



# GROWING GOOD

## Almond Sustainability 2017





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## Defining Sustainability for California Almonds

Sustainability requires balancing the needs of people, profit and the planet—something farmers know is essential to the long-term viability of their operations. While there is no one-size-fits-all approach to sustainability, California Almond farmers are committed to using research to evolve their practices and continuously challenging themselves to do more.

In 2005, California Almond farmers and processors created and adopted a formal definition of sustainability specific to almonds based on the three pillars of sustainability.



### SUSTAINABILITY (SƏ-STĀ-NƏ-'BI-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.

Meet the Farmers

# OVER 90% OF CALIFORNIA ALMOND FARMS ARE FAMILY FARMS

Many are owned and operated by third- and fourth-generation farmers who live on the land and plan to pass it down to their children! Almond farmers recognize the need to carefully manage resources for current and future generations and offer continued work for their employees while protecting their families, neighbors, local communities and the environment.

Uniquely California

# CALIFORNIA IS ONE OF THE FEW PLACES ON EARTH WITH THE MEDITERRANEAN CLIMATE NEEDED TO GROW ALMONDS

Ideal climate is a major reason the state produces more than 80%<sup>2</sup> of the world's almond supply. But California is unique in other ways too, including its rich soils, natural resources and infrastructure, and innovative research and technology. In addition to following federal regulations protecting workers, food safety and the environment, California farmers must also abide by stringent standards set by the state that further protect people and the planet.

1. United States Department of Agriculture. 2012 Agricultural Census. 2. Almond Board of California, Almond Board of Australia and INC.



# Committed to Continuous Improvement

Sustainability for California Almonds is interconnected and crosses all aspects of the almond lifecycle, inside the orchard and beyond. In addition to growing a healthy food that is good for people, California Almond farmers are working to continuously improve their practices in a way that's good for communities and the planet.



## A Solid Foundation

Underlying the advancement and innovation in each of the categories above is nearly \$70 million in Almond Board of California-funded research spanning more than 40 years. This has built a foundation for continuous improvement that is helping almonds to be an economically, environmentally and socially responsible crop for California.

TO LEARN MORE ABOUT HOW THE CALIFORNIA ALMOND COMMUNITY IS CONTINUOUSLY IMPROVING IN EACH OF THE CATEGORIES ABOVE, VISIT [ALMONDSUSTAINABILITY.ORG](http://ALMONDSUSTAINABILITY.ORG)

# Our Heritage of Sustainability

Sustainability is a journey—always improving and, where possible, seeing how the latest science and technology can be taken to the next level. The California Almond community is on a sustainability journey of its own and the following are important milestones we have achieved along the way.

**1843**

**FIRST-KNOWN ALMOND ORCHARD** planted in California

**1950**

**FEDERAL MARKETING ORDER ESTABLISHED** for almonds at the request of California Almond farmers, now known as Almond Board of California (ABC)

**1973**

**ABC LAUNCHES RESEARCH FUNDING PROGRAM** focusing on orchard health, pests, and food quality and safety

**FIRST ANNUAL ALMOND CONFERENCE**

held in Sacramento, CA, to share research results with farmers and processors with a goal of improving production practices

**1976**

**POLLINATION ADDED TO ABC RESEARCH PRIORITIES** to better understand the important role honey bees play in growing almonds

**1977**

**ABC BEGINS FUNDING RESEARCH TO EXPLORE HOW ALMOND COPRODUCTS (HULLS, SHELLS, WOODY MATERIAL) CAN BE PUT TO BENEFICIAL USES**, like livestock feed and creating alternative energy through cogeneration

**1982**

**ABC BEGINS INVESTIGATING IRRIGATION IMPROVEMENT** and other water-related research

**1995**

**ABC FORMS BEE TASK FORCE** to increase research focus and collaboration related to honey bee health

**1997, 2003, 2004, 2007**

**ABC WINS CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION, U.S. ENVIRONMENTAL PROTECTION AGENCY AWARDS** for developing and promoting best-in-class pest management practices

**2007**

**CALIFORNIA ALMOND FARMERS AND PROCESSORS ADOPT STATE-OF-THE-ART FOOD SAFETY PROGRAM** to ensure a wholesome, safe product

**2009**

**CALIFORNIA ALMOND SUSTAINABILITY PROGRAM LAUNCHED** to support almond farmer continuous improvement and adoption of sustainable practices

**2014**

**ABC PUBLISHES HONEY BEE BEST MANAGEMENT PRACTICES** for California Almonds, a tool for all involved in almond pollination to protect honey bees

**DECEMBER**

**UNIVERSITY OF CALIFORNIA PUBLISHES ALMOND ECONOMIC STUDY** quantifying the 104,000 jobs and \$11 billion almonds add to California's GDP<sup>1</sup>

**2015**

**FEBRUARY ABC UNVEILS NITROGEN CALCULATOR**, which helps almond farmers feed their trees while reducing environmental impacts

**APRIL**

**ABC LAUNCHES EDUCATIONAL TOOLKITS, VIDEOS** and more for all involved in almond harvest to reduce air quality impacts

**JULY**

**LIFECYCLE ASSESSMENT (LCA)** of growing almonds shows that more than 50% of emissions are offset by current practices and the almond trees themselves<sup>2</sup>

**SEPTEMBER**

**ABC AND ENVIRONMENTAL DEFENSE FUND** receive a USDA grant to explore how almond farmers can quantify greenhouse gas reductions to access California's cap-and-trade market

**OCTOBER**

**ABC FUNDS RESEARCH TO EXPLORE USING ALMOND ORCHARDS TO RECHARGE GROUNDWATER AQUIFERS** with partners at University of California, Davis; Sustainable Conservation; Land IQ and Lawrence Berkeley National Laboratory

**2016**

**MAY IRRIGATION CALCULATOR RELEASED TO ALMOND FARMERS**, providing real-time, tailored recommendations to use water more efficiently

**SEPTEMBER**

**ALMONDS OFFICIALLY RECOGNIZED AS "HEALTHY" BY FDA**, acknowledging their predominantly "good" monounsaturated fats and 14% of the Daily Value for fiber<sup>3</sup>

**NOVEMBER**

**ABC'S BIOMASS TASK FORCE IS CREATED** to guide research investment in novel, new uses of almond coproducts

**DECEMBER**

**SPATIAL ANALYSIS OF ALMOND PROCESSORS** finds 50% are utilizing solar energy at their facilities<sup>4</sup>

1: University of California Agricultural Issues Center. The Economic Impacts of the California Almond Industry. December 2014. 2. 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. 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. Land IQ. Almond Processor Solar Analysis. December 2016.



Almond Board of California leverages industry funding to support programs and resources essential to the California Almond community's culture of continuous improvement.

# GROWING

with Science, Innovation and Collaboration ...

## Rooted in Research

### RESEARCH PROGRAM

Launched in 1973, ABC's research program funds expert researchers from prestigious universities and institutions. Their findings provide the foundation for increased understanding and improved practices.

#### Focus Areas:

- Orchard, tree and rootstock improvement
- Irrigation and nutrient management
- Insect, disease and weed management
- Food safety
- Pollination and honey bee health
- Almond coproducts and biomass
- Air and water quality

Each funded research project shares findings through a midyear summary, poster and/or full report. These are available at [Almonds.com/researchdatabase](http://Almonds.com/researchdatabase), onsite at The Almond Conference and within ABC's annual *Research Update* print publication.

THIS YEAR ABC INVESTED IN 64 NEW RESEARCH PROJECTS TOTALING \$4.8M TO IMPROVE ALMOND FARMING PRACTICES ACROSS WATER EFFICIENCY, HONEY BEE HEALTH, COPRODUCT UTILIZATION AND MORE.

THIS BUILDS ON ABC'S MORE THAN 40-YEAR AND \$70 MILLION COMMITMENT TO CONTINUOUSLY IMPROVING THE CALIFORNIA ALMOND COMMUNITY THROUGH SCIENTIFIC RESEARCH.

### ACCELERATED INNOVATION MANAGEMENT

Nimble than ABC's traditional research program and featuring bold new partnerships, Accelerated Innovation Management (AIM) is designed to help meet the future needs of California Almond farmers and processors while benefiting local communities and the environment. Since its launch in 2015, AIM has funded 24 research projects across four initiative areas.

- **Water Management + Efficiency:** accelerating adoption of irrigation practices and technology that maximize crop per drop
- **Sustainable Water Resources:** exploring on-farm groundwater recharge and diversifying California's water supply
- **Air Quality:** understanding farming-related air quality impacts and how to decrease emissions
- **22nd Century Agronomics:** focusing on new technologies and out-of-the-box solutions to create the almond farm of the future



## Committed to Continuous Improvement

### EDUCATIONAL RESOURCES

While research provides the scientific basis for improved practices, ABC translates those findings into actionable and field-ready recommendations shared through a variety of resources and educational opportunities. Information from the California Almond Sustainability Program helps to prioritize what materials and tools get created.



To share these resources and recommendations, ABC's robust communications program leverages newsletters, magazines, workshops, social media and more to reach all involved in growing and processing almonds.

THE ALMOND CONFERENCE HAS BEEN HELD ANNUALLY SINCE 1973 TO SHARE FINDINGS FROM ABC'S RESEARCH PROGRAMS AND MORE.

IN 2016, THE ALMOND CONFERENCE INCLUDED 3,600 ATTENDEES // 50 SYMPOSIUMS // 260 EXHIBITORS // 120 RESEARCH POSTERS // \$27,000 RAISED FOR AG SCHOLARSHIPS

### CALIFORNIA ALMOND SUSTAINABILITY PROGRAM

A sustainability program tailor-made for California Almond farmers and processors, the California Almond Sustainability Program was established in 2009 to educate participants about sustainable farming practices and facilitate continuous improvement. Through self-assessments, participants learn about best practices and share information about their own sustainability practices to help tell the story of how California Almonds are grown.

To date, 4,022 modules have been completed, assessing 23% of California's productive almond acreage.

TO LEARN MORE ABOUT THE CALIFORNIA ALMOND SUSTAINABILITY PROGRAM, SEE PAGES 6-7.



**SPOTLIGHT ON:**

# California Almond Sustainability Program

Through the California Almond Sustainability Program (CASP) we can share key milestones and information about how California's 6,800 almond farmers grow their crops.

This helps the public better understand the responsible practices used to put food on their tables, while farmers who participate learn about opportunities for improvement.

Nearly a quarter of California's productive almond acreage has been assessed to date through CASP. The data gathered through farmer self-assessments provides statistically significant information about the use of distinct management techniques and practices across the California Almond growing region.

CASP offers participants a variety of tools to facilitate improvement in the orchard and beyond.



TO DATE, **4,022 MODULES** HAVE BEEN COMPLETED, **ASSESSING 23%** OF CALIFORNIA'S PRODUCTIVE ALMOND ACREAGE.

## 9 SELF-ASSESSMENT MODULES

Question-and-answer format modules allow participants to assess their current methods while learning about key best practices across the spectrum of almond farming topics.

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

SINCE LAUNCHING LAST YEAR, **623 SCHEDULES AND BUDGETS** HAVE BEEN CREATED WITH THE CALCULATORS.

## 2 CALCULATORS

Based on research, these interactive decision-support tools are designed to streamline decision-making and regulatory reporting requirements while minimizing environmental impacts.

### IRRIGATION SCHEDULING:

Uses farmer-submitted data about their orchard and irrigation system setup, with local weather data and other inputs to generate irrigation schedules, providing farmers with details about the optimal amount and timing of irrigation.

### NITROGEN BUDGETING:

Advises how much and when to apply nitrogen fertilizer based on orchard-specific yield estimates, tissue sampling and nitrogen available from other sources, helping farmers provide their trees with the nutrients they need while protecting water and air quality.

IN 2017, **25 CASP EVENTS** WERE OFFERED, REACHING **868 ATTENDEES**.

## 25 WORKSHOPS AND EVENTS

On-farm demonstrations, expert lectures and peer-to-peer sharing provides participants with opportunities for learning, collaboration and networking.

New this year, Almond Board's expert staff brought CASP directly to the orchard, meeting individually with more than 50 almond farmers. Visits served to familiarize farmers with CASP tools and provide farm-specific guidance, a service available to any California Almond farmer.



*"The biggest benefit for me of participating in CASP is seeing what other farmers are doing in the industry and how we can improve and incorporate new strategies into our operation. It has made me a better farmer."*

— Eric Genzoli, fourth-generation almond farmer  
Turlock, California

**FARM PROFILE:** almonds  
**ACRES OF ALMONDS:** 300



## SPOTLIGHT ON: Water

### LEADERS IN EFFICIENCY

Decades of Almond Board-funded research and innovation has led to impactful on-farm improvements and provides the foundation for continuing advancement.

### TRANSFORMATIVE CHANGE

The California Almond community began investing in research in 1982 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 nearly 80% of California Almond orchards are using microirrigation and, as older orchards are replaced, we expect that number to grow.

### A ROADMAP TO CONTINUED IMPROVEMENT

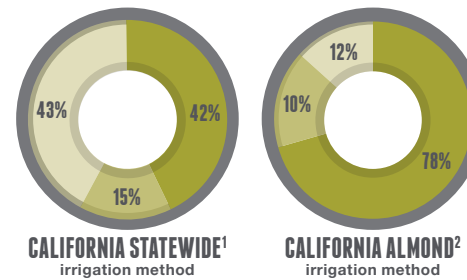
While almond farmers have made strides in irrigation efficiency, there's more everyone can do, which is why Almond Board and almond irrigation experts developed the Almond Irrigation Improvement Continuum in 2017.

The Continuum provides a path to improvement for every almond farmer across varying stages of irrigation precision using five key management areas.

#### EFFICIENT ALMOND IRRIGATION REQUIRES:

- 1 CALCULATING ORCHARD WATER REQUIREMENTS
- 2 MONITORING IRRIGATION SYSTEM PERFORMANCE
- 3 MEASURING APPLIED WATER
- 4 MONITORING SOIL MOISTURE
- 5 MONITORING PLANT WATER STATUS

## Almond farmers are AHEAD OF THE CURVE FOR EFFICIENT IRRIGATION ADOPTION



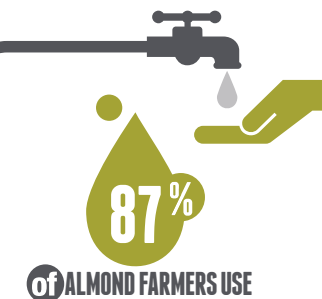
■ microirrigation  
■ sprinkler  
■ flood

**IMPROVEMENTS**  
in production practices  
and water-saving  
technologies have helped

**REDUCE**  
the amount of water  
it takes to grow

**1LB** of by

**33%**  
OVER THE PAST 20 YEARS<sup>4</sup>



**675,000 ACRES** OF CALIFORNIA ALMOND ORCHARDS  
have moderately good or better soil  
suitability for groundwater recharge<sup>3</sup>

**10** ALMOND FARMERS  
REPRESENTING 2,200 ACRES  
have been recruited to host on-farm  
recharge demonstration trials

Almond Board has funded  
**OVER 200 WATER RESEARCH  
PROJECTS SINCE 1982**



1. California Department of Water Resources. California Water Plan Update 2013: Volume 3, Chapter 2. 2. California Almond Sustainability Program. August 2017. 3. Land IQ. Groundwater Recharge Suitability Analysis. November 2015. 4. University of California, 2010. Food and Agriculture Organization of the United Nations, 2012. Almond Board of California, 1990–94, 2000–14.

### ON-FARM RECHARGE

Groundwater is a vital resource in California, held in underground aquifers that are collectively California's largest water storage system. In addition to surface water, which is moved around the state via rivers, aqueducts, reservoirs and canals, groundwater plays an important role in growing food and providing drinking water for Californians.

Overreliance on groundwater means that many of the state's aquifers are under pressure. That's why, in 2015, Almond Board launched an initiative to explore to what

extent almond orchards can be used to replenish underground aquifers. A number of orchard research trial sites are being flooded with excess winter storm water to determine how recharge may affect orchard health, water quality and other factors.

Water recharged through this program would benefit all Californians, not just farmers. Research findings will be used to develop best practices for almond farmers to participate in on-farm recharge and promote groundwater sustainability.



*"These aquifers are a shared resource between farmers, families and businesses, so the act of replenishing them through recharge brings benefits to a much wider community, including cities and urban areas. My hope is that when the next drought comes, we will have made fundamental changes to our water infrastructure for the better."*

— Nick Blom, second-generation almond farmer  
Modesto, California

**FARM PROFILE:** alfalfa, almonds, grapes, peaches, walnuts  
**ACRES OF ALMONDS:** 650

## SPOTLIGHT ON: Coproducts

California Almond farmers and processors have always taken responsibility for the crops' coproducts—hulls, shells and the tree itself—ensuring they're put to beneficial use rather than sent to landfill. A changing market for these materials has led Almond Board of California to focus research investment on new uses.

These innovations will bring value to the California Almond community and the local environment while contributing to zero waste and addressing greater needs across industries such as food, pharmaceuticals and automotive.

### MIMICKING MOTHER NATURE

Just like a tree falling in the forest provides nutrients to those around it, researchers are exploring the potential for recycling almond coproducts back into the soil and how that might affect orchard health.

- **WHOLE ORCHARD RECYCLING**, a process in which entire almond orchards are ground up at the end of their lives and the woody materials incorporated into the soil. Preliminary findings indicate this may return nutrients to the soil, increase water infiltration and storage<sup>1</sup> and slow the release rate of carbon dioxide, a greenhouse gas, into the atmosphere<sup>2</sup>.
- **BIOSOLARIZATION** (anaerobic soil disinfestation), which uses almond hulls and shells, water, tarps and the power of the sun to naturally deplete the soil of oxygen, making it inhospitable to key soil pests. Researchers hypothesize that this approach may lead to increases in soil fertility and decreased reliance on traditional soil pest control methods.

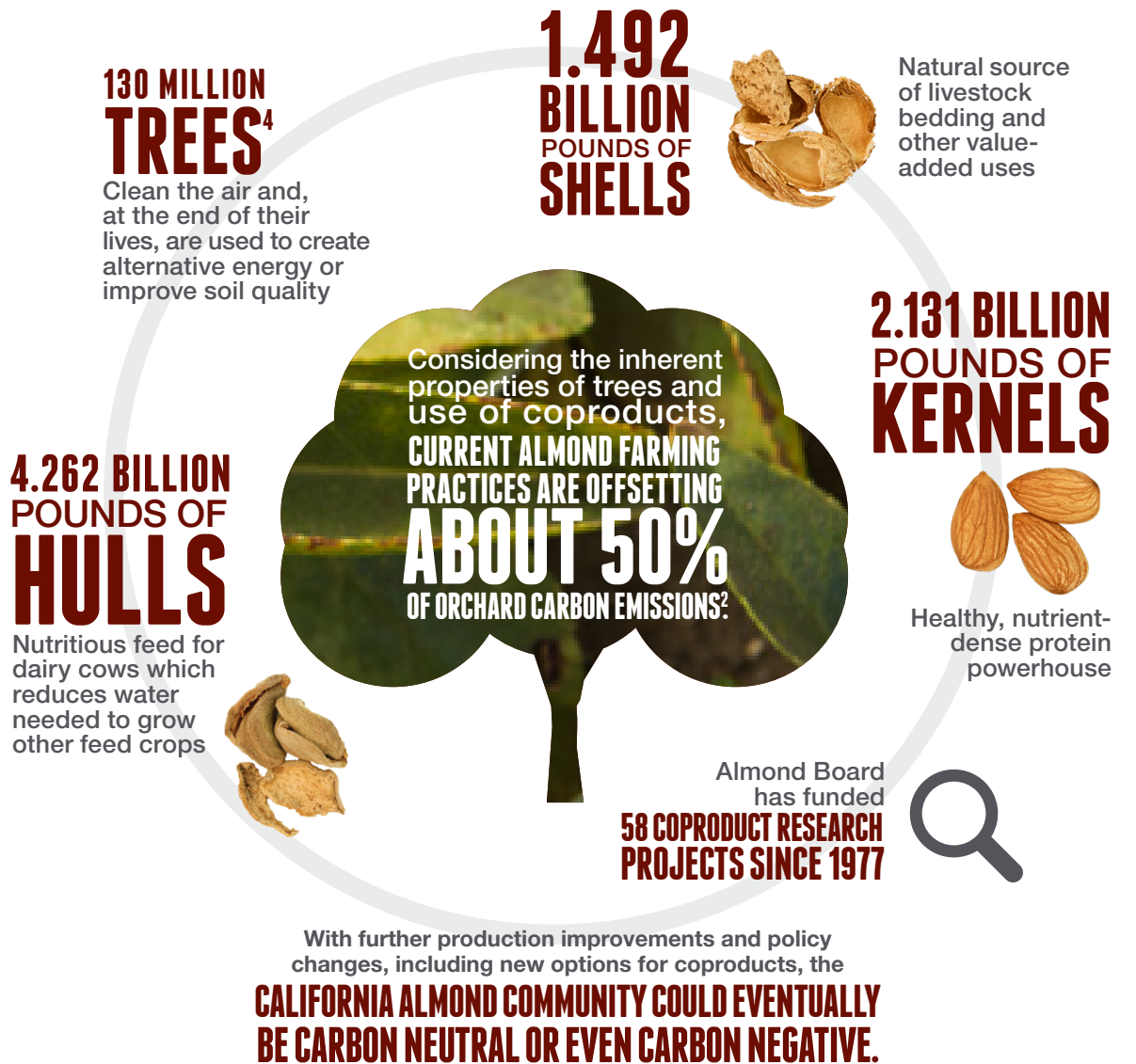
### A GENUINE BIOECONOMY

ABC is committed to innovative new uses of almond coproducts that can support California in creating a genuine bioeconomy where every byproduct is an input for another valuable product.

Research is underway investigating how components of almond hulls and shells can be transformed to provide value to other industries.

- **EXTRACTING** sugars from almond hulls to serve as fuel or a food ingredient, and the remaining fibrous material has value as an additive for foods, moisturizers, pharmaceuticals or even biochar.
- Through **TORREFACTION** (heating to controlled temperature), almond shells can be transformed to a charcoal-like product ideal for strengthening biodegradable plastics, such as tires, flower pots, garbage cans and more.

## IN 2016, CALIFORNIA ALMOND ORCHARDS GREW:<sup>3</sup>



1. 16-PREC3-Holtz. Almond Orchard Recycling. 2. Alissa Kendall, et al. Lifecycle-based Assessment of Energy Use and Greenhouse Gas Emissions in Almond Production, Part I: Analytical Framework and Baseline Results. *Journal of Industrial Ecology*, 2015. 3. Almond Board of California. Supplement to the Almond Industry Position Report. July 2017. 4. USDA-NASS. 2015 California Almond Acreage Report. April 2016. USDA-NASS. 2016 California Almond Objective Measurement Report. July 2016.



*“The Almond Board, in collaboration with our industry partners, are working every day to bring profitable, innovative solutions for coproducts back to growers and hullers/shellers. Having a robust economic outlook while remaining committed to environmental sustainability are not mutually exclusive, which is why I’m excited to be a part of this effort.”*

— Rory Crowley, second-generation almond farmer  
Chico, California

**FARM PROFILE:** almonds, walnuts

**ACRES OF ALMONDS:** 150



**SPOTLIGHT ON:**

# Bee Health and Pollination

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 workers and stored food to support a healthy start to their pollination season<sup>1</sup>.

Because of honey bees' essential role in almond production, Almond Board of California has invested more into honey bee health research than any other crop group<sup>2</sup>, and farmers have adopted voluntary measures to protect bees in the orchard and beyond.

## HELPING HIVES

The California Almond community is taking action in the orchard to support honey bee health during bloom and beyond.

## PROTECTING POLLINATORS

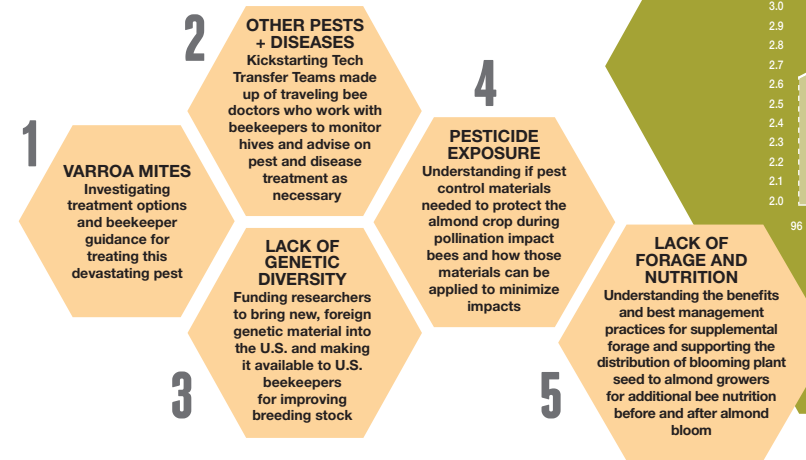
To help almond farmers achieve this goal, Almond Board of California, using research insights and in partnership with universities, government agencies, nonprofits and others, developed the Honey Bee Best Management Practices (BMPs) for California Almonds. The Bee BMPs provide key recommendations to everyone involved in the pollination process to make the orchard a safe and welcoming place for honey bees while balancing the need to protect the developing crop.

## GOING THE EXTRA MILE

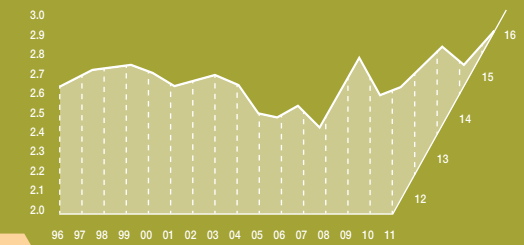
Working with honey bee research organization Project Apis m. and others, Almond Board encourages farmers to plant bee-friendly forage near almond orchards as additional food sources for honey bees before and after almond bloom. Beyond providing additional nutrition for honey bees and other pollinators, these plantings may help farmers improve soil health, water infiltration and more.

# THE BUZZ ON BEES

The decline in bee health has been linked to a variety of complex factors, including those influenced by beekeeping and crop production activities. This chart outlines those factors and how the California Almond community is helping address each area.



**THE NUMBER OF U.S. HONEY BEE HIVES IS AT A 20-YEAR HIGH**  
However, beekeepers still experience significant in-season losses and must work hard to maintain healthy apiaries.



**35%** of the world's food crops rely on pollinators to some degree

Almond Board has supported **113 RESEARCH PROJECTS** across all 5 MAJOR FACTORS impacting honey bees

Since releasing Bee BMPs in 2014, California Almond farmers have

**WIDELY ADOPTED VOLUNTARY PRACTICES TO PROTECT HONEY BEES<sup>4</sup>**

**94%** of farms coordinate with their beekeepers about what pest control materials may need to be used during bloom and how the beekeepers will be notified in advance

**93%** of farms provide clean water for bees to drink and cool themselves with while pollinating

Just like almonds are a nutritious snack for us, **ALMOND POLLEN** is very nutritious for honey bees, providing all 10 of the essential amino acids their diets require. Because of this, bee hives routinely leave stronger after visiting during almond bloom.<sup>5</sup>

1. USDA-ERS. Land Use, Land Cover and Pollinator Health: A Review and Trend Analysis. July 2017. 2. Gene Brandi. Vice President, American Beekeeping Federation. 3. USDA-NASS. Honey Production Report. 1996-2016. 4. California Almond Sustainability Program. Aug. 2017. 5. Ramesh Sagili. Department of Horticulture, Oregon State University.



*"I look at the relationship between beekeepers and almond farmers as symbiotic in many ways. Being a hobbyist beekeeper as well as an almond farmer enables me to see issues from both sides. Over the years, we have changed our farming practices and planted forage to promote bee health and nutrition because, at the end of the day, stronger hives can produce bigger crops."*

— Christine Gemperle, second-generation almond farmer Ceres, California

**FARM PROFILE:** almonds, beekeeping  
**ACRES OF ALMONDS:** 130



## MORE ON ALMOND SUSTAINABILITY AT:



### **Almonds.com/blog**

Regular posts about almond sustainability and more



### **@almondboard**

The latest sustainability updates in 140 characters or less



### **AlmondSustainability.org**

Detailed information about all areas of almond sustainability



### **Almonds.com/researchdatabase**

Reports from 40+ years of almond farming and environmental research



### **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

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