Farming in the Watershed
The Sunol AgPark Activity Guide

Sustainable Agriculture Education (SAGE)
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Produced by:
Sustainable Agriculture Education (SAGE)
www.sagecenter.org

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Farming in the Watershed

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Acknowledgements and Contributors

SAGE STAFF AND INTERNS
Sibella Kraus, SAGE President
Cynthia King, Sunol AgPark Education and Farm Manager
Johanna Ortis, Office Manager
Lisa Lombardo, Design Intern
Briana Robertori, Education Intern
Emma Chastain, Intern
Samantha Glenn, Intern
Ali Goldstein, Intern
Alex Holey, Intern
Reema Issa, Intern
Rita LeRoy, Intern
Sarah Pritchard, Intern
Kelly Trombley, Intern

CURRICULUM DEVELOPER
Margaret Kelley, Education and Greening Consultant

TEACHER ADVISORY BOARD
Brenda Calvert, John F. Kennedy High School
Jonathan Cohen, Prospect Sierra School
Katy Pearce, Ochoa Middle School
Phoebe Tanner, Martin Luther King Jr. Middle School
Sue Wiltz, Sunol Glen Elementary School

EDUCATION COMMITTEE
Christine Boynton, Alameda County Office of Education
Janet Hatano, Education Program Consultant
Elizabeth Hales, East Bay Regional Park District
Erica Herron, East Bay Regional Park District
Nancy Kaiser, East Bay Regional Park District
Carla Schultheis, San Francisco Public Utilities Commission
Leah Sokolofski, Alameda County Office of Education

FIELD TESTING INSTRUCTORS
Jeanne Bauer
Gail Broesder
Katie Colbert
Diane Dowholuk
Anthony Fisher
Jonathan Irvin
Cat Taylor
Farming in the Watershed Introduction

Acknowledgements and Contributors

TEACHERS
Emily Harris and Bonnie Hansen, Harder Elementary School
Kathy Moran, Joaquin Miller Elementary School, Oakland
Katy Pearce, Ochoa Middle School
Brie Regis, Prospect Sierra School
Holly Scott, Montair Elementary School
Sue Wiltz, Sunol Glen Elementary

EVALUATION CONSULTANT
Rachel Brand

DESIGN CONSULTANT
Noreen Fukumori

COPY EDITOR
Melinda Mizuno

PARTNERS
Alameda County Resource Conservation District
East Bay Regional Park District
Alameda County Office of Education
Banbury Fund

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San Francisco Public Utilities Commission Natural Resources Division:
Carla Schultheis, Tim Ramirez, Tim Koopman

AGPARK FARMERS
Baia Nicchia Farm and Nursery: Fred Hempel and Jill Shepherd
Iu-Mien Village Farms: Lew Chien Saelee, Muang Saechao and Warn Saechao
Fico: Luciana Messina
Terra Bella Family Farm: Shawn and Beth Seufert and Joe Sunderland

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The Sunol AgPark is a dynamic outdoor environment that offers San Francisco Bay Area students a unique opportunity to learn about sustainable agriculture in the context of a regionally-important watershed. The Sunol AgPark is located on 18 acres of land in the Sunol Valley owned by the San Francisco Public Utilities Commission (SFPUC) and leased by Sustainable Agriculture Education (SAGE). The Sunol AgPark was created from the mutual interest of SAGE and the SFPUC in developing an entity that integrates sustainable agriculture, natural resource stewardship, and public education about the Sunol Valley. The SFPUC is an agency of the City and County of San Francisco that provides water to 2.5 million Bay Area residents, and power and wastewater services to San Francisco. The SFPUC owns 40,000 acres in the Alameda Creek Watershed, for water supply purposes. SAGE is a nonprofit organization based in Berkeley, with a mission to develop urban edge agriculture and engage diverse populations with the sustainable agriculture movement.

_Farming in the Watershed_ is a new curriculum that introduces Sunol AgPark visitors to the concept of stewardship, and provides a framework for on-site experiential education. The curriculum investigates the unique resources of the AgPark site, including the historic Sunol Water Temple, the Arroyo de la Laguna creek, and three working organic farms. The confluence of these and other diverse elements at the AgPark encourage student inquiry into the relationship between farming, food, water, and culture. _Farming in the Watershed_ is organized into the following three units:

**Unit 1: Stewarding the Sunol Valley Through Time**
This unit explores the relationship between the Sunol Valley’s human inhabitants and the landscape over time. Activities include: drawing the Sunol Water Temple, building a model water system, and investigating the history of AgPark crops.

**Unit 2: Stewardship Through Farming and Eating**
This unit explores the connections between healthy farms, healthy food, and healthy communities, focusing on the AgPark farms. Activities include interviewing a farmer, observing insect diversity, and helping a farmer.

**Unit 3: Stewardship From Urban to Wild Landscapes**
This unit explores the relationship between the AgPark and the surrounding environment. Activities include building a model watershed, exploring creek diversity, and taking soil samples.

Each unit contains six lessons which focus on two or three key objectives. Visiting teachers are encouraged to select lessons which best complement their classroom teaching. The lessons are linked to California Academic Standards for grades 4-8 (see Appendix for more information).

_Farming in the Watershed_ was designed to stimulate students’ visions of a healthy, just, and sustainable future by challenging them to explore their roles as stewards—of their own health, their watersheds, and their communities.
Welcome Tour

BIG IDEA
The Sunol AgPark is an example of a new kind of farm, called an “AgPark”, where multiple tenants farm on public land and contribute to natural resource stewardship and public education efforts. The Sunol AgPark is in a place with a rich history, and is home to multiple organic farms that grow a wide diversity of crops for different markets.

BACKGROUND
Sunol Water Temple facts:
• Built in 1910 by William Bourn II, president of the Spring Valley Water Company, and designed by Willis Polk, a famous architect, to celebrate an important source of water, and the city’s water supply.
• At the time of the temple’s construction, half of the water used in San Francisco came from the East Bay and ran through the temple. Today only 15 percent of San Francisco’s water comes from the East Bay, and it runs through underground pipes rather than the temple.
• Fashioned after the Temple of Vesta at Tivoli outside of Rome, Italy
• The quotes engraved on the temple: Isaiah 41:18: “I will make the wilderness a pool of water and the dry lands springs of water.” and Psalm 46:4: “The streams whereof shall make glad the city.”
• Seriously damaged in the Loma Prieta earthquake of 1989, restored in 2001 with support from the local community. The restoration won the prestigious Preservation Design award from the California Preservation Foundation.

OBJECTIVES
Students will
• Identify 2-4 unique features of the Sunol AgPark.
• Describe ways they can be good stewards.
• Explore the significance of the Water Temple.

MATERIALS
• Relief map (California or SF Bay Area)
• Map of the Sunol AgPark, including farm plots, roads, drinking water, and bathrooms
• Clipboards, pencils, and AgPark scavenger hunt worksheet for each student pair

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class, students in pairs

ADAPTED FROM
Original
PROCEDURE
When all the students and chaperones have arrived at the temple, gather them together and welcome them to the AgPark. Have AgPark instructors introduce themselves. Divide the large group into smaller groups of 15 and move to agreed-upon areas on opposite sides of the temple.

PART I: Welcome and Overview (5 min)
1. Briefly introduce yourself and your relationship to the Sunol AgPark. Wear a name tag.
2. Outline the day’s plan.
3. Agree on safety and behavior guidelines: stay on the roads, stay with the group, don’t touch any farm equipment or eat crops without permission.
4. Tell students that they’re still in a classroom today, but the earth is the floor and the sky is the ceiling.
5. Demonstrate the signal you’ll use to assemble the group or to get their attention (e.g. whistle, deer’s ears, raised hand, clap and response).
6. Point out the toilets, and give them a chance to go before getting started.
7. Let the rest of the students explore the temple, being careful not to disturb the other group(s).

PART II: Partner pairing and introduction to “stewardship” (10 min)
1. Gather students in a circle. Tell them they’ll be working in pairs, each named after a different farm animal, which you will give them. They are to find their partner by making the sound their animal makes, with their eyes closed, until they find the other person making the same sound.
2. Have students close their eyes while you go around the circle and quietly give them their animals. Ask students to pay close attention to the sounds, smells, and feelings they notice while they wait.
3. Give students a few minutes to find their partners.
4. Give each pair a clipboard, pencil and worksheet, and give teams three minutes
to brainstorm “What makes a healthy Earth?” and “What makes a healthy you?” on their worksheets.

5. Take two minutes to discuss their ideas, and explain that they are here today to learn about stewardship, which means the responsibility of caring for ourselves, each other, and the planet.

PART III: The Water Temple in Context (5-7 minutes)
1. Use a relief map to point out the AgPark location, and its significance within the larger region (e.g. Alameda Creek watershed is an important source of drinking water for the region.)

2. Tell students that the Temple was built in this place because it’s at the confluence of three water sources: Alameda Creek, Arroyo de La Laguna, and the Pleasanton wells.

3. Ask students to share what they know about temples.

4. Ask students to walk around the temple with their partner transcribing the quote at the top, and to take two minutes to brainstorm the meaning of the quote and how the quote relates to farming today. If time allows, ask a couple of groups to share.

PART IV: Scavenger Hunt (20-25 minutes)
1. Remind students to carry their lunches and water, and to stay hydrated. Give students an opportunity to get their lunches from the bus or cars, if needed.

2. Once you enter the AgPark gate, gather the students in a circle.

3. Briefly introduce the AgPark, breaking it down into “agricultural” and “park.”

4. Give a brief overview of the AgPark (18 acres, multiple farms, the types of produce grown).

5. Explain that they are going on a scavenger hunt; they will be like detectives to discover facts about this special place.

6. Lead students on a tour of the farm, allowing them to stop to check things
off on their worksheets. When you arrive at the first activity station, have a couple of teams share one thing they saw that they weren’t expecting. Collect their worksheets.

MODIFICATIONS/EXTENSIONS
• If the students are distracted when they arrive, use a centering activity. Have students create a circle, and imagine being trees, with hands reaching up to the sky, and feet sinking down into the earth. Take three deep breaths, as if they are leaves respiring.
• If students aren’t smiling and feeling relaxed, have them make funny faces moving their mouth all around; stretching their face as much as they can until you see the smiles appearing.
Farming in the Watershed
Introduction to the AgPark

“Stewardship” is our responsibility for taking care of the people and places in our lives, including ourselves.

What makes a healthy earth?

What makes a healthy you?

What is the quote written around the top of the Sunol Water Temple?

Today’s Date___________
Farm Scavenger Hunt
Can you find the following things? Check the box next to the object when you find it!

Sights:
- Bird (What kind? ________________)
- Strawberry
- Compost Pile
- Cow (Hint: look up in the hills)
- Irrigation tape
- Tomato plant
- Cat or dog
- Chickens
- Farmers in the field
- Insects (What kind? ________________)
- Shades of green (How many? ________________)
- Something that is over 50 years old (What is it? ________________)
- Water vapor
- (Fill in the blank) ________________

Smells:
- Mint
- Rosemary
- Compost
- (Fill in the blank) ________________

Sounds:
- Bird chirping
- Engine running
- Chicken clucking
- Leaves rustling
- Bee buzzing
- (Fill in the blank) ________________
LESSON 1: Sunol Water Temple Works of Art

BIG IDEA
The Sunol Water Temple is a monument that celebrates the importance of water to our region. The Alameda Creek watershed has been a source of water for nearby communities for over 100 years. The temple is a work of art that reminds us to respect and care for the places that sustain us.

BACKGROUND
The Sunol Water Temple was built in 1910 to honor the importance of water to our region. It was built at this site to mark the confluence of three water sources: the Arroyo de la Laguna (arriving through a pipe), Alameda Creek (arriving through the Sunol filtration galleries), and the artesian well field of Pleasanton (also arriving through a pipe). The temple was commissioned by William Bourn, the president of the Spring Valley Water Company, which owned much of the Alameda Creek Watershed and sold water to San Francisco. Architect Willis Polk designed the temple, fashioned after the Temple of Vesta at Tivoli which honored the masterful aqueducts of the Roman Empire. The temple design is a circular pavilion of twelve fluted, sixty-foot high columns with a peaked clay tile roof and copper finial of three dolphins, tail to tail. The temple frieze quotes Isaiah 41:18: “I will make the wilderness a pool of water and the dry lands springs of water,” and Psalm 46:4: “The streams whereof shall make glad the city.”

At the time of the temple’s construction, 50 percent of the water used in San Francisco ran through the temple. None of the water flowing through the temple today is used for drinking.

OBJECTIVES
Students will
- Learn the history of the Sunol Water Temple.
- Appreciate the artistic nature of the Sunol Water Temple.
- Create a work of art inspired by the Sunol Water Temple.

MATERIALS
- Paper, pencils, crayons or paint
- A clipboard for each student

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class (approximately 15 students)

ADAPTED FROM
Original
Seriously damaged in the 1989 Loma Prieta earthquake, the Sunol Water Temple was beautifully restored in 2001 with support from an active community organization, “Save Our Sunol.” The restoration won the prestigious Preservation Design award from the California Preservation Foundation.

PROCEDURE
1. Gather students together in a shaded area next to the temple.
2. Prod their prior knowledge of temples and ask them to share any personal connections they have with temples or other monuments.
3. Share some brief background information about the temple with them.
4. Tell students that they will be given materials to sketch/draw the temple or create something in another art form (e.g. an essay or poem) inspired by it.
5. Allow students five minutes to tour the temple and examine it from various points of view (e.g. front, back, top, bottom, lying down, looking backwards between their legs, up close and far away, etc.). Perhaps they would like to focus on a small piece of the Water Temple and enlarge it.
6. Hand out paper, pencils, crayons, or paint, and a clipboard to each student.
7. Allow students twenty minutes to make their renderings.
8. If time permits, call on students to share their art and explain the idea behind their creation.
CLOSING DISCUSSION/EVALUATION
If time allows, ask students to reflect on the following questions:
• Why would people build a “temple” to water?
• How does the Sunol Water Temple relate to our stewardship theme?
• How can you celebrate water in your own way, at home, in school, or in your neighborhood?

MODIFICATIONS/EXTENSIONS
• If you have enough students, see how many people it takes to surround the temple holding hands. Then have everyone remember who they were holding hands with and how outstretched their arms were. Duplicate the circle in the open area next to the temple to estimate the diameter of the temple. An average adult step is two feet in length. Walk across the circle made by the students and that will tell you the temple’s approximate diameter (45 feet).
• For older students: Lead a discussion about the intersection of nature, art and architecture.
• For older students: Discuss the historical importance of the temple. Point out that another theory behind the temple’s construction was that the Spring Valley Water District wanted to have something beautiful to offer as its president wanted to sell the company to the City of San Francisco, and thought the temple would be good for marketing. Ask students to share an example of how businesses use this kind of marketing approach today.
LESSON 2: The First Groups of People in the Sunol Valley

BIG IDEA
The land and its people are dynamic; the only constant is change. The Sunol Valley has been home to many different groups of people through history. The Ohlone people lived in the Valley for about 4,000 years, followed by the Spanish missionaries, Mexican rancheros, and forty-niners seeking gold in California.

BACKGROUND
The human history of the Sunol Valley spans a long continuum of time, from Muwekma-Ohlone Indian pre-historic ancestors starting around 4,000 years ago, to the farming, ranching, and high-tech communities of today. Each group has relied on and related to the land in different ways: Indians hunted and gathered; Spanish Vaqueros grazed livestock; farmers tilled and introduced new crops; engineers dammed the creeks; and miners extracted many materials, such as gravel, which continues today. Each generation’s land use decisions affect what future generations inherit. See the activity for more background.

PROCEDURE
1. Split students into smaller groups of 4-5.
2. Distribute one pad of chart paper and a marker to each group.
3. Have students decide who in their group will be the recorder and who will be the reporter.
4. Instruct the students that you will give them some information on how the Sunol Valley has changed over time as a result of natural and human events. Every so often you will stop, give them a prompt and some time to discuss and record their group’s responses. Sharing will come at the end of the lesson.

OBJECTIVES
Students will
- Learn about the changes in the Sunol Valley’s over time, from California Indians to the Spanish missions and ranches.
- Reflect on and describe their personal connections to the history of California

MATERIALS
- Timer (or wristwatch)
- Chart paper pad for each small group
- Markers for each group
- Historical artifacts (fossils, art, photos...)
- Historical period foods, including pounded & leached acorns (collected in autumn and dried), jerky or sun dried fruit or vegetables, farm-fresh harvest
- Laminated timeline (optional)

TIME REQUIRED
45-60 minutes

GROUP SIZE
Half of the class, split into groups of 4-5 students

ADAPTED FROM
Original
5. Optional: as you read about each event, mark it on your laminated timeline.

CULTURAL STORY:
START: This area was inhabited as early as about 4,000 years ago. There is evidence that the ancestors of the “first people” came to the North American continent by walking from Asia over the Aleutian Islands (off the coast of Alaska), through Canada, down the Pacific Northwest to the San Francisco Bay Area. The movement of people is linked to waterways. Creeks were the animal migration corridors, later followed by humans.

About 1,000 years ago, an Ohlone Indian community lived in a village near the Sunol Water Temple site today, near the confluence of the Arroyo de la Laguna and Alameda Creek. The Ohlone group was called the Taunen-Ohlone. The Ohlones had everything they needed to survive: water, shelter, and abundant plants and wildlife for food. Everyone shared in the gathering of food. The Ohlones participated in a lot of ceremonies and rituals. The Chieftain tended to be the best storyteller of the group who could carry on the group’s oral traditions since there was no written language. Shamans could be either male or female, and were important healers (using plants as medicine) and ceremony leaders. The Ohlone gained social status and showed their wealth by giving their possessions away, showing that they could support more people than their immediate family.

STOP: Ask the students to discuss in their groups, “How does our culture show wealth? How is it different than or similar to the culture of the Ohlone?”

Allow 5–7 minutes of discussion and recording.

START: Indians lived in harmony or “in beauty.” If beauty was disrupted, they restored it through ritual. The Indians believed that people and place must remain linked.
LESSON 2: The First Groups of People in the Sunol Valley

The landscape was a certain place where you were born and belonged. It was comforting to know that you would be born, live and die in the same area. As an Ohlone, you were in your place of comfort. For hundreds of years, the Ohlones lived with very little change in their culture.

STOP: Ask the students to discuss in their groups, “Would you want to live and die within a mile of your birth? Why or why not?” Allow 5-7 minutes of discussion and recording.

START: Almost 250 years ago, in 1769, the first Spanish explorers came to this place with only hand drawn maps, far from their European homes. In contrast to the Ohlones, the men knew that in coming here, they would probably never see the place they called “home” again.

The Ohlone Indians welcomed them. In 1792, Juan Bautista De Anza, a Spanish Explorer rode his horse through this area, claimed the territory for Spain, and designated it as a “Rancho.” Spanish Explorers described the area as having grasses higher than the saddles of their horses. The environment was gentle and to them, it was a perfect place for farming, raising cattle and spreading Christianity.

STOP: Ask the students to discuss in their groups, “How does today’s landscape look similar to and different from what was just described?” Allow 5-7 minutes of discussion and recording.

START: Before long the eastern extent of Mission San Jose (1797 – 1833) included the Sunol Valley. The Padres and Spanish soldiers gathered the Indians from their villages and took them to the Mission (in present day Fremont) to learn European customs (including how to farm), help build adobe Missions, and learn Christianity. Once the Indians became Christians, they were often held at the mission against their will. Unfortunately, the Indians were exposed to European diseases, to which they had no immunity, and many died in the missions from measles and other diseases.

Mexico gained independence from Spain in 1821, and soon could no longer afford to run the missions. In 1833, the missions were secularized, and most of the Ohlones and other Native Americans left the missions to work on ranchos that were being established in the area. Some of the Ohlones formed villages at three Rancherias.
Today’s descendants of the Ohlone have integrated into modern life. Two families take care of the Ohlone traditions and burial ground at Mission San Jose.

In 1839, Rancho Valle de San Jose was established from the lands of the mission. Antonio Maria Sunol and Maria Bernal Sunol inherited 14,000 acres of the land, including the area known as Sunol today, which was used primarily for cattle ranching.

In 1848, California was ceded to the United States and gold was discovered in the foothills of the Sierra Nevada Mountains; by 1849 the word had spread and people from all over the world descended on California to try to get rich quick. Some of the pioneers turned to farming and ranching to supply the miners with food and supplies. For the most part, the farmers were the ones who gained wealth, as there were no grocery stores or facilities to help the newly arriving immigrants.

In 1849 San Francisco grew from a population of around 800 people to 40,000 people. In 1850 California became the 31st state admitted to the Union. During this time, the Sunol Valley continued to be subject to alluvial flows, with water carrying soil from the hills down to the valley floor. This made for excellent farming, which continues today.

STOP: Ask the students to summarize how land use changed from 4,000 years ago to today. (Use the optional timeline for help or create one on the board for reference.) Allow 5-7 minutes of discussion and recording.

ASK: “What is your group’s vision for the area? How will we and our descendants use this area similarly or differently from previous inhabitants?” Allow 5-7 minutes of discussion and recording.

CLOSING DISCUSSION/EVALUATION
Allow groups to report their recordings either question by question or from their entire report.

MODIFICATIONS/EXTENSIONS
• Ask students to take turns reading the history of the area
• Share legends from the region’s history
• Read a village scene from *The Ohlone Way* by Malcolm Margolin
• Take a field trip to Coyote Hills Regional Park in Fremont, CA; visit an Ohlone Village Midden Site
LESSON 3: Recent Past, Present, and Future of the Sunol Valley

BIG IDEA
The rich natural resources and pleasant weather of the Sunol Valley have attracted many people over time. Sunol residents have made livelihoods through farming, ranching, gravel mining, recreation, movie production, and building railroads. Today’s residents have created an active community, which gets organized to protect the heritage of the area and look out for its future.

BACKGROUND
The Sunol Valley and Niles Canyon area has attracted human settlement because of its rich and easily accessed natural resources, including soils, freshwater, and gravels. The gravels that house important ground water resources have also been mined to make roadbeds for cars and trains. The fledgling silent movie industry found a home in the quaint town of Sunol and Niles Canyon where movie stars like Charlie Chaplin played out chase scenes with the police. The colorful history of Sunol also includes the railroad that traveled through Niles Canyon. The Alameda Creek watershed helps provide water for 2.5 million people, and recreation for hikers, cyclists, and equestrians. In the 90’s, residents of Sunol started a citizen’s action group called “Save Our Sunol” (SOS) to preserve the town’s history, character, and resources for future generations.

PROCEDURE
Before the students arrive:
1. Make sure the eight story envelopes are assembled inside plain envelopes. Add historic photos to envelopes.
2. Put the clothesline up with the dates clipped to it in chronological order.

OBJECTIVES
Students will
• Place recent events in the Sunol Valley along a timeline
• Dramatize historical events in the Sunol Valley

MATERIALS
• Strips of paper which say: Ohlone Indians, Spanish Explorers, Sunol brothers, Gold Miners, etc.
• A list of eight key events in recent history on chart paper
• At least ten binder clips
• 1800, 1900, & 2000 on paper strips
• Clothesline
• 8 Charades story envelopes
• Charade props, sorted into bags

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class, students in pairs

ADAPTED FROM
Original
LESSON 3: Recent Past, Present, and Future of the Sunol Valley

3. Post on a chart pad:

Recent History of Sunol Valley and the Alameda Creek Watershed
- San Francisco buys Spring Valley Water Company
- Transcontinental Railroad arrives
- Early Town of Sunol thrives
- Charlie Chaplin’s *The Tramp* is filmed
- Gravel mining is expanded near Sunol Water Temple
- Sunol residents elect Bosco as Mayor
- Sunol-Ohlone Regional Park is created
- SAGE starts the Sunol AgPark

When students arrive:
4. Tell the students that for the next half hour they are going to be “History Detectives.” Their job is to piece together the puzzle of the Sunol Valley’s history.

5. Ask students to find a partner. Hand each team of students a story envelope, with a bag of associated props. The teams work together for 5-10 minutes to read their stories, and plan a charade of their historical event. Instruct students to develop a silent, one-minute charade, without talking or showing the clues from their envelope to the other teams. Teachers or chaperones can be encouraged to quietly read the stories to student groups. Circulate around to help the teams.

6. When students are ready, call them back together. Call on teams to volunteer to perform, one at a time. Once classmates figure out what the historical event is, students can read a few highlights of their story to their classmates. Give the actors their event (with the date) on a slip of paper, with a clip. Ask them to clip their event onto the timeline in the correct chronological order.

7. If the classmates don’t figure out who they are, ask the students to sit down, and they will get another try after everyone else has gotten a chance to perform their charade.
CLOSING DISCUSSION/EVALUATION

After the charades, ask students to debate the integration of tradition with the future:

- Which is more valuable: mining gravel or saving the Tule Elk? (Hint: Be balanced! We like driving automobiles and want roads (gravel), we also want wilderness. Can these two coexist?)
- What did stewardship mean for each group in the Sunol Valley?
- How would you preserve the traditions of Sunol, in light of cultural change, and technological progress, or would you?

MODIFICATIONS/EXTENSIONS

- Play Pictionary or hangman instead of charades, using a white board or chart pad.
- At the end of the charades, student pairs get up and without talking, form a line from the earliest activities to the most recent activities. Once everyone is in line, each pair of students tells the other students what event they represent and the date, to see if they are in the right sequence.
- As an English Language Learner alternative, give teams of students their historical event on a slip of paper. Then read all the stories about the history of Sunol out loud. When the students hear their event mentioned, they get up and act out a charade. They stay in front of the group. Every time a new team hears their event mentioned, they get up and do a charade. Each time a new team comes up, all the groups do their charade. By the end, all the teams are doing their charades in a kind of perpetual motion look, indicating an active history.
San Francisco Buys Spring Valley Water Company - 1930

In 1849, the City of San Francisco was in great need of water for its rapidly growing population. In those days water companies got water from the San Mateo and Santa Cruz springs and creeks and sold water from a wagon by the bucket to San Francisco residents (like an ice cream truck driving around town with water to sell). The Spring Valley Water Company of San Francisco purchased the 40,000-acre Alameda Creek Watershed (here in Sunol) in 1875. The farmland continued to improve as the floods brought fresh soil to the lowlands. However, the town of Sunol periodically flooded.

In 1910, the Sunol Water Temple was built to honor the place where three water sources met: the Alameda Creek, Arroyo de la Laguna, and Pleasanton artesian wells. The Sunol Water Temple was fashioned after the Temple of Vesta at Tivoli outside of Rome, Italy, which was built to honor the masterful aqueducts (irrigation system) of the Roman Empire. William Bourn II, President of the Spring Valley Water Company of San Francisco, and Willis Polk, a famous San Francisco architect, created the artistic architectural marvel called the Sunol Water Temple. It was designed to impress upon people the importance water plays in our culture and honor the masterful plumbing bringing water to the city.

In 1913, upstream from today’s Sunol AgPark, construction began on the Calaveras Dam to bring water to San Francisco. The completion of the dam basically stopped the floods that historically brought new soil to the valley floor. Nevertheless, farmers were successful using the land to grow a huge variety of crops from fruits, to nuts and vegetables. The construction of the dam was not as smooth as engineers had hoped; the original dam was finally completed in 1925. The construction brought new revenues to the town of Sunol.

The Spring Valley Water Company and all of its land and infrastructure was purchased by the City of San Francisco in 1930.
The Railroad Comes to Sunol - 1869

In 1869, the first ever Transcontinental Railroad passed through Sunol Valley on its way to the shore of the San Francisco Bay! This happened 16 years after the land had been surveyed for this purpose. President Abraham Lincoln suggested building a railway between the Mississippi River and the Pacific Coast and favored the route through the canyon, signing the Pacific Railroad Act in July 1862.

The railroad changed the nature of Sunol, and how much money its inhabitants made. For the first time, visitors came to the town of Sunol regularly and some made their homes here. Also, supplies came and left town more easily. Farmers were able to send and sell their agricultural products wherever the train stopped. This increased the income of farmers.

City folks came to Sunol to picnic, hike and camp. Businessmen built summer homes for their families and could take the train into the city for the workweek, returning to Sunol for the weekend. It was a happy place to “get away from it all.”

The railroad station closed in 1941, as it could not compete with the automobile. The old railroad tracks in Niles Canyon Road were paved over in 1928 to become Highway 84.

Volunteers of the Pacific Locomotive Associate have rebuilt a portion of the line between Sunol and Niles, so that future generations may enjoy a ride over this important link in America’s railroad history.
Early Town of Sunol Thrives - 1900

When the railroad came to town in 1869, it brought city visitors and more money. Businesses grew along the railroad track faster than weeds! In the late 1800s, Charles Lyon opened “Lyon’s Brewery Depot” near the Western Pacific Railroad Depot in Sunol, where a pint of beer was 5¢ and a pale of beer was 10¢. By 1880, the Brewery Depot was a thriving business, which continued until Congress passed a bill to prohibit the making and sale of alcoholic beer in 1919. They tried to make non-alcoholic beer but it was not popular and they lost their business. The brewery became a café.

From the late 1800s, bands provided music for dancing which was a popular form of entertainment. Some of the dances were held at the Sunol Water Temple! In the late 1800s there were two hotels, two blacksmith shops, two general stores, a butcher shop, a livery and feed store, several saloons, a school, a barber shop, five large hay warehouses and a post office; many more businesses than there are today.

The Trimmingham Brothers General Merchandise Store (1900 to 1933) supplied the work crews during the construction of the Calaveras Dam. The store sold everything from groceries, hardware, shoes, coal, and chicken feed to insurance. They collected meat from their pigeons, eggs from their chickens and fresh food to sell from their peach, apricot, fig and walnut trees.

Some people helped to develop Sunol as a town after they were forced out of San Francisco by the 1906 earthquake and fire. The Hughes family built their house and several others beginning in 1907. By 1908, Sunol had a population of 800 people. The town had poor water systems and no fire station. Most of the land was still agricultural. By the 1920s Mrs. Murphy, who owned “Andrews’ Place,” devoted a small space in her store to become the town’s first telephone switchboard operator, connecting all the calls to the town’s residents. The little town of Sunol suffered during the Great Depression of the 1930s and again during World War II from 1940-1945.
Charlie Chaplin’s *The Tramp* is Filmed in Niles - 1915

California’s first filmmaking center was not Hollywood! It was the Essanay Studios in nearby Niles (now part of the city of Fremont). Before talking movies, DVDs and color movies, movies were in black and white and had no sound. Louie Le Prince made the first silent movie in France in 1888. Not long after that, silent movies were being made here in the Sunol Valley.

In the movie theaters musicians played live organ or piano music to create atmosphere like suspense or romance depending on what was on the screen. People would “boo” and “hiss” for the bad guy and cheer for the good guy (just like they did for the live melodrama theater plays that they watched before movies were invented). The audience was very interactive with silent movies. Actors were very expressive with their bodies and faces because there was no talking. Many of the movies had periodic story lines that would flash on the screen. The audience would read them aloud. It cost about 10¢ to go to the movies. Everybody loved them.

There were several westerns filmed here, starring Gilbert M. “Bronco Billy” Anderson. Ben Turpin and Wallace Berry, famous silent movie stars also worked here. The Tom Mix and Hopalong Cassidy movies were made in Niles Canyon. The company was moved to Hollywood in 1916, but some of the cottages built by the studio on Second Street are still here and being lived in.

Near today’s Sunol AgPark, Charley Chaplin worked for a local movie studio called Essanay, based in Niles, where several silent movies including *The Tramp* were filmed. Rumor has it that silent film star Mary Pickford filmed two movies at the Little Brown Church (built in 1885 and white until the 1950s) in Sunol. Talking movies replaced silent films in the late 1920s.

Several independent films and one made-for-television movie starring Craig T. Nelson and Kirk Douglas were filmed on Main Street in Sunol more recently.
Gravel Mining is Expanded near Sunol Water Temple - 2006

Gravel mining in the Alameda Creek Watershed may have started as early as 1858 (when hydraulic mining started in the Sierra Nevada to extract gold), but probably started in the mid to late-1860s with the building of the railroad. Gravel was used as a bed for the railroad tracks to lie on.

Currently, Lehigh Hanson Inc, an international mining company, mines gravel across from the Sunol AgPark in the Sunol Valley. These gravels, which once housed groundwater, are now used for road building and other construction. You can see the gravel mining operation if you drive east on Highway 84 toward Sunol Regional Wilderness.

In 1995, the gravel mining company lobbied the Alameda County Board of Supervisors for permission to expand their operation from the southeast side of Highway 680 to land owned by San Francisco adjacent to the Sunol Water Temple. Residents and environmental groups combined forces to oppose the conversion of 242 acres of land historically used for agriculture to gravel mining. While their attempts to stop the quarry failed, they won some concessions, which limit the environmental impacts of the operation, and provide some financial benefits to the nearby community. In 2006, the San Francisco city officials approved the mining operation expansion.
Sunol Residents Elect Bosco as Mayor - 1983

In 1983, a local rancher got permission from the Alameda County Board of Supervisors to build a large residential development of 83 luxury homes on 440 acres of the Pleasanton Ridge. The residents of Sunol said, “No way.” They launched the “Save the Ridge” campaign and got over 50,000 signatures within 30 days to have a county referendum. The County Board then rescinded (removed) their permission and Pleasanton Ridge was saved from development. The land was then acquired by the East Bay Regional Park District for the public to enjoy as open space.

In 1983, Bosco, an 85-pound black Labrador dog, born November 1979, was elected town mayor. He served until his death in July 1994. He appeared on TV and in several magazines. He was beloved by the people of Sunol. A life-sized replica of Bosco is in a Sunol restaurant named “Bosco’s Bones and Brew.”

In 1995 Sunolians started “Save Our Sunol” (SOS). This local grassroots group waged a battle against Alameda County Board of Supervisors who approved a request from the gravel quarry mining company to expand their operations near the Sunol Water Temple. Their attempts to stop the quarry were unsuccessful; the gravel mining expansion began in earnest in 2006. SOS also successfully lobbied the City of San Francisco to restore the Sunol Water Temple, after it was damaged in the 1989 Loma Prieta Earthquake. The temple was restored in 2001.

Sunol’s town members know how to create community! They are active in many organizations, including:

- The Great Sunol Bed Races and Chili Cook-off
- Pacific Locomotive Association, which restore and run the railroad trains from Sunol to Niles
- Sunol Business Guild, which beautifies downtown Sunol
- Friends of the Park, which makes improvements to the downtown park
- Sunol Repertory Theatre, which raises money for Sunol Glen Elementary School
Sunol-Ohlone Regional Park is Created – 1962

There are many agencies involved in managing the land around Sunol. One of them is the East Bay Regional Park District (EBRPD), which was created in the height of the Great Depression in 1934. A concerned group of citizens in Berkeley and Oakland led a ballot measure to create the first regional park agency in the country, to preserve surplus lands for recreation and wilderness. The voters said, “yes” to taxing their property $1 per year to buy surplus watershed land to create open space for recreation, relaxation, and education. Taking inflation into account, homeowners aren’t taxed much more than that today.

The property which became the Sunol-Ohlone Regional Wilderness was purchased in 1962 from William Geary. Because of that purchase, the park is open to public visitation. Nearly 7,000 acres of historic ranch land remains largely unchanged today, as cattle grazing continues, alongside recreation and education activities.

Today, the EBRPD is the largest urban park district in America with over 100,000 acres in Alameda and Contra Costa Counties saved for hiking, picnicking, family camping, group camping, horse rides, backpacking, boating, fishing, swimming, other recreation and education.
SAGE Starts Sunol AgPark - 2006

In 2006, Sustainable Agriculture Education (SAGE) and the San Francisco Public Utility Commission (SFPUC), encouraged by Mayor Gavin Newsom, entered into an agreement to provide opportunities for local farmers to raise food for surrounding communities. SAGE signed a nine-year lease for the land, recruited farmers, and began hosting field trips to teach students about sustainable agriculture, watershed stewardship, and the history of Sunol.

The Sunol AgPark is an urban-edge farm, because it is at the edge of the urban (city) Bay Area. At the Sunol AgPark, farmers grow a diversity of crops for local markets. They are part of the regional food system. A food system is the network of relationships required to get food to your plate. These relationships include agriculture, or the production of food; processing, packaging, and preservation of food; distribution or transport of food to markets and customers; and consumption, or the cooking and eating of food.

By growing food close to where people live, the AgPark farmers are able to shorten the distance between where food is grown and where it is eaten. By selling directly to customers, farmers are able to get a larger share of the food dollar, which is important for them to be able to make a good living. The farmers in Sunol grow a diversity of organic crops, including tomatoes, peppers, strawberries, salad greens, squash, pumpkins, cucumbers, and figs. They sell their produce to a diversity of markets, including the Pleasanton and Menlo Park farmers markets, Monterey Market, and local restaurants. Two of the farmers also have Community Supported Agriculture (CSA) programs, where families can become a member of the farm, and get a weekly box of fresh produce.

The Sunol AgPark is a new model of an Agricultural Park, where farmers can grow healthy food, and people can come learn about where their food comes from.
LESSON 3: Recent Past, Present, and Future of the Sunol Valley

Suggested Costumes and Props

San Francisco Buys Spring Valley Water Company - 1930
• Wooden bucket (for selling/carrying water)
• Bowler hats, period appropriate men's suits, ties, spectacles
• Overalls, miner's hats, leather gloves, picks and shovels
• Architectural drawings or historic pictures of the Water Temple, pencil, clipboard

The Railroad Comes to Sunol - 1869
• Railroad hats, red or blue bandanas, train whistle (and bleach to clean whistle after use)
• Hammer or sledge
• Stove-pipe hat (Abraham Lincoln style)

Early Town of Sunol Thrives -- 1900
• Shopkeepers’ aprons
• Beer mugs
• Hammers & nails
• Pieces of two-by-fours
• Old-fashioned telephone

Charlie Chaplin's The Tramp is Filmed in Niles -- 1915
• Bowler hat, black suit, cane, glasses with nose and eyebrows
• Cardboard signs to hold up, reading: “Boo” and “Hiss”
• Historic police uniform, police baton, historically appropriate dress

Gravel Mining is Expanded near Sunol Water Temple -- 2006
• Gravel mining display from Hanson
• Work hats, work clothes, work gloves
• Picks, shovels

Sunol Residents Elect Bosco as Mayor -- 1983
• Dog bone and bowl
• Clipboards, and signature pages
• Paintbrushes and paints to restore Temple

Sunol-Ohlone Regional Park is Created – 1962
• Clip board, pencil, paper for signature gathering
• Knapsack, hiking stick, bandana
• Picnic basket, small picnic blanket
• EBRPD uniform shirt or jacket

SAGE Starts Sunol AgPark -- 2006
• Straw hats, bandanas, gloves
• Hoe, shovel
• Pack of seeds, plates & forks
LESSON 4: Nurturing a Sense of Place

BIG IDEA
Research indicates that spending time outdoors can improve our health and ability to learn, and can increase our happiness. By paying close attention to our environment, we can learn about the unique characteristics of each place we visit and develop a healthy appreciation for places we live.

BACKGROUND
Modern humans, particularly those in wealthy, developed nations, have become increasingly insulated from the natural rhythms of the Earth. We have buildings engineered to maintain a constant temperature, light bulbs to extend our days, food from all over the world preserved in various ways, and technological devices that have the potential to insulate us from one another (computers, televisions, MP3 players, etc.). While most of these technological developments emerged to improve our lives, research is beginning to demonstrate that our modern lifestyle has some downsides as well.

Some of the negative impacts of our modern lifestyle include air pollution, water pollution, climate change, and habitat loss that result from industrial processes used to manufacture our goods. Our lifestyle also negatively impacts our physical health, due to less exercise, and higher obesity, diabetes, and asthma rates. Our mental health also suffers: among students who spend less time outdoors, research shows higher stress and anxiety rates, less creative thinking and problem solving, and more difficulty learning. For these reasons, it is important to spend time outdoors and get to know and enjoy the places we live.

In order to ensure the good health of our environment, we must know, value, and care.

OBJECTIVES
Students will
- Sharpen awareness of their environment by practicing active listening and observation skills.
- Create a sound map that documents their auditory experience.
- Work in a team to explore the seasonality of crop production.

MATERIALS
- Copy of “Are You Connected?” for ea. team
- Pencil, paper & clipboard for ea. student
- Oranges cut into 6 wedges & bucket to collect peels
- Local Foods Wheel – one per team

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, in teams of 2-3

ADAPTED FROM
Guided Imagery – Carolyn Roth
Sound Map – Project Learning Tree
about the places we live. One of the best ways

to get to know a place is to use all of your

senses to experience it directly. The Sunol

AgPark is a unique place to explore, because

of the diversity of plants, animals, people,

and cultures within its boundaries. The

AgPark is adjacent to a stream, the Arroyo
de La Laguna, and is bordered by diverse

types of riparian (river-related) vegetation,

including sycamore trees, elderberry shrubs,

and mugwort plants on the stream banks. A

rich diversity of crops is grown at the AgPark,

and a number of weed species are also present.

Many animals, including insects, spiders,
birds, rodents, and domesticated animals

live at the AgPark. There are also different

farming groups at the AgPark, with different

ethnic backgrounds and farming practices.

All of this diversity makes for a rich sensory

experience.

PROCEDURE

1. Briefly introduce the big idea of this

   lesson: by paying attention to where we

   are, we can get to know, understand, and

   take care of the places we live.

2. Ask the students if they can share a

   personal example of how they developed

   a respect for someone/thing once they got

   to know him/it better or how they practice

   respect (for their home, their street, their

   school, etc,) every day.

3. Hand out the clipboards, paper, and

   pencils to each student. Students will use

   these after the Guided Imagery to explore

   and record what they find on the farm.

PART I: Guided Imagery

1. Ask the group to be perfectly quiet while

   you conduct the following observation

   experiment. Hand the bag of orange

   slices out for each student to take one.

   Instruct the group to hold onto their

   orange slice with two hands at all times

   and try not to drop it.

2. Begin guided imagery after each student

   has a wedge. Say: “Sit as comfortably as

   you can. Put all the things that you are

   carrying on the ground. Take a deep

   breath and relax.”
3. Hold up a whole orange to the group. Say: “I like to use an orange because it reminds me of the sun – the yellow/orange globe – that drives the water cycle on earth. Let’s metaphorically experience this miracle together.”

4. Demonstrating as you proceed, say: “Follow what I do.” Hold an orange wedge by the rind with both hands, “Everyone hold the orange wedge up to the sky and look at the sparkles reflecting back to you – that’s the water being held momentarily in this orange. We call it orange juice at this point in the water’s journey. The sparkle helps to remind us what goes into making our food. The water and the sun combine with nutrients to make our food. The sparkles are precious jewels in our world. Make the jewels move by rotating the orange in the light. Almost every living thing on earth is at least 65% water!”

5. “Hold the orange up to your nose and take a deep breath. Smell the fragrances given to that water by its temporary interaction with the sugars in the orange.”

6. “Place your thumbs at the wedge corners of the orange slice. Put the orange up to your ear and slowly, and slightly pull the peel back so that you can hear the connection between the rind and the fruit being released. Be sure that part of the rind is left attached to the orange.”

7. “Now smell the orange fruit; then smell the fruit’s connection to the rind … two very different smells from the same fruit.”

8. “Now using your right incisor tooth (pointy tooth next to your front tooth), take a small bite of the orange from the cut edge so that the juice squirts into your mouth and bounces on your tongue and down your throat.”

9. “Hold your orange up to the light and look at the liquid of life that we all share.”

10. “Now, using your left incisor tooth, take another small bite of the fruit so that the juice squirts into your mouth and bounces on your tongue and down your throat.”
LESSON 4: Nurturing a Sense of Place

11. “Hold the orange up to your nose again and take a deep breath to smell the fragrances of the fruit.”

12. “This orange, like all fruits, is a fancy seed package created by nature to reproduce and create more fruit. Now, slowly and reverently, without talking, eat your orange so that you can continue the journey of the water that has been in the fruit.”

13. Collect the rinds to compost.

PART II: Sound Map
Instruct students that you are now going to send them on a solo journey down the path, 15 seconds apart. They are to stay on the paths between the farms and find a place within a defined area in which they are to sit down and draw a ‘Sound Map.’ Demonstrate, by drawing concentric circles on a blank piece of paper. Explain that the position of the student is in the middle of the target and they are to draw lines out to all the sounds that they hear and end the line with an ‘x’ showing where the sound is located. If the sound is in front of them, they will draw the line toward the top of the page, if the sound is behind them, they will draw the line toward the bottom of the target, etc. If the sound is close to them, the line will be very short. If the sound is far away from them the line will be longer, and so on. Remind students that this is a solo activity that they will have five minutes to do it. They are to sit alone at least 15 feet from anyone, not talking, and not touching. Ask students to stand in a line and send them off 15 seconds apart. Give students five minutes for the task and then call them back together. Ask students to share what they heard and to show their Sound Maps.

Did they like the sounds they heard or not?
PART III: Are You Connected?
Get students into pairs or small teams. Hand out the “Are You Connected?” forms. Ask students to take 5 minutes to fill them out to the best of their ability. After 5 minutes, call students back together and ask students to share their findings.

CLOSING DISCUSSION/ EVALUATION
Ask students
• How can you learn more about a place or a person? Hint: spend time together, ask questions, observe, and listen. Everyone has a history, try to learn as many histories as you can.
• What does it mean to a person, family, or community to live in the same place for a long time?
• What can you do to get to know and help take care of your neighborhood or school?

MODIFICATIONS/EXTENSIONS
• Instead of sending students on a solo walk, ask them to create their individual sound maps sitting in a circle.
### Are You Connected?

**Names:**

What do you know about nature and your food supply? Fill in as many boxes as you can in the chart below to find out if you are “connected” to the place where you live, your bioregion.

<table>
<thead>
<tr>
<th>Season</th>
<th>What weather do you expect?</th>
<th>What do farmers need to do?</th>
<th>What food is harvested close to your home?</th>
<th>What can you celebrate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
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<td>Spring</td>
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<td>Fall</td>
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</tbody>
</table>
LESSON 5: Plumbing, Can’t Live With It, Can’t Live Without It!

BIG IDEA
The San Francisco Bay Area has a climate that is dry in the summer and wet in the winter. In order to provide water for drinking, farming, and other uses year-round, people have built extensive water systems to store, treat and deliver water. The Sunol Valley is a critical part of the San Francisco Bay Area’s water system.

BACKGROUND
The Alameda Creek watershed, where the Sunol AgPark is located, has been changed over time by natural forces and human activities. Natural forces like erosion have created water drainage routes from the mountains down to the San Francisco Bay, while deposition has filled in the lowlands. Humans have made extensive changes to the watershed by installing large-scale plumbing systems (dams, tunnels, pumps, pipes, wells) to deliver water and provide waste water treatment for homes, farms, and businesses while leaving some in-stream flows or “wild water” for plants and wildlife (especially aquatic animals like fish and frogs) that depend on creeks and streams.

Before the City and County of San Francisco grew to its current size, water was delivered by selling buckets of water from the creeks of Santa Cruz and San Mateo counties door-to-door and by using the limited ground waters of San Francisco. As the population grew, that system was no longer adequate. The Spring Valley Water Company, which sold water to San Francisco, purchased the 40,000-acre Alameda Creek Watershed in 1875. In 1913, construction began on the Calaveras Dam on Alameda Creek, upstream from the Sunol AgPark. The completion of the dam in 1925 stabilized the creek flows and essentially...
stopped the waters that historically flooded the Sunol Valley, including the AgPark site and the town of Sunol. Later, the dam was built even taller to hold more water, and is going through a seismic retrofit today.

Dams need constant maintenance and upgrading. Water running into the dams brings sediment that eventually fills up the reservoir. In that case, sometimes another dam is built to hold the debris. As dams age and undergo routine maintenance, they often need to be retrofitted and strengthened as the forces of nature weaken them over time. Since California is on “shaky ground,” earthquake retrofitting is a constant challenge for dam engineers. Today, Alameda Creek has several dams on it for water storage and use.

However, California’s largest reservoir is the large Sierra Nevada snowpack, which accumulates each winter in the tall mountain range 200 miles east of the Bay Area. The San Francisco Public Utilities Commission (SFPUC), which owns the water rights of the Alameda Creek Watershed, has made one of California’s most significant infrastructure improvements by drawing on water from the Tuolumne River, in Yosemite National Park. The Hetch Hetchy Water System, named after Hetch Hetchy Valley, where the main water reservoir is, transports water 167 miles (mostly by gravity), incorporating local regional waters as well, to customers in the Bay Area. The SFPUC provides water to 2.5 million Bay Area residents, through its partnership with other water districts like the East Bay Municipal Utility District (EBMUD).
PROCEDURE

1. Take students to a large cross-section of pipe used in the Alameda Creek Watershed plumbing delivery system. Stand in it, look at it, feel it, and ask the students to describe it and visualize it carrying water all the way to people’s homes, farms, and businesses. As you walk to the activity area, ask the students to count and observe the irrigation system and its components along the way. Ask inquiry questions that help them to focus on what they are looking at: valves, pressure meters, pipes – what kind of materials and color, T joints, elbow joints, clamps, etc.

2. Show students the map of the Hetch Hetchy Water System bringing water to the Bay Area from the Sierra Nevada. Use a California relief map to discuss the system’s route. Ask students, “Why did the engineers take the route they did to bring water to the Bay Area?” (Hint: to use gravity to move the water.) Trace the route on both maps.

3. Show students the map of the Alameda Creek Watershed with its plumbing system bringing water from the highlands of the local hills to the lowlands. Count the number of dams and visualize the water coming from the highlands to the lowlands. Ask students, “What do both these plumbing systems have in common?” (Hint: water runs downhill with the help of gravity. It is easier and cheaper to let water flow downhill than to use expensive pumps and energy to get the water to go uphill.)

4. Divide students up into two teams. Tell them, “Today, you are going to get 20 minutes to build your own miniature plumbing system using PVC [or other irrigation] pipes. Your systems must be able to water “x” plant or area. Your team must be able to disassemble the parts at the end of the experiment.” Students can use:
   - Short lengths of PVC [or other irrigation] pipe
   - Elbow joints and other irrigation joiners
• Connector for a PVC [or other irrigation] pipe to hose bib
• Lubricant like cooking oil to put inside joiners [so they can disassemble the PVC pipes at the end]
• Pressure meter that can be placed into PVC [or other irrigation] line
• Shut off valve that can be placed into PVC [or other irrigation] line

5. Students should work in teams. Consider assigning job titles to each team member (e.g. engineer, construction foreman, safety tester, etc.), and tell them they need to cooperate. At the end of 20 minutes, have the teams take turns testing their systems. They should connect their system to the water source and turn on the water. Have students read the PSI meter and be able to use the on and off valve system. Students then discuss what they did to achieve their goal.

6. After the test, students should disassemble their systems and put the pieces away.

CLOSING DISCUSSION/EVALUATION
Ask: “What did you learn today? What did you think was the most important lesson from today?”

Follow up with questions based on their answers to gauge what the students did and didn’t grasp. For example: “Why do we need plumbing? How are plumbing systems related to your food? Where does the water in your neighborhood come from? Why does a farmer need to understand irrigation methods in California? Is the entire water system completely in pipes?”
MODIFICATIONS/EXTENSIONS

- As a closing activity, lead students in “You hold California in your hands” activity. Emphasize that without the plumbing systems that early engineers built, locally available water would not be enough to support the number of people who live here. The water agencies like the San Francisco Public Utilities Commission have helped to create a livable Bay Area environment for all of us.

- Using a California shaded relief map, have students draw where they would place a plumbing system to bring water from the High Sierra to the Bay Area. Then use the Hetch Hetchy Water System map to compare the students’ systems to the existing systems. Discuss any differences or similarities.

- Research the history of the O’Shaughnessy Dam, in Hetch Hetchy Valley. How is John Muir connected to San Francisco’s water history? How has this history affected the region?

- Research the development of the East Bay water systems in Alameda Creek. How do these systems affect the region today?

- Research the SFPUC’s plans for 2030.

- Research where EBMUB, or your local water agency, gets its water, and the impact of those water systems.
LESSON 6: Where in the World Did Our Crops Come From?

BIG IDEA
People have been living in the Sunol Valley for nearly 4,000 years, and agriculture has been practiced here for at least 150 years. The crops that are grown at the Sunol AgPark today, like the people who live in the region, come from all different places and have rich cultural histories.

BACKGROUND
A wide variety of people have farmed in the Sunol Valley, bringing with them traditions and crops from all over the globe. Today, the Sunol AgPark farmers carry on many old traditions by growing heirloom varieties of crops, while also growing and developing new crops and new traditions. Most of the crops that are grown in Sunol originated in another part of the world and were brought to California because of their nutritional, economic, or cultural value. These crops continue to thrive today if they are well adapted to the local climate, and desired by customers in the marketplace.

The following are a few species that were historically grown in the Sunol Valley.

• Persimmons are historically important to the Sunol Valley and reflect Asian American history in Southern Alameda County. Japanese farmers brought persimmons to America 100 years ago.

• Chives have been grown in the Sunol Valley since the 1800s. The leaves are used in salads and soups to give a mild onion flavor. This herb is a member of the allium family along with garlic, leeks and onions.

• Olive trees grow well in California. Olives are a native of Syria and Asia Minor.

OBJECTIVES
Students will
• Explore the diversity of AgPark crops
• Learn the origin of ten different crops
• Learn the parts of a flower
• Do a comparative tasting of fresh and store-bought produce

MATERIALS
• One magnifying glass per pair
• Line drawing of a flower
• Laminated crop card for each student
• Crop identification worksheet
• Clipboards and pencils
• World map
• Farm-fresh food and store bought food (fresh, canned, dried or frozen)
• Utensils for sampling food
• Buckets for harvest, washing, & clean up

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, students in pairs

ADAPTED FROM
Original
Olives are actually a fruit. By definition a fruit is anything that develops from a flower and normally contains a seed. So when you are eating olive oil you are really drinking fruit juice! Olives are one-fifth to three-fifths oil. Stone-age farmers began to grow olives for their oil needs thousands of years ago. It was used in offerings to the gods, cooking, medicine, to burn in bronze lamps, and as a skin cleanser. Spanish conquerors brought olives to America. California is the largest American producer of olives with over 50,000 tons per year. Many trees live for several centuries. Olive branches are the symbol of peace and plenty.

PROCEDURE

1. Get permission from farmers in advance for students to explore, harvest and taste crops.

2. Instruct students to find a partner. Explain that they will get 2-3 crop cards that match real crops on the farm. Their job is to find their crops and make observations on the plants.

3. Describe the parts of a flower to students, using the line drawing, and pass around a few examples of flowers with magnifying glasses. You can pull the flower apart very gently to show all the parts of the flower. Describe how flower similarity often means that the plants are related, or in the same plant family. Ask the students, “Has anyone ever said to you, you look just like your dad, your mom, or your cousin? Well plants that look the same, or share similar characteristics, are often in the same family too.”

4. Show students the boundaries of where they can explore. Distribute crop cards, worksheets and clipboards to each team, and give them 20 minutes to find their crops.

5. Call students back together. Ask students to take turns reporting back to the group on what crops they found, and pointing out on the world map where their crops come from.
LESSON 6: Where in the World Did Our Crops Come From?

6. Lead students in a comparative tasting, depending on what is in season. If there are any edible weed species (mustards, radishes, etc.), you can have students taste the leaves or flowers. If you have permission to harvest crops, demonstrate to students how to harvest, before sending them to harvest in small groups. You can compare fresh produce from the field (e.g. strawberries, tomatoes) to store-bought produce. Have students vote which taste they prefer and discuss why. It is also informative to read any labels to see what kind of processing the food went through, or where the food came from.

CLOSING DISCUSSION/EVALUATION

• You may have heard of a watershed. What do you think a “foodshed” is? What have you learned about where some of your favorite crops originated?

• How might you help preserve some of the rich cultural traditions contained in our crops? How might you help bring healthy food to people?

• How does the story of our food coming to California inspire you to become part of history?

MODIFICATIONS/EXTENSIONS

• If there are not enough crop cards for each student, due to what is in season on the farm, hand out duplicate cards, and ask students to find their partner by matching their cards.

• Have students research the history of agriculture in their hometown.

• Students can study the current food economy of California, or the Bay Area, including crops grown for local consumption and for export, and the crops that are imported from other places.
Crop Worksheet

Name ___________________________ Today’s Date __________________

1) Name of crop number one: ___________________________
   a) How big is the plant?
   b) Describe how its leaves feel to the touch.
   c) Does this plant have any flowers or fruit? If so, describe them.
   d) Are there any insects on it? If so, what they are doing?
   e) Where is this plant from originally?
   f) What is one interesting fact that you learned from the crop card?

2) Name of crop number two: ___________________________
   a) How big is the plant?
   b) Describe how its leaves feel to the touch.
   c) Does this plant have any flowers or fruit? If so, describe them.
   d) Are there any insects on it? If so, what they are doing?
   e) Where is this plant from originally?
   f) What is one interesting fact that you learned from the crop card?
LESSON 6: Where in the World Did Our Crops Come From?

Crop Cards Page One, Front

Photo: Derek Ramsey, Chanticleer Garden, 2008

Photo: Rasbak

Photo: Sanjay Acharya
Crop Cards Page One, Back

<table>
<thead>
<tr>
<th><strong>Asparagus</strong></th>
<th><strong>Artichoke</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• A member of the lily family.</td>
<td>• A perennial in the thistle group of the sunflower family.</td>
</tr>
<tr>
<td>• Native to the eastern Mediterranean and Asia Minor.</td>
<td>• A Native of North Africa.</td>
</tr>
<tr>
<td>• Grown by the ancient Egyptians and Romans.</td>
<td>• Originally cultivated in Southern Europe.</td>
</tr>
<tr>
<td>• Plants must be two years old before they are ready for harvest.</td>
<td>• The part we eat is the plant’s flower bud.</td>
</tr>
<tr>
<td>• Harvested in the early spring by snapping off the spears and leaving the root system intact.</td>
<td>• Spanish settlers brought artichokes to California in the 1600’s.</td>
</tr>
<tr>
<td>• Each crown can produce a half pound of spears each year.</td>
<td>• Artichokes did not become widely grown or eaten in California until the 1920’s.</td>
</tr>
<tr>
<td>• Asparagus can grow 6 inches in one day and can live for 15 years.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Chard</strong></th>
<th><strong>Beans</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>• A type of beet that grows leafy greens instead of a big root.</td>
<td>• Domesticated independently in Central America and the Andes in South America.</td>
</tr>
<tr>
<td>• In the goosefoot family, like spinach.</td>
<td>• The Indians of the Southwestern United States built hundreds of miles of irrigation systems and grew what they called “The Three Sisters”: corn, beans, and squash.</td>
</tr>
<tr>
<td>• Often called Swiss chard because it is popular in Switzerland.</td>
<td>• The corn stalks provided support for the viney beans plants; the beans provided nitrogen to the corn; and the big, prickly squash leaves kept water in the soil from evaporating, and prevented pests.</td>
</tr>
<tr>
<td>• Consumed since the time of the ancient Greeks (unlike large-rooted beets that weren’t developed until the late 1500s.)</td>
<td></td>
</tr>
<tr>
<td>• All parts of the chard plant contain oxalic acid, which tastes astringent on the tongue.</td>
<td></td>
</tr>
</tbody>
</table>
LESSON 6: Where in the World Did Our Crops Come From?

Crop Cards Page Two, Front
Crop Cards Page Two, Back

**Figs**
- One of the oldest cultivated fruits.
- The fig that we eat originated in the region between Turkey and India.
- Greek sailors took figs to Spain 3,500 years ago.
- Spanish explorers brought figs to America.
- The first figs grown in California were planted in San Diego at the Spanish Mission. Figs travelled north with the Missions, and became known as Mission figs.
- The figs at the AgPark are grown in a traditional Italian way, in pots.

**Fava beans**
- Also called broad beans
- In a different genus from the common green bean.
- Grown as a cover crop instead of using chemical fertilizer.
- Fava beans and other legumes have little bumps on their roots that make more nitrogen than the plant uses. Nitrogen is an essential nutrient for other types of plants, and if it is not replaced, the soil will wear out and will not be able to grow as much food.

**Kale**
- One of the first leafy plants cultivated in the Mediterranean.
- By 500 B.C., continued preference for larger leaves led to the development of the vegetable we call kale.
- The most widely eaten green vegetable in Europe until the Middle Ages, when cabbage became more popular.
- Red Russian kale was introduced into America via Siberia by Russian traders in the 19th century.

**Garlic**
- One of the most versatile flavoring agents.
- Originated in Asia.
- A member of the allium family, which also contains onions, leeks, scallions, and chives.
- Garlic bulbs grow under the soil and its leaves may at first glance look like grass. The leaves, flowers, and heads of garlic are also edible.
- Garlic is known for its health giving properties.
LESSON 6: Where in the World Did Our Crops Come From?

Crop Cards Page Three, Front

Photo: H. Zell

Photo: Kham Tran

Photo: H. Zell

Photo: H. Zell
Crop Cards Page Three, Back

Mint
• Native to the Mediterranean and western Asia.
• Used by humans for nearly 10,000 years.
• There are many species of mints; all mints have the volatile oil menthol, which is cooling and fresh feeling.
• Early settlers brought mint to America primarily for medicinal uses.
• Mint plants are considered invasive because they can spread very quickly over large areas.

Lettuce
• A member of the daisy family.
• Its name comes from the Latin word for “milk.”
• Grown in ancient Egypt.
• Provides vitamins, minerals, dietary fiber and phytochemicals that our bodies need for optimum performance and health.
• Grown in the Sunol Valley since the mid-1900s.
• Darker and more bitter-tasting types of lettuce have more nutrients than iceberg lettuce.

Rosemary
• A fragrant bush of the mint family.
• Its name comes from the Latin words for “dew of the sea,” because in its original habitat, the Mediterranean coast, it got all the water it needed from ocean breezes.
• Rosemary’s waxy, pointed leaves show that its native environment is dry and hot.
• Its pretty blue flowers are a favorite of bees and can be planted at a farm to enhance bee habitat.

Mustard
• Wild mustard is common in California, and was originally brought to California by Spanish explorers.
• Mustard can be hot like wasabi or mild like white mustard.
• Members of the mustard family (cabbage, broccoli, cauliflower & turnip) have flowers with four petals.
• Mustard, the condiment, is made from mustard seeds that are finely ground.
LESSON 6: Where in The World Did Our Crops Come From?

Crop Cards Page Four, Front
Crop Cards Page Four, Back

Strawberry
- The only fruit that wears its seeds on the outside.
- Most common strawberries are a hybrid of two species native to the Americas.
- A member of the rose family, as shown by its five-petalled white flowers.
- Organic farmers use black or green plastic to keep competing weeds off strawberry mounds. The plastic also heats the soil, which helps to control bacteria that might kill the roots of the plants.

Sage
- Native to the Mediterranean region.
- Ancient Romans thought sage had significant healing properties. For this reason, its name comes from the Latin word for “to save.”
- At one time, the French grew sage for tea. The Chinese came to like French sage tea, and would trade four pounds of Chinese tea for one pound of sage tea.
- Recent studies show it may help control Alzheimer’s disease.

Tarragon
- A fragrant herb which originated in Siberia and Mongolia.
- Also known as Dragon’s Wort.
- It is likely that the Mongols brought tarragon to Europe in the 13th century.
- Today, tarragon is used in cooking throughout the world, and is a particular favorite of French cuisine.
- Used to flavor a popular Eastern European soft drink called Tarhun.

Tomatoes
- Originally from Peru.
- Transported to Mexico and grown by the Aztecs.
- Europeans were afraid to eat tomatoes because the leaves are poisonous.
- In the Nightshade family, like potatoes, paprika, eggplant, and petunias.
- The Spanish introduced tomatoes to the Caribbean, Asia, & Europe.
- Farmer Fred at the Sunol AgPark is breeding new award-winning tomatoes right here.
LESSON 6: Where in The World Did Our Crops Come From?

Crop Cards Page Five, Front
Crop Cards Page Five, Back

**Corn**
- Also known as maize, and technically a grass.
- Domesticated from a grain called teosinte in Mesoamerica in prehistoric times.
- The number one crop grown in the United States.
- Sweet corn, is picked early and eaten as a vegetable; field corn, is dried and eaten as a grain.
- Corn on the cob is popular in North America, but is almost unheard of in Europe.

**Walnuts**
- The oldest tree food known to humans, dating back 9,000 years.
- The English walnuts that we eat today are native to the Middle East.
- The bitter California black walnut is a Native American species.
- Indians used walnuts to make dice for games and as a dye.
- The English walnut was first cultivated in California missions in the late 1700s.
- Walnuts have been raised in the Sunol Valley since the 1800s.

**Cilantro**
- In the US, the leaves are called cilantro and the seeds are called coriander.
- Native to southern Europe, North Africa and southwestern Asia.
- Grown by humans since 2000 BC.
- Coriander seeds were found in King Tut’s tomb in Egypt.
- Brought to North America in 1670 by British settlers.
- Scientists recently found that chemicals in cilantro leaves have antibacterial properties.
LESSON 7: Farmers as Stewards of the Land

BIG IDEA
Farmers are responsible for taking care of, or stewarding, many of our land, water, and air resources. The decisions farmers make have a large effect on the health of our environment. The Sunol AgPark farmers are practicing small-scale organic agriculture to provide our region with a diversity of foods while protecting the surrounding ecosystem.

BACKGROUND
In 1900, almost forty percent of the US population lived on farms. By 2010, that number was down to two percent. Although everybody eats, only one percent of the US population considers farming their occupation. That means that 99 percent of the population depends on farmers to grow their food. Forty percent of US farmers are over 55 years old, which has led to concern over who will grow our food in the future.

While the total number of US farms has decreased over the last century, the total amount of food grown has increased, primarily through the use of large-scale mechanization, new crop varieties, irrigation, and synthetic pesticides and fertilizers. While this increased productivity has helped to feed our growing population, this type of intensified, high-input agriculture has caused many negative environmental, social, and economic effects, including fertilizer runoff and pollution, pesticide contamination of aquatic ecosystems and negative human health effects, loss of cultural knowledge and crop diversity, destabilized rural communities, and fewer farming jobs.

Sustainable agriculture is a way of practicing agriculture that is environmentally sustainable, socially just, culturally appropriate, and

OBJECTIVES
Students will
• Work in a team to interview an AgPark farmer
• Work in a team to convert interview notes into presentation form
• Work in a team to present a summary of their interviews to the larger group

MATERIALS
• Pencils and note pads or clipboards and paper
• Copies of the Farmer Interview Worksheet
• Digital recording equipment (if available)

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class, students in teams (as many teams as there are available farmers)

ADAPTED FROM
Original
The farmers at the Sunol AgPark practice sustainable and organic agriculture. Organic farmers do not use synthetic fertilizers or pesticides. The AgPark farmers each grow different crops, sell to various markets, and serve diverse communities. While this diversity helps make the community of farmers at the AgPark strong, all farmers have certain things in common, including growing food for a living. Farmers are ‘doers;’ there are many things they must do to grow and sell their crops. They must manage multiple factors, including how to prepare the soil, which crops to grow, when to plant, irrigate, and harvest, how to prevent pests and weeds from building up, how to organize the labor needed to get the work done, and where, and at what price, to sell their crops in order to make a sustainable living.

PROCEDURE
Confirm with farmers the plan for the interview, time allotted, and group size. Encourage farmers to give students some additional background information, and help them along if the interview seems too basic.

1. Tell students that they are going to be TV newscasters (journalists). They will work in teams and everyone will be involved in interviewing an AgPark farmer.
2. Create teams of student interviewers, with the number of teams depending on how many farmers are available. Assign students the names of the farmers they will interview.
3. Start by having students describe their vision/picture of a farmer to the class.
4. Distribute the Farmer Interview handouts among students.
5. Read the handout aloud and ask if there are any questions they don't understand.
6. Give students a few minutes to add one of their own questions. Encourage them to ask questions that they think would be interesting to their peers. Coach students to learn from their farmer, “What creates a healthy farm?”
LESSON 7: Farmers as Stewards of the Land

7. Encourage them to take additional notes from the interview on the back of the handout.
8. Before the students disperse, agree on a signal that indicates when the students are to finish their interviews and return to you.
9. After about 15 minutes, bring the students back as a class.
10. Give the groups 5 minutes to prepare their presentation.
11. Allow each group 5 minutes to present.

CLOSING DISCUSSION/EVALUATION
The presentation serves as the evaluation of how well the students met the stated objectives.

MODIFICATIONS/EXTENSIONS
• Depending on grade level/abilities, have students create all of the questions on their own by brainstorming in teams.
• Have students sketch a portrait of the farmer as the interview is being conducted.
• Instruct younger grade levels to only ask certain questions from the handout.
• If recording equipment was available, have students use their footage back in the classroom to create stories about their visit.
• Have students interview a family member to learn about any farming in their family history.
Farmer Interview Worksheet

Today’s date________________________

My name________________________My farmer’s name________________________

Reporters in my group________________________

1) Why did you become a farmer?

2) What is your favorite part of farming?

3) What’s the most difficult thing about being a farmer?

4) What is a healthy farm?

5) How do you keep your farm healthy?

6) What kind of characteristics and skills do you need to be a farmer?

7) ________________________?
LESSON 8: You Are What You Eat

BIG IDEA
Humans, plants, and animals all need similar things to thrive: sun, water, nutritious food, and protection from the elements. When you choose a balanced diet of fruit, vegetables, grains, protein and water, you improve and sustain your health and bodily systems. By eating foods that are grown organically, sustainably, and close to where you live, you limit your exposure to unhealthy chemicals, maximize the food’s freshness and deliciousness, minimize your carbon footprint and environmental impact, and support a greener economy. What’s good for you is good for the Earth.

BACKGROUND
Eating lots of fruits and vegetables is crucial to maintaining good health. People whose diets contain high amounts of fruits and vegetables are less likely to develop many diseases, such as strokes and other cardiovascular diseases, and certain cancers. The health benefits of eating fruits and veggies come from their rich stores of complex carbohydrates, dietary fiber, vitamins, minerals and other nutrients, as well as from the absence of fats, processed sugar, and sodium found in other, less healthy foods.

Not only are organically grown foods free of pesticides and artificial fertilizers, they may contain higher levels of vitamins and minerals than their conventional counterparts. Thus, eating organic is better for humans and better for the Earth in many different ways.

It’s easy for kids to incorporate more fruits and vegetables into their diets: suggest that kids put strawberries or bananas on their morning cereal or waffles; ask for veggies like mushrooms, scallions, or bell pepper in their scrambled eggs; eat an apple or orange as a

OBJECTIVES
Students will
• Re-examine their understanding of what makes a food “healthy.”
• Read and follow a recipe to prepare a healthy dish.
• Connect their health with that of the Earth.

MATERIALS
• Five different snack foods
• Recipe (from Kids Cook Farm-Fresh Food, or elsewhere)
• Instruction cards for each team
• Ingredients needed for the recipe
• Cooking supplies: Bowls, utensils, measuring cups and spoons, dishes, etc.
• Clean up supplies: sponges, dish soap, dish tubs, towels

TIME REQUIRED
1 hour

GROUP SIZE
Half of the class

ADAPTED FROM
Original
snack; and have carrot sticks or celery with peanut butter and raisins in their lunch.

To encourage kids to try new foods, it is often helpful to involve them in the preparation process. Research shows that learning about, growing, and cooking produce in school can have a positive impact on children’s diets.

**PROCEDURE**

1. Hold up two different food items, such as an apple and a bag of chips. Ask which one is healthier, and why. Continually replace the chips with healthier items (e.g., apple-flavored fruit snacks, apple juice, dried apple chips) until you are comparing a non-organic with an organic apple. Describe the differences in how they were grown. Ask: why is one healthier than the other?

2. Describe the presence of pesticides, fertilizers, and additives in foods. Have them follow where those additives go (Hint: into the plant/animal, into the earth, and into the eater).

3. Ask: “What does ‘You are what you eat’ mean to you?” Leave time for students to discuss or write a response.

4. For older students, ask “How does food get to our plate?” (Hint: trace the route food takes from farm field to plate and include the steps of harvesting, packing, transporting, storing, selling, preparing, and eating.)

5. Ask “What are some benefits of eating food grown closer to home?” (Hint: fresher produce, support for local farmers, reduction in environmental impacts of transporting food, and a more secure regional food system.)

**ACTIVITY**

6. Describe the dish that students will be preparing, pointing out each of the ingredients assembled on the demonstration table or to be harvested from the farm.
LESSON 8: You Are What You Eat

7. Review safety precautions with students, and demonstrate the cooking techniques the students will be using.

8. Break students up into groups of 2-4 to perform tasks called for by the recipe. Ideally, each group will have an adult chaperone to supervise and assist.

9. Distribute instruction cards to each group.

10. Release students into teams to wash their hands, and begin their jobs at their preparation stations.

11. When the recipe is prepared and prep dishes are clean, have students serve themselves and enjoy their dish. When they are done, have students clean their own dish and utensil, and ask for volunteers to clean the serving bowls and utensils.

CLOSING DISCUSSION/EVALUATION

Preparation of the assigned dish will demonstrate if the student has met the lesson’s objectives. In closing, ask the students to reflect on how eating healthy food benefits our bodies and our planet.

MODIFICATIONS/EXTENSIONS

• Give students seedlings to take home with care instructions.

• Send home a copy of the recipe from class.

• Conduct a nature walk to pick edible weeds such as wild radishes, field mustard, blue elderberry, or wild grape.
LESSON 9: Working on an Urban Edge Farm

BIG IDEA
Each growing season, farmers must prepare the soil, plant seeds, control weeds and pests, and harvest and sell their produce. Each step in this cycle requires choices and these choices affect the health of local ecosystems and communities. Healthy farms are the foundation for healthy communities.

BACKGROUND
Farmers are important members of our community, since they grow the food that we all need to survive. By choosing farming practices that support human and ecosystem health, organic farmers can enhance the health of surrounding communities. In a healthy community everyone has access to nutritious, affordable, and delicious foods, and everyone working in the food system is safe and treated fairly.

Farming is a difficult business to be in, due to the vagaries of weather, pest populations, and global markets. Because of this, farmers benefit when their local communities help share the risks inherent in farming by participating in a Community Supported Agriculture (CSA) program. In a traditional CSA, community members pay the farmer at the beginning of the growing season, and then receive shares of whatever fruits and vegetables are ripe each week throughout the season. This helps the farmer focus on growing the best produce she or he can.

At the Sunol AgPark, farmers interact with the surrounding communities in many different ways: some have CSAs; some sell their produce at farmers’ markets and farm stands or to local restaurants and grocery stores; some even let people come pick produce themselves.

OBJECTIVES
Students will
• Follow oral instructions to learn how to do a farm task
• Interact with a farmer
• Gain work experience on an organic farm
• Learn about the benefits of having an urban edge farm near their community

MATERIALS
• Gloves for students (optional)
• Farming tools like shovels, hoes, trowels, buckets

TIME REQUIRED
1 hour

GROUP SIZE
Half of the class, students in teams

ADAPTED FROM
Original
The mission of the Sunol AgPark is to provide farmland for small farmers so that they can grow healthy food to feed nearby communities. Since the AgPark is so close to cities such as Oakland, Berkeley, and San Francisco, city-dwellers can come visit the farms, talk to the farmers, and see how their food is grown. For more background information, see the SAGE web site: www.sagecenter.org.

PROCEDURE

Talk to the farmer beforehand to confirm the timing and size of the group they’ll be working with. Find out what activities the farmer has planned for the students. Remind the farmer to review safety protocols when working with tools.

1. Tell the students that today they will be helping a farmer grow healthy food for people in the surrounding area. Ask the students if they have ever helped a farmer before, or helped grow food?

2. Tell the students that it is important to listen carefully to the farmers’ instructions, to protect themselves and the farmers’ crops. Remind the students to ask questions if they don’t understand what they are supposed to do.

3. Separate the group into teams, and introduce the teams to the farmer they’ll be working with.

4. Give teams 40 minutes to help their farmer with the chosen task of the day.
CLOSING DISCUSSION/EVALUATION
Ask students to answer the following questions, either orally or in writing:

1. What are some of the advantages of having farms like the Sunol AgPark close to where we live?
2. What are some of the health, economic, and environmental benefits of buying and eating food that was grown close to home?
3. What surprised you about helping a farmer? What did you learn that you didn’t know before?

MODIFICATIONS/EXTENSIONS
• In May, have the students be part of a ladybug release.
• As a math lesson, do the following:
  1. Teach the students about weeds and how to pull them properly. Then have them see how many weeds they can pull in a designated space, or in a limited amount of time.
  2. Count the weeds to see which team was most productive.
  3. Measure the root and then the shoot (stem) to determine what the average root-to-shoot ratio is for each type of plant. Have students discuss the purpose of roots and shoots and the plant’s survival strategies.
  4. Compare root-to-shoot ratios of different plants by graphing them.
• Have students write about their experience helping a farmer upon returning to the classroom.
LESSON 10: Organic Food Production and the Economy of Food

BIG IDEA
Farming is a complex and challenging profession. Farmers need to use business and math skills in order to decide what to grow, where to sell it, and how much to charge customers, in order to make a living. Organic produce often costs more than conventional produce because it is more labor-intensive to produce.

BACKGROUND
Most farmers choose their profession because they love some part of it – plants, fresh air, independence, artistry, or tractors. There are many advantages to being a farmer. However, farming is also a complex and difficult business. Farmers have to use many skills to grow crops that other people will buy, and to sell enough to make a decent living.

Before food reaches the grocery store, farmers’ market, cafeteria, or restaurant, a farmer has taken many steps to produce and deliver it. Each of these steps takes time and resources, so the price that the farmer receives for their crops must cover all of these earlier steps.

The following sequence lists steps that farmers take to grow and market their products.

1. Develop a business plan: identify which crops to grow and who to sell them to at what price.
2. Find a place with good soil, sun, and water resources to farm.
3. Secure land (buy, lease, or sharecrop).
4. Secure water (install plumbing, get a water contract, etc.)
5. Protect the farm from predators and pests – install a fence if needed.
6. Secure equipment and tools needed to prepare beds, weed, harvest, etc.

OBJECTIVES
Students will
• Learn about the steps involved in getting a crop to market.
• Learn that farming is a business, and that successful farmers use a lot of math.
• Calculate a crop’s yield for market.

MATERIALS
• White board or chart pad and pens
• Strawberry worksheet for each team
• Clipboard for each team
• Pencils for each team
• A few calculators for adult chaperones
• Strawberries for tasting
• Utensils for food preparation
• Bucket
• Paper towels

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, students in teams of 2-3

ADAPTED FROM
Original
7. Secure seeds or seedlings.
8. Prepare the ground for planting (leveling, tilling, weeding, watering, etc.).
9. Plant seeds or seedlings at the right time of year.
10. Develop relationships with potential buyers (sign up for a farmers’ market, start a farm stand, contact grocery stores, wholesale buyers, restaurants, CSA customers).
11. Tend the plants until maturity (irrigate, fertilize, weed).
12. Buy packaging for produce (boxes, baskets, rubber bands, bags, etc.).
13. Harvest produce.
14. Clean and pack produce.
15. Transport food to market, insure and maintain vehicle.
16. Buy scales, batteries and calculator to determine cost to purchasers.
17. And begin again.

There are many benefits to diversified, small-scale organic farming systems, compared to large-scale mechanized farms, including increased employment opportunities, increased productivity per acre, and ecosystem and community food security benefits. However, small scale diversified systems are labor-intensive, and the extra human labor involved to grow and market food on a small scale, especially with organic production methods, increases the prices farmers need to charge to make a profit each year.

PROCEDURE
1. Before proceeding get permission to use a farmer’s crop for the lesson.
2. Lead a brainstorming discussion. Prompt student thinking with the following questions: “Pick any business or job -- how do you make money? What are the costs of production and marketing?” Write the students’ answers on the white board or chart pad to stimulate thinking about business models, and how business owners make a living.
3. Tell students that farming is a business like any other, except farmers often work with extra variables, like the weather, and other environmental factors, like
insect populations and soil nutrients. Ask students to brainstorm some of the steps involved in getting a crop to market.

4. Tell students that they are going to be farmers for the day, and calculate how many strawberries (or other crop) they will have to sell from one field.

5. Divide students into teams of 2 or 3, and distribute clipboards, worksheets, and pencils to each team. Ask students to designate one recorder and one or two counters.

6. Remind students not step on any of the plants, irrigation lines, or beds that the farmer has built. Emphasize that crops are the farmers’ livelihood, and students need to respect them.

7. Instruct each team to count off 10 plants that are next to each other to study. Once they have their study area, they are to work in teams to complete the worksheet. Have adult chaperones circulate between teams to help the students with any questions or math challenges. You can offer students a calculator to help with their long multiplication, if need be.

8. When the students have completed their worksheets, call them back to the gathering area.

9. If permitted by farmer, allow students to taste the strawberries (or other crops) they have been studying.
CLOSING DISCUSSION/EVALUATION

1. Have the study teams share their findings on the total amount of money the farmer can make by taking their crop to market (#9 on the worksheet). If the teams differ in their findings discuss the differences, check for calculation errors, and correct any mistakes.

2. Have students share their answers for #10 on the worksheet – whether they think a farmer can make enough money to make a living by selling the current crop in the market.

3. If not, ask students how they think a farmer might increase their income? What business strategies might they use to make more money?

4. Have students calculate what percentage of the plants in their row they used to estimate the total yield (e.g. 10 plants divided by total # of plants in their row).

5. Ask students if they think that was a big enough sample to make an accurate yield estimate. Was there much variation between rows? How might this affect a farmer’s choices?

6. Ask students to discuss the economics of food production. What did they learn? What surprised them?

MODIFICATIONS/EXTENSIONS

- For older students, use the list of “Getting Crops to Market Steps” (from Background), and University of California, Davis cost studies website to estimate production costs for AgPark crops. http://coststudies.ucdavis.edu/current.php

- Develop a cost calculation worksheet for AgPark crops.
Strawberry Study

Names: ________________________________

Find 10 strawberry plants that are next to each other. Be careful not to hurt any of the plants while you study them. These crops are a farmer’s income! Collect the following information:

1. For each of the ten study plants, count the number of flowers per plant:
   
   1. _______ 2. _______ 3. _______ 4. _______ 5. _______
   
   6. _______ 7. _______ 8. _______ 9. _______ 10. _______

2. Calculate the average number of flowers for the study plants.

3. Using the average number of flowers, if half the flowers successfully produce a fruit, how many fruits will you get per plant, on average?

4. Count the number of plants in the whole row you are studying.

5. Using the average number of fruits per plant (answer from #3), calculate the number of fruits the farmer can harvest from this one row.
6. If each basket of strawberries has 20 berries in it, how many baskets will this one row yield?

7. If the farmer sells their berries for $4/basket, how much money can they make selling all of the berries in this row?

8. How many rows of this crop does the farmer have in this field?

9. How much money can the farmer make by selling all of the berries in this field?

10. Do you think that is enough money to make a living?
LESSON 11: Insects R Us!

BIG IDEA
Insects are an important part of a farm ecosystem, or “agroecosystem.” Some insects pollinate crops, which helps crops produce fruit or seeds. Other insects are considered by farmers to be pests because they eat or damage crops. And yet other insects help control pest populations by predation. Ecological farmers use a whole-farm approach to manage pest populations, and encourage beneficial insects on the farm.

BACKGROUND
Plants and animals have a long, intertwined evolutionary history. As animals evolved on Earth, plants evolved in step, to increase their likelihood of survival. Animals can either help plants reproduce, by spreading their pollen or seeds, or they can limit their chance of reproduction, by eating them. Agricultural pests, including insects, weeds, diseases, and nematodes, destroy or damage 30 per cent of crops each year. This rate of crop loss has held steady since the 1940s despite the introduction of new pesticides and herbicides. Ecological pest management is an approach to controlling pest populations and encouraging beneficial insects on farms that limits the negative impacts on human health, farmers’ wallets, and the ecosystem.

There are many strategies that farmers use to manage pests on the farm, including increasing biodiversity, providing year-round food sources for beneficial insects, timing cultivation, mowing, and other activities with pest life cycles, and planting pest-resistant varieties. To manage pest populations, it is important to monitor insect populations on the farm.

OBJECTIVES
Students will
• Capture, inspect and identify one or more insects on the farm
• Consider the role that particular species play on the farm

MATERIALS
• Line drawing of typical flower
• Line drawing of honey bee
• Insect nets
• Bug boxes (magnifying lens on a box)
• Mini Field Guides to Common AgPark Pests
• Mini Field Guides to Common AgPark Beneficial Insects
• Complete field guide to common farm insects

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class, students in teams of 2-3

ADAPTED FROM
Original
LESSON 11:  Insects R Us!

Many crops rely on pollinators to produce fruit or seeds (including sunflowers, apples, melons, tomatoes and strawberries). European honeybees (Apis mellifera) are an important pollinator for many common crops. Ancient Egyptians were first to domesticate honeybees. The Pilgrims who came to America brought the European honeybee with them. In recent years, honeybee colonies have been declining, and scientists are trying to understand why. Other pollinators include native bees, butterflies, moths, hummingbirds, bats, flies, wasps and beetles.

PROCEDURE
1. Use a flower line drawing to show the parts of a typical flower. Briefly explain the parts, their function, and how they are useful to insects.

2. Use a line drawing of a bee to show the legs, pollen baskets, and body parts, and show the students how the bee collects pollen and gathers nectar.

3. Tell the students that they will be monitoring the insects and animals on the farm today.

4. Demonstrate how to use an insect net: look for an insect and then, with a sweeping motion, catch the insect and move it to the back end of the net. Clasp the net above the insect. Slide the bug box into the net, and gently place the box over the insect. Quickly and carefully put the lid on, careful not to hurt the insect, and shelter the insect from the sun. Be very careful to keep the animal alive so that it can be released after closer examination.

5. Hand out the Mini Field Guides to Common AgPark Pests and Common AgPark Beneficial Insects and give instructions on how to fold the guides.

(See instructions in Lesson 9.) Have students create (by folding) the two Mini Field Guides.

6. Ask students to find a partner, and give each pair an insect net, two bug boxes, and a species checklist. Tell students the boundaries within which they can explore, and repeat any behavior guidelines (e.g. to stay on farm roads and
paths). Tell the pairs that they can bring one insect back to the circle to share with the others.

7. Release the students to see how many animal species they can find on the farm. They can catch animals in their bug boxes that they want to study more carefully. If they can’t identify an animal, they can bring it to you or look it up in the Field Guide. After twenty minutes, call students back together.

8. Have students identify their specimens with the mini or full Field Guides. Ask them to identify the number of legs, evidence of pollen collection, body parts, antennae, and other interesting features.

9. Carefully release the animals.

CLOSING DISCUSSION/EVALUATION
Prompt the students to do the following:
• Describe what a bee (or other insect) looks like and what it does to benefit humans.
• Imagine yourself as a bee. How would you explain to people that you do an important job for them, bringing them the fruits, nuts and honey that they love?
• Imagine yourself as a farmer. What would you do to encourage healthy insect populations on your farm?

MODIFICATIONS/EXTENSIONS
• Research “Integrated Pest Management” and how it is used to manage certain pests.
• Research honeybees and Colony Collapse Disorder.
LESSON 12: Growing Soil for Food

BIG IDEA
Good, rich soil is essential for healthy farms, healthy foods, and healthy communities. Just like a good sandwich with lots of layers, soil also has a profile. At the top of soil is duff or humus, next is topsoil, followed by subsoil and lastly by parent material. Good farm soil is a combination of sand, silt, and clay, which is called “loam.” The sand creates micro-pores (tiny spaces) where roots of plants can find water; silt and clay help to hold water so it doesn’t drain too fast from the soil. Healthy soil is the foundation for healthy plants, and healthy people.

BACKGROUND
All foods can be traced back to soil. What is soil? Think of an apple as the earth. Both the apple and the earth have coverings. The peel is a covering for the apple. Soil is a layered covering for much of the land on earth. These layers are thick in some places and thin in others. From the top down, the earth has plants and/or duff (dead plant material), topsoil, subsoil and bedrock or parent material (which often influences the kind of soil above it). Soil is made of weathered rock, dead plants and animals, air, water, and bacteria.

There are many different kinds of soils on the earth. Soil comes in many different colors, and particle sizes. Large particles are called sand, and medium-sized particles are called silt, and the smallest particles are clay. Most soils have a mixture of the three sizes of particles. Decaying plant, bacteria, fungi, and animals contribute organic matter to the soil. This organic matter is decomposed over time, and its nutrients help nurture new plants and animals.

OBJECTIVES
Students will
• Learn about soil formation and soil conservation through discussion and experimentation
• Trace their lunch foods back to the soil from which they grew.

MATERIALS
• Student lunches
• Two rocks per team. Try to get sedimentary, metamorphic and igneous rocks for comparison.
• Large piece of paper (can be newspaper), for each team
• Paint trays, for each team
• Watering cans
• Shovel or trowel for each team
• Bug boxes (Optional)

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, students in teams of 2-3

ADAPTED FROM
Original
Plants help make soil by breaking apart rocks as their stems and roots grow. Some plants exude acidic compounds from their roots that break the rocks down, releasing minerals plants need to grow. Water helps make soil, too, by getting into cracks in rocks, and forcing rocks apart during freezing. Fast moving water in rivers moves rocks around causing erosion and decomposition. Water can also chemically wear rocks down.

PROCEDURE

1. Put students in teams of 2 or 3. Distribute two rocks and a big piece of white paper to each team. Have the students rub two rocks together over the paper. What falls from the rocks? Look at the rocks that you rubbed together. What do you see on the rocks? Repeat this several times to see if the results change. Have students look at each other’s work and compare their findings. Hint: look for particle size, color, and quantity. Different types of rock will yield different results. Once the students have created sand from their rocks, ask them if the farmers could use this to grow their crops. How does it feel? Does it have what is needed to raise food? What else is needed? Have students feel the farm soil in comparison. What’s different? If there is time, compare farm soil to the soil next to the creek. What is different and what is the same from each soil sample?

2. Many small animals live in the soil. In many cases, they help to keep the soil healthy. Instruct students to take 5 minutes to find some soil organisms and observe their behavior (e.g. earthworms, beetles, spiders, mites, etc.). They should see if they can follow the animals to their home, find out what the animals are doing, and where they are going. For example, if students find an ant, they should follow it, observe it, and record their observations. Ants can dig tunnels, live in a colony and help things to decompose. Look for worms, beetles, caterpillars, pill bugs, millipedes, etc. All these animals help to make new soil.
Note: If you can get to a compost pile, there will be a rich population of animals there. Use bug boxes to collect the animals and share with students. If these animals were not doing their work, we would have so much dead stuff on the earth’s surface that we wouldn’t even be able to touch the soil.

3. How can a farmer protect the soil?
   Remember that topsoil is a thin layer on the earth where almost all of our food grows. Without soil, we would be very hungry. Farmers have to keep their soil from blowing and washing away, while keeping it rich enough to grow food. Soil nutrients can be depleted if the same crop is grown year after year on the same ground, with the harvest being carried away. Farmers rotate the crops they grow, and use compost and other nutrients to replenish the nutrients in the soil. Lead a discussion to see what the kids know about saving soil.

**ACTIVITY 1: Erosion Experiment**

1. Have student teams dig a soil sample with grass cover out of the ground. Place the sample at the high end of the paint tray.
2. Have student teams dig a sample of soil without grass on it out of the ground. Place the second sample next to the first.
3. Sprinkle water on both samples.
4. Observe the water running off of each sample. Ask students, “In which case does the water carry more soil? In which case does more water stay in the soil? Can you draw a conclusion about which sample is better at conserving soil? Why?” If you were a farmer and you had to think of ways to conserve your soil, what would you do?
5. Clean up the experiment, and have students return their samples to where they got them.
ACTIVITY 2: *Lunch Bag Nature Hike*

1. Almost all food comes from plants, which grow in soil. Ask students to think about how each of their lunch items can be traced back to soil.

2. As the students sit down to lunch, ask each student to take one thing out of their lunch bag and trace back the origin of the food that they are holding, i.e., a hard boiled egg:
   - Came from a chicken which probably lives on a farm – where?
   - What did the chicken eat? Corn (a grass that we rely on very much in America), earthworms, grass, bugs, even mice that may have gotten into the chicken coop.
   - How did it get to you? Talk about transportation systems – including students’ trip to the store.
   - Even plastic wrap or bags go back to ancient forests and bogs, which grew in soil, and then were buried and transformed into oil over millions of years. And trees, processed into paper, came from soil where the tree grew.

3. Playfully continue with each student showing something from his or her lunch bag and tracing everything back to its origin with the class adding what they know so that the students get a strong feeling that they would not have a lunch without the soil that it took to grow their food.

**CLOSING DISCUSSION/EVALUATION**
- What are some of the things that you learned about soil?
- Why are plants called a cover for the soil?
- Describe how weather conditions (e.g. strong winds and heavy rainstorms) affect a farm field.
- Why must people take care of, or steward, the Earth’s soils?

**MODIFICATIONS/EXTENSIONS**
- Fill a glass jar with water, cover with a lid, and put the jar in a pan inside a freezer. After a day, look at the jar. What happened? How is liquid water different from frozen water? This demonstrates what freezing can do to rocks.
- Carry lunch leftovers to the compost pile, and search for decomposers. Emphasize that one animal’s waste is another’s food!
LESSON 13: Get To Know Your Watershed

BIG IDEA
We all live in a watershed, and rely on healthy watersheds for our drinking water. Our daily choices affect the health of our local, regional, and state watersheds, both upstream and downstream. Water is a limited precious resource, especially in an arid, highly populated state like California. Since many animal and plant species rely on fresh water, in order for ecosystems and human communities to survive and thrive, water must be used efficiently and watersheds must be protected from degradation and pollution.

BACKGROUND
A watershed is defined as the area of land which drains into the same place, often a river or creek system. John Wesley Powell, explorer and scientist, described a watershed as: “that area of land, a bounded hydrologic system, within which all living things are inextricably linked by their common water course and where, as humans settled, simple logic demanded that they become part of a community.”

California watersheds have been drastically altered and modified over time by dams and water diversions in order to meet fresh water needs for residential, agricultural, and business uses, and to provide flood control. The Alameda Creek Watershed is the largest drainage in the southern San Francisco Bay Area, draining approximately 650 square miles of the East Bay interior hills, before flowing through Niles Canyon, and then entering a twelve-mile-long flood control channel extending from Niles Canyon to the San Francisco Bay. Average annual rainfall in the watershed varies from 24 inches on Mt. Hamilton to 15 inches near Union City.

OBJECTIVES
Students will
• Work in a group to create a watershed model.
• Identify their community’s watershed on a map.
• Discuss how individual choices impact a watershed’s health.

MATERIALS
• East Bay Watershed Maps from Oakland Museum
• Map of Alameda Creek Watershed
• Relief maps of the San Francisco Bay Area and California
• Watershed models -- See Appendix
• Local maps (if students’ neighborhoods are not shown on East Bay maps)

TIME REQUIRED
1 hour

GROUP SIZE
Half of the class, students in teams

ADAPTED FROM
“River Cutters” Lawrence Hall of Science, University of California, Berkeley
The Alameda Creek watershed is used for grazing, housing, recreation, and agriculture, in addition to supporting fisheries and diverse wildlife. The Alameda Creek watershed contains three major reservoirs (San Antonio, Del Valle, and Calaveras) that can store a combined total of 225,000 acre-feet of water. About three million residents of the Bay Area rely on the Alameda Creek Watershed for some of their drinking water. Alameda Creek Watershed residents also rely on imported water from the SFPUC’s Hetch Hetchy water system and from the San Francisco Bay-Delta, which transports water from the Bay-Delta via the South Bay Aquaduct.

PROCEDURE
Make sure that watershed models are set up before students arrive, with the sand sloped up on one side of the container and excess water removed. Check with the teacher to see if students know how to read maps, and modify your presentation accordingly. Students may need an introduction to map-reading (using the legend, scale, etc.).

1. Lead a discussion of what a watershed is. Ask students to break down the parts of the word “watershed” to help them understand the process of water draining (“shed” as a verb), and the ability of the land to absorb and store water (“shed” as a noun). A watershed is both the land and the body of water which captures the water draining off of the land.

2. Ask students to break up into groups of two to five to brainstorm what the qualities of a healthy watershed are (e.g., clean water that is free of unsafe chemicals or pollutants, clean water that is good for drinking, swimming, and that provides high quality habitat for fish and other aquatic species).

ACTIVITY 1: What’s your watershed address?
1. Ask students: “Which watershed do you live in?”
2. Distribute East Bay Watershed Maps or road maps which include the students’ home town to each group and ask students to find their neighborhoods and local watershed.
3. Ask students: “Which watershed does your tap water come from?”

4. Use California and San Francisco Bay relief maps to show students the following watersheds:
   • San Francisco Bay-Delta and the South Bay Aqueduct which brings water to the East Bay.
   • Tuolumne River watershed in Yosemite National Park and the Hetch Hetchy water system, which runs through the Sunol Valley, and is managed by the SFPUC, to serve 2.5 million water customers in the San Francisco Bay Area.
   • Mokelumne River watershed in the Sierra Nevada, which is managed by EBMUD, to serve 1.3 million water customers in the East Bay.

5. Ask students: “Which watershed are we in now?”

6. Use relief and shaded maps to show students the Alameda Creek Watershed, which drains from Mt. Diablo in Contra Costa County and Mt. Hamilton in Santa Clara County. It is 650 square miles or 416,000 acres in size (imagine 416,000 football fields all put together).

**ACTIVITY 2: How do watersheds work?**

1. Ask students: “Now that you know more about the watersheds you live in and rely on for your water, how do watersheds work?”

2. Direct each group to a model watershed and instruct the students to build a small village on the land.

3. Instruct students to “turn on the flood” to see what happens to their village.

4. Ask students: “What would happen if they removed or added trees to their watershed?”

5. Ask students: “What would happen if farmers applied a lot of fertilizers or pesticides to their farms before a big storm?”
CLOSING DISCUSSION/EVALUATION
Ask the students to discuss how the different elements in a watershed – people, plants, farms, towns – impact the health of the land and the water. Ask students to write down two ways that they can be good stewards of their watersheds, and when they are done, to share one answer with the whole group.

MODIFICATIONS/EXTENSIONS
• Back in the classroom, students can research more about their local watersheds, what the primary threats are to the watershed’s health, and what their local community is doing to protect and enhance their watershed’s health.
LESSON 14: Sustaining Our Soil to Sustain Ourselves

BIG IDEA
Over 99.7% of the food humans eat is grown in soil, which makes soil the foundation of a healthy food system. Soil is a precious resource that must be protected in order for our farms and communities to thrive. Soil is created by slow geologic processes over long periods of time. Improving our agricultural practices to protect our soil is an important component of long-term sustainability.

BACKGROUND
Soil takes thousands of years to develop from parent rock, at an average rate of three inches per 1,000 years, although the exact rate varies by parent material and weathering conditions. Soil is created from parent rock by physical weathering (when rock is broken into smaller pieces by frost action, temperature changes, abrasion, and gravity) and chemical weathering (which leads to changes in the rock’s mineral composition as a result of chemical action of water, oxygen, and carbon dioxide). Plants and animals also create soil, by transporting minerals to the soil surface, and secreting organic acids.

Each shovelful of good top soil holds more living organisms than all the humans on Earth. Many types of organisms live in the soil (e.g., bacteria, fungi, algae, earthworms, beetles, moles) and improve the movement of air and water through the soil profile. Bacteria play an important role in converting soil nutrients into forms that plants can use. As organisms die and decompose, humus is formed from their remains. Humus fertilizes the soil and improves the soil’s structure.

Erosion is a natural process of wearing away the earth’s surface by water, wind, ice, etc. When human activity causes erosion rates

OBJECTIVES
Students will
• Learn about geographic & climatic factors that created the Sunol Valley soil.
• Investigate a soil sample & identify its mineral and biological components.
• Explain how soil resources can be protected.

MATERIALS
• Rock candy (that looks like rocks)
• Relief map of California
• Soil samples from different sites in jars
• Buckets of sand, silt, clay, loam & water
• Quart-size jar with soil sample & water
• Hand trowels & soil trays
• Hand lenses
• Paper, pencils & clipboards
• Paper towels, soap, water & bucket

TIME REQUIRED
1 hour

GROUP SIZE
Half of the class, students in teams

ADAPTED FROM
Original
to exceed soil formation rates, air and water pollution result. Excessive erosion also removes nutrients from the soil and limits soil productivity. Around the world, soil is being eroded 10 to 40 times faster than it is being replenished.

Farmers can limit soil erosion by using the following practices:
- planting cover crops
- reducing tillage
- planting windrows and grass filter strips
- leaving plant residues on the surface of the soil
- returning organic matter to the soil through compost applications

Other people can help to create new soil and replenish soil nutrients by composting their food scraps and plant material from their yards and gardens.

PROCEDURE
1. In pairs or as a group, ask students to share what they already know about soil. For example:
   - In what ways is soil important to our lives?
   - Is soil the same in every location? Is the AgPark soil the same as Oakland soil? Lake Tahoe soil? Hawaii soil? Mexico soil? Why or why not?
   - How might soil type affect what kinds of plants grow in it?
   - Do you think soil is alive or dead? Does soil “grow?” Does it “disappear?” How might soil change over time?

2. Ask students to look around the farm and the Sunol Valley. Ask them “Where do you think the soil we are standing on came from? Was it formed right here or has it traveled? How did it get here? (Hint: soil came from upstream.)
ACTIVITY 1: Rock On
1. Ask students to be as quiet as rocks.
2. Give each student a piece of rock candy. When everyone has one, instruct them to put it in their mouth and suck on it (but not to bite it).
3. After a few seconds, ask them to take it out and look at it carefully. Ask students to describe what is happening to their candy.
4. After several students have shared their responses, ask them what the scientific term is for the breaking down, cracking, changing colors, etc. that they observed (Hint: erosion).
5. Explain that “erosion” is a natural process of breaking down the earth’s crust. Describe the mechanical, chemical, and biological processes of erosion.
6. For older students: Ask students how geography might influence climate and erosion. Remind them of the geography of California (use a map) and that the Bay Area is much moister than Nevada, for example, because Nevada is in a rain shadow. Rain contributes to erosion, by physical, chemical, and biological processes, helping form deep soil.

ACTIVITY 2: What’s in the Soil?
1. Show students soil samples from different sites, and describe how soil is composed of inorganic particles of three different sizes (sand, silt and clay) and that loam, which is good for growing plants, is a mixture of all three particle sizes. The sand particles help the soil stay loose for roots to penetrate and the clay helps hold water, which plants need to grow.
2. Shake up a jar half full of AgPark soil and half full of water. Set it aside to let it settle. Students will get to see the particles settle out. The sand will be on the bottom with the silt, and clay particles will be layered on top.
3. Tell students that they will become soil scientists, and investigate what kind of soil we have at the AgPark. Divide students into pairs, and instruct each team to take a small soil sample (about a cup) from the edge of the farm field with a trowel and place their sample in a tray.
4. Ask students to investigate their soil using all their senses and write down their observations. Ask students to describe the color, texture, and smell of the soil and to note any animals they see. Then ask students to use a hand lens to look for smaller organisms in the soil and to draw pictures of any organisms they see.
5. Next ask students to form a small ball of moistened soil in their hands and to make a soil snake by pushing the soil through their thumb and forefinger. Ask students to observe how long their snake gets before it breaks. Snakes less than 1” indicate sandy soil, snakes 1-2” indicate medium texture or silty soil, and
snakes greater than 2” indicate clayey soil. Ask students what this tells them about the AgPark soil. Is it good for growing crops?

6. Ask students to return their soil to the farm field and clean up their stations.

CLOSING DISCUSSION/EVALUATION
Ask students to reflect on what farmers and other people can do to protect soil resources. Ask them to write down two things they learned about soil today. Then ask them to share what they learned with a neighbor. Each team should identify a representative and the representative will report back to the group one thing that their team learned.

MODIFICATIONS/EXTENSIONS
• Ask teachers to bring a soil sample from their school so that students can do a comparative soil test
• Have students scatter wildflower seeds or seedballs in the filter strip after they’ve completed the activities.
• Have students investigate the soil profile in the creek bed to identify depositional layers: topsoil, subsoil, and parent material. Students can draw a soil profile
• Learn more about erosion: Project WET, “The Sum of the Parts,” on page 267, can be done in the classroom.
• Read the book Dirt, The Ecstatic Skin of the Earth, by William Bryant Logan and/or watch the documentary, Dirt! The Movie (2009.)
LESSON 15: Biodiversity at the Farm Edge

BIG IDEA
Biodiversity is the variety of life forms on Earth, and includes genetic diversity within species, species diversity, and ecosystem diversity. All of the crops and domesticated livestock that humans rely on for food originated from Earth’s natural biodiversity. Biodiversity in farming landscapes helps provide ecosystem services that are essential to food production, including pollination and pest control. Agriculture can contribute to the conservation of biodiversity, or can drive biodiversity loss. Sustainable agriculture both benefits from and promotes biodiversity.

BACKGROUND
Our farms exist within ecosystems, and the health of our food system depends, in large part, on the health of our ecosystems. The rich biodiversity found on Earth has provided humanity with a wide diversity of foods, and continues to benefit our food systems and communities in many ways. In order to ensure a healthy food system for generations to come, humans need to protect the biodiversity upon which our farms and communities depend.

Agriculture began around 10,000 years ago in different parts of the world, including Mesopotamia, New Guinea, China, Mesoamerica, and the Andes, when people started selecting plants that were good to eat. Diverse agricultural systems evolved in these places in response to different climates, plant and animal species, and human cultures. Over the past millennia, and especially within the past 500 years, people and crops have migrated around the planet, so that today, almost all of the food we eat in California originated in a different place on Earth.

OBJECTIVES
Students will:
• Explore the biodiversity of the AgPark and in the adjacent riparian habitat.
• Learn to identify eight different plants by leaf structure.
• Discuss the importance of protecting biodiversity on farms.

MATERIALS
• Copies of the leaf key
• Bowls of water (one per table)
• Crayons (with the paper taken off)
• Copy paper (recycled)
• Clipboards
• Wildflower seeds or native plants (optional)

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class

ADAPTED FROM
Original
In the past hundred years, biodiversity loss has been increasing as a result of numerous factors including climate change and habitat loss. Biodiversity on and around farms contributes to important ecological processes upon which food production depends, including: soil nutrient cycling; erosion control; water filtration; pest control; and pollination. Since farms and ranches make up such a large percentage of our land use, biodiversity on farms is also essential to biodiversity conservation overall.

The Sunol AgPark benefits from being adjacent to the Arroyo de la Laguna creek and its riparian, or river bank, corridor. The banks of the Arroyo are densely vegetated with a diversity of groundcover, shrub, and tree species. This riparian plant community is part of the largest intact stand of Sycamore-Alluvial Woodland in the Alameda Creek Watershed and is an important interface between aquatic and terrestrial communities. Large tracts of open space occupy the hilly terrain to the south and west of the AgPark; these open space lands support a variety of ecological communities including non-native grasslands, scrub, and oak woodlands.

**PROCEDURE**

1. Tell students that they are going to explore biodiversity on and around the farm today. Ask students if they know what “biodiversity” is. If not, help them to figure out its meaning by breaking it down into “bio-” (life) and “diversity” (variety).

2. Distribute a copy of the leaf key to each student.

3. Demonstrate how to fold the leaf key into a mini-field guide, one step at a time:
   - Fold the paper in half length-wise (like a burrito); crease it really well.
   - Open, then fold it in half width-wise (like an omelet.)
   - Fold the paper in half again width-wise (like a fruit roll up.)
LESSON 15: Biodiversity at the Farm Edge

- Open it up, then re-fold the long fold, and moisten the middle two sections using a few drops of water.
- Carefully tear the middle two sections of the long fold, careful not to tear the outer two sections.
- Re-fold the long section and hold the two ends together (images facing out.)
- Push the two outer sections together to form a four-pointed star.
- Fold the star into a pocket sized mini field guide to trees of the Alameda Creek Watershed.

4. Distribute a crayon and clipboard to each student.

5. Ask students to take a look around them and notice the diversity of plants and animals they can see (on the farms, outside the fence, and toward the horizon in all directions).

6. Tell students that they are going to explore the riparian corridor (the area adjacent to the creek) and observe its biodiversity. Instruct students to count the number of species they see, and to write down the names of the species they see that are in their leaf key. Students can make leaf rubbings of the species they would like to remember, or ones they cannot identify.

7. Show students how to make a leaf rubbing. Usually the underside of the leaf has better veins to show up with a crayon rubbing. Tell students that in order to protect the area, they should keep the leaf attached to the tree when taking a rubbing, or use a fallen leaf.

8. Lead students to the riparian corridor and tell them how far they can go. Send them to explore in pairs. Give them ten minutes to search for species and make their leaf rubbings.

9. Call students back. Give them ten minutes to explore the AgPark farms and filter strip (again telling them how far they can go), and to count the number of plant species they can see, writing down the names of any species they recognize and taking careful leaf rubbings. Call
students back to share their findings and artwork. Ask students to compare how many different types of plants they saw in the riparian community versus on the farm.

10. If time/materials allow, distribute wildflower seeds or seedlings and demonstrate how to plant them on the filter strip. Explain the value of having these plants at the farm edge (i.e., to support pollinators and wildlife, and catch any farm runoff before it reaches the Arroyo de la Laguna Creek.)

CLOSING DISCUSSION/EVALUATION
Ask students to reflect on why biodiversity may be important to a species, a farmer, an ecosystem, and the planet.

Ask students to write down one thing they can do to protect biodiversity at home, at school, or in their communities

MODIFICATIONS/EXTENSIONS
• Do the discussion before the activities for older students.
LESSON 16: Geography and You

BIG IDEA
Geographical features, such as hills and mountains, protect the Sunol Valley from severe weather, by forcing wind currents up into the atmosphere, above the valley floor. The hills which form the eastern edge of the Sunol Valley, and the Sierra Nevada mountain range, 160 miles beyond them, capture precipitation, or atmospheric moisture, that evaporated from the Pacific Ocean. This precipitation is used to irrigate crops. These geographical features inform farmers’ decisions as to when, where, and what to plant and how protect their farms from the elements.

BACKGROUND
Geography is the science of Earth’s natural features, including landscape contour, and the interactions between climate, elevation, soil, vegetation, human and animal populations, land use, industry and other factors.

The driver of life on Earth is the sun. The sun heats the Earth at different rates, depending on latitude and season, causing varying temperatures around the globe. The shape of the land also influences the temperature and moisture (or “climate”) of an area. The sun causes water in the ocean to evaporate into the atmosphere; wind carries moist air up in elevation. Since cold air does not hold as much water as warm air, as moisture rises into cooler temperatures, it precipitates out of the atmosphere as rain, snow, or another form.

Earth systems often self-regulate, or remain stable over time in the face of disturbances. Wind (horizontal air motion relative to the surface of the earth) begins in a high-pressure area and moves to a low-pressure area (in the northern hemisphere, winds generally move clockwise) in order to approach a uniform

OBJECTIVES
Students will
• Learn how geography affects climate, which in turn affects plants and animals
• Learn how California’s geography makes it an important farm state
• Study characteristics of native plants at the AgPark and hypothesize about the relationship between the characteristics and the local climate

MATERIALS
• Topo map of Sunol Valley
• Relief maps of SF Bay Area & CA
• Maps of SF Bay Area, CA, US, & World
• Aerial photos of CA, Hetch Hetchy Water System, & Alameda Creek Watershed
• Leaf study worksheets & leaf samples
• Compass, clipboards, paper, & pencils

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, students in teams of 2-3

ADAPTED FROM
Original
pressure gradient across the Earth. This effect is particularly felt on California’s coast, where fog is often seen creeping from the ocean over the hills to the San Francisco Bay, as a result of moist ocean air moving to warmer inland zones.

PROCEDURE
1. Ask students: Why is California the number one farm state in the nation? Hint: Because of the unique geography of California.
2. Lead the students in an activity to demonstrate this:
   • Say “You hold California in your hands. Put your hands together in a cup in front of you.
   • “Your fingers are like the Sierra Nevada: where your fingers meet represents all the rivers on the west side of the Sierra Nevada coming down into the Great Valley of California.
   • “The heals of your hands are like the Coast Range;
   • “Your left thumb is the Siskiyou Mountains at the border with Oregon on the north and the right thumb represents the Tehachapi Mountains to the south.
   • “The deep lines in the palms of your hands (just below your fingers) are the San Joaquin and Sacramento River systems flowing through California’s great Central Valley.
   • “Where your hands meet is the San Francisco Bay Delta, the largest delta on the West Coast and an important area for hundreds of bird, fish, and other wildlife species.
   • “The SF Bay is where your wrists meet, which empties into the Pacific Ocean between your arms.
   • “The Pacific Ocean modifies the climate of California. This is California’s original water source, and it makes California the number one farm state in the nation because of the irrigation water it provides. Without the water
captured by the Sierra Nevada, California would be a desert.

- “The westerly winds (you can blow at your hands to simulate) bring the evaporated water in from the Pacific Ocean; most of it is trapped by the Sierra Nevada Mountain range, making the state of Nevada a desert. The little bit of rain that does make it over the Sierra Nevada often travels out to the Gulf of Mexico in Texas.”

- “(As an added bonus, your body is basically located at the Hawaiian Islands. So you can take a vacation in your mind at any time!)

- “Point out on your right hand the approximate location of Sunol AgPark (near the SF Bay, just between the heel of your thumb and the great valley). ‘We are here!’”

3. Ask students to find where they are on the maps, so that students can see the geography of California and the Sunol Valley. Show them where Niles Canyon is (west) and how the wind blows through Niles Canyon into the Sunol Valley. Have them hold California in their hands again and orient in the actual direction of the mountains.

4. Look at the maps to find the best representation of the Sunol Valley. Orient the maps in the proper direction and look at the hills of the valley to see how the maps represent reality. Solicit observations from the students and help them understand how the maps correspond to the real world.

5. Ask students to tell you what direction the wind is coming from. (They can lick their finger and stick it up in the air.

The wind will cool the finger from the direction that the wind comes. Also, they can throw dried leaves into the air to see which direction they are carried.) You can make it into a game by having all the kids in a circle; count to ten and everyone points at one time. Bring out the compass and check the direction.
6. Double check the wind direction by looking at the clouds to see which direction they are moving. They are being pushed by the wind. Does the movement of the clouds agree with your findings? Why would it be important for farmers to understand weather at their farm? How does wind direction impact planning on a farm?

7. Tell students they are going to observe native plants, and study their characteristics to try to understand how they have adapted to California’s climate. Distribute the leaf study worksheets to students teams, and direct them to find four different plant species to study. They are to observe leaf characteristics of their study plants, and observe how they are similar and different from other species.

8. Ask how long have these kinds of plants lived in this valley? How do these characteristics help them to survive?

9. If time allows, have students explore a few of the crops growing at the farm, and record their observations of the leaf characteristics of the farm crops. How are they similar to and different from each other, and from the native plants?

CLOSING DISCUSSION/ EVALUATION

• What evidence did you find today of how the native plant populations have adapted to the local climate?

• How does understanding climate and geography help farmers?

MODIFICATIONS/EXTENSIONS

• Use a cloud chart to identify the type of clouds and what they indicate about the weather.

• Make a relief map of your favorite park or valley

• Have students place a wind stick (meter stick with a 10” piece of surveyor’s tape at one end) in the field. The wind will blow the surveyor’s tape in the opposite direction from the wind. Students can map the wind by walking around the farm with the wind stick and recording wind direction at different locations on the farm. Observe whether the wind is steady or swirling. Look at the vegetation to see if this is a regular phenomenon or only occasional (Hint: If habitual, plants will be leaning away from the wind.)

• Students can research the peak heights and distances of mountain ranges, and study the varieties of produce that are grown in different regions of California, and how that relates to geographic features.
Native Plant Exploration

My name_________________________Today’s date_________________________

Plant #1
Draw the leaf here:

Describe the leaf’s characteristics (waxy, smooth, soft, small, spiky, etc.):

Plant #2
Draw the leaf here:

Describe the leaf’s characteristics:

What does it have in common with Plant #1?

________________________________________________________________________
Plant #3
Draw the leaf here:

Describe the leaf’s characteristics: 
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--------------------------------------------------
--------------------------------------------------

What is one difference between Plant #3 and Plant #2? 
--------------------------------------------------
--------------------------------------------------

Plant #4
Draw the leaf here:

Describe the leaf’s characteristics: 
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--------------------------------------------------

What is one thing Plant #4 has in common with Plant #3? 
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--------------------------------------------------

Why do you think these plants evolved their different characteristics? 
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--------------------------------------------------

How do you think these features help them to survive? 
--------------------------------------------------
--------------------------------------------------
LESSON 17: Can Agriculture and Nature Work Together?

BIG IDEA
Organic farmers use ecological principles to inform their farming practices. By paying attention to the dynamic agricultural ecosystems in their fields, organic farmers strive to work with nature to grow healthy food while minimizing negative environmental impacts. Crop diversification is one practice farmers use to build healthy soil, protect their crops from drought, pests, and disease, and minimize their financial risk.

BACKGROUND
Farms that have a diversity of crops species and varieties mimic natural systems and are more resilient to disease and other disturbances. In monoculture farming systems, where a single type of crop is planted, crops are more susceptible to damage from pest populations than in more diverse cropping systems. If one blight, or pest, begins in a large monoculture type farm, it can destroy the entire crop. The notorious Irish Potato Famine is one such example. In the 1800s, poor Irish farmers had recently been pushed off of preferable farming lands by the rising English demand for beef. Since potatoes grow well in marginal, or low-quality, soils and provide high caloric content, they became the staple food of the Irish lower class. In 1845, blight attacked the potatoes and most farmers lost their entire crop, leaving very little for the Irish people to eat for eight years after. As a result, one million people died and another million left Ireland for the new world.

The danger of a pest wiping out a whole farm’s crop isn’t the only reason organic farmers plant many different kinds of crops, however. Another benefit of growing a variety of foods on the same farm are the effects that polyculture, or growing more than one thing,

OBJECTIVES
Students will:
• observe the diversity of crops and animals at Sunol AgPark
• discuss the benefits of crop diversification.

MATERIALS
• Clipboards, paper and pencils (crayons for leaf rubbings) for each team
• Magnifying bug boxes (do not concentrate the sun through the lens)
• Pictures of a large scale monoculture, desert, and rainforest habitat

TIME REQUIRED
45 minutes

GROUP SIZE
Half of the class, students in teams of 2-3

ADAPTED FROM
Activity 1 – Teaching Science in an Outdoor Environment by Gross & Railton, “Using a Shadow Stick”
LESSON 17: Can Agriculture and Nature Work Together?

has on the soil. In a monoculture cropping system, since only one type of plant is grown, the nutrients in the soil become depleted and pest populations in the soil build up, making inputs such as artificial fertilizer and pesticides necessary. Erosion of the soil also becomes a problem if only one kind of plant is ever grown. On an organic farm where many types of crops are rotated, or grown at different times in the same spot, the soil retains its nutrients over time, pest and weed populations stay manageable, and the soil structure is improved, making erosion less of a problem. This is because different types of plants have different types of nutritional needs, attract different types of pests and weeds, and have different root lengths. For example, corn draws nitrogen out of the soil as it grows, whereas pea plants add nitrogen to the soil through bacteria that live on their roots. Planting corn one season, and peas the next will keep the soil from losing nitrogen. Corn also attracts pests such as corn borers if grown in the same field year after year. The reproductive cycle of these corn-loving pests can be broken by alternating between corn and crops that the pests don’t like, such as peas, tomatoes, and broccoli. Finally, since corn has shallow roots, it is important to grow other crops with deeper roots in the same soil to keep the soil aerated. Soils that are well aerated, and that aren’t left fallow, or empty, in the winter, as often happens in monoculture systems, are able to retain more moisture, thus preventing runoff and erosion, and resisting drought.

Since polyculture prevents diseases and pest infestation of crops, enriches soils, and reduces the risk of losing an entire year’s worth of produce, it makes good economic sense to grow more than one type of crop on a single farm. Rather than putting all their eggs in one basket, so to speak, organic farmers like to spread out their financial risk at the beginning of the growing season by investing their time and money in a diverse collection of crops. Since small farmers tend to sell directly to consumers though CSAs and farmers’ markets, having a variety of...
vegetables and fruits to offer to customers throughout the season also ensures that farmers will have a steady income.

**PROCEDURE**

1. Get permission from farmers to investigate their farm crops before proceeding.

2. Ask students, “Why do we have laws?” (Hint: Imagine if there were no stoplights at busy intersections, no lane stripes, no crosswalks, etc. on the streets where cars go. The result would be very hazardous on our health.) Once students have contributed their ideas, say, “In nature there are also laws that govern the healthy systems of our planet.” Ask students, “Can you name any laws of nature?” (Hint: students may need some prompts here like the seasons, night and day, water cycle, decomposition, etc.) Discuss how diversity is found naturally in nature drawing on different environments, such as deserts and forests, as examples.

3. Ask students to define diversity. How does diversity apply to human communities? To natural environments? To agricultural systems?

4. On the farm, investigate each farm for diversity:
   - Establish a time and a signal for bringing students back together before they set out on their investigation. Students get about 25 minutes for this exercise.
   - Send students in teams of 2 or 3 to record what is in each farmer’s field. Students sketch a picture of the farm crops where they are assigned. The sketch needs to include three major points: 1) total number of rows in each farm, 2) the variety of plants on the farm, (Students can record this by drawing a picture of representative leaves from each different kind of plant or by taking a careful leaf rubbing from each type of crop) and 3) the evidence of animals (including insects) in the field (hint: holes in the leaves,
LESSON 17: Can Agriculture and Nature Work Together?

cocoons, unnaturally curled leaves by insects, leaf or stem galls, etc. Students can use their bug boxes to get a closer look at the insects).

5. Call students back together to share their information. Ask students, “How does the farmer’s crops reflect nature’s diversity?” (Hint: If students have trouble with this question, show them a picture of different natural environments.)

6. Then ask, “How are the Sunol AgPark farms different from large-scale industrial farms?” (Hint: If students have trouble with this question, show them a picture of a “factory farm” where there is nothing but acres and acres of one kind of crop like wheat or corn.)

7. Then: “What would be the risks of planting only one crop on a massive scale?” (Hint: If farms grow only one crop and a pest comes through, they can lose everything. If farmers diversify their crops and a pest comes through, they won’t lose everything since pests tend to be species specific, affecting one type of crop.)

CLOSING DISCUSSION/ EVALUATION

• Ask students to share their observations about the different farmers they visited. What did they notice?

• If you were a farmer, how would you let nature inform your practices?” (Hint: use compost on the fields to recycle the nutrients once captured in the living plants and now captured in dead plants, allow the seasons – day length, rainfall – to determine when is a good time to plant seeds and to harvest crops, etc.)

• Since California has a drought summer, what must the farmers do for their plants? (Hint: irrigate or provide water for plants)

• How can you work with nature to take care of your own neighborhoods, schoolyards, and communities?

• How can you help create a more diversified landscape and world?

MODIFICATIONS/EXTENSIONS

• On the school grounds, make a shadow stick and follow it all year. It can tell you directions (N, S, E, &W), give information about the seasons, day length, etc.

• Make a school garden and compost pile for dead plants and leftover foods

• Plant some seeds in the hedgerow or in a farmer’s field if it is the right season.
LESSON 18: Watersheds – Not Just a Drop in the Bucket!

BIG IDEA
Every watershed begins with the incomparable water molecule! A watershed is the area of land that drains into a common water body, usually a lake or river. Sunol Valley is in the Alameda Creek Watershed. Alameda Creek drains 700 square miles, from Mt. Diablo in the north to Mt. Hamilton in the south. The watershed sustains a rich assemblage of wildlife species, and provides water for agriculture and ranching, recreation, and drinking. Over three million people rely on the Alameda Creek Watershed for their water. Maintaining high water quality and sufficient fresh water supply for competing demands is a mounting challenge.

BACKGROUND
All living things depend on water to survive. Humans and many other plant and animal species depend on fresh water, which comes from rain and snow, and travels by gravity to rivers, lakes, groundwater, and human-made reservoirs. Of the Earth’s water, 97.5% is salt water and 2.5% is fresh water, most of which is trapped in ice or snow, which leaves less than 1% of all water for human, plant and animal use. As Earth’s human population grows, demand for clean drinking water increases. Insufficient wastewater treatment and pollution of watersheds negatively impacts water quality, causing health and environmental problems for people and species. Water managers, such as the San Francisco Public Utilities Commission, work to ensure a safe and reliable fresh drinking water supply, while protecting the environment which provides our drinking water, and protecting the species with which we share our watersheds.

OBJECTIVES
Students will:
• describe a watershed
• refer to Alameda Creek watershed boundary features
• calculate the volume of water it takes to produce common items
• calculate their daily water use

MATERIALS
• Twelve 18” wooden stakes
• Mallet
• Colorful yarn
• Irrigation flags
• Four measuring tapes
• Clipboards & pencils
• Student worksheets & Instructor worksheet
• One calculator per team

TIME REQUIRED
50 minutes

GROUP SIZE
Half of the class, students in two teams

ADAPTED FROM
Original
Humans have altered watersheds to bring water from where it occurs naturally, to the places where humans live and work. Human societies typically developed around fresh water bodies. Today, engineering has made it possible for people to live hundreds of miles from their drinking water source.

Agriculture uses approximately 70 per cent of the world’s fresh water, and is an important part of the global and local water picture. On average, approximately eight gallons of water are needed to grow a tomato, 616 gallons of water are needed to produce a hamburger, and 1,800 gallons are used to make a pair of jeans. Each American uses about 100 gallons of water each day (drinking about a gallon) and about 1,700 gallons indirectly through eating, working, and other activities.

An extensive network of dams, pumps, and pipes have helped make California the fifth largest economy in the world, with irrigated agriculture being the state’s number one income generator. Human-constructed water systems, land development, unsustainable agriculture, and other activities have led to the degradation of aquatic habitats and imperiled many fish and amphibian species that depend on freshwater systems. An important sustainability challenge in this century is how to provide for both human and ecosystem fresh water needs.

PROCEDURE
Pre-lesson set up: Make two sample cubic feet placed at least three feet apart, using 18” stakes, pounded 6” into the ground. Place the sample cubic feet in an open area, where the students can work out in two directions from the starting area, and where the ground is soft enough to place the flags. Pound the four stakes 12” apart to make a cubic foot. Wrap the cubic foot in colorful yarn to visually display the volume occupied by one cubic foot.

1. Ask students to observe the Sunol Valley watershed by pointing out its boundaries at the crests of the hills. Draw attention to the vegetation differences. Ask students if they know how water affects

Image: Studer 2005

Photo: Michael C. Berch
the watershed (Hint: erosion, etc.). Ask if they know what changes humans have made to the watershed (Hint: dams, plumbing, bulldozing, mining, etc). Once you are satisfied that the students see what makes up a watershed, move on.

2. On the farm, find some water on leaves (or in a puddle, etc.) and gently pick it up with your thumb and forefinger. Slowly move your forefinger away from your thumb. Demonstrate how the water clings to your fingers. Have students duplicate what you did. Explain how this “hanging together” is called cohesion. In nature it can be seen as surface tension which allows water striders (insects) to walk on water.

3. Ask if anyone knows the chemical formula of water; do they know that “H2O” means two hydrogen atoms and one oxygen atom bonded together to make one molecule?

(Molecules are a collection of atoms [simple = same kind of atom, compound = more than one kind of atom]. The water molecule looks very much like a Mickey Mouse hat on someone’s head, with the hydrogen molecules at the same angle as the ears on the Mickey Mouse hat. Hydrogen atoms from one water molecule are attracted to the oxygen atoms of another water molecule.) Water molecules are so good at cohesion (community building) that they can make long “ropes” of water that can dissolve almost anything and carry it along. This cohesion comes from the attraction capabilities of the hydrogen atoms on the water molecules, allowing it to move in the water cycle and from freshwater reservoirs through pipes to our faucets and farms.

For this exercise the students calculate the number of cubic feet (volume) of water it takes to produce a particular item from the list below, then use measuring tapes to place the correct number of irrigation flags into the ground 12” apart to show the results of their calculations.

4. Split the students up into two teams and direct them to their respective starting locations (the two sample cubic feet staked out). Teams will work in opposite directions. Their job will be to calculate (using calculators) the number of cubic feet of water it takes to make a particular item. Explain that they will display their answers by measuring every 12 inches and placing the appropriate number of irrigation flags in the ground to make a cubic foot. Instruct students to round their answers; e.g., 13.3 cu ft = 13 cu ft. The team who correctly finishes the task first wins a point.

5. Distribute worksheets to each student group, so that each student pair has a copy.

6. Read aloud the calculation questions to the students, with the students following along.
LESSON 18: Watersheds—Not Just a Drop in the Bucket

Do the first calculation with the students, and demonstrate by placing the correct number of irrigation flags. To expedite the lesson, students can leave the irrigation flags out for the next calculations; adding to irrigation flags or taking them away.

7. Run through the calculations, asking one student per team to keep track of their team’s score.

Thought piece: One acre-foot provides enough household water to two families of four for a year. How do you think household use compare to “embedded” water use, or water that is used to make the things we consume? Why is it important to know cubic feet conversions? (Hint: because it gives a sense of the volume of water that we use, and helps and that’s the way the water managers measure water supply in reservoirs, and also demand by customers.)

8. Ask students to reflect for a moment. Where was the water that you used this morning yesterday? The faucet is only the “current” location or stop on the water’s journey. What could you do to use less water in your daily routine? In their teams, have students draw or write their thoughts on how a water molecule travels from the largest water reservoir in California (Sierra snow pack), to their faucet, and back again. Remind students that water molecules had to stick together through clouds, watersheds, rivers, reservoirs, hundreds of miles of pipes, and treatment plants to get to them. Their faucet (with the aid of gravity and pumps) helped pull on the “rope” of water, creating a tiny force that reacts all the way up the line. Ask students to reflect on their own use of water and how they have seen water used. How can they or others protect the quality of our water supply?

CLOSING DISCUSSION/EVALUATION

- Describe the boundaries of the Sunol Valley (Alameda Creek) watershed.
- How does the water we use affect the Alameda Creek or Tuolumne River Watershed?
- How can you use water more sustainably?

MODIFICATIONS/EXTENSIONS

- If done in the classroom, students can illustrate their calculations by shading in ¼” graph paper (each ¼” square represents a cubic foot).
- Make a model of a water molecule. Hand out toothpicks (one per student) and gumdrops (1 red and 2 yellow). Have students look at a Mickey Mouse hat. The water molecule looks very much like a Mickey Mouse hat on someone’s head, with the hydrogen molecules at the same angle as the ears on the Mickey Mouse hat. Break the toothpick into two pieces. Stick yellow gum drops on each end of the two toothpicks, then put the two empty ends into a red gumdrop at the angle of the Mickey Mouse ears. Ask student teams to see if they can put the water
molecule models together so that there is no space around them. Hint: They can’t. Water molecules are called “polar” molecules, because they are positively charged at the hydrogen ends and negatively charged toward the oxygen atom. Because opposite charges attract, hydrogen within one water molecule will orient toward the oxygen in another. This is why we don’t find pure water in nature. Water is always carrying a “buddy” with it in solution! Have students point to where something could be carried by their water molecule. This cohesion ability allows for water to be absorbed by roots and moved through plant stems and leaves and out the leaves to keep the leaves from being sunburned, as well as releasing the water back into the atmosphere...just like a rope. Students can eat their molecules after they are used for demonstration. Collect the toothpicks for the garbage. You can also use clay, and ask students to roll clay into small grape sized balls (red oxygen atoms are larger than yellow hydrogen atoms).

- Recombine gumdrops into other molecules (2 yellow gumdrops [hydrogen atoms] = one hydrogen molecule; 2 yellow gumdrops and 2 red gumdrops = hydrogen peroxide molecule; 2 red gumdrops = one oxygen molecule). These are different chemical formulas for a molecule. Scientists use these formulas to indicate a certain number of atoms which make different molecules, which are the building blocks of our world. Slowly moving molecules make up solid objects, faster moving molecules make up liquids and quickly moving molecules make up gas or vapor. Water is unique in that it is naturally abundant in all states: solid, liquid and vapor.

- Build solar water still:
  1. At the beginning of the day dig a glass bowl in the ground
  2. Place a large amount of grass stems and leaves inside the bowl
  3. Put a glass in the middle of the bowl
  4. Put some plastic wrap over the top of the bowl at ground level
  5. Put rocks or soil all the way around the top of the plastic wrap over the bowl so that there is no place for anything to escape from the bowl (but leave some slack in the plastic wrap)
  6. Place a small light colored rock in the center of the plastic wrap over the glass in the bowl so that the plastic wrap goes into a slight cone or “v” over the glass
  7. At the end of the day check the glass to see if any water came out of the grass, condensed on the plastic and rolled into the cup
  8. h.You just made a model of a mini water cycle showing how water evaporates out of vegetation, condenses in clouds and comes back to earth; also the bowl acts as a mini watershed with the plastic wrap on top to trap moisture and circulate it.
How much Water is in My Lunch?

My name __________________________ Today’s date __________________________

1 gallon = .134 cubic feet
1 cubic foot = 7.5 gallons
1 acre foot = 43,560 cubic feet

1. You decide to have a hamburger for lunch. It takes 616 gallons of water to make one hamburger patty. How much water in cubic feet did it take to make your hamburger patty?

2. It takes 20 gallons of water to make a hamburger bun. How much water in cubic feet did it take to make your hamburger bun?

3. You ask for cheese on your hamburger. A slice of cheese takes about 56 gallons of water to make. How much water in cubic feet did it take to make your slice of cheese?

4. You have a tomato on your burger for lunch. It takes 8 gallons to raise a tomato. How much water in cubic feet did it take to grow your tomato?
5. You drink a soda with your lunch. It takes 10 gallons to make one 16-ounce soda. How much water in cubic feet did it take to make your glass of soda?

6. For dessert, you have a cookie with your lunch. The cookie took 55 gallons to make. How much water in cubic feet did it take to make your cookie?

7. Add up the total amount of water in cubic feet that you used just at lunch

8. If everyone in your class used the same amount of water at lunch as you did, how much total water was used?

9. What percentage of an acre-foot of water did you and your classmates use at lunch?
Notes to Instructors

• Instructors should meet the school groups in the Sunol Water Temple parking lot. Try to be there early so that you are waiting for kids, not the kids waiting for you.

• There’s a difference between teaching kids and reaching kids. Students want to know that you care about them before they care about what you have to teach.

• Take care of students’ body functions right away … water and de-water. Students will be instructed by their teachers before they leave school that they are to bring their own water bottles and they will also have their lunches with them. Ask the teacher to keep the lunches until lunchtime, leaving the kids hands free for your activities.

• Talk to the teacher introduce yourself to the teacher and all the chaperones and ask about what you should be prepared for … kids who work well together, kids with special needs, ELL, cliques, troubled kids, etc.

• Hopefully the students will have nametags on … do your best to call the students by name! If there is time while students trade off using the rest room, you can get to know the other students who are waiting with you; play a “name game” or “ice breaker” as you wait for all student to assemble. (It’s good for students to use hand sanitizer after restroom visits, as chemical toilets don’t have sinks & hand soap.)

• Briefly introduce yourself to students and tell what your interest is in the Sunol AgPark (why you are here). Wear a nametag (first or “nick name” is enough) to increase rapport with the kids. Be friendly, have eye contact and interest in the students and their experiences.

• Big welcome to this unique place in history. (Ask questions to engage kids)

• What makes the Sunol AgPark so special? (Overview – urban edge, organic, sustainable agriculture, etc.)

• Say “We’re all part of the bigger, global picture - We are all one.”

• “Today, you will leave a piece of yourself here as a living partner of the Sunol AgPark.”

• Remind students that they are still in school today. Only today, their classroom has a ceiling that is the sky; walls are made of living trees; and a floor of real earth.

• Ask: “What do you expect to find out here today?” If they mention their fears, reassure them that there is little to worry about … (Maslow’s hierarchy of needs).

• Hint: Assure students no tigers, bears, (last California Grizzly was shot in the 1920s), etc. Address each fear that they raise individually. Remind students to stay with the group for all the fun that will follow.

• Agree on safety issues – create a signal that the instructor can use to assemble the group after an activity. Example: Your raised hand with thumb touching your two middle fingers (like the muzzle of a fox), with pointer and little finger extended into the air like ears on a fox head … As soon as students see your hand extended as fox head (hand signal) they raise their hand in the same gesture and become quiet. Once they raise their fox head, they stop talking; “hand up, mouth shut… quiet as a fox!” (You can emphasize by putting your pointer finger from your other hand up against your lips to “shush” the group.)
Appendix

Notes to Instructors

• You can practice the technique by having everyone talking and then, put your hand up to stop talking – it makes for a fun game.

• Agree on deportment issues while at Sunol AgPark – talk about how you are going to treat each other; like: allow one speaker at a time, stay with the group, etc.

• Tell them how much time they have with you and what you all are going to try to accomplish in that amount of time. Instructors must keep an eye on the time; you only have 50 minutes per lesson.

• It’s always great to have something students can eat from the farm. Food is the universal tranquilizer.
Sunol AgPark Farm Journal
A million farm stories are out there. Start writing yours!

This journal belongs to__________________________________________

I visited the Sunol AgPark on_____________________________________  

Memorable people that I met:_____________________________________

Memorable food that I ate:________________________________________

Memorable moments that I experienced:______________________________

Things that I saw:_______________________________________________

Things that I did:_______________________________________________

Things I would like to do again:___________________________________

Things I wouldn’t do again:_______________________________________

If they made a movie about our farm experience, it would be called______

Things that made me laugh:_______________________________________

Things that made me think:_______________________________________
Watershed Model Instructions

MATERIALS

For the entire group:
- 10 lbs of sand (fine sand is best - try using Netafim farm filter sand)
- Food dye
- Water
- Duct tape
- Large bucket (2-5 gallon)
- Nail
- Aluminum foil (optional)

For each student team – 2 to 4 students per team:
- Plastic blanket box (~20”x15”x3”)
- Plastic one gallon milk or water jug
- Two foot length of ¼” drip line tubing
- Adjustable drip emitter
- Connector fitting for drip line
- Clothes pin
- Sponge
- Block of wood (2”x4”x6”)
- Sturdy cardboard box or pot with eared handles
- Small wooden pieces, PVC, straws, sticks, trees, other objects to put in watershed

Advance preparation:
1. Fill the large bucket ¼ full with water. Place it in a convenient location for handwashing.

2. Pour 13 cups of sand into the pan. Add water slowly to the tub until the sand is moistened and sticks together.

3. Position a block of wood under one end of the tub, for maximum slope. Shake the lower end of the tub to settle the contents into a uniform slant.

4. Install the drip emitter on the end of the drip tubing. Fit the coupler fitting into the other end of the spaghetti tubing. Poke a hole with a nail into the lower rim of the jug and insert the coupler fitting. Tape around the jug-coupling connection with duct tape to prevent leaks.

5. Fill the jugs with water.

6. Place the jug on the box or pot to raise it above the watershed model. Position the drip emitter over the pan by clamping the tubing onto the pan’s rim with a clothes pin.
Watershed Model Instructions

Have students try different scenarios to alter the path of the river on the land. Some ideas:
- Make a channel with aluminum foil.
- Place debris in the path of the river (i.e. pebbles, twigs, cotton).
- Make a dam from aluminum foil and scoop out a hollow for a reservoir.
- Try to change the creek’s location by digging it a new channel.
- Add “culverts” using the plumbing parts.
- Make “trees” with twigs and cotton balls. Try lining the sides of the channel to see if they keep the creek banks from eroding.
- If there is time, have kids apply a few drops of food dye to the sand, refill the water jug, and do the activity again to mimic what happens when fertilizers are applied to farmland in a watershed.
- Encourage students to use their imagination with the available materials to create different scenarios around the river.
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<thead>
<tr>
<th>Lesson Number</th>
<th>Lesson Title</th>
<th>Subject</th>
<th>Grade</th>
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<tr>
<td>1</td>
<td>Sunol Water Temple Works of Art</td>
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<td>The First Groups of People in the Sunol Valley</td>
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<td>Recent Past, Present, and Future of the Sunol Valley</td>
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<td>4</td>
<td>Nurturing a Sense of Place</td>
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<td>Plumbing, Can’t Live With It, Can’t Live Without It!</td>
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<td>Where in the World Did Our Crops Come From?</td>
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<td>Farmers as Stewards of the Land</td>
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<td>You Are What You Eat</td>
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<td>9</td>
<td>Working on an Urban Edge Farm</td>
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<td>10</td>
<td>Organic Food Production and the Economy of Food</td>
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<td>Insects R Us!</td>
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<td>Growing Soil for Food</td>
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<td>13</td>
<td>Get To Know Your Watershed</td>
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<td>Sustaining Our Soil to Sustain Ourselves</td>
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<td>15</td>
<td>Biodiversity at the Farm Edge</td>
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<td>Geography and You</td>
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<td>17</td>
<td>Can Agriculture and Nature Work Together?</td>
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<td>18</td>
<td>Watersheds - Not Just a Drop in the Bucket!</td>
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<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking. 1.2 Combine short, related sentences with appositives, participal phrases, adjectives, adverbs, and prepositional phrases. 1.3 Identify and use regular and regular verbs, adverbs, prepositions, and coordinating conjunctions in writing and speaking. Listening &amp; Speaking - 2.1 Make narrative presentations.</td>
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<td>Artistic Perception - 1.3 Use their knowledge of the elements to describe similarities and differences in works of art and in the environment. Creative Expression - 2.1 Use various observational drawing skills to depict a variety of subject matter. Historical &amp; Cultural Context - 3.1 Research and discuss the role of the visual arts in selected periods of history, using a variety of resources. Aesthetic Valuing - 4.1 Construct and describe plausible interpretations of what they perceive in works of art. 4.2 Identify and describe ways in which their culture is being reflected in current works of art.</td>
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<td>Artistic Perception - 1.5 Describe and analyze the elements of art, emphasizing form as they are used in works of art and found in the environment. Historical and Cultural Context - 3.1 Describe how art plays a role in reflecting life. 3.2 Identify and discuss the content of works of art in the past and present focusing on the different cultures that have contributed to California's history and art heritage. Aesthetic Valuing - 4.2 Identify and describe how a person's own cultural context influences individual responses to works of art. 4.3 Discuss how the subject and the selection of media relate to the meaning or purpose of a work of art. 4.4 Identify and describe how various cultures define art differently.</td>
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<td>Listening and Speaking - 1.2 Interpret a speaker's verbal and nonverbal messages, purposes, and perspectives. 1.3 Make inferences or draw conclusions based on an oral report.</td>
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<td>Written/Oral Language - 1.1 Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts.</td>
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<td>People In the West 1800s - 8.8.5 Discuss Mexican settlements and their locations, cultural traditions, attitudes toward slavery, land-grant system, and economies. Transformation of Economy - 8.12.1 Trace patterns of agricultural and industrial development as they relate to climate, use of natural resources, markets, and trade and locate such developments on a map.</td>
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## Detailed California State Educational Standards by Lesson for Grades 4-8

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<td>California Life - 4.3.3 Analyze the effects of the Gold Rush on settlements, daily life, politics and the physical environment. 4.4.1 Understand the story and lasting influence of the Pony Express, Overland Mail Service, Western Union, and the building of the transcontinental railroad, including the contributions of Chinese workers to its construction. 4.4.6 Describe the development and locations of new industries since the 19th century. 4.4.9 Analyze the impact of 20th century Californians on the nation’s artistic development, including the rise of the entertainment industry.</td>
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<td>Listening and Speaking - 1.2 Interpret a speaker’s verbal and nonverbal messages, purposes and perspectives. 1.3 Make inferences or draw conclusions based on an oral report. 1.6 Engage the audience with appropriate verbal cues, facial expressions, and gestures.</td>
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<td>Nutrition &amp; Physical Activity 1.1.N Identify and define key nutrients and their functions.</td>
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<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking.</td>
<td>Listening and Speaking - 1.1 Ask thoughtful questions and respond to relevant questions with appropriate elaboration in oral settings</td>
<td>Geographic Features of CA - 4.1.4 Identify the locations of the Pacific Ocean, rivers, valleys, and mountain passes and explain their effects on the growth of towns. Transformation of CA - 4.4.7 Trace the evolution of California's water system into a network of dams, aqueducts, and reservoirs</td>
<td>Earth Sciences - 5.c Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it in other places. Investigation and Experimentation - 6.c Formulate and justify predictions based on cause and effect relationships.</td>
<td>Conduct multiple trials to test a prediction and draw conclusions about the relationship between predictions and results</td>
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<td>Listening and Speaking - 1.5 Clarify and support spoken ideas with evidence and examples</td>
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<td>Earth Sciences - 3.e Water vapor in the air moves from one place to another and can form fog or clouds, which are tiny droplets of water or ice, and can fall to Earth as rain or snow.</td>
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<td>1.1 Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts.</td>
<td>Listening and Speaking - 1.3 Restate and execute multiple-step oral instructions and directions</td>
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<td>Earth Sciences - 2.a Students know water running downhill is the dominant process in shaping the landscape, including California's landscape.</td>
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Appendix
Farming in the Watershed
SageCenter.org
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<td>4</td>
<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking. Listening and Speaking - 1.7 Emphasize points in ways that help the listener or viewer to follow important ideas or concepts. 1.8 Use details, examples, anecdotes, or experiences to explain or clarify information. 2.1 Make narrative presentations.</td>
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<td>Life Sciences - 3.b Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all.</td>
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<td>5</td>
<td>5</td>
<td>Written/Oral Language - 1.2 Interpret a speaker's verbal and nonverbal messages, purposes, and perspectives. Listening and Speaking - 1.5 Clarify and support spoken ideas with evidence and examples.</td>
<td>Nutrition and Physical Activity - 2.2.N Recognize that family and cultural influences affect food choices. 3.2.N Interpret information provided on food labels. 8.1.N Encourage and promote healthy eating and increased physical activity opportunities at school and the community.</td>
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<td>Investigation and Experimentation - 6.a Classify objects in accordance with appropriate criteria.</td>
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<td>Written/Oral Language - 1.1 Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts.</td>
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<td>Listening and Speaking - 1.5 Arrange supporting details, reasons, descriptions, and examples effectively and persuasively in relation to the audience.</td>
<td>Nutrition and Physical Activity - 2.2.N Evaluate internal and external influences on food choices.</td>
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<td>Earth Sciences - 5.f Students know the structures and processes by which flowering plants generate pollen, ovules, seeds, and fruit.</td>
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<td>Nutrition &amp; Physical Activity - 2.1.N Identify internal and external influences that affect food choices 3.1.N Identify resources for valid information about safe and healthy foods</td>
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<td>Listening and Speaking - 1.1 Ask questions that seek information not already discussed 1.2 Interpret a speaker’s verbal and nonverbal messages, purposes and perspectives</td>
<td>Nutrition and Physical Activity - 2.2.N Recognize that family and cultural influences affect food choices Personal &amp; Community Health - 8.1 N Encourage others to minimize pollution in the environment</td>
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<td>Listening &amp; Speaking - 1.2 Summarize major ideas and supporting evidence presented in spoken messages and formal presentations</td>
<td>Nutrition &amp; Physical Activity - 1.1.N Identify and define key nutrients and their functions</td>
<td>1.3.N Describe the relationship between food intake, physical activity, and good health</td>
<td>2.1.N Identify internal and external influences that affect food choices</td>
<td>5.1.N Describe how to use a decision-making process to select nutritious foods and beverages</td>
<td>7.1.N Practice how to take personal responsibility for eating healthy foods</td>
<td>7.3.N Identify ways to establish and maintain healthy eating practices consistent with current research-based guidelines for a nutritionally based diet</td>
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<td>Listening and Speaking - 1.2 Interpret a speaker's verbal and nonverbal messages, purposes and perspectives</td>
<td>Nutrition &amp; Physical Activity - 1.5.N Describe safe food handling and preparation practices</td>
<td>1.6.N Differentiate between more nutritious and less nutritious beverages and snacks</td>
<td>7.1.N Identify ways to choose healthy snacks based on current research-based guidelines</td>
<td>7.2.N Demonstrate how to prepare a healthy meal or snack using sanitary food preparation and storage practices</td>
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<td>1.2.N Identify nutrients and their relationships to health</td>
<td>1.5.N Differentiate between diets that are health-promoting and diets linked to disease</td>
<td>1.8.N Identify ways to prepare food that are consistent with current research based guidelines for a nutritionally balanced diet</td>
<td>2.2.N Evaluate external and internal influences on food choices</td>
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## Detailed California State Educational Standards by Lesson for Grades 4-8

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<td>9</td>
<td>4</td>
<td>Listening &amp; Speaking - 1.2</td>
<td>Nutrition &amp; Physical Activity - 2.1.N Identify internal and external influences that affect food choices 3.1.N Identify resources for valid information about safe and healthy foods 7.1.N Practice how to take responsibility for eating healthy foods 7.4.N Practice how to take responsibility for engaging in physical activity</td>
<td>Fitness Concepts - 3.2 Demonstrate the correct body position for pushing and pulling large objects Aerobic Capacity - 3.7 Sustain continuous movement for an increasing period of time while participating in moderate to vigorous physical activity</td>
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<td>Listening and Speaking - 1.2 Interpret a speaker's verbal and nonverbal messages, purposes and perspectives</td>
<td>Nutrition &amp; Physical Activity - 8.1.N Encourage and promote healthy eating and increasing physical activity opportunities at school and in the community</td>
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<td>Muscular Strength/Endurance - 3.7 Sustain continuous movement for an increasing period of time while participating in moderate physical activities</td>
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<td>Nutrition &amp; Physical Activity - 3.15.N Explain that incorporating daily moderate or vigorous physical activity into one's life does not require a structured exercise plan or special equipment, 2.2.N Evaluate internal and external influences on food choices 5.2.N Identify recreational activities that increase physical activity</td>
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<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking</td>
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<td>Mathematical Reasoning - 2.1 Use estimation to verify the reasonableness of calculated results</td>
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<td>Nutrition and Physical Activity 3.2.N Interpret information provided on food labels</td>
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<td>Mathematical Reasoning - 2.1 Use estimation to verify the reasonableness of calculated results</td>
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<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking</td>
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<td>Life Sciences - 2.a Students know plants are the primary source of matter and energy entering most food chains 3.c Students know many plants depend on animals for pollination and seed dispersal, and animals depend on plants for food and shelter</td>
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<td>Earth Sciences - 5.f Students know the structures and processes by which flowering plants generate pollen, ovules, seeds, and fruit</td>
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<td>Life Sciences - 2.c Students know decomposers, including many fungi, insects, and microorganisms, recycle matter from dead plants and animals. Earth Sciences - 5.b Students know natural processes, including freezing and thawing and the growth of roots, cause rocks to break down into smaller pieces. Investigation and Experimentation - 6.c Formulate and justify predictions based on cause-and-effect relationships</td>
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<td>Listening and Speaking - 1.5 Clarify and support spoken ideas with evidence and examples</td>
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<td>Investigation and Experimentation - 6.a Classify objects in accordance with appropriate criteria</td>
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<td>Listening &amp; Speaking - 1.2</td>
<td>Summarize major ideas and supporting evidence presented in spoken messages and formal presentations</td>
<td>Geographic Features of CA - 4.1.3 Identify the state capital and describe the various regions of California, including how their characteristics and physical environments affect human activity</td>
<td>Earth Sciences - 5.c Students know moving water erodes landforms, reshaping land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places</td>
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<td>Listening and Speaking - 1.2</td>
<td>Interpret a speaker's verbal and nonverbal messages, purposes and perspectives</td>
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<td>Earth Sciences - 3.d Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water 3.e Student know the origin of the water used by their local communities</td>
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<td>Written/Oral Language - 1.1</td>
<td>Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts</td>
<td>Earth Science - 2.a Students know water running downhill is the dominant process in shaping the landscape, including CA's landscape 2.b Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns Investigation &amp; Experimentation - 7.f Read a topographic map and a geologic map for evidence provided on the maps and construct and interpret a small-scale map</td>
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<td>Listening &amp; Speaking - 1.2 Summarize major ideas and supporting evidence presented in spoken messages and formal presentations. Speaking Applications - 2.1.a Establish a situation, plot, point of view, and setting with descriptive words and phrases</td>
<td>Geographic Features of CA - 6.1.5 Use maps, charts, and pictures to describe how communities in CA vary in land use, vegetation, wildlife, climate, population density, architecture, services, and transportation</td>
<td>Earth Sciences - 5.c Students know moving water erodes landforms, reshaping land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places.</td>
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<td>Earth Science - 2.a Students know water running downhill is the dominant process in shaping the landscape, including CA’s landscape. 2b Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns. Ecology - 5.b Students know matter is transferred over time from one organism to others in the food web and between organisms and the physical environment. 5.c Students know the number and types of organisms in an ecosystem can support depends on the resources available and on abiotic factors such as quantities of light and water, a range of temperatures, and soil composition.</td>
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<td>Earth Science - 4.a Students know that Earth processes today are similar to those that occurred in the past and slow geographic processes have large cumulative effects over long periods of time. 4b. Students know that the rock cycle includes the formation of new sediment and rocks that are often found in layers, with the oldest generally on the bottom.</td>
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<td>Listening &amp; Speaking - 1.2&lt;br&gt;Summarize major ideas and supporting evidence presented in spoken messages and formal presentations</td>
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<td>Life Sciences - 3.b Students know that in any particular environment, some kinds of plants and animals survive well, some survive less well, and some cannot survive at all</td>
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<td>Ecology - 5.d Students know different kinds of organisms play similar ecological roles in similar biomes 5.e Students know the number and types of organisms an ecosystem can support depends on the resources available and on abiotic factors such as quantities of light and water, a range of temperatures, and soil composition Investigation &amp; Experimentation - 7.a Develop a hypothesis</td>
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<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking</td>
<td>Geographic Features of CA - 4.1.4 Identify the locations of the Pacific Ocean, rivers, valleys, and mountain passes and explain their effects on the growth of towns (This lesson focuses on the growth of farms)</td>
<td>Investigation and Experimentation - 6.c. Formulate and justify predictions based on cause-and-effect relationships</td>
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<td>Listening and Speaking - 1.2 Interpret a speaker’s verbal and nonverbal messages, purposes and perspectives</td>
<td>Earth Sciences - 3b Students know when liquid water evaporates, it turns into water vapor in the air and can reappear as a liquid when cooled or as a solid if cooled below the freezing point of water. c Students know water vapor in the air moves from one place to another and can form fog, or clouds which are tiny droplets of water or ice, and can fall to Earth as rain, hail, sleet or snow. c Students know the origin of the water used by their local communities. a Students know uneven heating of Earth causes air movements (convection currents). a Students know the influence that the ocean has on the weather and the role that the water cycle plays in weather patterns. Investigation and Experimentation - 6.a Classify objects in accordance with appropriate criteria</td>
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<td>Physical Sciences - 3a Students know energy can be carried from one place to another by heat flow or by waves, including water. a Students know the sun is the major source of energy for phenomena on Earth’s surface; it powers wind, ocean currents, and the water cycle. 4.3 Students know differences in pressure, heat, air movement, and humidity result in changes of weather. Investigation and Experimentation - 7.a Develop a hypothesis. 7.h Identify changes in natural phenomena over time without manipulating the phenomena</td>
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<td>Applications - 5.3 Construct diagrams, maps, graphs or illustrations to communicate ideas or tell a story about a historical event</td>
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<td>Evolution - 5.3.1 Students know both genetic variation and environmental factors are causes of evolution and diversity of organisms</td>
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<td>Grade</td>
<td>English/ Lang. Arts</td>
<td>Health Ed.</td>
<td>History/ Soc.Sci</td>
<td>Science</td>
<td>Math</td>
<td>Visual Arts</td>
<td>PE</td>
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<td>18</td>
<td>4</td>
<td>Written/Oral Language - 1.1 Use simple and compound sentences in writing and speaking</td>
<td>Nutrition &amp; Physical Activity 1.1.N Identify and define key nutrients and their functions</td>
<td>Earth Sciences - 5.c Students know moving water erodes landforms, reshaping the land by taking it away from some places and depositing it as pebbles, sand, silt, and mud in other places</td>
<td>Number Sense - 1.2 Order and compare whole numbers and decimals to two decimal places 2.2 Round two place decimals to one decimal or the nearest whole number and judge the reasonableness of the rounded answer 3.4 Solve problems involving division of multi digit numbers by one-digit numbers Measurement and Geography - 1.1 Measure the area of rectangular shapes by using appropriate units, such as square meter Mathematical Reasoning - 3.3 Develop generalizations of the results obtained and apply them in other circumstances</td>
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<td>5</td>
<td>4</td>
<td>Written/Oral Language - 1.2 Interpret a speaker's verbal and nonverbal messages, purposes, and perspectives</td>
<td>Nutrition &amp; Physical Activity 1.1.N Identify and define key nutrients and their functions</td>
<td>Earth Sciences - 3.a Students know most of Earth's water is present as salt water in the oceans, which cover most of Earth's surface. 3.d Students know that the amount of fresh water located in rivers, lakes, underground sources, and glaciers is limited and that its availability can be extended by recycling and decreasing the use of water</td>
<td>Algebra and Functions - 1.1 Use information taken from a graph or equation to answer questions about a problem situation Mathematical Reasoning - 3.3 Develop generalizations of the results obtained and apply them in other circumstances</td>
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<td>6</td>
<td>4</td>
<td>Written/Oral Language - 1.1 Use simple, compound, and compound-complex sentences; use effective coordination and subordination of ideas to express complete thoughts</td>
<td>Nutrition &amp; Physical Activity 1.1.N Identify and define key nutrients and their functions</td>
<td>Earth Sciences - 2.a Students know water running downhill is the dominant process in shaping the landscape, including California's landscape. 2.b Students know rivers and streams are dynamic systems that erode, transport sediment, change course, and flood their banks in natural and recurring patterns</td>
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<td>7</td>
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<td>Nutrition &amp; Physical Activity 1.2.N Identify nutrients and their relationships to health Personal and Community Health - 8.3.P Demonstrate ways to accept responsibility for conserving natural resources</td>
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<td>8</td>
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<td>Nutrition &amp; Physical Activity 1.2.N Identify nutrients and their relationships to health Personal and Community Health - 8.3.P Demonstrate ways to accept responsibility for conserving natural resources</td>
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Appendix

Glossary

Introductory Tour of the Sunol AgPark

**AgPark** – Abbreviation for Agricultural Park. A collaborative, urban-edge farm on publicly owned land that integrates sustainable agriculture, natural resource stewardship, and public education, and that provides land access to multiple small-scale farmers.

**Natural Resource Conservation** – The care and protection or management of the Earth and all that resides on it and in it

**Relief Map** – A map with texture, raised areas, and color representing different heights of landforms such as hills and valleys.

**SAGE** – Sustainable Agriculture Education, a non-profit organization based in Berkeley, CA, whose goal is to develop urban edge agriculture and engage diverse regional populations with the sustainable agriculture movement.

**Shaded Relief Map** – A flat map that uses shading or colors to represent different heights of landforms such as hills and valleys.

**Stewardship** – Being morally responsible for the careful use of natural resources with respect to the principles or needs of a community or group of people.

**Watershed** – A land area where surface water from rain or melting snow and ice drains into a body of water such as a river, lake, wetland, or ocean; also called a drainage basin.

**Water Temple** – A structure built to honor the liquid of life.

UNIT 1

**Lesson 1: Sunol Water Temple Works of Art**

**Confluence** – Two streams, creeks or rivers flowing together; a place where they join.

**Commission** – To grant certain powers or the authority to carry out a particular task or duty.

**Earthquake** – A shaking or trembling of the crust of the earth caused by breaking and shifting rock underneath the surface.

**Watershed** – A land area where surface water from rain or melting snow and ice drains into a body of water such as a river, lake, wetland, or ocean; also called a drainage basin.

**Water Temple** – Structure built to honor the liquid of life.

**Lesson 2: The First Groups of People in the Sunol Valley**

**Adobe** – Clay and silt deposits on the earth often used in making bricks.

**Dynamic** – Relating to or tending toward change or productive activity.

**Geology** – The science dealing with the physical nature and history of the earth, including its structures and the development of its crust, composition of its interior, individual rock types, life found in fossils, etc.

**Inhabitants** – Local residents.

**Muwekma-Ohlone Indians** – Local “tribe” or group of the Ohlone Indians.

**Pre-historic Ancestors** – The people from whom a person or group of people descended before written history.
Glossary

**Spanish Missions** – Religious facilities established in California between 1769 and 1823 by the Spanish Catholics of the Franciscan Order with the purpose of converting Native Americans to Catholicism and assimilating them into European culture. Native Americans were often coerced into joining and remaining at the missions.

**Spanish Rancheros** – The large tracts of land divided by the Spanish Government to the benefit of the more wealthy Spanish cattle owners 1700 to 1850.

**Vaqueros** – Spanish cowboys.

**Taunen-Ohlone** – Group of Ohlone Indians who lived where the Sunol Water Temple is currently located.

**Lesson 3: Recent Past, Present, and Future of the Sunol Valley**

**Alameda Creek Watershed** – The land that drains into the Alameda Creek, where the Sunol AgPark, Town of Niles, Sunol Regional Wilderness are located.

**Charades** – A game in which a word, phrase or story is acted out without talking for others to guess.

**Chronology** – The arranging of events and dates in order of occurrence.

**Hang Man** – A game in which parts of a stick figure are drawn for every letter that is guessed incorrectly in the pursuit of guessing the right word. If the total figure is drawn before the word is correctly guessed, the guesser loses the game.

**Heritage** – The evidence of the past, found in historical sites, buildings, and the natural environment, considered the inheritance of modern society.

**Natural Resources** – The natural wealth of an area, consisting of land, forests, minerals and water.

**Niles Canyon** – A canyon created by earthquakes and erosion by Alameda Creek, where the town of Niles is located in southeastern Alameda County.

**Pictionary** – A game where a word, phrase or story is drawn out for others to guess.

**SFPUC** – Acronym for “San Francisco Public Utility Commission,” the government agency that manages the water resources for San Francisco and environs, and that owns much of the Alameda Creek Watershed, including the property where the Sunol AgPark and Sunol Water Temple are located.

**Timeline** – A visual representation of the order of occurrence of events.

**Lesson 4: Nurturing a Sense of Place**

**Bioregion** - An area characterized by its flora (plant life), fauna (animal life), and environmental conditions; an ecological community.

**Guided Imagery** – To give instruction or direction to imagine the life or being of something other than what is being physically experienced at the time of instruction.

**Sound Map** – A map that one creates by locating different sounds relative to oneself.

**Lesson 5: Plumbing, can’t live with it, can’t live without it!**

**Alameda Creek Watershed** – The land that drains into the Alameda Creek, where the Sunol AgPark, Town of Niles, Sunol Regional Wilderness are located.

**Culvert** – A conduit, especially a drain or a pipe-like construction of stone, concrete or metal that provides a pathway or diversion for water.
**Deposition** – The act of depositing, especially the laying down of matter by a natural process.

**Erosion** – The wearing away of rocks and other materials on the earth’s surface by the action of water, ice, or wind.

**Hetch Hetchy Watershed System** – The Tuolumne River system which has been dammed to provide water for the San Francisco Bay Area 167 miles away. Managed by the SFPUC.

**PVC** – A type of plastic used to make irrigation pipes.

**Relief Map** – A map with texture (raised areas) and color representing different heights of landforms such as hills and valleys.

**Reservoir** – A place where anything is collected, especially a natural or artificial lake or pond in which water is collected and stored for use.

**Shaded Relief Map** – A flat map that uses shading or colors to represent different heights of landforms such as hills and valleys.

**Watershed** – A land area where surface water from rain or melting snow and ice drains into a body of water such as a river, lake, river, lake, wetland, or ocean; also called a drainage basin.

**Westerly Winds** – The predominant wind pattern in California; winds that come from the west.

**Lesson 6: Where in the World Did Our Crops Come From?**

**Foodshed** – A new term for the area from which we get our food. Can be conceived locally, regionally, or globally.

**Global solutions** – Sustainable decisions that are good for the whole world.

**Originate** – To come from.

**UNIT 2**

**Lesson 7: Farmers as Stewards of the Land**

**Aquatic ecosystem** – An underwater system made up of a community of animals, plants, and bacteria interdependent on each other and on their physical environment.

**Contamination** – The addition of substances making a material harmful or impure, often the result of pollution.

**Cultural knowledge** – Knowledge that has been passed down from generation to generation within a particular culture.

**Destabilized rural communities** – Agrarian (farming) communities that have been made unstable, often by political, social, or economic changes.

**Irrigation** – The process of watering crops.

**Mechanization** – The replacement of manual labor with the use of machines.

**New crop varieties** – New types of plants, traditionally bred through crossing strains or artificially created through genetic modification.

**Organic agriculture** – Agricultural production system that prohibits the use of synthetic fertilizers, pesticides, and other chemicals, and relies instead on composting, healthy soil building, crop rotation, and biological pest control.

**Pollution** – The introduction of harmful substances into the air and the environment.

**Sustainable agriculture** – Any of a number of environmentally friendly farming methods that preserve an ecological balance by avoiding depletion of natural resources.
Appendix

Glossary

**Synthetic pesticides and fertilizers** – Man-made chemicals, designed to help protect and feed plants, which can negatively affect the environment and the people who come into contact with them.

**Lesson 8: You Are What You Eat**

**Additive** – A substance added directly to food during processing for preservation, coloring, or stabilization.

**Carbon footprint** – The amount of carbon dioxide released into the atmosphere as a result of a particular action or lifestyle.

**Complex Carbohydrates** – Complex carbohydrates are chains of three or more single sugar molecules linked together, and are found in foods like legumes, starchy vegetables like potatoes and corn, rice and grain products. These foods contain dietary fiber and many other nutrients.

**Conventionally grown food** – Food produced with chemical fertilizers to promote plant growth, insecticides to reduce pests and disease, and chemical herbicides to manage weeds. Pesticide residues often remain on and in the foods when they are eaten.

**Dietary fiber** – Edible plant fiber found in whole fruits, vegetables and grains. Although humans are unable to digest fiber, it maintains digestive tract health and is thus an important part of a healthy diet.

**Environmental impact** – Positive or negative effects of our actions on the environment.

**“Green” economy** – A monetary system that is designed to reduce environmental risks and result in improved human well-being and social equality.

**Nutritious** – Providing nourishment; healthful.

**Strokes/Cardiovascular Diseases/Cancer** – Examples of diseases that have been linked to lifestyle and diet.

**Thrive** – To grow or develop vigorously; to flourish.

**Vitamins/Minerals/Nutrients** – Different natural substances found in the food that we eat that keep us healthy and strong.

**Lesson 9: Working on an Urban Edge Farm**

**Community Supported Agriculture (CSA)** – A system in which growers and consumers share the up-front costs of a farming operation, as well as the risks and benefits of food production. In exchange for their support, the consumers receive a weekly share of the farm’s produce during the growing season.

**Global Market** – International trade and commerce.

**Local ecosystem** – A system made up of local communities of animals, plants, and bacteria interdependent on each other and on their physical environment.

**Pest Population** – A group of insects that are harmful towards agriculture.

**Vagary** – An unpredictable or erratic action, occurrence, course, or instance.

**Lesson 10: Organic Food Production and the Economy of Food**

**Production Costs** – The combined costs of raw material and labor incurred in producing goods.
Appendix

Glossary

Lesson 11: Insects R Us!

Co-evolution – The evolution of two or more species that interact closely with one another, with each species adapting to changes in the other.

Field Guide – Written and/or pictorial information of use in a natural setting to inform the reader about the environment and/or the natural objects in it.

Integrated Pest Management (IPM) – An ecological approach to controlling pest populations that seeks to limit or eliminates dependence on petroleum-based pesticides and herbicides.

Lesson 12: Growing Soil for Food

Compost – Plant matter that has been decomposed by worms, fungi, and bacteria, used for fertilizing and conditioning soil.

Clay – A natural substance with moldable properties composed of very fine, flat particles.

Duff or humus – Decayed plant material, often found on top of topsoil.

Fertilizers – Substances that enhance the growth production of plants; can be petroleum-based or organic.

Hormone – A substance formed in an organ or cells and carried by fluid to another organ or tissue where it has a specific effect such as growth; now often prepared synthetically to encourage rapid growth in livestock animals.

Igneous – Formed by solidification from a molten or partially molten state; also called plutonic rock – one of three basic classifications of rocks.

Loam – The topsoil that farmers love - a perfect combination of clay, silt, sand and organic matter.

Metamorphic – Formed from a different type of rock in a solid state in response to pronounced changes of temperature, pressure and chemical environment; one of three basic classifications of rocks.

Parent Material – Also known as bedrock. The origin of the soil in which we grow our food.

Petroleum – Also known as crude oil. A naturally occurring, flammable liquid formed from ancient living matter that is found beneath the Earth’s surface.

Riparian Community – A group of interacting organisms along a river or stream.

Sand – A granular material composed of rock and mineral particles, often containing a high amount of quartz.

Sedimentary – Formed from sediment or debris. Examples of sedimentary rocks include sandstone, shales, conglomerate, limestone, and gypsum. One of three basic classifications of rocks.

Silt – A soil sediment consisting of at least 80% fine earth and very fine sand and less than 12% clay.

Soil – Earth material that has been so modified by physical, chemical and biological agents that it will support rooted plants.

Subsoil – Soil that is less rich, and lies under the topsoil.

Topsoil – The generally rich soil that is a combination of organic and inorganic material that occurs on the top of the stratum of soils and from which our food grows; often called “dirt.”
UNIT 3

Lesson 13: Get to Know your Watershed

Alameda Creek Watershed - The land that drains into the Alameda Creek, where the Sunol AgPark, Town of Niles, Sunol Regional Wilderness are located.

Arid – Extremely dry.

Degradation – The wearing down of the land by the erosive action of water, wind, or ice.

Groundwater – Water located beneath the ground surface in soil pore spaces and in the fractures of rock formations.

Hetch Hetchy Watershed System – The Tuolumne River system which has been dammed to provide water for the San Francisco Bay Area 167 miles away. Managed by the SFPUC.

Aquifer – A wet underground layer of water-bearing permeable rock, gravel, or sand, from which water can be extracted through a well.

Reservoir – A place where anything is collected, especially a natural or artificial lake or pond in which water is collected and stored for use.

Watershed - A land area where surface water from rain or melting snow and ice drains into a body of water such as a river, lake, river, lake, wetland, or ocean; also called a drainage basin.

Lesson 14: Sustaining Our Soil to Sustain Ourselves

Compost – Plant matter that has been decomposed by worms, fungi, and bacteria, used for fertilizing and conditioning soil.

Cover crop – A plant, often a legume, grown to keep nutrients from leaching, soil from eroding, and land from weeding over, during the non-growing season. Cover crops are often plowed under instead of harvested, in which case they can be called “green manure.”

Decompose – To break down organic matter into simpler forms of matter, often by bacterial or fungal action; to rot.

Erosion – The process whereby earthy or rock material is loosened or dissolved and transported from one part of the earth’s surface to another.

Filter strip – A long, narrow section of plants at the edge of a farm which slows the rate of runoff, allowing sediments, organic matter, and other pollutants to settle out before they reach the edge of the farm. Filter strips reduce erosion and surface water pollution.

Geology – The science and study of the solid Earth and the processes by which it is shaped and changed, and the rocks of which it is composed.

Hedgerow – A row of plants, generally perennial shrubs, bushes, or trees, planted close together forming a barrier.

Humus – The dark organic material in soils, produced by the decomposition of vegetable or animal matter and essential to the fertility of the earth.

Parent Material – Also known as bedrock. The origin of soil in which we grow our food.

Subsoil – Soil that is less rich, and lies under the topsoil.

Tillage – The process of preparing the land for planting by mechanical agitation, such as digging, stirring, and overturning the soil.

Topsoil – The generally rich soil that is a combination of organic and inorganic material that occurs on the top of the stratum of soils and from which our food grows; often called “dirt.”
Lesson 15: Biodiversity at the Farm Edge

Aquatic – In or of water.
Terrestrial - On or of the land.

Biodiversity – The degree of variation of life forms within a given ecosystem, biome, or planet. Biodiversity is a measure of the health of an ecosystem.

Domesticated livestock – Animals that have been tamed and are raised in an agricultural setting to produce food or fiber, or are used for labor. Common examples include cows, sheep, goats and chickens.

Ecosystem – A system made up of communities of animals, plants, and bacteria interdependent on each other and on their physical environment.

Erosion – The wearing away of rocks and other deposits on the earth’s surface by the action of water, ice or wind.

Field guide – Written and/or pictorial information of use in a natural setting to inform the reader about the environment and/or the natural objects in it.

Leaf key – A pictorial and written guide to identifying plants by their leaves.

Leaf rubbing – An impression of a leaf’s texture made by rubbing a soft crayon or pencil across a piece of paper held against the leaf.

Riparian community – A group of interacting organisms along a river or stream.

Soil nutrient recycling – A process whereby nutrients are recycled in an ecosystem. Plants take nutrients from the soil and store them in plant tissues until they get eaten by animals or fall to the ground. There, they break down along with decomposing animals and feces. They are eventually re-incorporated into the soil by rainfall and earthworms, and the organic matter is further broken down into nutrients, which then become available to growing plants, starting the cycle over again.

Lesson 16: Geography and You

Alameda Creek Watershed – The land that drains into the Alameda Creek, where the Sunol AgPark, Town of Niles, Sunol Regional Wilderness are located.

Climate – The prevailing or average weather conditions of a region as determined by the temperature and meteorological changes over very long periods of time.

Geography – A descriptive science that deals with the study of the Earth and its lands, features, inhabitants, and phenomena.

Niles Canyon – A canyon created by earthquakes and erosion by Alameda Creek, where the town of Niles is located in southeastern Alameda County.

Relief map – A map with texture (raised areas) and color representing different heights of landforms such as hills and valleys.

“Topo” Map – Short for “topographical map.” A map that uses contour lines to designate geographical features on a flat piece of paper. Contour lines connect all the points of equal elevation.

Westerly Winds – The predominant wind pattern in California; winds that come from the west.
Lesson 17: Can Agriculture and Nature Work Together?

**Agro-ecosystem** – An ecosystem that relates to agriculture, but is not restricted to the immediate site of agricultural activity (the farm), but rather includes the entire region that is impacted by farming.

**Compost Pile** – A heap of plant matter that is in the process of being decomposed by worms, fungi, and bacteria.

**Decompose** – To decay or rot.

**Diversify crops** – To plant many different kinds of crops in order to mimic natural systems.

**Hedgerow** – A row of plants, generally perennial shrubs, bushes, or trees, planted close together forming a barrier.

**Species-specific** – Affecting only one type of crop, plant, or animal.

**Sustainable practice** – A routine that is good for the long-term health of the planet and its inhabitants.

Lesson 18: Watersheds – Not Just a Drop in the Bucket!

**Cohesion** – Community building, clinging together; the attraction of water molecules to each other as a result of hydrogen bonding.

**Habitat** – A place where plants and/or animals prefer to live; an animal or plant species’ home.

**Surface tension** – The attraction among water molecules at the surface of the liquid which creates a skin-like barrier between the air and underlying water molecules.

**Watershed** – A land area where surface water from rain or melting snow and ice drains into a body of water such as a river, lake, river, lake, wetland, or ocean; also called a drainage basin.