in this case to a point of difference in her commercial honey business.

In Gregory Duggan's Masters research with small scale fishers on the South Coast of South Africa he shows how participants moved fluidly across the perceived boundaries between fisher and researcher:

> 'Operating from a relational ontology, the boundaries of knowledge categories begin to blur and it is not possible to speak of Spoonbill or Oom Louis as a fisher or a scientist as they are always so much more from one interaction to the next' (2012:62).

He goes on to explain that:

> 'To speak of Oom Louis as solely a fisher bounds him to a static category. Oom Louis, as with all other actors, is a becoming.' (2012:62)

Duggan shows how fishers are engaged in a process of constant reinvention as they encounter different challenges. I have shown how Laura and other bee farmers used their bodies as mobile laboratories for testing the origin and quality of honey on site, as well as for identifying and evaluating particular flavours in the bottling and retail process. Using Duggan's language I would argue that Laura is simultaneously a farmer-researcher, farmer-tastevin (honey taster) and farmer-vintner (seller of vintages of honey). As such Laura defied a bounded idea of what it is to

be a bee farmer in that she drew on different abilities and skills according to the practical needs of the moment.

Kyle, a large scale commercial bee farmer, honey bottler and retailer, provided a further illustration of this multi-faceted way of knowing and doing bees when he said:

> 'Very few beekeepers are able to put production, packaging and retail together. Traditionally you have a fragmented supply chain – beekeepers are selling in bulk. Only a few are packaging honey. I am lucky to have put it together. I do everything. I am up there with one or two others. I probably pack the most honey. I import honey. I wear different caps. I do see the bigger picture.' (Interview 2/12/2011)

In his interaction with the bee hives it could be argued that overlapping, interlinked facets of Kyle came to the fore. Kyle's business spanned the full length of the supply chain, from production and importation through to bottling and retail. He asserted that wearing these 'different caps' allowed him a special, more expansive insight into the business of beekeeping. Law writes that actors can be 'more than one and less than many' (Law 2004:160). It could be argued that in order to 'see the bigger picture' Kyle assembled his learnings and experiences from the different parts of the business. In making management decisions he ruminated or drew on this constantly growing and changing multiplicity of recollections.

So what has been said so far about knowledge and the body? I have described instances in which bee farmers utilised their whole bodies in managing and making decisions about their bees. I have argued that in some cases farmers used their bodies like mobile laboratories, using their fingers and tongues to measure, discern and gather useful information. I have suggest, based on these intimate and sensitive engagements between farmer and bees, that knowledge was accreted or stored in farmers' bodies (Palsson 1994), creating a kind of embodied vision which became visible when applied as a skill (Hayward 2010). I showed how practitioners moved easily between different skill-assemblages according to the needs of the moment. This support's Duggan's assertion that practitioners should not always be confined to one skill category, as they are often able to embody and move between multiple ways of doing and being. This in turn supports Mol (2002) and Law's (2004) theory that one person can embody and utilise multiple knowledges, wearing 'different caps' simultaneously.

Taking the analysis further, the ethnography indicates that one person's embodied knowledge could have application and influence outside of their physical presence. Many years of hands-on experience with bees had in some cases crystallized into transferable knowledge, as with Kyle's knowledge about honey production. A long-time bee farmer, Kyle reminisced that as a child he used to spend hours lying on his stomach and watching the bees that lived under the floorboards of his family home. At fifteen he started keeping his own hives. When I met him Kyle was running a large honey production and bottling company and no longer had time to work with the bees directly:

> 'I don't get involved often. As an experienced beekeeper I am able to see the signs without being there – the condition of the supers and by speaking to the staff. The staff is making decisions, all based on years and years of informal staff training. They come raw'. (Interview 2/12/2011)

Through an ongoing process of training Kyle passed know-how on to his staff, training them to become his eyes and ears in the field. Figure 18 depicts the type of equipment that he was able to 'read' for signs of productivity or disease, making overarching management decisions accordingly. In this way he adapted a hands-on style of management to a hands-off, long distance approach that freed him up to fulfil his leadership role in the business. Beginning as a simple relationship between a boy and a colony of wild bees, Kyle's influence and judgment extended through a dynamic network of employees and equipment to hundreds of apiary sites.

What this indicates is that knowledge, which I claim so far is situated in the body, can also travel beyond the body. Kyle's ideas and instructions had influence beyond his immediate presence. Kyle's 'fingery eyes' allowed him to evaluate bee health and the efficacy of his workers practices at geographically distant apiary sites (Hayward 2010). Kyle did this by using his embodied vision to examine the equipment that his workers brought in from the field. He had trained himself to become a hands-off bee farmer, located at the administrative nerve centre of the business rather than in the field, but still with influence over his workers practices and decisions through his ongoing training and instruction.

For bee farmers in the field, responding to the minutiae of details that they felt finely with their 'fingery eyes' required body/mind synchronicity and agility (Hayward 2010). Working with bees at a commercial scale involved complex intellectual/physical synchronisation as farmers work intuitively with their bodies at the same time as executing focussed tasks such as checking hives for signs of disease. Conducting sharply focussed investigations required farmers to draw on embodied knowledge. While working through an apiary site a bee farmer would juggle multiple pieces of equipment: a smoker always at the ready in case the bees became restless, a hive tool in and out of a pocket, empty supers from the vehicle to the hive and full supers from the hive to the vehicle. In my first week of fieldwork I was so focused on being at the ready with the smoker that I stepped on a pile of live bees that had just been shaken from a brood box: a costly rookie error that could have potentially weakened the swarm or even killed the queen bee. The 'crunch' sound the bees made when I stepped on them is still with me today. What I realised from this experience was that my companions were skilled enough to make complex tasks appear deceptively easy and effortless, when in fact they required sophisticated physical-intellectual coordination.

At the same time as executing multiple tasks simultaneously, many management decisions were being made by bee farmers in situ and at high speed. With Dylan I often found myself running to keep up with the pace of daily work. He explained the importance of a fast pace, saying:

> 'I need to make a decision quickly because I need to get through 150 hives in one day'. (Field notes 23/11/2011)

In the interests of efficiency, he preferred to have a specific purpose when visiting an apiary site:

> 'I visit a bee site for a specific function: to feed, to check for disease, or do they need more space. Instead of getting distracted by other things I just do one function. This speeds up your beekeeping.' (Field notes 23/11/2011)

Apiary sites were often spread across large areas and hours of driving were sometimes required to move between them. Dylan's strategy for making the most of his time was to conduct his working day with a clear focus and at a fast pace: he drove fast between sites and when reaching a new site worked through his pre-decided tasks at a trot. He also streamlined his management approach by checking all the sites in one area for one particular issue (for example: do the bees have enough space?) and then sweeping the area again at a later stage to check for something

else (for example: is there disease in the hives?) Dylan explained that other bee farmers preferred to open up the hives less often, checking for multiple issues at the same time. The benefit of this hands-off approach was that, while it took longer to check a single hive, it allowed bees to work undisturbed for longer periods, leading to potentially healthier hives. This more hands-off approach also required less travelling and therefore less transportation expense and time. With awareness and consideration of the benefits of different management techniques Dylan tailored a style of management that worked best for him, in terms of speed and efficiency.

Figure 19: Dylan jotting down information in his diary at the end of a site visit

Performing complex tasks at high speed required an additional dimension of physical-intellectual coordination and skill, as I discovered in my first week of fieldwork when I was given the apparently simple task of counting the amount of supers on each hive before leaving an apiary site. My field notes attest to the challenge of the experience:

> 'At one site Dylan asks me to do the count for him. This involves very quickly counting how many hives have zero, one or two supers on top. He then jots this down in his diary under headings, with the name of the site besides (as in figure19). I found this quick counting very challenging, and Dylan laughed at me, saying that it is like second nature

to him. When I later ask if he ever goes over his bee records and looks at whether sites/areas are most productive and strategizes from there, he says that he doesn't, but that he should.' (Field notes 13/12/2011)

Not only was Dylan able to account for super numbers at a glance, but I also realised that he was keeping a lot of the information in his head, only checking his scribbled written records in his daily diary when his memory failed him (as in figure 19). This allowed him to move between apiary sites at speed, barely pausing to capture information about decisions that he had taken and changes that he had made at the site (such as adding new equipment).

Dylan's approach to record keeping could be described as complex form of mapping. He did not use an overarching Excel spread sheet to collate all the new fragments of information about an apiary site that he wrote in his diary. The process of collating all these different apiary sites into an overview of his business status at any given moment was therefore an ongoing internal function. In order to make overarching decisions about his business he would have to consult this dynamic mental map of information. Dylan also explained to me that his site locations were not documented:

'We don't use a map – the sites are integrated into our minds.' (Field notes 13/12/2011)

Dylan's mental map can also be approached as an embodied knowledge assemblage or knowledge space. Says Turnbull:

'A knowledge assemblage is made up of linked sites, people and activities; in a very important sense the creation of an assemblage is the creation of a knowledge space' (Turnbull 2000:19)

In this sense Dylan operated physically within a geographical space that is entangled with other valuable pieces of contextual information.

This dynamic map or knowledge assemblage also included subtle emotional information, which influenced decision making in a nuanced way. Based on what he had noticed from his record keeping Dylan commented that he really should just keep his hives in the most productive areas, and get rid of his other sites. But, he said:

'I am sentimental about my sites where I have a relationship with people, and I struggle to take the less productive bees off'. (Field notes 13/12/2011)

As well as feeling loyalty towards land owners, Dylan also responded emotionally to what he found at each new site, as these field notes attest:

> 'The bee sites that we visit have varying degrees of success. Dylan is happy when there is a lot of brood, when the bees are visibly strong when the hive is opened, when the honey is already flowing. He gets upset when there are already full supers, as he has missed a chance to collect even more honey, had he given them more space a week or so ago. 'The joy of finding full supers, the despair of finding fucked up hives – you have to be there to experience it'. I notice that Dylan is quite elated after a good site.' (Field notes 13/12/2011)

In this way Dylan's mental accounting system also had a social and emotional dimension. He took account of his longstanding relationships with landowners and factored in the value of those relationships into his decision making around when to keep bees on a piece of land and when to move them to more productive sites. The state of the hives also changed the way that he felt emotionally. He oscillated from joy to despair depending on the amount of honey that the bees produced. There is a possibility that these emotions also formed part of his dynamic map of bee sites, helping him to remember vividly where the bees had been productive and where they had met with misfortunate, such as vandalism.

Ingold argues that a human being has historically been conceptualised as 'a composite entity made up of separable but complimentary parts, such as body, mind and culture' and suggests that he or she can be more accurately viewed as 'a single locus of creative growth within a continually unfolding field of relationships' (2000:4). Dylan's decision making approach reflected the entanglement of social and ecological relationships involved in bee farming. It would make economic sense to put his bees in areas where the ecology supports a high volume of honey production, yet Dylan explained that there was more at stake in his decision making than financial gain alone. Some of the sites on which he kept his bees anchored relationships with land owners that he had developed over time, and who he valued for different reasons. He was in active engagement with the land, with the bees and with changes in the ecology of the area and made choices based on the intimate interplay of all of these factors. As such his decisions in this account were shaped by the social-ecological fluctuations at play in a particular context, rather than being informed by a balance sheet of economic interests alone. Dylan could

be viewed as ‘a single locus of creative growth’ in that he responded creatively, emotionally, physically and intellectually to the changing circumstances of his bee farming practice (Ingold 2000:4).

Dylan created a knowledge space in his own mind that linked geographical sites with feelings of loyalty and affection for landowners, feelings of joy at a good harvest and despair at a missed opportunity (Turnbull 2000). He had ‘integrated’ the location of each site into his mind. A geographical map of sites was overlaid with textual records and embodied recollections of the number of supers on each hive. This ever changing assemblage of texts, facts, sites and memories constituted a knowledge map that informed his daily work practices. The map was embodied in that it was linked to his emotional and intellectual memories as well as to physical tools such as his written records, forming a knowledge space or assemblage within which he conducted the complex task of managing his bees (Turnbull 2000).

Conclusion

The analysis in this sub-section supports some primary insights into embodiment and embodied knowledge. In the first section I showed that knowledge often emerges from embodied practices and experiences. Peter and Sylvia threaded the idea of capacitance through the different parts of their lives, bringing their family/work life into an iterative circuit. Chris and other bee farmers demonstrated their knowledge of bee farming through their use and retrofitting of equipment, reading other people’s equipment in situ as a measure of knowledge and ability. Chris used his understanding of bee behaviour to develop a simple and low cost adaptation to the basic Langstroth hive which allowed the bees to defend themselves, even when confined. In this way the analysis supports the ideas about embodied knowledge put forward by writers such as Ingold (2000) and Palsson (1994) which articulate an iterative relationality between knowledge and practice: knowledge is developed through practice just as practice is informed by different intellectual, emotional, embodied ways of knowing.

I explored some of the bodily technologies that were involved in the skill of bee farming in a particular instance. I argued that some farmers use physical sensations such as touch, taste, smell and sight as a mobile laboratory of finely tuned instruments. As farmer-researchers they are able

consult this sensory information in making management and business decisions. Multiple, interwoven skill sets indicate that these participants embodied hybrid identities and were able to view their work wearing 'different caps' (or performing different roles (Mol 2002)). In the field, participants were able to record important pieces of information quickly, adding to a complex assemblage of temporal, emotional and numerical information. In some of the instances highlighted here, bee farmers draw on this internal 'knowledge space' in making management decisions or developing business and livelihood strategies (Turnbull 2000). Dylan's bee farming management techniques interwove social and ecological in what can be conceptualised as a dynamic map, knowledge space or assemblage of relationality, emotional and intellectual memories and linked to written records of the number and health of swarms at each apiary site (Turnbull 2000). I reflected on my own learning experiences as a participant observer and apprentice bee farmer both as a benchmark for the highly developed skills of experienced bee farmers and as experiential data about the physical challenges and sensations involved in farming bees commercially.

Chapter 7 - Conclusion

Thrift recommends that, in order to revitalise cultural geography, we should 'recognise the richness of the world'(2004:121). This dissertation has documented some of the rich complexity involved in farming bees commercially in the Western Cape of South Africa. I have analysed this ethnographic material using relational concepts, with attention to bee farmers' knowledge practices. This conclusion critically considers how these ethnographic findings support, develop or challenge nature/culture, human/non-human and mind/body dualisms, bringing together the overall argument of the dissertation in what 'different ethos of engagement with the world' it might suggest (Thrift 2004:121).

The aim of this dissertaion, as laid out in the introductory chapter, was to to explore environmental knowledge practices among commercial bee farmers in the Western Cape, South Africa, using a relational theoretical framework, in order to interrogate dualistic framings of human/environment relations. The objectives were to understand the social-ecological relations between bees, plants and farmers; to understand how knowledge is performed through practice in bee farming and to understand how bee farmers are entangled in social-ecological realities. Methodologically, indepth interviews, participant observation and primary documentary sources (such as online bee farming discussion groups) were utilised to address these aims and objectives.

Entanglements

The overall assertion that this dissertation makes is that the social and the environmental, humans and non-humans, mind and body are not separate domains. Ingold states that:

> ‘In reality, human beings do not dwell on the other side of a boundary between society and nature but in the same world that is inhabited by creatures of all kinds, human and non-human’ (2005:501)

For the farmers that I worked with during the course of research, working with bees commercially was a highly sophisticated practice that knotted or tangled together knowledges, skills, bees, plants, equipment, diseases, legislation and researchers in ‘living’ landscapes (Whatmore 2006) and dynamic ‘weather worlds’ (Ingold 2007). I propose that this metaphor of an entanglement or intermeshing informed by the works of Haraway (2008), Ingold (2005; 2007; 2011) and found applied in the ethnography of South African anthropologists such as Cohen (2013), Duggan (2011) and Rogerson (2011), is a fitting description of the encounters between human and more-than-human actors that produced honey and pollination services in the Western Cape. It also reflects a complex, iterative relationship between knowledge and practice, mind and body in the execution of complex and skilled work.

In producing this dissertation about knowledge practices I became aware of my own knowledge practices as a researcher. Returning each day from fieldwork I captured my notes in *Nvivo* – a data capture programme which translated my scribbles into pages of uniform text with coloured coding threads running in straight, broken lines down the side of each page. Over the course of the next year these codes were knotted and unravelled in my mind and on the page in an exhausting process of thinking and writing. When I became ‘stuck’ I often took my work outdoors and I found that most of my best ideas unfolded while I was foraging through the open land or the beach near my home rather than at my desk. From the beginning I was entangled in my research: I was stung by bees, felt a new tenderness and protectiveness towards trees and insects and was colonised by strange concepts and ideas that awoke me at night with flashes of realisation. The process of producing this dissertation was therefore one of embodied engagement with a meshwork of theorists, practitioners, substances, information, ideas and sensations that rushed up to meet me when reading theory, writing analysis and talking to and working beside bee farmers.

The theoretical insight that can be distilled from this messy process is that studying knowledge practices is itself a knowledge practice. This is not a new realisation: Turnbull and Law are two

theorists who have articulated the idea most elegantly (Turnbull 2000; Law 2004). Yet it was transformative for me as a researcher to work with a body of literature that stated and restated the fact that, through my thinking and writing, I was not capturing or reflecting reality but in fact generating or performing a particular version of reality (Turnbull 2000; Law 2004). Isobel Stengers advises us to be 'idiots' in our thinking, writing:

> 'We know, knowledge there is, but the idiot demands that we slow down, that we don't consider ourselves authorised to believe we possess the meaning of what we know' (2005:994)

My understanding of what Stengers means, after much immersion and reflexion, is that research of this kind is not about revealing truth or producing clarity. Nor is it to 'produce abysmal complexity' (2005:994). Rather the purpose is to describe the richness of what we see, and to allow our minds to be challenged and changed by what we find. With this purpose in mind, I will go on to articulate some of the main insights that I distilled from this research.

In Chapter Four I used broad brushstrokes to sketch out some of the more obvious entanglements between people and environments. This illustration of basic connectivity showed that farmers shepherded bees from place to place, paying careful attention to the flowering time of different forage plants so that their bees were well positioned to take advantage of nectar flows in the area. These management processes also involved landowners: bee farmers were adept at securing and retaining bee sites through relationships of informal exchange. Members of the public were also entangled in this already complex mesh of relationships: where bee sites were accessible to the public, farmers often struggled with theft and vandalism. Researchers had in the past felt the tug of these pressures on bee farmers when their questionnaires had been ignored by farmers who wanted their bee sites to remain secret and therefore safer from theft and vandalism. I argue that, through this meshwork of relationality (Ingold 2005) bee farmers and honeybees, along with private landowners, landscapes, weather worlds (Ingold 2007) and forage plants, collaboratively provided an essential 'ecosystem service' to the agricultural industry, supporting food security and the economy. This supports Ernstson's sentiment that 'the benefits humans and society can derive from biophysical cannot be viewed as objectively existing "out there", but as entangled in social and political processes' (2013:8).

As this dissertation shows, the relationality between honey bee and bee farmer is a particularly interesting form of co-production. Honey bees sometimes behaved like managed livestock, allowing their honey to be harvested and their homes to be managed by farmers. At the same time their agency was also apparent: the bees stung farmers when they felt threatened and absconded from managed hives when they were not well accommodated. Unbound by property law they were able to fly, uninhibited, across territorial boundaries to access flowering plants that bee farmers could not access more directly. While colonies of bees are shaped by invasive management practices and even killed by bee farmers for different reasons, they are at the same time self-managing. The complex minutia of bee anatomy and swarm organisation cannot be exactly replicated by human beings, and is still mysterious to us in many ways (Raffles 2010). In this way bees are marginal creatures: they transgress the categories of nature and culture in that they are simultaneously wild and domesticated, managed and unmanaged (Cronon 1996).

By viewing pollination (and honey production) as a form of social-ecological coproduction, the significance of previously unnoticed or unappreciated relationalities that make up an 'ecosystem service' are made evident. One area in which this insight is of significance is in debates taking place around how to more successfully manage complex social-ecological systems. Ommer et al (2012:317) motivate for an approach to fisheries that considers 'human societies as an integral part of marine ecosystems' thereby supporting 'marine governance structures match the complex nature, interdependence and scale of the complex nature, interdependence and scale of social-ecosystem processes'. Given that bee farming in South Africa is currently far less regulated than bee industries elsewhere in the world; a very important area for future research is to consider ways in which future legislation might integrate local bee farmers' knowledges and concerns. This is especially pertinent given that existing legislation around the removal of listed eucalyptus trees directly affects Western Cape bee farmers' ability to deliver the ecosystem service of bee pollination upon which many crop farmers depend.

A second insight from the dissertation is that practitioners were actively and intimately engaged with the social-ecology in which they were embedded and through which they worked (Ingold 2000 and 2005). For example, farmers carefully observed eucalyptus trees, moving and managing their bees in careful timing with the flowering of plants in order to take advantage of

nectar flows taking place in a particular area. Some farmers were also able to ascertain the productivity and health of a swarm of bees or an apiary site in an instant using their 'fingery eyes' and 'embodied vision' (Hayward 2010). This close engagement with environments allowed them to tailor their management techniques to maximise honey production and therefore business profitability. They also keenly observed tree buds and bee behaviour over time in order to detect and predict the influence of wind, rain and aridity on nectar availability in the near and more distant future. In this sense bee farmers were also farmer-researchers and farmer-businessmen, able to draw on a movable feast of embodied knowledges and skills according to the needs of the moment (Duggan 2011). There is an exciting potential here for future science and social-science research into bee farming to take on a more collaborative quality, involving farmers more directly throughout the research process.

Given the speed of environmental change (both due to climate change and rapid depletion of natural resources) (Ommer et al 2009) it is imperative to understand how agricultural practitioners such as bee farmers navigate social-ecological complexity, change and related pressures and challenges in daily practice. Chapter Four demonstrated that participants responded to social-ecological challenges with a high degree of adaptability and flexibility. For example, Dylan managed the reputational risk of moving his bees into another farmers 'territory' through an intensive and ongoing process of consultation and negotiation involving different role players. He lessened the impact of fire on his business by keeping only his older, less valuable equipment in *fynbos*: a plant known to burn easily and regularly (Lindley et al 1998). Ben managed the commercial risk of a non-contractual, unstable relationship with a landowner by spreading his bees across multiple apiary sites rather than taking full advantage of the carrying capacity of particularly productive eucalyptus plantation. In the absence of formal risk management products, such as insurance policies, bee farmers had tailored their own proactive systems and techniques for managing risk. There is certainly room for a deeper analysis of South African bee farmer's innovative risk management knowledge practices, especially as a means of adapting to climatic changes already taking place in the region (Akoon et al 2009).

Deepening the assertion that honey and pollination are coproduced through meshworks of relationality, a third insight is that bees and bee farmers shape each other through the

management practices of commercial bee farming (Ingold 2011; Cohen 2013). Chapter Five and Six explored the iterative linkages between knowledge and practice, demonstrating that ways of knowing emerge from experience and that experiences also informed farmers' ways of knowing the world. By iterative I mean that there was a flow between farmer's observations and ways of knowing bees, and their own ways of knowing and doing. Dylan's strategy for dealing with the bee disease known as American Foul Brood was shown, for example, to be a performance of a Cape bee that is, at its genetic core, able to resist and overcome weakness and illness. I argued through their choice to 'lean into' and endure pain, Dylan and other bee farmers also enacted a version of bee farmer-ness that necessitated physical and psychological toughness. In this way participants enacted or 'did' both a tough Cape bee and a tough bee farmer through their bee farming practices, suggesting that a possible connection could be drawn between the two (Lien & Law 2010).

This insight around multiplicity presents an interesting challenge to Working for Water's ways of 'doing' eucalyptus trees in South Africa, as explored in Chapter Five. Bee farmers explicitly challenged what they verbalised as an 'apartheid' between indigenous and 'alien invasive' trees in South Africa. While water conservation practitioners sought to remove alien trees in order to protect biodiversity and conserve water (Marais & Wannenburgh 2008), bee farmers viewed many species of eucalyptus as abundant and irreplaceable sources of nectar and pollen (Allsopp and Cherry 2004) . I am not disputing that under specific conditions particular species of eucalyptus trees do not become invasive and impact on national water availability. What this research does indicate however is that there is a knowledge controversy amongst bee farmers around a) the value of eucalypts to society and b) whether they should continue to be removed in the Western Cape.

Lien and Law reflect that:

> 'The nature/culture divide is messy, it is heterogeneous, it is complex, and it isn't coherent. But it is endlessly consequential for everyone involved in fishy practices and other forms of relations that involve non-human beings. A performative approach to nature practices is one way in which we can begin to understand these consequences.'(Lien & John Law 2010)

The legal classification of some species of eucalyptus trees as alien and invasive has real consequences for bee farmers. As already mentioned, the Honey bee Forage Project, funded by Working for Water, is currently quantifying bee farmers' dependencies on eucalyptus and other forage sources. What this dissertation and other research already indicate however is that eucalyptus removal is indeed already pressuring bee farmers in the Western Cape in terms of their access to sufficient bee forage (Allsopp & Cherry 2004). One suggestion that I have is for more focussed qualitative research to be conducted into this political controversy around alien tree clearing in South Africa, especially as it relates to the critical ecosystem service of pollination in the Western Cape.

Another dualism that this research addresses is the assumption that people's minds and bodies operate separately, with the mind controlling the actions of the body (Thrift 2004). The final insight that this study offers is that, for the farmers that I worked with, the mind and body worked in integration. Farmers were able to use their bodies as complex mobile laboratories, discerning and probing the bee hive with their sensory organs. I suggest that the concept of 'fingery eyes' and 'embodied vision' (Hayward 2010) are particularly apt for capturing this entanglement between mind and body in the practice of bee farming. Laura used her finely tuned sense of smell and taste to develop particular vintages of honey while Kyle used his body awareness to make long distance management decisions based on the appearance of hives brought back from the field (Chapter Six). It became evident that this enskilment hinged upon intimate embodied engagements between bee farmers and bees. Bee farmers used their bodily senses to probe into the bee hive, gauging the mood and requirements of the bees and making finely tuned management decisions. In the same way that farmers had a fine feel for bees, bees also physically probed farmers with their stings and venom, demonstrating an even closer 'infoldment' between species (Haraway 2008). Such knowledge is shown to be accreted in the body and also to emerge from a person's intimate engagements with or 'foragings' (Ingold 2011) through the material world.

Concluding comments

Law describes the world as 'a structure with a discoverable shape, but is excessively filled with and made in heteromorphic currents, eddies, flows and vortices, unpredictable changes, storms,

and with moments of lull and calm' (Law, 2004:161). Approaching this fluid world required that I develop a way of writing and thinking that could accommodate rather than simplify complexity.

This study shows that a relational approach to knowledge can productively be applied to a particular ethnographic case study. Furthermore, it demonstrates that a relational ontology is useful in that it can be used as a methodological and analytical tool for destabilising entrenched ways of knowing the world through close attention to practice and performance (Lien & Law 2010). I argue that the concept of 'entanglement' captures the interconnectedness of bees, plants, practices, ideas, diseases, performances, and substances that were intimately involved in commercial bee farming practices. The potential is that, where entanglements of minds, bodies, species and natures are taken seriously, we can radically re-theorise human relationality with the environment in order to engage with social-ecological complexity in a more nuanced way.

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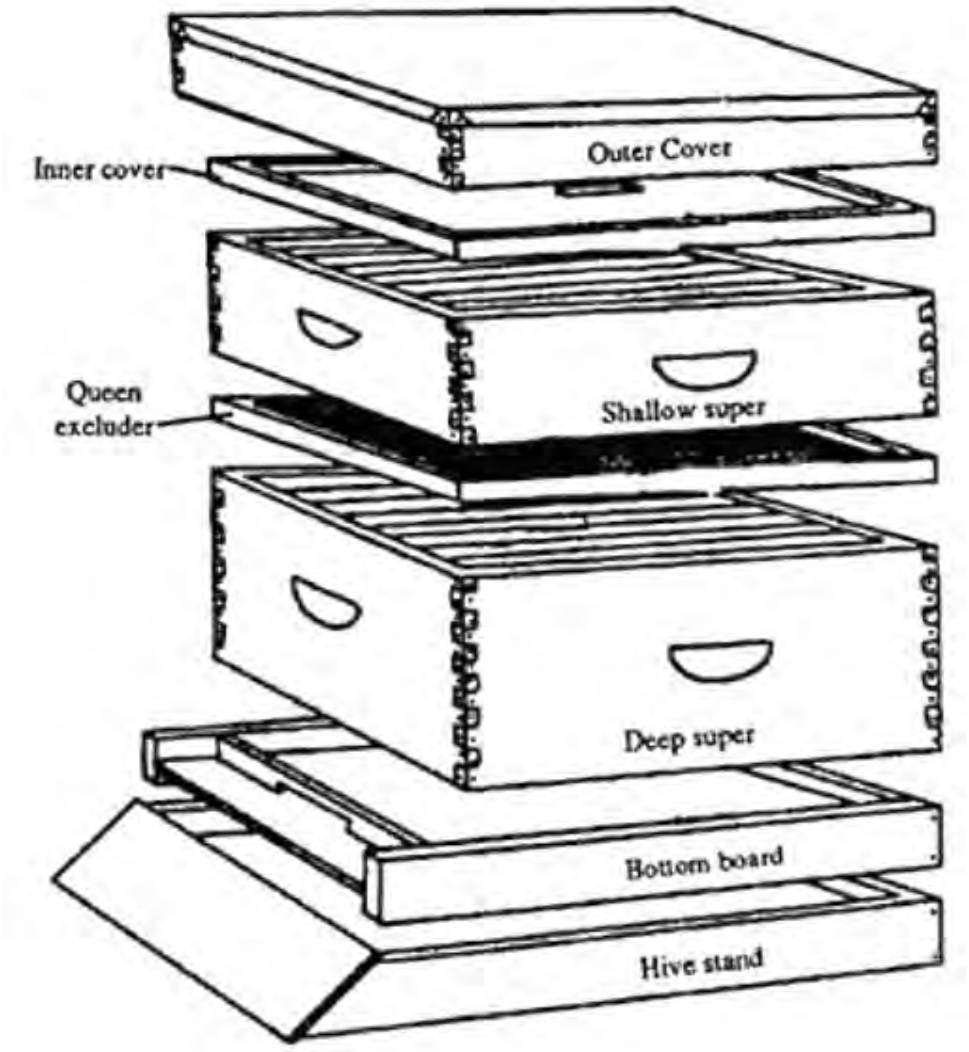
Appendices

Appendix A:

Langstroth beehive, exploded view (McGladdery 2004)



Elements of a beehive

Appendix B:

Map showing legislative boundary between *apis mellifera capensis* and *apis mellifera scutellata* territory as per Regulation Gazette No. 6388 (Department of Agriculture 1999) (map drawn by Allsopp for the author).

Appendix C:

Interview questions used as a rough guideline in open ended interviews

Background and training
How long have you been farming bees?
What kind of work did you do before this?
How did you learn to farm bees?
May I ask how old you are?
Size and location of business
How many swarms do you have at the moment?
Where do you keep the majority of your bees?
What is the ratio between the income you make from honey and from pollination?
How many people work with/ for you?
Challenges and concerns
Have you always had roughly this many swarms?
If not, why has the amount changed?
What are your greatest challenges right now?
Have these always been your greatest concerns?
How do you deal with these concerns?
Do you ever ask advice or get help from anyone when facing a challenge?
What kinds of resources do you consult when looking for information?