

Activity Book – What On Earth Is Soil?



Name _____

School _____

Grade _____

Teacher _____

Soil Detective Game

Can we live without soil? Stop and think for a moment. What did you have for breakfast this morning? Where did it come from? If you trace it back far enough, you'll find that no matter what you had for breakfast, it started with a green plant growing in the soil.

Directions: Circle the following 13 words in this block of letters. They may be located vertically, horizontally, diagonally or backwards.

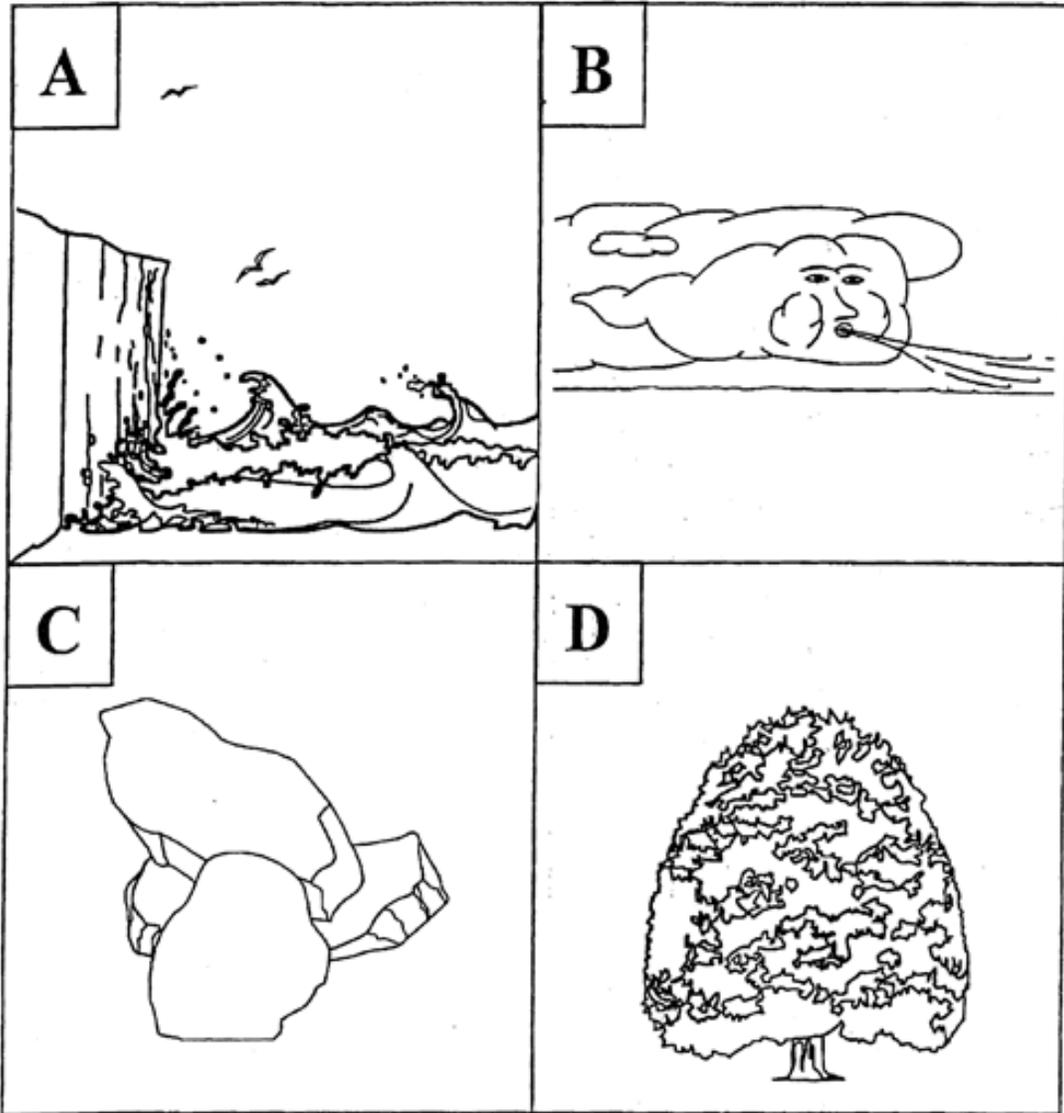
S	T	N	A	L	P	O	S	E	V
A	O	P	Q	I	J	T	B	W	E
N	O	I	U	H	O	C	E	A	G
D	M	D	L	O	C	N	Z	T	E
S	G	H	R	A	I	N	L	E	T
X	W	O	U	H	S	K	T	R	A
R	O	T	S	D	S	K	S	P	B
T	T	N	O	N	B	V	C	I	L
C	U	M	L	I	G	H	J	O	E
S	M	R	O	W	C	O	L	P	R

Words to look for:

COLD
HOT
ROCKS
WIND
RAIN

SAND
WATER
WORMS
PLANTS

VEGETABLE
SOIL
ROOTS
SUNSHINE



(Color on your own.)

Which of these makes up soil?

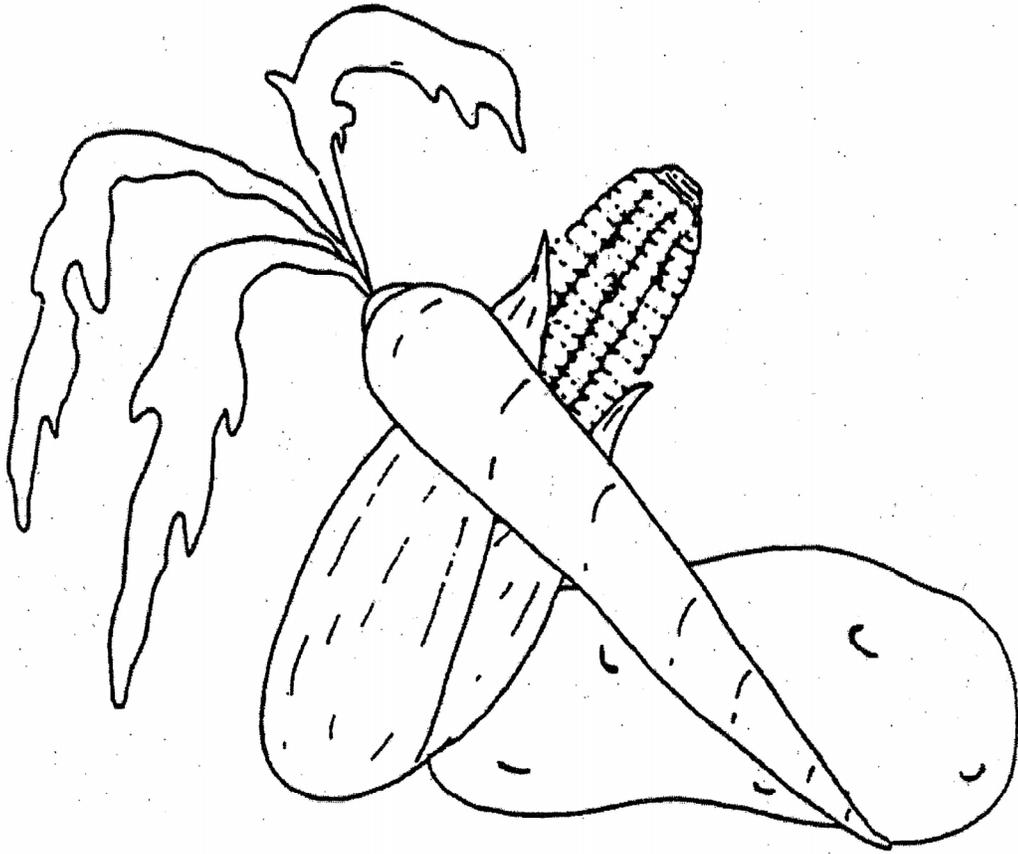
A _____

B _____

C _____

D _____

See page 8 for answers



Where are vegetables grown?

_____ A. The grocery store.

_____ B. The soil.

See page 8 for answers

List ten *vegetables* that depend on the soil to grow.

1. _____

2. _____

3. _____

4. _____

5. _____

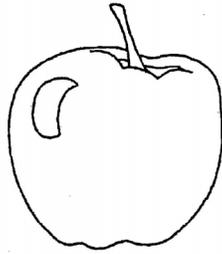
6. _____

7. _____

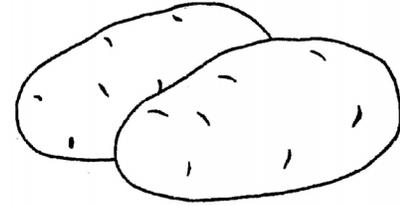
8. _____

9. _____

10. _____



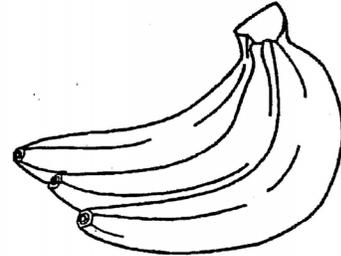
1. Apple



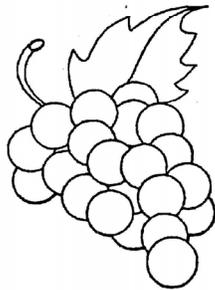
2. Potatoes



3. Carrot



4. Bananas



5. Grapes

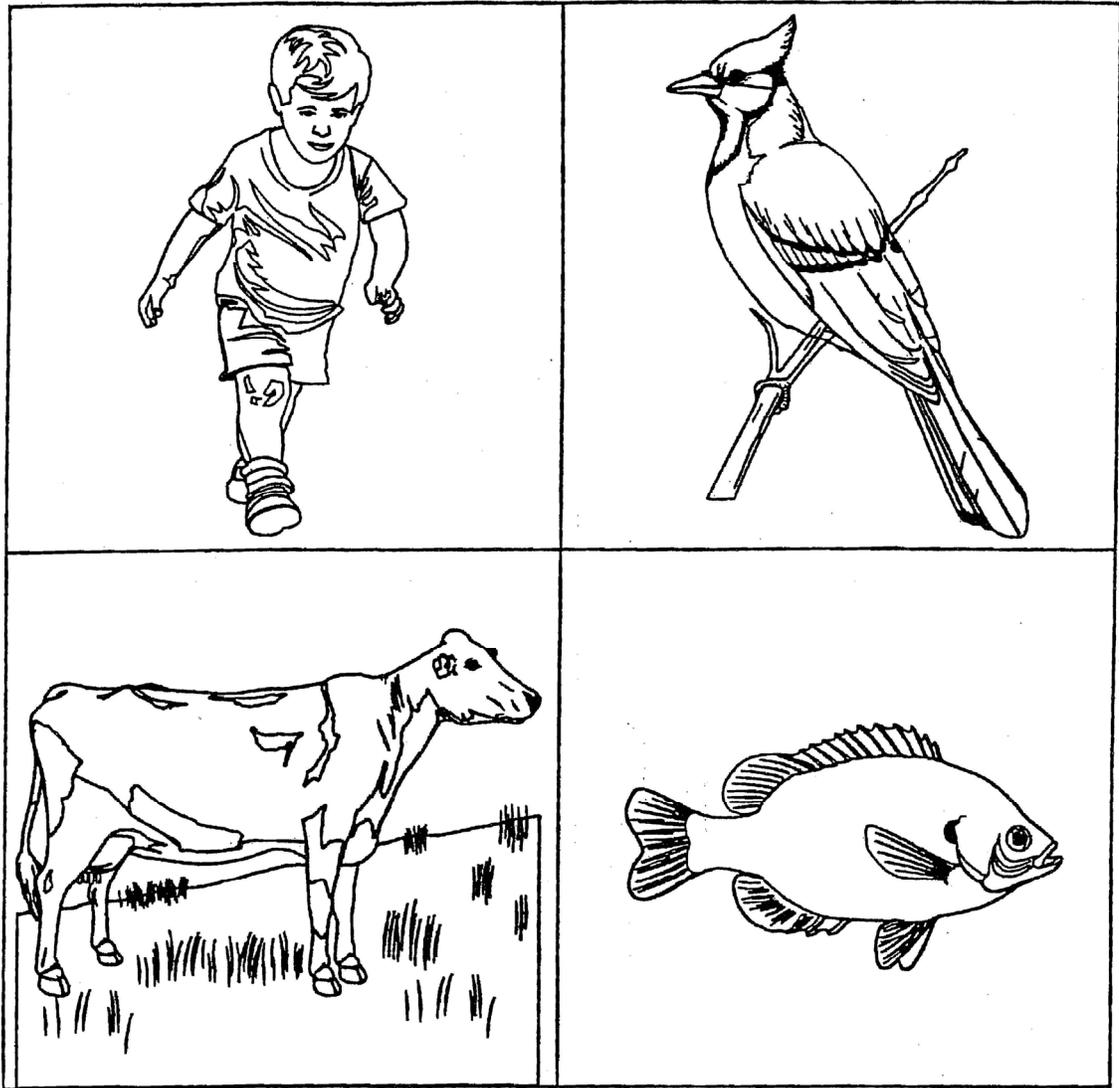


6. Peanuts

Which of these fruits and vegetables are harvested below the soil and which are above the soil? (Write the number).

Below _____ Above _____

See page 8 for answers



How many of these living things depend on the soil?

- _____ A. Boy
- _____ B. Bird
- _____ C. Cow

- _____ D. Fish
- _____ E. All living things

See page 8 for answers

Answer Page

Which of these makes up soil?

The answer is all of them.

- A. Water
- B. Air
- D. Rocks
- D. Organic Matter

Where do vegetables come from?

The answer is B.

Vegetables come from the soil.

Vegetables depend on the soil to grow, then they are taken to the grocery store.

Which of these fruits and vegetables are harvested below the soil and which are above the soil?

The answer is:

- | Below | Above |
|--------------|-------------|
| (2) Potatoes | (1) Apple |
| (3) Carrot | (4) Bananas |
| (6) Peanuts | (5) Grapes |

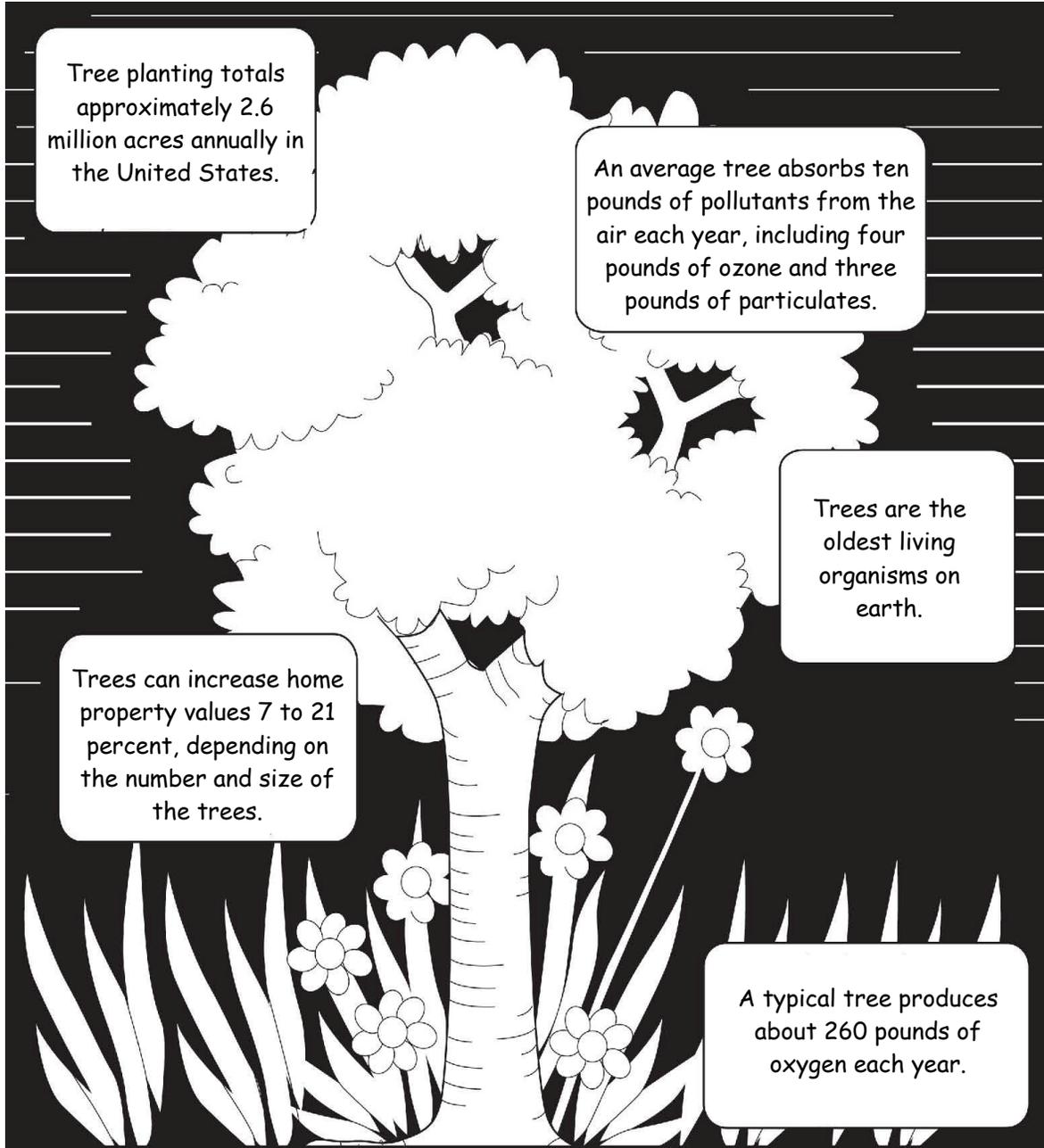
How many of these living things depend on the soil?

The answer is E.

All living things depend on soil to survive.

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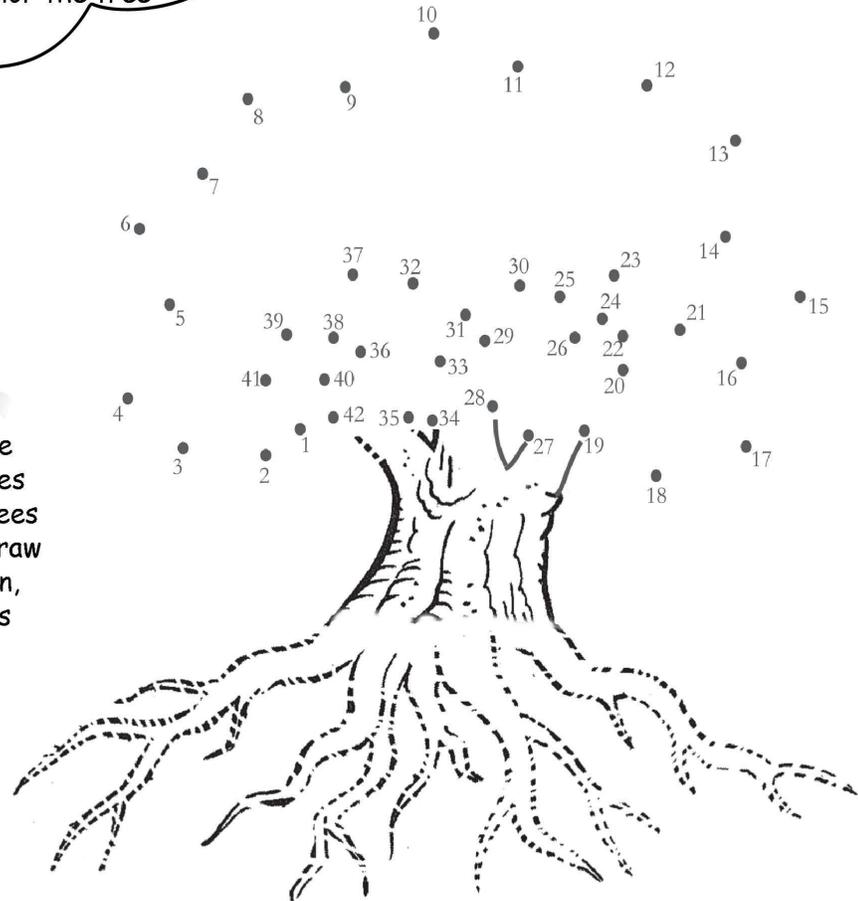
Conservation Trees



Look inside to learn more about trees!

A tree has different parts. LEAVES make food for the tree. BRANCHES hold the leaves up to the sun. The TRUNK holds the tree nice and tall. ROOTS get water and nutrients from soil. Connect the dots to complete the drawing of the tree. Then color the tree and all of its parts.

Trees need things around them to grow. Trees need SUN to make food in their leaves. Trees need RAIN for water. Trees need SOIL to grow big. Draw a YELLOW sun, BLUE rain, and BROWN soil for this tree so that it will keep growing.

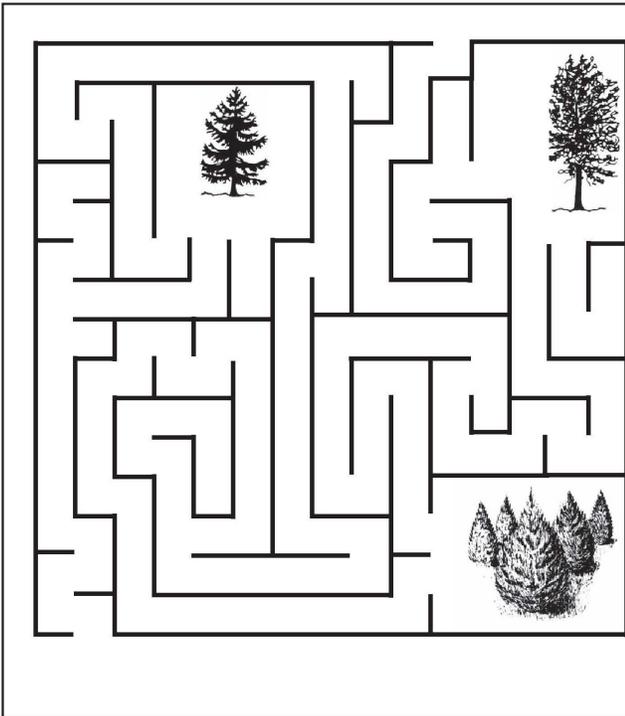


B T W C S R U B B E R L N
 I O U V E H G F B B P D M
 L Y J B K P E N C I L S C
 A S M L Z B M E R H F K I
 P U F T O P E D P G U C L
 L B V U H F D P A I E N D
 C A P E R T I K I J L Q W
 X S A E G N C L N R D I C
 O T P S T L I S T U E S A
 K A N I O Y N T J M R D R
 P H U V S M E D U E L I P
 T R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

Many of the things we use everyday come from trees. You might be surprised by some of the things made from wood.

Find the words from the list in the word search. Can you think of more products you use that come from trees? Make a list of the products and make your own word search to share with classmates.

- | | | |
|---------|-----------|---------|
| Carpet | Furniture | Paper |
| Clothes | Lumber | Pencils |
| Fruit | Medicine | Rubber |
| Fuel | Paint | Toys |



Trees make your town a better place to live. There are many places to plant trees, however there are also some things to keep in mind when planting a tree.

Be sure to find out where any underground utility lines are, make sure your tree will have plenty of room to grow, and choose the right type of tree. How do you know if it is the right tree? You can find more information at your local nursery. Landscape professionals should be able to tell you where a tree will grow healthy and strong.



Trees give us benefits every day. Sometimes we take for granted all we get from trees. But when you start adding it up, the gifts from trees are amazing! Solve these problems to see the benefits from one tree. For these problems, assume that this tree will live for 50 years.

This oak tree produces 5,475 acorns in one year. If one squirrel needs 5 acorns a day, how many squirrels can this tree feed for one year?
_____ squirrels

Trees transform carbon dioxide into oxygen that we need to breathe. If this one tree makes enough oxygen each day to fill 2 houses that measure 1800 square feet, how many houses full of oxygen will it produce over its lifetime? (Assume its oxygen production is steady. In reality, the rate varies with the growth of the tree.)
_____ houses full

Trees add water vapor to the air through transpiration. If an acre of trees can transpire 600 tons of water per day, and there are 40 trees per acre, how many tons of water will one tree transpire during the months of May, June, July, and August?
_____ tons

This tree adds 400 pounds of leaves to the soil each year. By holding soil with its roots, and by slowing the fall of rain with its leaves, the tree also prevents 100 pounds of soil from eroding each year. After 12 years, by how many tons of soil has this tree enriched this location?
_____ tons

Answers: Math pg. 3 1) 3 squirrels 2) 36,500 houses full 3) 1845 tons 4) 3 tons

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Activity Book - I Dig Dirt

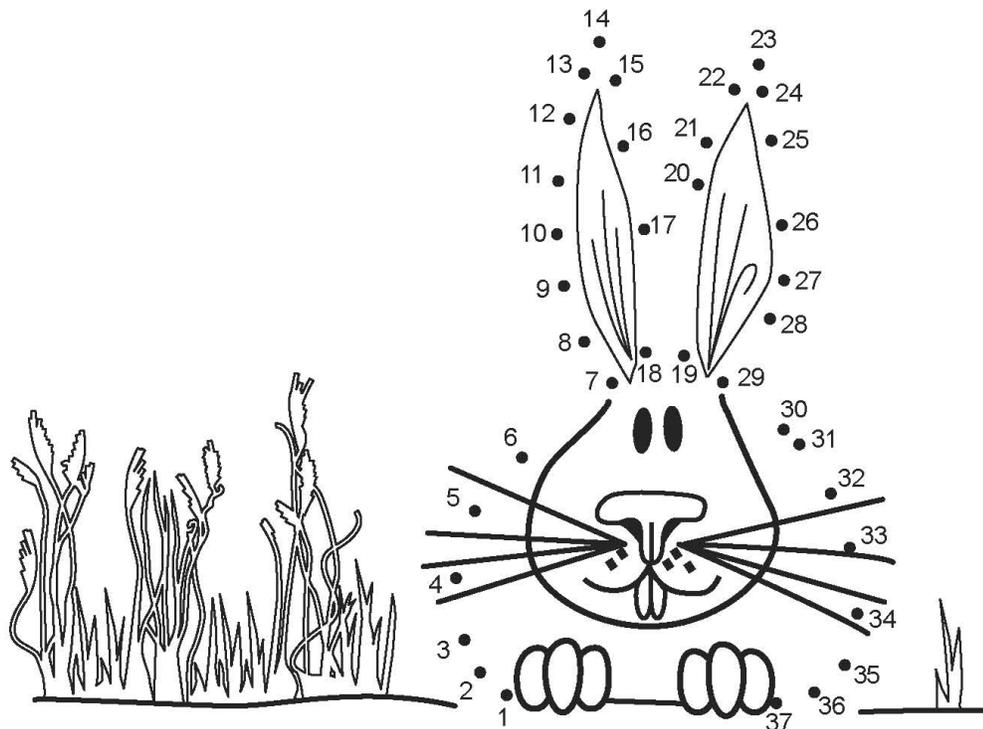


Hi My name is Dust E. Bunny. I dig dirt. You know, the stuff humans call "soil." I live in a watershed and my home just wouldn't be the same without soil.

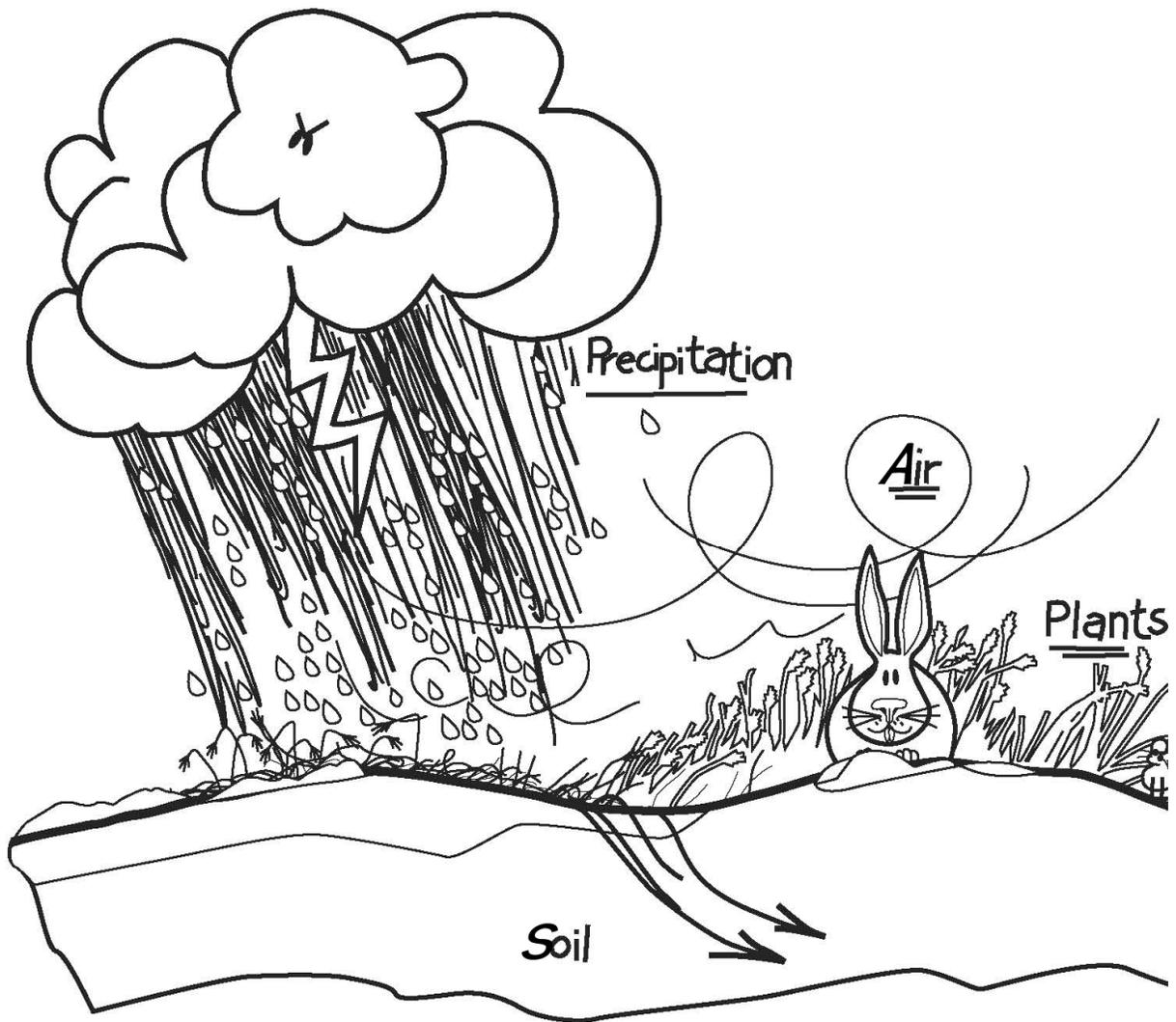
A watershed is an area in which all the water flows into one larger body of water such as a river or lake. When the water gets to the river or lake it needs to be clean for fish to live in and for farmers and ranchers to use for irrigation. A watershed needs plenty of healthy vegetation, not just for me to eat, but also to keep the soil from eroding and making the water dirty.

This activity book will explain what is needed to make a watershed healthy, how plants grow, and ways to keep the soil from eroding. Hop along with me and let's learn more about watersheds, plants, and soil. I'll be on every page of the activity book. Can you find me?

Connect the dots to finish the rest of my body so I'm ready to travel along with you.

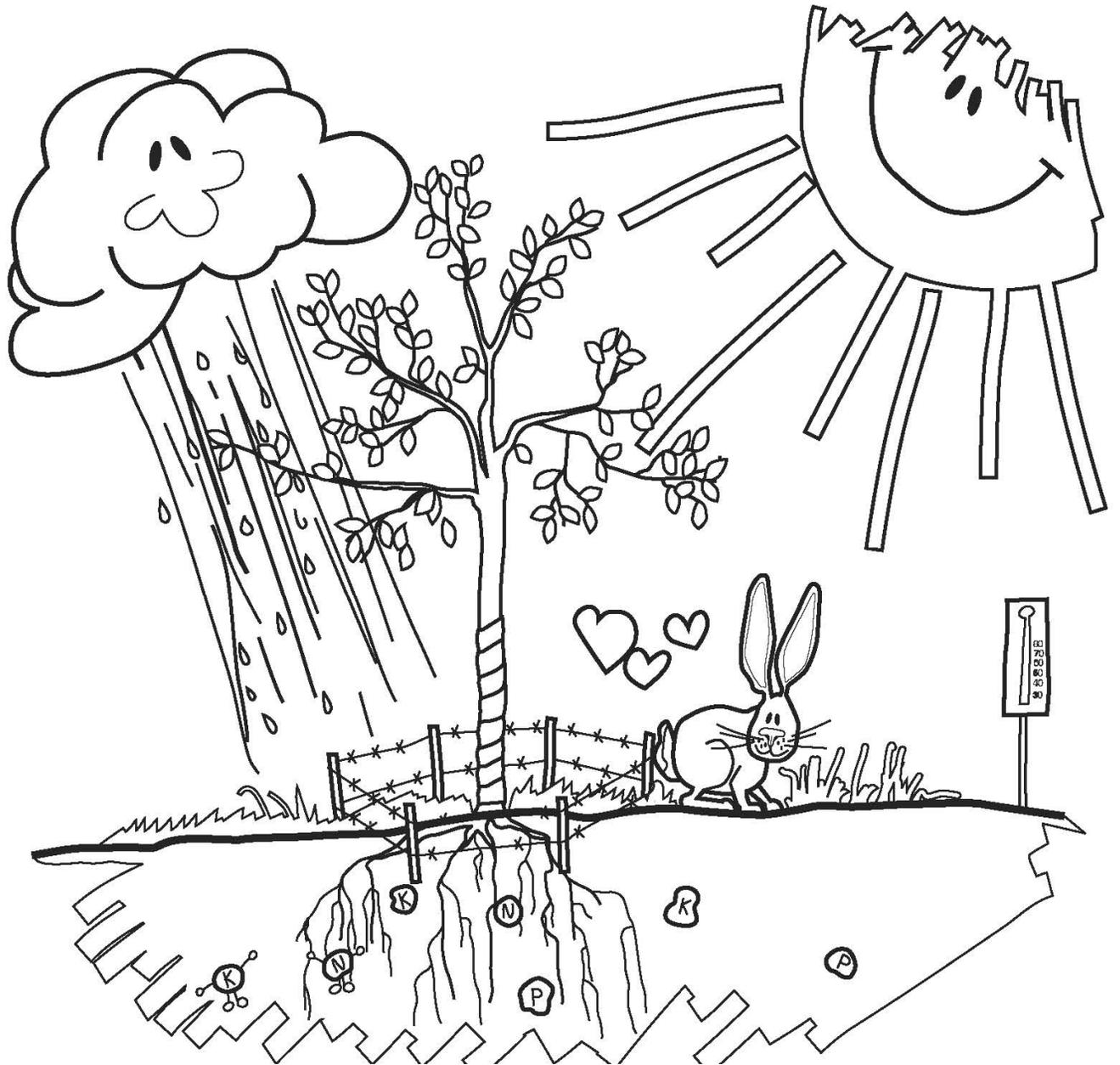


Watershed Components



Watershed Component: plants

What is needed to make plants
GROW??



Plants need:

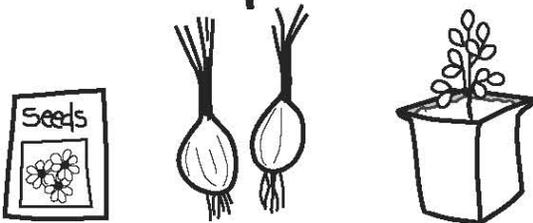
1. **Soil**

2. **Water**

3. **Air**

4. **Light**

5. **Temperature**

6. 

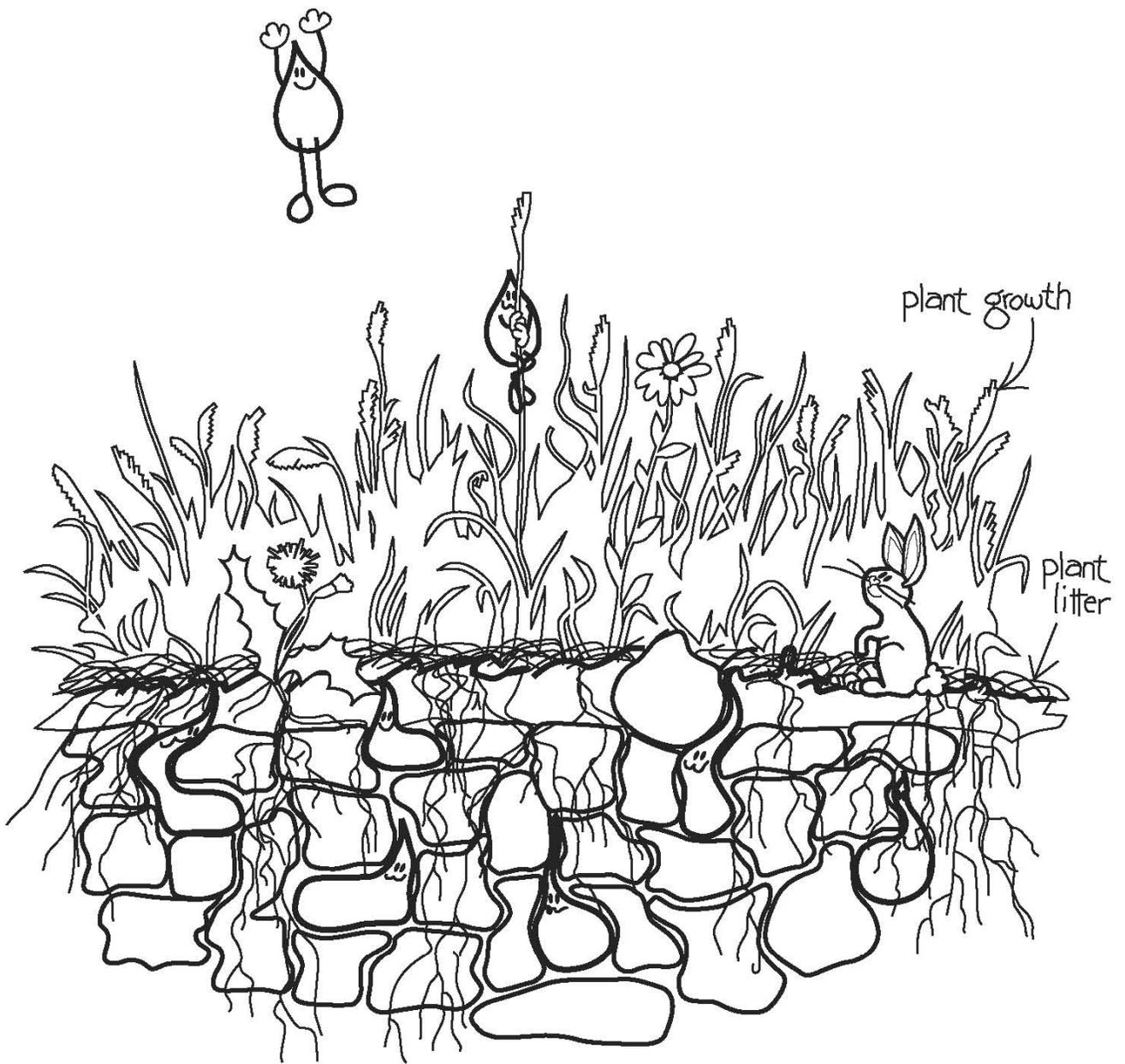
7. **Organic Matter**

8. **Nutrients**

9. **Care**

The effect of Plants on watershed stability





Ground Cover Is Needed For:

Rainfall Interception

Good Infiltration

Erosion Control

Water Quality

Grazing

Wildlife Habitat

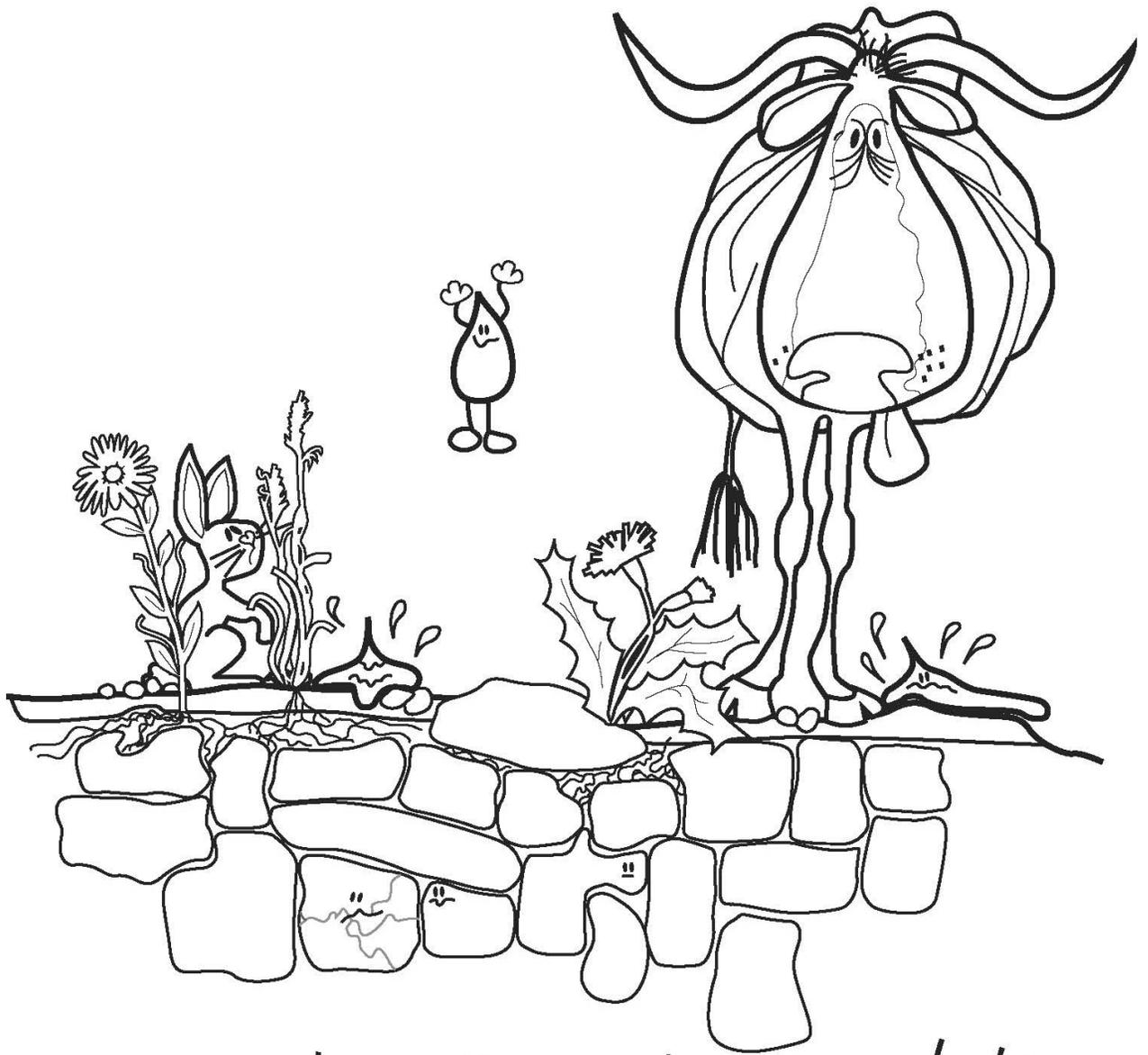
Reduced ground cover, from overgrazing, insect damage and/or drought, results in increased runoff & reduced available soil water.



Reduced plant growth & plant litter increases wind & water erosion.



Erosion reduces water quality and soil productivity by increasing sediment problems and by carrying away plant nutrients...



... and results in less vegetation
for livestock, wildlife and
watershed stabilization.

Watershed Component: soil

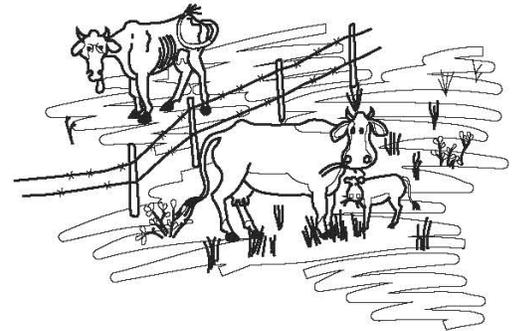
Soil characteristics & climate vary.

So do land Use opportunities!!

Roads



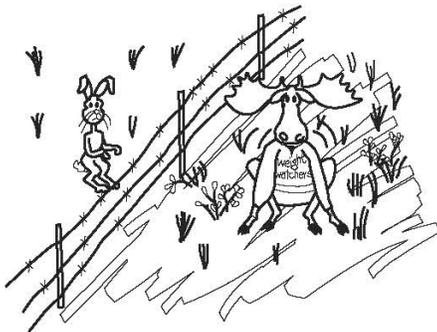
Livestock



Farming



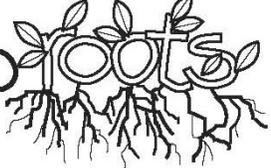
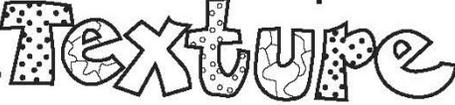
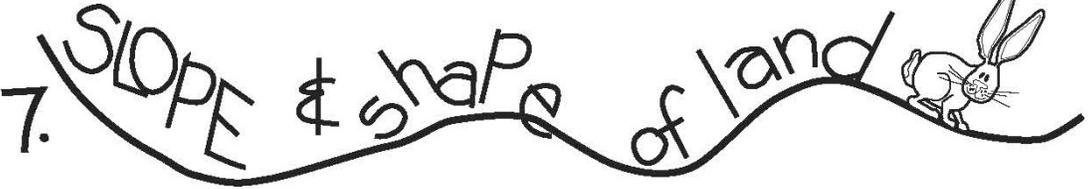
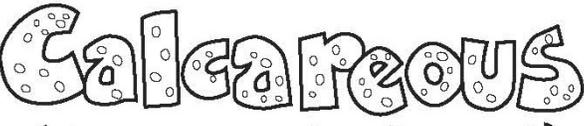
Wildlife



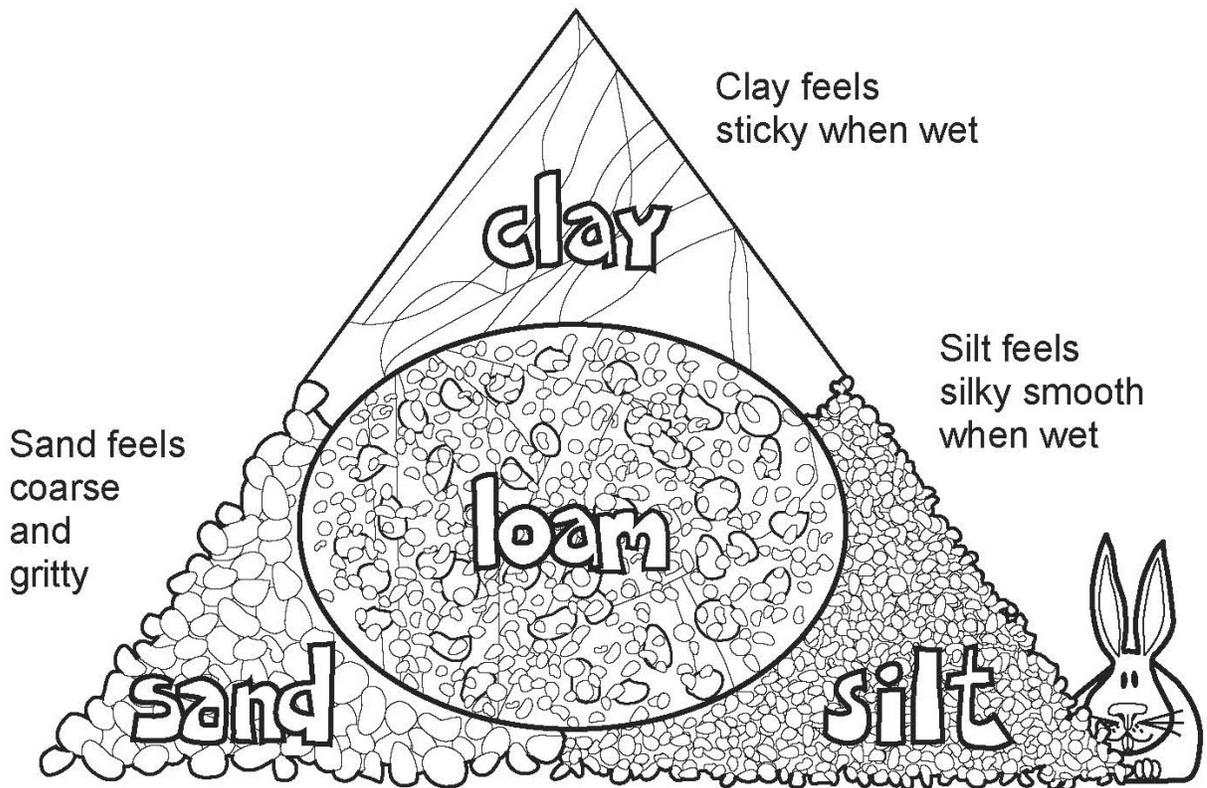
Homes



Soil Factors

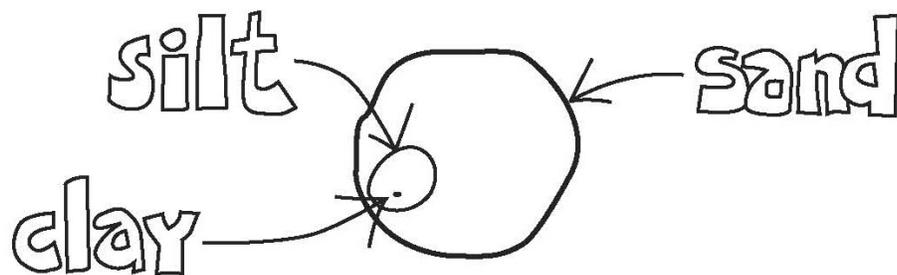
1. Natural soil drainage & overflow conditions
2. Soil depth favorable to  roots
3.  Texture
4.  Structure
5.  Permeability
6.  Gravel stones & other rock fragments
7.  SLOPE & shape of land
8.  Salinity or sodium problems
9. Strongly  Calcareous
(which means it has lime in it)

Soil Textures



Loam is a combination of sand, silt, and clay.

Relative size of sand, silt, and clay particles:



Plants

need all kinds of things to grow and be healthy. Fill in the blanks with words from the list below to continue learning about what makes plants healthy.

1. _____ falls from the sky and helps plants grow.
2. Your lawn grass needs _____ to hold the roots.
3. There are four basic soil textures, one of them is _____.
4. The soil texture with the largest particle size is _____.
5. Name one kind of soil erosion _____.
6. _____ help reduce soil erosion into streams.
7. Three-fourths of the earth is covered by _____.
8. _____ is a home for wildlife.
9. Protection of our natural resources is called _____.
10. Plants need _____ to make their leaves green.
11. The water _____ is nature's way of recycling water.

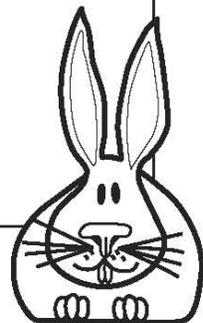
Word List

rain
wind
clay

buffers
sand
water

topsoil
habitat
conservation

sunshine
cycle



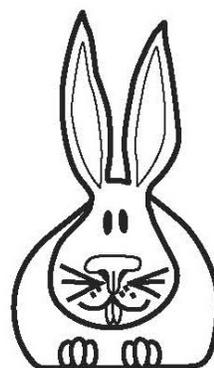
Many things are needed to make a watershed healthy.
 Find the following words which help describe a healthy watershed.
 (Hint: some words may be spelled backwards.)

Plants
 Grow
 Watershed
 Soil
 Water

Air
 Light
 Temperature
 Nutrients
 Climate

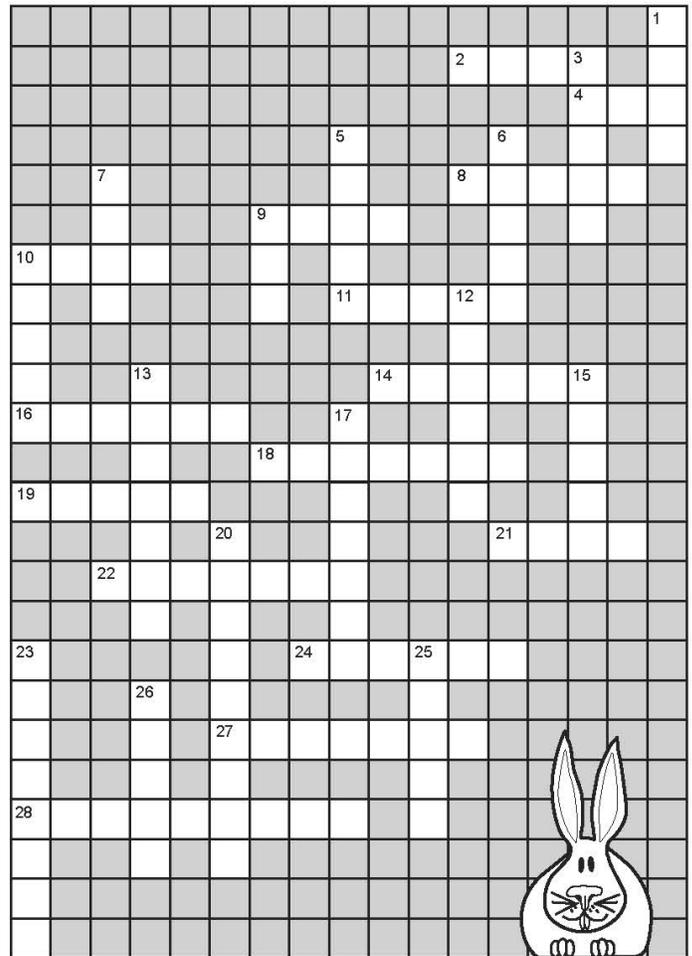
Rainfall
 Erosion
 Wildlife
 Livestock

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



Across

2. Nutrients, organic matter, and temperature are some more things that help plants _____.
4. Wind, or moving _____, can cause soil erosion.
8. Forests are full of _____.
9. Soil is also called _____.
10. _____, sleet, and snow are all forms of precipitation.
11. A _____ or hillside, would be a great place for sledding in the winter.
14. Organic matter can be sticks, _____, or mulch on the soil surface.
16. A small body of water that flows and meanders is called a _____.
18. Erosion reduces water _____.
19. _____ are the part of the plant that helps it to get water and nutrients from the soil.
21. An animal that lives in the water, such as a trout, is a _____.
22. Lack of moisture and severe heat cause a _____.
24. Clay is a type of soil that can be very _____ when wet, and very hard when dry.
27. When soil is blown or washed away, it is called _____.
28. Agriculture is the process of growing crops and _____ to provide food and other products for the world.



Down

1. A _____, or burning, is one way to manage vegetation.
3. When _____ infiltrates soil, it moves through the soil where it can be taken up by plant roots.
5. Crops are grown and livestock are raised on _____.
6. Livestock _____ plants that grow in watersheds.
7. Plant roots increase _____ stability by binding it together.
9. Some animals, like gophers, _____ burrows in the soil for their homes.
10. _____ break down slowly over time to form soil.
12. Rain, sun, and good soil are needed for _____ to grow.
13. Soil _____ is based on the types of particles in the soil and can be determined by the feel of the soil.
15. Farmers plant _____ in the soil that grow into crops.
17. Wildlife's homes can also be called their _____.
20. Nitrogen, phosphorous, and potassium are just some of the _____ plants need to grow.
23. _____ like rabbits, elk, and frogs can all share the habitat found in a watershed.
25. Farmers grow and harvest _____ to feed the world.
26. Where people build _____ depends on soil factors such as texture, structure, and drainage.

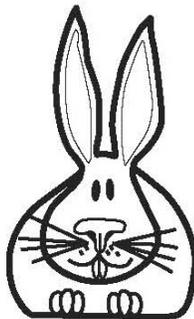
Complete each blank by matching the number to the letter to figure out the message below:

1	2	3	4	5	6	7	8	9
A	B	C	D	E	F	G	H	I

10	11	12	13	14	15	16	17	18
J	K	L	M	N	O	P	Q	R

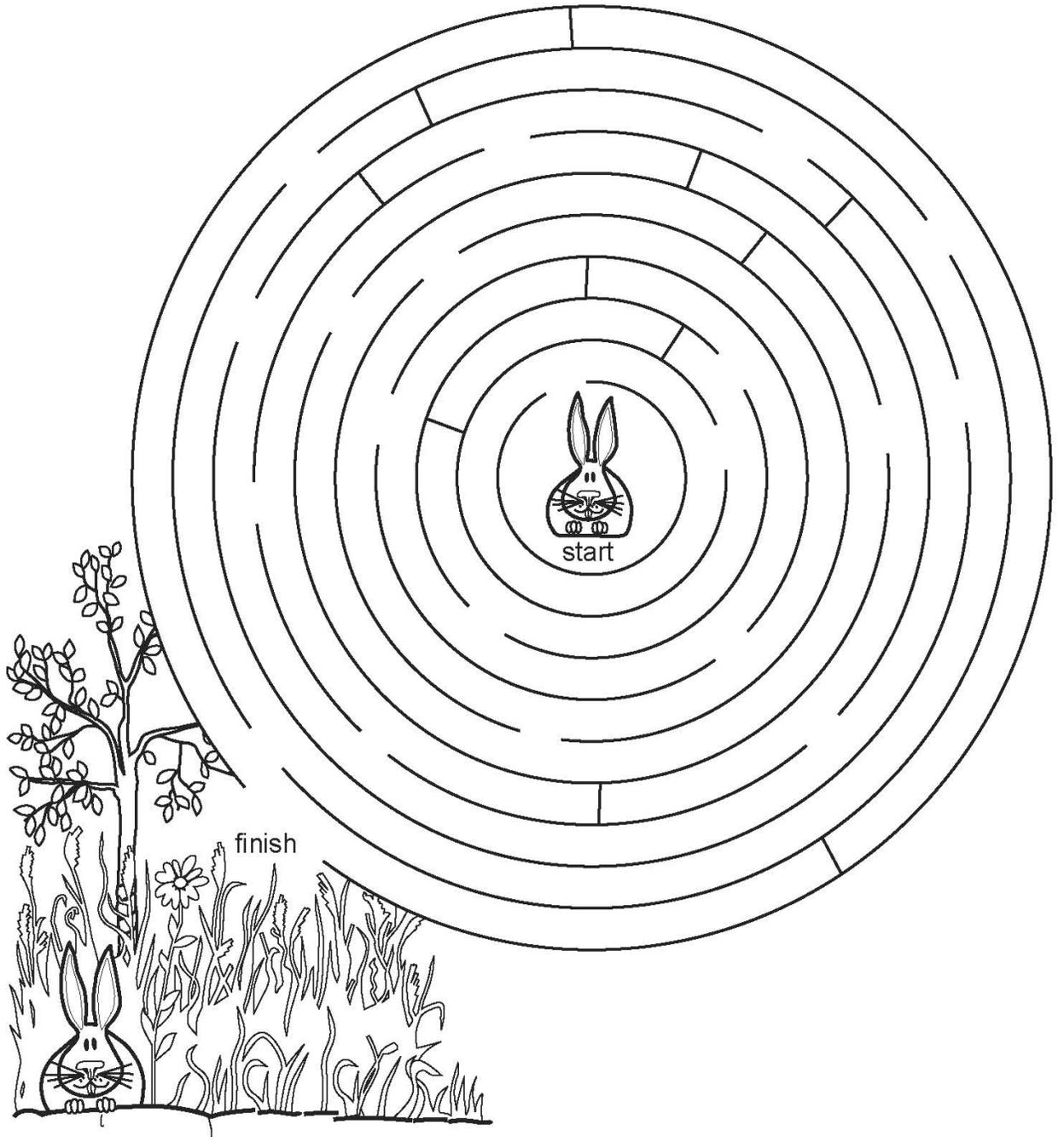
19	20	21	22	23	24	25	26
S	T	U	V	W	X	Y	Z

_____ 19 _____ 15 _____ 9 _____ 12 _____ 9 _____ 19 _____ 20 _____ 8 _____ 5
 _____ 6 _____ 15 _____ 21 _____ 14 _____ 4 _____ 1 _____ 20 _____ 9 _____ 15 _____ 14
 _____ 15 _____ 6 _____ 1 _____ 12 _____ 12 _____ 12 _____ 9 _____ 6 _____ 5
 _____ 15 _____ 14 _____ 5 _____ 1 _____ 18 _____ 20 _____ 8

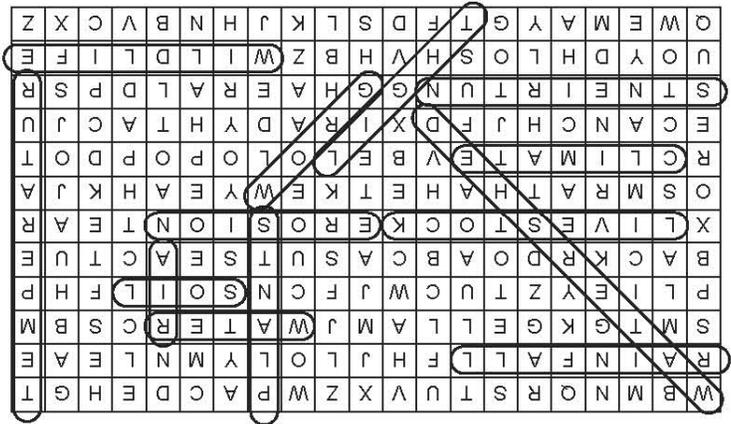
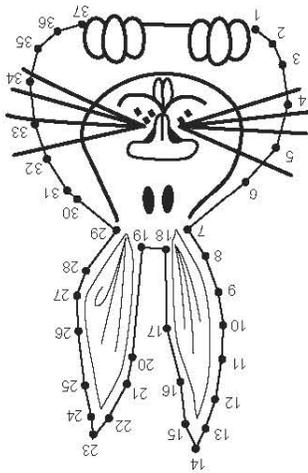
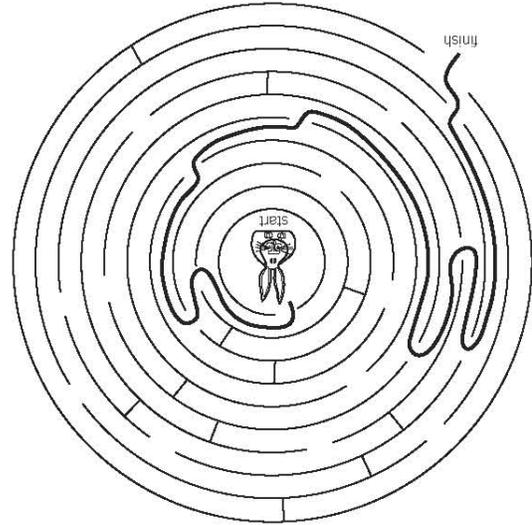
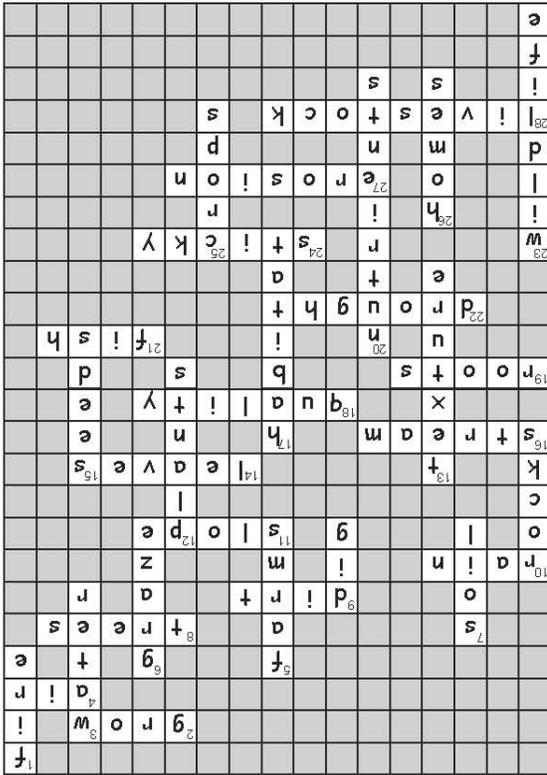


We have learned a lot throughout this activity book about how conserving our natural resources makes a healthy watershed and makes my home a great place to live.

Help me make my way through this maze to my healthy watershed.

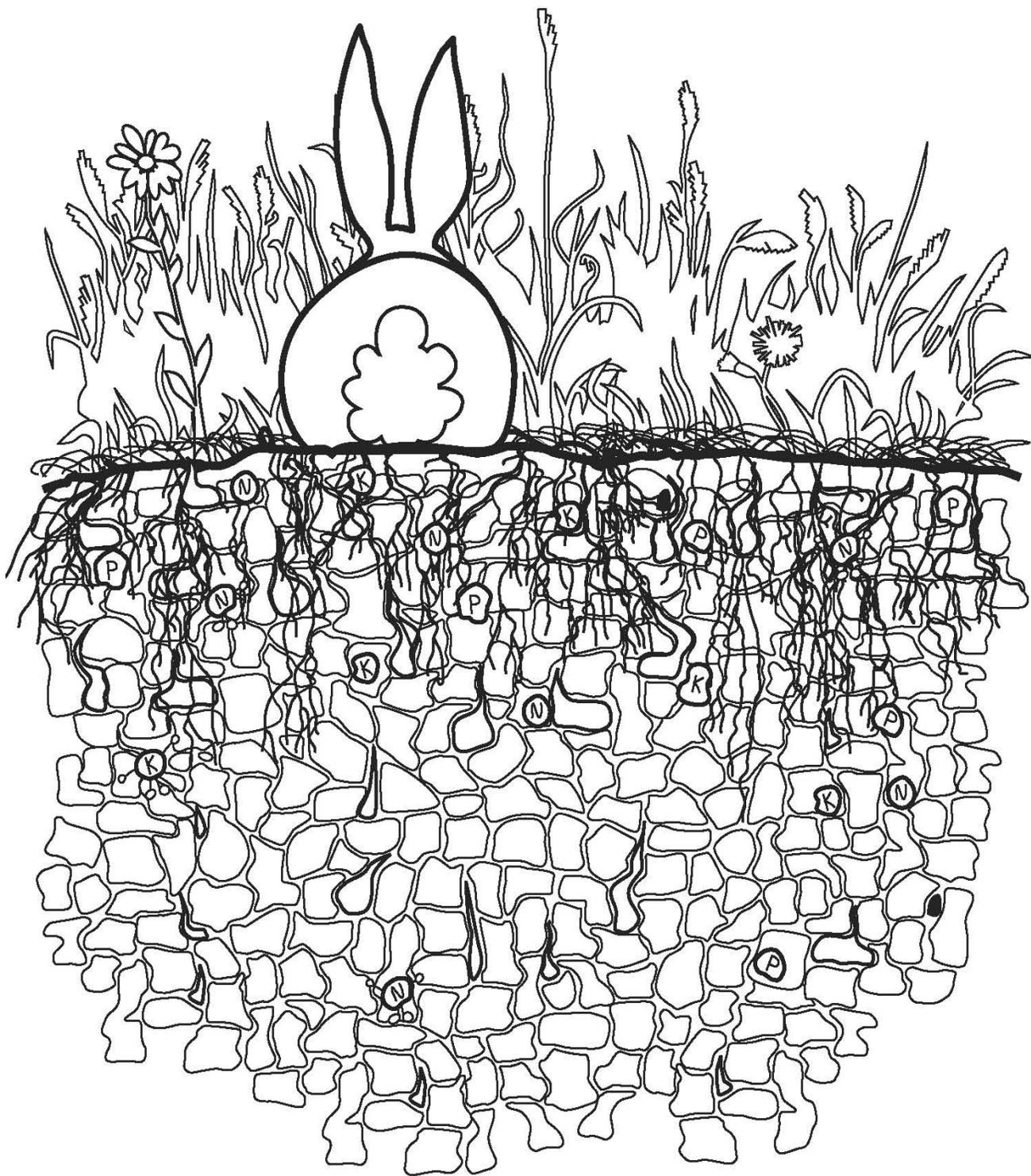


Answer Page



S O I L 15
 F O U N D A T I O N 14
 O F 13
 E A R T H 12
 W A T E R 11
 C L A Y 10
 S I L V E R 9
 W I N D 8
 T O P S O I L 7
 E R O S I O N 6
 H A B I T A T 5
 C O N S E R V A T I O N 4
 S U N S H I N E 3
 R E C Y C L I N G 2
 N A T U R E 1

1. Rain _____ falls from the sky and helps plants grow.
2. Your lawn grass needs _____ topsoil to hold the roots.
3. There are four basic soil textures, one of them is _____ clay.
4. The soil texture with the largest particle size is _____ sand.
5. Name one kind of soil erosion: _____ **wind**.
6. Buffers _____ help reduce soil erosion into streams.
7. Three-fourths of the earth is covered by _____ water.
8. Habitat _____ is a home for wildlife.
9. Protection our natural resources is called _____ conservation.
10. Plants need _____ sunshine to make their leaves green.
11. The water _____ cycle is nature's way of recycling water.



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What on Earth Is Soil?

- Soil makes up the outermost layer of our planet.
- Topsoil is the most productive soil layer.
- Soil has varying amounts of organic matter (living and dead organisms), minerals, and nutrients.
- Five tons of topsoil spread over an acre is only as thick as a dime.
- Natural processes can take more than 500 years to form one inch of topsoil.
- Soil scientists have identified more than 70,000 kinds of soil in the United States.
- Soil is formed from rocks and decaying plants and animals.
- An average soil sample is 45 percent minerals, 25 percent water, 25 percent air, and five percent organic matter.
- Different-sized mineral particles, such as sand, silt, and clay, give soil its texture.
- Fungi and bacteria help break down organic matter in the soil.
- Plant roots and lichens break up rocks which become part of new soil.
- Roots loosen the soil, allowing oxygen to penetrate. This benefits animals living in the soil.
- Roots hold soil together and help prevent erosion.
- Five to ten tons of animal life can live in an acre of soil.
- Earthworms digest organic matter, recycle nutrients, and make the surface soil richer.
- Mice take seeds and other plant materials into underground burrows, where this material eventually decays and becomes part of the soil.
- Mice, moles, and shrews dig burrows which help aerate the soil.

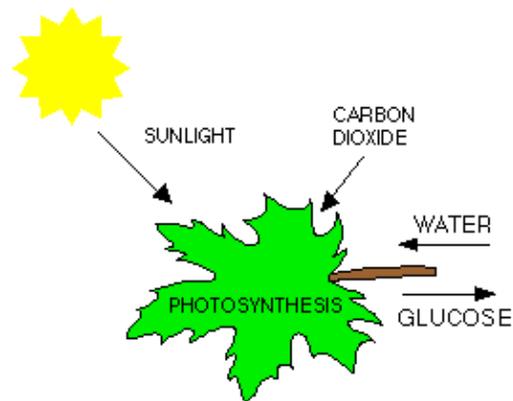


Why Do Leaves Change Color In The Fall?

Leaves change colors in the fall because of their food producing cycle.

Plants and trees use a gas from the air called carbon dioxide, water from the ground and sunlight to create their own food - or glucose. Glucose is a kind of sugar that plants use for food, energy and growth. The process of the sunlight turning the water and carbon dioxide into glucose is called photosynthesis. Photosynthesis literally means "putting together with light." A chemical called chlorophyll helps make photosynthesis happen and chlorophyll is what gives plants their green color.

During winter, there is not enough sunlight or water for photosynthesis. The trees begin to rest and live off of the food they stored during the summer. The green chlorophyll disappears from the leaves and as the bright green fades away, we begin to see yellow orange and red. Small amounts of these colors have been in the leaves all year long, we just couldn't see them in the summer because they were covered up by the green chlorophyll.



The bright reds and purples we see in leaves are made mostly in the fall. In some trees, like maples, glucose is trapped in the leaves after photosynthesis stops. Sunlight and the cool nights of autumn cause the leaves to turn this glucose into a red color. The brown color of trees like oaks is made from wastes left in the leaves.

It is the combination of all of these things that make the beautiful colors we enjoy in the fall.



Why Is Water So Important?

Did you know that you are mostly water? Two-thirds of your body is made up of water. You probably drink 6-8 cups of water, milk, fruit juice, or soda each day. Animals and plants are almost all water too. So we don't just use water... we **are** water.

Three-quarters of the earth is covered with water, and although most of it can't be used by people, plants or animals, water makes life on earth possible. You depend on water for drinking, cleaning, growing food, processing food, growing cotton for cloth, swimming, fishing, boating, cooking, putting out fires, and generating electricity through hydropower dams. Try to think of one item or action that doesn't involve water in some way!

Water also connects us to the rest of the natural world - plant and animal communities depend on water in many of the same ways: for food, hydration, and shelter. Since every drop is used again and again, water is the ultimate in recycling. It is important to protect this precious resource because we share it with all other living things, past, present, and future.



Unfortunately, people have not always used water wisely. We've over-used it to carry away our waste. We've put hazardous materials in or on the ground where they seep into ground water. We've often used more water than we need. Yet we can improve our water resource by conserving water at home, cleaning waste from industries and cities before it returns to rivers or lakes, and preventing pollutants from homes and farms from washing into waterways with the rain. Some communities have already begun to help!

One of the ways we can have a big effect on improving our water quality now is protecting it from future pollution and changing the small ways that people affect water. What you do in your community, or in your house, yard, road, park, business, school, farm or ranch can conserve water and improve its quality.

Interesting facts about water:

- A dairy cow must drink 4 gallons of water to produce 1 gallon of milk.
- Only 1% of the Earth's water is suitable for drinking.
- More than 39,090 gallons of water is used to produce one car, including the tires.
- An average person uses 100 gallons of water a day.
- One flush of a toilet uses 2-7 gallons of water.
- The average shower uses 15-25 gallons of water.
- It's possible to drink water that was part of the dinosaur era because all water is constantly recycled.

- A watermelon contains more water in it than any other food. It's 97% water.
- Water is the only substance on earth found in the three forms naturally – solid, liquid and gas.

Ten easy ways to save water!

1. Don't let the water run while you are brushing your teeth! The average person wastes 3-5 gallons of water this way each day!
2. Collect rainwater and use it to water your flowers and plants.
3. Wash your car on the grass. The ground will filter the soap and the grass will get watered at the same time.
4. Make sure the dishwasher is completely full before you wash the dishes.
5. Take shorter showers.
6. Only wash your clothes when you have a full load of laundry.
7. Don't flush things in the toilet that could be disposed of in a trash can.
8. Only water your lawn when needed. You can tell this by simply walking across your lawn. If you leave footprints, it's time to water.
9. Reuse your bath towels at home.
10. Don't use running water to thaw food.



Take the Water Conservation Challenge

Step 1:

Find out what your family's water bill was during one month.

Step 2:

Tell your parents that you are going to practice water conservation for one month and that you think this will save them money on their water bill.

Example:

In July your household water bill was \$36.98. After practicing water conservation, your next month water bill was \$28.32. You saved your family \$8.66!

Step 3:

Encourage your family to practice the water saving tips above this month and every month to save water and money!

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United States Department of Agriculture
Natural Resources Conservation Service

Worms Help Us!

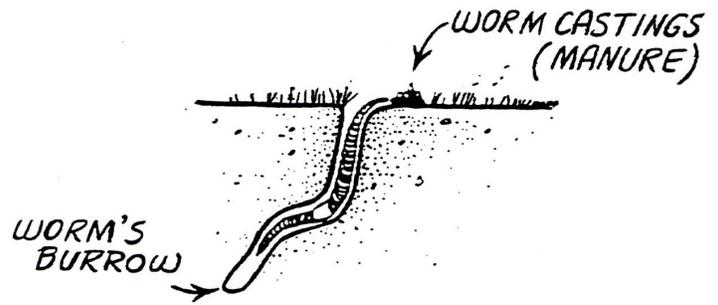


Worms are not just worms!

Earthworms are one of the most important groups of organisms that live in the soil. They recycle nutrients and burrow their way through the soil which improves soil structure. Their tunnels help roots grow and allow air, water and nutrients (plant food) to enter the soil.

Earthworms breathe through their skin and there must be moisture in the soil. If their skin dries out, they cannot breathe and will die.

Instead of teeth, earthworms have a gizzard, like a chicken, that grinds the soil and organic matter they eat. Worm excrement is commonly called worm casts or castings. These soil clusters are glued together when excreted by the earthworm and are quite resistant to erosive forces.



All Kinds of Earthworms!

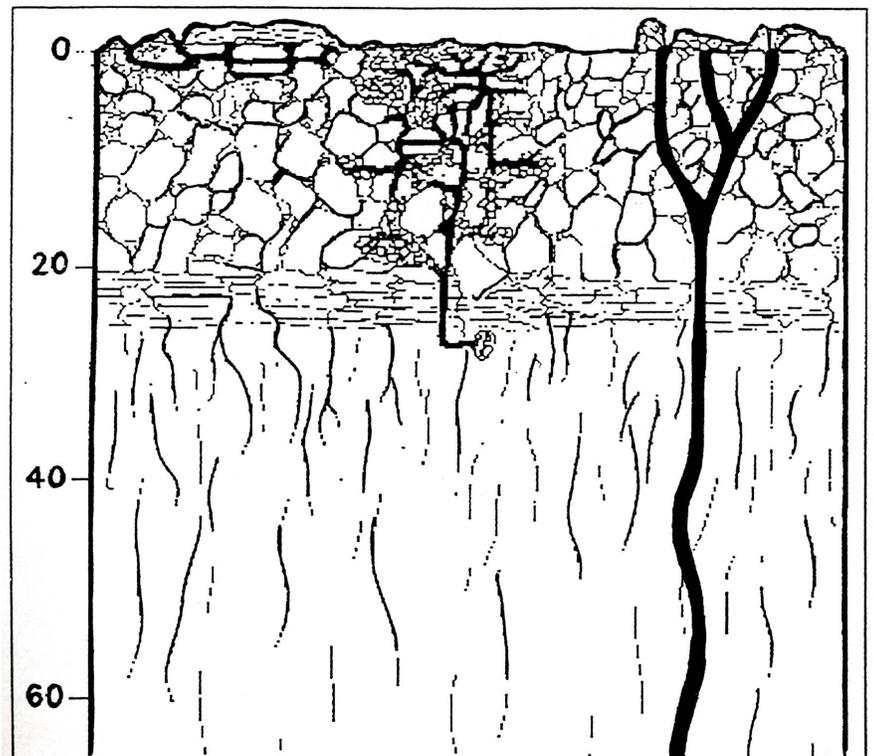
There are over 3,000 types of earthworms on earth ranging from microscopic to large. Different types of earthworms live in different places and perform different jobs.

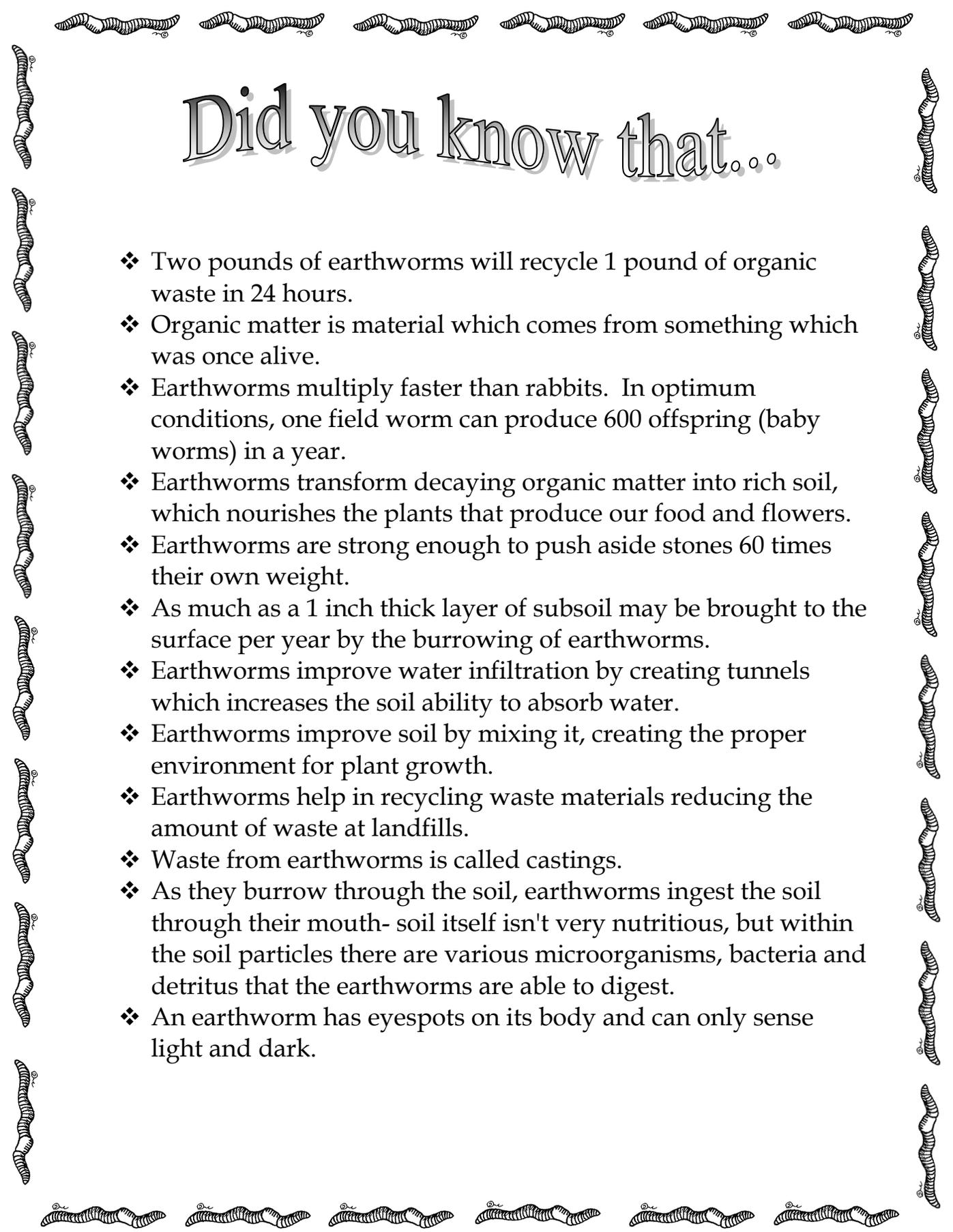
Soil surface dwellers feed on decaying roots, shoots, leaves and dung and live near the soil surface (0-15 centimeters depth). These worms are important for mixing the soil.

Topsoil dwellers are common and live in the top 20-30 centimeters depth of soil. They burrow through soil, eating and excreting it. As they burrow, they produce casts that help to improve the soil structure and increase the soil aeration by creating cracks and channels in the soil.

Subsoil dwellers tend to live in permanent burrows up to 3 meters below the soil surface; drag food such as leaves into their burrows from the soil surface; often larger than other types of earthworms. This kind of worm can be helpful in orchards by recycling the leaves that fall on the soil surface every year.

Surface dwelling Topsoil dwelling Subsoil dwelling

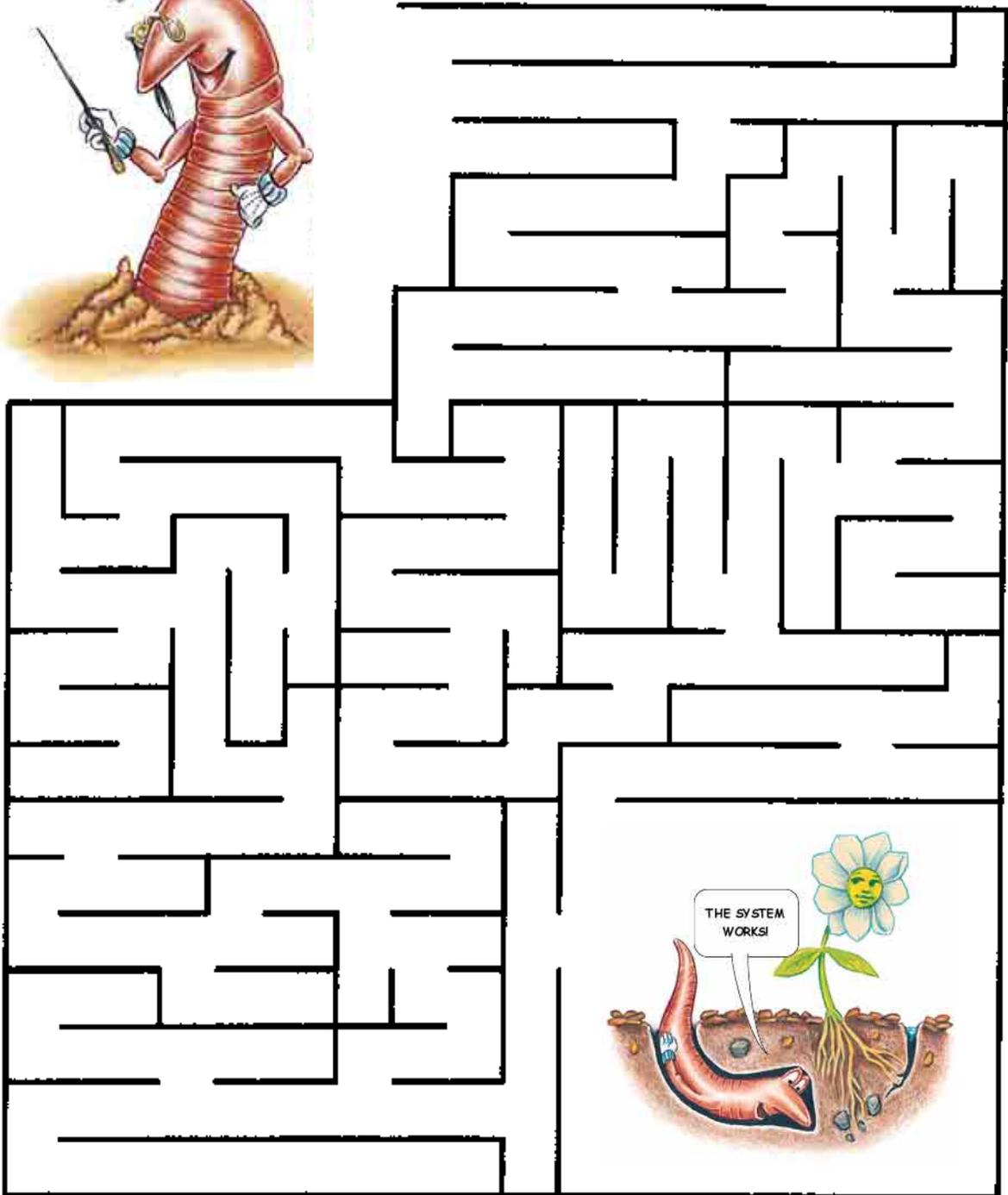


A decorative border of worms surrounds the page. At the top, there are seven worms. On the left and right sides, there are vertical columns of worms. At the bottom, there are seven worms. Each worm is drawn with a segmented body and small legs.

Did you know that...

- ❖ Two pounds of earthworms will recycle 1 pound of organic waste in 24 hours.
- ❖ Organic matter is material which comes from something which was once alive.
- ❖ Earthworms multiply faster than rabbits. In optimum conditions, one field worm can produce 600 offspring (baby worms) in a year.
- ❖ Earthworms transform decaying organic matter into rich soil, which nourishes the plants that produce our food and flowers.
- ❖ Earthworms are strong enough to push aside stones 60 times their own weight.
- ❖ As much as a 1 inch thick layer of subsoil may be brought to the surface per year by the burrowing of earthworms.
- ❖ Earthworms improve water infiltration by creating tunnels which increases the soil ability to absorb water.
- ❖ Earthworms improve soil by mixing it, creating the proper environment for plant growth.
- ❖ Earthworms help in recycling waste materials reducing the amount of waste at landfills.
- ❖ Waste from earthworms is called castings.
- ❖ As they burrow through the soil, earthworms ingest the soil through their mouth- soil itself isn't very nutritious, but within the soil particles there are various microorganisms, bacteria and detritus that the earthworms are able to digest.
- ❖ An earthworm has eyespots on its body and can only sense light and dark.

A-MAZE-ING Worm Maze



Know Your Worms

1. Worms eat

- a. plastic
- b. glass
- c. organic waste

2. Earth worms do not mix the soil.

- a. True
- b. False

3. Waste from worms is called

- a. compost
- b. castings
- c. food

4. Organic matter is material which comes from something which was once alive.

- a. True
- b. False

5. Earthworms have mouths.

- a. True
- b. False

6. Earthworms can see

- a. in color
- b. light and dark only
- c. black and white only

Answers: 1.) C. organic waste 2.) B. False 3.) B. False 4.) A. True 5.) A. True 6.) B. light and dark only

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