CCOF
FOUNDATION

ROADMAP TO AN ORGANIC CALIFORNIA

Benefits Report

2019

2016 CCOF Future Organic Grant Fund Recipient Jayne Miller at the UC Santa Cruz Center for Agroecology and Sustainable Food Systems.

PHOTO COURTESY OF CCOF

By CCOF Research Fellow Laetitia Benador, CCOF Director of Policy & Government Affairs Kelly Damewood, and CCOF Senior Outreach & Policy Specialist Jane Sooby

CCOF Foundation
Santa Cruz, CA
2019

Dedicated to the memory of Karen Klonsky, an agricultural economist and early supporter of organic farmers, who was the first to use statistics to paint a portrait of California's emerging organic sector.

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ABOUT THE CCOF FOUNDATION
The CCOF Foundation is a nonprofit organization that advances organic agriculture for a healthy world through training programs, scholarships, financial assistance, and educational campaigns. California Certified Organic Farmers (CCOF) is an organic certification agency and farmer-driven member organization that formed the CCOF Foundation in 2003 to support the next generation of organic producers. Today, the CCOF Foundation reaches thousands of producers, agricultural professionals, students, and consumers through its diverse programs and grant funds. For more information about the CCOF Foundation visit www.ccof.org/roadmap.

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METHODS
The authors reviewed relevant scientific literature from peer-reviewed academic journals, government agencies, and university agricultural studies with a focus on California-based research. Economic data was also drawn from select sources.

DESIGN & LAYOUT
Modern Species, LLC

Contents

Executive Summary

A rigorous body of research now demonstrates that organic agriculture provides evidence-based solutions to California's pressing economic, environmental, and social challenges. This report synthesizes the documented impacts of organic food and agriculture that were previously spread across government data, peer-reviewed studies, and other scientific literature. It finds that the organic sector contributes the following benefits to California and beyond:

- Creates opportunities for California farmers and food manufacturers because growth in organic food sales outpaces all other food sales in the United States.
- Provides a price premium to farmers and ranchers.
- Supports the next generation of American farmers seeking to establish viable businesses.
- Creates jobs, especially in California, the leader in organic agriculture and food sales.
- Stimulates local economies through local food sales.
- Reduces poverty rates and raises median household incomes.
- Mitigates climate change through practices that sequester carbon, lower energy usage, and reduce emissions.
- Protects soil and water quality by using soil-building practices that reduce erosion, prevent contamination of water bodies from runoff and nitrate leaching, and increase soil water holding capacity.

- Provides better living and working conditions for farmworkers and farmworker families through year-round employment and protection from routine exposure to synthetic pesticides.
- Protects pollinators that are key to sustaining a healthy food supply.
- Protects public health in rural and urban communities by reducing environmental and dietary exposure

Organic orchard in full bloom near the breathtaking Sierra Nevada mountains.

PHOTO COURTESY OF Abundant Harvest Organics, Fresno County, CA

to synthetic pesticides, antibiotics, and hormones.

- Produces fruits and vegetables high in nutrients like antioxidants, as well as meat and dairy with beneficial fatty acid profiles.
- Creates a sustainable global food supply by preserving natural resources while growing productive crops that are resilient to extreme weather conditions.

Overall, the science demonstrates that organic agriculture can sustainably feed the world's growing population while promoting public health and prosperity.

Foreword

The *Benefits Report* is revolutionary.

The magnitude of benefits documented in this report will inspire producers, consumers, advocates, and policy makers to act in thoughtful, new ways to create a healthier and more prosperous world through advancing organic agriculture.

The *Benefits Report* is the most recent and comprehensive compilation of peer-reviewed research and scientific data on organic agriculture. It is written and designed by a project team that reflects a new generation of talented and disciplined thinkers who will carry forth the research, knowledge, and passion long established in the organic community.

As the next part of this project, we will engage with a broad group of stakeholders to design a policy agenda for California policy makers and stakeholders to grow organic agriculture and provide solutions to pressing social, economic, and environmental challenges.

CCOF, an organization governed by the people who grow and make our food, was formed nearly a half-century ago — when organic food was hard to find — to advance organic agriculture. Today, organic food is everywhere, yet organic is less than 4% of agricultural land in California.

Let's move forward during the next half century to change that and realize the benefits of an organic California.

Cathy Calfo
CEO, CCOF

Organic dairy goats grazing cover crop builds healthy pasture soils while providing nutritious milk.

PHOTO COURTESY OF White Oak Farm, Williams, OR

Introduction

Organic may have started as a small grassroots movement in the 1970s, but today it is a multibillion-dollar worldwide market. With the introduction of the USDA certification and enforcement program in 2002, organic food sales grew exponentially. The growth of organic now outpaces all other sectors of the food industry with sales increasing from $3.6 billion in 1997 to $50 billion in 2017. Today, organic food is carried by all major retailers, and 82% of U.S. households purchase organic food and beverages.

But despite high demand and the booming marketplace, organic remains just 4% of California's agricultural land. This percentage is astonishing considering that California is not only the leading agricultural state, but it is also the leading organic state with the highest volume of organic crops and a multibillion-dollar organic processing sector.

The current discrepancy between consumer demand and organic production in California is a missed opportunity for policy makers seeking bipartisan solutions to the state and nation's economic, environmental, and social challenges. The scientific literature shows that organic stimulates California's economy, ensures a long-term food supply that promotes public health, and protects the natural resources that humans depend upon for nourishment and safe living conditions.

So how do we convey the importance of organic to our state and national leaders? How do we maximize the benefits of organic agriculture? How do we direct the organic sector towards solving our state and nation's pressing economic, environmental, and social challenges?

The *Roadmap to an Organic California: Benefits Report* is the first step in offering organic as a solution. It synthesizes the well-documented benefits of organic food and agriculture that were previously spread across government data, peer-reviewed journals, and other scientific literature. Policy makers, community leaders, and non-governmental organizations can use the benefits explained here to inspire their next campaign — whether it be to spur economic growth, protect environmental resources, or improve the socioeconomic conditions of vulnerable populations.

While the *Benefits Report* is the first step in offering organic as a solution, the next step will be the most important step yet — CCOF will convene diverse stakeholders and identify policies to increase organic acreage from 4% to 10% of agricultural land by 2030. This comprehensive policy agenda for organic agriculture will be published as *Roadmap to an Organic California: Policy Report* in January 2020.

CCOF is ready for an organic California, but we cannot do it alone. A project of this magnitude takes collaboration, dedication, and perseverance. **Will you join us?**

USDA Organic: It's More than a Label, It's the Law

Any agricultural product sold, labeled, or advertised as organic in the United States must be produced in compliance with the federal Organic Foods Production Act of 1990 and the U.S. Department of Agriculture (USDA) National Organic Program (NOP).[1]

The National Organic Standards

NOP sets and enforces federal organic standards — which are also known as NOP standards or "the organic standards" — for organic crop and livestock production, food manufacturing, labeling, certification, and materials.

Key standards include:

- Organic crop and livestock production must maintain soil quality and avoid contamination of natural resources by fertilizers and other inputs.
- Producers may not give animals hormones to promote growth or administer any drug in the absence of illness. If an animal falls sick it must be treated with antibiotics and cannot be sold as organic.
- Land used in certified organic production must undergo a three-year transition phase with no prohibited materials applied to it before it can be certified organic.
- Genetically modified crops are not allowed in certified organic production or in organic animal feed.
- All field operations and materials applied must be recorded and all products must be traceable back to the fields in which they were grown.
- Organic processed food may only include approved processing aids and additives.
- Organic operations must submit an organic system plan annually to their certifier for review and approval. Every operation is inspected at least once every year.

Soil Quality Standards

- Must implement tillage and cultivation practices that maintain or improve the physical, chemical, and biological condition of soil and minimize soil erosion.
- Must maintain or improve soil organic matter content (a key measure of soil health).
- Must avoid contamination of soil by fertilizers and other inputs.

Source: Soil fertility and crop nutrient management practice standard. (2018). U.S. Government Printing Office, Electronic Code of U.S. Federal Regulations, Title 7, Subtitle B, Chapter I, Subchapter M, Organic Foods Production Act Provisions Part 205. 7 CFR §205.203. Retrieved from https://www.ecfr.gov/cgi-bin/text-idx?SID=8068d639c730bc61c19a7e4ba58a5b0b&mc=true&node=se7.3.205_1203&rgn=div8

Organic Livestock Standards

- Fed an all-organic diet free of antibiotics and hormones.
- Ruminants required to graze on organic pasture at least 120 days a year.
- Year-round access to the outdoors, fresh water, clean air, shelter, and exercise areas.

Source: Livestock health care practice standard. (2018). U.S. Government Printing Office, Electronic Code of U.S. Federal Regulations, Title 7, Subtitle B, Chapter I, Subchapter M, Organic Foods Production Act Provisions Part 205, Subpart C, §205.238. Retrieved from https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=e5f6fa6eed887c3ad28f21f4068e1e51&rgn=div8&view=text&node=7:3.1.1.9.32.3.354.12&idno=7

Materials Allowed in Organic Production

In general, nonsynthetic i.e. natural substances are allowed and synthetic substances are not allowed in certified organic production. NOP carefully reviews and allows some synthetic materials, which are set forth in federal regulation under The National List of Allowed and Prohibited Substances.[2] NOP may add additional restrictions to allowed materials, and it must review every material on the National List every five years.

NOP reviews materials on the National List in coordination with the National Organic Standards Board (NOSB), a federal advisory committee made up of farmers, handlers, consumers, environmental representatives, scientists, and other stakeholders. The NOSB meets twice annually to review materials on the National List with the following criteria:

- The substance cannot be produced from a natural source and there are no organic alternatives.
- Manufacture, use, and disposal of the substance do not have adverse effects on the environment.
- The substance or its breakdown products do not have adverse effects on human health.
- The substance is generally recognized as safe by the U.S. Food and Drug Administration.[3]

The USDA Organic Certification Process

NOP accredits organic certification agents to certify compliance with the federal organic standards. Organic certification agents review and approve organic system plans, conduct annual on-site inspections, verify recordkeeping, and analyze crop samples to verify no prohibited materials were applied. Producers must immediately notify their certifier of any application, including accidental drift, of a prohibited material or a change in production practices that may impact compliance with the organic standards. If a producer is not in compliance with NOP standards, then the certifier must alert NOP, issue a noncompliance, and evaluate actions taken to correct the noncompliance.

The California State Organic Program

California is the only state with a state law and program designed to support NOP enforcement. The California State Organic Program works with agricultural commissioners throughout the state to regularly inspect farmers' markets, retail outlets, and production facilities. It also conducts pesticide residue testing and quickly addresses complaints and compliance issues. If an operation fails to correct a noncompliance, its certification could be suspended or revoked.

Synthetic Pesticides for Crop Production

Misiewicz, T., & Shade, J. (2018). Organic agriculture: reducing occupational pesticide exposure in farmers and farmworkers. Retrieved from The Organic Center: https://www.organic-center.org/wp-content/uploads/2018/09/Reducing-Occupational-Pesticide-Exposure.pdf

Synthetic Drugs for Livestock Production

Source: Organic Trade Association. (n.d). National list of allowed and prohibited substances. Retrieved from https://www.ota.com/advocacy/organic-standards/national-list-allowed-and-prohibited-substances

Food Processing Aids and Additives for Food Production

Sources: Nonagricultural (nonorganic) substances allowed as ingredients in or on processed products labeled as "organic" or "made with organic (specified ingredients or food group(s). (2018). U.S. Government Printing Office, Electronic Code of U.S. Federal Regulations, Title 7, Subtitle B, Chapter I, Subchapter M, Part 205, Subpart G, §205.605. Retrieved from https://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=9874504b6f1025eb0e6b67cadf9d-3b40&rgn=div6&view=text&node=7:3.1.1.9.32.7&idno=7#se7.3.205_1605

Overview of food ingredients, additives & colors. (2010). International Food Information Council and U.S. Food and Drug Administration. Retrieved from https://www.fda.gov/food/ingredientspackaginglabeling/foodadditivesingredients/ucm094211.htm

Organic artichokes.

PHOTO COURTESY OF Ocean Mist Farms, Monterey County, CA

SECTION 1

Organic Farming Helps the Economy

The thriving organic marketplace creates business opportunities for California's farmers and food manufacturers as well as the next generation of American farmers. Data shows that the organic sector creates jobs, contributes to local economic development, and reduces poverty rates while raising median household incomes. These benefits are especially pronounced in California, the nation's leader in organic agriculture and food production.

Creating Opportunity for California Farmers and Food Manufacturers

Supporting the Next Generation of American Farmers

Creating Jobs

Stimulating Local Economies

Reducing Poverty Rates

2017 CCOF Future Organic Farmer Grant Fund Recipient Emilio Otoniopa, student in the Farmer Education Course at Agriculture and Land Based Training Association (ALBA).

PHOTO COURTESY OF CCOF

Creating Opportunity for California Farmers and Food Manufacturers

Demand for Organic Products Drives Food and Farm Sales in California

Organic creates business opportunities for California farmers because organic leads growth in U.S. food sales — in 2017, organic food sales grew by 6.4%, well above the 1.1% growth in all food sales.[4] California leads the nation in organic farms, acreage, and crop and dairy sales.[5] In 2016, California accounted for 38% of total organic farm sales in the United States.[6]

California food manufacturers are also taking advantage of demand for organic products. In 2017, the gross value of organic processed foods in California was $11.65 billion, representing 17% growth from 2016.[7] This is a significant contribution to California's third largest manufacturing sector — food and beverage processing — valued at $25.2 billion in 2012.[8] Combined with the $2.9 billion value of organic agricultural commodities, organic produced $14.55 billion in gross sales in California in 2017.[9]

Farmers in California and throughout the United States have opportunities to increase organic farm sales to meet domestic demand for organic products.[10] The United States is the largest organic market in the world,[11] and in 2016 the United States imported $1.65 billion of foreign organic products.[12] While the majority of organic imports are products like bananas and coffee[13] that are not commonly grown in the United States, other organic imports include crops and products commonly produced in the United States like organic beef,[14] grains, and nuts.[15]

California farmers also have the opportunity to meet worldwide demand for organic products. Currently, organic exports are primarily to Canada and Mexico and to at least 104 different countries.[16] While organic export data is imperfect due to a lack of tracking codes, current government data shows that the most commonly exported crops — apples, lettuce, grapes, spinach, and strawberries[17] — are also commonly grown in California.

Organic Prices Support Farm Viability

In addition to demand, organic crop and livestock prices support the viability of California farmers. With 20% higher average crop prices,[18] organic price premiums contribute to profitable organic farms across the nation

and have been an important incentive for farmers to transition to certified organic production.[19, 20, 21, 22, 23] Studies show that ethnically, economically, and generationally diverse consumers will regularly pay a premium for organic products.[24, 25] Today, over eight in ten adult consumers in the United States buy organic products.[26]

Organic Agriculture Produces Competitive Crop Yields

On-farm research trials show that organic fruit,[27] vegetable,[28] grain,[29] and forage[30, 31] yields are comparable to conventional yields when organic farmers build long-term soil fertility[32] and use diversification practices such as crop rotation and multi-cropping.[33] In numerous research trials, organic yields are equivalent to and even surpass conventional yields.[34, 35, 36, 37, 38] Researchers attribute lower yields on working organic farms,[39] especially new or transitioning farms,[40] to gaps in knowledge about organic practices and adjustments to non-chemical management.[41] Yields typically increase when farmers learn better weed management techniques[42] and refine organic practices such as crop diversification, crop rotation, and cover cropping.[43, 44, 45] Numerous scientists conclude that with increased organic research and grower education, organic agriculture can produce highly competitive yields.[46, 47, 48]

Supporting the Next Generation of American Farmers

Demand for organic, as well as better crop prices, are two especially important factors for the next generation of American farmers who will help ensure a stable domestic food supply. The nation's farmer population is aging rapidly,[49] and the USDA reports 20% fewer beginning farmers in 2012 compared to 2007.[50] Proportionally more new and beginning farmers — farmers who have been the principal operators of their farms for ten years or less[51] — are starting organic farms than are starting conventional farms.[52] In California, 32% of organic farmers are beginning farmers compared to 26.5% in agriculture generally.[53] In addition, organic farmers report needing less off-farm employment than conventional farmers to supplement their income, even while they farm fewer acres.[54]

Creating Jobs

As a nearly $50 billion sector of the U.S. economy,[55] organic farms and businesses create jobs throughout the supply chain. In 2017, 42% of organic businesses hired additional employees,[56] while only 7% reported having reduced employment.[57] Agricultural economists calculate that areas with high levels of organic activity are associated with higher labor force participation rates[58] and lower county-level unemployment rates.[59] By applying a multiplier of 28,000 jobs for every $1 billion in retail sales[60] to California[61, 62] and national organic sales data,[63] the organic sector now creates an estimated 407,400 jobs in California and 1,383,200 jobs nationally.

EMPLOYERS IN THE ORGANIC SECTOR INCLUDE:

- ✓ Organic farms and ranches
- ✓ Distribution companies
- ✓ Organic certification companies
- ✓ Input suppliers
- ✓ Food manufacturers
- ✓ Retailers

The Impact of Organic in Sacramento

FARMERS SELLING DIRECTLY TO CONSUMERS IN SACRAMENTO

29 JOBS FOR EVERY **$1m** PRODUCED

FARMERS SELLING DIRECTLY TO CONSUMERS OUTSIDE OF SACRAMENTO

10.5 JOBS FOR EVERY **$1m** PRODUCED

A UC Cooperative Extension study in the Sacramento region found that 71% of farmers who sold directly to consumers through farm stands and farmers' markets, called "direct marketers," farmed organically. Farmers who sold directly to consumers generated twice as much local economic activity as farmers selling through retailers and significantly more than local businesses like automobile, building supply, and garden retail centers.[79]

Direct marketers generated $86 of additional economic activity in the Sacramento region for every $100 in sales while non-direct marketers generated $42 per $100 of sales.[80] Direct marketers also generated 29 jobs within the Sacramento region for every $1 million dollars of production. In comparison, farmers who did not sell their products within the Sacramento region created only 10.5 jobs for every $1 million dollars of production.[81]

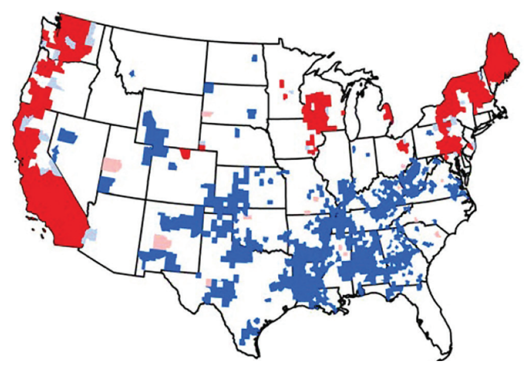
Stimulating Local Economies

Organic farms have a proportionally higher impact on local economies than conventional farms through local food sales. While only 5.5% of the 2.1 million farms in the United States sell directly to consumers,[64] 39% of organic farms direct-market to consumers.[65, 66] Studies show that local food sales can contribute more to local and regional Gross Domestic Product (GDP),[67] which is the most commonly used metric of economic performance,[68] than non-local food sales.[69] Farms that sell locally buy most of their inputs and services from nearby businesses and have proportionally higher local labor expenditures,[70] which recirculates dollars within the community[71] and generates downstream employment.[72, 73]

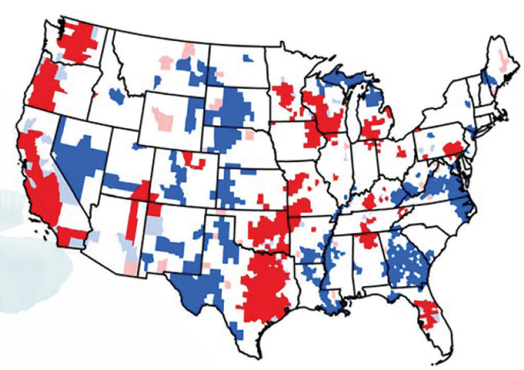
As referenced above, a study of the Sacramento, California region found that the local economy benefited more from direct sales through farmers' markets and farm stands than from non-direct sales through grocery stores, restaurants, or other distribution outlets.[74] Farmers selling locally tended to buy more local inputs, which generated increased revenue for businesses in the community.[75] Examples of regional sales include direct-to-consumer channels like farmers' markets, farm stands, and Community Supported Agriculture (CSA) programs[76, 77] and direct-to-institution channels like farm-to-school programs.[78]

Organic Production Hotspots vs. General Agriculture Hotspots, 2009

Hotspots Coldspots Outlier Outlier



ORGANIC PRODUCTION HOTSPOTS 2009



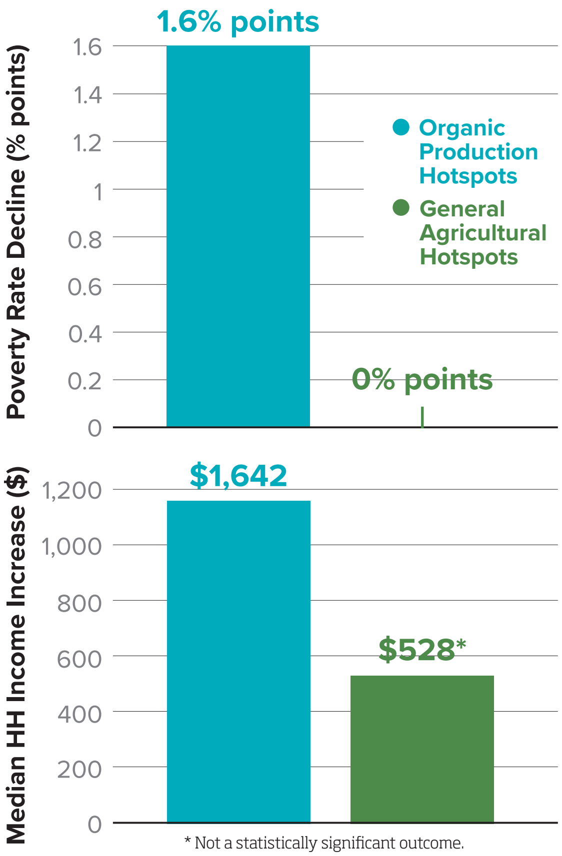
GENERAL AGRICULTURE HOTSPOTS 2009

GRAPHICS COURTESY OF
Edward C. Jaenicke & Organic Trade Association

Pastured poultry grazing in organic orchard.

PHOTO COURTESY OF Chino Valley Ranchers in Colton, CA

Organic Hotspots Impact vs. General Agricultural Impact on Poverty Rates and Household Income, 2009



* Not a statistically significant outcome.

Source: Marasteanu, I., & Jaenicke, E. (2018). Economic impact of organic agriculture hotspots in the United States. *Renewable Agriculture and Food Systems*, 1-22.

Reducing Poverty Rates

Agricultural economists have found that organic hotspots — counties with high levels of organic agricultural activity whose neighboring counties also have high organic activity — lower county poverty rates by as much as 1.6 percentage points and raise median household income by over $1,600.[82] By contrast, general agricultural hotspots do not affect poverty rates or household income.[83] The study found that these effects were not due to initial higher household income.

Another study of USDA data finds that areas with clusters of organic businesses have 4% lower county poverty rates and $9,000 higher median incomes than areas with few organic businesses.[84] California has numerous hotspots throughout the state, which suggests its communities are benefiting from the state's high levels of organic activity and farming.[85]

Why do consumers buy organic?

Consumers cite numerous reasons for choosing organic over conventional foods including avoiding toxins from pesticides, hormones, and antibiotics;[86] the perception that organic food is higher quality; alignment with consumers' values;[87] and to avoid highly processed foods and artificial ingredients.[88] Consumers in the United States also choose to eat organic food out of a desire to know where food comes from and for transparency in the supply chain,[89] which is provided by the rigor of the USDA organic certification process.[90]

Parents specifically cite concern for the health of their children as a top reason to buy organic and they ranked baby food as the most important food to buy organically.[91]

- ✓ Avoiding toxins from pesticides, hormones, and antibiotics
- ✓ Alignment with consumers' values
- ✓ Avoiding highly processed foods and artificial ingredients
- ✓ Knowing where food comes from
- ✓ Children's health

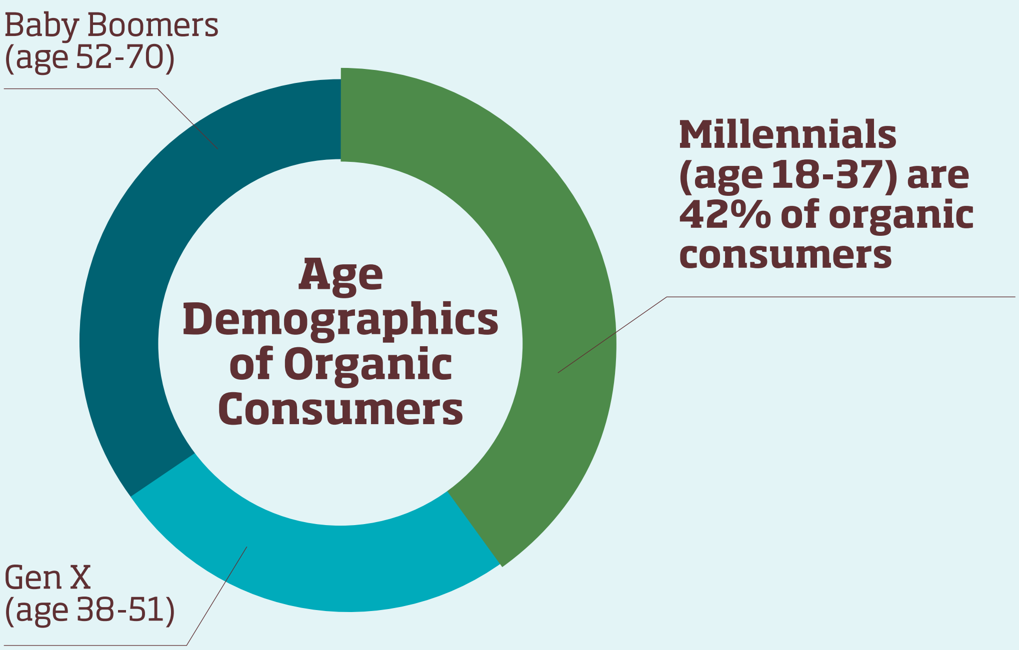
Organic demand is expected to grow as more Millennials, the largest group of organic buyers in the United States, become parents because they prioritize organic foods for their families.

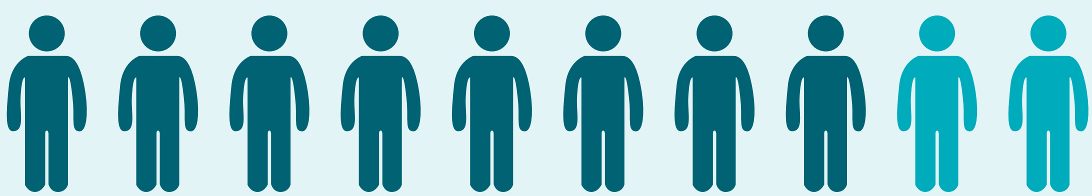
Who buys organic food?

Organic food is now mainstream — organic products are available at nearly three out of four grocery stores nationwide, making it more available and affordable than ever before.[92] Today the majority of Americans purchase organic food.[93]

Organic consumers are comprised of 42% Millennials (age 18–37), 26% Gen Xers (age 38–51), and 32% Boomers (age 52–70). The majority of organic consumers make under $80,000 per year (31% make less than $40K; 31% make $40–79K per year),[94] reflecting national trends showing that 60% of Americans make less than $75,000 per year.[95]

The organic sector is expected to remain stable or grow as generations who are conscious about health and the environment prioritize purchasing organic food for their families, especially their children.[96] Organic demand is expected to grow as more Millennials, the largest group of organic buyers in the United States, become parents because they prioritize organic foods for their families.[97]





Eight out of ten (82%) Americans **buy organic food.**

Analysis of sales data by The Hartman Group

Hedgerows planted around organic vegetable fields provide food and shelter for pollinators, beneficial insects and birds.

PHOTO COURTESY OF CCOF

SECTION 2

Organic Farming is Good for the Environment

Balanced farm ecosystems are at the heart of organic agriculture. By using practices that build soil health and increase biodiversity, organic producers cultivate resilient crops and livestock. Organic farming practices mitigate climate change, conserve water, and protect natural resources from pesticide drift and runoff. Organic farms are also healthy habitats for insects and animals that control pests and pollinate the fruits, vegetables, and nuts consumed by humans at almost every meal.

Mitigating Climate Change

Protecting Soil and Water Quality and Conserving Water Resources

Supporting Biodiversity and Protecting Pollinators

Grass-fed organic cows grazing on organic pasture.

PHOTO COURTESY OF Alexandre Family Farm, Humboldt County, CA

Mitigating Climate Change

Organic Crop and Livestock Production Sequester Carbon

University of California scientists identify climate change as a major threat to California's agriculture.[113] Their in-depth 2018 review of climate science recommends practices commonly implemented by organic farmers such as crop diversification and cover cropping because these practices mitigate climate change by creating healthy soils.[114]

Organic crop and livestock production practices build long-term soil fertility, creating healthy soils that can store increased levels of nutrients, including carbon.[115] The Rodale Farming Systems Trial, which is the longest running organic comparison study in the United States, documented that after 22 years, soil organic carbon increased by 15-28% in organically managed soils compared to 9% in the conventionally managed soils.[116]

At UC Davis's Long-Term Research on Agricultural Systems (LTRAS) study, researchers found that after 10 years, organic systems resulted in 14 times the rate of carbon sequestration as the conventional system.[117] After 20 years, organically managed soils sequestered significantly more soil organic carbon than conventionally managed soils.[118]

An extensive 2017 study comparing soils from 659 certified organic farms and 728 conventional farms found that organic farms across the United States consistently sequester more carbon than conventional farms.[119] Globally, evidence shows that organically managed soils hold significantly higher carbon and have higher rates of carbon sequestration than soil from non-organic systems.[120]

Organic meat and dairy production also can help mitigate climate change through grazing practices that capture and hold carbon in the soil. A wide spectrum of management practices and scales of operations exist in organic production,[121] so impact on soil carbon varies. However, all organic producers must graze ruminant animals on pasture for at least 120 days per year[122] while non-organic ruminants may be raised in confined feeding operations. Scientific evidence shows that grazing sequesters carbon in the soil,[123, 124] particularly under management-intensive grazing systems, which allow ruminants to graze for precise amounts of time in small, rotating pastures.[125]

Organic Farming Practices Use Less Energy

Energy use associated with agricultural inputs is generally lower on organic farms than on conventional farms because fossil-fuel-intensive synthetic pesticides and fertilizers are not allowed in organic production. In the United States, about 40% of energy used to produce crops and livestock is attributable to the energy used to manufacture synthetic fertilizers and pesticides.[134, 135] In contrast, organic farms use inputs that require less energy to produce such as composts, animal manures, and cover crops.[136]

A long-term USDA Agricultural Research Service (ARS) study found that organic production uses less energy compared to conventional because producing and transporting synthetic nitrogen fertilizers used in conventional production consumes more energy than the poultry litter used as nitrogen fertilizer in the organic system.[137]

Similarly, the 30-year report from the Rodale Farming Systems Trial shows that their organic systems used 45% less energy than the conventional systems and that energy efficiency was 28% higher in the organic compared to conventional systems.[138] Other studies

Measuring and Comparing Greenhouse Gas Emissions

Greenhouse gases (GHGs) have different warming effects in the atmosphere depending on their chemical structure and ability to hold heat. Scientists have developed a single unit, the CO_2 equivalent, to measure the warming impact of any gas relative to carbon dioxide. The value of CO_2 is set at one. Methane, a more powerful GHG, has a global warming potential of 25 CO_2 equivalents. Nitrous oxide, one of the most potent emissions from agriculture, equals 298 CO_2 equivalents. The CO_2 equivalents from any system can be summed to determine the global warming potential of that system.

indicate that organic farms that produce their own fertility through integrated crop-livestock systems, cover crops, or on-farm compost are more energy efficient than conventional farms.[139, 140, 141, 142]

Additionally, data from USDA's On-Farm Renewable Energy Production Survey shows that organic operations in California are more likely to install a small renewable energy system than the average California farm.[143]

Organic Farms Reduce Emissions

Microbial breakdown of both organic and synthetic fertilizers in the soil releases greenhouse gases (GHGs); nevertheless, numerous long-term studies show that the biological activity in organic soils makes organic farms overall sinks for GHGs.

UC Davis's LTRAS comparison study shows that after 13 years under organic management, organic plots under conservation and standard tillage stored 131% and 135% more carbon dioxide (CO_2) equivalents, respectively, than the corresponding conventional plots, which were net emitters of GHGs.[144]

These results are similar to those reported from the long-term ARS study at Beltsville that found lower energy use in the organic system.[145] In this study, no-till and conservation tillage conventional systems were net GHG emitters, while organic was a net GHG sink, even when adjusted for yield differences and accounting for energy used in tillage.[146] Analysis of five long-term grain cropping systems across the United States also concludes that organic systems release significantly fewer GHG emissions than conventional no-till grain production.[147]

Grazing-based organic livestock systems can make a significant contribution to climate change mitigation because two-thirds of California's agricultural GHG emissions come from intensive, non-pasture-based livestock operations.[148] The primary GHG associated with livestock production is methane, which is released by cows as they belch and is also released by microbes that decompose concentrated manure. Net methane emissions tend to be lower in pasture-based systems because the microbes that break down manure on pasture do not emit methane while the microbes that break down manure stored in lagoons do emit methane.[149] UC Davis scientists found that dairy cow and heifer manure on pasture emits minimal GHGs compared to lagoon storage, liquid slurry storage, and dry lot manure, which together account for 98% of dairy manure methane emissions in California.[150]

Another GHG released by agricultural practices is nitrous oxide (N_2O), which has 298 times the global warming potential of CO_2.[151] An evaluation of organically and conventionally managed soils at UC Davis show that conventionally managed soils release 56% more N_2O than organically managed soils.[152]

Protecting Soil and Water Quality and Conserving Water Resources

Organic Farming Reduces Soil Erosion

Soil erosion is a serious threat to food production in the United States and globally.[153] The newly released National Academies report, *Science Breakthroughs to Advance Food and Agricultural Research,* estimates that by 2030, widespread soil degradation will endanger food security, and makes the ominous prediction that, if no action is taken, the United States will run out of topsoil before the end of this century.[154]

Organic Farming Starts with Healthy Soils

Organic farmers build healthy soils as the foundation of a highly productive and sustainable food system by using fertility, pest control, and crop growing practices that cater to the specific conditions of their farmland.[98] Federal organic regulations require farmers to maintain or improve soil health,[99] and evidence from long-term comparison trials across the United States shows that organic practices significantly increase a major indicator of soil health, soil organic matter (SOM), even when tilled routinely for weed control (see callout box on tillage).[100, 101, 102, 103, 104]

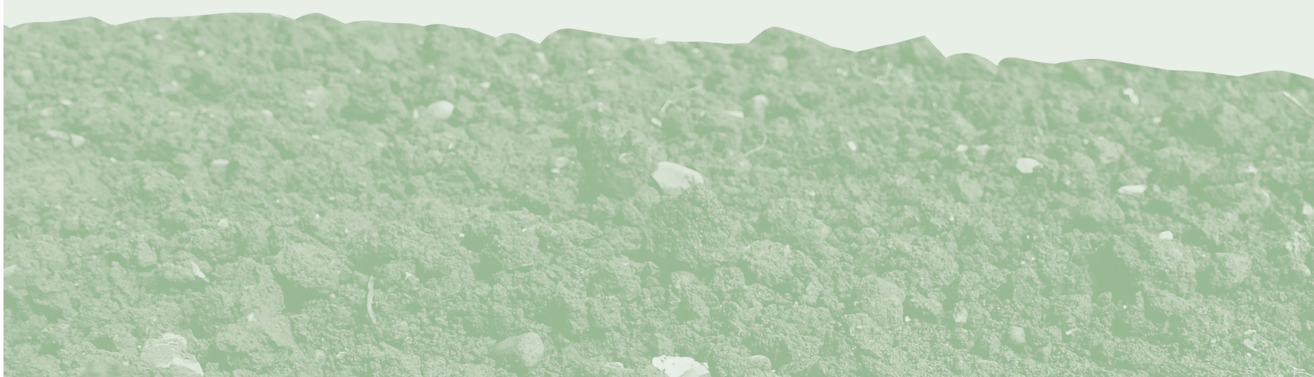
SOM is a complex of living microbes and decomposing plant and animal tissues.[105] Soil microbes break down organic fertilizers and plant residues, releasing some nutrients immediately to feed plants and storing the rest for slower release over time, building long-term soil fertility.[106] SOM plays a key role in holding soil particles together, improving soil structure.[107] Soils high in SOM can also absorb and store more water and nutrients, which reduces pollution from soil erosion and nutrient leaching.[108, 109, 110]

High levels of SOM allow soils to store (sequester) large amounts of carbon in the soil,[111] which reduces levels of the greenhouse gas CO_2 in the atmosphere.[112] Plants draw carbon dioxide from the atmosphere and combine it with water via photosynthesis to create the nutrients needed for plant growth as well as the oxygen we breathe. Carbon from the plants is stored in the soil when organic farmers incorporate crop residues.

Organic practices create fertile, water-absorbing, carbon-storing soils that protect natural resources and diverse living organisms and establish resilient, productive farms and ranches.

Benefits of Soil Organic Matter (SOM)

- ✓ Builds long-term fertility
- ✓ Reduces pollution from soil erosion and nutrient leaching
- ✓ Absorbs and stores more water and nutrients
- ✓ Holds carbon in the soil, which reduces CO_2 levels in the atmosphere
- ✓ Improves soil structure

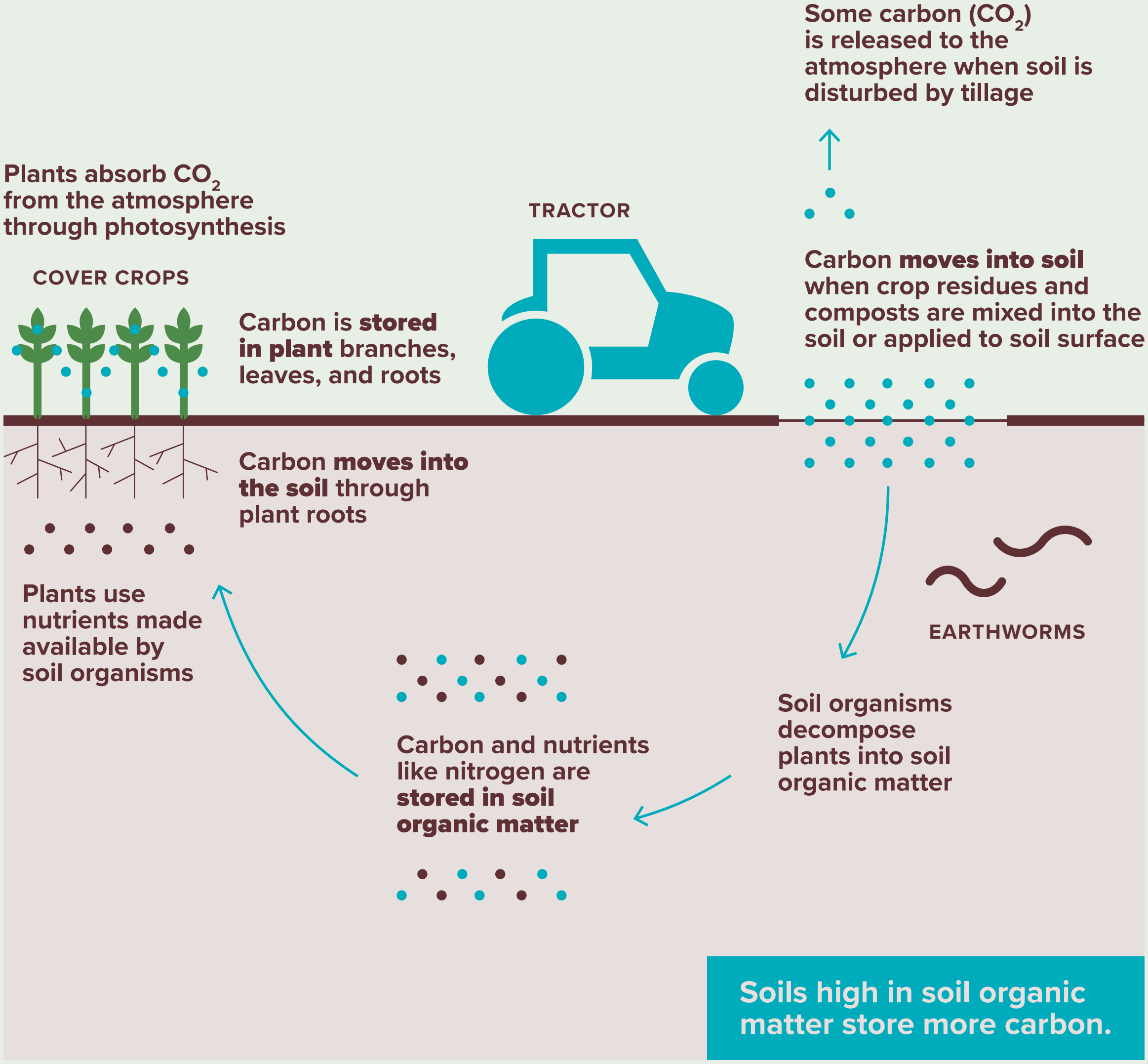


How Does Tillage Impact Organic Soil Quality?

Tillage is a method of preparing the ground for crops by digging, stirring, and overturning soil and weeds. Tillage mixes air into the soil which stimulates soil microbial activity, releasing carbon stored in the soil.[126, 127] Tillage can also deteriorate soil structure and soil quality.[128] Many organic farms use reduced tillage,[129] and organic farms effectively counter the negative effects of tillage by using a variety of organic soil-building practices.[130, 131, 132] As a result, organic farms store soil organic carbon and build soil quality even with routine tillage.

In one example, a six-year study on organic vegetable production in California's Salinas Valley found that despite intensive tillage, adding organic matter through annual cover cropping and compost applications increased soil health, as shown by increased overall soil microbial populations and levels of soil carbon in organic plots.[133]

How Do Healthy Soils Sequester Carbon?



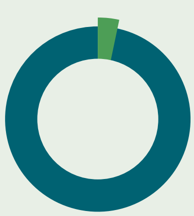
Organic rice fields provide habitat for sandhill cranes.

PHOTO COURTESY OF Massa Organics, Butte County, CA

Organic Farmers are Focused on Healthy Soils

Organic farms have higher participation than conventional farms in California Department of Food and Agriculture's (CDFA) Healthy Soils program. In 2018, 17 out of 64 (27%) of CDFA's Healthy Soils Incentives awards were made to certified organic farms, despite the fact that certified organic farms are only 3.5% of all farms in California.

27% of CDFA's Healthy Soils Incentives awards given to **certified organic farms**



3.5% of California's farms are organic

The federal organic standards require organic farmers to implement a crop rotation specifically to reduce soil erosion.[155] By increasing the diversity of crops grown in a rotation, organic farmers increase soil organic matter (SOM) levels,[156] which creates good soil structure[157] that absorbs water and prevents soil from blowing or washing away. Organic farmers also grow cover crops, which keeps the soil under vegetative cover for longer periods of time, preventing wind and water from carrying away topsoil.[158, 159]

Organic Farming Reduces Water Contamination by Agricultural Inputs

The federal organic standards specify that organic farmers must use practices that maintain or improve natural resources, including water quality.[160] Organic agriculture protects water quality by not using synthetic pesticides or fertilizers. Additionally, organic management improves soil structure to better retain water and nutrients and as a result, reduces leaching of fertilizers and pesticides into waterways.

Nitrate contamination of drinking water supplies is a significant problem in California. A UC Davis report commissioned by the California legislature showed widespread aquifer nitrate contamination in the Tulare Lake Basin and Salinas Valley, largely from fertilizers and animal manures applied to cropland.[161] The report documented that nitrates threaten drinking water quality for 2.6 million people in these regions of the state alone.[162]

Evidence shows that careful organic management can reduce nitrate leaching from farms. A Washington state study on organic, conventional, and integrated apple production showed that nitrate leaching was four to six times higher in the conventional than the organic plots.[163] A Michigan study comparing conventional and organic row crop production showed that, after 12 years, organically managed plots had 50% less nitrate leaching and over twice the nitrogen use efficiency (yield per unit of nitrogen fertilizer) as the conventional plots.[164] Similarly, an extensive Midwest study using high-level water monitoring systems found 50% fewer nitrate losses under organic grain production.[165] And while most studies focus on leaching from crop production, a 2008 study of dairy farms shows organic dairy production greatly reduced farm nutrient loss, including loss of nitrogen.[166]

At the same time, a significant challenge in organic nutrient management is timing nitrogen availability to crop need,[167, 168] which can lead to nitrate leaching, particularly during the rainy season.[169] However, a UC Davis study shows that well-managed certified organic farms have "tightly coupled" nitrogen cycling in the soil, which results in low soil nitrogen loss and high yields.[170]

Generally, organic farming is acknowledged by experts as an important strategy to reduce nitrate leaching.[171, 172] The UC Davis study documenting unhealthy levels of nitrate in California's groundwater recommends that research focus on replacing synthetic fertilizers with organic fertilizers, along with agricultural management practices that reduce nitrogen inputs and improve crop nitrogen efficiency.[173]

Organic agriculture also protects water from contamination by synthetic persistent pesticides. The U.S. Geological Survey found that no pristine streams remain in the Midwest: each sampled waterway was contaminated with at least 28 pesticides, negatively impacting algae and aquatic invertebrates.[174] Because organic farmers do not use persistent synthetic pesticides, they do not contribute to contamination of waterways by these harmful materials.

Organic Soils Conserve Water Resources

Organic agriculture conserves water resources by building soils high in organic matter that can better absorb and store water. Long-term comparison studies from across the country show that soils high in organic matter have better soil structure,[175] which increases water infiltration and water-holding capacity while reducing soil erosion and nutrient leaching.[176]

UC Davis's LTRAS study shows that, after 20 years, the organically managed soils absorb and retain water more efficiently than conventionally managed soils because organic soils have higher concentrations of soil organic matter.[177] Other studies that find increased water retention in organically managed soils include four trials in Nebraska reporting that, after 40 years, organic plots had 30–50% greater soil aggregation and ten times higher water infiltration than conventional plots.[178] In Pennsylvania, the Rodale Institute found that, under drought conditions, organic plots have higher corn and soy yields because the organic fields have higher water retention rates.[179]

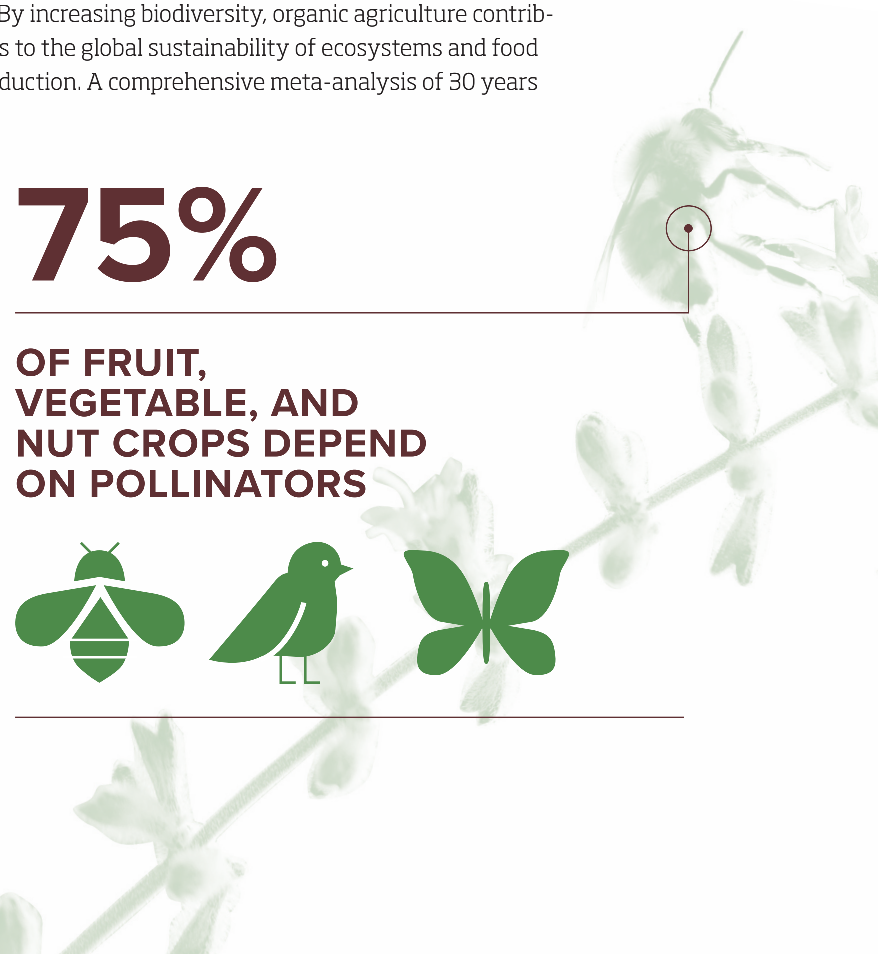
These studies show that organic soils can better use rainwater by absorbing and storing higher amounts of water in the soil, which increases water availability during dry weather and prevents soil and nutrients from being washed away from the farm.

Supporting Biodiversity & Protecting Pollinators

Organic Farming Practices Increase Biodiversity on Agricultural Land

Agriculture is one of the biggest drivers of biodiversity loss worldwide.[180] Scientists report that the loss of biodiversity, which is seen in the alarming rates of species extinction,[181] endangers the capacity of ecosystems and farms to support long-term food production.[182, 183] Fostering robust populations of diverse plants, animals, insects, and soil-dwelling organisms is a fundamental principle of organic production.[184] Organic farmers are required to implement practices that maintain or improve biodiversity on their farms.[185]

By increasing biodiversity, organic agriculture contributes to the global sustainability of ecosystems and food production. A comprehensive meta-analysis of 30 years



A beneficial organism is an animal, plant, insect, or soil-dwelling organism that contributes to plant growth. Beneficial organisms include natural pest enemies, which prey on crop pests, and pollinators.

of research concludes that organic farming increases biodiversity by 30% compared to conventional farming.[186] Similarly, another comprehensive meta-analysis shows that organic farming significantly increases populations of beneficial insects, birds, and soil-dwelling organisms, as well as non-bird vertebrates (mammals, reptiles, etc.) and plants.[187]

Organic Farming Reduces Pests and Pesticide Use

Organic farming practices support diverse populations of beneficial birds and insects that prevent and control pest outbreaks, thereby reducing reliance on pesticides.[188, 189, 190, 191] Since organic farmers do not use synthetic pesticides, they aim to create farms with a healthy balance of plants, animals, and microbes to regulate pests, as in a natural ecosystem.[192]

Extensive global analyses demonstrate that organic farms support higher populations of beneficial insects and bird species than conventional farms. Organic farms host on average 50% more organisms than conventional farms,[193] particularly natural pest enemies and pollinators.[194, 195] Without the use of synthetic pesticides, organic farms successfully control pests at the same rate as conventional farms,[196] without increasing pest populations.[197] To illustrate this, a study of 29 small organic farms in northern California found that the common practice of planting hedgerows on organic farms attracted birds that rapidly responded to an outbreak of caterpillars — the birds ate on average 80% of the caterpillars within seven hours.[198]

Increased biodiversity not only benefits the farm but also surrounding landscapes. A recent study found that increased agricultural land in organic production increased the diversity and abundance of tachinid parasitoids, a beneficial insect species that preys on crop pests.[199] Agricultural areas with more land in organic production had 42% more tachinids than areas with more land in conventional farms, benefitting all farms in the area through increased pest control.[200]

Finally, an important meta-analysis found that organic farms in the United States have higher populations of natural pest enemies than conventional systems, providing adequate pest suppression without the use of synthetic pesticides.[201] In this study, organic potato fields in Washington had 18% lower pest densities and 35% larger plants, showing that natural enemies on organic farms successfully controlled potato pests, resulting in healthier plants.[202]

ORGANIC FARMS IN THE U.S PROVIDE ADEQUATE
PEST SUPPRESSION WITHOUT THE USE OF SYNTHETIC PESTICIDES.

Organic Farms Protect Pollinators

Organic farming practices, such as plant diversification and the exclusion of synthetic pesticides, provide safe haven for pollinators. Pollinators such as honeybees, native bees, bats, butterflies, and moths are critical to food production because 87% of all flowering plant species and 75% of fruit, vegetable, and nut crops depend on pollinators to produce fruits or seeds.[203]

Honey and native bee pollination services are valued at $15 billion per year in the United States[204] and $190 billion worldwide[205] because their irreplaceable services play a critical role in global food security. For instance, a UC Berkeley study found that native bee populations on organic farms could provide 50–100% of pollination needs for an organic watermelon crop, while conventional farms

Vernon Peterson uses ladybugs to control pests in his organic orchard.

PHOTO COURTESY OF Abundant Harvest Organics, Fresno County, CA

needed to purchase supplemental pollination services because they received no pollination from native bees.[206]

One of the biggest threats to bees is neonicotinoid pesticides, which are neurotoxicants that target receptors in insect nervous systems.[207] Neonicotinoid exposure impairs foraging ability,[208] growth and reproduction,[209, 210] and motor skills,[211] leading to weaker colonies. Furthermore, a number of studies demonstrate that exposure to multiple pesticides, even those considered safe for bees, can cause greater damage through combined synergistic effects.[212, 213, 214] Organic agriculture prohibits the use of synthetic pesticides like neonicotinoids, which prevents bees from being exposed to the toxic chemicals present in the pollen and nectar of crops grown using pesticides or pesticide-treated seeds.

Organic farms also support pollinators by growing a diversity of rotating crops,[215, 216] and permanent hedgerows.[217, 218, 219] Diverse crops and hedgerows provide safe habitat and a constant source of food for pollinators[220] which counters the problem of severely reduced pollinator forage and nesting resources.[221] Overall, evidence shows that organic farms increase pollinator abundance[222, 223] and safeguard these precious organisms that humans rely on to pollinate the crops that are consumed at almost every meal.

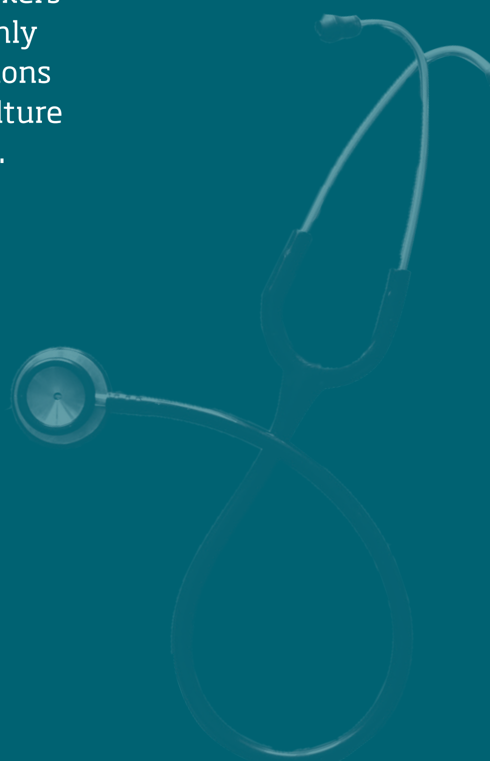
Organic cows.

PHOTO COURTESY OF Alexandre Family Farm, Humboldt County, CA

SECTION 3

Organic Farming Helps Society

By protecting and enhancing California's waterways, soils, air, and biodiversity, organic agriculture also protects and enhances the living and working conditions of urban and rural communities, especially farmworkers and their children. Organic agriculture produces highly nutritious crops resilient to changing climate conditions and resource constraints. As a result, organic agriculture ensures a secure food supply for future generations.



Protecting Public Health in Rural and Urban Communities

Organic Food is Highly Nutritious

Better Living and Working Conditions for Farmworkers

A Secure and Sustainable Food Supply

2015 Future Organic Farmer Grant Fund Recipient E.M. Downer Elementary School.

PHOTO COURTESY OF CCOF

Protecting Public Health in Rural and Urban Communities

Organic Agriculture Reduces Environmental Exposure to Synthetic Pesticides

Organic agriculture protects nearby rural and urban communities from exposure to synthetic pesticides that may persist in the air, water, and soil.[224] According to California Department of Pesticide Regulation data, residents in agriculture-intensive regions have 69 times the risk of poisoning from exposure to pesticide drift than other regions.[225] In California, boundaries between agriculture and residential areas are increasingly blurred—by 2003, researchers had already documented about 2.5 million acres of farmland within 0.33 miles of urban areas.[226]

The impact of exposure to synthetic pesticides is most severe for children because of their lower body weight and because they are in the early stages of physiological development.[227] Children are also at risk of increased exposures from playing outside and on the ground.[228] Childhood exposure to pesticides is linked to increased cognitive problems such as Attention Deficit Disorder (ADD),[229, 230] lower memory and intelligence,[231] and impaired neurobehavioral development,[232] as well as increased risk of diabetes[233] and asthma.[234] By prohibiting use of these pesticides, organic agriculture plays an important role in protecting children from harmful exposures.

Organic Agriculture Prevents Dietary Exposure to Synthetic Pesticides

Eating an organic diet prevents dietary exposure to pesticides such as organophosphates (OPs), which are allowed in conventional and prohibited in organic production.[239] OPs disrupt pests' nervous systems and can also disrupt human nervous systems when they are inhaled, ingested, or come in contact with the skin.[240] As the primary insecticide used for more than three decades,[241, 242] OPs have been detected in over 75% of the United States population.[243]

Studies show that OP levels, measured by metabolites in urine, quickly drop after starting an organic diet.[244, 245] Even diets composed partially of organic food can significantly decrease dietary exposure to pesticides.[246, 247]

A nationwide study of adult consumers found that those eating the least amount of organic produce had up to twice the amount of pesticide levels in their urine as those who ate organic the most frequently.[248] Children in non-agricultural households who eat organic diets are repeatedly found to have minimal to no pesticide residues in their urine compared to children who eat conventional diets.[249, 250, 251]

The federal organic standards not only prohibit synthetic pesticides, but they also protect consumers against inadvertent pesticide contamination. Although organic

crops can be accidentally exposed to prohibited materials from nearby conventional farms through irrigation water, dust, fog, or persistent pesticides applied to the soil before the farm was certified organic,[252] the federal organic standards require producers to protect their crops from contamination. Organic producers' practices to prevent inadvertent contamination of their crops is verified during annual on-site organic inspections and through mandatory random residue testing of crops in the field.[253]

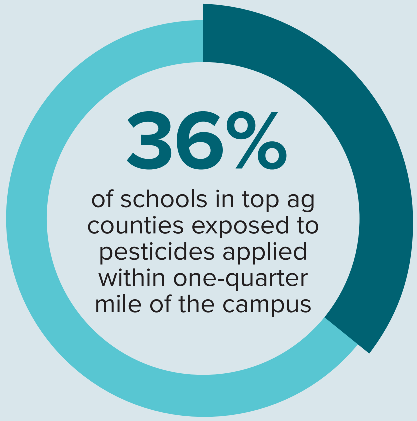
Government agency testing and peer-reviewed scientific studies overwhelmingly indicate that organic products have minimal residues compared to conventional products.[254, 255, 256, 257, 258] All products sold or labelled as organic must have less than 5% of the pesticide residue level allowed by the Environmental Protection Agency on conventional foods.[259]

Due to the potential adverse health impacts from dietary pesticide exposure, the U.S. Department of Health and Human Services President's Cancer Panel recommends that Americans decrease exposure to pesticides by switching to an organic diet.[260]

Organic Dairy and Meat Prevent Exposure to Antibiotics and Hormones

Widespread use of antibiotics in livestock production is a major cause of the global public health crisis of antibiotic resistance.[261] In confined animal production, antibiotics are commonly administered to healthy livestock in low doses for disease prevention,[262] and until recently were commonly used to promote animal growth.[263] As the largest

Organic Agriculture Protects Children from Pesticide Exposure at School



The California Department of Public Health (CDPH) published a study of 2,511 public schools in the 15 counties using the most agricultural pesticides in California.[235] It found that children in 36% of schools in these counties were exposed to agricultural pesticides applied within one-quarter mile of the campus.[236] The pesticides included carcinogens, reproductive toxicants, and developmental toxicants.[237] According to the CDPH, Hispanic children are 46% more likely than white children to attend schools near any pesticide of concern and are 91% more likely to attend schools in the top 25% of schools with the highest pesticide exposure.[238] Farming organically close to schools is one solution to this ongoing challenge. Organic agriculture bans synthetic pesticides, thus protecting children from harmful exposures while at school. In response to pesticide risks, the California Department of Pesticide Regulation implemented rules at the beginning of 2018 prohibiting many pesticide applications Monday through Friday within one-quarter mile from schools.

Schools were exposed to pesticides including carcinogens, reproductive toxicants, and developmental toxicants.

user of antibiotics in the United States,[264] conventional livestock production has contributed to multidrug-resistant pathogens and reduced the effectiveness of several classes of antibiotics used to treat both human and livestock infections.[265, 266]

Use of antibiotics and hormones is prohibited in organic production.[267] Instead, organic producers must use holistic practices to maintain the health of livestock, such as providing a forage-based diet on certified organic pasture for at least 120 days per year; providing adequate space and year-round access to outdoors; allowing livestock to engage in natural behaviors; and choosing appropriate breeds based on site-specific conditions such as resistance to the region's prevalent diseases and parasites.[268]

Studies show that organic farms harbor fewer antibiotic resistant microbes than their conventional counterparts[269, 270] and that organic meats are less likely to be contaminated with antibiotic resistant bacteria than conventional meat products.[271, 272, 273] For example, bacteria samples on organic chicken sold in Maryland retail stores had nearly no antibiotic resistance, while bacteria from conventional chicken samples were resistant to five or more antibiotics.[274]

A Stanford University meta-analysis,[275] the American Academy of Pediatrics,[276] and the President's Cancer Panel report of 2008–2009[277] all conclude that eating organic meat reduces exposure to antibiotic resistant bacteria.

Unlike organic livestock, conventional livestock may also be treated with growth hormones to increase production, which can contaminate animal tissues as well as water running off of the farm.[278] In humans, hormones support growth, development, and biological processes such as puberty.[279] According to the President's Cancer Panel, scientists suspect that growth hormones interfere with human hormonal systems (endocrine disruption).[280] For these reasons, the President's Cancer Panel recommended that Americans decrease exposure to growth hormones by switching to an organic diet.[281]

Organic Food is Highly Nutritious

Organic Fruits and Vegetables Are Higher in Specific Nutrients

Over the last decade, scientists have developed new tools to test for nutritional quality of organic foods compared to conventional foods. Meta-analyses use statistical methods to aggregate and detect underlying trends in the data from hundreds of studies on nutrients that impact human health, including vitamins, minerals, and phytochemicals (non-nutritive plant chemicals that can affect health through antioxidant functions).[282] Six out of eight peer-reviewed meta-analyses conclude that organic foods contained higher levels of certain nutrients than conventional foods,[283, 284, 285, 286, 287, 288] and two studies found no consistent nutritional differences.[289, 290]

The most recent meta-analysis, with the largest dataset to date, finds "statistically significant and meaningful differences in nutrient composition between organic and non-organic crops."[291] Organic fruits and vegetables had higher concentrations of a wide range of antioxidants, ranging from 19% higher phenolic acids to 69% higher flavanones.[292] This means that an individual switching from a conventional to an organic diet would intake 20–40% more antioxidants, or the amount gained in one to two extra portions of fruits and vegetables, without increasing caloric intake.[293]

Additionally, a growing body of individual crop studies finds that organic fruits and vegetables — including tomatoes,[294] sweet peppers,[295] brassicas,[296] spinach,[297] green peppers,[298] onions,[299] strawberries,[300, 301] blueberries,[302] apples,[303] plums,[304] peaches,[305] and pears[306] — contain higher levels of various vitamins, mineral micro- and macronutrients, and compounds high in antioxidant activity. Higher antioxidant concentrations are especially significant because they are linked to reduced risk of chronic diseases, including cardiovascular disease, neurodegenerative diseases, and certain cancers.[307]

ORGANIC MEATS ARE LESS LIKELY TO BE CONTAMINATED

WITH ANTIBIOTIC RESISTANT BACTERIA THAN CONVENTIONAL MEAT PRODUCTS.

Farmworkers harvesting organic kale.

PHOTO COURTESY OF Grimmway Farms, Kern County CA

Overall, the current meta-analyses and individual crop comparison studies show that organic fruits and vegetables can provide consumers with higher levels of a range of nutrients.

Organic Meat and Dairy Have Superior Fatty Acid Profiles

Organic animal production is based on raising healthy, antibiotic-free, grass-fed animals on pastures that are managed to preserve soil and water quality.[308] Recent studies show that organic meat and dairy have healthier fat profiles than conventional meat and dairy because of the animals' grazing and forage-based diet[309, 310, 311] required by national organic regulations.[312] Organic ruminant livestock, including cows, goats, sheep, and bison, must graze for at least 120 days per year on certified organic pasture.[313]

The most comprehensive organic milk research to date — a 2016 meta-analysis and literature review of 170 studies comparing the nutrient content of organic and conventional cow milk — finds that organic milk has a more beneficial fatty acid composition than conventional milk.[314] Similarly, results from a 2016 meta-analysis of 67 datasets,[315] and other recent studies,[316, 317] show better fatty acid profiles in organic meat.[318, 319, 320]

Most importantly, organic milk and meat in these studies had higher levels of various polyunsaturated fatty acids (PUFAs).[321, 322, 323, 324] The 2015–2020 American Dietary Guidelines recommend consuming PUFAs instead of saturated fatty acids because "strong and consistent evidence" shows health benefits, such as reduced blood levels of total cholesterol and of low-density lipoprotein-cholesterol (LDL-cholesterol), and a reduced risk of cardiovascular events (heart attacks) and cardiovascular-related deaths.[325]

Furthermore, while conventional dairies must supplement cow feed with synthetic vitamins to ensure adequate vitamin concentrations in milk, grazing in organic systems ensures sufficient vitamin concentrations.[326]

Better Living and Working Conditions for Farmworkers

Organic Farms Provide Stability for Farmworker Families

Organic farms tend to create more full-time, year-round employment opportunities for farmworkers, which increases wage security and family life stability for workers and their families. Organic farms use more labor-intensive practices than conventional farms to manage weeds, insect pests, and disease.[327, 328] Organic farmers also tend to grow a higher diversity of crops,[329] which requires more skilled labor than managing a single row crop.[330] This results in more sustained labor needs on organic farms.[331] A 2018 study of organic farming employment in ten Washington and California counties found that organic farms hire more workers per acre and more year-round workers than their conventional counterparts.[332]

Full-time, year-round employment helps provide livable wages for California farmworkers.[333] An in-depth 2015 analysis of wage data found that most California farmworkers did not have full-time employment and therefore only earned 58% of what they could have earned with year-round employment.[334] Forty-three percent of California farmworkers had more than two jobs[335] and caneberry

2016 CCOF Future Organic Grant Fund Recipient Jennie Wagner raising organic pastured pork in North Carolina.

PHOTO COURTESY OF CCOF

workers on California's Central Coast were unemployed an average of 130 days in 2014.[336]

Year-round employment on organic farms provides stability and improves educational opportunities for farmworker families. Farmworkers on organic farms express that year-round employment is "very valuable to them" because a secure job in one place provides the basis for a safe and stable family life and allows their children to receive an education without constant interruption.[337] If farmworkers cannot find year-round employment in one region, then they may move their family or leave family behind to earn income in another growing region.[338] A 2014 survey found that most farmworkers are married (63%) and have children (57%), but one out of four parents lives apart from their nuclear family.[339]

Despite the physically demanding and skilled work performed by farmworkers, farmworkers are among the lowest paid workers in the United States.[340] In 2017 farmworkers made 43% less than non-farm workers.[341] As a result, farmworkers struggle to afford housing, healthcare, food, basic amenities, and the same standards of living obtained by other professions.[342] Most U.S. government data on agricultural labor does not distinguish between organic and conventional farms, but some studies show that organic farms tend to provide higher wages than their conventional counterparts and mixed conventional-organic operations.[343, 344]

Overall, organic agriculture helps create better wage opportunities and more stable homes for farmworkers by providing more full-time, year-round employment opportunities.

Organic Agriculture Protects Farmworkers from Routine Exposure to Synthetic Pesticides

Organic agriculture protects farmworkers from routine exposure to synthetic pesticides by prohibiting these materials.[345] In the Agricultural Health Study, which has followed 89,000 American pesticide applicators and their spouses since 1993, scientists find that occupational pesticide exposure is associated with numerous long-term health effects.[346] They include higher risks of numerous cancers,[347, 348, 349] including prostate and ovarian cancer,[350, 351] bladder and colon cancer,[352] stomach cancer,[353] and lung cancer,[354] as well as neurodegenerative diseases,[355] adverse respiratory effects,[356] and mental health disorders such as depression.[357] Importantly, female spouses of male pesticide applicators have a "significantly higher" incidence of melanoma.[358]

Other scientific studies associate increased occupational pesticide exposure with numerous health effects such as impaired neurological functioning,[359] neurodegenerative diseases like Parkinson's Disease[360] and Amyotrophic Lateral Sclerosis (ALS),[361] reproductive problems,[362] and gastric cancer.[363]

Perhaps the most alarming impact of routine pesticide exposure occurs off the field when farmworker families are exposed to pesticides that enter their homes and communities. Children are disproportionately impacted by pesticide exposure starting prenatally through exposure in the womb.[364] In a California-based study of farmworker children spanning two decades, over 150 reports document an association between prenatal exposure to organophosphate pesticides and adverse neurodevelopmental and other health outcomes,[365] including poorer cognitive functioning,[366] lower IQ,[367] and inattention during childhood.[368] Other studies link prenatal pesticide exposure to impaired neurobehavioral development[369] and increased risk of weight issues.[370] California mothers living near applications of synthetic pyrethroids[371] or organochlorine pesticides[372] also have higher risks of birthing a child with autism spectrum disorder.[373, 374]

Children of farmworker families also have increased exposure risks outside the womb. For instance, the President's Cancer Panel report of 2008–2009 suggests that pesticide levels in carpet dust explain higher leukemia rates among children who live on or near conventional farms because they are exposed to pesticides in carpet dust when they play or crawl on the floor.[375]

Given the cancer, neurodevelopmental, and other health risks associated with synthetic pesticides, organic agriculture is an important alternative approach for protecting farmworkers and their families.

A Secure and Sustainable Global Food Supply

Organic Agriculture Can Ensure Food Security Under Extreme Weather Conditions

University of California scientists report that resource constraints and extreme weather in California are negatively impacting farm productivity and endangering food security locally and globally.[376] Crop yields are decreasing because of increased pest and disease pressures, reduced number of the chill hours fruit and nut trees need to produce, variable and unreliable water supply, and weather extremes such as heat waves and droughts.[377] Due to California's position as a world leader in agriculture, the study concludes with the "urgency and importance" of creating resilient farms in California.[378]

Organic practices can improve farm resiliency to extreme weather conditions such as drought or hurricanes by supporting healthy soils[379] and maintaining robust levels of biodiversity.[380, 381, 382] Because organically farmed soils tend to be higher in soil organic matter (SOM) than conventionally farmed soils,[383, 384, 385, 386, 387] they maintain soil structure under rain or wind,[388, 389] preventing topsoil and nutrients from eroding during heavy rains.[390] Enhanced biodiversity also helps farms be more resilient by supporting diverse species that can handle various environmental shocks.[391, 392, 393]

Organic soil management helps crops access stored water during periods of drought.[394, 395] For example, during five years of drought in the Northeast, organic corn yields were 28–35% higher and organic soybean yields were up to 50% higher than conventional yields.[396] When the drought was followed by extreme rainfall, organic fields captured twice as much water as conventional fields and produced 38-137% higher organic corn yields and 152-196% higher organic soybean yields than conventional fields.[397]

Worldwide studies show that healthy soils and biodiversity increase farm resilience to extreme weather.[398] In a comparison study of 1,804 farms in Central America after a hurricane, farms using organic soil management were left with 20–40% more topsoil and lower economic losses than their conventional counterparts.[399] In a study conducted 40 days after Hurricane Ike hit Cuba in 2008, researchers found that diversified farms had crop losses of 50% compared to 90-100% losses in monoculture farms with less biodiversity.[400]

Organic practices that increase farm resiliency help ensure a secure food supply in the aftermath of extreme weather events and under increased resource constraints.

Organic Agriculture Can Sustainably Feed a Growing Worldwide Population

International scientists recently determined that if food waste and demand for livestock products are reduced, then organic agriculture can feed 9 billion people by 2050.[401] In another global analysis comparing 293 organic and conventional crops, scientists found that current organic yields could supply at least the minimum calories per day, if not more, needed to sustain a growing worldwide population.[402] The minimum daily requirement for an adult is 2,200–2,500 kcal per day. Based on current organic yields, it is predicted that organic farming systems could produce 2,641 to 4,381 kcal per person per day.[403] As a result of this research, scientists conclude that organic agriculture can feed a growing population while also minimizing the environmental harms associated with other agricultural systems like loss of biodiversity, soil erosion, and water contamination.[404, 405] Organic agriculture offers society an abundant and food secure future.

IF FOOD WASTE AND DEMAND FOR LIVESTOCK PRODUCTS ARE REDUCED, THEN

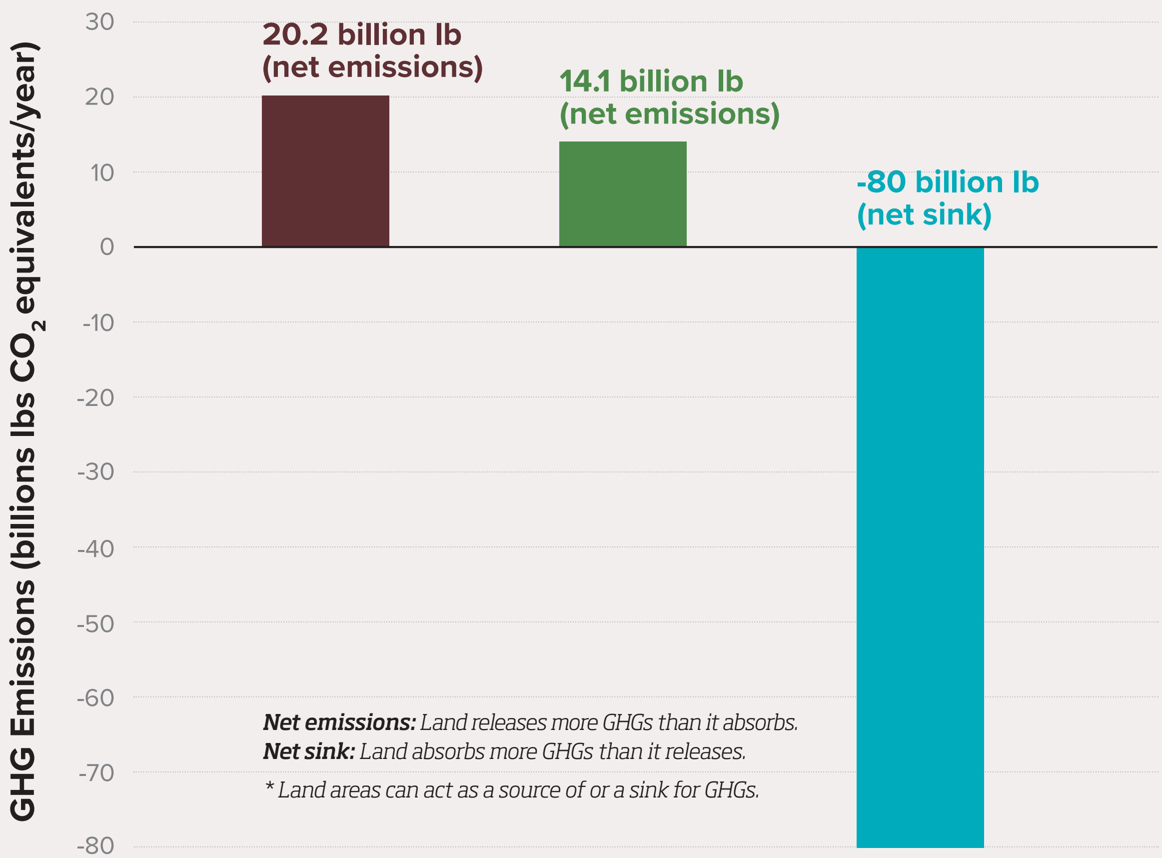
ORGANIC AGRICULTURE CAN FEED 9 BILLION PEOPLE BY 2050.

What are the Benefits of Increasing California's Organic Acreage?

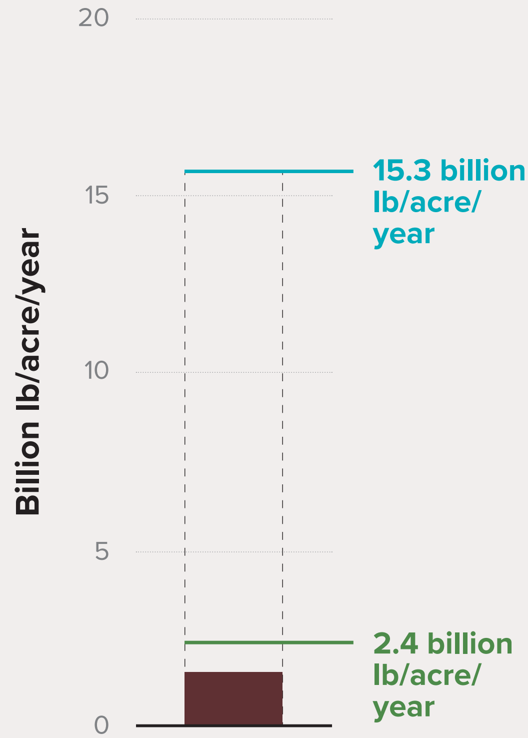
At present, organic farmland makes up only 4% of California's agricultural land. If California were to increase organic acreage to 10% by 2030, and eventually to 100% of agricultural land, then the economic, environmental, and social benefits would also increase.

● 4% Organic (Current) ● 10% Organic Scenario ● 100% Organic Scenario

Reduced Greenhouse Gas (GHG) Emissions from all California Crop Production (Standard Tillage)*[406]

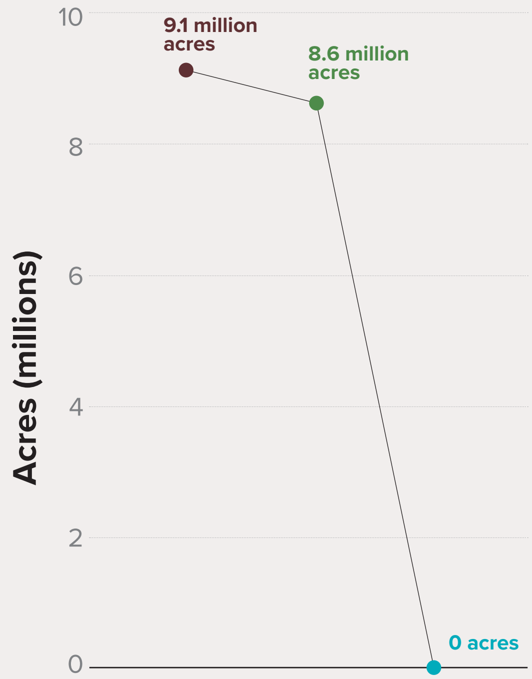


Increased Carbon Sequestration from California Cropland[407]

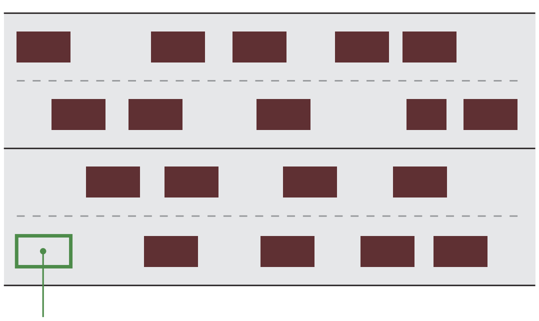


Reduced Farmland Treated with Cancer-Causing Pesticides

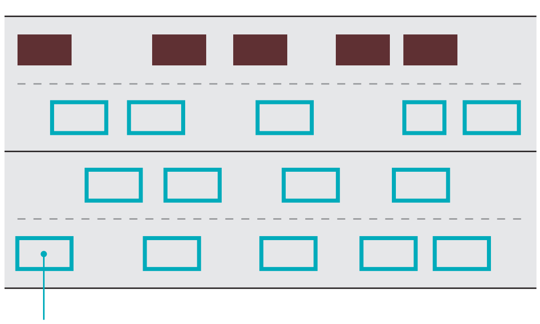
Calculated from data in California Department of Pesticide Regulation. (2016). Summary of pesticide use report data - 2016. Table 6. Retrieved from ftp://transfer.cdpr.ca.gov/pub/outgoing/pur/data/2016_PUR_report_text-files/table6_carcinogen_acres/table6_carcinogen_acres.pdf



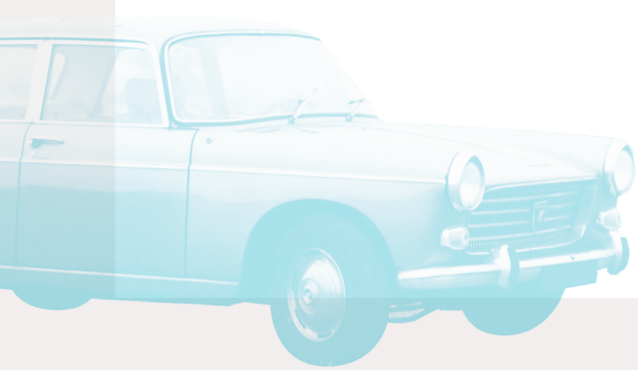
Increasing to 10% organic acreage would reduce emissions equivalent to 601,500 cars. Going fully organic would be the equivalent of removing 7.8 million cars from the road!



10% Organic Scenario: Removing 601,500 cars from the road



100% Organic Scenario: Removing 7.8 million cars from the road



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