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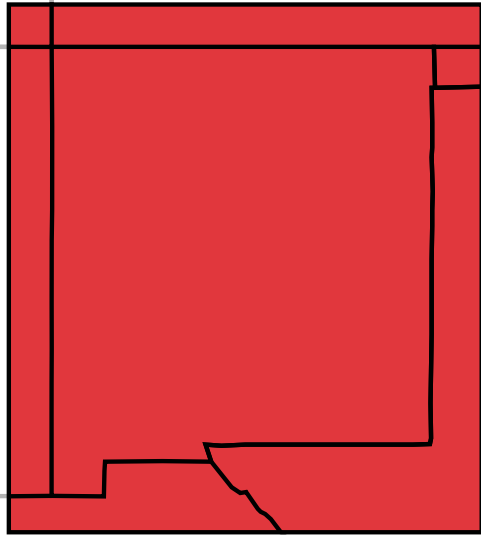
PHYSICIANS FOR
SOCIAL RESPONSIBILITY

DEATH

BY

DEGREES

**THE HEALTH THREATS
OF CLIMATE CHANGE
IN NEW MEXICO**



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This report was prepared by Physicians for Social Responsibility to alert New Mexico residents to the potential 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,
U.S. NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

The world is getting warmer at an unprecedented rate.

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 one 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 New Mexico, a state that may experience increased illness, mortality, and property damage due to changes in temperature and weather.

New Mexico—A State At Risk

New Mexico is a land of striking contrasts. Majestic peaks, such as the Sangre de Cristo Range, tower over the northern regions while the Great Plains stretch across the eastern two-fifths of the state. Ancient cliff dwellings are just a short drive away from high tech space centers. Visitors drawn to such sites often return to settle, adding to the colorful population mix of Native Americans, Spanish Americans, and Anglo-Americans. It is no wonder New Mexico earned the nickname The Land of Enchantment.⁵

Climate change, however, threatens to break the spell of enchantment by bringing in a heavy dose of reality—the potential health threats posed by global warming.

Over the next century, temperatures in New Mexico could change dramatically. Based on projections made by the Intergovernmental Panel on

Climate Change and results from the United Kingdom Hadley Centre's climate model, which accounts for both greenhouse gases and aerosols, by 2100 temperatures in New Mexico could increase from three to five degrees F, depending on the season.⁶

Since 1950 there have been 93 three-day heat waves in Albuquerque. More heat brings more cases of heat cramps, heat exhaustion, and heat stroke. In addition, heat tends to exacerbate the death rate from other medical conditions.

The elderly, infirm, children, and infants will likely suffer the most.

Climate change means extremes. While global warming could cause overall temperatures to rise during the winter months, predictions also include an increase in the frequency and intensity of winter storms and weather extremes, meaning winters with more days of very low temperatures. In addition, the amount of precipitation on extreme wet or snowy days in winter is likely to increase.⁷

Greenhouse gas concentrations increase heat and moisture in the atmosphere. Heat and water vapor create instability, possibly leading to more frequent and more severe weather activity⁸ such as tornadoes and thunderstorms. A warmer atmosphere is capable of holding more water vapor. Excess water vapor will in turn lead to more frequent heavy precipitation when atmospheric instability is sufficient to trigger precipitation events.⁹ Precipitation is estimated to decrease slightly (with a range of 0 to -10 percent) in summer, to increase slightly in fall (with a range of 0-10 percent) to increase by 15 percent in spring (with a range of 5-25 percent), and to increase by 30 percent in winter (with a range of 15-60 percent).¹⁰

New Mexico floods and flash floods could occur more frequently and with greater severity. Already the state has the tenth highest flash flood fatality rate in the nation. Flooding increases the risk of water contamination, gastrointestinal illnesses, and

How Global Warming Could Threaten Health in New Mexico

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 New Mexico could include the following:

- In desert cities, such as Deming, where maximum average summer monthly temperature is already 94 degrees, the predicted 5 degree rise in average temperature over the next century could bring average temperatures up to 99. Heat-related illness and death may result.
- Storms like the crippling winter storms of 1997 could become more common as more of New Mexico's precipitation falls in the form of rain, sleet, and ice.
- Severity and number of flash floods could increase New Mexico's flash flood fatality rate, already the tenth highest in the nation.
- To date 49 cases of hantavirus pulmonary syndrome have been confirmed in New Mexico. 23 were fatal. There is no cure for hantavirus infection and the number of cases of this disease could increase as the climate changes.
- In 1997, 39 adults and children in New Mexico died from asthma and that number could rise with worsening air quality.
- Allergy problems could get worse due to increased pollen and air pollutant levels.
- At least one climate division in the state has suffered from a severe to extreme drought sometime during 56 of the past 102 years, such as the drought experienced by the southern half of the state in 2000, and drought conditions could become even more severe with global warming.
- Increased drought conditions could lead to more extreme forest fires in the state. From 1992-1999 there was an annual average of 1,871 fires in the state burning an average 185,944 acres each year and in March 2000, the National Weather Service in Albuquerque stated that the 2000 fire season will likely pose a potentially higher than average fire danger.

property damage. Floods can also result in cases of bacterial diseases and respiratory problems. They may also help to further carve arroyos into New Mexico's already scarred land. Arroyos, in turn, are prone to flash flooding, so a dangerous cycle could develop.

The forecasted atmospheric instability could also lead to more thunderstorms, hailstorms, and lightning strikes. Deaths in New Mexico as a result of lightning already run at more than three times the national average. If climate change increases the frequency of lightning in the state, the death toll could to rise.

Parallel to the likely increase in heavy precipitation events in winter, increased temperatures may increase water evaporation in the summer, when precipitation is predicted to decrease, thereby drying out soils and vegetation. This may result in more severe and widespread droughts especially where and when atmospheric conditions do not favor precipitation. Other factors that can lead to drought are earlier snowmelts and the drying of the soil as plants increase their water uptake. Soils and reservoirs can retain only a fixed capacity of water therefore excess precipitation in the winter and spring could be lost as runoff rather than stored for summer use when it is most needed.

Drought warrants serious concern in New Mexico. At least one area in the state has been in a severe to extreme drought sometime during 56 of the past 102 years. This trend may continue. There is actually a triple threat for drought in the near future in New Mexico because of the combined effects of global warming, the region's natural tendency toward drought, and a probable new phase of the Pacific Decadal Oscillation, which many climatologists say led to New Mexico's devastating extended period of drought in the 1950's.

Drought also fuels forest fires, increasing the risk of more fires and greater damage from fires in the months and years to come. This is true both for unintentional fires and those intentionally set that may get out of control, like the recent fire in Los Alamos. Fires not only damage wildlife and property, but may also cause health problems. Smoke from forest fires can exacerbate respiratory illness.

Cases of rodent- and vector-borne disease could also multiply. Numerous health experts attribute the emergence of hantavirus pulmonary syndrome in New Mexico to environmental conditions resulting from climate extremes and increased rodent populations. This is a very serious health issue in New Mexico as 23 cases of hantavirus, almost fifty percent of all cases to date, have resulted in death. Health officials have also noted that plague outbreaks are linked to certain climate conditions. This is the same highly contagious disease that victimized most of Europe in the Middle Ages. Ironically, as New Mexico begins the new millennium, diseases that recall ancient epidemics could once again threaten human health.

Diseases that were once only associated with tropical regions, such as malaria and dengue, also may spread into the American Southwest. New Mexico's neighbor, Texas, experienced an outbreak of dengue fever in 1999. Climate change is forecast to produce a warmer and wetter climate that could support larger disease-carrying mosquito and tick populations in the state. In addition to malaria and dengue, mosquitoes can also spread encephalitis. Two forms of this disease already are established in New Mexico: St. Louis encephalitis and Western Equine encephalitis.

The Complex Origins of Climate Change

Since the end of the last Ice Age 10,000 years ago, temperatures worldwide have risen about nine 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 one 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.¹⁵

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 thirty percent. The gases will remain there for centuries, trapping heat and threatening human health.¹⁶

Global warming may also have an impact on air quality in New Mexico. Levels of ozone, the primary component of smog, commonly rise on hotter days. High ozone levels exacerbate asthma and other respiratory illnesses. 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.¹¹

Water quality and availability may also be compromised as the climate changes. Since these issues already warrant serious concern in the state, global warming may spell disaster for New Mexico's water supplies. Among the changes that may occur as a result of global

warming are reduced availability of water due to increased evaporation; reduced water reserves due to early melting of snow packs; altered seasonal cycles of runoff; and, increases in river and stream flow and variability. Low water flows can concentrate arsenic, mercury, and other pollutants in water, making water dangerous to drink or to use for agricultural purposes. Gastrointestinal diseases such as giardiasis and cryptosporidiosis that annually affect hundreds of New Mexicans could also become more common.

Lastly, climate change could impact New Mexico's economy. Many residents make a living from natural resource industries, agriculture, and tourism. These trades are subject to global warming effects. Job loss, decreased income, and an inability to afford health care could all result. This possibility is made worse by the fact that New Mexico already has one of the highest poverty rates in the country, second only to Washington DC.¹² Each year from 1996 to 1998 over twenty percent of all New Mexicans reported they had no health insurance coverage.¹³ Eighty-eight thousand of these individuals were children under the age of 19.¹⁴

New Mexicans need to be deeply concerned about the potential health impacts of global warming. Only precautions taken now can avert the potential health problems of the future. The following sections describe the specific health effects that are predicted to result from global warming over the next fifty to one hundred years. In some cases, there is a high level of certainty about the predictions. In others, the evidence is less definitive. 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.

Many New Mexicans Are Vulnerable to the Health Effects of Climate Change

*Climate change has potentially drastic consequences for our children, our children's children, and ourselves.*¹⁷

—FRED HANSEN, EPA

Many New Mexico 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. Children less than a year old are most sensitive to heat stress because their heat regulatory systems have not fully matured.¹⁸ In addition, a child's higher susceptibility to heat and cold is due to its body surface area being greater by percentage for its weight. A child dehydrates easier 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 a more severe impact on persons suffering from heart and lung diseases.¹⁹

Cardiovascular disease, including coronary heart disease and stroke, is the leading cause of death in New Mexico, accounting for 25.6 percent of all deaths in the state.²⁰ Every day in the state approximately nine people die from heart disease.²¹ Higher average temperatures could further elevate this statistic. 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 New Mexico's population, making greater numbers of people more vulnerable to higher temperatures. For example, 51.7 percent of adult New Mexicans are considered overweight, 23 percent report having a sedentary lifestyle, and 22.6 percent smoke.²² These statistics are even higher for members of the population over 55 years of age.²³

New Mexico's elderly are at risk due to 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 disease. Certain medications commonly taken by the elderly, such as tranquilizers and anticholinergics, also increase susceptibility to heat stroke.²⁴

The state's Native American population may also be especially vulnerable to the effects of climate change. Nationwide, indigenous peoples have the lowest per capita income of any population group.²⁵ More than half of all reservation Native Americans are said to live below the poverty level, which is more than four times the national average.²⁶ Lack of sufficient income may compromise the ability of these individuals to afford proper housing.²⁷ Individuals without air conditioning or refrigerators may be hit hardest in the warmer days to come. Further, a study conducted by the National Center for Chronic Disease Prevention and Health Promotion found that up to 20.4 percent of Native

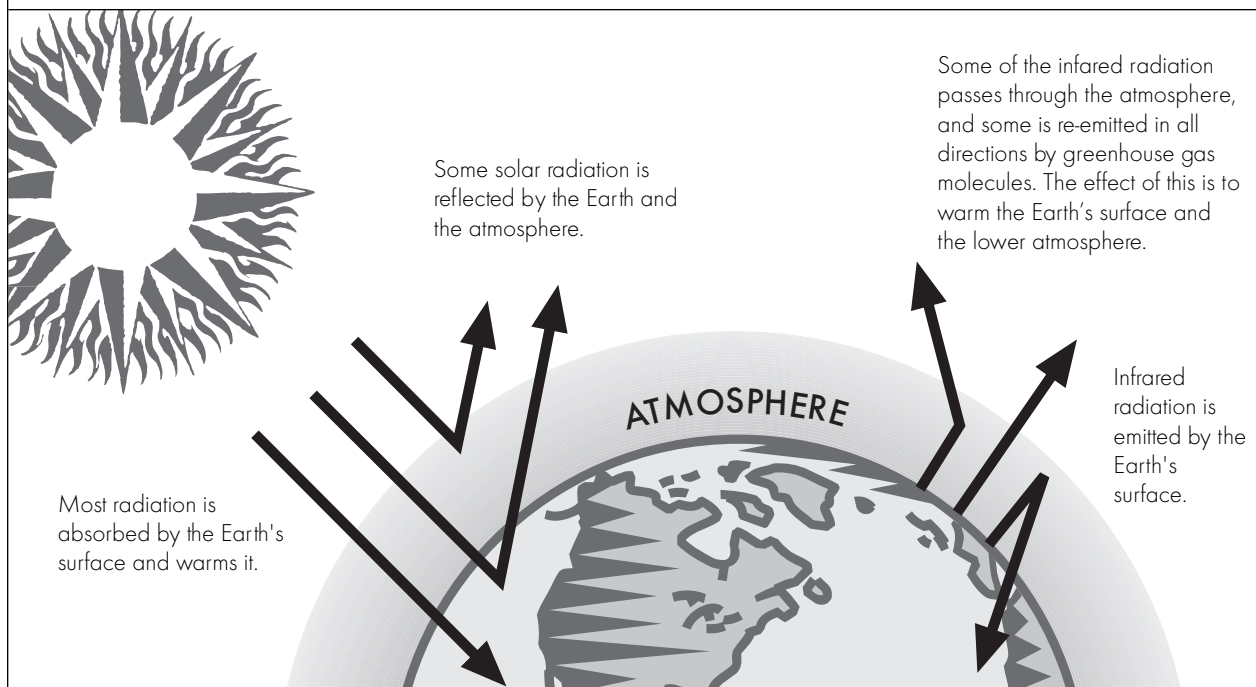
Americans that were polled in New Mexico reported cost as a barrier to obtaining health care. Due to such factors, the state's 134,000 Native Americans may have a harder time preparing for, and combating, the health problems that global warming is likely to bring.

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

Global warming means extremes. Climate models predict not only higher temperatures, but also more unpredictability in weather patterns and more extreme weather conditions, including extremely cold days.²⁸

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.²⁹ All of this could mean more floods, tornadoes, droughts, heat waves, and other natural disasters. While sporadic past weather events do not necessarily indicate a long-term pattern, weather trends in recent years closely correspond to computer models and predictions

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.

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 state of the economy, can also impact projections. A few scientists even argue that countervailing climatic 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. Scientists continue to uncover data that supports the occurrence of climate change. Recently, scientists at the National Oceanic and Atmospheric Administration announced that the winter of 2000 was the warmest winter on record since the United States government began keeping weather statistics 105 years ago.³⁰

This is the third year in a row that the record has been broken.³¹

In March of 2000, two separate studies, one by the National Oceanographic Data Center and the other affiliated with the Scripps Institution of Oceanography, revealed that the world’s oceans have significantly warmed over the past forty years. Researchers say human activities likely contributed to the ocean temperature rise,³² which is predicted to cause even more rapid global warming in the near future.³³ In addition, 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.

Adding to the concern about climate change, European researchers in April 2000 discovered a new greenhouse gas, trifluoromethylsulphur pentafluoride, which is said to be up to 22,200 times more powerful than carbon dioxide.³⁴ The newly discovered gas absorbs heat radiating from Earth’s surface, which contributes to global warming, and lasts for an unthinkable 3,500 years in the atmosphere.³⁵

Today concentrations of greenhouse gases appear higher than they have been in the past 450,000 years.³⁶ Even if certain individuals are able to adapt to changes caused by global warming, some populations will remain susceptible. The most vulnerable 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.

of what climate change could bring, and may well be warning signs. Although New Mexicans may be accustomed to high temperatures and rapid and extreme swings in weather conditions,³⁷ potential changes in weather patterns could prove to be surprising and severe. Already New Mexico sustains major damage from natural disasters. In 1998, insurance losses and federal disaster aid allocated to New Mexico totaled \$26,642,774.³⁸

High temperatures and extreme weather conditions can have wide-reaching health impacts, including illness, injury, and death. They can disrupt electrical power sources, compromise access to public service broadcasts, and

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 salmonella, 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.³⁹

Depending on their severity, extreme weather events can tax, or even cripple, emergency care programs. The consequences could prove disastrous in New Mexico, where the number of hospital beds is only two for every 1,000 people,⁴⁰ one of the lowest rates in the country.⁴¹ The loss of power that often occurs during storms may result in an inability to run oxygen machines and other necessary medical equipment, thereby endangering the health of some New Mexicans. New Mexico is particularly vulnerable to power outages because of its low number of electricity transmission lines. This low number hinders a utility's ability to divert power to other operational systems during a power outage.⁴²

Direct Effects of Heat on Health

*During the late 1990's we saw some of the hottest summers that we've ever had here in New Mexico. They led to big problems, such as drought, more frequent forest fires, and deterioration of the environment. Aquifers were almost pumped dry.*⁴³

—DARYL T. SMITH, MPH, PROGRAM COORDINATOR,
SOUTHERN AREA HEALTH EDUCATION CENTER,
NEW MEXICO STATE UNIVERSITY

The thirteen years from 1987 to 1999 are each among the fifteen warmest years on record. Global land temperatures in 1999 made the year the second hottest year recorded, beaten only by temperatures in 1998. By 2100 temperatures in New Mexico could increase by three degrees F in spring (with a range of 1–5 degrees), four degrees F in fall (with a range of 2–7 degrees), and five degrees F in winter and summer (with a range of 2–9 degrees).⁴⁴ To put this into perspective the average global temperature at the time of the last Ice Age was only nine degrees lower than temperatures are today.

Winters are getting warmer as well. According to data from the National Weather Service, January and February of 2000 were the second warmest start to a year in Albuquerque since record keeping began a century ago. This may be part of a trend, as the four warmest January–February periods in Albuquerque have all happened since 1995. Seven of the ten warmest January–February periods in the past century have come since 1980.⁴⁵ In February 2000, the eastern Plains cities of Tucumcari, Clovis, Roswell, and Carlsbad all averaged seven degrees above normal.⁴⁶ Albuquerque had temperatures that were five degrees above normal.⁴⁷ Higher temperatures could mean more multi-day heat waves. Since 1950 there have been 93 three-day heat waves in Albuquerque.⁴⁸ As temperatures rise, heat waves may become a more common occurrence.

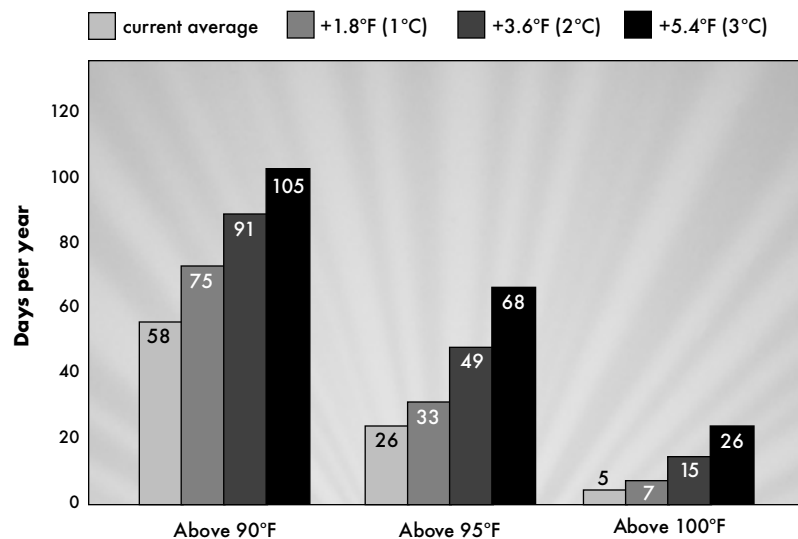
New Mexicans are used to high temperatures, particularly in the southern part of the state, along the lower end of the Rio Grande Valley, and in the Pecos River valley south of Carlsbad. There, the number of days without a killing frost, a period where dew or water vapor freezes as a result of cold temperatures, is already 220.⁴⁹ In desert cities, such as Deming, maximum average summer monthly temperature is 94 degrees.⁵⁰ If predictions hold true the average summer temperature in Deming could rise to 99 degrees. Thus even people in the hottest parts of New Mexico could face an increased health risk from heat stress as temperatures rise to new highs.

Heat can directly affect health. According to the American Red Cross, heat-related disorders are caused by a reduction in, or collapse of, the body's ability to shed heat by circulatory changes and sweating. Such disorders may also develop due to a chemical (salt) imbalance caused by too much sweating.⁵¹ Heat may lead to severe health problems, such as 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, including the elderly, children, infants, and the infirm, will suffer the most. Cardiovascular diseases, like coronary heart disease, also are a risk factor. Compounding the public health burden of heat waves is the fact that as excessive heat increases, so does the death rate from other medical conditions.⁵²

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 that commonly occurs among runners who are not properly conditioned and hydrated. The body can reach

FIGURE 2

Warming Projections for Albuquerque, New Mexico: Current Average Number of 90°F, 95°F, and 100°F Days Per Year Compared to Year 2100 Projections



The graph above illustrates the potential increase in the number of very hot days per year that would occur as a result of global warming by the year 2100. Three scenarios of climate change are shown. Low, plus 1.8°F (1°C); medium, plus 3.6°F (2°C), and high, plus 5.4°F (3°C) were added to a current average derived from historical weather data for the years 1951 to 1980. The medium scenario corresponds to the Intergovernmental Panel on Climate Change's 'best estimate' for the year 2100.⁵³

Source: Environmental Defense

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.⁵⁴ At greatest risk are infants, small children, the elderly, those working or exercising outdoors, persons with impaired mobility, and individuals suffering from cardiovascular disease.⁵⁵ 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.⁵⁶ On average, 400 people die each year in the United States from heat-related causes.⁵⁷ In 1998, there were 26 reported cases of accidental death from exposure to excessive heat or cold in New Mexico.⁵⁸

Health Consequences of Extreme Cold and Wet Weather

*One man died of exposure near Embudo on the 12th after running off the road in his vehicle and trying to walk for help. His snow-covered body was found two days later within several hundred yards of the automobile. Snow came too often and heavy to avoid more widespread shutdown of rural roads and the interstate highways crossing New Mexico.*⁵⁹

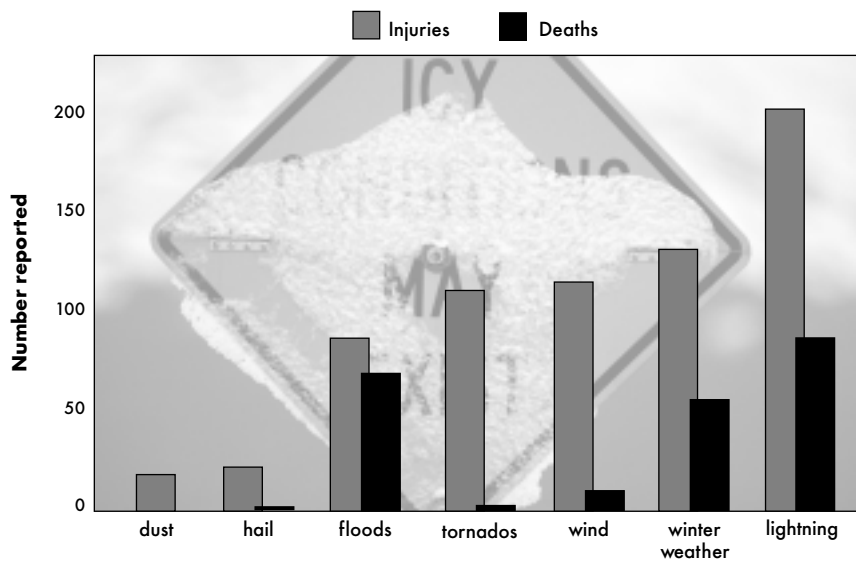
—NATIONAL CLIMACTIC DATA CENTER EVENT DETAILS,
WINTER STORM OF JANUARY 11, 1997

While average temperatures are expected to rise in New Mexico, the increased frequency of weather extremes may also mean more individual days of extremely low temperatures.⁶⁰ Over the next several decades, the state could experience much heavier precipitation that may add to the intensity of winter storms. By 2100, overall precipitation in New Mexico is estimated to increase by thirty percent in winter (with a range of 15–60 percent) and fifteen percent in the spring (with a range of 5–25 percent).⁶¹

Currently, all 32 counties in New Mexico experience severe thunderstorms that produce high winds, large hail, deadly lightning, and heavy rains at some time during the year.⁶² Although the conditions necessary for the formation of severe storms are hard to predict, many scientists expect that warmer winter temperatures will lead to harsher storms in the future.⁶³

If overall temperatures increase, more of New Mexico's precipitation could fall in the form of rain, sleet, and ice, increasing the likelihood of events such as the crippling winter storms of 1997. Just before Christmas of 1997, a snowstorm cost the state 2.5 million dollars in property damages and twenty million dollars in road damage.⁶⁴ During January of that same year, at least seven deaths occurred as a result of exposure.⁶⁵

FIGURE 3
Injuries and Deaths Related to Winter Weather (1959–1997)



The graph shows injuries and deaths for each type of weather that affects New Mexico. Winter weather is second in injuries and third in deaths.⁶⁶

Source: National Oceanic and Atmospheric Administration

Changes in weather in New Mexico can be abrupt and unexpected. A hiker, hunter, farmer, or cross country skier could begin outdoor work or travel in mild and sunny weather, but then unexpectedly face falling temperatures, wind chill, and freezing rain or snow as a storm front moves in suddenly. Those unfamiliar with the relationship between elevation changes and weather patterns may be at most risk. While weather is tranquil in the valley areas, at the same time blustery conditions could exist at higher altitudes, stranding travelers in regions like Clines Corners, Tijeras Canyon, the Continental Divide, Raton Pass, or the Ruidoso area. Even those who are familiar with the dramatic weather changes associated with elevation differences in the state can become lost or stranded in remote areas.⁶⁷

Unexpectedly cold weather and large snowfalls can pose a variety of possible health risks, such as hypothermia, frostbite, cardiac-related deaths, increased risk for automobile accidents, increased risk for falls on weather-beaten surfaces, and carbon monoxide poisoning.

Congestive heart failure is the most frequent reason for hospitalization among older adults.⁶⁸ People with heart problems are vulnerable to temperature extremes because their cardiovascular systems must work harder to keep their bodies at the right temperature.⁶⁹ 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. Recent studies show that cold weather elevates blood pressure that may lead to heart stress and could impair the flow of blood to the heart.⁷⁰ The constriction of the arteries may cause fluid to accumulate in the lungs, and could increase blood viscosity—raising the risk for blood clots.⁷¹

Hypothermia, an unintentional lowering of the core body temperature to or below 95 degrees F, is a deadly medical emergency.⁷² New Mexico has one of the highest death rates in the nation for hypothermia, with one individual dying from this condition for every 100,000 people.⁷³ A majority of cases of hypothermia are due to intoxication, however in some cases weather can be a contributing factor. 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.⁷⁴ An intoxicated person may not recognize these first signs of hypothermia and remain exposed to the cold weather. More serious cases can result in coma, low blood pressure, and cardiac irregularities.

Frostbite occurs when the skin is exposed to temperatures below 23 degrees F.⁷⁵ Such extreme cold increases the size of ice crystals under the skin.⁷⁶ 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.⁷⁷ At the final level, affected areas may have to be amputated.⁷⁸

Automobile accidents pose another winter risk in New Mexico. During a winter storm on January 5, 1977, when snowfall measured up to nineteen inches, the National Climatic Data Center attributed two fatal accidents directly to the weather. In one accident, a car traveling south of Carrizozo spun out of control on icy roads and collided with a school bus, killing a 27 year-old passenger. A passenger was also killed near the town of Tucumcari when a van slid off a road packed with snow, causing the vehicle to turn over several times.⁷⁹

Pedestrian falls on icy pavements, which can lead to injuries and even death, may also increase in number during inclement weather. New Mexico has one of the highest death rates from falls in the nation.⁸⁰ Slippery and uneven surfaces, which often occur as a result of winter storms, are listed as a primary risk factor.⁸¹ Even moderate injuries sustained in a fall may increase the risk of premature death.⁸²

Carbon monoxide poisoning poses yet another winter health risk in New Mexico. Carbon monoxide poisoning is the leading cause of non-intentional poisoning deaths in the United States.⁸³ It 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.⁸⁴ Carbon monoxide can attach itself to hemoglobin, impairing the oxygen-carrying capacity of the blood and starving a body's tissues and organs of oxygen.⁸⁵ Carbon monoxide poisonings can occur during blizzards when people sit in idling automobiles with exhaust pipes blocked by snow.⁸⁶ Poisonings may also occur during power outages, when people often use unvented residential appliances such as stoves and heaters.⁸⁷ Kerosene and propane-fueled space heaters, gas-fueled log sets, and cooking devices used improperly for heating can also expose people to potentially hazardous levels of carbon monoxide.⁸⁸ The New Mexico Poison Center received 319 calls regarding accidental carbon monoxide poisoning in 1997 and the number of calls has been on the rise in recent years.⁸⁹

Risks Posed by Tornadoes, Winds, Thunderstorms, Hailstorms, and Lightning

*Climate change will be manifested in a catalogue of disasters such as storms, droughts and flooding unparalleled in modern times.*⁹⁰

—INTERNATIONAL FEDERATION OF RED CROSS AND RED CRESCENT SOCIETIES

Climate change could increase the likelihood of more turbulent windstorms by increasing atmospheric instability. Severe windstorms and tornadoes already are cause for concern in New Mexico. New Mexico currently averages ten tornadoes per year.⁹¹ Between January 1993 and September 1999, 37 injuries in the state resulted from high winds and tornadoes.⁹² Two of these injuries were sustained as a result of thunderstorm winds that hit the Los Chavez area on May 24, 1999. Winds estimated at 80 miles per hour destroyed fifteen mobile homes and damaged 150 other homes from Los Chavez to Tome Hill between Los Lunas and Belen. Fortunately, residents had an hour notice to evacuate the area, minimizing the potential number of injuries.⁹³

Wind by itself can lead to injuries, but when combined with cold temperatures, dangerous wind chill can develop.⁹⁴ According to the National Weather Service, wind chill is based on the rate of heat loss from exposed skin caused by the combined effects of wind and cold. As the wind increases, heat is carried away from the body at an accelerated rate, driving down body temperature.⁹⁵

Wind also may result in dust storms. Dust storms usually strike suddenly and without warning, bringing with them an advancing wall of dust and debris that can be miles long and several thousand feet high.⁹⁶ Dust storms often last only a few minutes but, in that time, blinding, choking dust can quickly reduce visibility, making driving conditions hazardous.⁹⁷ A sudden dust storm near Roswell on July 13, 1998, resulted in a six-car pileup that the National Climactic Data Center attributed to low visibility. At least two people required hospitalization and six others were injured.⁹⁸

Breathing dust particles can also lead to a number of health problems. During dust storms, high winds cause dust to become airborne from areas with exposed dry soil, including the surrounding desert, dirt roads, and areas disturbed by construction or other earth-moving activities. From January 1995–March 1997, Doña Ana County, New Mexico experienced 171 exceedances of



the National Ambient Air Quality Standards (NAAQS) for particulate matter (PM). 168 of the 171 exceedences in Doña Ana County were caused by windblown dust raised by high winds. Dust storms were especially frequent and severe in 1996, in part because of the extreme drought this area experienced from fall 1995 through spring 1996.⁹⁹

The NAAQS for short-term (24-hour) average concentration of PM₁₀ is measured in units of micrograms of particulate matter per cubic meter of air

(=ug/m³). To meet the standard, the daily 24-hour concentration must not exceed 150 ug/m³ more than once per year, averaged over three years.¹⁰⁰

Concentrations of 155–254 are considered unhealthy for sensitive groups. General health effects include an increased likelihood of respiratory symptoms and aggravation of lung disease. People with respiratory disease, such as asthma, should limit moderate or heavy exertion. At levels between 255–424 there is an increase in respiratory symptoms and an aggravation of lung disease, especially for children, the elderly, and people with respiratory disease. Levels over 425 micrograms per cubic meter are considered hazardous and there is a serious risk of developing respiratory symptoms and aggravating lung disease. Everyone should avoid any outdoor exertion.¹⁰¹

Sand storms pose yet another wind-driven health risk. Just as wind can carry dust for miles, it may also move incredible amounts of sand. In addition to damaging crops and buildings, sand storms create hazardous driving conditions. A sand storm in southern Chaves County on April 13, 1999, created zero visibility along New Mexico Highway 2.¹⁰² The poor visibility was linked to two separate multi-car pileups with at least three injuries, before state police closed the road.¹⁰³

Climate Change May Reactivate Colorado Plateau Sand Dunes

The Colorado Plateau sand dunes, located in Colorado, Utah, Arizona, and New Mexico, have been stable, for the most part, during the past 100 years.¹⁰⁴ The word “stable,” when used in reference to sand dunes means that wind and other natural forces do not easily disturb the sand. Without such stability, the dunes could fuel damaging sand storms in each of the four plateau states

Two factors help to keep the dunes in check: wind and plants.¹⁰⁵ In order for plants to grow, a careful balance between precipitation and potential evapotranspiration, or water intake and evaporation by plants, must be present at the site.¹⁰⁶ Climate change could impact both stabilizing factors.

Global warming is predicted to increase the likelihood of more turbulent windstorms by increasing atmospheric instability. If wind is strong enough, it could break up the dunes, sending millions of grains of sand hurtling through the air. In New Mexico, this could especially affect dunes in the southern and northwestern parts of the state, where some active dunes exist alongside the stable ones.¹⁰⁷

Even more importantly, climate change is likely to affect the amount of vegetation that exists on the dunes. Vegetation is the primary reason that the Colorado Plateau sand remains mostly immobile.¹⁰⁸ Through compaction by roots, protection by leaf cover and overall moisture control, plants and trees like sagebrush, grasses, pinyon pine, and juniper allow the dunes to stay in place. Since global warming is predicted to change the species composition, geographic range, health, and productivity of trees and plant life,¹⁰⁹ vegetation growth on the dunes may be compromised.

If the dunes were activated, the biggest health, lifestyle, and economic impacts would be suffered by the Navajo and Hopi peoples, whose reservation land is either on, or downwind of, the largest areas of sand dunes.¹¹⁰ Sand storms could damage structures and have a negative effect on these Native Americans’ living conditions.¹¹¹ Sand could also cover grazing ground used for raising sheep and cattle, two animals important to the economy of the Navajo and Hopi.¹¹² Dry farming, another important income source, could also be affected.¹¹³

Thunderstorms and Lightning

Climate change could also heighten the likelihood of more turbulent thunderstorms by increasing atmospheric instability. Lightning from such storms can be dangerous and deadly. From 1980 through 1995, 1318 deaths nationwide were attributed to lightning,¹¹⁴ with New Mexico having the highest rate of fatality.¹¹⁵ According to the National Weather Service, New Mexico's average for lightning deaths per one million people was three times the national average between 1959 and 1993.¹¹⁶

Lightning can cause unconsciousness, cerebral bleeding, brain damage, and severe burns. It can also stop a victim's ability to breathe.¹¹⁷ This is not surprising when one considers that a single bolt of lightning could power a 100-watt light bulb for more than three months.¹¹⁸ Most lightning deaths and injuries occur outside. However, on April 29, 1999, an El Rito woman suffered burns in her own home when lightning broke several of her house windows.¹¹⁹

Landslides

Increased storm activity that is predicted to accompany global warming could heighten the risk for landslides, as one of the main triggers for this natural disaster is abnormally high precipitation.¹²⁰ According to a U.S. Geological Survey study, almost the entire state of New Mexico is already very susceptible to landslides.¹²¹ Landslides can damage property and cause injuries.

Hail Storms

*Most counties across the eastern half of the state will see large hail ranging from golf ball to softball at least 4 to 6 times during the spring and also during the summer thunderstorm season. Counties in the central and western areas will see damaging hail at least twice each year.*¹²²

—NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

If, as predicted, climate change brings with it more extreme weather conditions due to increased atmospheric instability and increased levels of precipitation, dangerous hailstorms are also likely to occur more frequently and cause greater harm. Hail develops when strong rising currents of air carry water to a height where freezing may occur.¹²³ Ice particles grow in size, until they become too heavy to be supported by the updraft and fall to the ground in the form of hail.¹²⁴ Hailstones often fall at speeds exceeding one hundred miles per hour¹²⁵ and can injure or kill humans, plants, and animals. On July 23, 1998 a brief, heavy thunderstorm produced copious small hail and gusty winds at Santa Fe, injuring two men.¹²⁶ Larger hailstones can pose an even greater danger. In New Mexico hailstones have been measured at four inches and larger, which is about the size of a large grapefruit.¹²⁷ Large hail causes nearly one billion dollars worth of damage to property and crops annually.¹²⁸ A hailstorm caused extensive damage in Belen, Tome, and Los Lunas on May 24, 1999.¹²⁹ According to the National Climatic Data Center, on August 4, 1998, the death of an individual in Kingston was attributed to a hailstorm.¹³⁰

More Illnesses, Injuries, and Fatalities Associated with Flooding

*A young man drowned while trying to cross the Hunters Point arroyo on Navajo Tribal lands southwest of Gallup. Two men and their vehicle became bogged in the arroyo. The survivor reported being hit by three waves of water and mud. The last wave separated the victim from the vehicle. His body was recovered seven miles downstream.*¹³¹

—NATIONAL CLIMACTIC DATA CENTER REPORT, SEPTEMBER 21, 1997

Floods and flash floods occur frequently in New Mexico. In 1999, at least 51 incidents of flooding were reported in the state.¹³² 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.¹³³ From January 1993 to September 1999, floods caused at least sixteen injuries and one death in New Mexico.¹³⁴

Two key contributors to flash floods are rainfall intensity and duration.¹³⁵ Given the forecasted rise in precipitation throughout New Mexico of ten to sixty percent by 2100, depending on the season,¹³⁶ more floods could be on the way. The amount of rain on extremely wet days is also predicted to increase due to climate change. Predicted warmer temperatures could also increase spring snowmelts in the state, further creating flood conditions.¹³⁷ This may especially endanger regions near the Sacramento Mountains, where precipitation and snowfalls can measure around 24 inches per year.¹³⁸

New Mexico flash floods may become more frequent and severe. Already New Mexico has the tenth highest flash flood fatality rate in the nation.¹³⁹ Flash floods occur within a few minutes or hours of heavy rains, a dam or levee failure, or a sudden release of water held by an ice jam. Their power is tremendous. Flash floods can roll boulders, tear out trees, destroy buildings and bridges, and carve out new channels. Rapidly rising water can reach

New Mexico's Arroyos and Flash Floods

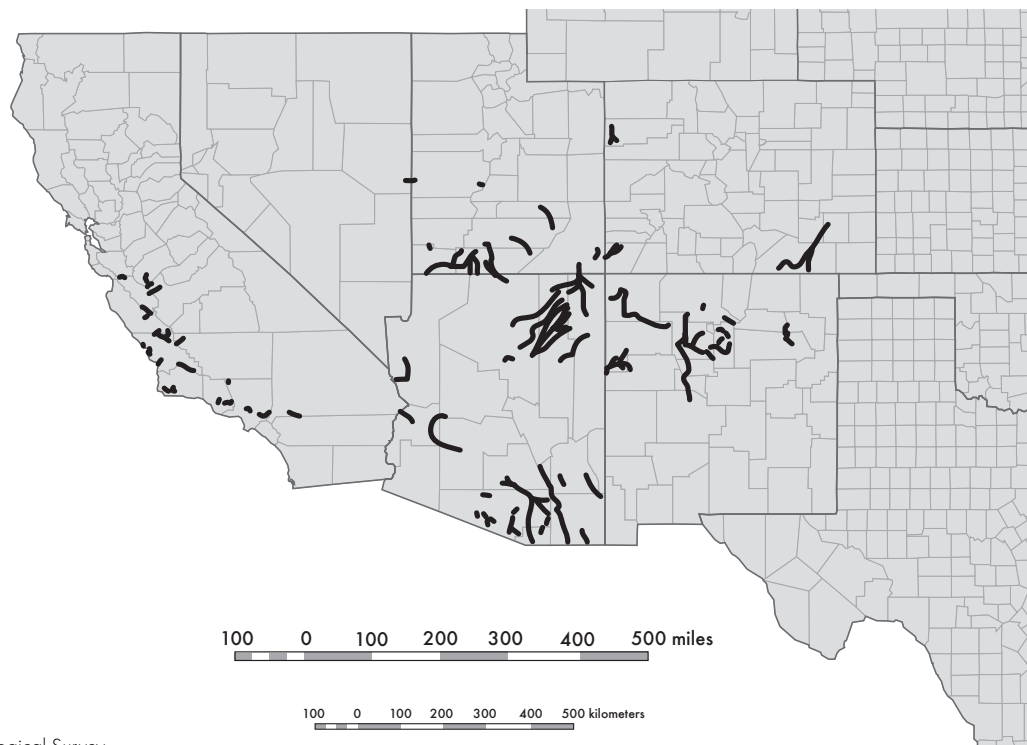
Arroyos can fill with water very quickly and flash floods can develop in less than a minute. These water-carved gullies or normally dry creek beds are most common in the arid and semi-arid climates of the Southwest. In addition, excessive deposits of sediment from upstream arroyos can fill downstream channels that otherwise would store floodwaters, thereby reducing the natural regulatory functions of stream channels and increasing flood severity.¹⁴⁰

In addition to creating conditions suitable to flooding, arroyos decrease agricultural productivity. As soon as arroyos begin to develop, the surrounding water table is lowered, making irrigation difficult. Further arroyos can deposit unproductive sediment from within the arroyo channel to downstream agricultural land where it is unwanted. As a result,

farmers may have to change their agricultural practices or be forced to relocate.¹⁴¹

Most arroyos in New Mexico are in the northwestern part of the state and in Grant County. The principle cause for arroyo formation is thought to be changes in climate that produce heavy rainfall.¹⁴² The most recent period of widespread arroyo formation occurred from 1865–1915. Since then, new arroyo formation has slowed, but existing arroyos have undergone widening, deepening, and changes in bed levels. Flooding and heavy rains that can cause arroyo formation are exactly what some climate change models predict. Thus, the future may bring the state not only more new arroyos, but also more frequent and severe flash floods.

FIGURE 4
Map of Documented Arroyos in the Southwest¹⁴³



Source: U.S. Geological Survey

heights of thirty feet or more. Because these events happen so suddenly, and with limited warning, most flood deaths are due to flash floods.¹⁴⁴

Many people underestimate the dangers of flash floods, because it is hard to believe that just an extra foot or two of water can prove to be deadly. Actually, water weighs 62.4 pounds per cubic foot and typically flows downstream at six to twelve miles per hour. Two feet of water is enough to overtake most automobiles. Many flash floods occur at night, increasing their danger and making it extremely difficult to plan an appropriate course of action that will get people to safety.¹⁴⁵

Floods endanger human health. Floods can also cause psychological stress ranging from depression to post-traumatic stress disorder, as residents may be displaced from their homes and could suffer economic losses.¹⁴⁶

Floodwaters contaminated with bacteria and parasites may 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. In individuals with suppressed immune systems this condition can persist and even be fatal, depending on the disease involved. Two of the greatest threats of gastrointestinal disease are from giardia and cryptosporidium.

- **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 fifteen years, *Giardia lamblia* has become recognized as one of the most common causes of waterborne human disease in the United States.¹⁴⁷ In 1998, 238 cases of giardiasis were reported in New Mexico.¹⁴⁸ In 1999, that figure rose to 265.¹⁴⁹ 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.¹⁵⁰ Symptoms of the illness include diarrhea, stomach cramps, upset stomach, and slight fever. Cryptosporidiosis can be serious, long lasting, and sometimes fatal for people with weakened immune systems.¹⁵¹ In New Mexico in 1999 there were 42 reported cases of cryptosporidiosis. In 1998, there were 48 reported cases in the state.¹⁵²

Floodwaters can contain human and animal fecal material. Sources include overflowing sewage systems and flooded pastures and croplands treated with fertilizer. New Mexico's farming communities, in particular, face risks when 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.

Flooding can also increase the risk of respiratory problems that are caused by particles released by bacteria, fungi, molds, and related organisms that can proliferate due to excess moisture in buildings. Respiratory problems may be caused by the chemicals used to disinfect flooded living areas as well. 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.¹⁵³

Human contact with rats and snakes can increase after floods, as they move into buildings to escape floodwaters. Rats can carry disease and parasites, while snakes may be poisonous and difficult to locate in buildings. Bites from non-poisonous snakes may also be dangerous if the wound becomes infected.¹⁵⁴

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. Increased temperatures may increase water evaporation in all seasons, especially the summer, when precipitation is predicted to decrease. Earlier snowmelts caused by climate change could also bring more droughts to New Mexico. Soils and reservoirs can retain only a fixed capacity of water therefore excess precipitation in the winter and spring may be lost as runoff. Making matters worse, higher temperatures could increase the drying of the soil as plants increase their water uptake. These factors are likely to result in more severe and widespread droughts where and when atmospheric conditions do not favor precipitation.

In the near future, New Mexico, and the rest of America's Southwest, may face up to ten years of severe drought.¹⁵⁵ Three indicators point to this forecasted decade-long drought: global warming, the region's natural tendency toward drought, and a probable new phase of the Pacific Decadal Oscillation (PDO), a fairly regular twenty to thirty year pattern of high and low pressure systems over the northern Pacific Ocean, off the coast of Alaska and Canada.¹⁵⁶

Droughts warrant serious concern in New Mexico, as they frequently lead to property damage and economic hardship. In addition, droughts can minimize water supplies and may concentrate pollutants and microorganisms in water. At least one area in the state has suffered from a severe to extreme drought sometime during 56 of the past 102 years,¹⁵⁷ such as the drought experienced by the southern half of the state in 2000.¹⁵⁸ Climate experts predict that, nationally, the areas affected by the 2000 drought will suffer damage close to that of the big 1998 drought, the costliest weather disaster in United States history. That drought cost the nation an estimated forty billion dollars in losses. The average annual cost of droughts is more than six billion dollars.¹⁵⁹

Farmers and ranchers are often among the hardest hit by drought. Many New Mexico ranchers grow their own supplemental cattle feed in the form of hay, alfalfa, and winter wheat. Most of these crops failed over the dry winter of 1995–1996 and hay prices rose rapidly into the spring of 1996. With pastures too dry to graze, and ranchers unable to afford high hay and grain prices from other regions, many began to liquidate their herds. As a result, livestock prices fell to as low as seventeen cents a pound, devastating many of New Mexico's ranchers.¹⁶⁰ Droughts also encourage the proliferation of pests that can damage crops.¹⁶¹

Lack of income and monetary losses may directly affect an individual's ability to afford medical insurance and health care. As it stands, New Mexico has the highest poverty levels in the country, with twenty four percent of the state's population reporting that they are in poverty.¹⁶² Family income is a strong predictor of insurance coverage, so it is no surprise that New Mexico has more individuals without health insurance than most states.¹⁶³ If drought reduces the already-low income of many New Mexicans, it may further preclude them from obtaining appropriate health care.

Droughts may also 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.

Water quality also suffers in times of drought because droughts concentrate microorganisms in water supplies. Existing water quality problems in bodies of water like McAllister Lake, McGaffee Lake, Three Rivers, Vermejo River, Chocorica Creek, Raton Creek, Sapello River, and Jemenez River, where pollution and other environmental threats already exist,¹⁶⁴ could be exacerbated.

A pattern of drought punctuated by sudden rains can lead to large increases in rodent populations that can carry diseases such as hantavirus.¹⁶⁵ As outlined by the National Drought Mitigation Center, additional health and social impacts of drought are: reduction in nutrition due to the high cost of food and

stress caused by dietary deficiencies; increased respiratory problems; increased conflicts over water use; reduced quality of life due to changes in lifestyle such as population migrations; reduced or modified recreational activities; and, property loss.¹⁶⁶

More Injuries and Fatalities Predicted to Occur Due to Forest Fires

As the climate warms, trees and forests that have adapted to the specific natural microclimates within New Mexico are predicted to change in range, health, and productivity.¹⁶⁷ Global warming could significantly impact New Mexico's trees, influencing biological diversity and decreasing growth by up to thirty percent.¹⁶⁸ Drought, higher temperatures, and extreme weather events are forecast to wreak havoc on the state's timber stands. Droughts dry out forests, paving the way for forest fires. From 1992–1999, there was an annual average of 1,871 fires in the state burning an average 185,944 acres each year.¹⁶⁹ And, in March 2000, the National Weather Service in Albuquerque stated that the 2000 fire season will likely pose a potentially higher than average fire danger.¹⁷⁰ This is a daunting prediction, based upon past fire rates, and one that already appears to be coming true.

In May 2000, an intentional fire set by the National Park Service flared out of control in Los Alamos. The fire was fueled by 50 miles per hour winds¹⁷¹ and hot, dry conditions in the area. The entire city of Los Alamos was evacuated, as were nearby suburbs, such as White Rock.¹⁷² Hundreds of homes burned to the ground¹⁷³ and at least 28,000 acres were scorched.¹⁷⁴ Smoke from the fire threatened the health of residents, particularly those with

pre-existing respiratory conditions, such as asthma.¹⁷⁵

Climate change could lead to fires of equal, or even greater intensity in the coming years. As exemplified by the Los Alamos event, forest fires destroy homes and other high value property. They may cause injury and fatalities to firefighters and nearby residents. Smoke from fires can cover a wide area and may exacerbate respiratory illness such as asthma and chronic obstructive pulmonary disease.¹⁸⁰

Fires can also cause power outages. In March 2000 unusually dry weather and too few electrical transmission lines led to the state's largest-ever power outage. Officials warn that conditions are right for a similar outage to happen again. The March outage was sparked by a fire that sent smoke rising up sixty-foot transmission towers. The electricity-

The Threat of Burning Radioactive Materials

Fires at sites with radioactive materials pose special threats to the health of the community and of emergency personnel combating the fire. A fire at Los Alamos National Laboratory in May 2000 burned nearly 300 contaminated sites.¹⁷⁶ Air monitoring filters detected the release of radionuclides into the air.¹⁷⁷ After the fire, the loss of vegetation, which normally helps to retain water and soil, increases the risk of flooding. Though laboratory officials insist there is no reason to worry, the attorney general of New Mexico has demanded proof that contaminated run-off from flood conditions will not threaten public health.¹⁷⁸

Although the full range of problems caused by the May 2000 fire are not yet fully known, residents living near Los Alamos may have been relatively lucky. In the aftermath of the fire, a previously little-known study by the Department of Energy came to light. This study, conducted in 1997, postulated what might happen in the case of fire at Los Alamos.¹⁷⁹ Burning plutonium and tritium-contaminated waste would send large doses of radiation into the air. Radioactive ash and dust could blow in the wind for weeks and months after a fire.

conducting smoke triggered a short-circuit that shut down all three transmission lines feeding Albuquerque, the state's largest metropolitan area with 500,000 people.¹⁸¹ Additionally, power was lost to towns along the Rio Grande, from Taos to Gallup. In all 1.6 million people were affected for up to six hours,¹⁸² and power supplies in hospitals, senior care facilities, and health care provider facilities were compromised.

Respiratory and Cardiovascular Disease from Air Pollution 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.*¹⁸³

—INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

*Power plants themselves add to global warming by burning fossil fuels. The persistent haze that hangs over the North West part of the state is discouraging. These power plants burn millions of tons of coal and let the smoke pollute the already parched and overgrazed land.*¹⁸⁴

—BRUCE SCHUURMANN, RADIOLOGIST AND PHYSICIAN, GALLUP, NEW MEXICO

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 that exacerbate allergies. Considering that one of the attractions for visitors and residents of the Land of Enchantment is its reputation for having a pleasant climate and clean air,¹⁸⁵ the possible effects of global warming on the state's air warrant immediate concern.

Smog

Ground-level ozone is the major component of 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. Ozone, or smog, is formed when nitrogen oxides and VOCs, emitted from motor vehicles, power plants, refineries, factories, and other combustion and industrial sources, are heated by sunlight.¹⁸⁶

New Mexico violates national ambient air quality standards for ozone virtually every year. There were five violations of the proposed EPA eight-hour standard for ozone in 1999.¹⁸⁷ This means that the state's air quality had ozone levels exceeding 85 parts per billion (ppb) on those occasions.¹⁸⁸ Doña Ana County has some of the state's worst air.¹⁸⁹

Automobiles also contribute a significant proportion of nitrogen dioxide and VOCs (both precursors of ozone) into the air, and car emissions remain a big problem in New Mexico. In Albuquerque the population has grown by more

than 25 percent since the mid-1970s. By 2015, Albuquerque's population is expected to reach 638,000, an average increase of 5,000 individuals per year. With increased population come more motor vehicles and more drivers.¹⁹⁰ In addition, the leading sources of vehicle-related air pollution in the nation include older, dirtier cars and the incredibly popular sport utility vehicles (SUVs).¹⁹¹

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.¹⁹² 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.¹⁹³ Even moderately exercising healthy adults can experience a fifteen to an over twenty percent reduction in lung function from exposure to low levels of ozone over several hours.¹⁹⁴ And, some healthy people simply are more sensitive to ozone than others, experiencing more ill effects than the average person.¹⁹⁵

A recent Harvard Medical School study has found a link between air pollution and heart problems.¹⁹⁶ An individual's heart rate varies somewhat throughout the day, depending on the person's physical activities and emotions. The heart of a healthy person is generally able to respond quickly to activity changes, such as going from a state of rest to exercising. On days with high ozone levels, the heart function of test subjects showed lower heart rate variability, an indicator that has been associated with heart problems and death.¹⁹⁷ Everyday air pollution may therefore impair the heart's ability to change the speed at which it beats, which could lead to cardiovascular problems and heart-related deaths.¹⁹⁸

The relation between ozone and asthma episodes is of special concern. Asthma is reaching epidemic proportions in the United States, affecting fifteen million people, including five million children nationwide. A leading cause of absences from school, asthma can reduce lung capacity and, if left untreated, can be fatal.¹⁹⁹ In 1997, 39 adults and children in New Mexico died from asthma.²⁰⁰ 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."²⁰¹ 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 1993.²⁰² Asthma accounts for one in six pediatric emergency room visits in the U.S.

Physicians do not fully understand what causes asthma, but warmer weather likely will make it worse because higher temperatures can cause ozone levels to rise. Studies have also shown an association between asthma exacerbations and increased rainfall. The probable mechanism of thunderstorm-associated asthma is release of allergenic starch granules from grass pollen, triggered by rainfall. Increased wind speeds and wind direction may also play a role.²⁰³

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.²⁰⁴ 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.²⁰⁵

Pollen

During March and May of 1999, New Mexico experienced 1,500 grains of pollen per cubic meter of air,²⁰⁶ more than fifteen times the daily average for the state. 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.²⁰⁷ Upper and lower respiratory allergies are also influenced by humidity and floods. The EPA notes that a two degree F warming and wetter conditions could increase respiratory allergies.²⁰⁸

Hantavirus and Other Rodent-Borne Illnesses and the Global Warming Connection

*My worst night, after the doctor told my family that it was only a matter of 2 or 3 hours, my boys stayed with me through the night. And each time when my heart rate would go flat, they would holler at me and shake me and say Hey Dad, it's time to come around. And my heart rate would pick back up enough that at least I'm still here. And that's the only reason that I made it, I believe.*²⁰⁹

—TIM, A HANTAVIRUS SURVIVOR

In May of 1993, a young New Mexico woman, recently engaged and making plans for her wedding, suddenly came down with flu-like symptoms. She probably shrugged off the symptoms as a routine case of influenza and tried to look forward to her upcoming nuptials. The marriage ceremony never took place. The woman became gravely ill and died on May 9.²¹⁰

While on route to the funeral, her fiancée also began to feel sick. A few days before he began his journey he had developed flu-like symptoms similar to what his girlfriend had experienced. His condition worsened. On May 14, he was brought into Gallup Medical Center, where he died shortly thereafter of then-unknown causes. Autopsies were performed on the young couple. Still no cause for death was evident. More deaths followed from the mysterious illness. On May 24, New Mexico doctors and epidemiologists, through a

letter, alerted the medical community that a new and dangerous disease might be emerging in the Four Corners region.²¹¹

After extensive tests on the victims and rodents in the area, researchers solved the mystery. A newly recognized strain of hantavirus, hantavirus pulmonary syndrome, was to blame for the deaths. In essence, a new disease had been identified.

Hantavirus pulmonary syndrome is a virus carried by rodents. In the Southwest it is often spread by *Peromyscus maniculatus*, a common deer mouse. The early symptoms resemble conditions associated with the flu: fever, muscle aches, chills, headache, nausea, vomiting, diarrhea, abdominal pain, and cough.²¹² Symptoms develop within one to six weeks after rodent exposure.²¹³ After several days, initial respiratory problems worsen rapidly.²¹⁴ A victim's lungs may fill with fluid, and the victim may die of respiratory failure. There is no known cure.²¹⁵ As of May 2000, 49 cases of hantavirus pulmonary syndrome have been confirmed in New Mexico.²¹⁶ Almost half of these cases, 23 out of 49, were fatal.²¹⁷ In 1999, there were ten reports of hantavirus in the state and exactly half of these resulted in death.²¹⁸ In April of 2000, New Mexico announced that the disease had moved into the new millennium, as hantavirus was diagnosed in a 38 year-old woman from San Juan County.²¹⁹ Many scientists attribute the emergence of the disease to climate change. A 1993 study by a team of southwest medical experts linked the disease outbreak to a period of high precipitation followed by drought.²²⁰ The heavy precipitation produced an abundance of rodent food resources, such as vegetation and insects. This led to an increase in rodent populations—up to a 20-fold increase over the previous year in some areas. The following drought reduced food sources and rodents were forced to compete for food, water and territory, increasing rodent-to-rodent contact and spreading the disease among the rodent populations. As the increased populations of mice exceeded the carrying capacity of their environments, rodents also moved into less stressful environments such as homes and buildings, thereby increasing the likelihood of rodent-to-human contact. Both increased precipitation and more severe droughts are predicted to occur more frequently in the area due to climate changes brought on by global warming.²²¹

As frightening as hantavirus pulmonary syndrome is, it is not the only rodent-borne disease that threatens New Mexicans. Two other diseases spread by rodents found in the state include plague and rat-bite fever.

Plague is an infectious disease of animals and humans caused by a bacterium called *Yersinia pestis*.²²² People can contract the disease via a bite by an infected rodent flea or by handling an infected animal,²²³ including a family pet.²²⁴ Millions of people in Europe died from plague in the Middle Ages when flea-infested rats inhabited human homes and places of work. Today, modern antibiotics are effective against plague, but if an infected person is not treated promptly, the disease may cause severe illness or death. Most people become ill two to seven days after being infected with plague bacteria.²²⁵ Symptoms include sudden onset of fever, shaking chills, headache, muscle pains, weakness, nausea, vomiting, diarrhea, and often swollen lymph nodes.²²⁶ In 1998, there were nine cases of human plague in New Mexico and 38 plague-infected cats and five dogs with the bacterium.²²⁷ There were six

human plague cases in New Mexico in 1999 from Cibola, Santa Fe, Mora, McKinley, Valencia and Bernalillo Counties. All patients recovered from their infections after treatment with antibiotics. The last plague fatality in New Mexico was in 1994 in an 8-year-old boy from Rio Arriba County.²²⁸

A recent study found a sixty percent rise in human plague cases in New Mexico following wetter than average winter-spring time periods (October–May).²²⁹ Plague has only been in New Mexico since the 1940s, but a large increase in per capita cases occurred in the 1970s and 1980s associated with the wetter than normal conditions. The increased precipitation apparently enhances food resources for small mammals that serve as hosts for the infected fleas. The moister climate may also promote flea survival and reproduction.

The study notes that if future climate conditions become more favorable for reproduction and survival of either wild mammal populations or their flea populations, then the probability of human infection via animal-flea-human contacts will likely increase.²³⁰

Rat-bite fever is a systemic bacterial illness caused by *Streptobacillus moniliformis* that can be acquired through the bite or scratch of a rodent or the ingestion of food or water contaminated with rat feces. Climate change has been linked with increases in rodent populations,²³¹ and thus this factor may be one reason the disease has re-emerged in the state in recent years. In 1996 two young New Mexico boys came down with the disease.²³² The first boy, a fifteen year-old, was taken to his local emergency department on July 2. For three days in a row he had experienced a high fever (up to 104 degrees), shaking chills, nausea, and vomiting. On July 29, a baseball teammate of the patient also sought medical treatment. He had similar symptoms, as well as severe backaches and a sore throat. The boys received extensive antibiotic treatment and support care. As a result, they recovered. Tests later showed that they both had rat-bite fever. It appears that they contracted it by drinking infected water at the site of a baseball field in Farmington.²³³

Given the recent rise in rodent populations, due in part to changes in the climate, the possibility of contracting rodent-borne disease will likely remain a concern for New Mexicans.

More Disease-Spreading Ticks and Mosquitoes Expected

*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.*²³⁴

—ROSS GELBSPAN, CLIMATE AUTHOR

In the warmer and wetter days to come, disease-spreading insects—referred to as vectors—may multiply in number, increasing the human health risks for the diseases they spread. In terms of vector-borne disease, the rate of insect biting and the rate of maturation for the disease-carrying microorganisms are

temperature-dependent. Both rates can increase with warmer weather.²³⁵ 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.²³⁶

A changed climate could also allow vectors and the diseases they carry to spread to and survive in new territories. Therefore in the future New Mexicans could suffer from diseases only previously seen in other parts of the country such as Lyme disease. Lyme disease is carried by ticks. To date all cases of Lyme disease reported in New Mexico were contracted outside the state, but a changed climate could create conditions that would allow the ticks that carry the disease to survive in New Mexico.

Dengue, also called “breakbone fever” poses a frightening threat to the state. Symptoms include muscle pain, fever, headache, chills, nausea and skin eruptions. The disease has already occurred in Texas.²³⁷ In just the past twenty years, there have been at least five outbreaks of dengue in New Mexico’s neighboring Lone Star state. The first three outbreaks were relatively small, but 63 cases were reported in 1980²³⁸ and another 66 were reported in 1999.²³⁹ One individual died from the disease in 1999. Health officials now say that dengue appears to be established in South Texas.²⁴⁰ If mosquitoes infected with dengue move up the Rio Grande corridor, dengue could spread into New Mexico.²⁴¹

Temperature, precipitation, and extreme weather events also can have an effect on the viability and geographical distribution of the anopheline mosquitoes that transmit malaria. Some of these mosquitoes are already found in the Southwest. 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.²⁴²

Generally, disease outbreaks are occurring more often 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.

Two other diseases spread by mosquitoes that pose threats in New Mexico are St. Louis encephalitis and Western Equine encephalitis.

St. Louis encephalitis affects up to 3,000 individuals each year.²⁴³ Though still rare in New Mexico, isolated outbreaks of the disease appear to coincide with climate changes that promote larger than normal mosquito populations in the state, so health officials are again monitoring the progress of this disease.²⁴⁴ The elderly and individuals who work outdoors are especially vulnerable. Many cases only result in fever with headache, but the illness can progress to body paralysis, seizures, coma and death.²⁴⁵ The disease is challenging for medical experts. It occurs in unpredictable epidemics because mosquito surveillance methods are poor or underutilized, prevention tools are limited, treatment is not always effective, and knowledge about its geographic distribution is incomplete.²⁴⁶ Mosquitoes that spread the disease like to breed in dark, stagnant waters. Some weather extremes predicted to occur as a result of global warming could promote the development of such pools of water, fueling the spread of St. Louis encephalitis.

Western Equine encephalitis is a similar disease. It too has already surfaced in New Mexico and is being monitored by health officials. Since 1964, thirteen cases have been reported in the state. Nationwide, there have been approximately 639 confirmed cases. Western Equine encephalitis has symptoms ranging from mild flu-like illness to coma and even death. Like St. Louis encephalitis, this disease is difficult for health experts to treat and prevent. Currently, there is no licensed vaccine for human use and no effective therapeutic drug. Control measures, such as pesticides to kill possibly infected mosquitoes, are potentially harmful to human health and the environment and can be quite expensive. The Center For Disease Control and Prevention states that insecticide applications to control Western Equine encephalitis can cost as much as 1.4 million dollars, depending on the size of the area treated.²⁴⁷

Relapsing fever is spread by ticks in New Mexico. Relapsing Fever is an illness caused by the bacteria *Spirochete*, which is carried by both ticks and wild rodents. Ticks can remain infected for life with the bacteria and can pass it on to the next generation.²⁴⁸ People contract relapsing fever after being bitten by an infected tick. Symptoms, which include fever accompanied by a rash, generally develop 8 days after the tick bite.²⁴⁹ Since the early 1990's, there have been two or three cases of relapsing fever each year in New Mexico.²⁵⁰ Epidemiologists in the state are now monitoring the progress of this disease.²⁵¹

Global Warming's Impact on New Mexico's Water Supply

*Climatic variability and the potential impacts of climate change increase the pressures acting upon the already-volatile mix of borderlands water allocations. Demand for water, in the meantime, continues to grow exponentially. As a result, the region's vulnerability will intensify, and traditional, nagging questions regarding water distribution will become even more pressing.*²⁵²

—DIANA LIVERMAN, UNIVERSITY OF ARIZONA, LATIN AMERICAN AREA CENTER

Water is New Mexico's most valuable resource.²⁵³ Already, the limited surface waters of the state are almost completely allocated through highly contested legal compacts and water-rights agreements.²⁵⁴ Global warming could complicate this difficult issue. Research suggests that climate change will affect precipitation, stream flows, runoff, water temperatures, and evaporation, thereby impacting New Mexico's water supply. Both the quantity and quality of water available could be at risk.

New Mexico residents now legally claim two to three times more water rights than the supply of water believed to exist. Previous estimates for available water in the Southwest varied widely, and it is now believed that even the higher estimates are not sufficient to meet the growing demand. The need for water is accelerating because of high population growth rates in the area and per capita use of water. The latter depends on a variety of factors, including house type, garden style, attitudes regarding conservation, and the cost of water. On average, Albuquerque residents use an enormous amount of water

Ground Water Pumping Leads To Land Subsidence

Groundwater is the principle source of water in New Mexico. But, as for most of the state's water sources, usage exceeds replenishment in many locations.²⁵⁵ This has led to dangerous land subsidence problems in most of the state. Land subsidence is the lowering of the land-surface elevation from changes that take place underground. While over-drafting of aquifers is the major cause of subsidence in the state, this effect is also caused by pumping oil and gas from underground reservoirs, dissolution of limestone aquifers (sinkholes), collapse of underground mines, drainage of underground soils and hydro compaction, or initial wetting of dry soils.²⁵⁶

As stabilizing water is pumped out of the ground, the lowered water pressure in sand and gravel leads to slow drainage of water from clay and silt beds. Support for the clay and silt is reduced and they compact. This, in turn, causes the land surface to lower. The damage to the land is permanent. Even aquifer recharging cannot restore the land back to its original surface elevation.²⁵⁷

The drop in elevation causes major problems. It changes the slope of streams, canals and drains, which can bring even more sediment into New Mexico's already contaminated waters. It may damage bridges, roads, railroads, storm drains, levees, and sanitary sewers. Damaged sewers may bring harmful bacteria such as giardia and cryptosporidium into water supplies. Land subsidence also damages private and public buildings.²⁵⁸ In Albuquerque, underground reservoirs are so overstressed that the foundations of several homes near the downtown area are cracking, an indication that the ground may be settling over air pockets left from an emptying aquifer.²⁵⁹

Earth fissures from land subsidence are, in many places, more than 100 feet deep and several hundred feet in length. These gigantic, hazardous cracks are formed by horizontal movement of sediments that occurs when ground water is pumped.²⁶⁰

Climate change is predicted to create more land subsidence problems in New Mexico.²⁶¹ In areas where global warming results in less precipitation and reduced surface water supplies, communities will pump more ground water. This likely will cause the compressible clay and silt of New Mexico to subside even further. Also, increasing population and water use for agricultural needs, such as irrigation, will further lead to more groundwater pumping, followed by subsidence.²⁶²

Global warming, therefore, could set off a chain of events that literally will scar New Mexico's once enchanted landscape.

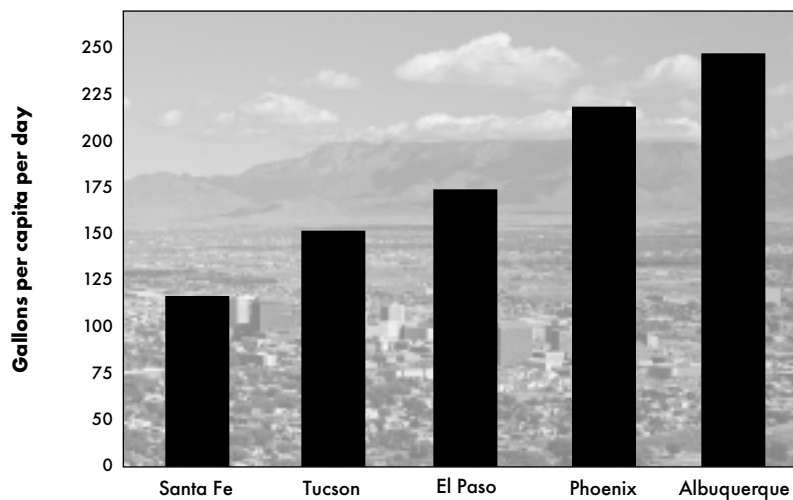
each day, around 250 gallons per capita per day. This is more than twice the per capita use in Santa Fe.²⁶³ The combined effects of over-apportionment and climate change could wreak havoc on the state's already taxed water supply.

While global warming may increase precipitation at certain times of the year, this may not add much to the amount of available water. The water supply forecast for New Mexico in 2000 is for well below average runoff through the spring snowmelt season. Flows of less than forty percent of normal volume are forecast for the Rio Grande, Rio Chama, Upper Pecos River, Gila and Jemez Rivers. Further, predicted flows range from 35 to 65 percent of normal in streams originating in the Sangre de Cristo Mountains.²⁶⁴ These shortfalls may be attributed to changes in soil moisture and evapotranspiration, such as increased evaporation rates, that can occur as a result of global warming.²⁶⁵

A warmer climate that promotes faster evaporation also may increase water salt levels. River salinity is very sensitive to climate change.²⁶⁶ Salt levels in Southwestern waters have been a problem for decades, causing international disputes between the United States and Mexico. Higher salinity levels can make existing water supply unusable or less usable, requiring greater access to alternative water, thus increasing competition for such supplies, which may very well already be allocated.²⁶⁷

About 88 percent of all New Mexicans depend upon groundwater for their drinking water needs.²⁶⁸ As climate change and increased demand reduce the amount of groundwater available, people may

FIGURE 5
Water Consumption in Southwest Cities



This graph illustrates per capita water consumption in Albuquerque and Santa Fe compared to other cities in the Southwest.²⁶⁹

Source: City of Albuquerque

be forced to dig deeper into groundwater regions, heightening their risk of contamination from leaking underground storage tanks, injection wells, landfills, surface impoundments, and oil and gas production sites.²⁷⁰ Additionally, deeper groundwater sources tend to produce high levels of arsenic that exceed state water standards.²⁷¹ This is because water at lower depths taps into volcanic strata water that is naturally high in poisonous arsenic.²⁷²

As groundwater supplies dwindle and become contaminated, users turn to reservoirs on the larger perennial rivers²⁷³ that are in many cases already reduced or depleted. In central and southern portions of New Mexico, adequate water supplies for irrigation and municipal uses already pose concerns.²⁷⁴ In addition to salt and other natural contaminants, surface waters in New Mexico often contain dangerous levels of mercury and fertilizers.²⁷⁵ The latter is not surprising, considering that fertilizer shipped into New Mexico totaled 149,004 tons in 1996 alone.²⁷⁶ There remains considerable uncertainty as to how regional precipitation and waterways will be specifically affected by global climate change, but it is clear that low stream flows can concentrate such water pollutants.

Sedimentation, or increase in the amount of fragmentary material, like soil, in bodies of water, poses yet another problem in New Mexico's surface waters. One of the largest carriers of sediment is the Rio Puerco Basin, which covers 6,177 square miles in the northwestern part of the state.²⁷⁷ It supplies more than 70 percent of the sediment carried by the Rio Grande upstream from Elephant Butte Reservoir.²⁷⁸ This sediment carries impurities and soil

contaminants, like fertilizers, into the state's surface waters exposing more and more people to unhealthy water. Since global warming helps to form sediment carriers, such as arroyos, the problem is likely to persist for many years to come.

The Precautionary Principle

By the time the data is in and the trends are abundantly clear, it may be too late to reverse the trends.

—MACK SEWELL, NEW MEXICO
DEPARTMENT OF HEALTH

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.”²⁷⁹

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.²⁸⁰

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

Never doubt that a small group of concerned citizens can change the world. Indeed, it is the only thing that ever has.

—MARGARET MEAD

This paper has reviewed in depth the threats to human health that could result due to 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 New Mexico 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 New Mexico, 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. New Mexico has 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. New Mexico is part of this growing problem. In the state, population growth could lead to more motor vehicles and longer commutes.²⁸¹ Cars and light trucks are responsible for as much as 45 percent of the ozone causing compounds that can cause respiratory problems.²⁸² 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 (SUV's) 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.

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. PSR is a non-governmental organization in official relations with the World Health Organization.

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

6 Support policies that can help to slow global warming. You can do this by working for and supporting candidates who are serious about reducing emissions of carbon dioxide and other greenhouse gases. Encourage your Members of Congress to increase appropriations for renewable energy research and development, to incorporate carbon dioxide emission reduction requirements into electricity restructuring legislation, and to commit to ratifying the Kyoto Protocol to the Framework Convention on Climate Change, an international agreement that would require countries to lower their emissions of greenhouse gases. In addition, request support for increases in the minimum miles per gallon standards for cars, SUVs and light trucks. More fuel efficient vehicles generate fewer of the harmful emissions that contribute to global warming and air pollution. Tell your Members of Congress to support action under the Corporate Average Fuel Economy (CAFE) law to raise fuel efficiency standards.

7 Work with local groups and chapters of national organizations to promote awareness of global warming and related issues in New Mexico. These include: the New Mexico chapter of Physicians for Social Responsibility (505-884-0112), The National Environmental Trust (505-984-8443), American Lung Association of Arizona/New Mexico (602-258-7505 or 1-800-LUNG-USA), American Heart Association New Mexico Affiliate (in Albuquerque 505-823-8700, in Las Cruces 505-541-6320), Southwest Research and Information Center (505-262-1862), Albuquerque Area Indian Health Service (505-248-4102), Forest Guardians (505-988-9126), Keep New Mexico Enchanting (505-984-1668), New Mexico Rural Water Association (1-800-819-9893), New Mexico Wilderness Alliance (505-843-8696), Tree New Mexico (505-265-4554), The Nature Conservancy, New Mexico Chapter (505-988-3867), New Mexico Wildlife Federation (505-299-5404) and Sierra Club, Rio Grande Chapter (505-820-0201).

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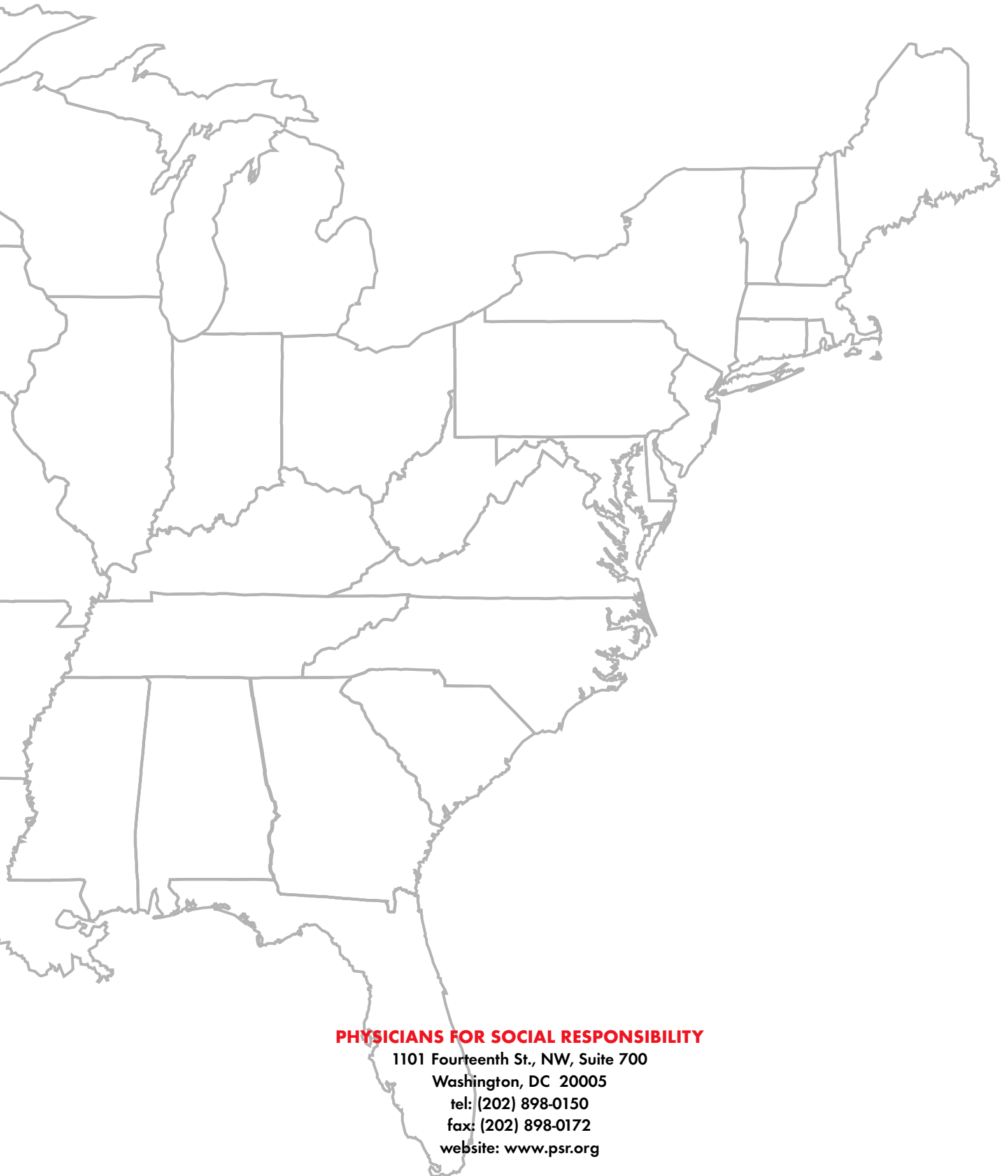
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