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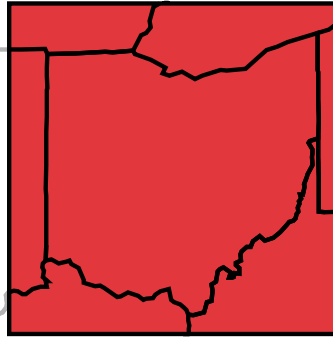
PHYSICIANS FOR
SOCIAL RESPONSIBILITY

DEATH

BY

DEGREES

**THE EMERGING
HEALTH CRISIS OF
CLIMATE CHANGE
IN OHIO**



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This report was prepared by Physicians for Social Responsibility to alert Ohio residents to the potential damaging health effects of climate change and to encourage them to reverse global warming's deadly course by reducing reliance on fossil fuels.

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Executive Summary: Death by Degrees

The rapid rate of warming since 1976, 0.35 degrees per decade, is consistent with the projected rate of warming based on human-induced effects. In fact, scientists now say that they cannot explain this unusual warmth without including the effects of both human-generated greenhouse gases and aerosols.

—D. JAMES BAKER, ADMINISTRATOR,
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The world is getting warmer at an unprecedented rate, never before seen in recorded history. Climate fluctuations have occurred during previous centuries, but at the dawn of the 20th century, a warming trend took hold that shows no signs of stopping.¹ During the past one hundred years, average global surface temperatures have increased by approximately 1 degree Fahrenheit. Each and every year from 1987 to 1999 has been one of the fifteen warmest years on record.²

Although uncertainties exist in measuring global warming, an overwhelming consensus has emerged over the last decade among scientists on several key points. First, the increase in temperature is real. Second, human activities—in particular our burning of fossil fuels—are affecting the climate system.³ Third, warmer conditions on Earth will directly affect our lives and well-being.⁴

This report describes how the changing global climate could impact human health. Our focus is on Ohio, a state that may experience increased illness and mortality due to changes in temperature and weather.

Because of its microclimates, cultural diversity, and unique mix of urban and rural centers, many believe Ohio is representative of the United States as a whole.⁵ It is often used by corporations nationwide to test products and to poll trends.⁶ Now Ohio faces a greater test, one relating to how its citizens will prepare for the possible health effects of global climate change.

The average temperature near Columbus has increased by 0.3 degrees F over the last century. Over the next century, climate in Ohio may experience additional changes. By 2100, temperatures in Ohio could increase up to 7 degrees F, depending on the season,⁷ based on projections made by the Intergovernmental Panel on Climate Change and results from the United Kingdom Hadley Centre's climate model, a model that accounts for both greenhouse gases and aerosols.

While global warming could cause overall temperatures to rise during the winter months, projections also forecast an increase in the frequency of weather extremes, meaning winters with more days of very low temperatures. As with excessive heat, extreme cold poses direct threats to human health. Heat and cold can lead to more cases of heat-related illness, hypothermia, and frostbite. Extreme weather and sudden temperature fluctuations can also affect persons with pre-existing respiratory and heart problems, exacerbating their conditions. Children and the elderly especially are at risk.

Floods in Ohio could occur more frequently, increasing the threat of water contamination, gastrointestinal illnesses, and property damage. With its many streams, lakes and rivers, Ohio already experiences flood events each year. The Ohio Department of Health warns that floods can result in cases of tetanus, bacterial diseases, and respiratory problems.

Climate change could heighten atmospheric instability, increasing the likelihood for turbulent storms and tornadoes. Wind and lightning from such storms cause deaths and injuries in Ohio each year.

Climate extremes also include drought. Recent droughts in Ohio have been among the worst in the state's history. For example, due to water shortages and economic losses, virtually every Ohioan was impacted by the 1999 drought. Farmers in the state suffered the deepest losses, with many either being forced out of business or requiring government aid.

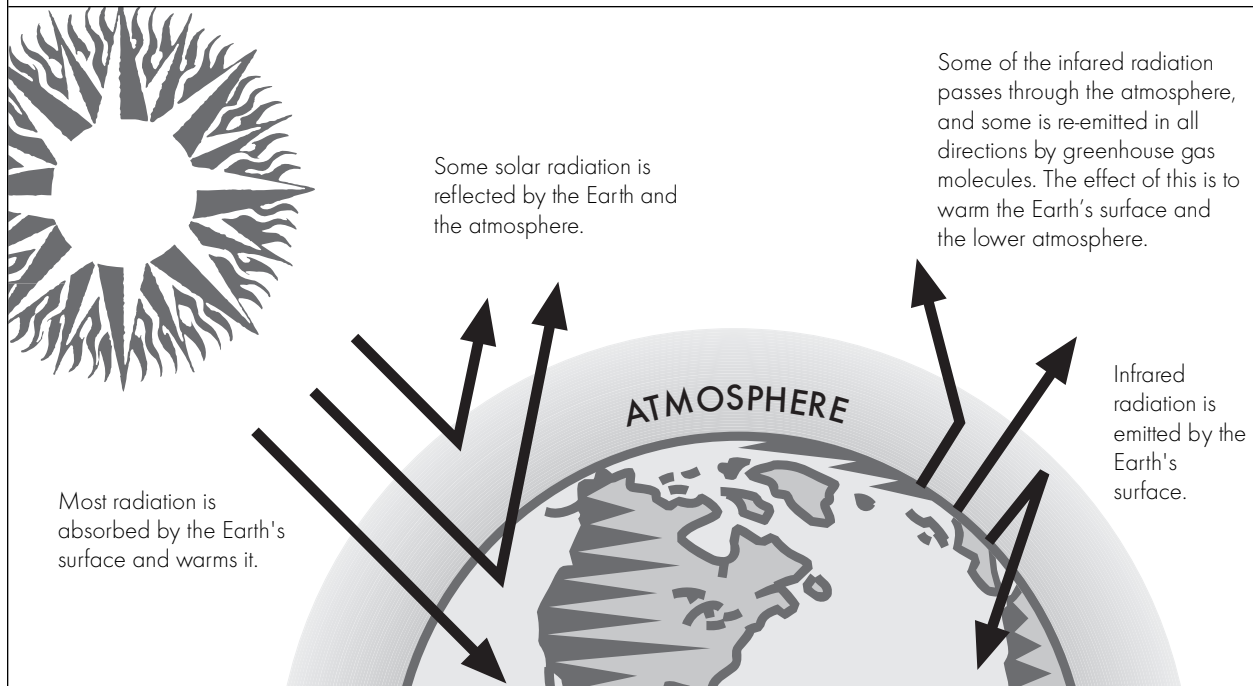
Global warming also could have an impact on air quality in Ohio. Levels of ozone, the primary component of smog, often rise on hotter days. High ozone levels aggravate asthma and other respiratory illnesses. Ohio already has some of the nation's worst air pollution. In 1999, the state ranked fifth highest for ozone levels in the country.⁸ In addition to asthma attacks, exposure to elevated ozone levels can cause shortness of breath, pain when breathing, lung and eye irritation, and greater susceptibility to respiratory illness, such as bronchitis and pneumonia.⁹

How Global Warming Could Threaten Health in Ohio

A number of health hazards may increase as a result of global warming. According to physicians who have studied global warming and its effects, the most severe health risks in Ohio could include the following:

- Ohio's current ranking as the fifth smoggiest state in the nation may get even worse, leading to more frequent and severe cases of cardiovascular disease, asthma, and other respiratory problems.
- More heat-related illness and death. Last year, Ohio's death toll from heat waves numbered in the double-digits and some models forecast that with a 3–4 degree rise in global temperature, heat-related deaths could double or triple in Ohio.
- Ohio's death rate from heart failure could increase further due to temperature extremes. The projected increase in both the number and severity of heat waves may be particularly deadly in counties such as Cuyahoga, Franklin, and Clark, where high rates of cardiovascular disease make people more vulnerable to premature death from heat.
- The water-borne Norwalk virus that sickened 27 Ohioans in 1999 could become more common as floods increase and become more severe.
- Ohio's exceptionally high number of deaths from accidental falls on pavements covered with snow and ice could rise even more if snowfall and the number and severity of storms increase.
- The number of Ohioans suffering and dying from carbon monoxide poisonings (the state averages 35 deaths annually) could increase with more blizzards and extremely low temperatures.
- Droughts, like Ohio's severe drought of 1999, could occur more often, resulting in economic and physical stress.
- Pollen levels and related allergies could get worse given warmer, wetter conditions.

FIGURE 1
The Greenhouse Effect



Energy from the sun drives Earth's weather and climate, as shown in this illustration. Water vapor, carbon dioxide and other atmospheric greenhouse gases trap some of the sun's energy, creating a natural "greenhouse effect." However, problems arise when the greenhouse effect is enhanced by human-generated emissions of greenhouse gases, such as through the burning of fossil fuels.

Water quality and availability may also be compromised as the climate changes. Gastrointestinal diseases like giardiasis and cryptosporidiosis, which annually affect thousands of Ohioans, could become more common.

Contaminated water could impact Ohio's food supply if people ingest waterborne toxic agents by eating seafood from contaminated waters or if they eat fresh produce irrigated, or processed with, contaminated water.¹⁰ Increased temperatures can encourage the growth of food contaminants such as *E. coli* and salmonella, bacteria that already affect over 100 Ohioans annually.¹¹

In the warmer and wetter days to come, mosquitoes and ticks in Ohio that carry diseases such as La Crosse encephalitis, Rocky Mountain Spotted Fever, and Lyme disease, could expand the range of their habitats and their ability to transmit deadly diseases.¹²

Lastly, climate change could also affect Ohio's economy. Many residents make a living from natural resource industries, such as agriculture, fishing, and tourism.¹³ These trades all are subject to global warming impacts. Job loss, decreased income, and ability to afford health care or carry health insurance may result. In 1996, over one million Ohioans were uninsured,¹⁴ including 400,000 children.¹⁵

Ohio, like the rest of the country, needs to be deeply concerned about the potential health impacts of global warming on its population. Only precautions

taken now can avert the potential health problems of the future. This paper reviews in depth the threats to human health that could result from climate change. The United States has the ability to adapt to, and prepare for, these changes because of its health care infrastructure and strong economy. However, we will only ameliorate the potential health effects of climate change by decreasing greenhouse gas emissions today and investing in strategies that will help us to prepare for what is to come.

Are we already experiencing the effects of global warming?

Recent scientific studies provide further evidence of signs of global warming. Of note most recently, scientists at the U.S. National Climatic Data Center (NCDC) reported that global warming rates appear to be accelerating.¹⁶ For sixteen consecutive months (from May 1997 to September 1998) each month broke the previous monthly world average temperature record.¹⁷ According to Thomas R. Karl, lead author of the NCDC paper, there is only a one-in-twenty probability that this string of record high temperatures was simply a chance event.¹⁸ Furthermore, a recent National Academy of Sciences report states that there is no question Earth's warming has accelerated during the past two decades.¹⁹ On January 19, 2000, NASA's Jet Propulsion Laboratory reported that the persistence of La Niña and El Niño events—which by causing warmer and cooler than normal sea-surface temperatures affect worldwide weather patterns—might be part of a larger, long-lasting climate pattern.²⁰

Most recently the National Oceanic and Atmospheric Administration (NOAA) reported that the world's oceans have warmed significantly over the past 40 years.²¹ The greatest warming occurred near the surface of the oceans, where temperatures increased by 0.56 degrees Fahrenheit.²² The NOAA researchers believe that this stored heat may be an early indicator of the warming of air and sea temperatures in the next ten years.²³ The scientists further suggest that the ocean data could help to explain inconsistencies that have occurred in past climate forecasting.

Ohio residents are no strangers to the occasional hot summer or the unusually bad storm. And, more sporadic recent weather events do not necessarily indicate a long-term pattern. However, weather trends in recent years closely correspond to computer models and predictions of what climate change could bring. They may well be warning signs. Such events include:

- More prevalent extreme weather conditions, such as the flooding and tornadoes that affected much of the state during the spring of 1998.
- A spate of heat waves. Nationwide, the number of heat-stressed days approximately doubled during the past 50 years. Ohio is no exception. The number of four-day heat waves in Ohio increased 200–400 percent in the last 45 years in Youngstown, Akron, Dayton, Cleveland, and Columbus.²⁴ Following the heat wave in 1999, which killed more than fourteen people in the greater Cincinnati area by the end of July,²⁵ the Ohio Department of Health issued a public health advisory to urge people to avoid heat-related

stress due to expected high heat and humidity levels.²⁶ In addition, health officials from all over the state acknowledged that the number of heat-related deaths was likely underestimated due to the difficulty of determining heat as the sole or primary cause of death. According to data from Ohio death certificates, the state averaged four heat-related deaths per year from 1993–1997, with a high of eighteen deaths in 1995 and a low of one in 1996. The highest number of heat-related deaths in recent years occurred in 1988, when a total of twenty people died.²⁷

- A rising caseload of vector-borne disease. For example, 489 cases of Lyme disease were reported in Ohio from 1982 to 1996.²⁸ In 1998, 46 cases were reported. In 1999 that figure rose to 78.²⁹ Lyme disease is an illness that may develop months, or even years, after an infected tick bites a victim.

The following sections describe the specific health effects that are predicted to result from global warming over the next 50 or 100 years. In some cases, there is a high level of certainty about the predictions. For others, the evidence is less definitive. In all cases, there is reason for serious concern and a need to take precautions now so that we are prepared for whatever global warming may bring.

The Complex Origins of Climate Change

Since the end of the last Ice Age 10,000 years ago, temperatures worldwide have risen about 9 degrees Fahrenheit, mainly due to natural changes in the geographical distribution of the sun's energy and in the amounts of dust, carbon dioxide, and other gases in the atmosphere.

In recent years, the rate of increase in temperatures has been accelerating. On any given day, the average temperature is about 1 degree F higher than a century ago. Seven of the ten warmest years in recorded history occurred in just the last decade, with 1998 topping them all.³⁰

Human activities are among the most important factors making Earth warmer. When motor vehicles burn gasoline and electric utilities burn coal, they release carbon dioxide and other gases into the atmosphere that trap warm air near Earth's surface, in much the same way that glass panels trap warm air inside a greenhouse—hence the term, “greenhouse effect.” Over the past 200 years, the concentration of greenhouse gases in the atmosphere has increased by 30 percent. The gases will remain there for centuries, trapping heat and threatening human health.³¹

Many Ohioans Are Vulnerable to the Health Effects of Climate Change

Many Ohio citizens, such as the young, the sick, and the elderly, are particularly vulnerable to the potential health effects of climate change. Children are at risk because their immune and other protective systems are not yet fully developed.³² Children less than a year old are most sensitive to heat stress because their heat regulatory systems have not fully matured.³³ In addition, a child's higher susceptibility to heat and cold is due to her body surface area being proportionally greater compared to her weight. A child dehydrates more easily due to external heat or fever compared to an adult with the same fever or in the same external temperatures.

Individuals with existing illnesses are especially sensitive to heat stress, air pollution, and other possible effects of global warming. Those persons suffering from cardiovascular and respiratory illness are less able to adapt to

additional physical stress caused by warmer and more humid environments. Air pollution has also been shown to have an impact on those suffering from heart and lung diseases.³⁴

Cardiovascular disease, including coronary heart disease and stroke, is the leading cause of death in the United States. Higher average temperatures could further elevate this statistic. It is also possible that warmer winters could reduce the number of deaths in winter months, however experts agree that the relationship between winter weather and mortality has been difficult to interpret.³⁵ In addition, several behavioral risk factors associated with the development of these diseases, such as being overweight, physical inactivity, smoking, and hypertension, already affect large proportions of Ohio's population, making them even more vulnerable to the higher temperatures. For example, 64 percent of Ohioans report having a sedentary lifestyle, 33 percent are considered overweight, and 26 percent smoke.³⁶

Ohio's elderly also are at risk due to a host of factors, including a possible drop in the efficiency of their heat-regulating systems, an increase in the temperature at which sweating begins, a decrease in the ability to perceive changes in temperature, and pre-existing conditions such as cardiovascular or pulmonary diseases. Certain medications commonly taken by the elderly, such as tranquilizers and anticholinergics, also increase susceptibility to heat stroke.³⁷

Weather Extremes May Lead to More Heat-Related Illnesses, Drownings, Electrocutions, and Other Accidental Deaths

Global warming means not only higher temperatures, but also more unpredictability in weather patterns and more extreme weather conditions.³⁸ Greenhouse gas concentrations increase heat and moisture in the atmosphere. Heat and water vapor create instability, leading to more frequent, and possibly more severe, weather activity.³⁹ All of this could mean more floods, tornadoes, droughts, heat waves, and other natural disasters.

Although Ohio is accustomed to rapid and extreme swings in weather conditions,⁴⁰ potential changes in weather patterns may still prove to be surprising and severe. Already Ohio sustains major damage from natural disasters. In 1998, insurance losses and federal disaster aid allocated to Ohio totaled \$281,882,716, ranking Ohio as 17th highest among all the states.⁴¹

High temperatures and extreme weather conditions can have wide-reaching health impacts, including illness, injury and death. They can disrupt electrical power supplies, compromising access to public service broadcasts. They can contaminate drinking water supplies, placing populations in jeopardy. Downed electrical power lines and leaks from natural gas or propane tanks can cause fires, electrocutions, and explosions. Intense rainstorms and floods can wash raw sewage into drinking water supplies and spread infectious diseases, such as salmonellosis, cryptosporidiosis, and giardiasis. Tornadoes, high winds, thunderstorms, and drought can intensify

forest fires, possibly leading to injuries, fatalities, and respiratory illness. Residents displaced from their homes by natural disasters can also experience psychological problems, ranging from depression to post-traumatic stress disorder.⁴²

Depending on their severity, extreme weather events can tax, or even cripple, emergency care programs. The loss of power that often occurs during such storms can result in an inability to run oxygen machines and other necessary medical equipment, thereby endangering the health of many Ohioans.

Direct Effects of Heat on Health

I've lived in Ohio for over 19 years. Every year, the summers seem to get hotter here. I'm lucky to have air conditioning, but residents who aren't so lucky, or who have to work outdoors, really suffer during the summer months.

—HEIDI J. LITTMAN, MD, PEDIATRICIAN, CLEVELAND, OHIO

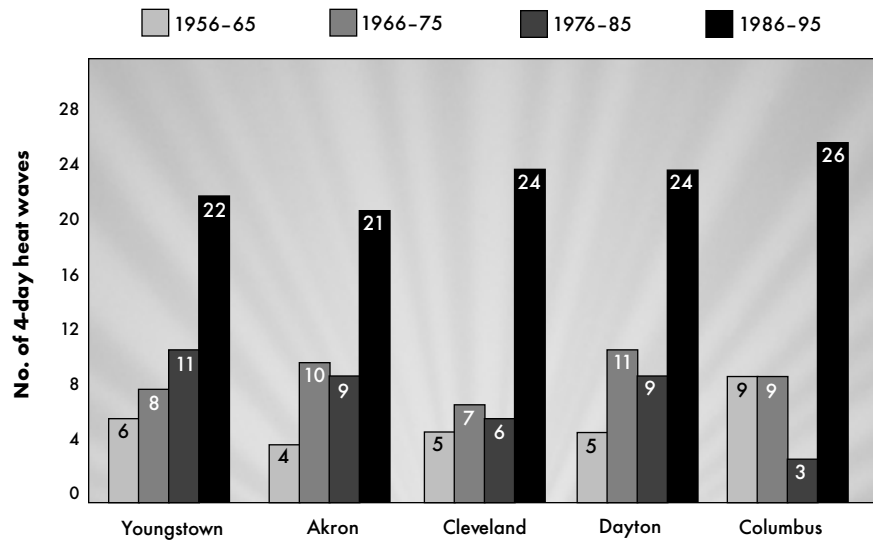
The thirteen years from 1987 to 1999 are each among the fifteen warmest years on record. Global land temperatures made 1999 the second hottest year recorded, beaten only by temperatures in 1998. Temperatures in Ohio coincide with this trend. Over the last century, the average temperature near Columbus increased 0.3 degrees F.⁴³ By 2100, average temperatures could increase as much as 7 degrees F, with a range of 2 to 7 degrees depending on the season.⁴⁴ To put this into perspective, for hundreds of millions of years, average global temperatures have varied by no more than 5 to 7 degrees F. The average global temperature at the time of the last Ice Age was only 9 degrees lower than temperatures are today.

Ohio ranked the twelve-month period from August 1998 to July 1999 the fourth hottest August–July period in the past 104 years, since humans began recording temperatures.⁴⁵ This particularly was true for southern Ohio, which experiences higher average temperatures than northern parts of the state.⁴⁶ In the summer months, higher temperatures mean more heat waves. This already appears to be happening. The number of four-day heat waves measured in Youngstown, Akron, Dayton, Cleveland, and Columbus increased 200–400 percent from 1956 to 1995.

Temperatures in winter months also are rising. Temperatures in February in Cincinnati and Columbus from 1997–2000 were commonly 7 degrees or more above what the National Weather Service considers normal for that time of year.

Temperatures hit 70 degrees and above in December of 1999, and January and February of 2000. The latter month boasted two all-time record high days, with temperatures in the mid-seventies. From November 22 to December 7, 1998, the National Weather Service in Wilmington recorded that, on average, the state had sixteen straight days with temperatures significantly higher than normal.⁴⁷ However, typical of extreme weather fluctuations predicted to accompany climate change, while temperatures in December 1998 rose to over 70, during the same month a record was also set for the

FIGURE 2
Occurrence of deadly heat waves on the rise



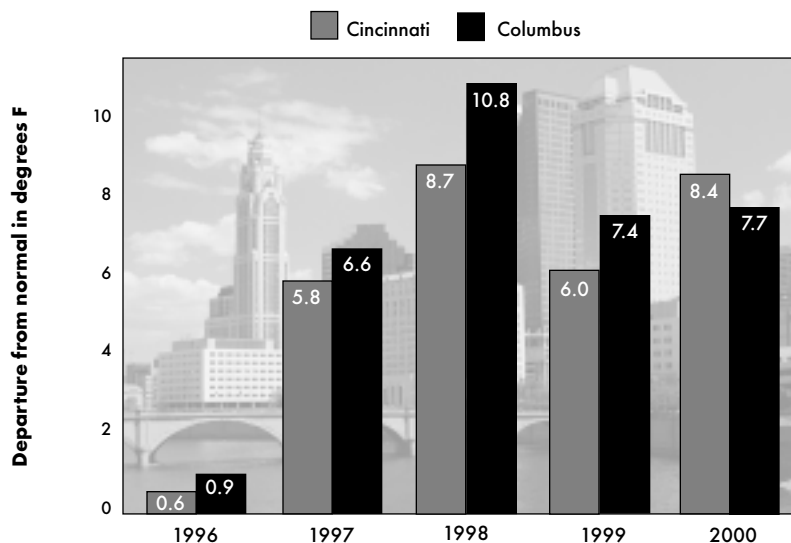
Along with the increase in average global surface temperatures during the past several decades there has been a dramatic increase in the occurrence of deadly heat waves. This graph shows the rise in number of 4-day heat waves in five cities in Ohio over four 10-year periods from 1956 to 1995.⁴⁸

Source: National Oceanic and Atmospheric Administration

latest occurrence of a first snowfall.⁴⁹ And, in January 1999, daily average temperatures ranged from 70 to -3 degrees F.

Heat can directly affect health, as explained below. Often heat leads to high humidity, which may interfere with the body's ability to cool itself through perspiration. One study predicts that a 4 degree F temperature rise in Cleveland or Columbus could double heat-related deaths from 30 to 60.⁵⁰ The

FIGURE 3
Cincinnati and Columbus experience higher than normal temperatures in February from 1996 to 2000



According to the National Weather Service in Wilmington, Ohio, the average daily departure of average daily temperatures from normal in February in Cincinnati and Columbus has consistently been above zero from 1996 to 2000.⁵¹

situation may be even worse in southern Ohio cities, such as Cincinnati, where summer deaths are estimated to triple with a warming of 3 degrees F, from 14 to 42 deaths.⁵² The Ohio Department of Health measured years of potential life lost due to premature death (death occurring before the age of 65). Overall, from 1990–1999, urban areas and the central southern section of Ohio had the highest rates for premature mortality.⁵³ While scientists have not linked this potential loss of life to climate change, one cannot help but notice that these same areas are those experiencing the highest temperatures.

Heat may lead to severe health problems like heat cramps, heat exhaustion, exertional heat injury, and heat stroke. In addition to heat and humidity, risk factors for these conditions include advanced age, lack of air conditioning, and use of certain medications. Vulnerable populations,

Air Conditioning: The Vicious Cycle

One of the sad lessons of the heat waves of the 1990's is that people who are not used to hot weather, and who do not have air conditioning, suffer the most. In the deadly 1995 Chicago heat wave that killed over 600 people, the highest casualties were among elderly residents with no air conditioning. Unlike previous heat waves, overnight temperatures did not drop sufficiently to provide much needed relief. Minimum nighttime temperatures increased abruptly in the 1970's and are on the rise, thus the cooling effect of night air is often not available during heat waves.⁵⁴

Those who can afford air conditioning are likely to use it more as the weather gets warmer. The hotter it gets, the more the demand for air conditioning increases. The energy used to provide air conditioning results in more greenhouse gas emissions in the atmosphere that cause global warming, as well as increased emissions of other air pollutants from power plants. Power plants often contribute up to 50 percent of the pollution in Ohio's air.⁵⁵ During the 1999 Tristate heat wave, demand for power was so high that Ohio power plants, such as Cinergy Corporation, planned to exercise rolling blackouts, in which selected neighborhoods would lose power for certain periods of time.⁵⁶

The plants that supply power to air conditioners emit fine particulate matter (PM). PM is possibly the greatest consistent threat to respiratory health. Inhaling PM can lead to premature death, increased hospital admissions and emergency room visits, increased respiratory symptoms and disease, decreased lung function, alterations in lung tissue and

structure, and changes to respiratory tract defense mechanisms. Sensitive groups at the greatest risk from such effects include the elderly, individuals with respiratory disease, such as asthma, and children. Research has linked between 2,330 and 5,334 premature deaths from heart and lung diseases in Ohio to microscopic particulate matter or soot. That is two to four times the number of Ohioans killed each year in auto accidents.⁵⁷

Ozone levels may also increase due to higher temperatures and increased emissions from power plants. Ozone can aggravate asthma and other respiratory conditions. As the weather heats up, people who do not have air conditioning are more likely to keep their windows open to allow for air circulation. And, it is during these hotter summer months that air pollutant levels are at their highest. Unfortunately, a disproportionate number of asthma sufferers are poor, and therefore are less likely to be able to afford adequate air conditioning.⁵⁸ Thus, those who are most susceptible to air pollution levels are also those who may be most exposed to ozone and PM in the air.

Demand for air conditioners among the poor is so great that when Reds shortstop Barry Larkin and his wife donated 100 air conditioners to Mercy Franciscan at St. John Center in Over-the-Rhine, the units were snapped up immediately.⁵⁹ City government officials in Over-the-Rhine provided free fans to the disabled and to senior citizens,⁶⁰ but a number of disadvantaged and poor Ohioans still do not have proper cooling devices that can help to protect them from heat-related illness and exacerbated respiratory conditions.

including the elderly, children, infants, and the infirm, will suffer the most. Cardiovascular diseases, such as coronary heart disease, also are a risk factor. Many Ohio residents currently suffer from coronary heart disease, with particularly high rates in counties such as Cuyahoga, Franklin, and Clark.⁶¹ Compounding the public health burden of heat waves is the fact that as excessive heat increases so does the death rate for other medical conditions.⁶²

Heat cramps are muscle spasms that primarily affect people who exert themselves through strenuous work or exercise. Mineral imbalances likely cause these cramps and salt and water replacement usually relieves them. A more severe condition is exertional heat injury, which commonly occurs among runners who are not properly conditioned and hydrated. The body can reach 102 to 104 degrees, with symptoms that include goose bumps, chills, nausea, vomiting, and unsteady gait. In severe cases, people may have incoherent speech or even lose consciousness. Muscles, kidneys, and blood cells may be damaged.

Heat exhaustion, or heat collapse, is the most common heat-related condition. It occurs when the cardiovascular system cannot keep up with heat demands. An affected person feels dizzy, weak, cold, and clammy, and has ashen skin and dilated pupils. The individual may require hospitalization.⁶³ At greatest risk are infants, small children, the elderly, those working or exercising outdoors, persons with impaired mobility, and individuals suffering from cardiovascular disease.⁶⁴ When moved to a cool place, a victim of heat exhaustion usually recovers.

Heat stroke, the most severe of these conditions, can be fatal. If body temperature reaches 106 degrees or above, damage to the kidneys, muscles, heart, and blood cells is likely. Sweating stops altogether. Death can occur immediately, or could be delayed up to several weeks due to complications such as renal failure.⁶⁵

Direct Effects Of Extreme Cold On Health

*In life and in death, Isaac Miller was largely ignored. The 78-year-old Over-the-Rhine man lived alone in a small room on Race Street and rarely had visitors...Neighbors found him in an unheated hallway Monday morning, freezing to death.*⁶⁶

—THE CINCINNATI ENQUIRER, 1999

While average temperatures are expected to rise in Ohio in the winter, the increased frequency of weather extremes may also mean winters with more days of extremely low temperatures.⁶⁷ Over the next several decades, the state could also experience much heavier precipitation. By 2100, precipitation in Ohio is estimated to increase by 15 percent in winter and spring (with a range of 5–25 percent), 20 percent in fall (range 10–35 percent) and 25 percent in summer (range 1–40 percent).⁶⁸ Already, annual precipitation in Geauga County in the northeast and Highland County in the southwest measures an average of 44 inches.⁶⁹

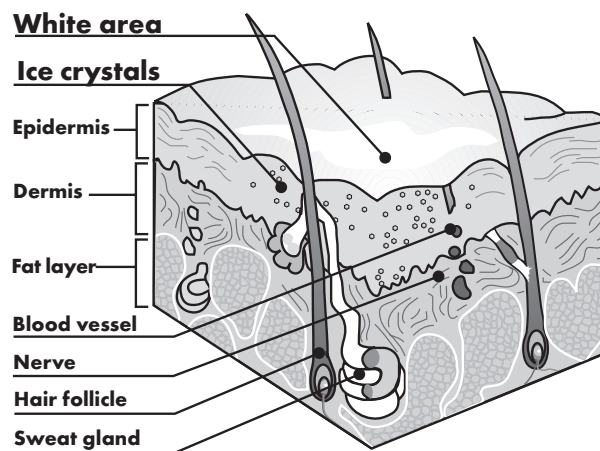
As overall temperatures increase, more of Ohio's winter precipitation may fall in the form of rain, sleet, and ice, increasing the likelihood of events such

as the crippling winter storms of 1999. On just one day, January 2, 1999, 56 people in Ohio were injured from falls on ice. In Ohio, deaths from fall-related injuries are currently at an all-time high. In Hamilton County, such deaths run at more than twice the national average and have caused enough concern at the Hamilton County General Health District that doctors there have formed a task force on the issue.⁷⁰ Elderly residents were particularly susceptible to falls on sidewalks and other walkways that were dangerously covered in ice.⁷¹

FIGURE 4
Effects of Frostbite

Global climate change could bring colder temperatures and winter storms to Ohio. One resulting threat to health is frostbite.

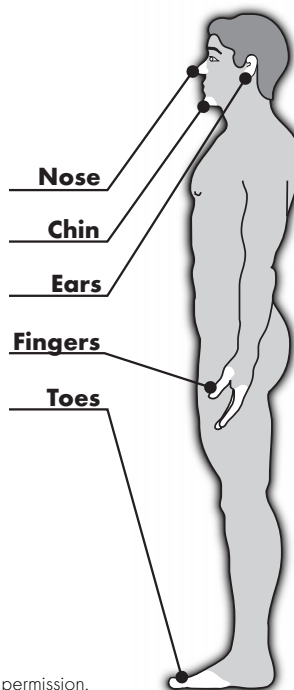
Frostbite occurs when the skin is exposed to temperatures below 23 degrees Fahrenheit. Extremely tiny ice crystals, floating in the body fluid under the skin, become larger until they damage cells. Skin first turns whitish, then becomes numb. A black tinge indicates the area has been damaged permanently.



Body parts most vulnerable

When the body becomes super cooled or exposed to the cold elements of winter, it instinctively draws its blood supplies inward toward vital organs—leaving body parts on the fringes to suffer the effects of cold, wind and wetness, and without adequate blood to provide warmth.

In the Tristate, “people don’t recognize that their ears are red or the tip of their nose is red because they can’t see them,” says Dr. Edward C. Jauch, emergency medicine physician at University of Cincinnati Medical Center and University Hospital.



Who’s most at risk for frostbite?

- Seniors, especially those with poor circulation.
- Homeless, because of constant exposure to cold air, freezing conditions and dampness.
- People with diabetes. A common complication of diabetes is neuropathy, or loss of nerve sensation in the feet because of nerve damage.
- Children, whose bodies may not retain heat as efficiently as adults and who may not notice the symptoms of frostbite if they’re actively involved in playing or fun outdoor activities.⁷²

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Although the conditions necessary for the formation of severe storms are hard to predict, some scientists expect that warmer winter temperatures will lead to harsher storms in the future.⁷³

Unexpectedly cold weather and large snowfalls can pose a variety of possible health risks, such as hypothermia, frostbite, cardiac-related deaths, and carbon monoxide poisoning.

- **Hypothermia**, an unintentional lowering of the core body temperature to, or below, 95 degrees F, is a deadly medical emergency.⁷⁴ From 1979 to 1995, Ohio averaged 22 deaths per year from hypothermia-related illness.⁷⁵ Early signs of hypothermia often are insidious. They include shivering, numbness, fatigue, poor coordination, slurred speech, impaired mental state, blueness or puffiness of the skin, and irrationality.⁷⁶ More serious cases can result in coma, low blood pressure, and cardiac irregularities. Elderly persons living alone are especially at risk.
- **Frostbite** occurs when the skin is exposed to temperatures below 23 degrees F.⁷⁷ Such extreme cold increases the size of ice crystals under the skin.⁷⁸ These crystals can cause damage at varying levels of severity: 1) frostnip, where skin turns white and may be slightly numb; 2) superficial frostbite, involving the skin and tissue, and; 3) deep frostbite, involving skin, tissue and bone.⁷⁹ At the final level, affected areas may have to be amputated. Frostbite threatens Ohioans every winter, as evidenced by fact sheets distributed by the Ohio Department of Health.⁸⁰
- **Congestive heart failure** is the most frequent reason for hospitalization among older adults.⁸¹ People with heart problems are vulnerable to temperature extremes because their cardiovascular systems must work harder to keep their bodies at the right temperature.⁸² The predicted increase in the number and severity of storms could, therefore, lead to more deaths due to heart failure and other forms of cardiovascular disease. Already Ohio has a high death rate for this condition, with 43,688 individuals dying of heart failure in 1998 alone.⁸³

One of the greatest winter health threats in Ohio is heart failure due to snow shoveling. This activity can affect people who are not used to physical exertion and puts them in a life-threatening situation, according to J. Nick Baird, state health director.⁸⁴ This strenuous activity, combined with the fact that breathing cold air constricts small blood vessels that carry blood away from the heart, thereby making the heart work harder, can lead to a dangerous situation.⁸⁵ Over one winter weekend in 1999, two Tristate men, one from Colerain Township and the other from Clermont County, died from heart attacks while shoveling snow.⁸⁶ The death rate for this activity is not surprising when one considers that an average shovel full of dry snow weighs about eight pounds, taking into account the weight of the shovel.⁸⁷
- **Carbon monoxide poisoning** poses yet another winter health risk in Ohio. Carbon monoxide poisoning is the leading cause of non-intentional poisoning deaths in the United States.⁸⁸ Approximately 1,200 people die annually from carbon monoxide poisoning. About 35 of these deaths are in Ohio.⁸⁹

Carbon monoxide is an odorless, colorless, and tasteless gas produced from incomplete combustion of fuels containing carbon, such as kerosene, natural gas, liquid petroleum, gas, and wood.⁹⁰ Carbon monoxide can attach itself to hemoglobin, impairing the oxygen-carrying capacity of the blood and depriving a body's tissues and organs of oxygen.⁹¹ The poor and the elderly are especially vulnerable to carbon monoxide poisoning. Carbon monoxide poisonings can occur during blizzards when people sit in idling automobiles with exhaust pipes blocked by snow.⁹² Poisonings may also occur during power outages, when people often use unvented residential appliances such as stoves and heaters.⁹³ Kerosene and propane-fueled space heaters, gas-fueled log sets, and cooking devices used improperly for heating can expose people to potentially hazardous levels of carbon monoxide, as well as other toxic gases.⁹⁴

Health Threats From Snowfall Extremes

Some climate change models predict more variability in snowfall conditions. Increased snowfall could pose problems in Ohio's snow belt, east of Cleveland. There, snowfall averages more than 100 inches per year.⁹⁵

As discussed above, the incidence of carbon monoxide poisoning, hypothermia, heart failure, and weather-related accidents could increase. The winter storms of January 1999 exemplify the type of problems we can expect with increased or severe snowfalls in the future. Early that month, temperatures in at least 27 counties quickly dropped into the teens, causing wet snow and ice to refreeze, creating ground, sidewalk, and road hazards. Many car crashes were reported and schools were forced to close. At least 56 injuries were reported. The combination of very cold temperatures—around 30 degrees F below zero with wind-chill—and thick ice hampered cities' efforts to make roads and walkways safe for the public. Property damage for one day alone, January 2, 1999, rose to \$600,000.⁹⁶

More Illnesses, Injuries And Fatalities Associated With Floods, Thunderstorms, Tornadoes and Strong Winds

*We were flabbergasted, to be honest with you. Our best information is that global warming is having an impact on rainfall now.*⁹⁷

—THOMAS R. KARL, NATIONAL CLIMATIC DATA CENTER,
ON FINDING CLEAR EVIDENCE THAT EXTREME RAINFALL EVENTS
HAVE INCREASED IN RECENT DECADES IN THE UNITED STATES

With its many streams, lakes, and rivers, Ohio is constantly under the threat of flood-producing storms. No area in the state is free from this threat.⁹⁸ Flooding occurs in Ohio every year, although the location and severity vary according to ground conditions and weather.⁹⁹ Given the forecasted rise in precipitation throughout Ohio of 5–40 percent by 2100, depending on the season, more floods could be on the way. The amount of rain on extremely



wet days is also predicted to increase, thus Ohio floods could become more frequent and severe.

Floods cause an average of 146 deaths per year nationwide, most of which are due to drownings associated with motor vehicle accidents in flash flood conditions.¹⁰⁰ Severe Ohio flood disasters occurred in June 1990 near Shadyside (Belmont County), where 26 people perished. Two residents lost their lives in 1992 due to flooding at Massieville (Ross County).¹⁰¹ It is estimated that for every 1,000 Ohio residents, 6.4 years of potential life are lost because of

accidents and adverse events,¹⁰² such as floods. Floods can also cause psychological stress ranging from depression to post-traumatic stress disorder, as residents may suffer economic losses and could be displaced from their homes.¹⁰³

Floodwaters contaminated with bacteria and parasites can result in cases of intestinal illness and infectious disease. Intestinal illnesses may occur with symptoms of nausea, vomiting, diarrhea, and fever. Diarrhea usually lasts only a few days, but for individuals with suppressed immune systems, depending on the organism, this condition can persist and even be fatal. Norwalk virus, a common water-borne agent that can proliferate in flood conditions, is just one infectious agent that causes intestinal symptoms as well as dehydration, muscle aches, headache, chills, and weakness. Norwalk has no specific treatment except supportive care. At least 27 Ohio individuals contracted Norwalk virus in 1999.¹⁰⁴

Two of the greatest threats of gastrointestinal disease are from giardia and cryptosporidium. Extreme weather events that cause flooding or disruptions in water supplies can bring on these diseases. **Giardiasis** is an illness caused by a one-celled microscopic parasite that lives in the intestines of people and animals and survives well in water. During the past 15 years, *Giardia lamblia* has become recognized as one of the most common causes of waterborne human disease in the United States.¹⁰⁵ In the past three years there have been over 1,000 cases of giardiasis reported annually in Ohio, with 1,247 in 1997, 1,095 in 1998, and 1,113 in 1999.¹⁰⁶ If the number of cases that go untreated or unreported is taken into account, the true caseload is probably several times higher.

Cryptosporidium poses another major threat to the water supply. It is an organism that is small, difficult to filter, resistant to chlorine, and ubiquitous in many animals.¹⁰⁷ Symptoms of the illness include diarrhea, stomach cramps, upset stomach, or slight fever. Cryptosporidiosis can be serious, long lasting, and sometimes fatal for people with weakened immune systems.¹⁰⁸ In 1999, there were almost 3,500 cases of cryptosporidiosis in the United States, with 75 occurring in Ohio.¹⁰⁹

Floodwaters can contain human and animal fecal material. Sources include overflowing sewage systems and flooded croplands. Ohio's farming communities, in particular, face risks when pastures and crop fields are flooded. Although skin contact with floodwater rarely poses a serious health risk, there is a threat of disease from eating or drinking anything contaminated with floodwater.

The Ohio Department of Health includes the following diseases and conditions in a publication that urges precaution against disease and injury in flooded areas.¹¹⁰

- **Tetanus** is an acute disease that usually enters the body through a wound. Tetanus bacteria are widely distributed in soil and street dust, and in the intestines and feces of certain animals. Soil fertilized with manure can be highly infectious. In agricultural areas, a significant number of human adults can harbor the organism. Floods not only help to spread tetanus, but also increase the chances that someone could develop puncture wounds or deep cuts and become infected. Tetanus is characterized by generalized rigidity and convulsive spasms of skeletal muscles. The muscle stiffness usually first involves the jaw (lockjaw) and neck, before it becomes generalized. Approximately 30 percent of all reported cases are fatal and survivors must often be hospitalized. Seniors and children are especially vulnerable. In 1998, one eight-year old who contracted tetanus had to be hospitalized for ten weeks.¹¹¹
- **Leptospirosis**, or mud fever, can occur when a person is exposed to water contaminated by the urine of domestic or wild animals.¹¹² Leptospirosis is a bacterial disease that can manifest itself in a variety of ways. Symptoms may include sudden onset of fever, headache, chills, severe muscle aches, watery eyes, rash, anemia, jaundice, mental confusion, and depression.¹¹³ Symptoms usually appear within ten days. The disease is treated with antibiotics.
- **Respiratory problems** may be caused by particles released by bacteria, fungi, molds, and related organisms that can proliferate due to excess moisture in buildings after a flood, and/or they may be caused by the chemicals used to disinfect flooded living areas. Respiratory ailments and allergies are the most common result of inhaling these organisms, but in some cases exposure can cause rampant infection characterized by fever, malaise, respiratory distress, shock, and even death.¹¹⁴
- **Tularemia**, or rabbit fever, is a bacterial disease caused by the bite of ticks, mosquitoes, or deer flies, by contact with the blood or tissue of an infected animal, or by drinking contaminated water. Floods increase the likelihood of contracting the disease by contaminating water supplies, creating environments in which vectors proliferate, and drowning animals. Symptoms of tularemia may include slow-growing ulcers, usually on the hands, and swollen lymph nodes. If the bacteria are inhaled, a pneumonia-like illness can follow. If ingested, the bacteria can cause sore throat, abdominal pain, diarrhea, and vomiting. Symptoms can emerge two to ten days after exposure and are typically treated with streptomycin or other antibiotics.¹¹⁵

- **Scabies and Head Lice.** Crowded conditions in shelters during flooding or other natural disasters may result in infestations of scabies and head lice. Scabies is a skin disease caused by a small mite (*Sarcoptes scabiei*) and is transmitted through direct contact with an infected person.¹¹⁶ Head lice also spreads easily from person to person. The condition is uncomfortable, as nits (lice eggs) accumulate on the scalp and cause itching. Scratching can lead to secondary bacterial infections.¹¹⁷

The 1998 Flood In Washington County

The June 1998 flash flood centered in Washington County, Ohio was one of the worst floods in recent history. From Saturday night, June 27, to Monday, June 29, severe thunderstorms continually battered the area. A rain gauge in nearby Meigs County reported 11.5 inches of rain. Another gauge near Amesville in Athens County registered five inches of rain in just three hours.¹¹⁸

The nonstop rains caused dozens of creeks, rivers, and streams to overflow. Creeks such as the Federal, Duck, and Mill released water onto the land. Rivers like the Shade and Muskingum caused torrents of water to spill onto normally dry areas. Water from the East Branch of the Shade River poured over bridges, rendering them useless. All roads to and from Portland were washed out or flooded, isolating the community. Property damage was extensive. Between 500 and 600 dwellings were affected by the flood. Homes and churches literally floated away. Several of those that remained standing contained up to four feet of water.¹¹⁹ Storm sewers overflowed into businesses. Water gushed through roofs already damaged by thunderstorm winds.

The President declared Perry, Morgan, Washington, Athens, Meigs, and Jackson counties federal disaster areas. At least eighteen bridges were either washed out or damaged. Many roads that survived the storm were still unusable due to fallen trees. The Athens County fire station had thirteen feet of water in its interior. The community of Macksburg was without public water for ten days. The Ohio National Guard spent nearly two weeks in the region after the flood. In its wake, the flood left \$10 million in property damages.¹²⁰

The human death toll was even more devastating. A 40-year-old male was killed when he and his wife desperately tried to escape the rising floodwaters in their car. Another death involved a 55-year-old woman. She was visiting a friend who lived in a mobile home. In an instant, fast-flowing water from a nearby stream picked up the mobile home and forced it down a short hollow. The owner of the home managed to grab onto a sycamore branch as the mobile home was being destroyed, which saved her from drowning. Her friend's body was recovered two miles downstream.¹²¹

Risks Posed By Tornadoes and Strong Winds

Climate change could also increase the likelihood of more turbulent windstorms by increasing atmospheric instability. Severe windstorms and tornadoes already are cause for concern in Ohio. For example, high winds beset passengers on a Lake Erie ferry on June 29, 1999. The ferry was en route from Port Clinton to Put-In-Bay on South Bass Island when winds led to waves averaging three to five feet.¹²² Winds then picked up even more, resulting in a ten-foot wave. The wave crashed through a window in the main passenger cabin of the ferry. Flying glass injured fifteen people and two were admitted to a local hospital.¹²³

Lightning also causes deaths and injuries in Ohio each year. On July 6, 1999, for example, a 36-year-old male construction worker was found lying dead in a puddle of water. Witnesses said he was struck by lightning.¹²⁴ The month before this happened, two young children, in Clermont County, and an adult, camping in Lucas County, were struck by lightning and taken to area hospitals.¹²⁵ The number of injuries and fatalities in Ohio due to lightning could rise as a result of global warming.

The Ohio Drought of 1999

*This year (1999) is over. It's lost. We haven't lost any cattle yet, but I was standing in the barn the other day and saw some guy drive by with six dead ones.*¹²⁶

—A GALLIA COUNTY FARMER

*It's the worst (drought) I've seen in my time.*¹²⁷

—DON VOLKERDING, A FARMER IN SOUTHERN WARREN COUNTY FOR OVER 50 YEARS

No one who experienced the drought of 1999, particularly Ohio's farmers, could forget this devastating event. Signs of drought began to surface in May 1999. The National Climatic Data Center reported that little rain fell from late May through much of June. Throughout Eastern Ohio, only 5.15 inches of rain fell from April-June of 1999, less than half of the average rainfall for that region, which is usually 10.73 inches.¹²⁸ Mansfield had 1.66 inches, making that month the fifth driest June on record.¹²⁹ Temperatures soared in the high 90's.¹³⁰ Still, farmers and residents remained hopeful, as scattered rains late in the month seemed to indicate that things were getting back to normal.

Not so. Crops began to show the effects of the drought. Corn and soybean growth was delayed, especially in central Ohio where growth was five inches behind schedule.¹³¹ By early August, most of the state's farmers were eligible for low-interest loans to cope with what was now being called one of the worst droughts in history.¹³² A panel of federal and state officials at that time reviewed damage estimates and found that Warren County farmers lost half of their corn crop and 31 percent of their soybean crops. At least half of the potato, pumpkin, and tomato harvests in Hamilton and Butler counties were lost.¹³³ Dried up springs forced cattle farmers to haul in water, or to use their already depleted groundwater sources.¹³⁴

The destruction brought incredible economic hardship to many Ohioans. Farmers who already lived paycheck to paycheck were particularly hard-hit. For example, in Gallia, the ninth poorest of Ohio's 88 counties, where farms average 140 acres and \$17,000 in annual income, almost 60 percent of farmers reported significant losses of 30 to 90 percent.¹³⁵ Desperate to earn income, some farmers sold their cattle or goods and went out of business.

Many Ohio farmers had no choice but to accept government aid. State agencies distributed \$4.85 million in aid to counties such as Adams, Athens, Belmont, Brown, Coshocton, Fairfield, Gallia, Harrison, Highland, Jackson, Jefferson, Licking, Meigs, Mercer, Monroe, Muskingum, Noble, and Scioto.¹³⁶ Despite this aid, many farmers never recovered.

Those not involved in agriculture suffered deep losses as well. More than 14 people died from heat-related illnesses and thousands of animals perished. The real death toll during the drought of 1999 may never be known as it is difficult to isolate heat as a cause of death if the victim had prior medical conditions or if the body was decomposed before an autopsy could be performed.¹³⁷ For example, some seniors who were already frail died during the drought. One woman who perished had a core body temperature of 107.5 degrees.¹³⁸

More Droughts Predicted

It may seem odd to think about droughts alongside floods and increased rainfall, but a variable and unstable climate that can shift from one extreme to another is precisely what global warming is likely to bring. The abrupt climate changes may increase the frequency and severity of Ohio droughts.¹³⁹

Over the years, Ohio has seen its fair share of droughts, but few can compare in severity to those of the last two years. 1999's prolonged drought was one of, if not the worst drought to have ever hit the state. During this recent drought, Ohio livestock producers qualified for \$4.85 million in state aid.¹⁴⁰ In addition to economic losses, droughts can result in water shortages and impaired local sewer systems. Individuals may be forced to curtail their use of water for hygiene, washing food, irrigation, and caring for livestock.

Droughts concentrate microorganisms in water supplies. Water quality problems in rivers such as the Ashtabula, Black, Cuyahoga, and Maumee, where pollution already poses health risks, could be exacerbated.¹⁴¹ Each of these rivers flows into Lake Erie,¹⁴² affecting pollution levels in Ohio's famous Great Lake. Droughts also encourage the proliferation of pests, such as aphids, locusts, and whiteflies, which can damage crops.¹⁴³ A pattern of drought punctuated by sudden rains can lead to large increases in rodent populations that can carry diseases such as hantavirus.¹⁴⁴

More Injuries and Fatalities Predicted to Occur Because of Forest Fires

Forested areas thrive in Ohio, particularly in the Allegheny Plateau region that covers the entire eastern part of Ohio, extending into West Virginia and Pennsylvania.¹⁴⁵ Global warming could significantly change Ohio's forests, influencing biological diversity and decreasing growth by up to 50 percent.¹⁴⁶ Drought, higher temperatures, and extreme weather events could wreak

havoc on Ohio's timber stands. Specifically, droughts dry forests, paving the way for forest fires.

Forest fires pose numerous public concerns. They can have a devastating effect on timber production and wildlife. They may destroy homes and other high value property. Wildfires can kill young trees that represent the timber for tomorrow.¹⁴⁷ From a health standpoint, they can cause injury and fatalities to firefighters and nearby residents. Smoke, which can cover a wide area, may increase respiratory illness, such as asthma and chronic obstructive pulmonary disease, particularly for people with pre-existing respiratory conditions.¹⁴⁸



Air Pollution and Respiratory and Cardiovascular Disease May Increase

*Projected climate changes could lead to exacerbation of respiratory disorders associated with reduced air quality in urban and rural areas and effects on the seasonality of certain allergic respiratory disorders.*¹⁴⁹

—INTERNATIONAL PANEL ON CLIMATE CHANGE

*During the summer months, I see kids who can't play outside because the air pollution levels put their ability to breathe at risk.*¹⁵⁰

—WILLIAM HARDIE, M.D., PULMONOLOGIST,
CHILDREN'S HOSPITAL, CINCINNATI, OHIO

Some air pollutants are affected by heat, such as ozone and volatile organic compounds (VOCs). When these pollutants increase, air quality decreases, especially in urban areas. Both ozone and VOCs have adverse health impacts. Climate change could also affect pollen levels, which aggravate allergies. Considering that Ohio has the fifth most polluted air in the United States,¹⁵¹ the possible effects of global warming on the state's air warrants high concern.

Smog

Ground-level ozone is the major component in what we commonly call smog, the most pervasive outdoor air pollutant in the United States. Smog is at its worst on hot, sunny days, which are likely to become more numerous with global warming. Ozone is a toxic and irritating gas that, even in small amounts, can affect lungs and health.

Many Ohio counties repeatedly violate national ambient air quality standards for ozone each year. These include Columbiana, Cuyahoga, Butler, Clark, Clermont, Clinton, Delaware, Franklin, Geauga, Hamilton, Jefferson, Knox, Lake, and several others.¹⁵² Statewide there were an unimaginable 461 violations of the proposed EPA eight-hour standard for ozone in 1999.¹⁵³ This means that the state's air quality had ozone levels exceeding 85 parts per billion (ppb) on those occasions.¹⁵⁴ During this same year, Ohio committed fourteen 1-hour violations where ozone levels were higher than 125 ppb.¹⁵⁵

Ozone, or smog, is formed when nitrogen oxides and volatile organic compounds (VOCs), emitted from motor vehicles, power plants, refineries, factories, and other combustion and industrial sources, are heated by sunlight.¹⁵⁶ Automobiles contribute a significant proportion of VOCs into the air, and car emissions remain a big problem in Ohio. The state's population has increased 27 percent over the past 25 years and this statistic has contributed to raising the number of vehicle miles traveled by 111 percent.¹⁵⁷ In addition, older, dirtier cars and the incredibly popular new sport utility vehicles (SUVs) are the source of the majority of vehicle-related air pollution.¹⁵⁸ Increasing auto emissions suggest that high ozone days and the associated health problems are likely to become more prevalent. In addition, motor vehicles themselves are a significant source of carbon dioxide, a greenhouse gas that causes global warming.

Ohio's Ozone Alley

*Throughout Ohio, 1,333,669 individuals, or twelve percent of the state's entire population, suffer from chronic lung disease. In essence, air quality issues in Ohio are about quality of life. Dirty air damages health and results in the loss of life.*¹⁵⁹

—LARRY MCALLISTER, PRESIDENT/CEO, AMERICAN LUNG ASSOCIATION OF OHIO

At first glance, the Ohio River Valley appears to be a relatively clean and safe place to live. Its mid-sized cities, tracts of rural lands, and low traffic levels appeal to many who visit the area. But a serious problem underlies this tranquil setting—air pollution.

Smog can cause lung damage, asthma attacks, and shortness of breath. Air problems in Ohio are worse than those in big Eastern cities such as New York and Boston, according to a new report prepared by the Ohio Environmental Council, the Ohio Valley Environmental Coalition, and the Regional Coalition for Ohio Valley Environmental Restoration.¹⁶⁰ For example, residents of Cincinnati and Marietta were exposed to more dangerous levels of ozone than residents of New York and Boston.¹⁶¹

Why is the air so bad in the valley? It turns out that power plants in the area, and nearby, often contribute up to 50 percent of the unhealthy air on a “bad air” day in the Ohio River Valley.¹⁶² Consider what manufacturing facilities release each year. Power plants in the valley emit a total of 1,042,805 tons of nitrogen oxides (NO_x), equivalent to NO_x emissions from 53 million cars.¹⁶³ Adding the emissions from upwind power plants results in 2,849,190 million tons of this pollution, or the equivalent of emissions from 146 million cars.¹⁶⁴ NO_x is a precursor to ozone, the main component of smog.

Power plant emissions are nothing new to the valley. Many of the plants were built in the 1940's—

1960's. A provision of the Clean Air Act exempts these older plants from the most up-to-date pollution control requirements. Comparatively, a “grand fathered” power plant is allowed to emit up to ten times as much as a modern power plant.¹⁶⁵ Congress created the exemption in 1977, assuming that many of the plants would soon be replaced with cleaner power generators. That has not been the case. Most of the old plants have outlived their expected retirement dates by decades and continue to emit pollution at levels equal to, or greater than, when they were built.¹⁶⁶

According to the Ohio Environmental Council report, a lasting solution to the valley's air pollution problems entails moving toward a future in which energy is produced by cleaner natural gas, renewable energy sources, and increased efficiency and conservation measures.¹⁶⁷ Another recent study, by the Union of Concerned Scientists, reveals that the Midwest could meet about twelve percent of its energy needs by the year 2010 from renewable energy.¹⁶⁸ Yet another study, released by the American Council for an Energy Efficient Economy, states that by this same time, investments in energy efficiency could reduce energy needs by 26 percent.¹⁶⁹ Until something is done to resolve the air problems in the Ohio River Valley, millions of people throughout the valley, and nearby regions, will continue to suffer from respiratory and cardiovascular illnesses influenced by air pollution.

Exposure to elevated ozone levels can cause severe coughing, shortness of breath, pain when breathing, lung and eye irritation, and greater susceptibility to respiratory illness such as bronchitis and pneumonia.¹⁷⁰ Numerous studies have shown that higher ozone levels cause more asthma attacks, increase the need for medication and medical treatment, and result in more hospital admissions and visits to emergency rooms.¹⁷¹ Even moderately exercising healthy adults can experience a fifteen to over twenty percent reduction in lung function from exposure to low levels of ozone over several hours.¹⁷² And, some healthy people simply are more sensitive to ozone than others, experiencing more health effects from ozone exposure than the average person.¹⁷³

Ozone causes breathing difficulty for over a million people in Ohio¹⁷⁴—approximately one-tenth of the state’s entire population.¹⁷⁵ In 1997, for example, 1,183,063 people in the Ohio River Valley suffered respiratory distress that was linked to ozone smog.¹⁷⁶ Smog most commonly affects the elderly, children, and those with respiratory ailments, such as asthma.¹⁷⁷ In 1997, smog was linked to 30,356 asthma attacks in Hamilton County alone.¹⁷⁸

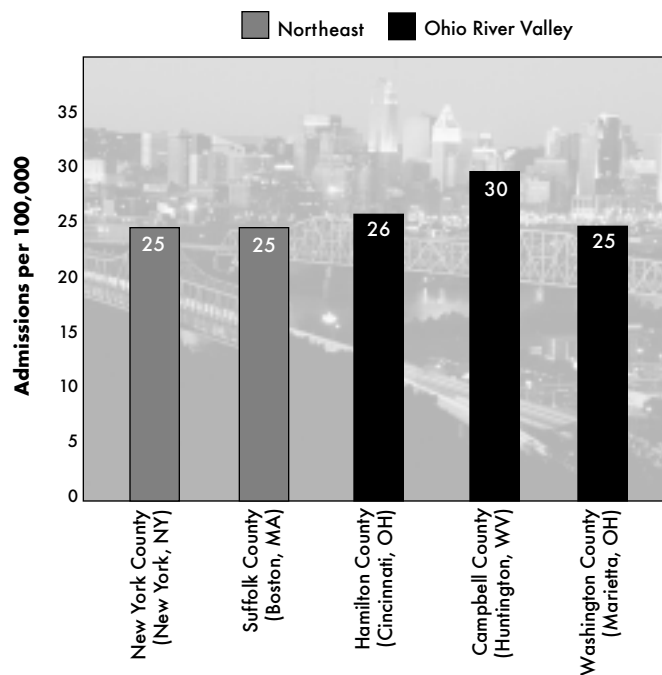
Of all the conditions linked in studies to ozone exposure, asthma is of special concern. Asthma is reaching epidemic proportions in the United States, especially among children. A leading cause of absences from school, asthma can reduce lung capacity and, if untreated, can be fatal.¹⁷⁹ Children have smaller airways than adults and breathe more rapidly, making them more vulnerable to asthma. When someone suffers repeated asthma attacks, the pathways of the lungs become so narrow that simple breathing is as difficult as “sucking a thick milk shake through a straw.”¹⁸⁰ The prevalence of asthma in children under age eighteen rose 72 percent from 1982 to 1994, while the death rate from asthma for children nineteen years and younger in the United States increased by 78 percent from 1980 to 1993.¹⁸¹ Asthma accounts for one in six pediatric emergency room visits in the U.S.

Children are not the only members of the population who are vulnerable to asthma. In 1997, 187 adults and children in Ohio died from asthma.¹⁸²

Physicians do not fully understand what causes asthma, but warmer weather likely will make it worse. One study found that warmer average temperatures are associated with increased asthma prevalence, possibly

FIGURE 5

Per Capita Respiratory Hospital Admissions Due to Ozone Are Higher for Cities in the Ohio River Valley than for Cities in the Northeast



When the relative rates of three distinct ozone-induced health effects are compared (respiratory hospital admissions, emergency room visits, and asthma attacks), Midwesterners experience a greater rate of ozone-related health effects than residents of the Northeast. This graph shows that those who live in the Ohio River Valley region have a greater per capita risk of hospitalization from ozone than do residents of large Northeast cities such as New York and Boston. Global climate change could increase ozone levels, putting even more Ohioans at risk for respiratory and cardiovascular health problems.¹⁸³

Source: Abt Associates and MSB Energy Associates

because higher temperatures are associated with higher levels of allergen exposure.¹⁸⁴

Volatile Organic Compounds (VOCs)

Another set of air pollutants consists of VOCs generated by power plants and municipal waste combustors, as well as motor vehicles, solvent use, and the chemical and food industries. VOCs include a variety of hazardous air toxins, including benzene, butanes, and toluene. VOCs in the atmosphere have two major health impacts: they are precursors to the photochemical production of ozone, and some VOCs are directly toxic. These hazardous air pollutants are associated with cancer as well as adverse neurological, reproductive, and developmental effects.¹⁸⁵ Higher temperatures cause VOCs to evaporate and disperse more rapidly into the atmosphere, causing ozone formation and health problems near and far from the pollutant's source.¹⁸⁶

Pollen

When the thermometer starts rising on warm days, pollen counts tend to rise as well. On April 21, 1999, for example, Dayton experienced 1,260 grains per cubic meter of pollen,¹⁸⁷ more than fifty times the daily average in this city. Many scientists believe that rising temperatures will create favorable conditions for an even wider variety of pollen-producing plants, leading to an increase in levels of airborne pollen and spores that aggravate respiratory disease, asthma, and allergic disorders.¹⁸⁸ Upper and lower respiratory allergies are also influenced by humidity and floods. The EPA notes that wetter conditions and a 2 degree F warming could increase respiratory allergies.¹⁸⁹ Thus, hay fever sufferers in Ohio could experience more attacks, during more months of the year.

Water Sources, and Health, May Be Compromised

Research suggests that climate change will affect precipitation, stream flows, runoff, water temperatures, and evaporation, thereby impacting Ohio's water supply. Both the quantity and quality of water available could be at risk.

There remains considerable uncertainty as to how regional precipitation and waterways will be specifically affected by global climate change. Certain facts, however, are clear. Low stream flows can concentrate pollutants in the water. Surface water systems such as Cinnamon Lake, Village of New Washington, Defiance, McClure, Napoleon, Mount Orab, Williamsburg, Blanchester, Wilmington, and Sardinia already contain a number of pesticides,¹⁹⁰ many of which are known carcinogens. And, cancer is already the second-leading cause of death in Ohio.¹⁹¹ In addition, disruptions in water supplies and flooding can bring on gastrointestinal diseases, such as giardiasis and cryptosporidiosis.

Troubled Water: Lake Erie's Continuing Problems

Twenty-five years ago, people said Lake Erie was “dead,” referring to the fact that the lake was incredibly polluted, many of its beaches were closed, and fishing was severely limited.¹⁹² Since then, the Ohio Lake Erie Commission, with other organizations and individuals, has worked hard to bring the lake back to life. Unfortunately, Lake Erie still has numerous problems, many of which are predicted to worsen as a result of global warming.

Lake Erie contains large amounts of contaminated sediments. Already a health risk, this matter could become even more of a threat because of droughts, such as those experienced in 1998 and 1999. Sediments in the lake are contaminated with elevated levels of phosphorous, mercury, cadmium, lead, chromium, cyanide, copper, zinc, and PCBs.¹⁹³ This sediment does not remain on the bottom of the lake. Small invertebrates take up these compounds into their bodies.¹⁹⁴ Small fish then feed on the invertebrates, absorbing the chemicals into their tissues. The cycle continues up through the food chain, eventually posing harm to humans and wildlife.

Bacterial pollution in Lake Erie is also a problem. The weather extremes that could occur in Ohio due to global climate change, such as droughts and floods, may make things worse. Droughts can concentrate bacteria levels, while floods raise the risk for contact with water contaminated with bacteria such as *E. coli*. People who have come into contact with bacteria-contaminated water from the lake, such as public bathers, have reported experiencing flu-like

symptoms. Infections of the eyes, ears, nose, and throat may also occur.¹⁹⁵ The bacteria that cause such illnesses can survive in human intestines¹⁹⁶ long after an individual has come into contact with contaminated water. These people can then unknowingly spread the bacteria to others.

Overall pollution in the lake from non-point sources also remains high. “Non-point sources” refers to any pollutant source other than the end of a pipe.¹⁹⁷ It can include runoff of soil particles, fertilizers, and pesticides from farms; erosion and the collapse of exposed stream banks; soil washed away from unprotected construction sites; and salts, metals, and other chemicals washed away from hardened surfaces of Ohio's cities and towns.¹⁹⁸ Most of these pollutants make their way into the lake via rivers in the north, such as the Grand, Cuyahoga, Sandusky, and Maumee.¹⁹⁹

A number of cities and tourist areas are located along the lake's shoreline. These too could be impacted, if increased precipitation leads to shore erosion, much in the same way that other states are experiencing coastal erosion due to rising sea levels. Coastal erosion could also affect wildlife habitat in the region. Tragically, many of the lake's unique ecosystems are fragile and susceptible to damage from both nature and humans. Over the years such disruptions have eliminated most of the lake's wetlands.²⁰⁰

For the sake of all who live or work in the region, and for the thousands of tourists who value this national treasure, clearly much effort is still needed to bring Lake Erie back to life.

Food Contamination

Warmer, moister weather encourages the spread of diseases caused by food contaminated with toxic *E. coli*, salmonella and hepatitis A.²⁰¹ People ingest these microbiologic agents by drinking contaminated water, eating seafood from contaminated waters, or by eating fresh produce irrigated or processed with contaminated water.²⁰² Higher ambient temperatures foster the growth of the pathogens that cause these illnesses.²⁰³ Heavy rainfall and runoff can wash the contaminants into public water supplies thereby helping to spread the disease.²⁰⁴

Hepatitis A is a liver disease with symptoms that include jaundice, fatigue, abdominal pain, loss of appetite, intermittent nausea, and diarrhea. An estimated 125,000–200,000 infections of hepatitis A occur each year in

the United States, of which two-thirds cause clinical disease and approximately 100 are fatal.²⁰⁵ Hepatitis A is usually transmitted through fecal-oral routes of exposure from food and waterborne sources. An average of 800 cases of hepatitis A are reported each year in Ohio.²⁰⁶

E. coli and **salmonella** also jeopardize health in Ohio. Commonly over 100 cases of *E. coli* occur in Ohio each year.²⁰⁷ Salmonellosis is an even greater problem in the state. In 1999, 1,320 cases of salmonellosis were reported in Ohio.²⁰⁸ Warmer temperatures and extreme weather events could bring these numbers up even higher in the months and years to come.

A Plague of Ticks and Mosquitoes

*Because of the heating of the atmosphere, disease-bearing insects are breeding faster and living longer at higher altitudes and latitudes. Witness the rapid increases in malaria, yellow fever, hantavirus, and Lyme disease in the northern latitudes. Most remarkably, there is no debate over climate change in any country except the United States.*²⁰⁹

—ROSS GELBSPAN, CLIMATE AUTHOR

In the warmer and wetter days to come, insects and rodents—referred to as vectors—could multiply in number, increasing the human health risks for the diseases they spread. In terms of vector-borne disease, meaning diseases carried by a host, such as a mosquito or tick, the rate of insect biting and the rate of maturation for the disease-carrying microorganisms are temperature-dependant. Both rates can increase with warmer weather.²¹⁰ In fact, field and laboratory studies have shown that temperature is the most important determining factor with respect to transmission of a viral agent by a vector.²¹¹ A changed climate could allow vectors and the diseases they carry to spread to, and survive in, new territories. Therefore, in the future, Ohioans could suffer from diseases only previously seen in other parts of the country.

Lyme disease, Rocky Mountain Spotted Fever, and ehrlichiosis are three diseases spread by ticks in Ohio.

Lyme disease is endemic to several regions of the United States and accounts for more than 95 percent of all reported cases of vector-borne illness in the country.²¹² From 1984 to 1996, 489 cases of Lyme disease were reported in Ohio.²¹³ Most cases are reported during the summer months when ticks thrive, but a warming trend could increase Ohio's tick population, while warmer winters will permit people to enter tick-infested habitats earlier in the season, thereby increasing the risk for transmission of the disease.²¹⁴ For example, the first case of Lyme disease in Ohio in 2000 was reported in January.

If left untreated, Lyme disease causes chronic conditions such as arthritis, neurological symptoms, and cardiac problems. Early symptoms include a rash or ring lesion at the site of the tick bite, fatigue, headache, neck pain, stiffness in muscles and joints, fever, and swollen glands. The rash may not develop for more than a month, if it does at all. Chronic disease symptoms may develop weeks, months, or even years after being bitten.²¹⁵

Rocky Mountain Spotted Fever (RMSF) occurs annually in Ohio, with cases numbering in the double digits. It is a disease of late spring and summer that most often occurs in Clermont and Lucas counties.²¹⁶ Global warming, however, could broaden the lifespan and range of the tick that carries the disease, allowing RMSF to pose a health threat during even more months out of the year. RMSF is caused by bacteria that can be transmitted to humans by the bite of the American dog tick. The tick is found throughout Ohio, particularly in areas with tall grass and weeds, such as uncultivated fields and meadows. They cling to grass at the edges of paths or animal trails, waiting to latch onto an animal or human.

RMSF can be fatal. Ohio recorded eighteen deaths since 1964, including one in 1996.²¹⁷ Symptoms can include sudden fever, headache, and muscle pain, usually followed by a rash that first appears on the arms and legs, before spreading to the trunk, palms, and soles. During the early stages of the disease, it may be confused with other illnesses, including meningitis.²¹⁸

Ehrlichiosis is a relatively new disease caused by a bacteria carried by the Lone Star tick. The first documented case of human infection occurred in 1986. Since then cases have been recorded from the southeastern United States to the Great Lakes. In Ohio, the Lone Star tick has established itself in Jackson and Lawrence counties.²¹⁹ Studies on deer in the area show that these animals test positive for Ehrlichia. Gallia and Adams counties also had positive blood tests from deer,²²⁰ and health officials are closely watching the potential spread of this disease to humans. Symptoms of Ehrlichiosis appear 7–21 days after infection and include sudden fever, headache, and muscle pain. In severe cases hospitalization may be necessary.

Other more exotic and frightening diseases also could become more prevalent as the weather gets hotter and wetter. Many of the organisms and processes linked to the spread of infectious diseases are especially influenced by climate variations, such as temperature, precipitation, and humidity. Therefore, climate change can be expected to cause shifts in the patterns of infectious diseases and where they are seen worldwide.²²¹ For example, public health officials throughout the world are seeing an alarming resurgence of mosquito-borne infections, such as malaria, and arboviruses (viruses borne by arthropods), like dengue fever.

Disease outbreaks are occurring more frequently in the United States due to factors such as increased immigration and travel abroad by Americans who bring diseases home. Once a parasite that causes a disease is brought into a state by travelers, a warmer climate can foster faster growth of the parasite, as well as the host organism, thus increasing the risk of local transmission. Some diseases spread by mosquitoes that could pose new threats in Ohio are malaria, West Nile encephalitis and La Crosse encephalitis.

La Crosse encephalitis already occurs in Ohio. Over 810 cases were reported in the state from 1963 to 1996.²²² Six of those cases proved to be fatal. Children under the age of fifteen are especially vulnerable. During 1996, Ohio reported 30 cases of La Crosse encephalitis, with one fatality, an eight year-old from Scioto County.²²³ La Crosse encephalitis causes inflammation of the brain. While the disease can cause serious illness and hospitalization for some, others may only develop symptoms of headache or fever. Thus, the Ohio Department of Health believes many cases may go

unreported each year. Seizures commonly are associated with children who are infected with La Crosse encephalitis. There is no specific treatment, other than supportive care.²²⁴

The State of the Science

Although the average temperature worldwide is increasing, hence the term “global warming,” the story becomes more complicated at the local level. One reason is that the warmer atmosphere holds greater amounts of water, resulting in more precipitation. Another is that warmer air means changes in wind patterns. The resulting weather changes will vary from place to place. In general, we can expect more extremes—more heat waves, more storms, wetter climates in some places, drier climates in others, and even cooler temperatures in certain areas. Many scientists, therefore, prefer the term “global climate change” to “global warming.” In this report, we use the two terms more or less interchangeably.

Our current understanding of the potential impacts of climate change is limited by a number of factors. Climate models that project climatic changes and their impacts are still being developed and perfected. Natural climate variability and other factors such as air quality, land use, population, water quality, health care infrastructure, and the economy can also impact projections. A few scientists even argue that countervailing climactic forces, such as sulfur dioxide, actually are cooling the atmosphere. However, the majority of climate scientists agree that greenhouse gases produced by humans are changing Earth’s atmosphere and that now is the time to take action on a global level.

Forecasting models are gaining credibility every day as weather patterns and other environmental occurrences confirm projected scenarios. In addition, scientists continue to uncover data that supports the occurrence of climate change. For example, a study published in the summer of 1999 in the scientific journal *Nature* examined Antarctic ice cores. Scientists found that atmospheric temperatures historically correlate with atmospheric concentrations of the greenhouse gases carbon dioxide and methane. Today, concentrations of these gases appear higher than they have been in the past 450,000 years.²²⁸ Even if certain individuals are able to adapt to changes caused by global warming, some populations will remain susceptible. These individuals include infants, children, the elderly, and the infirm.

Clearly the availability and continued development of better information on the potential impacts of climate change, and the interaction of these impacts with other important factors, is critical if society is to understand the science of climate change and to prepare for the changes global warming could bring.

The disease is caused by a virus transmitted to humans by the treehole mosquito, an insect that breeds in dark, stagnant waters that are often found in tree cavities. The weather extremes predicted to occur as a result of global warming could promote the development of such pools of water, further fueling the spread of this disease. Most cases are reported from August to September, but cases can occur as early as June and as late as October,²²⁵ especially given the recent overall rise in temperatures.

Malaria in Ohio? It sounds unlikely, but consider this: every year Ohioans contract malaria abroad and bring the disease back to Ohio with them.²²⁶ Temperature, precipitation, and extreme weather events can have an effect on the viability and geographical distribution of the anopheline mosquitoes that transmit the disease. Some of these mosquitoes are already found in Ohio. Many scientists estimate that an increase in average global temperatures of several degrees by the year 2100 could increase the capacity of mosquitoes to transmit the disease 100-fold in temperate countries.²²⁷ Although excellent disease surveillance programs and health care infrastructure make a malaria epidemic in the United States unlikely, as the climate warms and becomes more humid, malaria could appear more in Ohio.

West Nile virus has not yet posed a serious threat in Ohio, but that could change. The virus resulted in one of the most recent and disturbing new outbreaks of infectious disease in this country last year. The outbreak

was centered in the New York City area. Until the summer of 1999, the virus had never been reported in the Western Hemisphere.²²⁹ Fifty-six cases were identified as of October 19, 1999, resulting in seven deaths, and the Centers for Disease Control and Prevention feared the virus could travel beyond New York to other states.²³⁰ The virus is carried and spread by infected birds. Mosquitoes bite the birds as they travel, and then bite humans, passing along the disease. Recently government researchers found that some mosquitoes hibernating in New York City are probably carrying the West Nile virus.²³¹

Even **hantavirus**, a deadly virus carried by deer mice, is not inconceivable in Ohio. Nearly half of all cases of hantavirus infection result in death. The geographical range of the deer mouse is extensive. Cases have been reported as far north as Rhode Island.²³²

Weather-Stressed Crops Can Lead to Human Illness

*A drought poses more problems for farmers than just low yields or production losses. Toxins occurring in plants because of drought can pose health risks if not properly monitored.*²³³

—FRED DAILEY, DIRECTOR, OHIO DEPARTMENT OF AGRICULTURE

Ohio ranks 35th among all states in land area. Yet despite its relatively small size, Ohio is a leading agricultural state. While the number of farms declined from about 100,000 in the mid-1970's to 84,000 in the late 1980's, the average farm size has increased.²³⁴ Ohio's main field crops include corn, soybeans, hay, wheat, and oats. Like other states in the Corn Belt, Ohio raises many hogs, sheep, poultry, and cattle. Approximately 10,000 dairy farms in the region supply a vast market in Ohio's industrial centers.²³⁵

The extreme weather predicted to occur because of global warming may hit Ohio farmers hard. Already, last year's severe drought put many field and cattle farmers out of business. For many of those who held onto their farms, money was in short supply, due to reduced crop yields, delayed growing seasons, and livestock deaths from heat stress. Production losses for only part of the drought, up to the end of July 1999, totaled \$422 million.²³⁶ In addition to being subjected to economic and mental stress, recent studies show such affected individuals are more likely to not be able to afford health insurance. For example, three out of every ten Ohio residents (407,000) in families with incomes at or below the Federal Poverty Level reported their most recent insurance status as uninsured.²³⁷ Two out of every three uninsured Ohioans (66 percent) lived in families with incomes at or near the Federal Poverty Level. Finally, among Ohioans living in poverty, more than one in three (38 percent or 509,000) experienced a period without health insurance during the 1997–1998 period.²³⁸

What impacts agriculture affects all Ohioans. As food supplies dwindle, grocery prices go up. But this is not the worst threat. Weather-stressed crops of corn, other cereal grains, and oil seeds, can produce aflatoxin, a naturally occurring toxin that is potentially dangerous to animals and people.²³⁹ This toxic byproduct of certain fungi is known to invade field crops under adverse

environmental conditions, like those predicted to occur as the climate changes. For example, late season moisture can promote fungus growth inside kernels that have been cracked open by drought.²⁴⁰ When ingested, the aflatoxin can result in fetal abnormalities, slow growth, cancer, and liver damage.²⁴¹

Nitrate poisoning poses another threat. During drought, inefficient uptake of fertilizer by certain crops, such as corn, causes nitrate to accumulate in the plants. Nitrate concentrations above 1,000 parts per million can cause health risks.²⁴² In livestock, for example, acute nitrate poisoning may result in breathing difficulty, blue mucous membranes, a rapid weak pulse, dark brown blood, weakness, muscle tremor, or sudden death. Longer exposures may result in abortions and retarded growth.²⁴³ During last year's drought, only 52 percent of all tested samples of corn showed nitrate levels below 1,000 ppm.²⁴⁴

The Precautionary Principle

Legislators and environmentalists often refer to a legal term called "the precautionary principle" when dealing with global warming issues. The term's definition states, "When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically. In this context, the proponent of an activity, rather than the public, should bear the burden of proof."²⁴⁵

This theory comes down to common sense. In practice it is nothing new. An early example of the precautionary principle in action happened in 1854. During that year, London had a cholera epidemic. A doctor by the name of John Snow mapped the locations of local cholera deaths and discovered that most of them occurred within 250 yards of a public water pump. Suspecting that the water pump was the source of the contagion, Dr. Snow had the handle removed, making the pump

inoperable. Miracle of miracles, the plague ended. This was years before the biological cause of cholera was known.²⁴⁶

The precautionary principle has four main components. First, communities have a duty and a right to take anticipatory action to prevent harm. Second, the burden of proof of the harmlessness of a new technology, process, activity, or chemical is the responsibility of the proponents, not the public. Third, communities have an obligation to discuss and to explore a full range of alternatives to the hazards posed. Lastly, decisions must be open, informed, and democratic.

The precautionary principle is no different than practicing preventive medicine. Most of us go to the doctor when we feel that we may be at risk for a certain ailment. In other words, we take action to prevent something bad from happening to us. Global warming requires that same sense of precaution and a willingness to take action.

What You Can Do

Our new data and understanding now point to the critical situation we face: To slow future change, we must start taking action soon.

—D. JAMES BAKER, ADMINISTRATOR,
U.S. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

This paper has reviewed in depth the threats to human health that could result from climate change. The United States has a greater ability to adapt to, and prepare for, these changes than other countries due to our health care infrastructure and strong economy. However, the potential health effects of climate change are real and demand attention. Increased levels of heat, extreme weather events, vector-borne and water-borne diseases, air and water pollution can affect all Americans. The poor, elderly, young, and immunocompromised will be the hardest hit. We have the power to ameliorate the impacts of climate change by decreasing greenhouse gas emissions and investing in strategies that will help us to prepare for what is to come. But we must act now.

Can residents of Ohio do anything to reverse global warming before it creates a perpetual state of emergency? Yes, they can. The number one priority is to lower the use of fossil fuels. Opportunities for doing so are everywhere.

As an added benefit, the energy conservation techniques recommended here to combat global warming are very similar to those desperately needed to cut air pollution. In addition, they can increase our standard of living while reducing economic costs. Our quality of life in the future depends upon the actions we take today.

There is a lot you can do in Ohio, starting now, to combat global warming and bring down consumption of fossil fuels.

1 Demand that electric utilities use low-carbon technologies and renewable energy. Ohio has many dirty power plants that need to clean up their act. Support efforts that require all power plants to meet federal air pollution standards.

2 Get your own house in order. Use energy-efficient light bulbs. Install a solar thermal system to help provide your hot water (carbon dioxide reduction: 720 pounds per year). Recycle all of your home's waste newsprint, cardboard, glass, and metal (carbon dioxide reduction: 2,480 pounds per year). Lower your thermostat in winter and raise it in summer, thereby reducing the demand for electricity and the burning of fossil fuels. When purchasing a home or remodeling, request efficient insulation and energy efficient appliances, refrigerators, and water heaters.

3 Carpool more and drive less. Leave your car at home for one or two days a week and you will save tons of carbon dioxide emissions. Nationally, cars contribute 30 percent of greenhouse gases in the air. The Ohio Environmental Protection Agency estimates that passenger cars and

light trucks are responsible for as much as 45 percent of the ozone-causing compounds that can cause respiratory problems.²⁴⁷ This percentage figure is actually on the rise, due to increased use of light trucks and sport utility vehicles. Do your part, by carpooling and using public transportation whenever possible.

4 If you are buying a new car, go for a more energy-efficient one. Encourage automakers to develop and sell cars, trucks, and sport utility vehicles (SUVs) with better mileage and higher fuel efficiency, or CAFE, standards. At a web site newly launched by the EPA and the U.S. Department of Energy (<http://www.fueleconomy.gov>), you can do a side-by-side comparison and select the most energy-efficient vehicle that meets your needs.

5 Urge the businesses you patronize to become energy-efficient. U.S. businesses spend about \$100 billion on energy each year to operate commercial and industrial buildings. By using energy-efficient products and procedures, organizations could reduce their energy use by 35 percent, or \$35 billion nationally. There are now numerous programs in place to help businesses change their energy usage and save money at the same time. Put your favorite businesses in touch with EPA's Energy Star Buildings program

Where Physicians for Social Responsibility (PSR) Stands

Physicians for Social Responsibility (PSR), the active conscience of American medicine, uses its members' expertise and professional leadership, influence within the medical and other communities, and strong links to policy makers to address this century's greatest threats to human welfare and survival.

While we recognize that uncertainties exist in the measurement of global warming—just as all scientific measurement is uncertain—we are moved to action for several compelling reasons. First, the overwhelming consensus among scientists is that the Earth's temperature is increasing and weather patterns are changing in ways potentially harmful to human health. This fact is overlooked in statements funded by the energy industry that attempt to minimize the severity of global warming. Second, just like businesses, governments, and responsible individuals, PSR feels the need to act decisively in the face of uncertainty to protect those whose welfare has been entrusted to us.

We cannot say exactly when to expect a noticeable increase in floods, or in deaths from asthma among people living in smog-congested cities. No one can. But as Surgeon General Luther Terry stated in his 1962 report on motor vehicles and air pollution, the need for further research should not stop us from taking "all practicable steps to minimize" the hazard. We are certain that fossil fuels play a role in global warming, one step that we can control. For the sake of our own well-being, and that of future generations, we need to act now.

PSR is working to create a world free of nuclear weapons, global environmental pollution, and gun violence. In 1985, PSR shared the Nobel Peace Prize with the International Physicians for the Prevention of Nuclear War.

(1-888-STAR-YES, <http://www.epa.gov/greenlights>), and Climate Wise program (1-800-459-WISE, <http://www.epa.gov/climatewise>).

6 In this election year, work for candidates who are serious about reducing emissions of carbon dioxide and other greenhouse gases. Support senators who have taken a stand in favor of ratifying the Kyoto Protocol to the Framework Convention on Climate Change. Tell your members of Congress that we are not afraid of higher fuel efficiency, or CAFE, standards—for cars, SUV's and light trucks—and they should not be either!

7 Work with local groups and chapters of national organizations to promote awareness of global warming and related issues in Ohio. These include: the Ohio chapters of Physicians for Social Responsibility (northeast Ohio 216-721-2470, southwest Ohio 513-636-8116), American Lung Association of Ohio (800-LUNG-USA or 513-985-3990), American Heart Association Ohio Valley Affiliate (in Columbus 614-848-6676, outside Columbus 1-800-282-0291), Ohio Environmental Council, Inc. (614-487-7506), Ohio Energy Project (614-785-1717), and Sierra Club-Ohio Chapter (614-461-0734).

8 Encourage local, state, and national decision makers and politicians to support the Earth Day Clean Energy Agenda. On April 22, 2000, the 30th annual Earth Day will be celebrated all around the country. This year the Earth Day message includes the Clean Energy Agenda that calls for clean power, clean air, clean cars, and clean investments. A transition to energy efficiency and renewable energy will go a long way in combating global warming. Physicians for Social Responsibility is a member of the Earth Day Network (EDN), a global alliance of environmental organizations working together to battle climate change. Our Death by Degrees report can be used as an educational tool to raise awareness about the potential health effects of global warming as part of a message for the need for cleaner energy. Contact the Earth Day Network (206-264-0144) or visit the web site (<http://www.earthday.net>) for more information about Earth Day 2000 and to find out what events are planned in your area.

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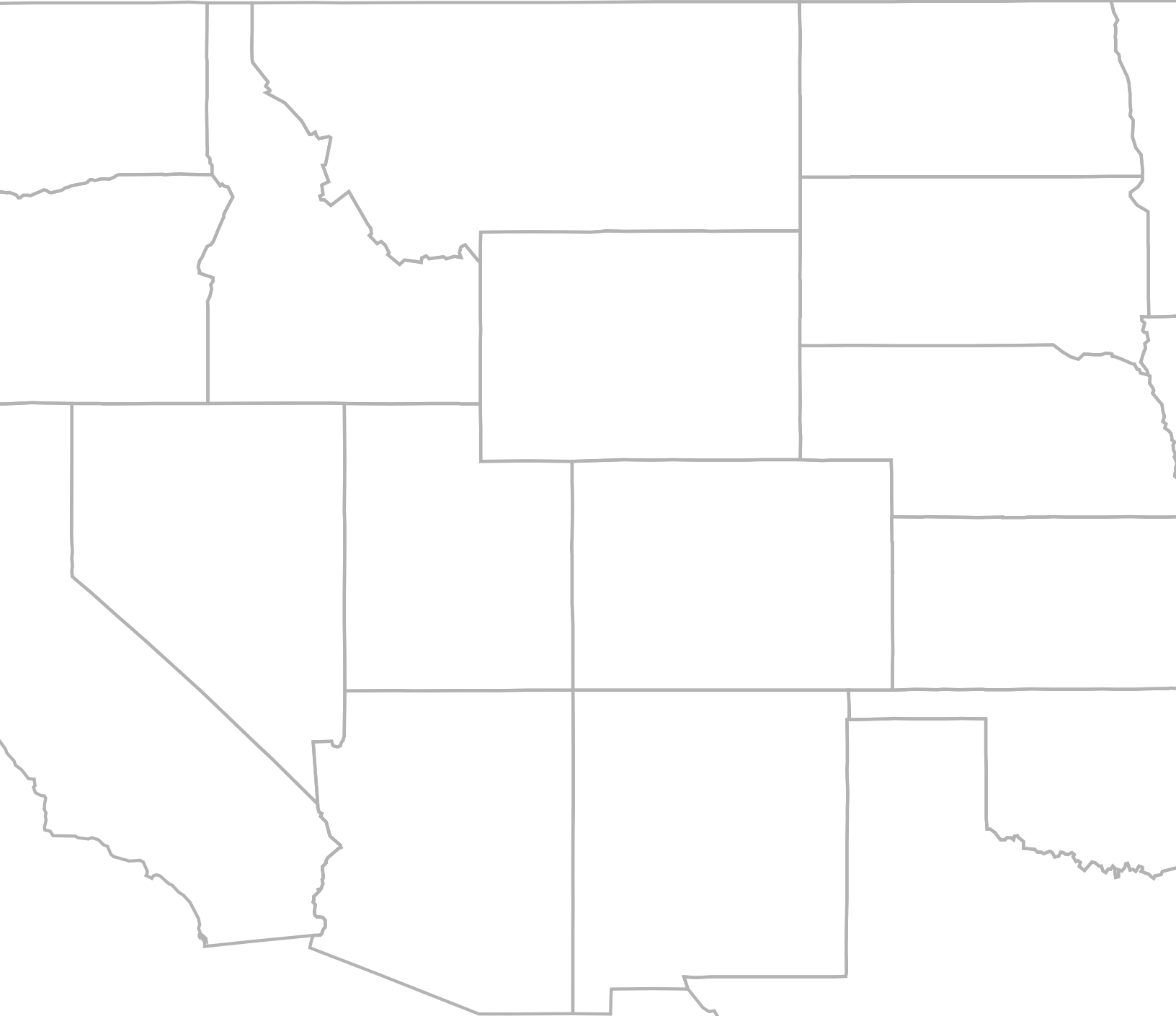
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