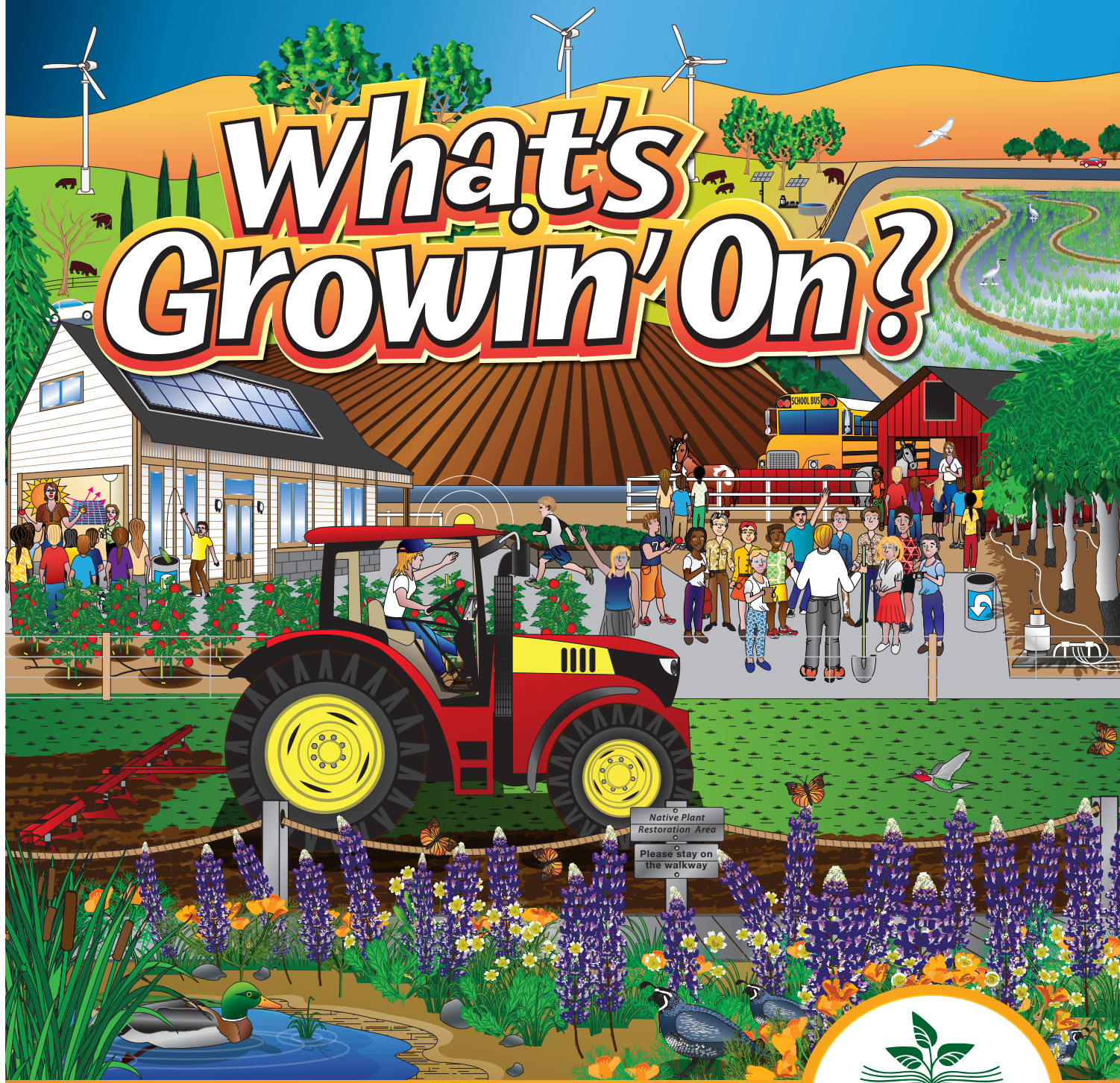


15th Edition

Agriculture and the Environment

What's Growin' On?



California Foundation for
Agriculture in the Classroom

Extra! Extra! Classroom Extensions

LearnAboutAg.org | 800-700-AITC (2482) | info@LearnAboutAg.org

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Introduction

Welcome! Thank you for your interest in California Foundation for Agriculture in the Classroom's student activity newspaper, ***What's Growin' On? Agriculture and the Environment***. Developed by educators like you and reviewed by industry experts, ***What's Growin' On?*** offers fun and engaging ways to teach and practice core academic skills while demonstrating the importance of agriculture in our lives.

EXTRA! EXTRA! Classroom Extensions contains ideas and opportunities for extending the content presented in the student activity newspaper. Activity ideas are varied to help you meet the different learning styles of students in your classroom. Opportunities for group work, hands-on activities, and visual displays support the needs of ELL students as well as challenge GATE students.

The agriculture-themed examples and activities found in ***What's Growin' On? Agriculture and the Environment*** are designed to motivate and inspire your students by connecting classroom lessons to real-life experiences and circumstances. This is accomplished by weaving agriculture into academics so students can better relate to food they eat, water they drink, clothes they wear, homes they live in, and all the open spaces they enjoy. Additionally, using the newspaper as an instructional tool allows young people to discover the relevance of their classroom studies by reading news stories, acquiring knowledge, forming opinions, and broadening their understanding of the world they live in.

California Foundation for Agriculture in the Classroom is dedicated to increasing the awareness and understanding of agriculture among California's educators and students. We provide educators with resources and programs that enhance agricultural literacy. To request a free teacher resource packet or a classroom set of the current edition of ***What's Growin' On? Agriculture and the Environment***, order online at LearnAboutAg.org/wgo or contact us via e-mail (info@LearnAboutAg.org) or phone (800-700-2482).

Sun Power

Extension Ideas

The Sun is #1!

Here are some fun facts about the sun. Have your students research three more facts about the sun and create a colorful poster to share their facts.

- In one hour, the sun can power 2880 trillion light bulbs!
- One second of the sun's energy output would power the US for 9,000,000 years!

CA Standards: CCSS ELA: W.3-8.7, SL.3-5.4

Ultraviolet Light

Learn about UV light by trying out this fun activity experimenting with UV-sensitive beads. For instructions, go to solar-center.stanford.edu/activities/UVBeads/UV-Bead-Instructions.pdf.

CA Standards: NGSS: 4-PS3-2, 4-PS3-4, 5-PS3-1, 5-ESS1-1, MS-PS1-4

The Food Web

Create a food web and connect it to agriculture! Be sure to include the energy from the sun, explain the steps and connections, and give a classroom group presentation.

CA Standards: NGSS: 5-PS3-1, 5-LS2-1, MS-LS1-6, MSLS2-2, 3

Use the following chart to create your food web! Pick your producer, primary consumer, secondary consumer, and decomposer!

Stages of the Food Chain	Examples of Each Stage
Sun	
Producers	Plants & Trees
Primary Consumers	Herbivores (insects, cows, horses)
Secondary Consumers	Omnivores or Carnivores (bats, raccoons, mountain lions, people)
Decomposers	Soil Bacteria, Earth Worms, Vultures

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Lesson Plan:** *Sun, to Moo, to You!* (Grades 4-6)

Institute of Electrical and Electronics Engineers (tryengineering.org)

- **Lesson Plan:** *Here Comes the Sun* (Grades 3-12)

Websites

- National Geographic
kids.nationalgeographic.com/explore/space/sun/#sun.jpg
- Planets for Kids
planetsforkids.org/star-sun.html

Books

- Hughes, Catherine. ***National Geographic Little Kids First Big Book of Space***. National Geographic, 2012.
- Taylor-Butler, Christine. ***Super Cool Science Experiments: Solar Energy***. Cherry Lake Publishing, 2009.

Blowin' in the Wind

Extension Ideas

Why is Air Important?

Air is essential for life on earth. Without it, animals and plants would not survive! Air is comprised of 78% nitrogen, 21% oxygen, and 1% carbon dioxide, argon, and other trace gases. Draw a pie graph and show the different percentages of gases in our air. Use different colors to highlight. Share with a neighbor.

CA Standards: CCSS ELA: SL.3-8.1; CCSS Math:3-5.MD

Building a Model Windmill

A windmill is a machine that converts wind energy into useful work by rotation. The rotation of the windmill gives power to either a motor or generator that is used in the production of electricity or any other kind of mechanical work. Have a classroom discussion about why this works, then check out this website for full instructions: easyscienceforkids.com/how-to-build-a-windmill-model-science-fair-experiment-facts-for-kids-video?print=1.

CA Standards: CCSS ELA: SL.3-8.1, RST.6-8.3; NGSS: 4-PS3-4, 5-ESS3-1, MS-PS3-1, 5

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Lesson Plan:** *STEM Connections - Energy and Agriculture* (Grades 9-12)

National Aeronautics and Space Administration (nasa.gov)

- **Lesson Plan:** *Air Is Something* (Grade 3)
www.grc.nasa.gov/www/K-12/Summer_Training/Elementary97/IsAirSomething.html

Websites

- Ozone Pollution Information
epa.gov/ozone-pollution/ozone-basics
- Ground Level Ozone: What Is It?
youtube.com/watch?v=THYoUULn_2U.ossary

Books

- Baker, L., Green, D. ***A Field Guide to American Windmills***. University of Oklahoma Press, 1985.
- Zunon, E., Mealer, B., & Kamkwamba, W. ***The Boy Who Harnessed the Wind***. William Morrow, 2012.

Digging into Soil!

Extension Ideas

Location of Soils

- Sand is found primarily around the mountain foothills, coastal areas, and along rivers and streams. Crops that thrive in sandy soils are potatoes, raspberries, and asparagus.
- Silt is common around streams and rivers. Crops that thrive in silty soils are roses, tomatoes, and nursery plants.
- Clay is usually seen in urban areas. Crops that thrive in clay soils include rice, lemons, and beans.
- Loam is found in the valleys and other flat regions. Crops that thrive in loamy soils include cucumbers, tomatoes, and eggplant.

Use the California Counties map on page 8 to locate the county and soil type, then color the map accordingly.

CA Standards: CCSS ELA: RI.3-6.3, 7, RI.7-8.3

Color	Soil Type	Crop Name	County
Blue	Loam	Cucumbers	San Diego Riverside
Red	Sand	Raspberries Asparagus	Ventura Orange
Green	Silt	Nursery Products Tomatoes	Humboldt Sacramento San Joaquin
Orange	Clay	Rice	Colusa Glenn

What Type of Soil Do You Have?

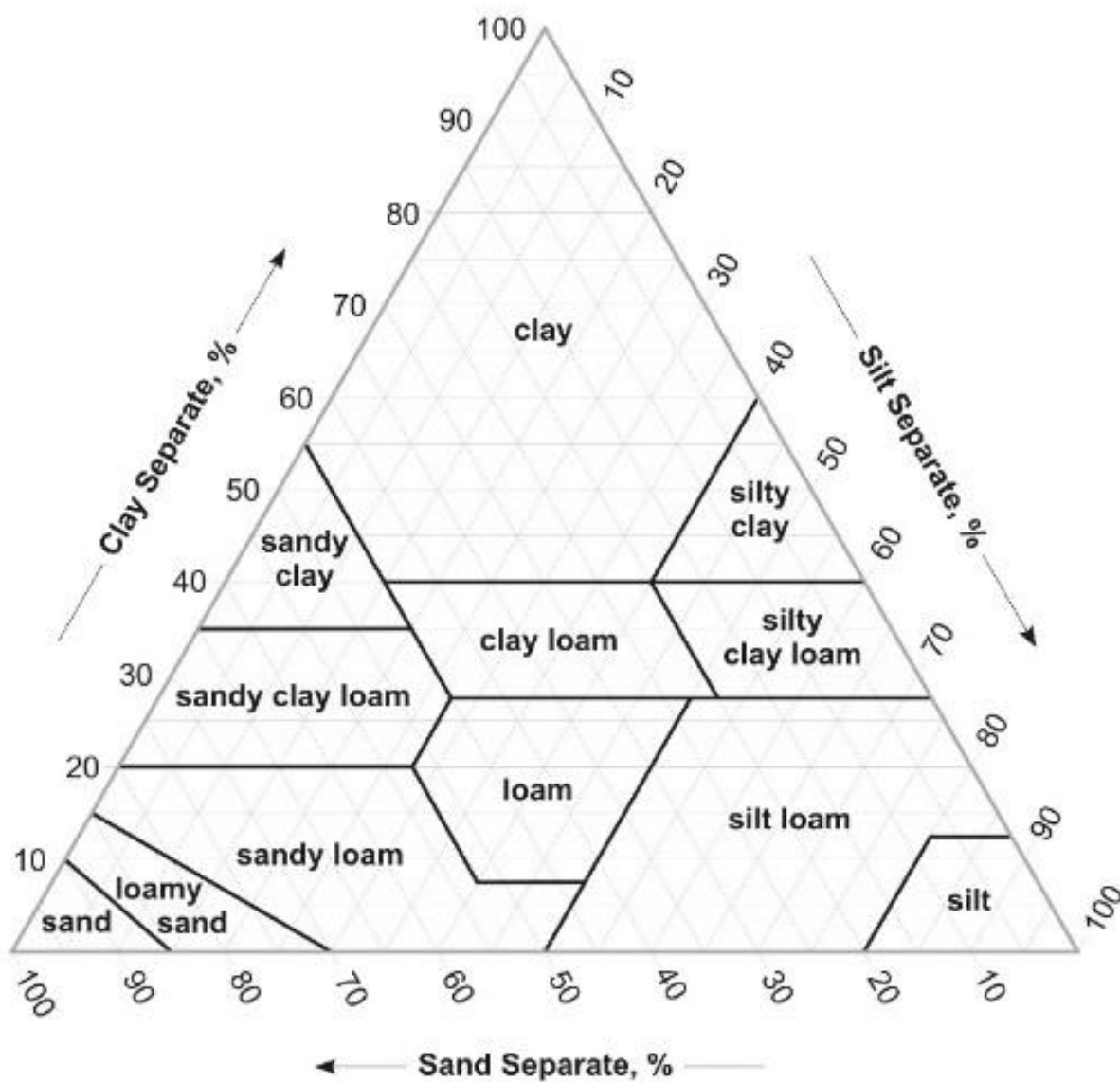
Soil scientists use the soil texture triangle (page 7) to determine the texture of a soil. Collect a small soil sample from your backyard, park, or school. Record the location where you gathered your sample from. Determine what type of soil you collected and add it to the county map. What commodities grow in your county? Check out the following websites for the soil texture calculator and commodities by county:

nrcs.usda.gov/wps/portal/nrcs/detail/soils/survey/?cid=nrcs142p2_054167

www.cdfa.ca.gov/Statistics/PDFs/2016Report.pdf.

CA Standards: NGSS: 4-ESS2-2, MS-ESS2-2

Soil Textural Triangle



California Counties Map



Soil Erosion Types: Soil erosion is caused by water and wind and can reduce crop production and pollute waterways. In contrast, the deep soils of the Central Valley and the fertile farm land of the Delta were created by erosion. Discuss the pros and cons of erosion and find out more by researching soil erosion types and alluvial fans online.

- Sheet Erosion occurs on sparsely covered soil and causes it to move away or downhill.
- Rill Erosion removes the soil by cutting multiple small water channels into the surface.
- Gully Erosion is caused by heavy water runoff that cuts deep channels into the land.
- Wind Erosion removes the fine layer of soil on the land surface.

Have your students look for photos to show the differences between erosion types. In small groups create posters defining and illustrating each type of soil erosion and what causes it; share with the class.

CA Standards: CCSS ELA: RI.3-5.1, 3, 7, W.3-8.7, SL.3-5.1, 2, 4, SL.6-8.1, RI.6.7

The Dust Bowl

The Dust Bowl took place in the 1930s in the Great Plains region of the US. A severe drought, farming practices, and wind all combined to form dust clouds as high as 10,000 feet! Research and answer the following questions:

- What caused the Dust Bowl?
- How did it affect California?
- What did we learn from the Dust Bowl?
- What is the Soil Conservation Service?

CA Standards: CCSS ELA: RI.3-5.3, W.3-8.7, RI.7.7

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Ag-Bites:** *Comparing Apples and Earth* (Grades 3-5)

National Agriculture in the Classroom (agclassroom.org/teacher/matrix)

- **Lesson Plan:** *From Boom to Dust* (Grades 9-12)
- **Lesson Plan:** *Keeping Soil in Its Place* (Grades 3-5)

Websites

- National Geographic
news.nationalgeographic.com/news/2014/12/141205-world-soil-day-soil-agriculture-environment-ngfood/
- Soil Science Society of America
soils4kids.org/about

- California Department of Food and Agriculture
cdfa.ca.gov
- Natural Resources Conservation Service
nrcs.usda.gov

Books

- Ateh, C., Bayles, M., Welbaum, G., & Mannes, J. ***Agronomy. Grow With It!*** American Society of Agronomy, 2016.
- Low, Ann Marie. ***Dust Bowl Diary***. University of Nebraska Press, 1984.
- Stanley, Jerry. ***Children of the Dust Bowl: The True Story of the School at Weedpatch Camp***. Crown Publishers, 1993.

Water Innovations

Extension Ideas

Water Pollution Demonstration

Demonstrate ways water can become polluted and ways to conserve water. You will need a clear plastic tub filled $\frac{3}{4}$ full with water. Other materials include a bottle cap, slotted spoon, spoon, tongs, laundry soap, salt, vegetable oil, small pieces of paper, trash and food, food coloring, rocks and soil, and towels. Add different materials to the tub of clean water one at a time. How does it change? Is the water still useable for drinking or irrigating? Stir the water- what happens? Try to remove items with the tongs from the water – is it easy or hard? Have a classroom discussion and brainstorm methods to clean the water. Have students work in groups to design and test a method. Groups should report on their findings. This activity is adapted from Iowa Agriculture in the Classroom.

CA Standards: CCSS ELA: SL.3-8.1, 4; NGSS: 4-ESS3-1, 5-ESS3-1, 3-5-ETS1-1, 2, 3, MS-ESS3-3, MS-ETS1-1

Service Learning

Check out these service learning projects to make a difference with how we take care of water.

- Participate in California Coastal Cleanup Day! Visit coastal.ca.gov for more information.
- Create a Rain Garden! Search online to find ideas.

Math Activity

If your drip irrigation line is broken, you could lose 4 gallons of water per minute. How much water would that be in 10 minutes? An hour? 24 hours? What other problems might you encounter if you have that much flow of water?

Answer: 40 gallons, 240 gallons, 5,760 gallons, erosion or plant damage

CA Standards: CCSS Math: 3-4.OA, 5.NBT.5, 7

Reclaiming and Reusing Agricultural Wastewater

Excess water that runs off fields after irrigation, is called tailwater and excess water from preparing processed food is called effluent. Both can be used in fields to irrigate crops; farmers have to apply these excess waters with care and be sure to not over-apply. Find other water and irrigation terms and have students create a water word dictionary.

CA Standards: CCSS ELA: RI.3-5.4, 5, RI.6-8.3, 4, W.3-8.4

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Ag-Bites: Water Cycle in a Cup** (Grades 5-8)

- **Agricultural Fact and Activity Sheets:** Learn the facts about Agricultural Water including sources, distribution, history, irrigation techniques, and economic value. There are also lesson ideas, fantastic facts, and a CA standards-aligned lesson plan.

National Agriculture in the Classroom (agclassroom.org/teacher/matrix)

- **Lesson Plans:** *Journey 2050 Lesson 3: Water* (Grades 6-8); *Learn, Protect, and Promote Water* (Grades 6-8)

Project WET (projectwet.org)

- **Lesson Plan:** Discovering Drought (Grades 3-6)

Websites

- U.S. Environmental Protection Agency
epa.gov/safewater/kids/waterfactsoflife.html
- Discover Water
discoverwater.org

Books

- Carlson, Nancy. ***Water: Sources, Use, Conservation***. Unknown Publisher, 2014.
- Paul, Miranda. ***Water is Water: A Book About the Water Cycle***. Roaring Book Press, 2015.

Journey on the Climate Trail

Extension Ideas

Service Learning

It's important for students to understand their impact on the environment. Have your students calculate their carbon footprint and compare it to the world average footprint. Go to meetthegreens.pbskids.org/features/carbon-calculator.html for a fun, youth-oriented carbon footprint calculator. Have students share the results with their classmates and make a classroom graph to show individual and class results. Compare your class to another class in your school! Make a school wide challenge to reduce your carbon footprint!

CA Standards: CCSS ELA: W.3-8.7; CCSS Math: 3-5.MD; NGSS: 4-ESS3-2, 5-ESS3-1, MS-ESS3-3

Did You Know?

If we didn't have any greenhouse gases our planet would be all ice? Have your students check out Climate Kids: NASA's Eyes on the Earth at climatekids.nasa.gov to find out more.

Resources

National Agriculture in the Classroom (agclassroom.org/teacher/matrix)

- **Lesson Plan:** *Weather on the Farm* (Grades K-2)

Discovery Education (discoveryeducation.com)

- **Lesson Plan:** *Weather Maps* (Grades 4-6)
school.discoveryeducation.com/lessonplans/programs/weathermaps

Websites

- NASA
climatekids.nasa.gov/menu/weather-and-climate
- Weather Wiz Kids
weatherwizkids.com/weather-climate.htm

Books

- Bennet, Jeffrey. ***A Global Warming Primer***. Big Kid Science, 2014.
- Taylor, Barbara. ***Weather and Climate: Geography Facts and Experiments***. Kingfisher, 2002.

Technology Ties it all Together!

Extension Ideas

Tech Check

What do a fork, a chair, a tractor, and computer all have in common? They are all examples of technology! Review the definition of technology and have your students search for, share, and list out all the technologies they can find on the front cover of *What's Growin' On?*. Here are some examples: satellite, wind turbine, solar pump, car, bus, solar panels, lights, GPS, fence, shovel, drip irrigation system, micro irrigation system, lister (implement), and tractor. These are just a few examples, there are more than twenty on the front cover!

CA Standards: CCSS ELA: W.3-8.4, SL.3-8.1

Technology History

Have your students create questions and conduct an interview with a local farmer about the history of technology. Here are some questions to consider:

- How long have you been farming?
- What technology has played the biggest role in the success of your farm?
- How has technology helped agriculture, as a whole?
- What changes have you seen in technologies that are used to farm?

CA Standards: CCSS ELA: W.3-8.4, SL.3-8.3

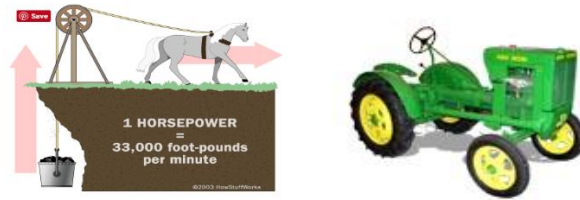
Have your students research more agricultural technological advancements. Have them create a timeline with photos or illustrations showing the progression of technology over time with agriculture. Here are a few technologies to get them started:

CA Standards: CCSS ELA: W.3-8.4, 7

- In 1794, Thomas Jefferson developed the Moldboard Plow. It lifted and turned over soil with the least resistance, allowing people to prepare soil easily for planting.
- In 1834, the first combine was built by Hiram Moore. It “combined” three different parts of harvesting grain: reaping, threshing, and winnowing. By 1871, BF Cook put a steam engine on the combine to drive it. Horses were no longer needed to pull the machine.

Horse Power!

Near the end of the 18th century, James Watt wanted to compare the power of his steam engine to the power of horses. He found that a strong horse could lift 150 pounds, 220 feet, in 1 minute. In other words, 1 horsepower was equal to 150 lb. x 220 ft./1 min. or 33,000 foot-pounds per minute. The term is still commonly used today to describe the amount of potential power an engine offers.



Activity: A Horse of Course!

A John Deere 62 tractor was built in 1937 and had 10 horsepower. Develop a piece of artwork showing 10 horses are equal to 1 tractor. Research and find other horsepower examples to compare and illustrate.

CA Standards: CCSS ELA: W.3-8.7; Visual Arts Content Grades 3-8: 5.0

Service Learning

Have you ever noticed an old sofa or other trash left alongside the road next to a farm field? Rural roadside garbage dumping is a problem for agriculture. Did you know it's up to the farmer to clean it up? What technology could you invent that would help with this problem? Although it wouldn't be safe for you to clean up that type of trash, what can you do in your community? Brainstorm with your classmates and come up with a plan. You might consider a school cleanup day or a workday in your school garden. Make it a challenge and see if you can get other classes to join in!

CA Standards: CCSS ELA: SL.3-8.1; NGSS: 4-ESS3-2, 5-ESS3-1

Resources

National Agriculture in the Classroom (agclassroom.org/teacher/matrix)

- **Lesson Plan:** *Biotechnology in Agriculture, Food, and Natural Resources* (Grades 9-12)
- **Lesson Plan:** *Hands, Horses, and High Tech Machines!* (Grades 3-5)

Websites

- From Drone to Tractor
sco.lt/7LPNnl
- USDA
nifa.usda.gov/topic/agriculture-technology

Books

- Burgan, Michael. ***Genetic Engineering***. Scholastic Library Publishing, 2016.
- Rose, Simon. ***Agricultural Drones***. Edge Books, 2017.
- Stanley, Diane. ***Ada Lovelace, Poet of Science***. Paula Wiseman Books, 2016.
- Wallmark, Laurie. ***Ada Bryon Lovelace and the Thinking Machine***. Creston Books, 2015.
- Woods, Michael. ***Ancient Agriculture: From Foraging to Farming***. Runestone Press, 1999.

Stay Calm and “Native” On

Extension Ideas

Chart Your Knowledge

California is home to approximately 6000 plant species, 4200 native plant species, and 1800 non-native species. Approximately 200 non-native plants are also considered invasive.

Have your students create a bar chart using the plant numbers provided above. Indicate the number of invasive species (hint: within the non-native bar) with a darker color and the native species with a lighter color. Provide a key and label each axis. Bonus: What percentage of California plants are native_____, non-native _____, and invasive_____?

Answers: native: 70%, non-native: 30%, invasive: .03%

CA Standards: CCSS Math: 3.MD.3, 4.MD.4, 5.MD.2; Visual Arts Content Grades 3-8: 5.0

Invasive or Non-Invasive? Vertebrate or Invertebrate?

Invasive animals can be divided into two major categories: vertebrates (animals with backbones, like mammals) and invertebrates (animals without backbones, like insects). Invasive animals can out-compete native animals for resources and habitat. Invasive species can also prey on native animals or introduce and spread disease.

Have your students research invasive and non-invasive vertebrates and invertebrates in California. See example to create a classroom chart; add a graphic and label each “non-invasive” or “invasive” and add a happy or mad bug emoji!

CA Standards: CCSS ELA: W.3-8.7

Invasive Animal Chart

Animal	Category	Graphic	Emoji
Wild Boar	Vertebrate		 Invasive

Service Learning

Have your students check out some of these cool ideas to further their knowledge with native and non-native species!

- Class Cookbook: Research native edibles and herbs and create recipes highlighting native species. Compile recipes to create a Native Plant Cookbook.
- Invasive Plant Removal: Learn about invasive plants in your local area. What are the challenges of controlling them? Learn to identify and remove the invasive plants found near your school or throughout your community.
- Create a brochure which identifies native, non-native, and invasive plants, animals, and insects.

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Agricultural Fact and Activity Sheets:** Learn about the background, diseases, prevention, controls, and economic impact of a variety of Invasive Species. There are also lesson ideas, fantastic facts, and a CA standards-aligned lesson plan.

National Agriculture in the Classroom (agclassroom.org)

- **Lesson Plan:** *Hungry Pests Lessons 1 – 4* (Grades 6-8)

Websites

- National Geographic Kids
kids.nationalgeographic.com/explore/science/green-invaders/#invaders-carolina-wren-with-food.jpg
- National Wildlife Federation
nwf.org/Wildlife/Threats-to-Wildlife/Invasive-Species.aspx
- National Institute of Environmental Health Sciences
kids.niehs.nih.gov/topics/natural-world/wildlife/invasives/index.htm
- California Invasive Plant Council
cal-ipc.org/resources/outreach/plantid.php

Books

- Collard, Sneed. ***Science Warriors: The Battle Against Invasive Species***. HMH Books for Young Readers, 2008.
- Hartman, Eve. ***What is the Threat of Invasive Species?***. Capstone Classroom, 2012.

Prolific Pollinators

Extension Ideas

Did You Know?

Some scientists estimate that one out of every three bites of food we eat exists because of pollinators like bees, butterflies, moths, birds, bats, and beetles – just to name a few! To attract native pollinators, an area must have adequate sources of food, shelter, water, and nesting sites.

Spider Superheroes

Spiders are not harmful to crops! They prey on insects and other pests in the garden. Without spiders, all crops would be affected. Read these facts about spiders and then add in eight more facts that your class has researched. Go to explorit.org/science/spider.html to learn more.

CA Standards: CCSS ELA: W.3-8.7

1. Spiders are a food source for birds, lizards, and wasps.
2. Most spiders have 8 eyes, but some have no eyes and some have 12 eyes.
3. A spider eats about 2,000 insects per year.
4. Spiders are carnivorous and therefore predators.
5. Spiders have two body parts, the cephalothorax (combined head and thorax) and abdomen.
6. Spiders have 8 legs.
7. Spiders are believed to have existed for more than 300 million years!
8. There are about 3,000 species of spiders in North America.

Spider Performance!

Create a Spider Superhero Play or Dance. Act out a scenario where the spider saves the day by eating insects that destroy crops. Share or sing facts about spiders. Record it and show your class. Have fun!

CA Standards: Content Standards in Dance, Music, Theatre, and Visual Arts: Grades 3-8: 2

What are Native Pollinators and Managed Bees?

Native or “wild” pollinators are species that are native to a region; they are found there and live there naturally. Examples include butterflies, bumble bees, moths, and flies. Managed Bees are kept by beekeepers and used for honey, beeswax, and pollination services. The European honey bee is the primary managed pollinator in the US. Have your students research their favorite fruit or vegetable and find out how it is pollinated! Create a poster to display.

CA Standards: CCSS ELA: W.3-8.7; Content Standards in Visual Arts 5.0: Grades 3-8

Citizen Science

Check out the following projects:

- Spiders In Your World
inaturalist.org/projects/where-is-my-spider
- Spider Survey
nhm.org
- Moths pollinate too! Check out Mothing
discoverlife.org/moth
- Various bee projects
beespotter.org

Resources

California Foundation for Agriculture in the Classroom (*learnaboutag.org*)

- **Agricultural Fact and Activity Sheet:** Learn about the history, varieties, commodity value, top producing counties, and nutritional value of Bees. There are also lesson ideas, fantastic facts, and a CA standards-aligned lesson plan.

National Agriculture in the Classroom (*agclassroom.org/teacher/matrix*)

- **Lesson Plan:** *Honey Bees: A Pollination Simulation*

Websites

- National Geographic Kids
kids.nationalgeographic.com/animals/honeybee/#honeybee-pink-flower.jpg
- Easy Science for Kids
easyscienceforkids.com/all-about-pollination/

Books

- Gray, Rita. ***Flowers are Calling***. Houghton Mifflin Harcourt, 2015.
- Huber, Raymond. ***Flight of the Honey Bee***. Candlewick, 2013.
- Woolf, Alex. ***You Wouldn't Want to Live Without Bees!***. Scholastic Library Publishing, 2016.

Animal Agriculture

Extension Ideas

Did You Know?

Goats are browsers and sheep are grazers. Have students look up the definitions in the *What's Growin' On?* glossary. Farmers use these two animals together for a reason – natural weed management. They also benefit the land by providing soil aeration from their hooves and fertilizer from their manure all while cleaning up the forage. This natural weed-eating also helps reduce fire hazards and assists with erosion control.

Fertilizer Ratios

Animal manure can be used as fertilizer. One cow produces 17 pounds of manure per day which provides enough soil nutrients to fertilize 56 pounds of corn or 84 pounds of tomatoes. Have your students find the amount of manure needed by solving the following ratios. Find the ratios of manure to corn and manure to tomatoes. Using these ratios, set up a proportion to solve the following and don't forget to convert from tons to pounds!

If an acre produces 5 tons of corn, how many gallons of manure would be needed? If an acre produces 40 tons of tomatoes, how many gallons of manure would be needed?

Answers: 17:56, 17:84; 5 tons x 2000 lbs/ton = 10,000 lbs., $17/56 = x/10,000$, $x = 3,035.6$ gal.; 40 tons x 2000 lbs/ton = 80,000 lbs., $17/84 = x/80,000$, $x = 16,190.3$ gal.

CA Standards: Math CCSS: 3.OA.3, 7, 4.OA.3, 5.NBT.5, 5.MD.1, 6-7.RP;

Online Activity

Have your students go to healthyeating.org/healthy-kids/kids-games-activities/dairy-farm.aspx for some interactive games to learn more about how dairy farms maximize resources.

Farmer Stories

Check out these California Dairies and hear about their stories!

- [youtube.com/watch?v=M4KzUqAUiHs](https://www.youtube.com/watch?v=M4KzUqAUiHs)
- healthyeating.org/healthy-eating/community-health-all-stars/dairy-innovation.aspx

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Lesson Plan:** *Build it Better* (Grades 6-8)

National Agriculture in the Classroom (agclassroom.org)

- **Lesson Plan:** *Homes on the Range* (Grades 6-8)

Websites

- Kids, Cows, & More!
kidscowsandmore.org/beef/
- Ag in the Classroom Kids Zone
agclassroom.org/kids/ag_facts.htm

Books

- Bregoli, Jane. ***The Goat Lady***. Tilbury House Publishers, 2008.
- Daynes, Katie. ***Farm Animals***. Usborne Publishing, 2003.
- Peterson, Cris. ***Clarabelle: Making Milk and So Much More***. Boyds Mills Press, 2013.

Plants Through Time

Extension Ideas

Did You Know?

The world's population is expected to grow to 9.6 billion people over the next few decades, which means farmers will need to grow as much food in the next 50 years as they did in the past 10,000 years combined.

What is a Seed?

A seed is a tiny plant. Seeds come in different sizes, shapes, and colors. Some can be eaten and some can't. Some seeds germinate easily while others need certain conditions to be met before they will germinate.

- **Draw a Seed:** Have your student's research and draw a seed. Label all the parts. Find others seeds to draw and compare.
- **Seed Dissection:** Get large bean seeds and soak in water for a few hours. Gently pull apart the two halves and identify the parts of the seed.

CA Standards: CCSS ELA: W.3-8.7, RST.6-8.3

Did You Know?

Seed banks keep plants from extinction by collecting seeds of plants. Conifer (evergreen trees) seeds are gathered to ensure certain trees are not eliminated by fires. Check out this site about seed banks and why they are good for the environment encyclopedia.kids.net.au/page/se/Seed_bank.

Resources

California Foundation for Agriculture in the Classroom (learnaboutag.org)

- **Ag-Bites:** *Desktop Gardens* (Grade 2-5), *Garden in a Glove* (Grade 3-8)

National Agriculture in the Classroom (agclassroom.org)

- **Lesson Plan:** various lesson plan ideas

Websites

- Discovery Kids
dkfindout.com/us/animals-and-nature/plants/
- Science Kids
sciencekids.co.nz/sciencefacts/plants.html

Books

- Bardoe, Cheryl. **Gregor Mendel: The Friar Who Grew Peas.**
- Peterson, Cris. **Seed, Soil, Sun: Earth's Recipe for Food.** Boyds Mills Press, 2012.

The Trouble With Trash

Extension Ideas

Did You Know?

- Food waste in developed countries (like the U.S.) is the most common at the end of the food supply chain. Retailers order too much supply and consumers waste leftover food and toss perishable food before it expires. (National Geographic)
- The United States wastes approximately 165 billion dollars in food annually. (Washington Post: How the US Manages to Waste \$165 Billion in Food each Year)
- Globally, one-third of the food produced for human consumption is not consumed. (United Nations Food and Agriculture Organization)
- Annually 30-40 percent of food produced in the United States is wasted. (USDA)
- 90 billion pounds of edible food goes uneaten every year. (USDA ChooseMyPlate.gov)
- Food waste is the single largest contributor to municipal landfills. (USDA ChooseMyPlate.gov)

Packaging

Have you heard of bioplastic packaging? Bioplastic is a compostable plastic derived from renewable biomass sources rather than plastics made from petroleum products. Scientists are currently investigating if they can use byproducts such as dried tomato skin to make bioplastic. Have your students write a list of different materials we could use to make bioplastic out of!

CA Standards: CCSS ELA: W.3-8.4

There's an App for That

What Smart Phone applications can help you reduce food waste? Have students check out these apps available to help reduce waste!

- *Food Keeper*
- *Food Cowboy*
- *Wasted No Food*
- *Spoiler Alert*

The Food Recovery Hierarchy

The Food Recovery Hierarchy focuses on ways to divert food waste. Each tier represents a different strategy to decrease food waste. Check out this website for more information: epa.gov/sustainable-management-food/food-recovery-hierarchy

What Does It Mean to Repurpose?

Think about and discuss with a partner: How could you repurpose food waste? Do you do anything now to help reduce food waste?

CA Standards: CCSS ELA: SL.3-8.1

Service Learning – Gleaning!

Gleaning is the action of gathering grain or other material left after the main crop has been harvested. Find out if there are gleaning projects in your neighborhood. Consider a community service project to help!

Resources

National Agriculture in the Classroom (agclassroom.org)

- **Lesson Plan:** *Journey 2050, Introduction to Sustainable Agriculture Lessons 1–4*

The New York Times (nytimes.com)

Lesson Plan: Clean Your Plate!

learning.blogs.nytimes.com/2008/05/19/clean-your-plate/?_r=0

Websites

- To learn more about food waste, check out this website!
newsela.com/text-sets/16189/foodwaste
- National Geographic talks about the connection between food waste and climate change!
news.nationalgeographic.com/news/2015/01/150122-food-waste-climate-change-hunger

Books

- Rubino, Ann. ***Emmet's Storm***. Catree Books, 2015.
- Chancellor, Deborah. ***Food Waste (Reduce, Reuse, Recycle!)***. PowerKids Press, 2010

Ag and the Environment Word Search

J Z H G G Y I M W H U E T G G X U C L L U E C R L C S V B D
 P F Q Y G S N D W W L N W R P G U A C D H A G L E I N D A I
 A B T T D I S O I B V X E Z K V F R H W L P U A R T O J F B
 W X O O A R Z Z A J O E W G J Q P B H M N D D R L S I O X N
 Q O I F A I O W Y Z N W K S S X A O B Q E R N L V I S F U F
 X A K N Y F E P E H Q S I S E H T N Y S O T O H P N S S T B
 L D J G G N B W O B M R M R N D M F X F C W S G G U I C R Q
 V O E T E I X U E N W J I J A X T O T B J O X Y T T M D C H
 S Z N R O B S M V R I W T H Y K F O S A P Z Z I S R E E D A
 N V N M Z E Z Y Y C J C A N M L K T N H T S S I S O S T T E
 R O A X G O L B N Q N B C N L W C P L A N I N M L P C P B E
 N S I A R M Z V S I S D S R E Z A R G P T S B S W P P E I K
 S R S T R R W T V V V U G B X O S I Z D U G F A P O C I J C
 M E U P A R I C E S T U B B L E Q N X L D V J S H A K F W Q
 S E P M T C B A A U C Q H C M A L T A B J C W D K G E J N P
 X A T M I O I A Y B U N Y U Q S J T D D I O T I S A R A P I
 A I T H Z N R T P G X C G D L D I K R B Y B P Q M Z M I T L
 N G V A A S A N S L E E I V O N Y Y I B T S M Q K Y P G S S
 T P J B G N P N T E L U B N G E C T C V H Y E Q W L J K T S
 I M Q I T M E E T K M R F Q P I V L K J B R O W S E R S W T
 A T L O O H A D C K X O Z U O E F F J D I O U R N X W O J S
 R S J T G J Y C I I X V D P R O G E N Y M N V Q H N R Y M P
 T I U I X F Z Q V G E C L Y R E C A M O P V O A M E B Q C U
 H F Q C N H V H L G E S G A K B V N U M L B Q H G C I U Y R
 L V I B R C C J I Y N S G U K Z V N D Z E I Z D G I O O G I
 X P K L N L P O U F J E T P X G A M A Y M E E R S T T G J W
 C Q V A S C B I D E D N O E Y T G U I V E H K N A E I I Q W
 V L B X O R G O P R I K D I R X H R F B N R K U F N C W N Y
 J R X A Y X Q X K N Z J K N J S L S C K T H V J E I P F K Q
 U S W X D L Z R M O D T Z J J M S K U D S L O I J K H P U L

ABIOTIC
 BIOMASS
 BIOTIC
 BROWSERS
 CARBONFOOTPRINT
 DOMESTICATION
 ECOSYSTEM
 EMISSIONS
 FORAGE
 GRAZERS
 GREENHOUSEGASES

HABITAT
 HEDGEROWS
 HYDROPONIC
 IMPLEMENTS
 INSULATING
 KINETIC
 LEGUMES
 METHANEDIGESTERS
 NONRENEWABLE
 OPPORTUNISTIC
 PARASITOID

PHOTOSYNTHESIS
 POMACE
 PROGENY
 RICESTUBBLE
 RUMINANT
 SILAGE
 SPECIES
 TRAIT
 URBAN

Field Trips and Guest Speakers

- Counties throughout California have Farm Days or Ag Day educational events for school students. Check with your local Farm Bureau or LearnAboutAg.org to see if an event is scheduled in your county.
- Mobile Dairy Classroom: Visit healthyeating.org/schools/mobile-dairy-classroom.aspx
- Arrange a visit to a local Farmers Market, farm, fair or other agricultural operation.
- Check out historical farms and local museums such as the Luther Burbank Home & Gardens, Santa Rosa.
- Invite in a Guest Speaker (farmer, county farm advisor, pest control advisor, master gardener, 4-H leader or member, FFA student).