

GROWING GOOD

ALMOND SUSTAINABILITY 2018

DEFINING SUSTAINABILITY

for California Almonds

Sustainability requires balancing the needs of people, profit and the planet. While there is no one-size-fits-all approach, California almond farmers are committed to evolving their practices and continuously challenging themselves to do more. In 2005, the California almond community created and adopted a formal definition of sustainability specific to almonds.

SUSTAINABILITY

(SƏ STĀ-NƏ-ˈBI-LƏ-TĒ) *NOUN*

Sustainable almond farming utilizes production practices that are economically viable and based upon scientific research, common sense and a respect for the environment, neighbors and employees. The result is a plentiful, healthy and safe food product.



ECOLOGICALLY SOUND

CALIFORNIA IS ONE OF FIVE PLACES ON EARTH WITH THE MEDITERRANEAN CLIMATE NEEDED TO GROW ALMONDS.

Learning, improving practices and reducing impacts through **45** years of Almond Board-funded research with a total investment of **\$80** million.



ECONOMICALLY VIABLE

ALMOND PRODUCTION SUPPORTS CALIFORNIA'S ECONOMY BY CREATING **104,000** JOBS STATEWIDE

and adding **\$11** billion to California's GDP while generating **\$21** billion in gross revenue¹



SOCIALLY EQUITABLE

MORE THAN **90%** OF CALIFORNIA ALMOND FARMS ARE FAMILY FARMS²

85% of California almond farmers and processors donate their time and money to local organizations³



CONTENTS

- 1 DEFINING SUSTAINABILITY FOR CALIFORNIA ALMONDS
- 2 ROOTED IN INNOVATION
- 4 COMMITTED TO CONTINUOUS IMPROVEMENT
- 6 SPOTLIGHT ON: CALIFORNIA ALMOND SUSTAINABILITY PROGRAM
- 8 SPOTLIGHT ON: WATER
- 10 SPOTLIGHT ON: ZERO WASTE
- 12 SPOTLIGHT ON: BEE HEALTH

1. University of California Agricultural Issues Center. The Economic Impacts of the California Almond Industry. December 2014. 2. United States Department of Agriculture. 2012 Agricultural Census. 3. California Almond Sustainability Program. August 2018.

ROOTED IN INNOVATION

Sustainability for California almonds is interconnected and spans from our orchards to our communities and beyond. Built upon a research program founded in 1973, the California almond community is on a sustainability journey, improving farming and processing practices along the way. The Almond Board of California (ABC) supports this effort by leveraging industry funding for essential research, programs and outreach. Opposite this page are key milestones the almond community has reached in core sustainability areas, supporting our commitment to continuous improvement.

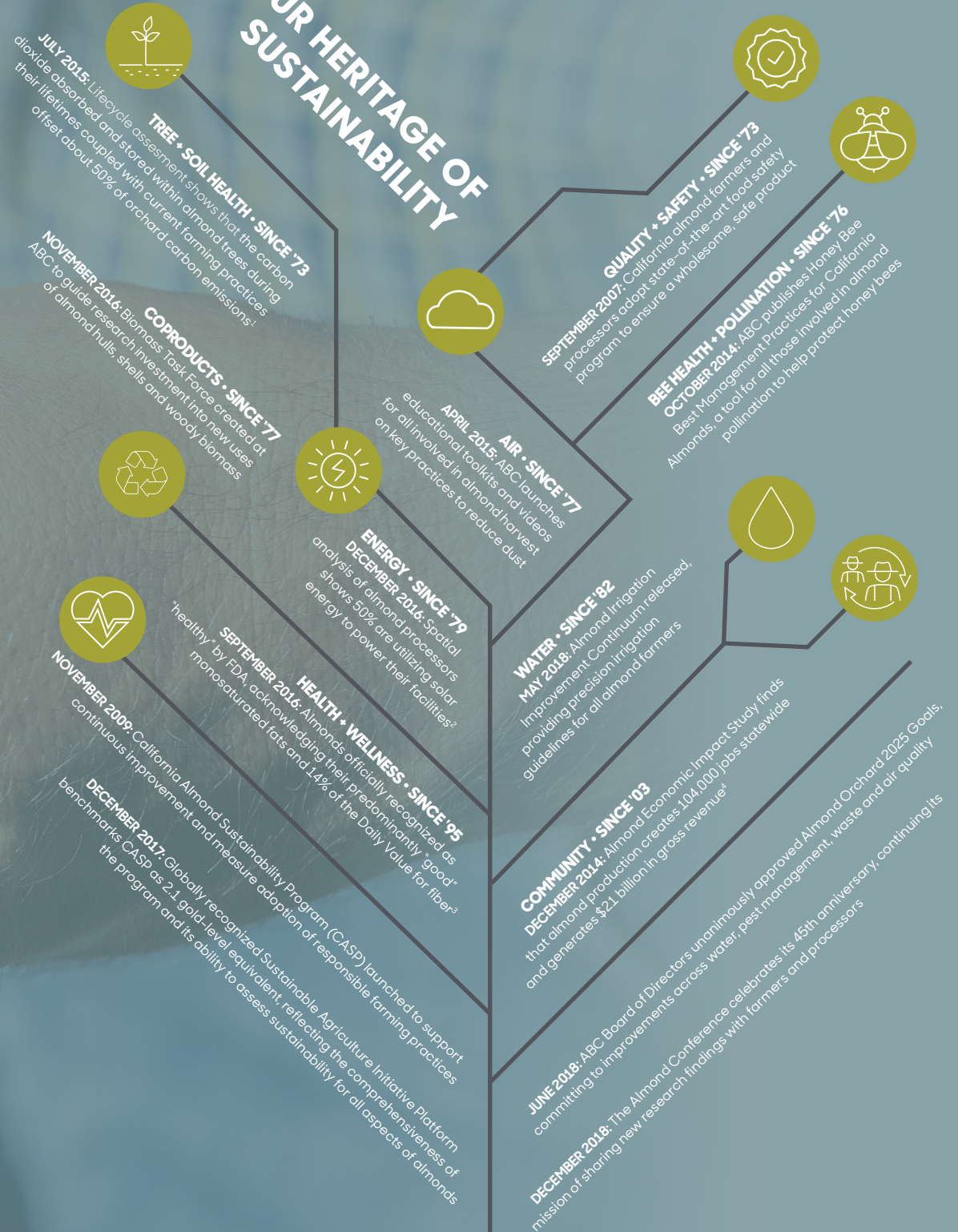


Meet Lydia Palma

**INSECT FARMING RESEARCHER,
UNIVERSITY OF CALIFORNIA, DAVIS**

“I enjoy working with the almond community because their goals align with ours. They’re investing in research so nothing goes to waste, with the goal of a neutral imprint. I would consider them a pioneering industry.”

OUR HERITAGE OF SUSTAINABILITY



DID YOU KNOW?

Each ABC-funded research project shares its findings through a midyear summary, poster and/or full report, all of which are available at Almonds.com/ResearchDatabase

1. Alissa Kendall, et al. Lifecycle-based assessment of energy use and greenhouse gas emissions in almond production. Part 1: Analytical framework and baseline results. *Journal of Industrial Ecology*. 2015.
2. Land IQ. Almond Process or Solar Analysis. December 2016.
3. Good news about almonds and heart health. Scientific evidence suggests, but does not prove, that eating 1.5 ounces of most nuts, such as almonds, as part of a diet low in saturated fat and cholesterol may reduce the risk of heart disease. One serving on almonds (28 grams) has 13 grams of unsaturated fat and only 1 gram of saturated fat.
4. University of California, Agricultural Issues Center. The Economic Impacts of the California Almond Industry. December 2014.



COMMITTED

to Continuous Improvement

In addition to growing a healthy food that people love, the California almond community is dedicated to producing an economically, environmentally and socially responsible crop for California. Recognizing our local role in California agriculture and global role as a powerhouse in almond production, we're working to grow almonds in better, safer and healthier ways, protecting our communities and the environment.

The Almond Orchard 2025 Goals are the latest way the California almond community is committed to continuous improvement.

FURTHER REDUCING THE WATER USED TO GROW ALMONDS



Over the past two decades, almond farmers have successfully reduced the amount of water needed to grow a pound of almonds by 33% via improved production practices and adoption of efficient microirrigation technology.¹ **By 2025, the California almond community commits to reduce the amount of water used to grow a pound of almonds by an additional 20%.**



INCREASING ADOPTION OF ENVIRONMENTALLY FRIENDLY PEST MANAGEMENT TOOLS

Responsible almond farming requires protecting the crop and trees from bugs, weeds and disease through an integrated pest management approach. This means using tools and techniques like beneficial insects, habitat removal, mating disruption and, when necessary, pesticides. To further protect our orchards, employees and communities, **by 2025, we commit to increase adoption of environmentally friendly pest management tools by 25%.**

ACHIEVING ZERO WASTE IN OUR ORCHARDS



Almonds grow in a shell, protected by a hull, on a tree: products traditionally used for livestock bedding, dairy feed and electricity generation. Changing markets for these coproducts are spurring innovation for higher value uses, both economically and environmentally, with promising leads in the areas of recycled plastics, fuel, beer and more. **By 2025, the California almond community commits to achieve zero waste in our orchards by putting everything we grow to optimal use.**



IMPROVING LOCAL AIR QUALITY DURING ALMOND HARVEST

California almonds are harvested by shaking the nuts to the ground where they dry naturally in the sun before being swept up and collected, a process that can create dust in our local communities. To address this nuisance, the almond community is taking short- and long-term steps to reimagine how we harvest and, **by 2025, commits to reduce dust during harvest by 50%.**



BETTER TOGETHER

Collaboration. Partnerships. Coordination. From ancient history to the present, one can easily observe that humans are able to achieve far more together than they can apart. The California almond community is no different. With a range of remarkable partners, our success is achieved jointly, leveraging allied organizations' strengths and circles of influence. These collaborations are supported on both sides with funding, in-kind donations, subject-matter expertise, sponsorships, research, extension and unique perspectives. A sampling of collaborations includes:

UNIVERSITIES:

Globally recognized² as a leading agricultural university, ABC funds numerous expert researchers at *University of California, Davis* to better understand and improve almond production practices.



GOVERNMENT:

Through a shared vision of optimal use of crop coproducts, ABC partners with the *USDA-ARS Western Regional Research Center* to explore creative applications for almond hulls and shells.



NONPROFITS:

Able to engage across agricultural and environmental interests and parlay with regulators and policy makers, *Sustainable Conservation* is breaking barriers in the effort to replenish California's underground aquifers, supporting ABC's work in this area.



BRANDS:

Coordinating the efforts of global brands to make impactful improvements, the *California Water Action Collaborative* is driving corporate water stewardship and supporting solutions for all who depend on water in California, including the almond community.

Meet Mark Kline



SENIOR PROCUREMENT MANAGER,
THE HERSHEY COMPANY

"Consumers more than ever want to know what's in their food, where the ingredients came from and how they are grown. The Almond Board of California's goals help Hershey to provide this information to our consumers."

INDUSTRY ORGANIZATIONS:

With a membership composed of diverse industry stakeholders, including ABC, the *Honey Bee Health Coalition* is working toward collaborative solutions for healthy managed and native pollinators.



1. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990-94, 2000-14. 2. QS World University Rankings by Subject. February 2018.

SPOTLIGHT ON:

CALIFORNIA ALMOND SUSTAINABILITY PROGRAM

Supporting Continuous Improvement + Highlighting Success

A sustainability program tailor-made for California almond farmers and processors, the California Almond Sustainability Program (CASP) was established in 2009 to educate participants about responsible practices, facilitating continuous improvement.

Through self-assessments, participants learn about best practices across the spectrum of almond farming topics and share information to help tell the story of how California almonds are grown. The information gathered through farmer self-assessments provides key metrics about the use of distinct management techniques.

globally recognized

Recently benchmarked against the Sustainable Agriculture Initiative (SAI) Platform's Farm Sustainability Assessment (FSA), CASP's self-assessments, paired with the U.S. and California regulatory systems, results in an FSA 2.1 gold-level equivalency.

This reflects the comprehensiveness of the CASP program, demonstrating that it can be used as an equivalent means of assessing sustainable practices relevant to the California almond community.



9 SELF-ASSESSMENT MODULES



4,895 modules completed, assessing 23% of California's productive almond acreage

- Irrigation management
- Nutrient and soil management
- Pest management
- Air quality
- Energy efficiency
- Bee health and pollination
- Financial management
- Ecosystem management
- Workplace and communities

2 ONLINE CALCULATORS



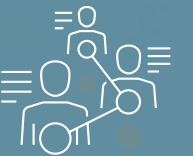
796 schedules and budgets created, supporting on-farm decision making

- Irrigation scheduling
- Nitrogen budgeting

WORKSHOPS AND EVENTS

31 events offered in 2018, reaching 1,436 attendees

- Orchard workshops
- Expert lectures
- Lunch + learns
- Individualized on-farm visits



Meet Jenny Edwards



FRUIT AND NUT PROGRAM LEAD, SUSTAINABLE AGRICULTURE INITIATIVE PLATFORM

"Programs like the California Almond Sustainability Program, that monitor progress at an industry level and offer producers a complete sustainability 'health check,' are critical to driving improvements and are a great example of sustainability leadership."

WATER

Making Every Drop Count

ON-FARM GROUNDWATER RECHARGE: EXPLAINED

The Almond Board of California is supporting research to understand how almond orchards can be leveraged to recharge underground aquifers, collectively California's largest water storage system and essential to cities and farms.



675,000 ACRES OF CALIFORNIA ALMOND ORCHARDS HAVE MODERATELY GOOD OR BETTER SOIL SUITABILITY FOR GROUNDWATER RECHARGE¹

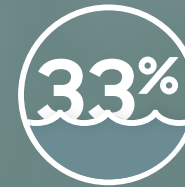
- 1 **PRECIPITATION:** Winter storms bring rain and snow, sometimes more than California's water infrastructure can handle.
- 2 **HIGH FLOWS:** Extra stormwater flows down rivers and canals. Instead of flowing out to the ocean, some of the water is diverted to farmland, reducing flood risk in the process.
- 3 **IN THE ORCHARD:** Dormant during the winter months, almond orchards can be flooded with excess stormwater, allowing the water to make its way into the soil without harming the trees.
- 4 **UNDERGROUND:** Water slowly makes its way down to underground aquifers, replenishing groundwater levels.
- 5 **DOING GOOD FOR ALL:** The water recharged through this program will bring benefits to all Californians, not just farmers.

ON-FARM IMPROVEMENTS

Starting in 1982, the California almond community began investing in research to determine if a new irrigation method—microirrigation—could work in almond orchards. The results were positive and, by targeting water applications directly to the trees' roots instead of uniformly across the field, farmers have conserved water and created other operational efficiencies.

Today 79% of California almond orchards use microirrigation² and, as older orchards are replaced, we expect that number to grow. While almond farmers have made great strides in irrigation efficiency, there's more everyone can do.

In addition to funding water research—totaling 210 projects to date—ABC and irrigation experts have developed the Almond Irrigation Improvement Continuum. Supported by dedicated ABC staff, the Continuum outlines a path to improvement for every almond farmer using five key management areas, providing research-based guidelines for optimizing irrigation precision and conserving water.



MORE CROP PER DROP

Improvements in production practices and water-saving irrigation technology have helped reduce the amount of water needed to grow each pound of almonds by 33% over the past 20 years.³

AHEAD OF THE CURVE

Almond farmers are leading adoption of efficient irrigation technology.



CALIFORNIA ALMOND IRRIGATION METHOD²

- 79% microirrigation
- 10% sprinkler
- 11% flood



CALIFORNIA STATEWIDE IRRIGATION METHOD⁴

- 42% microirrigation
- 15% sprinkler
- 43% flood

Meet Alex Bergwerff ALMOND FARMER, OAKDALE



"To be as efficient as possible with our water and energy, we use soil moisture sensors to monitor field conditions, aerial imagery to check for leaks and automated pump controls to monitor the amount of water we give the trees. By adopting these technologies, we can deliver water when the trees need it, as efficiently and responsibly as possible, and identify issues before they become problems."

1. Land IQ. Groundwater Recharge Suitability Analysis. November 2015. 2. California Almond Sustainability Program. August 2018. 3. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990-94, 2000-14. 4. California Department of Water Resources. California Water Plan Update 2013: Volume 3, Chapter 2.

SPOTLIGHT ON:

ZERO WASTE

Using Everything the Orchard Grows

WHOLE ORCHARD RECYCLING: EXPLAINED

Just like a tree decomposing in the forest provides nutrients to everything around it, researchers are exploring the potential for recycling whole almond trees back into the soil and the benefits this approach could bring to future orchard and soil health.



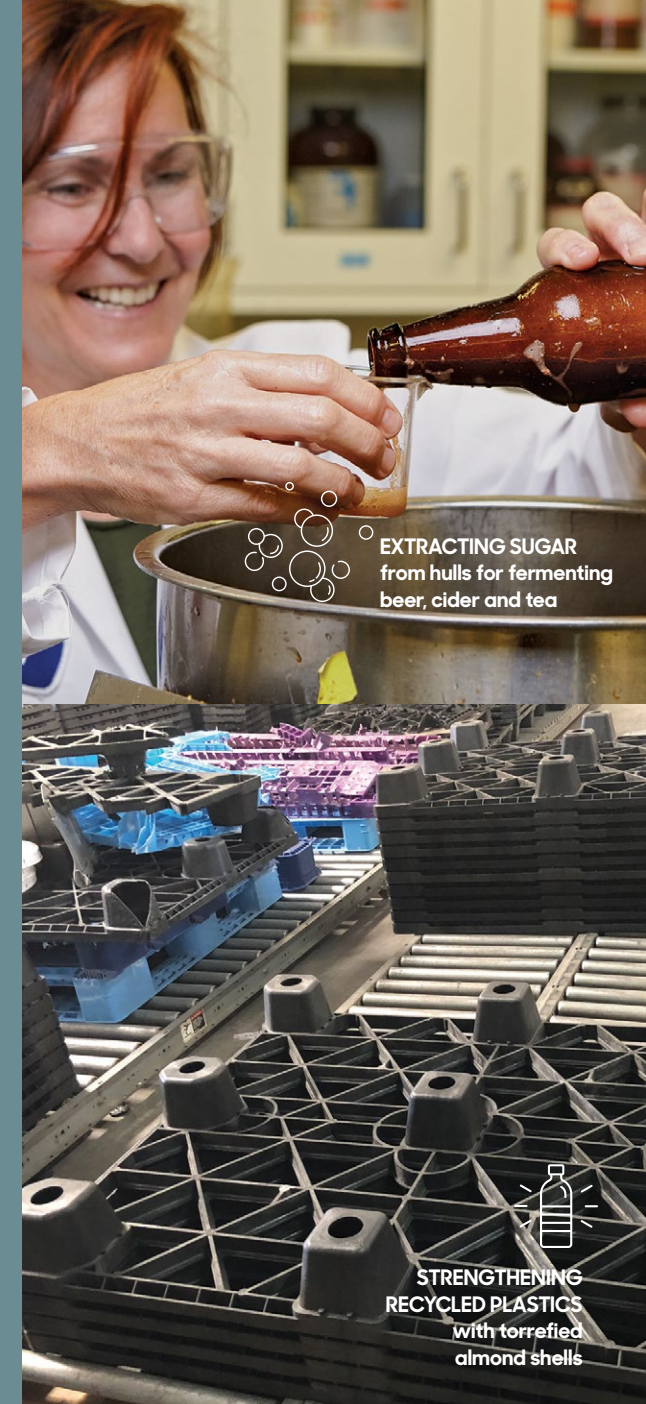
THE CARBON DIOXIDE ABSORBED AND STORED WITHIN ALMOND TREES DURING THEIR LIFETIMES COUPLED WITH CURRENT FARMING PRACTICES OFFSETS ABOUT 50% OF ORCHARD CARBON EMISSIONS.¹

- 1 ORCHARD REMOVAL:** At the end of their 25-year lifespan, almond orchards are removed, with each tree being ground up into small wood chips.
- 2 SOIL INTEGRATION:** Instead of removing the wood chips from the orchard system for other uses, a whole orchard recycling approach means the chips are spread and disced into the soil prior to planting the next orchard.
- 3 BREAKDOWN:** Over time, the wood chips decompose, releasing nutrients that the next orchard can use. What's more, the chips add organic matter to the soil, increasing water infiltration and storage², as well as slowing the release rate of carbon dioxide, a greenhouse gas, into the atmosphere.¹ Whole orchard recycling has the potential to prolong the benefits of sequestration and further offset emissions, moving almond farming closer to carbon neutral.

A GENUINE BIOECONOMY

Almonds grow in a shell, protected by a hull, on a tree. Traditionally, these coproducts have been used as livestock bedding, dairy feed and transformed into electricity. However, changing markets and increased production has led the California almond community to investigate new uses.

Building on historic research and with 66 research projects funded to date, ABC is supporting the scientists exploring innovative applications for almond coproducts that can support California in creating a genuine bioeconomy, where every byproduct is an input for another valuable product. This has the potential to provide value to other industries, farmers and the environment.



EXTRACTING SUGAR from hulls for fermenting beer, cider and tea

STRENGTHENING RECYCLED PLASTICS with torrefied almond shells

Meet Mike Curry



ALMOND HULLER/SHELLER, DENAIR

“Creating new ways to use a product that has historically been thought of as a single-use item is very exciting. The entire production and supply chain, including the consumer, will benefit from the development of new products from almond hulls and shells.”



FARMING INSECT LARVAE nourished with almond hulls for use in poultry production and aquaculture

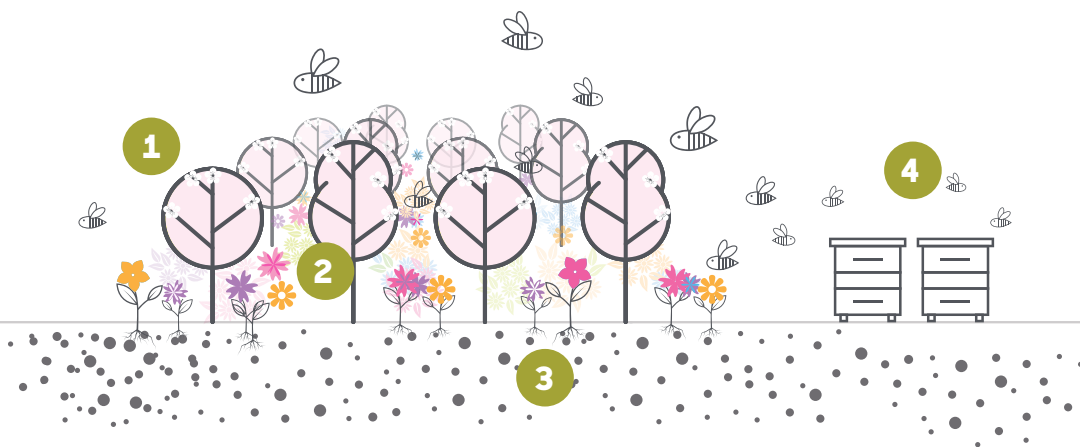
1. Alissa Kendall, et al. “Life Cycle–Based Assessment of Energy Use and Greenhouse Gas Emissions in Almond Production. Part 1: Analytical Framework and Baseline Results.” *Journal of Industrial Ecology*. 2015.
2. 17-PREC3-Holtz. Almond Orchard Recycling.

BEE HEALTH

Supporting Our Essential Pollination Partners

BEE PASTURES: EXPLAINED

In partnership with honey bee research organization Project Apis m. and others, ABC is working to understand best practices for planting wildflowers near and in almond orchards, as well as the ideal flower mixes that are attractive to honey bees, thrive with limited water and have minimal impact on orchard management.



20,700 FOOTBALL FIELDS OF WILDFLOWERS SINCE 2013, ALMOND FARMERS HAVE PLANTED OVER 27,000 ACRES OF BEE PASTURES THROUGH PROJECT APIS M.'S SEEDS FOR BEES PROGRAM.¹

- 1 ALMOND POLLEN:** Among the first plants to bloom each year, almond pollen is very nutritious for honey bees, just like almonds are for us! Almond pollen provides all 10 of the essential amino acids bees' diets require.²
- 2 BLOOMING FLOWERS:** Farmers plant bee-friendly wildflower mixes as additional food sources for honey bees to enjoy before and after almond bloom, providing benefits to native pollinators as well.
- 3 SOIL BENEFITS:** Beyond providing additional nutrition for bees and other pollinators, these plantings may help farmers improve soil health, water infiltration and more.
- 4 NO COMPETITION:** Initial research has shown that bees prefer almond blossoms to other flowers, ensuring that they will fulfill their role pollinating the almond crop before moving on to the bee pastures nearby.

BEE-FRIENDLY ORCHARDS

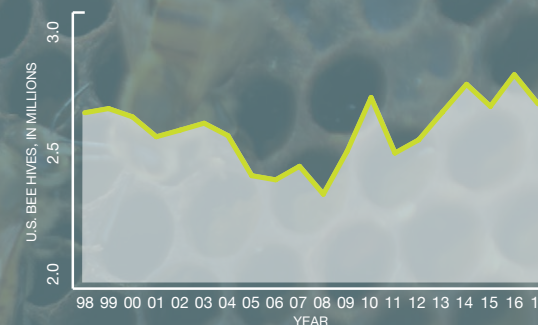
Every almond you eat exists because a honey bee pollinated an almond blossom. And every honey bee who visits an almond orchard gets its first natural food source of the year there, building up reserves of worker bees and stored food to support a healthy start to their pollination season.³

Because of honey bees' essential role in almond production, ABC has invested more in honey bee health research than any other crop group.⁴

And what's more, farmers have widely adopted voluntary measures, like Honey Bee Best Management Practices, to protect bees in the orchard and beyond.

120 RESEARCH PROJECTS

Since 1995, the Almond Board of California has supported research across bee health and pollination, spanning all five major factors impacting honey bees.



THE NUMBER OF U.S. HONEY BEE HIVES REMAINS STEADY⁵

However, beekeepers still experience significant in-season losses and must work harder to maintain healthy apiaries.

Meet Keith Kwan

ALMOND FARMER, MADERA



"Bees do so much good. They pollinate, they make honey, and are an integral part of producing our bountiful, diverse food supply. To keep them healthy, we've adjusted our practices to ensure their safety during bloom and added habitat along a waterway on our farm to support pollinators year-round."

1. Billy Synk. Director of Pollination Services. Project Apis m. November 2018. Represents total plantings from 2013-present. 2. Ramesh Sagili. Department of Horticulture, Oregon State University. 3. USDA-ERS. Land Use, Land Cover and Pollinator Health: A Review and Trend Analysis. July 2017. 4. Gene Brandt. Vice President, American Beekeeping Federation. 5. USDA-NASS. Honey Production Report. 1998-2017.



MORE ON ALMOND SUSTAINABILITY AT:



AlmondSustainability.org
Additional information about how the almond community is growing good



@almondboard
The latest on almond sustainability in 280 characters or less



Almonds.com/Blog
Get to know the California almond community through profiles, news, and more



Almonds.com/CASP
Why farmers and processors should participate in the California Almond Sustainability Program



SustainableAlmondGrowing.org
Online portal for California Almond Sustainability Program participants



Almonds.com/ResearchDatabase
Reports from 45 years of almond farming and environmental research

OR CONTACT:

GABRIELE LUDWIG
Director, Sustainability and Environmental Affairs
gludwig@almondboard.com

HARBINDER MAAN
Associate Director, Trade Marketing and Stewardship
hmaan@almondboard.com

DANIELLE VEENSTRA
Manager, Sustainability Communications
dveenstra@almondboard.com

JENNY NICOLAU
Manager, Industry Relations
jnicolau@almondboard.com

Almond Board of California
1150 Ninth Street, Suite 1500
Modesto, CA 95354 USA
Almonds.com

Document #2018CN0261
© 2018 Almond Board of California
Printed in Modesto, California