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Zombie Fields:

Ethical Concerns of Pollination in Industrial Agriculture

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In the past few hundred years, we have seen a drastic change in land used for agriculture in the United States. Much of what used to be thriving floodplains and open meadows filled with wildflowers and buzzing insects are now planted with a single cash crop. Native plants have been cut down and sprayed with herbicides to prevent competition with crops and even more chemicals are applied down the road to keep insects and other pests out. We see the same trend not only on our farms, but also in our front yards. What we perceive as beauty in presentation or economic gain in reality is just a simplification of the beauty nature has already created. Simplification doesn't always work, however. A neatly cut lawn with symmetrical shrubs may be aesthetically pleasing, but much of the food we eat is dependent on a complex system that has been evolving since long before we came along with our plows. That system is pollination and it helps to provide much of the food we eat. After plowing away all of the native plants and insects, farmers growing certain crops must pay to bring life back to their fields in the form of managed pollinators. European honeybees in particular are vital for the pollination of numerous crops in the U.S. and for feeding the earth's population at seven billion plus, and growing. A large chunk of our food system is now reliant on honeybees and while the services of honeybees are highly valued, their well-being is not. Furthermore, the well-being of the natural ecosystems which farmland has replaced is essentially disregarded in conventional industrial agriculture. This essay will explore issues in the industrial agricultural system pertaining to both managed and natural pollination services through the lens of environmental virtue ethics.

Over the past 50 years or so, U.S. farmland area has decreased while farm output has increased nearly threefold (Bigelow & Borchers, 2017; Wang et al., 2020). Denser, more productive fields are desired by farmers, yet they eradicate the natural forage that would typically support native pollinators. Native bee species have co-evolved with plant species that

have long existed in the fields, meadows, and valleys that are now used for agriculture. Both parties used to benefit from the presence of each other, but without their normal habitat and food sources, pollinators are no longer present where their services are much needed. There are over 4,000 native bee species in North America, some solitary and some social, that nest in the ground, hollow branches, wood, or holes in various objects that would normally be found in a non-agricultural field (Embry, 2010). Many years ago, an abundance of resources were available for these bees to forage freely on. Herbicides and pesticides have slowly killed not only the plants that native bees rely on, but the bees themselves. Any native pollinators that are able to survive the chemical applications and find habitat that hasn't been planted over are left to forage on the limited resources of a few cash crops. Many native bee species have a relatively small forage range compared to their European cousins and if they are unable to find food or shelter, they will die (Hellerstein et al., 2017). For pollinator-dependent crops, the absence of native pollinators due to agricultural expansion is felt via lower fruit set, farm productivity, and farmer profits. Over the years, more and more farmers have been forced to bring in managed pollinators, mostly European honeybees, to revitalize their fields and ensure prosperous fruit set.

For over 4,000 years, humans have utilized honey and beeswax from honeybees for medicinal, cultural, and sweetening purposes (Roffet-Salque et al., 2015; Lowe, 2018). In some places, honey hunters, brave people that make treacherous climbs to get honey from wild colonies, still exist. However, this is not the case in the United States. European honeybees are not native to North America and the United States is one of the few countries that exploits honeybees for pollination on such a large scale rather than using them primarily for honey production (Garibaldi et al., 2011). Post-industrial-revolution agriculture changed the way humans use honeybees. Over the past 80 years, the number of honey-producing colonies kept in

the United States has declined by about 50 % while the number of colonies being used for crop pollination has increased (Hellerstein et al. 2017). Rather than just being a source of sweetness that provided pollination benefits on the side, honeybees became livestock that is now shipped across the country to pollinate rows of crops like almonds, blueberries, apples, and cherries. It is not profitable for commercial beekeepers to just make honey and beeswax products anymore. Competition from the global honey market and high colony losses make pollination checks necessary to keep beekeeping operations afloat.

One third of the world's food crops today are dependent on or benefit from insect pollination (Hellerstein et al., 2017). In the United States alone, there were 2.67 million honeybee colonies recorded by the USDA in 2019 and pollination services are valued at around fifteen billion dollars, twelve billion of which is attributed to honeybees (Hellerstein et al., 2017; USDA-NASS, 2019). Such heavy reliance on a single insect has placed an enormous amount of stress on not only honeybees but the beekeepers themselves. Migratory commercial beekeepers are always on the move, sending bees to pollinate crops around the country as they come into bloom. Migratory beekeepers spend a few weeks to a few months in each location before they pack up their bees and move to the next flowering crop. Bees are exposed to chemicals, pests, and pathogens as they are shipped in close quarters across the country. In 2015, nearly half of all managed honeybee colonies were lost in the United States (Hellerstein et al. 2017). Furthermore, commercial beekeepers often feed bees sugar or corn syrup and pollen substitutes to keep colonies active during periods they would normally be dormant. All of these factors can create unnatural, harmful conditions for the honeybees and drive the cost of beekeeping and therefore the price of pollination up. For example, in California in 2016, the average price per hive for almond pollination ranged from $167-$185 (Hellerstein et al., 2017; Embry, 2018; Lowe, 2018).

Considering growers can bring in up to four or five hives per acre of trees, pollination can get pricy.

The current state of industrial agriculture is far from sustainable and is detrimental to both wild and managed pollinators, beekeepers, and growers of pollination-dependent crops. Eradication of native species and poor treatment of pollinators that we depend on to eat so lavishly is, from an environmentalist's perspective, maleficent and ethically wrong. Ethics refers to general moral principles that govern behavior, but takes many shapes and forms. Most branches of ethics concern humans' relationships with each other and with society. Environmental ethics, however, studies the moral relationship of humans to the environment as well as the value of the environment and nonhuman beings. At its core, environmental ethics involves understanding the relationship between humans and nature and identifying goods and values that result from said relationship (Sandler, 2013). Ecocentrism, an extension of environmental ethics, is based on the relationship between humans and the environment and argues that we are in fact a part of the natural world. An ethical approach to the environment is necessary because while we have shaped our environment to suit our needs, we are still as much dependent on environmental quality as the next living organism to support our well-being (Rolston, 2003). This approach can be difficult for traditional ethicists, however, as most of ethics is based on values, traditionally moral values. Environmental ethics argues that nonhuman beings have value intrinsically simply due to their existence and the role they play ecologically. It is this intrinsic value that most of environmental ethics has focused on (Cafaro, 2001). Bees, for example, are valuable in and of themselves because they exist. The fact that their existence helps increase biodiversity and fruit-set, just-so-happening to benefit humans, adds to their value,

regardless of if their decisions have a moral basis. Over the course of human history, a few 'naturalists' have reminded us of this value we should not only appreciate but also respect.

Rachel Carson with her publication of *Silent Spring* in 1962 is largely responsible for sparking the largest environmental movement in human history. In this world-changing book, Carson exposes the effects of chemical use not only in conventional agriculture but also in our communities and homes. She makes us question whether the great advancements in agricultural and household chemicals are really benefitting us. Carson writes in the second chapter of *Silent Spring*: "Nature has introduced great variety into the landscape, but man has displayed a passion for simplifying it. Thus he undoes the built-in checks and balances by which nature holds the species within bounds" (Carson, 1962). In this passage, Carson is referring to the practices of mankind, particularly in agriculture, that involve the removal of the undesired species from a landscape to exploit the land for production of just a few. While here, she is specifically referencing pests that destroy crops once other sources of food are removed from a landscape, this message applies throughout urban ecology. Biodiversity exists naturally in an ecosystem and any addition or removal of a species can have a cascading effect on the rest of the ecosystem.

Consider a blueberry barren in Maine. Typically, slightly acidic soils would allow blueberries to dominate in the understory, however a number of other plant species would be found in and around the barren as well. Those other plants would provide food and refuge for native insects and pollinators. Upon the blueberry grower burning the field to promote only blueberry growth, those native insects and pollinators are left homeless the grower is left without pollination services. As a result, honeybees must be brought in to pollinate blueberry crops and since blueberries only bloom once per year, both imported honeybees and any native pollinators that remain in the barrens will be left with just one food source for a short window of time. In

this scenario, mankind fails to realize the services that nature has already provided before manipulating it for a perceived additional benefit. As Rachel Carson would say, this is just one example of man's "conquest of nature" (Carson, 1962). Not only is the well-being of both the native and managed pollinators disregarded, but more stress is placed on humans to ensure fruit-set in an unnatural environment.

A common theme in environmental ethics and naturalist writing is the perceived separation of man from nature. We are able to alter our environment so considerably that it almost seems as though we are a separate entity. Naturalists from Thoreau to Carson have argued the ethical implications of this mindset, however my personal favorite to discuss the topic is Bernd Heinrich in his book *Summer World*. An elegant account of the New England woods through the growing season, *Summer World* walks the line between brilliant scientific writing and a fascinating personal anecdote while exploring humanity's relationship with the natural world. In the chapter "Death and Resurrections" Heinrich explains how the evolution of mankind's technology and self-awareness has led to the creation of several boundaries between us and nature (Heinrich, 2009). From birth until death, we aim to manipulate our surroundings to suit our needs. Even in our last moments of existence, we choose to waste fossil fuels to destroy our bodies and place yet another boundary between ourselves and the bounty of resources from which we came. We have continually separated ourselves from the rest of the natural world to better human well-being and "the coffin is a last attempt to place a boundary between ourselves and nature" (Heinrich, p. 157, 2009).

While the coffin is an extreme example of our desire to manipulate nature, Bernd's message is crystal clear. In all of our great feats over nature, we fail to realize that we are attempting to conquer something we are intertwined with. One of the greatest of these feats,

perhaps, is the ability to produce extraordinary amounts of food from a plot of land and successfully manipulate pollinators to help do so. Along the way, we fail to see the moral issues associated with habitat destruction, chemical applications, and industrial pollination. We are the only species as we know it capable of such high levels of moral consideration, yet we exercise that consideration in a primarily anthropocentric manner, disregarding the well-being of our surroundings. We can learn a lot from naturalists like Bernd Heinrich, who realized the value in seeing the world through an ecocentric lens. If we're able to realize that the very natural systems we aim to manipulate are in fact a part of and contribute to our well-being, we may be able to work with them rather than against them.

Virtue ethics is a branch of ethics that focuses on virtues and moral character with an intention of providing overall well-being for all individuals involved in an action. A virtue ethics approach to environmentalism focuses on character, or moral and mental qualities distinctive to an individual, as it pertains to the environment or human actions that affect the environment. Rather than having concrete right or wrongs, virtue ethics argues that judgement of character should be considered arbitrarily and with the interest of all parties involved (Hursthouse & Pettigrove, 2003). Environmental virtue ethics extends this approach to include the well-being of nonhuman parts of nature. Applying this approach to the current practices of industrial pollination exposes a number of issues. Not only have we disregarded the well-being of the land, pollinators, and in some regards our own health, but we have also employed poor character in the industrial agriculture setting. Re-exploring our relationship with the natural world through an ecocentric approach--one in which we realize the value of the environment and the effects of our actions on the well-being of ecological systems--can provide guidance for a sustainable future in both agriculture and beekeeping.

One way to help resolve the ethical issues associated with pollination in industrial agriculture is to increase farm diversity and decrease the prevalence of monocultures. Rachel Carson warned us of the danger of monocultures and chemicals that aim to reduce nature's variety, yet we didn't listen. Diversified farms that produce more than one cash crop and alternate between crops and livestock have proven to be more productive (Carolan, 2016). Smaller, diversified farms that provide food to local consumers would increase farm productivity and decrease numerous things such as food miles, cost of production, and chemical applications. An ecocentric approach to food production is one that aims to produce a variety while minimally altering the ecosystem already present. A farm can be an ecosystem in and of itself, but ensuring that it doesn't negatively impact the surrounding system can only benefit us. Alternating crops also reduces the risk of insect pest resistance and therefore leads to less chemical applications. Less chemicals applied to the environment reduces the risk of toxicity to beneficial insects, while diversified crop plantings provide more forage for pollinators. Even if the crops being grown don't immediately provide nectar or pollen for pollinators, the variety creates habitat gradients in which multiple types of native pollinators can thrive. For imported honeybees, fewer chemicals applied also reduces bee death, colony loss, and beekeeper stress; however it doesn't resolve the ethical issue that is the nation-wide, nutrient-poor, crammed pollination route that exists for honeybees each year.

With so much reliance placed on a single insect, we are playing with fire. Eventually, pollination demand will exceed honeybee availability in the United States, and growers will be forced to seek alternative options. One possible solution is to incorporate alternative pollinators into large-scale pollination to take some weight off of the shoulders of honeybees. A prime candidate for the pollination of large-scale flowering crops is *Osmia lignaria,* or Blue Orchard

Bees (B.O.B.'s). Blue Orchard Bees are solitary bees that are native to North America and are very efficient pollinators. They are active earlier in the season than honeybees and can live in agricultural fields if sufficient habitat is provided (Embry, 2018, Boyle & Pitts-Singer, 2017). They are known to fly once their body temperature reaches 54°, making them a prime candidate for pollination of early-flowering crops such as almonds or cherries that flower while most other bee species are still in diapause or are getting ready for warmer temperatures (Embry, 2018). Each adult female B.O.B. looks after her own eggs, which then hatch in the spring and do the same in close proximity to their hatching site. This attribute can help ensure they will be back each year for pollination. Rearing large numbers of B.O.B.'s for commercial use will not be without consequence, as any operation of the sort will increase the rate of stress and disease in populations, but with our dependency on honeybees, it is time to consider other options. B.O.B.'s are efficient pollinators that could reduce the stress placed on and improve the well-being of managed honeybees, but it is important to remember that they are not the save-all solution.

A final, and perhaps the most promising, way to resolve the ethical issues associated with pollination in industrial agriculture is to bring back habitat for the thousands of native bees that once thrived in North America. Not only does this strategy focus on the interrelationships of nature, but it also increases the well-being of all parties involved in pollination-dependent food production. By planting strips of wildflowers between and around crop fields, farmers of pollination-dependent crops are able to increase the native bee population and therefore visitation to the desired cash crop. This represents a tradeoff for farmers, however, because it takes time and money to plant wildflower strips, not to mention that they are providing flowers other than the crop's for bees to visit. However, these strips increase the populations of native pollinators via resources and habitat, while decreasing the reliance on imported honeybees. Any honeybees

that are brought in for pollination will also be better off because they are provided with more resources than just one crop. For lowbush blueberries in Maine, planting these wildflower strips, dubbed “pollination reservoirs”, paid for itself in just four growing seasons via increased fruit-set (Venturini et al., 2017).

Vast fields of monocultures and large-scale pollination involving truckloads of honeybees are still the norm in the United States. These practices not only increase the stress placed on bees, beekeepers, and farmers; but also put the future of our food system at risk. In its current state, industrial agriculture is detrimental to the well-being of both humans and the environment, unsustainable, and frankly unethical. A more sustainable and ethical approach can be seen through an environmental virtue ethics, particularly an ecocentric, viewpoint. When the well-being of all parties involved in industrial agriculture is considered, the system overall has the ability to be more productive. By prioritizing the well-being of pollinators via less chemical applications, planting of additional forage, and incorporating managed pollinators other than European honeybees, farmers and beekeepers are subsequently increasing their well-being via increased profitability, fruit-set, and farm sustainability. Sustainable agricultural practices have the potential to improve the well-being of the entire planet. We have historically turned land into ecological dead zones and brought in honeybees to revitalize fields and pollinate crops, ensuring we’d still turn a profit. When we consider ourselves as not in control of but rather a part of our environment, we can create an agricultural system that is not only prosperous, but also virtuous. Moving forward, it is our ethical duty to consider the well-being of the natural resources we have exploited and to implicate more sustainable practices in agriculture, particularly regarding pollination, to ensure the sustainability of our planet for years to come.

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