Food for Thought

A Classroom Guide to Agriculture

Ecological Farmers Association of Ontario

Contents

Agriculture is Everywhere

Agriculture is Everywhere!

From the time we wake up in the morning to the time we go to bed at night, agriculture plays a role in almost everything that we do!

If you had a shower this morning, your soap or your shampoo contained ingredients like fats from cattle or oils from plants. What did you have for breakfast? You can thank farmers for things like the grains for toast, cereal and pancakes, for milk and butter, for sugar, for eggs and bacon, and even for jam and peanut butter.

The clothes that you're wearing probably have been made with fibres from cotton plants. Maybe you're wearing wool, silk, or leather too. All of these come from farms.

At school, the paper you write on and the books you read are made from paper. Believe it or not, trees are an agricultural crop! Even the ink that you write with contains corn and soybean by-products.

You can probably think of hundreds more things that you use or eat everyday that we have agriculture to thank for. Agriculture really is everywhere!

Ontario Agriculture Trivia!

Amaze your friends and impress your family with these incredible Ontario farms facts!

1. Ontario's Agri-food industry contributes $25 billion each year to the provincial economy and employs more than 640,000 people!

2. McIntosh apples are the most popular variety of apple sold in Ontario.

3. In 2003, 805,300 hectares of soybeans were harvested in Ontario at 2.1 metric tonnes per hectare.

4. There are over 67,000 farms in Ontario. About 1,000 of them are organic farms.

5. In 2003, there were 71,000 colonies of bees in Ontario. They produced 3,363 tonnes of honey. Sweet!

6. Ontario has over half of the "Class 1" (highest quality) agricultural land in Canada.

7. Ontario farms produce over 2.5 billion litres of milk each year. That's enough milk to fill the Skydome two times!

8. 93% of the dairy cows in Canada are a breed called the Holstein. There are approximately 509,000 Holstein cows in Ontario!

9. 25% of Canada's organic production comes from Ontario!

Be a Farm Detective

Which thing in each row would you **not** find growing or being raised on a farm in Ontario?


strawberry

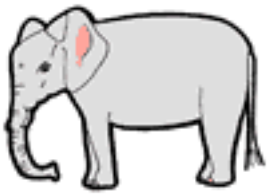

peach

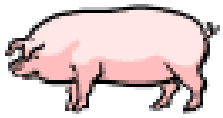

grape


pineapple


chicken


emu


elephant


pig


corn


banana


tomato


pear


pumpkin

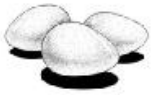

sheep


apple


gorilla

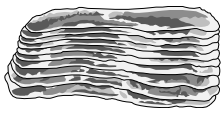
Where Does it Come From?

Do you know where the things you eat come from? See if you can find the matches below!



eggs

ice cream



bacon

milk

bread

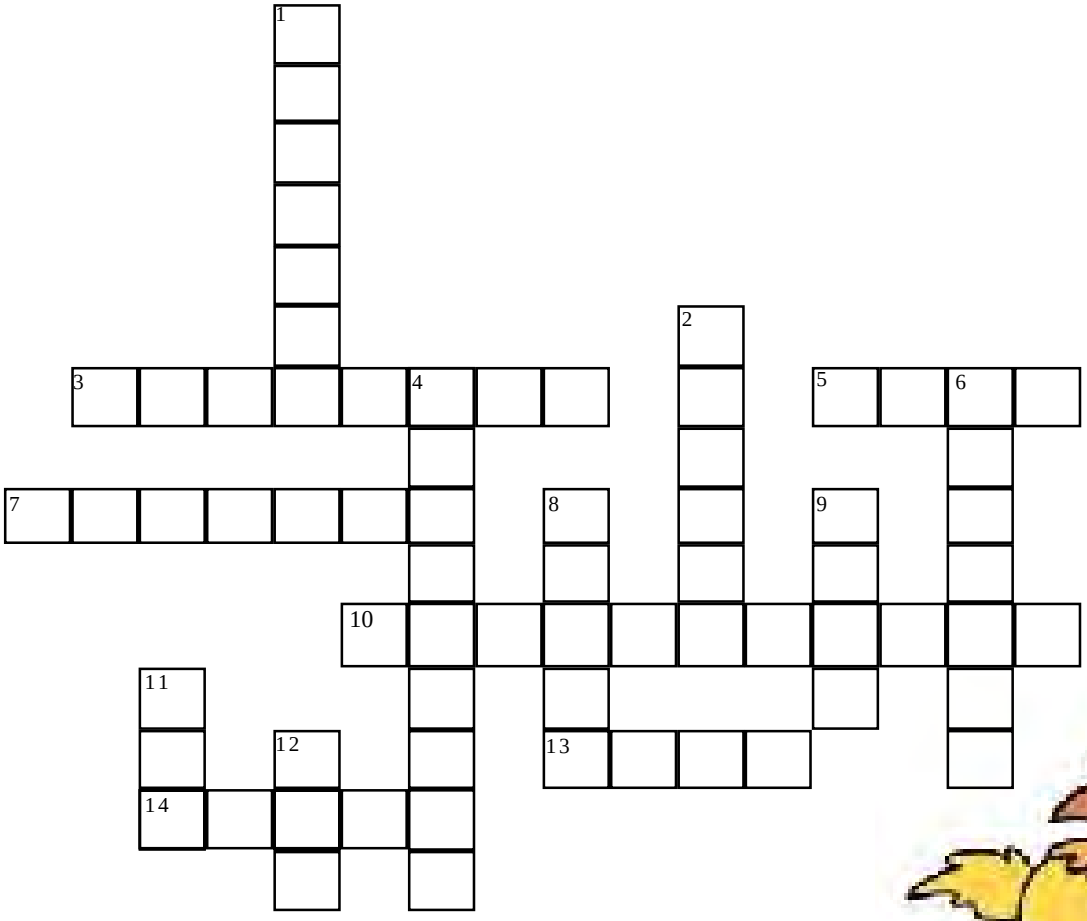
wheat

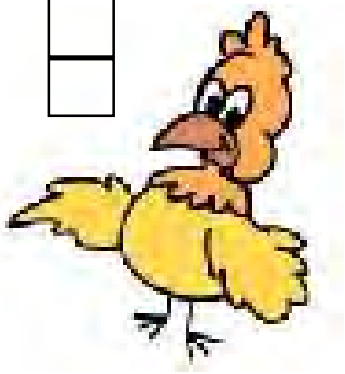
chickens

cows

pigs

Agriculture is Everywhere!





Across

3. This ball is made from pig skin.
5. You'll find this farm creature in ponds rather than in pastures.
7. The skin of cattle is used to make this fabric often used for jackets and shoes.
10. This crop also grows in the wild in many parts of Ontario where it's a favourite food of bears!
13. This fibre is made by caterpillars (although they are usually called worms)!
14. Feathers from this creature are used to fill things like pillows and sleeping bags.

Down

1. Believe it or not, cattle by-products are used in this material for paving roads!
2. Camera film is made with gelatin that comes from the bones of these animals.
4. Canola oil is used to make de-icer for these large flying machines.
6. This useful plant can be found in products such as tofu, birthday candles and printing ink.
8. Plants used to produce pulp for paper.
9. Not just for popping, this plant is used in fuel for cars.
11. You might think it's hogwash, but hair from this animal is used in drywall.
12. It makes an instant lawn.

Isn't All Food Organic?

The word organic has a number of different meanings and it can be pretty confusing when it is used to describe the food we eat. If you look up "organic" in a dictionary, you will see definitions like "derived from living organisms" or "any compound containing carbon". So, in a sense, all food *is* organic**.** Usually though, if the word organic is used when talking about food it is used to describe how that food has been grown. "Certified" organic means that the food has been produced using a set of guidelines approved of by the Canadian government.

Growing food is not an easy job. Farmers everywhere have to deal with some big challenges to make sure their plants and animals grow big and stay strong and healthy**.** They need to prevent diseases and insects that can make plants and animals sick. They need to make sure both plants and animals get enough nutrients to grow. They need to control weeds that can crowd out young plants and they need to keep animals safe from predators.

Most of the farmers in Ontario are called "conventional" farmers. They usually deal with the types of problems listed above by using "synthetic" chemicals to kill bugs and weeds, to fertilize (feed) plants, and to keep animals healthy and to help them grow quickly. "Synthetic" means that these chemicals are not found in nature. These chemicals solve many farming problems, but some people worry that they are not healthy for people or for the environment. Some chemicals can stay in the soil for a long time after their job is done. Sometimes they kill beneficial plants and insects as well as harmful ones. Sometimes they pollute our water. Some of the chemicals given to animals may end up in the meat we eat or the milk we drink.

An increasing number of people are starting to farm organically. Organic farmers are different from conventional farmers because they use nature's ways of solving farming challenges. Organic farmers use things like compost to help keep the soil healthy. Healthy soil helps plants grow strong. They also grow a number of different types of plants and grow each type in a different place each year to make sure that nutrients in the soil don't get used up. This also helps control insects and diseases. They use things like good bugs and natural insect repellents to control pests. Weeds are controlled by digging them up or by planting different crops at the same time to make sure there isn't enough room for weeds. Animals spend lots of time outside, eat natural foods, and live in environments that help to keep them happy and healthy. Many organic farmers say they enjoy farming more after switching to organic methods and they are glad not to handle so many toxic materials anymore. However, some people feel that this, the organic way of farming, means more work than conventional farming and is more risky.

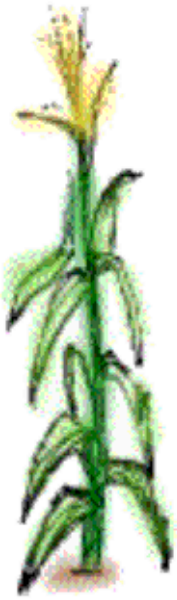
Any way you look at it, farming is hard but very important work!

Ecological Agriculture

Some farmers are concerned not just about finding alternatives to using chemical pesticides and synthetic fertilizers on their fields and medicines for their livestock, but are interested in the connections between all parts of their farms. Instead of looking at a farm as a series of fields or pastures, these farmers look at their farms as ecosystems. This means that features such as wood lots, waterways, wetlands, and the organisms that live in these areas are also important parts of the farm.

Some farmers take this ecological approach one step further and are trying to make their farms sustainable systems. A sustainable system uses materials in continuous cycles, uses renewable sources of energy, encourages biodiversity, and doesn't degrade the environment.

Find the words about ecological agriculture hidden in the puzzle below.
Hint: words can go up, down, or on a diagonal!



x	k	r	e	l	r	d	t	h	l	i	o	s	c	m	g	w	k
b	t	e	k	l	e	o	e	s	w	h	b	s	e	b	n	o	n
g	y	q	a	w	b	d	t	e	o	m	n	t	u	s	i	o	x
e	h	t	c	r	g	a	r	a	k	p	s	s	n	y	l	d	t
w	k	z	i	e	t	u	w	p	t	y	m	o	v	k	c	l	l
s	y	n	r	s	t	h	s	e	s	i	i	o	m	t	y	o	l
b	h	o	l	s	r	n	w	o	n	t	o	e	c	n	c	t	g
z	w	g	a	m	j	e	c	o	c	e	s	n	q	e	e	s	e
s	p	p	f	p	a	e	v	e	r	m	r	t	y	m	r	w	g
c	i	n	a	g	r	o	n	i	p	m	i	s	w	n	e	i	a
t	w	e	t	l	a	n	d	s	d	f	s	i	j	o	c	n	l
b	o	n	n	q	o	d	h	j	d	o	l	q	m	r	o	d	l
v	o	i	f	c	c	d	l	h	p	d	i	a	n	i	l	b	i
s	u	s	t	a	i	n	a	b	l	e	n	b	z	v	o	r	t
g	r	a	z	i	n	g	v	i	r	u	i	p	f	n	g	e	g
t	g	t	m	a	u	f	f	y	r	f	p	x	z	e	y	a	m
p	d	d	x	d	e	e	n	e	p	v	z	l	a	p	c	k	h
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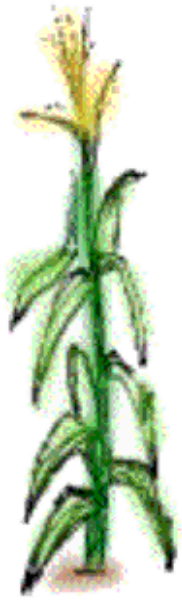
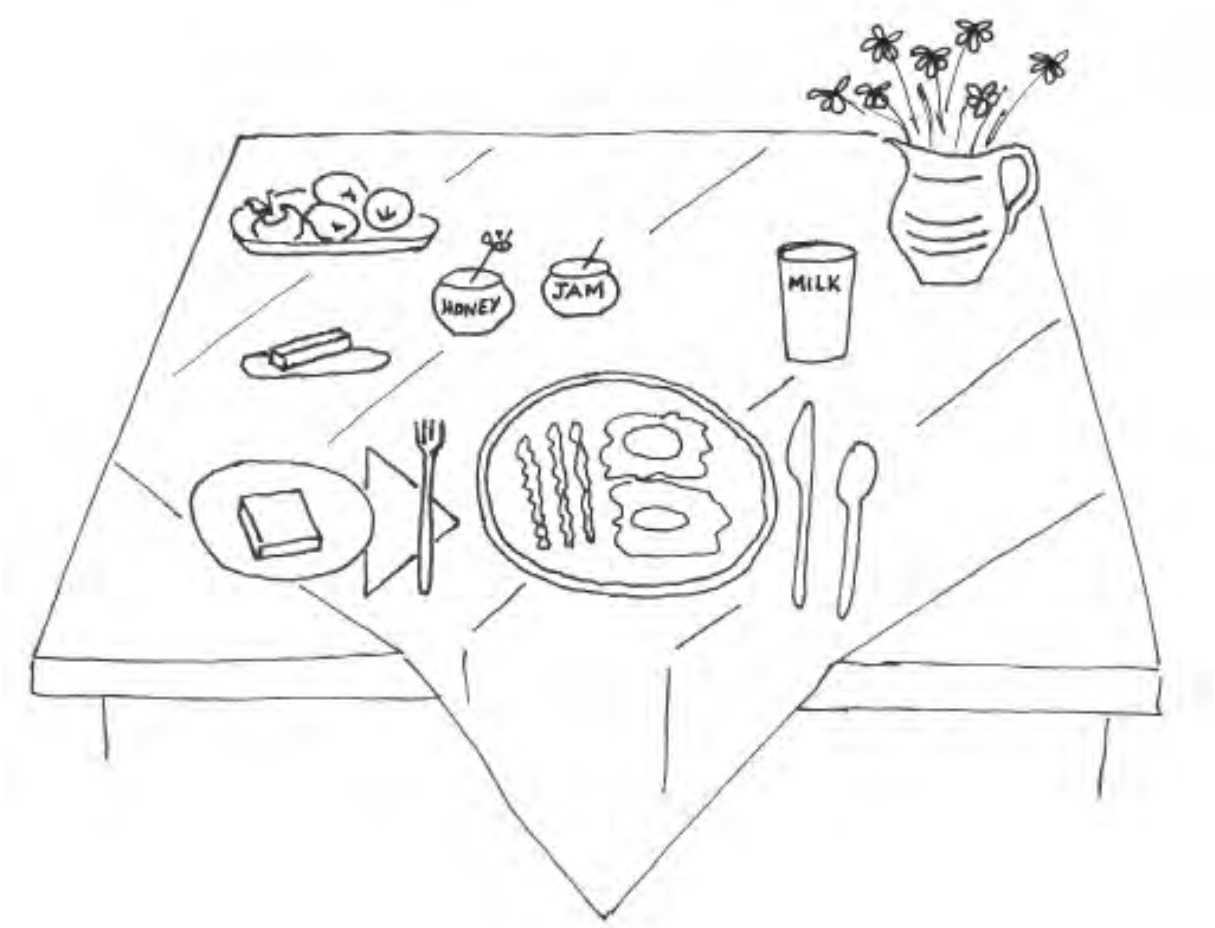


biodiversity
compost
connections
earthworms
ecology
ecosystem
environment
grazing
hedgerows
manure
organic
pasture
recycling
renewable
rotation
soil
sustainable
tillage
waterways
wetlands
wildlife
windbreaks
woodlots

Where is the Agriculture?

Colour all of the things in the picture below that came from a farm!



Agriculture is Everywhere

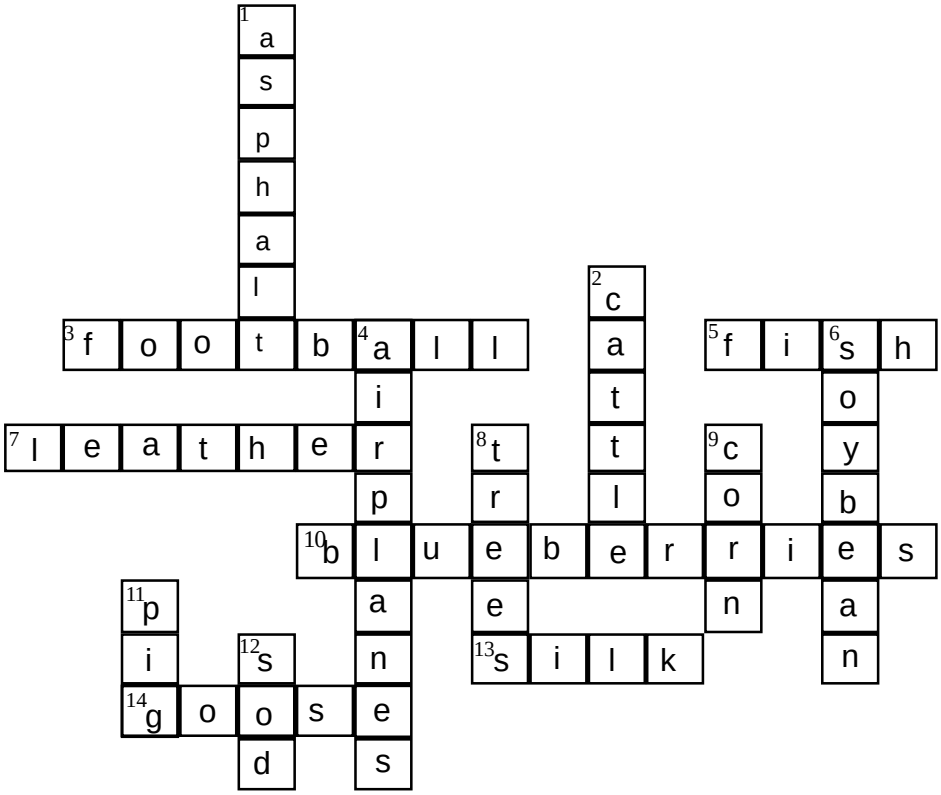
Teachers' Page

1. In small groups, have students develop a "pro and con" list for both conventional and organic farming. Discuss the results as a class.

2. Bring in samples of conventional and organic produce and conduct a taste test. Are there other factors that might affect the taste or flavour of food? (i.e. seasonal, variety, ripeness, locally grown, distance travelled, time between harvest and eating, storage)

3. Take a class trip to an organic farm in your area or invite an organic farmer in to discuss the benefits and challenges of growing food this way.

Agriculture is Everywhere!



A Brief History of Farming in Ontario

A Brief History of Farming in Ontario

Early in our history, humans survived by following the herds of animals they hunted and by gathering other foods, such as plants, fruits, and nuts that they found along the way. Around 15 000 BC, people living along the Nile River began experimenting with growing food. By 8000 BC many groups throughout the Near East were growing crops like wheat and barley and were raising animals.

The beginning of farming might be one of the most important events in human history. Farming meant that people could stay in one place for longer periods of time. It gave them more control over their food supply and meant that they needed to spend less time looking for food and could spend time on other activities.

In Ontario, archeological evidence suggests that people began farming around 1400 years ago. The Princess Point people, who lived in the Grand River area of Southern Ontario, planted corn. By the time Europeans arrived in Ontario in the early 1600s, Iroquoian people (descendants of the Princess Point people) were growing a number of crops like corn, beans, squash, sunflowers and tobacco.

About every 10 years or so, as resources, like wood, around a village got used up, people would move their villages to a new place. Because there weren't nearly as many people living in what is now Ontario as there are today, this practice worked well. It meant that farms were moved before all of the nutrients in the soil got used up and it meant that the soil had lots of time to rest before it was used again.

Farming changed when Europeans arrived. Lots of people came to the New World, excited by the idea of all of the rich land available for farming. Europeans brought different ideas with them about farming. Maybe the most important difference was the idea that land could be owned by individual people. They set up farms and stayed on them for very long periods of time. Many of these farms are still being farmed today!

By the 1800s there were farms all over Ontario. New technologies like the steel plow, invented by John Deere in 1837, meant that farmers could farm greater areas of land and produce more food than ever before. Around this same time, farmers began to notice that their crops weren't always growing as well as they had in the past. Most of the land being used had been farmed for decades, farmers were farming more land than ever before, and some of the land being farmed hadn't been very good to begin with. Huge areas of trees had been cut down to make more farm land and without the trees more soil was being eroded. Although most farmers were already using animal manure to feed their plants, they became

more and more interested in other things that could be added to soil to make it produce crops better. By the 1850s, many farmers were using fertilizers other than manure, such as salt, lime, plaster and ash to try to increase production on their farms.

After World War II, lots of new chemicals were invented to feed plants (fertilizers), to kill weeds (herbicides) and to kill insects (insecticides). This provided farmers with new methods of dealing with the challenges they were facing. This was good news because it meant that farmers could produce more food on the same amount of land. This was especially important because more and more people were moving away from farms and into cities. In 1901, almost 60 percent of people in Ontario lived on farms. In 2001, just over 15 percent of people in Ontario lived outside cities!

We have begun to realize that many of the things we have invented to deal with farming problems have created new problems. For example, some of the chemicals that were invented turned out to be not as safe as we thought they were. We also know now that just depending on chemicals instead of figuring out what causes the problems in the first place has meant that a lot of farming challenges haven't really been corrected. There are lots of different ideas about how to solve farming challenges. Farmers and scientists are trying to find solutions that will make sure that we continue to be able to grow food to eat and, at the same time, minimize the damage we are doing to the environment.

Photo courtesy of Meeting Place Organic Farm

Not all farmers believe that new technology is better technology. Farmer Tony McQuail uses horses on his organic farm in Lucknow, Ontario, because they lower energy costs and because they have less of an impact on the environment than machines that use fossil fuels.

The Three Sisters

An Iroquois Legend

The sun, heralding the dawn, caressed Mother Earth into wakefulness and cradled her in loving arms.

Crimson melted into grey, diffusing a rose hue into the sky. A young Indian boy, distracted from his hunting, failed to notice the unfolding light and instead stood transfixed as he gazed at three of the most beautiful girls he had ever seen. Stretching their arms above them, they gracefully rose from the ground, gathering the plants about them.

The smallest of the three was clad in the greenest of greens, and was fresh and new because earlier her body had been kissed by the morning dew. The next maiden was attired in the brightest of yellows, brimming over with blossoms like golden sunshine. The last and eldest was a tall willowy woman whose movements were slow and serene. Her slender body bent with the wind. Looking down at her two younger sisters who were much smaller than she was, she gave them a loving smile. Her green hair waved in the wind and was, like her youngest sister, clothed in green.

The boy continued to gaze at the three sisters because never before had he seen such a lovely sight. Watching them play, he had completely forgotten his hunt. Since the smallest was too young to walk, she crawled among the flowers and other plants. The girl in yellow could walk, and ran far beyond the field, returning to play with her sisters for only a short while before running away again. The eldest quietly walked among the plants bestowing kisses and smiles upon them and her sisters. She danced with the sunbeams, her hair gleaming green in the sunlight.

That night the boy returned to his village and, although his parents scolded him for failing to bring home some game, went back the next day to watch the three sisters again. Every morning after that throughout the summer, he would return to his hiding place to secretly admire them, departing shortly afterwards to hunt for food. As the summer wore on he grew to love all three sisters although he knew them only from a distance.

Crawling among the plants one day, the youngest sister came across the young boy. Being so small she could observe him

without being detected. She was intrigued by this new creature and remained hidden while she watched him. Day after day she returned, unbeknownst to him.

One day she did not rejoin her sisters. The boy had finally discovered her and had taken her home to share her with his family. Because she liked this Indian who seemed so kind and gentle, she agreed to go with him, forgetting about her sisters.
As the days became shorter, the eldest's hair faded until it was completely bleached by the sun. She continued to smile until she realized that her youngest sister had disappeared. Then her smile faded also and she no longer danced with the rays of the sun. Instead she bent her head in loneliness and grief and wept because the sisters had never before been separated. The golden sister wept also.

It happened that the sister in yellow also met the boy and, after she came to love him, she too returned to his longhouse where the youngest lived.

The eldest was now alone. She did not leave because she had to nurture the plants in her field. She called out daily, hoping the others would hear her. Only at the end of the summer did the boy reveal to her the whereabouts of her sisters. Since harvest was complete, she joyfully followed the boy home and the three were reunited. The young boy provided warmth and shelter for them during the cold days and in gratitude, the youngest decided to reciprocate his kindness. She jumped into their cooking pot and kept their stomachs full and their bodies warm for a long while. The sister in yellow sat on the shelf drying herself preparing to help fill the dinner pot later in the winter. Seeing the boy's kindness, the eldest then joined her middle sister on the shelf so that she too might repay him.

Each year the Iroquois give thanks to the Three Sisters for providing nourishment for their families. The eldest of the Three Sisters is the protector of the corn, the Corn Spirit. The sister in yellow is the Squash Spirit while the sister clad in green is the Guardian of the Bean.

Retold by: Miriam Johnston, *Ontario Indian*, Vo. 4 No. 1, October 1981

Did You Know?

Corn, beans and squash were traditionally planted together. The three plants work together.

- Corn makes a natural "pole for the beans to climb as they grow.
- The beans use nitrogen-fixing bacteria to put nitrogen back into the soil. Nitrogen helps the corn and the squash grow.
- The large leaves of the squash shade the soil, trapping moisture in the ground and limiting weed growth!

Other History of Agriculture Activities

Teachers' Page

1. Visit a local museum or living history site to see what life was like for early settlers. You can find the museum closest to you by visiting the Ontario Museum Association website.

2. Who lived in your area before the Europeans? Were they farmers? How was their way of life changed by European contact? Contact your local band council or Native Friendship Centre to find out.

3. Have students imagine that they are a settler in 1850 Ontario (Upper Canada). What problems are they facing as settlers? What do they enjoy? Have them write a letter to an imaginary family member back home in Europe.

4. How have poor farming practices caused problems? Have students research issues linked to the Dust Bowl of the 1930s or linked to the B.S.E. (Bovine Spongiform Encephelopathy) outbreaks in Britain in the 1980s and in Canada in 2003 that may have resulted from livestock feeding practices. Another issue you can study is pesticide resistance. You may also have students look at the use of DDT and Rachel Carson's book *Silent Spring*.

5. Farming practices changed radically after WW2. Have students research what pressures made farmers increase chemical inputs and farm larger acreages. How did industrial capacity, developed for the war effort, lead to changes in agriculture?

Soil

The Real Dirt on Soil

You may not think of dirt as being very important, but it is. All living things on the Earth depend on soil to live!

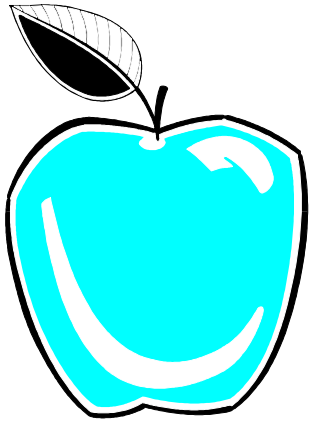
The ground beneath our feet is made up of a number of layers. The three main layers are topsoil, subsoil and bedrock. The top layer is, as you might have guessed, topsoil. This layer is where most plant roots grow. Topsoil contains decaying plant and animal matter and a rich supply of minerals that plants need to grow. This layer is also home to all kinds of microscopic organisms like bacteria and fungi that are important for healthy plants.

Below the topsoil is the subsoil layer. This layer is where tree roots live. It contains minerals like iron, aluminum and phosphorus. The bottom layer is classed as bedrock and isn't really soil at all. This layer of rock has very few available nutrients in it and is too hard for roots to push through. It is sometimes called "parent material" because as it breaks down it turns into soil. This is a very slow process.

It takes nature over 500 years to replace 2.5 centimetres to topsoil! Because soil is so important we need to take care of it. 500 years is a long time to wait for more of it!

How Much Soil is There?

Soil is everywhere, isn't it? Actually, only a very small portion of the Earth can be used for growing our food. Try this "appealing" exercise to find out how much there is. (You will need an apple and a knife.)



1. Imagine that your apple is the planet Earth.

2. Cut your apple into quarters. Three parts represent all of the water on Earth; only one part is land.

3. Cut the land piece in half. One of these pieces represents deserts, mountains or land covered in ice.

4. Cut the other land piece into quarters. Three of these pieces are too hot, too rocky, too wet, or too infertile to grow food, or they are covered with roads and cities.

5. You should now be left with 1/32 of your apple. If you peel this piece of apple, the peel represents the amount of topsoil available for us to use to grow food for all the people on Earth.

Food for thought.

Activity adapted from the United States Department of Agriculture.

All Soil isn't Created Equal

There are three basic types of soil.

- **Clay** soil is made up of very fine particles.
- **Sandy** soil has larger particles and feels gritty.
- **Loam** soil is a mix of clay, sand and organic matter (decomposed plants and animals).

Compare some different soils from your neighbourhood. Make a chart to record your findings.

1. Collect a number of soil samples from different locations in your schoolyard or neighbourhood. Store each sample in an air-tight container to keep them from drying out. Don't forget to label your containers so you know where the samples came from.

2. Examine the texture of each sample by rubbing a bit between your fingers. You may need to moisten them a bit so that it will roll into a small ball.
   - **Clay** soil: When moist, this soil will squeeze through our fingers like toothpaste. It is very hard to crumble if dry.
   - **Sandy** soil: This soil will run between your fingers. It has a gritty feel.
   - **Loam** soil: This soil crumbles easily.

   (Some soil may be a mixture of soil types, for example, sandy-loam or clay-loam.)

3. Use different grades of screen to examine the particle size of each of your samples.

4. Use a microscope to examine the organisms living in each sample.

5. Examine water content. Weigh a portion of each sample. Let these portions dry for a day and weigh them again.

6. Compare the density of each sample (mass by volume).

7. What other comparisons can you make?

8. Which soils are the most useful for agricultu

Blowing in the Wind

Soil erosion is what happens when soil is washed away by water or blown away by wind. In most places soil is held in place by grasses, trees or other plants. When these plants are removed, rain and wind can carry the soil away. This is a problem because it takes Nature a very long time to replace it. It takes about 500 years for Nature to make 2.5 centimetres of soil! Since we depend on soil to grow our food, erosion is a very serious problem!

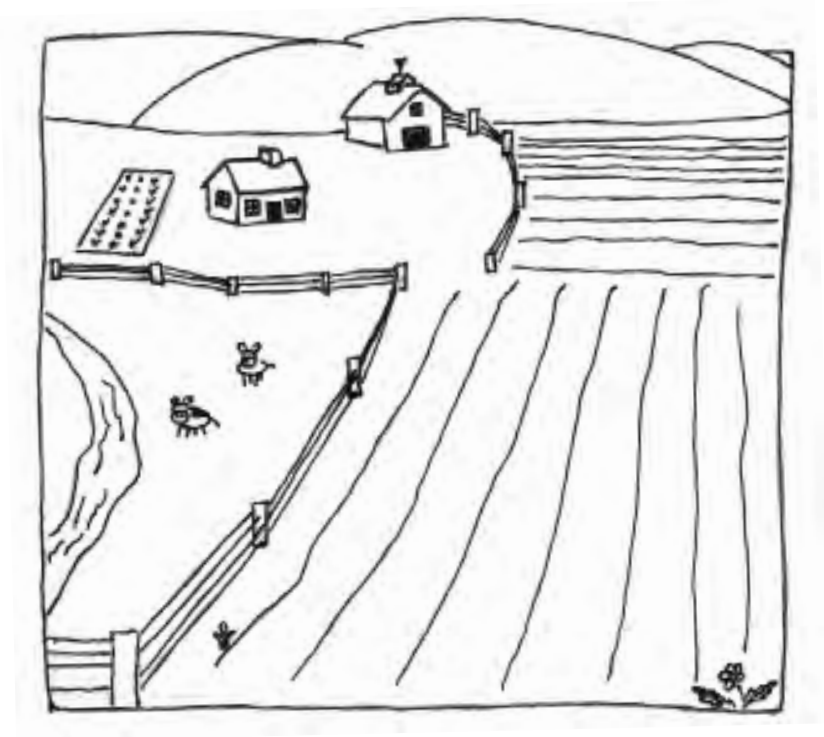
Because soil is so important to farmers it might come as a surprise that farming can be a big cause of erosion!

- Plowing and cultivating disturbs the soil and removes plants. This can leave soil exposed to wind and rain.
- If lots of organic material (compost) isn't mixed back into the soil regularly, the soil becomes less able to absorb water. This makes it easier for wind to blow soil away and easier for it to be washed away by rain.
- Removing trees and shrubs from the sides of fields to make bigger fields means that wind blowing over fields doesn't have anything to slow it down, so it picks up more soil.
- If farm animals like cows spend too much time in one area they can eat all of the ground cover (overgraze) and compact the soil. Compacted soil doesn't absorb water easily, so it tends to erode. If farm animals are allowed near streams, they can trample the banks and send soil into the water.
- After a crop is harvested in the fall, if farmers plough their fields and leave them bare for the winter melting snow and spring rains can wash soil into streams, rivers and ditches.
- Sometimes farmers plough steep hills to get as much cropland as possible. Unfortunately, when heavy rains come, soil gets washed down the hills.

If you were a farmer, what could you do to reduce erosion on your farm? List some ideas below.

Blowing in the Wind

Part Two



If this was your farm, what could you do to minimize erosion? List your ideas below or add them to the picture above!

S.O.S.
(Save Our Soil)

Farms aren't the only place we find soil. It's right in your own backyard! Erosion control is important everywhere.

In small groups, explore your schoolyard. Identify an area where erosion is taking place. Look at places like paths, hills and playgrounds. Try to list some ideas for minimizing or stopping the erosion that you found. Share your ideas with the rest of the class.

Places we found erosion:

Ideas for fixing the problem:

Word Search Puzzle: Under our Feet

n i t r o g e n l m w o t w c
l f h i o x b h i i a x u l v
b i s q q o k x o n t o a r v
e u o u m o t u s e e y i v b
x x d s r i v s p r r a h e m
y t n a b o m p o a k l d i u
o c a b d u h l t l i r y d i
q r s h i l s p a s o p n d s
u f g c z v r i s c d t c h s
b u l a n o r i k o w o q e a
m a r m n e c g k y h f u i t
c a o i t i f u n g i p u m o
z w o c d y c t s o p m o c p
h w a l s x s s x t k p i l t
p b m r z s m r o w h t r a e

Words to find:

air
bacteria
bedrock
calcium
clay
compost
earthworms
fungi
iron
loam
minerals
nitrogen
organics
phosphorus
potassium
roots
sand
subsoil
topsoil
water

Hint: Words can go up, down, or on a diagonal!

Soil Communities

Did you know there is a whole other world under our feet? Healthy soil is filled with plants and animals. In fact, one gram of soil can contain more than one billion microbes representing thousands of different species! Actually, it is these plants and animals that make the soil healthy. How do they do it?

Organic matter is an important component of soil. Animal manure is one source of organic matter, and plants and animals (both above and below the ground) supply organic matter when they die. Soil organisms break down this organic matter and release nutrients back into the soil. Some of these nutrients need to be changed a bit before they can be used by plants; bacteria and fungi in the soil do this. Organisms, like worms, also "aerate" (allow air into) the soil. By digging, eating and mixing the soil they help keep it loose and help water to move through the soil easily.

Of course, not all of the organisms found in soil are helpful. Some organisms can damage plants by eating them, by transmitting diseases to them, or by competing with them for soil nutrients. In healthy soil, these unfriendly organisms are usually in small enough numbers that they do not cause severe damage.

When soil is farmed, this balance between good and unfriendly organisms can be changed. Cultivating, or digging the soil can disrupt soil communities. Planting the same crop year after year in the same field can also cause problems by encouraging certain types of diseases or pests to build up in the soil. Chemical pesticides and fertilizers also kill many of the friendly organisms as well as the unfriendly. Use of these chemicals may actually create a better environment for some unfriendly organisms.

By reducing the amount of cultivation they do, by rotating crops, and by reducing or eliminating the use of chemical pesticides and fertilizers, farmers can help maintain healthy soil. This is important because healthy soil means healthier plants and healthier plants mean better quality food for everything that eats it!

Word Search Puzzle: Soil Organisms

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

Words to find:

ACTINOMYCETES
ALGAE
ANTS
BACTERIA
CENTIPEDES
EARTHWORMS
FUNGI
GROUNDHOGS
GRUBS
INSECTS
MICE
MILLIPEDES
MITES
MOLES
NEMATODES
PROTOZOA
ROOTS
ROTIFERS
SLUGS
SNAILS
SPIDERS

Hint: Words can go up, down or on a diagonal!

Soil

Teachers' Page

All Soil isn't Created Equal

Discuss which type of soil plants would be most likely to flourish in.

A mix of particle sizes, as in loam soil, allows for good drainage but does not allow soil to dry out too quickly. A good balance of particle sizes also means that there are air pockets in the soil. Air is important for root growth. Loose soil allows roots to move through it easily as they grow. All soil types benefit from having organic matter added to them. Ideally, good soil should consist of at least 5% organic matter. Organic matter increases the water holding capacity of sandy soil, improves drainage in clay soil, loosens dense soil, and improves the nutrient levels available to plants.

Erosion Control

There are a number of strategies that farmers can use to minimize erosion.

- Fields can be kept covered with crops, green manures (plants that can be worked back into the soil as compost), or stubble (the plant parts, like stalks, left after a crop is harvested).
- Windbreaks can be planted around the edges of fields and streams to reduce the speed of wind.
- Soil quality can be improved by adding organic matter like compost or well rotted manure. Soil high in organic matter holds together better, absorbs water better and is more resistant to erosion.
- Animals should be moved regularly to different fields to prevent soil compaction and to minimize overgrazing.
- Streams should be fenced. Animals can knock soil into streams and can eat vegetation that stabilizes banks.
- Poor -quality land can be allowed to naturalize and be used as wildlife habitat rather than for growing crops.
- Marshes should be retained. Marshes act as natural sponges for rain water and help to prevent flooding and soil erosion. (They also act as natural water filters, removing sediment and chemicals.)

It's not just farmers that can help minimize erosion! There are things we can all do.

- Stay on trails when hiking or bike riding.
- Don't harm plants. Their roots help keep soil in place.
- Speak out when you see erosion! Talk to your local conservation authority or to government leaders like your mayor or your MPP when you see problem areas in your community.

Save Our Soil

Have your class adopt an area of your schoolyard. Use your class's erosion investigation to identify an area in need of help. Implement some of the ideas developed by the students to solve an erosion problem!

Soil Detectives

Collect samples from 3 different areas such as a wooded area, a garden, and your school playground. Using a microscope, compare the number and types of living things found in each sample.

Create a Soil Map

Have students create maps of the different types of soil found in your schoolyard. Are there areas were there is a lot of organic matter (like gardens)? Are there very sandy areas? You might want to use this as a follow-up activity to your soil identification activity.

Other Soil Activities

Give students a map of your region. How is land in your area distributed? What natural and human factors affect where farmland is located (climate, land contours, drainage, soil type, urban development, etc.)? What are the most commonly grown crops in your region? Why? What was grown in your region 10 or 20 years ago?

As a class, investigate zoning plans for your region. Zoning information is available from your municiple or regional planning department. How do/will these plans affect how land is used?

Plants

What do Plants Need to Grow?

What do humans, other animals and plants have in common? We all need similar things to help us grow and to keep us strong and healthy. Match each living thing below with the things that it needs. (Use red line to show human needs, yellow lines for the needs of other animals, and green lines for the needs of plants.)

water

humans

the right temperature

room to grow

other animals

sunlight and air

food

plants

shelter

protection from predators

Plants: More Than Just Nice Things To Look At

Green plants are pretty amazing things. Imagine being able to make your own food, just by sitting out in the sunshine! Of course, plants need more than just sunlight to grow big and stay healthy. They also need water, air, and nutrients found in soil.

Did you know that green plants are also important recyclers? We all know that humans and other animals breathe in oxygen and breathe out carbon dioxide. But, you might not know that green plants use carbon dioxide when they are changing sunlight into food and give off oxygen.

That's not all! Plants also are an important part of another recycling system. One of the nutrients plants get from soil is called nitrogen. Plants use nitrogen to make plant protein. When animals eat plants, this plant protein gets turned into animal protein. When animals die, bacteria help to turn these proteins back into the nitrogen that plants need to grow!

Plant Parts

How many of these plant parts can you name?

These parts of the plant are found underground. They anchor the plant and absorb water and minerals from the soil.

— — — — —

This part holds the leaves up and carries water and nutrients between the roots and the leaves.

— — — —

Big or small, these parts collect energy from the sun and turn it into food for the rest of the plant.

— — — — — —

This is where seeds are made. They attract insects and sometimes smell nice!

— — — — — — —

This is the fleshy tissue that some plants have around the seeds and is some people or animals.

— — — — —

When the time is right, this part of the plant will grow into a new plant!

— — — —

What's That You're Eating?

We eat different parts of plants. Can you think of some examples?

roots that we eat:

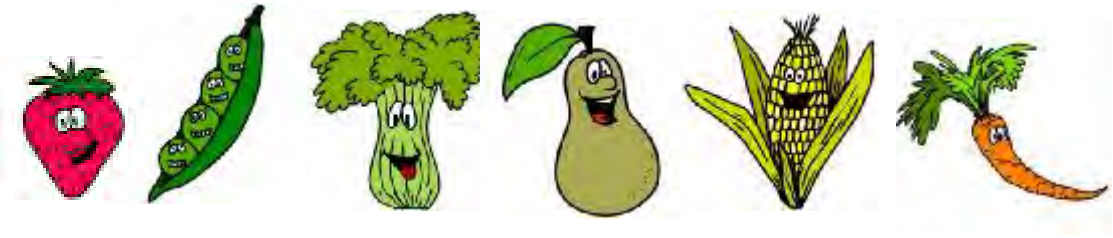
stems that we eat:

leaves that we eat:

flowers that we eat:

fruit that we eat:

seeds that we eat:



Make Your Own Plant Food!

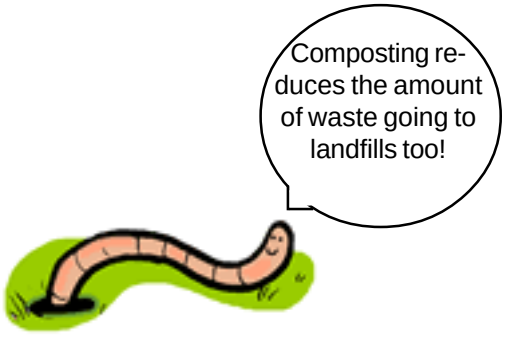
Healthy soil is full of millions of tiny creatures. Earthworms and other tiny organisms eat pieces of plants or food scraps and turn them into a natural plant food called worm compost. With the help of our friend the earthworm, you can turn your lunch or snack scraps into food for plants. Here's how:

1. Start with an opaque container (does not let light in) with a lid. A medium-sized Rubbermaid container will work well for a classroom.
2. Use a drill to make holes about 0.5 centimetres big and about 10 centimetres apart in the bottom and sides of your bin.
3. Line your bin with a piece of cotton fabric or a fine screen so that your worms don't escape!
4. Fill your bin with about 20 cm of shredded newspaper. Sprinkle the paper lightly with water. The paper should be wet but not soggy.
5. Add a few tablespoons of soil or sand.
6. Add worms! Red Wigglers work well and are available at most bait shops. You will need about 50-100 worms.
7. Put the lid on and place your bin in a location where it won't be too hot or too cold. A back corner of your classroom, away from windows or heating vents, works well.
8. After a few days, begin adding food scraps to the bin. Mix the scraps into the paper rather than leaving it sitting on top.
9. Don't expect the compost to appear overnight! It will takes the worms about three months to produce enough compost to use.

Tips:
Scraps like veggies and fruit (except for citrus) work well. Avoid adding meat, dairy products or fats to your composter. The worms don't like them and they can also make your compost smelly.

To harvest your compost, gently push the contents of your composter to one side. Add fresh bedding and food scraps to the other side. Wait a few days; the worms will migrate to the new pile and you can harvest your compost!

Visit Yucky Worm World (yucky.kids.discovery.com) for some great worm information!



Get Growing!

We know that plants need sunlight, air, water and soil to grow, but will any soil do? Try this experiment to figure out what grows the biggest, healthiest plants, or design an experiment of your own!

You will need:

3 flower pots
sand
potting soil
seeds (radish or lettuce works well)

1. Fill and lightly pack one flower pot with sand. Label this pot “sand”.
2. Fill and lightly pack one flower pot with potting soil. Water the soil well, allowing the water to run through the pot. Repeat five times. Label this pot “leached soil”.
3. Fill and lightly pack one flower pot with potting soil. Label this pot “potting soil”.
4. Plant three seeds in each pot. Dig a small hole for each seed (twice as deep as the seed is big), put in the seeds and lightly cover.
5. Water each pot (let them drain in a sink, or place them on a saucer) and place in a sunny window.
6. Check your pots every few days to make sure the soil feels damp. Water when necessary.

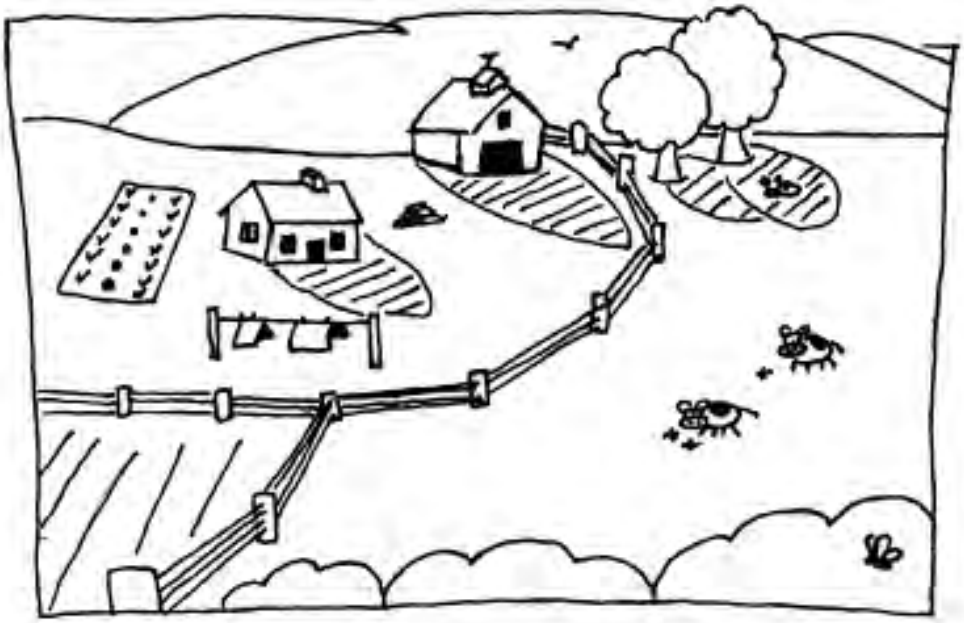
In which pot do you think the plant will grow biggest and healthiest?

Which plant is growing best after one week (compare things like height or number of leaves)? After two weeks? After four weeks? Make a chart to record your observations.

What conclusions can you make about what plants need to grow?

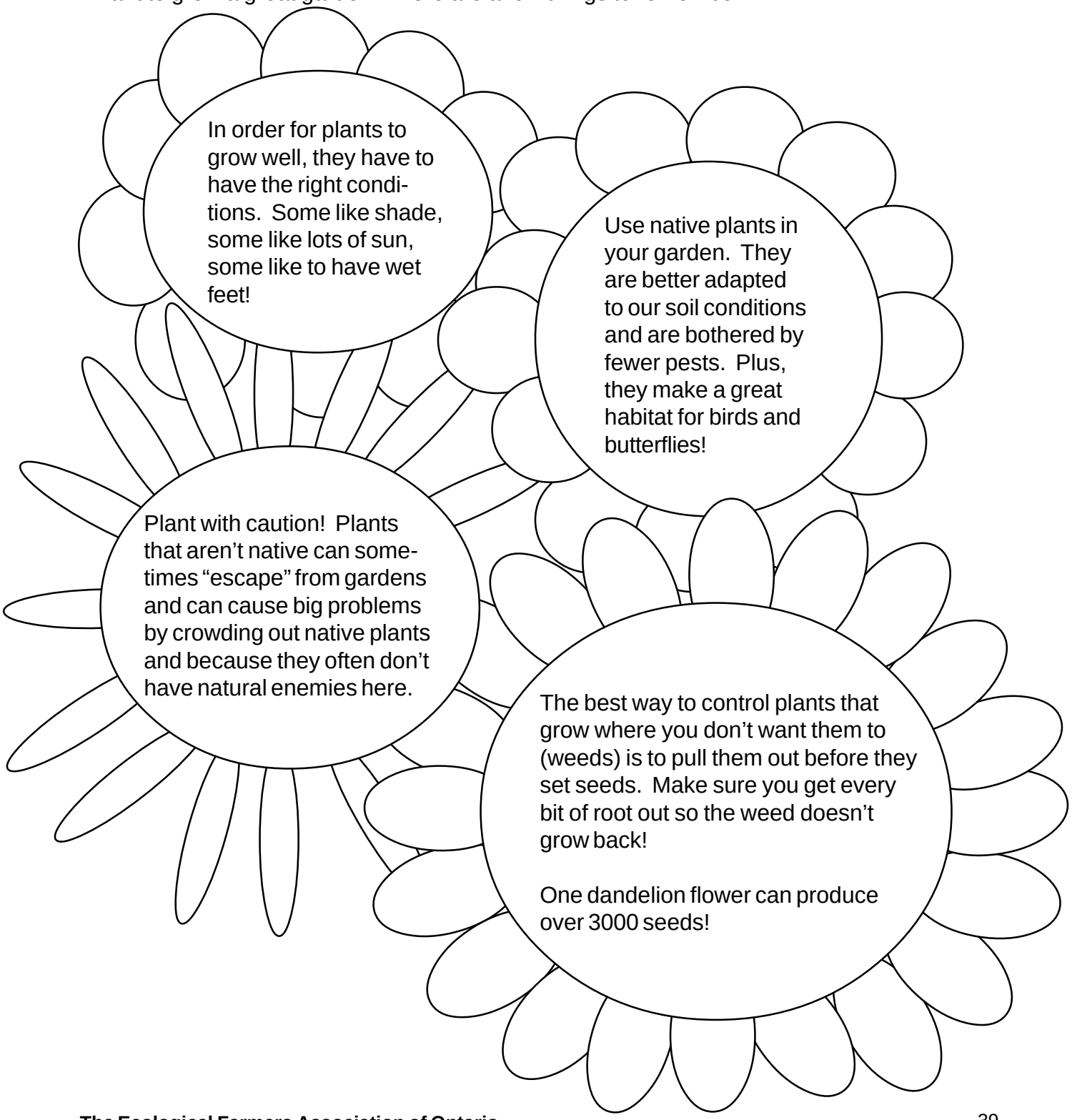
Plant Power

Have a good look at the picture on this page. How many uses of plants can you see? List your answers below!



Here We Grow!

Want to grow a great garden? Here are a few things to remember.



Techno-Food

Since humans first began planting seeds to grow food, farmers have been experimenting with plants. They have saved seeds from their healthiest plants and from the plants that seem to be the most tolerant of drought and the least bothered by insects. They have even created hybrids (created by combining the pollen and seeds of different parent plants) to make new plants that are stronger, bigger and healthier than their parent plants.

In recent years, scientists have taken this one step further. Scientists have now found a way of creating new types of plants by changing the genes of the plants we know. These genes might come from another plant species or they might come from another type of organism altogether. These new plants are called Genetically Engineered varieties, or Genetically Modified Organisms (GMOs). These new plants are being made to give them built-in protection from certain types of insects or chemicals. Sometimes these new plants contain added nutrients. *Golden Rice* is an example of this type of plant. It has had vitamin A added to it. The scientists developing these new plants hope that they will make farming easier, that farmers will need to use fewer chemicals on their fields, and that they will help to find a solution to farming problems in countries where people don't have enough to eat.

Not everyone agrees that Genetically Modified Organisms are a good thing though. Some people think they are downright scary and have given them the nickname Franken-foods. People who are not in favour of GMOs argue that we don't really know if changing the genetic structure of our food is safe. They also argue that while GMOs appear to be solving some farming problems, they are also creating new problems. Because the GMOs are owned by big companies, farmers are not allowed to save seeds from their own crops. Pollen from these crops is carried by the wind to other fields and can contaminate other crops. Organic farmers can't sell their crops as organic if contamination occurs. The possiblity of contamination also means that neighbouring farmers can't be sure what type of seeds they are saving. This is especially worrying because this may decrease the diversity of seeds available. Seeds can escape from fields and because they are not plants that occur in nature, there is a risk that they might become weeds that are difficult if not impossible to kill. Pests feeding on GMO crops that can produce insecticides may become resistant to these chemicals. Consumers are also worried about GMOs. Right now, food doesn't have to be labelled to show whether or not it contains genetically modified ingredients. Because genes are not visible to the naked eye, consumers have no way of knowing what unexpected genes their food may contain. This could be a concern particularly for vegetarians, people with cultural diet restrictions, and for people with food allergies.

What do you think?

Saving Seeds, Protecting Diversity

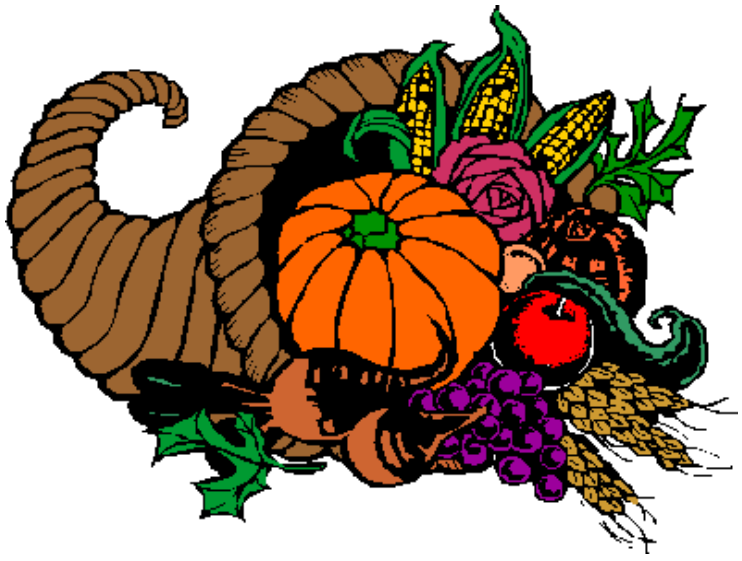
For thousands and thousands of years, farmers have been saving seeds from their plants and using them to grow the next year's crops. Because some plants do well in dry conditions, some better in wetter soil, some like more sun, and so on, farmers have also been able to save the seeds of plants that do best in the conditions in their fields. So, other than giving farmers seeds that do better under their growing conditions, why is it important to save seeds?

There are lots of reasons. Perhaps the most important reason is that once a variety of plant disappears, its genes disappear with it. This means that the genetic material of that plant is gone forever. For example, there are many types of fruits, vegetables, and flowers that were popular 150 years ago that no longer exist!

Having lots of diversity also means that we will be better able to grow plants that can adapt to changes in the environment. We need to have a large variety of plants that do well in very different environmental conditions. Although it sometimes seems that scientists can simply invent plants to meet our needs, even biotechnology must start with existing genetic material.

We also still have a lot to learn about the plants around us. Some medicines, for example, like aspirin (willow), quinine (cinchona bark), and digitalis (foxglove) were discovered "by accident" from plants that we might not have otherwise thought of as valuable and worthy of conservation. Who knows, those weeds in your garden may hold the cure to cancer or the common cold!

By saving seeds, we are protecting genetic resources for future generations.



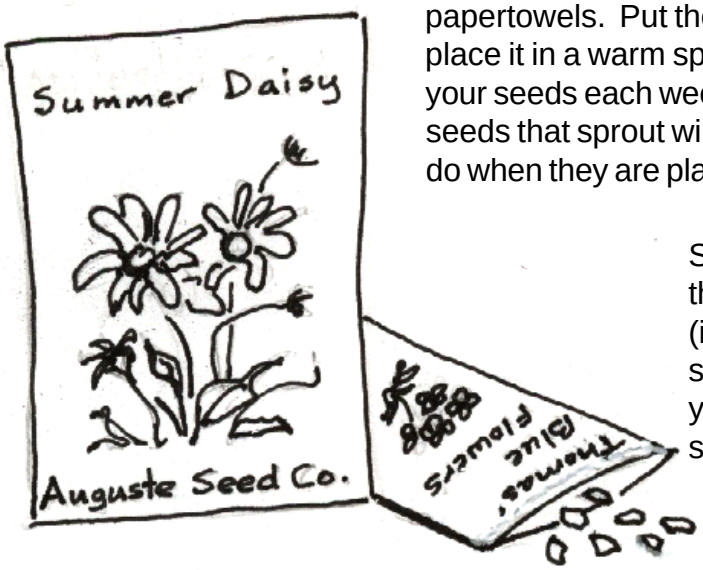
Seed Saving Basics

You can save seeds too; it's easy! Here's how:

1. Pick a ripe piece of fruit (apples, pears, blueberries, and grapes work well). Carefully cut the fruit in half and remove the seeds.
2. Rinse the seeds in water to remove the fleshy bits. Skipping this step can result in mouldy seeds!
3. Lay the seed on some paper towel and allow to dry for a few days.
4. If you want to save flower seeds, collect ripe seed pods or flower heads (they are the dry ones). Gently shake the seeds into a paper bag.
5. Seeds store best when they aren't exposed to light, so store all your seeds in a paper bag or an envelope.
6. Seeds also store best if they are kept dry. Place your paper bag or envelope of seeds into a tightly sealed glass jar. If you want, you can also add a package of silica gel (you can often find these in medicine bottles and shoe boxes–ask an adult).
7. Don't forget to label your seeds including the date they were collected!

To avoid disapointment:

Although archaeologists have found seeds from the time of the pyramids that were still viable (would still sprout), it's best to plant your seeds within a year for best results!



If you want to test seeds to see how well they will germinate (start to sprout), place some (at least a dozen) between damp papertowels. Put the papertowels into a sealed plastic bag and place it in a warm spot like the top or your refrigerator. Check your seeds each week until they start to sprout. The number of seeds that sprout will give you an idea of how well your seeds will do when they are planted.

Some seeds need special treatment before they will germinate. Some need a cold period (in the fridge or freezer), some need to be soaked in water before planting. If none of your seeds germinate, you may need to do some research!

Plants

Teachers' Page

Get Growing

Because the viability of seeds may vary, you will need to run a number of these experiments at the same time to ensure you have enough plants to compare the rate of growth.

By running the water through the potting soil, water soluble nutrients are removed (leached).

Ask the students to consider how the "leached" soil could be improved to increase the rate of growth and vigour of the plants.

Ask students to consider the advantages and disadvantages of using chemical fertilizers vs. natural fertilizers (like well rotted manure or compost) to feed their plants.

Plant Parts - Answers

roots
stem
leaves
flowers
fruit
seed

What's That You're Eating - Examples

roots: carrots, parsnips
stems: celery, rhubarb
leaves: lettuce, spinach, cabbage
flowers: broccoli, cauliflower
fruit: tomatoes, cucumbers
seeds: peanuts, peas, rice, flour (ground wheat seeds)

Plant Power

Plants perform a lot of services other than providing us (and lots of other creatures) with food. How many of these services can students name?

- Plants help to maintain a breathable atmosphere by giving off oxygen.
- Plants remove toxins, including carbon dioxide, from the air making it more breathable for us and protecting our atmosphere.
- Plants keep us cool by providing shade.

- Plants help decrease soil erosion by holding soil in place with their roots.
- Plants provide us with fibre for clothing and paper and with building materials for homes and furniture.
- Plants provide us with fuel like wood, ethanol, and even fossil fuels that came from plants eons ago!
- Many plants have medicinal uses.
- Plant extracts are used in perfumes.
- Plants are often used for dyes.

Habitat Map

Have students draw maps of your schoolyard showing different growing conditions. Are they shady areas? Sandy areas? Wet areas? High traffic areas?

Techno-Foods

- There has been a lot of media attention around Genetically Modified Foods in recent years. You may want to look at a case-study such as Percy Schmeiser vs. Monsanto Canada to help students understand the concerns of some Canadian farmers concerning GMOs.

- Have students investigate the benefits and risks associated with GMOs. Benefits might include allowing vaccinations to be incorporated into foods creating an affordable, efficient way of vacinating huge numbers of people; or, crops could be developed that would grow well on marginal land which could increase the options for food growing in many third-world countries. Risks might include the fact that the longterm safety of genetically altered food is not well understood; or, that the regular consumption of some genetic material might make humans susespitble to new diseases. Because GMOs are patented, another longterm risk of GMO use might be that the right to grow all food is controlled by a small number of big companies.

- Have students discuss why foods are not labeled to indicate whether or not they contain GMOs. One argument against labelling is that it would be too costly. Since both GMO and non-GMO plants from crops like canola are processed together, all foods containing canola, except for those that are certified organic, may contain GMOs!
  Do consumers have a right to know if their food contains GMOs? Should consumers have a choice?

- Have students research and discuss hunger. While some companies claim the increased production from GMO crops will feed the world, many people working in developing countries feel that poverty, food distribution, politics and corporate greed are the real issues causing hunger.

Animals

Here a Barn, there a Barn

Just as there are different ways of growing crops on a farm, there are different ways of raising farm animals (livestock). Two of these approaches are called “conventional” and “organic”.

Most conventional farmers feel it is best (or more economical) to keep a large number of one type of animal on a farm. Animals are usually kept in barns. Barns are used to keep animals safe from predators and bad weather. Barns make it easier to feed animals and to give them fresh water and allow farmers to control the temperature that the animals live in. Using barns also means that it is possible to keep a large number of animals without using up a lot of land; some barns can have three or four floors! Animals like beef cattle, dairy cows, pigs, and chickens are often housed this way. Conventional farmers feed their animals foods containing medicines to keep animals healthy by preventing disease and to help them grow more quickly.

Organic farmers don’t usually keep as many of one type of animal as conventional farmers. Usually there is a mix of different animals on an organic farm. Although animals sometimes sleep in barns on organic farms, all animals spend at least part of their day outside. Often animals are allowed to find their own food. Letting an animal eat grasses and other plants while outside in a field is called grazing. Organic farmers believe that animals are the least stressed when they are free to move around in an uncrowded, comfortable, natural area. Conventional medicines in food aren’t used because organic farmers believe that keeping animals happy is a good way of keeping them healthy. (Animals that become sick are given medicines, but they no longer would be sold as organic.) Because animals spend time outside, they also need to find ways of protecting their animals from predators like hawks, coyotes, and wolves. Some of these ways include using fencing, portable pens and guard animals.

Photo courtesy of Gayl Creutzberg

Build a Home for Hector!

Hector the pig needs a home. Draw and label all of the things that he will need to grow big and stay healthy. What will he eat? Where will he sleep? What other things will he need?

Old MacDonald had a Llama . . .

When you think of farm animals, what things come to mind? You might be surprised by some of the animals you can find on farms in Ontario!

Animals (also called livestock) can be part of a farm for many different reasons. Some animals are raised to provide us with food. Beef cattle, sheep, pigs, goats and chickens are some of the animals that we raise for meat. Dairy cows, sheep, goats, and chickens can also provide us with food like milk and eggs. Other animals work on the farm: draft horses, for example, are used by some farmers to pull farm machines like plows. Believe it or not, llamas and donkeys are sometimes used by farmers to protect animals like sheep from predators. Animals can also be an important part of a farm because their "poop" (manure) can be composted and spread on fields after it has been composted to help keep soil healthy and to feed plants.

Here are other animals that can be found on some farms in Ontario. What are they used for?

emu

rabbits

honey bees

turkeys

geese

ducks

Photo courtesy of Gayl Creutzberg

This guard llama protects a herd of sheed from predators on a farm in Bruce County, Ontario.

Animals in Hiding

There is an Ontario farm animal hiding in each sentence below. Can you find them?

Example: There's a bee in "I'll **be e**leven next month".

1. We can go at six o'clock.
2. It's nice to do good deeds.
3. You can keep the watch or sell it.
4. Tell me if I should start now.
5. Will a map help you?
6. Please turn the music down!

Hint: You might need to look in three words to find some of the animals.

Farm Animals

Teachers' Page

Old MacDonald had a Llama . . . Animal Uses

emu - raised for meat and oil
rabbits - raised for meat
honey bees - produce honey, help pollinate crops
turkeys - raised for meat
geese - raised for meat and eggs. Geese can also be used as guard animals and can be helpful for weeding crops.
ducks - raised for meat and eggs. Some ducks are also used to control insect populations.

Answers to "Animals in Hiding"

1. Goat
2. Dog
3. Horse
4. Fish
5. Llama
6. Emu

Media Watch

Watch your local newspaper for two weeks. How many stories can you find about farm animals?

Not in My Backyard!

Sometimes controversy arises over farm animals, often in the case of what are called "factory farms" (very large numbers of animals on one farm). Factory pig farms, in particular, have been in the news frequently lately. Have the class discuss why people might get upset about having this type of farm near where they live. Discuss why this type of farm exists. Are there alternatives?

Research Topic

Antibiotic resistance in animals and humans is an increasing concern. Have students research and discuss how routine use of antibiotics in raising livestock can contribute to resistance.

Pests

What a Pest!

What is a pest anyway? You might think we're talking about your little brother, but really we're talking about plants and insects. Of course, not all plants and insects are necessarily pests. Generally, we use the word pest to describe something that is causing a problem. A plant pest is called a weed and is a plant that grows where we don't want it to. These usually cause a problem because they can crowd out plants that we do want. In the case of insects, a pest is an insect that causes damage to plants, destroys things, or hurts animals or people or makes them sick.

Trying to label things pests can be a tricky thing though. What you call a pest, I might not! Try to identify the pests that sometimes aren't pests below.

I eat aphids in your garden.
I can appear in large numbers in your house and sometimes I bite!

— — — — — — —

I can often be found flying around garbage cans and water fountains and boy, can I sting!
I pollinate flowers, fruit, and vegetables.

— — — —

I grow in lawns and gardens where I'm usually not wanted.
My leaves are tasty in salad.

— — — — — — — — —

If you touch me, my oils might make you itchy.
Deer like to eat my leaves and birds enjoy my berries.

— — — — — — — — —

What's Bugging You?

Word List:

aphids
fruitflies
ladybug
moth
spiders
lacewing
mosquitoes
honeybees
carpenter
ticks

Across

4. These tiny, flying insects breed in fruits and vegetables.
6. They have eight legs.
8. These tiny insects harm plants by sucking sap.
9. The larvae of this insect eat holes in wool clothing.
10. This delicate sounding bug is really a fierce predator of plant-munching insects!

Down

1. This large black ant nests in wood.
2. They help farmers by carrying pollen from flower to flower.
3. They get on you (and on your pets) to suck blood.
5. They might give you an itchy bite, but bats like to eat them.
7. A single one of this type of insect can eat as many as 5, 000 aphids!

Still Being Bugged?

Famers and gardeners try lots of different ways to control insect pests. One strategy is to use "synthetic" (human-made) chemicals called insecticides. These chemicals sometimes kill the adult insects and sometimes stop adult insects from being able to reproduce. Synthetic pesticides need to be used very, very, carefully. Improper use can upset the soil's natural insect communities. Improper handling can also make you very sick. Remember, pesticides are poisons.

Some people worry about using chemicals. There is a concern that pesticides kill good bugs as well as bad even when they are used properly. Birds and animals that eat insects that have come in contact with these chemicals can also become sick or die. There is also a concern that these chemicals stay in the soil for a long time after their job is done and may eventually find their way into our drinking water.

There are ways to control pests without chemicals. Encourage predators like birds and toads which can help control insect populations. Make sure you don't harm insects like ladybugs, lacewings, and praying mantis; they eat many garden pests. You can sometimes avoid pest problems by planting native plants and by not planting the same plants in the same spots each year. If you still can't control your bug problem try to use only solutions made with natural ingredients.

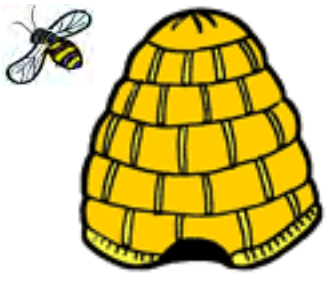
Unscramble these things you might find in a pest-free garden:

ridb sohues

sotda

wgseanlic

teavni atlnsp



To Spray or Not to Spray

What are pesticides? In a nutshell, pesticides are synthetic chemicals used to control insect and weed pests. The term pesticide is usually used as an umbrella term for both insecticides (used to kill insects) and herbicides (used to kill plants). The debate over the use of pesticides has been going on for decades, with no end in sight. There are clearly strong arguments to be made on both sides of the issue. Working in small groups, examine one of the following statement pairs. Divide your group in two, each group taking one side of the argument. Research your position and present your findings to the rest of the class in using a debate format.

- Pesticides are an essential element in the production of food for human consumption. Without their use, food production levels would decrease by 40%.
- The success of organic farms proves that pesticides are not a necessary part of food production.

- While there are clearly arguments to be made regarding the necessity of pesticide use in residential settings, for businesses such as golf courses pesticide use is an economic essential.
- Because of the environmental costs of pesticides and their potential risk to humans, their use in any urban setting for aesthetic purposes is irresponsible.

- Although many of the pesticides commonly used forty years ago are now known to be unsafe, due to advances in science, the benefits of using modern pesticides outweigh the hazards.
- Many of the pesticides used forty years ago that are now known to be unsafe were thought to be perfectly safe at the time. We simply don't have enough information to be sure of the long term risks of pesticide use.

- Pesticides are legally available products which are already heavily regulated. The choice of whether or not to use these products should be up to the individual.
- In order for there to be a substantial decrease in the amounts of pesticides contaminating our environment, governments must take a stand and enforce compulsory control of pesticide use.

Pests

Teachers' Page

Uninvited Visitors

Have students research invasive, non-native plants and insects like purple loosestrife or the ash-borer beetle. What strategies are being used to control these pests? What steps can we take to minimize this type of problem in the future?

Weedy Snacks

Dandelions are actually a very nutritious plant! Try these weedy snacks for your class.

NB: Dandelion can sometimes be found in the greens section of grocery stores. If you choose to pick your own leaves, choose plants that haven't flowered yet. **Only pick leaves of plants that you are certain have not been sprayed with herbicides!**

Dandelion Caesar Mini-Pitas
Mix 1/4 c. (50 mL) dandelion leaves and 1 ½ c. (375 mL) leaf lettuce with 1 Tbs. (15 mL) of prepared Caesar dressing. Stuff into mini-pitas.
(Makes 12-24 mini-pitas depending on how full you stuff them!)

Dandelion Dip
1 c. (250 mL) dandelion leaves
1/4 c. (50mL) chopped walnuts (optional)
½ c. (125 mL) cottage cheese
1 Tbs. (15 mL) mayonnaise or plain yogurt

Combine ingredients in blender until smooth. Serve with crackers.

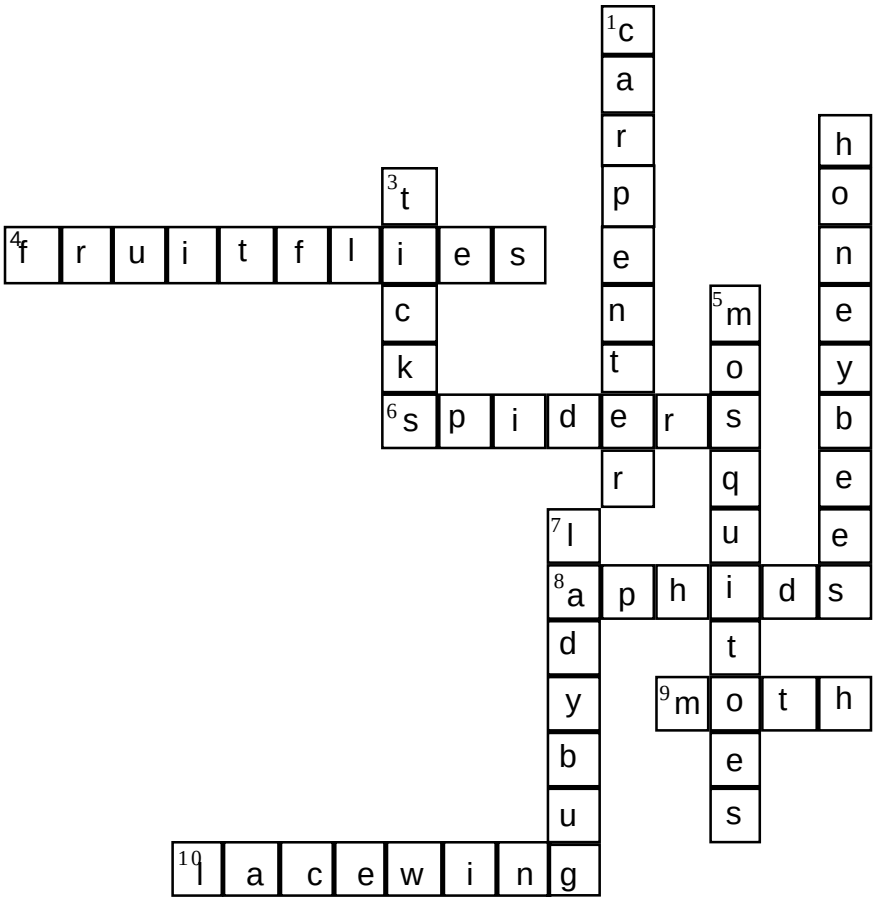
What a Pest! (answers)

ladybug
wasp
dandelion
poison ivy

Research Topic

Have students investigate and discuss alternatives to pesticides through integrated pest management (IPM) and biological pest control.

What's Bugging You?



Still Being Bugged? (answers)

bird houses
toads
lacewings
native plants

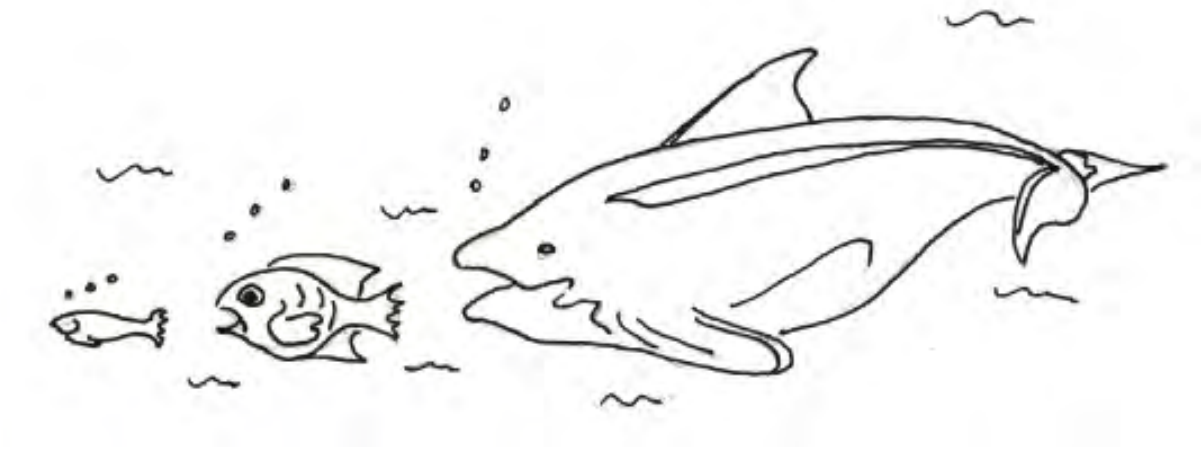
Communities and Connections

Everything is Connected!

All life on Earth depends on a natural recycling process to survive. All living things get energy from the food they eat. They then pass that energy on to whatever eats them!

Let's start with plants. Green plants use sunlight to make their own food. They also need nutrients from the soil. Because, for the most part, plants make their own food they are called **producers**.

Because everything other than green plants needs to eat something else for food, all other living things are called **consumers**. There are a number of different types of consumers. Animals that eat only plants (herbivores), like sheep and cows, are called **primary consumers**. Animals that eat meat (carnivores), like hawks or wolves, are called **secondary consumers**. Animals, like crows and vultures, that eat dead animals are called **scavengers**. The special organisms that return nutrients from dead plants and animals to the soil after everything else is done with them are called **decomposers**. Bacteria, fungi, and many insects are **decomposers**. Then, with the nutrients returned to the soil, the whole process can start again!

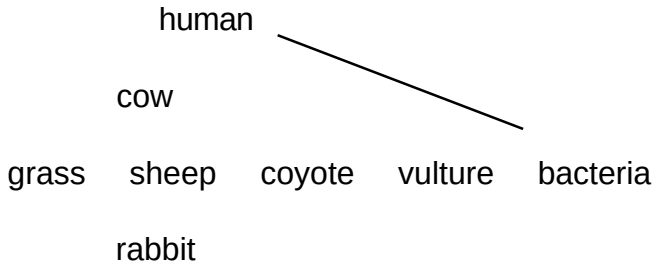


Food Chains

No, we're not talking about McDonald's! A food chain shows connections between the living things in an environment. Food chains start with a green plant, then show what eats the plant and then what eats the plant eater! We've drawn our example of a food chain as a straight line, but can you think of a way to make it a circle?

grass→sheep→coyote→vulture→bacteria

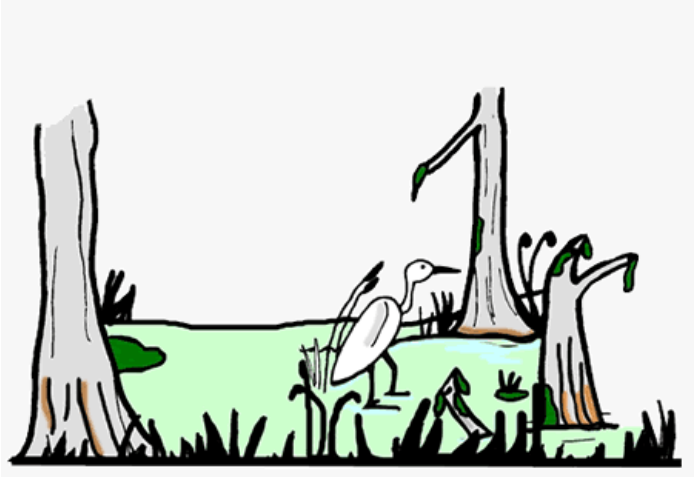
Because most things eat more than one other thing, food chains can be linked together to make food webs.



Try drawing your own food web!

Communities and Changes

A group of plants of animals that are all the same is called a **population**. A field of corn or a school of fish are both examples of populations. A group of different populations living in the same area is called a **community**.



What are some of the plant, animal and insect populations might you find in the community in the picture above?

How would the community in the picture above change if someone wanted to use the land to grow crops?

How would the community change if someone wanted to use the land to build a shopping centre?

What natural events could cause the community to change?

Everything is Connected

Teachers' Page

Food Chains

You may want to give students elements of a food chain and have them sort out the chain order.

example: grass seed, mouse, snake, hawk, bacteria
example: bacteria, fungi, fortifer, paramecium, nematodes, insects, moles

Communities and Changes

Human changes will cause the natural communities to change. Many of the existing communities will disappear, but some new communities may develop.

- Logging may destroy habitat for some populations, but will create opportunities for others.
- A change from small mixed farming to large scale cash crop farms will have the same effect.
- Even landscaping may create new habitats for new communities.
- Garbage dumpsters may attract populations of pests that wouldn't have been in the area previously.

Natural events that cause habitat and community changes include things like fires, floods, and changes in water volumes.

Chain Reaction

Try this activity with your class to emphasize the connections between organisms in a community.

1. Have the students stand in a circle so that they are facing the next person's back. Ask them to place their hands on the shoulders of the person in front of them.
2. On the count of three, have the students slowly lower themselves into a sitting position. Each student should now be sitting on the lap of the person behind them. Explain that each of them represents a different organism, or population of organisms in a community.
3. To demonstrate the effect of losing a population of organisms from a community, remove one student from the circle! What might bring about this loss?

Making Choices

Action and Consequence

Divide into small groups. Consider one of the following situations. As a group discuss the possible actions that could be taken and the positive and negative outcomes for each action. Be prepared to share your ideas with the rest of the class.

1. You are a member of City Council for a large Ontario city. There is a proposal before council to issue a permit to build a series of new housing subdivisions and a mall on the edge of town. The development will mean that many new jobs will be created and much needed housing will be built. The proposed development is for an area that is currently classed as “Class 1" farmland (farmland with the best soil and climate conditions). Do you vote in favour or against the permit being issued? Why?

2. You just inherited a 400-hectare farm. In the middle of one of your fields is a marsh. One of your neighbours has suggested that you should drain and fill in the marsh. It would make it easier to move your tractor through the field and would increase the amount of your farmable land. What do you do and why?

3. You are a farmer who grows primarily wheat. A new genetically modified strain of wheat has recently been approved by the Canadian government. The manufacturer’s salesperson that visited your farm last week said that use of this new strain could mean a substantial increase in your profits. Since last year’s crop didn’t do as well as you had hoped it would, this sounds great! Your neighbour, an organic farmer, is concerned that your use of a genetically modified wheat might contaminate her own organic wheat crop. What do you do?

4. While doing your weekly grocery shopping you notice that there are three types of tomatoes available for sale. One type of tomato, on special for less than half the cost of the other two, is grown in Chile. The second type is grown in British Columbia. The third, an organic tomato, comes from California. What do you buy and why?

5. You are an organic farmer raising free-range chickens. They roam in a ¼-hectare fenced enclosure eating grass and insects. Over the past few weeks 10 of your chickens have disappeared! You have noticed that a red-tailed hawk appears to have made a home in one of the trees near your chicken run. You try hanging fishing line across the top of your run to deter the hawk from going after your chickens, but chickens continue to disappear. How do you solve the problem?

Action and Consequence

Teachers' Guide

Remind students that there are no right or wrong solutions to any of these problems. If discussions seem a bit slow or wrap up too quickly, you may want to suggest some of the following points for students to consider.

Situation 1

- Have students consider the apple exercise on page 21 of this kit.
- What would happen if the new housing development isn't built?
- Are there alternatives for where new housing could be built?

Situation 2

- If the marsh is filled, how would wildlife be affected?
- Would drainage change if the marsh was filled? What effect would this have?
- Do farmers have a right to do what they want with the land they own?

Situation 3

- What are the advantages and disadvantages of genetically modified organisms?
- What might the poor performance of last year's crop suggest?
- Do farmers have a right to do what they want with the land they own?
- Should farmers/landowners be responsible if actions on their land affect a neighbour?

Situation 4

- What are the working conditions like in Chile compared to Canada and the U.S.?
- How much did it cost to transport the tomatoes and what is the environmental impact of each choice?
- Why are there no local tomatoes available? Are they in season? How might this affect your choice?

Situation 5

- How could a hawk be beneficial to a farmer?
- Could there be another reason for the chickens disappearing?
- Are there alternatives for housing the chickens that might be in keeping with Organic practice?

Ethical Consumerism

Ethical consumers believe that it is necessary to consume less in order to protect the environment. They also believe that we need to consider the environmental and social impacts of what we do consume.

Select several food items found in your lunch. As a class, list the hidden environmental and energy costs. How much packaging is there? Is it recyclable? How much transportation was required to get the food from the source to the consumer? How processed is it? How does processing affect environmental costs? Has the food been refrigerated at any point? (Freon used in refrigeration can cause ozone damage.) Is it possible to find out where the ingredients of a processed product come from? How was it grown? (If conventionally grown, it used fertilizers that are produced using fossil fuels.)

Is there a social cost to food? Research labour practices and standards of living in countries that export food to Canada. How do these conditions compare to Canadian farms and factories?

You can make a difference!

You don't have to live off the grid and produce all of your own food in order to make a difference. If everyone does a little, big changes can happen!

Buy locally! Buying locally requires less transportation to get food to you and has less of a negative environmental impact. You will also be helping to support your local economy.

Not happy with the food choices available to you? **Talk to your school** about food available in the cafeteria or vending machines. You can also ask to talk to your local grocery store manager. Grocery stores will often carry items requested by regular shoppers! You can buy food from Farmers Marketsor directly from local farmers. Some organic farms even have a Community Shared Agriculture (CSA) program that provide consumers with fresh, local food on a regular basis!

Think before you buy! Consider the hidden environmental costs before you buy.

Educate others! Talk to your family and friends about their consumer practices.

Explore recipes that use seasonal foods! Using foods that are in season reduces the need to buy non-locally produced foods.

Any other ideas?

Hey, Where did that Big Mac Come From?

We are all familiar with the parts of a Big Mac: two all-beef patties, special sauce, lettuce, cheese, pickles, onions, on a sesame seed bun. But where do these parts come from? The obvious answer would be that they come from your local McDonald's Restaurant, but since your local McDonald's doesn't grow wheat or raise cattle, the real answer is obviously more complex.

For this exercise you will need:

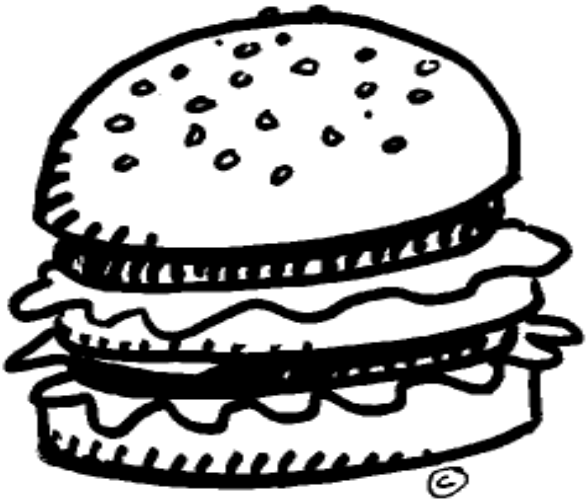
- a map of the world
- straight pins
- string

1. As a class, research the origins of each of the parts (and possibly of their components) of a Big Mac. In addition to the actual point of origin, see if you can determine the path that these foods have taken before actually reaching you, the consumer. Where, for example, was the lettuce grown? Where does the lettuce go to be chopped up? Where is packaged? Is it shipped to a central distribution centre before being delivered to your local McDonald's?

2. Place a pin in the map for each of the locations discovered above. Connect the pins showing the path followed by each item using a piece of string.

3. If you're feeling really ambitious, you can add up all of the distances the food in your Big Mac has traveled before it reached you!

4. If you were to do the same activity with a hamburger you made at home, how would your two maps compare?



The Real Cost of Food

Teachers' Page

Hey, Where Did That Big Mac Come From?

Ingredient lists can be found on the McDonald's corporate site (www.mcdonalds.com). After viewing this list, you might want to decide to only source the major components of items such as the special sauce and the bun. If your students hit roadblocks and are unable to trace the sources of the Big Mac components, you might want to have a discussion about the transparency of corporate food processors. Why might corporations not want to share this information? What are concerns that, as consumers, we should have about a lack of transparency? Should companies be required to tell us where ingredients come from?

A Loaf of Bread

According to UNESCO data from 1984, the following is a breakdown of energy expenditures needed to make one loaf of bread.

Wheat growing (fertilizer, tractors, drying, grinding)	19.4%
Making the flour (direct energy, packaging, transportation)	12.9%
Making and baking the bread (gas, electricity, packaging)	64.3%
Selling the bread	3.4%

Talking Points

Have students think about and discuss the following ideas.

- In Canada we import over 85% of the organic food products we consume. Canadian farmers export over 80% of the organic food products we produce.
- People in many parts of the world are dying of starvation. In Canada, tonnes of produce is dumped every year because it doesn't meet with consumer standards (e.g. peaches that are too small or apples that are the wrong shape).
- While some people feel that levels of food production need to be increased in order to deal with world hunger, supporters of local and sustainable food systems feel there would be enough food now if issues of access, poverty and politics were addressed.
- According to the Ontario Ministry of Agriculture and Food, if all agricultural pesticides were banned, it is estimated that food production would drop by 40%.

Glossary

biodiversity - The variety of life in all its forms.

community - A group of different populations living in the same area.

compost - Natural fertilizer that is made by active biological organisms from food scraps, animal manure, and fallen leaves.

consumer - An organism that can't produce its own food and must eat something else to survive.

contaminate - To make impure by contact or mixture with harmful bacteria, fungi, or dangerous chemicals.

cover crop - Plants planted for the specific purpose of covering the soil. These plants are either havested or plowed inot the soil to improve soil health.

cultivation - Tillage to prepare the ground for seeding, transplanting, or for weed control.

environment - The total of all external conditions which act upon an organism or community of organisms to influence development or existence.

fertilizer - A natural or synthetic material added to soil to supply plants with certain essential nutrients.

genetic engineering - The modification of an organism's genetic information by methods other than breeding and selection.

genetically modified organism (GMO) - Plants or animals whose genetic information has been modified by methods other than breeding and selection.

herbicide - A substance used to kill pest plants.

insecticide - A substance used to kill insect pests.

manure - Animal dung or other organic material (green manure) used to fertilize soil.

nitrogen - Gas that occurs naturally in the air and soil, where it is converted into usable forms for plant use by bacteria and other natural processes.

off the grid - Not connected to the electrical utility grid.

organic - Of, pertaining to, or derived from living organsims.
- A set of standards for faming that addresses environmental and animal welfare issues.

overgrazed - Land that has too many animals for the plant population to support.

pesticide - A substance used to kill insect, plant, or animal pests.

pollution - Substance which contaminates water, soil or air to the extent that it is no longer useful or is harmful to living things.

population - A group of animals that are all the same.

producer - An organisms capable of making its own food.

sustainable farming - A farming practice that does not deplete or exhaust the resources upon which it depends.

tradition - A mode of thought or behaviour followed by a people continuously from generation to generation.

Resources

Websites for Teachers and Students

www.schoolnet.ca
Program information on soil, biodiversity, habitats, etc. This site also has on-line activities about sustainable development.

www.davidsuzuki.org
Lots of information on a variety of environmental issues.

Minnesota Agriculture in the Classroom (www.mda.state.mn.us) This website has lots of very good resources for teachers including downloadable curriculum pages on various aspects of agriculture including Integrated Pest Management.

Green Teacher (www.greenteacher.com)
This on-line magazine has many interesting articles and program ideas.

Earthbound Farm Organic (www.ebfarm.com)
This is an American site, but it has lots of good definitions and information on plants.

Ontario Agri-Food Education Inc. (www.oafe.org)
OAFE has a number of agricultural resources available for teachers, produced primarily by commodity and agricultural interest groups.

Seeds of Diversity (www.seeds.ca) This charitable organization is dedicated to developing a living gene bank to conserve and document public-domain, non-hybrid plants of Canadian significance. The site has information on seed exchanges and seed saving.

Canadian Biodiversity Information Network (www.cbin.ec.gc.ca) This Environment Canada site has a great kids section and lots of information for educators including numerous links to other sites, many of which are also Canadian.

Organic Agriculture Centre of Canada (www.organicagcentre.ca) This Government of Canada site focuses on research and education. It is a great resource for teachers and there are links to other kid-friendly sites.

Rodale Institute (www.kidsregen.org)
"Healthy soil, healthy food, healthy people". Lots of information for kids and teachers including curriculum information for grades 2-6.

Statistics Canda (statcan.ca/english/kits/agric/organl.htm) Lesson Plans are available for Secondary School students.

Federation of Ontario Naturalists (www.ontarionature.org)
Excellent education resources can be found on this site, especially on the topic of soils.

ecokids.ca
This site has a variety of links and activity ideas. It also has information about national programs that kids can participate in.

The International Society for Ecology and Culture (www.ise c.org.uk/gfindex.html)
This site features an interesting "Global Food Index" with some great stats for discussion.

Community Resources

The Ecological Farmers Association of Ontario
Box 127
Wroxeter, ON N0G 2X0
519-335-6566
www.efao.ca

Everdale Environmental Learning Centre
P.O. Box 29
Hillsburgh, ON N0B 1Z0
519-855-4859
info@everdale.org

J. Steckle Heritage Homestead
811 Bleams Rd.,
Kitchener, ON N2E 3X4
www.web.net/~jsteckle/edu

Ontario Museum Association (www.museumsontario.com)
A guide to Ontario museums is available on-line.

About the Ecological Farmers Association of Ontario

EFAO Mission and Mandate

The Ecological Farmers Association of Ontario was established in 1979:

1. To develop and provide programs promoting the practice and advancement of ecological agriculture which maintains and enhances the health of the soil, water, crops, livestock, and the diversity of the environment.

2. To educate and increase the public's understanding of ecological methods like soil tillage, green manures, cover crops, composting, crop rotations, soil erosion control, and conservation practices by offering course, seminars, conferences, farm tours, meetings, and publishing a newsletter and by collecting, researching, and disseminating information on this topic to the general public.

3. To bring together people who are concerned about ecological agriculture so they can share experiences, support each other and create community.