CALIFORNIA'S CLIMATE-SMART FARMS

INTRODUCTION

OVERVIEW

These engaging, flexible activities invite middle school students to examine ways our food is connected to climate change by focusing on California-grown crops. These activities involve students in analyzing different sources of evidence to draw conclusions about how to address climate change issues.

GRADE LEVEL: 6–8

CENTER FOR ECOLITERACY

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CALIFORNIA FOOD FOR CALIFORNIA KIDS® downloadable resource

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CALIFORNIA FOOD
FOR CALIFORNIA KIDS®

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Dear Educator,

How does climate change affect the foods we eat? How does our food affect climate change? And how can we develop healthy responses to meet the climate challenges our young people will face?

The Center for Ecoliteracy developed this suite of activities—California's Climate-Smart Farms—to address these questions and more.

These activities engage middle school students in questioning and observing climate-related phenomena. Then, through case studies, students will discover California farmers across the state who are working with people, places, and food to nurture more resilient and sustainable ways of living.

Thought provoking and flexible, these activities engage many types of learners with inquiry-based, hands-on, project-based experiences. You'll find that they are easy to manage in different settings, use few materials, take little time, and may be done by students working on their own or with small or larger groups.

In developing these lessons, our aim was that you and your students might learn together and connect to the value of caring for our world. And, perhaps most importantly, discover a basis for hope grounded in science and expressed through the extraordinary creativity and commitment of those who produce our food.

A healthy, sustainable food supply is essential to a healthy, sustainable future. Our wish is for you and you students to question, learn, and take the actions that will help their generation achieve the healthiest possible outcomes for themselves and the planet.

With gratitude,

Alexa Norstad
Executive Director
Center for Ecoliteracy

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CALIFORNIA FOOD FOR CALIFORNIA KIDS®

Using This Guide

The following activity sets are designed to engage students in exploring the connections between their food and climate change. Focusing on topics illustrated by different California crops, students examine how climate change and the way we grow our food are interrelated.

The activities involve students in analyzing evidence from informational text, hands-on investigations, online research, and farm profile case studies. Students apply a framework of claim–evidence–reasoning to draw conclusions about the issues and how to address them.

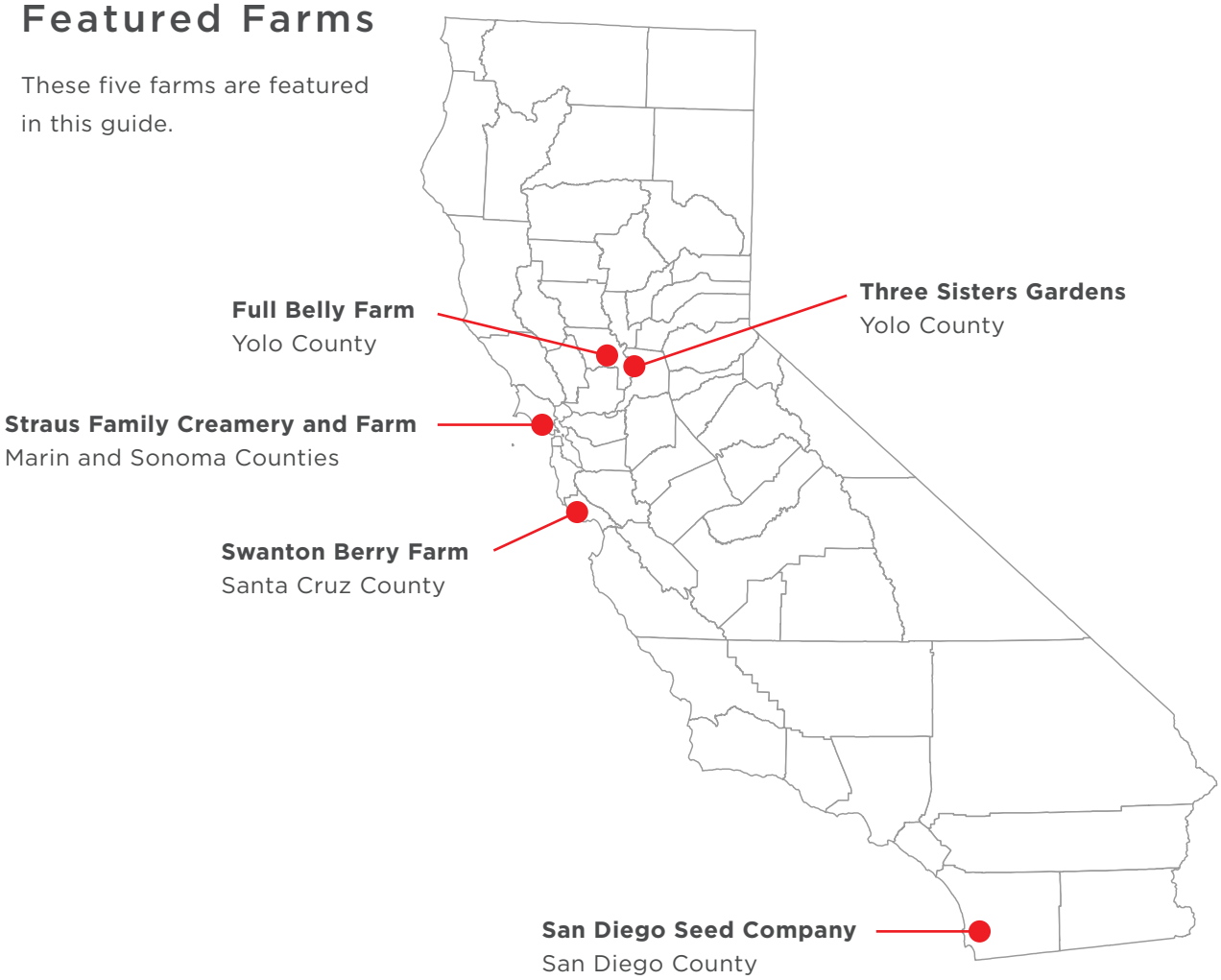
These activity sets are designed to be thought-provoking and flexible. They are easy to manage in different settings, use few materials, take little time, and may be done by students working on their own or with small or larger groups.

Feel free to pick and choose among the activities and adapt as necessary for your group or setting. Each activity in an activity set is designed to stand alone, or the activities may be combined to make a more complex learning progression.

See Standards Connections on pages 9–10 for the specific content standards these activities support.

Featured Farms

These five farms are featured in this guide.



Making Local Connections

Farms and farmers featured in these lessons reside in the regions shown on the map. To make your lessons as vibrant as possible for your students, consider the following ideas for localizing their experience of food, agriculture, and climate change awareness:

- **Connect with your campus food service.** If your school or district purchases food from local farms, ask if some of those farmers could visit your school to meet and talk with students. Your school nutrition professionals might be helpful in hosting student taste tests so that students can savor and learn more about their food and where it comes from.
- **Connect with local farmers through supportive organizations**. Organizations that could help make farmer connections include Community Alliance with Family Farmers (CAFF), your local farmers markets or food hubs, and your local chapter of United Farm Workers.
- **Connect with local agricultural resources.** There is an array of local, county, and statewide resources that can help make connections with farmers and farming knowledge. These include: local colleges, county agricultural commissions, Future Farmers of America (FFA), 4H clubs, CalFresh, UCANR, and UC Cooperative Extension. Many communities have local gardening groups and Master Gardener associations that can share knowledge and possibly seeds for school gardens and classroom projects.
- **Connect with your school garden.** If there is a garden on your campus, reach out to discover how your teaching could be connected with what is grown there. Is the garden curriculum addressing climate change challenges? Could your students learn from or share their knowledge with students and others connected to the garden project?

How the Activities Are Organized

Each activity set in this guide presents an issue related to climate change for students to explore. Each includes a Teacher Overview that includes a summary of the three activities in that activity set, as well as background information, resources for the teacher, and extension ideas.

The activity sets are formatted as Student Pages that guide students' exploration of the issue and evidence related to it. You may share the Student Pages by either printing them out on paper or providing them electronically.

The three activities in each activity set focus on a California-grown crop and engage students in different kinds of evidence related to the issue:

- **Informational Text**. The first activity within each activity set introduces the issue through an infographic, data table, or other data source for students to analyze.
- **Investigation.** The second activity involves students in a hands-on or research investigation to explore the issue more deeply.
- **Farm Profile.** The third activity provides a farm profile that describes what farmers are doing and invites students to identify other ways people can make a difference.

Each activity also encourages students to gather more evidence through internet research and provides links to videos and websites to get them started.

Claim–Evidence–Reasoning

The activities involve students in examining evidence to make a claim, and then substantiating their claim with reasoning. **This methodology supports both NGSS and Common Core and is a way to develop a student's skill in analytical thinking and argumentation.**

Each activity provides evidence as the basis for student explorations. Each also offers links to other resources for further research.

For more information about this approach, and how to introduce it to your students, see **"Designing Science Inquiry: Claim + Evidence + Reasoning = Explanation"** by Eric Brunsell in Edutopia. https://www.edutopia.org/blog/science-inquiry-claim-evidence-reasoning-eric-brunsell

Activity Sets

These activities involve students in analyzing evidence from informational text, hands-on investigations, online research, and farm profile case studies. Students apply a framework of claim–evidence–reasoning to draw conclusions about the issues and how to address them.
Note: Complete activity sets for all the *California's Climate-Smart Farms* lessons are available at: https://www.ecoliteracy.org/download/climate-smart-lessons

Dairy and Greenhouse Gases

Activity 1: What do cow burps have to do with climate change?

Activity 2: How do cows produce methane?

Activity 3: How can people minimize methane from farming?

Sweet Corn, Water, and Climate Change

Activity 1: How do water shortages affect corn and other crops?

Activity 2: Is there evidence of drought in California?

Activity 3: What can farmers and others do to conserve water?

Wheat, Soil, and Climate Change

Activity 1: How are soil and climate change connected?

Activity 2: How do soil organisms contribute to healthy soil?

Activity 3: How can people nurture soil health to as a response to climate change?

Strawberries, Pests, and Climate Change

Activity 1: How are strawberries, pests, and climate change connected?

Activity 2: Are pesticides a good solution?

Activity 3: What can farmers and individuals do to control pests sustainably?

Seeds and Climate Resilience

Activity 1: How are seeds and climate change connected?

Activity 2: How do temperature and moisture affect seed germination?

Activity 3: What can we do to build climate resilience?

Standards Connections

The activity sets in this guide support the following education standards.

Standard	Activity Set				
	Dairy and Greenhouse Gases	Sweet Corn, Water, and Climate Change	Wheat, Soil, and Climate Change	Strawberries, Pests, and Climate Change	Seeds and Climate Resilience
Next Generation Science Standards					
Disciplinary Core Ideas					
LS1.A: Structure and Properties of Matter	x				
LS1.B: Growth and Development of Organisms	x	x	x	x	x
LS1.C: Organization for Matter and Energy Flow in Organisms	x		x		
LS2.A: Interdependent Relationships in Ecosystems	x	x	x	x	x
LS2.B: Cycle of Matter and Energy Transfer in Ecosystems	x	x	x	x	
LS2.C: Ecosystem Dynamics, Functioning and Resilience			x		
ESS2.D: Earth's Systems	x	x		x	
ESS3.D: Global Climate Change	x	x	x	x	x
Science and Engineering Practices					
Planning and Carrying Out Investigations	x		x		x
Analyzing and Interpreting Data	x	x	x	x	x
Constructing Explanations and Designing Solutions	x	x	x	x	x
Obtaining, Evaluating, and Communicating Information	x	x	x	x	x
Crosscutting Concepts					
Patterns	x	x	x	x	x
Cause and Effect	x	x	x	x	x
Energy and Matter in Systems			x		x
Stability and Change	x	x		x	x

Standards Connections, Continued

The activity sets in this guide support the following education standards.

Standard	Activity Set: Dairy and Greenhouse Gases	Sweet Corn, Water, and Climate Change	Wheat, Soil, and Climate Change	Strawberries, Pests, and Climate Change	Seeds and Climate Resilience
Common Core Standards, English Language Arts					
Reading Informational Text: Key ideas and details	x	x	x	x	x
Reading Informational Text: Integration of knowledge and ideas	x	x	x	x	x
Common Core Standards, Mathematics					
Ratios and Proportional Relationships	x				
Statistics and Probability	x				
C3 Framework (Social Studies)					
Geography: Human-environment interactions	x	x	x	x	x
Geography: Geographic representations		x			
History: Historical sources and evidence		x			

Glossary

Note: This glossary includes words and phrases used in the activities. Additional vocabulary support may be needed for external resources suggested in the activities.

Active ingredient (in pesticides) (noun) A chemical in a pesticide product that kills or otherwise controls pests.

Adapt (verb) To change in response to a new or changed environment.

Arthropod (noun) An animal without a backbone that has a hard, outer skeleton and three or more pairs of legs that can bend. Insects and spiders are examples of arthropods.

Bacteria (noun) Microscopic, single-celled organisms.

Carbohydrate (noun) A molecule made up of carbon, hydrogen, and oxygen that can be broken down by organisms to release energy.

Carbon (noun) An element and essential component for all living organisms.

Carbon cycle (noun) The process in which carbon atoms are exchanged among the Earth's air, soil, living organisms, and in modern times, the burning of fossil fuels.

Carbon dioxide (CO^2) (noun) A colorless, odorless gas, with each molecule composed of one carbon atom and two oxygen atoms. Carbon dioxide is a primary greenhouse gas.

Climate resilience (noun) The ability to prepare for and respond to events or trends related to a changing climate.

Companion planting (noun) Sowing together crops that enhance each other's growth or protect each other from pests.

Conservation (noun) The protection of natural resources, including caring for them and not wasting them.

Cover crop (noun) Plants grown to protect and enrich the soil.

Crop yield (noun) The amount of crop grown per unit area of land.

Decompose (verb) To rot or decay. When decomposing, dead organisms are broken down into smaller components.

Deficit (noun) A shortage of something.

Dormancy (in plants) (noun) The state of being alive, but not growing.

Drought (noun) A prolonged period of abnormally low rainfall causing a shortage of water.

Embryo (noun) A plant or animal in its earliest stage of development.

Enteric (verb) Relating to the intestines.

Fermentation (noun) The chemical breakdown of a substance by bacteria or other microorganisms.

Fertilization (in plants) (noun) The fusing of a male reproductive cell (pollen) with a female reproductive cell (ovum or egg) to form a new plant.

Fungi (noun) A group of organisms that includes yeasts, molds, and mushrooms.

Fungicide (noun) A chemical that kills fungi.

Germinate (verb) To sprout from a seed.

Greenhouse gas (noun) A gas in the atmosphere that absorbs the sun's energy and helps hold heat in.

Heirloom (in farming) (noun or adjective) A variety of a fruit, vegetable, or grain that was saved for its flavor or other qualities and passed down from one generation to the next.

Holistic (adjective) Dealing with the whole of something rather than individual parts.

Irrigation system (noun) A set of pipes, drip emitters, valves, sprinklers, ditches, or other components used to water plants.

Local seeds (noun) Seeds produced by small-scale farmers for plants that have characteristics specific for the location.

Methane (noun) A colorless, odorless gas with each molecule composed of one carbon atom and four hydrogen atoms.

Microbe (noun) A microorganism that causes disease or fermentation.

Mite (noun) A tiny animal that has eight legs and is related to spiders.

Nematode (noun) A roundworm.

Organic (in farming) (adjective) Grown according to USDA organic standards that address, among many factors, soil quality, animal raising practices, pest and weed control, and use of additives.

Organism (noun) An individual plant, animal, or single-celled life form.

Pest (noun) An organism that destroys or damages a crop.

Pesticide (noun) A chemical used to kill pests.

Photosynthesis (noun) The chemical process by which plants make their food using energy from the sun to turn water and carbon dioxide into carbohydrates.

Pollen (noun) The male reproductive cell of flowering plants.

Pollinate (verb) To transfer pollen from a flower's male part (the stamen) to the female part (the pistil) of the same flower or another flower.

Produce (noun) Fruits or vegetables that are grown for eating.

Protozoan (noun) A single-celled organism. Plural is protozoa.

Renewable energy (noun) Power from sources that cannot be used up, such as the sun, wind, and waves.

Reservoir (noun) A storage area for large quantities of water.

Resilient (adjective) Able to withstand or recover quickly from difficult circumstances.

Rumen (noun) The first part of the stomach of cows and other ruminants, which partly breaks down food through fermentation.

Ruminant (noun) One of a group of animals that can get nutrients from plant material by fermenting it in a specialized stomach. Cattle, sheep, deer, and giraffes are ruminants.

Scarce (adjective) Not enough to satisfy the need.

Seed coat (noun) The outer covering of a seed.

Seed development (noun) The process by which plants form seeds.

Sequester (verb) To collect and store carbon dioxide to keep it from entering the atmosphere.

Silk (in corn) The long, threadlike parts of an ear of corn through which pollen travels to the ovum.

Snowpack (noun) The slow-melting packed snow accumulated over the course of a winter.

Soil organic matter (noun) The living or once-living part of soil, including small bits of fresh plants, microbes, and decomposing plant and animal remains.

Tassel (in corn) (noun) The topmost part of a corn plant, which produces pollen.

Tillage (noun) The preparation of soil for planting by digging, stirring, or overturning it.

Toxic (adjective) Poisonous.

Variety (in plants) (noun) A group of plants within a species that has one or more distinguishing characteristics.

Vulnerable (adjective) Likely to be harmed or damaged by something.

CENTER FOR ECOLITERACY

ABOUT THE CENTER FOR ECOLITERACY

The Center for Ecoliteracy is an internationally recognized leader in education for the sustainability of people and the planet. Since 1995, the Center has engaged with thousands of educators from across the United States and six continents. The Center offers publications, seminars, coaching for teaching and learning, in-depth curriculum development, keynote presentations, and technical assistance. Our California Food for California Kids® initiative connects public school districts as they advance their work in providing students with fresh, locally-grown food and reinforcing connections between the classroom, cafeteria, and garden. With a network of over 100 public school districts across the state, California Food for California Kids helps districts share the knowledge, experience, and caring of its participants to advance practical solutions that transform school food systems and how students learn about the food they eat.

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PHOTOS

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Additional photo credits are provided in each lesson.

Our deepest gratitude to the farmers who shared their stories, knowledge, and photos in the development of these lessons. Their generosity and dedication will help students understand and adapt to the challenges they may face in the future of agriculture.