Basic Water Environment Series – Youth Guide
Michigan State University Cooperative Extension Service
4-H Club Bulletin/ Michigan Sea Grant
Robert W. George, Fisheries and Wildlife
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Marine Science

Member's Manual

MICHIGAN SEA GRANT PROGRAM - ADVISORY SERVICE -

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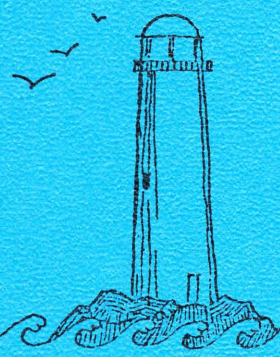

Basic WATER

ENVIRONMENT Series

4-H — Youth Programs
Cooperative Extension Service
Michigan State University

Basic Environment Series:

WATER

PURPOSE: To acquaint the member with the role of water in everyday life and the problems associated with the availability of clean water.

OBJECTIVES: Through observation and experimentation, the member will become acquainted with positive and negative effects man has on water.

BASIC CONCEPTS ... TO BE DEVELOPED THROUGH LEARNING ACTIVITIES:

1. Water is essential to the well being of plant and animal life.
2. Man's actions greatly influence water quality.
3. Water serves many uses.

CONTENTS

ACKNOWLEDGMENTS

This material was developed in cooperation with the Michigan 4-H Developmental Committee for Natural Resources and Environmental Education. It was pilot tested and revised to reflect the ideas and suggestions of both youth (members) and adult leaders and teachers.

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Extension Specialist
Environmental Conservation Education

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WATER CHARACTERISTICS

WATER is the liquid
which falls as "**RAIN**" to make

STREAMS
RIVERS
LAKES
SEAS

CHEMICALLY, of course--
"water" is "H_2O" --
2 atoms Hydrogen = 11.18% weight
1 atom Oxygen = 88.82% "

—

ODORLESS - TASTELESS
TRANSPARENT

—

POOR CONDUCTOR
GOOD SOLVENT

—

FREEZES @ 32° F (0°C)
BOILS @ 212° F (100° C)
at sea level atmospheric pressure

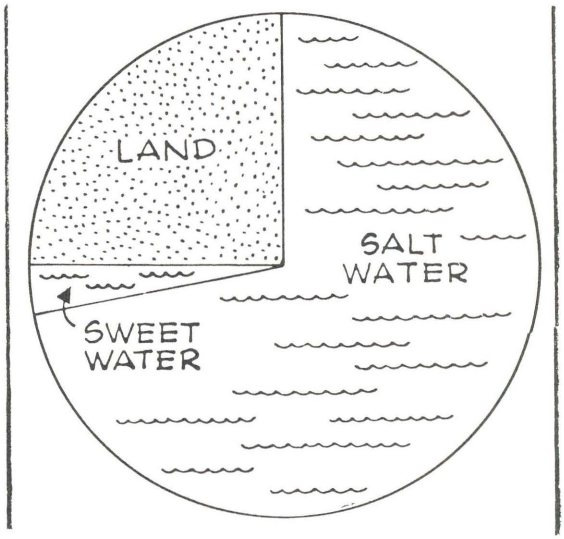
Appears as -
"LIQUID WATER"
"STEAM"
"WATER VAPOR"
"ICE"
} depending on TEMPERATURE and PRESSURE

At the most, we can live without water for only 3 or 4 days, although we can live without food for up to 20 or 30 days.

Clearly, water is very important.

OUR WATER PLANET

Only 3% of the world's water is fresh! 97% of the world's water is salty sea water—of no use for people to drink or for watering crops.



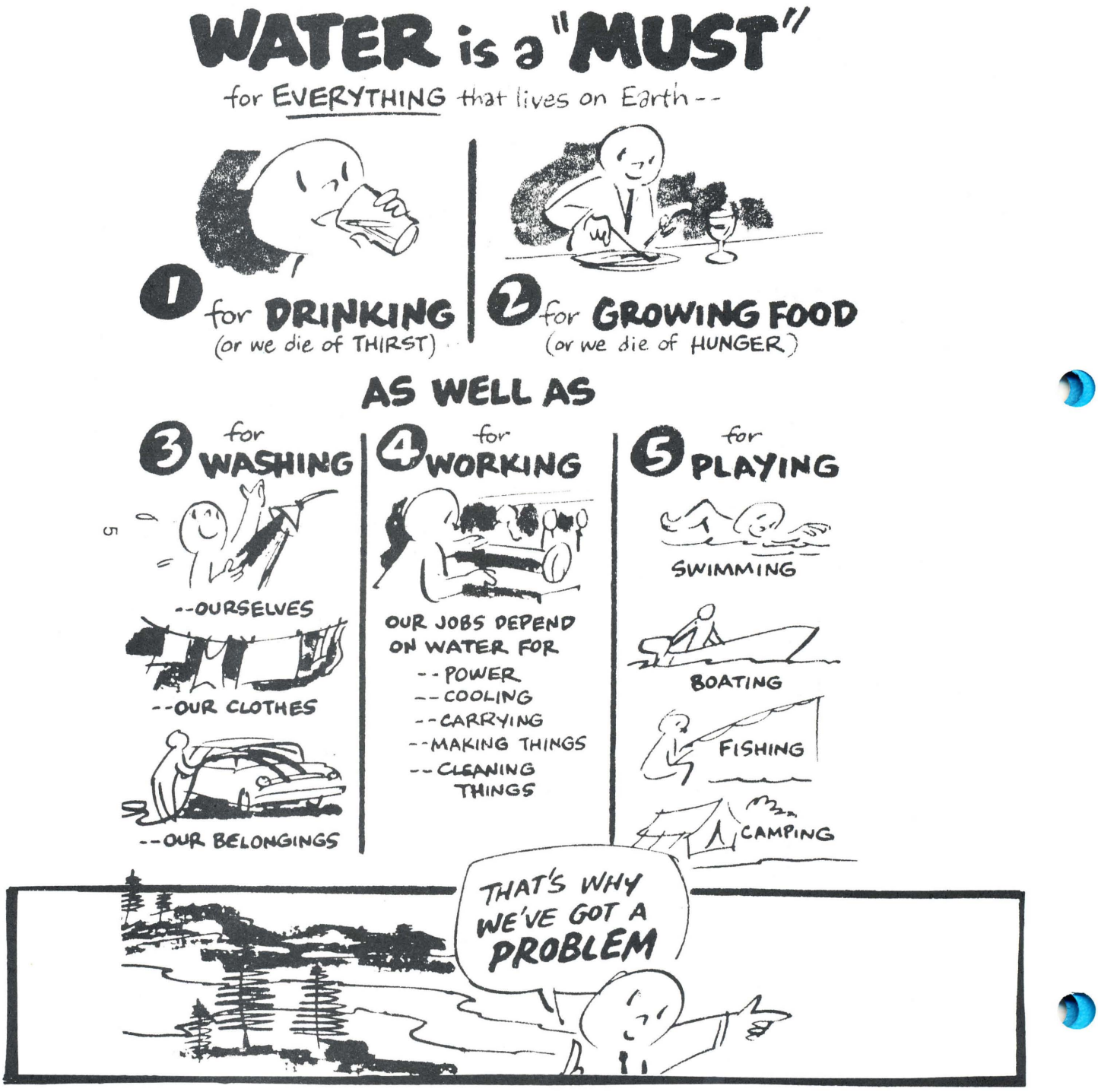
But the sea is important too. For instance algae are small plants and plankton are small animal organisms. Both live in the sea and in lakes. They provide the basic food for sea animals. They produce about 75% of the oxygen in the air.

BASIC FOR ALL LIFE

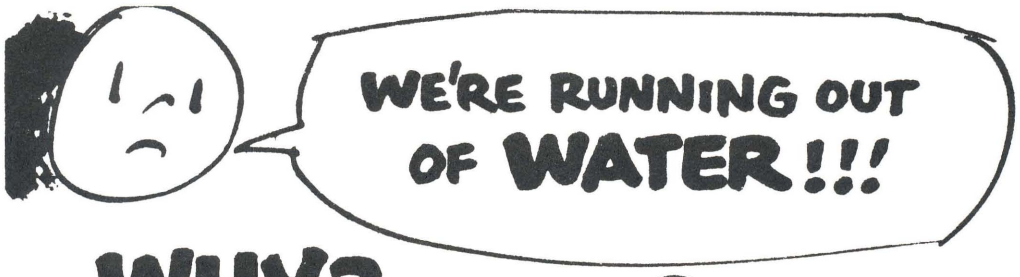
Water . . . that simple molecule which is made up of two atoms of Hydrogen and one atom of Oxygen, is basic to every form of life.

Did you know that up to 90 percent of the weight of a living being is water? As we will see in this project, the freezing, evaporation, and the special chemical properties of water are what makes life possible.

Study the following pages to find more reasons why water is important and why our supply of water is in danger.

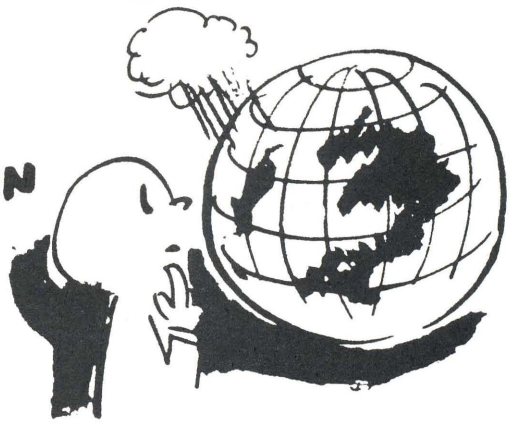


WHAT IS OUR PROBLEM?



WHY?

because -- the **AMOUNT OF RAIN** stays about the **SAME** each year while



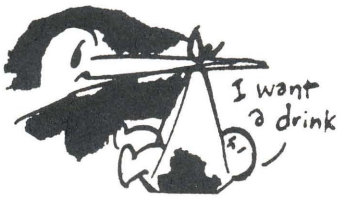
the POPULATION GROWS

(in the U.S.)

- UP 1950 -- 150 MILLION

- UP TODAY -- 190 MILLION

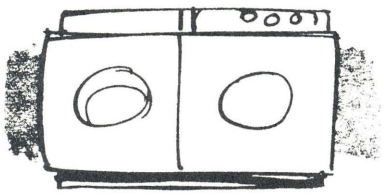
- UP 1980 -- 260 MILLION



NOTE: the rate of population increase will be much greater in Latin America, Asia, Africa, in the next 20 years

2 NOT ONLY **MORE** PEOPLE, **BUT**

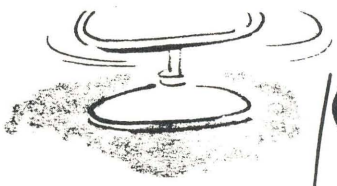
HOME LAUNDRIES



PER PERSON USE UP

SINCE 1900 (in U.S.)

LAWN SPRINKLERS



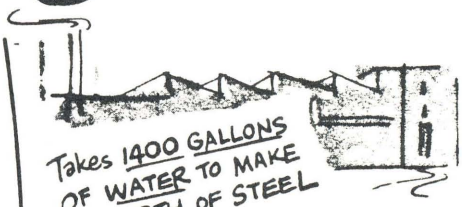
Total use of water--

TODAY--355 BILLION GALLONS

1980 (est.) 600 " "

PER DAY

3 AND MORE USE IN



Takes 1400 GALLONS OF WATER TO MAKE $1 WORTH OF STEEL

--industry use **up** since 1900

--uses **160 BILLION GALLONS PER DAY** (in U.S.)

4 AND MORE USE IN

IRRIGATION use up since 1900

--uses **145 BILLION GALLONS PER DAY** (in U.S.)

. . . . and that's why we must

LEARN TO USE OUR WATER WISELY.

Introduction to the Basic Water Project

ACTIVITY HIGHLIGHTS

Activity 1 — (page 6) THE WATER CYCLE — Follow the path of a rain drop through the water cycle.

Activity 2 — (page 8) GRASSES AND SOIL — Demonstrate how water evaporates from the soil and transpires from the grass.

Activity 3 — (page 8) FLOWERING PLANTS — Use a plastic bag to demonstrate transpiration and condensation of water.

Activity 4 — (page 8) LEAVES — Compare the loss of water from bottles with different amounts of leaf transpiration.

Activity 5 — (page 9) SURVIVAL STILL — Build your survival still. Set up and demonstrate how pure drinking water can be found in an emergency.

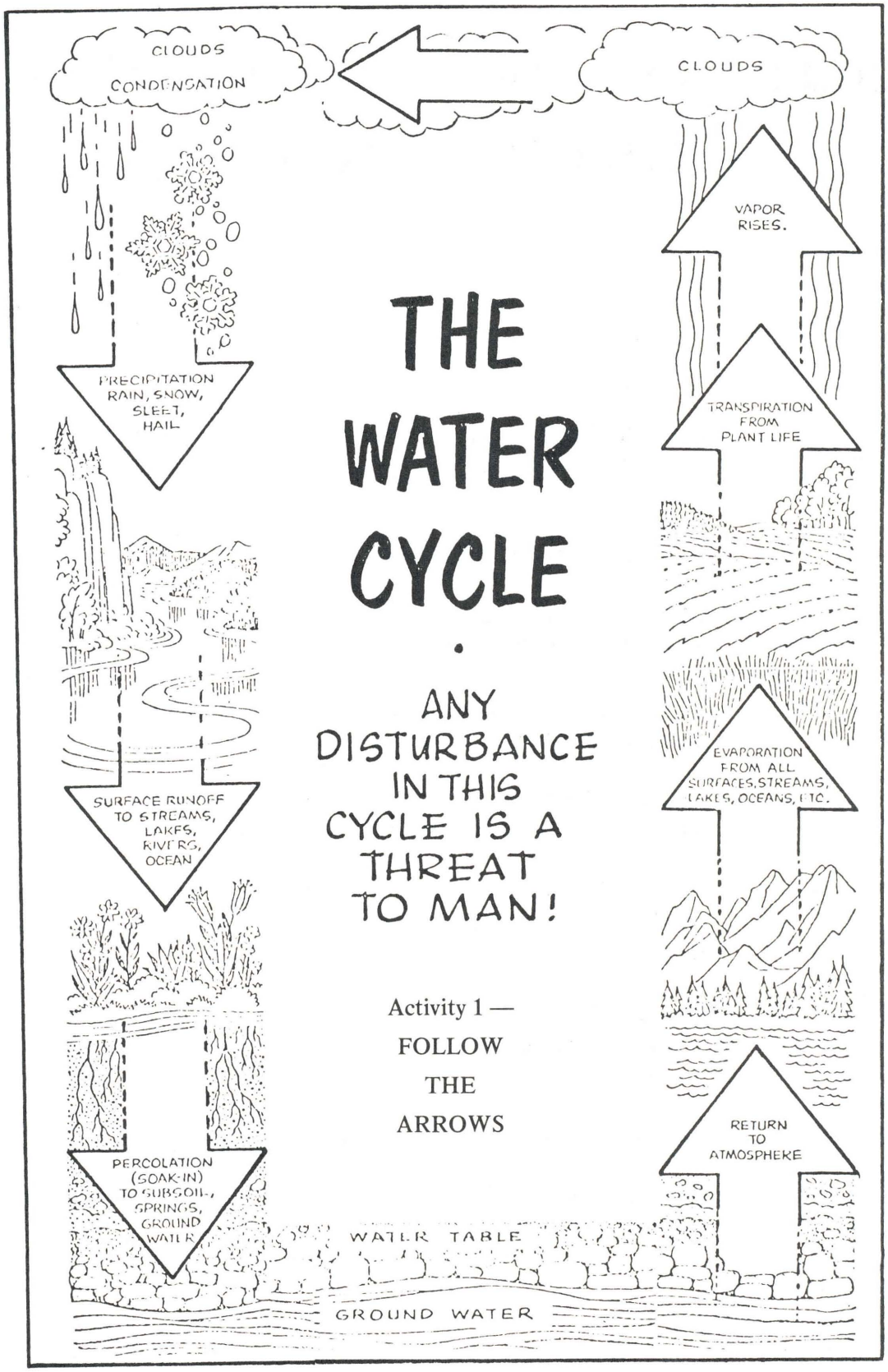
Activity 6 — (page 10) FERTILIZED TO DEATH — Using an aquarium, demonstrate how waters can be spoiled from too much fertilizer.

Activity 7 — (page 11) OIL SLICK or HOW FAR DOES OIL SPREAD? — Use a container filled with water to demonstrate what happens with an oil spill. See how far oil spreads.

Activity 8 — (page 14) PRIMARY WATER USES — Measure and evaluate the use of water in your home, for agriculture, and in your community.

Activity 9 — (page 17) WATER SANITATION CHECK — Check your drinking water. Learn how to take a water sample and have it tested.

Activity 10 — (page 17) PERCOLATION TEST — Investigate the drainage—the rate water can soak into the ground.


CLOUDS
CONDENSATION
CLOUDS
VAPOR RISES.
PRECIPITATION RAIN, SNOW, SLEET, HAIL
TRANSPIRATION FROM PLANT LIFE
THE WATER CYCLE
ANY DISTURBANCE IN THIS CYCLE IS A THREAT TO MAN!
Activity 1 — FOLLOW THE ARROWS
EVAPORATION FROM ALL SURFACES, STREAMS, LAKES, OCEANS, ETC.
SURFACE RUNOFF TO STREAMS, LAKES, RIVERS, OCEAN
RETURN TO ATMOSPHERE
PERCOLATION (SOAK-IN) TO SUBSOIL, SPRINGS, GROUND WATER
WATER TABLE
GROUND WATER

CONSERVATION and the WATER CYCLE*

Water is probably the natural resource we all know best. All of us have had firsthand experience with it in its many forms—rain, hail, snow, ice steam, fog, dew.

Yet, in spite of our daily use of it, water is probably the natural resource we least understand. How does water get into the clouds, and what happens to it when it reaches the earth? Why is there sometimes too much and other times too little? And, most important, is there enough for all the plants, all the animals, and all the people?

Water covers nearly three-fourths of the earth; most of it is sea water. But sea water contains minerals and other substances, including those that make it salty and that are harmful to most land plants and animals. Still, it is from the vast salty reservoirs, the seas and oceans, that most of our precipitation comes—no longer salty or mineral laden. Water moves from clouds to land and back to the ocean in a never-ending cycle. This is the water cycle or the hydrologic cycle.

Ocean water evaporates into the atmosphere, leaving impurities behind, and moves across the earth as water vapor. Water in lakes, ponds, rivers, and streams also evaporates and joins the moisture in the atmosphere. Soil, plants, people, and animals, and even factories, automobiles, tractors, and planes contribute moisture. A small part of this moisture, or water vapor, is visible to us as fog, mist, or clouds. Water vapor condenses and falls to earth as rain, snow, sleet, or hail, depending on the region, climate, season, and topography.

Every year about 80,000 cubic miles (333,240 cubic kilometers) of water evaporates from oceans and about 15,000 cu mi (64,483 cu km) evaporates from land sources. Since the amounts of water evaporated and precipitated are almost the same, about 95,000 cu mi (395,723 cu km) of water are moving between the earth and the sky at all times.

Storms at sea return to the oceans much of the water evaporated from the oceans, so land areas get only about 24,000 cu mi (99,972 cu km) of water as precipitation. Precipitation on the land averages 26 inches (66.04 centimeters) a year, but it is not evenly distributed. Some places get less than 1 in (2.54 cm) and others more than 400 in (1,016 cm).

The United States gets about 30 in (76.2 cm) a year, or about 4,300 billion gallons (16,277.3 billion liters) a day. Total stream flow from surface and underground sources is about 8.5 in (21.59 cm) a year, or about 1,200 billion gal (4,542.5 billion *l*) a day. This is the amount available for human use—homes, industry, irrigation, recreation.

The difference between precipitation and stream flow—21.5 in (54.6 cm) a year, or 3,100 billion gal (11,734.7 billion *l*) a day—is the amount returned to the atmosphere as vapor. It is roughly 70 percent of the total water supply. It includes the water used by plants.

People can exist on 1 gal (3.785 *l*) or so of water a day for drinking, cooking, and washing though they seldom do or have to. In medieval times, people probably used no more than 3 to 5 gal (11.36 to 18.93 *l*) a day. In the 19th century, especially in Western nations, people were using about 95 gal (359.61 *l*) a day. At present in the United States, people use about 1,500 gal (5,678.1 *l*) a day for their needs and comforts, including recreation, cooling, food production, and industrial supply.

When water hits the ground some soaks into the soil, and the rest runs off over the surface. The water that soaks into the soil sustains plant and animal life in the soil. Some seeps to underground reservoirs. Almost all of this water eventually enters the cycle once more.

Man can alter the water cycle but little, so his primary supply of water is firmly fixed. But he can manage and conserve water as it becomes available —when it falls on the land. If he fails to do so, he loses the values that water has when used wisely.

It is man's obligation to return water to streams, lakes, and oceans as clean as possible and with the least waste.

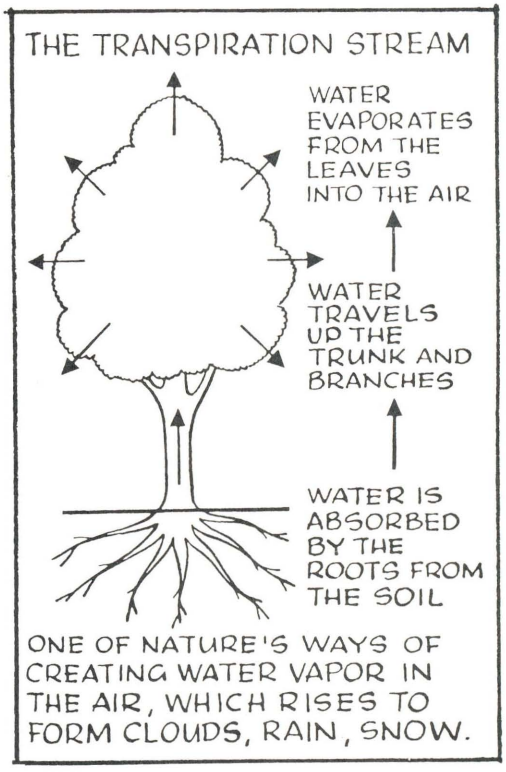
*A 40x 28-inch color reproduction of the Water Cycle illustration is for sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402—Price 35 cents.

THE WATER CYCLE—ANY DISTURBANCE IN THIS CYCLE IS A THREAT TO MAN.

- Polluted air can change the precipitation.
- Destroyed vegetation or topsoil causes erosion.
- Ditching and draining may affect the water table.
- Polluted groundwater causes lack of water.
- Destroyed plant life causes diminished transpiration.

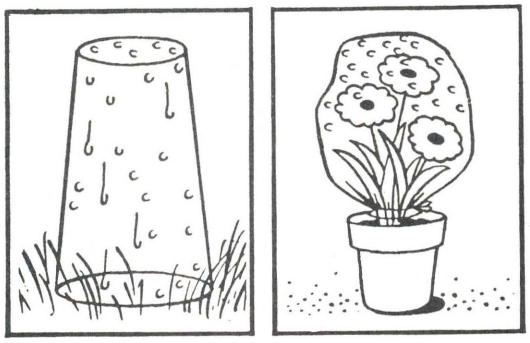
ROLE OF PLANTS IN THE WATER CYCLE

TRANSPIRATION is a process in which plants send water vapor into the atmosphere. The roots absorb water from the soil. The water passes through the plant stem or trunk, through the branches, to the leaves and evaporates into the air from the surface of the leaves. Thus, transpiration from plant life is one of nature's ways of creating water vapor in the air which rises to form clouds. These clouds eventually provide rain and snow. This is just one of the marvelous jobs done by trees and other plants. (See diagram, *The Water Cycle,* page 6.)



Activity 2 — GRASSES AND SOIL

Take a drinking glass or a glass jar and put it upside down on some grass. You will soon see how water evaporating from the soil and grass condenses to form drops of water inside the glass.

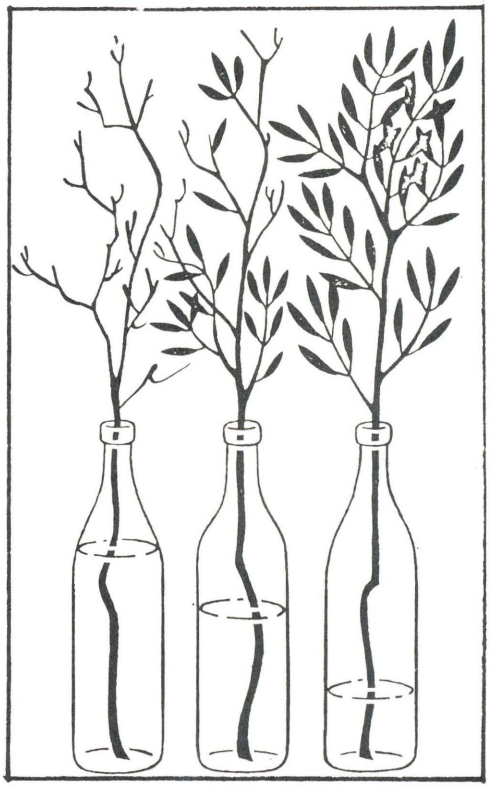


Activity 3 — FLOWERING PLANTS

Water a potted plant. Place a transparent plastic bag over it and put it in the sun. Then observe how, very soon, drops of water form inside the bag.

Activity 4 — LEAVES

Fill 3 bottles with equal amounts of water. In the first bottle, place a branch without leaves. In the second, a branch with a few leaves. In the third, a branch with many leaves. After a few days, you will find that a lot of the water has gone from the third bottle. It has evaporated through the leaves!

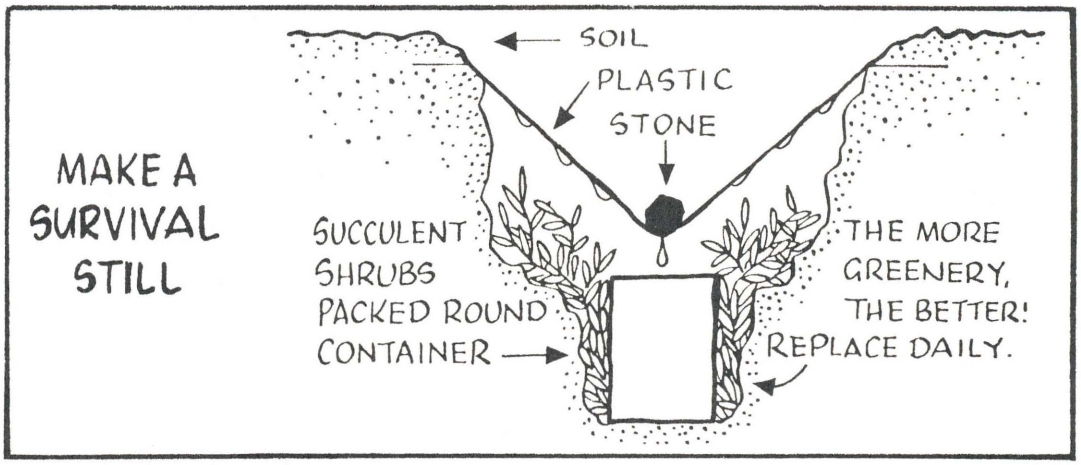


PLANT TRANSPIRATION CAN SAVE LIFE

NO ONE NEEDS TO DIE OF THIRST! Adventuresome 4-H'ers, explorers, and others occasionally find themselves without pure drinking water. But if you have a thin plastic sheet with you—which you should carry on every outdoor venture, for it has many uses—you can easily get water from the air. Study the sketch, and do it this way:

Activity 5 — SURVIVAL STILL

1. Dig a hole about 30 inches (76.2 cm) square and 18 inches (44.72 cm) deep.
2. In the center of the hole place any container, such as a coffee can.
3. Surround the container with leafy shrubs —plenty of them.
4. Place the plastic sheet (which should be at least one yard [1 meter] square) loosely over the hole. Place stones or soil around the edges to keep it in place.
5. Put a small stone in the center of the sheet so that the plastic will sag toward the container.



HOW IT WORKS

The soil and plant material in the hole give off water vapor; transpiration takes place. The moisture in the air under the plastic sheet condenses on the under side of the plastic. These drops of water roll down the plastic into the container. (Note: When you no longer need the hole, be sure to replace all the soil.)

FOLLOW-UP ACTIVITY

Display activities 2, 3, 4 and 5. Draw a poster of the tree diagram, illustrating the transpiration stream. Explain the importance of plant life in the Water Cycle. Also display a reproduction of the Water Cycle chart. Set up a Survival Still outdoors to demonstrate how pure drinking water, via plant transpiration, can be made in an emergency. (Note: The Survival Still will work best in a sunny spot with plenty of fresh succulent leaves. A high temperature causes evaporation from the leaves to be more rapid and increases the capacity of the air for water vapor.)

WATER — "FERTILIZED TO DEATH"

Various nutrients in water that comes from factories, households, and farmlands (particularly phosphate) are "food" for plants in lakes, dams, etc.

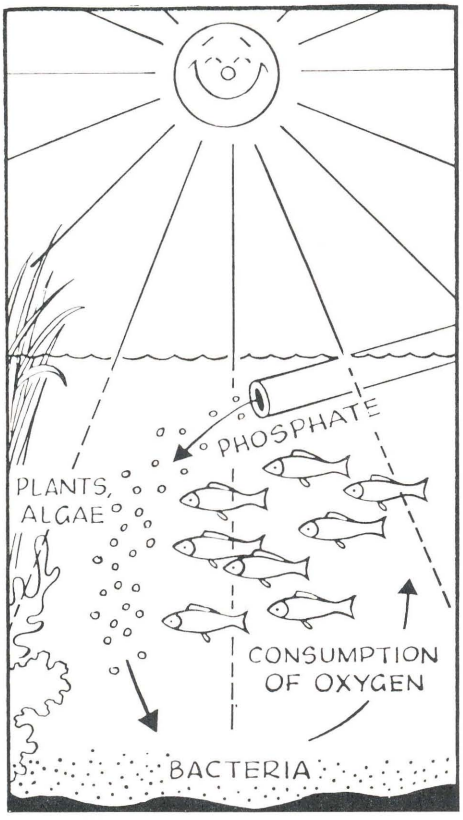
An increase in the amount of phosphate increases the amount of plant life, especially the small plants called algae.

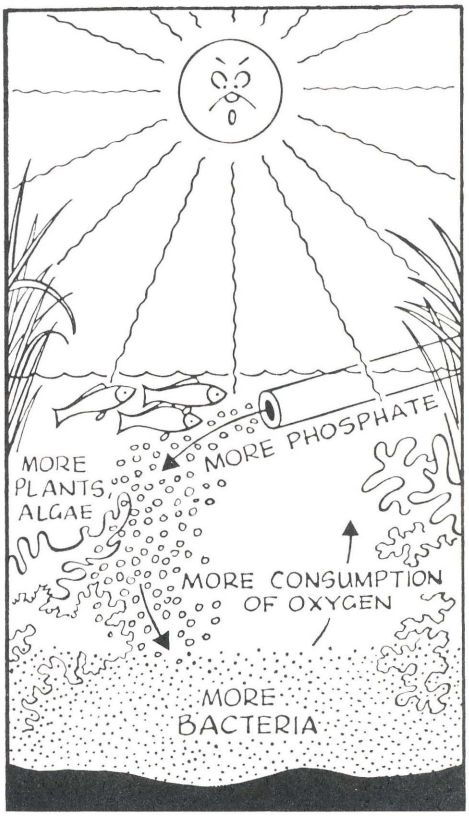
When this underwater vegetation dies and sinks to the bottom of the lake, the bacteria at the bottom start to decompose it. In order to cope with the increasing amount of vegetation, the bacteria need oxygen which they take from the water. In time all the oxygen is consumed. Fish and other water inhabitants die as the lake becomes a stagnant water body.

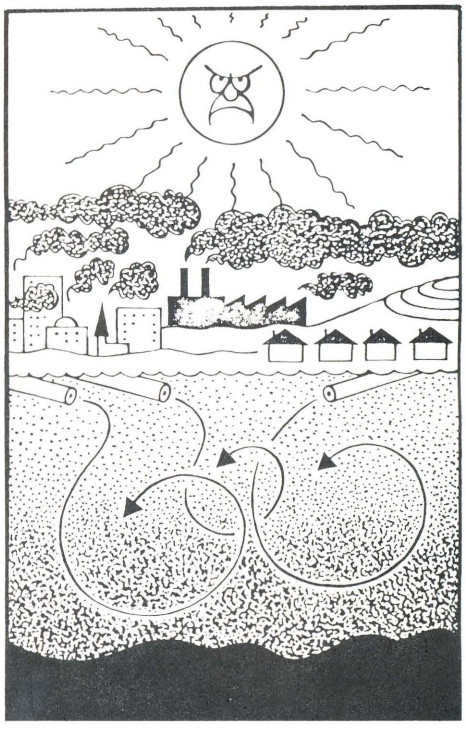
As the above process goes on, the dark and dirty water also prevents the sun's rays from penetrating the water. (The sun's rays are needed to help the plants in the lake produce new oxygen.)

Activity 6 — FERTILIZED TO DEATH

Set up a 5- or 10-gallon aquarium with soil, water, and plants from a river or pond. Leave the aquarium in the sun. Add a small amount of house plant fertilizer (half the recommended weekly allotment for a plant). Add more two or three times per week. Make observations with the group at least twice a week. Notice how long it takes to show any results. What are the results? Does this ever happen in nature? Careless use of fertilizers or detergents are among the major causes of this phenomenon which scientists call eutrophication.







WATER POLLUTION

OIL POLLUTION — BLACK TIDE OF DEATH

SEAS OF SHAME! The waters of the world are sick with pollution. Crabs have been found full of deadly cadmium. Fish have been found polluted with nerve-poisoning methyl mercury and substances such as cyanuric chloride, DDT, strontium 90, and other man-made killers. Oil is another major pollutant.

After sailing the Atlantic in his reedship "Ra," explorer and ex-Scout Thor Heyerdahl warned that man is killing the oceans. He saw trails of oil lumps stretching for thousands of kilometers.

Beaches in many parts of the world need constant cleaning as oil pollutes them again and again. Apart from the damage done to fish and other marine life, vast numbers of birds, including penguins, have been destroyed by oil.

Chemical dispersants sprayed on oil slicks are widely used today, but it has been shown that some of these chemicals may do more damage to aquatic life than the oil itself.

WHAT ARE THE CAUSES?

Unscrupulous tanker captains still clean out oil tanks at sea.

Oil tankers (and other oil-burning ships) are wrecked on the coasts or suffer disaster at sea, pouring out huge quantities of oil.

Off-shore oil buoys suffer damage in heavy weather, and oil is released.

Industry contributes its share when oil is allowed to reach rivers and find its way to the sea. Even householders send oils of one kind and another down their drains.

Activity 7 — OIL SLICK or HOW FAR DOES OIL SPREAD?

Do you know how much oil it takes to cover the surface of a body of water? Why not try an experiment to find out?

Obtain a container which is not important for later use. A cut-off milk jug might work well since it can be disposed of after use.

Fill the jug with about 2 inches (5.08 centimeters) of water. Ask each group member how much oil it will take to cover the surfaceof the water. When all of the opinions are recorded, add one drop of oil to the container (larger containers may require up to 5 drops).

WHAT YOU CAN DO

1. If you live near a lake, get a large map of your area. Observe signs of oil pollution. Pinpoint them on your map and include the date. Take photographs.

2. Watch your newspapers for news of oil pollution on beaches.

FOLLOW-UP ACTIVITY

Display your evidence: maps, photographs, records, press cuttings, etc. Supplement your own material with photos cut from magazines, especially color photos. If you can take color slides on your shoreline expeditions, use them in your display.

MAN'S USES OF WATER

MODERN MAN USES 20 TIMES MORE WATER THAN HIS ANCESTORS

THE FRESH WATER NEEDS OF AGRICULTURE AND INDUSTRY are very great and increase all the time. In many of the poorer countries, the rainfall is not enough and more fresh water is needed to water the farmlands. In many of the rich countries the need for water is great because industries, farmers, and householders consume much more water. Through the activities of these groups, many water sources have become unusable due to pollution.

WHAT MODERN MAN HAS DONE TO WATER

Modern man has harmed his water supply in many ways. He has changed its color from sparkling blue to muddy brown.

Accidentally or on purpose, he has dumped millions of tons of soil into it.

He made it foam with detergent. The phosphate in detergents causes the algae and other water plants to grow so fast that they age lakes and add bad tastes and odors to the water.

Man has polluted the waters through waste chemicals and oil spillage. He has dumped everything from cans and bottles to old motor cars into lakes, rivers, and streams.

Factory and household effluent have been poured into rivers, lakes, and the sea, poisoning the waters.

Pesticides have been washed into the waters from household gardens and farmlands, adding to the poisons.

"Fall-out" from nuclear explosions has poisoned the waters as well as the air and the land.

All this man-made harm to water is destroying fish, birds, and many other kinds of wildlife. It has made many beaches and recreational waters and resorts so dirty and ugly that they have had to be closed. It is making vast amounts of water useless and dangerous to marine life, bird life, animal life of all kinds, and to man himself.

SOME THINGS YOU CAN DO

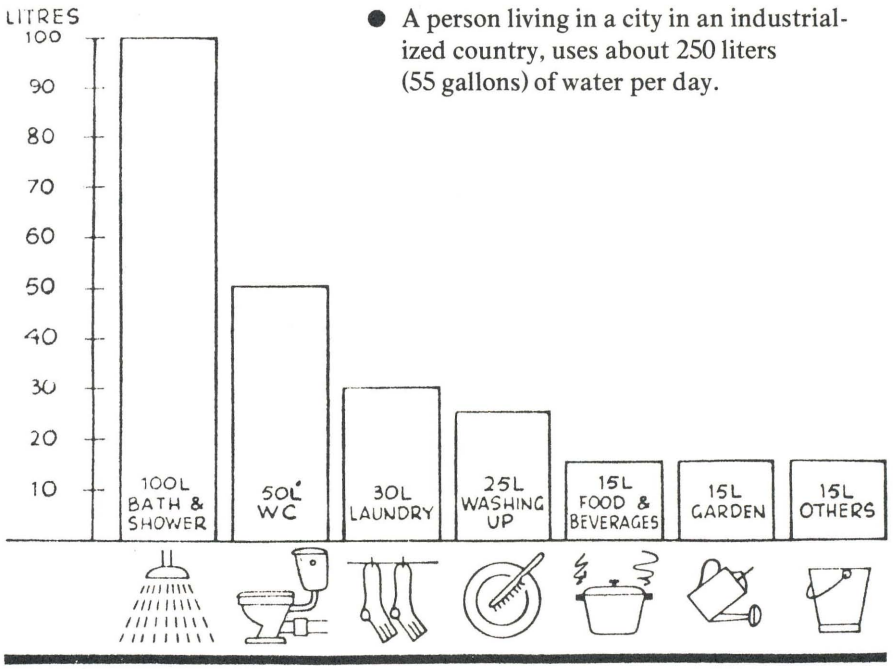
Make sure the detergent used in your home is low in phosphate content or entirely free of phosphate.

Don't flush toilets unnecessarily. (It's almost criminal, as some people do, to use 8 liters [2 gallons] of water to flush away a tissue or a cigarette end!) And don't put heavy paper, cigarettes, foil, plastic bags, rags, grease, solvents, medicines, or other chemicals into toilets or sinks. These substances reduce the effectiveness of your community sewage facilities.

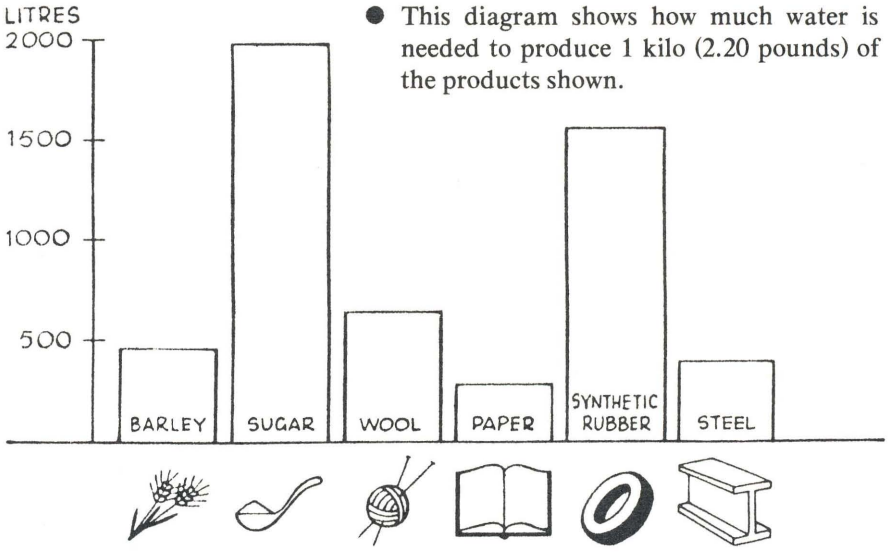
When changing the oil of an automobile, motorcycle, boat, lawn mower, or other engine, make sure that none is spilled. One liter of oil makes one million liters of water undrinkable! (With the energy crisis, many countries are now collecting old engine oil and re-refining it.)

Check all your tap washers. Dripping taps waste vast quantities of water. Don't wash under a running tap. Use the basin plug. Use less water for baths and other purposes. And always turn the tap off tightly!

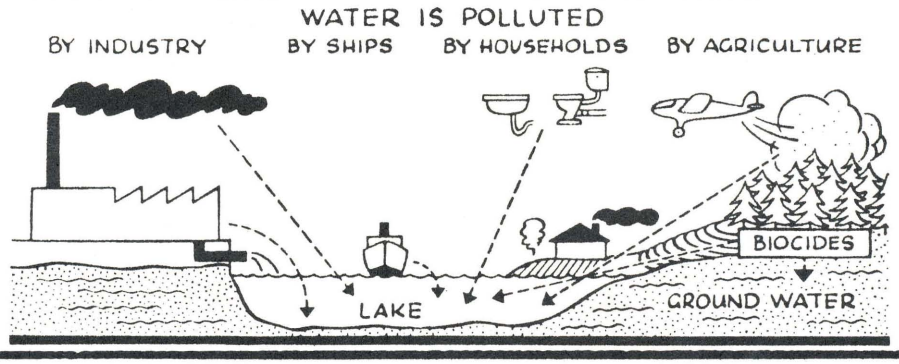
When developing flower and vegetable gardens, remember you need much less water when your soil is rich in humus or is mulched or both.



- A person living in a city in an industrialized country, uses about 250 liters (55 gallons) of water per day.



- This diagram shows how much water is needed to produce 1 kilo (2.20 pounds) of the products shown.



PRIMARY WATER USES

HOME

Activity 8 — PRIMARY WATER USES

This activity has been designed to help you get a better idea of the amounts of the water used in everyday life.

You are to make a study of the water that you use at your home in a single day. Measure or estimate the amounts used every time you use any water. List how the water was used, amounts used, and then the total for the day. Record either in quarts or gallons.

	USES	AMOUNTS		USES	AMOUNTS		USES	AMOUNTS
1.	_____	_____	6.	_____	_____	11.	_____	_____
2.	_____	_____	7.	_____	_____	12.	_____	_____
3.	_____	_____	8.	_____	_____	13.	_____	_____
4.	_____	_____	9.	_____	_____	14.	_____	_____
5.	_____	_____	10.	_____	_____	Total	_____	

In addition to the above exercise, you may want to check a leaky faucet at your home. Set a container under a leaky faucet for an hour. Measure the water lost for the hour and then multiply it by 24 and determine the amount lost per day. This can be done either in quarts or gallons (a quart is equal to .946 liters).

Record your results: HOUR _____ 24 HOURS _____

AGRICULTURE

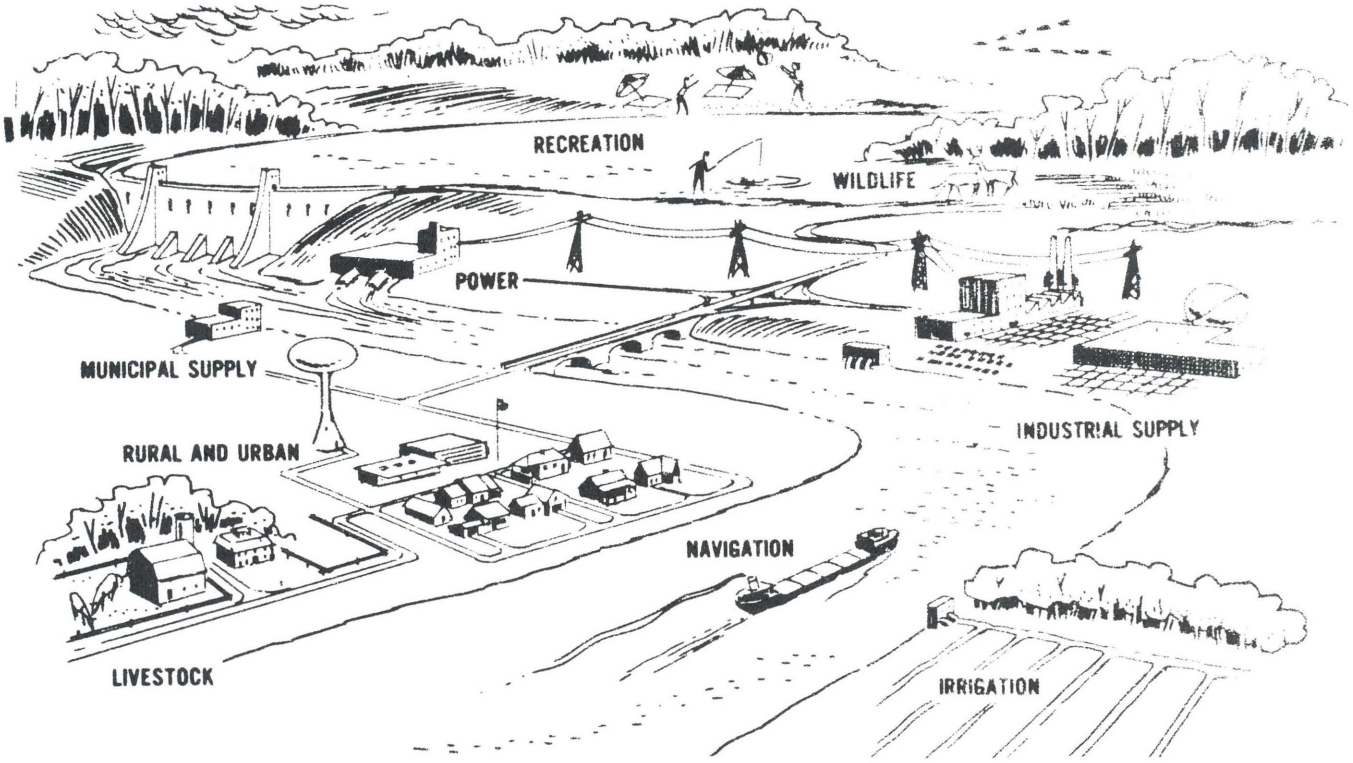
This activity has been designed to help you gain a better understanding of the importance of water and agriculture. As you should know, water is the most important element to a plant or animal.

Listed below are some animals and crops that are common water users on the farm. You are to guess the amounts used by each. After you have made a guess, check the correct answers found on page 17.

ITEMS	GUESS	AMOUNT
1. Corn per plant during growing season	_____	_____
2. Potato per plant during growing season	_____	_____
3. Ragweed during growing season	_____	_____
4. Tomato — 1 stem during growing season	_____	_____
5. Wheat — one stalk during growing season	_____	_____
6. Dairy cow — per head per day	_____	_____
7. Beef animal — per head per day	_____	_____
8. Horse — per head per day	_____	_____
9. Sheep (ewe) — per head per day	_____	_____

As you can see, water plays an important part in the life of all the above. Therefore, care must be taken to assure an adequate water supply to each.

COMMUNITY



Some cities and communities have to take water from rivers that are polluted by sewage and industrial waste. They have to purify the water before it is fit for human use. How much do you think you would be willing to pay for a gallon (3.785 liters) of water? How many of these water uses do you find in your community? Do you know any people who drink water that comes from a river? Is the water in this river used for any other purposes than for drinking?

LIST HOW WATER IS USED IN YOUR COMMUNITY:

_____

_____

LIST WATER PROBLEMS IN YOUR COMMUNITY:

_____

_____

_____

_____

YOUR DRINKING WATER

The need for quality drinking water is well known. But how do we find out about water quality? Two water quality factors will be examined.

The first test is the Water Sanitation test or Water Quality test. This test is for a "living factor" in contrast to the physical factors that will be examined in the second test. There are many types of living organisms which can cause disease. A lot of these disease causers require water for some part of their life cycle. For example, bacteria living in poor-quality drinking water can cause dysentery—a disease which often involves diarrhea and infection of the digestive tract. The State Department of Health will perform the laboratory tests to check for these living factors—the Water Sanitation Check.

The second test is the Percolation Test ("perc-test"). The "perctest" is actually a test of the porosity of the soil (the amount of pore space in the soil for water to flow through). It measures the rate of flow as well as the amount. It is also important to know the ability of the soil to soak up rainwater. When rainwater is soaked up, it cannot carry germs, fertilizer, or pollution into drains or streams. It is important in the location placement when making a drainage field for a septic tank.

STUDY YOUR DRINKING WATER

1. Find out the main source of your community's drinking water. A dam? A river? Wells? Visit the source, and take photographs.

2. Find out what treatment is given to the water before it is used by the community for drinking and other purposes. Someone at your local municipal water department or regional water board can give you information.

3. Draw a simple sketch plan, showing the progress of the raw water from its source through the water treatment plant, and so on, to where it reaches the taps in your home as pure drinking water.

WATER QUALITY TESTS

Activity 9 — WATER SANITATION CHECK*

This activity is for those young people who do not have city water in their homes. Safe water is a must. Drinking unsafe water can cause some of the following: typhoid, diarrhea, internal parasites, cholera. Therefore, a check of your water is important.

Water sample bottles are available from your county health office. Take the bottle home and fill it from your water supply. Make sure not to allow the top of the bottle or the bottom of the lid to touch anything because this will alter the test results. Take the bottle back to your club meeting and mail all the water samples as a group. By sending more than one in a package, the postage is cheaper.

Mail the bottles to Lansing as described in the bottle instructions in cooperation with your city or county health department.

Fill in the following information:

1. Location of the well
2. Water supply: private, public, etc.
3. Source of the water: well, spring, other
4. Sampling point: well, faucet, other
5. Well: age, depth, diameter
6. Well casing capped: YES or NO
7. Well distance from the septic tank

After you get your sample results back, fill in the blank to show if the water is safe or unsafe.

8. Draw a map of your yard to show the location of the well, septic tank, and drainage field. You may wish to include trees, the house, and other buildings.

*If you do have a city water supply, work as a group on some special site, such as your school, community center, or place where they do have a separate well. Sample and record findings as a group.

Activity 10 — PERCOLATION TEST

Do a percolation test around your home. The purpose of this test is to determine the ability of the water to soak into the ground. The faster the rate, the better the drainage. A key to the drainage at your home would be how many puddles remain after a rainstorm.

For this activity, remove the top and bottom from a coffee can. Place a ruler inside the can. Push the can about an inch into the ground. Fill the can with water. Record the amount of time it takes for 1 inch to soak into the ground. For the best results, record the times for the 2nd, 3rd, and 4th inches. This measurement should be transferred into inches per hour.

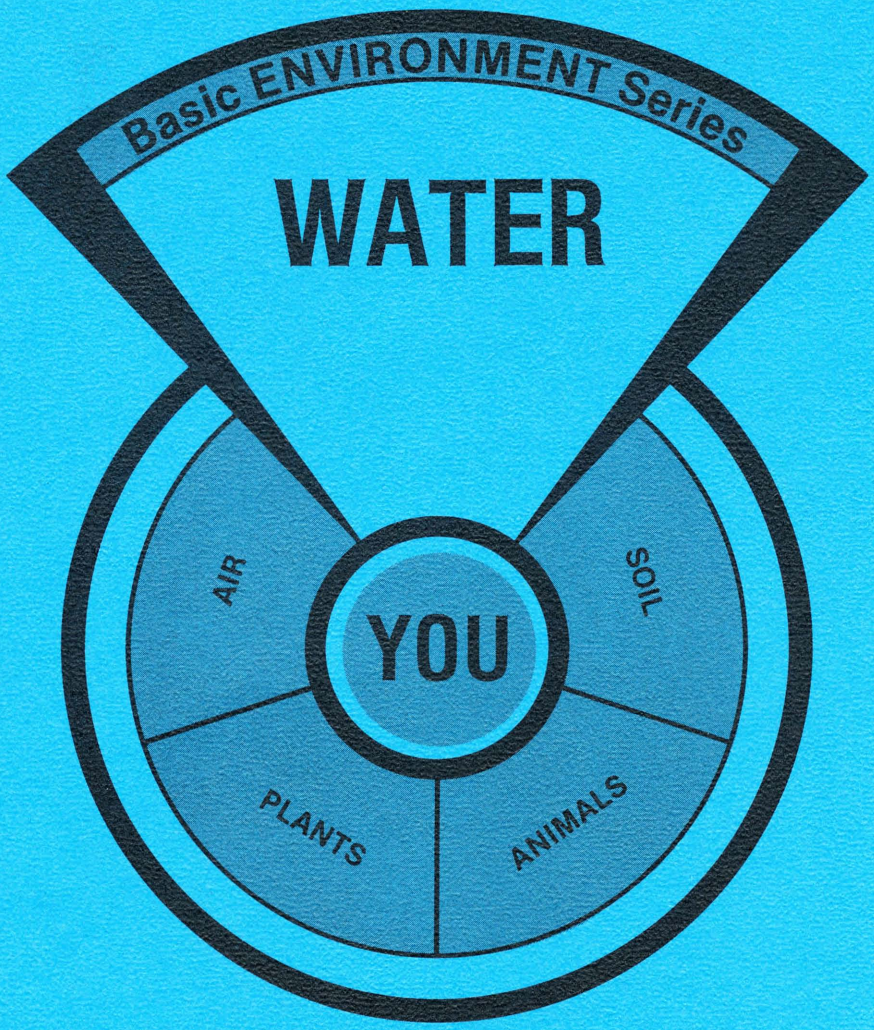
Example:

If 1 inch (2.54 cm) = 10 minutes, then in 60 minutes (1 hour) it would be 6 × 2.54 cm or 6 inches (15.24 cm) per hour.

Try this in different areas of the yard. If the soil is very loose or firmly packed, results will be different. The type of soil will also affect this percolation rate.

Water Requirements for Activity 8: WATER AND AGRICULTURE, from: *Water and the Land,* USDA—SCS Publication.

1. Corn per plant during growing season	54 gal.	204.41 liters
2. Potato per plant during growing season	24 gal.	90.85 liters
3. Ragweed during growing season	140 gal.	529.96 liters
4. Tomato—1 stem during growing season	35 gal.	132.50 liters
5. Wheat — 1 stalk during growing season	25 gal.	94.64 liters
6. Dairy cow—per head per day (80# milk per day)	12-15 gal.	45.42-56.78 liters
7. Beef animal—per head per day	8-10 gal.	30.3-37.85 liters
8. Horse—per head per day	10-12 gal.	37.85-45.42 liters
9. Sheep (ewe)—per head per day	1-1½ gal.	3.785-5.68 liters



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