DID YOU KNOW?
Field bindweed is used as a medicine. It is also a weed that can be very difficult to destroy. Its vines can wrap around and choke many crop plants and flowers. Its seeds can still sprout and grow after being buried in the soil for 50 years!

A piece of its root only 5 cm (2 in) long can grow into a new plant.

THE FIELD BINDWEED PLANT
Field bindweed is a perennial. Its long, slender stems trail on the ground or wrap around other plants. The vines grow 0.3 to 1.8 meters (about 1-6 ft) long. The flowers are white to pink in color. The leaves are shaped like arrowheads. The seeds grow in pods about 5 mm (0.2 in) long. On average, one plant produces about 550 seeds. The plant has a thick taproot, which can grow to a depth of 7 meters (about 25 feet). Many side roots grow out from the taproot.

ORIGINS
Field bindweed is native to Europe and Asia. People accidentally brought it to other parts of the world. Its seeds were mixed in with grains that were being shipped.

CLASSIFYING FIELD BINDWEED

FAMILY
Convolvulaceae
(morning glory family)
The family is commonly called the morning glory family because most of the flowers open in the morning, and close again in the afternoon.

GENUS
Convolvulus
In Latin, this means "to wrap around."
The stems of this family run along the ground and wrap around plants and other objects.

SPECIES
Arvensis
"Arvensis" is Latin for "of the field." Field bindweed grows as a weed in orchards, and in fields of corn, small grains, sugar beets, and grapes.

FRIEND . . .
For many years, people have used field bindweed as a medicine. Native Americans have used it to treat spider bites, fevers, and wounds. Europeans have used it as a laxative.

. . . OR FOE?
Field bindweed can quickly choke out other plants. The roots take up a lot of water from the soil, so crops and flowers growing near field bindweed cannot get enough water.

I’ll keep cutting down the shoots. That way the food stored in the roots will be used up and the plant will eventually die. I’ll also put a heavy layer of straw on the soil.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
GARDEN HIKE

WHAT IS THE GARDEN HIKE?
The Garden Hike is a “mobile interview.” You will interview gardeners as you walk through the garden.

WHAT TO DO...BEFORE GOING TO THE GARDEN

Background Research
✔ Read about community gardens on the Garden Mosaics website. Also go to the Community Garden Inventory Database on the Garden Mosaics website and read about some other gardens.
✔ Discuss with your friends why you think community gardens are important.

Generate Questions
✔ Brainstorm a list of questions that you think are important to ask gardeners.
✔ Look at the online Community Garden Inventory Form. Make sure to include the questions you need answered to fill in the form on your list.

WHAT WILL YOU NEED?
✔ copy of Community Garden Inventory Form
✔ 3x5 inch cards or paper to write your questions on
✔ pencils
✔ clipboards
✔ cameras (optional)

Practice Interviewing
✔ Review interviewing skills on the website and practice interviewing with your friends.
✔ Decide what everyone is going to do during the interview in the garden.

WHAT WILL YOU NEED?

During the Garden Hike, you will ask questions about things that interest you in the garden.

WHAT WILL YOU NEED?

Don’t forget drinks and snacks!

WHAT TO DO...BEFORE GOING TO THE GARDEN

Background Research

What do we want to learn about?

Why do you think the community garden is important?

✔ Talk to your group leader or read the Garden Mosaics Program Manual about gardener permission forms.

Generate Questions

Who will introduce us to the gardeners?

Who will tell the gardeners what we want to do?

We could write our questions on 3x5 cards so each person has their own questions to ask.

Practice Interviewing

We have to make sure all the questions from the Community Garden Inventory Form are answered.

I’ll take notes, if you like.

May I take the photos?

How should we end the interview?

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
WHAT TO DO...AT THE GARDEN

✔ Introduce yourselves and the activity to the gardeners.
✔ Tell them about the Garden Hike.
✔ Begin at one end of the garden and walk through the garden with the gardeners. As you walk, ask questions from your checklist.
✔ Also ask questions about what you see and about things that seem to be important to the gardeners.
✔ Don’t be afraid to ask questions about things you don’t understand or want to learn more about. The gardeners will be excited to know that you are interested in what they do!
✔ Observe things, take photos, and jot down notes about what you see.
✔ Before you leave, make sure you have answered all of the questions on your checklist and on the Community Garden Inventory Form.

WHAT TO DO...AFTER YOU LEAVE THE GARDEN

Review findings
✔ Discuss the visit to the community garden. Talk about what you learned about the community garden.
What did we learn about the people and plants in the garden?
What did you not understand?

Share online
✔ Write down the answer to each question on the Community Garden Inventory Form. Then enter your data onto the online form.

What might you want to learn more about?

Learn more
✔ Check out the online Science Pages. Click on any pages that might help you to understand more about what you learned.

Why might these gardens be important to neighborhoods?

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
Many different kinds of insects visit a garden. Some can be harmful, but most are helpful.

**How can you tell an insect from other animals?**

All insects have 3 pairs of legs and 3 body parts (head, thorax, and abdomen). A hard outer covering protects the insect’s body. This covering is called an exoskeleton.

Spiders, sow bugs, and millipedes are not insects. Can you see some differences?

**How does an insect grow?**

An insect begins life as an egg and changes shape as it grows. This is called metamorphosis.

In insects such as butterflies, moths, and beetles, the egg hatches into a larva, which becomes a pupa. Then a mature adult emerges from the pupa.

In other insects, such as grasshoppers and aphids, the young insect (nymph) looks like the parent when it hatches. It sheds its exoskeleton several times as it grows.

Insects are cold-blooded animals, so the rate at which they grow depends on the temperature. Cooler temperatures slow down their growth, and warmer temperatures speed up their growth.

Some insects have only one generation per year. Others have up to 12 generations per year, depending upon the temperature.

**What does an insect eat?**

Lots of insects come to a garden to eat. Some come to suck nectar and eat pollen. Others chew on leaves, stems, and fruits. Some are predators and prey on insects and other small creatures.

Mouthparts of most insects are specialized for a particular kind of food. Some mouthparts are adapted for biting or chewing. Others are adapted for sucking up blood, nectar, or other fluids.

A chewing insect has jaws called mandibles that move together when the insect is eating.

Both the adults and the larvae of ladybug beetles have chewing mouthparts for feeding on aphids.

The proboscis of a moth or butterfly curls up when the insect is not feeding.

**The proboscis of a moth or butterfly is used to suck nectar.**

A sucking insect, such as an aphid or bug, has needle-like stylets inside its beak that pierce stems.

**The proboscis of an aphid or bug is used to suck up plant juices.**

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
WATER CYCLE IN THE GARDEN

Water falls on the soil when it rains, or when the garden is watered. What happens to this water?

Some water flows away over the top of the soil. This is called runoff.

Some water seeps into the soil, filling spaces between soil particles. Water seeps through sandy soils much faster than through clay soils or compacted soils.

Water seeps through the soil beyond the root zone.

Water soaks into the soil down to the roots of plants. Water taken up by roots moves through the stems to the leaves.

Some water evaporates directly from the soil surface, especially in hot, dry climates. This causes water from lower layers in the soil to be pulled to the surface. As water is pulled up through the soil, it may carry dissolved salts. When the water evaporates, salt deposits are sometimes left on the surface of the soil.

Water in clouds eventually forms clouds.

Water that is evaporated or transpired eventually forms clouds.

WATER IN THE GARDEN Science Page

TOO MUCH OR TOO LITTLE WATER

Plants need both water and air in the soil. Ideally, half the volume of soil should be pore spaces. About half of each pore space should be filled with water, and about half with air. When soil does not have the right balance of air and water, plants may suffer from stress.

Neither air nor water can enter compacted soil.

Watering the soil too much will fill all the pore spaces with water. Without air, plant roots suffocate and die.

If soil does not get enough water, the roots cannot take up water to replace what is lost through transpiration.

Plants are most affected by water stress right after they are planted or transplanted, and while fruits are forming. Root crops, such as beets and carrots, are vulnerable to water stress while the roots are growing.

These tomatoes have blossom end rot because they did not get enough water when they were forming fruits.

Our garden did not get enough water, so this carrot has a hard core. The lettuce is bitter, and the cucumbers are small and misshapen.
GARDEN MOSAICS

WHAT IS A GARDENER STORY?
A Gardener Story is an “oral history” about a gardener.

You will interview the gardener, and create a story about what he grows and how he got interested in gardening.

I wonder what plants he grows.

How does he use the plants?

Does he have any planting tips that are good for the environment?

How does he grow the plants?

Are there any other questions you think are important?

Every gardener has some interesting way to plant vegetables or flowers.

Often these practices are carried on from parents and grandparents. Because many gardeners are elderly, their unique practices are in danger of being lost if they are not recorded.

WHY THE GARDENER STORY?

WHAT WILL YOU NEED?

✔ copy of Gardener Story Form
✔ copy of the Gardener Story Guiding Questions
✔ 3x5 inch cards or paper
✔ pencils
✔ clipboards
✔ cameras and film
✔ drinks and snacks

If you have a tape recorder, you could tape your interview.

WHAT TO DO...BEFORE GOING TO THE GARDEN

Background Research
✔ Read some Gardener Stories on the Garden Mosaics website. What makes a good Gardener Story?
✔ Talk to your group leader before you start, or read the Garden Mosaics Program Manual about gardener permission forms.

Who will introduce us to the gardener, and explain what we want to do?

Who would like to take notes?

Who will take photos?

We’ve got to remember to thank the gardener for letting us interview him.

Generate Questions
✔ Brainstorm a list of questions that you think are important to ask the gardener.
✔ Look at the online Gardener Story Guiding Questions. Make sure to include the questions on your list that you need answered to complete the Gardener Story. Write down your questions on 3x5 cards or paper to take to the garden.

Practice Interviewing
✔ Review the interviewing skills on the website. Practice interviewing with your friends.
✔ Decide what everyone is going to do at the interview.

Does any one have a tape recorder to tape the interview?

Maybe someone should make sure all our questions are answered.

GARDEN MOSAICS
(www.gardenmosaics.org)

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
WHAT TO DO...AT THE GARDEN

Make introductions
✓ Introduce yourselves to the gardener.
✓ Explain that you would like to hear his story.

Ask questions
✓ Ask questions from your list.
✓ Also ask questions about things that seem to be important to the gardener. Your Gardener Story will be more interesting if you can capture things that the gardener is excited about.
✓ Don’t be afraid to ask questions about things you don’t understand or want to learn more about.

Collect information
✓ Before the interview ends, make sure you have answered all of the questions on your list and on the Gardener Story Guiding Questions.
✓ If it’s OK with the gardener, take photos to illustrate the information.
✓ Thank the gardener and share your drinks and snacks.

I’m growing the same vegetables my family grew for generations in the Dominican Republic.

WHAT TO DO...AFTER YOU LEAVE THE GARDEN

Review findings
✓ Discuss the interview.
✓ Write down the answer to each question on the Gardener Story Guiding Questions Form.
✓ Discuss what information and photos you want to include in the Gardener Story that you submit online.

Share online
✓ Decide who will write the story.
✓ Write up the story and submit it online with your photos to the Garden Mosaics website. If you taped the story, you can also create a slide show with audio quotes from the gardener.

Learn more
✓ Check out the online Science Pages. Click on any pages that might help you to understand more about what you learned.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
From the late 1800’s through the 1940’s, the main purpose of community gardens in the U.S. was to grow food.

**LATE 1800’S POTATO PATCH MOVEMENT**
Cities were growing rapidly. Many people were out of work. Across the country, cities began offering garden plots to poor people so they could grow their own food.

**EARLY 1900’S LIBERTY GARDENS**
The U.S. government recruited people to grow Liberty Gardens during World War I. Growing your own food was a way that every American could contribute to the war effort.

**1930’S RELIEF GARDENS**
The Great Depression began. Relief Gardens were promoted to improve people’s spirits, and to provide food and work.

**1940’S VICTORY GARDENS**
When the U.S. entered World War II, the government launched a Victory Garden campaign. By 1944, 20 million Victory Gardens produced 44% of the fresh vegetables in the U.S.!

Many vegetables were stored for winter.

From the late 1960’s to the present day, community gardens have served many different purposes.

**IMPROVING NEIGHBORHOODS**
People in cities turn vacant lots into beautiful gardens. Gardens provide a quiet place to sit in the shade, or to meet and talk with friends. Children play in gardens and older people get exercise while gardening.

**EXPRESSING CULTURAL TRADITIONS**
Many immigrants and Americans from all ethnic backgrounds bring plants and cultural traditions to the gardens, creating multi-cultural garden mosaics.

A casita in a Puerto Rican community garden

**GROWING FOOD**
Many people grow their own food because they like the taste of fresh vegetables. Others are concerned about rising food prices or about chemicals in foods. Some simply want to teach their children where their food comes from.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
INTERPLANTING FOR PEST CONTROL Science Page

Interplanting is growing one kind of plant alongside a different kind of plant. Some plants attract helpful insects. Other plants confuse or repel insect pests. When these plants are interplanted, they can help protect your crops from insect pests.

INTERPLANT TO ATTRACT AND SHELTER HELPFUL INSECTS

Most insects that eat insect pests also eat nectar and pollen from flowers. They have short mouth parts for chewing, rather than long tubes for sipping, so they need flowers with easy-to-reach nectar and pollen.

Flowers in the Aster family, such as marigolds and sunflowers, have wide, open flowers, so they are an excellent choice for attracting helpful insects.

Herbs like parsley, dill, and coriander have flat-topped clusters of small flowers. They also have strong fragrances that attract beneficial insects.

HOW TO CONFUSE OR REPEL INSECT PESTS

Many insect pests attack only certain kinds of crops. They spread more quickly if a large area is planted with only the kind of crop they eat. If you interplant crops, it’s not as easy for insect pests to spread and cause damage.

Many gardeners interplant with herbs and flowers that have strong scents, which may confuse or repel insect pests looking for crops to feed on. Here are some combinations that many gardeners use.

- Basil among tomatoes
- Marigolds among eggplants
- Nasturtiums among squash
- Garlic among cabbage
- Cabbage white butterfly
- Cabbage white butterfly
- A large cabbage patch presents a big target for cabbage white butterflies flying by. Also, lots of cabbages in one spot make it easier for the cabbage white butterflies to move from one cabbage to the next. The same number of cabbages scattered among other crops over a larger area is a much less obvious target.

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DID YOU KNOW?
In 9th century England, the yearly calendar was divided into four quarters. August 1st, called Lammas Quarter, marked the start of one of the quarter periods. On that day people had a festival to celebrate harvesting the first wheat of the season. They often ate a leafy green at that time of year, which they called lambsquarters!

CLASSIFYING COMMON LAMBSQUARTERS

FAMILY
Chenopodiaceae

Members of this family are grown as root and leaf vegetables, flowers, herbs, and grains.

GENUS
Chenopodium
In Greek, this means “goose foot.” Some members of this family have leaves shaped like a goose foot.

SPECIES
album
In Latin, “album” means white. The flowers and undersides of leaves are whitish.

THE COMMON LAMBSQUARTERS PLANT
Lambsquarters is an annual. It grows from about 1 to 2 meters (3-6 ft) high in one growing season.

Tiny green flowers are at the tips of branches. They have no petals.

Leaves are shaped sort of like triangles.

The underside of leaves are covered with a white powder.

10 cm (4 in)

A FRIEND...
Young lambsquarters can be eaten raw or cooked like spinach. It contains more iron, protein, vitamin B2, and vitamin C than either spinach or cabbage. Seeds can be eaten raw. They can also be dried and ground, and then used in hot cereals or baked goods.

In winter, song birds eat the tiny lambsquarters’ seeds.

...OR FOE?
One lambsquarters plant can produce 75,000 seeds. The seeds can sprout and grow in almost any soil. Lambsquarters can outgrow most crop plants, and quickly take over any bare soil.

Lambsquarters grows very quickly, but at least it’s easy to pull up.
Mulch is a covering that is placed on top of bare soil. Some materials that are used for mulching include:

- hay, straw, or wood chips
- compost
- black plastic
- yard wastes, such as grass clippings and leaves

**WHAT ARE THE BENEFITS OF MULCHING?**

* Mulch protects the soil.
  When it rains on bare soil, water washes away a lot of soil with it. The soil also gets compacted and crusty when hit by hard rains. Then neither air nor water can enter the soil and get down to the roots of plants.
  Rainwater trickles through a mulch, and slowly seeps into the soil rather than washing away. The soil stays loose, and the soil surface does not get crusty. Mulch keeps muddy rainwater from splashing crops, so they are cleaner and less likely to get diseases.

* Mulch prevents loss of water from the soil surface.
  Under a hot sun, bare soil gets very warm. A lot of water evaporates from the soil surface. That means a lot more watering is needed.
  Mulch shades the soil, keeping it cooler. Less water evaporates from the soil surface.

* Mulch prevents weeds from growing.
  Weeds can sprout and grow on bare soil. That means a lot of weeding is needed.
  Mulch shades out weeds, which compete with crops for nutrients, water, and light. The few weeds that grow are easy to pull out.

* Mulch improves the soil.
  Over time, organic mulch materials decay, adding nutrients and humus to the soil.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
NEIGHBORHOOD EXPLORATION

WHAT IS A NEIGHBORHOOD EXPLORATION?
A Neighborhood Exploration allows you to discover your neighborhood using aerial photographs, maps, and a walk.

WHY THE NEIGHBORHOOD EXPLORATION?
You can learn what is in the neighborhood and what is missing. Then you can share what you learn with others, and even develop a plan for improving the neighborhood.

WHAT DO YOU NEED?
✔ aerial photograph (airphoto)
✔ map
✔ paper
✔ pencils
✔ clipboards
✔ cameras and film
✔ poster board, glue, and other supplies for making collage
✔ drinks and snacks

WHAT TO DO...BEFORE THE WALK
Airphoto and map
✔ Look at the airphoto and map. If you need help recognizing things, go to the “Aerial Photographs” and “Topographic Maps” Science Pages.
✔ Mark on the airphoto or map, or list on a separate piece of paper, places where you would like to take photos on your neighborhood walk.

Plan walk
✔ Decide how you are going to walk around the neighborhood.

Who’s taking photos?
Let’s work out a route.

What groups will go where?
When are we going to go on the walk?

WHAT DO YOU NEED?
✔ aerial photograph (airphoto)
✔ map
✔ paper
✔ pencils
✔ clipboards
✔ cameras and film
✔ poster board, glue, and other supplies for making collage
✔ drinks and snacks

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
WHAT TO DO...DURING THE WALK

Walk around the neighborhood
✔ Walk to the sites marked on your maps and airphotos, or on your list.

Take photos
✔ Take photos of places where people can get fresh food, enjoy nature, relax and talk to friends, get exercise, and see concerts.
✔ Also take photos of vacant lots and other places that could become gardens or small parks, or where trees could be planted.
✔ Take photos of places that interest you!

Make notes
✔ Jot down notes about where you take the photos.

WHAT TO DO...AFTER THE WALK

Review findings
✔ Compare what you learned from the airphoto and map with what you saw on the walk.
✔ Talk about what you found in the neighborhood.

Did we figure out places correctly on the airphoto and map?

How did the neighborhood differ from what we saw on the airphoto and map?

What new features did we find on the walk?

What kind of things can we do in our neighborhood?
Are there places in the neighborhood where trees could be planted or that could be made into new gardens or small parks?

What things are missing from the neighborhood?

How might we improve the neighborhood?

Make collage
✔ Make a neighborhood collage with airphotos, maps, and the photos you took. Add comments about what you saw. Be creative!

We can use our collage for sharing what we’ve learned with other people.

Learn more
✔ Check out the online Science Pages. Click on any pages that might help you to understand more about what you learned.
**PAPALO Science Page**

**DID YOU KNOW?**
In Mexico, papalo branches are kept in water on café tables, so diners can tear up fresh leaves and add them to beans or tortillas. Because cooking destroys the flavor, papalo leaves are only used fresh or added to meals at the last moment.

**CLASSIFYING PAPALO**
Papalo is a member of the Asteraceae, or Compositae, family. The composites make up the largest family of flowering plants, with about 20,000 species, including sunflowers and daisies.

<table>
<thead>
<tr>
<th>FAMILY</th>
<th>GENUS</th>
<th>SPECIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asteraceae</td>
<td>Porophyllum</td>
<td>ruderale</td>
</tr>
<tr>
<td>(or Compositae)</td>
<td>In Latin, this means &quot;leaves with pores.&quot;</td>
<td>means &quot;growing in rubble or waste places.&quot;</td>
</tr>
</tbody>
</table>

The flower head of a plant in this family is commonly mistaken for a single flower, but it really is many flowers grouped together. Pores are tiny openings. You can see the pores on papalo leaves without a microscope. Oil comes out of the pores, which gives papalo leaves a strong scent and flavor. Papalo grows well on dry slopes, ravines, and roadsides. It has even been known to grow on nearly bare rock.

**ORIGINS**
Papalo is native to Mexico, Central and South America, growing as far north as Texas. Papalo is being introduced to gardeners in the U.S. as “a great new herb from Mexico.”

**GROWING AND HARVESTING PAPALO**
Papalo is easy to grow in sunny places where the soil is well-drained. You can use papalo instead of cilantro in cooking. Papalo has the advantage that it does not go to seed in the early summer, like cilantro does. Pick papalo leaves when young for a milder flavor. The flavor gets stronger the older the leaves are.

**USES**
Papalo leaves are used to flavor soups and stews, grilled meats, beans, salsa, and salads. The leaves also are used as a medicinal herb for many ailments, such as high blood pressure, upset stomach, and infections.

**THE PAPALO PLANT**
The flower looks like an unopened marigold bloom, and then it opens into a ball that looks like a dandelion flower. Papalo has egg-shaped leaves, which have a lovely, spicy, sharp scent and flavor. In the U.S., the plant grows up to 1 meter tall during one growing season. In warmer climates, the plant can grow over 2 meters high.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
**PEPPERS Science Page**

**DID YOU KNOW?**
When Christopher Columbus set out for the New World, he hoped to find black pepper, a spice that grew in Asia. Instead he found the Arawak Indians eating another plant that was spicy, but not related to black pepper. He called it “red pepper” because it had red pods.

**ORIGINS**
Peppers are native to South America. People there ate wild peppers nearly 10,000 years ago, and farmers began growing the plant over 7,000 years ago.

**THE PEPPER PLANT**
In temperate climates, pepper plants last only one growing season. In tropical areas, they are woody shrubs that grow from year to year.

**NUTRITIONAL VALUE OF PEPPERS**
Peppers are an excellent source of vitamins A and C. As green pods turn red, the vitamin content increases. One red bell pepper has...

- ... the same amount of vitamin A as 1/3 of a carrot.
- ... the same amount of vitamin C as 3 oranges.

**GROWING AND HARVESTING PEPPERS**
Peppers thrive in well-drained, fertile soil. They must have a constant supply of water in order to set fruit.

**USES**
Peppers are used raw in salads or in cooking. They can be used fresh or dried, whole or ground into spices. The capsaicin in hot peppers is also used in medicine.

**CLASSIFYING PEPPERS**

**FAMILY**
Solanaceae
The Latin name “solanum” means “nightshade.”

**GENUS**
Capsicum
This name comes from the Greek word “kapto” meaning to bite. Hot peppers have a taste that bites your mouth!

The heat in hot pepper is from capsaicin, a substance mostly found in the tip of the fruit, in the ribs, and in the seeds.

**SPECIES**
Three capsicum species are widely cultivated.

- Capsicum annuum
- Capsicum frutescens
- Capsicum chinense

**GARDEN MOSAICS**
(www.gardenmosaics.org)
Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
**DID YOU KNOW?**
One redroot pigweed plant can produce over 100,000 seeds! Some can live up to 40 years in the soil. Tiny seeds are inside the fruit.

The fruit grows from the flower.

**ORIGIN**
Redroot pigweed is native to tropical America. Today it can be found on every continent.

Native Americans of North America have traditionally used redroot pigweed as a vegetable and a grain crop.

**THE REDROOT PIGWEED PLANT**
Redroot pigweed is an annual. The plant can reach to 2 meters (6 1/2 ft) high in one growing season.

The black, shiny seeds sprout and grow in late spring and early summer when the soil becomes warm.

It flowers in late summer and fall.

Small green flowers are tightly packed in tall spikes at the top of the plant.

Some flowers are also in clusters along the stem.

The stems are reddish and hairy.

The taproot is red.

The leaves are diamond-shaped and rough.

Small plants that do not yet have flowers are used in salads or are cooked like spinach. The seeds can be roasted and ground to make flour. The whole seeds can be cooked to make cereal.

The seeds are food for many insects, birds, and mammals.
WHAT IS A RAISED BED?
A raised bed is a mound of soil in which gardeners plant their crops and flowers. Many raised beds are framed or enclosed. Frames help keep the soil in place during rainstorms and watering.

WHAT ARE THE BENEFITS OF A RAISED BED?
* Once the soil is prepared, you don’t have to walk on it again during the growing season.
  Make sure the beds are no more than two arm lengths wide, so that you can reach everywhere within the bed without stepping in it.
* If you have contaminated or poor soil, it’s easier to bring in good soil to create a raised bed than to amend the soil in the whole area. In soggy areas, the soil in raised beds will drain more quickly.
* The soil in raised beds warms up earlier in the spring and stays warm longer in the fall. This extends the growing season.
* It’s easier to tend the garden when it is raised above ground level, because you don’t have to do as much bending.

HOW DO YOU BUILD A RAISED BED?
1. Making a raised bed on a city lot
   Use string to mark off where the bed will be. Use a pickaxe to loosen up hard, compacted soil and rubble in the bed. This will help the bed drain, and will allow roots to grow deeper. Have good topsoil delivered to the site. Work some of the topsoil into the existing soil to a 15 cm depth. Build the frame around the bed, and fill it with soil.

2. Making a raised bed using existing soil
   Rake the soil from the walkways to the top of the bed. Make the soil mound about 15 cm high. To make the bed more permanent, build an edge with wood planks, or another material that will keep the soil in place.

3. Making a raised bed frame
   You can build the sides of a raised bed out of cinder blocks, stones, or landscape timbers. Do not use treated lumber or railroad ties. They contain poisons that you do not want in your garden soil. Hold the planks in place with stakes or steel rods or pipes. You can also use wood screws to fasten the corners together. Do not use nails, as they might split the wood.

4. Preparing soil
   Mix lots of compost or other organic matter into the soil in your raised bed. Flatten the top with a rake before planting. You can plant crops closer together than in a regular garden. You do not need space between rows of plants, because you walk outside the beds.
RUE Science Page

DID YOU KNOW?
The club on a deck of cards is a rue leaf.

ORIGINS
Rue is native to the Mediterranean region. Ancient Egyptians, Romans, and Greeks believed that rue could treat many illnesses. During the Middle Ages, Europeans believed it had magical powers.

THE RUE PLANT
Rue is a small evergreen shrub that is shaped like a mound. It grows up to 60 cm high.

GROWING RUE
Rue thrives in well-drained soil in full sun.

CLASSIFYING RUE

FAMILY
Rutaceae (Citrus family)
There are more than 1,600 species of shrubs and trees in this family. Most have strong scents.

GENUS
Ruta
In Latin, this means “bitter.”

SPECIES
graveolens
In Latin, this means “strong smelling.”

USES
Today, rue is mostly used as an ornamental plant in rock gardens and herb gardens. It has also been used as a medicine for earaches, an insect repellent, and an herb for flavoring foods. Some processed foods are flavored with rue. Some cosmetics and perfumes also contain rue.

Be careful if you grow rue in your garden. Some people get a rash when they touch it.

I’m going to transplant these little rue plants all around my garden.

GARDEN MOSAICS
(www.gardenmosaics.org)
Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
DID YOU KNOW?
Snap beans and dry beans come from the same species of plant. Different varieties are harvested at different stages of growth. Snap bean varieties are harvested when the pods are young and tender. Dry bean varieties are harvested when the bean pods are dry and the seeds are hard.

ORIGINS
Snap beans come from a plant that is native to Central and South America. People were growing beans in Peru over 7,500 years ago — before they were growing corn or making pottery.

CLASSIFYING BEANS
Snap beans, also called green or string beans, belong to the Legume family.

FAMILY
Fabaceae
(Legume family)

GENUS
Phaeasolus
In Latin this means "small boat."

SPECIES
vulgaris
means "common."

THE SNAP BEAN PLANT
There are two main types of snap beans - bush beans and pole beans.

GROWING AND HARVESTING SNAP BEANS
Snap beans are very easy to grow. Do not plant until all danger of frost has passed and the soil is warm. They like full sun and well-drained soil. Keep well-watered.

USES
Snap beans are used in stir fry, stews, and soups. You can also steam them and eat them right away, or add them to a salad.

USES
Snap beans are ready to pick when they are the width of a pencil and the pods snap when you break them.

Genius Mosaic is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
The soil is home for billions of living things. They are working all the time, helping to create healthy soil for growing plants.

**ANIMALS**
Animals, such as rabbits and moles, dig holes and help mix up the soil. Their tunnels let air reach plant roots, let water drain through soil, and provide spaces where plant roots can grow.

**SMALL CREATURES**
Small animals stir up the soil and make holes where air and water can enter the soil. They chew up dead plants into tiny pieces so fungi and bacteria can break them down more easily. They also feed on bacteria, fungi, and protozoa, and help release the nutrients in them for plants to use.

**BACTERIA**
One teaspoon of topsoil may contain 50 million one-celled bacteria! They help to break down dead plant and animal matter. In doing so, they release nutrients for use by other microbes, small animals, and plants.

Nitrogen-fixing bacteria can take nitrogen gas from the air, and convert it into a form that plants can use to grow. Some of these bacteria live in nodules on the roots of beans, peas, and other plants called “legumes.”

**FUNGI**
Fungi start the decay of fresh organic matter. They soften up plant matter, and make it easier for bacteria to join in the decay process.

**HELPING SOIL LIFE**
You can help provide soil life with food, water, and air. When their needs are met, soil organisms will grow and multiply, and keep your soil healthy.

Add organic matter to the soil, and use organic mulch on the surface. Turn over soil as little as possible and do not compact the soil.
SOIL pH Science Page

WHAT IS SOIL pH?
Some substances, like lemon juice, are acids. Acids have a sour taste. Other substances, like aspirin, are bases. Bases have a bitter taste. Substances that are neither acidic nor basic are said to be neutral.

The pH of a substance, such as soil, is a measure of how acidic or basic it is. The pH scale goes from 0 to 14. The halfway point, pH 7, is neutral. A pH value below 7 is acidic; a pH value above 7 is basic.

Each time you move one unit lower on the pH scale, acidity increases ten times. For example, a pH of 6 is ten times more acidic than a pH of 7.

WHY IS SOIL pH IMPORTANT?
Soil pH is important because it affects the health of plants. Before a nutrient can be used by plants, it must be dissolved in soil water. Most plant nutrients dissolve when the soil is slightly acidic. Many plants do well at a pH range of about 6 to 7.

How do you measure the pH of soil? Many liquid dyes change color when they come into contact with acids or bases. You can measure the pH of a soil by saturating the soil with dye for a few minutes, and observing the color of the liquid.

How do you change the pH of soil? You can add substances to soil to make them more or less acidic.

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
WHY TEST SOIL?
By testing the soil, you can determine how suitable your soil is for growing different types of plants. You can also find out if you need to add fertilizer, lime, or other soil amendments to help plants grow.

Some tests help you find out if your soil is polluted with toxic substances. High levels of lead and other heavy metals are a health risk, especially for small children.

Is this soil good for growing vegetables? Do I need to buy lime and fertilizer? Is there lead in the soil that will harm my family’s health?

TYPES OF TESTS AVAILABLE

A pH test measures the acidity of the soil. It tells you how much lime or sulfur should be added to make the soil suitable for growing plants.

A soil nutrient test measures the levels of phosphorus, potassium, and other plant nutrients in soil. It tells you how much fertilizer is needed to make up for the lack of certain nutrients in your soil.

I wonder why my plants are not growing well? I’ll get my soil tested to see if it’s lacking plant nutrients.

A soil texture test measures the amounts of sand, silt, and clay in your soil. You can also measure how fast water drains in soil using the soil percolation or “perc” test. The results suggest how to best use or improve the soil.

A salinity test tells you if your soil is too salty for plants to grow well.

No wonder my seeds won’t sprout! The salinity test shows that salt is a problem in this dry climate.

A heavy metal test shows how much lead and other heavy metals are in your soil. If toxic amounts are found, you will be given some safety tips.

Look! Old paint is chipping off! Before I grow any vegetables here, I’ll have to get this soil tested to see if it has high lead levels.

You can also send a soil sample to a lab to test for heavy metals, texture, salinity, and organic matter content. Get a soil sample box and information sheet, and follow the directions carefully. Fill in the soil information sheet, and send it with your soil sample to the lab.

The lab sent me the results of my soil test. Now I know what I have to do to improve my soil.

HOW TO TEST YOUR SOIL
Garden stores sell kits that you can use to measure the pH and nutrient levels of your soil. These kits will give you fairly accurate results. You can send a soil sample to a lab for more accurate measurements of pH and nutrient levels.

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SOIL TEXTURE Science Page

SOIL PARTICLES

Soil is made up of particles of rock that have broken down over time. These particles vary in size. They are classified into three sizes—sand, silt, and clay. Soil texture is a measure of how much sand, silt, and clay a soil contains.

Soil texture is important because it determines how fast water drains through a soil. It also determines how much water a soil can hold, and can be used by plants.

CLAY

Clay is less than 0.002 mm in diameter. Clay particles are extremely small, and can be seen only through an electron microscope.

Clay feels sticky when wet. It easily forms into a ball and a ribbon at least 5 cm long.

Water drains very slowly through clay soil. Therefore, clay soil remains saturated after a heavy rain. When this happens, there is little air in the soil, and plant roots cannot find oxygen. Clay soils can be difficult for gardeners to plant in.

SILT

Silt is 0.002-0.05 mm in diameter. You can see silt particles only through a microscope.

Silt feels like flour. It forms into a ball that easily breaks apart. If you squeeze it between your thumb and fingers, it will not form ribbons.

SAND

Sand is the largest size rock particle in soil—0.05-2 mm in diameter. You can see sand particles without a microscope.

Sand feels gritty. You cannot make wet sand form a ball that holds together.

LOAM

Loam is a mixture of sand, silt, and clay particles. It is ideal for gardeners. Usually loam is easy to dig, and is neither too dry nor too wet during the growing season.

Composition of different types of loam soils

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
**DID YOU KNOW?**
Spanish explorers brought tomato seeds to Europe in the early 1500’s. At that time, most Europeans thought tomatoes were toxic, and would not even taste them. Italians were the first Europeans to use tomatoes as a key ingredient in their cooking.

**ORIGINS**
Tomatoes are native to the Andes Mountains in South America.

By the time the Spanish arrived in Mexico, the native Mexicans were growing and eating tomatoes. The name “tomato” comes from the Mexican word “tomatl.”

**CLASSIFYING TOMATOES**

**FAMILY**
Solanaceae (Nightshade family)
There are about 3,000 species in this family.

- Deadly nightshade
- Tobacco
- Bell pepper
- Eggplant
- Hot pepper
- Tomato
- Potato

This family includes many poisonous species, such as deadly nightshade, as well as many edible species.

**GENUS**
Lycopersicon
In Greek this means “wolf peach.”

Scientists gave tomatoes this genus name at the time when most people thought they were poisonous.

This wild tomato relative is one of several species in this genus found in Ecuador and Peru.

**SPECIES**
esculentum
means “something that can be eaten.”

Scientists gave tomatoes this species name after people realized that they were not poisonous.

**THE TOMATO PLANT**
There are more varieties of tomatoes than of any other vegetable.

Some varieties are bushy, with fruit produced at the tips of branches. Other varieties are more like vines. The fruits come in many shapes, sizes, and colors.

The compound leaves are divided into a number of leaflets.

The small flowers are yellow.

**GROWING AND HARVESTING TOMATOES**
Tomatoes thrive in full sun in well drained, fertile soil. Set out transplants one week after the last frost date. Most varieties need to be supported by stakes or cages. Keep well watered. Once fruits begin to ripen, pick them daily.

These cages support my tomato plants so they don’t get knocked down by the wind.

**USES**
Most tomato varieties can be used for both fresh eating and cooking. However, Italian paste tomatoes are best for cooking into sauces. Large beefsteaks are good for slicing.

Ravioli with tomato sauce

Garden Mosaics is funded by the National Science Foundation Informal Science Education program, and by the College of Agriculture and Life Sciences at Cornell University.
**TOMATES O JITOMATES — Página de ciencias**

**A ENTERARSE**
Los exploradores españoles llevaron semillas de tomate o jitomate a Europa a principios de siglo XVI. Allá la gente creía que el tomate era venenoso y no lo comían hasta que los italianos lo hicieron ingrediente importante en su cocina.

**ORÍGENES**
El tomate es originario de los países andinos en Suramérica.

A la llegada de los españoles a México, ya los pobladores lo cultivaban y lo comían. El nombre se deriva de la palabra náhuatl, lengua hablada en México, “tomatl”.

**CLASIFICACIÓN DEL TOMATE**

**FAMILIA**
Solanaceae (familia solano)
Existen unas 3,000 especies en esta familia.

**GÉNERO**
Lycopersicon
En griego, significa “durazno o melocotón de lobo”.

Los científicos le pusieron este nombre al género porque en ese tiempo casi todos creían que el tomate era venenoso.

Este pariente silvestre del tomate pertenece a una de las muchas especies de este género que se encuentran en Ecuador y Perú.

**ESPECIE**
esculentum significa “que se puede comer”.

Los científicos le pusieron este nombre a la especie cuando se dieron cuenta que no era venenosa.

**CULTIVO Y COSECHA DEL TOMATE**

Los tomates se dan muy bien a pleno sol en suelo fértil bien drenado. Los trasplantes se hacen una semana después de la última fecha de helada. Casi todas las variedades necesitan soporte de estaca o enalambrado. Hay que mantenerlos regados. Cuando los tomates empiezan a madurar hay que recogerlos todos los días.

**USOS**
Casi todas las variedades de tomate o jitomate se pueden comer frescas o cocidas. Pero las italianas que se emplean para pastas son las mejores para salsas de cocina. Los tomates “bistec” son buenos para comer en rodajas.

Garden Mosaics se produce con el apoyo financiero del programa de educación informal de ciencias de la National Science Foundation y el College of Agriculture and Life Sciences de Cornell University.
TOPOGRAPHIC MAPS Science Page

WHAT IS A TOPOGRAPHIC MAP?

A topographic map is a very accurate and detailed map of a region. It includes natural features, such as rivers, lakes, valleys, and hills, and human-made features, such as roads, bridges, and buildings.

Here is a topographic map of Prospect Park, Brooklyn, New York City.

COLORS AND SYMBOLS

To read a topographic map, you need to know what the colors and symbols represent. Vegetation, such as grass and trees, is green. Water, including lakes and rivers, is blue. Contour lines are brown. Towns and cities are pink or gray. Symbols are used to represent features, such as churches and schools. The meanings of symbols are explained in a key, which is sometimes called a legend.

CONTOURS

Topographic maps show the shape or relief of land—where it goes up and down, as in hills or valleys. Contour lines join up places that are the same height—or elevation—above sea level.

The diagram below shows contour lines at every 10-foot change in elevation. Where spacing between contour lines is close, it means the land is steep. Where spacing is wide, the slope is gentle.

The letters BM followed by a number stands for benchmark. A benchmark on a building or post shows its exact height in feet above sea level.

SCALE

The scale of a map indicates how much actual features are shrunk or scaled down. The scale may be shown as a ratio such as 1:12,000. This means 1 unit of length on the map equals 12,000 units of distance on the ground. The scale may also be written in words or shown as a line:

1 inch represents 1,000 feet.

The scale of the map above is 1:12,000. One inch on the map equals 12,000 inches, or 1,000 feet, on the ground. Or 1 cm on the map equals 12,000 cm, or 120 m on the ground.

USING MAPS

Many different people use topographic maps.

Scientists use topographic maps to study the environment. City planners use the maps to help locate suitable places for buildings, roads, or parks. Aircraft pilots need topographic information for flight planning and navigation. Topographic maps are also used by hikers.

Using the scale and contour lines on a map, you can not only measure how far you have to travel to get from one place to another, but also how far up and down hill you have to go to get there.
**TO WATER OR NOT TO WATER?**

In most areas, rain alone does not meet all the water needs of garden plants. You need to water the garden.

The soil is dry all the way down to the depth of the plant roots. It’s time to water.

You need to add enough water so that it seeps all the way down to the plant roots. If you just water the soil surface, the roots will grow close to the surface and then the plants will wilt more quickly.

**WATERING METHODS**

1. A watering can and hose are useful for small gardens.

Direct the water to the base of the plant, not on the leaves.

Many farmers in hot, dry places use drip or trickle irrigation.

2. Sprinklers are cheap and convenient, but they waste a lot of water to evaporation, especially on hot, windy days.

I’m using a gentle rain nozzle so the water can slowly soak into the soil.

I’ll move the sprinkler around to other spots so all the garden gets enough water.

Little water is lost to evaporation or run-off when you use the drip or soaker hose methods because the water goes into the ground near the plant.

3. A drip or trickle irrigation system applies water directly to the area in the soil where roots are growing.

Water during early morning. At this time temperatures are cooler and it is less windy, so there is less evaporation.

4. A soaker hose is a plastic or canvas hose with holes all along its length. It is placed along one side of plants or underneath mulch. Water seeps out slowly.

The gentle stream of water causes little or no compaction of the soil.

**SAVING WATER IN THE GARDEN**

Make the most of available water in the garden.

Collect rain water from roof-tops in rain barrels. Keep the rain barrel covered to prevent mosquitoes from breeding.

Add organic matter to the soil. It holds the water, which then can be used by plants.

Water during early morning. At this time temperatures are cooler and it is less windy, so there is less evaporation.

Cover the soil with mulch, which smothers weeds and allows water to seep slowly into the soil. A mulch cover also reduces evaporation of water from the soil.