fects will be at least as disastrous as the immediate destructiveness of the nuclear weapons themselves.[48]

In the first few days, millions of people will perish. The initial blast, firestorms, heat, radiation, hurricane-strength winds, and choking smoke and dust will cause an unprecedented number of casualties. Even if civilian centers are not targeted, the deaths will be in the millions, for military, industrial, and government centers are often in densely populated areas.[49] In the worst-case scenarios far more people will die in the months and years thereafter. Almost all urban centers will be destroyed. While not everyone will perish, a large percentage of the total population will be burned or poisoned by radiation. The very fabric of life might unravel. With transportation and communication systems severed, power plants destroyed, governments incapacitated, and medical supplies unavailable, the necessities of life will be lacking in many regions. And if several industrial nations were destroyed, there would be little chance of aid from the outside, just as there was after World War II. Indeed, with farmers no longer growing food or unable to transport it to urban areas, the Western world would be threatened by famine, pestilence, and civil disorder not seen since the Middle Ages.[50]

But even worse is the "nuclear winter" scenario, which has come under attack by respected scientists. However, if the doomsday ecologists are on target, global temperatures would plunge, especially in the Northern Hemisphere, to at least –10° F. The world would be in an artificial winter from three months to two years. As a result, the food cycle would be disrupted and millions of people would die.[51]

The Wrath of Mother Nature

"Oh, my God! Los Angeles has vanished! . . . Wait a minute. There's more. Orange County is gone too. And most of San Diego. And . . ." So goes the book *The Last Days of the Late Great State of California* (1968) by Curt Gentry, a California journalist.[52]

Will the end come at the hands of Mother Nature? Today very few scientists believe that natural causes—earthquakes, volcanoes, floods—can precipitate a global catastrophe. To be sure, nature can still get angry and cause great havoc on a regional level. Thousands of people could still die because of one of these upheavals. And for others caught up in such a calamity, their world may in effect come to an end.

Throughout history people have viewed nature with great awe. Earthquakes, volcanoes, tidal waves, floods, and the like have roused terror. Most often the forces of nature were viewed as the instruments of God, but some people saw nature as acting without God. Today a collection

of scientists, prophets, psychics, astrologers, and eccentrics predict widespread natural catastrophes, if not the absolute end of humanity. The calamities that most frequently arouse an apocalyptic excitement include earthquakes, volcanoes, an ice age, and a polar shift.

Earthquakes head the list. Why? A sense of the havoc they can wreak is deeply imbedded in the human psyche. In the Middle East, where much of our thinking is rooted, earthquakes are the most common natural disaster. The Old Testament prophets, Jesus, and John of Revelation spoke of them, as did Nostradamus. And in our day a host of soothsayers including Edgar Cayce and Jeane Dixon have predicted them. Semiscientific seers like Jeffrey Goodman and Immanuel Velikovsky refer to them apocalyptically.[53]

History has witnessed a number of devastating earthquakes. The most deadly earthquake occurred in central China in 1556; approximately 830,000 people perished. The Lisbon earthquake of 1755 killed about 60,000 people. The 1811–12 quake in New Madrid, Missouri, killed few people because of the sparse population. But it shifted the topography of the entire area. Chile experienced a major earthquake in 1960, killing 3,000 people and sinking about 5,000 square miles of land. The worst natural disaster of the twentieth century occurred in Tangshan, China, in 1976 when 242,000 people perished.[54]

Could earthquakes endanger life on earth? Probably not. But one theory conjectures that gigantic earthquakes could impact the rotation of the earth. Scientists know that the earth's rotation wobbles and that this wobble is related to earthquakes and volcanoes. Moreover, even minor variations in the rotation axis can affect climate on the earth's surface and stresses within the earth. But scientists don't know whether an axis shift causes earthquakes or earthquakes cause axis shifts, which could be catastrophic. If the latter, an earthquake might well be indirectly connected with the end of the world.[55]

Volcanoes may be nature's most spectacular expression, but they have not evoked much apocalyptic excitement. While they had a role in the end-time scenario of the Norseman, they play little role in the Christian and Western traditions. Moreover, unlike earthquakes, which strike without warning, volcanoes send a clear signal before erupting. Thus, if humans perish, it is usually because they failed to evacuate the area.[56]

Still, there have been at least two doomsday explosions in modern times. Perhaps the most devastating eruption took place in 1883 on Krakatoa, an island in what is now Indonesia. The explosion could be heard nearly 3,000 miles away, and about 37,000 people perished. In 1902 Mount Pelée blew up on Martinique in the Caribbean. About 40,000 died, largely because they failed to heed the ample warnings.[57]

A more likely but far more distant threat to world survival is ice. Scientists say that ice ages occur in cycles that last perhaps 100,000 years. Between these ice ages are balmy interludes, but they are the exception not the rule. Geologists insist that a new ice age is all but inevitable; sheets of ice will again spread over much of the Northern Hemisphere.[58] We are now about halfway through the warm interlude. In about ten to fifteen thousand years a new cycle will begin. Ironically, there must first be a warming for ice to soften and move south. Because the greenhouse effect may quicken the process, some scientists believe that a new ice age will be upon us within two thousand years. They disagree, however, as to the effects of this new ice age. Some scientists believe it will be devastating, but humanity will survive. Others say no one will survive. Regardless, we ought not lose any sleep over it—it's still thousands of years away.[59]

The Quiet Apocalypse

The end of the world may be sneaking up on us, say some environmentalists. We are committing global suicide. Global warming, spilled oil, poisoned seas, ozone depletion, radioactive soil, acid rain, and toxic waste are "combining to bring the earth to the brink of apocalypse." Thus the "coming end will be a strictly do-it-yourself apocalypse."[60] No one is doing it to us; we are doing it to ourselves!

Nearly all scientists view the rape of the environment with extreme concern. Unless we do an about-face in the near future, humanity will face serious problems. But there is disagreement as to whether the environmental damage can be reversed. The pessimists "warn of doom within a century unless mankind mends its ways. Pshaw, say the skeptics. But they, too, see a need for change."[61] The doomsday environmentalists—those that believe the planet is near death—view the greatest threat as coming from three related problems. Global warming, deforestation, and the depletion of the ozone—especially global warming—could bring us to the brink of a secular Armageddon.

The greenhouse effect (or global warming) has many environmentalists up in arms. The earth's temperature is rising because the upper atmosphere contains too much carbon dioxide, which comes from the burning of fossil fuels (oil, gasoline, and coal). Such substances serve as a blanket trapping the earth's heat. Up to a point this is normal. But excessive gases cause a gradual warming of the earth's temperature.[62]

The greenhouse effect had its beginnings in the nineteenth century. With industrialization and later the automobile, tremendous amounts of fossil fuel were burnt, emitting enormous quantities of carbon dioxide into the atmosphere. Such emissions have accelerated rapidly in the twentieth century, bringing the world to a crisis point.[63] Global warming threatens the climate equilibrium. Temperatures could rise from three to thirty degrees Fahrenheit. Even a change of a few degrees would dramatically affect life on earth. Weather patterns in every part of the globe would change. Some areas would be drier, significantly reducing the food supply. Others would experience monsoons and floods. Even a rise in temperature of a few degrees would melt the polar ice caps; the oceans would rise, submerging coastal areas throughout the globe. Most of the world's major cities would be inundated. And we have said nothing about a rise of twenty to thirty degrees. This would be unimaginably disastrous.[64]

Doomsday by deforestation! Could it happen? In *Earth in the Balance* Vice-President Al Gore says that the destruction of the rain forests and the living species found therein "represent[s] the single most serious damage to nature now occurring."[65] Forests and the plant and animal life they house are the key to biodiversity. And without a hospitable ecosystem "the remaining tenure of the human race would be nasty and brief."[66]

What if we lose some species? Who needs these birds, insects, and plants anyway? We do! Our ecosystem cannot be altered significantly without impacting human life. On a more direct level, the forests provide humanity with pharmaceuticals, fibers, petroleum substitutes, timber, and other essential products.[67]

Deforestation is also an aspect of the greenhouse effect—it magnifies global warming. Carbon dioxide levels in the atmosphere are higher because of the mass destruction of the world's forests. Trees consume much carbon dioxide, which they need for photosynthesis. Therefore, the fewer trees, the more carbon dioxide in the atmosphere, and the greater the global warming.[68] And we know what a catastrophe this will cause.

The third environmental problem with the potential for worldwide disaster is the depletion of the ozone. The earth's atmosphere has a thin ozone layer which protects us from harmful ultraviolet sunlight. Unfortunately, chlorofluorocarbons (CFCs), which are used in refrigeration systems, some aerosol sprays, fertilizers, jets, and the production of foam packaging, contain ozone-destroying chemicals.[69] Some governments have taken steps to greatly reduce CFCs. Yet scientists tell us that a hole in the ozone about the size of the United States exists over Antarctica. Another one might be developing over the heavily populated Northern Hemisphere. Without this ozone shield all kinds of problems will develop—genetic abnormalities, skin cancers, cataracts, and damage to marine life. In fact, some scientists even contend that the increase in radiation could destroy all plant and animal life. Could a hole in the

ozone bring doomsday? Probably not. But southern Chile, where an ozone hole exists, has experienced some ominous phenomena—blind cattle and sheep, withered trees and cactus, severe sunburns, and strange spots on animals. One farmer even tried to put sunglasses on his sheep.[70]

Standing Room Only

Planet earth is small, and at this time we have no place else to go. Eventually, we will run out of space and the ability to feed ourselves. The end will come because of overpopulation and lack of food. In *The Population Bomb* (1968), scientist Paul Ehrlich said we would cross this threshold by the 1970s: "At this late date nothing can prevent a substantial increase in the world death rate." Despite crash programs to feed people, millions will starve. Such "programs will only provide a stay of execution" unless there are successful efforts to control the population.[71]

Ehrlich's first prediction misfired, but like many religious prognosticators he did not recant. He has continued to make similar forecasts. His 1991 book *The Population Explosion* says that our runaway population will result in "a billion or more deaths from starvation and disease." Moreover, society as we know it will dissolve.[72]

Of course, not all scientists agree with Ehrlich's doomsday predictions. Some starry-eyed optimists see the world supporting from 25 to 30 billion people. They see most of the world improving its agricultural productivity to something approximating that of North America and Europe. More-realistic scientists set the limits at around 15 billion.[73]

Scientists also disagree as to when, if ever, humanity will reach the limits. The optimists point to the slow population growth in the industrial nations and say that the whole world will emulate this pattern. The world's population should stabilize within tolerable limits, somewhere between 10 and 15 billion. Other scientists point to the runaway population growth in the developing world. Barring a nuclear war or a devastating plague, the upper limits will be reached around 2100. Mother Earth will snap. Billions will die from starvation and disease.[74] There will also be incredible tension, for lack of food brings out the animal instincts in humans. It will be survival of the fittest. With the lack of space prohibiting privacy, people will become unsociable and hostile. Poverty will run rampant. Even if humanity survives, much of the world will be crowded into metropolises like Mexico City, São Paulo, and Calcutta.[75]

Awareness of the population peril goes back as far as English economist Thomas Malthus and his 1798 *Essay on the Principle of Population:* "The power of population is indefinitely greater than the power in the earth to produce subsistence for man." Malthus believed that the population would grow until checked by a lack of food. For a while, people accepted Malthus's ideas. But improved agricultural methods came along, allowing fewer people to produce more food on less land. As a result, the world population grew from about 1 billion in Malthus's day to about 6 billion in 2000.[76]

But Malthus may eventually prove to be right. Improved agricultural methods have increased the food supply—only to be outstripped by an exploding population. Today much of the world is not being fed properly and mass famines are common. Unless the world's population is drastically limited in the next one hundred years, the crash will come. Indeed, the rider on the black horse (famine) may stalk humanity once again. And this is to say nothing about the environmental problems caused by overpopulation. The more people polluting nature and cutting down trees, the greater the chance for environmental catastrophe.[77]

Plague and Pestilence

The pale horse of the apocalypse—representing death by plague and disease—has stalked humanity through history. Quite often it has been associated with end-of-the-world panics or divine judgment. In Matthew 24:7 Jesus speaks of "famines, and pestilences, and earthquakes" as signs of the end. Revelation 8–16 tells of God's pouring out his judgment at the end of the world in the form of pestilences and plagues.

Horror of horrors—the Black Death terrified Western society as no plague ever has. During the Middle Ages it killed about one-third of Europe's population. No one knew what caused it. "Some say that it descended upon the human race through the influence of the heavenly bodies," wrote Giovanni Boccaccio in his *Decameron*. A grand conjunction of Saturn, Jupiter, and Mars in March 1345 was thought by some enlightened scientists of the day to have corrupted the earth's atmosphere and caused the plague. Many said that it was "a punishment signifying God's righteous anger at our iniquitous way of life." Still other Europeans blamed it on the Jews, insisting that they had poisoned the wells.[78]

Most people connected the Black Death with some form of divine judgment or end-of-the-world scenario. But when the plague continued for centuries, people gradually began to think in terms of natural causes. By the early twentieth century they figured out that bacilli from rat fleas had caused the epidemic.[79]

The Black Death illustrates how pestilences relate to end-of-the-world thinking. Religious people see plagues as a divine instrument for punishing humanity for its evil and as a sign of the end. To secular thinkers

epidemics have natural causes—sometimes unknown. They may also view plagues apocalyptically, but not as the end of the world, for plagues are usually local in scope. A new pestilence, however, adds to the horror. People become particularly terrified when an unknown disease—one they don't understand—attacks.[80]

To a large extent modern medicine has curbed the specter of widespread epidemics, but not completely. During World War I more than 3 million Russians died of typhus. In 1918 an influenza epidemic killed 20 million people throughout the world. But this attack did not set off an end-of-the-world panic, for influenza was a known disease that could be treated.[81]

Then came AIDS. By the 1980s it had surfaced in America, largely among homosexuals. As long as it was confined to the gay community, it did not set off a major crisis. But when AIDS began to go mainstream, it stirred up considerable apocalyptic excitement, for the disease has no known cure. Once contracted it usually proves fatal.[82]

The chief causes of AIDS are homosexual or promiscuous heterosexual activity and the exchange of needles for taking drugs, all of which most Christians consider to be immoral. Thus some Christians declared AIDS to be God's judgment for sin. By the mid-1980s the spread of AIDS had begun to arouse some apocalyptic excitement. Jerry Falwell said, "AIDS is God's judgment on a society that does not live by his rules."[83] Then Jack Van Impe really stirred matters up. Quoting Revelation 16, he related AIDS to the sin of bestiality. In Africa's jungles men committed sex with monkeys carrying the virus and thus catapulted the disease to global proportions. In the belief that AIDS could wipe out civilization, Van Impe declared that by 2020 the disease might kill the last human on earth.[84] Citing a CIA study, Hal Lindsey estimated that by the mid-1990s 75 percent of sub-Saharan Africa could be infected by AIDS.[85]

But such apocalyptic talk is not confined to the doomsaying preachers. Millions will obviously die if a cure is not found. In 1992 the World Health Organization estimated that 40 million people will be HIV-infected by 2000. And as AIDS spreads among heterosexuals, the crisis will grow worse unless a cure is developed.[86]

Could much of the world wind up like Uganda, which currently represents the worst-case scenario? Estimates in 1992 said that half of Uganda's population of 18 million had contracted HIV and that many could die in the near future. British journalist Dan Wooding feared that Uganda might become "so decimated that it will not be able to exist as a nation." While AIDS is not as bad elsewhere, it has destabilized other countries in the developing world by inflicting especially the young adults in the prime of life.[87]

In the mid-1990s a measure of medical progress with HIV helped to reduce the hysteria over AIDS. But along came the gruesome Ebola virus. Having first surfaced in Sudan in 1976, it lay dormant for about sixteen years, only to arise in 1995 to kill again—this time in Zaire. It is one of the most elusive, mysterious, and deadly pathogens in the world. The Ebola virus ravages the human body by destroying the immune system and causing massive bleeding that usually ends in a horrible death.[88] True, most scientists say that the Ebola virus is ill suited to bring about doomsday. It cannot be transmitted by a sneeze or cough; it kills its victims so quickly that they don't have much chance to infect others. Still, if a mysterious disease without a cure ever got loose in a major urban center, a catastrophe would result.[89]

Futurists envision two other plague-related nightmares—biological warfare and diseases from outer space. Even small powers can develop a stock of devastating bacteriological weapons. Such weapons could also be launched by a clandestine organization. However, for a global doomsday to be a real possibility, a major power with missiles and planes would probably have to get involved. More far-fetched is the possibility of unknown germs entering Earth from a spacecraft. If humans ever begin to explore other planets, such a scenario will be a realistic concern.[90]

Big Scary Things from the Sky

Suppose we come to our senses and eliminate nuclear, chemical, and biological weapons. Suppose we also solve our environmental problems, and medical science learns to control all communicable diseases. Would the possibility of doomsday then be eliminated? Not entirely! Planet earth could still be bombarded by a comet or asteroid. Or we could experience some other cosmic disaster such as the sun exploding.[91]

"During a human lifetime, there's roughly a 1-in-10,000 chance that Earth will be hit by something big enough to wipe out crops worldwide and possibly force survivors to return to the ways of Stone Age hunter-gatherers," writes Sharon Begley. Those odds are about the same as one's dying in a car crash during any six-month period, getting cancer from breathing automobile exhaust in Los Angeles, or dying from anesthesia during surgery. The fact is that "killer asteroids and comets are out there. And someday, one will be on a collision course with Earth." The only question is when. If life on Earth goes on long enough, scientists believe that such a fate is inevitable.[92]

Before proceeding we need to define some terms. What is the difference between comets, meteors, meteorites, and asteroids? Comets consist of frozen gases. Like planets, they travel around the sun, but in ir-

regular orbits. Meteors are small particles entering the earth's atmosphere, where they burn up and are seen as shooting stars. The remains of these shooting stars are called meteorites, solid objects of metal and stone that actually reach the earth. Asteroids are large meteoroids whose usual orbit lies between Mars and Jupiter.[93]

For several millennia people have watched cosmic objects—comets, meteor showers, and asteroids—with great fascination. They saw them as strange and unnatural events and as omens for good or ill. "These signs forerun the death or fall of kings," says a minor character in Shakespeare's *Richard II*. Christians more often view such cosmic activities as signs of God's wrath rather than his favor. But while they may be omens, they do not always point to the end of the world.[94]

Of the various astronomical phenomena comets have generated the most end-of-the-world excitement. The appearance of a comet in 1843 swelled the ranks of the Millerite movement, convincing many that Christ would return shortly. In 1910 Halley's comet prompted an end-time panic. Many people believed that it would collide with the earth and smash it to bits. To no avail scientists pointed out that Halley's movement had been known for two centuries and that it would miss the earth by millions of miles. In 1910 Halley disappointed the doomsdayers; its reappearance in 1986 prompted no apocalyptic excitement.[95]

Are comets merely omens of doom, or could they become agents of doom? Could a collision with a large comet destroy planet earth? This possibility has been the grist for many science fiction stories. And, in fact, some astronomers contend that a huge comet smashed into the earth 65 million years ago, killing the dinosaurs and about two-thirds of all life. (Other scientists believe that even worlds could collide.)[96]

In June 1908 a huge fireball streaked across the Siberian sky. What scientists believe was a comet leveled 80 million trees in a circle about twenty-five miles in diameter. Scientists theorize that the comet, which was several miles in diameter and about 10 million tons in weight, exploded in the atmosphere right before reaching the ground. Thus it created no large crater. But the people in Siberia thought that the world had ended.[97]

In our day the Swift-Tuttle comet concerns some scientists. Most comets originate in far space beyond Pluto. Gravity pulls some of them toward the sun, and at times they cross the earth's orbit. About two hundred visit the earth's environs every two centuries. Swift-Tuttle (named after the two astronomers who first saw it) passed within 110 million miles of Earth in 1862. Astrophysicist Brian Marsden calculates that Swift-Tuttle will come much closer to the earth in August 2126. And if it goes slightly off course, it might even hit the earth. The odds are 1 in 10,000.[98]

Meteorites constantly bombard Earth, but they are usually small and do little damage. Fortunately, the larger asteroids, which could devastate Earth, are fewer in number. But so much for the friendly skies. Earth has taken some major hits: scientists have verified 139 craters, and erosion has undoubtedly erased many more. Meteor Crater, which is near Winslow, Arizona, has a 3-mile circumference. The 30-mile-wide Vredefort Ring in South Africa may have been a meteorite. The largest one in recent years struck Siberia in 1947.[99]

Actually, the near misses have caused more anxiety than have the hits. The asteroid Hermes passed Earth by 500,000 miles in October 1937. If it had crashed, Hermes would have packed more punch than all the nuclear weapons in the world. In August 1972 an asteroid with five times the power of the Hiroshima bomb passed over Wyoming. Another asteroid missed Earth by 700,000 miles in March 1989. Had it arrived six hours later, civilization might have been destroyed. In 1992 the asteroid Toutatis came within 2 million miles of Earth. It will be back, swooping less than 1 million miles away in 2004, says Gareth Williams of the Smithsonian Astrophysical Observatory.[100]

If the comet misses, the friendly skies have other ways to do us in. Scientists tell us that the days on Earth are getting one second longer every sixty thousand years because the moon is gradually pulling away from the earth. As this occurs, the earth's rotation slows down and oceanic tides are disrupted. In about 10 billion years each day and night will equal fifty of our current days. Such a climatic change will have a drastic effect on plant and animal life.[101]

In addition, if a comet or asteroid doesn't strike this planet, a star might. Our Milky Way is hurtling toward its nearest neighbor—the galaxy Andromeda—at about seventy miles a second. In about 5 to 10 billion years they will collide. And since Andromeda is two to three times larger, the Milky Way will get the worse of the collision. Our galaxy will be destroyed and consumed.[102]

But before Andromeda gets us, our own sun may do us in. Planet earth may well get cooked by its own star. The sun is now about 4.5 billion years old, making it a middle-aged star. Its fuel supply is moving to its outer edges. As a result, the sun is gradually getting bigger and brighter. In about 2 billion years Earth will feel the effects; for example, winters in New England will hit about 90° Fahrenheit. In about 7 billion years, the oceans will boil, and the sun will get so large that it engulfs the inner planets of Mercury and Venus and chars Earth into a cinder. But this will be the last hurrah for the sun. It will run out of fuel and become a dwarf star. It will then be too cold for any form of life in our solar system to survive.[103]

The Secularization of the Four Horsemen

The four horsemen portrayed in the Book of Revelation symbolize a catastrophic end to the world. For most of Western history, people have believed that the end would come at the hands of God. But God now has some competition—humanity might destroy itself. To be sure, the sacred and secular apocalypses overlap at points. In fact, given a particular view of divine providence, Christians can interpret secular disasters as being directed by God. Traditionally, natural calamities—earthquakes, volcanoes, and such—have been seen as the work of God. Some Christians even attribute manmade catastrophes—wars and the rape of the environment—to divine providence.

This chapter, however, has focused on a different perspective—that there will be a natural and secular end to the world. While the sacred and secular apocalypses are often muddled together, they differ at two points—the end results and the causes. In a strict sense, apocalyptic thinking entails both disaster and triumph. The secular apocalypse places little emphasis on triumph. No golden age will follow a nuclear war or an environmental catastrophe. At best, humankind will pull back from the edge of a precipice and avert a calamity. But this can hardly be viewed as a triumph, let alone a golden age.

The major point of divergence concerns causes. Who or what causes wars, earthquakes, famine, pestilence, environmental crises? Or, should the ultimate disaster, a nuclear holocaust, occur, who would be responsible? Christians may not say that God has caused these calamities, but they will say that he has permitted them. Conversely, secular thinkers look to natural or human causes. While they may not be irreligious people, they focus on secondary factors, that is, human beings or nature, rather than the ultimate cause, God. They emphasize what can be observed or scientifically validated. Such thinking has its roots in the late Middle Ages. While the vast majority of the people attributed the Black Death to divine judgment, some individuals began to look for natural causes. As the modern world emerged in the eighteenth and nineteenth centuries, the notion of a secular apocalypse began to gain momentum. But it was not until the post–World War II era that such thinking took off: humanity does not need God to destroy the world; they can do it themselves!

We have seen that the end without God can come in several ways. If doomsday comes via an environmental crisis or a plague, there will be a quiet apocalypse. Or, as T. S. Eliot put it, "This is the way the world ends, not with a bang but a whimper." On the other hand, if the end comes by means of a nuclear war or a cosmic collision, it may be with a bang after all.[104]