Re-Wilding Honey Bees

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Practical Beekeeping for the Farmer

Many modern, large-scale farms and orchards require insect pollination to produce their crops.

In the past 80 years, we have put a lot more focus on industrialized, mechanized farming and putting multiple acres into production.

With this trend toward monoculture, we have engineered an environment that is less capable of supporting insect pollinators year round.

Land development and agricultural cultivation have decreased habitat and wild forage for honey bees and native pollinators.

The current model of beekeeping

- Many large, commercial beekeeping operations today participate in migratory beekeeping, in which beekeepers ship colonies of bees all over the country to pollinate different crops.
- The benefit for beekeepers is twofold; it can provide consistent forage for honey bees (limiting the need for supplemental feeding) and beekeepers can make money (~$200/hive/farm) on these pollination contracts.
- This approach was borne largely out of the green revolution and our move away from small family farms towards a larger, more industrialized farm model.

Can your land currently support honey bees?

Honey bees, especially in coastal California, require a diversity of forage year round.

For farms that are well diversified and close to more wild habitat, it is likely that at least one bee colony will have enough forage to survive all year there.

For large farms that are not well diversified and do not have much non-crop vegetation to supplement the bees, it is less likely that the bees will be able to thrive in that locale without being supplemented with artificial feed.

The first step in determining if honey bees will succeed in your landscape is to take stock of what flowering plants you have in your immediate area, their blooming season, and other land management practices (like pesticide use).

The nutritional needs of honey bees

Just like humans and other animals, honey bees are most healthy when they have a variety of forage (food) available to them.

Nectar and pollen from different blooms have unique nutritional profiles and varied micronutrients.

When we keep honey bees in monocultural landscapes, like large farms, their variety of forage in also very limited, leading to poorer health.

This dietary issue is compounded when there are pesticide residues present in the plants and the soil, and worse still when there are systemic pesticides.

Assuring healthy food is the first step in ensuring healthy honey bee colonies.

A unique challenge for honey bees in California

Due to multiple drought years, bees have been having a hard time finding enough forage in rural landscapes. As a result, bees that would normally do all right in the rural landscape are suffering from a lack of nutrition and sometimes starvation

Many wild plants which would normally be a good source of nectar are not. If there is insufficient groundwater, the blooms cannot push nectar. You may see flowers, but they often have very little available nectar.

We are now seeing that bees in managed, irrigated landscapes (farmland) and in urban and suburban environments pften have more available forage than bees in the wilderness.

California honey bees are “awake” the whole year

- Honey bees in Coastal California have a different story, as we do not get a “true winter” with consistent freezing temperatures.
- Due to this lack of consistent freezing temperatures, honey bees in CA still go out to forage during the warm winter days when it’s above 55F.
- The bees remain metabolically active year-round, which is often harder on them.
- Needing initial fuel to power their foraging flights, the bees consume nectar/honey stores in the hive prior to heading out to collect more nectar.
- However, there are far fewer fall/winter blooming plants. So, the bees end up expending more energy than they can replace from their foraging efforts.
- This leads to an ongoing reduction of food stores in the hive.
- This scenario is exacerbated when there are more honey bee colonies in a smaller geographic area than would occur in nature (i.e. an apiary) and can also lead to colonies robbing each other out, potentially spreading pests and disease.

Keeping Bees in Agricultural Areas

I have been working with a beekeeper in the Napa Valley for 3+ years and we have been seeing issues with queen fertility, longevity and at times total queen failure.

We have reason to believe that this is due to fungicide use. Both grapes and olives, which are staple crops in the region, receive fungicide application in order to ensure the vines do not succumb to a number of different fungal diseases.

Almonds are also very susceptible to fungal diseases and are therefore usually sprayed with fungicides to ensure a successful nut set. This is one more challenge bees are facing.

Applying fungicides at dusk allows for 10+ hours of dissipation. Avoiding spraying directly on blooms is also key in protecting bees from poisoning.

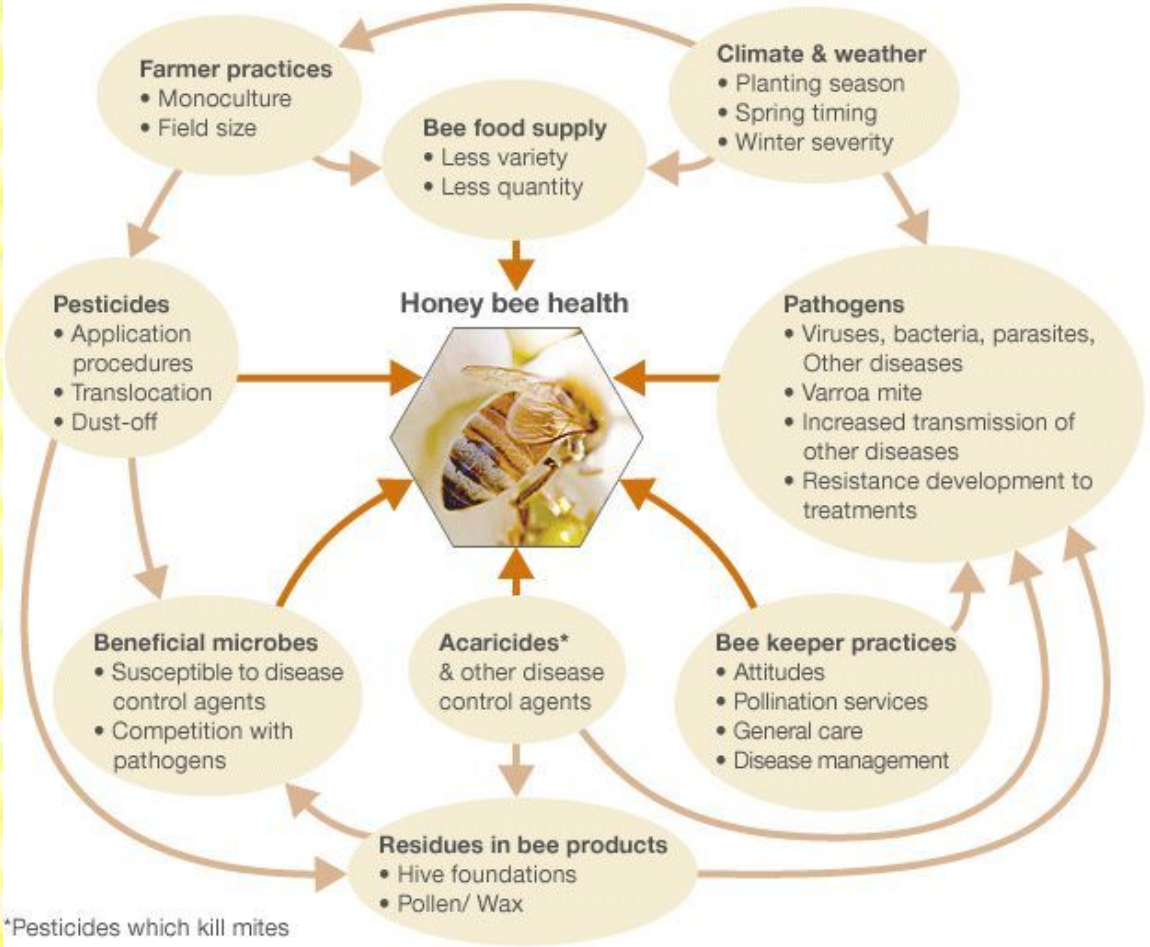
Scientific studies show the dangers of fungicides:

Agricultural use of triazole fungicides in combination with insecticides can potentially harm bees by compromising their capacity to extract sufficient energy from their natural diet.

In Washington and many other states, fungicides are not addressed by pollinator protection guidelines, which focus on other types of pesticides.

From: Disruption of quercetin metabolism by fungicide affects energy production in honey bees (*Apis mellifera*) - Contributed by May R. Berenbaum, January 6, 2017 PNAS

Stress factors in honey bee populations



*Pesticides which kill mites

Source: OPERA Bee health in Europe, 2013

Broad effects of herbicides and pesticides:

- There is some media coverage regarding the effects of pesticides, particularly neonicotinoids, on honey bee and native pollinator health.
- Many of these pesticides are insidious--they’re seed treatments that become systemic in the structure of the plant. Rather than a broad-spectrum chemical that is very toxic but not as long-lasting, these systemic pesticides get into the pollen of the plant and are present, at sub-lethal but still detrimental levels, for the entire lifecycle of the plant.
- These chemicals not only affect pollinator and other fauna health, but they also affect the soil and the groundwater for unknown amounts of time. We believe it to be on the order of years, decades, or longer.
- The best thing we can do as citizens is to not use pesticides on our own plants and to check with our plant nurseries and suppliers to make sure the plants we purchase are organic and have not been treated with chemicals.

Hedgerows

Aside from providing habitat and forage for honey bees and other pollinators, hedgerows provide habitat for a number of insects that predate crop pests like aphids, mealy bugs and caterpillars. They can therefore double as beneficial insectaries which can be quite useful in organic production.

Hedgerow habitat provides protection for beneficials from pesticide drift. Unlike honey bees, which can forage up to 3 miles, many native pollinators only fly a short distance from their nest sites to forage (<500 yards) so planting insectaries or hedgerows close to crops can greatly increase the amount and diversity of insect pollinators, which has been shown to produce a better, more uniform crop.

Hedgerows have a host of other benefits. They are a great way to re-wild farms, build in biodiversity and improve the surrounding environment.

Source: Hedgerows for California Agriculture A Resource Guide by Sam Earnshaw

Give Bees a Chance

By maintaining even one or two beehives on a farm, you will vastly increase your local pollination potential.

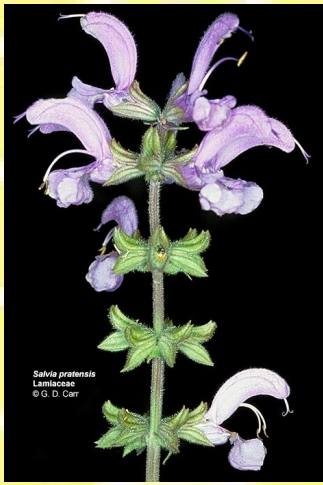
By building up the habitat and planting supplemental forage (non-crop vegetation like hedgerows) around these honey bee hives, you will also be encouraging native pollinators to take up residence around your crops that need pollination.

While California land is expensive and can be hard to justify “fallow” or non-cropped land, there may be ways to implement small pockets of habitat that do not greatly decrease productive land.

This model of increasing hedgerows, end caps and cover crops appears a wise investment for orchardists and those producing fruit and nut crops that need pollination.

Top 5 Forage Families for Bees

1. Asteraceae/Compositae: Daisies/Sunflower/Cosmos
2. Boraginaceae: Borage, Phacelia, Echium
3. Lamiaceae: Mints/Salvias/Rosemary/Lavender
4. Rosaceae: Roses/Berries/Fruit/Nut Trees
5. Polygonaceae: Buckwheat/grasses



Darwinian Beekeeping

Dr. Thomas Seeley of Cornell University is a pioneer in the field of natural beekeeping and has coined the term “Darwinian Beekeeping” to describe the ways in which bees have lived and adapted in the wild versus how they’re currently commercially managed.

The backbone of Darwin’s theory of natural selection is “survival of the fittest”. In beekeeping, that translates into knowing when to let weak colonies go so that you’re not propagating sub-par genetics in your local gene pool.

Seeley and other holistic beekeepers believe by mimicking the lives of feral bees (in the design and spacing of hives, minimal management, minimal harvesting, propagating local bees, not treating or feeding) we can begin to regenerate the health and resiliency of honey bees.

Environment of evolutionary adaptedness	Current circumstances
1. Colonies genetically adapted to location	Colonies not genetically adapted to location
2. Colonies live widely spaced in landscape	Colonies live crowded in apiaries
3. Colonies occupy small (ca 1.5 cu ft) cavities	Colonies occupy large (ca. 3+ cu ft) hives
4. Nest cavity walls have a propolis coating	Hive walls have no propolis coating
5. Nest cavity walls are thick (ca. 4+ in)	Hive walls are thin (ca. 3/4 in)
6. Nest entrance is high & small (ca. 4 sq in)	Nest entrance is low & large (ca. 12 sq in)
7. Nest has 10-25% drone comb	Nest has little (< 5%) drone comb
8. Nest organization is stable	Nest organization is often altered
9. Nest-site relocations are rare	Hive relocations can be frequent
10. Colonies are rarely disturbed	Colonies are frequently disturbed
11. Colonies deal with familiar diseases	Colonies deal with novel diseases
12. Colonies have diverse pollen sources	Colonies have homogeneous pollen sources
13. Colonies have natural diets	Colonies sometimes have artificial diets
14. Colonies are not exposed to novel toxins	Colonies exposed to insecticides & fungicides
15. Colonies are not treated for diseases	Colonies are treated for diseases
16. Pollen not trapped, honey not taken	Pollen sometimes trapped, honey often taken
17. Beeswax is not removed	Beeswax is removed during honey harvests
18. Bees choose larvae for queen rearing	Beekeepers choose larvae for queen rearing
19. Drones compete fiercely for mating	Queen breeder may select drones for mating
20. Drone brood not removed for mite control	Drone brood sometimes removed and frozen

Darwinian Principle #1: Local Bees are Better Bees

In much the same way that humans in different regions have physiology adapted to colder or warmer climates, honey bees (and especially queen bees) are acclimated to specific climates. A queen from Hawaii is accustomed to rearing brood all year long, in line with constant forage and warm temperatures. She may have a heck of a time living somewhere like Maine, where there is a long and harsh winter.

The stress and temperature extremes a shipped queen is subject to greatly impacts her fecundity. If you're going to purchase bees, your best bet is to find a producer less than 100 miles from where you want to raise the bees.

Hyper-local options are: catching a swarm in a bait hive from your area, though that can be hit or miss, or splitting an existing hive from another beekeeper in your area.

Local Bees from a Swarm or Splitting a Hive

Darwinian Principle #2: Crowded Bees are less healthy

Adequate hive spacing is an integral part of Darwinian Beekeeping, and one I see many beekeepers disregarding.

In the wild, bees will self-segregate their hives to be about a mile apart from one another. This reduces competition for forage, risk of robbing, and spread of pests and disease.

Commercial beekeepers and even hobbyists tend to crowd their hives very close to one another-- this is convenient for the beekeeper but unhealthy for the bees.

Especially if practicing treatment-free beekeeping, mites on bees will drift to different colonies and can rapidly decimate multiple colonies in an apiary.

Ideally, if space permits, place hives 100’ apart. This will allow the bees the defensible space to live more like they would in nature.

Better to have only one or two hives per acre, if possible.

Log Hives/Bee Trees have thick walls & small entrances

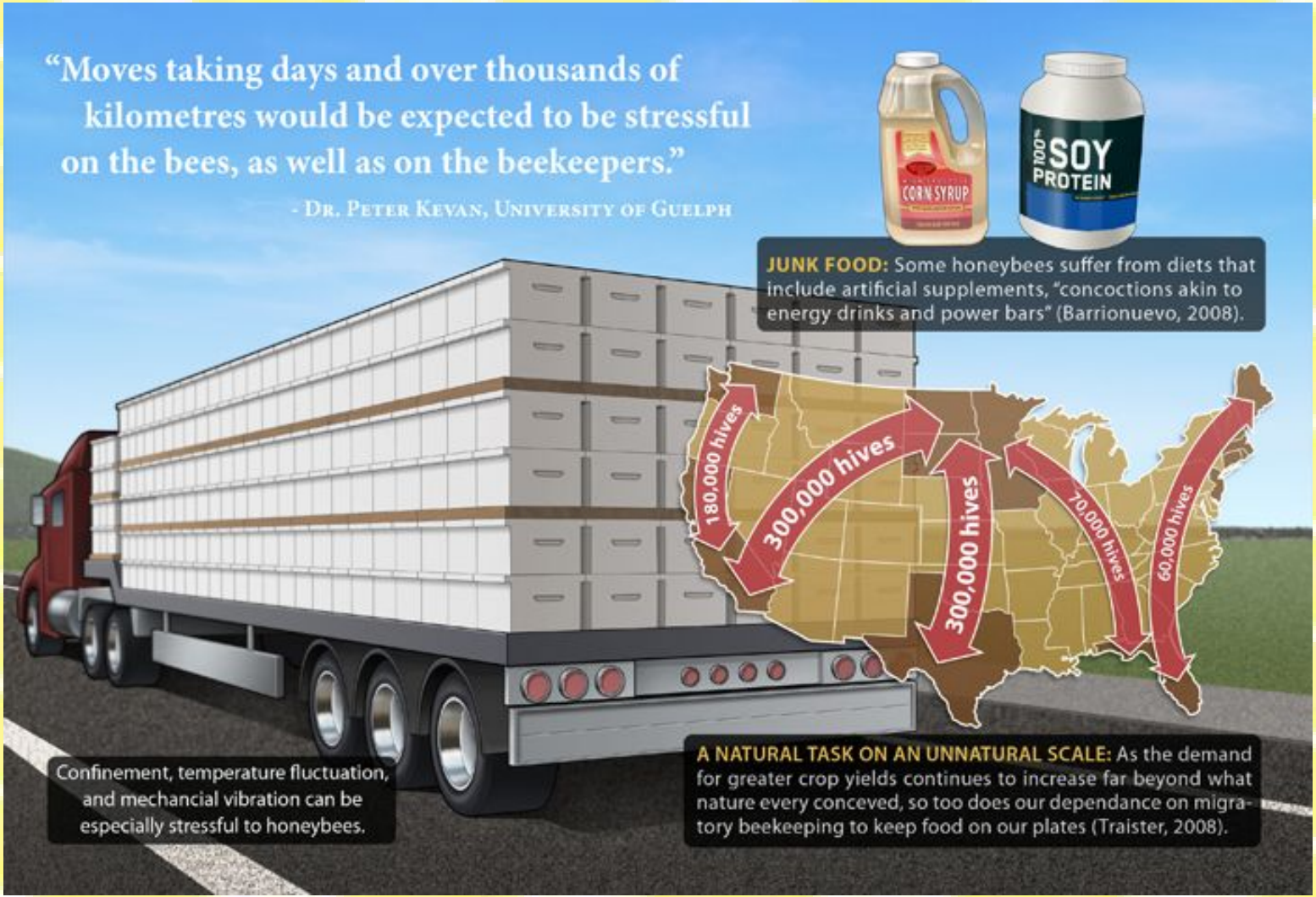
Darwinian Principle #9: Stationary over Migratory

Bees are not meant to be moved, but that has become the norm with migratory pollination services.

Colonies that are moved must “reset their GPS” and discover a new landscape. It has been found that these colonies lose weight (consuming more of their honey stores in the interim) and suffer other negative health effects during these times.

When bees are packed up and moved on trucks, they’re forced into close quarters which is stressful and puts them at risk of contracting new diseases and pests from other nearby colonies.

If we put more energy into creating more robust and biodiverse farm borders and hedgerows, we can begin to have at least a few stationary hives on farms, improving


"Moves taking days and over thousands of kilometres would be expected to be stressful on the bees, as well as on the beekeepers."
- Dr. Peter Kevan, University of Guelph
CORN SYRUP
100% SOY PROTEIN
JUNK FOOD: Some honeybees suffer from diets that include artificial supplements, "concoctions akin to energy drinks and power bars" (Barrionuevo, 2008).
180,000 hives
300,000 hives
300,000 hives
70,000 hives
60,000 hives
Confinement, temperature fluctuation, and mechancial vibration can be especially stressful to honeybees.
A NATURAL TASK ON AN UNNATURAL SCALE: As the demand for greater crop yields continues to increase far beyond what nature every conceved, so too does our dependance on migratory beekeeping to keep food on our plates (Traister, 2008).

The problem(s) with migratory beekeeping

There are several major issues with the current industrial beekeeping model:

1. It uses fossil fuels to truck bees cross country.
2. It stresses the bees to be cooped up in their hives during transit.
3. Only consuming one type of forage in excess leads the bees to be malnourished and ultimately less healthy--and it exposes the bees to pesticides if the farms are not organic.
4. It speeds up disease transmission and mite transfer between the bees by having so many hives in such close proximity during these periods of contractual pollination. This in turn calls for more chemical and antibiotic treatments within the hive to keep sickness and disease at bay.
5. It continues to promote and support the unsustainable farm model of giant monocultural operations, rather than encourage biodiversity and sustainable farming practices like crop rotation and beneficial insectaries.

Darwinian Principle #11: Disease Transmission

A study from the University of Exeter and UC Berkeley found “the pandemic [of Deformed Wing Virus] is man made rather than naturally occurring, with human trade and transportation of bees for crop pollination driving the spread.”

If bees are kept locally, they deal with familiar diseases.

If bees are moved here, there and everywhere, they are more likely to be stressed and immune-compromised. This not only makes them more susceptible to disease and for pests to get the upper hand, but also that any pests to diseases they may carry will be easily transferred onto novel populations.

If we focus on rewilding and keeping bees locally, over time we should see improvements in colony health and immunity and lower pest and disease transmission.

Darwinian Principles #12&13: Diverse and Natural Diets

When bees are used for pollination, they do not have a wide variety of pollen and nectar. As a result they have poor nutrition, negatively impacting their health.

When bees are “staged” in interim locations before and after pollination contracts and during transit, they’re fed sugar syrup and pollen patties which do little to support their nutritional needs.

By focusing on planting and maintaining a diversity of quality forage for bees on farms we can support their nutritional needs.

By ensuring hives are located in environments that can adequately support bees’ nutritional needs, we will be helping bees live healthier lives.

Darwinian Principle #14: Novel Toxins

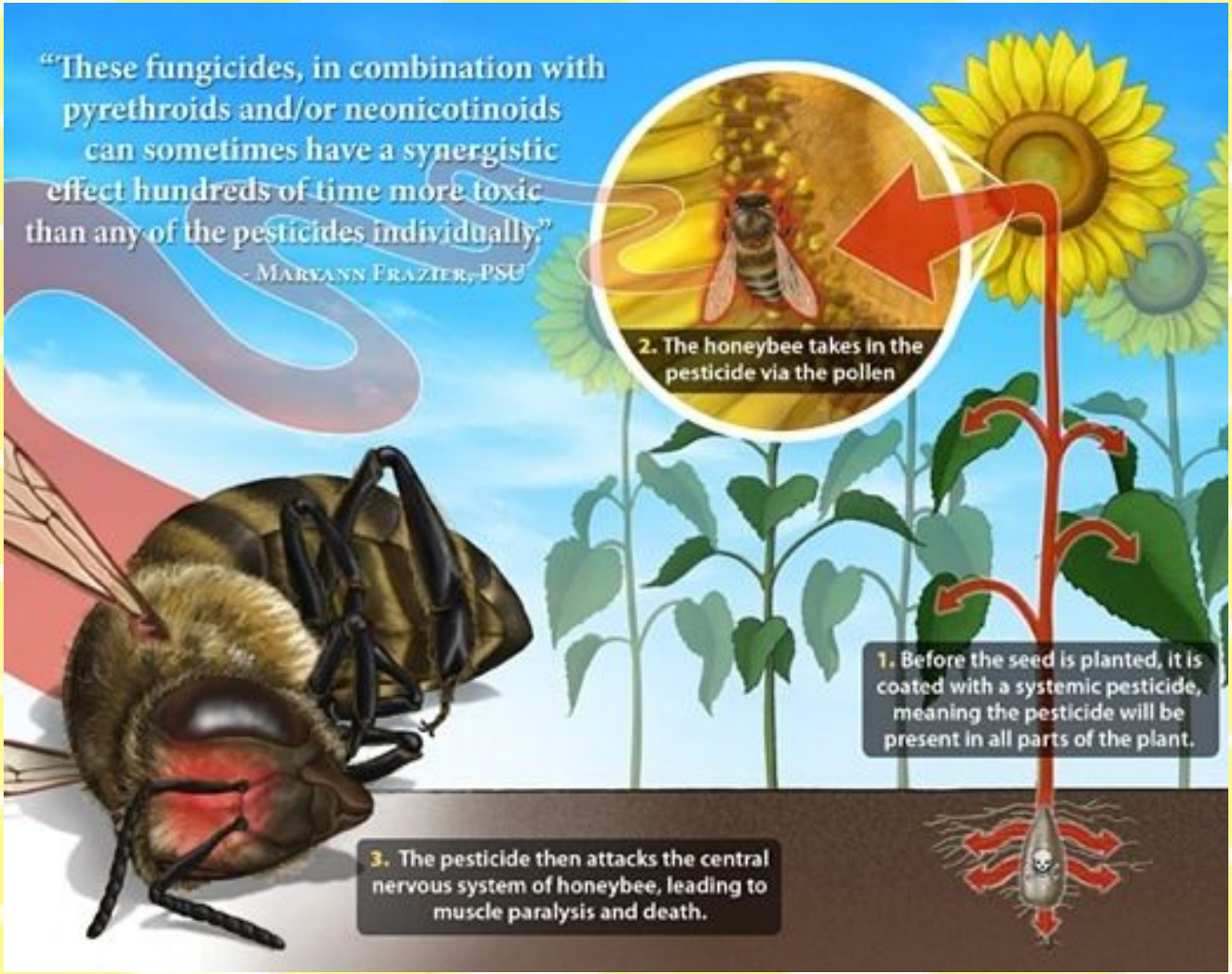
In much the same way that bees suffer from novel diseases and inadequate nutrition when they are moved around for pollination, bees are also subjected to novel toxins in the form of insecticides, herbicides and fungicides.

When we keep bees locally, and especially if we are keeping them on organically managed land, they have far fewer chemicals in the environment that could negatively impact them.

There have not been adequate long-term or synergistic studies done on bee health and pesticides in the U.S.

Studies in Spain and France have shown that all pollen and wax sample analyzed contained multiple residues including acaricides from mite treatments.

Source: http://www.affaire-gaucho-regent.com/pdf_abeilles/chauzat-faucon.pdf


"These fungicides, in combination with pyrethroids and/or neonicotinoids can sometimes have a synergistic effect hundreds of time more toxic than any of the pesticides individually."
- Maryann Frazier, PSU
2. The honeybee takes in the pesticide via the pollen
1. Before the seed is planted, it is coated with a systemic pesticide, meaning the pesticide will be present in all parts of the plant.
3. The pesticide then attacks the central nervous system of honeybee, leading to muscle paralysis and death.

Darwinian Principle #15: Disease Treatment

While at first it might seem caring and compassionate to treat bees for diseases, it is interfering with natural selection.

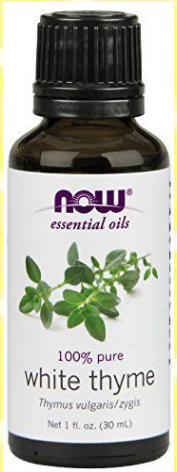
I believe since humans so anthropomorphize bees, we assume that it is cruel to let bees die of disease.

However, it is because of human interference in the lives of bees that many of these diseases have proliferated over the years.

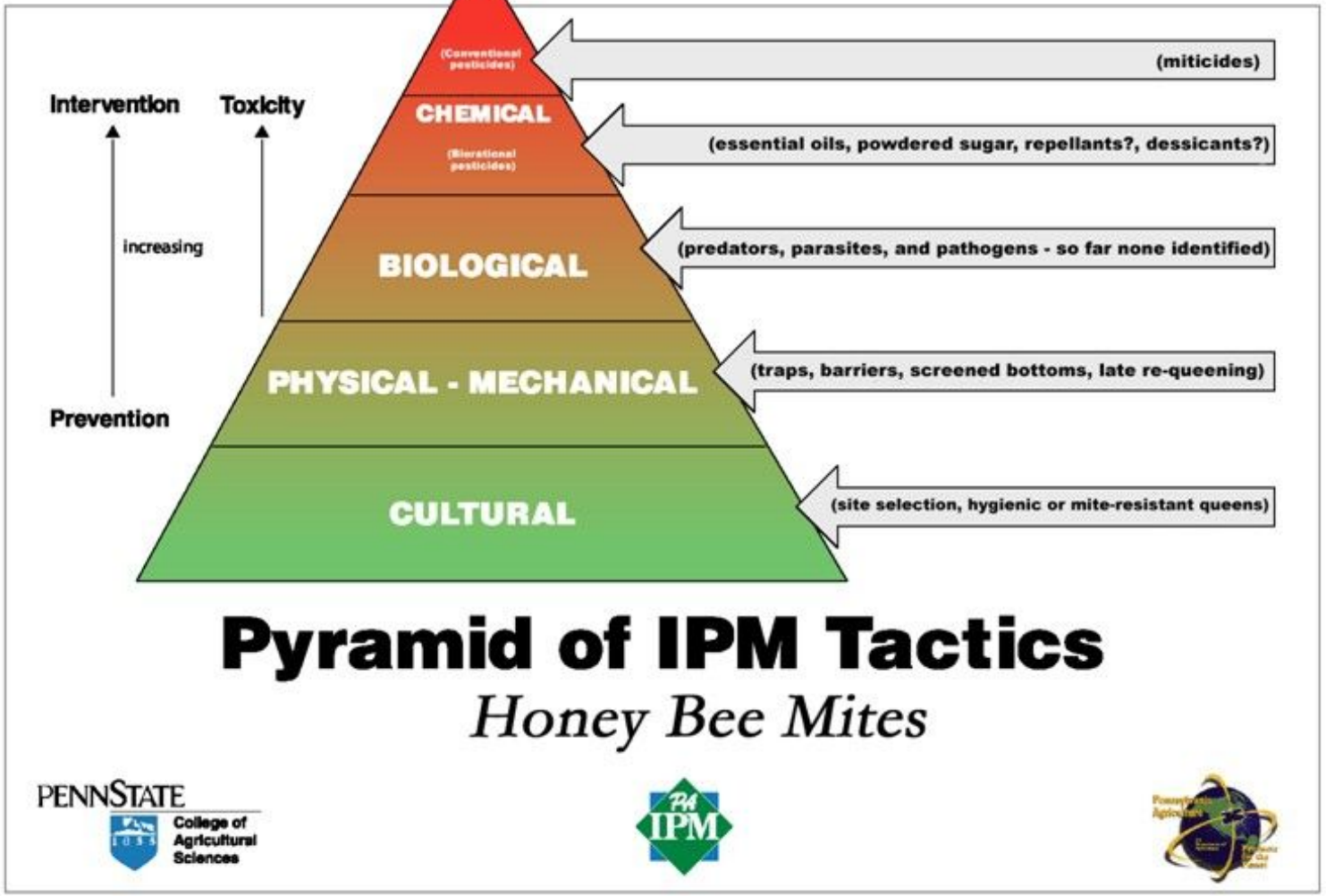
If we stop interfering by putting chemical inputs in the hive to treat disease, and transition to a more holistic and natural approach to caring for bees, we will see that the bees eventually get stronger.

But, the weaker, chemical dependent bees will first die-off before the stronger survivors are able to proliferate and spread their genetics to future colonies.

Chemical Treatments: Soft/Organic/Harsh



HopGuard® II



Pyramid of IPM Tactics

Honey Bee Mites

PENNSTATE College of Agricultural Sciences

PA IPM

Conventional beekeeping is the “problem”

We need bees to be wild. We don't want to coddle them. All the default ways of thinking and managing bees and the impulse of wanting to help them does the contrary. We are creating a situation in which the species is dependent on human intervention for their survival.

Beekeepers are sold a bill of goods that by utilizing all of the trinkets the bee suppliers sell them, they will have success. That just isn’t the case anymore.

Real world observation of bees living with varroa mites demonstrates that the mites themselves are not going anywhere. Killing mites is treating the symptom but not the root cause of the issue. Beekeepers are interfering with the bees natural lives by moving them around and using the bees for their own economic gain.

Beekeepers must give bees the time and space to learn to live with varroa mites.

Egalitarian Agrarian!

Large farms require more hives for pollination and those large contracts are more lucrative for commercial beekeepers.

This puts small and mid-scale farms at a significant disadvantage. If they only need 30 hives versus 300, they will be bumped from the commercial contracts and not receive those needed hives.

If farms do not get the pollination services they require, they will have significantly lower crop yields, putting them at a further economic disadvantage.

Enabling smaller farms to maintain even a few beehives on their farms will help alleviate some of this inequality. This is also a social justice issue, as many smaller farms are run by Latino farmers and people of color.

We all work hard, people and bees, and we all deserves respect and support!

Concerns and Challenges of Farmers

Large scale farms, particularly ones in the Salinas valley producing leafy greens, are in a tough spot due to rigorous food safety standards.

Outbreaks of E. coli and salmonella have spurred regulatory agencies to put stricter standards in place. These have hindered farms' abilities to focus on maintaining existing habitat or planting more non-crop vegetation.

These regulations might appear to be noble, as they're supporting food safety and public health, but they could actually be hindering farms' abilities to adequately protect the environment and local ecosystems.

Source: http://calag.ucanr.edu/archive/?article=ca.v062n02p68

Roadblocks to Implementation:

How can we make this goal of stationary, bee-centric beekeeping a reality? It will take time and therefore be expensive to train farm staff on how to care for colonies on their own.

California land is also very expensive, so designating some portion of it for habitat will mean less land in production- can this be offset by the cost savings of not needing to hire migratory hives?

We need to think big picture on this- look beyond the immediate fiscal impacts to the future of our pollinator populations. Perhaps there are Incentives for Farmers or Tax Credits that could be put in place?

There also is the compounded issue of disease transmission to local hives from any migratory hives that are brought in for pollination- but this could further spread awareness of existing issues.

Let’s work together to create a more ecological, regenerative and productive agricultural landscape. It’s a long road, but it’s the right road to be on!

See Thomas Seeley speak at the UC Davis Bee Symposium on 3/3/18!

Santa Cruz BEE Company

Visit: http://scbee.co for more information about Emily's work
Upcoming Classes through Cabrillo College Extension: 2/10, 2/17, 2/24, 3/24
Contact: santacruzbeeco@gmail.com (908) 752-8284