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Water shortage in paradise

Stories from the almond grower, the matchmaker, the packer and the beekeeper

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California is a land where milk and honey flow: it is the USA's number 1 milk producer (with 1,710,000 cows) and number 2 honey producer (with 500,000 hives).¹ But even these half a million colonies of honey bees are far from sufficient for the annual event that dominates the nation's beekeeping: the pollination of 1.3 million acres of almond trees.

Starting from mid-February and lasting around four weeks, these orchards require both an estimated 2.3–2.6 million hives to ensure adequate pollination, as well as a plentiful supply of water.² Californian summers are dry and agriculture depends on an intricate system of reservoirs and dams to catch winter rainwater and snow melt, which is then distributed later in the year via canals. The state has been in drought for much of the twenty-first century and this is now exacerbated by the climate crisis.

Farmers have responded by drilling deeper wells (sometimes down to 2,000 feet with oil drilling equipment), depleting the aquifer so severely that subsidence is an issue in the almond lands of the San Joaquin Valley. Over-pumping has also caused shallower wells to run dry, and whole communities have to rely on water deliveries by truck and bottled water for drinking.

In September 2014, California's Sustainable Groundwater Management Act (SGMA), which states that by 2040 well owners can't pump more water from the ground than can be recharged during the winter rain season, will face severe consequences and, because trees need a minimum amount of water to survive, the choice is between irrigating or ripping them out. These hard choices will have a direct impact on the suppliers of bees. Some 20 years ago, pollination services became more valuable for US beekeepers than the sale of honey. Will that change once again? Here are differing perspectives.

The almond grower

AgriLand is one of the top five nut-producing companies in California and manages for (absentee) owners approximately 30,000 acres, 95% of which are almond and pistachio orchards. The latter are wind-pollinated and can withstand higher temperatures, but almond trees require more hands-on management.

Of the 10,000 acres of almond trees AgriLand used to manage, around 1,000 have already been taken out of production – as per their owner's instruction. So AgriLand has either stopped all management (such as abandoned orchards are easy to spot as they are covered by dead trees) or the trees were pulled out at a cost of \$1,000 per acre.³



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Instead of using bee brokers, AgriLand's farm manager Jed Webster, who showed me around, is responsible for ensuring pollination. He used to contract 20,000 hives, but nowadays that figure is down to 15–16,000. This is because of the reduced acreage and because AgriLand now counts frames per acre instead of colonies per acre, so they only contract strong colonies. The company pays an independent local beekeeper to inspect 15% of the hives to ensure they meet the target of 16–17 frames per acre.

The suppliers are paid \$190 per hive, which is approximately \$10 less than smaller suppliers whose payment is less guaranteed. Jed expects the price per hive to drop further (perhaps to \$180) as a result of the reduction of almond orchards. AgriLand's hives are usually supplied by only six beekeepers, the smallest operator supplying 1,000 hives, the biggest supplying 6,000. More than 50% of the bees are trucked in from Florida, the others from western states such as Utah and Idaho.

The price for almonds at present is \$2–2.10 per lb, which is below the cost of production (\$2.50 per lb). Still, this is far better than the 2023 price, which was \$1.40–1.50 per lb.

An extreme hot spell in early June 2024, caused the almond trees to 'shut down' at 100F (37.8C) during a critical period of nut development, resulting in smaller kernels. Even extra water could not combat this heat, which is a particular threat in the San Joaquin Valley, the hotter southern part of the Central Valley. One method of conserving water is to plant cover crops such as mustard, vetches and clover, but AgriLand's first attempt in 2024 was not successful, likely because there was still too much herbicide in the ground from previous years' efforts to clear weeds.

Alongside the climate crisis, the almond industry is also affected by the USA's political issues. Plans to deport illegal workers, which in some farming sectors make up 80% of the work force, are already causing havoc in the valley communities with workers not showing up for work for fear of an impending raid, and children being kept out of school.

The matchmaker

In late October, I met Charlene Carroll, her daughter Paula, and Lisa, the granddaughter of the friend with whom Charlene started their bee-brokerage firm Pollination Contracting Inc 48 years ago. They had just signed their first pollination contract for the 2025 season, a simple one-page document which has not



- 1 Almond storage at the processor, Stewart & Jasper
- 2 Almonds and honey – Californian gold
- 3 An abandoned almond orchard
- 4 Three generations of bee brokers, Paula, Charlene and Lisa of Pollination Contracting Inc

changed at all over the years. The charge per hive is \$5 – to be paid by the almond grower – Pollination Contracting never charges the beekeeper.

Back then, Charlene and Lisa's grandmother had trouble getting a loan of \$500 to start their business because they were women. At the end of their first season, not only had they repaid the loan but they had made a profit of \$150. They never looked back and never needed to take out a loan again. Today, Charlene, Paula, and Lisa link 200–300 almond growers with 40–50 beekeepers to broker for 35,000–50,000 hives that need to be placed every year.

What makes these three so special is that they deal even with very small bee operations, matching them with small almond orchards. And they ensure that, when the pollination begins, all hives are at the strength they should be: eight full

frames of bees as a minimum. In order to provide such a hands-on approach, they only work within a two-hour drive of their office in Manteca.

They start their matchmaking early in the season, dealing with beekeepers as far away as Florida (almost 3,000 miles away). According to the women, the Florida bees are very healthy and fit. The locations of their bee suppliers almost cover the whole map of the USA, including Arkansas, Montana, the Dakotas, Iowa, Oregon, Washington and Oklahoma.

One semi (the US term for an articulated lorry) carries 400–480 hives. The trip from Florida lasts for several days, and there can be issues: when the vehicle hits a rough patch of road or a pothole and it is cold outside, clustering bees can fall down and die. For that reason (and to save costs), some beekeepers try to hedge their bets by delivering some hives early, in November



The packer

Matchmaker Charlene, at very short notice, arranged a visit to one of her customers: Steward & Jasper Orchards, in business since 1948. Jim Jasper took over from his father and has managed the business for 58 years. According to him the company is in the industry's top 15.

The almond harvest begins in late August and lasts for eight to ten weeks. The hulling and shelling begins in early September, ten days after the start of the harvest. By the end of December these first two processing steps are finished, but the onward processing and packing unit works year-round. Steward & Jasper process almonds grown on around 25,000 acres which belong to 150 growers. Half of what they process is grown within 15 miles of the factory, nothing further away than 40 miles. Steward & Jasper own some orchards too, which provide about 4% of what they process. In total they handle around 50 million lbs (23 million kg) of almonds per year.

The factory manager Ray Henriques gave me a tour and a crash course in almond processing: the unprocessed almonds are fumigated (organic ones are frozen separately) and stored in a huge pile on a bed of sand. The net load of a single truck delivering almonds from an orchard is 44,000lbs (20,000kg) of almonds 'in husk and shell', of which 23% are almond kernels and 77% are shells, dirt and sticks which are used by dairies as bedding.

The kernels are separated by variety and into one of seven size grades. Certain varieties are popular with certain companies – the US chocolate company Hershey, for example, prefers Padre almonds because of their small kernel size. Other varieties are reserved for baked goods because they blanch better. It is beneficial to the growers to have different almond varieties so that bloom and harvest times vary, allowing pollination and machinery requirements to be spread over time.

The kernels of the 2024 harvest are generally one size smaller than usual because of the heat and the water shortage during the main growing season. A machine checks 1kg of each batch for insect damage, split or broken kernels, as well as other defects such as 'doubles' (two nuts that have grown and fused in one shell). Each test batch can be traced back to the grower and even a particular field.

For their own orchards, Steward & Jasper source 90% of their hives from Pollination Contracting (Charlene, Paula and Lisa's company) and 10% from local beekeepers – in total they hire 3,500 hives. They have learnt to value reliable brokers who

or December. For this reason, there are now limits on the number of overwintering out-of-state hives in certain regions. Some hives are placed directly in the orchards and others are placed in so-called staging areas – either way the bees will need to be fed.

In the mid-twentieth century most beekeepers supplied bees to the (then) 1.5 million acres of almond orchards for free, but fees were introduced in 1978 at the price of \$11 per hive. In 2011, the year daughter Paula joined the business, the price per hive had risen to \$125. In 2017, when Lisa joined, the hive rental price for one month was \$165–175. In 2024, it was \$190–200 per hive. When the price rose to \$150–200, growers started to reduce the stocking density to only 1–1.5 hives per acre; previously 4–5 hives per acre had been the norm.

Charlene, Paula and Lisa inspect 15% of the hives when they arrive in the orchard, making sure that hives from *all* beekeepers and suppliers are included.

What is their take on colonies dying before

the season? They think it is a combination of bad management, not giving bees supplements, insufficient feed, and bad queens. On top of that stress from coming out of winter, travel and often having no food when placed in orchards before the bloom has started. At that point the bees are understandably very defensive. Particularly in staging areas, bees should be checked and cared for by crews hired by the bee supplier – but as in all industries there are good and bad actors.

And how do the three generations of bee brokers see the future of the industry? The years 2021–24 were (not only in their experience) awful: on top of an oversupply of almonds and export restrictions resulting from the global supply chain chaos during the pandemic, fuel, energy and feed prices rose which led to increased prices for hives. According to the three, the biggest new threat is the increasing use of self-fertile almond tree varieties. But overall, they believe that things are improving again: "Our business is not going away."

