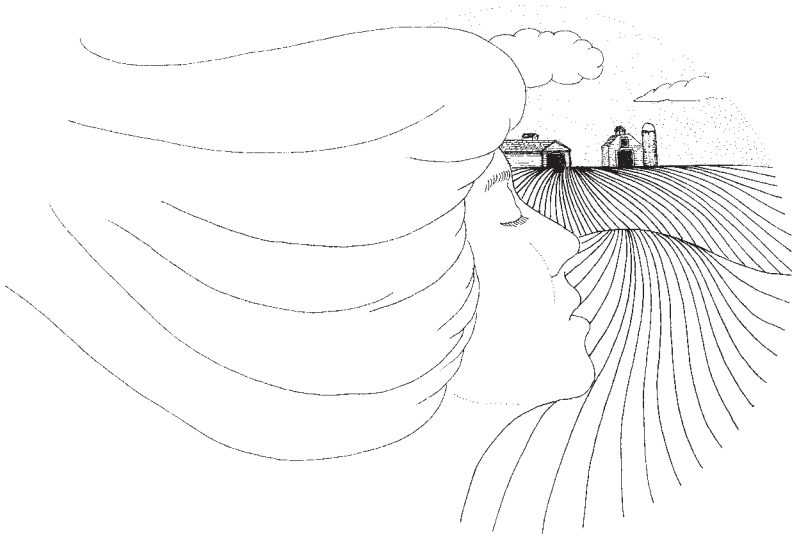
9-1998

Iowa Air Pollution -- Iowa Environmental Issues Series

Iowa Association of Naturalists

Iowa Air Pollution

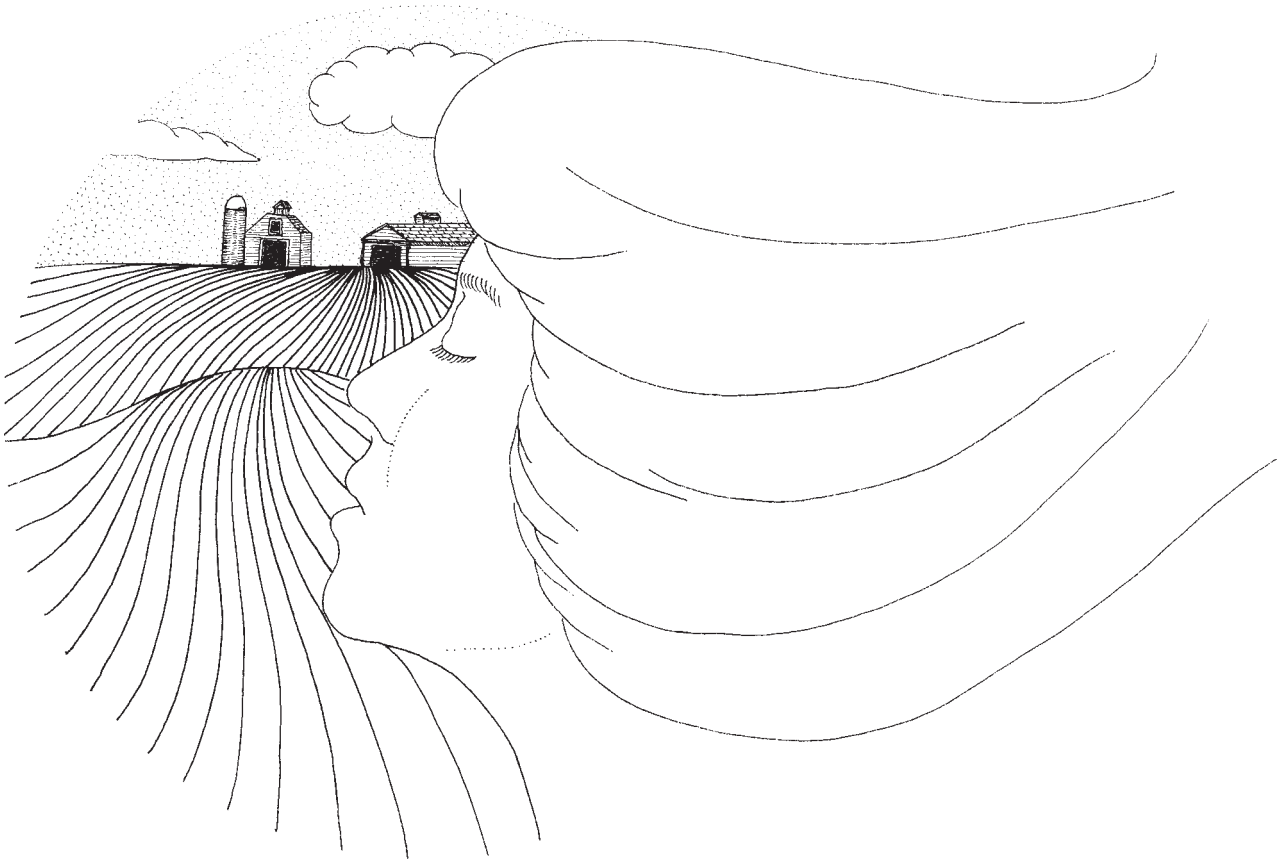
Iowa Association of Naturalists



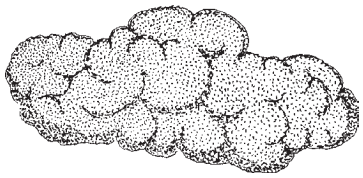
Iowa Environmental Issues Series

Iowa Air Pollution

Take a deep breath

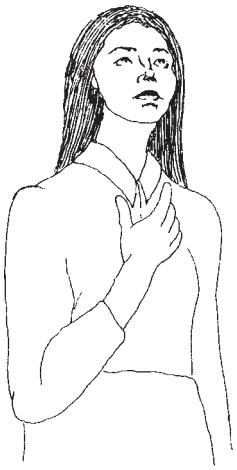


When we think of Iowa, we think of a rural state with clean, clear air. When we take a deep breath, we take comfort in knowing the air is clean and healthful. We imagine ourselves to be immune from the choking filth of big industrial cities. Although headlines may tell stories of polluted water and eroding farm land, we are confident that Iowa's air is clean. However, in some places in Iowa, air pollution is a problem.



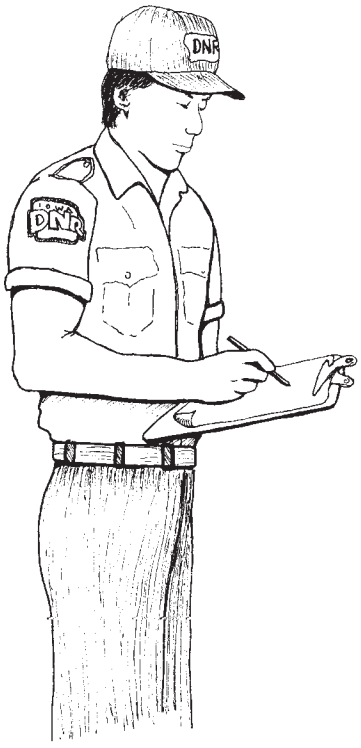
Something in the air

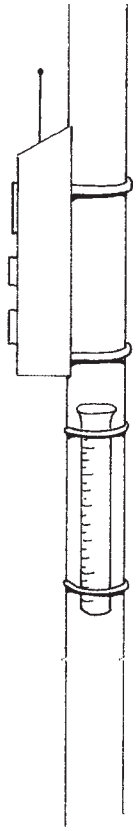
A variety of substances are floating around in Iowa's air. Many of the more harmful substances are created through human activities. These pollutants are classified according to their makeup and their effects on people. **Particulate pollutants** consist of fine particles of dust, soot, or other materials carried in the air. Six **chemical pollutants**, consisting of various chemical substances, have been closely monitored throughout recent decades. These chemicals may be directly harmful to people or may become harmful when they react with other chemicals in the atmosphere. Some particulate and chemical pollutants are deadly. These **hazardous air pollutants** may be radioactive, carcinogenic, or have other toxic effects.



Monitoring Iowa pollution

Air pollutants are monitored and regulated by the Iowa Department of Natural Resources (DNR). The federal **Clean Air Act** of 1990 requires states and businesses to maintain levels of known pollutants below National Ambient Air Quality Standards (NAAQS). Businesses and utilities must keep their emissions below the amounts allowed by the State of Iowa and the Clean Air Act. If they are not able to meet these standards, major emitters must use the "lowest achievable rate technology" to reduce emissions. Any increase in emissions must be offset somewhere else in the facility so as to decrease total emissions and help clean up dirty areas. There also are rules requiring major emitters that move into clean areas to use the "best available control technology." This rule helps prevent Iowa's clean air from becoming polluted when industries come in from out-of-state.





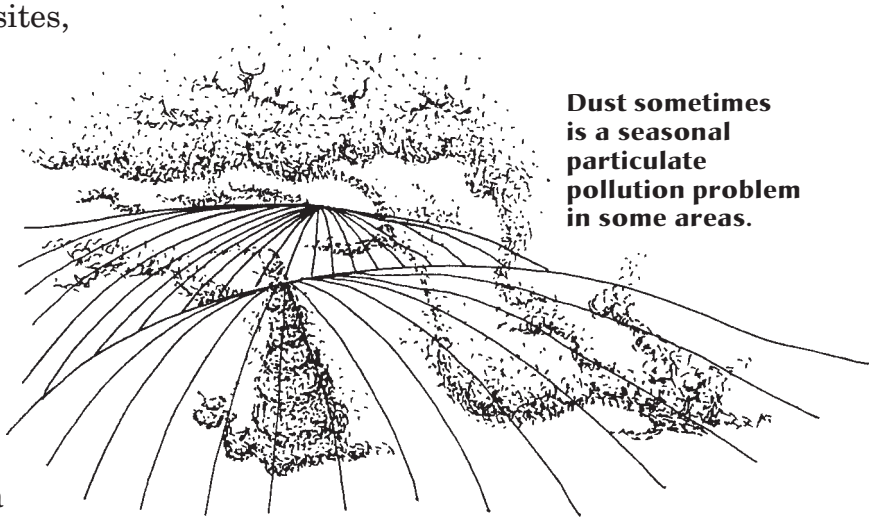
It is difficult to detect air pollution and predict where best to place monitors. It is

not feasible to have pollution monitors everywhere. In order to protect Iowans, laws have been written to prevent air pollutants from being emitted at their sources. The Clean Air Act requires major sources of air pollutants to have an operating permit that ensures they are meeting clean air standards.

Air pollutants

Particulates

Particulates are the most common type of air pollutant in Iowa. There are seasonal particulate problems such as dust from agricultural activities, gravel roads, construction work sites, and smoke from burning leaves. Some of the more dangerous particulates are found year-round near cement plants, foundries, scrap yards, milling operations, and asphalt and gravel plants.



Dust sometimes is a seasonal particulate pollution problem in some areas.

Dust, smoke, and diesel exhaust are particulate pollutants that pose direct health threats to people. Asthma sufferers, people with other lung problems, and children are most vulnerable to this pollution. Some types of particulates also indirectly affect people when they combine with chemical pollutants.

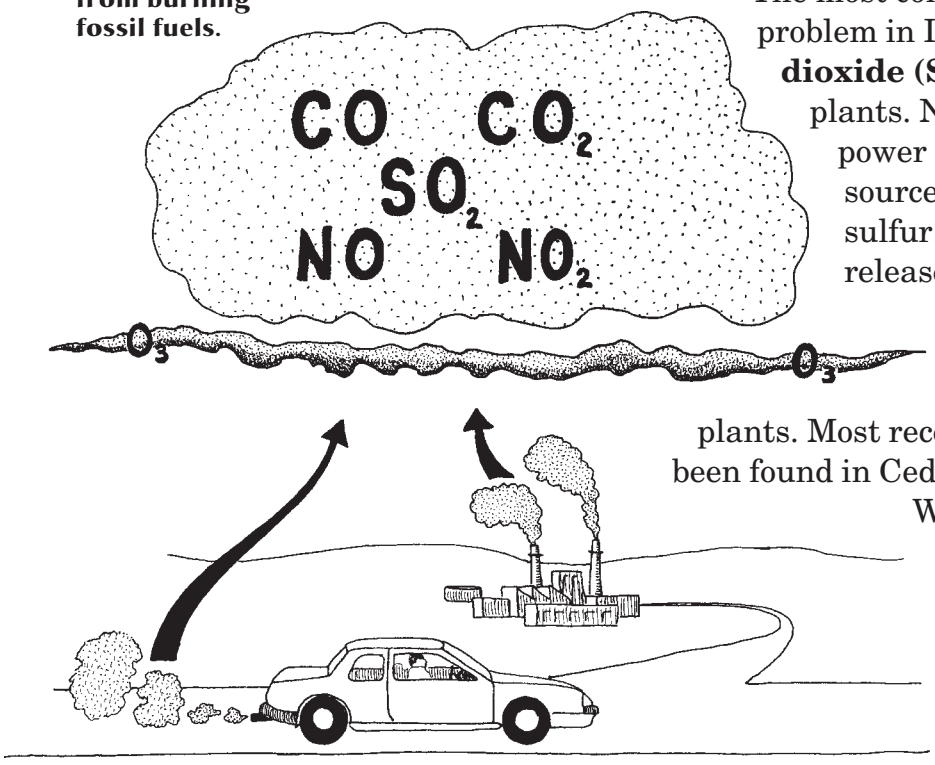
The DNR monitors the number of very small particles, smaller than ten microns, found in Iowa's air. These **PM-10 particulates** are able to penetrate and damage people's lungs and cause the worst health problems. Although the Clean Air Act requires most areas of the country to maintain low levels of PM-10 particulates, many areas, including some places in Iowa, do not always meet the national standard.

Cities in Iowa which have exceeded the PM-10 standard in recent years are Buffalo, Davenport, Des Moines, and Mason City.

New standards may soon be adopted that require monitoring of even smaller particulates, PM-2.5. Iowa has only recently begun to monitor PM-2.5 particulates at one site in Linn County. It is yet unknown whether a new PM-2.5 standard would be exceeded anywhere in Iowa.

Chemical pollutants

Chemical pollutants are released constantly into Iowa's air. The majority of these pollutants are the result of burning fossil fuels by utilities, industries, and motor vehicles.



Many chemical air pollutants result from burning fossil fuels.

The most common chemical air pollution problem in Iowa is the release of **sulfur dioxide (SO_2)** from electrical power plants. Nearly all of Iowa's electrical power plants use coal as their source of fuel. Coal contains more sulfur than other fossil fuels and releases SO_2 into the atmosphere when burned. High levels of SO_2 have been observed near several Iowa power plants. Most recently, high SO_2 levels have been found in Cedar Rapids and Muscatine. When people breath large amounts of SO_2 it affects their lungs and can cause permanent lung damage. Sulfur dioxide is also a main ingredient of acid rain.

Nitrogen oxides (NO_x) are a group of pollutants resulting from fossil fuel use. Cars, trucks, airplanes, and other motor

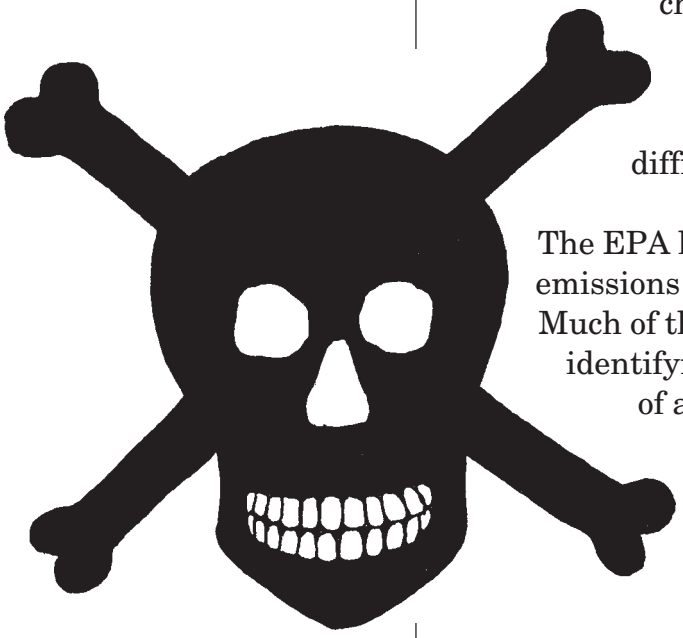
vehicles release NO_x in their exhaust. Like SO_2, nitrogen oxides are damaging to lungs and react in the atmosphere to cause acid rain. Most of Iowa is not plagued with great concentrations of motor vehicle traffic and, therefore, NO_x are not generally thought to have a direct serious effect on Iowa's air. Concentrations of NO_x have not been measured in Iowa since 1981.

High in the atmosphere, **ozone (O_3)** provides a valuable shield against dangerous solar radiation. **Ground-level ozone**, however, is a dangerous pollutant and a chief ingredient of smog. **Smog** is actually a mixture of ozone and other chemical and particulate pollutants called **volatile organic compounds (VOC)** released through the burning or vaporization of fuel. Although often seen as a major urban problem, smog has occurred in Iowa's larger cities and can even drift into rural areas. In 1989 and again in 1992, ground-level ozone levels surpassed the NAAQS in the Davenport area. People who breath smog may experience breathing difficulties, asthma, eye irritation, nasal congestion, reduced resistance to infection, and premature aging of lung tissue.

Carbon monoxide (CO) and **lead** are also chemical pollutants released as a result of motor traffic. Both can be deadly. In areas of heavy traffic congestion, people can become sick from CO poisoning or may suffer long-term health risks from lead poisoning. It is difficult, however, to measure pollution levels in congested, street-level downtown areas. Iowa has not had any measured lead or CO levels above the NAAQS during the past ten years. However, CO poisoning does occur when people encounter the pollutant in a confined area such as a garage or in a home. In recent years, lead has become much less of a problem. Laws enacted to eliminate lead from gasoline, except for off-road use, have reduced the amount of lead air pollution dramatically.

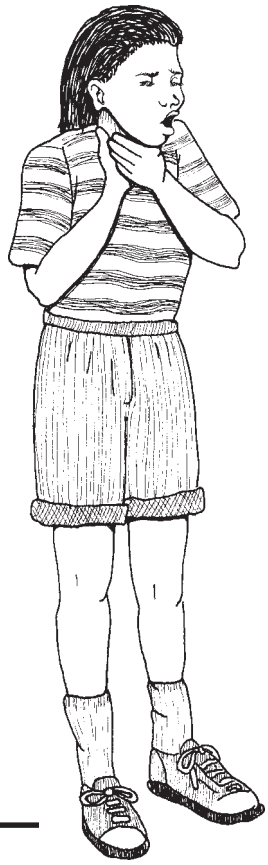
Hazardous air pollutants

The 1990 Clean Air Act categorizes 188 substances as hazardous air pollutants. Examples of these pollutants include asbestos, beryllium, mercury, vinyl chloride, and benzene. They often are released by motor vehicles, industries, and chemical manufacturers. Most of these hazardous air pollutants do not have set NAAQS and are difficult to monitor in the air.



The EPA has a goal of reducing the nationwide emissions of air toxics by 50 percent during the 1990s. Much of this work is being done at the state level by identifying, monitoring, and controlling point sources of air toxics such as chemical plants and other businesses that use dangerous chemicals.

Air pollution and human health



Air pollution directly affects our lungs, heart, and bones. Isolated high levels of SO_2, ozone, and particulates have been potential health hazards in Iowa during the 1980s and 1990s. People living in Cedar Rapids and Muscatine have been exposed to atmospheric SO_2 levels above the NAAQS. Particulates are a known problem in Mason City and Buffalo, and high levels of both particulates and ozone have been measured in Davenport.

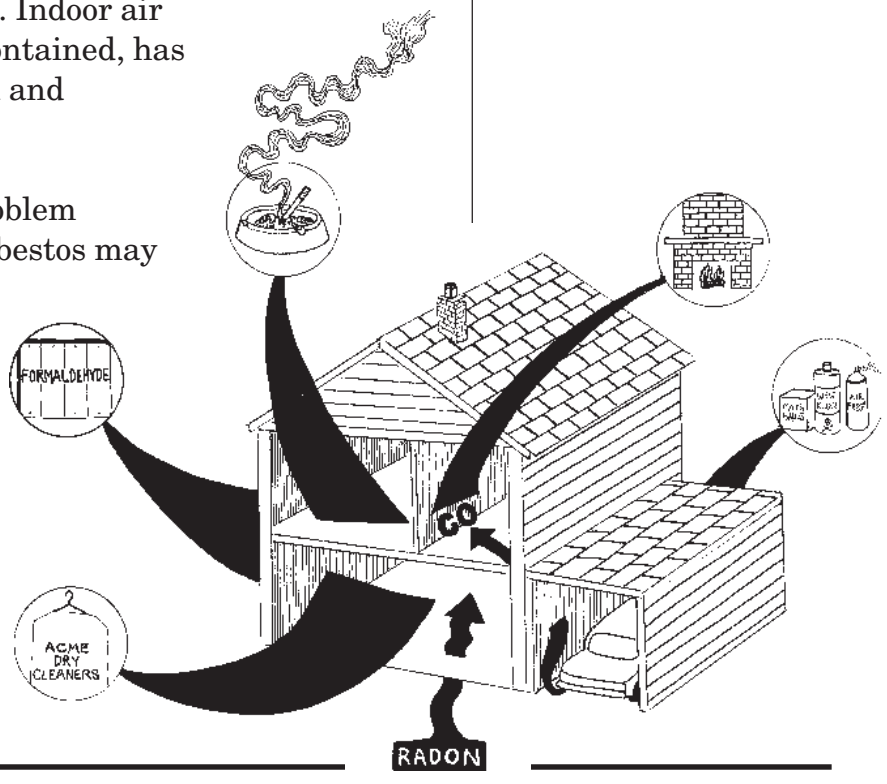
Air-borne sulfates and particulates are damaging to lungs, especially among children and the elderly, leading to asthma, bronchitis, emphysema, decreased lung function, and cancer. Ozone pollution also is dangerous to lungs and tends to weaken the body's immune system. Air pollution is absorbed by bones and then released into the body when people become vulnerable to bone loss such as during pregnancy, nursing, and osteoporosis. Air pollution is even felt down deep in our hearts. Carbon monoxide replaces oxygen in the blood, depriving the heart of oxygen and essentially smothering it.

1996 National Ambient Air Quality Standards Violations in Iowa

City	Pollutant	Date
Mason City	PM-10	1/26/96
Mason City	PM-10	3/5/96
Buffalo	PM-10	4/18/96
Buffalo	PM-10	11/16/96
Cedar Rapids	SO_2	1/18/96
Cedar Rapids	SO_2	2/28/96
Cedar Rapids	SO_2	3/2/96
Davenport	PM-10	10/30/96
Des Moines	PM-10	4/25/96

The air inside

Some of the same pollutants released outdoors also are released indoors. Indoor air pollution, because it is contained, has the potential to be concentrated and especially dangerous.



Indoor air pollution is also a problem because of its many sources. Asbestos may be present in the insulation of older homes. Some wood products and aerosols release formaldehyde. Pesticide residues, second-hand cigarette smoke, chemicals associated with dry cleaning, mothballs, air fresheners, and various airborne pathogens may also be part of indoor pollution. The

problems are worse during winter months when houses are more tightly sealed and fresh air is not circulated in from the outdoors.

Home heating systems and attached garages are another source of deadly indoor air pollution. Carbon monoxide from cars running in the garage, fireplaces, or improperly vented furnaces and stove exhausts can build up in a house. It is especially dangerous because it cannot be seen or smelled. People living within a house with CO may feel sick, have headaches, and eventually become unconscious. Exposure to high levels of CO for even a few minutes can have lethal effects.

The soil surrounding a home may be a source of indoor air pollution. **Radon** is a colorless, odorless, naturally-occurring gas that seeps into houses from the surrounding soil. The gas is radioactive and is a serious health threat, thought to be second only to cigarette smoking as a cause of lung cancer.

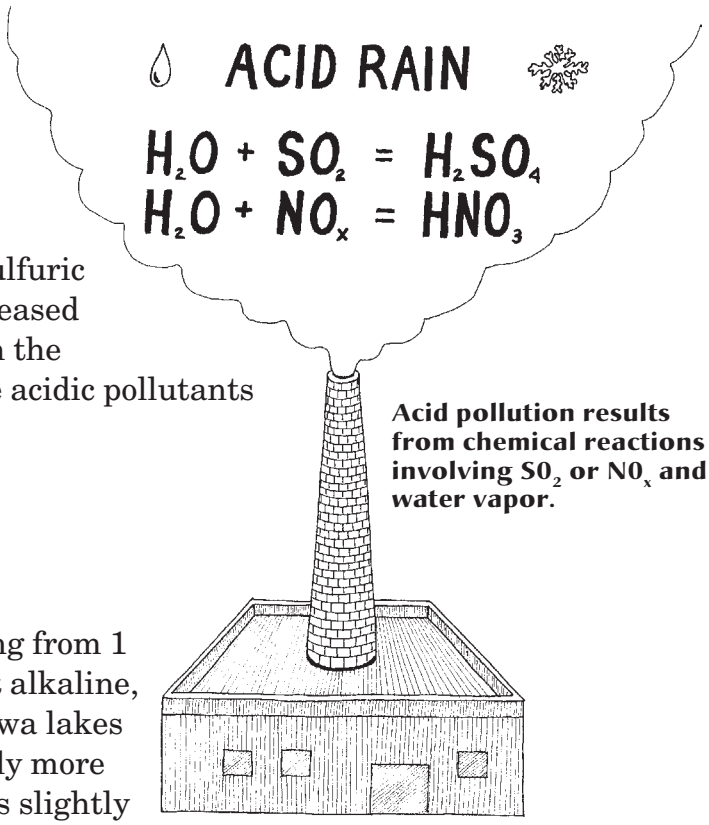
Air pollution across borders – acid rain

Air pollution has the ability to spread across state and international borders and become a global problem. Problems such as acid rain, global climate change, and high-level ozone depletion do not respect political boundaries.

The recipe for acid rain

Certain chemicals, when released into the atmosphere, react with water vapor and become acidic. This **acid pollution** may come to Earth as rain, snow, or any other form of precipitation. It may even settle onto the land as a dry precipitate. However, all forms of acid pollution are commonly referred to as **acid rain**.

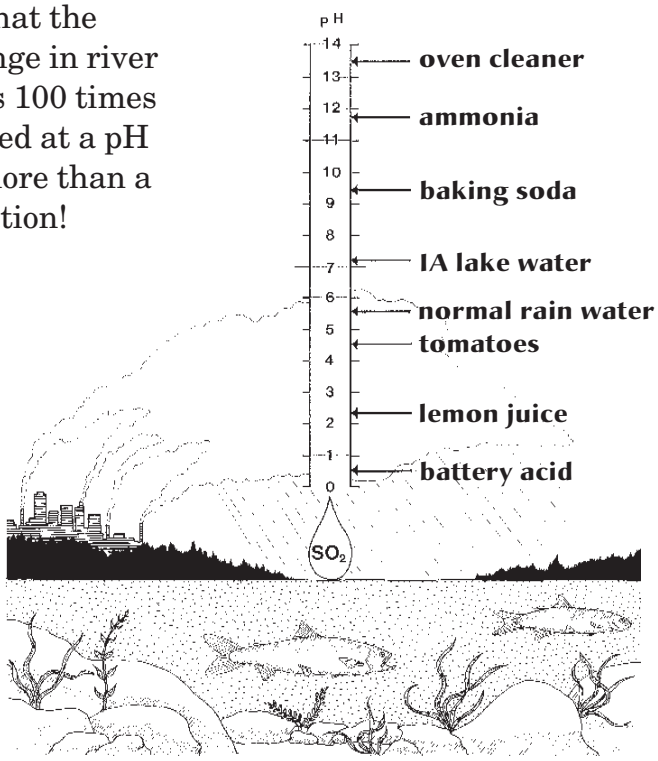
Some fossil fuels, coal in particular, contain large amounts of sulfur. When coal is burned to produce electricity, sulfur dioxide is released into the atmosphere. In the atmosphere, SO_2 combines with water vapor to produce sulfuric acid. Likewise, nitrogen oxides (NO_x) released during the burning of fossil fuels react in the atmosphere to produce nitric acid. These acidic pollutants are the dangerous elements of acid rain.



Acid pollution results from chemical reactions involving SO_2 or NO_x and water vapor.

How acidic is it?

Acidity is measured on a pH scale ranging from 1 to 14. A pH of 1 is most acidic, 14 is most alkaline, and 7 is considered neutral. Water in Iowa lakes and streams normally has a pH of slightly more than 7. Normal precipitation, however, is slightly acidic, with an average pH of 5.6. Acid rain is precipitation that has a pH below 5. The difference doesn't sound like much, but the pH scale is a logarithmic scale. A change in acidity from pH 5 to pH 4 means that the precipitation is ten times more acidic. A change in river water pH from 7 to 5 means that the water is 100 times more acidic. Acid rain even has been measured at a pH below 2 - more acidic than lemon juice and more than a thousand times as acidic as normal precipitation!



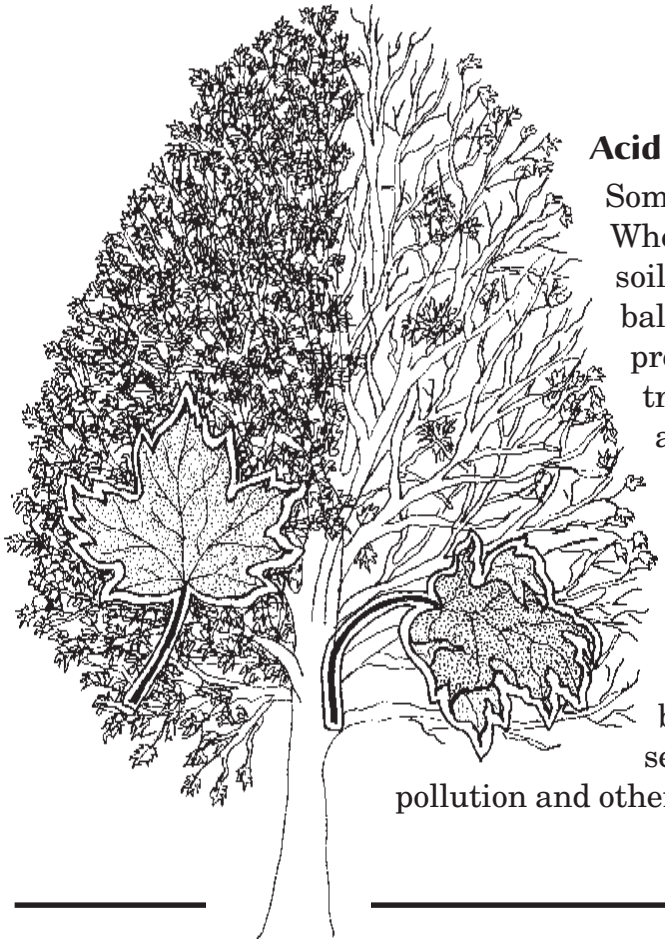
Acids in lakes

Acid rain is most commonly recognized as a problem affecting lakes. The problem, however, damages some lakes more than others. The ability of a lake to neutralize acidity is called **buffering capacity** and depends on the alkalinity of underlying rock and surrounding soils. Lakes and streams containing a lot of underlying

limestone, which includes most of Iowa, usually have a good buffering capacity.

Although Iowa lakes may not be affected much by acid rain, lakes in other states have been devastated. When a lake is acidified, dangerous amounts of metals are dissolved in the water. In addition to the acid, high levels of aluminum, mercury, zinc, lead, manganese, and cadmium may build up in the water. Some of these metals are toxic to fish and other aquatic life.

Thousands of lakes already have been affected by acid rain. In some cases, acid rain has been responsible for "killing" lakes. A dead lake may appear clean and clear, but its waters are sterile and void of life. In North America, most acid-vulnerable lakes are in the northeastern United States and southeastern Canada. But other lakes like those in the beautiful Boundary Waters Canoe Area Wilderness of Minnesota, the forests of Wisconsin, and the Colorado Rocky Mountains are also vulnerable to the dangers of acid rain.



Acid pollution and plants

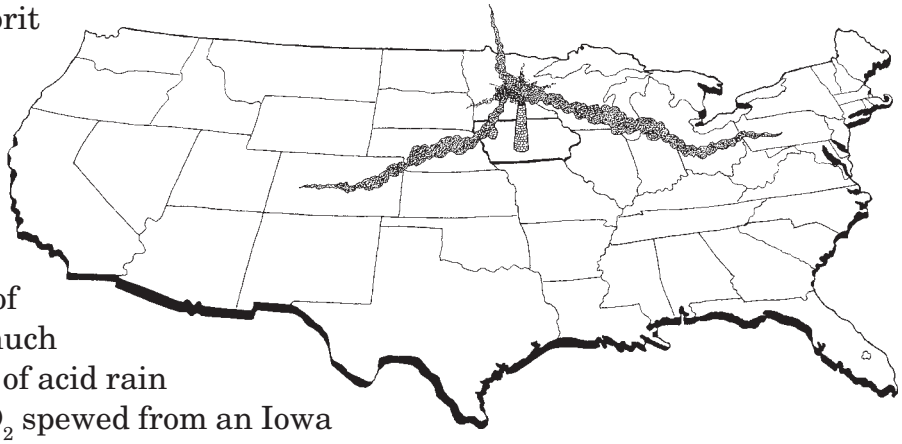
Some forests are being harmed by acid rain. When acid rain enters the soil, it changes the soil pH, dissolves minerals, and changes the balance of soil nutrients. Acid rain in the presence of ozone is especially harmful to trees and other plants, weakening their ability to survive other environmental stresses. Spruce and maple trees growing in eastern states are dying due to acid rain. By affecting forests, acid rain is endangering wildlife and destroying a valuable natural resource. Some studies show that acid rain affects not only forests but also fruits and vegetables. Soybeans seem to be especially vulnerable to acid pollution and other air pollutants.

Acid rain ruins buildings

Nature is not the only victim of falling acids. Even where lakes are protected by a high buffering capacity, many human-made structures are crumbling away due to acid rain. The acid eats away buildings and statues and dissolves paints from finished surfaces. The Statue of Liberty and the Gettysburg historical site have been damaged by acid rain. In Iowa, acid rain may be responsible for damage to the state Capitol building and other important structures.

An Iowa problem

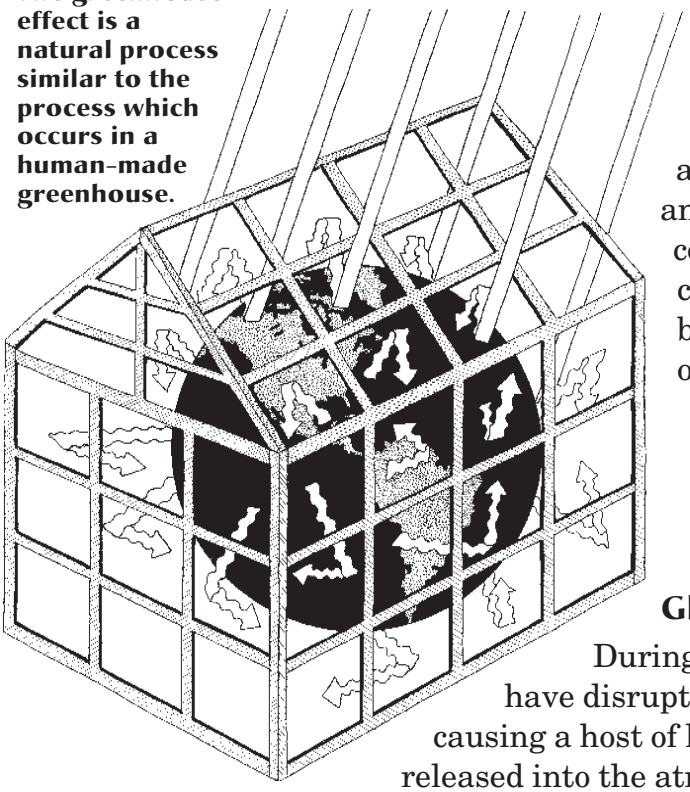
Acid rain is not easy to see and can't be smelled. It does not seem to be changing our lives in Iowa. For most Iowans, acid rain is an invisible problem. We may slip to the assumption that acid rain is someone else's problem. It is not.



The Midwest is a chief culprit in the acid rain problem. More than half of all U.S. SO_2 emissions originate in the Midwest through the burning of coal. In 1994, Iowans burned more than 19 million tons of coal. Because we burn so much coal, Iowans generate a lot of acid rain pollutants. Every ton of SO_2 spewed from an Iowa utility goes somewhere. It travels through the atmosphere and rains or settles on plants, people, wildlife, forests, and water. Sometimes the pollution is emitted from tall smokestacks and travels great distances through the air, affecting communities far from Iowa. We are helping to destroy forests in the Adirondacks, and we are polluting lakes in Canada. Acid rain is a problem that transcends borders. It is a state problem, a national problem, and a global problem.

Air pollution and global climate change

Some gases in the atmosphere are important regulators of climate. Sunlight passes through the atmosphere and warms Earth's surface. Earth releases some of this warmth in the form of infrared energy back into space.



The greenhouse effect is a natural process similar to the process which occurs in a human-made greenhouse.

Certain gases called **greenhouse gases** act as a barrier to this process. Along with water vapor, they absorb the escaping heat and then send it back to Earth. These greenhouse gases have always been present in our atmosphere and keep our climate from becoming too cold. This known natural process is commonly called the **greenhouse effect** because it is similar to the process which occurs in a human-made greenhouse.

Global climate change

During the past few hundred years, people may have disrupted the natural greenhouse effect by causing a host of human-made greenhouse gases to be released into the atmosphere. The amount of greenhouse gases in the atmosphere increased 50 percent during the past hundred years and likely will more than double in the next hundred years. These additional greenhouse gases may lead to **global climate change**, thought to result in a general **global warming**.

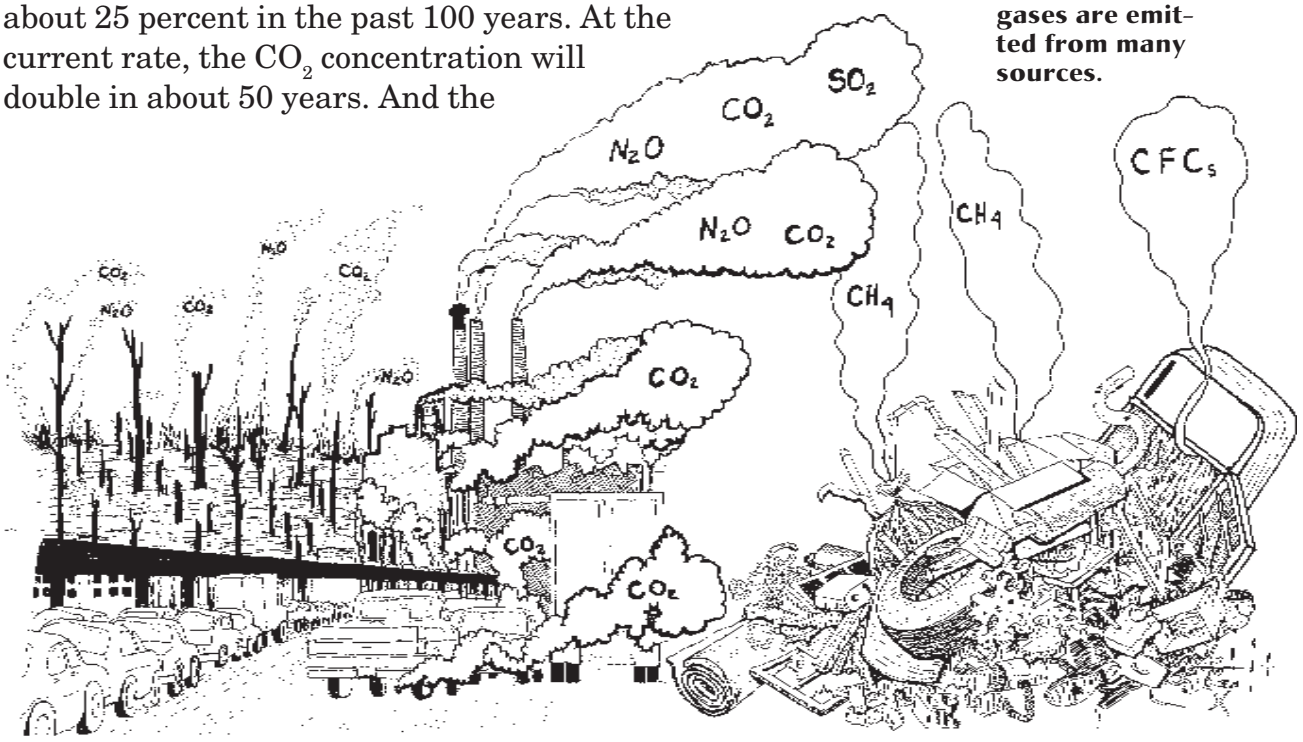
Most scientists agree that the accelerated accumulation of greenhouse gases in the atmosphere will warm Earth. However, global climate change still presents many questions. Potentially, how hot will Earth get? How quickly will it heat up? Which areas of the globe will heat the most? Will some places become colder? What happens when Earth

heats up? These questions are very difficult to answer because global climate relies on many factors, many of which are poorly understood.

The greenhouse gases

A large number of gases contribute to the greenhouse effect. The main culprits of potential global warming are carbon dioxide (CO_2), methane, nitrous oxide (N_2O), and chlorofluorocarbons (CFCs). These four gases are thought to account for 87 percent of our greenhouse gas pollution.

Carbon dioxide (CO_2) makes up approximately half of worldwide human greenhouse gas contributions to potential global climate change. When people burn fossil fuels for energy or cut forests to meet the demands of a growing human population, CO_2 is released into the atmosphere. The United States consumes more fossil fuels and, therefore, produces more CO_2 pollution than any other nation in the world. Although CO_2 is not the only greenhouse gas, scientists often create scenarios of global warming based on the doubling of CO_2 since before the industrial revolution. Carbon dioxide concentrations in the atmosphere have increased about 25 percent in the past 100 years. At the current rate, the CO_2 concentration will double in about 50 years. And the

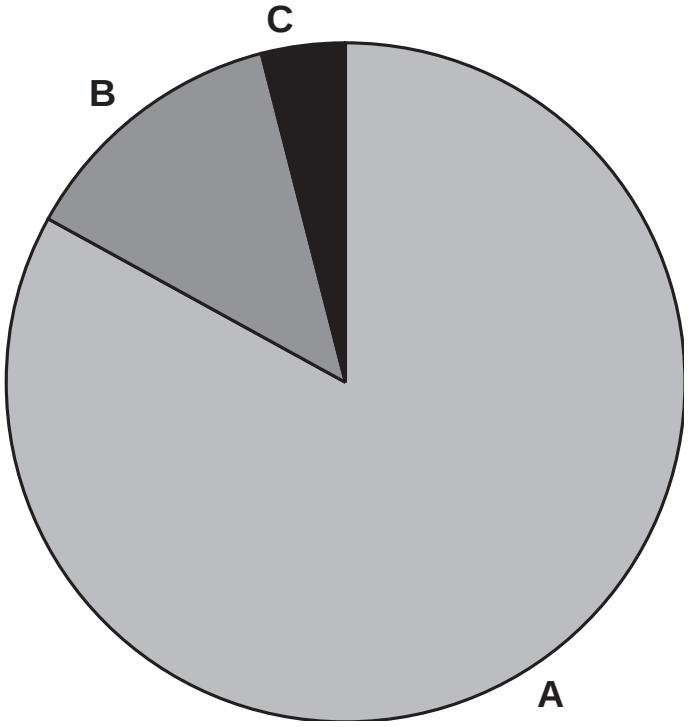


Greenhouse gases are emitted from many sources.

problem is long-lasting. A single CO_2 molecule may remain in the atmosphere for 250 years.

Iowa utilities, industries, and automobiles are responsible for the great majority of our state's CO_2 pollution. They use a variety of fuels but rely heavily on coal or petroleum. In all, Iowans release nearly 100 million tons of CO_2 into the atmosphere each year. In 1992, Iowa was ranked 15th in per-capita emissions of carbon dioxide and eighth in emissions from the private sector.

Iowa Greenhouse Gas Emission for 1992



A. Carbon Dioxide (CO_2) 96,896,381 Tons

B. Methane 15,717,988 Tons

C. Nitrous Oxide 4,680,450 Tons (Expressed as $C0_2$ Equivalent)

Methane in the atmosphere has nearly doubled during the past 300 years. Sources of methane pollution are many. Landfills and agriculture are the main sources of U.S. methane emissions. Worldwide, livestock and rice fields are responsible for most of the methane released into the

atmosphere. Methane is also released during coal mining and through the search for and use of natural gas. Large amounts of methane are trapped under the frozen surfaces of permafrost. If global warming occurs, this stored methane will be released as the permafrost melts. There is much less methane in the atmosphere than CO_2. The methane which is in the atmosphere, however, is a more powerful greenhouse gas. A molecule of methane has 3.7 times more global warming potential than a molecule of CO_2 and remains in the atmosphere for approximately ten years.

Like methane, much of the **nitrous oxide (N_2O)** released into the atmosphere is the result of agriculture. Nitrogen fertilizers, burning forests to clear land for agriculture and other developments, and use of fossil fuels are the main contributors to N_2O pollution. Nitrogen oxide is found in small concentrations in the atmosphere but is an important greenhouse gas. It may remain in the atmosphere for 175 years and has 270 times the global warming potential of CO_2.

Chlorofluorocarbons (CFCs) are manufactured chemicals used in foam manufacturing, refrigeration, solvents, and air conditioners. Although only small amounts of CFCs can be found in the atmosphere, they are very important greenhouse gases. One CFC molecule has 10,000 times an effect on global warming as one molecule of CO_2 and may remain in the atmosphere for 75 years.

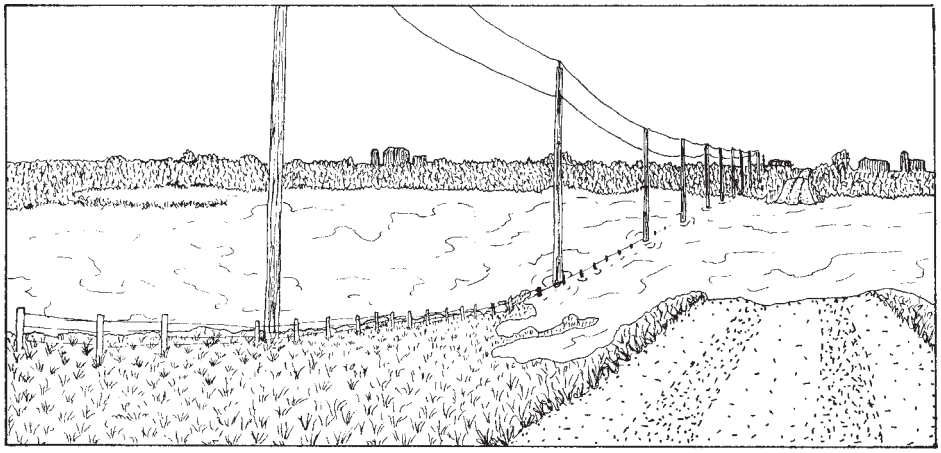
CFCs are doubly dangerous in the atmosphere. In addition to being greenhouse gases, they also are known destroyers of the ozone layer which filters harmful solar radiation in the upper atmosphere. As CFCs accumulate in the atmosphere, Earth may get hotter and we will be exposed to dangerous levels of solar radiation.

Life in a greenhouse

Three main U.S. climate-modeling centers try to predict local climate changes due to the greenhouse effect. They are the National Center for Atmospheric Research (NCAR),

Geophysical Fluid Dynamics Laboratory (GFDL), and NASA's Goddard Institute for Space Studies (GISS). The models they generate often predict a 3° F to 8° F rise in global temperature by the middle of the next century. Predictions for individual states and localities are harder to make.

We cannot be certain how life will change if Earth warms, and this uncertainty is possibly the biggest danger of global warming. Because Iowa is an agricultural state, not being able to make assumptions about climate will be particularly disastrous. Storms and floods may be more intense and unpredictable. Growing seasons and ranges for growing crops may change. We may need to deal with new pests that expand their ranges in a warmer climate. Farming could become a much riskier industry. Food production could be disrupted, biological communities would be damaged, and social and economic problems could be widespread. The possible effects of global warming have been compared by some experts to that of a nuclear war.



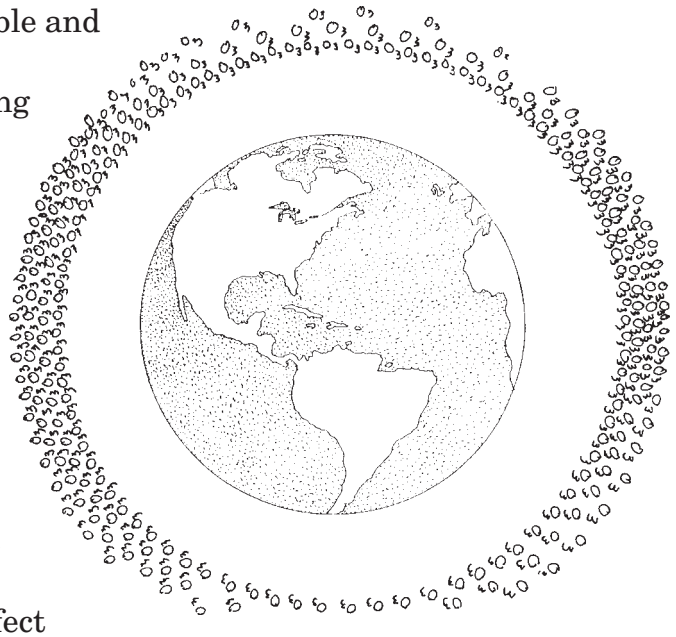
Global warming may drastically affect agriculture.

Some scientists are predicting a warm-up for Iowa between 5° F and 14° F. Possible scenarios for Iowa include shifting weather patterns. Changes in cloud cover will further affect temperature. Rainfall and droughts will affect soil moisture, plants, and the process of evaporation. Some predictions for Iowa show a state that more closely resembles modern-day Kansas.

A crack in the shield — atmospheric ozone and CFCs

In addition to being known greenhouse gases, CFCs are responsible for damaging the **ozone layer** in the upper atmosphere. Although ground-level ozone is a dangerous pollutant, atmospheric ozone acts as a protective barrier to otherwise dangerous solar radiation.

Chlorofluorocarbon molecules are very stable and hold together until they reach the upper atmosphere. There they break apart, leaving free chlorine atoms to "grab" oxygen atoms away from ozone (O_3). For every one percent decrease in the ozone layer, two percent more **ultraviolet (UV) radiation** is allowed to penetrate the atmosphere and reach life on Earth's surface. Ozone destruction is especially apparent over the poles where thinning of the ozone layer has left noticeable holes and where higher radiation levels have been monitored. The most common threats from UV radiation are skin cancer and eye disorders. But ozone depletion may also affect plants and wildlife and lead to disruptions in food chains and human food supplies, especially in the oceans.

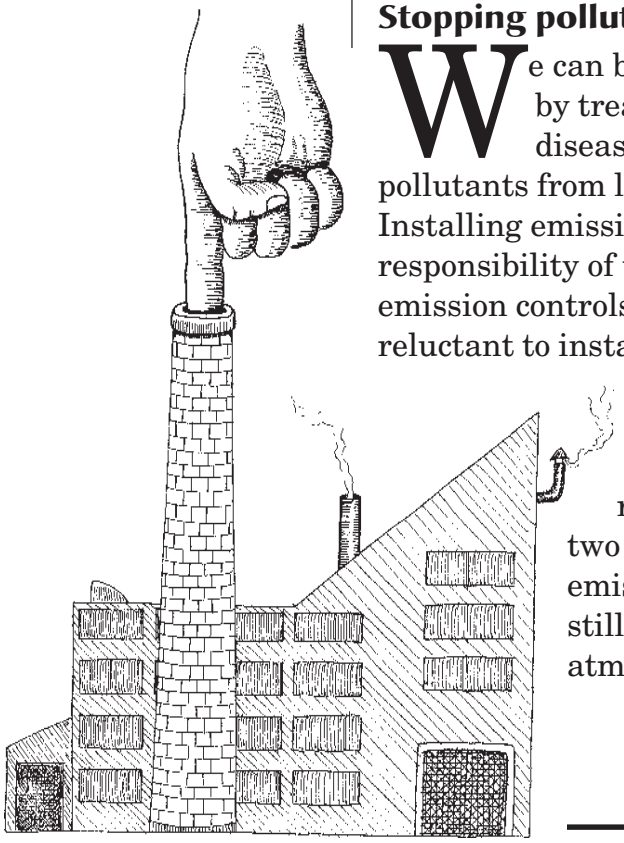


Atmospheric ozone (0_3) forms a protective layer around the Earth. This layer is becoming thinner in some places due to the release of human-made chlorofluorocarbons (CFCs).

Like many chemical products, CFCs first were seen as wonder compounds used in air conditioning, refrigeration, foam manufacturing, aerosols, solvents, and electronic cleaners. Because they are so stable, CFCs do not break down to produce surface air pollution and appeared to have no detrimental side effects. However, in the mid-1970s, people began to realize that CFCs were not so wonderful. By then, the chemical had already established itself as part of the world economy. In 1990, the world CFC market was worth $2 billion and more than 375,000 businesses were using the wonder chemical. CFCs had found their way into most American homes.

The problem of ozone depletion is being addressed locally and globally. The Clean Air Act calls for a scheduled phase-out of CFCs and dangerous CFC replacements. By law, CFCs must be recaptured, recycled, or safely disposed. In many cases, this is done through regulations at landfills and by businesses and utilities that sell or power CFC-producing appliances. Worldwide, nations agreed to move toward eliminating ozone-depleting chemicals in the **1990 Montreal Protocol**. Implementation of the agreement would phase-out CFCs by the year 2000 and eliminate other ozone-depleting chemicals by the year 2040 or, if possible, by 2020. A key element in the protocol was the establishment of a fund to help developing nations adopt CFC-free technologies.

Cleaning the air



Stopping pollution at the source

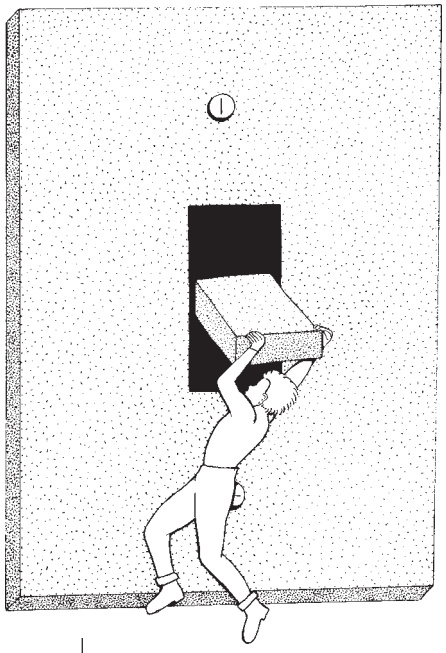
We can best solve the problems of air pollution, not by treating the symptoms but by dealing with the diseases. Emission controls are available to trap pollutants from leaving smokestacks or exhaust pipes. Installing emission control systems are often the responsibility of utilities or other industries. Because emission controls are expensive, many companies are reluctant to install them. However, this is not always the case. The DuPont Company in Fort Madison invested in technology that uses condensers that are 93 percent efficient and CFC free to recover vapors from acetone, a VOC. These two condensers reduce the potential VOC emissions by 24 tons and save $8,000 worth of still-useful products from escaping into the atmosphere each year.

Taking control of SO_2 and acid rain

When acid rain pollutes a lake or alters the soil, little can be done to clean up the mess. Sometimes lime is added to acidified lakes or soil to reduce the pH. Liming, however, is expensive, temporary, and usually not very effective. And liming does not reverse the damage which has already been done. The whole chemistry of an acid-infected lake is changed. Some lakes which were killed by acid rain have been limed and then restocked with fish but unsuccessfully. Acid-damaged buildings and statues can be repaired but still will be vulnerable to acid deterioration in the future.

Preventing acid rain requires an initial investment but in the long-run may be cheaper and is a healthier, more effective solution. Utilities prevent acid pollution from leaving their stacks by installing scrubbers which add lime to the flue gases. They can also use low-sulfur coal or remove sulfur from coal prior to burning by converting it to a liquid or gas.

Flipping the switch



Energy use is our state's greatest contributor to chemical air pollution. The largest single contributors are electric power plants. We, therefore, can reduce air pollution by using less electricity.

We have already proven that we can conserve energy. A good example of energy conservation is the 3M Corporation of St. Paul, Minnesota. Through technological advances and investments in energy efficiency, 3M was able to save $732 million in energy costs over a 17-year period. The corporation was able to save enough fuel to operate a million homes for a year. 3M also saved thousands of tons of acid rain pollutants from being emitted into the atmosphere.

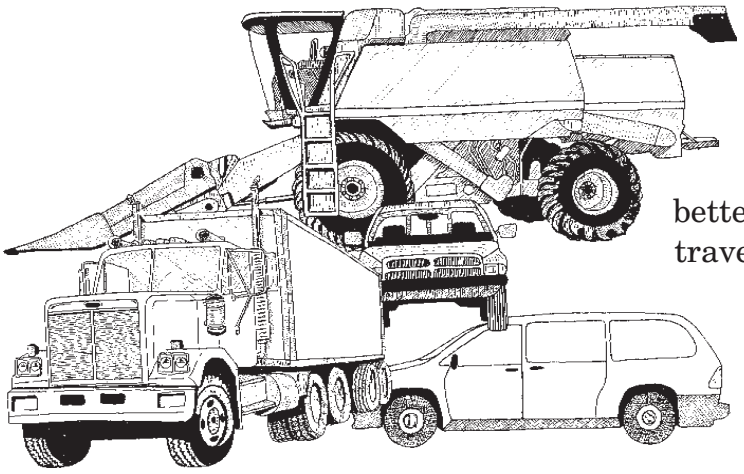
We can all reduce air pollution by insulating our homes, turning off appliances when we are finished using them, and purchasing only energy-efficient products. We can also use cleaner fossil fuels such as natural gas which still contributes to air pollution but not as much as coal or petroleum.

Conservation and energy efficiency can help reduce air pollution. But to eliminate much of the problem, we will need to learn to use alternative fuels. There are ways to use non-polluting energy sources such as solar, wind, and water. Nationally, if we double our use of alternative fuels, we will prevent billions of tons of CO_2 and other air pollutants from entering the atmosphere each year. Alternative fuels make up eight percent of the U.S. energy supply and two percent of Iowa's energy. In Iowa, a huge potential exists for solar, wind, biomass, and hydropower - all of which produce electricity with minimal pollution.

Each of us can help bring clean energy to our lives by supporting the development of these sources of energy. Rebates, low-interest loans, and other incentives can be used to encourage energy efficiency and the use of alternative fuels by both consumers and industry. Your legislators make energy policy and need to know your feelings about the future of energy and the environment.

Gas guzzling

The use of petroleum is another large contributor to Iowa air pollution. All the previously mentioned chemical pollutants and some particulates and air toxics are blown into the air in motor vehicle exhaust.



Automobiles have become more efficient users of energy but can do better. In 1974, the average U.S. new car traveled at 14 miles per gallon (mpg). In 1990, the average new car was moving along at 28.3 mpg. Technology exists to someday make a car that gets better than 120 miles per gallon.

Iowans are gas guzzlers. Our vehicles average a mere 12.4 mpg. Each of these gas guzzlers releases about 84 tons of CO_2 over its lifespan. A car which gets 27.5 mpg would release less than half this much pollution while being driven the same number of miles.

An agricultural state

Modern agriculture has become dependent on gas-guzzling machinery and heavy use of commercial fertilizers which break down and release nitrous oxide. By using techniques of sustainable agriculture, farmers can reduce greenhouse gases and other air pollutants. Practices such as crop rotation, reduced tillage, planting diversified crops, and establishing woodlots require less fertilizer, clear less land for crops, and are more energy efficient. Newer farm machinery burns less gas, further reducing production costs and harmful emissions.

You are what you buy

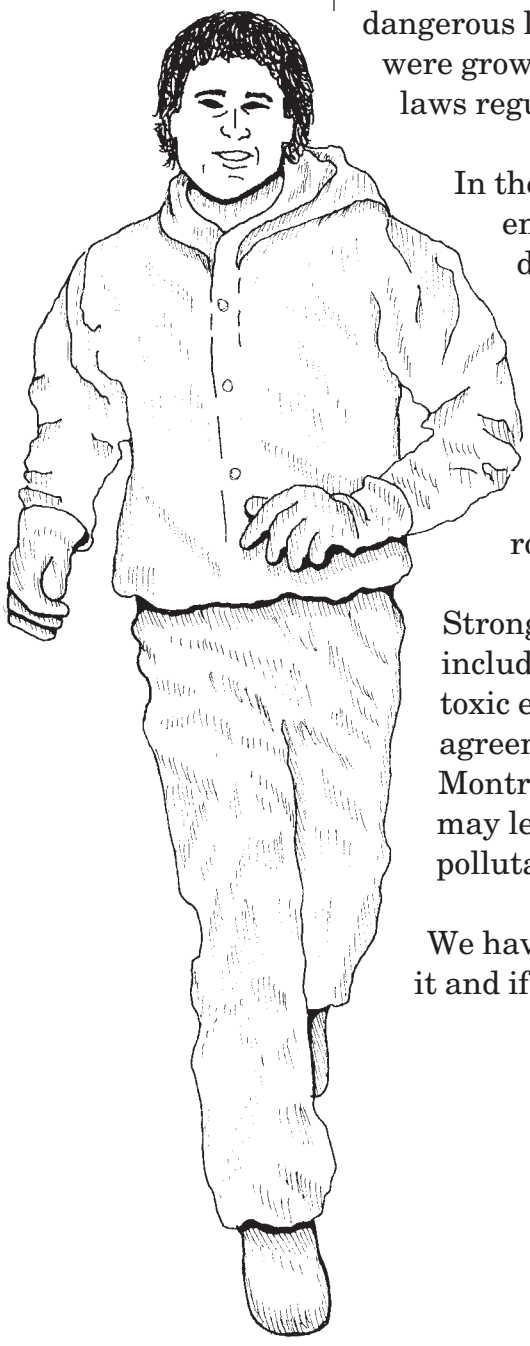
Each of us has the power to reduce air pollution through our role as consumers. The energy used to make a product, along with the materials in a product, almost always contribute to air pollution. But some products are better than others. If we were to stop buying products that are over-packaged or that release CFCs or produce greenhouse gases, we would save energy and reduce air pollution. By exercising our power of choice, we can send a message to companies and industry that we will not pay for products that damage the environment.

Think globally - act globally

Global climate change, atmospheric ozone depletion, and acid rain present problems that move across borders. Even if Iowa accomplishes the impossible and totally eliminates its release of greenhouse gases, CFCs, and acid pollution, Earth will continue to warm, the ozone layer will continue to thin, and lakes will continue to be acidified. Acting alone, we can reduce the problem but not solve it. Air pollution moves across the globe and settles in from everywhere. People from around the world, from everywhere, need to cooperate to get our planet out of hot water. We need to cooperate with other countries, share our technologies, and each do our part.

Reasons to breathe easy

There are reasons to breathe easy in Iowa's air. The air has become cleaner in many ways since the first Clean Air Act was passed. Before the mid-1970s, clouds of soot and smog were common in many cities, and dangerous levels of air pollutants such as lead, CO, and SO_2 were growing in the atmosphere. Today, Federal and state laws regulating air pollution have reduced these threats.



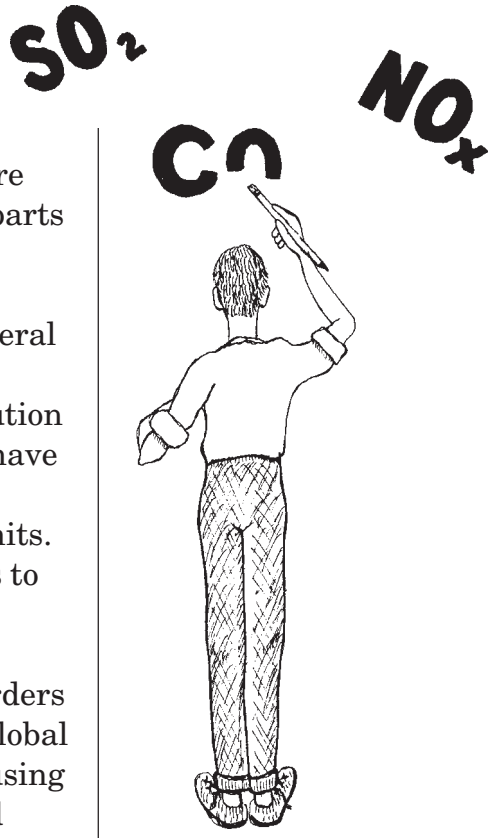
In the 20-year period from 1970 to 1990, SO_2 emissions dropped 27 percent, particulates were down 63 percent, and lead emissions dropped a dramatic 96 percent! During the past ten years, dangerous SO_2 levels monitored in Clinton, Iowa dropped 80 percent. In January 1996, EPA Administrator Carol Browner announced the completion of the leaded gasoline phase-out. Leaded gasoline can now only be used in off-road vehicles.

Stronger regulation in the 1990 Clean Air Act, including more strict regulation of SO_2, PM-10, and air toxic emissions, likely will clean the air further. Global agreements such as those recently agreed to in the Montreal Protocol and on greenhouse gas emissions may lead to cooperative actions to reduce global air pollutants.

We have learned we can have clean air if we really want it and if we are prepared to work for it.

Where do we go from here?

Iowa's air is relatively clean. Most of the state is free of the heavy motor traffic that causes more serious problems in urban states. And during the past few decades, the air has become, in many ways, cleaner and healthier. In some places, however, the air does endanger the health of Iowans. Electric utilities, motor vehicle exhaust, and a few industries are most responsible for air pollution in Iowa. This pollution comes in the form of tiny particulates, dangerous chemicals, and life-threatening air toxics. When people are exposed to these air pollutants, lungs, hearts, and other parts of the body can be damaged.



The Iowa Department of Natural Resources monitors several types of pollutants. The concentration of air pollutants is compared to national standards based on how much pollution can be tolerated by people. Businesses and utilities that have the potential to emit large amounts of air pollution must demonstrate their safety before obtaining operating permits. This sometimes means they must adopt new technologies to protect the air from pollution.

Air pollution affects everyone. Acid rain moves across borders where it can destroy lakes, forests, and even buildings. Global climate and the ability of Earth to shed excess cancer-causing radiation is affected by air pollution. Problems associated with air pollution, therefore require cooperation among cities, states, and countries. Everyone has a role to play. Every individual can do his or her part by conserving energy, being a careful consumer, and lending a voice to support policies that work to reduce air pollution.

Useful resources

Air Currents Newsletter; Brian Button, Editor; Air Quality Bureau, Iowa Department of Natural Resources, Des Moines, IA. (call 515-281-7832)

Air Pollution: The Invisible Thief of American Agriculture; Paul W. Hansen; Izaak Walton League of America, Arlington, VA; 1990.

Ambient Air Quality Standards, 1985-1995; Iowa Department of Natural Resources, Des Moines, IA; 1996.

America's Energy Choices: Investing In A Strong Economy And A Clean Environment: Executive Summary; Union of Concerned Scientists, Cambridge, MA; 1991.

Clean Air Act Amendments of 1990: Summary of Key Titles; U.S. EPA; Washington, DC; November 15, 1990.

Earth In The Balance: Ecology and the Human Spirit; Al Gore; Houghton Mifflin Company, Boston, MA; 1992.

Global Warming: Opposing Viewpoints Series; Tamara L. Roleff, Editor; Greenhaven Press, Inc., San Diego, CA; 1997.

Iowa Energy Bulletin; Energy Bureau, Iowa Department of Natural Resources, Des Moines, IA.

Iowa Air Quality Progress Report; Iowa Department of Natural Resources, Des Moines, IA; 1990.

Meeting the Environmental Challenge: EPA's Review of Progress and New Directions In Environmental Protection; U.S. EPA, Washington, DC; 1990.

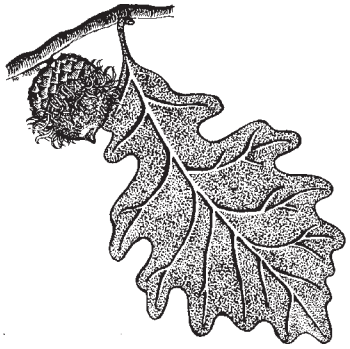
The Plain English Guide to the Clean Air Act; U.S. EPA; Washington, DC; 1993.

The Search For Clean Air; Video narrated by Walter Cronkite; Films For The Humanities, Princeton, NJ; 1994. (available for loan; call 515-281-7832)

Tailpipe Emissions Standards: A Report to the General Assembly; Richard Ney; Iowa Department of Natural Resources, Des Moines, IA; 1991.

Teacher's Guide To World Resources; Sarah A. Snyder; World Resources Institute, Washington, DC; 1991.

Toward A Sustainable Energy Future: 1992 Iowa Comprehensive Energy Plan; Iowa Department of Natural Resources, Des Moines, IA; 1992.



Iowa Association of Naturalists

The Iowa Association of Naturalists (IAN) is a nonprofit organization of people interested in promoting the development of skills and education within the art of interpreting the natural and cultural environment. IAN was founded in 1978 and may be contacted by writing the Conservation Education Center, 2473 160th Rd., Guthrie Center, IA 50115, 515/747-8383.

Iowa Environmental Issues Series

In order to make wise decisions, people need a basic understanding of the factors involved in current environmental issues. They need to understand how their lifestyle is tied to these issues and how changes in lifestyle can impact the environment. The Iowa Association of Naturalists has created this series of booklets to offer a basic understandable overview of Iowa environmental issues. These booklets will assist educators in teaching students about topics that affect the Iowa environment. The seven booklets in this series are:

Iowa Habitat Loss and Disappearing Wildlife (IAN-101)
Iowa Air Pollution (IAN-102)
Iowa Water Pollution (IAN-103)
Iowa Agricultural Practices and the Environment (IAN-104)
People, Communities, and Their Iowa Environment (IAN-105)
Energy In Iowa (IAN-106)
Iowa Waste Management (IAN-107)

The *Iowa Environmental Issues Series* is published by IAN with major funding from the REAP Conservation Education Board (September 1998).

Review Committee

Cele Burnett, Consultant, E Resources Group, Inc.
Dan Cohen, Naturalist, Buchanan County Conservation Board
Detra Dettmann-Easler, Camp and Program Director, Louisa County Conservation Board
Jean Eells, Consultant, E Resources Group, Inc.
Judy Levings, State 4-H Youth Development Specialist, Iowa State University
Jim Pease, Extension Wildlife Specialist, Iowa State University
Diane Pixler, Naturalist, Marshall County Conservation Board
A. Jay Winter, Training Officer, Iowa Department of Natural Resources

Editorial Board

Text: Dan Cohen
Illustrations: Mark Müller
Design and Layout: Ames Best Communications
Published by: Iowa Association of Naturalists

Iowa Air Pollution is one in a series of seven booklets that are part of the *Iowa Environmental Issues Series*. The booklets in the series include:

Iowa Environmental Issues

Iowa Habitat Loss and Disappearing Wildlife	(IAN-101)
Iowa Air Pollution	(IAN-102)
Iowa Water Pollution	(IAN-103)
Iowa Agricultural Practices and the Environment	(IAN-104)
People, Communities, and Their Iowa Environment	(IAN-105)
Energy In Iowa	(IAN-106)
Iowa Waste Management	(IAN-107)

The Iowa Association of Naturalists also has produced five other booklet series that provide readers with a clear, understandable overview of topics concerning the Iowa environment and conservation. The booklets included in each of the other five series are listed below.

Iowa Wildlife Series

Iowa Mammals	(IAN-601)
Iowa Winter Birds	(IAN-602)
Iowa Nesting Birds	(IAN-603)
Iowa Reptiles and Amphibians	(IAN-604)
Iowa Fish	(IAN-605)
Iowa Insects and Other Invertebrates	(IAN-606)

Iowa's Natural Resource Heritage

Changing Land Use and Values	(IAN 501)
Famous Iowa Conservationists	(IAN 502)
Iowa's Environmental Laws	(IAN 503)

Iowa Wildlife and People

Iowa Wildlife Management	(IAN-401)
Keeping Iowa Wildlife Wild	(IAN-402)
Misconceptions About Iowa Wildlife	(IAN-403)
State Symbols of Iowa	(IAN-404)
Iowa Food Webs and Other Interrelationships	(IAN-405)
Natural Cycles In Iowa	(IAN-406)
Iowa Biodiversity	(IAN-407)
Adapting To Iowa	(IAN-408)

Iowa Plants

Iowa's Spring Wildflowers	(IAN-301)
Iowa's Summer and Fall Wildflowers	(IAN-302)
Benefits and Dangers of Iowa Plants	(IAN-303)
Iowa's Trees	(IAN-304)
Seeds, Nuts, and Fruits of Iowa Plants	(IAN-305)
Iowa's Mushrooms and Other Nonflowering Plants	(IAN-306)
Iowa's Shrubs and Vines	(IAN-307)

Iowa's Biological Communities

Iowa's Biological Communities	(IAN-201)
Iowa Woodlands	(IAN-202)
Iowa Prairies	(IAN-203)
Iowa Wetlands	(IAN-204)
Iowa Waterways	(IAN-205)

These booklets are available to download via PDF on the ISU Extension Store:

store.extension.iastate.edu

This publication is printed on recycled paper.