Inside the Edible Schoolyard Classroom

THE GARDEN COMPANION

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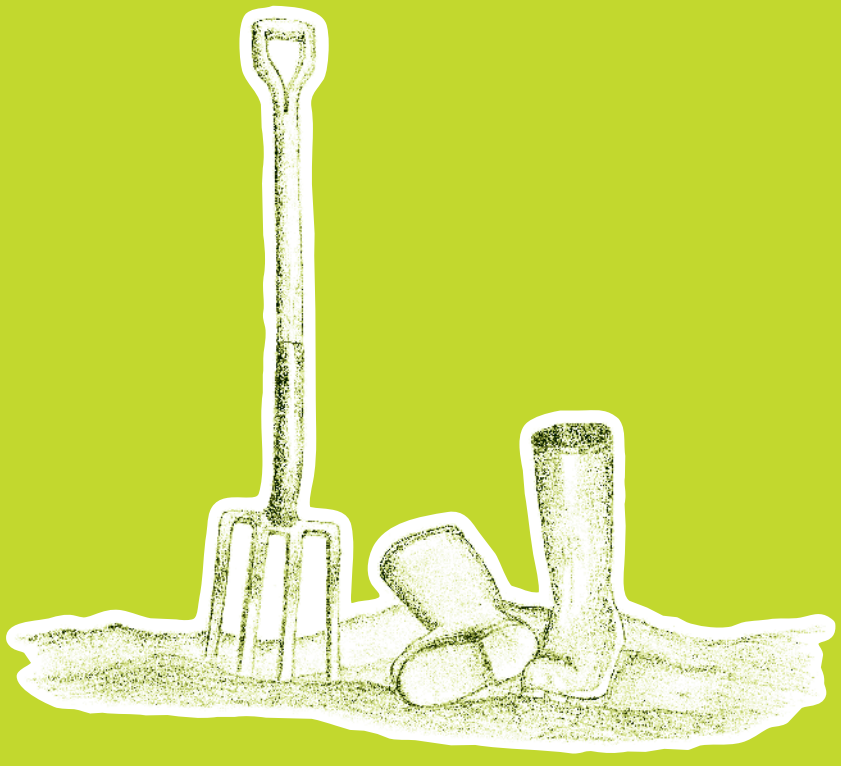
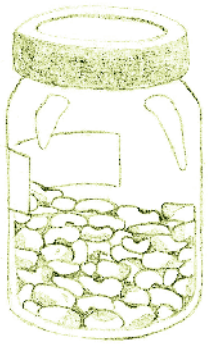


CHEZ PANISSE FOUNDATION

Cultivating a New Generation


HERB
CHARD



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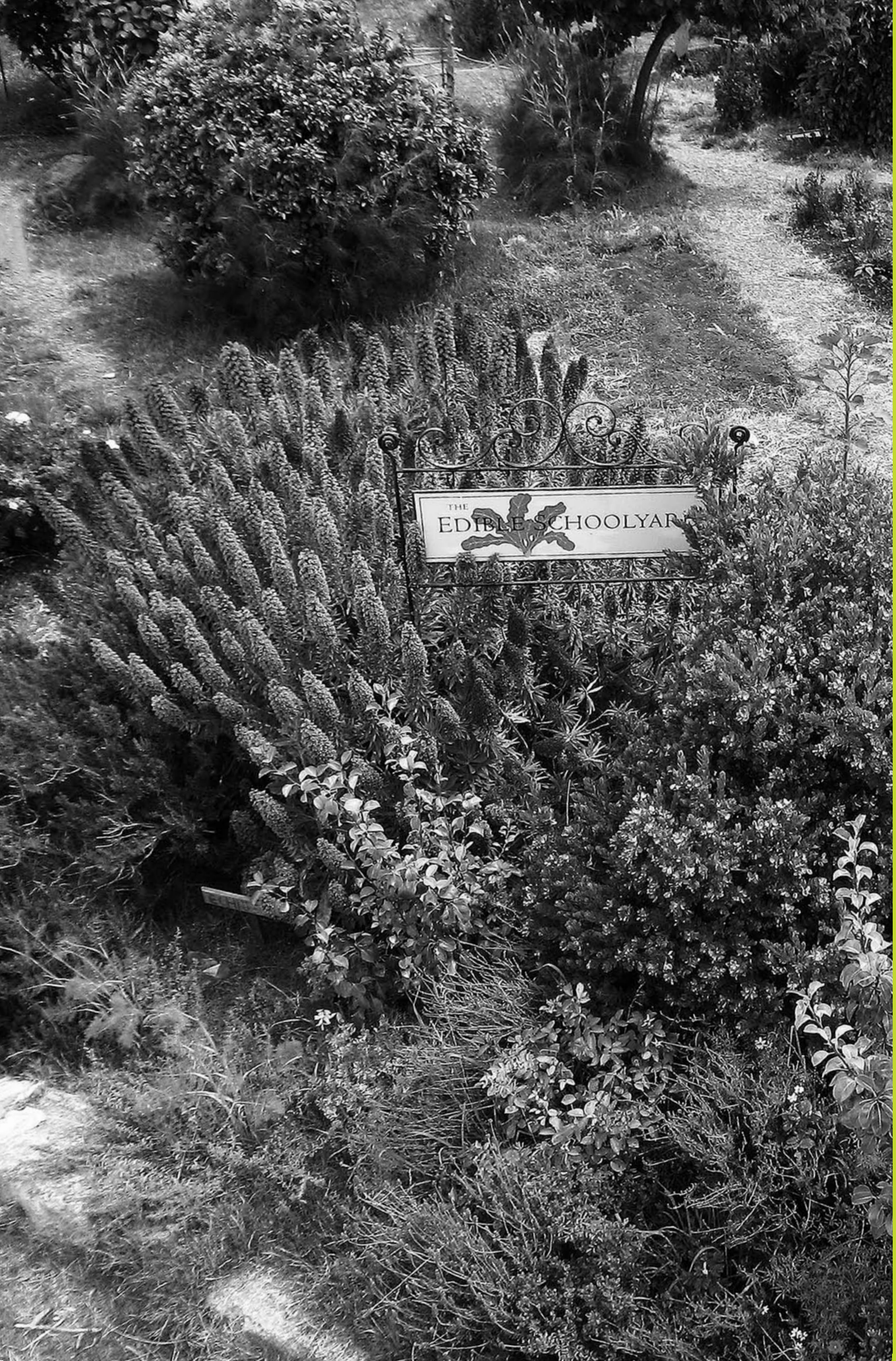
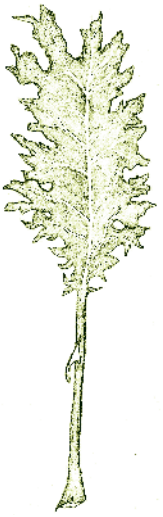

THE
EDIBLE SCHOOLYARD



Foreword

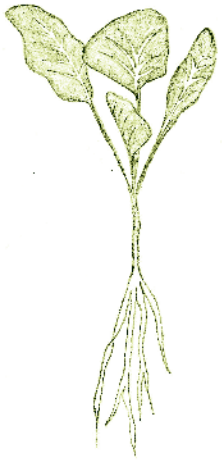
The Edible Schoolyard in Berkeley, California is a place where the traditional educational setting is turned upside down: in the kitchen teachers, are cooks and cooks are teachers; in the garden, students are the keepers of the soil and shepherds of the harvest. They learn by doing and are engaged with all of their senses. All of this takes place in a standard public middle school each and every day.

A few years ago we started to imagine what might change if children across the United States participated in their education in this way. We began to document our best practices so that others could learn from our decade of work. The result has been a series of documents that provide lessons, inspiration and stories from 10 years of Edible Education, beginning with *Inside the Edible Schoolyard Classroom: The Kitchen Companion* and its counterpart, *Inside the Edible Schoolyard Classroom: The Garden Companion*.

At the time of publication, the Edible Schoolyard has a network of affiliate programs in five cities across the country. Our programs are no longer located only in public schools—affiliates now include after-school programs and a children's museum as well. These programs and institutions share our mission: to build a movement that will change the way your children eat and think about food for a lifetime.

Our goal is not to create programs identical to the Edible Schoolyard in Berkeley. This guide is meant to be instructive; within our story are the core values that guide our work. We hope it will inspire new ideas and new programs everywhere.

Carina Wong
Executive Director
Chez Panisse Foundation



Introduction

Since its inception in 1996, the story of the Edible Schoolyard (ESY) has been retold hundreds of times. Walking through our garden at Martin Luther King Jr. Middle School in Berkeley, California, one is greeted by flora and fauna native to the area, bountiful fruit and vegetable crops, annual and perennial flowers, beautiful structures, and a landscape of meandering paths and crop beds. Our story details the transformation that occured in how we think about education, place, trusting young people, and our relationship to food, and includes dedicated staff, teachers, students, AmeriCorps members, and community volunteers. Over the years, the Edible Schoolyard garden has inspired many similar projects. This book is designed to help those who hope to cultivate their own gardens, and in turn inspire growth in the community and particularly its youth.

How to Use This Book

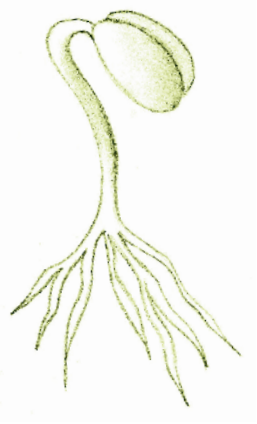
As with all living things, no two gardens are exactly alike. The Edible Schoolyard garden is unique for both the plants and creatures that live in it and the collective vision it represents. We created this book to share our experiences and accumulated knowledge with anyone interested in building an educational garden in their own school or community.

In the first chapter, "Evolution and Values," we outline our garden's history, highlighting the challenges of creating an alluring space with and for middle school students. We also describe some of the core values that inform this ongoing process. In the second chapter, "Creating the Classroom: Nuts and Beets," we explore the specifics of our space, the people who work within it, the plants and animals that live there, and the resources and routines that help it thrive. We also take you through the garden season by season, outlining the key activities that take place over the spring, summer, fall, and winter.

Finally, in the "Lessons" chapter, we provide step-by-step lessons that educators can use or adapt to work best with their own students and the materials available to them. Further resources appear in the Appendix.

Whether you wish to use the Edible Schoolyard as a model for projects in your own community or are simply interested in learning more about what we do, we hope this book will educate and encourage you.

A thriving, complex, garden ecosystem does not happen overnight.



Evolution and Values

Garden History

THE FIRST FEW YEARS: 1996–1999

A thriving, complex garden ecosystem does not happen overnight—it takes years of cultivation and careful observation. The area originally designated as our garden space was a blighted acre of asphalt. We knew that without support from the school community our program would never thrive, so we planned with teachers, collaborated with the community, and sought funding for three years before we even started digging.

While the easiest way to transform our barren acre into a thriving garden would have been to hire a crew of skilled adults or landscape architects to install it, our founding garden manager took a different approach, envisioning a garden that would evolve slowly, guided by the creativity and resourcefulness of our students. With no formal design to guide them, students built almost everything in the garden, laying irrigation, digging drainage, and constructing terrace walls from recycled concrete. The involvement of the students affected the materials and construction methods: a shade structure called the Ramada, for example, was built with branches from trees around the garden rather than commercial lumber, which would have required the use of tools inappropriate for middle school students. Empowering the students to make key decisions in the garden's construction made it a transformative environment where students could engage with a space they helped create.

Cultivating the garden was not easy. The compacted soil—more likely to yield to a pickaxe than a spade or garden fork—inspired students to build raised beds contained by waddled sides made of willow branches. The available resources and interaction between students and their teachers shaped our overall garden plan. Giving students an important role in creating and maintaining the garden let them know we had faith in their capacities.

Early on in the garden's development we planted young fruit trees and built a propagation table. Students and staff worked together to transport materials from the north to the south end of the garden via irrigation pipes, running them forward as people pushed. Ponds and "rivers" (drainage ditches) were dug, waddle fences were constructed, and students collaborated on a mosaic bench, ceramic tiles, stone paths, and concrete walls to define the space. Eventually, a unique landscape emerged.

For the first three years, producing quantities of food was a goal but not the primary focus of our efforts. The geographic distance between the garden and the kitchen did not lend itself to using the produce in a totally efficient way, so we encouraged students to enjoy garden fruits and vegetables in their freshest state. Students foraged raspberries, carrots, Cossack pineapples, radishes, and sweet peas and ate them either raw or cooked into simple snacks on an outdoor propane stove. On one cold, damp December morning, our first significant harvest of potatoes was immediately transformed into a batch of tasty latkes.

Beginning with soil fertility is the best way to ensure that your garden's complex ecological system will be successful and sustainable. In our case, we initially relied exclusively on municipal compost to amend the soil, applying about 150 tons to the garden in the first four years. As students created the landscape, they began to enhance the fertility of the garden. Though we taught them to shovel from the base of the pile to efficiently move the compost into the garden, one day students moved to the top of the pile and began digging from the center. They had decided to create a volcano, complete with a steaming crater, and while this was not the most efficient way to work, it was a creative approach that made learning and hard work more fun. Remaining open to spontaneous moments such as these became critical to our overall approach.

Yesterday we picked out jobs. I picked preparing the soil for the cover crop. It was fun being there with my friends, being able to talk and work at the same time. Mr. Hansen taught us a way to do it faster and easier without hurting ourselves. You have to be very careful around tools.

—Justina

It took time and patience to come up with a fertility system that best met the needs of our program. We tried several composting methods in our first four years; our original "closed system" was comprised of two large wooden boxes. Through trial and error we developed an open pile system, which results in an excellent compost and allows students to observe and interact with all stages of decomposition. Kitchen waste comes directly to the garden and enables us to fertilize the garden without municipal compost. Our compost system is now the true heart of the garden. We have even built a worm bin for vermicomposting, which provides nutritious fertilizer and valuable content for a variety of garden lessons.

Amending our soil with a few minerals and organic fertilizers, including kelp meal, stone meal, gypsum, oyster shell, and volcanic phosphorus, is an ongoing process that ensures healthy soil. We have found that the use of amendments also allows us to make curricular connections to chemistry: students learn that plants need a healthy balance of nutrients from the soil, just as we need a balance in the foods we eat for a healthy diet.

MOVING FORWARD: 2000–2006

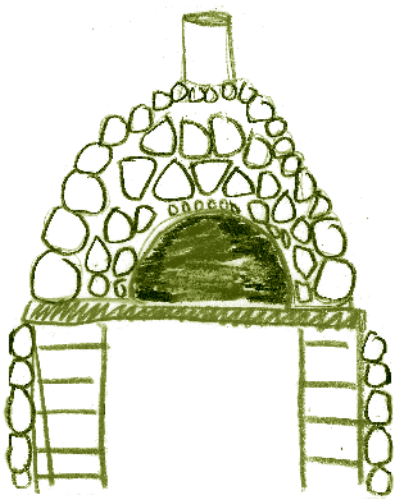
By 2000, we were able to shift our attention from creating a new space to growing food. This evolution was made possible by a variety of factors: the soil fertility was improved, and we better understood which crops would be successful in our microclimate; an increase in support from local farms provided us with healthy plant starts, enabling us to grow food more consistently; and the kitchen classroom was relocated from the far west end of campus to a bungalow adjacent to the garden.

Our staff was also evolving, and with the new faces came new ideas. We began to rethink how we taught in the garden, introducing more formalized activities to students without compromising the experiential core of our teaching values. Specific lessons were developed to emphasize hands-on learning.

The earthquake retrofit the entire campus underwent in 2000 presented benefits and challenges—we lost a significant portion of our garden space to a fire access lane, our oven had to be rebuilt, and a windbreak of olive trees was planted on the western edge of the garden to protect it from prevailing westerly winds. The garden, teachers, and students showed tremendous resilience in the face of these changes, demonstrating the sense of community that had been established along with the project.

As a non-profit organization working within a school, we counted on continual support from the teaching community. A teacher liaison position was formed to coordinate class schedules and keep us connected to the myriad shifts, activities, and challenges at school. We developed consistent methods for teaching gardening techniques while refining the language we used; from that process came a specific set of skills and language that all students become familiar with over their three years in the garden. The skills and vocabulary include but are not limited to: cultivation, propagation, composting, harvesting, plant parts, insects, seasonality, cover cropping, and seed-saving.

Gradually, we established traditions. We began harvesting and grilling the fresh-picked sweet corn with sixth graders, for example, and now cook pizza each year in our wood-fired pizza oven to celebrate eighth graders' completion of three years in the program. And during the times of the year when there is more produce and herbs than the kitchen can use, we do an extensive harvest and share the abundance, as well as suggested recipes, with students and their families. We call it "Harvest to Home," and it is particularly bountiful right before the Thanksgiving holiday.



FRUITION: 2006–PRESENT

In the winter of 2006, we added a greenhouse to the garden—a major turning point in our program. The greenhouse facilitated the development of propagation lessons and allowed us to rely less on donated or purchased plant starts. We now propagate enough plants to share with other school gardens in the Berkeley Unified School District, and host a very successful annual spring plant sale. This popular community event generates income for the garden and allows us to share our resources with the surrounding community.

Today, Sarah, Nancy, and me planted little seedling lettuce in a bed. They were sooo cute!
—Elisa

Over the past few years, the garden has reached a new maturity. In 2008, our fruit trees—planted by the first students who worked in the garden—boasted the largest harvest of apples, plums, and figs yet. Students working in the garden during the 2007–08 school year harvested, washed, weighed, and brought to the kitchen almost 2,500 pounds of fruits and vegetables, 200 bunches of herbs, 800 eggs, and countless bouquets of seasonal flowers.

We continue to collaborate with classroom teachers through joint staff development days and conferences. The sixth-grade teachers work together to create a common sixth-grade experience, integrating the garden, the kitchen, and the classroom. In the fall, students come to the garden with their science class for eight weeks, during which time they are assigned to read *Seedfolks*, by Paul Fleischman. We have had students adapt the story into a play for the entire school, and for the last two years, Paul Fleishman has come to do writing workshops with the students. Sixth graders also take field trips to community gardens, a canoe trip to study sloughs, and a bicycle trip to the nearby San Francisco Bay. When students go to the kitchen in late fall, they choose a vegetable grown in the *Seedfolks* garden and it becomes an ingredient in a kitchen recipe. Activities such as these imbue the garden and kitchen with the potential to become a lens through which the entire sixth-grade curriculum is taught.

Over 4,000 students have shaped our garden landscape, and after a decade of hard work, creativity, fun, and learning, the garden continues to provide inspiration for teachers and students interested in creating similar programs. We host nearly 1,000 visitors a year. Educators, parents, reporters, media outlets, classes, gardeners, and students come from all over the world to observe the work we do. We have dedicated ourselves to an outreach program in the hope that our garden will bolster similar programs in other schools.

Values

CURIOSITY

The garden inspires exploration, investigation, and inquisitive learning. When the sight of a slimy grub, towering sunflower, or colorful butterfly catches a student's eye, he or she is encouraged to ask questions and find out more. Working together in the garden provides the opportunity for students to tap into their inherent curiosity about the natural world.

RESPONSIBILITY

The act of cultivating a bountiful garden instills a feeling of ownership in students. We ask students to take responsibility for keeping the garden maintained and for leaving tools where they belong and in good working order. Being entrusted with such important work results in a powerful sense of pride in the beauty and productiveness of their garden.

HANDS-ON LEARNING

The garden is an ideal place for learning by doing. Students become active participants in their own education, utilizing all styles of learning; they feel the steam of the compost rise as they turn it, and marvel over the strangely life-giving process of decomposition. The opportunities for hands-on learning in the garden are endless, and in turn stimulate curiosity, observation and deep comprehension.

INTERCONNECTEDNESS

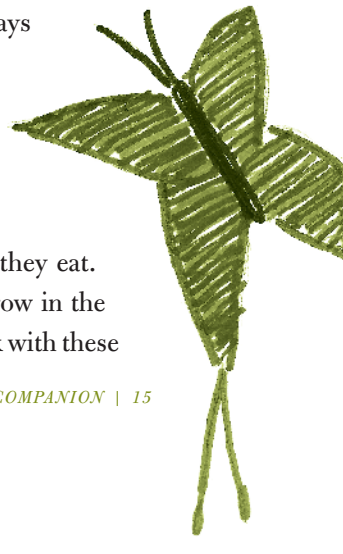
From the first time students sift compost or observe a bee flying from flower to flower, they are introduced to the many webs that bring the garden to life. The garden helps students grasp these connections and shows them that they too are active agents in a complex ecological web.

DIVERSITY

We grow hundreds of varieties of plants on our one-acre piece of land. Variety makes gardening more interesting and fun, but diversity is also essential for a healthy garden. Some plants attract beneficial insects while others repel unwanted pests; some plants bring nitrogen to the soil while others have deep roots that break up heavy soils. If there is a year when powdery mildew takes over our cucumbers and squash, the rest of the garden is immune to a similar fate. Martin Luther King Jr. students come from a wide variety of racial and socioeconomic backgrounds, respond to a range of learning styles, and all bring something vital to their community; in their own example is a striking analogy to the importance of diversity to a garden's health and prosperity.

APPRECIATING NATURE

City-dwelling students do not always have access to safe outdoor spaces; a school garden allows them to observe nature, experience the pleasure of work, and simply play. It is also the perfect place to learn about the origins of the food they eat. As students observe which crops grow in the garden throughout the year and work with these



foods in the kitchen, they gain a cumulative understanding of the relationship between environment and sustainability.

COLLABORATION

In the garden, students have the opportunity to engage in real work alongside classmates with whom they may not otherwise engage. Constructing a trellis for fragrant sweet pea tendrils, for example, requires conversation and the sharing of ideas; students learn that in order to complete a task, they must operate as a team.

USING REAL TOOLS

Real tools promote trust, expertise, responsibility, and skill. Real tools are also well-made and stand up to years of use. In their time at the Edible Schoolyard, students learn the names and unique qualities of specific tools, as well as how to use and care for them.

Yesterday in the garden was a lot of hard work but it was really fun! First I started shoveling rocks into wheelbarrows. Then I took the wheelbarrow over to where the other part of the class was digging a berm. Then I emptied the wheel-barrow and they put the rocks on the new path.

—Terron

Connecting to the Kitchen

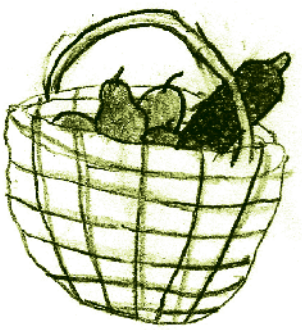
Emma and I went to pick flowers for Ms. Scarboro's birthday. I really, really like the school garden.

—Megan

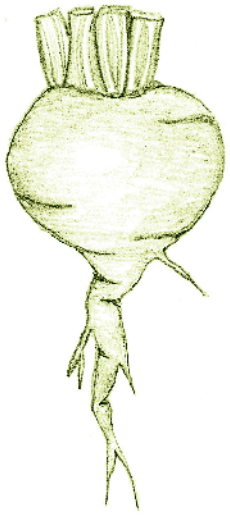
By involving students in each step of the seed-to-table process, the kitchen and the garden become two integral parts of one whole. In the garden, students cultivate beds, plant seeds and seedlings, tend crops, and harvest produce, using the produce they pick to prepare delicious seasonal recipes in the kitchen. The cycle is completed when they bring kitchen food scraps to our compost piles after cooking together.

Each day, the kitchen classroom uses at least one ingredient from the garden. Sixth graders harvest amaranth, for example, and combine it with other grains to prepare a ten-grain cereal. Students prepare wonton soup using bok choy that they have transplanted as unbelievably tiny seedlings. When we fire up the wood-burning oven in spring to make pizza, students recall having harvested the tomatoes and basil to make the sauce in the kitchen classroom.

To facilitate this coordination, garden teachers create a weekly harvest sheet for the kitchen. We meet once a week as a group to walk kitchen teachers through the garden and show them the status of our crops. There are always times, of course, when a big harvest of lettuce is ready a few weeks before the kitchen staff wants it, or the broccoli they were counting on is eaten by deer. We plan the garden schedule as well as we can and hope for the best. And while we will never grow enough to provide every class with all of their ingredients, we are proud of how many delicious, seasonal recipes the kitchen can make with what we have grown.




CARROTS



Creating the Garden Classroom: Nuts and Beets

Who's in the Garden?

STAFF AND COMMUNITY

In the early years of the Edible Schoolyard, the garden was coordinated entirely by a garden manager, who was assisted by classroom teachers and community volunteers. As we grew we added workers, until we reached our current configuration of four staff members. Today we benefit from the skills of a garden manager and teacher, an assistant garden manager and teacher, and two AmeriCorps garden teachers. A part-time garden consultant was also brought on to help increase the productivity of the garden and provide in-depth training on organic gardening. This staff-to-student ratio has created a better learning and working environment for all. Our staff size allows the program to maintain thorough and consistent care for the garden throughout the intense summer growing period. Summer care brings the garden to peak productivity just as students begin each new school year.

AmeriCorps members play an important role in our program. They bring youthful idealism and specific skills and experiences to the program such as book-making, wool-spinning, natural dyeing from garden plants, cooking, and chicken care. We are especially proud that three former students of the Edible Schoolyard have returned to work in the garden as AmeriCorps members or volunteers. Other former AmeriCorps members are now working as garden coordinators in other school districts.

Enthusiastic and committed classroom teachers have been an invaluable part of the garden from the start. During each class period, a science teacher accompanies a class of about thirty students to the garden and either leads a work group or circulates to facilitate learning and group dynamics. Garden time also gives classroom teachers the opportunity to see their students in a new light; teachers often comment on how a student who has struggled in the classroom suddenly shines in the garden. In addition to being present for and engaged in garden classes, teachers also play the crucial role of taking the garden back into the classroom and weaving it into the lessons they teach.

Volunteers are another important component of garden classes. Our volunteers are adult members of the school and local community who come in once a week to work with student groups on gardening tasks, assist the garden teachers, and connect with students. Their participation is invaluable to us and to the students.

The community is also involved in the four Saturday workdays we hold each year. These volunteers help out with some of the large, noxious weed removal and enjoy a day of work, a delicious lunch, and community building.

We also invite the community to buy the plants propagated by students at our annual plant sale, held on Mother's Day weekend. This allows community members to support our project while encouraging them to plant their own gardens at home.

STUDENTS

Martin Luther King Jr. Middle School has over 950 students in grades six, seven, and eight. Sixth graders come to the garden with raw enthusiasm and an eagerness to literally dig in. Their energy is channeled into turning the compost piles and collecting grubs to feed to the chickens, but we also take the time to infuse their curiosity with substantial concepts. At this age, we introduce students to our most structured lessons. From *composting* and *seed-saving* to *germination* and *dormancy*, we introduce terms that will follow students through their years in the garden. Sixth grade also offers the richest opportunity for connection to the classroom. Life webs, energy flows, and matter cycles are key concepts of the sixth grade science curriculum, and almost everything we do in the garden can be brought back to the classroom and expanded upon.

Seventh graders come to the garden in late fall. Having not worked in the garden since they were sixth graders the previous spring, teachers often find them inches taller and slightly more aloof. Their energy is turned towards each other and they are ready for a new experience. While we still engage them in classic jobs—cultivating, amending, composting, planting, harvesting—we also give seventh graders opportunities to take on larger work projects. We offer garden activities that can be combined easily with socializing such as seed-saving, plant propagation, or designing packets for our seed swaps. We also recognize that students are eager to eat and incorporate more tastings into the program.

By the time students reach eighth grade, they have two full years of gardening experience behind them. Their interest in socializing has become a full-time focus and their likes and dislikes are more strongly established. We take this time to celebrate the work they have put into the garden and give them the opportunity to use the skills they have developed. In the fall, we offer eighth graders a tomato tasting that helps us determine the most popular varieties for the next year's planting. As a culminating event, every eighth grader prepares pizza and cooks it in the wood-fired oven in the garden. Their last Edible Schoolyard experience is a Garden Olympics activity that includes wheelbarrow races, "Garden and Kitchen Jeopardy," and a celebratory slideshow highlighting their time in the garden and kitchen. By the time they are chopping thyme and garlic and watching the cheese on their pizza bubble in the oven, eighth graders are on the verge of graduation from three full years of growing and preparing delicious, healthy food.

Growing things everywhere

Apples to make apple cider

Radishes, cabbage, corn,
and other veggies

Dirty hands after working

Everything's organic

Nice staff

CHICKENS

There are many reasons why we keep chickens at the Edible Schoolyard: they contribute to the garden by eating weeds and bad bugs, cultivating the soil by scratching at it, fertilizing soil with their nutritious manure, and laying eggs that students use in the kitchen. The true worth of our chickens is on display, however, when a group of students stands mesmerized around the flock; many students love to pick the chickens up and pet them. Even students who are at first nervous around the chickens often overcome their fears and can be seen later in the year with happy hens tucked under their arms. Chickens are adored members of our community, providing students with entertainment and cherished companionship.

The idea for keeping chickens came from one of our AmeriCorps members, who rescued an abandoned chicken from a local park. The chicken stayed at the garden during the day and spent evenings at the home of a staff member. This was not a particularly ideal, convenient, or conventional method of animal husbandry, but our students' enthusiasm for this one little chicken prompted us to introduce chickens as a permanent fixture in the garden. Within a year of our first chicken's appearance, the coop had been built and five new hens had been introduced. We raised many more hens from chicks.

We currently have 13 hens in our garden; all of the handling they get over the years makes them quite tame and used to people. We have no roosters, as they are noisy and cause otherwise mellow chickens to become aggressive. We keep many different breeds in our flock—Araucanas, Cochins, Wyandottes, Buff and Black Minorcas, Rhode Island Reds, Polish—that all live together wonderfully. This diversity provides both a mix of personalities and a wide range of egg size and color. Every chicken is the favorite of at least a few students, but by far the most popular is our Polish, whose poofy hairdo and slight frame never fail to charm. We've lost a few to old age and animal attacks and added a few as well. These comings and goings, while sometimes challenging for students, also provide great lessons on predators, prey, and "pecking order" in the natural world.

Thirty Names for Thirteen Hens

Ginger	Brownie
Fat Licorice	Cow
Skinny Licorice	Speckles
Lee Lee Legwarmers	Spot
Cinnamon	Sunny
Hippity	Bob
Hoppity	Joe
Zen	Scrawny
Afro	Road Runner
Goldilocks	Henrietta
Goldilocks's Grandma	Cous-Cous
Bowie	Alejandra
Curious	Ella
Peanut Butter	Fishy
Blondie	Peeps

We let the hens out every day to search the garden for grubs, dig in the compost pile, or take dirt baths. They occasionally wander too far into the garden and start nibbling on our seedlings and greens; should we tire of chasing them back toward the compost piles, we place them in the chicken tractor, a portable house that we can place over garden beds where we want the chickens to be contained.

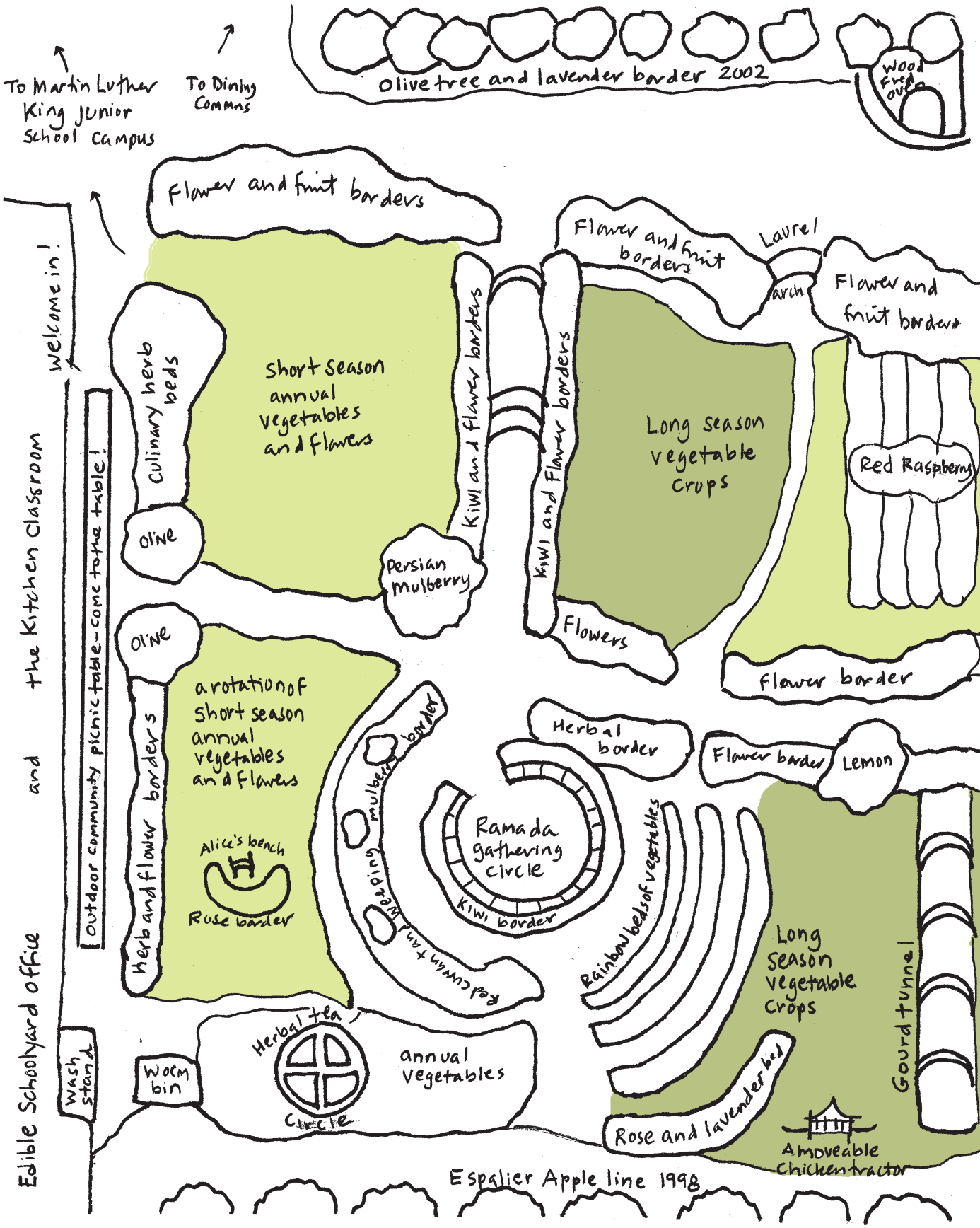
Collecting the eggs is a popular activity that often takes place after school. One lucky student grabs a basket and searches the laying boxes for what he or she hopes will be a bounty of eggs. A few eager helpers usually pitch in. Finally the proud group totes a still-warm, colorful basket of eggs to the kitchen, where they are labeled and refrigerated for use in a cooking lesson. When we crack one of these eggs in the kitchen, students notice the strength of the shell and deep yellow of the yolk and learn firsthand that healthy, well-fed chickens produce a beautiful egg. Using these eggs to make fried rice or a frittata gives students an up-close look at the garden-to-table process in action.

Edible Schoolyard Chicken Diet

- organic chicken scratch (corn and wheat)
- grubs, snails, slugs, earwigs
- weeds, weed seeds, kitchen scraps
- when we're not looking, our kale, lettuce, broccoli…

There are many things to consider before adding chickens to a youth garden program, including how the animals will be cared for during the absence of garden staff. We have found that community members and students are sometimes more than happy to care for the hens in our absence.

The Space


To Martin Luther King Junior School Campus
To Dining Commns
Olive tree and lavender border 2002
Wood Fired Oven
Flower and fruit borders
Flower and fruit borders
Laurel arch
Flower and fruit borders
Welcome in!
Culinary herb beds
Short season annual vegetables and flowers
Kiwi and Flower borders
Kiwi and Flower borders
Long season vegetable crops
Red Raspberry
Olive
Persian Mulberry
Flowers
Flower border
Olive
Outdoor community picnic table- come to the table!
Herb and flower borders
a rotation of short season annual vegetables and flowers
Alice's bench
Rose border
Herbal border
Flower border
Lemon
Ramada gathering circle
Kiwi border
Mulberry border
Grapevine border
Red Currant and Berry
Rainbow beds of vegetables
Long season vegetable crops
Gourd tunnel
Herbal tea Circle
annual vegetables
Worm bin
Wash stand
Rose and lavender bed
Moveable Chicken tractor
Espalier Apple line 1998
Edible Schoolyard office and the Kitchen Classroom


Fruit terraces
rainwater catchment
outdoor table
To lower school playarea and apple terraces 2005
soil bins
Glasshouse
the chicken palace
pond
solar pump
Toolshed
Flower and fruit borders
outdoor propagation area
Flowers
Short season annual vegetable rotation
Fig, apple and pineapple guava borders
The Mother Oak tree
a shady meeting area for hot days
Flowers
Raised bed box
Short season annual flowers + vegetables
Loquat + fig borders
California Native plants
Flower border
Persian Mulbery
mixed fruit trees: 1997
Long-season vegetable crops
plum
compost
Three sisters milpa field
Berryman Entrance
Hazel Copse
Alice's Olive
Golden raspberries
Mushroom Corner

STRUCTURES

This is a list of our main garden structures from south-to-north, starting at the kitchen and ending by the compost piles. All of these were built in collaboration with local handymen and artists—some paid workers and others volunteers—and most were constructed as part of a garden class with students.

The Ramada At the heart of our garden is the Ramada. It provides a central spot for beginning and ending each garden lesson and is designed like a giant spider's web. The circular structure, 20 feet in diameter, is laced with deciduous kiwis and various climbing annuals that provide cover in summer but still allow sun to penetrate. Straw bales around the circumference provide over 30 seats—enough for a middle school class, their teacher, volunteers, and garden staff. The Ramada is also occasionally used by the community for meditation, meetings, and celebrations.

Washstand A washstand hooked up to garden hoses allows produce to be washed and weighed before it is taken to the kitchen. Two double sinks provide soaking and rinsing areas. On either side of the sinks are tabletops for bundling, sorting, and arranging produce.

Worm bin A four-tier stackable worm bin, constructed of wood, is used for decomposing kitchen scraps. Castings are prepared as "worm tea" and used to fertilize plants in the garden.

Picnic tables Picnic tables offer a space where groups of students can do a variety of jobs. One very long table in the south end of the garden, made from a recycled tree, can accommodate an entire class.

Apple tree espalier A constructed wire-and-bamboo suspension training system for espaliered apple trees lines the eastern border of the garden. Currently well-established and bearing fruit, the 11 espaliered trees represent 11 different varieties of apples.

Wood-fired oven We use the oven to bake pizza and a variety of other foods, such as roasted vegetables and bread. A former King Middle School student constructed the oven in the spring and summer of 2002, with help from students.

Pond After many years of excavation and planning, in the summer of 2007 we finally finished creating a pond. The pond boasts a solar-powered waterfall, an assortment of native and exotic water plants, a rapidly expanding population of mosquito fish, and three goldfish.

Gourd tunnel Using steel posts and chicken wire, students in our 2007 Summer Program constructed a gourd tunnel. A seventh grader and an apprentice welder forged two iron arches, which now form the beginning and end of the tunnel. Students walk through the tunnel as part of orientation each fall and are encouraged to examine the tenacious tendrils and large gourds dangling over their heads.

Raised bed In the winter of 2008, we received a grant from the Berkeley Public Education Foundation to build a handicap-accessible garden bed for wheelchair-bound staff and students. Students assembled a kit, prepared the soil, filled the box, and planted beets, chard, kale, and breadseed poppies.

Greenhouse The greenhouse was assembled over the 2005–06 school year by staff and community members. It features two wooden-slat tables, which run lengthwise on either side, with a pathway in between. An automatic timer engages a sprinkler system that distributes water both inside and out. The addition of our greenhouse drastically improved our ability to propagate plants for our own garden, the community, and the plant sale.

Soil bins Constructed in 2008, the soil bins are at the north end of the garden near the tool shed and propagation area. These bins store potting mix ingredients and finished mixes. The area also has a large and accessible space where a group of students can work comfortably.

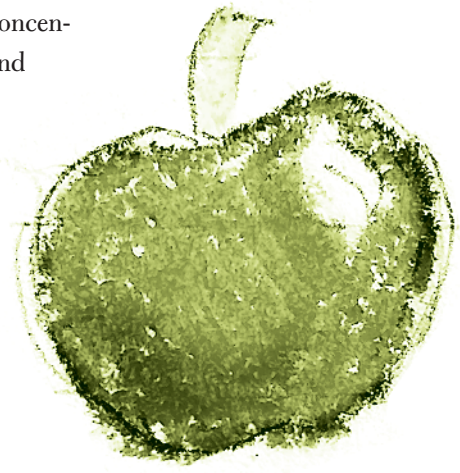
Propagation area This area contains a large table for seed-starting as well as many wire-topped tables for storing plants that need extra care but do not need to be in the greenhouse. We use a seed log to keep track of germination rates, the amount of seed needed for our garden space, and year-to-year consistency.

Tool shed The tool shed was built in 1998, and is made of hand-milled wood from a fallen redwood. Inside the shed, innovative racks on wheels hold a variety of tools as well as 30 pairs of boots. The portability of these racks makes for easy student access.

Rainwater catchment Over the winter of 2007–08, a catchment system was built for collecting rainwater that drains from the roof of the tool shed. A simple gutter, chain, and catchment barrel allow us to capture gallons of unchlorinated water every time it rains. This water is used to make compost and/or worm teas (organic fertilizers made by combining water and compost or worm castings), as well as to water chlorine-sensitive crops. A grant from the Alameda Countywide Clean Water Program will extend this project to include storage tanks and an educational component in the future.

Chicken coop The Palais de Poulet, as it was named, houses our hens at night and on weekends. Built in the summer of 2002 with help from Summer Program students and volunteers, it continues to evolve. The coop now holds five nesting boxes and a roosting house; it also features sunken wire walls with rocks around them to keep predators out, a few simple wooden roosts, and water and feed dishes.

Chicken tractor Built in 2004, the chicken tractor corrals hens and concentrates their beneficial scratching, eating of weeds and insects, and fertilizing on one bed at a time. This increases the benefit of the chickens to our garden while preventing them from munching on crops. The tractor can be moved easily by a group of kids. Transporting hens from the coop to the tractor is a favorite garden activity.



Mushroom corner In the winter of 2007–08, staff and students built a mushroom-growing station behind the compost area. The mushroom corner includes three mesh growing "walls" and a rectangular, pagoda-like stack of alder logs.

EQUIPMENT

Working with tools is an essential part of every student's experience at the Edible Schoolyard. Each sixth-grade class stops at the tool shed during its very first visit to the garden. The second time sixth graders come to the garden, we begin by asking them what they think "respect" means in this outdoor environment. The conversation naturally evolves from respecting the plants and animals to a discussion of respecting one another, and how to use tools correctly. We then introduce a few basic guidelines regarding tool usage, usually through a brief skit.

Tool Guidelines

Primary tool use guidelines include:

- Use the right tool for the right job.
- Carry the tool without dragging it or swinging it around.
- When using a tool, keep it below your waist.
- Clean the tool and return it to its proper place when finished with it.

An in-depth tool orientation is then given at the shed. Students are introduced to the equipment they will use most often at the Edible Schoolyard: rubber boots, gloves, garden forks, flat spades, wheelbarrows, weeding tools, trowels, watering cans, and more. They are asked to observe the organization of the tool shed, noting that tools are color-coded and that each one has a proper storage location. Students may notice grains or other seeds drying on the rafters. We also show students the tool-cleaning station next to the shed, which contains wire brushes and two half wine barrels filled with a mixture of sand and linseed oil. From the beginning of their time in the garden, we give students the responsibility of caring for the tools, for each other, and for the garden. If students have trouble cleaning or replacing their tools, we revisit these guidelines and if necessary have them work without tools for a day. While our tools acquire a good amount of wear and tear over the course of a year, they remain in good working order because of the care students take with them.

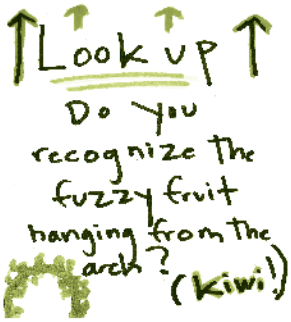
A list of tools we keep in the shed is provided in the Appendix.

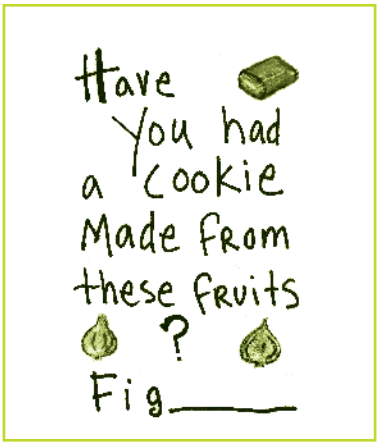
Garden Orientation

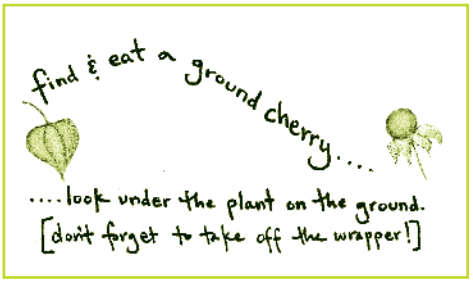
CARD HIKE

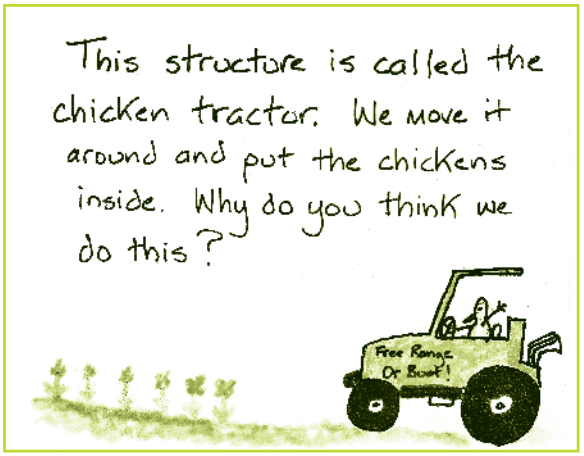
Sixth-grade students must get to know our garden before getting to work. Their first visit at the beginning of the year is full of wonder and curiosity, as well as the potential to be overwhelmed. It is impossible to even see across the garden at this time of year, full as it is with corn, amaranth, sunflowers, and scarlet runner teepees. For this reason, we designed a card hike as an alternative to giving students a conventional tour: students independently follow a path of descriptive cards that highlight various aspects of the garden and kitchen, so each can observe the space in solitude and at his or her own pace.

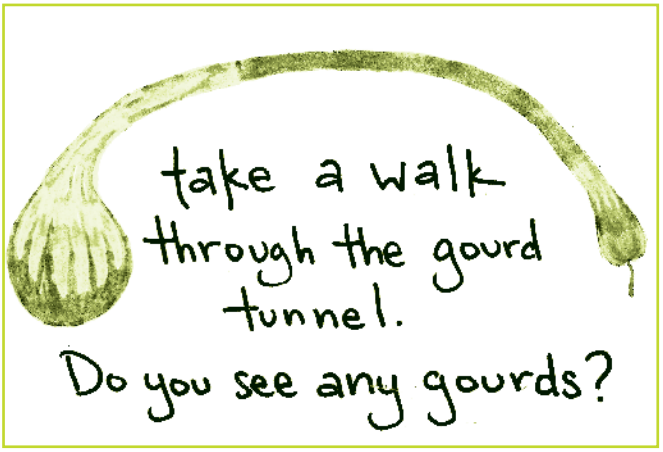
Before creating each year's card hike, the staff walks around the garden for direction and inspiration, paying close attention to areas we want students to notice. A typical hike consists of 50 cards and takes a class of 28 students about 45 minutes to complete. Each card displays a simple phrase that is colorfully illustrated on sturdy paper. We try to be as clear and concise as possible. Illustrations help to clarify each card: a drawing of an unripe tomato next to a ripe one helps a student learn to pick and taste a Sungold. We also make several arrow cards, which we include along the hike to keep students on the right path. We laminate the cards and attach each one to a wooden stake.

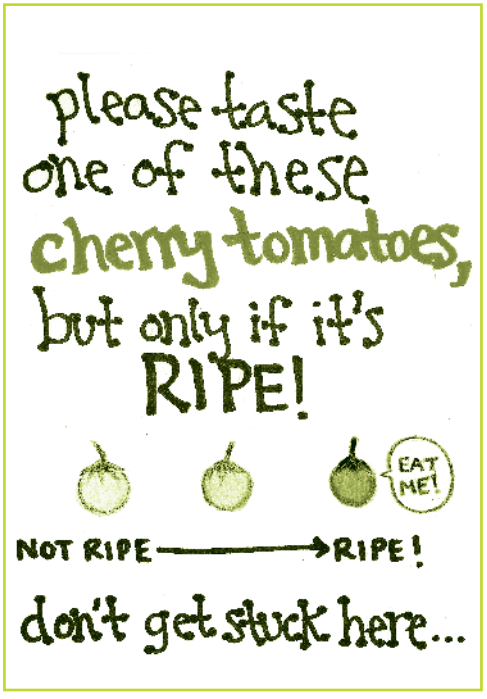












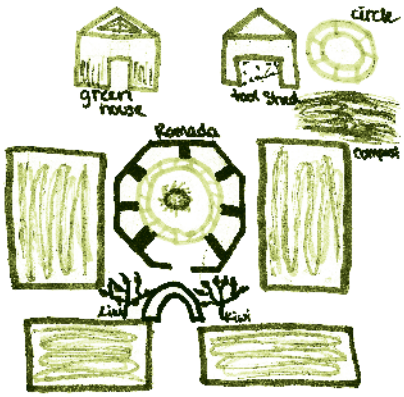
We direct students to the hike and stagger them 30 seconds apart, so each has time to proceed quietly. The teacher can lead waiting students in a game of Garden Jeopardy until it is their turn. Teachers and volunteers post themselves in areas where students may bunch up or get lost. Once the first students make it all the way back to the Ramada, they play another garden game until everyone has finished the hike. At the end of class, each student shares something he or she learned on the hike. Students display their new knowledge proudly, having discovered it for themselves. They also write about their first impressions of the garden in journals. We are always amazed by how much students remember from the card hike.

Class Routines and Rituals

CLASS STRUCTURE

Garden classes are 90 minutes long. The students meet in their classroom and walk to the garden, accompanied by their classroom teacher. The presence of the teacher in the garden is crucial, allowing for deeper connections back in the classroom, more relevant activities in the garden, and improved class management.

Over the years, we have learned that the garden class experience should be contained. To that end, we provide a very clear beginning, middle, and end to a class, and students respond to the routines of the program in a positive way. We begin and end every class in the garden by meeting in the Ramada. This circular space contains straw bale seats for all of the students, teachers, and volunteers in a garden class. The opening circle is when we take the time to frame the class, describe different jobs for the day, and present the closing circle activity. We also use this time to discuss garden terms or concepts. Meeting in the Ramada helps students to focus in an outdoor space and sets a good tone for the class.



The opening circle often involves presenting a question for students to contemplate during class. This question varies by class, time of year, and grade level, but examples include: *If you were a garden superhero, what would your superpower be? If you could make a recipe at home using something from the garden, what would you make?* On days when we plan to teach a specific lesson, we also use the opening circle to introduce that lesson's main ideas.

After we have described the jobs and presented the closing activity, students break into work groups and take on their seasonal garden tasks, which have been decided by our staff. Some classroom teachers prefer to select working groups to promote positive dynamics. In many cases, though, students can earn the privilege of choosing their own groups. They do this by showing respect at opening and closing circles as well as out in the garden and when cleaning up. Our staffing and robust volunteer program provides an average ratio of one adult to seven or eight students.

Students typically have 45–50 minutes to work, after which time we ring a bell for clean-up. At the end of class, after students have cleaned and put away their tools, we reconvene in the Ramada. Closing circle activities range from discussing the question asked at the beginning of class to playing a garden-related game. We use this time to reflect on work accomplished in the garden, reinforce garden lessons, and build community within the class.

A partial list of our closing circle activities appears in the Appendix.

GARDEN JOBS

We typically present four jobs at each opening circle, depending on the number of adults available and the scope of the day's work. Tasks are chosen by garden staff and are based on daily and seasonal needs of the garden. We choose as wide a variety of jobs as possible; having more choice means students are more likely to do something they have never done before, something they like, or something they know they can succeed at.

Accompanied by a garden or classroom teacher, each group heads to its work area to hear a more detailed description of its task and the tools they will need. A typical day might include cultivating and edging beds, transplanting, seed-saving, building and turning compost, harvesting food for the kitchen, seeding or potting up small plants, weeding, mulching, and occasionally preparing a snack for closing circle. Students take breaks for water or foraging but must ask an adult's permission before leaving the group.

Some tasks are ongoing and can be started and stopped at any time, such as weeding. Others, such as transplanting a bed of baby lettuce, have a precise beginning and end. A garden group's goal is not necessarily to "complete" every task, and most students find work in the garden to be rewarding regardless. By encouraging students to take pleasure in the process of work and not simply its end result, we allow space for spontaneity and discovery.

About 20 minutes before the end of each class, a teacher signals the beginning of clean-up by ringing a loud cow bell. The clean-up process is organized; students know how to clean tools properly, use sand and linseed oil to prevent rust, and store tools. Following clean-up, everyone returns to the Ramada for the closing circle.

While the above outlines a typical class in the garden, we also occasionally provide special activities or lessons for the whole class to participate in. Descriptions of some of the core lessons are provided in the last chapter of this book.

I will miss working in the garden, but I know in February I can get my hands dirty again. Thank you garden staff! A fellow gardener,

—Zoe

Fall in the Edible Schoolyard

tomatoes
cucumbers
summer squash
snap beans
eggplant
hot peppers
tomatillos
celery
celeriac
figs
apples
pears
pineapple guavas
cape gooseberries
mulberries
raspberries
olives
basil
cilantro
parsley
dill
potatoes
leeks
onions
sweet corn
popcorn
dent corn
kale
collards
chard
lettuces
bok choy
tatsoi
winter squash
radishes
carrots
beets
mint
lemon verbena
marjoram
rosemary
bay leaves
oregano
thyme
dry beans
amaranth
golden amaranth
quinoa
millet
flowers

After a foggy Bay Area summer, the Edible Schoolyard garden basks in the long and sunny days of autumn, and is abundant to the point of overflowing. Tomatoes ripening on the vine are surrounded by the piquant smells of basil plants and colorful displays of blooming flowers. We harvest something every day. We open up soils that have been working hard through the summer and feed them with our homemade compost. We sow cover crops in beds that need a rest and transplant our late fall and winter plants in others. After the sunflowers begin to hang their heads but before the squirrels bulk up for winter, we save as much seed as we can. Fall is an abundant and active time in the garden, a perfect reflection of the energy pulsing within King Middle School after a long summer away.

Over the first few weeks of school, sixth-grade classes begin their orientation with a card hike in the Edible Schoolyard. During their second visit we introduce them to the garden's bounty with a delicious harvest of sweet corn, which they grill and eat in class. In subsequent weeks we teach them garden basics: harvesting, respecting all living things, tool care, cultivating, and composting. In their science classes, students are working through their ecology unit, and the garden becomes a natural, hands-on tool for teaching ecological principles and concepts. It is with this foundation that students embark on three years of working in the program.

CULTIVATING

The Edible Schoolyard garden cultivates an average of 70 beds for annual vegetable crops. Depending on the crops grown, cultivation may be necessary at multiple times throughout the year. In general, however, annual beds are cultivated once in the fall, after the summer crops are finished, and again in spring, after the cover crops have been cut down and summer crops are being planted once again. Crop rotation and maintenance of soil fertility are crucial to helping the garden thrive.

At the Edible Schoolyard, we cultivate by hand. Students use garden forks to loosen and aerate the soil and square spades are used to pronounce the edges of a bed. When a bed is finished, a fork held out at shoulder height and dropped will sink down to its hilt. A quick pass over the soil with a rake removes large debris and prepares the bed for planting.

We cultivate with almost every class throughout the fall and spring seasons. One of our most physically demanding jobs, cultivating channels excess energy and excitement into productivity. It also allows students to observe life in the soil and develop an appreciation for the decomposition process, which is aided by earthworms and other soil-dwelling invertebrates. To get this job done well, it is ideal to incorporate our chickens. Often, at the end of class a group will place the chicken tractor on top of the newly cultivated bed and bring chickens to scratch around, eat grubs, and fertilize the soil.

SEED-SAVING

One of the first deliberate agricultural acts performed by humans, seed-saving has taken many forms over the last 10,000 years. Early Mesopotamians selected seed heads from wheat and barley plants that did not drop seed when they reached maturity; this act allowed them to cultivate the crop for food. Saving seeds is a simple way to make world history seem less abstract to students because it allows them to grasp connections between their own daily lives and those of people who lived thousands of years ago.

Seed-saving also increases a student's awareness of natural cycles. Letting a plant "go to seed" allows them to consider the life cycle of an annual plant and helps them understand that only through the death of a parent plant is the life of the next generation ensured.

Materials for Seed-Saving

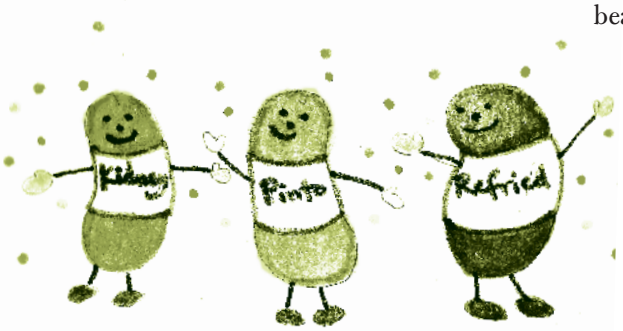
- paper bags both small and large
- a few shallow bowls of various sizes
- envelopes and glass jars for storage
- flat screens for sifting and drying seeds
- markers and labels

10 Easy Seeds to Save

sunflowers
beans
sweet peas
calendula
hollyhock
cosmos
nigella
coriander
fennel
dill

We maintain a seed bank that we share with other school and community gardens, and try especially hard to preserve the genetic integrity of heirloom and other rare varieties of seed. The following is a list of garden vegetables, grains, annual herbs, and flowers from which seeds have been successfully saved with the help of our students, and a brief description of the seed-saving process for each.

Beans Seeds belonging to at least two dozen varieties of heirloom beans have been saved over the last 10 years at the Edible Schoolyard, both pole and bush varieties. We grow pole beans on a trellis or interplant them with corn and squash in the "Three Sisters" method (a traditional method of planting corn, beans and squash together in one bed). Beans are ideally left on their plants until pods mature or dry up. The plants may be uprooted and hung upside-down in a dry place. Once the pods are dry, the beans are shelled and then stored. Shelling beans is very social work—ideal for middle schoolers—and is both an excellent alternative to more labor-intensive tasks on hot days and an ideal classroom activity on rainy days.



Lettuce Allowing lettuce plants to bolt and saving their seeds is easy and educational. About two-to-three weeks after the lettuce flowers initially open, we tip the top of the stalk into a grocery bag and shake the seeds free. This is done every day until seeds no longer fall. The seed is then winnowed out from the plant material and stored.

New World grains Along with the Hopi Red amaranth that grows in our garden, we also grow and save seed from golden amaranth, quinoa, flint corn, and popcorn. Amaranth and quinoa are easy grains to process and can serve as excellent tools for teaching about traditional cultures of the Americas and the processes of threshing and winnowing. Flint corn and popcorn are prone to cross-pollinating and should be kept apart when saving seed.

When our ears of corn are fully developed, we hang them upside-down until they dry completely. Kernels of flint corn may also be ground into masa for tortillas or made into popcorn for a perfect midwinter snack.

Old World grains In addition to the grains we grow as cover crops, we grow barley and winter wheat for harvest. The plants must be left until seed heads are fully developed. We then cut and bundle together the stalks and hang them for additional drying. Once dry, we place a handful in a burlap or cotton sack and pound on a hard flat surface to thresh the seeds from the chaff, winnowing what's left. Our students then grind the wheat we haven't saved for seed into flour for the pizza dough that is cooked in our wood-fired oven.

Reasons to Save Seed

- Avoid spending precious money purchasing seeds.
- Encourage the development of locally adapted varieties by saving seed from your own healthy plants with preferred traits—color, shape, insect-resistance, hardiness.
- Maintain biodiversity of plants for future generations by preserving and sharing open pollinated heirloom seeds.

Annual flowers We have saved seeds from sunflowers, sweet peas, cosmos, calendula, agrostema, poppies, tithonia, hollyhock, flax, nigella and more. While each flower is a bit different, the general idea is to wait until the flowers bloom and drop their petals, leaving the seed heads behind to harvest and thresh.

Annual herbs The seeds we save most often are dill, fennel, and coriander—all members of the *Umbelliferae* family. If these crops are permitted to flower and go to seed, they will produce seeds that are easy to harvest. Different umbels on a particular plant will ripen at different times, so multiple harvests of that plant might be necessary.

We may also save seed from tomatoes, teff, sorghum, oats, millet, white sage, lovage, purple podded peas, rose geranium, lion's tail, and epazote.

GROWING CORN

Every spring, seventh-grade students plant sweet corn for the incoming sixth graders to enjoy in the fall. Most of our students are familiar with this delicious staple but have not tasted it freshly picked and grilled. On their first day working in the garden, each sixth-grade student takes part in the Edible Schoolyard tradition of harvesting, roasting, and eating a piece of corn. They wander through towering rows looking for a ripe ear, checking the silks and squeezing the ears in the hope of finding the best one. This is their first true harvest in the garden and one they are bound to remember. After they get over their squeamishness about the earworms that live at the top of most organic cobs, students are in awe of our corn's delicious flavor.

After this first day, the students' excitement for the garden is piqued and the basic concepts of harvesting and pollination have been introduced. Over their years in the garden, they will build upon this foundation by planting and harvesting Three Sisters, grinding Blue Hopi corn, designing seed packets for strawberry popcorn, and seeding the sweet corn for the new sixth graders.

AMARANTH AND ALEGRIA

Amaranth, a gorgeous plant with a rich history, is also wonderful for teaching the concepts of threshing and winnowing. This plant grows voraciously in our garden; we yield enough to provide our 320 sixth graders with one plant each.

The main variety we grow is Hopi Red, though we also sow Golden Amaranth—great for popping and making the sweet Mexican treat alegria—and a few other decorative varieties. In a short amount of time, students learn how to separate the shiny black amaranth seed from the chaff and marvel at the volume they can collect. Students are impressed that amaranth grows so big from such tiny seeds. Many run their hands through the collective bowl, noticing how smooth the seeds are and how good it feels to dig around in them. The crowning moment, however, is when they observe their hands turning pink from working with the seeds. Once we show them that, with a little mashing and the addition of water, the chaff can create a vibrant pink dye, students can't wait to paint one another's faces and hands. At the end of class, a band of 30 pink faces leaves the garden.

Students find amaranth all the more interesting when we explain its history as a staple crop of the Aztecs that was all but eradicated from Mexico by the Spanish. Many students have studied ancient cultures and colonialism but have never touched an amaranth plant before, and this lesson gives them a sense of how special it is, along with its place in American history.

Another activity involving amaranth is the preparation of alegria in the garden. Alegria (meaning "happiness") is a granola bar-like street food sold in Mexico and India. It is made from popped amaranth, sunflower seeds, and a sweetener—usually brown rice or maple syrup—and is a wonderful way to use amaranth seeds. Popping the amaranth is dramatic and fun; it pops like live confetti. Our cooking space allows plenty of room for students to set things down and move around each other easily.

We provide lessons on amaranth, alegria, and corn in the next chapter of this book.

CIDER HOUSE MATH

Every year we turn our apple harvest into cider that is shared during a closing circle. A group of students will cut and press the apples, and serve the fresh cider to the rest of the class. The apple press is a simple tool with screws, a plane, a lever, and gears, which can be purchased at specialty cooking stores or on the Internet. Students love to see the whole process of turning freshly harvested apples into sweet juice. We use different varieties of apples, ensuring that our cider is made from tart, sweet, and differently colored apples—both inside and out. This Edible Schoolyard tradition has been turned into a math lesson on volume, weight, and proportionality.

FORAGING

Before there was an Edible Schoolyard garden or a kitchen at King Middle School, we held tastings in the classroom using a biweekly, community-supported agriculture box. Our goal was to have students taste seasonal, organic, local produce that had been freshly picked, try new fruits and vegetables, and expand their palates. Because the garden was developed before the opening of the kitchen classroom, much of what was grown was either eaten during the garden classes or sent home. As we realized that students enjoyed eating straight from the garden, we began to plant in a manner that directly promoted foraging.

Though we now focus on growing crops for use in the kitchen classroom, our commitment to having students try new things during garden classes continues. We plant many crops knowing they will never make it to the kitchen. Raspberries, ground cherries, mulberries, loquats, pineapple guavas, cherry tomatoes, and sugar snap peas are some of the classics.

It is a pleasure to see students delight in finding a ripe raspberry, peeling the papery skin off of a ground cherry to reveal its bright orange fruit, or tasting a mulberry for the first time. Several years ago an exchange student came to our school from Norway; one of the first English words he learned was *forage*.

I really liked the card hike. I followed the directions. Some of them said to taste and I tasted. I really liked the golden raspberries. I was hooked on them! I could not leave!

—Mati

Winter in the Edible Schoolyard

kiwis	*fennel*
lemons	*mushrooms*
broccoli	*snap peas*
kale	*snow peas*
collards	*pepino dulce*
chard	*Asian greens*
cabbage	*green garlic*
cauliflower	*fava beans*
beets	*mint*
radishes	*parsley*
carrots	*cardoons*
arugula	*bok choy*
mustard greens	*tatsoi*
spinach	*flowers*

When the rains come in winter, our garden world changes. Daylight hours shorten, the temperature drops, brassicas and lettuces thrive, and we throw the last of the fall plants into the compost pile. We are lucky to have a year-round growing season in Berkeley; winter is a crucial time to care for our fruit trees and soil, and we ask classes to reflect on the needs and limitations of a winter garden. Students watch the apple trees lose their leaves while the Meyer lemon tree explodes with ripe fruit. They wheelbarrow woodchips all over the garden to prevent our well-trod paths from becoming mud pits. Perennial beds are cut back and sheet-mulched with layers of manure, cardboard, and straw. Beds that aren't used for winter crops get cover-cropped and some of the fall cuttings are potted up in the greenhouse. Our water catchment system overflows and we use the collection to water the mushroom cultivation area.

UNDERSTANDING SOIL

Winter is a great time to help students appreciate the value of good soil. We begin by telling them that we think they ate dirt for breakfast. The looks they give in response range from disgusted to disbelieving! Then we trace a few breakfast foods all the way back to the soil that nurtured their key ingredients. "But I ate a bagel for breakfast," a student might say. "Bread doesn't grow in the dirt, does it?" Soon students see that a bagel is made from wheat that grew in soil, and even cream cheese came from a cow that ate plants grown in soil. We also explain that soil is responsible for some of the clothes we wear and the buildings we live in. Telling students that they wouldn't be wearing that new pair of jeans if it weren't for cotton crops gives them a newfound respect for the soil.

The hardest question for students to answer is seemingly the simplest: *But what is soil?* The answers that first come to mind are: *Mud? Dirt?* Then we shift the question to: *What is soil made of?* The answers follow, and students realize how much they already know. We dig into the soil to feel the difference between clay and sand, and see how water does or doesn't flow through it. The fact that soil is alive is the most amazing concept to share with students, but also the most challenging; it's an idea that becomes easier to grasp as we work through a lesson called "We All Ate Dirt for Breakfast," included in the last chapter of this book.

PLANTING COVER CROPS

We use winter cover crops to prevent erosion, build soil fertility, inhibit weeds, and attract beneficial insects. Grains such as oats, barley, rye, and wheat have complex root systems that fan out underground, giving the soil the structural integrity it needs to resist erosion during rainy months. Legumes such as fava beans, vetch, bell beans, clover, and fenugreek are sown due to their nitrogen-fixing abilities. Flax and phaselia are also sown as winter covers and they are especially good insect-attractors in the early spring.

The grains and legumes are sown individually or in a mix, depending upon our priorities for a particular bed. The cover crop is then left to grow throughout the winter and into early spring. Once the legumes are about 50 percent in flower, we either chop them and add them to the compost pile or incorporate them into the beds.

Cover crops provide a great lesson in sustaining our soil. Students learn about erosion in the classroom, but when we hose down an open flat of soil and watch it wash away, they see the concept in action. Pulling a fava bean out of the ground reveals the nodules on the roots that store the nitrogen the plant has taken from the air. Most of our cover crops are returned to the garden after they have broken down in our compost piles, illustrating the cycle of fertility, and teaching that we feed the soil so that it can feed us.

BUILDING IN THE GARDEN

Building a structure in the garden is an especially great activity during winter months, when there are fewer tasks at hand, and students learn about garden maintenance in the process. The main structures we build with students are trellises and waddle fences, but they also create other structures like raised beds, potato towers, and stone walkways. The building materials we use most are bamboo and hazel; we are lucky to have neighbors who deliver high quality bamboo to us, while hazel grows in the garden.

Building a garden trellis or fence almost always involves a saw, a sledgehammer, or another tool that requires great care, and is an opportunity to teach students the proper and safe way to use equipment. They are especially eager to use the sharp or heavy tools and almost always treat them with the required seriousness.

We used black bamboo and white bamboo. We used sailor knots to tie them together. That was the fun part.
—Jason

We also involve students in bigger building projects. They took part in erecting our tool shed years ago, for example, and just last year students helped build our pond, digging the hole with picks and working together to move a huge concrete bench out of the way. Being a part of these big projects gives students pride in doing real physical work and inspires a sense of ownership over the garden.

TENDING FRUIT TREES

Fruit trees were among the first plantings in the garden. To accompany the fig and loquat, we planted three weeping mulberries and one Persian mulberry, along with olive trees and a variety of citrus trees. As the garden developed, pineapple, guava, plum, pear, apple, pomegranate, persimmon, and kiwi trees were all planted and tended. Not every fruit tree survived, but there are over 80 trees thriving in the garden today.

Our wide variety of fruit trees provides the raw pleasure of eating fresh fruit from the garden through every season. They are a touchstone of the garden and require significant care to remain healthy and productive.

We prune, weed, fertilize, and mulch fruit trees in winter. We fertilize with horse manure and mulch with straw after weeding. Winter is the best time to fertilize fruit trees, as root growth is stimulated during dormancy and winter rains allow nutrients and microbes to penetrate the soil around tree roots more easily.

Cool and wet days in the garden can be challenging for the hardiest of middle school students, but the work of shoveling and pushing wheelbarrows around the garden to mulch the fruit trees is a satisfying and warming way to spend a winter class.

HISTORY WALKS

Traditionally, our math and science teachers have taken their students to the garden while our humanities teachers have taken students to the kitchen. The sixth-grade humanities teachers at King Middle School have been using the focus question, "What role does the acquisition of food play in the settlement and development of a civilization?" throughout their study of the ancient world, and created "History Walks" as a way to use the garden to explore the answer.

The Mesopotamia Walk uses the garden to emphasize the developments of the Mesopotamian civilization and its continued influence on our current agricultural practices. The main ideas include the development of irrigation systems to transport water from rivers to fields, the standardization of brick size to facilitate building, and the domestication of plants and animals.

RAINY DAY CLASSES

For the days when even ponchos and rain boots can't make a garden class possible, we have a few indoor activities up our sleeves. Worm lessons, for example, have been a part of the sixth-grade curriculum for many years. Every student encounters worms in the garden, whether while cultivating a bed, turning the compost pile, or sifting through the worm bin. This series of lessons digs deeper into the purpose of these helpful creatures and provides a great opportunity for overlap between the garden and the classroom.

The entire rainy day lesson on worms is provided in the next chapter of this book.

Mushroom Cultivation

Mushrooms are quite simple to cultivate on a small scale. The easiest species to begin with is the oyster mushroom, or *Pleurotus ostreatus*. It is a decomposer species, which means it grows readily on straw or woodchips. Sterilization of the growing medium greatly increases production and is a great opportunity for teaching the scientific method (hypothesis, experiment, control, results, and conclusion based on production rates from sterilized vs. unsterilized and across different growing media). Mushroom spawn can be purchased from many mushroom suppliers.

Comparing the life cycles and ecological roles of wild and cultivated fungi makes for a great wintertime lesson. Fungi are the great decomposers and many are tree companions, extending the root systems of trees by up to 100 percent! They are instrumental in the regeneration of forests ravaged by fire and deforestation, and are effective at breaking down toxic chemicals into simple, non-toxic organic compounds, which decompose without polluting the land, rivers, and seas.

Spring in the Edible Schoolyard

broccoli	*leeks*	*fava beans*
cabbage	*green garlic*	*rhubarb*
kale	*bok choy*	*winter wheat*
collards	*tatsoi*	*barley*
chard	*snap peas*	*cilantro*
spinach	*snow peas*	*parsley*
carrots	*garlic scapes*	*basil*
radishes	*oranges*	*mint*
lettuce	*loquats*	*chives*
beets	*artichokes*	*thyme*
spring onions	*fennel*	*flowers*

The signs of spring are everywhere. In just a few short weeks the plums start flowering, the daffodils open up, and our tomato seeds germinate, ushering in the long and fruitful spring season. We begin seeding our spring and summer crops in the greenhouse, and we harvest the first snap peas and artichokes of the season. Our cover crop beds have grown healthy and tall from the winter rains and are ready to be added to our compost pile. Students, bubbling with spring fever, enthusiastically chop down fava bean plants and vetch that climb up rye stalks. They build massive piles of compost that will be turned and turned and finally feed the summer plants. Cultivation of the beds begins in earnest when we prepare them for planting with wheelbarrows of sifted compost. Before long, kiwis that were just leafing out are flowering and sweat peas are blossoming above our heads. Potatoes are up and the other nightshades grow big in the greenhouse before making their way into warm beds. The garden isn't the only thing waking up after winter—the bug population does too, and we teach students to watch insects repopulate the garden and observe pollination in action.

Spring is an incredible time to teach and work in the garden. The energy is palpable, with every group of students contributing significant work to change the garden. Students happily snack on loquats, radishes, and carrots while they prepare the garden for the summer and fall harvests.

COMPOSTING

Visitors who enter the garden through its back gate are welcomed by our compost area. When the compost piles are actively decomposing, steam rises from the layers of weeds, straw, horse manure, and kitchen scraps. This dramatic display of heat and energy can lure even the most aloof student in to observe the composting process. If the steam alone doesn't fascinate students, the pile being too hot to touch is sure to inspire curiosity. When we mention that we could cook an egg in the compost or that a chicken carcass would break down completely if added to the mix, even the hardiest skeptics are all ears. The big question looms: *Why is it hot?* We encourage students to connect their own experiences to those of the decomposers working hard in the

compost: *How do you feel after you've been working hard in the garden? What does the school gym feel like when it's filled with students dancing their hearts out?*

Compost is an essential part of our garden's health. The compost we create with students improves soil structure and fertility, loosens clay soils, stimulates good root growth in plants, and provides food for essential microorganisms in the soil. A well-managed pile includes all food scraps from the kitchen classroom and any plant materials pulled from the garden. Many rich and engaging lessons are built around waste diversion and the creation of nutritious soil.

Tending to the compost involves many active jobs for students: building and turning the piles regularly, sifting them, and spreading compost on the garden beds. Sometimes the piles are fragrant and students are reluctant to dig in. As an answer to this dilemma, a group of seventh-grade boys once devised a game in which they line up at a distance from the pile and run in, one at a time, to turn to the pile, and then quickly run out before the smell overwhelms them. While perhaps not the most efficient method, this was certainly entertaining. By the end of class, the pile was turned and the boys were worn out from their efforts, proud of their accomplishment.

We try to incorporate other school activities into the garden compost. For example, we work with teachers and students to collect classroom vegetable and fruit waste. With the opening of the Dining Commons, we plan to integrate waste from the preparation of school lunch into our compost. This will allow us to create even more valuable fertilizer for our garden and further connect the students and staff to the seed-to-table cycle.

Our full lesson on compost is found in the next chapter.

PROPAGATING

Involving students in every aspect of garden maintenance is at the core of the Edible Schoolyard philosophy. By working with plants at every stage of their development, students develop a better understanding of where food comes from and what is required in order for it to grow. One way we encourage this is by engaging students in the seeding of annual plants.

Students new to the propagation area are walked through the greenhouse, where they can observe the various seedlings and talk about the different methods of growing plants. They are then settled into our workspace by the greenhouse, which includes many tables and soil storage bins. It is here that we outline the process of seeding, and the first step is to create an appropriate potting mix by mixing together a handful of ingredients. Following a recipe, every student gathers one component of the mix. Some students sift compost, others shovel

our base soil mix or measure out amendments that the mix requires. Once the ingredients have been mixed together thoroughly with shovels and hands, it is time to water the potting mix down and begin seeding.

We like to start by seeding a crop that has fairly large seeds, and encourage students to work slowly. We show students how to fill the flats with soil evenly and without compaction, and then demonstrate how to plant the seeds. To help make labeling the flats easy, we use a white board to model the information that should be included in each tag and where to find it (date, plant name, variety name, seed company). The seeds may come from our own garden or from a variety of seed companies, and labeling is an important step in distinguishing varieties.

Students are also involved in propagating perennials. In autumn, our staff takes cuttings from perennials, which are intended for propagation. We allow the cuttings to root in perlite and then have students pot the delicate new plants in a nutrient-rich potting mix. These plants range from the familiar, like rosemary, to plants that are often new to students, like rose geranium or lemon verbena.

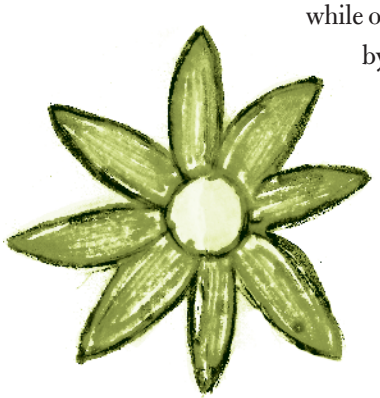
Working in the greenhouse with the baby plants is ideal for students who enjoy careful and detailed work. For those who come to class with excess energy and an eagerness to dig in the soil, this job can be a challenge—albeit a rewarding one. Later, students revisit their hard work and mark how the flats of plants have flourished.

We provide some of our potting mix recipes in the Appendix.

INSECTS AND POLLINATION

Within minutes of arriving in the garden, students encounter some of the many insects that live there. Reactions are mixed, but most classes include a squealer or two, and many students are uncomfortable around bees or spiders. With this in mind, we make an effort to reintroduce insects in a different light: bees are interested in pollen and nectar and will sting you only as a last resort; spiders are beneficial to the garden because they eat bad insects; and butterflies are beautiful but they also help the garden through pollination.

We teach students that some insects are beneficial to the garden and crucial to maintaining its healthy cycles, while others are pests we try to minimize. Over time, a student who was once repulsed by the slime of a worm will be bold enough to hold one. Even those fearful of bees may dare to hold a male after being taught that it doesn't have a stinger. To help students transition from fear to fascination, we offer a bee lesson in every seventh-grade class. We have been lucky to have a local professor and his graduate students, who are studying insects, make an engaging presentation to our students. They provide accessible information accompanied by great images and even live bees, which are cooled down to allow for handling and careful observation. This has been a valuable addition to our garden lessons and a component we plan to continue and expand.



Studying the pollination process is another way to teach appreciation for insects. Pollen might make some people think of itchy noses and sneezing fits, but pollination—the transfer of pollen from one flower of a plant to another to fertilize its ovaries—is an essential part of our food system. Pollinators play an integral role in the production of hundreds of commonly enjoyed food crops.

Bees—both native and honeybees—are nature's primary pollinators. They are not, however, alone. Moths, butterflies, beetles, and flies also serve as pollinators, as well as 1,035 species of vertebrates, including some birds, mammals, and reptiles.

We provide two lessons, one on plant pollination and one on bees, in the next chapter.

MAINTAINING FERTILITY

Former students of Martin Luther King Jr. Middle School frequently pass through the garden and marvel at the transformation that has taken place over the last 13 years. As they learned early in their time with us, the most important component of a thriving garden is healthy soil, and plant growth is the clearest indicator of soil health.

We manage garden fertility by planting seasonal cover crops and closely managing a thermophyllic composting system. In addition to the classic winter cover crops, to break up particularly compacted soils we sow quick cover crops in the spring and summer. These get harvested and added to our compost pile, and with the help of microorganisms, they provide a balanced diet of nutrients for our plants. Our large-scale composting system provides garden beds with nearly all of the fertility they need to thrive. We have always tried to minimize our reliance on outside amendments, but we do add horse manure and old straw to our piles.

Our annual beds are amended, in conjunction with cultivation, twice a year—once in the spring, before the planting of summer crops, and once at the end of the primary growing season, before the planting of cover crops, brassicas, peas, and other winter vegetables. Unless a bed is being planted with a cover crop, a full wheelbarrow of sifted finished compost is added. Additionally, if the previous crop fed especially upon a particular nutrient, we amend the soil accordingly. For example, corn feeds a lot on nitrogen, so we either plant a nitrogen-fixing cover or add a concentrated dose of nitrogen amendment, such as kelp meal.

ANNUAL PLANT SALE

Every Mother's Day weekend, we host a big plant sale. Preparing for the sale means a lot of propagation and greenhouse work for students, work that begins in late February. The volume of plants we grow allows us to involve lots of students in making soil mixes, seeding vegetables, and potting up perennial cuttings. They propagate plants—many from seed we have saved—and label them for the sale. As the sale gets closer, students help make signs and organize the masses of plants into categories.

In addition to learning about plant propagation, students learn that plants have monetary value. When we tell them how much plants are worth and challenge them to mentally calculate the value of the plants they have just potted up, students gain a newfound awe for the tiny seedlings. When the greenhouse begins filling up and the math calculations require pen and paper, the awe turns into excitement over being part of a significant fundraising event. We encourage each student to take a plant he or she has grown and take it home or give it as a gift. Students come back telling of lettuce growing on window sills or cherry tomato plants taking over the sides of houses—stories full of amazement and pride.

The sale has become a community event. We usually have one or two student volunteers to assist with talking to people, writing up receipts, and helping customers to their cars with their plants.

We provide a comprehensive list of the plants we propagate for the sale in the Appendix.

Lessons

Sixth Grade: Corn Lesson

This is a multi-faceted lesson on several topics such as using corn as a staple, plant parts, pollination, tasting, and cooking outdoors.

OBJECTIVES

Students will:

- learn about the parts of the corn plant: stalk, roots, cob/ear, leaves, tassle, silk, and kernel
- learn how to select a ripe ear of corn, harvest it, and remove the husk properly
- learn about the four different types of corn: flint, dent, pop, and sweet
- compare and contrast two types of corn
- write a process paragraph, complete with signal words about how to harvest, prepare, cook, and eat corn

MATERIALS

- ripe, sweet field corn
- grill and fuel (mesquite charcoal)
- sharp knife
- cutting board
- butcher paper and markers
- tongs
- paper towels

BEFORE YOU BEGIN

Get the charcoal lit in the grill so that the coals will be ready right before class. Select a harvest area. Set a wheelbarrow next to the grill area to collect cob scraps. Set up napkins, a cutting board, and a knife for cutting each ear into two pieces on a table. Then create a characteristic chart on butcher paper to compare the differences (in size, shape, color, flavor, texture, and kernels) between corn from the Edible Schoooyard and the farmers' market. Post the chart and have a set of markers ready.

PROCEDURE

During the second class in the garden, separate the class into three smaller groups. Each group will spend two-thirds of the class working on a garden job and the remaining third at the corn station. Rotate the groups about every 20 minutes.

At the corn station students go into the corn field, participate in a mini-lesson about the parts of the corn plant, and learn how to select ripe ears. Each student works with a partner to harvest either two different varieties from our garden or one variety from our garden and one from the Farmers' Market. Each student then shucks the corn and puts the husk and silk into the wheelbarrow to be composted. Many cobs have earworms inside, which can be removed easily with garden clippers; we usually tell students that the presence of earworms indicates that the corn is perfectly sweet and delicious.

Point out the silk, remarking that each thread is actually a pollen tube, and that each kernel is attached to a tube. Also point out that corn is wind-pollinated. Then put the corn onto the grill and talk about the different types of and uses for corn while it cooks. Complete the characteristic chart at this time, or take it back to the classroom for a follow-up writing lesson on comparing and contrasting.

When the corn is ready, have each student carefully remove his or her cob from the grill. Cut each cob in half so that pairs of students can taste the two different types of corn. As they eat, engage students in a conversation about which types they prefer and why.

CLOSING ACTIVITY

Work with students to create a "found poem" about corn. Have the first student in the circle choose a word about corn, the next student add another word, and so on, until every student has contributed. Students may use the same word more than once.

BACK IN THE CLASSROOM THE NEXT DAY

Have students write process paragraphs about harvesting, cooking, preparing, and eating corn. Remind them to use time-order words such as *first*, *next*, *then*, *after*, *before*, *while*, *last*, and *during*.

GARDEN FOLLOW-UP

The week after the students have harvested all of the sweet corn from the garden, we bring them an unexpected part of the plant to taste in closing circle: the corn stalk. Having the students chew on the fibrous stalk and taste the sweetness is a great opportunity to talk about photosynthesis. While they have learned about how plants create sugar from the sun, this is a memorable way to see it in action.

Next we went from the blue corn to the sweet corn and each picked an ear to grill. We peeled off part of the leaves and grilled the rest along with the corn. My corn wasn't pollinated so I shared Emily's. I must say it tasted really good, even without butter.

—Charlotte

Sixth Grade: Amaranth Lesson

The goal of the amaranth lesson is to teach students about this important grain from a historical and nutritional perspective.

OBJECTIVES

Students will:

- learn that amaranth was first grown in Mexico 7,000 years ago, and was a staple crop of the Aztecs
- identify amaranth plants that are ready for harvesting
- remove seeds from the stem of the amaranth by threshing
- separate amaranth seeds from their chaffs by winnowing
- learn that amaranth seeds are edible when popped, boiled, or ground into flour, and have an unusually high protein content
- learn that the amaranth plant contains pigment and can be used as a dye

MATERIALS

- tarps
- shears
- bowls for winnowing
- large bowls
- sifting screens
- whiteboard and erasable markers
- mortar and pestle
- water

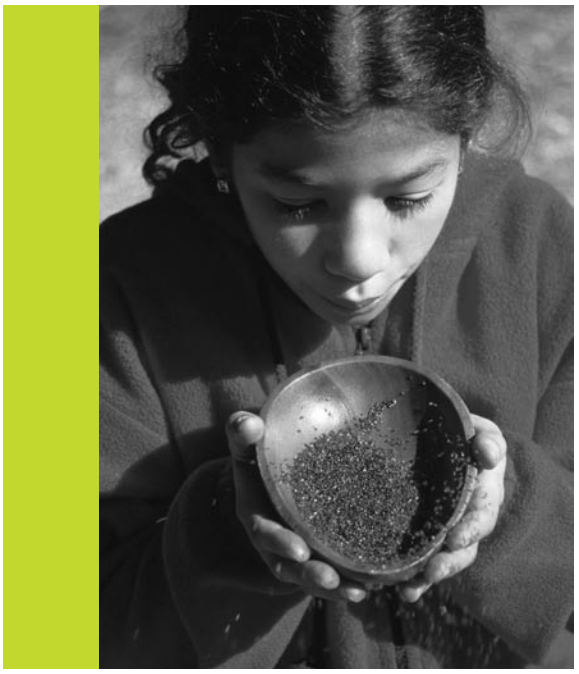
Note: For every 2–3 students, have a set of screens and a set of bowls. Also be sure there is enough ripe amaranth in the garden for each student to pick one plant.

PROCEDURE

In an opening circle, introduce the whole class to the amaranth plant by explaining that they are going to save its seeds. Then share some of the history and uses of the plant. We have found the following facts to be particularly engaging for students:

1. Amaranth was a staple crop of the Aztecs, grown 7,000 years ago in what is now Mexico.
2. Its seeds can be eaten popped, boiled, or ground into flour.
3. Its leaves can be eaten like spinach.
4. Its seeds have the highest protein content of any grain (18 percent).
5. The plant contains a pigment that can be used as a dye.
6. We use amaranth seeds for eating and planting.

After going over these facts, find a ripe plant and model how it is harvested. Then have students break into smaller groups to process the plant. Each student can harvest his or her own plant, then walk with the small group to the tarp station. As each small group watches, model threshing the plant over the tarp. Use the term



"threshing" in your explanation to reinforce the importance of garden vocabulary. Also have students listen to the sound of the seeds falling on the tarp, observing that it sounds like rain on a tin roof.

After the plants are fully threshed, have students compost the stalks. Then work with the whole group to guide the seeds from the tarp into one big bowl. Encourage them to proceed calmly so they don't lose any of their seeds.

Now, using the set of three screens (with decreasing gauge size), show how to sift out the bigger pieces of chaff and leaves that are mixed in with the seeds. After you have modeled this technique, have small groups attempt it themselves.

Once each group has a bowl of seeds with just small bits of chaff mixed in, model winnowing. While they are working on this, have students define the terms *harvest*, *thresh*, *sift*, *chaff*, and *winnow* in their own words. A volunteer can record these definitions on the whiteboard. Once the seeds are successfully winnowed, combine them in one large bowl and encourage students to admire the large amount of seeds produced by just a few plants.

During the clean-up process, collect some of the leftover chaff to make dye. Adding a bit of water, have students crush the chaff in a mortar and pestle until a thick dye is created. Talk about how this dye may have been used in ceremonies in the past. Those students who are interested can paint their faces, hands, and hair with the stunning pink pigment.

CLOSING ACTIVITY

To wrap up the activity as a large group, have students create an acrostic poem together. Encourage them to use words or phrases they have learned about amaranth. Accept a wide range of answers from as many students as possible. Read the finished poem aloud together. In the following weeks, ask the students what they remember about amaranth.

Acrostic Poem

A*ztecs*

M*exico*

A*mazing*

R*eddish-pink*

A*ll over the garden*

N*ever-ending*

T*iny seeds*

H*iding*

Sixth Grade: Alegria = Happiness

The goals of preparing alegria in the garden are to teach the students a new way of preparing amaranth and get them cooking outside.

OBJECTIVES

Students will:

- learn about cooking outside over an open flame
- learn a method of popping or toasting seeds
- review the facts about amaranth from the winnowing and threshing lesson

MATERIALS

- recipe written where students can see it
- propane stove with two burners
- two measuring cups
- teaspoon measurer
- two large bowls
- one small bowl
- three wooden spoons
- three or more potholders
- one saucepan for heating honey/syrup
- one heavy pan for toasting sunflower seeds, and then popping amaranth
- a sheet pan lined with parchment paper
- one knife
- sunflower seeds
- amaranth
- cinnamon
- sweetener (honey, rice syrup, or maple syrup)

PROCEDURE

Prepare alegria for the entire class with one small working group.

This recipe makes enough to provide one class of 25–30 students with snack-sized portions.

INGREDIENTS:

2/3 cup toasted sunflower seeds
4 cups popped amaranth seeds
1 teaspoon cinnamon
1 cup sweetener

METHOD:

Begin by toasting the sunflower seeds over medium heat, then set them aside in a small bowl. Turn up the stove to high heat and add the amaranth in small amounts. Pop the amaranth seeds, stirring and/or shaking the pan to keep them from burning. The seeds should not take more than 10–15 seconds to pop. Repeat this in small batches until you have popped enough amaranth for your alegria.

When your amaranth is popped, pour the sweetener into a saucepan and heat it over medium-high heat. When it gets very hot and begins to bubble, add the cinnamon and the sunflower seeds. Let the mixture bubble for a minute more and then turn the heat down to low. Stir in the popped amaranth a little at a time. When the mixture is very thick and hard to stir, pour it onto the sheet pan. Press it into the pan using your fingers and let it cool. When it is cool, cut it into pieces and enjoy!

CLOSING ACTIVITY

In the closing circle, serve the alegria on a platter lined with amaranth leaves. Give the students who prepared the snack the opportunity to tell the class how they did it, then review all that the students learned about amaranth in the previous lesson.

Sixth Grade: We All Ate Dirt for Breakfast (A Lesson on Soil)

This lesson aims to further student understanding of soil composition and soil's value as a natural resource.

OBJECTIVES

Students will:

- learn that soil is composed of many ingredients, all of which fall under four categories: rock, organic matter, air, water
- understand that some soil materials hold water and nutrients and others drain both quickly
- sample the garden soil and determine which type they are observing
- understand that soil is alive
- appreciate the importance of topsoil in creating our food and sustaining our lives

MATERIALS

- large whiteboard, erasable markers
- sample flat of garden soil (full of twigs, leaves, visible rocks, worms.)
- one flat of each: sand, silt, clay, pebbles
- four empty soda bottles with bottoms cut out and mouths covered with cheesecloth
- four measuring cups
- one Mason jar and lid for each student
- trowels
- spoons
- hydrogen peroxide
- one flat of barley or wheat, sown three weeks earlier
- two watering cans
- small samples of compost and garden topsoil

BEFORE YOU BEGIN

Prepare your flats of different soils days or weeks in advance, as needed. One day before the lesson, prepare a soil sample from the garden by shaking it with water and leaving it to sit. On the day of the lesson, fill the old water bottles with the different soils.

PROCEDURE

Explain to the group that they will spend an hour investigating soil. Talk them through the aims and objectives of the lesson. Then have students brainstorm the ways they depend on soil every day, such as for growing food and providing materials for clothes and homes.

What is soil? Display an open flat, full of soil, in the middle of the picnic table. Be sure it has a variety of easy-to-spot components such as worms, grubs, other insects, sticks, leaves, rocks, small rocks, and sand. Ask students to identify the ingredients they see in the soil. Record their ideas on the whiteboard. Add items students may have missed. Then ask them to classify all the items listed into the following four categories:

- rock particles (clay, silt, sand)
- organic material (decomposing matter in the form of sticks, leaves, roots, etc., and the decomposers which break them down)
- air (provides oxygen for plant roots and beneficial organisms)
- water (plants and soil organisms require water for survival)

Types of soil This part of the lesson focuses on rock, the primary ingredient in most soils. Soil type is determined mostly by the ratio of sand, silt, and clay in the soil. Have samples of all three and let students feel them. Explain that the difference between the three is the size of the rock particles. Ask students to guess which type has the largest and smallest particles.

Next, conduct "drainage races" by placing equal amounts of each soil ingredient into the soda bottle funnels with cheesecloth covering their bottoms. Tell students you will pour two cups of water into each bottle and have them predict which one will drain the quickest and why. Then pour. Students should observe that sand drains the fastest because it has the biggest particles, therefore it has the most space between particles, and water can pass through it more easily. Also explain that when water passes through soil quickly, so too do the soil's nutrients.

Identify the soil in your garden To illustrate the layering of soil's different components, have one soil sample jar that was shaken the day before and has settled. Then give each student a Mason jar. Students can spread out around the garden and fill their jars about halfway with samples of topsoil.

Add water to each jar until it is full. Then cover and shake the jars. Set the jars down and ask students to hypothesize how the particles will settle. They should notice that the sand settles at the bottom of the jar, and organic matter floats on the surface. These samples will not settle completely during one class period, so use your pre-shaken example to demonstrate what fully settled soil looks like. Identify the layers in your sample and have students use this information to determine the contents of their own jars.

Soil is alive! To help students appreciate the life within soil and the amazing powers of compost, have them take samples of compost, clay, sand, and garden topsoil. Explain that you will add hydrogen peroxide to the samples and that upon contact with living organisms, it will fizz. The amount of fizzing will reflect how much life is in the sample. Have students predict which material will fizz the most. Finally, add the hydrogen peroxide. Compost should fizz the most, followed by garden soil, clay, and sand. Discuss why the compost is the most full of life.

CLOSING ACTIVITY

To emphasize the value of soil and the importance of taking care of it, close the soil lesson with an erosion demonstration. Have two flats of soil ready—one that is just soil and one that is full of well-established barley or wheat. Have one pair of students hold the flats at a gentle angle while another pair pours a watering can of water onto the flats, simulating a rainstorm. As the plain soil washes away, ask students to explain what is happening. Explain that one inch of topsoil can be removed from land by erosion in one year, and that it takes 600 years or more for nature to create one inch of topsoil. Then ask the students to share ideas about why the flat with barley is not losing soil. You can lift up the plants to show them the roots that are wound around the soil, holding it in place. This powerful visual supports teachings from related lessons on cover crops and sustainability.

Today in the garden my group worked on the compost. We measured the temperature of the bed. We also turned the compost. The highest temperature was 125°F. I thought that was a pretty high temperature for a pile of rotting plant material.

—Isabel

Sixth Grade: Rainy Day Worms

Students will be able to identify the anatomy of a worm and understand the important role that worms play in the garden.

OBJECTIVES

Students will:

- identify the different parts of a worm and its functions
- understand how a worm moves
- appreciate the role that worms play in the soil and the garden

MATERIALS

- worms from a worm bin
- cafeteria trays
- popsicle sticks
- hand lenses
- *Wormania!* video (Flower Press 2004)

BEFORE YOU BEGIN

Introduce the lesson as an opportunity to get to know one of our best friends in the garden. Split students into two groups and do a choral reading of "What Am I?" (provided below). Students take turns reading every other statement out loud, then discuss new ideas or things that interested them.

WHAT AM I?

1. I never sleep.
2. I have no arms.
3. I have no eyes.
4. I have no ears.
5. I have no legs.
6. I lay eggs.
7. At birth I am clear-to-opaque and very small.
8. I do not age.
9. I can live for a long time (15 years).
10. I have over 1,000 species in the world.
11. I am cold-blooded.
12. I have 2–5 pairs of hearts.
13. I have both male and female organs.
14. I catch no diseases.
15. I breathe through my skin.
16. I can eat up to my own body weight each day.
17. I have no teeth.
18. I am very strong and muscular.
19. I am a tireless worker.
20. I have a big appetite.
21. I am a natural, perfect recycler.
22. I eat your garbage and help the environment.
23. I turn your garbage into valuable fertilizer.
24. My castings increase the amount of nutrients available to plants.
25. I mix up the soil.
26. I aerate the soil.
27. My enemies are frogs, moles, man, centipedes, and birds.

PROCEDURE

After the introduction, it is time to examine our slimy friends. Give every student a cafeteria tray, a popsicle stick, and a hand lens. Then give each table of four students a small pile of worm castings, with worms. Have each student pick a worm out of the pile to examine. Emphasize the need to respect the worms because they are fragile living beings who help the garden. Circulate around the room helping students use the hand lens to identify the anatomy of the worm, draw a picture, and label the parts that they have found. Ask students to look for cocoons and slimeballs—evidence of reproduction in action. It is likely that other critters are also present in the compost. Help students identify these.

To finish the class, watch Mary Applehoff's *Wormania!*. This informative video will reinforce the ideas you have been working on.

ADDITIONAL ACTIVITIES

You can follow up this activity by having the students read *There's a Hair in My Dirt!*, by Gary Larson. This book is about an earthworm and what the world looks like from its perspective. Ecological principles are taught along with important information about worms and their role as decomposers. Students can then create their own cartoon in the style of Gary Larson, incorporating the information they know about worms into something humorous. Use several examples of worm cartoons found in his collection for inspiration, and then let students develop their own.

Sixth Grade: Compost Lesson

Students will understand that decomposition occurs in the compost pile, reducing waste while providing a nutrient-rich material that enriches garden soil.

OBJECTIVES

Students will:

- learn that compost is decaying organic matter
- understand that decomposers break down decaying matter by using it as a food source and that this process creates heat in the pile
- identify decomposers in the compost pile using the acronym FBI (fungus, bacteria, invertebrates)
- learn to build and turn a compost pile
- appreciate that composting reduces waste and provides essential nutrients which maintain the health of garden soil

MATERIALS

To build the compost pile:

- food scraps
- plant scraps
- straw
- manure
- leaves

To maintain the pile:

- forks
- shovels
- compost thermometer

Other:

- seed-to-table cards

PROCEDURE

Show students a pile of finished compost and encourage them to feel and smell it. Ask them to share ideas about what this material is and what it is made of. Then bring the students to an in-process pile whose ingredients (food scraps, straw, leaves, plant scraps, manure) are visible. Have them speculate about how the first pile was transformed into the last pile. Finally, explain that this process is worth understanding because it provides fertility to our garden and reduces waste.

Build a pile! Building a compost pile with students is a great way to teach them about what can seem like an intangible and magical process. Work with them to layer the materials listed above in an approximate ratio of three carbons/browns to one nitrogen/green. Leave this pile to sit for a few weeks.

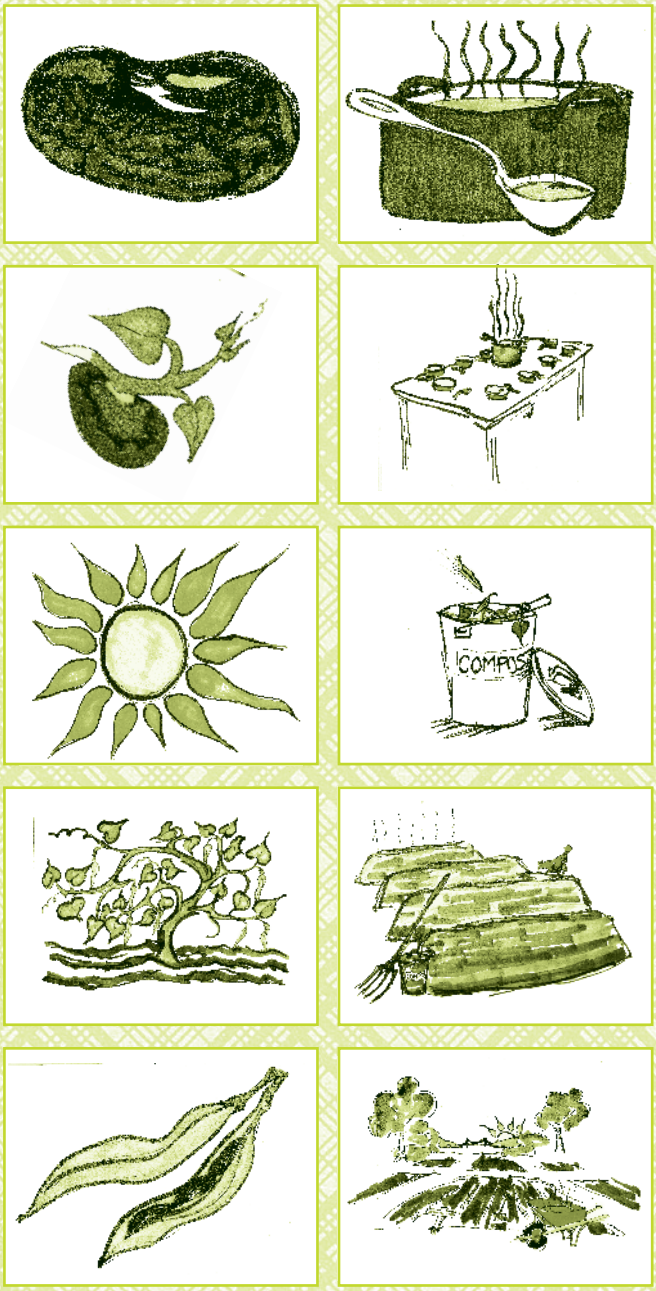
Return to the pile once it has broken down somewhat. Have students look at the pile and see if they can find any insects or decomposers. Can students see them with the naked eye?

Introduce students to the term "FBI," which stands for fungus, bacteria, and invertebrates. Explain that these are the living components of the pile. To demonstrate, invite students to feel the active pile and notice the heat. If they are having a hard time understanding why the pile is hot, prompt them to think about how they feel after they have been working hard or dancing in a group at a school dance. Then ask them to guess the temperature of the pile. As a reference point, tell students an average shower is around 100°F. Finally, use a compost thermometer to measure the actual temperature with students.

Matter cycles Ask discussion questions such as: *Where else does compost form? What would happen if the leaves that fell from trees never decomposed? Is it possible that there are cells in our bodies that are indirectly descended from dinosaurs or a 200-year-old tree?* Compost is a rich example of a matter cycle. To illustrate this integral process and how it connects to all of the food we cook and eat, create a set of cards that illustrates the seed-to-table stages. Give the card set to a group of students and challenge them to put the cards in order. Remind them that a cycle has no set beginning or end.

Waste Approximately two-thirds of our trash is biodegradable and therefore compostable. Not only does composting food and plant materials reduce what we put into a landfill, it also provides a nutrient-rich amendment for the soils that feed us. Invite students to bring food scraps from other meals or snacks eaten in school for use in your compost pile. This involves them in all stages of compost creation.

Seed-to-Table Cards



CLOSING ACTIVITY

Have students measure the height of the pile they built and label it with the date. Work with them over time to record the shrinkage of the pile, how many times it gets turned, and how long it takes for the pile to be finished and ready to be reincorporated into the garden. They can even follow how their finished compost fertilizes a specific bed and helps particular plants to grow.

Seventh Grade: Sex in the Garden (A Lesson on Plant Fertility)

Students will be able to identify basic plant parts and their roles in pollination.

OBJECTIVES

Students will:

- identify plant parts on a diagram and describe the function of each one
- understand the process of pollination
- understand the many ways that pollen can travel
- appreciate that pollination is required to create most foods we eat including fruits, vegetables, meat, and dairy

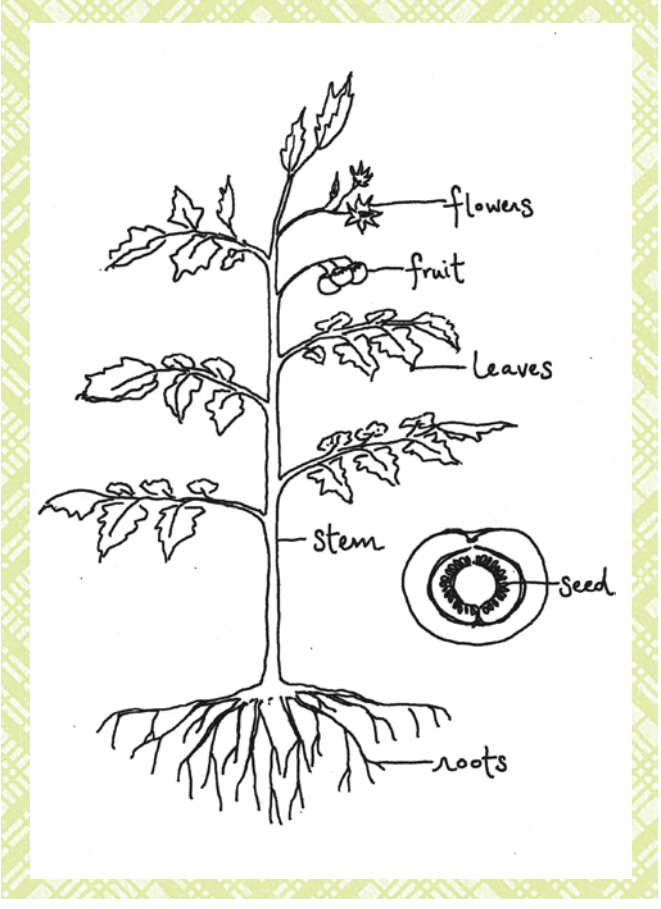
MATERIALS

- diagram of a common plant with flowers and fruit
- diagram of a flower with its reproductive parts labeled
- garden with different flowers to see and identify

PROCEDURE

Display a diagram of a plant with flowers and fruit and ask students to identify as many parts as they can. Discuss the functions of each of the following:

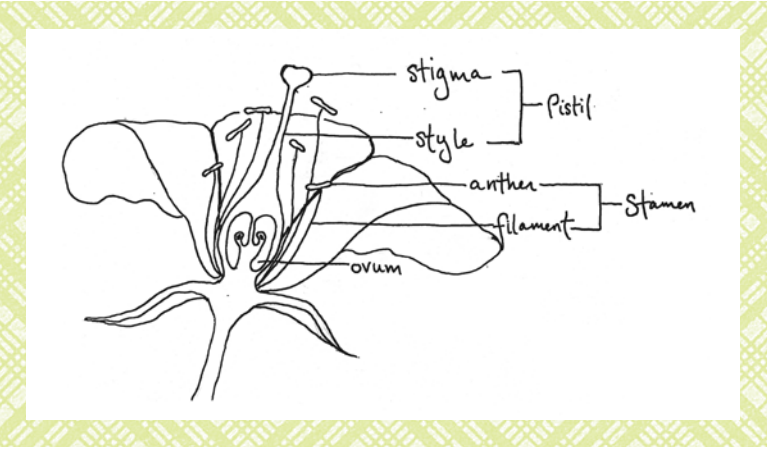
- **roots:** anchor and support the plant, take in water and nutrients, and store food; some can produce new plants
- **stems:** support leaves to get sunlight, transfer water and nutrients; some store liquid and food or can produce new plants
- **leaves:** use sunlight and chlorophyll to convert carbon dioxide and water into sugar for food, give off water to regulate temperature, and give off carbon dioxide; some can produce new plants
- **fruits:** protect and help disperse seeds
- **seeds:** produce new plants and provide food for young plants



Make sure students understand that plants come in many different shapes and types, and that the diagram only represents one example.

Next, using a diagram of a basic flower, have students identify reproductive parts and discuss their function:

- **stamen:** male part of a flower, including filament and anther, that produces pollen
- **pistil:** female part of flower, including style and stigma, that contains the ovules
- **ovules:** potential seeds of the flower found in the pistil



Working individually or in small groups, have students look at examples from the garden. Identify the different plant parts of each flower and note how they differ from one plant to the next. Discuss why these differences might be important.

Describe the process of pollination, explaining that pollen from one flower lands on the pistil of another flower and goes down into the ovary to create seeds.

Have students brainstorm ways that pollen may travel, such as with the help of wind, insects, animals, and water. Discuss how plants and their pollinators have adapted to one another.

Then tour the garden to look at flowers and discuss the adaptations each has made in order to encourage pollination. Talk about color, shape, and fragrance. Ask: *What kind of pollinators does this flower attract and how do you know? How does this flower advertise itself or make itself more appealing to pollinators? Does it make itself easy or difficult to pollinate?* Try to find examples of at least three different ways that plants are pollinated, including pollination by wind.

Seventh Grade: Bee Lesson

Students will understand the difference between native bees and honeybees and the important role both play in pollination.

OBJECTIVES

Students will:

- learn the difference between native bees and honeybees
- identify the three main interests of bees
- understand that bees sting only as a last resort
- experience catching a bee and observe the difference between male and female bees

MATERIALS

- nets
- collection jars

PROCEDURE

This lesson can be introduced with the staggering fact that over 35 percent of our food crops require pollination. If this doesn't grab students' attention, a short list of a few of their favorites will: strawberries, peaches, kiwis, apples, watermelon, figs, pomegranate, coconut, cucumbers, pumpkins, carrots, sesame, and vanilla. Since bees are a major pollinator and one that we see a lot of in the garden, we have good reason to know and love the bee.

Native bees vs. honeybees After the framework and goals of the bee lesson have been laid out, identify important distinctions between native bees and honeybees and point out that you will be talking mostly about native bees in this lesson.

- Honeybees live in hives, in a group, while almost all native bees are solitary and nest in the ground. Honeybees are from Europe. You may wish to define *native* to explain how native bees are adapted to your particular climate and ecosystem.
- Research some local bee statistics to give students a sense of the bee population. We tell students that there are 85 species of bees in Berkeley, 1,600 in California, and somewhere between 20,000 and 40,000 in the world.

The interests of bees Explain to students that bees have three interests: pollen, nectar, and sex. Use this information to reassure them that bees are not really inclined to bother or sting people.

- Ask students if they have ever been stung and have a few students share their stories. Point out situations in which the bees were threatened by being swatted or stepped on or where the "bees" in question were actually wasps. If the insect was flying around a soda can or other food, for example, it was a wasp and not a bee.
- Point out that wasps are carnivorous and, unlike bees, are attracted to your lunch when you are picnicking.

- Remind students that bees are only interested in nectar or pollen; they don't eat anything else.
- A bee's first reaction when it is scared is to fly away, its second is to buzz, and its last resort is to sting.
- Only female bees can sting. A bee's stinger is also its ovuduct, from which eggs are released. Therefore, male bees don't have stingers. Male bees are mainly useful for reproduction; they don't pollinate, either.
- Female bees have fuzzy legs and bellies to collect pollen. They collect the pollen and nectar to feed themselves and their young; pollination happens by accident.

Fun Bee FAQs

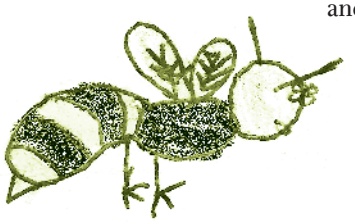
What is honey?
Honey is nectar that honeybees have swallowed and then regurgitated in the hive. Bees flap their wings on the regurgitated liquid, causing evaporation and creating honey.

How long do bees live?
Queen honeybees can live from 2–5 years, a worker (female) lives from 1–4 months, and a drone (male) lives for 40–50 days.

Where do native bees lay eggs?
They make nests in the ground in which they lay eggs. Then they seal their nests. New bees emerge from the ground after they hatch. Native bees don't live in these holes, they only lay their eggs there.

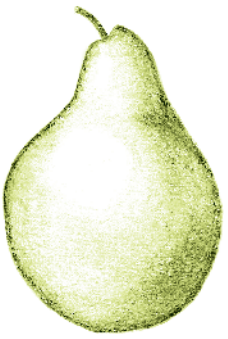
How fast can bees fly?
A honeybee can fly about 15 miles per hour.

Observing bees Demonstrate the correct way to catch a bee with a net and without damaging a plant. This involves a gentle but quick swipe of the net over a plant. Show students that bees fly upwards, so letting them go is as simple as holding the net open to the sky. Then provide nets for students and let them walk through the garden in small groups, looking for bees. Once they have caught one, examine it to see if you can tell what kind it is and if it is male or female. Point out that if a bee is covered with pollen, it is definitely female. Students can feel both male and female bees buzz through the net. If you are sure a bee is male, allow students to hold it.



Thank you for teaching me how to pick corn, edge a bed, make apple cider, and how to cultivate. I have learned many things from you and hope to learn more in February.

—Gilo



Appendix

Tool Shed Contents

hand-cultivation tools

rakes (T and fan)

garden forks

pitchforks

shovels (flat, round, snow)

spades (flat, round)

hoes

trowels

sturdy wheelbarrows

brooms

harvesting knives

hand shears

loppers

machetes

sledgehammers

pickaxes

sprinklers

hoses

watering cans

watering wands

baskets (for eggs)

harvesting crates (for harvesting and sifting)

buckets

thermometers (for compost)

saws (pruning, bamboo, grass, carpentry)

basic carpentry/plumbing tools (hammers, pliers, wrenches, screwdrivers)

basic carpentry/plumbing hardware (nails, screws, nuts, bolts, tape, staples, replacement fittings, valves, heads)

wire

twine and rope

wooden stakes

organic soil amendments (rock phosphate, kelp meal, gypsum, oyster shell)

bamboo (for structures, trellising, fencing, and stakes)

sunscreen

rubber pads (for seating on wet days)

ponchos, rain jackets

rubber boots

gloves

screens (for winnowing amaranth and other grains)

bowls (for seed-saving and winnowing)

linseed oil (to be added to sand for cleaning tools)

Liquid Fence (deer repellent)

backpack sprayer (for foliar feeding)

rubbing alcohol (for cleaning pruning tools)

mower

weed-whacker

rototiller

gasoline

ladders (including a tri-pod orchard ladder for harvesting/pruning fruit trees)

Closing Circle Activities

GARDEN JEOPARDY

Rather than engage with a closing circle question, we might play a garden-related game or taste something fresh from the garden and then reflect on it. Below is a description of one of our favorite garden games.

We have built a Jeopardy board from a thin slab of wood, five hooks to hang the categories on, and 25 sleeves from library books to hold the question cards. The sleeves, available at stationary stores, are each labeled with point values (from 5 to 25). We choose categories and questions to fit various themes and try to include both easier and more challenging questions. Some of our themes include *Plant Parts*, *The Winter Garden*, and *Garchin* (a mixture of "garden" and "kitchen").

When it's time to play, we break the class into two teams and give each student the opportunity to choose a question for his or her team. Students must confer with their groups as they answer questions; if a group answers incorrectly, the other team gets a chance at their question. To keep the game close, we throw in Daily Doubles that give losing teams the chance to catch up quickly. In no time, the students are fully engrossed in the game, whispering with their teammates and cheering when their answers are correct.

Listed below are two classic Jeopardy themes and a few questions from each category. The possibilities are endless and it is a fabulously fun way to reinforce garden lessons.

PLANT PARTS FOR THE SIXTH GRADE

We play this version of Jeopardy following the sixth graders' first time out to the garden. While some of it is very basic, it helps us get a sense of the class' working knowledge.

Fruits

15. Fuzzy on the outside and sweet on the inside, I grow on a vine (*kiwi*).

25. Lots of people think I am from Italy, but my true home is Mexico (*tomato*).

Seeds

15. Pinto, black, and lima are a few of my names; you can't make chili without me (*beans*).

25. I can be sweet, popped, or ground into flour; you might not recognize me in a tortilla (*corn*).

Flowers

20. Some people think I look like little trees, others like to eat me with melted cheddar cheese (*broccoli*).

25. You eat me petal by petal, but the best part of me is my heart (*artichoke*).

Leaves

15. I am a popular ingredient in soul food. Many people like to cook my green leaves with pork (*collard greens*).
20. You use me in coleslaw and sauerkraut. I can be green, red or purple (*cabbage*).

Stems and Roots

10. I am a deep red color that will stain your fingers. My name is what your heart does (*beet*).
25. I make a delicious pie with strawberries, but alone I am sour. Eat only my stem, because my leaves are poisonous (*rhubarb*).

FALL GARDEN JEOPARDY FOR THE EIGHTH GRADE

We play this version of Jeopardy with the eighth graders after they have participated in a scavenger hunt in the garden and done a tomato tasting. At the same time they are learning about food preservation in the kitchen with tomatoes and basil.

Tomatoes

5. Name three common culinary uses of tomatoes (*pasta sauce, ketchup, salsa, salad, pizza sauce, etc.*).
25. I am a powerful antioxidant found in tomatoes (*lycopene*).

Flavor

5. Originally grown in ancient Egypt, I am famous for making a delicious soup with potatoes (*leeks*).
20. Loaded with vitamins and native to tropical America, I am a crucial ingredient in hot salsa (*hot pepper*).

Food Preservation

5. Of the following, I am the only crop that will last into winter without special preservation: tomatoes, zucchini, pumpkins, cucumbers (*pumpkins*).
10. All of the following are common food preservation techniques, except one: canning, freezing, baking, pickling, cheesemaking (*baking*).

Fall Garden

5. I am both a flower and a grain. I am in the garden now, huge and red (*amaranth*).
20. We are the three main crops of some Native Americans. We are inter-planted in the garden. Bonus five points if you can give our title as well (*corn, beans, squash/Three Sisters*).

Miscellaneous

5–25. This category includes a wide range of questions from pop culture, current events, and other random garden questions, e.g., *What is one theory about why honeybees have been dying across the U.S.?*

Potting Soil Mixes

The first step in propagating our greenhouse plants is using various recipes to create the best soil mix for a particular plant or seed. We make our different mixes using both commercially purchased ingredients and those gathered directly from the garden. Since we often start our vegetable seeds in seedling cell flats, we have a special soil mix just for those. Here are our basic soil mix recipes:

SEEDLING FLAT MIX

10 gallons peat moss

7 gallons vermiculite

3 gallons sifted homemade compost

1 gallon perlite

1 cup each kelp and gypsum

BASIC SEED-STARTER MIX

1/2 wheelbarrow coco peat

1/2 wheelbarrow organic potting soil

2 cups vermiculite

PRICK-OUT MIX (FOR POTTING UP YOUNG PERENNIALS BEFORE THEY GO TO THE GARDEN)

1/2 wheelbarrow organic potting soil

1/4 wheelbarrow sifted homemade compost

10 gallons peat moss

1 gallon perlite

2 gallons of vermiculite

1 cup each oyster shell and kelp

Plants for Sale

Our plant sale inventory differs slightly from year to year, depending on which plants we propagate and how the seedlings fare. There is, however, always a core of plant varieties that people can expect to find for sale. Here is a list of the plants we most commonly sell:

Culinary Herbs

Annual

- basil
- parsley
- chervil
- coriander
- dill
- shiso

Perennial

- rosemary
- marjoram
- chives
- sage
- oregano
- thyme
- winter savory

Tea

- lemongrass
- lemon verbena
- black mint
- spearmint
- chamomile
- anise hyssop
- lemon balm

Flowers

Annual

- sunflower
- cosmos
- zinnia
- cleome
- strawflower
- sweet pea
- salpiglossis
- snapdragon
- nigella
- statice

Biennial

- sweet William
- digitalis
- campanula

Perennial

- lavender
- salvias
- rose geranium
- lion's tail
- phlomis
- columbine
- dahlia
- iris
- white sage
- yarrow

Fruit

- golden and red raspberry
- strawberry
- currant
- fig

Vegetables

Annual

- cucumber
- winter squash
- summer squash
- melon
- rainbow chard
- lettuce
- kale
- collard
- garlic
- leek
- bunching onions
- pepper
- eggplant
- tomatillo
- cape gooseberry
- tomato

Perennial

- artichoke
- rhubarb

What's on Our Shelves

There are many useful resource books available on gardening and planning curriculum for school gardens. This is a partial list of the publications that we refer to throughout the year. These books were selected to represent what we think will build a good reference library foundation to support any garden project you or your students may want to pursue.

Ashworth, Suzanne. *Seed to Seed: Seed Saving Techniques for the Vegetable Gardner.* Decorah, IA: Seed Saver Publications, 1991.

Bradley, Fern Marshall and Barbara W. Ellis. *Rodale's All-New Encyclopedia of Organic Gardening : The Indispensable Resource for Every Gardener*. Emmaus, PA: Rodale Press, 1992.

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Daar, Sheila Hort, William Olkowski and Helga Olkowski. *The Gardener's Guide to Common-Sense Pest Control*. London: The Taunton Press Inc, 1996.

Dardick, Pam and Pam Pierce. *Golden Gate Gardening: The Complete Guide to Year-Round Food Gardening in the San Francisco Bay Area & Coastal California*. Seattle, WA: Sasquatch Books, 1998.

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Parrella, Deborah and Shelburne Farms. *Project Seasons: Hands-on Activities for Discovering the Wonders of the World*. Shelburne, VT: Shelburne Farms, 1995.

Pfieffer, Ehrenfried. *Weeds and What They Tell*. Kimberton, PA: Bio-dynamic Farming and Gardening Association, 1970.

A Word of Gratitude

We are grateful to the many organizations and individuals who inspired and supported this work, including: The Compton Foundation for supporting the Edible Schoolyard and the growth of our affiliate program; The Forrest & Frances Lattner Foundation, one of our longest term supporters, for contributing to the Edible Schoolyard since 2001; the Center for Ecoliteracy, for providing our first grant in 1996 to get the garden started; The William Zimmerman Foundation, for their support of this work and our AmeriCorps members; and The Rosalinde and Arthur Gilbert Foundation, for their support of our suite of publications. We especially thank our garden staff, past and present, without whom this work would not be possible: Kyle Cornforth, Susie Walsh Daloz, Benjamin Eichorn, Marsha Guerrero, Wendy Johnson, Geoff Palla, and Kelsey Siegel; and our AmeriCorps members Vera Fabian and Rebecca Bloomfield. The success of our program depends on the committed teachers and administrators at Martin Luther King Jr. Middle School; our thanks to them for over a decade of dedicated service.

And to the children who delight and teach us each day, we thank you for making the program what it is.

About the Chez Panisse Foundation

Founded by Alice Waters in 1996, the Chez Panisse Foundation develops and supports educational programs that use food traditions to educate, nurture, and empower youth. The Foundation envisions a curriculum that, integrated with the school lunch service, gives children the knowledge and values to build a humane and sustainable future. The Edible Schoolyard is a program of the Chez Panisse Foundation.

For more information, and a full list of our publications, please visit www.chezpanissefoundation.org

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CHEZ PANISSE FOUNDATION

Cultivating a New Generation