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Basic Air Environment Series - Member's Guide
Michigan State University Cooperative Extension Service
4-H Club Bulletin
Robert George, Environmental Conservation Education
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4-H 1046

Member's Guide

Basic AIR

ENVIRONMENT Series

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

AIR

PURPOSE: To develop understanding about air and its importance in our lives. To develop a real concern for what we are doing to our air—*air pollution* and motivate each of us to do something for "clean air."

OBJECTIVES: To learn about the composition of air and investigate the causes and effects of air pollution. To appreciate the importance of air in our environment and the need for air quality.

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

- Air is a mixture of gases.
- There is air in water and in soil.
- The oxygen-carbon dioxide cycle is basic to life.
- Air pollution affects all things: living and non-living.
- Weather is a result of air movements and changes.
- Each individual can do something for clean air—it is our responsibility.

CONTENTS

ACKNOWLEDGMENT

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.

Robert W. George
Extension Specialist
Environmental Conservation Education

THE AIR AROUND US

One of the best things about our earth is the gigantic ocean of air that surrounds it. This ocean of air is held in place by the earth's gravity. And although it rises above us about 600 miles (965.61 kilometers), it is also in the soil under our feet, as well as in oceans, lakes, rivers, ponds, and streams. It's a good thing that it is in so many places so plants and animals can get the amount they need, no matter where they live. You breathe in about 6000 gallons (22,712.47 liters) of air a day.

Air is made up of a mixture of invisible gases. About four-fifths of it is nitrogen. Plants need this in order to grow. However, nitrogen must go through a chemical change before plants can use it.

About one-fifth of air is made up of oxygen, which is a very important part as far as animals are concerned. They must all take in oxygen in order to live.

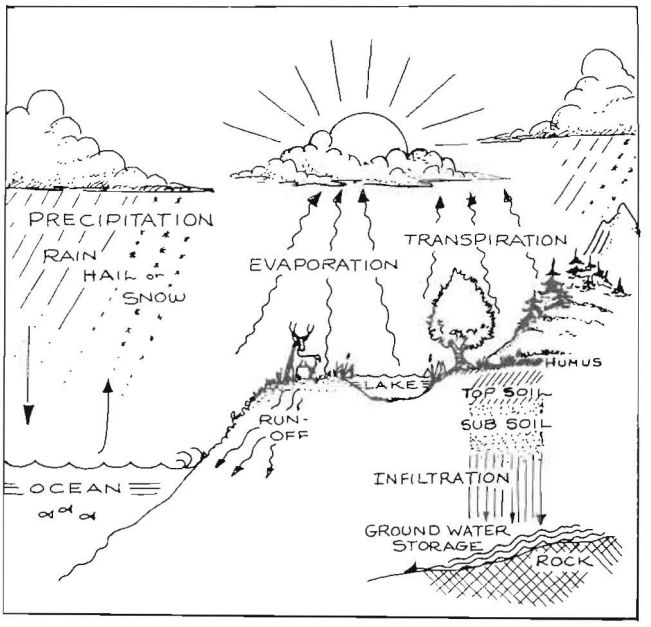
Even though air contains a very small amount of carbon dioxide, it is also very important. A little later we will find out how plants use this gas to help make raw materials for food. We will find out how oxygen and carbon dioxide keep circling around between plants and animals. Scientists believe that before plants and animals lived there was very little of either or these two gases in the air.

Pure air also has traces of such gases as ozone, argon, neon, helium, and hydrogen near the earth. There are larger amounts of some of them farther away.

Another important part of the air is a gas called water vapor, found in the air layer nearest the earth. It is water that has evaporated from oceans, lakes, rivers, and other wet places. Lots of it is also given off by plants and animals. When water changes into water vapor, it is just as dry and invisible as any other gas. The amount that air contains at any one time has a lot to do with the kind of weather we have.

Water keeps traveling in an endless circle, too. It evaporates into the air as water vapor, condenses into clouds that move about over land and sea, and falls back to earth as rain, snow, hail, or sleet. Then it evaporates into the air again as water vapor and the process starts all over again. We call this process the WATER CYCLE.

The way the water cycle works keeps water distributed pretty well over the earth. Some may evaporate from the ocean but travel a long distance over dry land as water vapor before it condenses again. Then it may return as rain or snow to a dry place where plants and animals need it badly.



Although tiny dust particles found in most air near the earth aren't gases, they also play an important part in keeping things on earth alive. They act as centers around which water vapor condenses into water droplets in order to form clouds. In this way dust particles help return water vapor from the clouds to earth as liquid water.

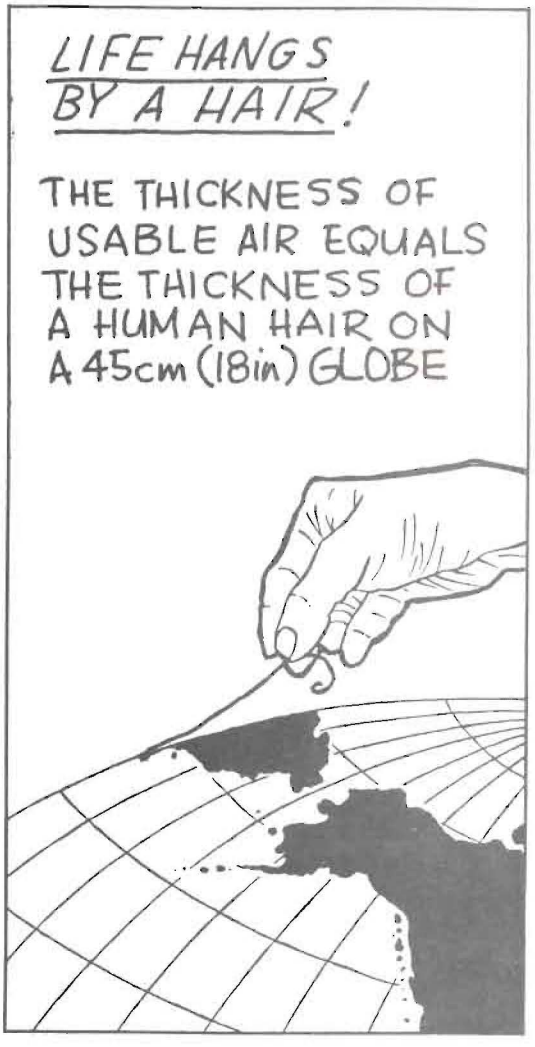
Even though we can't see, smell, or taste pure air, we can prove that it is made up of tiny particles, called molecules, that have weight. To prove that air has weight, blow up a football and weigh it on a scale while the air is inside. Then let the air out and weigh it again. The difference between the two weights is the weight of the air inside the football. Because of its weight, air stays in place around the earth instead of drifting off into outer space. It is also the weight of air molecules that become packed together, according to the temperature, that makes air pressure.

OUR AIR ENVIRONMENT

THE THIN LAYER OF AIR ON WHICH LIFE DEPENDS

We make a dangerous mistake if we think that the air around us is limitless. The layer of air around the earth is only about 10 miles (16.09 km) thick. Of this, only the first 3 to 4 miles (4.83 to 6.44 km) contains enough oxygen to be of use to human beings.

The layer of air into which we dump so much of our waste is only a few miles (kilometers) thick. If we continue to pollute it, this thin layer of air will soon be filled. It is already so polluted that our lives and the lives of countless living things are at stake.



People, plants, and animals need air to live!

Q—Why do plants, animals, and people need good clean air?

In order to live, people and animals need to breathe the oxygen that is in the air. Fish in an aquarium get oxygen from the air that is dissolved in the water. They breathe by taking the oxygen out of the water with their gills.

Q—What happens to fish when water becomes polluted and all the oxygen in the water is used up? Where can they get more oxygen? Can fish survive?

Animals have been using up oxygen from the air and from the water for millions and millions of years. Why hasn't all the oxygen been used up?

- *Green plants give off oxygen* and need carbon dioxide to make food for themselves.
- *Animals,* including people, *give off carbon dioxide* when they breathe, and they need oxygen.

Plants and animals help each other!

Let's take a closer look at air—the atmosphere. Our outdoor air is often called "community air" because it belongs to no one but to everyone.

Some of the things we do to our "community air" tends to spoil it. We put things into the atmosphere that contaminate it so that it is no longer the health-supporting resource necessary for quality life and living.

THE AIR WE BREATHE

Simple demonstrations follow that show what is in the air that plants, animals, and people breathe.

Materials needed: clean glass bottle, steel wool, soup plate, water, two glass custard cups, small amount of lime water, soda straw, tin can, ice cubes, flashlight or slide projector, vacuum cleaner, facial tissues, deep cake pan, white paper, rock, glass slide, petroleum jelly, magnifying glass or hand lens.

1. *Air contains OXYGEN*—Push a wad of steel wool all the way down to the bottom of a bottle. Fill the bottle about half full of water and shake it well, until the steel wool is very wet. Pour off the water. Put one inch (2.54 cm) of water in a soup plate. Now put the bottle, mouth down, into the plate and let the bottle stand for one day and night. The water will rise up into the bottle. See how rusty the steel wool has become. The steel wool combined with oxygen in the air inside the bottle to form rust. The water then rose to take the place of the oxygen in the air that was used up by the steel wool.

2. *Air contains CARBON DIOXIDE*—Get a small amount of lime water from a drug store. Put it into two clear custard cups. Blow through a soda straw into the lime water in one cup. The carbon dioxide from your breath will make the lime water milky. Place a second cup of lime water in the fresh air for a few hours. Watch what happens. Whenever carbon dioxide meets lime water, the lime water becomes milky.

3. *Air contains WATER VAPOR*—Get a tin can which has had the top smoothly removed. Remove the label and scrub the can with steel wool until it is bright and shiny. Fill it half full of cold water. Add two or three ice cubes. Soon, droplets of water will form on the sides of the can. When warm air meets the cold sides of the can, the water vapor in the air changes back into droplets of water.

4. *Air contains DUST*—Pull down the shades in a room, switch off the lights, and turn on a flashlight or a slide projector light. Little specks of dust will be dancing in the beam of light. (You can often observe dust particles in a ray of sunlight coming through a window.)

   Tape a piece of facial tissue over the end of the hose of a tank-type vacuum cleaner. Hold the hose up in the air and turn on the machine. After several minutes, switch off the vacuum cleaner, remove the tissue carefully, and look at it under a bright light with a magnifying glass or hand lens.

5. *Air contains SMOKE AND SOOT*—Cut out a piece of white paper so that it fits the bottom of a deep cake pan. Place the paper in the cake pan, and put a rock on the paper to keep it down. Put the pan outside on a window sill so that the fresh air can get to it. After a day or two, see how much smoke and soot has collected.

   Smear a glass slide with a thick layer of petroleum jelly, and put it outside on a window sill. Leave it for a few days. Then take the slide in, put it on a piece of white paper, and study it under a bright light, using a magnifying glass or hand lens.

CONCLUSIONS:

All air has oxygen, carbon dioxide, water vapor, dust particles, and smoke and soot.

When air has lots of smoke, soot, dust, and other gases, we say that air is being polluted. When the air is thick with smoke, soot, other gases, and fog, we call this condition smog. What do you think causes polluted air or smog in your town or community?

THE IMPORTANCE OF AIR

Demonstrate the importance of air and the effects of air pollution.

What are the basic needs of all living things?

People, like all living things (plants and animals), can live only if certain basic needs are met. The four basic environmental needs of all living things are: sun, soil, water, and air.

How does the body get the oxygen it needs?

The body's need for oxygen is satisfied by the lungs bringing in air.

What happens to the lungs when they bring in dirty air?

The lungs show the effect of the air they bring in. If one lung received only pure air and the other the polluted air which surrounds us more and more, the pair of lungs would look quite different. The normal, healthy, pinkish-red lung tissue breathing pure air would probably be retained. But, with air pollution, the other lung would be darkened by particles carried in from the atmosphere.

What does it mean when the lung is dark?

A black lung is not, by itself, proof of illness. A black lung proves only the presence in the tissue of particles inhaled from polluted air. The impure air that deposits this dirt in the lung tissue does have an injurious effect on health.

Why does a rural area have air different from the air in a city?

Air in the country is cleaner because there are fewer people living and working close together. Polluted air which would produce the darkened lung is found wherever there are large numbers of people living and working together amid the factories and businesses necessary to fill people's needs and desires.

What are the major sources of pollution in a city?

There are five major sources of today's pollution. They are:

Industry—of the many industries, the major polluters are pulp and paper mills, iron and steel mills, petroleum refineries, and chemical manufacturers.

Space heating—that is, the heating of buildings.

Incineration—burning of industrial waste, trash, and garbage.

Transportation—automobiles, motorcycles, trucks, buses, coal and diesel trains, ships, and planes.

Power plants—which supply electrical energy for lights, air conditioning, appliances, machinery, and trains and subways run by electricity.

THINGS TO DO

Make a list of all human activities you can think of that contribute to pollution.

_____

_____

_____

_____

_____

_____

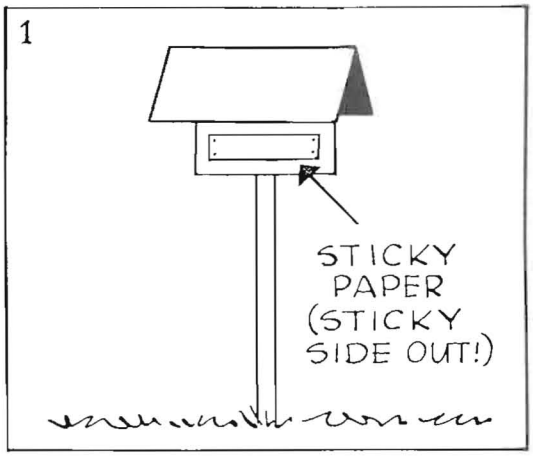
Collect news items and magazine stories on air pollution (very helpful for demonstrations and talks).

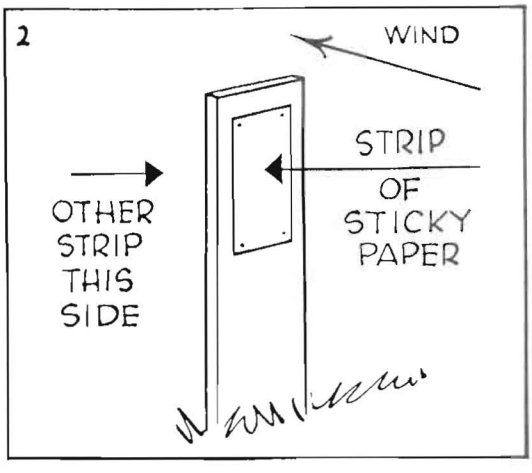
Find or draw pictures of air pollution sources.

BE AN AIR POLLUTION DETECTIVE

DETECT AIR POLLUTION

Use one or more of these air pollution detection devices. Keep a simple record of your findings. Display the results in a demonstration or in your club exhibition on air.



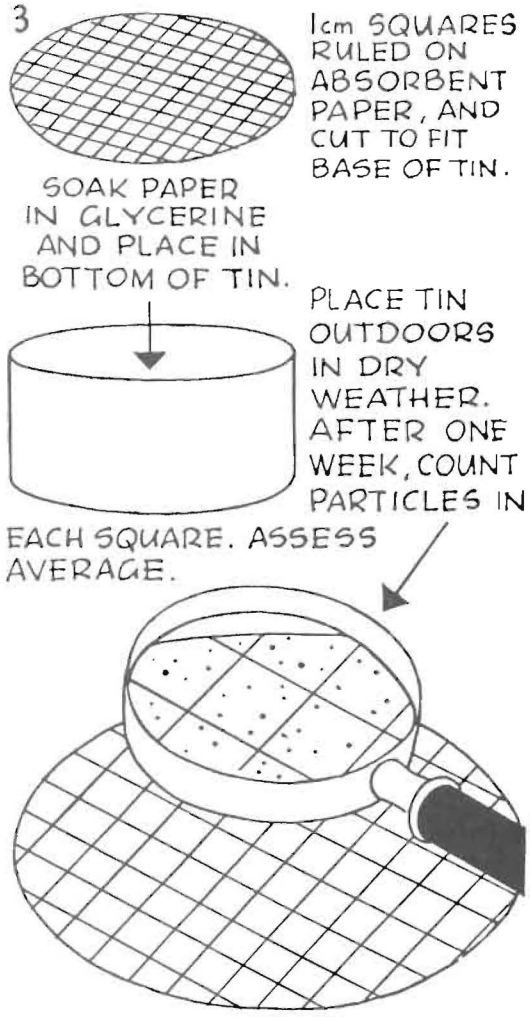


1. Get two strips of sticky paper—a car bumper sticker, self-adhesive tape, or stiff paper smeared on one side with petroleum jelly. Affix one strip outdoors, exposed to the air but protected from rain as shown in the sketch. Keep the other strip indoors, protected from exposure. After one or two weeks, compare the two strips with the aid of a magnifying glass. Record what you find, by way of particles, etc., on each strip. Also record the number of days over which the experiment was conducted.

2. Smear two strips of cardboard with petroleum jelly. Affix the strips to each side of a plank that is driven into the ground—with one strip facing the prevailing wind. After one week, compare the two strips—preferably under a magnifying glass. Write a simple record of what you find. Note particularly the direction from which the worst air pollution comes.

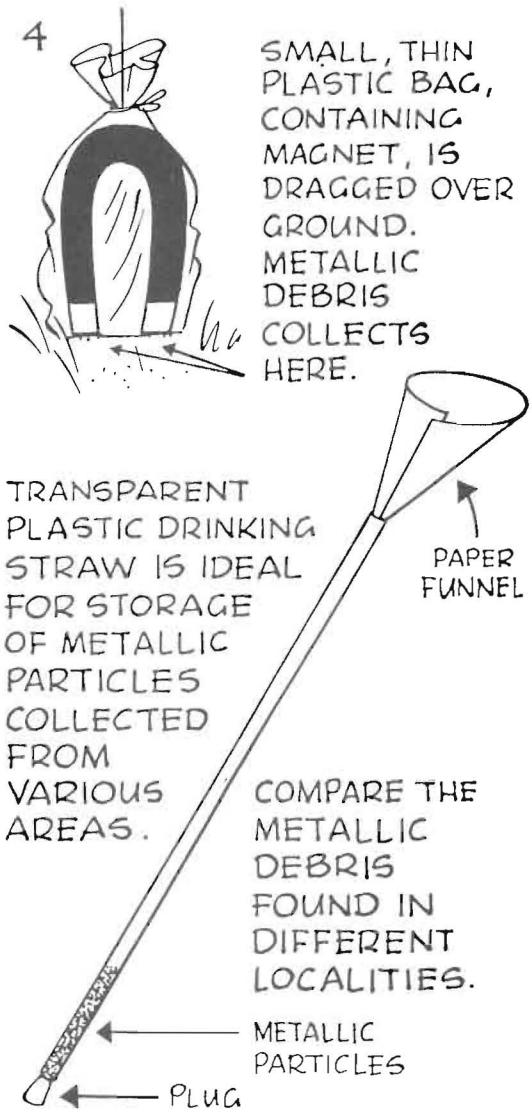
OTHER EXPERIMENTS: a) You can demonstrate the presence of sulfur dioxide in the air by hanging a well-polished silver (or silverplated) spoon at a place where there is heavy traffic. For example, tie the silver spoon to a stick and suspend it from a window sill for a few days over a street where the traffic is heavy. b) Demonstrate the amount of pollution in the air by putting a coffee filter or a paper tissue over the hose of a tank-type vacuum cleaner.

3. Rule 1 cm (0.39 inch) squares on a sheet of absorbent paper—filter paper if possible. Place the paper in a wide tin or jar, and soak it with glycerol (also called glycerine). Place this device outdoors in dry weather; bring it inside when it rains. After a week, count the number of particles on each square—using a magnifying glass—and calculate the average per square. Then replace the device outdoors again for another week, and repeat the particle count. Record notes on your findings.

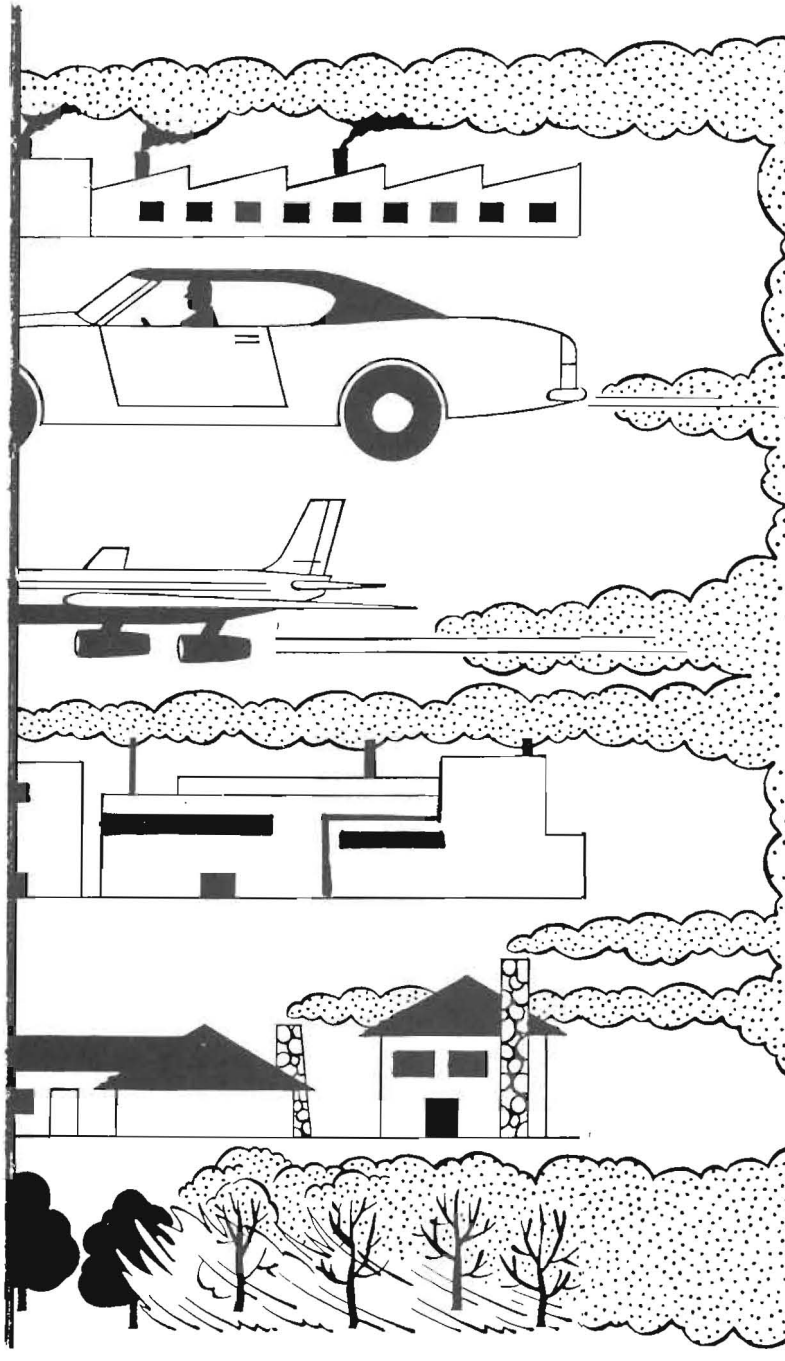


4. Magnetic material in our environment is due to manufacturing processes or transportation activities. Here's how you can detect pollution in the form of magnetic materials: Place a small magnet in a thin, transparent plastic bag. Attach a string to the bag, and drag it over the ground. Compare the material you collect in different areas, such as a main highway or road; the vicinity of a manufacturing plant; downwind versus upwind of an urban area; a field; a wooded area, etc.

Good containers for the storage of collected magnetic materials can be made from transparent drinking straws. Plug one end of the straw, and insert a paper funnel in the other end. Use a different straw to collect the material gathered in each area.



Main Causes of Air Pollution



- Factories fill the air with a great variety of dangerous substances. There are many other ways of disposing of these substances, but the cost is high.
- Motor cars and other road vehicles are major air polluters. They fill the air with about 75 million tons of pollutants every year. This increases every year!
- A jet airplane gives off as much soot and other particles as 24 thousand cars!
- Oil is widely used in houses, hotels, factories, etc., for heating, cooking, power. The sulphur dioxide poured into the air from oil furnaces contaminates both water and soil and also causes metal corrosion in vehicles, machines, metal structures, etc.
- Coal fires play their part. It was the particles from all the coal fires heating the houses in London, England, that caused the air pollution catastrophe in December 1952 – when 4 thousand people died in one week.
- Grass and forest fires all play their part in polluting the air. Likewise, when you burn garden and other household waste, you add to the problem.

THINGS TO DO

Investigate the growth and nature of industry and pollution in your own area. The Chamber of Commerce and your official air pollution control agency can help you. Take photographs. Prepare a report.

AIR IN SOIL AND WATER

Learn about the air that is in our soil and in our water.

GREEN PLANTS are the key to the air quality in soil and in water. Small animals are the air-quality "controllers" in soil and water.

Is there air in the soil? Is soil a solid?

Soil is a mixture of particles of sand, silt, clay, and organic matter (decaying plant material and dead animal remains) with varying amounts of pore space (openings between particles). Soil pores hold free air and water. Roots of plants tend to make new openings between particles; and, as the root dies and decomposes, this passageway is filled with air or water. The soil pore space is really the key to the life in soil.

Is soil alive?

Soil particles are not alive, but the mixture with organic matter and the addition of air and water make a "living medium" upon which much life is dependent. Many small animals inhabit the "living soil," using water and air to assist in the growth and decomposition processes.

What about the CO_2 in the soil air? — the water?

As plants die and decompose, they increase the carbon in the soil and, in turn, increase the amount of CO_2 in the soil air. CO_2 is a major need of green plants! Soil tillage is an important consideration in the availability of CO_2 and the rate of decomposition. Even more important is the addition of CO_2 by falling rain, because it is also extremely soluble in water.

Is there really air in water?

The oxygen in our air is very solvent in water, and as water is stirred it becomes aerated—the oxygen in the air is dissolved in the water. This oxygen in water is the basis for most life in water—both plant life and animal life.

Plants give off oxygen (O) in the presence of sunlight—and use carbon dioxide (CO_2). The animals in the same environment are giving off carbon dioxide (CO_2) and using up the oxygen (O) supply. Note: During the night, plants in a water environment "switch around" and use up the oxygen supply in competition with the animals. This is why fish tend to suffer from lack of oxygen in certain waters that are heavily infested with plants and tend to be low in supply of dissolved oxygen.

How do animals help plant growth? Nitrogen?

As they break down organic matter, certain minerals are released that, in turn, become available to another (growing) plant for plant food. Also, certain small animals called nitrogen-fixing bacteria increase the amount of nitrogen in the soil by taking it from the soil air. Legumes are the plants that develop small nodules (bumps) on their roots which serve as the home and "manufacturing plant" for nitrogen-fixing bacteria. The bacteria use the nitrogen from the soil air and fix it into a form that is available to plants for their "plant food."

Learn how "Life-Supporting" AIR is the key to survival.

Build a Terranium—A terrarium is probably the easiest habitat to set up and maintain. Yet, each type is a microhabitat in itself. It can be a community of small plants alone, or it can be set up as a natural home for some specific animal.

This may be a group activity—Record your findings.

CHOOSE ONE OF THE FOLLOWING:

1. Plant Terrarium
2. Rotting Log Terrarium
3. Meadow Terrarium

1. **Plant Terrarium** — Select a container that has a small top or provide a glass top that will *hold in moisture.* Provide a base of coarse sand, chips, or pea gravel for drainage. Add some pieces of broken-up charcoal to this base. For soil, use a mixture of two parts of *sharp mason's sand* and one part peat moss or leaf humus. Landscape with rock, small driftwood, live moss, and low-growing woodland plants like partridgeberry, moneywort, or small ferns and liverwort on a piece of log. The plants may outgrow the container, so they may need to be thinned out or replaced occasionally.

2. **Rotting Log Terrarium** — Collect a piece of old, rotting log from the woods. Select a piece with bark that has some moss lichens or slime mold showing on it. Often you will find a log that has small ferns or other plants growing on it. Take some of the leaf humus or decayed log material found underneath it. Place the humus material and leaf mold over a layer of sand which has been placed in the bottom of the terrarium for drainage. Place the piece of log in a natural position over the humus and cover the top of the terrarium to conserve moisture. Water occasionally to keep the log damp. Your log may be the home of bark beetles, wood-boring beetles, spiders, ants, or a red-backed salamander. Watch the slime molds or other fungi grow on the log. This is a good way to show how microorganisms break down the products of photosynthesis, and it illustrates the statement that there must be death before there can be life.

3. **Meadow Terrarium** — A home for insects and spiders. The size of this type of terrarium will be decided by the animals to be kept in it. A battery jar or gallon-size, wide-mouthed jar (from mayonnaise or pickles) can be used for insects like crickets, while orb spinning spiders would need a 10-gallon aquarium tank. Begin by placing gravel in the bottom for drainage. Cover this with sand, then with a layer of soil. Plant the entire terrarium with field sod. Include some pieces with tall grasses or weed plants to be placed at one end. Provide a piece of log or driftwood for insects to climb onto or hide under. A small, shallow container of water should be sunk to ground level at one corner. Although this type of terrarium should be kept fairly dry, water should be sprinkled on the plants each day for insects that depend on dew for their water. If a snake is to be kept in the terrarium, it is very important that a rock or dry log be provided for the snake to climb onto. Cover the terrarium with screening so there will be good ventilation.

FOLLOW-UP ACTIVITY

Discuss:

1. Aerobic activity in soil—in water;
2. Anaerobic activity in soil—in water;
3. What animals do to soil air; and
4. What animals do to the air in water.

AIR CONDITIONING

The role of weather in nature's "air conditioning."

We know how pollutants get into the air. But how do they get out?

Once pollutants are emitted, a number of things can happen to them. In normal circumstances, pollutants are washed out of the air by rain or dispersed by wind.

Before the pollutant is washed out or blown away, what can happen?

Before enough time elapses for either of these to take place, the polluting chemical compounds may change into other, sometimes more harmful, combinations.

Before sufficient diluting by the wind, pollution can be a problem for areas in the wind's path.

When the pollution is washed out of the air by the rain, it is not necessarily destroyed. (DDT is now known to kill fish that live in water into which pollution-filled rain flows.)

Suppose there is no wind or rain. Does that mean the pollutants remain stationary? What happens?

Even without a wind, the normal mixing of the air dilutes the polutants to some degree.

Mixing occurs this way: The sun's rays warm the earth, and the earth warms the air at its surface. The warmed air rises and expands. Under normal conditions, the air is cooler as the distance from the earth increases. As the warm air rises, the cooler air above sinks to take its place.

What is this air movement called?

This air movement is called convection.

In the convection process, the pollutants are mixed and diluted. (Our cities and industrial areas produce pollutants too fast for convection to disperse.)

Is there a connection between the air movement of convection and the air movement of wind? What is it?

The wind itself is the product of convection. When the sun heats the whole of the earth that faces it, and the surface air rises, not only is there up-and-down mixing, but cool air moves in from areas that the sun does not reach.

The earth rotates continuously, so that the sun strikes ever-changing parts of it. The result is that the air currents are churned into a number of major winds.

These winds are further altered by the irregularities of the earth's surface.

Sometimes, even though our pollution-causing activities are the same, levels of air pollution rise. Why?

A layer of warm air sometimes lies above a layer of cool air at the earth's surface. This is known as an inversion.

In an inversion, the cool air cannot rise and the pollutants are trapped.

What might happen to some of us in an inversion?

Inversions lasting several days have been responsible for some famous air pollution disasters, in which many people, mostly old and suffering from a heart or respiratory disease, became ill, and even died.

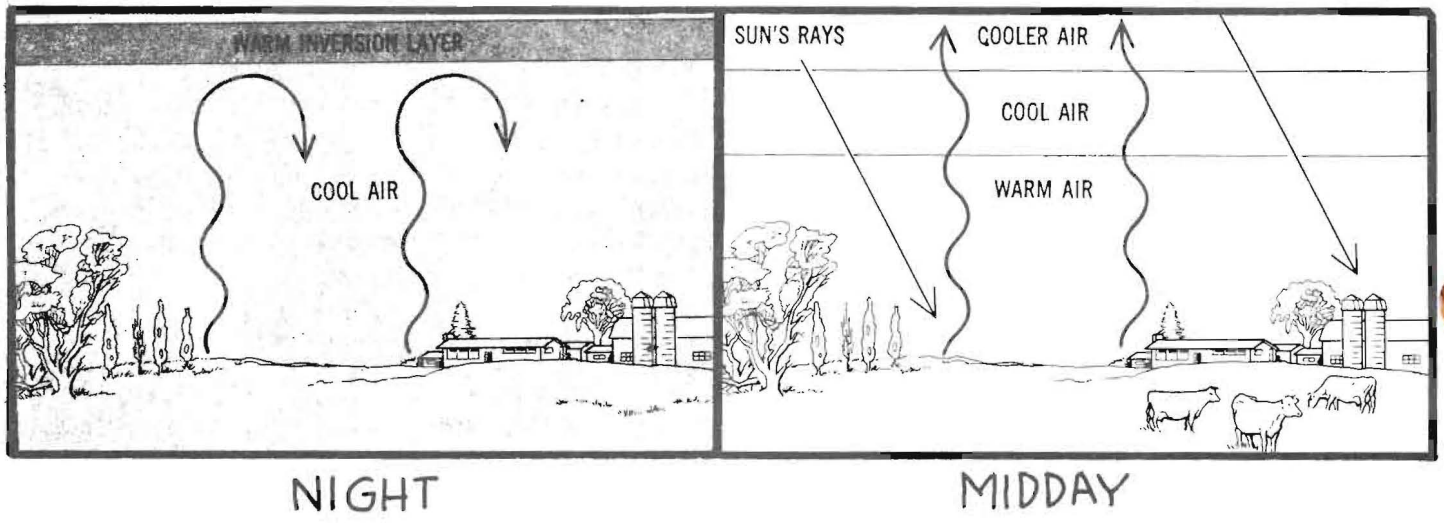
Develop the **concept of inversions** by the following demonstration.

Use four milk bottles or 16-ounce laboratory bottles. Place two in the refrigerator or outdoors on a cold day. Place the other two on a radiator or in a pan of hot water.

Hold a piece of paper with tongs. Light the paper with a match and let it burn inside one of the bottles containing warm air. When the bottle is filled with smoke, invert one of the cold bottles over it. The smoke will rise from the warm air to the cold air.

Next, burn a piece of paper in the remaining bottle with cold air. Invert the remaining warm bottle over it. The smoke will stay in the cold air.

Use weather maps to show how pollution might travel in your area.



EFFECT OF THERMAL TURBULENCE ON AIR CIRCULATION

At midday the sun's rays warm the earth and create an unstable condition with the warmest air at the bottom and moving freely upward (right). At night, the cool earth cannot heat the surface air enough to penetrate the warm air layer above. In consequence, the surface air, with whatever pollutants it contains, remains close to the earth (left).

AIR AND HEALTH

Examine the effects of air pollution on the human body.

PEOPLE MUST BREATHE. They must breathe whether the air around them is polluted or not.

What symptoms might develop if people breathe polluted air?

Air pollution can produce these symptoms: runny or stuffed-up nose, dizziness, cough, blurred vision, headache, fatigue, shortness of breath, burning, teary eyes, sore throat.

How does the body defend itself against polluted air?

Normally, the respiratory system defends itself from foreign matter through narrowing of the breathing passages and by the cleansing action of the cilia and mucus.

What is mucus? What does it do?

Mucus is a sticky substance which lines the airways and traps dirt and germs as they enter the body.

What are the cilia? How do they work?

The hair-like cilia move like waves and brush the dirt-laden mucus up and out.

How else does the body defend itself against air pollution?

Teary eyes, runny nose, and cough also demonstrate the body's attempts to protect itself.

Sometimes the defenses do not work.

What symptoms might indicate that the defenses are not working perfectly?

Certain pollutants in certain quantities can get past the defenses and cause other symptoms like dizziness, headache, blurred vision, sore throat, shortness of breath, and fatigue. After one lives in polluted air for a long time, permanent changes may take place within the body.

What might these changes be?

There may be a thickening or an increase of mucus. There may be changes in the cilia. The cilia may be slowed down or even completely paralyzed. Some of the cilia may be destroyed.

What might be the result of these changes within the body?

When the cilia are damaged or cannot function properly, the body is more susceptible to infection. The body's airways may become permanently constricted and obstructed, so that breathing is always difficult.

Air pollution is probably also connected with the enlargement and loss of resiliency of alveoli. This condition also makes breathing difficult.

Can air pollution actually cause disease?

Air pollution can cause respiratory disease. It is one of the causes of asthma in some people.

Can air pollution cause any other diseases than asthma?

Air pollution can contribute to respiratory disease. Although it is not the cause, air pollution contributes to such infectious respiratory diseases as the common cold, influenza, and pneumonia.

How does it contribute to diseases caused by germs?

Air pollution attacks the body's defenses and leaves it more susceptible to the bacteria and viruses that cause infectious respiratory diseases.

Does air pollution affect any chronic diseases?

Although a single cause is hard to find, air pollution is considered a factor in some chronic diseases. The chronic respiratory diseases affected by air pollution are emphysema, chronic bronchitis, and lung cancer.

Air pollution is associated with heart disease. Constricted airways and damaged alveoli place a greater burden on the heart. The heart must work harder to get enough oxygen to the blood, since the lungs cannot bring in enough by themselves.

Can air pollution kill people?

Air pollution can, and has, caused death.

Investigators have concluded that 168 people suffering from respiratory or heart disease died because of pollution in New York City a few years ago in an inversion during a period of heavy pollution.

Although air pollution has not yet been proven to be a cause of emphysema and lung cancer, deaths from these respiratory diseases are approximately twice as high in the city as in the country.

What do many people do that makes the effects of air pollution even worse?

Cigarette smoking is an especially dangerous form of air pollution.

Inhaled cigarette smoke affects the lungs even more than we ordinarily think of as air pollution. Cigarette smoking is considered to be a major cause of lung cancer, chronic bronchitis, and heart disease. Cigarette smoking also contributes to emphysema.

Scientists have found that people who smoke and breathe polluted air suffer from lung diseases and heart trouble much more than those who just smoke or who just live in dirty air.

BROADENING UNDERSTANDING
(Group Activity)

Discuss the famous air pollution disasters. Enlarge on the defense system of the respiratory tract.

THINGS TO DO

Look up accounts of the famous air pollution disasters. Research one of the diseases related to air pollution.

THINGS TO DO FOR CLEAN AIR

Examine the ways air pollution can be controlled or prevented; and determine the part played by industry, government, and individuals working alone and in citizen groups.

Can we get rid of air pollution? How?

Many pollutants can be removed from the air. Scientists and engineers have the knowledge to eliminate a good deal of air pollution now (although they continue to search for cheaper, better, and less wasteful methods). It can be done through technical changes.

What kinds of technical changes might be made?

Devices called electrostatic precipitators, filters, centrifuges, and scrubbers can remove almost all particulate matter. Scrubbers can also remove many of the gases. Gases can be removed, too, by burning and by absorption into such materials as charcoal.

Since every action we take has an effect on other things, might other problems be created in some of our solutions to air pollution? What might they be?

Some ways to end air pollution create other kinds of pollution. Even air pollution control equipment produces another kind of waste which must be disposed of. This waste is usually less dangerous and more easily handled however.

Getting rid of waste in sanitary landfill areas uses up land. (Today, many urban areas have to send their garbage miles away, by train, to find places to dump it.)

Dumping waste into a river or ocean causes water pollution.

Water pollution can kill fish. Water plants may multiply and then use up the oxygen as they decay. Drinking supplies can be contaminated.

We might use up nonpolluting materials—like natural gas.

What can we do to prevent new problems at the same time that we control air pollution?

We must reuse materials that are now considered waste. Elements—such as sulfur—that have value should be separated out. Newspapers, metals, and glass that are now part of trash should be used again. Ways should be found to use solid waste materials for heating, power, building, and other useful ends.

We must eliminate unnecessary consumption. No extra wrappings or containers should be used. No electric appliances should be manufactured for tasks that can be done easily by hand. No automobiles should be driven where public transportation can be made available.

We must see that presently operating systems which produce air pollution either change their processes or install controls.

Do you think these changes will come about easily? Why not?

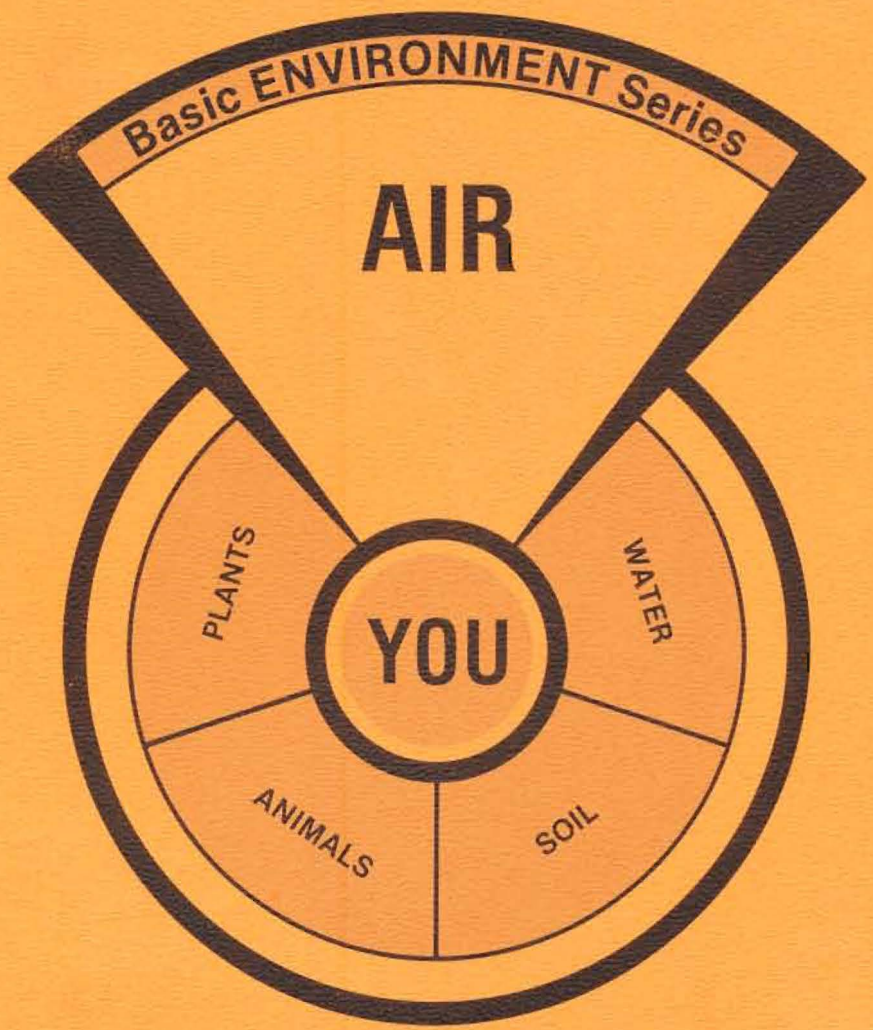
WHAT THE INDIVIDUAL CAN DO

The individual can help by not creating pollution himself/herself.

The individual should: keep cars and furnaces in good repair, refrain from racing the car's engine or from letting it idle when it is temporarily parked. Stop open burning of leaves or trash. Refrain from leaving lights on or electric appliances running when not in use. Use a fly swatter instead of an insecticide. Refrain from smoking, especially when others must inhale the smoke—some people are made sick by it. Use public transportation, a car pool, or a bicycle whenever possible, instead of a car.

One must be willing to pay for clean air—either by taxes or in increased costs of products made by industries with air pollution controls.

As long as so many people exist in crowded communities, we cannot recover that relatively clean country air. *But if* the necessary changes are made, *if* citizen groups continue to keep watch, and *if* YOU and every other person does his/her own task—WE CAN COME CLOSE TO BREATHING CLEAN AIR.



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