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Principles of Sustainable Beekeeping

Anna McAtee
Regis University

PRINCIPLES OF SUSTAINABLE BEEKEEPING

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Anna McAtee

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Thesis written by

Anna McAtee

Approved by

_____

Dr. Jason Taylor
Thesis Advisor

_____

Dr. Eve Passerini
Thesis Reader or Co-Advisor

Accepted by

_____

Dr. Tom Howe
Director, Regis College Honors Program

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Introduction

During the rise of the 2020 global pandemic one thing close to my heart never shut down. In a time of human social isolation, my honeybees buzzed all around me, continuing their own essential services. Looking into the hive taught me that there are endless lessons of wisdom waiting to be revealed from embracing an open state of mind in Nature. Beekeeping radiates the practice of living in the present moment and the immediacy of being alive. In a way, the bees made me more human. Through watching the superorganism of a honeybee colony, I saw the true magnitude of collective understanding and the sharing of power. The companionship of my beehive colonies reminded me to move in my own world with intention, to be resilient in the face of extreme challenges, and the importance of communal care.

The earliest meaning of the word *keep* is "to observe, lookout for, to lay hold with the hands." Beekeeping is to look, to watch, and to show up in presence and respect. Rather than controlling the hive, it is an interdependent relationship of working with the colony to help support what is needed. During a time of global environmental collapse, we must shift from being a "bee-haver" to a "bee-keeper". A keeper of the bees establishes a respectful relationship incorporating responsibility and observation, which reveals solutions to most problems that adversely impact honeybee health. Truthfully, bees are the teacher, coaching their keepers in lessons of life to become more conscious and aware of our environment.

Laying in my yard speckled with white clover, I watched my teacher bees hover from flower to flower when I was young. Curiosity overpowered my fear of being stung. Naturalist Bob Pyle would call this my "place of initiation" where I experienced awe and wonder- the basis of one's commitment to the protection of Nature. Fast forward to the present, I am graduating

with degrees in Environmental Science & Biology and furthering my environmental education in graduate school. Through my Environmental Science studies, beekeeping has taught me that protection for the environment is not a heroic duty to complete, but rather a recognition of a responsibility for everyone to realign our inherent reciprocal relationship with the environment. I'm not here to "save the bees", but more importantly, to be open to the new possibilities and lessons the bees have to teach us. To be a beekeeper is to be a lifelong learner of regenerative earth stewardship that rekindles the relationship between ecological and human-made systems.

My thesis is a collection of my experiences working with bees, interwoven with lessons from sustainable beekeepers and research in natural beekeeping. I feel gratitude for the people, credited and uncredited, who have innovated practices to establish a reciprocal relationship with honeybees. I honor and acknowledge that the origins of beekeeping dates back thousands of years ago in North Africa and that the history of Black people of the African diaspora, and that beekeeping is intertwined and cannot be ignored or unacknowledged. Like many other progressive beekeepers, I want a more accessible and diverse beekeeping industry that is inclusive of all classes, identities, and abilities. I want a beekeeping community that works with the cycles of the ecosystem and supports the practices of intersectionality within ecology.

I wish to share these lessons in sustainable beekeeping in a compiled and accessible manner so that all people may understand and utilize sustainable and resilient beekeeping practices. I want to participate in the emerging culture that works with the natural systems of honeybees observed in the wild by combining scientific research with the experiences of real beekeepers. Not only are these lessons applicable to fellow beekeepers, but also important for all people to be exposed to this relationship with the natural world. All voices and perspectives are essential in the environmental movement towards ecological relationships rooted in reciprocity.

My thesis begins with the importance of honeybees, both their role in our holistic ecosystem and our everyday lives. I will bring into focus the issues and diseases that resulted from our current beekeeping practices. To conclude, I offer the reader an alternative way to address the decline of honeybees, with seven main principles that reflect the major components of the sustainable practices of beekeeping. The seven principles are beginning points in the journey of radically reimagining stewardship practices with roots in care and reciprocity.

Importance of Honeybees

Honeybees are extremely important in ensuring food security, as they pollinate 80% of our cultivated crops (University of Arkansas Division of Agriculture, 2021). Not only do their pollination services largely contribute to food security, but also are vital for the biodiversity of wild plants. Beyond monetary value assigned by our modern society, these pollinators have an important role in complex, interconnected ecosystems. Honeybees are a keystone species in our environment, meaning that the removal of this species will create a ripple effect that destabilizes the entire ecosystem. Honeybees support the growth of trees, flowers, and other plants, which serve as food and shelter for other animals as well as humans. There are still benefits that honeybees give to us that we are discovering daily. Propolis, a substance created by honeybees with botanical sources, has been harvested in beehives in human medicine since ancient times and is now being studied for a myriad of antimicrobial properties. In fact, there are scientific studies being published this year on propolis' potential against SARS-CoV-2 infection (Berretta et al. 2020). Bees have countless contributions for our health and wellbeing, ensuring our ability to co-exist in a functional ecosystem.

Issues of Current Beekeeping Practices

When the phenomenon of entire honeybee colonies abandoning their hive repeatedly occurred 10 years ago throughout North America and Europe, the public became introduced with the term of Colony Collapse Disorder (CCD). With a collective confusion of the causes when first identified, we now know it is a complex problem consisting of global environmental collapse and poor beekeeping practices. While there hasn't been a reported case of CCD in years, bee populations are still on the decline and CCD is inappropriately used as the explanation.

While one could point the blame on the adverse impacts of industrial agriculture, my thesis intends to focus on actionable change that beekeepers can do to help honeybee populations thrive beyond sustainability. Focusing on changing our intention is the first step towards regenerative change. Natural beekeeper Sam Comfort calls for the shift from the overwhelming ambiguity of the phrase CCD to "PCD: People Collapse Disorder". He writes about how the foundation of CCD/PCD is in the general public's lack of interest in how our ecosystem works. We have lost touch working with the slow cycles of Nature and replaced it with the anthropocentric domination of the environment. The pests and mites that are blamed as the problem are just the byproducts of mistreatment from our practices. Most of the focus in commercial beekeeping is on maximizing honey output and not on the health and longevity of the lives of bees. As the beekeeping industry has been breeding for bigger, more manageable, and inbred bees, it was only a matter of time until pests came to take advantage of it.

By centering the health of honeybees as the main focus, we can create positive change and start a new vision; a tangible vision that consists of people embracing the stewardship of the land and working in community to create biodiversity. The future of our honeybee populations

not only includes listening to science, but also listening to beekeepers and their experiences. The hive has endless variables which are hard to isolate in scientific study and there is wisdom within the generational knowledge of the beekeeping community. Well-known sustainable beekeeper Kirk Webster points out that beekeepers don't have the option of breaking Nature into pieces and isolating variables in the lab to understand the impacts, but rather they are compelled to move towards beauty, diversity, and resilience with the guide of past experiences. The call to action to reestablish our reciprocal relationship with the environment involves committing ourselves to diversity, community, and energy. As we turn away from our transactional actions with the environment and move towards a symbiotic relationship, we need to open our hearts and minds to what we can learn from all things, starting with something as simple as a honeybee. Out of the many lessons that a bee colony can teach us, let us embrace constructive change with an open mind.

Introduction to Sustainable Beekeeping

Examining the wild lifestyles of bees brings to light the ways in which beekeepers may unknowingly be causing stress and harm to their bees. These important differences ask the beekeeper community for a reconsideration of hive management practices. The losses of honeybees challenge us to examine beekeeping practices not from the view of isolated activities or aspects, but rather as dynamic relations and vitalities (Philips 2014). By attuning and adjusting to accommodate bee dispositions, keepers can learn to work together to shape each other and the form of practice. As natural beekeeper Sam Comfort says, “Bees and flowering plants have been dancing together for years. The bees can guide us to a new paradigm. To be a natural bee-steward in this way is truly carrying a torch.” This kind of socioecological approach that is attentive to the connections between the human and nonhuman natures will be the global catalyst for social changes (Cilia 2019).

While current practices disrupt the natural rhythms that exist in a colony, this does not mean people cannot keep bees, but rather that we need to change and adapt our practices to engage in the co-constitutive relationship (Philips 2014). We need to look at past symbiosis and let go of exploitative control. By continuing to learn and live together with an open mind, establishing new norms of practice are the first step forward.

“The work might be hard, but only because we’re not used to it. If we care about future generations, and the other beings who share the Earth with us, we have to stop expecting other people to solve our problems; to learn from others instead of taking from them, and do our share of the work. This work is more satisfying and meaningful than just about anything else you can do at this point. The old beekeeping is dying, and a new one is struggling to be born. Are you going to the funeral, or assisting with the birth?”

-Kirk Webster

Seven Principles of Sustainable Beekeeping

1. Work with local honeybees.

To start a hive incorporating the first principle of sustainable beekeeping, use honeybees adapted to your geographic region. Although honeybees are technically an introduced species (not native to the United States), local honeybees have undergone the process of adaption by natural selection, producing morphology and behavior suited for their colony's location. The survival rate of the colony is closely linked to the honeybee's ability to tolerate the surrounding climate. Kirk Webster, a well-known natural beekeeper in Vermont, raises honeybees local to his area and they have survived the long intense winters without treatment since 2001. Using local honeybees allows for adaption to local climate, seasons, flora, predators, and diseases in their specific home region.

All honeybees have similar traits, but commercial beekeepers have brought out differences in behavior through breeding. Commercial beekeepers often order honeybees from across the country because they are bred to produce lots of honey and are selected against swarming and defensive behavior. However, breeding against natural behavior compromises colony defense and social immunity (Meuiner, 2015). Commercial keepers are breeding for profit rather than promoting natural genetics, which generates weak and susceptible honeybee populations. A sustainable operation makes up all losses with growth within the apiary. The current system of constantly importing new colonies from around the country is unsustainable. Because the honeybees do not have genetic diversity and are not adapted to the local climate, they will mostly likely die over the winter and purchasing replacement packages is a costly operation. In addition, there is increasing evidence that the global honeybee trade with inbred queens has detrimental effects such as the spread of diseases and pests.

One option of acquiring local honeybees is to capture a wild swarm. During the Spring and Summer, healthy growing honeybee colonies need more space and will divide their colony, producing a swarm. Wild swarms of honeybees typically have a more genetically diverse colony, indicating a healthier and more disease resistant hive. Not only are they local honeybees, but they are also survivors of local conditions without the human interference of treatments and sugar feed. They are adapted to the local bioregion, making them more resilient than honeybees shipped in from other areas.

As capturing a swarm in an urban environment may be difficult, a beekeeper also has the option of buying colonies and queens raised from local beekeepers that practice sustainable methods. Getting in contact with your local beekeeping association is a good way to find the best place to buy healthy honeybees in your area. Promoting the keeping of local honeybees helps to sustainably maintain natural diversity and prevents the collapse of colonies. The sooner we utilize beekeeping with local and genetically rich honeybees, the safer the environment will be for future colonies.

2. Use structural hives that mimic natural homes of honeybees.

Honeybee colonies found in the wild reside in hollow trees. The hollow trunk provides nest insulation that is extremely important in reproduction and productivity. Across time and geographic locations, beekeepers invented many different hives for their domesticated honeybees: The Top bar hive, Langstroth hive, Warre hive, and Comfort hive. The Langstroth hive is the most common hive structure due to its wide availability in stores. However, when compared to the natural homes of honeybees, the common Langstroth hive is enormous and poorly insulated, requiring a huge energetic cost for the thermoregulation of the colony. As of

now, the hive that best replicates their natural home of a tree trunk is the Top bar hive (Sharashkin, 2018).

Top bar hives are a long hive that flow horizontally. The Top bar hive contains no plastic pre-formed sheet foundation, but rather has horizontal bars that allow honeybees to create their own comb. When the comb is independently built, honeybees will build a smaller size cell than the size on pre-formed sheets. At this smaller size, natural beekeepers say it is less favorable to the pest, the varroa mite, and secondary diseases are less frequent. Dee Lusby, the pioneer of small cell beekeeping, teaches that the smaller cell size not only makes her honeybees mite and disease resistant, but also allows her to have more bees per frame. Dee teaches that the larger bee (promoted in the plastic pre-formed sheets) is not as strong, cannot get to the smaller flowers for foraging, and is susceptible to more parasites. While smaller natural comb promoted from Top bar hives may not completely solve the problem of outside pests, it is certainly a way to alleviate stress on bees.

The Top bar hive has many benefits, including the ability to easily build one with scrap wood and minimal materials for less than $50. Much more accessible than buying a starter Langstroth hive kit for over $300, Top bar hives also allow for easier inspections with less lifting involved. Beekeepers with physical limitations can easily keep honeybees in the Top bar hive because all the brood can be inspected with the lift of a lid. In addition, the Top bar hive does not require the "accessories" that the commonly used Langstroth Hive requires. A hive tool is not needed, as any sharp object or gentle, slow moving hand works perfectly. Because entire boxes of brood do not need to be moved during the inspection, the honeybees are more docile and one does not need the expensive protective gear, as a simple long-sleeved shirt and pants protect just as well.

Also, the smoker to calm the honeybees is only sparingly used, as the top bar hive provides a way for beekeepers to inspect less invasively.

Importantly, the Top bar hive is not the perfect answer for all beekeepers because the best hive design depends on one's geographic location and environmental variables. There are too many external variables in the natural environment to claim that one hive will work best for all beekeepers. Warre hives and comfort hives are another excellent option that mimic honeybee natural habitats, so it is important to find a hive that works with the beekeeper and the natural rhythm of the honeybees.

3. Give your beehives adequate inter-colony space.

Inter-colony distance plays an important role in the life of honeybees. Wild honeybee colonies live widely spaced throughout the environment. With domesticated Langstroth hives, beekeepers can fit many colonies in a small space. For the beekeeper, this makes it easier to visit, perform hive checks, and harvest honey. However, beekeepers risk disrupting the adaptive biology of their bees by housing them in movable hives that are crowded together in apiaries.

Crowded honeybee colonies experience greater competition for forage, greater risks of being robbed, and greater problems in reproduction (Seeley & Smith, 2015). When hives are placed close together, there is also a chance of drifting. Drifting occurs when a returning forager bee returns to the wrong colony which leads to pathogen and parasite transmission between colonies. As inter-colony distance decreases, the average varroa mite numbers increase (Nolan & Delaplane, 2017). Hive boxes clustered together allows pests and diseases to rapidly spread and evolve to be more virulent.

Beginner beekeepers are recommended to start with at least two hives and as their numbers might grow, it is smart to start with reasonable spacing between the hives. Efforts to enhance honeybee health provides opportunities for dispersed and small apiaries being the rule (Neumann & Blacquiere 2017). When hives are properly spaced and genetically diverse, diseases do not spread easily. Furthermore, low density and widely spaced colonies have significantly greater honey production and reduced winter mortality (Dynes et. al., 2019). If spacing widely apart is not possible for your needs, spacing colonies about 100 feet apart greatly reduces the likelihood of spreading disease and pests. Properly spacing structural hives significantly increases honeybee colony health and productivity.

4. Operate treatment-free hives.

The common honeybee pest, the varroa mite, is the largest cause of colony losses. The varroa mite feeds on honeybee fat bodies, weakening the overall health of the honeybee and rapidly spreading throughout the hive. Found worldwide, it is hardly possible to encounter a mite-free colony and the control strategies are an essential aspect of beekeeping (Genersch, 2010). It is of vital important to be monitoring your honeybees for varroa mites throughout the season with alcohol washes so that proper chemical-free management practices can be taken. As the environmental community advises preventative measures over remedial treatment, there are ways to reduce the risk of varroa mite infestations: No crowding of colonies within apiaries, no maintaining of unnaturally large colonies for honey production, and no movement of colonies out of their local environment. By following the other principles of sustainable beekeeping, it naturally decreases the risk of varroa mite invasions.

A common response to the varroa mite is to use chemical treatments to kill the mites. However, it is extremely important when maintaining a sustainable hive to not use synthetic

chemical treatments. Interference in managed colonies of the honeybee removes the selective pressure for the evolution of host resistance traits, while rapidly selecting for highly virulent parasite lineages (Conlon et al., 2018). In other words, when beekeepers interfere by using chemical treatments, we breed weak bees that cannot fight the mites on their own. In addition, the varroa mites are evolving resistance to the chemical treatments and it is clear they will never be completely eradicated. There might be heavy initial hive losses with no-treatment methods, but that small percentage of colonies that survive will reproduce and acquire resistance to the mite through natural selection.

Keeping and breeding honeybees that are resistant to collapse by the varroa mite is an essential step in supporting sustainable long-term solutions and resilient honeybee health. Natural beekeeper Sam Comfort has not applied any chemical treatments to his hives since 2005. Because of this, his bees have a broad genetic base with the ability to host any number of mites and still not get the diseases. He claims, "…the only way is let them run their course and don't breed from the dead bees. This is the only way out of the mite problem – stop seeing it as a problem that a beekeeper can fix." Terry Combs, professor and beekeeper of 50+ years, also refuses to use varroa mite chemical treatments and claims his early colony losses have gone from 83% in 1996 to less than 5% in the past few years, with 3 of the last 5 years having no losses. (Combs, 2020). Sustainable beekeepers are also starting to see a social immunity mechanism in their hives, which include behaviors such as the uncapping of brood with mites. Throughout scientific literature, honeybees are displaying an ability to rapidly co-evolve with the varroa mite when chemical treatments are not utilized.

A large and divisive topic in the beekeeping community lies in the practices of controlling varroa mite populations. Beekeeper Ang Roell from *They Keep Bees* says it best- keep your hives

"Treatment free, but not stupid." If the hive is about to collapse, use the nonchemical practice of splitting colonies which is associated with the lowest winter losses (Haber et al., 2019). Ang Roell in their book *Radicalize the Hive* also suggests brood breaks and open and closed breeding to keep mite levels down. Rather than reverting to chemical treatments at the first sign of mites, spend time deciding which chemical-free practice will work best with your hives. Cooperation in the beekeeping community on sustainably managing varroa mite populations is essential in the journey of honeybee co-evolution and adaptation.

5. Practice minimal interference with the hive.

While wild colonies only experience disturbances from predators, managed colonies are cracked open, smoked, and manipulated by beekeepers about once a week. Continuous and constant intervention can be dangerous for hive health. During an experiment on honey flow, colonies that were inspected at least once a week had 20-30% less honey production than in colonies that were not inspected as frequently (Seeley, 2019). A balance of beekeeper intervention in the hive is needed for honeybee health and productivity.

Beekeeping is about timing and a shared rhythm. The most important thing to remember when beekeeping is to practice the art of noticing (Philips, 2020). It requires watching, listening, and being close with focus and intent. Without even entering the hive and interrupting the system, beekeepers can observe colony productivity through the signal of flight patterns and buzzing. A soft hum with busy activity at the hive entrance is reassuring, while sluggishness and silence are troubling and is a sign to go inside and check on the hive. Taking a moment of observation ensures respect for the colony's tempos and rhythm.

However, hive inspections are inevitable as a beekeeper. When entering the hive, Roda, the owner of Indigo Acres Apiary, says to inspect with a purpose. Her goal is to have each hive no longer than 15 minutes and to keep detailed notes during hive inspection to have a plan of action for current and future inspections. When inspecting inside the hive, have goals such as, "Is the colony showing signs of swarming? Does the colony have enough honey and pollen stores? Is there a queen present? How are the mite levels?" When inspecting with a purpose, beekeepers allow the colony to experience the least amount of disturbance to their natural rhythms. With consistent observation and detailed record keeping, honeybees experience minimal interference and many colony issues (and stings!) can be avoided.

6. Be mindful when harvesting honey from your colonies.

When a beekeeper harvests honey from the hive, they are taking the bee's food and nourishment. In order to survive, bees need pollen, nectar, honey, and water. Pollen provides the amino acids, fats, minerals, and vitamins that bees need to develop and work. Honeybees will mix pollen and nectar to produce "bee bread", a fermented bee food that provides an important protein source for developing bees. Honey starts as nectar from blooming plants which honeybees break down into simple sugars and evaporate using the fanning of their wings which creates liquid honey. Honey is a carbohydrate that provides energy for colony maintenance and daily activities. Storing honey suggests a planning for the future of the colony. Most importantly, honey provides the food and energy to survive the brutal winter months. With proper nutrition and function, hives produce about 44 pounds of pollen and 132 pounds of honey per year in North America (Seely, 2019). Because of the essential importance of honey and pollen to honeybees, beekeepers need to consider an ethical and modest harvest of the surplus honey.

In commercial beekeeping, it is a common practice to extract lots of honey then supplement with artificial feed, often in the form of a sugar syrup. Beekeepers will mix high fructose corn syrup or refined sugar with water and feed it to the bees to ensure survival after taking honey. One thought is that it saves the hive from dying due to a lack of food. It allows the beekeeper to make more money selling the honey and feeding their bees a cheap food substitute. However, honey is very different than a sugar water solution. Honey contains unique enzymes and nutrients that bees need for energy. It is not scientifically documented what happens as a result of artificial feed, but current commercial beekeepers are reporting decreased honey production and a decline of honeybee health.

For all beekeepers, honey can be a bonus or an exploitation, so temporal considerations are important for long-term and short-term concerns (Phillips, 2020). It is essential to recognize the differences in the duration and rhythms of bee and human lifetimes and be mindful of how much honey is harvested during each season. In combination with previous principles, knowing the temporalities of blooming patterns and nectar flows is essential when deciding when and how much honey to harvest. It requires constant research and interest in the local ecosystem due to the ever-changing environment. While each beekeeper will have different recommendations on how much surplus honey to harvest, the idea is that one should leave enough honey so that the colony can function and survive the winter without the help of artificial feed. Honey is not the purpose of beekeeping, but rather a byproduct of keeping a healthy hive. If the beekeeper makes the health of their bees the main priority, plenty of honey will follow.

7. Invest time in planting native and wild forage.

Access to forage is a critical factor influencing honeybee health because pollen and nectar are required as the source of daily energy to feed the entire colony and build wax comb. Spring pollen comes from Willow, Aspen, Maple, and Alder trees, which only lasts a few weeks. Next up to bloom are dandelions and clovers. Following the trend, Black locust, Basswood, and other trees provide nectar later on, but unfortunately the bloom time is short and a rainy season may wash away most of the nectar.

While the natural blooming cycles provides resources for honeybees, there is still a general lack of plant diversity that hurt bee populations. With the monoculture crops of industrial agriculture and suburban development eliminating vital food sources, honeybees need more diverse forage. Because bees get their proteins and vitamins from pollen, the monoculture crops put nutritional stress on honeybees. Natural beekeeper, Sam Comfort, plants clover and buckwheat seed every year on his farm and gives seeds to neighboring farms because honeybees can forage up to a six-mile radius. Sam Comfort says that his attention and energy in planting wild forage results in hives with the best survival rates, as it "makes a noticeable difference in bee health, honey production, and overwintering." Even if one does not own beehives, letting the yard grow with white clover and dandelions can help local colonies of honeybees.

In urban beekeeping, an important aspect to consider is that honeybees are not repelled by insecticides. Research suggests that they will collect contaminated nectar and pollen while foraging which causes significant mortality after exposure through contact and ingestion (Naiara et al., 2020). By bringing back the insecticides and fungicides into the hive, it will also appear in all the nectar, water, pollen, and therefore, honey as well. The greater the separation between the hive and the use of insecticides and pesticides, the less exposure the foragers from your colony

will experience. If you are surrounded by the use of chemicals, consider putting hives on a different piece of property.

Conclusion

The decline of honeybee health calls us to rethink our practices in beekeeping. Our call to action to put the heath of honeybees at the roots of our practices involves committing ourselves to diversity, community, and energy. Adjusting to new practices while also being attentive to sustainability as it evolves takes commitment and intentional work. However, this work allows us to live out the vision of reestablishing our relationship with the land based in reciprocity and thriving with biodiversity. By building a strong relationship with honeybees, the future of beekeeping will work with the natural rhythms of bees that promotes health and longevity.

I wrote seven principles to help guide beekeepers in maintaining a more sustainable hive. My principles were about keeping local bees, utilizing structural hives that are similar to their natural homes, spacing out hives, ethical honey harvesting, spending time planting native forage, operating treatment-free hives, and practicing minimal interference. While there is still more research to discover and conversations to engage in as we strive for better ways to keep honeybees, I hope my writing is a step forward that encourages community collaboration. Combining beekeeper experiences with scientific evidence provides fresh alternatives that promotes the continuation of learning and living in community with an open mind. Especially during a time of uncertainty, it is important to remember that academic experience and life experience are both valid ways of knowing. Sharing lessons in sustainable beekeeping in an accessible and compiled manner provides intentional action that all people can do to help honeybee populations thrive. The shift to a relationship based in reciprocity with the environment around us is radical and there are many different paths to change. Guided by the honeybees, one beekeeper can take us forward on the journey to thriving beyond sustainability.

Beekeepers Acknowledged

Kirk Webster

Kirk Webster owns Champlain Valley Bees and Queens in New Haven, Vermont. He has taken care of 300 colonies for honey production without treatments of any kind since 2001, all the while sustaining his apiary with his own bees and queens.

Sam Comfort

Sam Comfort of Anarchy Apiaries manages about 600 full-sized colonies and about 360 mating nucs with treatment-free operations.

Roda

Roda is the founder of Indigo Acres established in 2014. She feels it is her duty to provide chemical free forage and soil for all pollinators. Her apiary has 25+ colonies and is still growing with public hive tours and Bee Camp for kids.

Terry Combs

Terry Combs' lifelong interest in insects and spiders led him to the art of beekeeping which he has pursued for 50+ years. He is a 100% chemical-free beekeeper in his apiaries. Terry teaches beekeeping classes and insect classes at a local college and teaches outreach and educational presentations.

Dee Lusby

Dee Lusby is the pioneer of small cell beekeeping and a life-long beekeeper with over 700 hives in southern Arizona. Dee believes modern beekeeping has lost its way and encourages beekeepers to find their way back to biological beekeeping.

Ang Roell

Ang is a nonbinary, white, Ukranian evaluator, facilitator, writer and beekeeper working at the nexus of systems change and the environment. They run a small apicultural business built upon the practices of reciprocity modeled on the social norms of the bees themselves. Simultaneously, they work as a work-place culture consultant with organizations activated around making lasting change by shifting power structures.

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